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Unpacking the Opinion of Taiwanese on COVID-19 Policies: Going Beyond Simple Aggregate Satisfaction

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Abstract

This research examines Taiwans public health behaviors, attitudes, and policy opinions regarding COVID-19 policies during the pandemic, taking South Korea as a comparison. We assess how public approval of COVID-19 policies correlates with partisanship, voting behavior, and confidence in government and healthcare during the pandemic. We focus on three major issues: 1) Identifying key factors associated with confidence in the governments pandemic response. 2) Investigating the connection between presidential voting behavior and pandemic policies. 3) Evaluating respondents confidence in specific policies and the healthcare system during the pandemic. We collect samples from the Taiwan Social Change Survey (TSCS) conducted between September and December 2021, obtaining 1,260 complete face-to-face interview responses. We use Goodman and Kruskals lambda to measure the correlation between each policy and the respondents responses. Using decision tree learning and considering the region as a random effect in the mixed-effects logistic regression, we examine the relationships between political outcome variables and their explanatory counterparts. Our study reveals that political factors and demographic characteristics significantly shape public confidence in Taiwans governmental and healthcare responses to COVID-19. The majority of Taiwanese people, irrespective of voting preferences, generally support measures such as mobile phone surveillance to track infected individuals, border closures, mandatory face masks, and isolation of those with the disease to curb COVID-19 transmission. Additionally, the closure of educational institutions as a public health measure enhances public confidence in the government.

Keywords: Partisanship, presidential votes, health policies, goodman and Kruskals lambda, mixed-effects logistic regression.

1. Introduction

Governments worldwide have responded to the changing COVID-19 environment of limited information and have confronted many uncertainties since early 2020 when the virus first burst forth. Their evolving COVID-19 policies have included a number of non-pharmaceutical interventions, such as lockdowns, school closures, travel bans, border closures, business closures as well as vaccination

policies to counteract the spread of the virus. Those actions impacted the effectiveness of work practices (Chu et al., 2022) and spurred sustainable online learning (Chu et al., 2021) and other lifestyle changes due to restrictions put up during the COVID-19 pandemic.

Measuring public opinion is crucial to the democratic process and has been particularly important during the COVID-19 pandemic. Survey datasets can provide insights into how citizens respond to government interventions, their level of trust in public health authorities, and their willingness to comply with public health guidelines. The literature has focused primarily on overall or aggregate satisfaction with government responses to the pandemic. Many studies look for significant factors that impact citizens' satisfaction concerning their government's responses to the COVID-19 pandemic (Rich et al., 2020; Chen et al., 2021; Sarker et al., 2021; Gadarian et al., 2021; Chen et al., 2022; Mizrahi et al., 2021; Huang, 2020). This paper fills this gap by providing a detailed examination of the views within Taiwan on specific COVID-19 policies, rather than a broad measure of satisfaction.

Due to lessons learned from the 2003 SARS outbreak, the Taiwan government established comprehensive standard operating procedures (SOPs) to handle infectious diseases (Yueh et al., 2022). Thus, despite being located just 100 miles from China, where the SARS-CoV-2 virus originated, Taiwan maintained a low case count and death toll throughout the pandemic during the early stages of 2020. This attracted considerable international attention (Wang et al., 2020).

This research examines Taiwans public health behaviors, attitudes, and policy opinions about COVID-19 policy issues during the pandemic period (September-December 2021) and uses South Korea as a comparison. Established in 1985 the Taiwan Social Change Survey (TSCS) tracks the long-term trends of sociality changes and is administered through face-to-face interviews. Various studies use TSCS cohort datasets to investigate changes in health outcomes; such as in Lin et al. (2022). The quality of face-to-face interview surveys is commendable. They capture a broad age range and tend to be more expensive than online surveys. Online surveys often face limitations in representativeness, as younger individuals tend to dominate the response pool. Nevertheless, they still provide valuable insights through nationally representative data on various topics. In contrast, while face-to-face interviews provide deeper insights, they also carry the risk of interviewer bias, which may influence respondents' answers to sensitive questions, such as those related to COVID-19 health behaviors, adherence to non-pharmaceutical interventions, or voting behavior. This type of response behavior is commonly referred to as social desirability bias and often results in the underreporting of socially undesirable behaviors and the overreporting of socially desirable ones.

Taiwan boasts the most commendable global record in controlling the virus - a distinction it achieved in 2020 when it rapidly spread across Europe and the United States (Wang et al., 2020). Given that COVID-19 cases in Taiwan were sporadic until May 2021 (Chen et al., 2022), it is reasonable to use survey data following the onset of the more severe outbreak. We choose to focus on survey data collected from September to December 2021 instead of using the entire 7-month survey period specified in TSCS. Given the rapidly evolving nature of COVID-19 issues, we opt not to use an excessively long period for our study.

Examining government approval through survey datasets is essential, because they help understand the public's perception and satisfaction toward a government's pandemic response. By analyzing survey data, it can assess the effectiveness of its policies and identify areas that require improvement. To the best of our knowledge, most research on COVID-19 policies depends on broad survey questions regarding policies in general (e.g., satisfaction with government responses to COVID-19 policies) rather than specific ones. Our study offers insights into Taiwan's perspective using nationally representative survey data on various objectives, complemented by an international comparison. The importance of this research is to provide clearer insights and to understand the implications of this work.

We focus on three major issues: 1) Identifying the crucial factors associated with respondents' confidence regarding the government's response to the pandemic. 2) Analyzing the relationship between presidential voting behavior and various policies implemented during the pandemic. 3) Assessing respondents' confidence with specific policies and the healthcare system during the pandemic.

This study delves into Taiwanese perspectives on COVID-19 policies, moving beyond merely aggregate satisfaction, thus offering a comprehensive view of strategic plans for infectious disease control in preparation for any future pandemic.

Political partisanship in many countries has significantly impacted attitudes about government policies enacted during the COVID-19 pandemic (Gadarian et al., 2021; Ward et al., 2020). Those who identify with the current governing party are more satisfied with government policies than those who either support the opposition or identify with no political party (Chen et al., 2022). We thus employ political partisanship as one factor to determine if partisan perceptions vary over COVID-19 responses. Partisanship may influence how one views health-related measures, because people tend to evaluate political issues based on their political beliefs and party affiliation, rather than on objective analysis of the evidence.

