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MODELING THE OPTIMAL PORTFOLIO CHOICE IN THE TOURISM INDUSTRY IN TERMS OF THE COVID-19 PANDEMIC

Summary. The present pandemic COVID-19 has resulted in global challenges, economic and healthcare crises, and posed spillover impacts on the global industries, including tourism and travel that the major contributor to the service industry worldwide. The tourism and leisure industry has faced the COVID-19 tourism impacts hardest-hit and lies among the most damaged global industries. Changes in the market of travel services in the world in terms of the pandemic were reasonably expected to move in the negative direction. On the other hand, the diversification of capital markets allows leading companies successfully to maneuver in the midst of this range of negative factors. The article deals with a number of cases to explain this mechanism. The optimal diversified portfolio in the field of tourism is identified as a result of such analysis. On the base of created portfolio, the tendencies of price stabilization in the market of this type of services were revealed. The article uses a wide range of Python packages, machine learning tools and Fama-French modeling.

Key words: tourism industry, portfolio optimization, ARIMA, institutional environment, stock exchange.

Introduction and problem statement. As the world is facing an unprecedented global health, social and economic emergency with the COVID-19 pandemic, travel and tourism is among the most affected sectors with airplanes on the ground, hotels closed and travel restrictions put in place in virtually all countries around the world. The COVID-19 pandemic has caused significant disruptions in the global economy. By the end of the first quarter of 2020, the COVID-19 pandemic had brought international travel to an abrupt halt and significantly impacted the tourism industry. For many developed and developing countries, the tourism sector is a major source of employment, government revenue and foreign exchange earnings. It's unquestionably that the COVID-19 pandemic remains an influential factor, but the diversification of capital markets, access to capital as developed as emerging markets remains crucial for the future.

Methodology and data. For the data analysis in this research next Python packages were used: pandas, NumPy, datetime, matplotlib, pypfopt. Linear regression (LR) and machine learning (SVM – Support Vector Machine, DT – Decision Tree) models were chosen for the price prediction. The most relevant for institutional analysis was accepted the 5-factor model Fama-French. Since William Sharpe's creation of the Sharpe ratio in 1966, it has been one of the most referenced risk/return measures used in finance. We will use this instrument to construct our optimal portfolio. Analysis of portfolio will be done on the base of price dynamics, returns change and cumulative return. Paying much attention to the stationarity we will use Autoregressive Integrated Moving Average (ARIMA). But also taking into account the fact that

a stationary time series have no predictable patterns in the long-term. The research data were collected and used from the yahoo.finance and investing.com.

Analysis of recent research and publications. Issues of modeling the optimal portfolio choice in the sphere of tourism, in their works researched and developed by such scientists as: J. Abbas [1], A. Aburumman [2], A. Adebiyi [3], A. Adewumi [3], A. Akbiyik [9], Ch. Ayo [3], S. Bogdan [5], M. Chen [6], R. Fabac [4], P. Iorember [1], Z. Ivanović [5], S. Jang [6], G. Mamirkulova [1], R. Mubeen [1], D. Mundar [4], S. Raza [1], N. Ugur [9], K. Vanukuru [10] and others. However, despite the available research, the problem of modeling the optimal portfolio choice in the tourism industry needs further study in the context of the COVID-19 pandemic.

The purpose of this work is to check perspectives of tourism market in world economy practice especially during the COVID-19 pandemic, to analyze mostly applied instruments for price prediction and to create example of portfolio optimization in tourism sphere.

Results of the research. According to the published New Paradigm for International Tourism Policy tourism leads "to the development of common or shared preferences, modes of behavior, institutions and norms. In short, tourism accelerates the process of global economic integration" [7].

So, pandemic could create big obstacle for this accelerator of integration. Did that really happen? And if so, did we manage to reverse this trend?

N. Ugur and A. Akbiyik emphasized that tourism industry was one of the world's greatest markets until the world met a pandemic in the 21st century. Their results revealed that the

tourism sector is easily affected by global crises. Under the prevailing conditions "travel insurance has become a hot topic, which may be a way of reanimating the industry by offering travel packages, including travel insurance services" [9].

A. Aburumman noted that "the coronavirus pandemic affected every industry and especially the MICE one" (Meetings, Incentives, Conferences and Exhibitions). The research revealed that under the conditions of harsh travel restrictions and closed borders the UAE MICE industry "is faced with a sharp reduction of demand" [2].

