

CONFERENCE PROCEEDINGS OF THE 1ST CONFERENCE IN BUSINESS RESEARCH AND MANAGEMENT
UNIVERSITY OF CASTILLA – LA MANCHA, TOLEDO, SPAIN – MAY 26TH–27TH, 2022

This edited book contains the conference proceedings of the “1st Conference in Business Research and Management”, organized by the University of Castilla – La Mancha and the University of Rome “Tor Vergata”. The Conference took place on May 26th and 27th 2022, at the University of Castilla – La Mancha in Toledo. The aim of the Conference was to discuss the most important managerial and organizational implications of the pandemic and the future challenges that public and private organizations will have to face in the coming years, the so-called “New Normal”. The volume contains all the 49 extended abstracts presented during the Conference.

Essays by Alberto ALCALDE-CALONGE, Gianluca ANTONUCCI, Mimoza ARIFI, Alexis Jacobo BAÑÓN GOMIS, Hulusi BINBASIOGLU, Juan Climent BLASCO, Juan Jose BLAZQUEZ-RESINO, María Isabel BONILLA DELGADO, L. Javier CABEZA-RAMÍREZ, Riccardo CAMILLI, M. Carmen CANO VICENTE, Alessia CARECCIA, Katerina Fotova ČIKOVIĆ, Nathalie COLASANTI, María CORDENTE-RODRÍGUEZ, Nicola COZZOLI, Inmaculada CRESPO-MORÁN, Matteo CRISTOFARO, Violeta CVETKOSKA, Nino DEMINASHVILI, Tinatin DOLIDZE, Mario J. DONATE, Chiara FANTAUZZI, Anabel FERNÁNDEZ-MESA, Luis Alfredo FERRER-BAUZA, Rocco FRONDIZI, Fernando FUENTES-GARCÍA, Alejandro GAMÓN SANZ, María Ángeles GARCÍA-HARO, Alejandro GARCÍA-POZO, Pier Luigi GIARDINO, Camilo GIRALDO GIRALDO, María Isabel GONZÁLEZ RAMOS, Thais GONZÁLEZ-TORRES, Marta GOTOR CUAIRÁN, Fátima GUADAMILLAS GOMÉZ, Santiago GUTIÉRREZ BRONCANO, Jannicke Baalsrud HAUGE, Dea HAXHINASTO, Fernando Octavio HERNÁNDEZ VILCHIS, Inés HERRERO, Ivo HRISTOV, Igor IVANOVSKI, Pedro JIMÉNEZ ESTÉVEZ, Evica Delova JOLEVSKA, Erika JONUSKIENE, Yasemin KESKIN YILMAZ, Andromahi KUFO, Jorge LINUESA-LANGREO, Attila LOIBL, Ricardo MARTÍNEZ-CAÑAS, Marina METREVELI, Michele MILONE, José MONDÉJAR-JIMÉNEZ, Juan-Antonio MONDÉJAR-JIMÉNEZ, Miguel GONZÁLEZ-MOHINO, Lior NAAMATI-SCHNEIDER, Aleksandar NAUMOVSKI, Christopher P. NECK, David NEIRA, Quinones NILTON, Beatriz ORTIZ GARCÍA, Gabriele PALOZZI, Susana PASAMAR, Eva PELECHANO-BARAHONA, José-Luis RODRÍGUEZ-SÁNCHEZ, Pablo RUÍZ PALOMINO, Jemma SAAKYAN, Francisco José SÁEZ-MARTÍNEZ, Fiorella Pia SALVATORE, Sandra M^a SÁNCHEZ-CAÑIZARES, Francisco SÁNCHEZ-CUBO, Sergio SÁNCHEZ RAMÍREZ, Hemant SHINDE, Eriona SHTEMBARI, Marija SPASOVSKA, Antoniu STEFAN, Ioana Andreea STEFAN, Julio SUÁREZ-ALBANCHEZ, Dolores Lucía SUTIL, Mariam TKHINVALELI, Nivaldo Vera VALDIVIEZO, José-María VALERO-GARCÍA, Joaquín Alegre VIDAL, Juan-José VILLANUEVA-ÁLVARO, Walter VESPERI, Amarildo ZANE, Anastassia ZANNONI.

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Universidad de
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TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

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MODELING AND FORECASTING STOCK PRICE MOVEMENTS

MARIJA SPASOVSKA¹, VIOLETA CVETKOSKA²,
ALEKSANDAR NAUMOVSKI² AND IGOR IVANOVSKI²

KEYWORDS: Stock Market, Forecasting, Quantitative Methods, Moving Average, Simulation Modeling.

1. Objectives

The subject of this research is to investigate which quantitative methods and techniques are most commonly used to forecast stock price movements, as well as the factors that influence the price formation of shares on the Macedonian Stock Exchange. The objective of this study is to create a quantitative analysis model that can forecast the movements of stock prices on the Macedonian Stock Exchange.