Some studies explore public attitudes toward a country's approach to dealing with the COVID-19 pandemic from an international perspective, e.g., Chen et al. (2021). Their finding shows that respondents in South Korea and Japan reacted contrarily to those in Western countries. They also conclude that people in Asian countries have distinct standards and may have different degrees of satisfaction with their government's responses.

Comparing South Korea and Taiwan in the context of disease-prevention measures is particularly meaningful for several reasons. Both countries are located in East Asia and share similar geopolitical challenges. South Korea and Taiwan have analogous cultural attitudes toward public health and community responsibility. Both countries have robust healthcare systems, but they operate under different frameworks. Both countries have aging populations, which are more susceptible to infectious diseases. South Korea and Taiwan have advanced technologies and have integrated them into their disease-prevention strategies. Both countries have dealt with previous pandemic like SARS and MERS. This research chiefly investigates Taiwan's public attitudes, behaviors, and policy opinions about COVID-19 policy issues compared to those in South Korea during one period of the pandemic.

The COVID-19 pandemic has been a major, common test for leaders worldwide (Herrera et al., 2020; Rich, 2023). Rich (2023) evaluates the impact of satisfaction with COVID policies on presidential evaluations in Taiwan. A government's COVID-19 policy is not a singular, monolithic approach; it comprises a series of multifaceted policies addressing various pandemic aspects. They range from public health measures, such as mask mandates and social distancing, to economic policies. Given this diversity, it is natural for the public to have varying opinions on each policy. As COVID-19 infections occurred in Taiwan only sporadically before May 2021 (Chen et al., 2022), this study designates the survey period as September to December 2021 and investigates the correlation between demographic variables, party affiliation, presidential voting behavior, and policy opinions with approval ratings during the pandemic. Additionally, it assesses how respondents' reactions differ based on the strictness of lockdown policies during the pandemic. We further compare the presidents of both countries to determine the degree of their domestic public support.

This study's primary contribution lies in the analysis of diverse perspectives on COVID-19 policies in Taiwan, utilizing a national research project dataset. The key insight from this study highlights the influence of party affiliation and voting behavior on shaping people's perceptions of government responses to the COVID-19 pandemic. Confidence in the healthcare system demonstrates a significantly positive correlation with voting behavior in the 2020 presidential election, party affiliation, and education levels. Additionally, this study emphasizes that contrary to expectations, opinions on epidemic prevention policies do not significantly influence government trust, highlighting the greater impact of political factors. Regardless of their voting preferences, an overwhelming majority of people in Taiwan support measures such as the use of mobile phone surveillance to track infected individuals, closing borders to other countries, wearing face masks, and isolating individuals known to carry the disease, in order to combat the spread of COVID-19 transmission. In democratic societies, it is rare to see such a broad consensus, as seen in Taiwan in late 2021, on backing four specific epidemic prevention measures requiring people to wear face masks, placing individuals known to carry the disease in isolation, using mobile phone surveillance for tracking infected individuals, and

shutting borders to other nationsirrespective of political party ties.

2. Materials and Methods

Taiwan and South Korea have been praised for effectively reacting to the COVID-19 pandemic (Chan et al., 2022; Kim et al., 2022), as both took on significant roles in the global response to it, provided aid and medical supplies to other countries in need, and shared their knowledge and expertise in managing the virus with other countries. However, the two countries followed different approaches to containing the virus. Taiwan's response to COVID-19 is characterized by early and aggressive action based on SOPs of the 2003 SARS outbreak. The government implemented comprehensive measures, including border controls, quarantine protocols, contact tracing, and social distancing requirements. The country also built a system for real-time communication and coordination between healthcare providers and government agencies, allowing swift and coordinated responses to outbreaks (Huang, 2020; Chan et al., 2022). South Korea was one of the first to be hit hard by the virus (Chen et al., 2022), but it quickly implemented mass testing, contact tracing, and isolation. The government initiated an extensive testing regime that allowed for rapid identification and isolation of infected individuals. It also set up a sophisticated contact tracing system that enabled health officials to track the spread of the virus and contain outbreaks (Kim et al., 2022). Various factors, including healthcare infrastructure, political landscape, and economic considerations have influenced each country's approach to controlling COVID-19. Consequently, comparing the effectiveness of approaches across countries is complex and necessitates thorough analysis. To shed light on this, we provide the following data descriptions.

Data Acquisition

We extract TSCS samples with September to December 2021 as the survey period, obtaining 1,260 complete respondents, and collect information from TSCS on demographic covariates that include gender, age, level of education, monthly income level, and region in Table 1. Gender is coded as a binary variable: 0 for females and 1 for males. Of the 1,260 respondents, 594 are male and 666 are female. The average age is 50.55 years old with a age range of 19 to 93. Age is categorized into four groups: under 34 years, 35-49 years, 50-64 years, and 65 years and older. In contrast to web-based surveys, face-to-face interviews offer the advantage of being inclusive across all age demographics. It is well-known that different age groups have varying levels of Internet access and comfort with digital technology. Specifically, the elderly group is often underrepresented in web surveys due to their limited familiarity or access to digital platforms. Moreover, the elderly group may encounter difficulties navigating web survey interfaces, which can result in incomplete or inaccurate data collection (Loges and Jung, 2001; Selwyn et al., 2003). Table 1 exhibits that 22.54% of the respondents in the face-to-face interviews belong to the elderly group, who are over 65 years old. Monthly income goes into three categories: below NT$29,999 (approximately US$1,000), NT$30,000-59,999, and above NT$60,000. Table 1 categorizes residential cities into six regions based on their geographical locations.

We also collect two measures related to politics: partisanship (affiliated with Pan-Blue alliance, Pan-Green alliance, or others) and the 2020 Presidential vote choice (voting for Ing-Wen Tsai or other). The related questions are: "In general, do you lean more towards any political party?" "Did you vote in the January 2020 presidential election held in Taiwan? Which candidate did you vote for?" In terms of partisan affiliation, the Pan-Green alliance includes supporters of the Democratic Progressive Party, New Power Party, Taiwan People's Party, and Taiwan Solidarity Union. The Pan-Blue alliance comprises supporters of KMT (Kuomintang), New Party, and People First Party.

