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Designing and explaining the stock price forecasting model in real estate mass construction companies in Tehran Stock Exchange using data panel regression model

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ABSTRACT

One of the most important favorite topics for economists and financial analysts is to explain the reason and trend of price fluctuations because a large number of factors affecting profitability in this market are associated with risk.

Due to the changes in the industry index in recent years and the complexity of the economic environment of construction in Iran, one of the most important issues for capital market participants and shareholders of the mentioned group is the possibility of forecasting stock prices. Therefore, the purpose of this study is to design and explain the stock price forecasting model in real estate mass construction companies on Tehran Stock Exchange using the data panel regression model. The research is quantitative in terms of the data type and practical in terms of the result and descriptive and exploratory in terms of the purpose.

The statistical population of the study consists of all companies listed in the group "Mass Construction and Real Estate" on Tehran Stock Exchange. The results showed that for the overall stock index, both moving average and autoregressive factors have a positive and significant effect with more than 99% certainty and the retrospective trend of the stock index is predictable. Also, the Covid-19 pandemic has a negative effect and with more than 90% certainty has a significant effect on the movement of the stock index and in the long-term causes the stock index to decline. However, in the case of the real estate index, only the first-degree autoregression coefficient is significant with more than 99% certainty and has a positive coefficient, and the coefficient related to the moving average of the first degree is significant but with more than 90% certainty is effective on real estate index. But in the case of the real estate index, the Covid-19 pandemic impact factor is negative but not significant. In other words, the prevalence of Covid-19 disease does not have a significant impact on the real estate business and consequently the shares related to this business.

Keywords:

stock price forecast, real estate, Tehran Stock Exchange

1. Introduction

The unknown factors influencing stock price changes are always a reason to start predicting changes in companies' stock prices. Predicting stock prices or efficiency is possible by discovering patterns of behavior. One of the most important favorite topics for economists and financial analysts today is to explain how and when prices fluctuate and prices trends which have created different ways and different views on this issue. When an analyst reaches the stage of fundamental analysis or valuation of a company's stock, becomes confused by the multiplicity of stock valuation methods. There are several methods for valuing stocks that depending on the financial structure of the company, field of activity, and how the company operates, methods specific to the company's situation should be used. There are common and simple methods such as deductive methods. There are also more advanced and practical methods that make it more accurate to value a company's stock, such as cash flow discounts. In the world of analytics, there is no absolute method that can be recognized as the best method because the conditions and situation of each company are different from another company, and in a broader dimension, the conditions and fundamental situation of each industry are different from other industries. This makes -the factors that are considered "important" for examining the stock of a company- different from other companies and even companies in the same group. Therefore, the choice of a company's stock valuation method depends entirely on the type of activity, the company's financial structure, the field of activity, etc. Considering the importance of the construction industry in Iran and the capacity of the capital market in its development, this study will design and explain the stock price forecasting model in the real estate mass construction industry in the Tehran Stock Exchange using random processes.

Developing countries including Iran have a high degree of macroeconomic variables volatility. In these countries exchange rates, stock prices, and other major macro variables are fluctuating more than in advanced and industrial economies and these fluctuations create an uncertain environment for investors and make it difficult for investors to decide on future investments and may incur large losses. Therefore, to increase investment and consequently achieve long-term and continuous economic growth, attention to the capital market -especially the stock exchange as one of the main pillars of the capital market and factors affecting the stock price index such as exchange rate and its uncertainty- is too important (Heydari and Bashiri, 2012). Uncertainty is a situation in which either possible future events are not known or if they are known the probability of their occurrence or the probability distribution function is unclear. In such a situation, despite both or one of the above cases making decisions about the future becomes complicated and it is said that a "space of uncertainty" has ruled over the decisions. The concept of uncertainty in modern economics was first introduced by Keynes. He argued that with the uncertainty of future demand, the economy would be in a state of fundamental instability. According to Keynes, regulating and stimulating the demand side plays a major role in eliminating this uncertainty. Keynes also states that if uncertainty about a future economic activity is severe monetary policies become ineffective (Goji and Padash, 2017). One of the most important, effective, and stimulating markets for economic development is the stock market which has a large number of factors affecting profitability in this market associated with risk and it can be stated that the stock market is uncertain (Heydari et al., 2013). Most current studies have been based on identifying and managing risks, but there are many disagreements between risk and uncertainty, and if a variable is uncertain, the risky analysis will not be able to explain the behavior of the variable. Under these conditions, stochastic differential equations, because they contain a Vinci component that is not derivative, can model the behavior of a variable with uncertainty (Tayebi et al., 2013). The changes in capital market parameters are continuous over time and the continuous changes of the variable over time are shown by differential equations and the equations obtained by allowing random behavior in the coefficients of a differential equation are random differential equations (Tayebi et al., 2013).

