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FINANCIAL CONTAGION OF THE ECONOMY TOURISM SECTOR IN DIFFERENT COUNTRIES DURING THE COVID-19 PANDEMIC

Abstract. The purpose of the study is to identify the financial contagion that spread through the channels of the stock market in the economy tourist segment of different countries during the COVID-19 pandemic. The tourism industry has proved to be extremely susceptible to the pandemic shock, so it is necessary to have objective quantitative estimates of this susceptibility. The study is based on an extensive empirical base, including data on stock indices that reflect the stock quotes of the largest travel companies. The method of advanced correlation analysis was used as a specific method of detecting financial contagion, based on the Forbes-Rigobon approach. The classic Forbes-Rigobon test was supplemented with a sliding dynamic method, which made it possible to identify the intensity of country contagion in the tourism sector. The peculiarities of understanding the financial contagion essence in economic systems are revealed. A brief overview of modern research on the infection problems in tourism is made. A statistical analysis of COVID-19 impact on a number of countries has been carried out, the pandemic features and consequences for the tourism sector have been identified. For 5 countries (China, Taiwan, Great Britain, Greece and Turkey), test statistics for financial contagion are calculated. Dynamic estimates of the contagion were obtained, which allowed us to obtain a picture of the scale and intensity of financial contagion in international tourist markets during the pandemic. The recipients of financial infection from China were the tourist markets of Taiwan and Greece. At the same time, these countries turned out to be transmitters of financial contagion at the same time – with varying intensity, they transmitted it to other tourist markets.

Keywords: financial contagion, tourism, COVID-19 pandemic, testing, correlation



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«ФИНАНСОВОЕ ЗАРАЖЕНИЕ» ТУРИСТСКОГО СЕКТОРА ЭКОНОМИКИ В РАЗНЫХ СТРАНАХ В ПЕРИОД ПАНДЕМИИ COVID-19

Цель исследования, представленного в данной статье, заключается в выявлении «финансового заражения», распространившегося по каналам фондового рынка в туристском сегменте экономики разных стран в период пандемии COVID-19. Отрасль туризма оказалась чрезвычайно восприимчива к пандемическому шоку, поэтому необходимо иметь объективные количественные оценки этой восприимчивости. Исследование основано на обширной эмпирической базе, включающей данные о фондовых индексах, которые отражают котировки акций крупнейших туристских компаний. В качестве конкретного инструмента выявления «финансового заражения» выступал метод продвинутого корреляционного анализа, использующий подход Форбс-Ригобона. Классический тест Форбс-Ригобона был дополнен скользящим динамическим методом, позволившим выявить интенсивность странового «заражения» в туристском секторе. Раскрыты особенности понимания сущности «финансового заражения» в экономических системах. Сделан краткий обзор современных исследований по проблематике «заражения» в туризме. Проведён статистический анализ влияния COVID-19 на ряд стран, выявлены особенности и последствия пандемии для туристского сектора. В отношении 5 стран (Китая, Тайваня, Великобритании, Греции и Турции) рассчитана тестовая статистика на «финансовое заражение». Получены динамические оценки «заражения», позволившие получить картину масштабов и интенсивности «финансового заражения» на международных туристских рынках в период пандемии. Реципиентами «финансового заражения» из Китая оказались туристские рынки Тайваня и Греции. При этом данные страны оказались одновременно и трансмиттерами «финансового заражения» – с разной интенсивностью они передавали его на другие туристские рынки.

Ключевые слова: финансовое заражение, туризм, пандемия COVID-19, тестирование, корреляция



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Introduction

In modern conditions, the tourism and hospitality industry is very sensitive to external and internal factors such as uncertainty, financial instability, crises and pandemics. Any shock (for example, natural, technogenic or financial) can jeopardize tourist demand, lead to losses in the companies' activities operating in the tourism sector. Compared to other industries, tourism is particularly vulnerable to diseases, natural disasters and crises (see [4, 6]). However, it is also able to quickly recover from shocks, which makes it attractive for business and tourists themselves.

