FORECASTING VALUE ADDED OF AGRICULTURAL SUB-SECTORS DURING FOURTH FIVE-YEAR DEVELOPMENT PLAN IN IRAN

Shahriar Nessabian
Faculty of Economics and Accounting, The Islamic Azad University, Central Tehran Branch
*Corresponding author's e-mail: shahriar nessabian@gmail.com

This article focuses on forecasting the values added of agricultural sub-sectors, including agronomy, fishing, forestry, animal husbandry and agricultural services, using the Artificial Neural Networks (ANN) model. It compares the resulting figures with the target estimates throughout the plan [within the years 1384-1388 (2005-2009)]. It turns out that the forecasted values added in the sub-sectors of agronomy and agricultural services are higher and slower than the estimated values added required due to the plan, respectively. Also the high conformity of the estimated and forecasted value added on the horizon of the fourth five-year plan, while the other sub-sectors both the values are close to each other. The results indicate that the capability of ANN method for forecasting variables is more suitable than the other methods.
Keywords: Forecasting; value added; Artificial Neural Networks; Feed Forward Network; MATLAB Software

INTRODUCTION

Agriculture is one of the most important economic sectors in the Iranian economy, sharing about 23% of the gross domestic product, being influenced by environmental conditions. One of the ways to calculate GDP is the value added approach and its forecasting in agricultural sub-sectors is necessary because of increasing importance of agriculture in the Iranian economic development.

Forecasting process usually involves the acquisition of historical *Nessabian* information and their generalization to the future conditions. It is one of the major tools that managers would need to administer their organization particularly in competitive environments (Tkacz, 2001).

The extraordinary success of neural networks used for data analysis urged economists to pay more attention to Artificial Neural Network model. This model required multiple data, and it was initiated in financial markets, forecasting foreign currency rate, stock prices and different stock exchange indices (Olsan and Mossman, 2003) during the end of 1980s. The works carried out by Kohzadi (2000) forecasted the stock price of Shahd Iran Factory for the next month, using data within a period of three months. Moreover, the Feed Forward (FF) model is the most precise for forecasting (Kohzadi and Abolhassani, 2000), considered the number of network inputs equals to the number of delayed variables of auto-regressive process. It has difficulties for two reasons. First, this method is not applicable to the moving average process since there is no auto-regressive model. Second, Box-Jenkis models are linear models and their results could not be used in non-linear models such as neural networks (Tkacz, 2001).

The objective of the present paper is forecasting the value added of agricultural sub-sectors in the course of the Fourth Five-Year Development Plan in Iran and its comparison with the estimated target figures [within the years 1384-1388 (2005-2009)].

MATERIALS AND METHODS

Along with the old common models, the new forecasting methods have been introduced and called the Artificial Neural Networks (ANN), similar to the brain. They transfer the hidden law beyond the data to the network structure through processing of the experimental data. In fact, by doing calculations on numerical data such networks learn the laws so that they are called intelligent systems (Boruvka and Penizek, 2006; Gail and Neelakantan, 2002; Monisha *et al*., 2005).

The actual value of the fourth plan has not been officially reported for comparison of forecasted value added figures, therefore, the target rate of the fourth development plan for the agricultural division (an average annual growth rate of 6.5%) has been used to estimate the value added of agricultural sub-sector throughout the plan. The stationery of time series data (value added of agricultural sub-sectors) is examined based on forecasting capability of ANN model. The value added of agricultural sub-sectors is forecasted during the horizon of the plan.

RESULTS AND DISCUSSION

In the FF network, the number of data relating to the first step of each variable was given to the network. Subsequently, the next data being the first of the following year, was forecasted. This data then compared to the actual data and it continued until the difference was minimized. The process continued until all data were completed.

Later, the actual and simulated data were arranged in twelve-year spans (based on the format of the software system) and their validity was carried out by comparing the value added forecasted with the estimated model. For this purpose, the index of agreement (d) was used.

$$d = 1 - \frac{\sum_{i=1}^{n}(p_i - o_i)^2}{\sum_{i=1}^{n}(|p'_i| + |o'_i|)^2} \qquad (1)$$

IN index (1), $p'_i = p_i - \bar{o}$ and $o'_i = o_i - \bar{o}$, where: Oi is the observed ; Pi is simulated values ; $\bar{o}$ is the average observed ; $\bar{p}$ is simulated values and n is the number of samples, respectively (Rocco *et al*., 2007; Tung and Jenchao, 2006) as shown in Table 1.

