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Research Article

Predicting The Share of Tourism Revenues In Total Exports

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ABSTRACT

Tourism revenues are a significant source of income under the current account service item of countries. These revenues are not included in exports, despite being compared with the export revenues of the countries and in economics the ratio of tourism revenues to export revenues is used as an indicator. In developing economies, tourism revenues play a role in closing the current account deficit. The prediction of this rate in countries with foreign trade deficit is important in developing tourism, export and import policies for the future. In this study, multiple linear regression method (MLR), one of the traditional methods, and the artificial neural network method (ANN), one of the machine learning methods were used to estimate the rate of tourism revenues of the sample country Turkey to its export revenues. In the model of the study covering 2004-2020 period, the number of tourists received, total income from tourism, average expenditure by tourists per capita, population, total export revenue, growth rate, Euro/TL and US Dollar/TL rates were chosen as independent variables. As a result of the study, the R2 value was found to be 91.7% for ANN and 90.8% for MLR which were very close to the ideal value. According to the predicts made on the model developed based on this, the rate of Turkey's tourism income to total export income in 2025 is estimated as 31.83% according to ANN; 32.73% according to MLR while in 2030, it is estimated to be 33.25% according to ANN and 36.78% according to MLR.

Keywords: Tourism, Export, Foreign Exchange, Machine Learning, Turkiye

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1. Introduction

Tourism revenues are a significant source of income under the current account service item of countries that meet their need for foreign sources. In countries that aim to reach a certain development level, the achievement of growth and development and the development of international trade should be forward-looking. Thus, policies that increase foreign exchange reserves and balance foreign exchange supply and demand should be followed, sectors that serve this purpose should be developed, and an effect that increases the international competitiveness of countries should be ensured.

Exports, foreign debt, private equity, and portfolio investments are the factors that determine the foreign exchange supply in a country. In case there is deficit in their balance of payments, states take various measures to eliminate it. The first of such measures is to increase foreign exchange reserves. To increase foreign resources, export of goods and services, which varies depending on international demand, is an important source. The balance of payments is composed of three different accounts as current account, capital, and reserve. Since tourism revenues in the services item under the current account do not display the features of goods produced in the real economy, their share in export revenues is not shown.

Traditional theories on foreign trade were created towards trade of goods produced in the real economy. Theories explaining its effect on the international trade are lacking since variables of the tourism sector include human behavior, the difficulty of numerical measurement and the fluidity in this sector (Eilat & Einav, 2004). Thus, it is mostly products produced in the real economy that collect attention regarding the export of goods and services.

Tourism, which is a service sector, is an important service item helping countries to achieve their macroeconomic goals, next to ensuring the foreign trade balance with its structure that increases employment. This sector makes significant contributions to export activities of states while the demand-increasing effect tourist create when they visit a different country correspond to the demand of the consumer from the producer in the real economy (Balaguer & Cantavella-Jorda, 2002). Globally, tourism services forestalled exports of food and automotive products and become the fourth largest sector in the global export industry (Bilgicli & Altınkaynak, 2016). Thus, for many developing countries this sector has a high-income generation potential.

Tourism sector is increasing in importance in Türkiye with its climate and geographical conditions, young population, high quality service and organization structure. Thus, in the scope of Turkish Tourism Strategy the 9th Development Plan (2007-2023), various targets dispersed to a broad area such as coastal tourism in addition to health, thermal, winter sports, mountain and nature, rural and eco-tourism, congress and fair tourism, yacht tourism and golf tourism. In addition, sustainable tourism approach was adopted and it was targeted to increase employment, making tourism a pioneer sector, becoming one of the top five countries in the international market regarding number of tourists and tourism revenue and becoming an international brand (RepublicofTurkiyeMinistryofCultureandTourism, 2007). Applications towards achieving such purposes assume key roles regarding

increasing service export and foreign currency supply, ensuring international competition and at the same time ensuring foreign trade balance.

Purpose of this study is examining the share of tourism revenues that ensure high level of revenue, employment, and foreign exchange input in export that is an important tool of foreign trade policy. Multiple linear regression analysis and artificial neural networks were used as study method, predicted rate of tourism revenues to export revenues was tried to be estimated.

2. Literature

In the literature review on the subject, studies on predict methods used in tourism sector, foreign trade volume and its impact on economic growth were investigated. Accurate predicts and evaluations in the tourism sector, which has an important place in economic growth and expansion of foreign trade volume, can guide future economic planning. Predicting methods are significant for decision makers to make accurate forecasts about the sector based on country and company. In the literature review section of the study, domestic and foreign studies previously conducted were thus examined.