Nowadays the main attention of researchers is focused on the tourism sector response to the COVID-19 pandemic. There are systematic reviews and empirical studies that examine the features and nature of the pandemic crisis course in the tourism sector of the economy, its consequences and measures to combat and counter [12, 15]. Various works emphasize that tourism has become one of the industries that has experienced the greatest severity of the pandemic. Moreover, the economy of many countries before the pandemic was very closely connected with tourism. For example, the share of Spanish tourism in 2019 was 14.3% of GDP. The tourism industry contribution has exceeded the other systemic economy sectors contribution such as construction and retail.

It should be noted that any crisis, including a pandemic one, is not static, but spreads in different directions and with different intensity. This circumstance allows us to consider crisis processes from the standpoint of the financial contagion theory, an approach popular among economists that focuses on the transmission of negative shocks through various channels from one market to another one. In this article, we will consider the country aspect of the financial contagion transmission in the tourism sector. For this purpose, we will briefly review the work on this issue and present the results of our own study, which made it possible to identify the extent and direction of infection in tourism during the pandemic crisis.

Financial contagion and tourism contagion: a brief review of approaches

The problem of financial contagion became an object of attention in economic research in the late 1990s after a series of crises in emerging markets. More than a decade later, the global financial crisis and Europe's sovereign debt crisis have demonstrated the importance of identifying which transmission channels are relevant during different crises. The COVID-19 pandemic has further heightened interest in the mechanisms and consequences of infection, both in the biomedical and economic sense.

Theoretical and methodological approaches to financial contagion are extensive – there are various interpretations of understanding the essence and characteristics of contagion in economic systems, various theories of contagion and empirical methods for measuring it are put forward. Problems associated with the results of estimating contagion in the context of countries and sectors of the economy are discussed (see [11]). If we abstract from the various details and subtleties of this approach, then financial contagion should be understood as increased dependence between countries or markets after some kind of shock, i.e. due to the negative momentum during the crisis compared to the pre-crisis period, inter-market relations can change dramatically and the economy can lose its stability. At the same time, contagion often looks like a “chain reaction” – the initial shock first affects only certain markets or countries, but then spreads to other markets or countries through various channels with varying intensity. The channels themselves may differ depending on the crisis or region. The main channel is, of course, the financial channel, but the transmission of infection through the trade channel is also possible (it is relevant for countries dependent on exports and imports).

In methodological terms, it is very important to be able to accurately and correctly identify the infection facts. For this purpose, there are special techniques and methods that, at a quantitative level, make it possible to obtain adequate estimates of the extent and intensity of

infection. Unfortunately, these methods have not been used in studies of contamination in tourism systems, although the topic of contamination in tourism is present. Our analysis of contemporary publications allows us to distinguish the following two directions.

The first direction is associated with social contamination, which manifests itself through behavioral mechanisms and interpersonal relationships in tourism. In the most general case, social contagion refers to the spread of an idea or practice through a social system, which occurs through social interactions within this system. Moreover, this spread may not have a negative connotation; contagion can be seen as a kind of ideas or activities diffusion. However, there is also a negative aspect – in tourism, for example, such infection is often associated with deviant behavior, which is understood as a deliberate violation of the law, social norms, corporate policy norms, and principles of interaction with customers [10]. You can even give hypothetical examples of such deviant contagious behavior. In particular, a tourist who visited country A, in response to a simple problem unresolved by the hotel manager, is rude to him and writes a negative and biased review on the online platform about the entire hotel. In addition, he takes with him some property of the hotel. The hotel manager, outraged by this behavior, deliberately delays calling a taxi and suggests to the driver that he charge this tourist a higher fee. In addition, the manager adds the tourist to the “black list” of hotel chain clients, which is used by other employees. The process of such infection growth can continue (for example, a tourist can share his “trophies” on social networks, thereby provoking such behavior of his friends and subscribers who are going to go to country B), involving new participants and launching new channels for transmitting the initial negative impulse (e.g. an unresolved problem in a hotel).