An epidemiological measure of disease severity is the case fatality ratio (CFR), which is calculated using the following formula:

$$CFR = \left(\frac{\text{Number of deaths due to the disease}}{\text{Number of confirmed cases}} \right) \times 100. \tag{1}$$

We employ time-varying CFRs for COVID-19, utilizing a 7-day moving average of confirmed cases and deaths to smooth daily fluctuations due to reporting delays and inconsistencies. This approach enhances trend clarity and accuracy by compensating for the lag between infection and death. Moreover, it minimizes noise from irregular reporting patterns like weekends or holidays, ensuring a more reliable and stable CFR. This ratio proves especially valuable in comparing disease severity across countries. Figure 1 illustrates the CFRs for Taiwan and South Korea from February 21, 2020, to March 31, 2022, highlighting the particularly severe situation in Taiwan during the second half of 2021. The figure reveals that the daily CFR in Taiwan during this period is notably higher compared to other times.

To assess public opinions regarding the stringency of lockdown policies aimed at reducing social activities and human contact, this study utilizes eight statements from the TSCS 2021 data. Participants evaluated these statements using a 4-point Likert scale, ranging from 'definitely should have the right' to 'definitely should not have the right,' in response to the question: 'Do you think Taiwan's government should or should not have the right to do the following during times of severe epidemics?' Statements a-f in Table 2 connect to Taiwanese people who underwent movement restrictions or COVID-19 lockdown since March 2020.

Closing its borders to foreign tourists on March 19, 2020, Taiwan also mandated a 14-day quarantine for returning citizens and foreign residents. This proactive approach enabled the country to successfully prevent community transmission of COVID-19 until May 2021, with early cases occasionally popping up (Chen et al., 2022). However, the situation changed in May 2021 with the first community outbreak in the Taipei area, leading to a swift increase in daily cases that surpassed 100 within a week. In response, the Central Epidemic Command Center (CECC) of Taiwan escalated the epidemic warning to level 3 across the nation on May 19, 2021 as part of its efforts to intensify control measures. The government then implemented a mandatory mask-wearing policy, placed stringent restrictions on gatherings, closed pubs and entertainment venues, and limited restaurants to take-out service.

Statements g and h relate to closing schools and borders. After 2.5 years, starting on October 13, 2022, arriving travelers no longer had to quarantine. For the eight items, responses are recorded on a scale of 1 to 3 during data analysis: '1' indicates 'disagree' and corresponds to 'probably should not have the right' or 'definitely should not have the right;' '2' indicates 'agree' and corresponds to 'probably should have the right;' and '3' indicates 'strongly agree' and corresponds to 'definitely should have the right.'

In assessing confidence during the COVID-19 pandemic, we use two items that are evaluated on a five-point Likert scale. The scale ranges from 'increased it a lot' to 'decreased it a lot.' These items respond to the question: 'Does the way the COVID-19 pandemic is handled in Taiwan increase or decrease your confidence in the healthcare system and government?' Statement i, 'How has your confidence in the healthcare system changed during the pandemic?', relates to the admission and treatment of COVID-19 cases. The choices can then be: increased it a lot, increased it a little, neither increased it nor decreased it, decreased it a little, and decreased it a lot. The last statement, labeled as *j*, concerns 'confidence in the government'. It serves as a general evaluation of the change in confidence in the government's performance. Responses for these two items are recorded on a binary scale for data analysis: '1' indicates a 'Yes' for either 'increased it a lot' or 'increased it a little,' while '0' is used for all other choices.

Ethical approval

The TSCS study received approval from the Institutional Review Board of Humanities & Social Science Research at Academia Sinica, Taiwan, and underwent an IRB review process for data collection. For this study, IRB waived the requirement for informed consent as it was retrospective, and all personal information in the dataset was anonymized. Additional information and details about the TSCS study will be made available upon the manuscript's publication. All methods were performed in accordance with the relevant guidelines and regulations.

Table 1 Demographic variables: 1,260 respondents

Item		No.	%
Gender	Male	594	47.14
	Female	666	52.86
Region	Region 1 (Taipei-New Taipei-Keelung, northern Taiwan)	249	19.76
	Region 2 (Taoyuan-Hsinchu-Miaoli)	170	13.49
	Region 3 (Taichung-Changhua-Nantou)	283	22.46
	Region 4 (Yunlin-Chiayi-Tainan)	231	18.33
	Region 5 (Kaohsiung-Pingtung-Penghu, southern Taiwan)	228	18.10
	Region 6 (Yilan-Hualien-Taitung, eastern Taiwan)	99	7.86
Age	$\leq$ 34	242	19.21
	35-49	355	28.17
	50-64	379	30.08
	$\geq$ 65	284	22.54
Education	Junior high school and below	345	27.38
	Senior high school	369	29.29
	College	125	9.92
	University	337	26.75
	Master's degree and above	84	6.67
Monthly income	below NT$29,999	677	53.73
	NT$30,000-59,999	427	33.89
	above NT$60,000	156	12.38
Partisanship	Pan-Blue	201	15.95
	Pan-Green	325	25.80
	Others	734	58.25
2020 Presidential vote	Ing-Wen Tsai	541	42.94
	Others	719	57.06

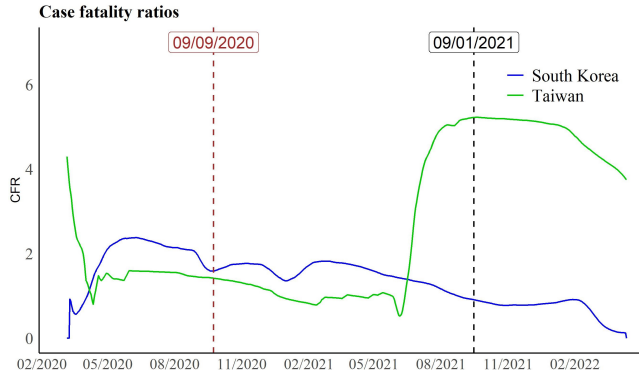

Figure 1 Daily time-varying CFRs for South Korea and Taiwan, with vertical lines on September 9, 2020, and September 1, 2021, indicating the survey start dates for South Korea and Taiwan, respectively

Assessing Relationships

Our survey data consist of nominal variables, with at least one of these variables having more than two levels. When working with two nominal variables, where at least one has more than two levels, a valuable measure of association to consider is Goodman and Kruskals lambda, λ (Khamis and Harry, 2008). The value of λ ranges between 0 and 1 with values closer to 1 indicating a stronger association. We use the phi coefficient method to measure the degree of association between two binary variables. The values of phi range from -1 to 1. A value close to 0 indicates minimal association, while values close to -1 or 1 signify a strong association. The magnitude of phi means the strength of the association, while the sign (positive or negative) reveals the direction of the relationship.