The 'd' represents the model performance ranging between 0 and 1. As shown in Table 1, in all agricultural sub-sectors, the index of agreement (d) is close to 1 which is indicative of a good model fitting and high conformity between the actual value added and simulated value added of agricultural sub-sectors (Demuth and Beale, 2001).

Selection of a artificial neural network (ANN) with training algorithm and appropriate structure provide a powerful tool for forecasting a time series. Finally, Tables 2 and 3 indicate the results of value forecasting and estimated of agricultural sub-sectors throughout the fourth five-year development plan.

Tables 2, 3 and Figures 1 to 5 indicate that the forecasted values added in the sub-sectors of agronomy and agricultural services are highly and slowly correlated with the estimated values added throughout the fourth Iranian five-year development plan, respectively and this difference between forecasted and estimated value added in sub sector of agricultural services due to agricultural sector in Iran is nearly traditional. Also Figure 6 indicates the high conformity of the estimated and forecasted value added on the horizon of the fourth five-year plan.

Table 1. Index of agreement (d) findings

Sub-sector	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8	Cycle 9	Cycle 10	Cycle 11	Cycle 12
Agronomy	1	0.99	1	1	0.99	0.99	1	1	0.98	0.95	1	0.97
Animal Husbandry	0.99	1	0.98	1	0.99	0.99	0.98	0.98	1	1	0.99	0.96
Forestry	0.98	0.99	1	0.95	0.97	0.99	0.95	0.95	0.98	1	1	0.97
Fishing	0.99	1	0.99	0.93	0.94	0.97	1	0.95	0.96	0.92	0.95	0.98
Agricultural Services	1	0.98	0.93	0.96	0.99	1	0.98	0.98	0.95	0.97	1	0.96

Table 2. Results of value added forecasting of agricultural sub-sectors throughout the fourth Iranian fifty-development plan **(**Figures in terms of billion Rials)

Sub-sector/year	2005	2006	2007	2008	2009
Agronomy	34590.44	35370.244	37333.40	39090.44	40750.431
Animal husbandry	17490.54	18050.44	18647.41	19364.10	20024.40
Forestry	741.20	814.70	842.90	879.10	914.50
Fishing	1347	1375	1379	1412	1443
Agricultural services	1955	2002.74	2085	2172	2249

Table 3. Estimation of value added of agricultural sub-sectors throughout the fourth Iranian five-year development plan, while applying the objectives of the plan to the agricultural sector

(Figures in terms of billion Rials)

Sub-sector/year	2005	2006	2007	2008	2009
Agronomy	33801	35031	36306	37627	38997
Animal husbandry	16900	17251	17610	17976	18350
Forestry	703	703.49	703.98	704.47	704.97
Fishing	1281	1283	1286	1288	1291
Agricultural services	1964	1969	1974	1979	1984

Figure 1. Comparison of forecast values and estimation of the value added of agronomy sub-sector throughout the fourth development plan

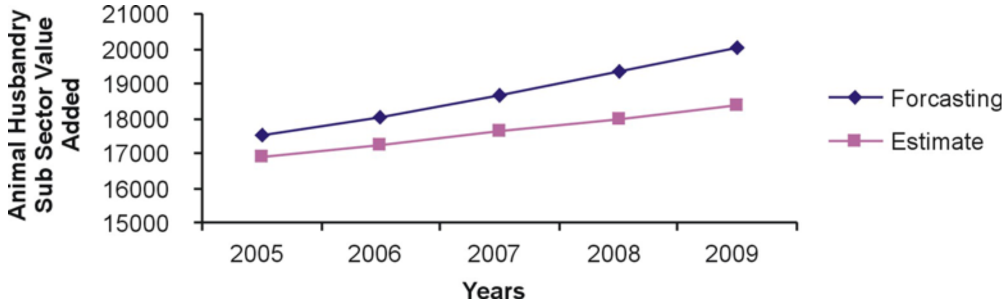


Figure 2. Comparison of forecast values and estimation of the value added of animal husbandry sub-sector throughout the fourth development plan

