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Predicting demand of electronic banking services in Iran using ARIMA method

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Abstract: This article pays on predicting demand of Electronic Banking Services in Iran using ARIMA method and calculations using EVIEWS software. In recent years, the need to increase demand for internet banking service infrastructure is more than ever before. In this paper, ARIMA method estimated demand of e-banking services. The results show the increasing demand for banking services is reflected in the need to increase infrastructure.

Key words: Demand for electronic banking services; ARIMA method; E-banking infrastructure

1. Introduction

Payment system is the mechanism that can transfer funds from one bank account to another bank account and the role of the state in the economy, such as vessels and the money goes to the various economic agents. The fact that the operating and monitoring the proper operation, accuracy and integrity of the monetary system is considered as one of the main tasks of central bankers in the world today. Central Bank of the Islamic Republic of Iran with regard to the issues, problems and challenges facing the banking system and the need to move it to the evolution of the strategies and methods of customer service, network management and information exchange between the Bank Restructuring (acceleration) in the Payment Systems Department in addition to performing duties related to the clearing and settlement of payments, e-cards, the main task of formulating regulations and standards and to supervise their implementation on the unit's, to the creation of a central banking network, thus creating harmony in motion the country's banks to provide technology-based banking. Fortunately, since the establishment of the key steps in the country's banks were taken using standardized methods of communication and information technology facilities in the affairs relating to the payment and it is hoped that with the cooperation and coordination of movements promising banking network will be the easier path. The use of ICT in economy, trade and commerce, electronic commerce phenomenon with numerous definitions that over time it has been presented discussed and used. The term electronic commerce and electronic business is formed of two parts. "Trade" the action or process that is performed to define the content and "e" is an adjective that means business data and business processes through electronic technologies. Such as business processes that cover the finds can be valued inquiries, tenders, negotiations, contracts, delivery, and payment and so on. The concept of electronic technologies refers to technologies that enable it to perform all the activities required for each of these processes exist. Being multi-channel, inclusive of universality, timeliness and bilateral, should enjoy the same features as a technology to be recognized as a new technology. This technology could be cited, including Internet, intranet, extranet, and the like. Many researchers believe that electronic commerce any communication or transaction between the organization and environmental elements such as customers, Partners or state occurs with the use of electronic tools. Others consider it only includes buying and selling electronics goods on electronic networks and computers. (Turban, 2002; Astinfeld 1998; Zouas, 1998)

Types of electronic payments in the country
- The device processor
- Terminals for sale
- Terminal branches
- Telephone Bank
- Mobile phone
- Internet Banking

In this article, all of the demand for electronic banking in the country from April 2007 and has studied Persian date March 2013 monthly and process it using Arima method and the forecast is fitted.

2. A review of the literature

2.1. Internal

Rasoulinejad (2012), a comprehensive study is conducted to predict the growth of e-banking. Period 2006-2012 was used and growth factors such as credit cards, investment growth of information technology, development of website visitors by banks and literate population growth as factors affecting the growth of e-banking is considered and

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using different neural networks to predict the growth of e-banking payment. The result is a multilayered feedforward predictive power of the model is higher than the other models. In this study, both supply and demand, and is also considered the factors influencing them.

Sharzeie and Ghaffari Nejad (2013) using the method of artificial neural network model autoregressive accumulated quarterly moving average (SARIMA) predicted demand for e-banking. The study period was 2006 to 2013. The results showed that ANN transactions upward trend and the relative superiority of their investigation.

2.2. Foreign Research

Moss et al (2003) based on linear dynamic models autoregressive (AR) and moving autoregressive (ARMA) and the method of nonlinear wavelet techniques have attempted to predict the average monthly number of banking transactions. They predicted a total of 17 months and finally, the ARMA model based on least squares fitting method was selected as the best model.

Simotes et al (2007) to predict the daily demand money from ATM machines using two neural network models were acting autoregressive and concluded that the prediction of daily demand money from ATM machines using ANN is more accurate.

Asenlemen and Vesala (1999) using a linear fixed effects panel data to forecast demand for electronic payments paid. Pay their share of the total electronic payments in the period 1988 to 199 in 1997 to 2006 to meet the predicted values.

Gann et al (2005) to predict the choice of paying customers, in the form of field research.

Were considered as variables such as service quality, perceived risk, cost factors, personal factors, and; using logistic regression model 3, multilayered feed forward neural networks and probabilistic models. The results showed that neural network model to predict the demand for e-banking has been more successful than others.

