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Small Model for Economy of Iraq Based on Semi-simulated Data

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Abstract In this paper, vector autoregressive model (VAR) is used to represent the most important variables in the Iraqi economy which are, Foreign Investment (FI), Iraqi Investment (II), Imports (IM), Exports (EX), Expenses (EXP), Income (IN), Broad Money (M2), Oil price (OI), Gross Domestic Product In Constant Price (2007=100) (GDP), Gross Foreign Assets of CBI (GF) and Exchange Rate in market price (ER). VAR model is estimated and some related tests are conducted. As a result, small model for economy of Iraq is obtained. To complete the work, principal component analysis is used for policy-making and prioritization for economy of Iraq. Most of information, approximately 86.13, is contained in three factors only. Based on the obtained results, all plans, policies and programs of economic and development in Iraq must be made according to the effects of factors and consequently variables under consideration.

Keywords Vector autoregressive model (VAR), Principal component analysis, Stability, Wald Test, Semi-simulated data, Akaike information criterion (AIC), Schwarz information criterion (SC)

1. Introduction and Work Aims

The VAR model was introduced by Sims (1980) as a method to analyze macroeconomic data. He developed the VAR model as an alternative to the traditional system, which involved several equations.

Athanasopoulos et al in 2010 studied the joint determination of the lag length, the dimension of the cointegrating space and the rank of the matrix of short-run parameters of a vector autoregressive (VAR) model using model selection criteria. They considered model selection criteria which have data-dependent penalties as well as the traditional ones. They suggested a new two-step model selection procedure which is a hybrid of traditional criteria and criteria with data-dependant penalties and they proved its onsistency. Their Monte Carlo simulations measure the improvements in forecasting accuracy that can arise from the joint determination of lag-length and rank using their proposed procedure, relative to an unrestricted VAR or a cointegrated VAR estimated by the commonly used procedure of selecting the lag-length only and then testing for cointegration. Two empirical applications forecasting Brazilian inflation and U.S. macroeconomic aggregates growth rates respectively show the usefulness of the model-selection strategy proposed here. The gains in different measures of forecasting accuracy are substantial, especially for short horizons.

Emmanuel in 2015 used the VAR models to model the Growth Domestics Products (GDP) of Ghana with other two selected macroeconomic such as inflation and real exchange rate for the period of 1980 to 2013. The empirical results derived, indicated that all the variables were stationary after their first differencing. The study further established that there is cointegration between macroeconomic variables and GDP in Ghana indicating long run relationship. The VECM (3) model was appropriately identified using AIC information criteria with co-integration relation of exactly one.

Kononenko in 2015 used VAR Methodology as well as Vector Error Correction (VEC) methodology to examine the existence and direction of causality between economic growth and IMF lending for Ukraine. The paper examines the IMF lending data for the period of 1991-2010. Robust empirical analysis indicates that IMF lending has a negative effect of on Ukraine's economic growth in the short term. Policy implications of this finding are that, despite short-run decline in economic growth, IMF lending can result in a long-run sustainable growth for Ukraine. For this, policymakers need to ensure that fund's money are used not only to cover budget's deficit, but also to finance institutional reforms.

Demeshko et al in 2016 characterized the relations of the discrete time domain DVAR model with its corresponding Structural Vector AR (SVAR) and Continuous Time Vector AR (CTVAR) models through a finite difference method

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across continuous and discrete time domain. They further clarified that the DVAR model of a continuous time, multivariate, linear Markov system is canonical under a highly generic condition. Their analysis shows that they can uniquely reproduced its SVAR and CTVAR models from the DVAR model. Based on these results, they proposed a novel Continuous and Structural Vector Autoregressive (CSVAR) modeling approach to derive the SVAR and the CTVAR models from their DVAR model empirically derived from the observed time series of continuous time linear Markov systems. They demonstrated its superior performance through some numerical experiments on both artificial and real-world data.

Gudeta et al in 2017 investigated the effect of export and import on real economic growth of Ethiopia. Yearly data set on the variables are obtained for the period 1982 to 2015 from national bank of the country. VAR analysis suggests that the lagged variables of both export and import have significant contributions in predicting the economic growth of the country.

In 2018, Forni et al resumed the line of research pioneered by Sims and Zha (Macroeconomic Dynamics, 2006, 10, 231–272) and make two novel contributions. First, they provided a formal treatment of partial fundamentalness, that is, the idea that a structural vector autoregression (VAR) can recover, either exactly or with good approximation, a single shock or a subset of shocks, even when the underlying model is nonfundamental. In particular, they extended the measure of partial fundamentalness proposed by Sims and Zha to the finite-order case and study the implications of partial fundamentalness for impulse-response and variance-decomposition analysis. Second, they presented an application where they validated a theory of news shocks and found it to be in line with the empirical evidence.

Huber and Pfarrhofer in 2019 provided a parsimonious means to estimate panel VARs with stochastic volatility. They assumed that coefficients associated with domestic lagged endogenous variables arise from a Gaussian mixture model. Shrinkage on the cluster size was introduced through suitable priors on the component weights and cluster-relevant quantities were identified through novel shrinkage priors. To assess whether dynamic interdependencies between economies are needed, they moreover impose shrinkage priors on the coefficients related to other countries' endogenous variables. Finally, their model controls for static interdependencies by assuming that the reduced form shocks of the model feature a factor stochastic volatility structure. They assessed the merits of the proposed approach by using synthetic data as well as a real data application. In the empirical application, they forecast Eurozone unemployment rates and shows that their proposed approach works well in terms of predictions.

Hecq et al in 2019 developed an LM test for Granger causality in high-dimensional VAR models based on penalized least squares estimations. To obtain a test which retains the appropriate size after the variable selection done by the lasso, they proposed a post-double selection procedure to partial out the effects of the variables not of interest. They conducted an extensive set of Monte-Carlo simulations to compare different ways to set up the test procedure and choose the tuning parameter. The test performs well under different data generating processes, even when the underlying model is not very sparse. They investigated also two empirical applications: the money-income causality relation using a large macroeconomic dataset and networks of realized volatilities of a set of 49 stocks. In both applications they find evidences that the causal relationship becomes much clearer if a high-dimensional VAR is considered compared to a standard low-dimensional one.

Aikman in 2019 presented a methodology for modelling the interaction between quantiles of endogenous variables in a VAR. They apply this to a bivariate quantile VAR on euro area data for industrial production and a financial stress indicator. They find that financial shocks shift the shape of the distribution of industrial production in the short term, increasing the fatness of the tail.

Owing to its simplicity and less restrictions, the vector autoregressive with exogenous variable (VARX) model is one of the statistical analyses frequently used in many studies involving time series data, such as finance, economics, and business. PTBA and HRUM energy as endogenous variables and exchange rate as an exogenous variable were studied by Warsono in 2019. The data used were collected from January 2014 to October 2017. The dynamic behavior of the data was also studied through IRF and Granger causality analyses. The forecasting data for the next 1 month was also investigated. On the basis of the data provided by these different models, it was found that VARX (3,0) is the best model to assess the relationship between the variables considered in this work.

In this paper, we have two aims, the first one is the modeling of most important variables of Iraqi economy, model estimation and related issues. The second aim is the policy-making and prioritization for economy of Iraq.

2. VAR Process Model

The vector autoregression (VAR) is usually used for forecasting systems of interconnected time series and for analyzing the influence of random errors on the system of variables. VAR processes are common in economics because they are easy and ductile models for multivariate time series data. Var models became standard tools since Sims (1980) contested the way traditional simultaneous equations models were named, recognized and recommended these models as alternatives. These models are treated in depth in books of Lütkepohl (2005) and Hamilton (1994). VAR models does not need for structural modeling by considering every endogenous variable as a function of the lagged values of all of the endogenous variables in the system. Suppose that we interested in a set of m related time series variables collected in $y_t = (y_{1t}, y_{2t}, \dots, y_{mt})^T$.

The mathematical form of a VAR model is,

$$y_t = Bb_t + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + u_t \quad (1)$$

Where y_t is a m vector of endogenous variables, A_i $(i = 1,2, \dots, p)$ are $(m \times m)$ matrices of parameters, b_t is a vector of deterministic terms such as a constant, a linear trend and/or seasonal, B is the matrix of parameters related with b_t, and u_t is a vector of errors that may be jointly correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables. The error process u_t is assumed to be white noise with zero mean, that is, $(u_t) = 0$, the covariance matrix, $E(u_t u_t^T) = \Sigma_u$, is time invariant and the u_t's are serially uncorrelated or independent.