Palmer et al. (2006) tested the effect of artificial neural networks (ANNs) in their predicts on the tourism sector. In the study inquiring theoretical infrastructure and power of the method, popular tourism region of Spain, the Balear Islands were selected as area, tourism expenditures were taken as quarterly data from 1986-2000 period. In the study 60 time series were used, actual values were compared to estimated values. According to findings, it was decided that artificial neural networks models are effective method that could be used in predicts for the tourism sector (Palmer et al., 2006).

Şen and Şit (2015) on development of tourism sector in Turkish economy and its contributions, development of the sector in 2000-2012 period and the development trend in the noted process were analyzed with macro indicators. In the study, the effect of tourism expenditures on foreign trade deficit and current account deficit was tested. During the noted 12 year-period 236% increase was achieved in tourism revenues, the share of closing the foreign trade deficit was determined to be 34%, and the share of closing current account deficit was determined to be 78%. It was established that tourism sector could assume an effective role in narrowing the foreign trade and current account deficits (Şen & Şit, 2015b).

Şit (2015) inquired the effect of reel foreign currency exchange rate on tourism revenues of Türkiye. The study used monthly reel foreign currency exchange rates from 2000-2012 period and their effect on tourism revenues were analyzed. Unit root tests, frequency distribution, and Toda Yamamato causality tests were used as research method. According to findings, it was decided that there was a dual interaction between reel foreign currency exchange rates and tourism revenues (Şen & Şit, 2015a).

Constantino et al. (2016) studied predict power of artificial neural networks models in tourism demand for Mozambique. The data set of the study was prepared for 2004-2013 period. The number of overnight accommodations was taken as dependent variable showing tourism demand; consumer price index, gross domestic product

(GDP), and exchange rate values against South Africa, United States of America (USA), Portugal and England, where the relationship between tourism and tourism is intense, were taken as independent variables. In the study, where the predict accuracy was measured with the Mean Absolute Percent Error (MAPE) statistic, a high reliability of 6.5% was achieved. It was concluded that artificial neural network models that could reach a high degree of accuracy could contribute to the growth of the tourism sector and that accurate predicts in tourism demand could guide economic actors in terms of products and (Constantino et al., 2016).

In their study for Croatia, the tourism region of Europe, Folgieri et al. (2017) compared artificial neural networks approach and linear regression analyzes in estimating tourism demand. In their models, the number of tourists arriving in the country in the 2007-2012 period was accepted as tourism demand and dependent variable, while monthly average temperature values, harmonized consumer price index, the number of online reservations, share allocated for environmental protection in gross domestic product (GDP), the change of national currency's value against Euro, the number of monthly foreign and domestic tourist visitors, terrorism index and happiness index were accepted as independent variables. The predict performances of the analysis results were compared using the mean square error (MSE) method for the artificial neural network approach and the R2 method for the linear regression and it was established that the artificial neural network approach approached a more reliable predict value than linear regression. It was concluded that the artificial neural network model could be an effective and accurate method in the tourism planning predicts of economic units (Folgieri et al., 2017).

Tunca and Saraçlı (2019) tested the impact of artificial neural networks (ANN) method on tourism revenue and tourism expenditure predicts. In the study quarterly data from 2003-2018 period were used and compared to values realized in the first quarter of 2019. In the study, individual and package tour expenditures of touristic visitors to the country were accepted as tourism income; touristic food, accommodation, health, transfer, sports, entertainment, jewelry, mobile phone roaming fees were accepted as tourism expenditure data. Predict performance was measured with the average absolute percent error (MAPE) statistic and a close relationship was found between the relevant period and the actual values. According to the findings, it was concluded that artificial neural network model and predicts could be effective in the plans and programs of the tourism sector, which has a high potential for the Turkish economy (Tunca & Saraçlı, 2019).

Çuhadar (2020) the impact of artificial neural network method on tourism revenues was investigated. In the study, Exponential Smoothing, Box Jeckins and Artificial neural network models (ANN) were used in tourism revenue predict to understand the developments in the tourism sector, to guide policy makers and to test the method that can give accurate predict values for the future. The performance values of the findings were measured with the mean absolute percent error (MAPE) statistic and it was concluded that the artificial neural network model had a higher success value than the other models (Çuhadar, 2020).

