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Research Article

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Comparison of Neural Network Models, Vector Auto Regression (VAR), Bayesian Vector-Autoregressive (BVAR), Generalized Auto Regressive Conditional Heteroskedasticity (GARCH) Process and Time Series in Forecasting Inflation in Iran

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Abstract

This paper has two aims. The first is forecasting inflation in Iran using Macroeconomic variables data in Iran (Inflation rate, liquidity, GDP, prices of imported goods and exchange rates) , and the second is comparing the performance of forecasting vector auto regression (VAR), Bayesian Vector-Autoregressive (BVAR), GARCH, time series and neural network models by which Iran's inflation is forecasted. The comparison of performance of forecasting models used to forecast Iran's inflation has been done based on the Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) of the models. Due to the annual values of Inflation, liquidity, GDP, prices of imported goods and exchange rates at free market to estimate different models in this paper and compare root mean square error and Mean Absolute Percentage Error of models by which inflation has been forecasted, neural network model had better performance than others models in forecasting Iran's inflation. Indeed root mean square error and Mean Absolute Percentage Error of neural network model have less value rather than root mean square error and Mean Absolute Percentage Error of other forecasting models.

Keywords : Inflation; Forecast; Neural network; Vector auto regression; Bayesian Vector-Autoregressive; GARCH; Time series.

1 Introduction

INflation has been a problem for Iran's economy over the last decades. Iran's inflation condition has never been the same, so that at some years Iran's economy had experienced relative inflation reduction and at some other year's inflation jumps. In the past years, inflation as an undesirable economic phenomenon, has left devastating effects on Iran's economy. In general there are many different ideas about causes and contributing factors of inflation among economists. Some economists, in particular refer to the role of money and its effects on nominal variables, indeed they believe money and injecting it into the economy, despite its many positive effects such as facilitating the exchange of trade and accelerating the process of economic growth and prosperity, negligence and inattention to the process of increasing it can be a very fundamental problem in the economy. Others consider excess demand

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or increasing the production costs and structural factors as the causes of inflation in the economy. Another group of economists emphasize on increase of prices of imported goods as an affective factor in inflation. Forecast inflation process is very important at Economic policy adjustments. It also has led to the use of different models to forecast the rate of inflation; for this purpose, a variety of forecast models have been developed in competition with each other. In this paper, neural network models, VAR, VAR Bayesian, GARCH and time series are used to forecast inflation in Iran and then compare them with the forecasted results.

Then, in the first section, explanations will be provided about inflation and the relevant theories. Literature review is presented in the second section. Description of the data and stipulated models will be discussed in the third section. In the fourth section, inflation will be forecasted by using the above mentioned models. Finally, in the fifth section conclusions will be presented.

2 Inflation

Inflation theories seek to explain the causes and nature of inflation and in each of which specific causes are considered in promoting inflation. In general, the theories presented in the context of inflation are classified as follows.

2.1 Inflation theory of Demand attraction

Inflation theory of demand attraction considers inflation due to the increase of total demand. Increased demand can be caused by the following:

- Increased consumption and independent investment
- Expansionary fiscal policy
- Expansionary monetary policy
- Reduction of money Independent Demand
- Increase of exports and reduction of imports

John Maynard Keynes argued that if demand for consumer goods is more than their supply, this excess demand creates inflation gap and the prices are increased to fill the gap. This is the phenomenon that Keynes calls pure inflation.

2.2 Monetarism and inflation

Proponents of monetarism believe that inflation is a monetary phenomenon and liquidity growth is the main cause of it. So that money is neutral in the long run, therefore quantity of money as a major macroeconomic variable and also one of the main instruments of state policy that is used to control inflation. Monetarists believe that inflation is a monetary phenomenon in the long term and inflation is caused just as a result of high growth rates and the permanent money supply. So that inflation is created by high and continuous growth of the money supply.

2.3 Inflation theory due to price pressure

In inflation theory due to price pressure, unlike monetarism and Keynesianism which consider excess total demand relative to aggregate supply in conditions of full employment as a source of inflation, imbalance in the sections of presenting economy, particularly the increasing cost of production and transmission of aggregate supply curve is considered as the main reason of increasing prices. This is the result of increase production and transport costs of supply curve due to wage increase or increasing raw material costs. In fact, the growth rate of higher wages and the price of other institutions and production factors of productivity growth of each of these factors makes the possibility of a sustained cost pressure inflation.