By using the lag operator $A(L) = I_m - A_1 L - \cdots - A_p L^p$, (1) can be reformed as,

$$A(L)\, y_t - Bb_t = u_t \quad (2)$$

The VAR process is stable if all roots of the determinantal polynomial are outside the complex unit circle, which is mean that, $Det[A(\omega)] \neq 0$ for $\omega \in, |\omega| \leq 1$. Since that any stable process y_t has time invariant means, variances and covariance structure and is, hence, stationary.

VAR models are suited tools for **forecasting**. If the u_t's are independent white noise, the minimum mean squared error (MSE) h-step forecast of y_{t+h} at time t is the conditional expectation given y_s , $s \leq t$,

$$y_{t+h|t} = E(y_{t+h} | y_t, y_{t-1}, \dots)$$

$$= Bb_{t+h} + A_1 y_{t+h-1|t} + A_2 y_{t+h-2|t} + \cdots + A_p y_{t+h-p|t} \quad (3)$$

Where $y_{t+i|t} = y_{t+i}$ for $i \leq 0$. Using this formula, the forecasts can be computed recursively for $h = 1,2, \dots$. The forecasts are unbiased, that is, the forecast error $y_{t+h} - y_{t+h|t}$ has mean zero and the forecast error covariance is equal to the MSE matrix. The one-step ahead forecast errors are the u_t's.

VAR models can also be consumed for analyzing the connections among variables involved. For example, Granger (1969) determined a notion of causality which given that a variable y_{1t} is causal for a variable y_{2t} if the information in y_{1t} is beneficial for ameliortating the forecasts of y_{2t}. If the two variables are jointly generated by a VAR process, it turns out that y_{1t} is not Granger-causal for y_{2t} if a simple set of zero conditions for the VAR model coefficients are fulfilled. Hence, **Granger-causality** is light to check in VAR processes.

2.1. Estimation and Model Specification

Usually, in practical applications, the process which has generated the time series under study is unknown. So, if VAR models are considered as appropriate, the lag order has to be determined and the parameters have to be estimated. Consequently, for a given VAR of order p, estimation can be well done by the ordinary least squares (OLS). For a sample of size k , $y_1, y_2, \dots, y_k$, and assuming that moreover initial values $y_{-p+1}, \dots, y_0$ are available, the OLS estimator of the parameters $Q = [B, A_1, \dots, A_p]$ will be,

$$\hat{Q} = \left(\sum_{t=1}^{k} y_t v_{t-1}^T\right)\left(\sum_{t=1}^{k} v_{t-1} v_{t-1}^T\right)^{-1} \quad (4)$$

Where, $v_{t-1}^T = \left(b_t^T, y_{t-1}^T, \dots, y_{t-p}^T\right)$. Under standard assumptions the estimator is consistent and asymptotically normally distributed. Actually, if the residuals and, hence, the y_t's are normally distributed, that is, $u_t \sim (0, \Sigma_u)$, the OLS estimator is equal to the maximum likelihood (ML) estimator with the usual asymptotic optimality properties. It is well known that, the number of parameters is also large, when the dimension m of the process is large, then the estimation precision may be low if a sample of typical size in macroeconomic studies is available for estimation. In that case, it may be opportune to use so-called subset VAR models by estranging excessive lags of some of the variables from some of the equations. Generally, other estimation methods may be more efficient if some restrictions are enjoined on the parameter matrices.

By the following most popular model selection criteria, VAR order selection is usually done,

1. Akaike's information criterion (AIC) (Akaike, 1973), with the form,

$$AIC(l) = Log\ Det(\hat{\Sigma}_l) + 2lm^2/k$$

2. Hannan-Quinn criterion (HQC) (Hannan and Quinn, 1979), with the form,

$$HQC(l) = Log\ Det(\hat{\Sigma}_l) + (2lm^2/k)\ Log(Log(k))$$

Where, $\hat{\Sigma}_l = \sum_{t=1}^{k} \hat{u}_t\, \hat{u}_t^T$ is the residual covariance matrix of a VAR(l) model estimated by OLS. The VAR order is chosen which perfectly equipoises both terms. Factually, models of orders $l = 0,1, \dots, p_{max}$ are estimated and the order p is chosen such that it minimizes the value of the criteria.

The fact that $AIC < HQC$ implies to that the HQC generally chooses models with a smaller p while AIC chooses models with a higher order p.

Once a model is estimated it should be checked that it represents the data features sufficiently.

If some of the time series variables to be modeled with a VAR have stochastic trends, that is, they manage similarly to a random walk, and then another model framework may be more suitable for analyzing especially the trending properties of the variables. Stochastic trends in some of the variables are generated by models with unit roots in the VAR operator, that is $Det\left(I_m - A_1\omega - \cdots - A_p\omega^p\right) = 0$, for $\omega = 1$. Variables with such trends are nonstationary and not stable. They are often called integrated. They can be made stationary by differencing. Furthermore, they are called cointegrated if stationary linear combinations exist or, in other words, if some variables are driven by the same stochastic trend. Cointegration relations are often of specific benefit in economic studies. In that case, reparameterizing the standard VAR model such that the cointegration relations appear immediately may be appropriate. The so-called vector error correction model (VECM) of the form,

$$\Delta y_t = Bb_t + \Theta y_{t-1} + \Phi_1 \Delta y_{t-2} + \cdots + \Phi_{p-1} \Delta y_{t-p+1} + u_t \quad (5)$$

is a simple example of such a reparametrization, where Δ denotes the differencing operator defined such that, $\Delta y_t = y_t - y_{t-1}$, $\Theta = -\left(I_m - A_1 - \cdots - A_p\right)$ and $\Phi_i =$

$-A_{i+1} - \cdots - A_p$ for $(i = 1, \dots, p-1)$. This parametrization is acquired by subtracting y_{t-1} from both sides of the standard VAR formulation and rearranging terms. Its merit is that Θ can be decomposed such that the cointegration relations are straight sitting in the model. More accurately, if all variables are stationary after differencing once, and there are $m - r$ common trends, then the matrix Θ has rank r and can be decomposed as, $\Theta = \delta\gamma^T$, where δ and γ are $(m \times r)$ matrices of rank r and γ includes the cointegration relations. A detailed statistical analysis of this model is offered in Johansen (1995).

3. Model of Iraqi Economy

In this section, a small model for economy of Iraq will presented according to data obtained from the website of central bank of Iraq. The variables used here are Foreign Investment (FI), Iraqi Investment (II), Imports (IM), Exports (EX), Expenses (EXP), Income (IN), Broad Money (M2), Oil price (OI), Gross Domestic Product In Constant Price (2007=100) (GDP), Gross Foreign Assets of CBI (GF) and Exchange Rate in market price (ER). The data shown in table (1) in appendix. Three of variables IM, EX and GDP have been compiled on an annual basis, while the other variables were compiled on a monthly basis. To unify these basis, we estimated three annual models based on time as independent variables to simulate the monthly values of these variables. The models are as follows,

$$\text{IM} = 659.491\ t - 2.36437\ t^2 + 0.0271158\ t^3 - 0.000175894\ t^4 \qquad (6)$$

With adjusted determination coefficient R^4 equal to 97.9491 and mean square error equal to 4.1018E7.

$$\text{Ex} = 0.538477\ t + 0.0105689\ t^2 - 0.0000988688\ t^3 + 1.55976\text{E-}7\ t^4 \qquad (7)$$

With adjusted determination coefficient R^4 equal to 93.9906 and mean square error equal to 248.287.

$$\text{GDP} = 6.53025\ t - 0.121239\ t^2 + 0.000946019\ t^3 - 0.00000245094\ t^4 \qquad (8)$$

With adjusted determination coefficient R^4 equal to 99.1058 and mean square error equal to 229.995.

Three models are accepted to represent data according to F-ANOVA test at all popular significant levels 0.01, 0.05 and 0.10. The simulated data are recognized by red color in table (1) and the variables which are simulated will recognized by letter s, to be GDPS instead of GDP, EXS instead of EX and IMS instead of IM.

We will present our work according to the following steps,

(1) The VAR model is considered. Table (1) shows the results of model estimation. The estimates of model parameters are in the first line at each of independent variables. The second line contains the standard deviation for each corresponding estimate while the third line contains the computed t- statistic to test the null hypothesis, which is said that the parameter under consideration is equal to zero, against the alternative hypothesis, which is not said that. The p-value is contained in the fourth line. The bold font for the p-values is used to recognize the rejected hypotheses, which is meaning that the variable has an effect.

(2) The values of Adj. R-squared, Log likelihood, Akaike AIC and Schwarz SC in table (1), show that the model is worked well done.