Bingöl et al. (2020) investigated the relationship between tourism revenues and macro variables for Türkiye. In the study time series method was used and Toda Yamamato causality and ADL co-integration analysis were conducted. With the data

set prepared for 1986-2019 period, tourism revenues were determined as dependent while inflation, employment, Gross Domestic Product (GDP), and dollar exchange rate were accepted as independent variables. A long-term relationship between variables was determined with ADL co-integration analysis. It was concluded that there was a one-way causality from foreign exchange rate and inflation to tourism revenues and from tourism revenues to employment (Bingöl et al., 2020).

Usmani et al. (2021) studied the effect of touristic visits and tourists' expenditures on economic growth in Brazil, Russia, India, and China. In the study annual data from 1995-2016 period was used, panel data analysis together with Dumitrescu-Hurlin causality tests were applied. Gross Domestic Product (GDP) values of the countries was accepted as dependent variable while the number of tourist visitors and international tourism expenditures were accepted as independent variables. According to findings, a significant effect of tourist visitors on economic growth was not detected and a significant and one-way causality was found between tourist expenditures and economic growth (Usmani et al., 2021).

Nguyan et al. (2021) investigated the impact of artificial neural network models in predicting tourism demand of Vietnam, that is the area of Southeast Asia that receives the most tourists. In the study where Vietnam's tourism structure and the falling and changing tourism demand due to Covid-19 was assessed, the number of tourists that the state received in 2008-2020 period was accepted as data demonstrating tourism demand. Predicting validity of artificial neural network method was calculated with mean absolute percent error (MAPE) statistic and a high level of reliability between 7.9%-9.2% was received. In the findings achieved in the study, it was concluded that artificial neural network models could be an effective method for tourism planning accompanied with data selected for the previous 12 months (Nguyen et al., 2021).

Bozkurt (2021), the effect of international tourism expenditures on foreign trade volume in the OECD countries was inquired. In this study tourism expenditures in 2000-2018 period were assessed in the scope of 36 countries and panel data analysis and least squares method were used. According to findings, it was concluded that there was a linear relationship between tourism expenditures and foreign trade volume and foreign trade volume expanded with increasing tourism expenditures (Bozkurt, 2021).

In their study on assessing the level of importance of factors affecting tourism revenues, Altındağ and Akay (2021) tested artificial neural networks approach and Path analysis. In the study, the number of visitor tourists, the dollar rate, the number of tourism agencies and the number of beds in tourism facilities, which were considered to affect tourism revenues, were discussed and the effect between tourism revenues was investigated by Path analysis and artificial neural network method. According to findings and comparisons, it was concluded that artificial neural networks methods gave more approximate results compared to Path analysis and that the number of visitor tourists was at the top of variables effecting tourism revenues while it was followed by the number of tourism agencies, the number of beds in tourism facilities, and dollar rate (Altındağ & Özlem, 2021).

Çinel and Yolcu (2021) investigated the relationship between tourism revenues and foreign trade balance using artificial neural networks method. In the study dataset

from 2013-2020 period and monthly tourism revenues were accepted as independent variable, monthly current account balance was predicted. According to findings, a direct and strong effect was determined between tourism revenues and foreign trade balance. In the study it was determined that the increase in tourism revenue had a decreasing effect on current accounts deficit and that using an approach uniting artificial neural networks and time series analysis methods could reveal correct predicting values (Cinel & Yolcu, 2021).

Demir and Bahar (2022) studied the relationship between tourism revenues and foreign debt for Turkey. In the study quarterly data from 2003-2021 period were used, tourism revenues and gross outstanding foreign debt was accepted as data in American dollars. Johansen-Juselius cointegration and Granger causality method were used in the study where it was found that 1% increase in tourism revenues in the long-term lead to 0.262% decrease in external borrowing rate while a unidirectional causality was determined from tourism revenues to external borrowing. In the study it was concluded that tourism could be an effective sector for increasing foreign currency input in a state and become a source for external borrowing (Demir & Bahar, 2022).

Özkurt and Bilgir (2022) studied the relationship between tourism revenues and economic growth for Turkey. Dataset of the study was tourism revenues of 1980-2020 period and Gross Domestic Product values. ARDL cointegration test and analysis were conducted in the study where it was concluded that tourism revenues in the long term had a significant and consistent impact on economic growth (Özkurt & Bilgir, 2022).

