COVID-19 and its impact on tourism sectors: implications for green economic recovery

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Abstract
The COVID-19 pandemic posed huge hurdles to green economic recovery and the tourism sector. This paper examines challenges in the Zhejiang, Fujian, and Shandong provinces of China’s coastal tourism and green economic growth in the wake of the COVID-19 pandemic. To assess this impact, the study used econometrics models based on the Chinese provincial data from March 2020 to April 2021. According to the results, coastal tourism’s related income fell drastically regardless of where the people live. Fisherman’s earnings dropped by 26%, while captains and owner’s earnings dropped by 49% on average. This also resulted in a shortage of food supply that endangered food security. During the pandemic, the number and duration of tourism trips dropped in all study locations. In addition, results indicated that in the wake of COVID-19, lower economic growth and recessions resulted in a significant decline in green investments. The paper proposes that to achieve green recovery and the recovery of the tourism sector, the local and central governments need to increase green investments and the literacy of the people in charge of coastal tourism.

Keywords COVID-19 Impacts · Green investment · Socioeconomic impacts · Coastal tourism · Fishery industry · Green growth

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1 Introduction

The year 2020 was terrible for the tourism sector, with 1 billion fewer international arrivals, according to a report by the World Tourism Organization (UNWTO, 2021). The Global tourism number drastically declined, the supply and demand were both under stress, and trade costs rose dramatically (Baldwin and Tomiura, 2020). While many experts warn of potential epidemic threats, the corona-virus appears to have surprised governments, companies, and families, adding to a lengthy list of probable unexpected tragedies. At the same time, economic or commercial difficulty is at the heart of the COVID-19 quandary (Newton et al., 2021). However, global health calamity is harming the lives of millions of people. COVID-19 is placing a large-scale economic and financial disaster owing to its influence on the supply-and-demand environment and productivity for climate change mitigation (Love et al., 2021). Initial research on the effects of COVID-19 poses a danger to global green investment and is causing public health concerns throughout the world (Del Lo et al., 2021; Li et al., 2021; Yoshino et al., 2021a, b; Taghizadeh-Hesary et al., 2021a; Wong et al., 2022; Zhao et al. 2022). Earlier studies found that the pandemic and the resulting low investments in green projects will endanger achieving sustainable development goals (SDGs) and other climate-related goals. Hence urgent measures and supportive policies are needed to achieve SDGs.

The pandemic has impacted different economic sectors, including tourism resources and ecological, cultural, and visual levels. Among the affected tourism sectors is coastal tourism. In China, the contribution of fisheries and coastal tourism to the gross domestic product (GDP) is more than 3.5 percent. More than 10 million people rely on the earnings from coastal tourism and fishery for their livelihood, directly or indirectly.

The COVID-19 pandemic has wreaked havoc on national and international food supply networks. Because of shifting consumer demand, market access, and logistical issues connected to transportation and the loosening of border barriers, the fishing industry is indirectly affected by the pandemic. The tourism sector fell because of the closure measures, including restaurants, hotels, tourist attractions, schools, and universities (Caulkins et al., 2020). Furthermore, due to raw material constraints in the supply chain of green investment, transportation limitations, and product shortages, fishers’ production, warehouse owners, processors, packers, and shippers are unable to continue operating in many regions. These issues significantly influence food security, especially for regions that rely primarily on fishing as a source of income (Shafi et al., 2020). Declining fisheries in Asia, Africa, and Europe, combined with border restrictions, will significantly impact export markets.

In this regard, this paper’s main objectives and novelties are (a) to determine the impact of COVID-19 on coastal tourism sector markets and green investment in three locations in China and provide policy solutions to ensure the community’s long-term socioeconomic status improvement and green recovery (b) This study also analyzes the central relevant policies and mitigates the adverse impact
of COVID-19 on China’s tourism sector. (c) The study examines the influence of the pandemic on financial markets and green investment and the role of fiscal policy in addressing this change. The empirical analysis provided in this research examines the changes that have occurred throughout this time, providing fresh insights into future regulation. Another contribution of this paper is to evaluate tourism’s understanding of COVID-19 preventive strategies or their impact on fishers in small and distant seas and increase the growth of a green economic recovery. Based on the research mentioned above, this new paper contributes to the literature in the following aspects: (1) determine the impact of COVID-19 on fisherman markets and green investment and provide policy solutions to assure the community’s long-term socioeconomic status improvement and green economic recovery. (2) Considering the new green financial vulnerability and regulation in the analysis. (3) Examining the Covid-19 impact on tourism and green markets and comparing China-selected regions.

The remaining sections of the paper are as below:

Section 2 provides the literature review. Section 3 presents the data and empirical analysis. Section 4 shows the empirical results. The last section concludes the paper and provides policy recommendations.