Paul and Makhraji (2010) to forecast cash from ATM machines began in 2003. He had been employed by AR. In their study, the independent variables such as the location of the branch or ATM, the number of current accounts, retirement account number, account number and salary were considered as factors affecting demand.

3. Method ARIMA

(ARIMA), a broader model of autonomous moving average (ARMA) in Statistics and Econometrics, particularly used in time series analysis. The model used in time series modeling to better understand or predict the future. These models are used in a non-static data (non-stationary) requirement. In most cases, this model is ARIMA (p, q, d) is shown where p, d, q are non-negative real numbers that are unknown degree of autonomy, integrity and the moving average. Box-Jenkins ARIMA models constitute an important part of the approach to time series models. For a given time, where t is an integer index and are real numbers, then the ARMA (p, q) as follows:

$$\left(1-\sum_{i=1}^{p}\alpha_i L^i\right) X_t = \left(1+\sum_{i=1}^{q}\theta_i L^i\right)\varepsilon_t$$

Where L is the lag operator and the autonomous model and the parameters of the moving average and the error model. Generally the error terms are assumed to be independent random variables with the same distribution. Normal distributions with mean zero random variables are removed. Suppose that a polynomial of degree $\left(1-\sum_{i=1}^{p}\alpha_i L^i\right)$ a unit root "d" is. Then we can write:

$$\left(1-\sum_{i=1}^{p}\alpha_i L^i\right) = \left(1+\sum_{i=1}^{p-d}\phi_i L^i\right)(1-L)^d .$$

A model of ARIMA (p, q, d) factors of the polynomial expression is as follows:

$$\left(1-\sum_{i=1}^{p}\phi_i L^i\right)(1-L)^d X_t = \left(1+\sum_{i=1}^{q}\theta_i L^i\right)\varepsilon_t$$

And can therefore be seen as a special case ARIMA (p, q, d) with the self with the same roots. ARIMA models for data with non-stationary processes that can distinguish procedures are used:

A constant process (with mean zero) is modeled as a linear process (for example, linear growth behavior) then a process model into a square (for example, the behavior of second order) in the ARIMA model can be modeled as a combination sees the two models. The first is non-stationary, while the latter is wide-stationary. In the case of standard techniques can then be used to formulate the process of having a sufficient number of observations to predict the payment.

4. Stability tests

The easiest way to determine the stability of a variable, that variable diagram is observed. But given the fact that this method is not accurate enough, stationary time series variable to be tested, the unit root test, which is the most common tests used to detect stationary time series process. To illustrate, consider the following first-order process Vector:

$$\text{t}\, \boldsymbol{Y} = \boldsymbol{\varphi}\, \boldsymbol{y_{t-1}} + \boldsymbol{\varepsilon}\text{t}$$

If the above equation coefficients using ordinary least squares (***OLS***) is estimated to be the one being tested, can examine stationary and non-stationary time series process. That is, if $\mathbf{1} \geq |\boldsymbol{\varphi}|$, then $\boldsymbol{Y}$ a non-stationary times series and its variance over time and tend towards infinity. If $|\boldsymbol{\varphi}| < \mathbf{1}$, then $\boldsymbol{Y}$series Paysta (or difference stationary) is. So stagnation (GD Paysta) time series can be considered by examining the $\boldsymbol{\varphi}$value is strictly less than one, is evaluated.

The overall test, the null hypothesis $\boldsymbol{\varphi}$ = 1 $\boldsymbol{H_0}$: the hypothesis$\boldsymbol{H_1}$: $< \mathbf{1}$. Test Dickey - Fuller and Dickey - Fuller generalized.

Standard Test Dickey - Fuller, the following equation is estimated after subtracting Y_{t-1} from both sides of the equation is that it will:
So:

$$-Y_{t-1} = Y_t\ (\ -1)Y_{t-1} + \varepsilon t \qquad \varphi$$

$$\Delta\,t = \delta\, Y_{t-1} + \varepsilon t \qquad Y$$

Where $\delta = \varphi$ - 1. The opposite hypothesis to test the null hypothesis and reliability comes time series as follows:

$$\begin{cases} H_0 = \ \delta = 0 \\ H_1 = \ \delta < 0 \end{cases}$$

Clear statistics to test the hypothesis $H0$, the t-statistic is calculated as follows:

