Heuristically long-term money exchange rates forecasting for low technological in progress developing countries

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Abstract:

Long-term forecasting exchange rate is one of the inevitable requirements of the organizations that are involved in international economic activities. The concept that is frequently echoed, especially in global stock markets, is short-term exchange rate forecasting. Therefore, to choose the required factors that determine the exchange rates, it is necessary for the chosen factors to cover a very large extent on the economic and political developments. Forecasting exchange rate is usually realized two general ways: 1- by using the factors that are chosen, to predict that there would be a decrease or increase in the current rate.2-by using regression to start analyzing the previous changes in the price of the currency, and continue the discovered model into future and give the new price. The present paper is the result of a quality upgrading, through the industrial engineering analysis, on choosing the most efficient and comprehensive parameters for the prediction. Here, by engaging regression and neural network a new way of forecasting is obtained. In this study a number of data are used, two third of which were used to train the model and the other one third were used for testing the output resulted from implementing the model was very close to the test portion data.**Keywords**
Exchange Rate, Forecasting, Regression, Neural Network, Monocultures countries economy

Introduction

The influence of neural networks in various sciences and their reliability in normal conditions is the axiom of current world. With this science to predict various events (according to determining correct and appropriate indices)

capabilities of this science are considered large. What presented in this paper is forecasting the exchange rate of developing countries which do not enjoy the high speed of technology in long-term interval (investment). So far, many models offered which were applied in the various countries, but confronted with errors and cannot safely be trusted. One of the major reasons for the failure of this model is that in these countries, government is the main determinant of currency, but the government can also be applied in line with its long-term strategic objectives and ideas that are not included in any of the indices of presented models. The problem which this article considered is that governments cannot control the price of fake currency for a long time, because it will face a sharp decline in currency treasuries (in the form of cheaper retail) that it causes government's economic failure and sudden increase in the price of the currency or by sharp decline of demand (in the case of profiteering) this also causes sudden declining the price of currency which have consequences of a sudden increase of the national currency and inactivating the export value. But in both cases, the price of the currency after the passage of time and in the long run inevitably tend to the actual price. Therefore, the correct choice of effective indicators can be concluded that if abnormal factors such as war and natural disasters do not effect on economy heavily, it can be achieved to evaluate a success factor in long-term investments in stock market more smoothly and show more their authority in contracts. The data used in this study is economic data related to the country of Iran due to the political and social changes over the past decades that only data from the last thirty years has been used for calculations.

Literature Review

In studies Jalaei and colleagues attempted to estimate the model of behavior of real exchange rates for years 1959-2001 by method of Vector Auto Regression (VAR) and Vector Correction Error Model (VCEM) and short-term and long-term behavior of real exchange rate targets. Short-term and long-term estimates showed that real exchange rate behavior effects on your behavior in a past period. (01) Carrera and Restut (2008) in their article examines the long-term behavior of the real exchange rate in nineteen countries of Latin American in the period 1970-2006. The results do not confirm observing law against purchasing power and it shows the effect of permanent shocks on the real exchange rate in Latin America. According to the results of Balasa- Samuelson, government spending, terms of trade, openness, foreign capital flows and currency system effect on the real exchange of Latin America. (02) The results of Sabbagh Kermani and Shaqaqi Shahri show that during the period in question, the federal deficit, relation of trade and money volume causes increasing real rate of currency of Iranian economy, and vice versa, increasing in variables of import taxes, net foreign assets as well as oil prices, the exchange rate are the reducing agents of currency rate. (03) Leem and Stein in an article explain severe changes of real rate of currency of Australia by using correlation tests and season data of the years 1973 to 1992 by variation of principal factors. These factors include: the terms of trade, private savings rate, fiscal policy, capital productivity in commercial and non-commercial sectors and global interest rates. The results show that the trade deficit and growing debt capital is created primarily by an increase in productivity savings that stimulate investment and reduce social or screw. (04) Dargahi and Gechlou in a paper examines the stability of the real exchange rate in the Iranian economy and the factors affecting it in the short and long terms. According to the results of this study, real price of oil, level of productivity growth, rate of capital accumulation, the intensity of trade and exchange controls, fiscal policy, monetary policy and the policy of nominal value of the national currency were determinant factors in the real exchange rate of Iran. (05) Shahabi in 2014 in an article investigated macro indices affecting the exchange rate of the country and it refers to the fact that to achieve effective indices on the exchange rate cannot simply suffice by strategic goods such as gold or oil or even indicators as stock index. To him and his colleagues determining reliable values can effectively cover all the indices, or commodities which use three main indicators of household benefit-cost ratio, the ratio of export to import and GDP. (06) It seems that this way of thinking and explanation of the selected type of variable indices is to detect a long-term period. Non-natural factors such as internal and external policies of a country cannot be a factor in determining exchange rate in the long run. But all the big and small factors may affect exchange rate in their covers. We offer this model to determine the price of the currency in the long term regardless of the use of indicators presented abnormal in this paper which could be the best measure to stay away from artificial control currency price taken into account.