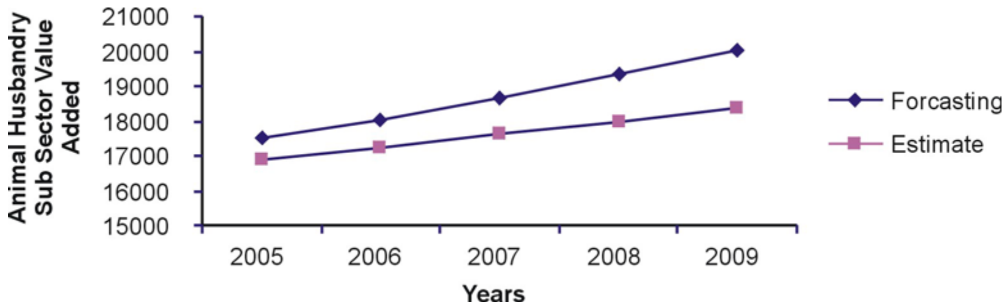


Figure 3. Comparison of forecast values and estimation of the value added of forestry sub-sector throughout the fourth development plan

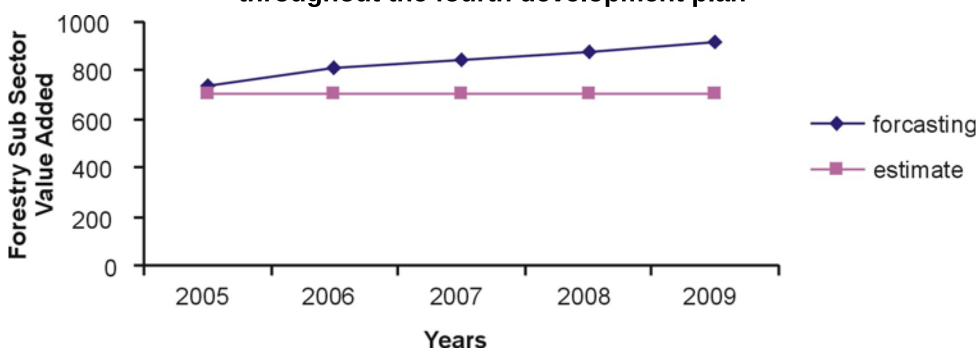


Figure 4. Comparison of forecast values and estimation of the value added of fishing sub-sector throughout the fourth development plan

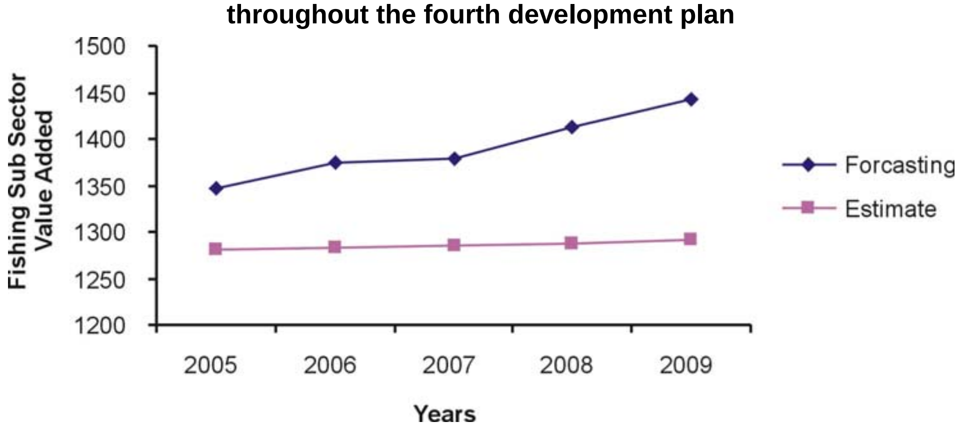


Figure 5. Comparison of forecast values and estimation of the value added of agricultural services sub-sector throughout the fourth development plan