2.4 Inflationary expectations

Albert Aftalion Criticizing the theory of quantity of money, proposed the influence of psychological factors on inflation. He believes that in addition to the quantity of money, expectation variables about prices and social and political factors also affect the rate of inflation. He noted that if the owners of income predict increase of prices in the future, they convert their money to product quickly and increase their price at the present time by increasing current demand of goods and services. On the other hand, whenever the producers and traders expect an increase in prices, add to their warehouse storage and postpone the supply of goods and services to the future which leads to the promotion of inflation by reducing the supply.

2.5 Theory of structural inflation

In general it can be said that structural inflation means that, inflation occurs and continue due to the conditions related to economic, political, governmental, cultural imbalanced structures and so on. Structural inflation is dedicated to undeveloped and developing countries. In such countries Inflationary pressures are mainly due to the Economic Growth pressure on Heterogeneous and undeveloped social and economic structures.

2.6 Imported inflation

Some economists believe that inflation is caused by increasing prices of imported goods. They also relate its strength and weakness to the amount of imported goods and services in the community. In the current world situation and the severe economic dependence on each other, the problem of balance of payments in developing countries is a serious problem. Import prices and its volume are major sources of the increase in domestic prices and destruction of exchange relation.

Finally it should be mentioned that, within the framework of general equilibrium theory, the present situation in all markets is effective in the price level. In this respect, it seems that a complete theory of inflation should be focused on all the economic markets and, influencing factors. In addition, inflation is a dynamic issue and the rate of change of prices (not the equilibrium level of prices) is concerned. So the main issue in relation to inflation is considering the effective factors in changing level of prices "(not the level of prices)."

3 Literature review

Considering the importance of the issue, many researchers have carried out wide investigations in dealing with inflation and have sought a solution to control it. In this section, some of these studies are presented.

Central Bank of the Islamic Republic of Iran (1381) has tried to examine the relationship between inflation and variables affecting it in the form of a seasonal model. The model for the period (1360-1380) has been evaluated and the results are as follows:

- One percent increase in liquidity provided stable condition of other variables will increase inflation on average 0.96 percent.
- One percent increase in GDP, provided stability of all other variables, reduces inflation on average of 0.07 percent.
- One percent increase in the exchange rate, provided stability of all other variables, increase inflation on average of 0.12 percent.

Moshiri (1380) has considered forecasting inflation in Iran by using the structural model, time series and neural networks. Forecasts has been made in this study using time series data for the period (1377 - 1338). The results of this study show that neural network model for forecasting the future course of inflation in Iran has superiority over other competing models.

Another study by Dadgar, Keshavarz and Tyatrj (1385) entitled "Explaining the relationship between inflation and economic growth due to the characteristics of the Iranian economy" Barro model, (1996) and Alexander Sarl (1997) is discussed. In this model, different thresholds for inflation are considered. Considering the variables used to estimate the model, conditional of least squares (CLS) method is used, which can be a criterion for selecting of the optimal inflation threshold by minimizing the squared error. The results show that at the study period, there is a one-way causal relationship between inflation and economic growth in Iran and in one domain of inflation there is a positive relationship between economic growth and inflation and in other domains the relationship becomes neutral with single inflation rate and then the relationship becomes negative.

"Heidari and Parvin (1387) in an article entitled Modeling and forecasting inflation in Iran using BVAR models variable over time, have considered modeling and forecasting Iran's inflation using quarterly data within the time period (second chapter 1981 to first chapter 2006)." The results indicate that the modified and variable BVAR model over time has better performance in comparison with traditional BVAR and variable BVAR models in the usual time.

"In Zarra Nezhad and Hamid (1388)" forecasting inflation rate in Iran's economy using dynamic artificial neural networks (time-series perspective). In this article, dynamic artificial neural networks are designed to forecast the rate of inflation in the form of multi- layered network using required variables data during the period 1338 -

1386 and according to the inflation perspective, time series are designed by the help of different algorithms of propagation learning method. Designed network assessment has been done to determine the best network based on forecast error. The results showed that the best networks are those that are taught by Levenberg-Marquardt learning algorithm; activating functions of their middle layer are non-linear and activating functions of output layer are linear and the number of neurons in each layer is chosen optimally. According to this network, the inflation rate in the period of 1387-1391 is forecasted from 21.99 to 10.59 per cent.