(3) The initial VAR model (which is contained all considered independent variables and lagged variables of order 2 according to criteria in table (2)) is as follows,

ER = 1.292 ER_{-1} - 0.351 ER_{-2} - 0.00028 GF_{-1} - 0.0003388 GF_{-2} - 0.4237 OI_{-1} + 0.4995 OI_{-2} + 1.504 $GDPS_{-1}$ - 2.91 $GDPS_{-2}$ - 2.455e-07 EXP_{-1} + 1.6565e-07 EXP_{-2} + 1.4167e-07 IN_{-1} - 1.385e-07 IN_{-2} - 4.4675 EXS_{-1} + 1.333 EXS_{-2} - 0.00356 IMS_{-1} + 0.0051 IMS_{-2} - 1.223e-05 FI_{-1} + 9.89e-06 FI_{-2} - 3.327e-06 II_{-1} + 1.6e-06 II_{-2} + 4.38e-07 $M2_{-1}$ + 2.5475e-07 $M2_{-2}$ + 100.55

GF = - 3.36 ER_{-1} - 5.724 ER_{-2} + 0.61435 GF_{-1} + 0.2188 GF_{-2} - 10.226 OI_{-1} + 49.55 OI_{-2} - 308.625 $GDPS_{-1}$ + 282.808 $GDPS_{-2}$ + 4.912e-05 EXP_{-1} - 1.409e-05 EXP_{-2} - 3.582e-05 IN_{-1} + 7.295e-06 IN_{-2} + 253.25 EXS_{-1} + 43.7688 EXS_{-2} + 0.37053 IMS_{-1} - 0.267 IMS_{-2} + 0.000244 FI_{-1} - 0.000241 FI_{-2} + 3.0417e-05 II_{-1} - 0.0002017 II_{-2} + 2.89e-05 $M2_{-1}$ + 3.073e-05 $M2_{-2}$ + 12748.07

OI = 0.03761* ER_{-1} - 0.036 ER_{-2} + 6.4681e-05 GF_{-1} + 2.9723e-05 GF_{-2} + 1.489 OI_{-1} - 0.6038 OI_{-2} - 1.0554 $GDPS_{-1}$ + 0.4211 $GDPS_{-2}$ + 1.089e-07 EXP_{-1} + 1.211e-08 EXP_{-2} - 1.0204e-07 IN_{-1} - 3.272e-08 IN_{-2} + 1.665 EXS_{-1} + 0.2634 EXS_{-2} + 0.00053 IMS_{-1} - 0.001153 IMS_{-2} - 2.921e-07 FI_{-1} + 2.9576e-07 FI_{-2} + 1.293e-07 II_{-1} - 6.691e-08 II_{-2} - 1.2737e-07 $M2_{-1}$ + 8.339e-08 $M2_{-2}$ + 6.684

$GDPS$ = 0.0054753* ER_{-1} - 0.00533 ER_{-2} - 1.270648e-05 GF_{-1} + 1.11512e-05 GF_{-2} + 0.01916 OI_{-1} - 0.02474 OI_{-2} + 0.84514 $GDPS_{-1}$ - 0.1086 $GDPS_{-2}$ - 1.372e-08 EXP_{-1} + 7.363e-09 EXP_{-2} + 1.4514e-08 IN_{-1} - 6.055e-09 IN_{-2} - 0.02621 EXS_{-1} + 0.07958 EXS_{-2} - 0.00026 IMS_{-1} - 4.0256e-05 IMS_{-2} - 1.93478e-07 FI_{-1} + 1.55591e-07 FI_{-2} - 5.02166e-08 II_{-1} + 3.1218e-08 II_{-2} - 9.6437e-08 $M2_{-1}$ + 1.30627e-07 $M2_{-2}$ + 2.581

EXP = - 20063.186* ER_{-1} + 29132.994 ER_{-2} - 1469.215 GF_{-1} + 1579.646 GF_{-2} + 147402.404 OI_{-1} + 125033.64 OI_{-2} + 1092145.579 $GDPS_{-1}$ - 21436.69 $GDPS_{-2}$ + 0.1897 EXP_{-1} + 0.13856 EXP_{-2} + 0.40743 IN_{-1} - 0.235 IN_{-2} - 3191803.31 EXS_{-1} - 341863.69 EXS_{-2} + 2327.7 IMS_{-1} - 528.95 IMS_{-2} - 5.4258 FI_{-1} + 3.821 FI_{-2} - 0.787 II_{-1} + 1.45658 II_{-2} - 3.73872 $M2_{-1}$ + 3.68252* $M2_{-2}$ - 20724629.4

IN = - 163957.477*ER_{-1}+ 197231.444 ER_{-2} - 1755.3933 GF_{-1} + 2066.1762 GF_{-2} + 212580.87 OI_{-1} + 391844.534 OI_{-2} + 1753313.7254 $GDPS_{-1}$ + 34403.7 $GDPS_{-2}$ - 0.141078 EXP_{-1} - 0.0610626 EXP_{-2} + 0.7207 IN_{-1} - 0.13178 IN_{-2} - 5292199.22 EXS_{-1} - 704813.2 EXS_{-2}+ 4248.33 IMS_{-1}- 1511.43 IMS_{-2}- 6.58571 FI_{-1}+ 4.6481 FI_{-2}- 1.461 II_{-1}+ 2.5451 II_{-2}- 4.40613 $M2_{-1}$+ 4.2039 $M2_{-2}$- 68251824.82

EXS = 0.0007692*ER_{-1}- 0.000873 ER_{-2} + 1.15629e-05 GF_{-1} - 1.8591e-05 GF_{-2} + 0.0197 OI_{-1} - 0.00092 OI_{-2} + 0.00977 $GDPS_{-1}$ - 0.01995 $GDPS_{-2}$ - 1.45756e-09 EXP_{-1} + 5.7589e-09 EXP_{-2} + 1.1807e-10 IN_{-1} - 4.161232e-09 IN_{-2} + 0.6341 EXS_{-1} + 0.0682 EXS_{-2} + 8.020e-05 IMS_{-1}- 0.0001 IMS_{-2}- 3.58e-08 FI_{-1}- 1.204e-09 FI_{-2}- 9.8478e-08 II_{-1}+ 9.9565e-08 II_{-2}- 2.58e-08 $M2_{-1}$+ 3.9371e-08 $M2_{-2}$+ 0.14377

IMS = 2.1868*ER_{-1}- 2.41268 ER_{-2} + 0.003263 GF_{-1} - 0.00312 GF_{-2} + 6.939 OI_{-1} - 4.6393 OI_{-2} - 26.4994 $GDPS_{-1}$ - 12.9734 $GDPS_{-2}$ - 2.685e-06 EXP_{-1} + 2.57169e-06 EXP_{-2} + 2.5098e-06 IN_{-1} - 1.773625e-06 IN_{-2} - 46.2467 EXS_{-1} + 32.53676 EXS_{-2}+ 0.9272 IMS_{-1}- 0.0778 IMS_{-2}+ 4.545e-05 FI_{-1} - 6.499e-05 FI_{-2}- 5.679e-06 II_{-1}- 2.3959e-06 II_{-2}- 1.73862e-05 $M2_{-1}$ + 2.4863e-05 $M2_{-2}$+ 847.86

FI = 1946.34*ER_{-1}+ 1281.74 ER_{-2} + 7.097 GF_{-1} + 30.406 GF_{-2} + 4517.77 OI_{-1} - 6680.866 OI_{-2} + 15972.33 $GDPS_{-1}$ - 15893.8573 $GDPS_{-2}$ + 0.0009 EXP_{-1} + 0.00073 EXP_{-2} - 0.000717 IN_{-1} - 0.00137 IN_{-2} + 26077.564 EXS_{-1} - 39725.965 EXS_{-2}- 161.0082 IMS_{-1}+ 127.9697 IMS_{-2}+ 0.84961 FI_{-1}- 0.05567 FI_{-2}- 0.011626 II_{-1}+ 0.11277 II_{-2}+ 0.0012364 $M2_{-1}$- 0.02178 $M2_{-2}$- 4394115.7

II = - 3543.093*ER_{-1}+ 159.5519 ER_{-2} - 34.301 GF_{-1} + 0.3739 GF_{-2} - 12075.02 OI_{-1} + 19601.485 OI_{-2} + 24823.637 $GDPS_{-1}$ + 27680.25 $GDPS_{-2}$ - 0.006797 EXP_{-1} - 0.002719 EXP_{-2} + 0.00537 IN_{-1} - 0.00074 IN_{-2} - 152482.92 EXS_{-1} - 50657.1691 EXS_{-2} - 69.773 IMS_{-1}+ 91.788 IMS_{-2}+ 0.10014 FI_{-1}- 0.082 FI_{-2} + 1.0953 II_{-1}- 0.242 II_{-2} + 0.0329 $M2_{-1}$ - 0.00323 $M2_{-2}$+ 4727355.5