Nowadays the issue of valuing companies / incomplete projects has become one of the most important issues for most investors and shareholders because they can price their assets and securities and decide whether to buy or sell based on valuation models. In other words, based on valuation models, losses due to price reductions can be avoided and gains due to an increase in asset prices can be welcomed. Accordingly, the valuation of assets, including

securities and real assets, is one of the main elements influencing investment decisions. Also, the principled valuation of assets leads to the optimal allocation of capital resources, and in contrast, incorrect valuation and failure to use appropriate methods in determining the true value of assets leads to non-optimal allocation of capital and waste of capital resources. Valuation is the knowledge that can be used to model all the factors affecting the cash flow of companies and determine the intrinsic price of stocks by discounting the cash flows of the company. The valuation model simulates all of a company's financial processes so that investors can calculate the relative impact of reports on the inherent stock price and regulate their transactions based on expected profits. Managers can also measure the impact of their decisions before implementing them and make the most profit for shareholders. The efficiency of reputable stock exchanges in the world is rooted in institutions that make their major transactions based on accurate evaluations (Taraghijah and Nikoomaram, 2015). The activation of the stock exchange and the formation and launch of hundreds of investment companies in Iran promise to enter this era of economic development in the country. Proper and scientific activity in this period can pave the way for the entry of wandering or active capitals in non-productive markets to the right path and constructive activities and bring economic development and prosperity. The first step in this direction is the implementation of the scientific principles of stock valuation. (Amin Investment Company, 1981). Another important role of proper valuation is its two-way relationship with the value creation of companies. A rational assessment of the value of the company provides the necessary conditions for value creation. Financial assets are the tools for the value creation and management of the company. Having an efficient set of securities can be effective in enhancing the value of the company and the continuation of the company's value creation. To have an efficient set of securities, the valuation process can be very useful and effective (Roodposhti et al., 1981). "Mass construction, real estate" share group with 13 leased companies, 6 real estate contracting companies, and 6 other active companies with 1163 index, the annual return of 102.19%, semi-annual return of 39.89% (04/May/2019) one of the share groups of Tehran Stock Exchange is a part of Iran's mass construction industry. Due to the changes in the industry index in recent years and according to the complexity of the economic environment of construction in Iran, one of the most important issues for capital market participants and shareholders of the group is the possibility of forecasting stock prices. Therefore, the issue in this study is:

What is the stock price forecasting model in the real estate mass construction industry of the Tehran Stock Exchange using random processes?

2-Theoretical foundations and research background

2-1. Financial markets:

A financial market is a formal and organized market in which funds are transferred from individuals and units facing a surplus of financial resources to individuals and units requesting funds (resources). It is obvious that in these markets, the majority of lenders are households and the majority of applicants for funds are economic enterprises and the government (Raei and Telangi, 2008, p. 6).

2-2. The concept of profit:

Profit is one of the main items of financial statements that have different uses in different writings. Profit is usually used as a basis for calculating taxes, as a factor in formulating dividend payment policy, as a guide for investors, and as a factor for decision making in forecasting. One of the main applications of profit is to use it as a forecasting tool that helps people to predict future profits and economic events (Balquei, 2002, p. 524).

2-3. Stock price forecast:

Price is one of the most important indicators for evaluating the performance of corporate executives and most importantly, evaluating the performance of companies in the securities market. Pricing and its evaluation are a very sensitive and also complex process (Abbasian et al., 2005). In the financial literature, the value of an asset is equal to the present value of the future cash flows from that asset. The intrinsic value of a common stock is also calculated from the discount of future cash flows. Cash flows of common stock include dividends and selling prices of shares (Qalibaf and Mazaheri, 2005).

2-4. Introducing mass construction and real estate share group:

"Mass construction, real estate" share group with 13 leased companies, 6 real estate contracting companies, and 6 other active companies with 1163 index, the annual return of 102.19%, semi-annual return of 39.89% (04/May/2019) one of the share groups of Tehran Stock Exchange is a part of Iran's mass construction industry. Due to the changes in the industry index in recent years and according to the complexity of the economic environment of construction in Iran, one of the most important issues for capital market participants and shareholders of the group is the possibility of forecasting stock prices.

2-5. Research background:

Domestic researches:

Table (1): Summary of internal research related to the research topic:

Author	Subject	Research Methodology	Results
Monajjemi et al. (2009)	Forecasting stock prices in the stock market using fuzzy neural networks and genetic algorithms	The research method is an exploratory algorithm.	The combined model of fuzzy neural networks and genetic algorithms has much better predictions and has a higher speed and stronger approximation ability to forecast stock prices than a single neural network.
Dehghani and Hosseini (2009)	Stock price forecasting using neural networks (Case study of Shiraz stock market)	The research method is an exploratory-algorithm.	The proposed neural network can accurately predict the closing price of all three companies tomorrow. This research showed that if we use input variables from technical data, we can study different companies or even different industries with only one network.
Afshar Kazemi and Keshmiri (2016)	Stock price forecasting using a combined neural network model, Markov hidden model ,and genetic algorithm	The research method is an exploratory-algorithm.	Compared the results of the prediction with the absolute mean error percentage criterion with other prediction models and showed that the combined model has a more suitable performance.
Ebadi (2009)	Forecasting the total stock price index in theTehran Stock Exchange market using artificial neural networks	The research method is combined (post-event and exploratory)	The neural network model was designed as 5 neurons in the input layer, 6 neurons in the hidden layer and one neuron in the output layer. By changing the functions and number of hidden layer neurons, an attempt was made to select the network with the lowest mean error. These multilayer perceptrons neural networks were trained with an error propagation algorithm. Experimental data were analyzed using a regression estimation model and neural network. MAE, RMSE, and U-Thiel criteria showed the relative superiority of the neural network method, but the MSE criterion was lower due to the increase in the error sentence in the linear regression method and was superior in terms of the small difference between real and predicted data. In the case of the ARIMA model, the examination of the above criteria shows the relative superiority of the neural network. In general, the neural network showed high efficiency in meeting the overall stock price index of the Tehran Stock Exchange (TEPIX).
Molaei et al. (2016)	Modeling stock price behavior using stochastic differential equations to model stock price behavior	The research method is combined (post-event and exploratory)	To model the behavior of the price index, two stochastic differential equations have been used, which are: geometric Brownian motion and geometric Brownian motion with nonlinear Garch. According to the results of this study, (1) according to the logarithm of the likelihood function, geometric Brownian motion with nonlinear Garch in all three groups of data has a better performance than geometric Brownian motion. (2) Based on the pattern of stochastic differential equations with random fluctuations, the overall price index is more influenced by good news. (3) The effect of bad news on the index of 30 large stock companies is more than the effect of good news. (4) The unconditional variance of the overall index has a structural failure in two- time points, the unconditional variance of the

Author	Subject	Research Methodology	Results
			index of the top 50 companies has a structural failure at a time point, and the unconditional variance of the index of 30 large stock companies is stable and has no structural failure.
Jaafari (2009)	Price forecasting using stochastic differential equations and time series	The research method is exploratory and modeling.	In this research, The Geometric Brownie motion model and Merton's Jump-Diffusion model were used. Geometric Brownian motion model was used to model and predict non-jump data and Merton's Jump-Diffusion model was used for jump data. Using the maximum likelihood method, these models were calibrated and the unknown parameters of the models were calculated. Finally, to evaluate the performance of the mentioned models, the prediction was performed using time series models and their results were compared.

From the table above, it can be seen that many types of research have been presented on stock price forecasting patterns and different variables and elements in each of the patterns have been described as components of stock price forecasting. On the other hand, each of these patterns and models has been developed by mathematical methods (neural networks, genetics, clustering methods, etc.) and various statistical methods, which according to the above table, research framework of Jaafari (2020), Khodaveisi and Mollabahrami (2016) and Farnoosh et al. (2016) is close to the present study. Therefore, based on these researches, the model and pattern presented in the present study can be described.

b) Researches conducted in other countries:

Ofomata et al. (2018) in the article "A Stochastic Model of the Dynamics of Stock Price for Forecasting" introduced a random model to show the dynamic behavior of stock prices for forecasting. A random model of some selected stocks in the Nigerian Stock Exchange (NSE) was formulated. And four different stocks and market prices were considered. The probability of any change in the stock price was mentioned, and the drift (expectation) and the fluctuation (covariance) of the change were obtained, which led to the formation of random differential equations. Stock price changes were examined for an average of 60 days. Storm coefficient and oscillation coefficient were determined for stochastic differential equations and stock price simulation model, Euler Maruyama method was used for the stochastic differential equation system. Using simulation, stock price forecasting was done for a short period. The results showed that the investor can invest in stocks to get the best return after following an overly long-term trend.

3. Research Methodology

a) Research type and data analysis method:

The present study is quantitative in terms of data type and applied in terms of results and descriptive and exploratory in terms of purpose. Considering that in this research, the past trend of companies' share value is examined, or in other words, the historical information of companies is used, therefore this research is considered post-event in terms of type. The data aggregation will be in Excel columns and will be analyzed using Ivory software with the help of a panel regression test. Since the research method is field-based and deals with real data, to provide information on companies listed on the Tehran Stock Exchange, according to the research variables, from different sources, (Rahavard Novin software, databases of the Stock organization) is used and we analyzed them using Ives software.

b) Statistical population:

Is a list of all members of the statistical population from which the sample group is selected. All companies listed in the "Mass Construction and Real Estate" group of the Tehran Stock Exchange form the statistical population of the research.

4. Data analysis

Section 1: Data Panel Model

Review of research model:

Testing research hypotheses is done by estimating the regression model. Next, the regression model will be fitted and then the hypotheses will be examined. Initially, the Chow test is used to determine whether the panel method is more efficient in estimating the model or the integrated data method.

Table (2): Chow test results for the regression model

Redundant Fixed Effects Tests
Equation: EQ01
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	0.024924	(1,64)	0.8751

As can be seen in Table 2, the significance level of the Chow test was calculated to be more than α = 0.05, so with 95% certainty, the possibility of estimating the model using the panel method is not confirmed. Since the null hypothesis of the Chow test based on equality of the width origins was not rejected, fitting the integrated data is on the agenda. The results of model estimation by integrated data method are presented in Table 3.