"In Thakur, Bhattacharyya and Modal (2015) in an article entitled" "Artificial Neural Network Based Model for Forecasting of Inflation in India" by using monthly economic data of India (GDP, exchange rate, exports, money supply, foreign exchange reserves, imports, gold price, oil prices, and the trade balance) From January 2000 to December 2012 discussed about Inflation in India. India's inflation forecast in this paper was carried out using neural network and has been compared to the forecasts of credible sources such as the International Monetary Fund (IMF) and the Economist Intelligence Unit (EIU) of India's inflation that perform their forecasting according to time-series models. The results of this study indicate better performance of neural network in forecast of India's inflation and has provided more accurate forecasts in comparison with International Monetary Fund and the Economist Intelligence Unit.

"Onimode, Alhassan and Adepoju (2015)" "Comparative Study of Inflation Rates Forecasting Using Feed-Forward Artificial Neural Networks (ANN) and Auto Regressive (AR) Models". In this paper, using monthly data from November 2011 to October 2012, inflation rate of Nigeria is forecasted, with Autoregressive models and neural network inflation. According to the results obtained and MSE comparison between different models, in general neural network model has provided more accurate results.

4 data description

The data used in this paper to investigate the subject of study include: Inflation, liquidity, GDP, prices of imported goods and exchange rates in the free market. The used period for variables in this article are 1352-1394 and annual. In unit root tests, none of the variables were stable, except for the inflation variable. By logarithm and then differencing of the first order of liquidity variable, logarithm and then differencing of the first order of gross domestic product variable, logarithm and then differencing of the first order of imported goods price and logarithm and then differencing of the first order of foreign exchange rate, all the variables were stable based on Dickey-Fuller test at a significance level of 95 percent. Abbreviations used in this paper for the variables are listed in Table 1:

Explanations	Abbreviations
Inflation rate	inf
First order difference of liquidity Logarithm	dlm2
First diffrerence of gross domestic products logarithm	dlgdp
First order difference of imported goods price logarithm	dlim
First order difference of exchange rate on free market logarithm	dle

Table 1: Used variables

4.1 Stability and instability of the model's variables

By using generalized Dickey-Fuller test, stability of variables have been studied. All variables became stable after logarithm or logarithm and differencing. Dickey-Fuller test results are presented in Table 2.

	Statistic value	Significance level
dle	-4.03	0.0031
dlim	-4.53	0.0008
dlgdp	-4.54	0.0007
dlm2	-4.25	0.0017
inf	-4.64	0.0005

Table 2: Generalized Dickey-Fuller test results

4.2 Model clarification

4.2.1 Vector Autoregressive model

Specifically, the VAR model taking into account inflation as an endogenous variable and serial correlation between the residuals, is supposed to be an appropriate model for forecasting. VAR model will be shown as:

$$Z_t = \alpha + \sum_{j=1}^{p} A_j Z_{t-j} + u_t \qquad (4.1)$$

Where p is the number of lags in the model, α is a vector $M \times 1$ from stables, Z_t is a vector $M \times 1$ from M variable of model, inflation, liquidity, gross domestic product, imported goods price and foreign exchange rate which are considered as endogenous variables and residuals u_t are distributed as random vectors.

4.2.2 Bayesian Vector-Autoregressive

In econometric structural models which widely do economic forecasts, the problem of too much fitting is solved by entering the variables into the equation that suggests economic theory and have the greatest relationship with the dependent variable; so economic theory is the main source of previous convictions in structural models and in the old beliefs the problem is solved by withdrawing a large number of variables from the equations. It should be noted that withdrawing variables from the equation indicates that the coefficients are zero, therefore according to such provisions, useful information are ignored in historical data.

