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Nowcasting the Gold Prices in Türkiye Employing Multilayer Perceptron (MLP) Networks

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ABSTRACT: Gold is a valuable metal which is widely used to accumulate capital and also as the raw material for a spectrum of jewellery and technological devices. Considering the broad utilization of gold, it is important to model the gold prices on both the country and the global levels. In this study, the gold price in Türkiye is modelled dependent on various related factors. The import, export and production amounts of gold as well as the exchange rate are considered as the input data affecting the gold prices. The seasonal-trend decompositions of the data are analysed as the first step. Then, a multilayer perceptron type deep learning network is developed in Python programming language for the modelling of the gold prices in Türkiye for the period of 2013M01-2023M02. The 70% of the available data is used as the training data whereas 30% of the data is taken as the test data. The actual gold prices and the results of the developed multilayer perceptron deep learning model are plotted which visually shows that the developed model accurately nowcasts the gold prices. The performance metrics of the developed nowcasting model namely the coefficient of determination, mean absolute error, mean absolute percentage error and the root mean square error are also calculated which further verify the accuracy of the developed model. It is argued that the developed model for the modelling of the gold prices can also be used for other countries or regions.

KEYWORDS: Gold prices, multilayer perceptron, nowcasting, deep learning, modelling.

I. INTRODUCTION

Gold has been used both as jewellery and as a reserve and exchange tool for centuries and has a distinct place among precious metals. People are interested in gold since ancient times thanks to its superior physical and chemical properties such as resistance to acids, easy processing and electrical and thermal conductivity. Due to these crucial properties, gold has become an indispensable part of both the financial markets and the industrial production. Although gold has not been used as a strength indicator of money after 1973, it still stands out as one of the best market performance indicators and also as one of the most important metallic commodities traded worldwide. Gold is a precious metal that is in demand as one of the best investment instruments globally by governments and central banks as well as the household.

Institutions and individuals keep gold for various reasons. For example, people with high income use gold for speculative purposes while people with low income may keep gold for hedging. Thanks to its physical existence, gold also provides trust for individuals and household. Furthermore, holding gold is a widely accepted practice especially for the developing nations where the motive of trust of the gold is common. Therefore, gold is a preferred investment tool for individuals. In addition, gold also provides some level of value keeping against the effects of inflation appearing on cash funds. Gold has always maintained its importance as a means of savings in the past and it appears to be so also for the future. On the other hand, investors have trust in the gold as a stable investment instrument considering the economic and financial fluctuations. As a result, gold has been considered to be an alternative investment tool to stocks.

The demand for gold has increased with its use in industrial and technological products and the development of the jewellery industry in the recent years. On the other hand, developments in financial markets and alternative investment instruments have made these alternative tools to be important competitors to gold as a store of value. After then, the emergence of financial crises and the search for reliable investment tools has increased the popularity of gold again. As a result of this, the gold prices has risen to higher levels after the global financial and pandemic crisis. During the pandemic crisis, as a result of the increasing money supply and the uncertainty brought by the pandemic, the demand for gold has increased which led the ounce price of the gold to rise from around \$1500 in December 2019 to \$2050 in July 2020.

Modelling and estimating gold prices have become a crucial goal not only for economists, but also for central banks, government treasury units, financial institutions and individuals due to its popularity and importance. Central banks, governments and large-

Scale financial institutions pay more attention to the modelling of the gold prices for the stabilization of the financial structure and plan their investment policies. On the contrary, individuals and the small-scale financial institutions aim to increase their income by modelling the gold prices, Gold has been proved to be an effective hedging tool and safe instrument against economic and political ripples.

The gold prices are determined according to demand and supply in the free market therefore it is crucial to analyse the factors affecting the gold prices. As it is mentioned before, the economic crises and the pandemics also increased the popularity of gold, which is always considered to be a safe investment instrument. This led the economists, investors and academics to perform studies for investigating the factors which have impacts on the gold prices. There are mainly two factors determining the price of gold namely the supply and demand. The gold supplies are originated from several sources such as the gold mined from the mines, scrap gold supplies, gold sales by central banks and the sales of gold as a form of jewellery. The demand is mainly originated from the gold requirements of advances technological devices such as computer chips, jewellery and the gold ingot demand by large-scale financial institutions and the central banks.

In this work, the monthly gold prices of Türkiye for the period of 2013M01-2023M02 is modelled considering the importance of the nowcasting and forecasting of the gold prices. The factors affecting the gold supply and demand namely the gold imports, gold exports and the gold produced from mines are taken as the principal inputs of the model while the exchange rate is also considered for increasing the accuracy of the model. First of all, the monthly gold prices, gold import and export quantities, the amount of gold produced in mines and the monthly USD/TRY exchange rate are taken from the official sources. The seasonality and nonlinearity of these data are then investigated using seasonal-trend decomposition in Eviews software. As the next step, a multilayer perceptron deep learning network is developed in Python programming language for the modelling of the gold prices. The 70% of the available data is used as the training data while the remaining 30% is taken as the test data. The actual monthly gold prices and the results of the developed multilayer perceptron deep learning network are plotted which show the high accuracy of the model for nowcasting. In addition, the figure of merits of the developed model such as the coefficient of determination, mean absolute error, mean absolute percentage error and the root mean square error are calculated also in Python programming language further verifying the accuracy of the developed model. It is then argued that similar multilayer perceptron deep learning networks can be utilized for the nowcasting of the gold prices for other countries and regions.