3. Material and Method

In the study a dataset of 17 data for 6 years from 2004 to 2020 years was used. Data were normalized using decimal scaling method. In the study feedback artificial neural networks method was used. Study results were analyzed using R2, MSE, and RMSE methods. The working principle of the model is shown in Figure 1.

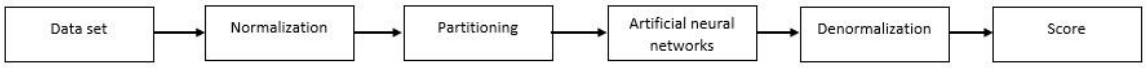

Figure 1. Working principle of the model

3.1. Dataset

17 data for the period between 2004-2020 used in the study were compiled from the Turkish Statistical Institute, the Central Bank of the Republic of Turkey, and the Association of Turkish Travel Agencies. In the established model, the percentage weight of tourism revenues, which is the subject of the research, according to total exports, was determined as the dependent variable. As entry units, the number of foreign visitors that came to Turkey, the total tourism revenue from these foreign visitors, the average expenditure per foreign visitor, total export income, population, growth rate, the Turkish lira equivalent of the US dollar and the Turkish lira equivalent of the Euro were selected as independent variables.

While designing the research model, independent variables were selected in two main groups. It was considered that the change of the first three independent variables related to the first group of tourism according to years will determine the predictive power of the model especially in tourism. Şit (2015), Constantino et al. (2016), Altındağ and Akay (2021), Usami et al. (2021), Çinel and Yolcu (2021) used these independent variables in their studies on tourism. Since the second main group of the model was export revenue, population, growth rate, the Turkish lira equivalent of the US dollar and the Turkish lira equivalent of the Euro were the main variables that provided information about the export level of the country, they were chosen as the input independent variables in the model. Şit (2015), Constantino et al. (2016), Bingol et al. (2020), Usami et al. (2021), Altındağ and Akay (2021), Özkurt and Bilgir (2022) added the growth rate and exchange rates as variables in their studies on tourism.

In the study, multiple regression method from among traditional methods and artificial neural networks method from among machine learning methods were used to investigate the predict of tourism revenues in exports. Because artificial neural networks method provided quite successful results in studies on tourism by Palmer et al. (2006), Folgieri et al. (2017), Tunca and Saraçlı (2019) Çuhadır (2020), Çinel and Yolcu (2021), and Nguyan et al. (2021), this method was used in the study next to multiple regression method. Thus, it is considered that results achieved by comparison of two methods would contribute to the literature.

3.2. Data pre-processing

Normalizing the properties of the data is a useful step in limiting the values of all the properties in pre-decided ranges. There may be many properties in the dataset and the dimensions of these features can be different. A value with a large size may cause greater weight in the classification process and may shift the classification accuracy in that axis. Thus, each property in the data should have approximately equal spacing and the same effect.

In the study, decimal scaling method was used to operate on data and for ease of calculation to conduct normalization. In this method, the decimal points of the feature values are moved. This movement of decimal points is completely dependent on the maximum value among all values in the feature. The decimal Scale normalization formula is,

$$A^{\mathrm{i}} = \frac{A_j}{10^m} \qquad (1)$$

Where, Ai is the scaled values, Aj is the range of values, m is the smallest integer Max(|Ai|) <1.

Since normalized values are between 0 and 1, it is impossible to compare the resulting values with real values. Denormalization process was applied to compare the values received with real values. Thus, it is possible to compare real values with predicted values.

In the study, using the cross-validation method, the same data samples were grouped differently to increase the amount of data. In this method, the data are initially divided randomly as test and training data. While training data are used in the model establishment phase, test data are not used in model setup; the accuracy of the

model is tested on this new data set (Bishop, 1995; Temel et al., 2012). In the study, 10% of the data is used for both verifications set and training set in each iteration. As a result of 10 iterations, the results are collected, and the accuracy of the model is calculated.

3.3. Methods

In the study multiple linear regression and artificial neural networks method from among artificial intelligence methods were used.

3.3.1. Artificial neural networks

Artificial neural network (ANN) method is an artificial intelligence method imitating working principles of the human brain. Artificial neural networks emerged because of mathematical modeling of the learning process of human brain. ANN creates its own experiences with information achieved at the stage of training and then gives the most correct decisions on similar issues.