Artificial Neural Network Model:

Artificial neural network is a simplified model of a centralized system that puts the human brain as sample and by using sophisticated computational structure of the neuron communication makes ability to react to changes and adaptations to the environment. Artificial neural network with existing data processing, knowledge or rules expressed by the pass data to the network structure based on calculations on numerical data, examples and general laws. (07) The most important features of neural networks is their ability to learn. Learning capabilities include

ability to set network parameters through time and different situations, with the aim that the network has been trained for a specific situation, despite small changes in environmental conditions that can maintain their effectiveness. After training, the network could be dealing with a new entry that is not encountered during training, use of interpolation process and provides appropriate output. In other words, network-based training, and relationship analysis algorithm learns the appropriate number of points gained in space. Artificial neural networks, however, are not comparable with the normal nervous system, but has some features that make them in the field of pattern recognition, robotics, modeling, control, classification, identification, prediction and optimization in various applications of technical, financial, security, production of industrial, medical and transportation and in general all those who need to learn is linear or non-linear which is unique. The overall structure of artificial neural network includes an input layer, middle layer and output layer. (07)
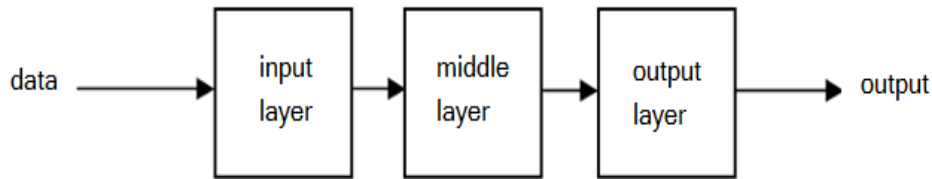
Figure 1. The general structure of an artificial neural network