$M2$ = 13659.4366*ER_{-1}- 13933.864 ER_{-2} - 44.234 GF_{-1} + 89.1996 GF_{-2} - 11745.15 OI_{-1}+ 28321.38 OI_{-2} + 249914.34 $GDPS_{-1}$ - 99876.7868 $GDPS_{-2}$ - 0.003586 EXP_{-1} + 0.00965 EXP_{-2} + 0.010561 IN_{-1} - 0.0156 IN_{-2} - 168245.3197 EXS_{-1} - 52714.051 EXS_{-2}- 747.871542 IMS_{-1}+ 645.5 IMS_{-2}- 0.3181 FI_{-1}- 0.12795 FI_{-2}+ 0.05816 II_{-1}+ 0.064677 II_{-2}+ 0.881 $M2_{-1}$+ 0.072087 $M2_{-2}$+ 98509.199

(9)

Graph (1) represent the residuals for each considered random variable,

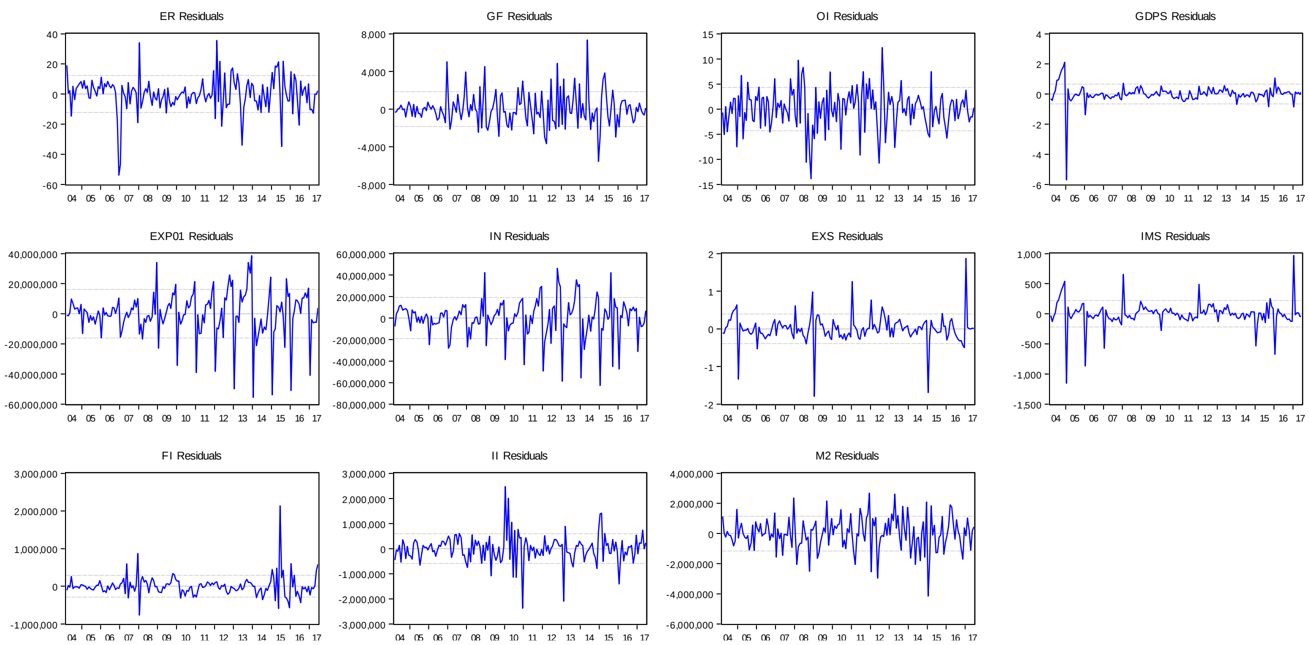

Figure (1). Residuals for each considered random variable

(4) According to the results of t-test in table (1) and Granger Causality/Block Exogeneity Wald Tests in table (3), the final VAR model (which is contained the effective independent variables only) is as follows,

ER = 100.55- 0.4237 OI_{-1} + 0.4995 OI_{-2} - 1.223e-05 FI_{-1}+ 9.89e-06 FI_{-2}- 3.327e-06 II_{-1} +4.38e-07 $M2_{-1}$+ 2.5475e-07 $M2_{-2}$

GF = 12748.07 + 0.61435 GF_{-1} + 0.2188 GF_{-2} + 4.912e-05 EXP_{-1} - 3.582e-05 IN_{-1} - 3.36 ER_{-1} - 5.724 ER_{-2} - 10.226 OI_{-1} + 49.55 OI_{-2}

OI = 1.489 OI_{-1} - 0.6038 OI_{-2} + 1.089e-07 EXP_{-1} - 1.0204e-07 IN_{-1} + 1.665 EXS_{-1} + 0.2634 EXS_{-2}

$GDPS$ = 0.01916 OI_{-1} - 0.02474 OI_{-2} + 0.84514 $GDPS_{-1}$ + 1.4514e-08 IN_{-1} - 9.6437e-08 $M2_{-1}$+ 1.30627e-07 $M2_{-2}$

EXP = - 1469.215 GF_{-1} + 1579.646 GF_{-2} + 0.40743 IN_{-1} - 3.73872 $M2_{-1}$+ 3.68252* $M2_{-2}$

IN = 197231.444 ER_{-2} - 1755.3933 GF_{-1} + 2066.1762 GF_{-2} + 0.7207 IN_{-1} - 4.40613 $M2_{-1}$+ 4.2039 $M2_{-2}$+ 212580.87 OI_{-1} + 391844.534 OI_{-2}

EXS = 0.0197 OI_{-1} + 0.6341 EXS_{-1} - 9.8478e-08 II_{-1}+ 9.9565e-08 II_{-2}- 2.58e-08 $M2_{-1}$+ 3.9371e-08 $M2_{-2}$

IMS = 2.1868*ER_{-1}- 2.41268 ER_{-2} + 6.939 OI_{-1} + 0.9272 IMS_{-1}- 26.4994 $GDPS_{-1}$ - 12.9734 $GDPS_{-2}$- 1.73862e-05 $M2_{-1}$ + 2.4863e-05 $M2_{-2}$

FI = - 4394115.7 + 30.406 GF_{-2} + 0.11277 II_{-2}+1946.34*ER_{-1}+ 1281.74 ER_{-2}+ 0.0012364 $M2_{-1}$- 0.02178 $M2_{-2}$

II = 4727355.5 + 19601.485 OI_{-2} + 1.0953 II_{-1}- 0.242 II_{-2} - 3543.093*ER_{-1}+ 159.5519 ER_{-2}+ 0.0329 $M2_{-1}$ - 0.00323 $M2_{-2}$

$M2$ = 13659.4366*ER_{-1}- 13933.864 ER_{-2} + 0.881 $M2_{-1}$- 0.3181 FI_{-1}- 0.12795 FI_{-2}

(10)

(5) According to the results in tables (4) and (5) and figure (2), It is clear that No root lies outside the unit circle, then VAR model satisfies the stability and consequently stationarity condition.

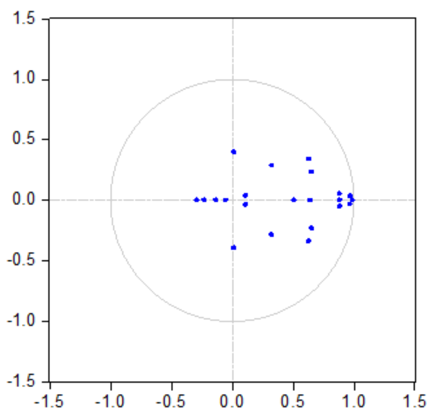

Figure (2). Inverse roots of AR characteristic polynomial

Table (1). Shows the results of model estimation and evaluation

Independent Variables	Dependent Variables										
	ER	**GF**	**OI**	**GDPS**	**EXP**	**IN**	**EXS**	**IMS**	**FI**	**II**	**M2**
ER(-1)											
Parameter estimation	1.291746	-3.359808	0.037610	0.005475	-20063.19	-163957.5	0.000769	2.186842	1946.338	-3543.093	13659.44
Standard deviation	(0.07291)	(11.0445)	(0.02569)	(0.00393)	(95828.4)	(113146.)	(0.00234)	(1.30788)	(1737.22)	(3544.09)	(6871.00)
T statistic	[17.7174]	[-0.30421]	[1.46389]	[1.39230]	[-0.20937]	[-1.44908]	[0.32833]	[1.67204]	[1.12037]	[-0.99972]	[1.98798]
probability	**0.0000**	0.7632	0.1405	0.1636	0.8342	0.1475	0.7417	**0.0929**	0.2611	0.3170	**0.0485**
ER(-2)											
Parameter estimation	-0.35058	-5.723954	-0.036043	-0.00533	29132.99	197231.4	-0.000873	-2.412683	1281.740	159.5519	-13933.86
Standard deviation	(0.07385)	(11.1871)	(0.02602)	(0.00398)	(97065.7)	(114607.)	(0.00237)	(1.32477)	(1759.65)	(3589.85)	(6959.71)