II. LITERATURE SURVEY

There are large number of studies regarding the factors affecting the gold prices and the modelling of these prices due the importance of the subject. For example, the relationship between the gold prices and the GBP/USD exchange rate is studied in a paper using weekly data and it is exposed that there exists a strong bidirectional relationship between the gold prices and the GBP/USD parity (Capie et al., 2005). Similarly, it is shown that there exists a strong relationship between the gold prices and the exchange rates for the 1982-1990 period (Sjaastad, 2008). According to several studies in the literature, there is an inverse relationship between the USD index and the gold prices (Koutsiyannis, 1983; Ghosh et al., 2002; Vural, 2003). In another work, the causality relationship between the USD/TRY exchange rate and the gold prices in Türkiye for the period of 2006-2018 is investigated using the Granger causality test and it is demonstrated that there exists a long term causality relationship between the USD/TRY exchange rate and the gold prices (Cingoz and Kendirli, 2019). In another work, it is shown that there exists an inverse relationship between the USD index and the gold prices (Koutsiyannis, 1983). Similarly, the economic data of Pakistan for the period of 2001-2018 is studied using regression method where it is concluded that there is a weak inverse relationship between the exchange rate and the gold prices (Lan et al., 2019). Similarly, the Granger causality test was applied on the economic data of Pakistan for the period of 1997-2018 in another work and it is observed that gold prices affects the exchange rate (Bakhsh and Khan, 2019). In another study, the economic data of Türkiye for the period of 2008-2017 is analysed using augmented Dickey-Fuller and Granger causality tests where it is shown that there is a unidirectional causality relationship from the gold prices to the EUR/USD exchange rate (Oner, 2018). The economic data of Kazakhstan is studied using the least squares method and the Johansen cointegration test where it is concluded that there is a unidirectional causality relationship from the debt stock to the gold prices (Syzdykova, 2018).

In another study, the economic data of Türkiye for the 1996-2015 period is investigated employing causality tests and it is shown that exchange rate, interest rate and the oil prices affect gold prices in a unidirectional causality relationship (Doganalp, 2016). The economic data of India, China, Brazil, Chile, Russia, Malaysia and Czech Republic are studied using Copula model and it is exposed that there is a causality relationship between the exchange rate and the gold prices (Wen and Cheng, 2019). The two-step Engle-Granger cointegration and Granger causality tests are utilized for analysing the economy of Türkiye for the 2002-2013 period and it is concluded that there is a unidirectional causality relationship from the gold prices to the exchange rate (Oncu et al., 2015). In another study, the monthly data of Türkiye for the 2000-2014 period is studied employing Johansen cointegration test to investigate the causality relationships among gold prices, exchange rate and the real estate prices and it is shown that there exist causality relationships among these variables (Coskun and Umit, 2016). The economic data of Türkiye is studied for the period of

1989-2003 using vector autoregressive method and it is exposed that there is an inverse causality relationship between the gold prices and the exchange rate (Senturk et al., 2013). Similarly, the multiple linear regression method is utilized to study the economic data of Malaysia for the 2003-2012 period where it is shown that there exists an inverse relationship between the gold prices and the exchange rate (Ibrahim et al., 2014). In another work, the economic data of the USA is analysed for the period of 1989-2007 employing causality tests and it is exposed that there is a positive relationship between the gold prices and the oil prices whereas there exists an inverse relationship between the gold price and the exchange rate (Wang and Chueh, 2013). The economic data of the USA and the UK are utilized using regression analyses and it is shown that gold prices are considered as safe haven against the fluctuations of the USD and GBP exchange rates (Ciner et al., 2013). A similar result has been observed such that gold is seen as a safe haven against cash in another study (Joy, 2011). In another work, the economic data of Türkiye for the period of 2002-2011 is studied using causality analysis and it is concluded that the gold prices is affected positively by the USD/TRY exchange rate (Omag, 2012).

The interaction among the international gold and oil prices and the USD, EUR and GBP exchange rates are studied using the data of the 1971-2009 period and it is argued that there is a negative relationship between the gold prices and exchange rates (Pukthuanthong and Roll, 2011). In another study, the economic data in the period of 1998-2011 is analysed employing cointegration test where it is concluded that the gold prices affect exchange rates (Sujit and Kumar, 2011). The economic data of India is studied for the 2002-2008 period employing vector error correction models and it is shown that there exists a causality relationship between exchange rates and the gold prices (Sharma and Mahendru, 2010). In another work, the relations among the gold prices, oil prices and the exchange rate in Türkiye for the 1992-2010 period are studied and it is exposed that the exchange rate and gold prices have inverse relationship (Toraman et al., 2011). The economic data of Türkiye for the period of 1996-2005 is studied in another work using multiple factor method and it is argued that the exchange rates and the oil prices affect the gold prices (Poyraz and Didin, 2008). In another study, the daily data for the period of 1991-2004 are used to analyse the relationship between the gold prices and various exchange rates where it is shown that the USD exchange rate have more impact on the gold prices compared to other currencies (Sjaastad, 2008). In another work, the short term relationship between the gold prices and the exchange rates are studied for the period of 1976-1990 using cointegration tests and it is argued that there exists an inverse relationship between the gold prices and the exchange rates (Dooley et al., 2005). The generalized autoregressive conditional heteroscedasticity model is utilized in another work for the period of 1971-2004 and it is concluded that there is a strong relationship between the exchange rates and the gold prices (Capie et al., 2005). In another work, the relationship between the gold prices and the FTSE100 index is investigated employing Granger causality tests and it is shown that there is a bidirectional causality relationship between the gold prices and the FTSE100 index (Tolu, 2020). The relationship between the gold prices and the BIST100 index is studied in another work using the Toda-Yamamoto test for the period of 2006-2018 and it is concluded that there does not exist any causality between the gold prices and the BIST100 index (Basarir, 2019). On the other hand, the economic data of Pakistan is investigated for the 2000-2013 period in another study utilizing regression analysis where it is found out that there is an inverse relationship between the KSE100 index and the gold prices (Khan et al., 2016).