The second direction in the study of infection in tourism, which we found in foreign publications, is more of an applied nature. It is related to real medical infection and is associated with the use of modern technologies, in particular,

service robots as a tool that allows, if necessary, to minimize contacts between the tourist and the staff of travel companies. Indeed, today the clients of many hotel and other tourism enterprises have become more sensitive to the potential risks of infectious diseases. Despite the presence and even increase of tourist needs, there is a parallel trend towards social avoidance. In [7], this trend is illustrated by the use of service robots by customers when choosing a hotel in a crowded place. Service robots as non-contact and atypical service providers are becoming more preferable in an environment where people feel signals of infection. During the pandemic, this was empirically confirmed – experiments were conducted with visitors to Chinese restaurants, which showed that the risks of infection motivate customers to choose service robots rather than use the traditional service [8]. Service robots are associated with less interpersonal contact, consistent with the social avoidance trend driven by the infection danger.

In general, if we talk about the infection effects in tourism, then the financial aspect of this problem is practically not affected in modern literature. In our practical part, we set the task of filling this gap by obtaining estimates of infection by country during the pandemic. For this purpose, using data on the dynamics of sectoral tourism stock indices, we will test the hypothesis of infection in several paired bundles of the form “country 1 → country 2”, where country 1 is the supposed source of infection, country 2 is the supposed recipient of infection.

Data and methodology

To obtain estimates of financial contagion in tourism, the open resource Investing.com was used, from which daily data on sectoral stock indices were taken, including shares of companies in the tourism sector of the different countries economy. We limited the sample to the following set of 5 countries: China – FTSE China A 600 Travel & Leisure, Taiwan – Taiwan OTC Tourism, United Kingdom – FTSE 350 Travel & Leisure, Greece – FTSE Travel & Leisure, Turkey – BIST Tourism. Russia and a number of other countries attractive for

tourism were not included in our sample, since these countries do not use sectoral tourism indices.

It should be noted that sectoral stock indices do not reflect the full variety of relationships of the tourism economy sector, which, as you know, includes a number of sub-sectors, such as transport, catering, travel agencies and many other organizations providing tourism services. It is advisable to use other indicators that characterize the tourism development from different angles, in particular, tourist flows and expenses, company revenues, costs for a tourist product, etc. At the same time, due to stock one can detect fluctuations in the stock prices of the largest players in the tourism market. Their increased volatility is a harbinger of possible financial contagion; based on the dynamics of stock indices, one can suspect its presence. In addition, stock indices are high-frequency indicators (we analyzed daily statistics on them), which cannot be said about traditional tourism indicators (as a rule, either annual or monthly statistics are kept on them). High frequency allows you to form a large sample and get more reliable estimates of infection.

To identify the infection effects, it is necessary to distinguish between two periods: crisis and pre-crisis. We did this based on the official pandemic announcement date – March 11, 2020. The pre-crisis period covered the steady development of international tourism observed in 2019 and early 2020. The crisis period covered the first two waves of the pandemic. It was for these periods that data on stock indices were collected – more than 1500 observations were used.

Financial contagion was recorded using special test statistics (Forbes-Rigobon test), based on advanced methods of correlation analysis. It is widely used in foreign studies, but so far it is little represented in Russian publications and is absolutely not represented in tourism studies.

The Forbes-Rigobon (FR) test statistic for the infection transmission from country i to country j is:

$$FR(i \rightarrow j) = \frac{\frac{1}{2} \ln\left(\frac{1+\hat{\rho}_{y|x}}{1-\hat{\rho}_{y|x}}\right) - \frac{1}{2} \ln\left(\frac{1+\hat{\rho}_x}{1-\hat{\rho}_x}\right)}{\sqrt{\frac{1}{T_y-3} + \frac{1}{T_x-3}}}, \quad (1)$$

where $\hat{\rho}_x$ is an estimate of the standard correlation coefficient of tourism indices between countries i and j in the pre-crisis period x , $\hat{\rho}_{y|x}$ is an estimate of the heteroscedasticity-adjusted correlation coefficient of tourism indices between countries i and j in the crisis period y , T_x и T_y are the duration of the pre-crisis and crisis period.

$$\hat{\rho}_{y|x} = \frac{\hat{\rho}_y}{\sqrt{1+\delta \cdot (1-\hat{\rho}_y^2)}}, \quad (2)$$

where $\hat{\rho}_y$ is an the standard correlation coefficient estimate of tourism indices between countries i and j in the crisis period y , δ is the coefficient of growth in the tourism index volatility for country i in the crisis period compared to the pre-crisis period.