2 Literature review

Due to the lockdowns and the economic downturns because of the COVID-19 pandemic, millions of individuals have lost their jobs. Many industries, such as tourism, have been hit hard, and many scholars have begun to study the role of high and new technologies, such as digital technology, in revitalizing the national economy (Zhang and Shang, 2022). Many countries throughout the world are undergoing similar transformations. Furthermore, despite significant success in vaccination, there is still much uncertainty about how the virus will evolve in the months and years ahead, particularly regarding mutations and general disparities in vaccinations for climate change mitigation. The pandemic and the economic uncertainties had a significant impact on the financial markets globally. A review of the literature on the economic impacts of the pandemic reveals that several studies focused on the impact of the COVID-19 pandemic on national and international financial markets (Li et al., 2021; Dai et al., 2022; Taghizadeh-Hesary et al., 2021a; Karim et al., 2022; Wong et al., 2022; Zhao et al. 2022). In this section, we reviewed the earlier studies on the impact of COVID-19 on financial markets and green investments.

Many financial policies have been stressed by the impact of COVID-19 and the increase in uncertainties. The US treasury bill market showed symptoms of stress in March 2020. Bond and money market funds have also been hit hard. It is critical that the financial markets quickly recover. During the COVID-19 crash in February and March 2020, the index (S&P 500) lost a third of its value but regained all losses in August 2020 and gradually climbed since then.

Similarly, the US government bond rates (as a percentage of 10-year Treasury bond yields) surged dramatically in February and March 2020 before returning to pre-crisis levels later that year. The Fed’s quick response to avert a global financial
catastrophe may have contributed to the speedy recovery of financial markets. However, these patterns have aroused worries about a potential gap between green investment and the actual economy and the economic recovery anticipated based on financial market data. It is on the verge of a worldwide pandemic, an unusual event that parallels earlier financial and economic catastrophes, most notably the Global Financial Crisis (GFC) and the Great Depression. Since then, the lethal virus has been placing unprecedented pressure on financial markets, affecting human health and the whole economy. After more than a year, the US economy has not entirely recovered. Regardless of the impact, the extent and size of the intervention are unprecedented, and it will undoubtedly have a long-term impact on economic and financial studies in the years ahead.

While several studies focus on financial market upheaval (Costa et al., 2022; Deev and Pilhal, 2022; Karim et al., 2022; Hasan et al., 2022), others demonstrate how real-world events exert pressure on financial markets, how risk premiums and asset prices are affected, and how policy actions are affected (Mensi et al. 2022; Soni and Nandan, 2022). Some papers provide fresh data and empirical investigations that hint at their influence on markets and economies (Taghizadeh-Hesary et al., 2022; Barbier, 2022), while others feature new theories that unite dynamics and economics (Mostafiz et al., 2022). Some scholars also turned their attention to the relationship between economy and green energy. They found that economic growth had a positive and significant impact on the use of renewable energy (Shang et al., 2022a, b). In addition, there are also studies that show that renewable energy consumption and public health expenditure play an important role in improving the load capacity of ASEAN countries, especially under the influence of the COVID-19 epidemic (Shang et al., 2022a, b). In conclusion, as the GFC altered the regulatory environment considerably, the COVID-19 crisis may be used as a genuine stress test to assess which laws are effective and which areas of the financial industry require (ongoing) improvement.

Born et al. (2020) stressed the lethal influence in assessing externality. In the early phases of an outbreak, people may reasonably anticipate the risk of subsequent illnesses. Policies can be put in place to lessen the risk. In this instance, people can work from home, decreasing the financial burden of mitigation efforts. Born et al. (2020) expanded on this by looking at a model with different departments that can work from home, with its epidemiological considerations. They fitted models using data from several sectors and showed that model predictions match health and economic performance data. The writers presented the findings of numerous studies. Mask laws are unquestionably helpful, but they aim to reduce future mortality. Other political actions, such as restaurant, bar, and gym closures, have also resulted in fewer deaths, which is similar to the findings of some scholars who found that increasing the participation of government authorities can mitigate the impact of disease outbreaks (Shang et al., 2021). Additional measures may not be successful, such as liquidating medium- and low-risk businesses. It is critical to determine causation and correlation while reviewing the outcomes of a thesis study. The authors conducted several experiments to discover causal linkages, including examining the influence of state policies on small counties and comparing counties in the same state.
The COVID-19 shock’s progression and the financial system sector it hit were unanticipated. The bond market is at the core of the financial crisis to a considerable extent. During the peak of the COVID-19 crisis in March and April 2020, (Beraha and Đuričin, 2020; D’Adamo et al. 2020; Shen et al. 2020) researched this market. Financial market turbulence is a major source of anxiety since there is a risk of a domino effect on the actual economy. For example, the GFC evidence vividly reveals this domino effect as corporations struggle to secure funding for investments and operations. Recent events raise serious concerns about whether businesses are better prepared for potential financial crises. The elasticity of the corporation altered considerably after the stock market meltdown induced by COVID-19 in February and March 2020, according to Fahlenbrach, Rageth, and Stulz (2021). They believe that companies with higher financial flexibility must lower the COVID’s impact compared to those with less flexibility since they can rapidly replace liquidity shortfalls. They discovered that firms with flexible finances (liquidity, short-term debt, and (late 2019) long-term debt) did well during stock market lows, whereas companies with rigid stock prices dropped. It is worth mentioning that the performance variability persisted during the ensuing equities market surge.