The following model is obtained for the data panel according to the estimates:

$$Tepix=-62144.54+1.04(AR(1))+\varepsilon$$

Then, to know the normality status of the fits of the fitted model, the Jark-Bra test and histogram diagram are used. Jark-Bra statistic is a statistic with chi-squared distribution and degree of freedom two. If this statistic is less than 5.7, it can be concluded that the desired statistical distribution is normal according to the chi-squared table.

Table (3): Results of regression model fitting

Dependent Variable: TEPIX
Method: Panel EGLS (Cross-section weights)
Date: 07/08/21 Time: 21:02
Sample (adjusted): 1397M02 1399M11
Periods included: 34
Cross-sections included: 2
Total panel (unbalanced) observations: 67
Iterate coefficients after one-step weighting matrix
Convergence achieved after 6 total coef iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-62144.54	278305.1	-0.223296	0.8240
AR(1)	1.048683	0.038257	27.41124	0.0000

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

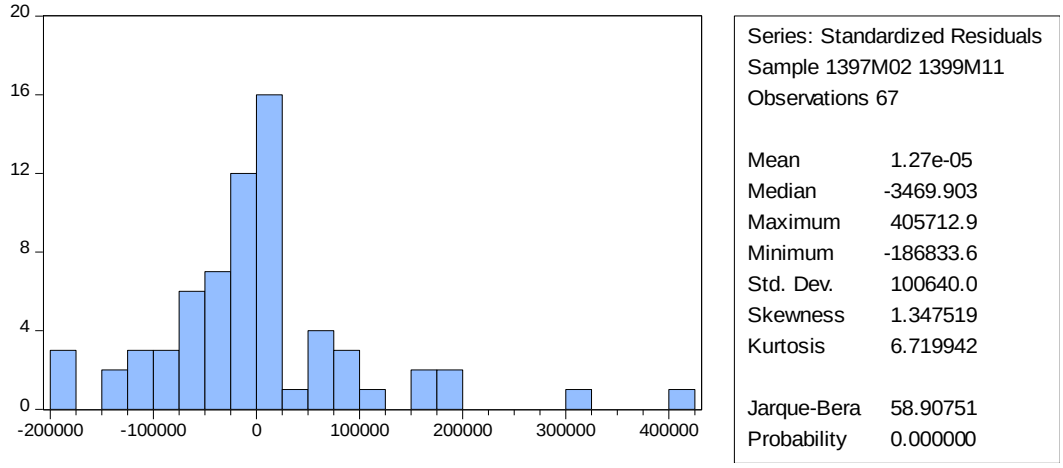
R-squared	0.953858	Mean dependent var	421638.6
Adjusted R-squared	0.952417	S.D. dependent var	359390.4
S.E. of regression	102200.4	Sum squared resid	6.68E+11
F-statistic	661.5185	Durbin-Watson stat	1.100982
Prob(F-statistic)	0.000000		

Table (4): Jark-Bra test results for the model

	Test statistics	Significance level	Result
Regression model waste	9.58	0.000	Abnormality of the model waste distribution

As can be seen in Table 4, the significance level of the Jark-Bra test is calculated less than α = 0.05, so with 95% certainty, the waste distribution is not normal. Figure 1 shows the waste histogram of the first regression model.

Figure (1): Histogram of the regression model waste



As can be seen in Figure 1, the regression model waste is symmetrical and bell-shaped, and this indicates that despite the normal distribution of the regression model waste it is completely symmetric and the model has no statistical problems.

Finally, the forecast is presented in the following diagram:

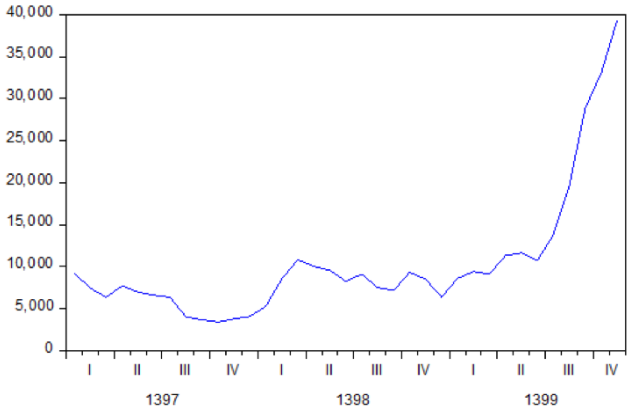
Section 2: Overall Stock Index

We extract the time from April 2018 to February 2021 from the Central Bank on an annual basis and examine this two-and-a-half-year period.

Introducing model variables:

Table (5): Introducing the variable

Variable name	The mark	Variable type
Overall stock index	PRICE	Dependent



The chart above shows the price trend of the total stock index monthly in the period 2018 to 2021. Initially at a slow pace and then at a very high pace in 2021 has increased.

Phillips-Perron unit root test:

The results of the unit root test of model variables based on the Phillips-Perron test are reported in Table 6. The results show that the model variables based on the Phillips-Perron test are reliable.

Table (6): Results of Phillips-Perron Permanence Test (at Level)

Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		4.296753	1.0000
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	4047448.
HAC corrected variance (Bartlett kernel)	4047448.