2. Theoretical Background

Many domestic and foreign authors are drawn to the capital market's dynamism and changes, as well as the urge to benefit from stock trading. Several stock price forecasting surveys have been done around the world, and several forecasting models have been established. Artificial intelligence is becoming increasingly important in doing research as we move

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into the digital age. As a result, Sadia *et al.* (2019) can be considered a very important work, in which artificial intelligence allows the system to learn and improve from past experiences without reprogramming.

The forecast should be consistent, accurate, and efficient. In stock price forecasting, Kim and Kim (2019) establish a new model based on the fusing of a short-term memory neural network that goes beyond single models. Petrova (2015) focuses on stock market analysis and forecasting in the Republic of North Macedonia, and outlines three main valuation methods (discount discount, comparison of stock market coefficients and net profit after action and discount cash flow). Momirovski (2014) uses a more in-depth technical analysis to forecast the stock price. He forecasts the price of shares in North Macedonia using the relatively new online service “Best Net Analytica.” Apart from these two references, there are no official sources of theoretical knowledge and research in the domestic literature that allude to the use of simulation modeling for the investigation of a specific phenomenon. As a result, we can underline the originality of this paper, because it will be the first in our nation to construct a simulation model to forecast the future price movement of shares on the Macedonian Stock Exchange. The research’s findings will provide significant information to investors in North Macedonia’s capital market.

3. Methodology

A combined methodological approach is used, which is adapted to the objective’s goal. Historical method, synthesis and analysis method, descriptive method, comparative analysis method, generalization and specialization method, as well as induction and deduction methods are used as general and special scientific approaches. The survey approach was employed in the application section to conduct the empirical investigation. The developed model was solved using the moving average approach (Brockwell and Davis, 2016) and the simulation method (Anderson *et al.*, 2015).

A computer-based approach was used to construct a model for predicting stock price changes. A Palisade tool, @Risk is a Microsoft

Excel add-on that was used to solve the simulation model. The shares of Komercijalna Banka AD Skopje, which are now the most traded on the stock exchange, were used to construct a model for anticipating the movement of stock prices. The monthly share prices of Komercijalna Banka AD Skopje are used as input in the model over the last five years.

4. Findings

As a first step, we used the Palisade time series tool to forecast the stock price for the year 2022 on a monthly basis. For January 2022, the expected price for Komercijalna Banka shares is 11749 macedonian denars, for February 2022, the estimated price is 11898 macedonian denars, and so on (Table no. 1). The results of this prognosis are visually depicted in Chart 1. With a probability of 5–95% and 25–75%, we can also see the maximum and lower bounds of price movement.

Table 1. Komercijalna Banka AD Skopje share prices forecasted for 2022. SOURCE: own calculation according to data from <https://www.mse.mk/mk/issuer/komercijalna-banka-ad-skopje> (November 25th 2021).


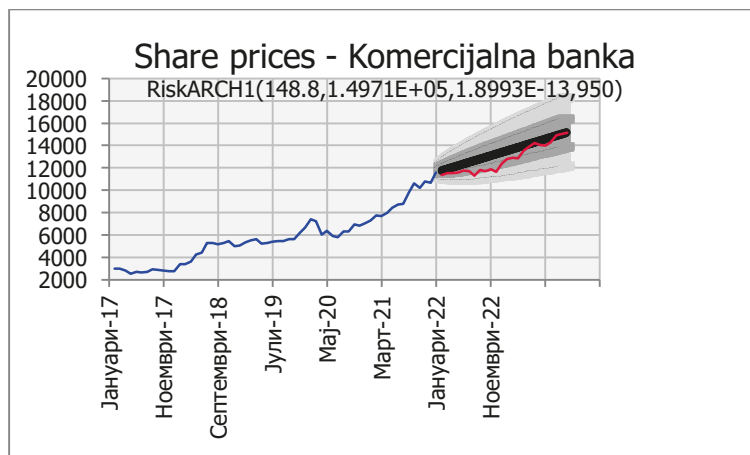
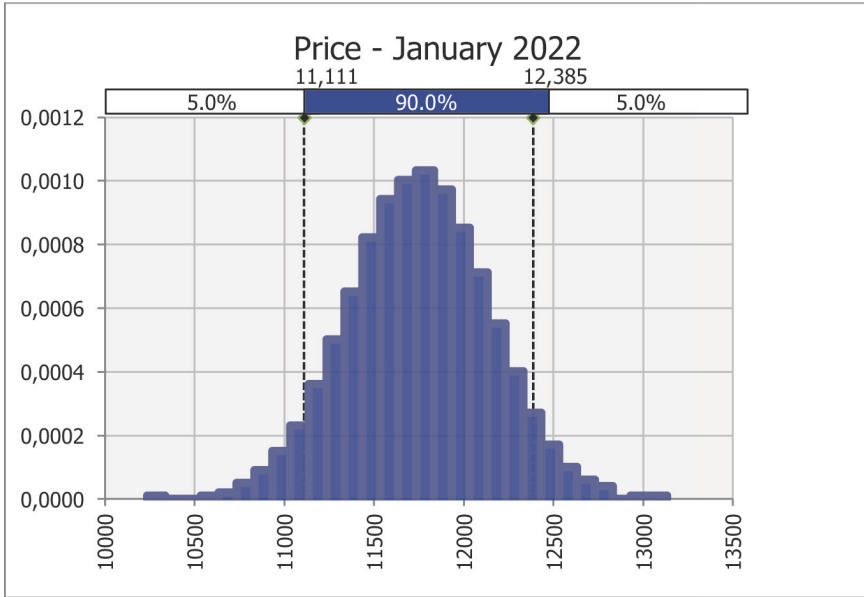
No.	Date	Price
61	22-Jan	11,749.00 ден
62	22-Feb	11,898.00
63	22-Mar	12,046.00
64	22-Apr	12,195.00
65	22-May	12,344.00
66	22-Jun	12,493.00
67	22-Jul	12,642.00
68	22-Aug	12,790.00
69	22-Sep	12,939.00
70	22-Oct	13,088.00
71	22-Nov	13,237.00
72	22-Dec	13,386.00 ден
Column Sparkline		
Min		11,749.00 ден
Max		13,386.00 ден
Average		12,567.25 ден