We examine the relationships between political outcome variables and their explanatory counterparts using decision tree learning and mixed-effects logistic regression. The mixed-effects logistic model is a subtype of the generalized linear mixed model. We particularly use this model when the response variable is binary. It models the log odds of the success probability as a linear combination of the predictor variables and includes both fixed and random effects. These random effects allow for a more accurate modeling of variability, both within and between clusters or groups, thus enhancing the model's robustness, generalizability, and alignment with the underlying data structure. For a detailed discussion, readers may refer to Hedeker (2003).

Decision tree regression is an effective and readily interpretable method that can handle nonlinear relationships between input features and the output variable, making it properly suited for social science research. In our study we use 'scikit-learn' Python package and the decision tree regression model to analyze our data. This model can handle both categorical and continuous data and hence is useful for our analysis of categorical data. To explore those differences, we examine the relationships between political variables and explanatory variables via a mixed-effects logistic regression approach.

Statistical Model

Different regions in Taiwan may have unique characteristics that influence confidence levels in the government during the pandemic. These characteristics could encompass historical, cultural, economic, or political differences. By including the region as a random effect in our model, we account for unobserved heterogeneity across regions. This approach enhances the model's generalizability, helps prevent overfitting, and addresses correlations within individual regions.

Let $Y_{i,j}$ denote the binary response variable indicating confidence in the government for the i^{th} individual in the j^{th} region. The mixed-effects logistic regression model for this response is specified as follows:

$$\begin{aligned}\log\left(\frac{P(Y_{i,j}=1)}{1-P(Y_{i,j}=1)}\right) &= \beta_0+\beta_1\text{Gender}+\beta_2\text{Age}_2+\beta_3\text{Age}_3+\beta_4\text{Age}_4+\\ &\beta_5\text{Education}_2+\beta_6\text{Education}_3+\beta_7\text{Education}_4+\beta_8\text{Education}_5+\\ &\beta_9\text{Income}_2+\beta_{10}\text{Income}_3+\beta_{11}\text{Voting}+\beta_{12}\text{Partisanship}+u_j,\end{aligned} \tag{2}$$

where $P(Y_{i,j}=1)$ represents the probability that the i^{th} individual in the j^{th} region expresses confidence in the government. Here, $\beta_0,\beta_1,\ldots,\beta_{12}$ are the fixed-effects coefficients, and u_j is the random effect associated with the j^{th} region, assumed to follow a normal distribution with mean 0 and variance σ_j^2.

We now consider the model for confidence in the healthcare system during the pandemic. Let $W_{i,j}$ denote the binary response variable indicating confidence in the healthcare system for the i^{th} individual in the j^{th} region. The mixed-effects logistic regression model for this response has the same structure as Equation (2), but with $Y_{i,j}$ replaced by $W_{i,j}$:

$$\begin{aligned}\log\left(\frac{P(W_{i,j}=1)}{1-P(W_{i,j}=1)}\right) &= \beta_0+\beta_1\text{Gender}+\beta_2\text{Age}_2+\beta_3\text{Age}_3+\beta_4\text{Age}_4+\\ &\beta_5\text{Education}_2+\beta_6\text{Education}_3+\beta_7\text{Education}_4+\beta_8\text{Education}_5+\\ &\beta_9\text{Income}_2+\beta_{10}\text{Income}_3+\beta_{11}\text{Voting}+\beta_{12}\text{Partisanship}+u_{2j},\end{aligned} \tag{3}$$

where $P(W_{i,j} = 1)$ denotes the probability that the i^{th} individual in the j^{th} region expresses confidence in the healthcare system during the pandemic. In this model, u_{2j} is the random effect for the j^{th} region, also assumed to follow a normal distribution with mean 0 and variance σ^2_{2j}.

Table 2 Measurement of public opinions and confidence during the COVID-19 pandemic

Item	Description
a	Shut down businesses and places of employment
b	Demand that people stay at home
c	Use digital (mobile phone) surveillance to track infected people
d	Require people to wear face masks
e	Ban public gatherings
f	Place people known to carry the disease in isolation
g	Suspend compulsory education and close schools and kindergartens
h	Close borders to other countries
i	Confidence in the healthcare system during the pandemic
j	Confidence in the government

3. Results/Discussion

To explore the opinions of Taiwanese on COVID-19 policies beyond simple aggregate satisfaction, we examine respondents' reactions to statements a to h during the COVID-19 pandemic, which pertain to the government's policies. We first use Goodman and Kruskal's lambda to measure the rank correlation between each statement and respondents' partisanship. We then investigate the rank correlation between each statement and respondents' 2020 presidential voting behavior. The policies detailed in Table 2 represent the primary contribution of this study. Most studies on COVID-19 policies rely on a simple survey question addressing policies as a whole rather than specific ones. Evidence from South Korea and other regions suggests a partisan divergence regarding COVID-19 policies. However, this might merely reflect satisfaction with the presidency. Using the data from Taiwan presented here, one can discern the confidence or tolerance for specific policies and to what extent.

Table 3 Goodman and Kruskals lambda coefficients for assessing the association between public opinions and various factors during the COVID-19 Pandemic

Item	Partisanship	Presidential vote	Confidence in the government during the pandemic	Confidence in the healthcare system during the pandemic
	1=Pan-Green; 0= Others	1=Voter; 0=Others	1=Yes; 0=No	1=Yes; 0=No
a	0.077 (.227)	0.166 (.003)	0.207 (<.001)	0.229 (.002)
b	0.036 (.568)	0.128 (.022)	0.176 (.002)	0.154 (.031)
c	0.007 (.915)	0.064 (.247)	0.094 (.105)	0.067 (.345)
d	0.260 (.011)	0.157 (.084)	0.275 (.004)	0.314 (.006)
e	0.053 (.534)	0.152 (.041)	0.211 (.007)	0.250 (.009)
f	0.097 (.383)	0.187 (.057)	0.332 (.002)	0.239 (.054)
g	0.025 (.709)	0.162 (.009)	0.293 (<.001)	0.071 (.383)
h	0.018 (.818)	0.056 (.407)	0.171 (.016)	0.065 (.458)

The numbers within parentheses indicate the p-values.