Table (7): Results of Phillips-Perron Permanence Test (with Double Differential)

Null Hypothesis: D(BITCOIN,2) has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.141527	0.0000
Test critical values:	1% level	-3.653730	
	5% level	-2.957110	
	10% level	-2.617434	

*MacKinnon (1996) one-sided p-values.

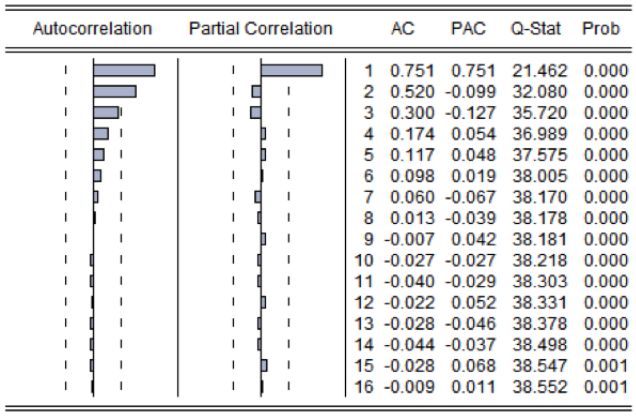
The obtained statistic is equal to 4.29 which is not significant considering the significance level of the coefficient. Therefore, the permanence test should be repeated with double differentiation.

The table above shows the significance level for the differential mode is less than 0.05. Therefore, the permanence of the variable in the differentiated state is confirmed.

Box-Jenkins display method:

After determining the final model, which means determining the degree of differentiation and determining the degree of each of the AR and MA processes, it is necessary to know both the degree of significance (which was done in the previous section) and the degree of AR and MA which is determined by examining the correlation diagram.

The following figure shows the correlation diagram



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.751	0.751	21.462	0.000
		2	0.520	-0.099	32.080	0.000
		3	0.300	-0.127	35.720	0.000
		4	0.174	0.054	36.989	0.000
		5	0.117	0.048	37.575	0.000
		6	0.098	0.019	38.005	0.000
		7	0.060	-0.067	38.170	0.000
		8	0.013	-0.039	38.178	0.000
		9	-0.007	0.042	38.181	0.000
		10	-0.027	-0.027	38.218	0.000
		11	-0.040	-0.029	38.303	0.000
		12	-0.022	0.052	38.331	0.000
		13	-0.028	-0.046	38.378	0.000
		14	-0.044	-0.037	38.498	0.000
		15	-0.028	0.068	38.547	0.001
		16	-0.009	0.011	38.552	0.001

The correlation diagram has two parts: self-correlation and partial self-correlation. The dashed line next to the allowable limit shows the changes. If partial self-correlation exceeds the allowable line, we have the MA process, and if self-correlation exceeds the allowable line, we have the AR process. The special exceed degree also indicates the desired degree for each case. In the diagram above, it is clear that both self-correlation and self-correlation have exceeded the allowable limit, and according to the diagram above, the degree of both is the same. Since the permanence was also of the first degree (1), the box-Jenkins can be examined below. It is determined from the correlation diagram which is presented in the general results below:

D(EXCHANGE RATE): ARIMA(1, 2, 1)

This means that both AR (1) and MA (1) and double differentializing are correct for the variable under consideration.

Model estimation:

The following table summarizes the initial estimate of the equation.

Table (8): Results of ARIMA model estimation research (dependent variable: overall stock index)

Method: ARMA Conditional Least Squares (BFGS / Marquardt steps)
Date: 03/12/21 Time: 18:57
Sample (adjusted): 1397M02 1399M11
Included observations: 34 after adjustments
Convergence achieved after 22 iterations
Coefficient covariance computed using outer product of gradients
MA Backcast: 1397M01

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5919.697	2517.334	2.351574	0.0255
CORONA	-3031.713	1707.381	-1.775651	0.0859
AR(1)	1.208550	0.060980	19.81880	0.0000
MA(1)	0.335364	0.183866	1.823961	0.0781

R-squared	0.948735	Mean dependent var	10514.15
Adjusted R-squared	0.943609	S.D. dependent var	8114.888
S.E. of regression	1927.032	Akaike info criterion	18.07548
Sum squared resid	1.11E+08	Schwarz criterion	18.25505
Log likelihood	-303.2832	Hannan-Quinn criter.	18.13672
F-statistic	185.0652	Durbin-Watson stat	2.035550
Prob(F-statistic)	0.000000		

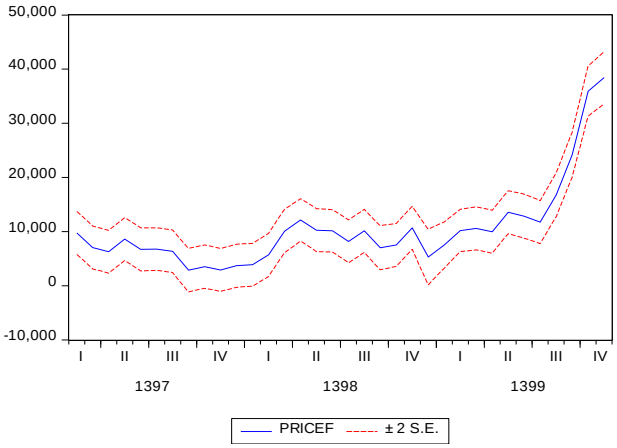
Inverted AR Roots	1.21
	Estimated AR process is nonstationary
Inverted MA Roots	-.34