As the earlier studies show, the COVID-19 pandemic significantly impacted the financial markets. This pushed the investors to invest in safer types of assets. Hence those assets with higher risks, including the green asset, will find more difficulties in accessing finance that would endanger the achievement of the climate-related goals and the carbon neutrality targets (Yoshino et al. 2020; 2021a and b; Taghizadeh-Hesary et al. 2021b; Saboori et al. 2017; Li et al. 2022). The contribution of this study to the literature is to examine challenges in Chinese provinces’ coastal tourism and green economic growth in the wake of the COVID-19 pandemic. Coastal tourism was selected as a sector that was neglected in the literature; however, it has a significant role in boosting the green economy, especially in rural coastal areas.

3 Data and empirical analysis

The tourism sector and green investment data were collected from the China provinces of Zhejiang, Fujian, and Shandong coastal regions to conduct our empirical analysis. Preventive health precautions data were collected through an interview during the COVID-19 pandemic. They were chosen at random during data collection, depending on their availability. This paper selected COVID-19 data from March 2020 to April 2021 from the Wuhan Health Commission and the National Health Commission of the People’s Republic of China. The selection of the variables was based on this study’s objective and literature review.

3.1 Data analysis

We used Generalized AutoRegressive Conditional Heteroskedasticity (GARCH) in our empirical analysis. GARCH is a statistical model used in analyzing time-series data where the variance error is believed to be serially autocorrelated.
GARCH models assume that the variance of the error term follows an autoregressive moving average process. Table 1 shows the outcome of the GARCH model, including means, median, and standard deviation values. On the other hand, the other two COVID-19 linked indices’ means (0.944) change from P1 to P2. Furthermore, for all GARCH models and all green and fish trade indices, the standard deviations of dynamic conditional correlation model (DCC) model parameters ratios changes by 20% from P1 to P2. The standard deviation of the time-varying hedge ratio anticipated from the DCC model for the fish trade index drops from P1 to P2. Table 1 presents that the orders of magnitude of overlay proportions are influenced by the conditional correlation fluctuations between the hedged asset and the futures contracts. The COVID-19 pandemic appears to have an impact on this type of behavior. While the COVID-19 pandemic infection affects fish trade and green investment production in China, this result equates to increased market instability.

As shown in Table 1, this study period is P2, which runs from March 20, 2020, until September 30, 2021. The model correlation with two green trade inputs indicators increased by 20 to 25%, and the mean 0.811 and 0.797 values increased by 5% in starting COVID-19 period. The asymmetric dynamic conditional correlation model (ADCC) is an example of a conditional correlation model. The standard deviation values output indicators: 0.172% for the green-fish trade and 0.422% for the green investment increased by 30% in each region.

| Table 1 | Model descriptive analysis |
|---------|---------------------------|
|         | COVID- tourism sector | Green- tourism sector | Financial markets |
| P1      | P2            | P1     | P2     | P1     | P2     |
| CCC     |                |        |        |
| Mean    | 0.888        | 1.040  | 1.041  | 0.911  | 0.966  | 0.992  |
| Median  | 0.888        | 1.055  | 1.041  | 0.910  | 0.955  | 0.941  |
| Std. Dev| 0.066        | 0.040  | 0.199  | 0.231  | 0.009  | 0.301  |
| DCC     |                |        |        |
| Mean    | 0.944        | 0.621  | 0.811  | 0.677  | 0.888  | 0.591  |
| Median  | 0.954        | 0.796  | 0.855  | 0.711  | 0.913  | 0.700  |
| Std. Dev| 0.081        | 0.401  | 0.130  | 0.648  | 0.109  | 0.677  |
| ADCC    |                |        |        |
| Mean    | 0.941        | 0.741  | 0.910  | 0.914  | 0.910  | 0.931  |
| Median  | 0.967        | 0.740  | 0.944  | 1.166  | 0.891  | 0.995  |
| SD      | 0.069        | 0.097  | 0.245  | 0.615  | 0.168  | 0.338  |

P1 and P2 refer to the time covered by the study; DCC = dynamic conditional correlation model; ADCC = asymmetric dynamic conditional correlation model; Source: Authors’ calculations.
3.2 Empirical analysis

The empirical studies used for green investment financial modeling have gained popularity. The initial application of regime-swapping is in modeling recession and business cycle growth, reflecting the term for a long time pattern of sequence of economic gradually (Hamilton, 1989). The regime model is a swapping prototype covering price changes, novel energetic pricing, and basics that last several following a change. The technique became popular in financial modeling (Bollain-Parra et al., 2021).