Also, a lot of instruments were involved for the analysis of this and accompanied market.

Z. Ivanović and S. Bogdan proposed several optimal mixes with different risk/return options to show on which foreign tourist markets Croatia must focus [5].

S. Jang and M. Chen applied a financial portfolio theory to estimate optimal market mixes with various return/risk options [6].

R. Fabac and D. Mundar concentrated their attention on the historical data of the values of the shares. They used values of the outstanding shares of the Zagreb Stock Exchange. Their research task was finding the optimal portfolio at the Zagreb Stock Exchange based on the concept of dominant portfolio by Markowitz approach [4].

A. Adebiy, A. Adewumi and Ch. Ayo used effectively ARIMA model for the stock price prediction. Published stock data were obtained from New York Stock Exchange and Nigeria Stock Exchange [3].

K. Vanukuru proposed to realize Stock Market Prediction using machine learning. Python was a chosen programming language. To predict stock prices for the large and small capitalizations it was used Support Vector Machine (SVM) [10].

We have a lot of officially regulated with serious level of control trade environments but also free and risky. Over-the-counter trading (OTC) refers to party-to-party exchanges that happen privately through extensive, decentralized networks. In the simplest terms, the OTC markets seem to be "junior markets". It used to think that their participants are too small to qualify for listing in the big centralized exchanges. Even in our research we will see the opposite. OTC consists of three stock exchanges: OTC Pink, OTCQB and OTCQX. Participants of OTCQX must fully comply with US securities laws but trade remains private and decentralized.

The choice of portfolio for analysis is traditionally focused on market leaders. This, in our opinion, suggests a fairly long period of operation, and hence the ability to meaningfully diversify its presence in world markets. In our case,

this approach has paid off. We received from 4 to 6 different markets, among which we will choose the most optimal under the current conditions (Table 1).

Our next step is to propose the optimal market for individual elements of our portfolio. The cases of Air China, Ryanair and Las Vegas Sands are presented separately. The case of Air China is presented on Figure 1.

The case of Ryanair is presented on Figure 2.

The case of Las Vegas Sands is presented on Figure 3.

On the base of the best markets of separated elements of our portfolio it was created a combined portfolio as a result of successful diversification in world markets (Figure 4). Portfolio participants are presented in the upper left corner of the chart.

We will continue our analysis by completing the portfolio optimization based on the Sharpe ratio.

Optimal portfolio according to this approach gives the next result:

([('RY4C.DE', 0.02841), ('IHG.L', 0.00888), ('CLV.F', 0.03235), ('CCL', 0.0), ('RCL.MX', 0.0), ('BKNG.MX', 0.34558), ('MAQ.MU', 0.17138), ('LUV.MX', 0.4134), ('601111.SS', 0.0)])

Expected annual return: 26.1%; annual volatility: 20.7%; Sharpe Ratio: 1.17.

It means that in chosen by us portfolio shares of Carnival, Royal Caribbean and Air China have to be excluded. The shares of InterContinental Hotels Group and Ryanair have been minimized. Maybe it is a little unexpected but the most important placement of shares of our portfolio leader – Southwest Airlines (LUV.MX) is a Mexico Stock Exchange.

Let's make some price prediction analysis for LUV.MX, using linear regression, Support Vector Regressor, Decision Tree and ARIMA. The growing tendency was revealed.

We can also include in our analysis Fama–French approach but using factors for developed markets even in case of Mexico Stock Market because of status of investigated object.

Model shows that this business is not a growth stock and is less risky than the market as whole.

As expected for this firm 5 factor Fama-French Model with factors for emerging markets is not working (Prob. (F-statistics) = 0.705). For comparing from our portfolio in case of AIR CHINA such model shows Adj. R2 = 0.37 and Prob. (F – statistics) = 7.6*10-6. But in this case, we are talking about a trading floor in Shenzhen.

In case if we don't observe such high diversity level the situation could be like in Indian market. Here the down sloping trend remains almost unchangeable during last 4 years (Figure 7).