The null hypothesis (about the infection absence) assumes that at a given significance level α ($\alpha = 0.01$ or $\alpha = 0.05$) $FR < FR_{крит}$. If $FR > FR_{крит}$, then the null hypothesis is rejected. This means that transmission from country i to country j cannot be ruled out.

Results

Statistical Analysis of the Pandemic Impact on International Tourism

Anticipating our results on identifying the contagion effects in tourism, we briefly characterize the features of the pandemic manifestation and its consequences for the tourism sector of each country from the sample.

China. Chinese tourists were the most active visitors in the world before the pandemic. In addition, they actively traveled within the country – according to the Ministry of Culture and Tourism of the PRC in 2019, the number of such trips reached 6 billion, the total income from tourism amounted to 6.6 trillion yuan (almost 1 trillion dollars), and the tourism contribution to the economy – 10.9 trillion yuan (11% of GDP) [3]. In a

short time, China has become a destination that competes with such traditional tourism centers as France, Spain, and the USA. However, COVID-19 has changed the situation. China posted the highest rate of job losses in travel and tourism. In 2021, there were 8.9 million fewer jobs in this area than in 2019. At the same time, compared with other countries, China experienced a faster recovery of domestic tourism. In 2021, income from domestic tourism increased by 31%. This was achieved by increasing the tourist activity of urban residents, who took advantage of government initiatives number to support the tourism industry.

It is quite clear that since China was the coronavirus crisis source, preventing the infection spread and ensuring security were the top priorities. This country was the first to introduce strict quarantine measures and limited the movement of citizens. Then the state policy was formulated and implemented and appropriate security and support measures were taken. In particular, financial assistance was provided to travel companies, a range of services with the "safe" tag was launched, new insurance products were introduced in the tourism market, significant discounts were provided on hotel accommodation and entertainment events, the development of "cloud tourism" was supported, etc. [14].

Taiwan. This island nation is economically heavily dependent on tourism. In the pre-pandemic period, the main tourist flow was provided by geographically close Asian countries (out of almost 12 million tourists who came to the country in 2019, half of the guests are tourists from China, Japan, Hong Kong and South Korea). However, due to the COVID-19 pandemic outbreak, Taiwan has closed most tourist routes and imposed strict border controls, resulting in a sharp decline in inbound tourism. Thus, the total number of tourists in the first five months of 2020 amounted to only 1.2 million people [13].

At the same time, it is important to note

that Taiwan is considered one of the most effective regions in the world in combating the spread of COVID-19. The measures taken to contain the epidemic and the high degree of the healthcare system readiness made it possible to minimize the negative consequences. Tourism industry in the period 2020-2021 twice received assistance from the state, which allowed it to maintain employment and avoid bankruptcy. In 2022, the third assistance package was implemented, including the provision of \$ 439 million to the tourism business. Travel agencies, tour operators, hotels and service companies at the country's international airports received funds. Through subsidies, they continued to pay their employees 80% of their salaries until September 2022, which contributed to the tourism business support [5].

Great Britain. Before the pandemic, the tourism sector of the economy in this country accounted for a significant share. However, COVID-19 has seriously hit this sector – if in the third quarter of 2019 the inbound tourist flow amounted to almost 12 million people, then in the second quarter of 2020 it became 0.4 million people¹. Some recovery took place only towards the end of 2021; however, in general, the situation with tourism in the UK is one of the most difficult in Europe. The high intensity of the coronavirus spread has led to the introduction of government restrictions affecting the tourism sector.

At the same time, government measures were taken in the country to support this area. In particular, small businesses received subsidies in the amount of 10 thousand pounds, small hotels – grants in the amount of 25 thousand pounds [1, p. 92]. Tax incentives and preferential loans were also provided to cultural and tourism organizations and assistance was provided to those companies that were under the threat of bankruptcy. In general, this contributed to avoiding the negative scenario of the crisis development.