The swapping Markov model is well defined as follows:

\[ y_t = \beta S_t + \pi_1, S_{yt} - 1 + \pi_2, S_t x_t - 1 + \theta S_t \mu_t, \mu_t \sim iid(0, 1) \]  

(1)

where \( y_t \) is the endogenous variable impacted by the lag of the endogenous variable \( y_{t-1} \), i.e., the lagged-dependent factor, \( x_t - 1 \) is the exogenous lag, \( S_t \) donates procedure regime at period \( t \), and \( \mu_t \) is present the stochastic error terminology. However, regime model flipping can affect the entire distribution; it is more limited in its impact on the model’s intercept \( \beta S_t \), autocorrelation \( \pi_t, S_t \), and volatility \( \theta S_t \). (Bollain-Parra et al., 2021). Our suggested framework considers that an exogenous factor shifts between two regimes based on the Markov swapping model’s posterior probability from the state \( j \) to state \( i \) which are stated as:

\[ P_{ij} = \Pr(S_t = j | S_{t-1} = i), \text{ where } i = 1, 2 \text{ and } j = 1, 2. \]  

(2)

The chance of a regime shift for any two-chain state is determined by the amount of time expended of the regime time-varying model and uses Markov transition possibilities,

\[ P_{1j} + P_{2j} = 1 \text{ for } j = 1, 2 \text{ and } P_{1i} + P_{2i} = 1 \text{ for } i = 1, 2. \]  

(3)

where swapping regime Markov framework \( i \) is equal to \( 1/(1 - P_{ii}) \). The long-time we spend in regime \( i \), the greater the parameter \( P_{ii} \). The \( S_t \) is an exogenous variable in regimes one and 2, which reflect lower and higher price product green investment financial modeling. The specifics of these strategies are described in-depth (Hamilton, 1989). For the sake of convenience, the specification of Eq. (1) can be written as follows:

\[ \ln Y_t = \beta_0, S_t + \beta_1, S_t \ln Y_{t-1} + 1 + \beta_2, S_t \ln X + \mu_t \]  

(4)

The assessed parameters contain lag of age \( (age - 1) \), lag of education \( (educ - 1) \), lag of fishes \( (fish - 1) \), lag of GDP \( (GDP - 1) \), lag of Gender \( (Gender - 1) \), lag of Health facility \( (HF - 1) \), lag of Occupation \( (OP - 1) \). The survey locations were carefully chosen to encompass the coastal areas of Zhejiang, Fujian, and Shandong coastal regions. Most of the inhabitants here rely on the marine (small-scale) tourism sector for their livelihood.
3.3 Panel data models

The panel data technique was used to analyze each indicator’s fixed and random effect models. The panel effect model input and output indicators calculated the COVID-tourism sector, green-tourism sector, and financial markets. For all of the observations under investigation, the dependent variable is comparable. In the random effect model, on the other hand, firms directly affect unobservable human characteristics that are unrelated to the dependent variable. The following is the panel data green investment regression equation used in this study:

\[
DFMR_{it} = \beta_0 + \beta_1 \text{COVID-19}_{it} + \beta_2 \text{LMCAP}(-1)_{it} + \epsilon_{it}
\]  

(5)

\(DFMR_{it}\) denotes daily fish market returns of the firm I at time t; \(\text{COVID-19}_{it}\) represents the daily growth in total COVID-19 cases and daily growth in total death cases due to COVID-19 in time t and remains constant for every firm I and \(\text{LMCAP}(1)_{I}\) represent the lagged value of firm factors for which the log of the daily market capitalization of the firm I at time t is taken into account. In addition, I stands for the total number of businesses, t for the study period, and the error term of the firm I at time t.

4 Empirical results

4.1 GARCH data analysis

Based on the GARCH models, results from estimation for Panel A: exponential general autoregressive conditional heteroskedastic (EGARCH), Panel B: conditional correlations, Panel C: marginal skewness and kurtosis parameters, and Panel D: Residual diagnosis are provided in Table 2. The recent green investigation shocks on financial markets have substantially impacted the fish trade volatility. It is also clear that the anticipated volatility has not changed. For the P1 period, the result is valid. Volatilities in the COVID-19-related stock indexes are conditional on previous knowledge. Recent shocks, as well as lag volatility, have a substantial impact on current volatility.

As shown in Table 2, the correlations between financial markets and green investments are all significant. The DCC-GARCH finding implies that recent COVID-19-related shocks (7.923%) can explain a considerable portion of the pairwise correlations, with the Panel A, B, C, and D estimation (4.319%). The panel A test demonstrates that neither the standardized residuals nor their squares have autocorrelations.
Table 2: The bivariate GARCH models