ANN creates an output set that correspond to an input set it was given. To do this, the network is trained with samples of the relevant event to have the ability to generalize. With this generalization output sets correspond to similar events is determined.

ANN is composed of interconnected artificial cells that can operate parallel to each other. These cells are known as neurons. Connections of each neuron are accepted to have a value. Artificial neural networks are composed of three layers: input layer, intermediate (hidden) layers, and output layer. Elements in the input layer is responsible for conveying information in the external world to the system. Input processing does not take place at input layer at some networks. There might be multiple intermediate layers between input and output layers. Each neuron at a layer is connected to the neuron on a higher level with various weights. Every data at input layer is multiplied with weight value and conveyed to the hidden layer. The result is transited through a transfer function at hidden layer and sent to output layer (Kutlu & Badur, 2009). It calculates the net input into the cell. Various functions are used for this purpose. The most frequently used is multiplying input values with weights and adding.

$$NET = \sum_i^N X_i W_i \quad (2)$$

Here X shows input, W weight value and n shows the total number of inputs to the cell. Activation function is used to determine the out that would be produced corresponding to net input into the cell. There are various activation functions. As in adding function, all cells (neurons) do not have to use the same function in activation function as well. The formula that must be used to determine the correct output could be found by trial-and-error method. In the frequently used Multilayer Detectors model usually sigmoid function is used and derivation of the function value must be calculated (Öztemel, 2012).

$$f(NET) = \frac{1}{1+e^{-NET}} \quad (3)$$

The working principle of ANN is presented in Figure 2.

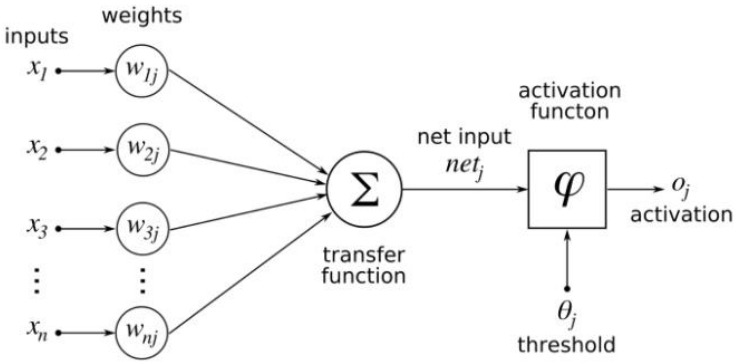

Figure 2. The working principle of the ANN

Artificial neural networks are separated into two as feedforward and feedback, according to connection of neurons they contain to each other. In feedforward networks, neurons are in the form of regular layers from input to output. Bonds from layers are only from one layer to the next layers. The information coming to the artificial neural network passes to the input layer after being processed through the intermediate layers and the output layer and then goes out to the outside world. In feedback artificial neural networks, unlike feedforward networks, the output of a cell is not given as an input to the layer of the next cell. It can also be connected to any cell in the previous layer or in its own layer as an input.

Artificial neural networks can produce output according to the given inputs only through the network learning. Artificial neural networks can be separated to two categories, as supervised and unsupervised, according to their learning algorithms. In unsupervised learning, only sample inputs are given to the network during learning. Any expected output information is not given. According to the information given in the introduction, the network creates its own rules to classify each sample among itself. Output values are also given for input values given to the network during supervised learning. The network updates its weights to generate the desired outputs for the given inputs. By calculating the error between the outputs of the network and the expected outputs, the new weights of the network are arranged according to this margin of error.

3.3.2 Multi linear regression

Multilinear regression analysis is used to predict the value of an analysis according to the value of another. The variable that is wanted to be predicted is labelled as dependent variable. The variable used to predict the value of another is labelled as independent variable.

A linear regression defines a regression model that is composed entirely of linear variables. They help understanding and predicting behavior of complicated systems, analyze financial and biological data. There are two types of linear regression analysis: Simple regression and multiple regression. In simple regression only one explanatory variable is used while in multiple regression many explanatory variables are used.

The simple linear regression model is a prediction algorithm that aims to draw the y = ax + b line suitable for data models in two-dimensional space. The purpose of drawing this line is to produce the closest results to the desired value (dependent

variable). There is only one dependent and one independent variable, the relationship between independent and dependent variables is linear, and the type of regression line is a straight line. Simple linear regression is not suitable for large data.