In a study regarding the gold prices and the interest rates, the economic data of the 1973-1979 period is studied using regression models and it is shown that interest rates affect the gold prices (Abken, 1980). The relationship between the gold prices and the exchange rate is investigated for the period of 1976-1990 employing cointegration analysis and it is concluded that there exists an inverse relationship between the gold prices and the exchange rate (Dooley et al., 1992). The connection between the gold prices and the inflation is studied for the USA, the UK, Japan and Germany for the period of 1970-1996 and it is found out that there is a strong long term connection between the gold prices and the inflation (Harmston, 1998). In another work, the level of three different gold prices and eight stock market prices are investigated for the 1991-2001 period and it is exposed that there exists a short term relationship between the gold prices and the stock market prices (Smith, 2001). The relationship between the gold prices and the USD index is studied employing the generalized autoregressive conditional heteroscedasticity method in another paper for the 1984-2003 period where it is concluded that there exists a causality relationship between the gold prices

and the USD index (Tully and Lacey, 2007). In another study, the economic data of the 1998-2006 period is analysed using the periodic generalized autoregressive conditional heteroscedasticity method and it is shown that the fluctuations of the gold prices affects the financial institutions and the futures exchange (Cheng et al., 2009). In another work, the factors affecting the gold prices is studied using the least squares method for the period of 1995-2009 and it is exposed that global money supply affects the gold prices in a positive way (Topcu, 2010). Similarly, the factors affecting the gold prices for the 1992-2010 period is analysed utilizing multivariate generalized autoregressive conditional heteroscedasticity method and it is shown that there is a strong inverse correlation between the USD index and the gold prices (Toraman et al., 2011). In another study, the economic data of the 2010-2011 period is considered and it is concluded that gold is a safe haven against the fluctuations of the oil prices (Reboredo, 2013). The economic data of the 1988-2013 period is studied in another work and it is shown that oil prices and inflation affects the gold prices in a positive way while the exchange rate affects the gold prices in a negative way (Elmas and Polat, 2014).

In another work, the gold prices in Türkiye is investigated considering various factors such as real interest rates, BIST100 index, consumer price index and the London gold exchange prices and it is concluded that the London gold exchange prices affects the gold prices in Türkiye (Menase, 2009). The models regarding the modelling and estimation of gold prices are considered on the economic data of the 1995-2008 period and it is shown that wavelet neural networks has the best accuracy for modelling the gold prices (Lineesh et al., 2010). In another study, the factors affecting the gold prices in Türkiye are analysed using the vector autoregressive method where it is observed that there exists a unidirectional causality relationship from the USD/TRY exchange rate to the gold prices (Soytas et al., 2009). Similarly, the possible variables affecting the gold prices in Türkiye is studied using vector autoregressive approach and the Johansen cointegration test where it is argued that consumer price index affects the gold prices (Atay, 2013). The modelling performances of several methods are investigated in another work for the prediction of the gold prices in Türkiye and it is concluded that Mackey-Glass chaotic time series method provides accuracy (Cevizkiran, 2012). Similarly, the modelling performances of the autoregressive integrated moving average with exogenous variable (ARIMAX) models and the probit models are compared for the prediction of the gold prices in Türkiye where it is exposed that the ARIMAX model has better accuracy for the decreasing trend of the gold prices while the probit model is better during the increases of the gold prices (Deveci, 2013). In another work, the possible factors affecting the global gold prices is considered employing the least squares method and it is shown that oil prices and the inflation rate affects the gold prices positively while Dow Jones index and the interest rates affect the gold prices inversely (Polat, 2013). Similarly, several factors possibly affecting the global gold prices for the 2002-2013 period are investigated utilizing artificial neural networks and it is concluded that there is a strong inverse causality relationship between the silver prices and the gold prices (Yuksel, 2014). In another study, the gold prices for Türkiye is modelled employing autoregressive moving average method and the artificial neural network method where it is argued that the performance of the autoregressive moving average model has the best accuracy (Benli and Yildiz, 2014). Similarly, various factors which may have impact on the global gold prices is investigated in another work utilizing autoregressive distributed lag approach and it is shown that the debt stock of the USA significantly affects the global gold prices both in the short term and the long term (Basar, 2015).