Greece. In pre-pandemic 2019, the tourism and travel industry contribution to the Greek

¹ Number of inbound visits to the United Kingdom (UK) from 1st quarter 2015 to 4th quarter 2021. URL: <https://www.statista.com/statistics/518938/inbound-visits-united-kingdom-uk-by-quarter/>.

economy was an impressive amount of 38.2 billion euros². In 2020, it has more than halved. In 2021, it was possible to partially compensate for the losses – the contribution reached 27.2 billion euros. This was done thanks to the economic policy pursued by the Greek government. It implemented a support plan with a budget of 24 billion euros to save tourism companies, hotels and their staff. A new employment support mechanism was introduced, VAT was reduced in some tourism industry segments (providing transport, catering services, travel agency activities), and the programs “Tourism for All” and “Public Tourism” were developed. This made it possible to improve the statistics. For example, in the period from January to August 2021, Greece was visited by 8.6 million tourists from different countries [9]. In general, after two years of quarantine, Greece is rapidly returning to pre-crisis levels, overtaking many competitors.

Turkey. Tourism has always played an important role in this country – in 2019, Turkey received a record number of foreign tourists (almost 52 million people) and expected to improve this figure in 2020. However, COVID-19 made adjustments. The export of tourism services decreased by 65.1% compared to 2019 (from \$34.5 billion to \$12.6 billion), employment in the tourism sector fell sharply (from 548.9 thousand people to 27.4 thousand people) [2, p. 44]. The main reason for this decline was the fact that the tourist flow was greatly reduced and many Turkish hotels did not receive safety certificates due to the pandemic. Therefore, about 30% of hotels in the 2020 season were completely closed.

During the pandemic, various tours (health, business, sightseeing, etc.) were canceled. Restrictions were placed on travel within the country. Turkish tourism has experienced the biggest crisis in history. Therefore, the authorities were forced to take a number of measures to stimulate demand. Thus, the Healthy Tourism program has been launched, under which all companies in the

tourism sector must have certificates confirming the level of hygiene, cleanliness and safety for the tourists' health.

Tourism financial contagion estimates in the country section

Since it seems logical to assume that shocks in tourism during the pandemic spread from China (the source country of the coronavirus infection itself), we first checked whether infection was observed in the “China → another country” paired bundles. Figure shows the calculations results, where the height of the columns corresponds to the Forbes-Rigobon test statistics value. The critical value was set based on the tabular value of the Student's test for a significance level of 0.05. It was 1.65 for our sample.

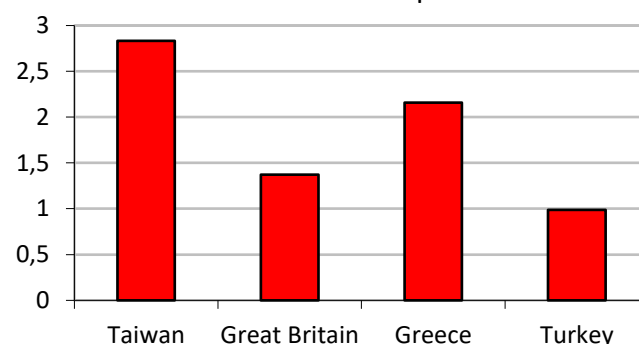


Fig. 1 – Financial contagion test statistics of the tourist sector of the economy of different countries, spread from China

Figure 1 also shows that the critical value was exceeded in two cases, i.e. from China; financial contagion in the tourism sector was transmitted to only two countries from our sample – Taiwan and Greece. Taiwan's susceptibility to the pandemic shock can be explained by geographic proximity to China, while Greece's susceptibility in general to its economy weakness (against the other Eurozone economies background), which did not allow to quickly stop the crisis that had arisen.

We developed this result by examining the infection intensity in the tourism sector of these countries. For this purpose, a sliding method was applied to the Forbes-Rigobon test, i.e. carried

² Total contribution of travel and tourism to GDP in Greece from 2019 to 2021. URL: <https://www.statista.com/statistics/644573/travel-tourism-total-gdp-contribution-greece/>.

out multiple calculations of test statistics with a shift of the unchanged “window” of the sample by one step (calculated FR_n , where $n=1, 2 \dots N$, N is the infection assessments number). Thus, the infection rate dynamics of the tourist market in Taiwan and Greece was obtained (Fig. 2). The fig. 2 shows that the infection intensity in Taiwan was higher than in Greece, and for Greece, at the end, the attenuation and, ultimately, the cessation of infection is obvious.