The following model is obtained for the overall stock index according to the estimates made:

Tepix=-5919.69-3031.7(CORONA)+1.20(AR(1))+ 0.33(MA(1))+ε

As can be seen, all coefficients of the model are significant with a probability of more than 90%. Therefore, the choice of both AR (1) and MA (1) was correct. The coefficient obtained for AR (1) is 1.20, which 't' statistic is 19.81 and is quite significant. Also, MA (1) has a coefficient of 0.33 and a t-statistic of 4.82, and its significance is confirmed with more than 90% certainty. Also, the coefficient of determination of 94% indicates the complete explanation of the model by the variables. The Covid-19 variable is also quite significant.

The forecast value of the overall stock index is as follows:



Forecast: PRICEF	
Actual: PRICE	
Forecast sample: 1397M01 1399M11	
Adjusted sample: 1397M02 1399M11	
Included observations: 34	
Root Mean Squared Error	1810.131
Mean Absolute Error	1521.184
Mean Abs. Percent Error	16.88573
Theil Inequality Coefficient	0.068775
Bias Proportion	0.000043
Variance Proportion	0.006456
Covariance Proportion	0.993501
Theil U2 Coefficient	0.895161
Symmetric MAPE	16.69343

The forecast for the coming years predicts a downward trend with fluctuations. Now that we are in 2020, this prediction has been confirmed.

Section 3: Real Estate Index

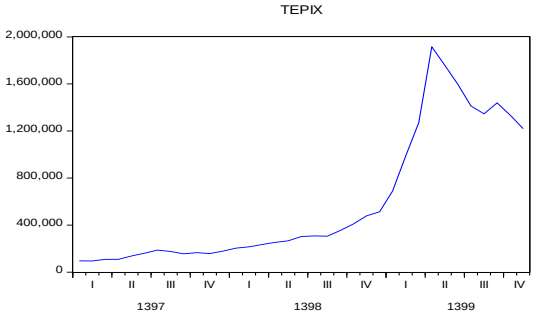
We extract the time from April 2018 to February 2021 from the Central Bank on an annual basis and examine this two-and-a-half-year period.

Introducing model variables:

Table (9): Introducing the variable

Variable name	The mark	Variable type
Real Estate Index	TEPIX	Dependent

Variable behavior over time is presented below:



The chart above shows the value of the Real Estate Index monthly in the period 2018 to 2020. Initially at a slow pace and then at a very high pace in 2019 has increased. In 2020, however, there has been a downward trend.

Phillips-Perron unit root test:

The results of the unit root test of model variables based on the Phillips-Perron test are reported in Table 10. The results show that the model variables based on the Phillips-Perron test are reliable.

Table (10): Results of Phillips-Perron Permanence Test (at Level)

The obtained statistic is equal to -0.80 which is not significant considering the significance level of the coefficient. Therefore, the permanence test should be repeated with differentializing once.

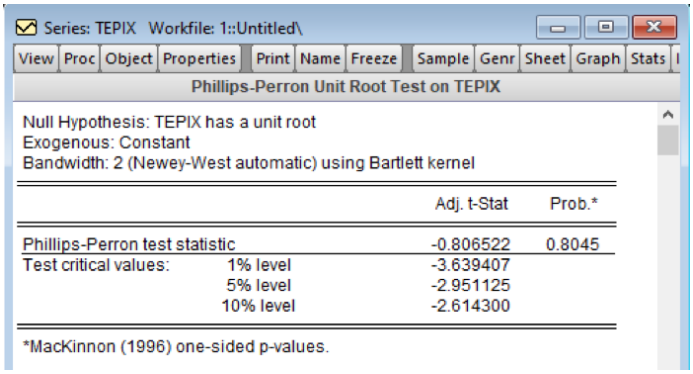
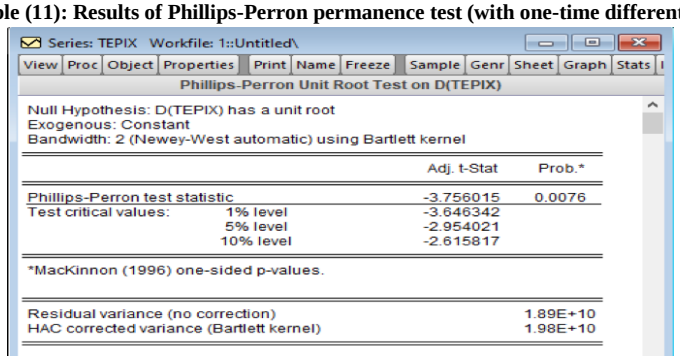