Notes: This table excludes cases with missing item responses for public opinions on lockdown policies. The second column stands for the dichotomy in partisanship. The category labeled as '1' denotes the Taiwan Pan-Green alliance and '0' denotes others, encompassing supporters of the Pan-Blue alliance and other parties. The third column marked with category '1' states voting for incumbent President Ing-Wen Tsai in the 2020 presidential election.

The results in Table 3 indicate that voting behaviors in regard to the presidential election and political partisanship identification vary for many issues. Voting for incumbent President Tsai is

strongly positively associated with four statements (a, b, e, and g), but not with c and h, which relate to personal freedom, and not with d and f in the context of disease prevention. In other words, using digital (mobile phone) surveillance to track infected individuals in statement c and closing borders to other countries in statement h are restrictions on personal freedom and travel. Requiring people to wear face masks, as in statement d, and placing individuals known to carry the disease in isolation, as in statement f, are measures aimed at preventing the spread of COVID-19. There is no apparent correlation between voting behavior in the presidential election and these four issues (c, h, d, and f). The majority of people in Taiwan, irrespective of their voting behavior, generally support measures such as the use of mobile phone surveillance to track infected individuals, closing borders to other countries, wearing face masks, and isolating individuals known to carry the disease, to aid in reducing the transmission of COVID-19. Regarding four out of eight issues, supporters who voted for President Tsai are more likely to approve of measures related to managing the COVID-19 pandemic, with at least a 5% significance level.

Taiwan banned visitors from Wuhan, China on January 23, 2020, and this travel ban gradually extended to other countries. Taiwan next imposed entry restrictions for non-residents and quarantine measures on all returning citizens and residents starting on March 19, 2020 (Han et al., 2020). CECC further tightened quarantine measures for travelers coming to Taiwan starting on January 15, 2021 (CECC, 2020). Statement h denotes the imposition of mandatory quarantine on inbound passengers and the imposition of isolation for people suspected of having or known to be positive for COVID-19. The restrictions on movement (c. Use of mobile phone surveillance to track infected people) and travel (h. Close borders to other countries) caused considerable lifestyle changes for many people. Some studies in the literature acknowledge COVID-19 pandemic movement restrictions as threatening human rights (Spadaro and Alessandra, 2020).

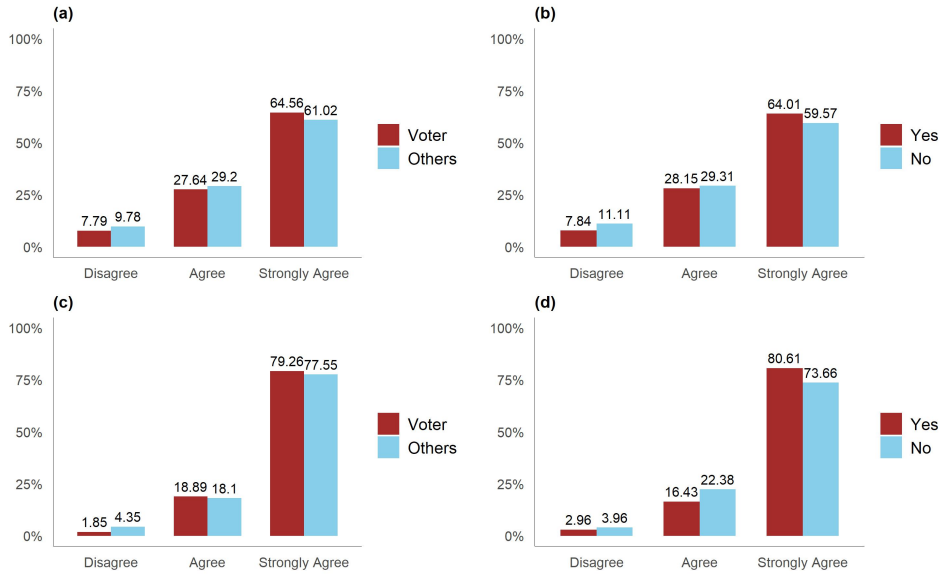

Figure 2 Upper panel: Support for using digital (mobile phone) surveillance to track infected individuals, grouped by (a) Presidential vote ("Yes" as Voter) and (b) confidence in the government (2 levels). Lower panel: Support for closing borders to other countries, grouped by (c) Presidential vote ("Yes" as Voter) and (d) confidence in the government (2 levels)

Confidence in the government

When we categorize confidence in the government into two levels, we observe no linear association for statement c (the second to last column in Table 3). Figure 2(a) indicates that over 90% of respondents either agree or strongly agree that the Taiwan government should have the right to use mobile phone surveillance to track infected individuals, regardless of their presidential vote (92.2% for those who voted for President Tsai and 90.22% for those who did not). Figure 2(b) illustrates that roughly 90% support the government's right to use mobile phone surveillance for tracking infected individuals, irrespective of their government satisfaction levels (92.16% for those indicating 'Yes' and 88.88% for those indicating 'No' regarding increased confidence in the government). Remarkably, over 95% of respondents support closing borders to other countries, a position consistent regardless of their satisfaction with the government or their choice in the presidential vote, as illustrated in Figures 2(c) and 2(d).

We then use several variables to predict an increase in confidence in the government: gender, age, education level, monthly income level, region, and political factors. We exclude cases with missing income information from this data analysis. Figure 3 presents confidence in the government classified by a regression tree. The decision tree graphic provides a nuanced understanding of voting behavior in Taiwan during the COVID-19 pandemic, emphasizing how public health crises can influence political preferences beyond traditional party lines. Despite individuals' inherent political inclinations, the data suggests that their satisfaction with pandemic policies significantly impacts their voting behavior. For instance, the decision to vote "Yes" or "No" in the context of approving the government's response to COVID-19 is not solely dictated by longstanding party allegiance. Instead, it is influenced by specific demographic factors such as age, education level, and region, as well as by perceptions of the government's and healthcare system's efficacy in handling the pandemic.