The artificial neural network and vector autoregressive models are utilized to model the gold prices in Türkiye for the 2000-2014 period in another study and it is shown that the accuracy of the artificial neural networks is better than the accuracy of the vector autoregressive model (Aydin and Cavdar, 2015). In another work, a hybrid model is developed using the generalized autoregressive conditional heteroscedasticity model and the artificial neural networks for the prediction of gold prices and it is concluded that the hybrid model provides 25% less error compared to the generalized autoregressive conditional heteroscedasticity model itself (Kristjanpoller and Minutolo, 2015). The modelling performances of the artificial neural networks and the generalized autoregressive conditional heteroscedasticity model for the daily gold price data in the 2010-2014 period is analysed in another study where it is argued that the generalized autoregressive conditional heteroscedasticity model provides slightly better accuracy compared to the artificial neural network approach (Kocak and Un, 2014). In another work, autoregressive integrated moving average method is utilized to predict the gold prices for the 1990-2015 period and it is shown that ARIMA(0, 1, 1) model is appropriate for the modelling of the gold prices (Sharma and Baby, 2015). Similarly, the generalized autoregressive conditional heteroscedasticity model is employed for the forecasting the gold prices of Türkiye and it is concluded that the prices of the London gold exchange impacts the gold prices in Türkiye (Yurdakul and Sefa, 2015). The artificial neural network and autoregressive integrated moving average modelling techniques are compared for the modelling of the gold prices in the 1990-2008 period and it is exposed that the artificial neural network structure provides higher accuracy than the autoregressive integrated moving average model (Mombeini and Chamzini, 2015). In an extensive study, the modelling performances of seventeen methods for the estimation of the gold prices are investigated utilizing the global gold prices data of the 1972-2003 period and it is concluded that the random walk model provides the lowest error (Hassani et al., 2015). In another work, the performances of the ARIMA, artificial neural networks, vector autoregressive and the Holt-Winters exponential smoothing methods for the estimation of the gold prices are analysed and it is shown that the vector autoregressive method gives the most accurate results (Islamoglu, 2015). The gold prices in India for the 1979-2017 period is modelled in another work utilizing the autoregressive integrated moving average method and it is exposed that the ARIMA(1, 1, 1) model gives accurate results for the prediction of the gold prices (Naz and Ahmad, 2016). In another extensive study, the gold prices and the consumer price indices of 54 countries are considered and the least squares method is employed for the modelling of the gold prices and it is shown that the consumer price indices of Canada, Germany, Australia, India, Switzerland, Sweden, United Kingdom, Uruguay, Zimbabwe and the United States can be used to model the gold prices in these countries (Sharma, 2016).

As it can be observed from the literature survey, there are large number of studies in the literature regarding the modelling and forecasting the gold prices both globally and on country basis. Considering the importance of the subject, the monthly gold prices in Türkiye for the period of 2013-2023 is modelled in this study. Various factors affecting the gold prices namely the import and export amounts of gold, the domestic gold production and the USD/TRY exchange rate are taken as the factors affecting the gold prices which is supported by the studies existing in the literature. Then, a multilayer perceptron type deep learning model is developed for the modelling and nowcasting the gold prices and it is shown that the developed model successfully nowcasts the gold prices. The details of the modelling methodology and the considered data are presented in the next section.

III. MATERIAL AND METHODS

First of all, the considered variables namely the gold import, gold export, gold production, gold price and the USD/TRY exchange rate are taken from the Electronic Data Distribution System of the Central Bank of Türkiye (EVDS-CBRT, 2023). The gold price is given as TRY per grams and this unit is converted to USD per grams for an assessment compared to global gold prices. As the next step, the seasonal-trend decomposition in Eviews is applied to the considered data in order to investigate the seasonality and nonlinearity present in the data. For this aim, the seasonal-trend decomposition using Loess algorithm is used in Eviews (Cleveland et al., 1990; Hill et al., 1998). The actual data and their seasonal components together with the seasonally adjusted data are presented in Figures 1-5 for the gold import, gold export, gold production, gold price and the USD/TRY exchange rate, respectively.

