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Title

THE EFFECTS OF JOINING TO WTO ON NON-OIL EXPORT OF IRAN

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ABSTRACT:

In this study we aim to evaluate the effects of globalization with the precision and non-precision factors on non-oil export of Iran .The underlying objective of the paper is to provide support for a model that predicts these effects with the GMDH-neural network method as an instrument for complicated non- linear trends especially with the limited observations. We used International Trade Integration of Industry (IIT) as an index of globalization. The results indicate the globalization variables have much more effects on non-oil export in globalization process.

JEL codes: C45-C53-F47

Key words: globalization- non-oil export- GMDH, neural network –factors of production productivity - oil revenues- inflation- exchange rate- gross domestic production (GDP) - growth rate of world income- imports of capital goods.

1) INTODUCTION:

One of the basic goals in the economic policies is augmentation in share of Iran economy and to improve his situation in international trade and world economy. Because of that the sale of oil and its products as well as the government revenue of crude oil were not sustainable during the past years and the fact that crude oil is an exhaustible resource make it unreliable for sustainable development of the Iran economy so diversifying the economy away from its heavy reliance on oil revenues and improving the economy's future growth is an important goal and the policies should concern over the years with a view to expand non-oil export and reduce the dependence of Iran economy on oil export .

Having a competitive environment is the most important need for improving non-oil export so being in international markets specially globalization become necessity.

Stability in international economic relation , policies , programs and economic activities are the first and most important advantage of joining to WTO(World Trade Organization) that bring with itself suitable situation for diversify the nations export base.

The statistic of Iran export shows the various export expansion. In 2006 the growth rate of non-oil export was 47.2%amounting to 16.3 $billion,trade partners of Iran exeeds 100 countries. Values of exports in $million as well as percentage shares of the major export commodity group are shown on table1-1.

Table 1-1) Value of non-oil exports and percentage shares in 2005-2006 (in million dollars)

Year:2006		**Year:2005**		**Name of products**
Percentage shares	**value**	**Percentage shares**	**Value**	
68.8	11210	61.8	6850	Manufactures
12.7	2070	14.9	1650	Agriculture
3.2	527.5	5.8	641	Carpet and household manufactures
5.2	849.5	4.0	444.6	Mineral material
10.1	1643.8	13.5	1490.7	Others
100	16300.8	100	11076.3	Sum

The paper is divided in to 4 sections. The first section introduced the subject matter, the second section discussed method and material, result and discussions are presented in third section, while the fourth examine the conclusions.

2) METHOD AND MATERIAL:

2-1) MODELLING USING GMDH NEURAL NETWORKS

By means of GMDH algorithm a model can be represented as set of neurons in which different pairs of them in each layer are connected through a quadratic polynomial and thus produce new neurons in the next layer. Such representation can be used in modelling to map inputs to outputs. The formal definition of the identification problem is to find a function $\hat{f}$ so that can be approximately used instead of actual one, f in order to predict output $\hat{y}$ for a given input vector $X = (x_1, x_2, x_3, ..., x_n)$ as close as possible to its actual output y. Therefore, given M observation of multi-input-single-output data pairs so that

$y_i = f(x_{i1}, x_{i2}, x_{i3}, \ldots, x_{in})$ (i=1, 2,…, M)

It is now possible to train a GMDH-type neural network to predict the output values $\hat{y}_i$ for any given input vector $X = (x_{i1}, x_{i2}, x_{i3}, \ldots, x_{in})$, that is

$\hat{y}_i = \hat{f}(x_{i1}, x_{i2}, x_{i3}, \ldots, x_{in})$ (i=1,2,…,M).

The problem is now to determine a GMDH-type neural network so that the square of difference between the actual output and the predicted one is minimised, that is

$$\sum_{i=1}^{M} [\hat{f}(x_{i1}, x_{i2}, x_{i3}, \ldots, x_{in}) - y_i]^2 \to \min .$$

General connection between inputs and output variables can be expressed by a complicated discrete form of the Volterra functional series in the form of

$$y = a_0 + \sum_{i=1}^{n} a_i x_i + \sum_{i=1}^{n}\sum_{j=1}^{n} a_{ij} x_i x_j + \sum_{i=1}^{n}\sum_{j=1}^{n}\sum_{k=1}^{n} a_{ijk} x_i x_j x_k + \ldots \quad \textbf{(1)}$$