In this structure, neuron is the smallest unit of data processor which forms the basis of the performance of neural networks. Another unit of computing complex network of artificial neural activation function is selected based on special need of problem solving. (07). Basic features on neural networks can be divided by their structure and operational or dynamic characteristics. Network structure determines which network is composed of multiple neurons and these neurons are located in the network and how and in what form are connected to each other. Neural networks are a large number of interconnected neurons or processing units which have been formed. The basic characteristics of neurons as input signals, strength of synaptic connections, and the output signals of neurons are in threshold. Nero dynamic properties of neural networks shows how an artificial neural network learns, how the new information compares with the knowledge of the self-taught, how is classified information, how it works and how to call a stored pattern, if necessary, your number of classes will be increased. Processing based on artificial neural network analysis of complex information parallel will be by 68 main elements. An artificial neural network analyzes data and maintains the basic elements of elements and relations between them in memory and it teaches information. In a split structure, artificial neural networks can be separated into two categories: single-layer and multi-layer. The number of outputs in a single layer network, there are neurons in one layer and in parallel work. In the multi-layered artificial neural networks, hidden layers are between the input and the output layer. The number of intermediate layers in multi-layer network are with regard to the question which depends on the designer's choice. But it should be noted that by increasing the number of layers of the network, it greatly increases the computational complexity and duration of the training and learning network becomes longer. In artificial neural networks, network design task, choose the most efficient method of training for network design. Supervised learning method involves training artificial neural networks (sponsored), intensive learning (reinforcement) and unsupervised learning (not supervised). On the other hand, learning algorithms, mathematical instruments by which the manner and speed training artificial neural networks to achieve steady and appropriate adjustment parameters of the network. Among learning algorithms, we can point to Hebbian algorithms which are competitive, error correction, amplification, and propagation. Among the types of artificial neural networks, artificial including the most functional networks which are able to select the appropriate number of layers and neurons and also the right choice of learning algorithm, a non-linear estimation do with arbitrary precision. Artificial neural networks of neurons in each layer is connected to all neurons in the previous layer. (07)
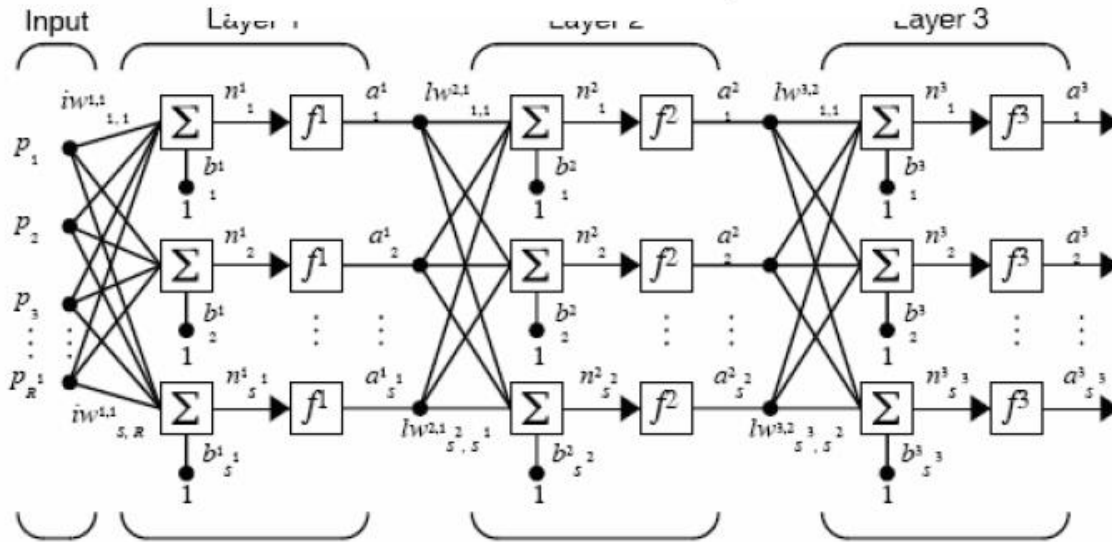
Figure 2. Three-layer neural network with s neurons in each layer

Each neuron in the Multilayer Perceptron two network performs calculation. In the first calculation, the function calculates the signal and calculates the second estimation error in curves of the parameters that connects the input neuron to other neuron. Design and construction of artificial neural networks predicts longer than other models designed. Because, artificial neural networks, in addition to selecting a set of input variables, build a network of predicted best by trial and error. One of the problems predicted by neural networks. This problem occurs when the network is very low training error and test error is large networks. The problem is in conjunction with network design, failure in network architecture, or as a result of the complexity of the analysis. To avoid this problem, ways of reducing the number of learning, the less hidden neurons in the network architecture and the use of early stopping rule is using data validation. (07)

Time series models:

Basically one of the main objectives of economic models is accurate forecasting of economic variables in order to assist policy makers in making correct decisions. Since there are different methods to predict the economy, they can be divided according to the different formats of the most important ones:
1. Division based on linear models and nonlinear models
2. Classification based on structural models and time series models (08)
Although structural models to explain the situation had relative success but they were not very successful track record in forecasting. In contrast, time series models have enjoyed significantly better results. Also, due to the increased precision, accuracy and performance prediction models involve more complex models that can explain the behavior of the time series more correctly, Therefore, in recent years economists focused on nonlinear models. Given the fact that the structures of nonlinear models with long memory market is appropriate and corroborates the notion that linear models to describe the nature of these markets are inefficient and I hope you understand now the situation of model. (09) In addition, econometric forecasting based on linear models are along with extreme limitations. However, new models of neural networks can have a better linear and nonlinear econometric models. Neural network models with natural entity has a parallel distributed processing and its most important feature and ability is to model complex nonlinear relationships without prior assumptions about the nature of the relationship between data. (10) Neural networks are included into two dynamic and static networks. Static networks such as neural networks - artificial (ANN) have feedback factor and therefore not included delays and using inputs that are directly associated with feed forward. However, in dynamic neural networks such as autoregressive model with exogenous variables (NNARX), output depends on current and past values of inputs, outputs and the structure of network. (10)