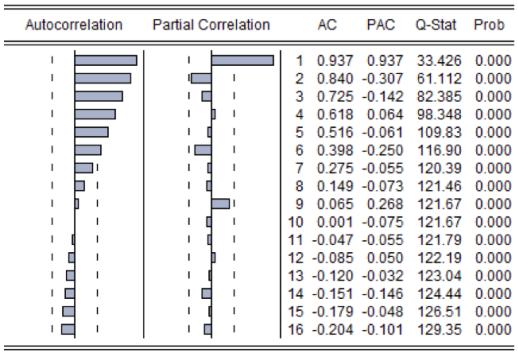
Table (11): Results of Phillips-Perron permanence test (with one-time differential)



The table above shows the significance level for the differential mode is less than 0.05. Therefore, the permanence of the variable in the differentiated state is confirmed.

Box-Jenkins display method:

The following figure shows the correlation diagram



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.937	0.937	33.426	0.000
		2	0.840	-0.307	61.112	0.000
		3	0.725	-0.142	82.385	0.000
		4	0.618	0.064	98.348	0.000
		5	0.516	-0.061	109.83	0.000
		6	0.398	-0.250	116.90	0.000
		7	0.275	-0.055	120.39	0.000
		8	0.149	-0.073	121.46	0.000
		9	0.065	0.268	121.67	0.000
		10	0.001	-0.075	121.67	0.000
		11	-0.047	-0.055	121.79	0.000
		12	-0.085	0.050	122.19	0.000
		13	-0.120	-0.032	123.04	0.000
		14	-0.151	-0.146	124.44	0.000
		15	-0.179	-0.048	126.51	0.000
		16	-0.204	-0.101	129.35	0.000

The correlation diagram has two parts: self-correlation and partial self-correlation. The dashed line next to the allowable limit shows the changes. If partial self-correlation exceeds the allowable line, we have the MA process, and if self-correlation exceeds the allowable line, we have the AR process. The special exceed degree also indicates the desired degree for each case. In the diagram above, it is clear that both self-correlation and self-correlation have exceeded the allowable limit, and according to the diagram above, the degree of both is the same. Since the permanence was also of the first degree (1), the box-Jenkins can be examined below. It is determined from the correlation diagram which is presented in the general results below:

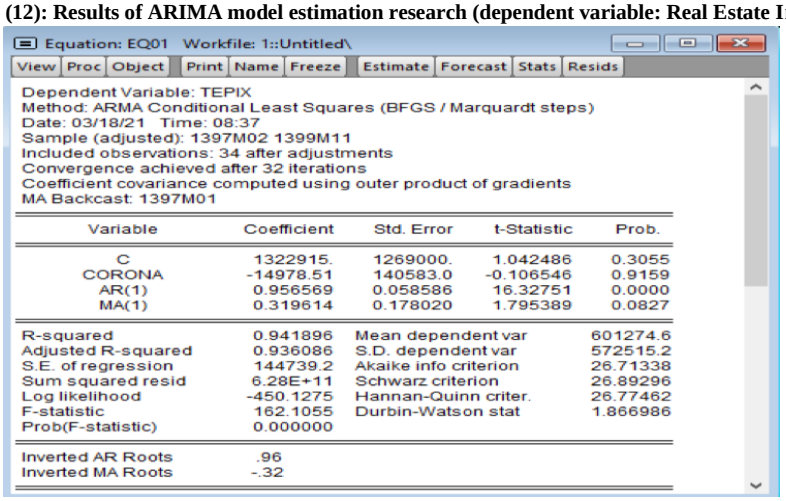
D(EXCHANGE RATE): ARIMA(1, 1, 1)

This means that both AR (1) and MA (1) and double differentializing are correct for the variable under consideration.

Model estimation:

The following table summarizes the initial estimate of the equation.

Table (12): Results of ARIMA model estimation research (dependent variable: Real Estate Index)



Equation: EQ01 Workfile: 1::Untitled\

View | Proc | Object | Print | Name | Freeze | Estimate | Forecast | Stats | Resids

Dependent Variable: TEPIX
Method: ARMA Conditional Least Squares (BFGS / Marquardt steps)
Date: 03/18/21 Time: 08:37
Sample (adjusted): 1397M02 1399M11
Included observations: 34 after adjustments
Convergence achieved after 32 iterations
Coefficient covariance computed using outer product of gradients
MA Backcast: 1397M01

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1322915.	1269000.	1.042486	0.3055
CORONA	-14978.51	140583.0	-0.106546	0.9159
AR(1)	0.956569	0.058586	16.32751	0.0000
MA(1)	0.319614	0.178020	1.795389	0.0827

R-squared	0.941896	Mean dependent var	601274.6
Adjusted R-squared	0.936086	S.D. dependent var	572515.2
S.E. of regression	144739.2	Akaike info criterion	26.71338
Sum squared resid	6.28E+11	Schwarz criterion	26.89296
Log likelihood	-450.1275	Hannan-Quinn criter.	26.77462
F-statistic	162.1055	Durbin-Watson stat	1.866986
Prob(F-statistic)	0.000000		