|                                | Tourism sector | COVID- tourism sector | Green - tourism sector | Financial markets – tourism sector | After Covid-19 - the tourism sector | Tourism sector – green finance |
|--------------------------------|----------------|-----------------------|------------------------|------------------------------------|-------------------------------------|--------------------------------|
|                                | P1             | P2                    | P1                     | P2                                | P1                                  | P2                                |
| **Panel A: Individual EGARCH estimates** |                |                       |                        |                                    |                                     |                                    |
| $\lambda_{11}$                 | $-0.190^{***}$ | $-1.301^{***}$         | $-0.184^{***}$         | $-1.400^{*}$                       | $-14.644^{***}$                     | $-7.013^{***}$                     |
| $\lambda_{21}$                 | $0.119^{***}$  | $-0.188^{***}$         | $0.131^{***}$          | $0.194$                            | $-0.092$                            | $0.760^{***}$                      |
| $\lambda_{31}$                 | $4.12E-04$     | $-0.822^{***}$         | $-0.008$               | $0.281^{**}$                       | $0.235^{*}$                         | $0.316^{***}$                      |
| $\lambda_{41}$                 | $0.989^{***}$  | $0.835^{***}$          | $0.989^{***}$          | $0.844^{***}$                      | $-0.839^{***}$                      | $0.123$                            |
| $\lambda_{12}$                 | $-0.269^{***}$ | $1.742^{***}$          | $-0.295^{***}$         | $3.044^{***}$                      | $-1.419^{***}$                      | $-3.719^{***}$                     |
| $\lambda_{22}$                 | $0.143^{***}$  | $-0.291^{***}$         | $0.174^{***}$          | $0.103$                            | $-0.577^{***}$                      | $0.071$                            |
| $\lambda_{32}$                 | $-0.01$        | $-0.764^{***}$         | $-0.027^{***}$         | $-0.714^{***}$                     | $-0.189$                            | $-0.757^{***}$                     |
| $\lambda_{42}$                 | $0.981^{***}$  | $0.778^{***}$          | $0.980^{***}$          | $0.665^{***}$                      | $0.463^{*}$                         | $0.589^{***}$                      |
| **Panel B: Conditional correlations** |                |                       |                        |                                    |                                     |                                    |
| $DCC$                          |                |                       |                        |                                    |                                     |                                    |
| $\rho_{12}$                    | $0.979^{***}$  | $0.981^{***}$          | $0.807^{***}$          | $0.570^{***}$                      | $0.857^{***}$                       | $0.713^{***}$                      |
| $\theta_{1}$                   | $0.133^{***}$  | $0.618^{*}$            | $0.032$                | $0.561^{***}$                      | $0.282^{***}$                       | $0.747^{***}$                      |
| $\theta_{2}$                   | $0.440^{***}$  | $-0.02$                | $0.379^{*}$            | $-0.104$                           | $0.035$                             | $0.002$                            |
| $ADCC$                         |                |                       |                        |                                    |                                     |                                    |
| $\delta_{1}$                   | $5.22E-10$     | $5.79E-09$             | $1.64E-09$             | $0.324^{***}$                      | $0.332^{***}$                       | $0.150^{**}$                       |
| $\delta_{2}$                   | $0.893^{***}$  | $0.428^{***}$          | $-0.994^{***}$         | $0.966^{***}$                      | $0.949^{***}$                       | $0.956^{***}$                      |
| $\delta_{3}$                   | $0.495^{***}$  | $0.659^{***}$          | $-0.306^{***}$         | $1.01E-09$                         | $0.357^{***}$                       | $0.432^{**}$                       |
| **Panel C: Marginal skewness and kurtosis parameters** |                |                       |                        |                                    |                                     |                                    |
| $DCC$                          |                |                       |                        |                                    |                                     |                                    |
| $s_{1}$                        | $0.05$         | $0.17$                 | $0.176$                | $198.848$                          | $0.911^{**}$                        | $-0.837$                           |
| $k_{1}$                        | $12.530^{***}$ | $5.78^{***}$           | $11.564^{***}$         | $-63.831$                          | $9.971^{**}$                        | $7.920^{***}$                      |
| $s_{2}$                        | $-0.026$       | $-0.565$               | $0.204$                | $-0.538$                           | $0.455$                             | $-0.865^{*}$                       |
| $k_{2}$                        | $13.490^{***}$ | $6.880^{***}$          | $6.982^{***}$          | $4.503^{***}$                      | $9.341^{***}$                       | $6.166^{***}$                      |
| $DCC$                          |                |                       |                        |                                    |                                     |                                    |
Table 2 (continued)