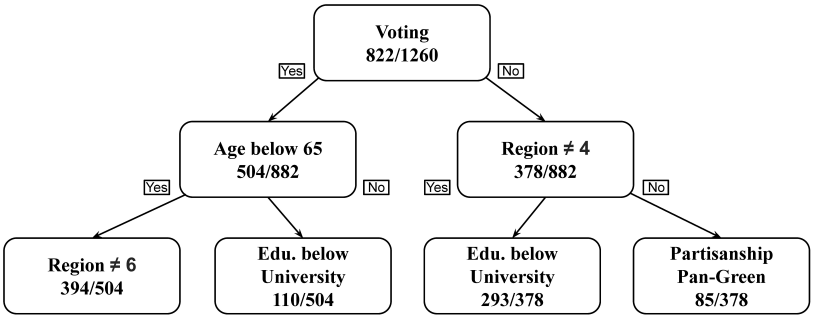

Figure 3 Decision tree for the political variable 'confidence in the government'

The analysis of 882 out of 1260 participants voting "Yes" in favor of the government's pandemic response highlights a critical insight: when faced with public health emergencies, the electorate's priorities may shift towards immediate and effective management of the crisis, overshadowing traditional party loyalty. For example, among those who approved the government's handling of the pandemic, a significant portion is under the age of 65, indicating that younger demographics might prioritize competent crisis management over partisan considerations. Furthermore, regional differences, such as being from regions other than 4 or 6, and educational levels, also play a crucial role in shaping these attitudes.

This evidence suggests that, in times of crisis, political leaders and parties cannot solely rely on their traditional voter base for support. Instead, their response to emergencies, such as a pandemic, becomes a pivotal factor in earning public approval and potentially swaying voter behavior. The findings challenge the narrative presented in the literature that suggests individuals' unwavering support for their preferred political party, underscoring the complexity of voter behavior in the face of unprecedented challenges.

The results of the mixed-effect logistic regression, where we consider eight public opinions and treat the region as a random effect (as in Table 4), highlight variability in 'confidence in the government' across regions. The fixed effects in the model do not adequately explain this variability. The variance for the random effects is 0.041, and the standard deviation is 0.202. This suggests that differences in 'confidence in the government' persist across various regions.

The predictors, such as the elderly group, voting for Ing-Wen Tsai, affiliation with the Pan-Green alliance, and supporting the policy of suspending compulsory education and closing schools, significantly increase the odds of confidence in the government. This significant increase in confidence following policy implementation to suspend compulsory education and close schools and kindergartens suggests that the community highly values this action in the interest of public health. This policy, which aims at safeguarding children and youth and preventing the spread of COVID-19, has evidently resonated with the public's expectations for strong and protective measures during this crisis.

Table 4 Estimation for Model 1: mixed-effects logistic regression; the response variable is "confidence in the government"

Parameter	**Estimate**	**Std. Error**	**z-value**	**p-value**
(Intercept)	-0.701	0.349	-2.008	.045
Gender (Male)	-0.199	0.137	-1.447	.148
Age (35-49)	0.144	0.196	0.735	.462
Age (50-64)	0.292	0.206	1.416	.156
Age ($\geq$ 65)	0.482	0.240	2.010	.044
Education (Senior high school)	-0.053	0.196	-0.272	.786
Education (College)	-0.159	0.260	-0.613	.540
Education (University)	-0.202	0.226	-0.892	.372
Education (Master's degree and above)	0.006	0.326	0.020	.984
Monthly Income (NT$30,000- 59,9999)	0.182	0.159	1.149	.250
Monthly Income (above NT$60,000)	0.025	0.230	0.110	.912
Vote (Ing-Wen Tsai)	0.900	0.156	5.788	$<$.001
Partisanship (Pan-Green)	1.228	0.211	5.808	$<$.001
Policiy Opinion: *a*	0.215	0.175	1.225	.221
b	0.004	0.175	0.023	.982
c	-0.199	0.161	-1.239	.215
d	-0.121	0.261	-0.449	.654
e	0.251	0.224	1.120	.263
f	0.276	0.253	1.093	.274
g	0.471	0.183	2.533	.011
h	-0.005	0.188	-0.025	.980

Each of the eight public opinions labeled as '1' indicates strongly agreeing and '0' indicates others. Random effects for regions: Variance = 0.041, Std. Dev. = 0.202.
Number of observations: 1260, groups: region, 6.

Confidence in the healthcare system

When we turn to confidence in the healthcare system during the pandemic as the response variable, the results in Table 5 indicate that education level and political factors (voting for Ing-Wen Tsai and Pan-Green partisanship) are significant predictors of confidence in the healthcare system, while gender, age, income level, and public opinions do not show significant effects. Additionally, there is some regional variability in the response variable.

Table 5 Estimation for Model 2: mixed-effects logistic regression; the response variable is "confidence in the healthcare system"

	Estimate	Std. Error	z value	p-value
(Intercept)	-0.014	0.390	-0.036	.971
Gender (Male)	0.099	0.161	0.614	.539
Age (35-49)	-0.048	0.258	-0.184	.854
Age (50-64)	-0.271	0.256	-1.057	.291
Age ($\geq$ 65)	-0.268	0.285	-0.942	.346
Education (Senior high school)	0.439	0.209	2.102	.036
Education (College)	0.667	0.307	2.169	.030
Education (University)	0.833	0.264	3.159	.002
Education (Master's degree and above)	0.882	0.406	2.170	.030
Monthly Income (NT$30,000- 59,9999)	0.083	0.188	0.442	.658
Monthly Income (above NT$60,000)	0.043	0.294	0.148	.882
Vote (Ing-Wen Tsai)	0.763	0.191	3.989	$<$.001
Partisanship (Pan-Green)	0.470	0.237	1.979	.048
Policy Opinion: *a*	-0.383	0.199	1.927	.054
b	-0.011	0.204	-0.055	.959
c	-0.004	0.186	-0.024	.981
d	0.116	0.293	0.396	.692
e	0.425	0.245	1.737	.082
f	0.209	0.283	0.741	.459
g	-0.089	0.222	-0.399	.690
h	-0.013	0.218	-0.058	.953

Each of the eight public opinions labeled as '1' indicates strongly agreeing and '0' indicates others. Random effects for regions: Variance = 0.030, Std. Dev. = 0.173.
Number of observations: 1260, groups: region, 6.