Which is known as the Kolmogorov-Gabor polynomial (Sanchez et al. 1997; Iba et al. 1996; Ivakhnenko 1971; Farlow 1984; Nariman-zadeh et al. 2003)? This full form of mathematical description can be represented by a system of partial quadratic polynomials consisting of only two variables (neurons) in the form of

$$\hat{y} = G(x_i, x_j) = a_0 + a_1 x_i + a_2 x_j + a_3 x_i x_j + a_4 x_i^2 + a_5 x_j^2 \quad \textbf{(2)}$$

In this way, such partial quadratic description is recursively used in a network of connected neurons to build the general mathematical relation of inputs and output variables given in equation (1). The coefficient a_i in equation (2) are calculated using regression techniques (Farlow 1984; Nariman-zadeh et al. 2003) so that the difference between actual output, y, and the calculated one, $\hat{y}$ for each pair of x_i, x_j as input variables is minimized. Indeed, it can be seen that a tree of polynomials is constructed using the quadratic form given in equation (2) whose coefficients are obtained in a least-squares sense. In this way, the coefficients of each quadratic function G_i are obtained to optimally fit the output in the whole set of input-output data pair, that is

$$E = \frac{\sum_{i=1}^{M} (y_i - G_i())^2}{M} \rightarrow \min \quad . \qquad \textbf{(3)}$$

In the basic form of the GMDH algorithm, all the possibilities of two independent variables out of total n input variables are taken in order to construct the regression polynomial in the form of equation (2) that best fits the dependent observations (y_i , i=1, 2, …, M) in a least-squares sense.

Consequently, $\binom{n}{2} = \frac{n(n-1)}{2}$ neurons will be built up in the first hidden layer of the feedforward network from the observations $\{(y_i, x_{ip}, x_{iq});$ (i=1, 2, …, M)$\}$ for different $p, q \in \{1,2,\ldots,n\}$. In other words, it is now possible to construct M data triples $\{(y_i, x_{ip}, x_{iq});$ (i=1, 2, …, M)$\}$ from observation using such $p, q \in \{1,2,\ldots,n\}$ in the form

$$\left[\begin{array}{cc|c} x_{1p} & x_{1q} & y_1 \\ x_{2p} & x_{2q} & y_2 \\ \hline x_{Mp} & x_{Mq} & y_M \end{array}\right].$$

Using the quadratic sub-expression in the form of equation (2) for each row of M data triples, the following matrix equation can be readily obtained as

$$A\mathbf{a} = Y$$

where $\mathbf{a}$ is the vector of unknown coefficients of the quadratic polynomial in equation (2)

$$\mathbf{a} = \{a_0, a_1, a_2, a_3, a_4, a_5\} \qquad (4)$$

And

$$Y = \{y_1, y_2, y_3, \ldots y_M\}^T$$

is the vector of output's value from observation. It can be readily seen that

$$A = \begin{bmatrix} 1 & x_{1p} & x_{1q} & x_{1p}x_{1q} & x_{1p}^2 & x_{1q}^2 \\ 1 & x_{2p} & x_{2q} & x_{2p}x_{2q} & x_{2p}^2 & x_{2q}^2 \\ \hline 1 & x_{Mp} & x_{Mq} & x_{Mp}x_{Mq} & x_{Mp}^2 & x_{Mq}^2 \end{bmatrix}$$

The least-squares technique from multiple-regression analysis leads to the solution of the normal equations in the form of

$$\mathbf{a} = (A^T A)^{-1} A^T Y \quad (5)$$

Which determines the vector of the best coefficients of the quadratic equation (2) for the whole set of M data triples. It should be noted that this procedure is repeated for each neuron of the next hidden layer according to the connectivity topology of the network. However, such a solution directly from normal equations is rather susceptible to round off errors and, more importantly, to the singularity of these equations

2-2) VARIABLES IN THE MODEL

For finding out the variables that have probable effect on non-oil export we are inspired by papers like: Kuze(1981)- Goldeschtien and khan .M.s patterns (1971)- Pesaran M. H.(1984)- Thirlwall.(1999) - Band.M (1979),(1987)- Hothaker H.S. and S.P. Magee.(1969)- Pakdaman .R(1997)- Shakeri.A (2004)- Ameliau Santos-Paulino(2002)- Abrishami.H and his callgous (2006) etc.