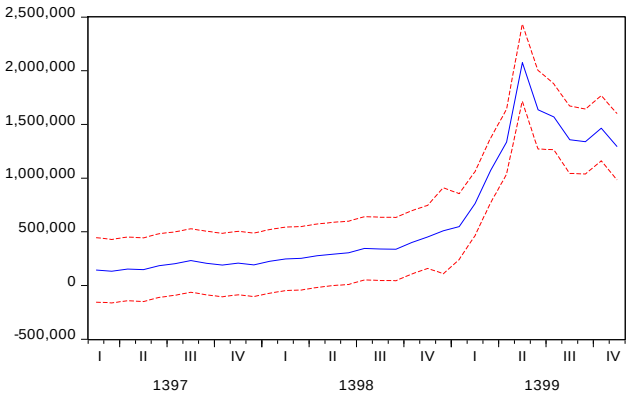
Inverted AR Roots	.96
Inverted MA Roots	-.32

The following model is obtained for the Real Estate Index according to the estimates made:

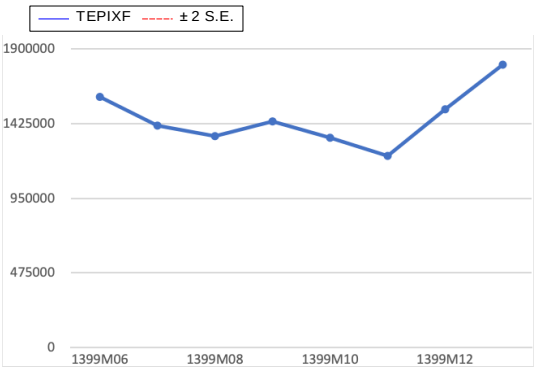
Tepix=1322915-14978.5(CORONA)+0.95(AR(1))+ 0.31(MA(1))+ε

As can be seen, all coefficients of the model are significant with a probability of more than 90%. Therefore, the choice of both AR (1) and MA (1) was correct. The coefficient obtained for AR (1) is 0.95, which 't' statistic is 16.32 and is quite significant. Also, MA (1) has a coefficient of 0.31 and a t-statistic of 1.79, and its significance is confirmed with more than 90% certainty. Also, the coefficient of determination of 94% indicates the complete explanation of the model by the variables. But the Covid-19 variable is not significant.

The forecast value of the Real Estate Index is as follows:



Forecast: TEPIXF	
Actual: TEPIX	
Forecast sample: 1397M01 1399M11	
Adjusted sample: 1397M02 1399M11	
Included observations: 34	
Root Mean Squared Error	135958.8
Mean Absolute Error	76139.13
Mean Abs. Percent Error	14.65327
Theil Inequality Coefficient	0.083013
Bias Proportion	0.000005
Variance Proportion	0.013757
Covariance Proportion	0.986239
Theil U2 Coefficient	1.070225
Symmetric MAPE	13.75631



The forecast for the coming years predicts a downward trend with fluctuations. Now that we are in 2020, this prediction has been confirmed.

The following is a forecast for next month's Real Estate Index:

So, the forecast is bullish for the market.

5. Conclusion and Recommendations

In this research, first, it was analyzed and forecasted as panel data, considering both the overall stock index and the real estate index. In this case, the moving average cannot be used. Because the moving average is not aligned with the features of the panel data. But AR (1) index is significant in the panel data and has a positive coefficient. Therefore, the considered index (combination of stock exchange and real estate index) is related to the values of previous periods and is predictable by trends. While the stock index and real estate index were examined one by one, for both studied indices (stock exchange and real estate index), the trend of moving average and self-regression was evident. For the overall stock index, both moving average and self-regression factors have a positive and significant effect with more than 99% certainty and the retrospective trend of the stock index is predictable. Also, the Covid-19 pandemic has a negative effect and with more than 90% certainty has a significant effect on the movement of the stock index, and in the long run, the stock index will decline. But in the case of the real estate index, the Covid-19 pandemic impact factor is negative but not significant. In other words, the prevalence of Covid-19 disease does not have a significant impact on the real estate business and consequently the shares related to this business.

The studied models are presented below:

The following model is obtained for the Real Estate Index according to the estimates made:

$$Tepix=1322915-14978.5(CORONA)+0.95(AR(1))+0.31(MA(1))+\varepsilon$$

The following model is obtained for the overall stock index according to the estimates made:

$$Tepix=-5919.69-3031.7(CORONA)+1.20(AR(1))+0.33(MA(1))+\varepsilon$$

The following model is obtained for the panel data according to the estimates:
Tepix=-62144.54+1.04(AR(1))+ε

Due to the negative and significant impact (with more than 90% certainty) of the Covid-19 Pandemic on the overall stock index, It is necessary for the industries that have lost in the pandemic outbreak to have the appropriate support from the banking network and related institutions so that they can resume their business.
It is suggested to compare the possibility of forecasting stocks related to different industries and how each one is affected by Covid-19 pandemics. In this way, it can be hoped that a solution will be found to predict all industries and compare the impact of Covid-19 on different industries.

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