|                      | Tourism sector | COVID- tourism sector | Green- tourism sector | Financial markets – tourism sector | After Covid-19 - the tourism sector | Tourism sector – green finance |
|----------------------|----------------|----------------------|----------------------|-----------------------------------|------------------------------------|-------------------------------|
|                      | P1 | P2 | P1 | P2 | P1 | P2 | P1 | P2 | P1 | P2 | P1 | P2 | P1 | P2 | P1 | P2 |
| s1                   | −0.255 | −0.038 | −0.37 | 0.513 | 0.39 | 0.258 | 0.086 | 0.495 | −0.841 | −22.223 | −0.967* | −0.022 |
| k1                   | 6.397*** | 4.158*** | 10.643*** | 11.505 | 6.988*** | 8.908*** | 8.307 | 7.525 | 10.804*** | 134.65 | 7.310*** | 8.203 |
| s2                   | 0.043 | −0.622** | 0.238 | −0.717** | 0.08 | −0.857** | −0.057 | −0.027 | 0.577 | 1.761* | −0.498 | −0.533 |
| k2                   | 6.223*** | 4.836*** | 5.314*** | 3.476*** | 6.048*** | 5.298*** | 5.444 | 2.942 | 8.092*** | 9.171*** | 6.258*** | 7.23 |
| ADCC                 | s1 | −0.059 | −0.609 | 0.056 | 2.332 | 0.653 | −0.27 | 0.151 | 0.617 | −1.149 | −1.958 | −1.267 | −0.466 |
|                      | k1 | 6.973*** | 6.476* | 9.828*** | 16.606 | 6.987* | 12.683** | 10.194 | 6.974 | 17.022 | 25.915 | 7.195 | 8.106 |
|                      | s2 | 0.439* | 0.8 | 0.388* | −0.428 | 0.026 | −0.74 | 0.095 | −0.003 | 0.379 | −0.535 | −0.475 | −0.507 |
|                      | k2 | 6.494*** | 7.511 | 6.834*** | 4.485*** | 6.824* | 6.960*** | 5.553* | 2.946*** | 7.519*** | 5.098** | 5.367* | 6.235* |
| Panel D: Residual diagnosis | Q(12) (i = 1) | 3.265 | 11.325 | 3.32 | 8.235 | 7.265 | 7.235 | 11.325 | 12.356 | 5.36 | 13.26 | 8.3265 | 11.223 |
|                      | Q2(12) (i = 1) | 18.667 | 7.677 | 18.882 | 2.746 | 18.244 | 11.722 | 7.766 | 2.474 | 7.741 | 8.44 | 6.2028 | 7.47 |
|                      | Q(12) (i = 2) | 13.235 | 9.326 | 11.235 | 11.325 | 12.565 | 11.225 | 12.653 | 7.235 | 11.235 | 8.32 | 8.3265 | 12.652 |
|                      | Q2(12) (i = 2) | 26.062 | 7.222 | 18.82 | 6.276 | 7.26 | 4.666 | 46.18 | 8.486 | 16.272 | 6.67 | 6.4272 | 4.642 |
|                      | AIC (CCC) | −6.846 | −6.687 | −4.072 | −2.74 | −4.243 | −2.66 | −4.27 | −4.676 | −4.216 | −2.724 | −4.027 | −2.708 |
|                      | AIC (DCC) | −6.86 | −6.041 | −2.706 | −2.206 | −2.782 | −2.276 | −4.078 | −4.677 | −4.021 | −2.417 | −2.772 | −2.711 |
|                      | AIC (ADCC) | −6.602 | −6.222 | −4.061 | −2.422 | −4.107 | −2.772 | −4.122 | −4.666 | −4.076 | −2.421 | −2.726 | −2.841 |

*Significance at the 10% levels, **significance at the 5% levels, ***significance at the 1% levels; Source: Authors’ calculations
Table 3  COVID-19’s impact on Zhejiang, Fujian, and Fujian provinces’ fish trade

| Questions                                      | Answer range | Zhejiang (%) | Fujian (%) | Shandong (%) |
|------------------------------------------------|--------------|--------------|------------|--------------|
| Monthly income before Covid-19                 | < 10,000     | 6.67         | 1.00       | 8.00         |
|                                                | 10,000–19,000| 79.05        | 46.00      | 48.00        |
|                                                | 20,000–29,000| 11.43        | 26.00      | 14.00        |
|                                                | ≥ 30,000     | 2.86         | 27.00      | 30.00        |
| Monthly income after Covid-19                  | < 10,000     | 36.19        | 28.00      | 72.00        |
|                                                | 10,000–19,000| 56.19        | 49.00      | 22.00        |
|                                                | 20,000–29,000| 7.62         | 17.00      | 4.00         |
|                                                | ≥ 30,000     | 0.00         | 6.00       | 2.00         |
| COVID-19 affected                              | Lack of labor| 25.63        | 84.00      | 25.00        |
|                                                | Low price of hotels | 100 | 55.00 | 67.00 |
|                                                | Concern of infection | 32.65 | 48.00 | 29.00 |
|                                                | Tourism transportation problems | 24.36 | 57.00 | 91.00 |
|                                                | Lack of processing systems | 0.00 | 0.00 | 14.00 |
|                                                | Lack of ice/Higher price of ice | 14.29 | 6.00 | 0.00 |
| Tourism before days                           | 20–22        | 7.62         | 0.00       | 0.00         |
|                                                | 23–25        | 15.24        | 0.00       | 0.00         |
|                                                | > 25         | 39.05        | 0.00       | 0.00         |
| Tourism after corona days                     | 17–19        | 13.33        | 0.00       | 0.00         |
|                                                | 20–22        | 31.43        | 0.00       | 0.00         |
|                                                | 23–25        | 17.21        | 0.00       | 0.00         |
|                                                | 1–2 trips    | 10.32        | 38         | 75           |
|                                                | 3–4 trips    | 24.32        | 51         | 11           |
|                                                | 5 and above trips | 0.00 | 5      | 0            |
| Tourism comparison to other years             | Less         | 100          | 80         | 87           |
|                                                | Higher       | 0            | 1          | 0            |
|                                                | Same         | 0            | 18         | 0            |
|                                                | Stopped/No   | 0            | 3          | 12           |
| Special support received by tourism           | Yes          | 0            | 24         | 4            |
|                                                | No           | 100          | 76         | 96           |
|                                                | Sources of support |              |            |              |
|                                                | Govt. organizations | 0  | 0 | 3 |
|                                                | NGOs         | 0            | 20         | 0            |
|                                                | Local        | 0            | 2          | 0            |
|                                                | Is it sufficient? |              |            |              |
|                                                | Yes          | 0            | 2          | 0            |
|                                                | No           | 0            | 25         | 5            |
| Expected support from the government          | No expectation| 0            | 18.00      | 0.00         |
|                                                | Food rations | 62.32        | 55.00      | 71.00        |
|                                                | Financial support | 49.36 | 12.00 | 39.00 |
|                                                | Loan without/less interest | 0.00 | 22.00 | 0.00 |
|                                                | Protective equipment | 33.32 | 0.00 | 0.00 |
|                                                | Alternative income source | 0.00 | 0.00 | 2.00 |
|                                                | Life insurance | 0.00 | 2.00 | 0.00 |
| Damage tourism BOATS                          | Yes          | 100          | 12         | 62           |
|                                                | No           | 0            | 88         | 38           |