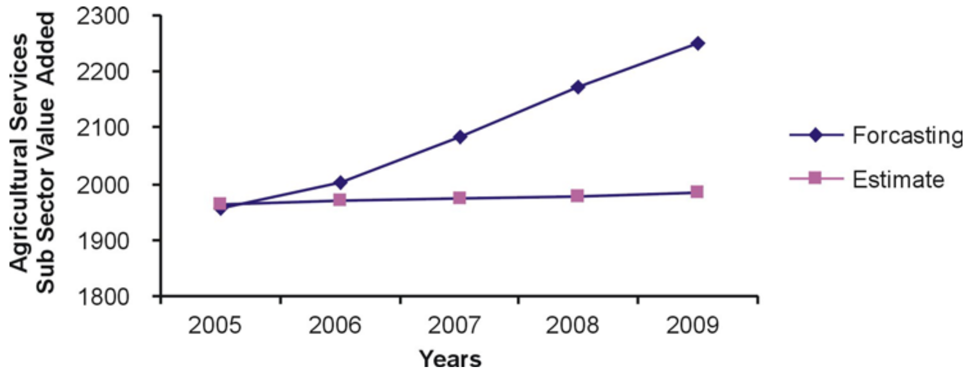
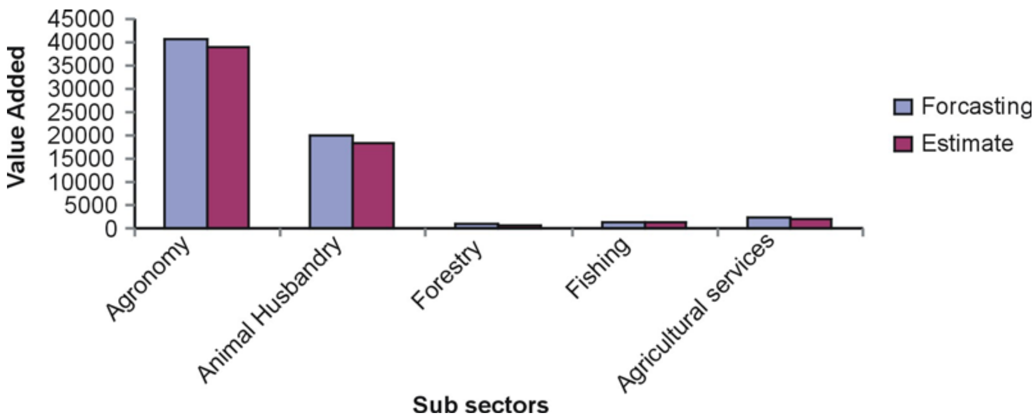


Figure 6. Comparison of estimation values and forecasting the value added of agricultural sub-sectors on the horizon of the fourth five-year development plan (2009)



CONCLUSION

This forecast values are quite close to the objectives of the plan. While the gap between both the forecasted and estimated values added are nearly negligible in the other sub-sectors. Using the ANN model of agricultural sectors is more appropriate than the other techniques applied for forecasting.

REFERENCES

Boruvka, L. and V. Penizek. 2006. A test of an artificial neural network allocation procedure using the Czech soil survey of agricultural land data. Developments in Soil Science (31): 415-424.

Demuth, H. and M. Beale. 2001. MATLAB 6.1/Neural Network Tool Box, the Math Works.

Gail, M. and R. Neelakantan. 2002. A neural network based classification scheme for sorting sources and ages of fecal contamination in water. Water Research 36(15): 3765-3774.

Kohzadi, N. and L. Abolhassani. 2000. Comparison of stock forecast of Shahd Iran Factory using artificial neural networks and mono-variable time series: A collection of all articles presented to the third conference of Iranian agricultural economy. Mashhad University: 865-886.

Monisha, K., T. Robbert and C. Hill. 2005. Artificial neural networks for corn and soybean yield prediction. Agricultural Systems 85(1): 1-18.

Olsan, D. and C. Mossman. 2003. Neural network of Canadian stock returns using accounting ratios. Interl. J. Forecasting 19: 453-465.

Rocco, F., M. Carfagi and M. Daou. 2007. Artificial neural network software for real-time estimation of olive oil qualitative parameters during continues extraction. Computers and electronics in agriculture 55(2): 115-131.

Tkacz, G. 2001. Neural network forecasting of Canadian GDP growth.釣nternl. J. Forecasting 17: 57-69.

Tung-Chueng, C.H. and Ru-Jenchao. 2006. Application of back-propagation networks in debris flow prediction. Engineering Geology 85(3-4): 270-280.