Independent Variables	Dependent Variables										
	ER	**GF**	**OI**	**GDPS**	**EXP**	**IN**	**EXS**	**IMS**	**FI**	**II**	**M2**
T statistic	[-4.74721]	[-0.51166]	[-1.38502]	[-1.33798]	[0.30014]	[1.72094]	[-0.36773]	[-1.82121]	[0.72841]	[0.04445]	[-2.00207]
probability	**0.0000**	0.6123	0.1691	0.1777	0.7641	**0.0855**	0.7122	**0.0686**	0.4650	0.9613	**0.0433**
GF(-1)											
Parameter estimation	-0.000285	0.614349	6.47E-05	-1.27E-05	-1469.215	-1755.393	1.16E-05	0.003263	7.097300	-34.301	-44.234
Standard deviation	(0.00057)	(0.08571)	(0.00020)	(3.1E-05)	(743.697)	(878.094)	(1.8E-05)	(0.01015)	(13.4821)	(27.5046)	(53.3239)
T statistic	[-0.50295]	[7.16750]	[0.32440]	[-0.41634]	[-1.97556]	[-1.99910]	[0.63596]	[0.32144]	[0.52642]	[-1.24710]	[-0.82953]
probability	0.1341	**0.0495**	**0.0607**	0.1232	0.3849	0.5841	0.7840	0.3684	0.8188	0.4000	0.8040
GF(-2)											
Parameter estimation	-0.000339	0.218795	2.97E-05	1.12E-05	1579.646	2066.176	-1.86E-05	-0.003121	30.40652	0.373897	89.19958
Standard deviation	(0.00057)	(0.08699)	(0.00020)	(3.1E-05)	(754.759)	(891.155)	(1.8E-05)	(0.01030)	(13.6826)	(27.9138)	(54.1170)
T statistic	[-0.58997]	[2.51523]	[0.14689]	[0.36003]	[2.09292]	[2.31854]	[-1.00751]	[-0.30302]	[2.22227]	[0.01339]	[1.64827]
probability	0.3524	0.5835	0.8149	0.4164	0.5258	0.8128	0.2786	0.3798	0.8547	0.7415	0.5678
OI(-1)											
Parameter estimation	-0.423735	-10.22577	1.488916	0.019160	147402.4	212580.9	0.019734	6.939136	4517.772	-12075.02	-11745.15
Standard deviation	(0.20813)	(31.5289)	(0.07334)	(0.01123)	(273563.)	(323000.)	(0.00669)	(3.73364)	(4959.27)	(10117.4)	(19614.7)
T statistic	[-2.03589]	[-0.32433]	[20.3011]	[1.70675]	[0.53882]	[0.65815]	[2.95070]	[1.85855]	[0.91097]	[-1.19350]	[-0.59879]
probability	0.2082	0.6328	0.1761	0.8915	0.4852	0.3271	**0.0000**	0.4550	0.7520	0.3643	0.6180
OI(-2)											
Parameter estimation	0.499517	49.55186	-0.603835	-0.024738	125033.6	391844.5	-0.000925	-4.639323	-6680.866	19601.48	28321.38
Standard deviation	(0.24478)	(37.0809)	(0.08626)	(0.01320)	(321735.)	(379878.)	(0.00787)	(4.39111)	(5832.57)	(11899.0)	(23068.8)
T statistic	[2.04065]	[1.33632]	[-7.00043]	[-1.87363]	[0.38862]	[1.03150]	[-0.11758]	[-1.05653]	[-1.14544]	[1.64733]	[1.22769]
probability	0.6075	0.9477	0.8536	0.6356	0.9366	0.8895	0.5141	0.5907	0.6089	0.7380	0.9245
GDPS(-1)											
Parameter estimation	1.503959	-308.6249	-1.055385	0.845137	1092146.	1753314.	0.009770	-26.49939	15972.33	24823.64	249914.3
Standard deviation	(1.98895)	(301.296)	(0.70087)	(0.10728)	(2614218)	(3086645)	(0.06391)	(35.6793)	(47391.8)	(96683.4)	(187442.)
T statistic	[0.75616]	[-1.02432]	[-1.50583]	[7.87782]	[0.41777]	[0.56803]	[0.15287]	[-0.74271]	[0.33703]	[0.25675]	[1.33329]
probability	**0.0015**	0.6907	0.7261	0.3334	0.2507	0.2376	0.7508	0.5042	0.0000	0.5826	0.4479
GDPS(-2)											
Parameter estimation	-2.908026	282.8078	0.421076	-0.108614	-21436.69	34403.71	-0.019947	-12.9734	-15893.86	27680.25	-99876.79
Standard deviation	(1.86583)	(282.644)	(0.65748)	(0.10064)	(2452385)	(2895566)	(0.05996)	(33.4706)	(44458.0)	(90698.2)	(175839.)
T statistic	[-1.55857]	[1.00058]	[0.64044]	[-1.07924]	[-0.00874]	[0.01188]	[-0.33270]	[-0.38761]	[-0.35750]	[0.30519]	[-0.56800]
probability	**0.0070**	0.6718	0.7208	0.4119	0.3903	0.3761	0.9919	0.2974	0.4803	0.6344	0.5583
EXP (-1)											
Parameter estimation	-2.46E-07	4.91E-05	1.09E-07	-1.37E-08	0.189673	-0.141078	-1.46E-09	-2.69E-06	0.000904	-0.006797	-0.003586
Standard deviation	(1.7E-07)	(2.5E-05)	(5.9E-08)	(9.0E-09)	(0.21822)	(0.25766)	(5.3E-09)	(3.0E-06)	(0.00396)	(0.00807)	(0.01565)
T statistic	[-1.47888]	[1.95301]	[1.86146]	[-1.53201]	[0.86918]	[-0.54754]	[-0.27321]	[-0.90165]	[0.22859]	[-0.84220]	[-0.22919]
probability	0.4607	0.3058	0.1331	**0.0000**	0.6762	0.5701	0.8780	0.4579	0.7354	0.7952	0.1864
EXP (-2)											