Source: Authors Calculation
4.2 Impact of COVID-19 on the coastal tourism sector in China

COVID-19 has harmed coastal tourism in China, as demonstrated in Table 2 (A). Table 2 shows the impact of COVID-19 on the Fujian province fish trade, which is the main component of the coastal tourism revenue in the province.

Before COVID-19, Zhejiang tourism was 20–25 days per month, while daylight fishing was restricted to less than 20 days throughout the trial period (Table 3). Tourism expeditions lasting more than one day also dramatically decreased at each study location, from 7 to 15 to 4 to 6 h (Table 3). Most fishermen (76–100 percent) did not report any specific help throughout the pandemic at the three survey sites. The few fishermen who got help said they were “insufficient” (Table 3). Regardless of geographic area, Fishermen favored distribution (54–68 percent) and financial help (13–50.48 percent) when asked what sort of support the government aims to offer the tourism sector’s did not expect the government to help them with money or food. According to all responders to Zhejiang, fishing nets and boats deteriorated due to a lack of activity, resulting in fewer tourism excursions.

Conversely, 38.10 percent of respondents said the economic issue would drop fishing. 36% claimed the crisis would drive tourism out of business in Shandong, while 46% said the same in Fujian. The fishing business would be badly harmed if the recent corona epidemic continued, according to all respondents from Zhejiang (100%) and the majority of respondents from Barguna (84%) and Fujian (69%). When asked how they plan to deal with the aftermath of the Corona crisis, 33.33 percent of Zhejiang tourism-related people said they needed to enhance their transportation.

In comparison, 46 percent of Fujian and Barguna fishers stated they had no idea. (See Table 3B) The following two findings’ statements emphasize fishermen’s concerns: (“We are not terrified of the Corona, but we are afraid of starvation,” and ”The Corona is not a poor man’s sickness, but a wealthy man’s ailment,” respectively.)

4.3 Kruskal–Wallis H test

The Kruskal–Wallis model is performed to see if the drop in monthly income following COVID-19 differs by a group of fishermen and by geographic location since the "decrease in monthly income" variable is not normally distributed. During COVID-19 (p = 0.05), tests revealed a statistically significant difference in monthly income between three groups of fishermen (p = 0.05) and three geographic regions (p = 0.05). More specifically, in the group of fishermen, the average monthly income declined by 13.23 percent to 49.07 percent, and in the geographical region, it decreased by 15.43 percent to 64.68 percent. Captains and proprietors lost the most money (49.07 percent), and Fujian was the most affected geographically (64.68 percent), as shown in Table 4.
Table 4 shows the impact of COVID-19 on the average monthly earnings of fisherman.