Tests:

To verify the authenticity and accuracy of relevant indicators selected, GDP indicator, the ratio of imports to exports and household spending data relating to income ratio to 2002 to 2013 years were used. The price of dollar is given from extracting and decision on forecasting of currency rate in all periods. According to a survey that was conducted with different types of regression and Fuzzy Inference System that was used to predict, data set in several modes available are put to the best system and the best type of regression and configuration dataset was obtained. As previously mentioned, to get the most optimal solutions of the system must use data that have been extracted from normal conditions. Therefore, to achieve the best possible response systems, the data are presented for year 2002 to remove unusual factors such as political control, internal or external conflict and natural disasters. It is worth noting indicators used in these tests than the price of the dollar, all data are annual. So when data is matched with three-month period for the index number for the first quarter, second, and third of all under the twelfth month of the twelfth year ago which have been the end of year. A total of three sets of data using the data sets with five parameters regardless of the ratio (exports + imports + index + GDP + household income, household expenses) were considered till perhaps a more appropriate system shows that our income is the result of work as follows;
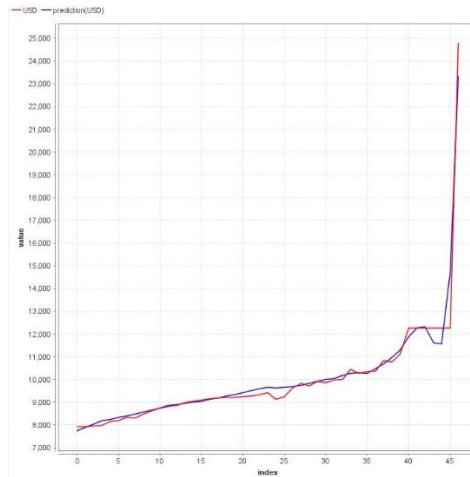

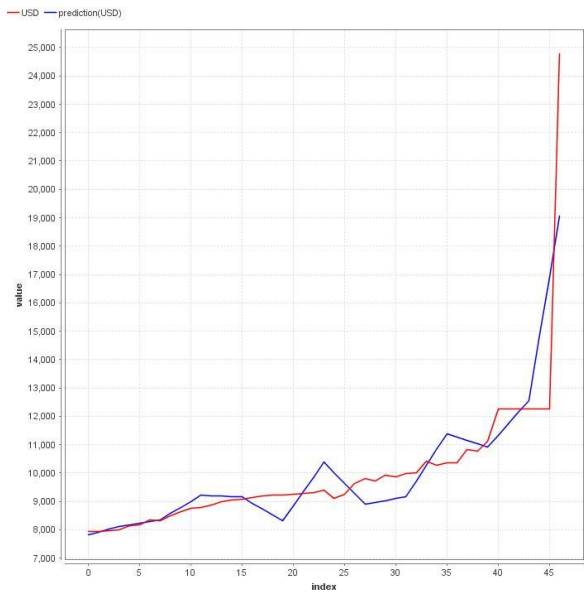Figure 3. Additive Regression by using Neural Network as Classifier with 5 parameters dataset

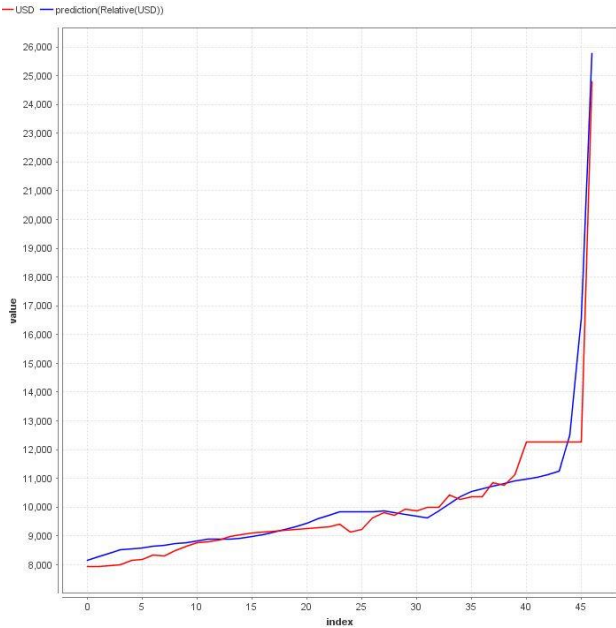Figure 4. Linear Regression with 5 parameters dataset