Because of that Iran is an oil exporting country and the importance of oil in Iran economy, so we use oil revenues as a variable in pattern. The study utilized annual data for model estimation **that** was extracted from central bank of Iran.

3) MODEL SPECIFICATION, RESULTS AND DISCUSSIONS:

We used the Multi-Objective OptimizationProgram that was designed withtarget of reducing the error in modelling and forecasting that simultaneously increase the precision of forecasting and the stability of process for measurement the scale of variables effects in different patterns.

$$\mathbf{GNOX = f\ (RP_t,\ RPE\ ,GW_t ,GW_{t-1}\ ,GMC_t\ ,GMC_{t-1}\ ,GGDP_{t-1}\ ,\ EB_{t-1}\ ,AP_t ,AP_{t-1}\ ,GPRO_t ,GPRO_{t-1}\ ,OR_{t-1}\ ,IIT_{t-1},\ OPENOX\ ,GNOX_{t-1})}$$

All variables are as defined in below table:

Table 3-1)

variables	Title
RP_t	Relative prices[1]
RPE	Real exchange rate export (Pd/Pf)
GW_t, GW_{t-1}	Growth rate ofworld income
GMC_{t-1}, GMC_t	Growth rate of capital goods import (in current year and one term ago)
$GGDP_{t-1}$	Growth rate of GDP in one term ago
EB_{t-1}	Informal exchange rate in one term ago
AP_{t-1}, AP_t	Inflation (in current year and one term ago)
$GPRO_{t-1}, GPRO_t$	Growth rate of production factors productivity(in current year and one term ago)
OR_{t-1}	Oil Revenues in one term ago
IIT_{t-1}	International Trade Integration of Industry in one term ago
OPENOX	Trade intensity index
$GNOX_{t-1}$	Growth rate of Non-Oil export in one term ago

Note: it's conventional to specify the export demand function as a multiplicative or constant elasticity function of relative prices measured in a common currency and foreign income. RP=Pd/Pf Pf: the foreign price, Pd: the domestic price

By means of the ability of GMDH algorithm for discretion non-linear trends in modelling and forecasting the growth rate of non-oil export , the effective variables are world income- globalization indexes- real exchange rate export- prices relative that used as an input for GMDH that the result are shown on table 3-2.

Table3-2) output of GMDH method for first process.

Variables	RP_t, GW_t, GW_{t-1}, GMC_t, GMC_{t-1}, $GGDP_{t-1}$, $GPRO_{t-1}$, $GPRO_t$, IIT_{t-1}, $GNOX_{t-1}$, $OPENOX_t$, RPE_t, AP_t, AP_{t-1}, EB_{t-1}, OR_{t-1}
Omitted variables	$_t$, AP_{t-1}, EB_{t-1}, OR_{t-1} AP
Variables with double effect	GW_t, , IIT_{t-1}
RMSE	0.014
MAPE	.118
Prediction error percentage	3.654
Prediction exactitude percentage	96.346
Theil in equality coefficient	0.061