There are several aspects of healthcare for examining the Taiwan government's response to the COVID-19 pandemic. Taiwan provided and integrated its national health insurance (NHI) database with its immigration bureau in order to generate instantaneous warnings during clinical visits based on travel history and medical symptoms and to aid in case identification. The NHI card in Taiwan can help track and detect suspected cases in real-time (Wang et al., 2020). Compared to the initial young age group in Table 4, older respondents expressed appreciation for the government policies. As shown in Table 5, the respondents with higher levels of education appreciate the healthcare system during the pandemic. We conclude that highly educated respondents enhance their understanding of public health issues and pandemic management, fostering a greater appreciation for the healthcare system's efforts and challenges. Educated individuals, with improved access to and comprehension of complex information, tend to develop a more insightful view of the healthcare system. Those with a higher education level, aware of global health standards, often appreciate their country's healthcare response by comparing it with international practices.

The 'Age' variable, particularly in the case of the elderly, does not significantly impact appreciation for the healthcare system. This may stem from the elderly's experiences with the system or increased vulnerability due to higher comorbidities during the COVID-19 pandemic. Note that, after the survey period in March 2022, the CFRs for individuals over 70 in Taiwan are notably higher compared to those in Japan, Hong Kong, and South Korea (Chen et al., 2022).

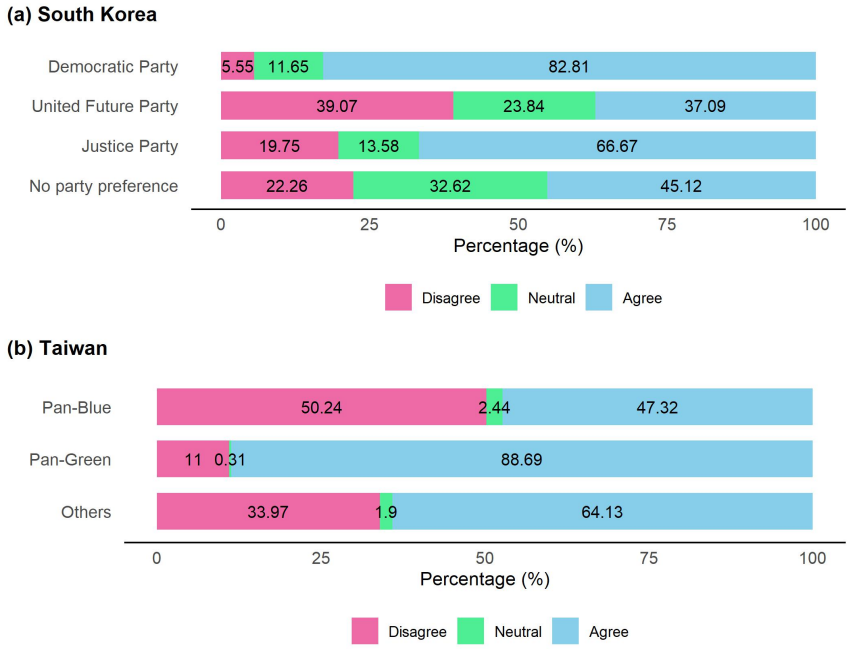

Figure 4 Public satisfaction and confidence in the government's COVID-19 response, categorized by political parties: (a) satisfaction in South Korea; (b) confidence in Taiwan

Note: In Taiwan the term 'disagree' corresponds to both 'decreased it a lot' and 'decreased it a little'. The term 'neutral' signifies 'neither increased it nor decreased it'. Finally, 'agree' equates to 'increased it a little' and 'increased it a lot'.

We see that the covariate 'presidential vote' more significantly explains both political variables better than the 'partisanship' variable. The correlation between 'presidential vote' and 'partisanship' is only 0.526 based on the phi coefficient method, which measures the degree of association between two binary variables. The value is between 0.3 and 0.7, indicating a weakly positive association. This study validates the literature (Markus et al., 1979; Bourgeois et al., 2020) that demonstrates differences between party affiliation and voting behavior. Overall, partisan affiliation and voting behavior are related but distinct concepts in political science. Partisan affiliation provides a general sense of an individual's political attitudes and behaviors over time. Voting behavior reflects more immediate factors influencing an individual's choice in a particular election. Put differently, citizens overall are less likely to turn out as voters versus solid partisans, and their presidential voting behavior is less consistent than those strongly identifying with a political party.

South Korea

We employ open-source surveys from two periods. Data on the first 1,200 South Koreans come from Rich et al. (2020) via a web survey during September 9-18, 2020, using quota sampling by region and gender. Their study asked each respondent to evaluate the statement, 'I am satisfied with the South Korea government's response to the 2020 coronavirus outbreak,' on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'. The CFR for South Korea, as in Figure 1, is relatively lower than that of Taiwan. This discrepancy might be attributed to mass testing in South Korea (Kim et al., 2020).

To understand the evolving perceptions of COVID-19 policies, Rich et al. (2022) present a pre-election web survey of 945 South Koreans on February 18-22, 2022 using quota sampling on gender, region, and age. Their study asked respondents to evaluate on a five-point Likert scale the following

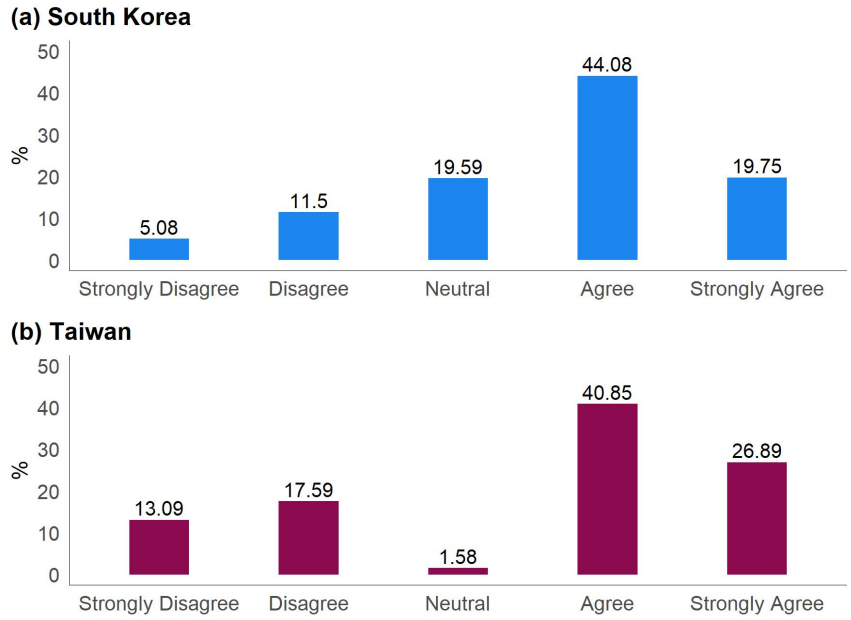

Figure 5 Respondents expressed satisfaction and confidence in their government's COVID-19 responses: (a) satisfaction in South Korea (Data source: September 2020); (b) confidence in Taiwan (Data source: September to December 2021).