This has led some economists suspect to the provisions and stated that these provisions act like fences in forecasts, thus they developed Bayesian Vector Regression method developed which is more flexible and shows previous statistics convictions more accurately. At first it seems that there is no difference between BVAR and UVAR models (there are current and lagged values of all variables in both models), however, due to excessive use of previous convictions for reducing excessive estimate, it is similar to the structural model. Although the resources of previous convictions and the ways used by previous convictions in BVAR models are different from structural models, in BVAR model researchers use previous statistical convictions and economic knowledge to guess the values of coefficients which lead to the best forecast. So in the BVAR method, statistical theory and observation are the main sources of previous convictions; while in structural models, economic theory is the main source of previous convictions.

In BVAR models overestimating is done by selecting a large number of coefficient, but moderating the impact of data is done on them. So as long as modelers have enough confidence to express conjectures about the coefficients, this makes random patterns, that may generate data, have excessive fitting or completely remove modification variable, The advantage of this method, compared to other methods, is that the generated data with previous convictions (to predict) is more objective and more renewable This has been confirmed by several researchers. Since this method was conducted by economists who worked at the Federal University of Minnesota and Federal Reserve Bank of Minneapolis, this method is known as previous convictions of Minnesota system.

Bayesian VAR model used in this paper to forecast inflation is as follows:

$$\begin{pmatrix} (inf)_t \\ (dlm2)_t \\ (dlgdp)_t \\ (dlim)_t \\ (dle)_t \end{pmatrix}' = c + \sum_{j=1}^{p} \left(\begin{pmatrix} (inf)_{t-j} \\ (dlm2)_{t-j} \\ (dlgdp)_{t-j} \\ (dlim)_{t-j} \\ (dle)_{t-j} \end{pmatrix}' \right) A_j + \begin{pmatrix} u_t^{inf} \\ u_t^{dlm2} \\ u_t^{dlgdp} \\ u_t^{dlim} \\ u_t^{dle} \end{pmatrix} \qquad (4.2)$$

4.2.3 Time series models

Time series patterns that are often used for short term forecasts, try to explain the behavior of a variable based on its past values. These patterns are able to present accurate forecasts in situations where substructure of economic model is unknown. Unlike econometric patterns that need statistical data and economic theories, these patterns do their job only with past statistical data variables and do not need economic theory. Time series patterns that relate the current values of a variable to its past and present value, are called univariate time series model. Autoregressive Processes (AR), Moving Average Processes

(MA), Autoregressive Moving Average Processes (ARMA) are some of these models.

Autoregressive Moving Average Processes and Autoregressive cumulative Moving Average Processes Autoregressive Moving Average Processes is created from modulation of Autoregressive Processes and Moving Average that is shown as follow:

$$\begin{aligned} y_t &= \alpha + \varphi_1 y_{t-1} + \varphi_z y_{t-z} + \cdots + \varphi_\nu y_{t-\nu} \\ &+\varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_z \varepsilon_{t-z} + \cdots \\ &+\theta_q \varepsilon_{t-q} \end{aligned} \quad (4.3)$$

This equation is called the ARMA (p, q) where p where p refers to the number of Autoregressive sentences (AR) and q refers to the number of Moving Average sentences (MA). If we show lagged sentences by the operator L, the above equation can be rewritten as follows:

$$\varphi(L) y_t = \alpha + \theta(L) \varepsilon_t \quad (4.4)$$

But if one time series was not stable and it's necessary to become stable by differencing, this time series follows Autoregressive cumulative Moving Average ARIMA (p, d, q) as it is shown:

$$(L)(1 - L)^4 y_t = \alpha + \theta(L) \varepsilon_t \quad (4.5)$$

In this process p, q and d respectively show autoregressive sentences, Moving Average and number of differencing (for stability of time series). In fact, it can be said that all autoregressive, moving average and moving average autoregressive processes are certain forms of ARIMA. For example, if $p = d = 0$ and $q = 1$, we have a first order moving average process. So in case of making a series stable, we can express ARIMA process in ARMA form.