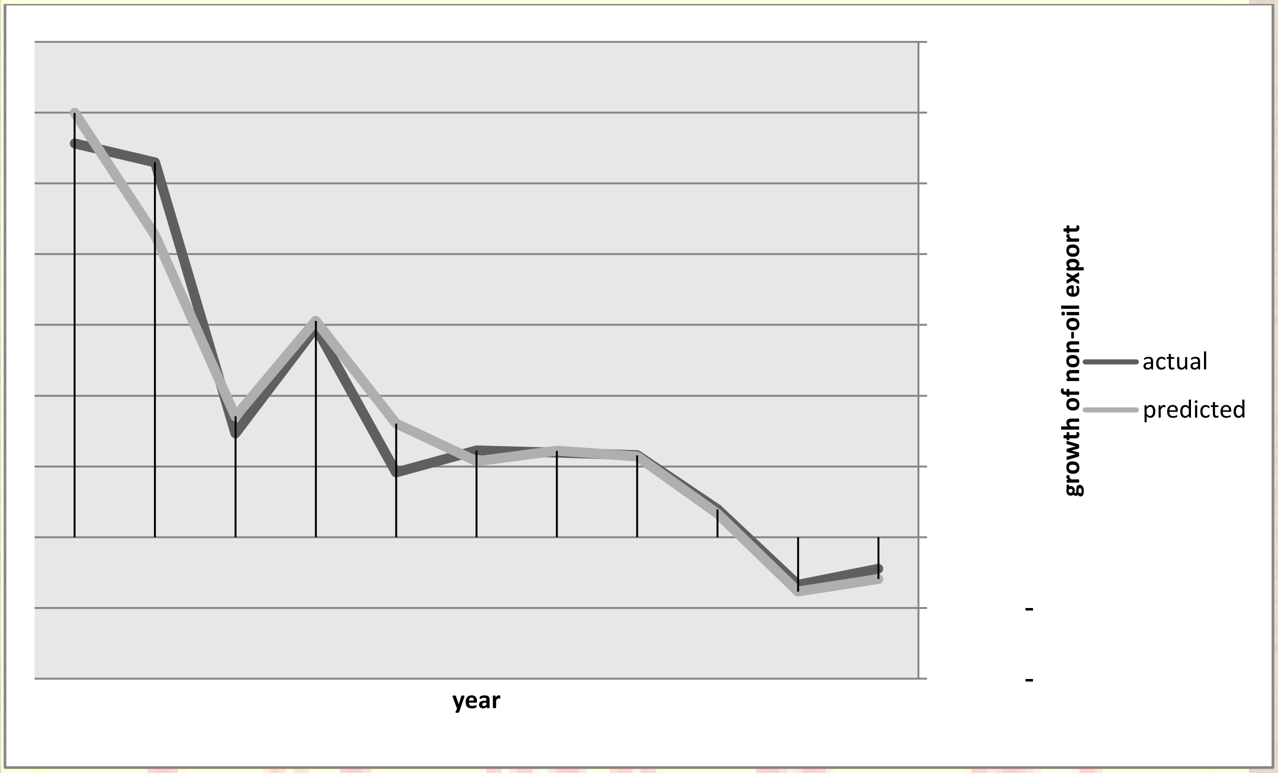
The first row indicates the primarily variables. One of the most important features of GMDH algorithm is the ability of omitting the redundant variables so we have the omitted variables in second rows. In view of the fact that we put Inflation and its first cease in price relative variables (RP) and the effect of exchange rate in real exchange rate export variable (RPE) so were omitted in modeling process. Also oil revenue was distinguished without impressive that the research shows it's authoritative. So in first process all variables were omitted except and the growth real production (GGDP) and productivity (GPRO).

All of the exogenous variables were effective in modeling process but the third row contains: growth of world income (GW) and index (IIT) were had double effect on growth rate of non-oil export.

The fourth to eighth rows were determined the standards measurement of prediction errors in first process GMDH test that shows high exactitude and enough authoritative in predicting. Also The statistic less than 0.55 shows that modeling has high authoritative.

The figure 3-1 shows the comparison between actual and predicted in first process.

Figure3-1



In second process we used the effective variables that were distinguished in first process as the inputs for neural networks so second patterns have 12 variables that are shown with their results on table 3-3.

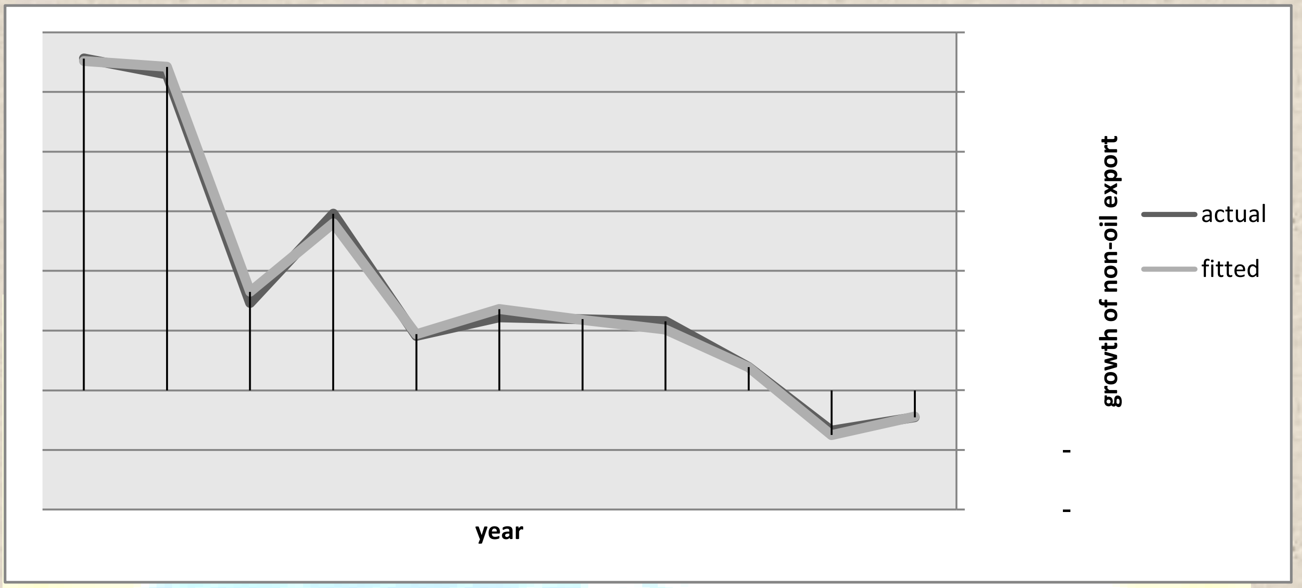
Table3-3) output of GMDH method for second process