Multilinear regression model is used in cases when more than one independent variable in the system effects the result. Multilinear regression is the analysis conducted to reveal the relationship between one independent variable and a series of related independent variables. Multilinear regression studies the linear relation between two or more independent variables and one dependent variable. Equation 4 shows the multilinear variable. Here, y is used as dependent while x is used as independent or prediction variable.

$$y = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \cdots . + \beta_k X_{ik} + \varepsilon_{ij} \quad (4)$$

defined as i=1,2,3,...,n and j=1,2,3,...,n.

Here, X_{ij} shows the level of j^{th} independent variable at i level while B_j, shows j^{th} regression coefficient, e_{ij} shows the error prediction, and k shows the number of independent variables.

As the equation demonstrates, there are many independent variables in the system in multilinear regression. Thus, the effect of variables on the system could be different and such effects can give positive or negative results. There are several methods to measure the effect of variables on the system. The backward elimination method is one of the step-by-step comparison methods. First of all, a significance value is determined. The variable with the highest p-value (probability value) at that time is determined and in case P>SL the variable is removed from the system and the model is recreated after which this step is repeated. Elimination is concluded when P<SL for all variables. The forward elimination method includes the same steps as the backward elimination method. As a difference, the algorithm includes a single variable in the beginning, as opposed to backward elimination, and the number of variables increases with each step. In the Bidirectional Elimination method, the criteria for adding a variable to the system and eliminating from the system are found separately, that is, there can be two SL values. The system first considers the variable with the lowest p-value. Then, keeping this variable constant, all other variables are included in the system, and the variable with the lowest p-value is determined once more, ensuring that it remains in the system. The P-Value used in these definitions is the probability that, under a given statistical model, the statistical sum of the data is equal to or higher than the observed value.

4. Results and Discussion

In the study, 17 data belonging to 2004-2020 period are used to predict Turkey's tourism revenue in total export. In the study multilinear regression and artificial neural networks methods are used. In the developed model, eight independent variables and one independent variable are used. The basic working structure of the model designed in the study is presented in Figure 3.

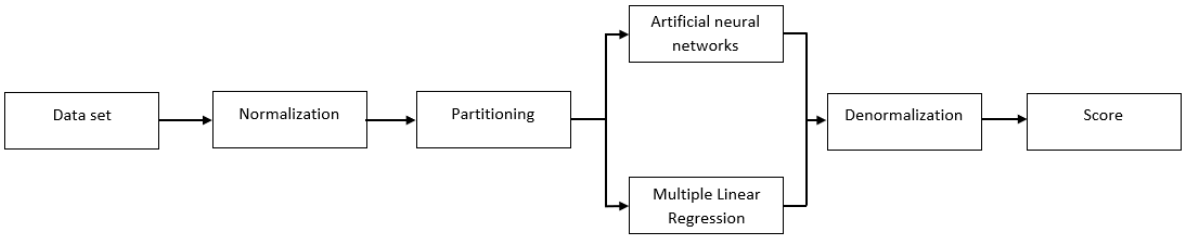

Figure 3. The basic working structure of the model

In the study variables are scales between 0 and 1 to make the most correct analysis, that is they are normalized. Decimal scaling method is used to that aim. Thus, both all data are reduced to the same interval and the difficulty of working with large data is removed. Because the predicted values will be between 0 and 1 after the analyses are completed, they will not be meaningful. As a solution, denormalization is made in the study and real values are calculated.

Data used in the model are separated into two in terms of their purposes as training and test. Although there are no definite rules regarding separation rate of data, usually trial and error method is used. As a result of the tests performed, the data are divided into two with the rates that provide the highest success rate. As a result of the test studies carried out in this study, it was decided to use 80% of the data for training and 20% for testing. Different methods can be used in the selection of data for training and test purposes. Take from top, linear sampling and draw randomly are some of the data selection methods that can be used. In the study, linear sampling method was preferred in data selection to compare the results of the two models.

Statistical data achieved because of the multilinear regression analysis are presented in Table 1. Table 1 shows the effect of all independent variables on the dependent variable. Coefficients, standard error, t and P values are given in turns.