Figure 1 Graphic presentation of forecasted stock prices of Komercijalna Banka AD Skopje. SOURCE: own calculation according to data from <https://www.mse.mk/mk/issuer/komercijalna-banka-ad-skopje> (November 25th 2021).



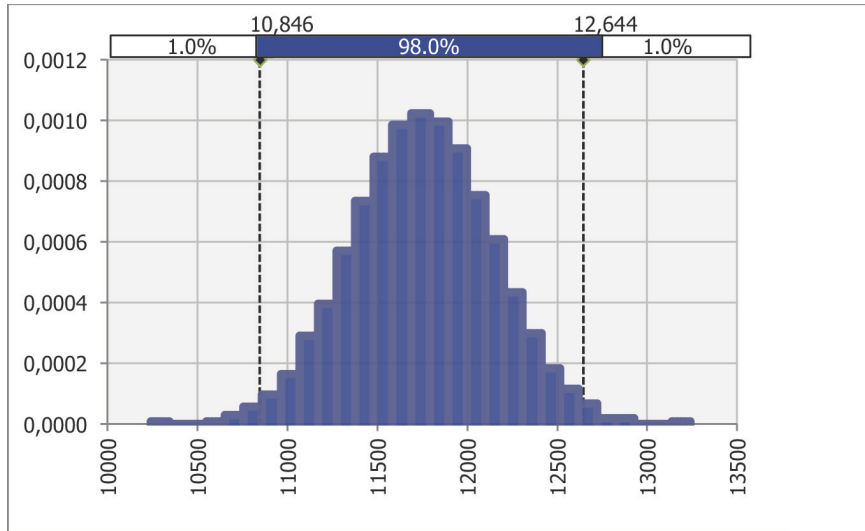
A simulation of each of the results presented in Table 1 for each month was also undertaken for a more complete examination and improved reliability of the results. To do so, we chose the anticipated price for January 2022 and used the simulation tool to run 1000 simulations of the Komercijalna Banka share price in January, yielding the results given in Chart 2. We can see from Chart 2 that the share price in January 2022 will most likely be in the range of 11111 to 12385 denars. With a 5% probability, we can predict that the price will be below 11111 denars, or, in a more optimistic scenario, we can say that the share price of Komercijalna Banka for January will be greater than 12385 denars.

Figure 2 Forecasted share price of Komercijalna Banka AD Skopje for January 2022 with 90% certainty. SOURCE: own calculation according to data from <https://www.mse.mk/mk/issuer/komercijalna-banka-ad-skopje> (November 25th 2021).



If we're not feeling so optimistic, we can look at the outcomes of Chart 3, which employs a greater level of probability. There is a 98 percent chance that the share price of Komercijalna Banka will be between 10846 and 12644 denars in January 2022. By adjusting the dashed lines in charts 2 and 3, we may change the procedure and receive various answers for varying levels of certainty.

Figure 3 Forecasted share price of Komercijalna Banka AD Skopje for January 2022 with 98% certainty. SOURCE: own calculation according to data from <https://www.mse.mk/mk/issuer/komercijalna-banka-ad-skopje> (November 25th 2021).



5. Conclusions

A simulation model for forecasting the future share price of Komercijalna Banka AD Skopje is developed in this study. The Palisade software package was used to do the analysis. Based on the findings, it is projected that the share price of Komercijalna Banka will rise slightly over the next year, with a price range of 10873 to 15539 denars with a 90% probability. These findings are critical for all present and future investors to better understand their earning potential and risk exposure. In the future, we want to study the stock values of the most traded securities on the Macedonian stock market over a significantly longer period of time and apply a machine learning algorithm to predict them.

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