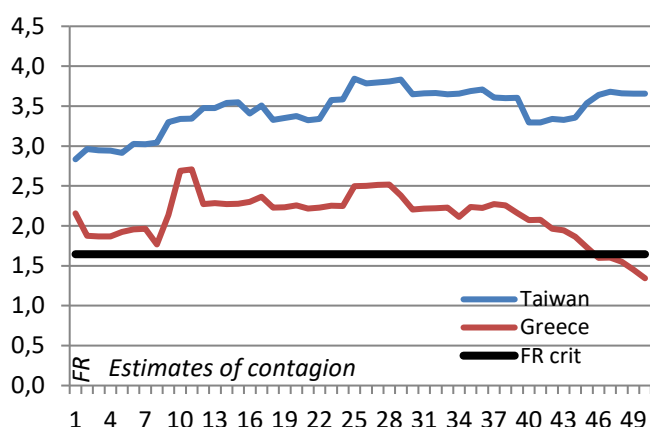


Fig. 2 – Dynamic estimates of Forbes-Rigobon test statistics on the financial contagion of the tourism sector in Taiwan and Greece

The next result of our study was the conclusions about the subsequent transmission to other countries of financial contagion from these two countries, which were vulnerable to tourism shocks that came from China. In other words, we tested the hypothesis that the infection recipient countries turned out to be its transmitters at the same time. We immediately obtained dynamic estimates – in Fig. 3 they are presented in the bundles “Taiwan → other countries” (a) and “Greece → other countries” (b).

Figure 3 shows that Turkey took the main shock from Taiwan, and Taiwan from Greece. Overall, Taiwan was the country most susceptible to shock transmission, being the recipient of a double infection (from China and Greece). The UK, despite the difficult situation during the pandemic, on the contrary, has demonstrated resilience to this shock. Perhaps this is due to the effectiveness of restrictive measures that

prevented the infection from spreading to the tourist segment of the economy.

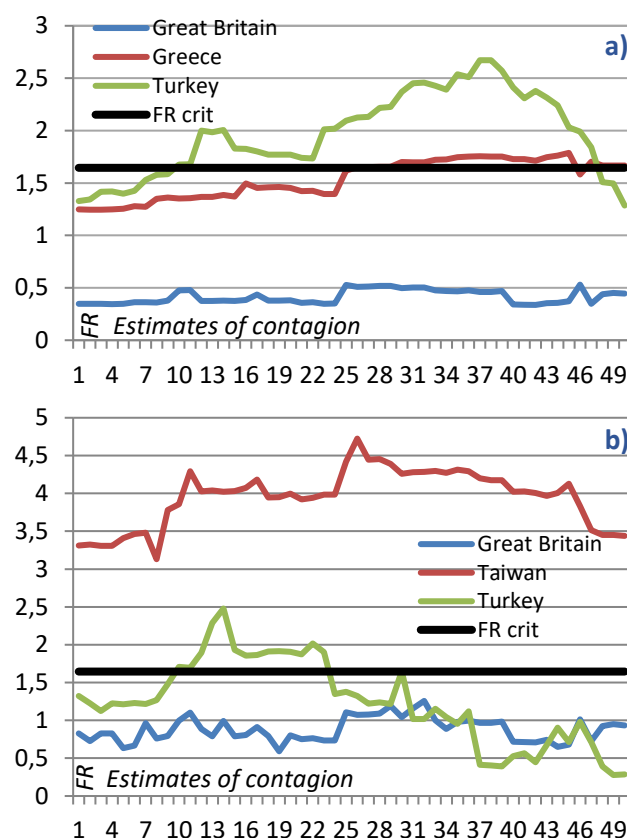


Fig. 3 – Dynamic estimates of Forbes-Rigobon test statistics on the financial contagion of the tourism sector in the bundles «Taiwan → other countries» (a) and «Greece → other countries» (b)

Conclusion

Thus, it is extremely important to be able to assess the nature and extent of the spread of various crises. This can be done based on the financial contagion methodology. This article describes the essence of this approach, illustrates its capabilities in relation to the tourism sector of the economy of several countries during the COVID-19 period. The main conclusion of the empirical part of our study is that, despite the serious crisis burden on tourism, there was no mass tourist infection that spread through the stock market during the pandemic. From China, financial infection was transmitted to only two countries, which, in turn, transmitted it to other countries with varying intensity.

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