Variable	Coefficients	Standard error	t-value	P value
Foreign Visitors	0,6887	0,6689	1,0296	0,0473
Total Tourism Revenue from Foreign Visitors	-0,2341	0,9787	-0,2392	0,3531
The Average Expenditure per Foreign Visitor	0,3196	0,2483	1,2872	0,0335
Total Export	-1,645	0,1999	-8,2291	0,0012
Population	0,2176	0,1692	1,2862	0,0249
Euro/ Turkish Lira	0,0391	0,0676	0,5773	0,5947
US Dollar/ Turkish Lira	-0,0381	0,0188	-2,0282	0,0259
Growth Rate	0,0307	0,0464	0,6631	0,8378
Intercept	-0,1698	0,2089	-0,8129	0,0117

Table 1. Results of multilinear regression

Study of Table 1 reveals that the independent variables including of the number of arrivals, average expenditure, total exports, population, and dollar exchange rate under 0.05 from the p values in the model and the fixed parameter of the model are significant. The number of foreign visitors, Euro/TL and growth variables remaining outside such variables were not found significant.

Table 2 shows that when variables that were not found significant were removed from the model, this new model is also statistically significant (0.0333 <0.05).

Variable	Coefficients	Standard error	t-value	P value
Foreign Visitors	0,4788	0,0376	12,7205	4,30E-6
The Average Expenditure per Foreign Visitor	0,2613	0,0360	7,2674	0,0002

Total Export	-1,6637	0,1616	-10,2945	1,77E-5
Population	0,3720	0,1161	3,203	0,0150
US Dollar/ Turkish Lira	-0,0302	0,0170	-1,7764	0,0189
Intercept	-0,2162	0,0818	-2,6416	0,0333

Table 2. Results of multilinear regression

When the p values in the new model are studied, as presented in Table 2, all are found to be under 0.05 and significant. The predicted equation on the share of Turkey's tourism revenues in total exports using partial regression coefficients in the coefficient column,

$$\Upsilon = -0{,}2162 + 0{,}4788X_1 + 0{,}2613X_2 - 1{,}6637X_3 + 0{,}3720X_4 - 0{,}0302X_5 \qquad (5)$$

This equation shows that there was a linear relationship between number of arrivals, average expenditure, and population and the share of Turkey's tourism revenues in total exports variable and increase in these variables would lead to increase of the share in realized exports. On the other hand, an inversely proportional relationship is found between total exports and dollar independent variables and the share of Turkey's tourism revenues in total exports. Increase in these variables causes decrease of the share in realized exports variable when the effect of other independent variables is held constant.

A supervised and feedback artificial neural network model was created for the artificial neural network method. There are no rules to follow while deciding on the number of hidden layers and neurons in artificial neural networks. Trial and error method was used for the selection of the parameters that directly affect the success of the model. The model consists of two hidden layers and two neurons in each hidden layer. 1000 iterations were carried out to get the best result in the model.

The success and error values of the models according to ANN and multiple linear regression methods are presented in Table 3.

	ANN	**MLR**
R^2	0,961	0,916
MSE	0,126	0,268
RMSE	0,355	0,518
MAPE	0,023	0,038

Table 3. Comparison of the models

An R^2 value of 1 that demonstrates how well the data fit a linear curve, indicates that the test data provided a linear curve. As a result of the study, the R2 value was found to be 91.7% for ANN and 90.8% for MLR and it was observed that this was very close to the ideal value. The MSE value is used to demonstrate how close a regression curve is to a set of points. It could be argued that near-zero prediction models are more successful. As a result of the study, MSE value was found to be close to the ideal value with 0.347 for the ANN and 0.381 for the MLR. If the RMSE value used to find the distance between the predicted values and the actual values is zero, this means that the model does not make any error. Therefore, the RMSE value is desired to be close to zero. In the study, it was observed that the RMSE value was 0.589 for ANN and 0.617 for MLR, which was close to the ideal value. According to Table 3, it was observed that ANN was more successful and had fewer errors.

Because normalized values had an interval between 0 and 1, they were not significant with real data. These values can be denormalized and compared with real values.

Years	Real data	Predicted denormalized data	
		ANN	MLR
2008	15.532	15.477	15.056
2012	14.757	15.242	14.232
2016	10.715	11.212	11.180
2018	13.562	13.668	12.874

Table 4. Comparison of the models

For artificial neural networks, the difference between real values and predicted values was 3.24% and for multilinear regression this was 4.65%. Error tolerance value was in the desired value interval which demonstrates the model was applicable.

5. Conclusion

Tourism is a significant source of revenues in foreign trade policy. Developing countries are economies that have current account deficit due to their structures. The importance of tourism revenues in covering this deficit is undeniable. Thus, their share in export revenues is used as an important indicator. In this study, the share of tourism revenues in export revenues of Türkiye in developing countries category was predicted using artificial neural networks and multiple regression methods from among machine learning methods.