| Type of tourism                   | PRE-COVID-19                  | POST COVID-19                  | % income decreased | P-value |
|----------------------------------|-------------------------------|--------------------------------|--------------------|---------|
| Tourism                          | 166.37±40.33 (US dollar)     | 43.57±91.70 USD dollar        | 31.50              | 0.0001  |
| Skippers and Boat owners         | 366.21±117.91 USD dollar     | 181.28±117.29 USD dollar      | 52.09              |         |
| Others (Carpenters and Engineers)| 277.49±31.59 USD dollar      | 41.29±41.29 USD dollar        | 19.29              |         |
| Geographical location            | Income before COVID-19        | Income reduction after the start of COVID-19 | % of Income reduction | P-value |
| Zhejiang                         | 171.18±60.27 USD dollar      | 26.42±93.40 USD dollar        | 15.43              | 0.0001  |
| Fujian                           | 252.61±161.90 USD dollar     | 163.40±110.32 USD dollar      | 64.68              |         |
| Shandong                         | 256.14±120.58 USD dollar     | 103.73±112.13 USD dollar      | 40.50              |         |
| Physical location                | Fishing frequency before COVID-19 | Reduction in fishing frequency after start of COVID-19 | % of Fishing reduction | P-value |
| Zhejiang                         | 17.59±11.12                  | 3.28±2.57                     | 18.65              | 0.0001  |
| Fujian                           | 2.86±0.81                    | 1.26±0.83                     | 44.05              |         |
| Shandong                         | 3.08±0.93                    | 0.22±0.76                     | 7.14               |         |

Source: Authors’ calculations
4.4 Panel Co-integration test

We use a panel co-integration test when the series has a unit root. This technique determines whether two or more variables have a long-term relationship. There are four test statistics within the dimension built on the (panel co-integration statistics); there are four test statistics: panel v-statistics, panel rho-statistics, panel PP-statistics, and panel ADF-statistics. Second, the cluster test was based on three tests, namely Group rho-statistic, Group PP-statistics, and Group ADF-statistics, to determine the relationship between breadth (group means panel co-integration data). Tables 5 and 6 show the results of the panel co-integration test for the GDP and CE models, respectively.

In Table 6, the results of the panel co-integration test for the GDP model show that statistics and weighted statistics from panel PP-statistics and panel ADF-statistics.

5 Conclusion and policy recommendations

The COVID-19 pandemic has posed huge hurdles to the green economic recovery, tourism sector, and financial markets. Therefore, this paper examines challenges in 3 Chinese provinces’ tourism markets using emerging financial data from the COVID-19 period. Tourism’s related sectors’ income falls due to this, regard-
less of where people live. Fishers’ earnings dropped by 26%, while captain and owner’s earnings dropped by 49%. During the pandemic, the number and duration of tourism trips dropped in all study locations. COVID-19 can harm not just the income and livelihoods of coastal tourism but also China’s whole economy. COVID-19 has substantially influenced the earnings and livelihoods of China’s small enterprises in the coastal tourism-related sector. Across all research regions, anglers’ higher knowledge of COVID-19 is positively connected with increased adoption of preventive measures. COVID-19’s preventative lockdowns prohibited fish from being transported, resulting in labor scarcity, reduced fish and rice availability, and fluctuated tourism market prices. People’s income falls due to this, regardless of where they live.

2. Tourism sector earnings dropped by 26%, while captain and owner’s earnings dropped by 49%. During the pandemic, the number and duration of tourism trips dropped in all study locations. Tourism and declining income are more widespread in China Governments, non-governmental groups, and the business sector have provided minimal assistance to fishermen. Nevertheless, it also has the potential to harm China’s whole economy.

5.1 Policy recommendations

1. Knowledge of China’s tourism sector related to people’s preventative conduct is linked to higher literacy or education levels. As a result, providing educational opportunities for tourism sector-related people and their families is critical. Better education is linked to increased understanding and adherence to COVID-19 or other disease prevention measures. Primary care informants (local physicians, community health clinics) can increase knowledge about and encourage safety because most fishers in the research region have limited access to local doctors. Local government agencies should promote and oversee local health services to enhance tourism sector-related people’s livelihoods. Rather than relying on traditional medications, tourism sector-related people should be encouraged and assisted in seeking better medical care at local government-run clinics and public hospitals. Most low-income fishers lack the basic health and safety equipment (disinfectants, masks, etc.) to protect themselves in the event of a pandemic. As a result, official assistance for public health and safety items can assist tourism sector people in maintaining their preventive measures.

2. Giving health insurance to registered tourism sector-related people and conducting periodic medical examinations at government-sponsored tertiary or specialized medical care institutes can increase the immunity of this sector toward future epidemics and pandemics.

3. Transportation limitations are considered key issues are influencing tourism in all research areas. During the fishing season, registered fishers could not receive existing social support due to transportation constraints, exacerbating the fishers’ food insecurity. Hence infrastructure development in the coastal areas is key to enhancing food security and ensuring the health of the residents.
5.2 Future research

The pandemic is having a severe and direct impact on various economic sectors. Researchers should address the critical nexus of health and the economy. Future studies should open up new insights by developing dynamic macroeconomic models that assess the economic and health impacts of the pandemic using dynamic models.

Declarations

Conflict of interest We (authors) confirm that we have read, understand, and agreed to the submission guidelines of the journal. We confirm that all authors of the manuscript have no conflict of interests to declare. We confirm that the manuscript is the authors’ original work and the manuscript has not received prior publication and is not under consideration for publication elsewhere.

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