4.2.4 General model of GARCH (p, q)

If the conditional variance equation of error is defined as follows:

$$\inf_t = \omega_0 + \alpha \varepsilon^z_{t-1} + \beta \inf_{t-1} \quad (4.6)$$

Above generalized ARCH model is called GARCH $(1, 1)$ where the functional conditional variance is composed of three components:

1. 1. Long-term average value which is defined by the fixed component ω_0.
2. 2. News and information from fluctuations in the last period that is defined as the square residuals $(\alpha \varepsilon^2_t - 1)$.
3. 3. Conditional variance fluctuations in the last period $(\beta \inf_{t-1})$

GARCH $(1, 1)$ model can be generalized to the general form of GARCH (p, q), so that p shows the number of lag in conditional variance and q the number of lagged squared q residuals in the last period. So it can be written:

$$\inf_t + \omega_0 + \sum_{i=2}^{q} \alpha_j \varepsilon^z_{t-j} + \sum_{j=1}^{p} \beta_j \inf_{t-j} \quad (4.7)$$

As can be observed GARCH model is similar to the ARMA process in which Auto-Regressive component $\inf_{t-j}$ is a representative of Moving Average rank-order GARCH component and the Moving Average component ε^z_{t-j} is a representative of rank-order ARCH component. If the rank is $p = 0$, There is only one moving average and ARCH model appears as a special case of the general model GARCH that in general, show it by GARCH $(0, 1)$.

4.2.5 Artificial intelligence systems

About forty years ago artificial intelligence were considered in various fields and extensive discussions and researches and applications began about it. However, at this time there had been substantive progress on these and many researchers' ideas have been fulfilled in practice. One of the main reasons for this rapid progress can be seen in the use of tools that perform based on "Soft computing". Soft Computing System or computational intelligence means to extract intelligence, knowledge, algorithm or the mapping of the numerical calculations based on the presentation of up to date numerical data. Computational Intelligence system originally provides dynamic system estimation model for the approximation of functions and mappings.

The general structure of artificial neural network

Each artificial neural network is composed of a collection of neurons that are grouped in layers. The way the neurons arrange in different layers and the way neurons connect to each other, the number of neurons in each layer and intermediate layer (hidden) determine the neural network architecture, that as soon as determining the network architecture, the processing of the inputs starts.

5 Neuron

Neuron is the smallest processor unit of information that forms the basis of the performance of neural networks. Input and output data, respectively, is shown by p and a scalar.

The impact of p input on a output is determined by the w scalar. x_0 is also another input in which constantly is 1 and multiplied in the cross b and added to wp. The result of this addition will be n net input to f function. The net input and output of this neuron is defined by the following expression:

$$n = wp + b \tag{5.8}$$

$$a = f(wp + b) \tag{5.9}$$

But generally neurons have more than one input. One neuron with R input in which w_{ij} Shows weight of the j input in relation to the i neuron and because there is only one neuron here, weight matrix of w will be converted into a row vector. The net input and output neurons will be as follows:

$$n = \sum_{i=1}^{R} P_j w_{ij} + b \tag{5.10}$$

$$a = f\left(\sum_{i=1}^{R} P_j w_{ij} + b\right) = f(WP + b) \tag{5.11}$$

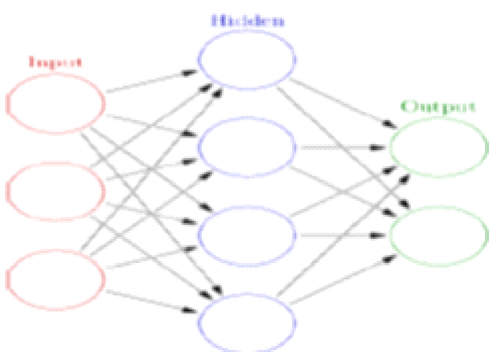

Chart 1: The overall structure of artificial neural network

An artificial neural network consists of connected nodes similar to network of neurons in the brain. Here each circular node shows an artificial neuron and each arrow represents the output connection of a neuron as it is input to another neuron.

To avoid saturating the network and not involving the network in a local minimum, data are usually normalized at intervals $[0, 1]$ or $[-1, 1]$. Inflation data in this article is normalized using the following equation on the interval $[-1, 1]$.

$$\gamma_n = \frac{2(\gamma_{actual} - \gamma_{\min})}{\gamma_{\max} - \gamma_{\min}}$$

In the above equation γ_{actual} represents the actual amount of data; γ_n represents the normalized amount of data; $\gamma_{\max}$ represents maximum amount of data and $\gamma_{\min}$ represents minimum amount of data.