Independent Variables	Dependent Variables										
	ER	**GF**	**OI**	**GDPS**	**EXP**	**IN**	**EXS**	**IMS**	**FI**	**II**	**M2**
Parameter estimation	1.66E-07	-1.41E-05	1.21E-08	7.36E-09	0.138564	-0.061063	5.76E-09	2.57E-06	0.000725	-0.002719	0.009653
Standard deviation	(1.7E-07)	(2.5E-05)	(5.9E-08)	(9.0E-09)	(0.21838)	(0.25785)	(5.3E-09)	(3.0E-06)	(0.00396)	(0.00808)	(0.01566)
T statistic	[0.99699]	[-0.55975]	[0.20686]	[0.82127]	[0.63450]	[-0.23682]	[1.07866]	[0.86284]	[0.18317]	[-0.33667]	[0.61649]
probability	0.1208	0.3156	0.5209	0.2790	0.9930	0.9905	0.7385	0.6975	0.7198	0.7594	0.5701
IN(-1)											
Parameter estimation	1.42E-07	-3.58E-05	-1.02E-07	1.45E-08	0.407428	0.720724	1.18E-10	2.51E-06	-0.000717	0.005372	0.010562
Standard deviation	(1.4E-07)	(2.1E-05)	(4.8E-08)	(7.4E-09)	(0.17952)	(0.21196)	(4.4E-09)	(2.5E-06)	(0.00325)	(0.00664)	(0.01287)
T statistic	[1.03726]	[-1.73116]	[-2.12009]	[1.97009]	[2.26956]	[3.40029]	[0.02690]	[1.02437]	[-0.22035]	[0.80913]	[0.82053]
probability	0.6125	**0.0000**	0.7432	0.6754	**0.0484**	**0.0458**	0.5234	0.7463	0.5974	0.2112	0.4048
IN(-2)											
Parameter estimation	-1.39E-07	7.29E-06	-3.27E-08	-6.05E-09	-0.235336	-0.131785	-4.16E-09	-1.77E-06	-0.001372	-0.00074	-0.015643
Standard deviation	(1.4E-07)	(2.1E-05)	(4.9E-08)	(7.6E-09)	(0.18430)	(0.21761)	(4.5E-09)	(2.5E-06)	(0.00334)	(0.00682)	(0.01321)
T statistic	[-0.98796]	[0.34343]	[-0.66224]	[-0.80055]	[-1.27692]	[-0.60561]	[-0.92355]	[-0.70512]	[-0.41074]	[-0.10858]	[-1.18379]
probability	0.4744	**0.0106**	0.8407	0.7347	**0.0365**	**0.0206**	0.3106	0.7785	**0.0254**	0.9762	0.1183
EXS(-1)											
Parameter estimation	-4.467483	253.2506	1.665415	-0.026209	-3191803	-5292199	0.634055	-46.24675	26077.56	-152482.9	-168245.3
Standard deviation	(3.47875)	(526.978)	(1.22584)	(0.18764)	(4572362)	(5398653)	(0.11178)	(62.4045)	(82889.9)	(169103.)	(327843.)
T statistic	[-1.28422]	[0.48057]	[1.35859]	[-0.13968]	[-0.69806]	[-0.98028]	[5.67215]	[-0.74108]	[0.31460]	[-0.90172]	[-0.51319]
probability	**0.0661**	0.9196	0.8552	0.5995	0.7304	0.5880	**0.0765**	0.8445	0.7785	**0.0000**	0.6853
EXS(-2)											
Parameter estimation	1.333305	43.76877	0.263427	0.079584	-341863.7	-704813.2	0.068175	32.53676	-39725.97	-50657.17	-52714.05
Standard deviation	(3.26926)	(495.242)	(1.15202)	(0.17634)	(4297005)	(5073535)	(0.10505)	(58.6463)	(77898.1)	(158919.)	(308100.)
T statistic	[0.40783]	[0.08838]	[0.22866]	[0.45132]	[-0.07956]	[-0.13892]	[0.64896]	[0.55480]	[-0.50997]	[-0.31876]	[-0.17109]
probability	0.4020	0.4593	0.9348	0.7519	0.5324	0.3556	**0.0796**	0.9488	**0.0075**	**0.0050**	0.7312
IMS(-1)											
Parameter estimation	-0.003556	0.370529	0.000534	-0.000259	2327.723	4248.334	8.02E-05	0.927196	-161.0082	-69.77312	-747.8715
Standard deviation	(0.00726)	(1.09974)	(0.00256)	(0.00039)	(9541.94)	(11266.3)	(0.00023)	(0.13023)	(172.981)	(352.896)	(684.167)
T statistic	[-0.48984]	[0.33693]	[0.20891]	[-0.66270]	[0.24395]	[0.37708]	[0.34380]	[7.11967]	[-0.93079]	[-0.19772]	[-1.09311]
probability	0.6434	0.7394	0.8423	0.5091	0.8073	0.7062	0.7301	**0.0000**	0.3505	0.8402	0.2826
IMS(-2)											
Parameter estimation	0.005091	-0.266722	-0.001153	-4.03E-05	-528.9502	-1511.434	-0.000109	-0.077801	127.9697	91.78788	645.5435
Standard deviation	(0.00710)	(1.07602)	(0.00250)	(0.00038)	(9336.17)	(11023.3)	(0.00023)	(0.12742)	(169.250)	(345.286)	(669.413)
T statistic	[0.71672]	[-0.24788]	[-0.46059]	[-0.10507]	[-0.05666]	[-0.13711]	[-0.47539]	[-0.61058]	[0.75610]	[0.26583]	[0.96434]
probability	0.4884	0.8071	0.6507	0.9130	0.9548	0.8910	0.6334	0.5428	0.4482	0.7876	0.3427
FI(-1)											
Parameter estimation	-1.22E-05	0.000244	-2.92E-07	-1.93E-07	-5.425811	-6.58571	-3.58E-08	4.55E-05	0.849608	0.100138	-0.318125
Standard deviation	(3.6E-06)	(0.00054)	(1.3E-06)	(1.9E-07)	(4.72140)	(5.57463)	(1.2E-07)	(6.4E-05)	(0.08559)	(0.17461)	(0.33853)

Independent Variables	**Dependent Variables**										
	ER	**GF**	**OI**	**GDPS**	**EXP**	**IN**	**EXS**	**IMS**	**FI**	**II**	**M2**
T statistic	[-3.40458]	[0.44844]	[-0.23076]	[-0.99858]	[-1.14919]	[-1.18137]	[-0.31019]	[0.70534]	[9.92627]	[0.57348]	[-0.93972]
probability	0.2944	**0.0820**	**0.0332**	**0.0479**	**0.0234**	**0.0007**	0.9785	0.3056	0.8252	0.4181	0.4057
FI(-2)											
Parameter estimation	9.89E-06	-0.000241	2.96E-07	1.56E-07	3.820537	4.648070	-1.20E-09	-6.50E-05	-0.05567	-0.082102	-0.127953
Standard deviation	(3.4E-06)	(0.00051)	(1.2E-06)	(1.8E-07)	(4.44647)	(5.25001)	(1.1E-07)	(6.1E-05)	(0.08061)	(0.16445)	(0.31882)
T statistic	[2.92342]	[-0.46985]	[0.24810]	[0.85266]	[0.85923]	[0.88534]	[-0.01107]	[-1.07092]	[-0.69063]	[-0.49926]	[-0.40134]
probability	0.3559	0.7402	0.4903	0.4282	0.2018	0.5449	0.3536	0.4719	0.6806	0.9069	0.2543
II(-1)											
Parameter estimation	-3.33E-06	3.04E-05	1.29E-07	-5.02E-08	-0.787149	-1.460919	-9.85E-08	-5.68E-06	-0.011626	1.095319	0.058161
Standard deviation	(1.7E-06)	(0.00026)	(6.1E-07)	(9.4E-08)	(2.28365)	(2.69634)	(5.6E-08)	(3.1E-05)	(0.04140)	(0.08446)	(0.16374)
T statistic	[-1.91478]	[0.11557]	[0.21116]	[-0.53584]	[-0.34469]	[-0.54182]	[-1.76390]	[-0.18221]	[-0.28084]	[12.9688]	[0.35520]
probability	0.5886	0.8565	0.6787	**0.0638**	**0.0031**	**0.0032**	0.4005	0.3028	0.9558	0.4856	**0.0000**
II(-2)											
Parameter estimation	1.60E-06	-0.000202	-6.69E-08	3.12E-08	1.456583	2.545098	9.96E-08	-2.40E-06	0.112769	-0.242103	0.064677
Standard deviation	(1.8E-06)	(0.00027)	(6.3E-07)	(9.6E-08)	(2.33250)	(2.75401)	(5.7E-08)	(3.2E-05)	(0.04228)	(0.08626)	(0.16724)
T statistic	[0.90172]	[-0.75016]	[-0.10699]	[0.32614]	[0.62447]	[0.92414]	[1.74602]	[-0.07526]	[2.66692]	[-2.80653]	[0.38673]
probability	0.8260	0.8178	0.7815	**0.0093**	**0.0026**	**0.0037**	0.1862	0.1324	0.3237	0.9483	0.4331
M2(-1)											
Parameter estimation	4.38E-07	2.89E-05	-1.27E-07	-9.64E-08	-3.73872	-4.406125	-2.58E-08	-1.74E-05	0.001236	0.032910	0.880834
Standard deviation	(9.6E-07)	(0.00015)	(3.4E-07)	(5.2E-08)	(1.26206)	(1.49013)	(3.1E-08)	(1.7E-05)	(0.02288)	(0.04668)	(0.09049)
T statistic	[0.45619]	[0.19865]	[-0.37644]	[-1.86203]	[-2.96240]	[-2.95687]	[-0.83618]	[-1.00937]	[0.05404]	[0.70508]	[9.73394]
probability	**0.0433**	0.7442	**0.0000**	**0.0869**	0.5901	0.5105	**0.0031**	**0.0625**	0.3607	0.2310	0.5517
M2(-2)											
Parameter estimation	2.55E-07	3.07E-05	8.34E-08	1.31E-07	3.682520	4.203941	3.94E-08	2.49E-05	-0.021778	-0.003233	0.072087
Standard deviation	(9.3E-07)	(0.00014)	(3.3E-07)	(5.0E-08)	(1.22302)	(1.44404)	(3.0E-08)	(1.7E-05)	(0.02217)	(0.04523)	(0.08769)
T statistic	[0.27377]	[0.21801]	[0.25433]	[2.60267]	[3.01100]	[2.91124]	[1.31678]	[1.48951]	[-0.98225]	[-0.07147]	[0.82204]
probability	**0.0481**	0.1761	**0.0000**	**0.0587**	0.6976	0.3025	0.9062	0.2937	0.2499	**0.0968**	0.2349
C											
Parameter estimation	100.5544	12748.07	6.684152	2.581223	-20724629	-68251825	0.143767	847.8597	-4394116	4727355.	98509.20
Standard deviation	(39.5085)	(5984.93)	(13.9220)	(2.13102)	(5.2E+07)	(6.1E+07)	(1.26954)	(708.732)	(941387.)	(1920513)	(3723342)
T statistic	[2.54514]	[2.13003]	[0.48011]	[1.21126]	[-0.39910]	[-1.11317]	[0.11324]	[1.19630]	[-4.66770]	[2.46151]	[0.02646]
probability	**0.0077**	**0.0344**	0.6673	0.2140	0.6899	0.2658	0.9096	0.2378	**0.0000**	**0.0139**	0.9072
R-squared	0.988381	0.993980	0.979363	0.957775	0.514482	0.598661	0.966681	0.969914	0.893609	0.971244	0.998694
Adj. R-squared	0.986515	0.993013	0.976049	0.950994	0.436516	0.534212	0.961330	0.965083	0.876524	0.966627	0.998484
Log likelihood	-615.4898	-1418.767	-448.6027	-148.3032	-2869.708	-2896.288	-65.43179	-1077.404	-2228.065	-2342.144	-2448.068
Akaike AIC	7.981122	18.02209	5.895033	2.141290	36.15886	36.49109	1.105397	13.75505	28.13831	29.56430	30.88836
Schwarz SC	8.423179	18.46415	6.337089	2.583346	36.60091	36.93315	1.547454	14.19710	28.58037	30.00635	31.33041