$$t = \frac{\hat{\delta}}{se(\hat{\delta})}$$

Where $\hat{\delta}$ and δ are estimated se $(\hat{\delta})$ standard deviation was calculated. The basic problem is that in this case, the statistics provided by OLS, under the null hypothesis of the unit root, normally distributed so there is not a standard form. Dickey and Fuller (1979), showed that the unit root null hypothesis, this statistic does not follow a normal distribution of t, therefore, critical quantity t cannot be used for testing. Practical solution proposed by Dickey and Fuller (1979), τ instead of using the t test suggest that and has a limiting distribution. Critical values of τ for different sample sizes to help test and simulation methods Dickey and Fuller have been obtained and tabulated. If the absolute value of τ score is calculated, the absolute value of the critical values provided by Dickey and Fuller τ, bigger, then a stationary time series cannot be ruled out and the time series is stationary. However, if the absolute value is less than the absolute value of the parameter τ is calculated to be critical, then the null hypothesis is accepted that there is a unit root in the time series of a random walk process and the result is non-stationary. Also, Dickey and Fuller (1979) to test the stationary time series, distribution of some statistic τ according to the above equation, the patterns and trends with regard to intercept, intercept and no trend and intercept and process estimates have been derived. Unit root test - the common Fuller discussed above, is only valid when the studied time series, a self-described process is first order. If this assumption does not hold and the time series is correlated with higher interrupt the process described in the order of P, then the sentences disruption assumption of white-noise is a violation of tε. When the error terms are correlated with, there is no test of Dickey - Fuller used to assess stability. Because in this case the extent and distribution of the critical values obtained by Dickey and Fuller still apply. Dickey - Fuller test generalized (ADF), a parametric correction for higher-order correlation with the assumption that the time series X is a process AR (p) as follows, and components makes the difference with P lag of the dependent variable Y is added to the right side of the equation:

$$\Delta\,Yt = \delta + \sum_{i=1}^{p} \beta Y_{t-1}\,\Delta + \varepsilon t\, Y_{t-1}$$

Then the generalized states, is used for static tests. One important result obtained by Dickey and Fuller (1981), the distribution of the test statistic for the static part, the difference depends on the number of intervals in regression ADF. Components of the differential interval (number of optimal) serial correlation in the residuals to eliminate, to the three criteria Akaike (AIC) and Schwartz - Bayesian (SBC) and Hanan Quinn (HQ) and the adjusted values of the three standard criteria determined. Unit root test in following table to demand for electronic services in Iran

Table 1: Dickey-Fuller generalized test

Variable Level	Statistics	Possibility	Result
Level	-1.37	0.86	Unstable
Once the differential	-8.65	0.000	Stable

Once stabilized differential application of electronic services in Iran.

5. Calculation

The calculations were performed using EVIEWS software. Beginning to recognize the demand for banking services in the studied time period varies journalist to look correlation diagram:

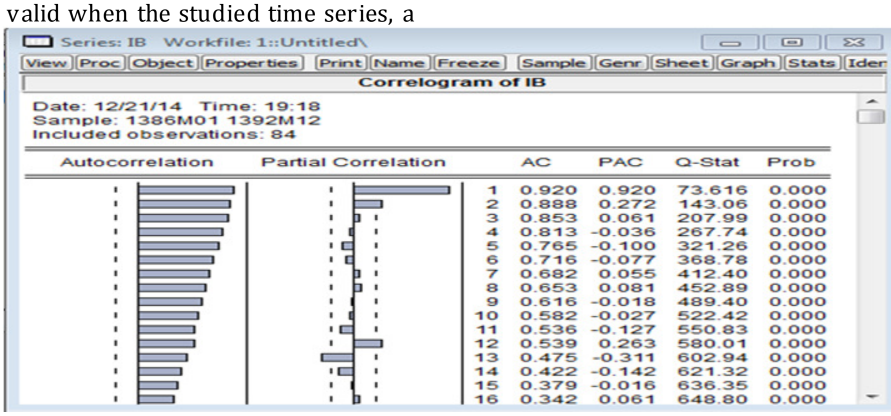

Fig. 1: Correlation journalist once asked a series of e-banking services

As can be seen in the graph log correlation, autocorrelation curves downward and his first words, the partial correlation has crossed the line. This suggests that there is a correlation model AR (1).

6. Results report

The following table summarizes the forecasts for the demand equation is given in the e-banking services.