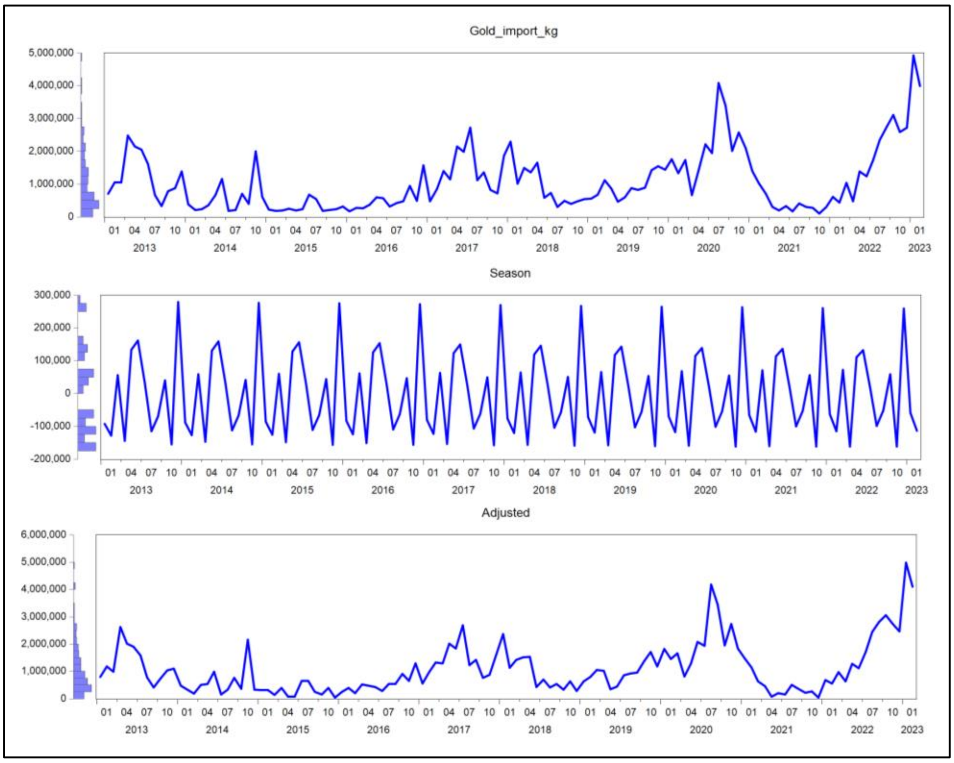

Figure 1. The gold import data in kg, its seasonal component and the seasonally adjusted data

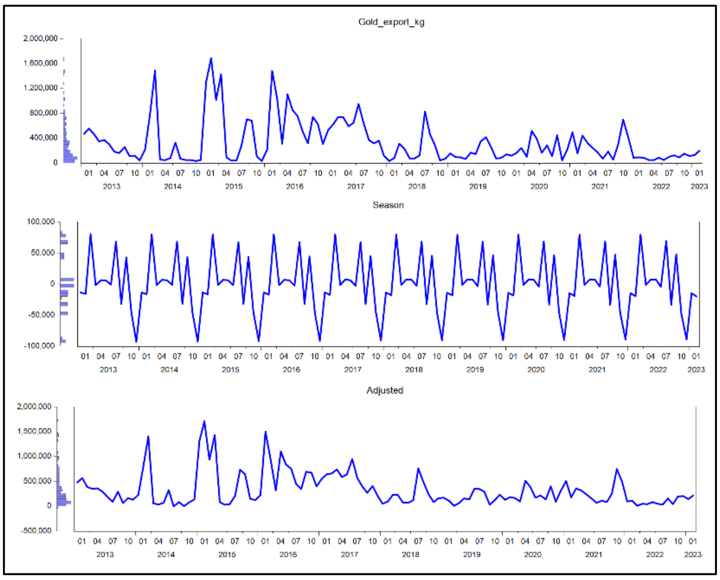

Figure 2. The gold export data in kg, its seasonal component and the seasonally adjusted data

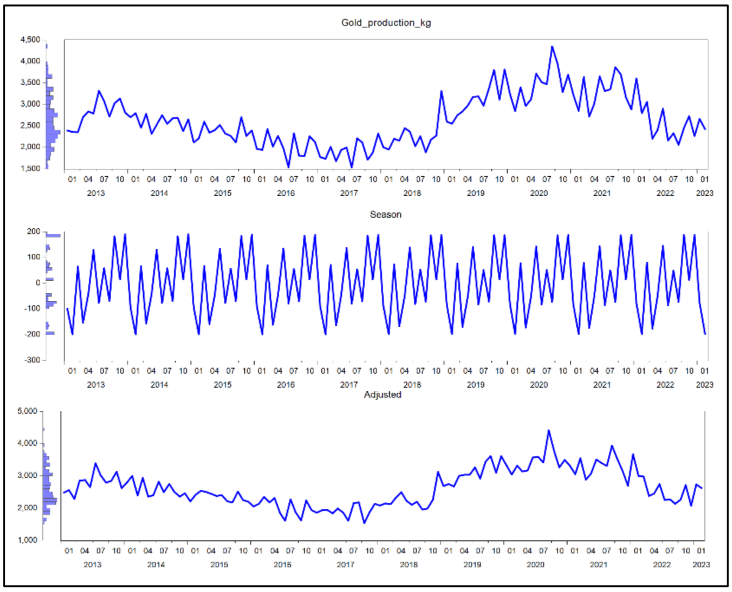

Figure 3. The domestic gold production data in kg, its seasonal component and the seasonally adjusted data

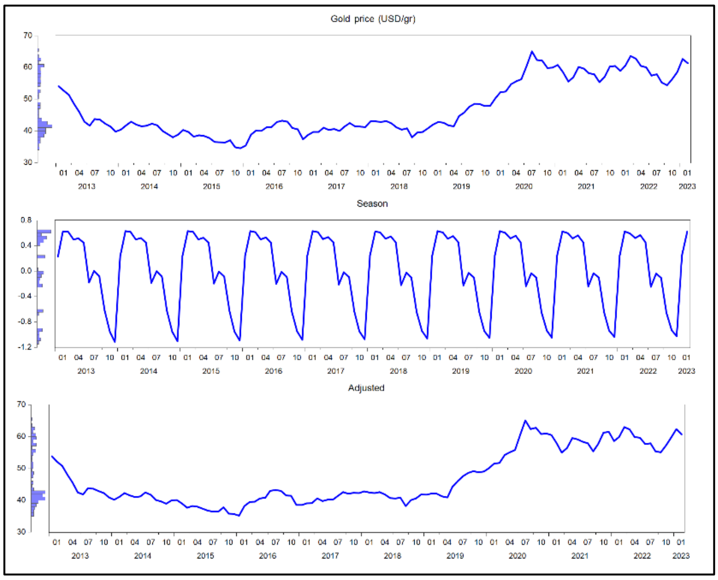

Figure 4. The gold price data in USD/gr, its seasonal component and the seasonally adjusted data