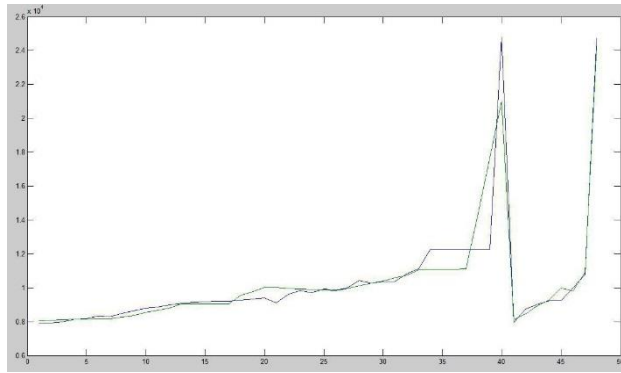Figure 5. Relative Regression with 5 parameters dataset

Figure 6. Fuzzy Inference System with 5 parameters dataset

Now the results of the second set of data has to consider three indices (index + GDP + ratio of exports to imports ratio of household income on household expenses) paid discussed.
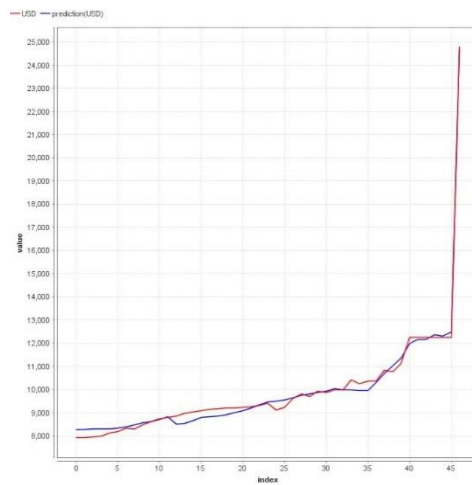

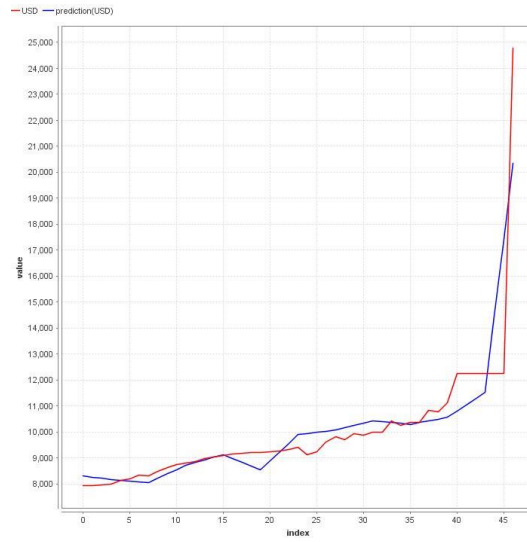Figure 7. Additive Regression by using Neural Network as Classifier with 3 parameters dataset

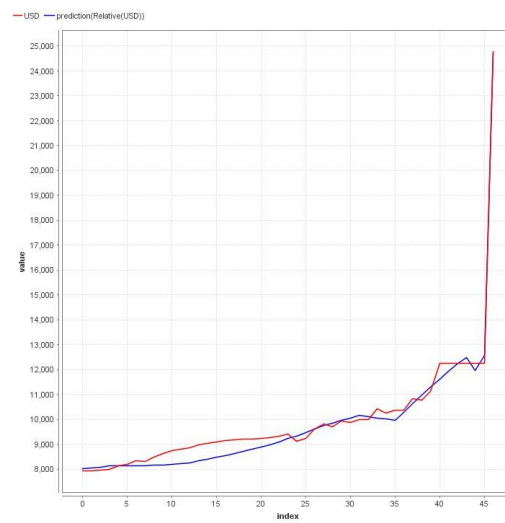Figure 8. Linear Regression with 3 parameters dataset