Table 2: Summary of estimated coefficients from the regression model

Variable	Obtained coefficient
Intercept	1.36
AR (1)	0.99

The coefficient of determination for the model obtained is equal to 0.92 screen is a good fit both 1026.8, which is a good indicator model. But given that Watson camera 2.67 model and the number is divisible by 2, which represents the distance is no autocorrelation. The MA model must also be taken to verify the accuracy of the model. To find the MA again be observed correlation chart recorder (this time the residual model).

As can be seen in the graph log correlation, autocorrelation slight downward curve and its first term relationship has crossed the line. This suggests that, in whom there is a correlation model of the MA (1). However, this estimation is performed by taking the moving average.

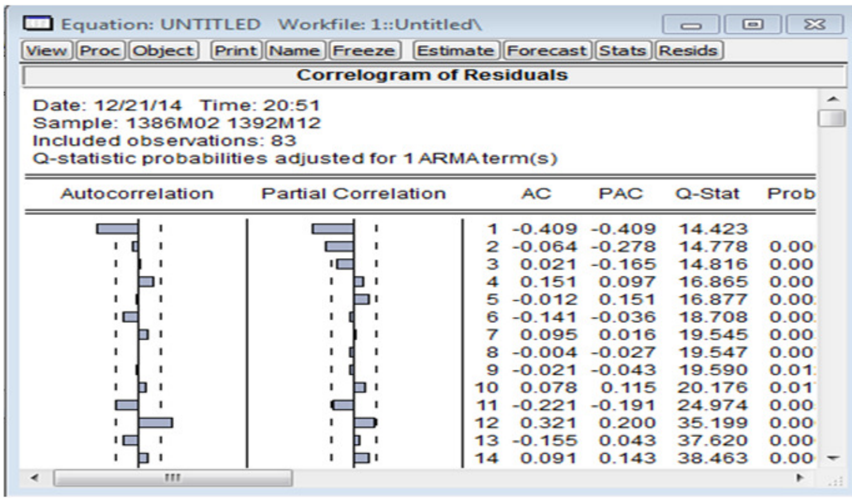

Fig. 2: Graphic correlation equation fitted the residual time series

Table 2: Summary of estimated coefficients from the regression model

Variable	Obtained coefficient
Intercept	1.36
AR (1)	1.01
MA (1)	-0.48

The coefficient of determination for the model obtained is equal to 0.94 is a good indicator of the model 648.2 model, which is a good indicator. But given that Watson camera 2.03 model and the number are not divisible by 2, which represents the distance is no autocorrelation. However, prediction accuracy is examined for the years studied.

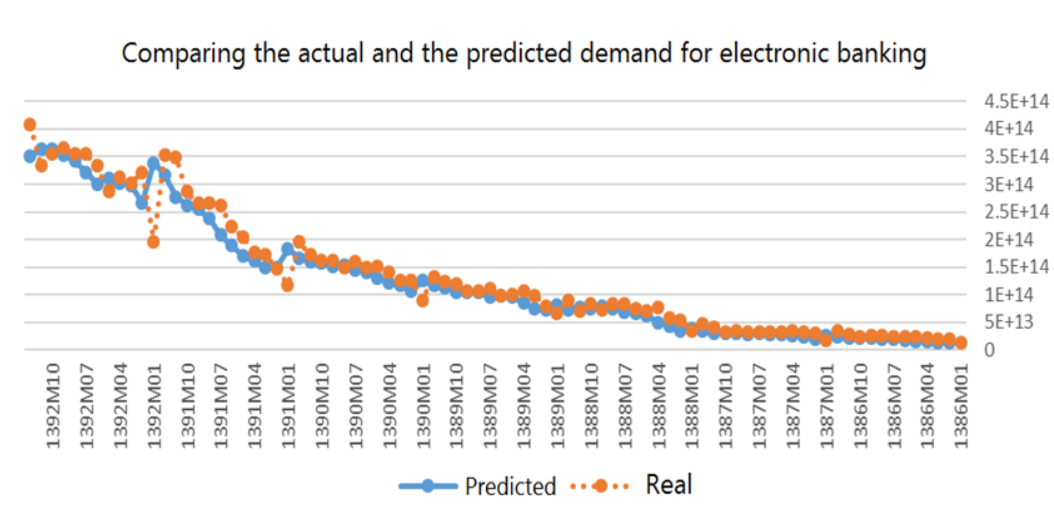

Fig. 3: Fitting the model predicts well the increasing volume of electronic banking application.

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