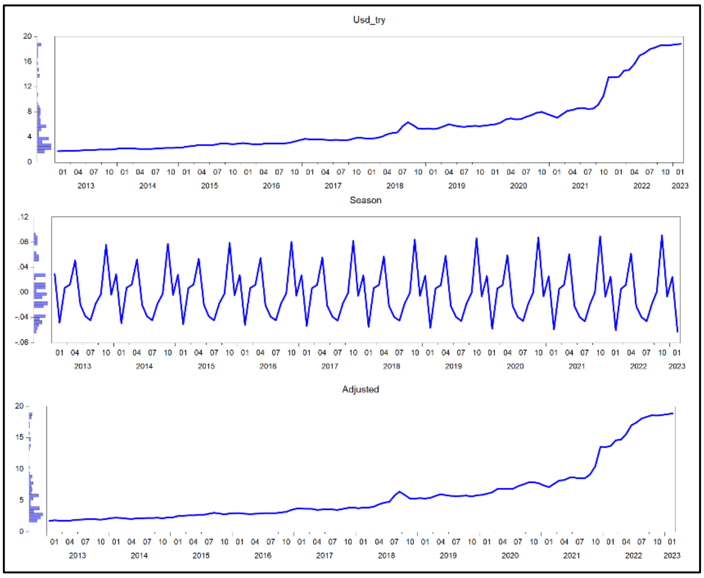

Figure 5. The USD/TRY exchange rate, its seasonal component and the seasonally adjusted data

As it can be seen from Figures 1-5, the data related to the gold prices, gold import, gold export and domestic gold production have strong seasonal and nonlinear components. This indicates that the modelling of the gold price has to be performed using nonlinear methods for achieving high accuracy. In this study, multilayer perceptron deep learning networks is utilized for the modelling of the gold price dependent on the gold import, gold export, domestic gold production and the USD/TRY exchange rate data. The general structure of the multilayer perceptron neural network is shown in Figure 6 (He et al., 2020).

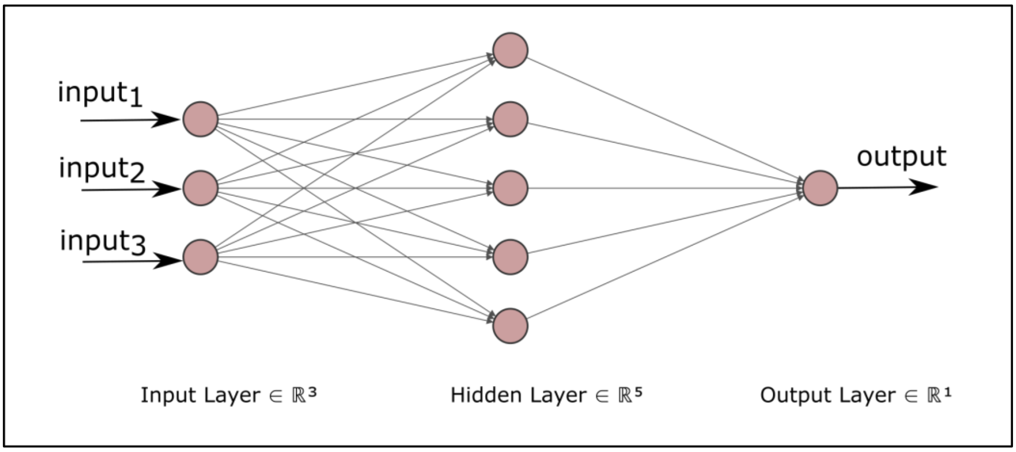

Figure 6. General structure of a multilayer perceptron network

The nodes in Figure 1 represent the perceptrons which perform nonlinear activation functions and the arrows have weights which are adjusted according to the training data to enable the training of the multilayer perceptron network. The output signal y can be expressed dependent on the input signals x_i, weights w_i and the activation functions performed by the perceptrons $F()$ as in Equation (1) (Aggarwal, 2018; Vang-mata, 2020).

$$y = w_0 + \sum_{j=1}^{q} w_j . F\left(w_{0j} + \sum_{i=1}^{p} \lambda_{ij} . x_i\right) + \varepsilon_t \qquad (1)$$

In Equation (1), w_j and λ_{ij} represent the model parameters of the multilayer perceptron network. The activation function $F()$ introduces the nonlinearity to the model that enables to model the nonlinearity of the data as in the case of the variation of the gold price and the related data as observed from Figures 1-5. The choice of the number of hidden layers, the number of neurons in each layer and the activation functions constitute an optimization problem where the error regarding the result of the multilayer perceptron and the actual data has to be minimized (Imani et al., 2019). The test phase of the multilayer perceptron network reports the error of the model. It is worth noting that objective performance metrics have to be used to properly assess the performance of the developed multilayer perceptron model.

It is worth noting that the available data has to be divided into the training data and the test data and the conventional training and test data division of 70% and 30%, respectively, is chosen in this work. The available data is split into training and test data employing the test_train_split class available in the SKLearn library of the Python programming language (Bisong, 2019; Hao and Ho, 2019). The actual multilayer perceptron network is also developed in Python programming language using the MLPRegressor class of the SKLearn library (Mukhopadhyay et al., 2019; Maqbool et al., 2023). The developed multilayer perceptron neural network has three hidden layers each containing ten perceptrons as shown in Figure 7. The perceptrons employ rectified linear unit functions as the activation functions. It is worth noting that the number of layers and the number of perceptrons in these layers are optimized according to the data.