Table 1

The chosen sample

Sample for analysis	Used markets
Southwest Airlines	LUV, LUV.MX, SWN.SG, S10034.SA, OL8F.L, SWN.DE
Las Vegas Sands	LVS, LCR.DU, LCR.DE, LVS.MX, LCR.F, L1VS34.SA
Marriott International	MAR, OJYW.F, MAQ.MU, MAR.MX, MAR.VI
Booking Holdings	BKNG, BKNG.MX, PCE1.F, BKNG34.SA, PCE1.BE
Royal Caribbean	RCL, RC8.SG, RCL.MX, RC8.F, OI1W.L
Carnival	CCL, CUK, CCL.L, CUKPF
Trip.com	TCOM, CRIP34.SA, TCOMN.MX, TCOM.VI, OI50.IL, CLV.F
InterContinental Hotels Group	IHG, IHG.L, ICHGF, IC1H.F, IC1H.SG, I1HG34.SA
AIR CHINA	0753.HK, AICAF, AIRYY, 601111.SS, AD2.VI
Ryanair	RYAAY, RYA.L, RY4C.DE, RY4C.F, RY4C.IR

Note: relation to the suffix of ticker: DE – XETRA Stock Exchange, MX – Mexico Stock Exchange, SA – Sao Paolo Stock Exchange, L – London Stock Exchange, SS – Shanghai Stock Exchange, HK – Hong Kong Stock Exchange, VI – Wiener Boerse AC, SG – Stuttgart Stock Exchange, F – Frankfurt Stock Exchange, IR – Irish Stock Exchange, BE – Berlin stock exchange.