variables	RP_t, GW_t, GW_{t-1}, GMC_t, GMC_{t-1}, $GGDP_{t-1}$, $GPRO_{t-1}$, $GPRO_t$, IIT_{t-1}, $GNOX_{t-1}$, $OPENOX_t$, RPE_t
Omitted variables	GW_{t-1},GMC_{t-1},$GPRO_{t-1}$,$GPRO_t$
Variables with double effect	RP_t,GMC_t ,$GGDP_{t-1}$, IIT_{t-1} , RPE_t
RMSE	**0.0096**
MAPE	**0.036**
Prediction error percentage	**2.503**
Prediction exactitude percentage	**97.497**
Theil in equality coefficient	**0.0416**

The results of second process out put indicate that factors of production productivity were putted away of the effective variables group in globalization.In the face of that abas shakeri in his paper (2004) was recognized this variable and exchange rate and inflation as effective variables on non-oil export with out globalization .So this variable has effect on non-oil export but in globalization process its effect is very little square up to other effective global variables that let us to omit it. The capital goods import,growth rate ofworld income in one term ago aren't impressive. The variables that have double effect on non-oil export are: growth rate of GNP in one term ago- growth rate of capital goods import in present - relative prices- real exchange rate export and International Trade Integration of Industry (ITI) index in one term ago and the other effective variables have the same effect. At last the standard errors were increased and Theil statistic like in first process shows that modelling has high authoritative.

The figure 3-2 shows the comparison between actual and predicted in second process.

Figure3-2



In third process, in final pattern we use effective variables in second process as inputs for neural-network. The results are shownon table3-4.

Table3-4) output of GMDH method for final process

Variables	RP_t, GW_t, GMC_t, $GGDP_{t-1}$, IIT_{t-1}, $GNOX_{t-1}$, $OPENOX_t$, RPE_t
Omitted variables	---------
Variables with double effect	RP_t, GW_t, GMC_t, $GGDP_{t-1}$, IIT_{t-1}, $OPENOX_t$
RMSE	0.0056
MAPE	0.012
Prediction error percentage	1.469
Prediction exactitude percentage	98.531
Theil in equality coefficient	0.0244

All of the variables in final patterns were effective on non-oil export and all variables except real exchange rate export and growth rate of non-oil export in one terms ago have double effect on growth rate of non-oil export. The prediction error in final process was reduced in comparison with two former processes and Theil statistic corroboratethat the modelling authoritative was increased.

In final pattern we have effective variables:

$$\mathbf{GNOX}_t = \mathbf{f}\,(\mathbf{RP}_t, \mathbf{GW}_t, \mathbf{GMC}_t, \mathbf{GGDP}_{t-1}, \mathbf{IIT}_{t-1}, \mathbf{GNOX}_{t-1}, \mathbf{OPENOX}_t, \mathbf{RPE}_t)$$

The figure 4-3 shows the comparison between actual and predicted in final process.