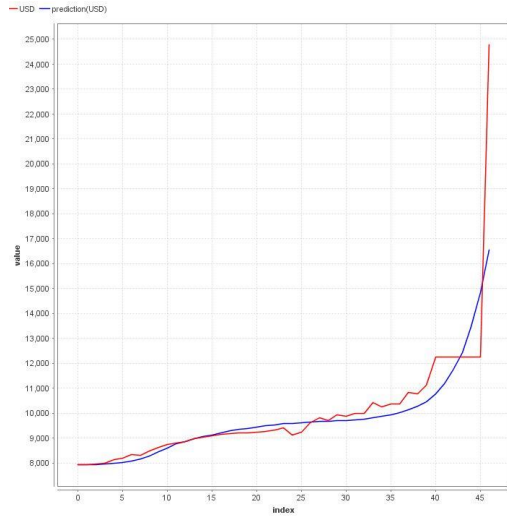Figure 9. Relative Regression with 3 parameters dataset

Figure 10. Transformed Regression by using Neural Network as Classifier with 3 parameters dataset
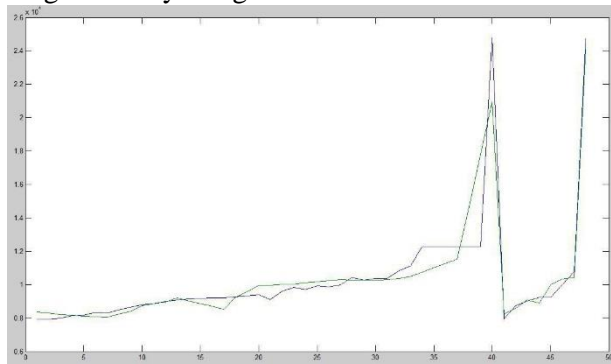

Figure 11. Fuzzy Inference System with 3 parameters dataset

And the results of the latest data that household income and household spending only third index as a measure of detection puts his prediction criterion;
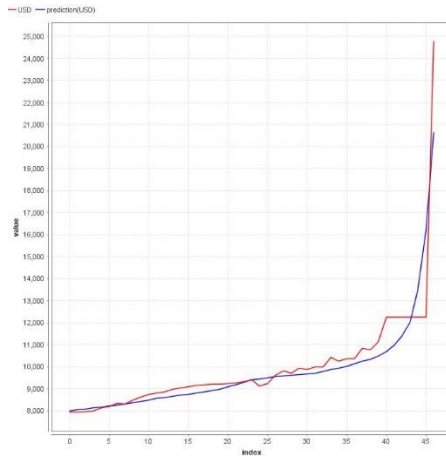
Figure 12. Additive Regression by using Neural Network as Classifier with 2 parameters dataset
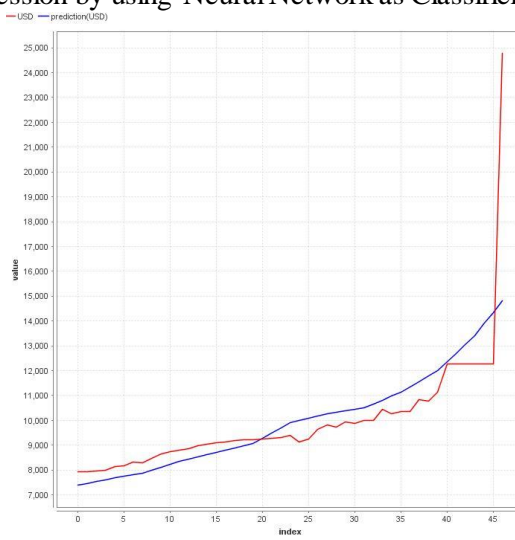