5.1 Criteria of information and forecast error

Criteria of information between the simplicity of model and the suitable fitness seek an optimal point and their difference are in coefficient of significance to these two issues. The most important of them are: Akaike information criterion, Schwarz-Bayesian and Hannan-Quinn. Among these criteria, Akaike have the lowest and Schwartz-Bayesian have the most importance to simplicity models and Hannan-Quinn criterion for $T > 8$ is placed between the two above criteria. The models that have the least amount of these criteria will be selected.

In the second criterion, the best model is selected based on the lowest forecast error. Different statistics such as Mean Square error (MSE) or root mean squared error (RMSE), mean absolute percentage error (MAPE) are evaluated to determine the best forecasting model. Meanwhile, the MSE or RMSE criterion was the most commonly studied criterion as follows:

$$\text{MSE} = \frac{\sum_{t=T+1}^{T+n} (\hat{y}_t - y_t)^2}{n}$$

$$\text{RMSE} = \sqrt{\frac{\sum_{t=T+1}^{T+n} (\hat{y}_t - y_t)^2}{n}}$$

In this statistics T is the number of observations and n is the period in which forecasting takes place and y_t and y_t^8, respectively, are actual and forecasted values of the intended variable that

MAPE	RMSE	
0.88	11.75	AR(1)
0.25	3.65	GARCH(1,1)
1.18	16.82	VAR
0.62	8.2	BVAR
0.002	0.16	ANN

Table 3: results of the studied models

Predicted amount at 1395	
21.6	AR(1)
16.6	GARCH(1,1)
17.8	VAR
19.6	BVAR
9	ANN

Table 5: predicted inflation amount at 1395

show the difference between the forecast error. Finally, a model in that MSE or RMSE is lower than that of the other models, will be preferred. In this paper, the MSE and MAPE criteria are used to determine the best forecast model.

$$\text{MAPE} = \frac{\sum_{t=T+1}^{T+n} |\hat{y}_t - y_t|^2}{n}$$

5.2 Forecast

Inflation forecast has been done with respect to available information in the sample that is according to intra sample forecasts method. In fact, the sample is divided into two sections. First section is 1352-1392 that is used for estimation models and second section is 1393-1394 that is used for inflation forecast during these two years. Forecasts have been done for a further period of two years.

To evaluate the forecasts in this article forecast error criteria RMSE and MAPE have been used. Results of predict structural models and time series models and neural network are shown in Table 3.

The above results generally show that neural network model is better than structural models and time series models in inflation forecast. As shown in Table 3 forecast errors of neural network model criteria is much less than forecast errors of structural models criteria and time series models.

Actual and forecasted inflation amounts are given in Table 4 for different models.

Using the studied models, inflation in Year of 1395 is also forecasted, results of which are presented in Table 5.

6 Conclusion

Inflation has been one of the chronic problems of recent decades in Iran. However, the status of these variables has never been the same and Iran's economy has experienced a relative decline in some years and some inflation jumps in some other years. Quantitative Analysis of inflation in recent years has shown that Iran has been among the countries with the highest inflation rate in the world in recent years. Nevertheless investigation of the quality of inflation in recent years shows that despite the high inflation rate, it has been a particular feature (For example price shock caused by the first stage of adjusting subsidies, exchange rate appreciation due to sanctions). In this research it was aimed to forecast inflation in Iran using different structural models, time series and neural networks and compare the performance of these forecasting models. Using the structural and time series models as well as neural networks, Iran forecast was done based on existing data (Inflation, liquidity, GDP, prices of imported goods and exchange rates). Root mean square error (RMSE), Mean absolute percentage error (MAPE) of different models have been studied. In general, by comparing the forecast errors criteria of structural model, time series and neural network, results showed that neural network model in comparison with other models in forecasting Iran's inflation had better performance. In fact, the root mean squared error and mean absolute percentage error of neural network are less than root mean square error and mean absolute percentage error of vector autoregressive models (VAR), Bayesian VAR (BVAR), GARCH, time series. Iran's Inflation in recent years, has been more influenced by temporary factors and in economic expression, inflation temporal component (crust) is influenced, and as a result with discharge of these shocks on inflation, inflation process has been declining naturally. While fundamental long-term inflation factors in Iran such as Iran structural economic problems including severe liquidity growth and lack of monetary discipline in governments still exist that in economic expression, this part of inflation is called core in-

Table 4: Actual and predicted inflation amounts

	AR(1)	GARCH (1,1)	VAR	BVAR	ANN
actual amount 1394	11.6	11.6	11.6	11.6	11.6
Predicted amount 1394	23.5	16.6	24	20	11.57
actual amount 1394	15.6	15.6	15.6	15.6	15.6
Predicted amount 1394	27.2	16.6	35.8	23	15.66

flation and it seems that by losing shocks effect, inflation rate is approaching its core. The core is basically affected by the institutional structure of the economy that its resolve requires fundamental and continuous detailed planning.