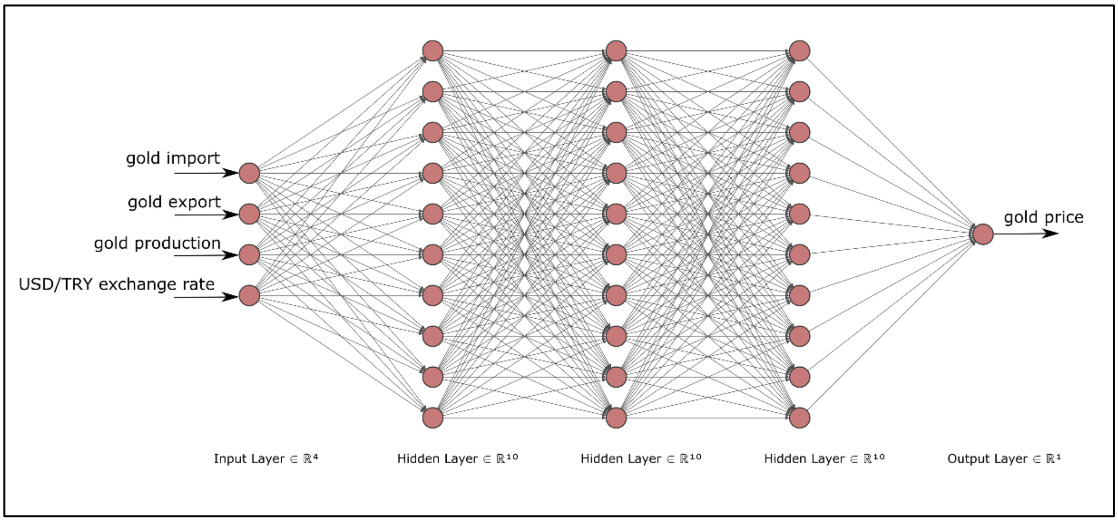

Figure 7. The developed multilayer perceptron network for the modelling of the gold price

The results obtained from the developed model and its performance assessment are given in detail in the next section.

IV. RESULTS AND DISCUSSION

The developed multilayer perceptron model whose details are given in the previous section is trained using the 70% of the available data. The test_train_split class of the SciKit Learn library is utilized for selecting the training data. The loss curve regarding the training phase of the developed multilayer perceptron network is shown in Figure 8. It can be observed from Figure 8 that the training phase converges in a small number of epochs, namely 144 epochs.

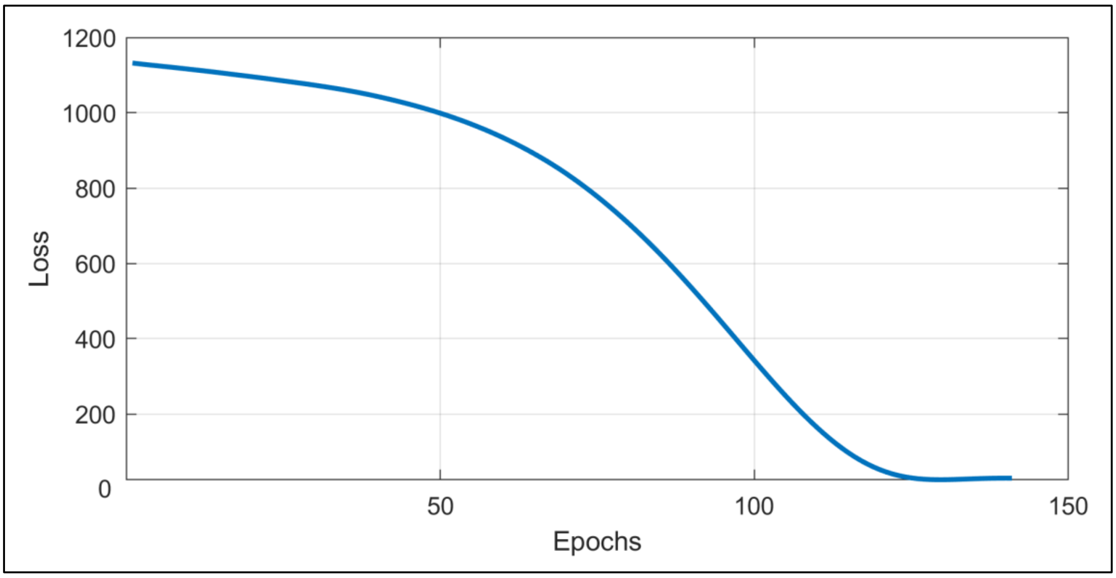

Figure 8. The loss curve regarding the training phase of the developed multilayer perceptron network

After the training phase is completed, the nowcasted gold price results of the developed multilayer perceptron deep learning network is obtained and plotted with the actual gold prices on the same axis pair as shown in Figure 9.