Table (2). VAR Lag Order Selection Criteria for Endogenous variables ER, EXP, EXS, FI, GDPS, GF, II, IMS, IN, M2 and OI

HQ	SC	AIC	FPE	LR	LogL	Lag
228.9380	229.0668	228.8499	6.78e+85	NA	-17610.44	0
208.0780*	**209.6237***	207.0206	2.25e+76	3322.900	-15808.59	1
208.9325	211.8952	**206.9059***	**2.05e+76***	**220.8856***	-15678.75	**2**
210.2741	214.6536	207.2782	3.15e+76	143.8980	-15586.42	3
211.5905	217.3870	207.6254	4.98e+76	133.4418	-15492.15	4
212.7557	219.9691	207.8213	7.33e+76	134.8007	-15386.24	5
213.8435	222.4738	207.9398	1.11e+77	126.4020	-15274.37	6
214.8671	224.9144	207.9942	1.84e+77	115.2953	-15157.55	7
215.3488	226.8129	207.5066	2.19e+77	133.8379	-14999.01	8

* indicates lag order selected by the criterion: LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion and HQ: Hannan-Quinn information criterion.

Table (3). VAR Granger Causality/Block Exogeneity Wald Tests

Dependent Variables	**Excluded Variables**											**All**
	ER	**GF**	**OI**	**GDPS**	**EXP**	**IN**	**EXS**	**IMS**	**FI**	**II**	**M2**	
ER												
Chi-sq	-	3.097316	4.405433	4.096541	2.421947	1.521343	2.532914	0.718858	11.59153	6.179693	8.058371	37.67000
df	-	2	2	2	2	2	2	2	2	2	2	20
Prob.	-	0.2125	0.1105	0.1290	0.2979	0.4674	0.2818	0.6981	**0.0030**	**0.0455**	**0.0178**	0.0097
GF												
Chi-sq	5.076663	-	5.228316	1.093129	3.844707	3.075065	0.771399	0.141326	0.228150	1.794244	2.622747	43.64003
df	2	-	2	2	2	2	2	2	2	2	2	20
Prob.	**0.0790**	-	**0.0732**	0.5789	0.1463	0.2149	0.6800	0.9318	0.8922	0.4077	0.2694	0.0017
OI												
Chi-sq	2.145341	0.584287	-	4.332315	4.392798	6.739103	6.026127	0.535613	0.062679	0.069964	0.326400	23.80282
df	2	2	-	2	2	2	2	2	2	2	2	20
Prob.	0.3421	0.7467	-	0.1146	0.1112	**0.0344**	**0.0491**	0.7651	0.9691	0.9656	0.8494	0.2511
GDPS												
Chi-sq	1.949362	0.174995	3.520527	-	2.422344	3.895480	0.316694	3.981483	0.997380	0.372366	13.35454	47.88027
df	2	2	2	-	2	2	2	2	2	2	2	20
Prob.	0.3773	0.9162	0.1720	-	0.2978	0.1426	0.8536	0.1366	0.6073	0.8301	**0.0013**	0.0004
EXP												
Chi-sq	0.129806	4.615666	3.783241	0.742477	-	5.417097	1.467796	0.255598	1.386998	0.560540	9.106173	39.21558
df	2	2	2	2	-	2	2	2	2	2	2	20
Prob.	0.9372	**0.0995**	0.1508	0.6899	-	**0.0666**	0.4800	0.8800	0.4998	0.7556	**0.0105**	0.0063
IN												
Chi-sq	3.160038	5.422555	12.57388	1.477454	0.523250	-	3.016709	0.449760	1.463628	1.152142	8.784987	55.08437
df	2	2	2	2	2	-	2	2	2	2	2	20
Prob.	0.2060	**0.0665**	**0.0019**	0.4777	0.7698	-	0.2213	0.7986	0.4810	0.5621	**0.0124**	0.0000
EXS												
Chi-sq	0.137053	1.105082	37.74319	0.196877	1.181757	0.952776	-	0.288924	0.396598	3.288749	4.667758	56.76265
df	2	2	2	2	2	2	-	2	2	2	2	20
Prob.	0.9338	0.5755	**0.0000**	0.9063	0.5538	0.6210	-	0.8655	0.8201	0.1931	**0.0969**	0.0000
IMS												
Chi-sq	3.323650	0.108774	5.077325	5.333833	1.137759	1.186464	0.550377	-	1.329919	0.265486	5.070104	34.42396
df	2	2	2	2	2	2	2	-	2	2	2	20
Prob.	0.1898	0.9471	**0.0790**	**0.0695**	0.5662	0.5525	0.7594	-	0.5143	0.8757	**0.0793**	0.0234
FI												
Chi-sq	26.05095	20.37389	1.362445	0.130066	0.135243	0.319633	0.277093	0.941263	-	24.85766	13.28919	42.25688

Dependent Variables	Excluded Variables											All
	ER	GF	OI	GDPS	EXP	IN	EXS	IMS	FI	II	M2	
df	2	2	2	2	2	2	2	2	-	2	2	20
Prob.	**0.0000**	**0.0000**	0.5060	0.9370	0.9346	0.8523	0.8706	0.6246	-	**0.0000**	**0.0013**	0.0026
II												
Chi-sq	7.226421	4.383645	3.043823	1.310663	1.195673	0.689328	3.446200	0.086531	0.328982	-	6.218307	20.56340
df	2	2	2	2	2	2	2	2	2	-	2	20
Prob.	**0.0270**	0.1117	0.2183	0.5193	0.5500	0.7085	0.1785	0.9577	0.8483	-	**0.0446**	0.4232
M2												
Chi-sq	4.116843	3.435801	2.621214	3.391340	0.380059	1.589727	1.086174	1.209556	6.570115	2.179424	-	35.37901
df	2	2	2	2	2	2	2	2	2	2	-	20
Prob.	0.1277	0.1794	0.2697	0.1835	0.8269	0.4516	0.5810	0.5462	**0.0374**	0.3363	-	0.0182

Table (4). Roots of Characteristic Polynomial for Exogenous variables C and Endogenous variables ER, GF, OI, GDPS, EXP, IN, EXS, IMS, FI, II and M2 with Lag specification: 1 2

Modulus	Root
0.992161	0.992161
0.972620	0.971990 - 0.034996i
0.972620	0.971990 + 0.034996i
0.887163	0.885611 - 0.052456i
0.887163	0.885611 + 0.052456i
0.885879	0.885879
0.716361	0.630399 - 0.340249i
0.716361	0.630399 + 0.340249i
0.695934	0.655871 - 0.232717i
0.695934	0.655871 + 0.232717i
0.644114	0.644114
0.510897	0.510897
0.433906	0.326616 - 0.285650i
0.433906	0.326616 + 0.285650i
0.396172	0.016430 - 0.395831i
0.396172	0.016430 + 0.395831i
0.287712	-0.287712
0.227214	-0.227214
0.132879	-0.132879
0.120371	0.113804 - 0.039217i
0.120371	0.113804 + 0.039217i
0.049131	-0.049131

Table (5). Group unit root test: Summary for Series: ER, EXP, EXS, FI, GDPS, GF, II, IMS, IN, M2 and OI with lag length selection based on SIC from 0 to 13

Cross-sections	Prob.**	Statistic	Method
Null: Unit root (assumes common unit root process)			
11	0.0939	-1.31722	Levin, Lin & Chu t*
Null: Unit root (assumes individual unit root process)			
11	0.2107	-0.80387	Im, Pesaran and Shin W-stat
11	0.4266	22.5660	ADF - Fisher Chi-square
11	0.0000	81.1213	PP - Fisher Chi-square

4. Principal Component Analysis

For the purpose of policy-making and prioritization for economy of Iraq, principal component analysis is used. By using Kaiser criterion, we have three eigenvalues greater than one 6.084415, 2.18072 and 1.210415, so we have three factors. These factors contain 86.13% of information. The corresponding information for each factor taken as a percentage (86.13% will be treat as total information; by meaning that without losing a significant part of the original information) is as follows respectively, 64.2%, 23% and 12.8%.