As a result of the study, R2 value is 91.7% for ANN and 90.8% for MLR. These results are accepted as high success rates in the literature. To increase training success and shorten its duration, the data were normalized between 0 and 1. At the end of the model they were denormalized to make data meaningful and real values of data were received. The difference between real values and predicted values was found to be 3.24% for artificial neural networks and 4.65% for multiple regression. Predictions using the developed models revealed that the share of Turkey's tourism revenues in total export is predicted as 31.83% according to ANN and 32.73% according to MLR in 2025 and 33.25% according to ANN and 36.78% according to MLR in 2030. Results reveal that ANN method has a higher rate of predication success like Palmer et al. (2006), Folgieri et al. (2017), Çuhadır (2020), and Nguyan et al. (2021) in the literature.

Current account deficit is an important problem in growth and development of countries. Tourism sector has a high potential to achieve revenues towards reducing account deficit. This study reveals the importance of tourism's share in export. Results of the study would be guiding for decision makers in developing countries such as Turkey for forward-looking planning of tourism and foreign trade policies. Through this model, countries that have current account deficits can successfully predict the share of tourism revenues in exports in the future..

References

Altındağ, İ., & Özlem, A. (2021). Determining the Importance Levels of Factors Affecting Tourism Income in Turkey. Adiyaman University Journal of Social Sciences(37), 397-426.

Bingöl, N., Pehlivan, C., & Han, A. (2020). Empirical Investigation of the Relationship Between Tourism Receipts and Macro Variables for Turkey. Ekev Akademi Journal, 24(82), 245-262.

Bishop, C. M. (1995). Neural networks for pattern recognition. Oxford university press.

Bozkurt, K. (2021). The Effect of International Tourism Expenditures on Foreign Trade Volume in OECD Countries Karamanoğlu Mehmetbey University].

Cinel, E. A., & Yolcu, U. (2021). The Effect of Tourism Revenues on Foreign Trade Balance in Turkey: The Comparison of Forecasts Obtained Via Different Neural Networks Journal of Social Sciences And Education, 4(1), 98-118.

Çuhadar, M. (2020). A comparative study on modelling and forecasting tourism revenues: The case of Turkey. Advances in Hospitality and Tourism Research (AHTR), 8(2), 235-255.

Demir, E., & Bahar, O. (2022). The relationship between tourism revenues and external borrowing: an empirical analysis on Turkey. International Journal of Social Sciences and Education Research, 8(1), 87-98.

Kutlu, B., & Badur, B. (2009). Stock market index prediction with artificıal neural networks. Istanbul Management Journal, 20(63), 25-40.

Nguyen, L. Q., Fernandes, P. O., & Teixeira, J. P. (2021). Analyzing and Forecasting Tourism Demand in Vietnam with Artificial Neural Networks. Forecasting, 4(1), 36-50.

Özkurt, İ. C., & Bilgir, B. (2022). The Relationship of Tourism Revenues and Economic Growth in Turkey: The Ardl Approach. International Journal of Management Economics and Business, 18(1), 277-303.

Öztemel, E. (2012). Artificial neural networks. Papatya.

Palmer, A., Montano, J. J., & Sesé, A. (2006). Designing an artificial neural network for forecasting tourism time series. Tourism management, 27(5), 781-790.

Republic of Turkiye Ministry of Culture and Tourism. (2007). Turkey Tourism Strategy Action Plan. https://www.ktb.gov.tr/Eklenti/906,ttstratejisi2023pdf.pdf?0

Şen, A., & Şit, M. (2015a). The Empirical Analysis of Real Exchange Rate Impact on Turkey's Tourism Receipts. Journal of Yaşar University, 10(40), 6752-6762.

Şen, A., & Şit, M. (2015b). Role and Importance of Tourısm Receipts in Turkish Economy. Dicle University Journal of Economics and Administrative Sciences, 5(8), 30-45.

Temel, G. O., Erdogan, S., & Ankaralı, H. (2012). Usage of Resampling Methods for Evaluating the Performance of Classification Model International Journal of Informatics Technologies Bilişim Teknolojileri Dergisi, 5(3), 1-8.

Usmani, G., Akram, V., & Praveen, B. (2021). Tourist arrivals, international tourist expenditure, and economic growth in BRIC countries. Journal of Public Affairs, 21(2), e2202.