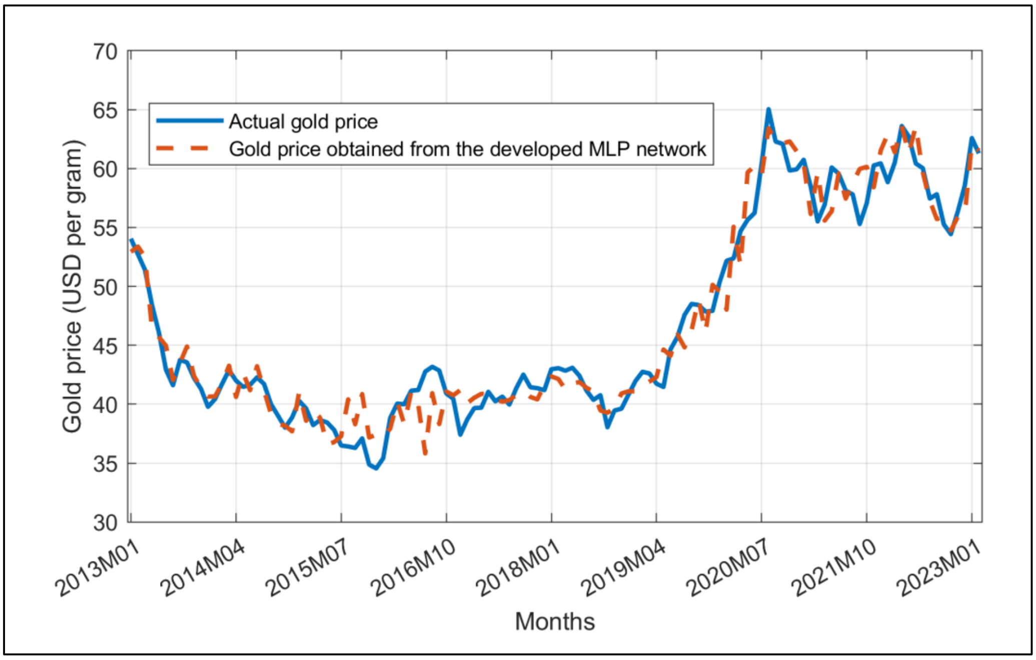

Figure 9. The actual gold price and the gold price obtained from the developed multilayer perceptron model

As it can be seen from Figure 9, the nowcasting results of the developed multilayer perceptron deep learning network accurately represents the actual gold price. In order to assess the performance of the developed model, the coefficient of determination (R^2), mean absolute error (MAE), root mean square error (RMSE) and the mean absolute percentage error (MAPE) values regarding the results of the developed model are calculated utilizing Equations 2-5 (Mombeini and Chamzini, 2015).

$$R^2 = \frac{\sum_1^l (O - avg(O))^2 - \sum_1^l (O-M)^2}{\sum_1^l (O - avg(O))^2} \quad (2)$$

$$MAE = \frac{\sum_1^l |O-M|}{l} \quad (3)$$

$$RMSE = \sqrt{\frac{\sum_1^l (O-M)^2}{l}} \quad (4)$$

$$MAPE = \frac{100}{l} \sum_1^l \left|\frac{O-M}{M}\right| \quad (5)$$

In Equations 2-5, *O* is the actual data, *M* is the result of the developed multilayer perceptron model and *l* is the length of the data. The performance metrics of the developed model are calculated in Python programming language using the classes existing in the SKLearn.metrics library. The numerical values of these performance metrics are presented in Table 1.

Table 1. Performance metrics regarding the developed multilayer perceptron network model

R^2	MAE	MAPE	RMSE
0.952	1.362	2.947%	1.864

The performance metrics of the model given in Table 1 verify the accuracy of the model. The models having an MAPE value less than 10% is considered to be highly accurate models (Lewis, 1982; Martin and Witt, 1989; Witt and Witt, 1992; Cuhadar, 2013; Nelson et al. 2016) therefore it can be said that the multilayer perceptron network developed in this study is a highly accurate model.

V. CONCLUSIONS

Considering the importance of the nowcasting of the gold prices, the monthly gold prices in Türkiye for the period of 2013M01-2023M02 are modelled employing a multilayer perceptron network in this work. The gold prices, gold import and export amounts, gold production quantities and the USD/TRY exchange rate data are gathered from the official sources as the first step. Then, the seasonal-trend decomposition is performed employing the STL algorithm in Eviews software followed by the plots of the original data, seasonal components and the seasonally adjusted data. It is observed from these characteristics that the considered data have highly seasonal and nonlinear components therefore a nonlinear modelling technique should be utilized to achieve an accurate nowcasting performance. Therefore, a multilayer perceptron network model is developed in Python programming language for the nowcasting of the gold prices. The nonlinear activation functions of the perceptrons have the form of rectified linear unit functions and this provides accurate modelling of the highly nonlinear gold price data dependent on the other variables. The 70% of the available data is taken as the training data while the remaining 30% of the data is utilized as the test data. The actual gold prices and the results obtained from the developed multilayer perceptron network model are plotted on the same axis pair demonstrating the accuracy of the model. Furthermore, the performance metrics of the model namely the coefficient of determination, mean absolute error, mean absolute percentage error and the root mean square error are calculated using the classes of the SKLearn.metrics library in Python programming language. The performance metrics verify the high accuracy of the model such that the coefficient of determination and the mean absolute percentage error values of R^2=0.952 and MAPE=2.947% are achieved respectively. It is argued that the developed multilayer perceptron network model can also be used to predict gold prices for other countries and regions.

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