Figure3-3

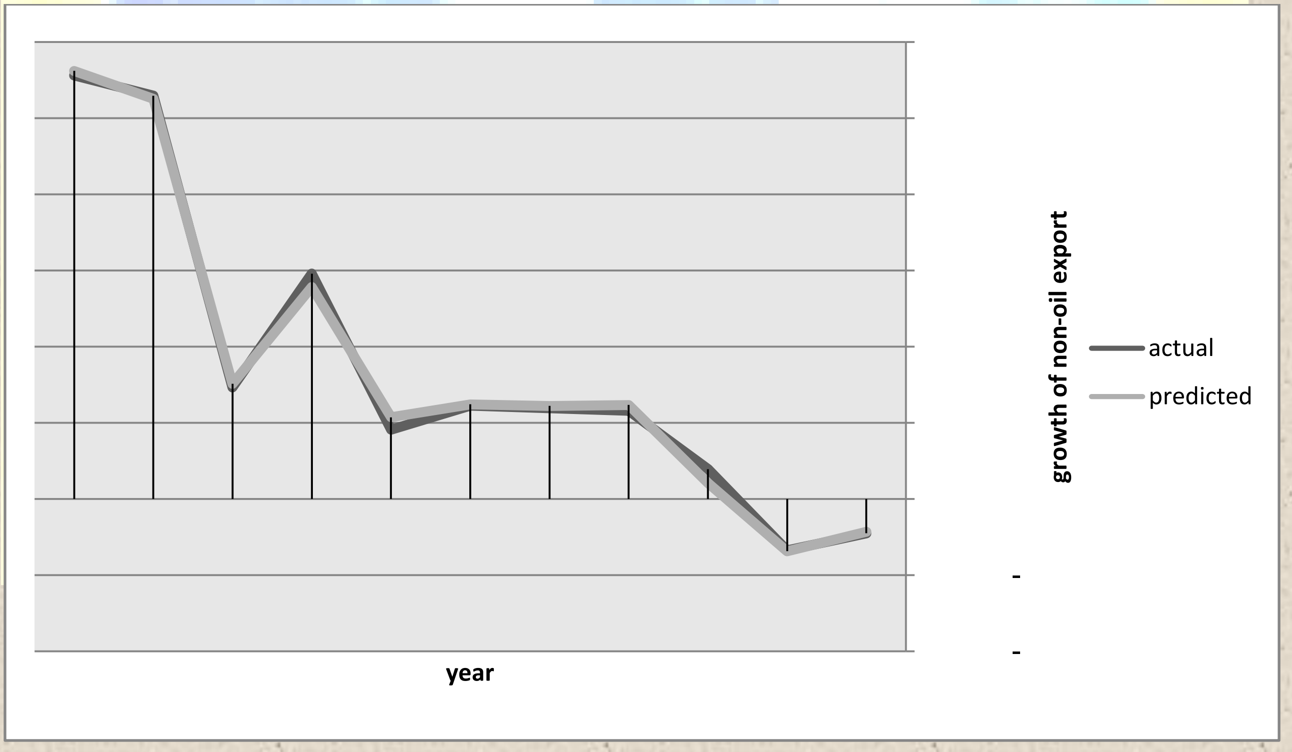


Table3-5 was compared triple pattern in standard errors.

Theil in equality coefficient	Prediction error percentage	MAPE	RMSE	pattern
0.061	3.654	0.118	0.014	**First process**
0.042	2.503	0.036	0.0096	**Second process**
0.024	1.469	0.012	0.0056	**Final process**

Table 3-5

It's observable that standard errors in process were decreased and the prediction exactitude was increased.

In other words by moving to final process errors have considerable reduction, as errors in second process reduce within the limits of 14.6% in comparison with first processes. The difference between numeral RMSE in first and final processes pattern is equal toF (10, 10) =62.5that is more than its critical value $F_{0.05}$ (10, 10)= 2.98.[F= MSE (1)/MSE (3).]

By omitting the endogenous variables except real growth production the scale of errors in modelling and forecasting improved but by omitting the exogenous variables specially globalization indexes – growth rate ofworld income and growth rate of capital goods import from pattern, errors in modelling and forecasting will increase.Consequently growth rate of non-oil export in globalization are affected by exogenous and international variables.

4) CONCLUSION:

The underlying objective of the paper was modeling non-oil export of Iran and in these processes it was used two group of variables (internal and external) as inputs for neural network in premier mode land because of the ability of GMDH algorithm in omitting redundant variables we could gain the final pattern that have more prediction exactitude in comparison with first pattern. Also the results indicate that globalization indexes, growth rate of world income and growth rate of capital goods import are more effective on growth rate of non-oil export than the other variables. Of course the growth of real production as the most important internal factor has the effective role on non-oil export.

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