Source: author's development

Figure 1. Diversification of markets for Air China

Source: author's development

Figure 2. Diversification of markets for Ryanair

Source: author's development

Figure 3. Diversification of markets for Las Vegas Sands

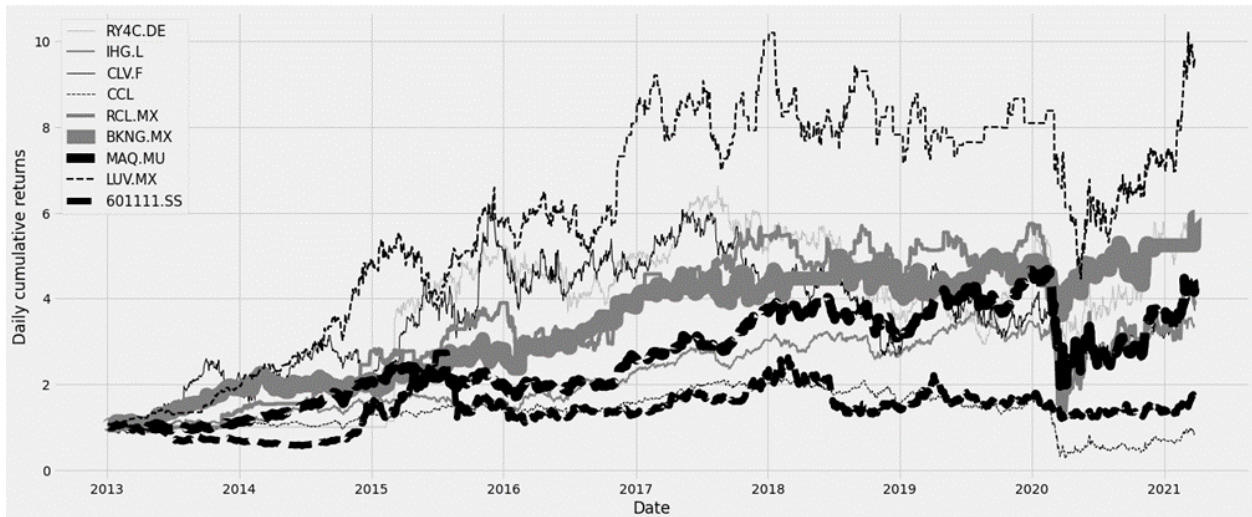*Source: author's development*

Figure 4. Best Choice for the sample

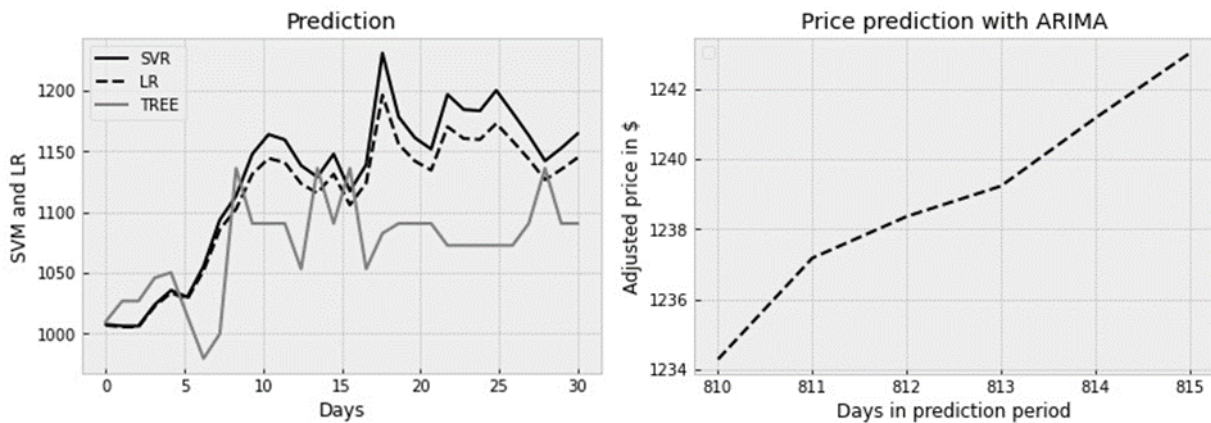*Source: author's development*

Figure 5. Different methods for LUV.MX price prediction

Notes: for model ARIMA was chosen an order $(p, z, q) = (5, 2, 2)$. Confidence level for linear regression and SVR represent properly 0.33 and 0.36.

Source: author's development

Table 2

Analysis of Southwest Airlines perspective in the Mexico Stock Market*

Const	Mkt – RF	SMB	HML	RMW	CMA
0.01** (0.309)	0.38 (0.1)	0.47 (0.4)	0.74 (0.06)	0.27 (0.72)	-0.71 (0.36)

Notes: Adj. R-squared = 0.136, Prob. (F – statistics) = 0.02, Number of monthly observations = 61 (before the 26.03.2021), Durbin-Watson = 1.915.
* Main index of this market correlates with factors for developed markets so we make our analysis on the base of these factors
** In cells: coefficients and probability levels.

Source: author's development

Conclusions. The tourism market in the world demonstrates strong trend for survival. It's an obvious fact but we mean only strong diversified companies. The important instrument on this way seems to be skillful use of capital sources. It's unquestionably that the COVID-19 pandemic remains an influential factor, but the diversification of capital markets, access to capital as developed as emerging markets remains crucial for the future. Significant losses will occur in institutionally weak markets, in particular in conditions of underdeveloped and not unified in the world economy stock market. The methods we have used to predict the dynamics of stock prices of companies represented in the tourism market confirm the steady trend of stabilization and development. It seems that globalization in this case is being rethought from the approach to unification to the approach of the ability to enjoy the benefits of diversification.
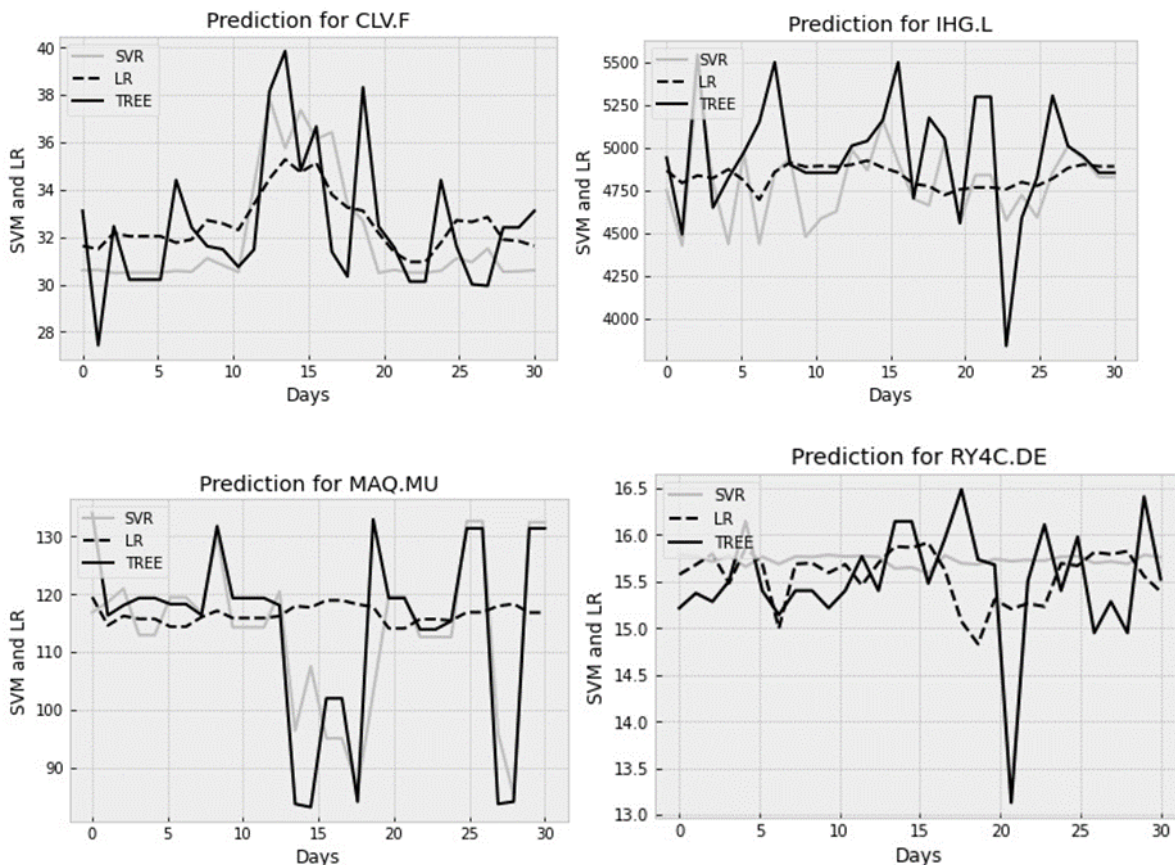
Figure 6. Demonstration of stability based on prediction methods