Note: In Taiwan the term 'Strongly Disagree' corresponds to 'decreased it a lot', 'Disagree' corresponds to 'decreased it a little', 'Neutral' signifies 'neither increased it nor decreased it', 'Agree' equates to 'increased it a little', and 'Strongly Agree' corresponds to 'increased it a lot'.

statement: "I am satisfied with the South Korea government's response to the 2022 coronavirus outbreak."

Figure 4(a) illustrates public satisfaction with the South Korea government's COVID-19 response, categorized by political parties, while Figure 4(b) presents confidence in the Taiwan government, also organized by political parties. More precisely, Figure 4 presents the percentage of supporters who responded with: "I am satisfied with the South Korea government's response to the 2020 coronavirus outbreak". Survey results reveal that views on COVID-19 mainly fall along partisan lines, with supporters of the Democratic Party (DP) judging the government's response positively and non-supporters overwhelmingly opposed. Among DP supporters, 82.81% agree with the 'Government satisfaction' issue, while the conservative United Future Party (recently rebranded as the People Power Party; PPP) has only 37.09% agreement on this issue. In Taiwan, 88.69% of Pan-Green supporters have 'confidence in the government', while Pan-Blue supporters register 47.32% on this matter.

Jae-in Moon was South Korea president from 2017 to 2022. Prior to his presidency, he served as leader of the Democratic Party of Korea. It is not surprising that 95.05% of respondents who agree with the government's pandemic policies also approve of President Moon's performance (Rich et al., 2020). Rich et al. (2022) report that support for the government's responses appears mixed, with disagreement outpacing agreement during early 2022 at 43.6% versus 35.8%. As before, perceptions deviate from party affiliation, whereby supporters of the ruling DP are satisfied with the responses (64.8%) to a great extent, while supporters of the major conservative party (PPP) are mostly dissatisfied (71.4%). Figure 5 illustrates those satisfied with their government's COVID-19 response for South Korea in 2020 and Taiwan in 2021.

4. Conclusions

This study investigates the relationships between party affiliation (presidential vote) and public opinion concerning the government's policies to the COVID-19 pandemic in Taiwan and uses South Korea as a reference country. The primary contribution of this study lies in breaking down and analyzing the diverse viewpoints on COVID-19 policies in Taiwan. This disaggregation of various perspectives on COVID-19 allows for a better understanding of public opinion, policy decisions, and scientific debates surrounding the pandemic. Both Taiwan and South Korea have been successful in containing the spread of COVID-19, mainly due to their swift and coordinated responses and their willingness to implement strict measures to control the virus. While their approaches have differed, both countries have demonstrated the importance of early action.

Party affiliation provides a forceful anchor in assessing responses to the COVID-19 pandemic, because it significantly shapes individuals' perceptions of their government's response to the pandemic. Rich et al. (2020) indicate that individuals in South Korea tend to evaluate their government's actions and policies through the lens of their political affiliation. Besides party affiliation, our results indicate that the 2020 presidential voting behavior in Taiwan closely relates to the government's responses to the pandemic. Rich et al. (2020) find in South Korea that women and older respondents are more supportive of COVID-19 policies. In Taiwan, Pan-Green supporters, voters of President Tsai, or older respondents exhibit greater support for the government's COVID-19 policies.

This survey indicates that the Taiwan government's responses to the pandemic have garnered widespread support from the public. Taiwan suffered a significant increase in cases amid low vaccination coverage levels in May and June 2021. The Taiwan CECC announced a COVID-19 vaccine distribution strategy on June 20, 2021, outlining ten approved priority groups (Chen et al., 2022). The Japan government made the sixth donation of COVID-19 vaccines in October 2021, giving a total of more than 4.2 million vaccine doses to Taiwan. A low vaccination rate was observed during the survey period. This might explain why an overwhelming majority of people in Taiwan endorse non-pharmacological interventions, such as requiring people to wear face masks, isolating individuals known to carry the disease, using mobile phone surveillance to track infected individuals, and supporting closing the country's borders to combat the spread of COVID-19.

Several studies in the literature also discuss partisan polarization in the U.S. concerning COVID-19 policies (Clinton et al., 2020; Gadarian et al., 2021; Chen et al., 2022). Taiwanese voters in the 2020 presidential election exhibited strong support for the government's policies, presenting robust positive associations with all statements except for two statements on movement and travel related to personal freedom. In 2021, most people in Taiwan did not show voting polarization on four specific issues, regardless of their presidential vote in the previous year. The majority of Taiwanese, irrespective of voting preferences, are generally receptive to using digital surveillance via mobile phones to track infected individuals, and support closing borders to other countries, requiring people to wear face masks, and isolating individuals known to carry the disease to help curb COVID-19 transmission. Amidst a shortage of the COVID-19 vaccine in late 2021, Taiwan's citizens showed a willingness to adhere to restrictions and cooperate with measures to control the spread of the infectious virus. The closure of educational institutions as a public health measure has notably boosted public confidence in the government, reflecting approval of its decisive pandemic response.

Finally, the time frame of this study is limited to a specific period (September to December 2021), which may not capture the complete trajectory of public opinion throughout the pandemic. However, this period is valuable for investigation, as it coincides with the peak in CFR, making it a critical phase for understanding public sentiment.

Data Availability

The datasets used and analyzed in the current study are available in the Survey Research Data Archive (SRDA) repository, https://srda.sinica.edu.tw/datasearch_detail.php?id=3459.

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