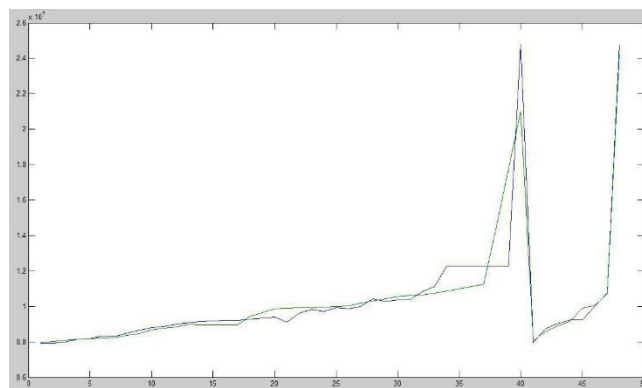Figure 13. Linear Regression with 2 parameters dataset

Figure 14. Fuzzy Inference System with 2 parameters dataset

Conclusion and Recommendations:

As was stated, various factors are effective in predicting exchange rates in the low single-product of technological speed. The paper concludes that the pattern models cannot forecast exchange rate for subject of certain products. Thus, to determine the best indicator of the impact can be most general indicators such as GDP, exports and imports, income and household expenses should be considered. By extracting data relating to the factors listed and compare them with the use of different systems and given that two-thirds of the real exchange rate information for training and the remaining third was used to test the best results are as follows. Best results are acceptable and very close to reality if you use all five independent factors:

In Figure 3. Additive Regression by using Neural Network as Classifier with 5 parameters dataset and error result RMSE= 470.164

In Figure 4. Linear Regression with 5 parameters dataset and error result RMSE= 1238.524

In Figure 5. Relative Regression with 5 parameters dataset and error result RMSE=777.799

In Figure 6. Fuzzy Inference System with 5 parameters dataset and error result MSE= 1.1932e^6

And the best results are acceptable and very close to reality, when combined with each other to form factors using the GDP indicator and the ratio of exports to imports ratio of household income on household expenses.

In Figure 7. Additive Regression by using Neural Network as Classifier with 3 parameters dataset and error result RMSE= 232.686

In Figure 8. Linear Regression with 3 parameters dataset and error result RMSE= 1140.506

In Figure 9. Relative Regression with 3 parameters dataset and error result RMSE= 342.723

In Figure 10. Transformed Regression by using Neural Network as Classifier with 3 parameters dataset and error result RMSE= 1325

In Figure 11. Fuzzy Inference System with 3 parameters dataset and error result MSE= 1.2922e^6

And the best results are acceptable and very close to reality if the household income is only the third index and household spending as a measure of detection puts his prediction criterion;

In Figure 12. Additive Regression by using Neural Network as Classifier with 2 parameters dataset and error result RMSE= 949.641

In Figure 13. Linear Regression with 2 parameters dataset and error result RMSE= 1604.292

In Figure 14. Fuzzy Inference System with 2 parameters dataset and error result MSE= 1.28e^6

The real exchange rate (RER): Nominal exchange rate relationship between the two countries shows the value of money, while the real exchange rate represents the relationship between the two price levels. The real exchange rate relationship between domestic prices and international prices is considered. In fact, the real exchange rate index of the degree of competitiveness of a country is observed by showing the number of units of foreign goods needed to buy a unit of measure (Haqiqat and Jorkany, 2005) Real and nominal exchange rate effects on the domestic economy and external factors.

Internal real exchange rate (IRER): Exchange rates are relative prices of tradable goods in terms of non-tradable goods prices (Hynkel and colleagues), internal real exchange of two goods and three commodities which is defined in two ways. First, the relative prices of tradable goods, i.e. entry and exit, in terms of the prices of non-traded commodity that is called the exchange rate. The second method is to calculate the prices of importable and exportable in terms of the price of non-traded goods (Mehrara, 2004) than export prices to the price of non-tradable goods, the actual rate of export and the domestic currency prices of imported goods to non-tradable goods, the actual rate of the domestic currency is called import.

External Real Exchange Rate (ERER): External Real Exchange Rate is the ratio of foreign to domestic amount of a price index Price (like the general price level external or internal to the general price level of external costs to internal cost to the single currency) are moderated where PGf foreign goods price index, PGd price index of domestic goods and E is the nominal exchange rate.

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