Notes: The stabilization trend was revealed also for other ingredients of portfolio on the base of Support Vector Regressor, Linear Regression and Decision Tree Method (Figure 6).

Source: author's development

Figure 7. Tourism market in India: best portfolio

Notes: Presented firms are Easy Trip, Thomas Cook, BLS International, Xiamen Lutong International Travel Agency, Transcorp International Limited, Cox & Kings, Crown Tours, Asya Infosoft Limited.

Source: author's development

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МОДЕЛЮВАННЯ ВИБОРУ ОПТИМАЛЬНОГО ПОРТФЕЛЯ В ІНДУСТРІЇ ТУРИЗМУ В УМОВАХ ПАНДЕМІЇ COVID-19

Анотація. Пандемія COVID-19 привела до глобальних проблем, криз у сферах економіки та охорони здоров'я, а також спричинила побічний вплив на глобальні галузі, включаючи туризм та подорожі, які є основними факторами розвитку сфери послуг в цілому світі. Індустрія туризму та дозвілля стала однією з найбільш постраждалих галузей у світі від впливу пандемії COVID-19. Було очікувано, що зміни на ринку туристичних послуг у світі в умовах пандемії COVID-19 будуть рухатися у негативному напрямку. Проте встановлено, що диверсифікація ринків капіталу дозволила провідним компаніям туристичної галузі успішно маневрувати серед усього кола негативних факторів. У статті проаналізовано ряд випадків для пояснення дії такого механізму на прикладі таких компаній, як Southwest Airlines, Las Vegas Sands, Marriott International, Booking Holdings, Royal Caribbean, Carnival, Trip.com, InterContinental Hotels Group, AIR CHINA та Ryanair. В результаті аналізу визначено оптимальний диверсифікований портфель у сфері туризму. На основі створеного портфеля виявлено тенденції стабілізації цін на ринку даного виду послуг. У статті для дослідження використано широкий спектр пакетів Python, а також інструментів машинного навчання та моделювання Fama-French. Встановлено, що туристичний ринок у світі демонструє позитивну тенденцію до відновлення. В першу чергу, мова йде про сильні диверсифіковані компанії. Важливим інструментом у такій тенденції є вміле використання джерел капіталу. Вплив пандемії COVID-19 на індустрію туризму залишається безсумнівним, але диверсифікація ринків капіталу, а також доступ до капіталу розвинених ринків та ринків, що розвиваються, залишаються вирішальними для майбутнього. Значні збитки передбачаються на інституційно слабких ринках, зокрема в умовах нерозвинених фондових ринків. Використані методи прогнозування динаміки курсів акцій компаній, представлених на туристичному ринку, підтверджують стійку тенденцію стабілізації та розвитку індустрії туризму. Встановлено, що процес глобалізації переосмислюється від підходу уніфікації до підходу можливості використання переваг диверсифікації.

Ключові слова: індустрія туризму, оптимізація портфеля, ARIMA, інституційне середовище, фондова біржа.