References

[1] H. Heidari, S. Parvin, Modeling and Forecasting Iranian Inflation with Time Varying BVAR Models, *Iranian Journal of Economic Research* 36 (2009) 59-84.

[2] Y. Dadgar, Gh. Keshavarz, A. Tyataraj, The Analysis of Relationship Between Inflation and Economic Growth in Iran, *Journal of Economic Literature* 5 (2006) 59-88.

[3] N. Dehmardeh, Z. Kasaee, Roots of Inflation in Iran (1959-2007), *Journal of Economic Literature* 15 (2011) 165-188.

[4] M. N. Shahiki-tash, Forecasting inflation and price index with neural networks, *Quarterly Journal of The Macro and Strategic Policies* 4 (2014) 51-67.

[5] M. R. Abdollahi, Quantitative and Qualitative Inflation Analysis in Economy of Iran(2009-2014), *Islamic Parliament Research Center of Iran* Serial No. 14192 (2014).

[6] S. Moshiri, Forecasting Iranian Inflation Rates Using .St ructura l, Time Series, and Artificial Neural Networks Models, *Journal of Economic Research (Tahghighat-e-Eghtesadi)* 36 (2001) 147-184.

[7] M. Zarra-Nezhad, Sh. Hamid, Prediction of Inflation Rates in Iran Using Dynamic Artificial Neural Network (Time Series Approach), *Quarterly Journal of Quantitative Economics* 1 (2001) 145-167.

[8] R. Nasr Isfahani, K. Yavari, The Effects of Nominal and Real Variables on Inflation in Iran, *Iranian Journal of Economic Research*, 16 (2003) 69-99.

[9] T. Cogley, S. Morozov, T. J. Sargent, Bayesian Fan Charts for U.K. Inflation: Forecasting and Sources of Uncertainty in an Evolving Monetary System, *Journal of Economic Dynamics and Control* 11 (2003) 1893-1925.

[10] K. Geoff, A. Meyler, T. Quinn, Bayesian VAR Models for Forecasting Irish Inflation, *Economic Analysis, Research and Publications Department, Central Bank of Ireland*, PO Box 559, Dublin 2. 4/RT/98 (1998).

[11] K. Heidari, An Evaluation of Alternative BVAR Models for Forecasting Iranian Inflation, *Iranian Journal of Economic Research* 50 (2009) 65-81.

[12] C. Lack, Forecasting Swiss inflation using VAR models, *Swiss National Bank Economic Studies* No. 2 (2008).

[13] S. Moshiri, N. Cameron, Neural Network Versus Econometric Models in Forecasting Inflation, *Journal of Forecasting, J. Forecast* 19 (2000) 201-217.

[14] E. Nakamura, Inflation Forecasting using a Neural Network, *Economics Letters* 86 (2005) 373 - 378.

[15] N. R. Nino, BVARs Forecasting Colombian Inflation, *31st Symposium of Forecasters, Prague, Czech Republic* June (2011) 26-29.

[16] B. M. Bonimode, J. K. Alhassan, S. A. Adepoju, Comparative Study of Inflation Rates Forecasting Using Feed-Forward Artificial Neural Networks and Auto Regressive (AR) Models, *IJCSI International Journal of Computer Science* (2015), www.IJCSI.org.

[17] G. S. M. Thakur, R. Bhattacharyya, S. S. Mondal, Artificial Neural Network Models for Forecasting Inflation in India, *Fuzzy Inf. Eng.* 8 (2015) 87-100.

[18] G. P. Zhang, Time series forecasting using a hybrid ARIMA and neural network model, *Neurocomputing* 50 (2003) 159 - 175.

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