The factors are,

(1) The first factor contains; Exchange Rate in market price (ER) variable (with a percentage of 17.2% (based on the information contained in the factor only) and 11% (based on all information included in the analysis), Exports (EX) variable (with a percentage of 20% (based on the information contained in the factor only) and 12.8% (based on all information included in the analysis), Gross Foreign Assets of CBI (GF) variable (with a percentage of 21.6% (based on the information contained in the factor only) and 13.9% (based on all information included in the analysis), Imports (IM) variable (with a percentage of 20.9% (based on the information contained in the factor only) and 13.5% (based on all information included in the analysis) and Broad Money (M2) variable (with a percentage of 20.3% (based on the information contained in the factor only) and 13% (based on all information included in the analysis).

(2) The second factor contains; Foreign Investment (FI) variable (with a percentage of 28.4% (based on the information contained in the factor only) and 6.6% (based on all information included in the analysis), Gross Domestic Product In Constant Price (2007=100) (GDP) variable (with a percentage of 18.2% (based on the information contained in the factor only) and 4.2% (based on all information included in the analysis), Iraqi Investment (II) variable (with a percentage of 28.9% (based on the information contained in the factor only) and 6.6% (based on all information included in the analysis) and Oil price (OI) variable (with a percentage of 24.5% (based on the information contained in the factor only) and 5.6% (based on all information included in the analysis).

(3) The third factor contains; Expenses (EXP) variable (with a percentage of 53.3% (based on the information contained in the factor only) and 6.8% (based on all information included in the analysis) and Income (IN) variable (with a percentage of 46.7% (based on the information contained in the factor only) and 6% (based on all information included in the analysis).

Based on the above results, all plans, policies and programs of economic and development in Iraq must be made according to the effects of factors and consequently variables under consideration.

5. Summary

Most important eleven variables in Iraqi economy have been considered. Some of these variables have been compiled on an annual basis, while the other variables were compiled on a monthly basis. To unify these basis, the monthly values of these variables are simulated. VAR model is estimated and all related tests and indicators are obtained. The VAR model presented here has become ready for Iraqi economy explanation and forecasting. principal component analysis is used for the purpose of policy-making and prioritization for economy of Iraq. According to the effects of factors and consequently variables under consideration, plans and policies of economic and development in Iraq must be done.

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Appendix

Table (1). Data of variables under consideration, Foreign Investment (FI), Iraqi Investment (II), Imports (IM), Exports (EX), Expenses (EXP), Income (IN), Broad Money (M2), Oil price (OI), Gross Domestic Product In Constant Price (2007=100) (GDP), Gross Foreign Assets of CBI (GF) and Exchange Rate in market price (ER)

DATE	FI	II	IMS	EXS	EXP	IN	M2	OI	GDPS	GF	ER
1/31/2004	567,602	1,560,816	264.0679	0.23117	468,749	1,119,448	7,445,000	26.39	1.496749701	1,569.12	1,476
2/29/2004	567,602	1,563,185	526.3	0.470993	1,119,353	1,886,653	7,671,000	26.48	2.938197214	2,071.58	1,409
3/31/2004	567,602	1,230,167	786.7591	0.71922	1,920,634	3,242,379	7,899,000	27.46	4.325647332	1,828.77	1,422
4/30/2004	637,627	1,249,460	1045.506	0.975607	2,618,212	4,145,310	8,261,000	26.70	5.66039111	2,257.64	1,442
5/31/2004	637,627	1,278,742	1302.601	1.239909	3,488,315	4,960,940	8,502,000	30.29	6.943705872	2,842.47	1,462
6/30/2004	999,745	1,413,113	1558.102	1.511883	15,097,975	13,218,342	9,147,000	30.74	8.176855202	3,193.15	1,460
7/31/2004	999,779	989,967	1812.063	1.791289	16,540,405	21,085,926	9,367,000	31.28	9.361088953	4,413.70	1,463
8/31/2004	1,025,992	1,310,011	2064.541	2.077885	18,797,954	23,781,490	9,705,000	34.01	10.49764324	4,462.33	1,463
9/30/2004	1,028,912	1,559,589	2315.587	2.371436	20,869,089	27,876,535	9,775,000	34.83	11.58774044	5,095.21	1,463
10/31/2004	1,028,912	1,234,057	2565.252	2.671703	24,374,839	33,274,185	9,588,000	37.00	12.6325892	4,733.56	1,463
11/30/2004	1,028,912	1,292,994	2813.586	2.978453	26,800,967	40,022,031	9,885,000	39.14	13.63338443	5,679.45	1,463
12/31/2004	1,055,556	1,076,225	3060.636	3.291452	32,117,491	32,982,739	12,254,000	30.72	14.59130731	6,924.08	1,462
1/31/2005	1,055,557	890,114	1399.721	1.298793	1,010,030	4,965,739	12,474,000	27.79	6.811261203	8,286.93	1,457
2/28/2005	1,133,741	766,734	1503.275	1.415634	2,527,842	4,132,869	12,899,000	28.44	7.195874147	8,976.77	1,461
3/31/2005	1,228,687	1,040,098	1606.342	1.534475	4,757,612	7,498,260	13,650,000	38.49	7.563176768	9,332.69	1,469
4/30/2005	1,291,209	1,390,243	1708.939	1.655234	6,332,496	11,027,989	13,732,000	40.51	7.913663732	8,324.88	1,474
5/31/2005	1,367,018	1,784,801	1811.083	1.77783	7,432,887	14,014,371	13,888,000	42.28	8.247823676	9,274.78	1,473
6/30/2005	1,383,975	1,775,045	1912.789	1.902182	10,352,309	18,592,689	13,792,000	41.65	8.5661392	8,893.86	1,468
7/31/2005	1,397,883	1,160,531	2014.072	2.028211	13,160,137	21,806,294	14,036,000	46.82	8.869086873	8,904.18	1,475
8/31/2005	1,422,586	793,640	2114.946	2.155837	15,705,267	26,618,844	13,278,000	51.65	9.157137232	8,407.10	1,480
9/30/2005	1,436,480	927,031	2215.427	2.284981	18,229,751	30,285,106	13,138,000	55.40	9.430754779	9,236.80	1,481
10/31/2005	1,446,933	1,069,174	2315.525	2.415566	20,267,030	34,618,385	14,051,000	53.67	9.690397985	10,033.20	1,476
11/30/2005	1,456,790	1,315,269	2415.254	2.547512	22,791,497	37,805,783	13,272,000	48.04	9.936519288	10,564.12	1,477
12/31/2005	1,573,156	1,406,780	2514.626	2.680744	26,375,175	40,502,890	14,684,000	46.07	10.16956509	12,001.15	1,478
1/31/2006	1,632,947	1,466,189	1521.44	2.002157	2,087,710	2,450,635	15,267,000	45.62	8.35484398	12,414.17	1,482
2/28/2006	1,687,586	1,668,324	1578.887	2.098577	4,096,114	5,198,145	15,826,000	50.54	8.522270851	12,801.02	1,480
3/31/2006	1,750,016	1,468,759	1636.144	2.195749	8,110,930	8,841,160	16,701,000	50.86	8.680231169	13,209.86	1,480
4/30/2006	1,741,213	1,329,528	1693.215	2.293619	11,358,817	12,552,373	16,842,000	54.43	8.829064494	13,567.91	1,481
5/31/2006	1,894,425	915,613	1750.104	2.392136	14,333,493	17,201,883	17,128,000	59.85	8.969105537	13,460.99	1,485
6/30/2006	1,919,979	712,079	1806.817	2.491245	16,459,986	21,453,026	17,486,000	59.91	9.100684156	12,903.57	1,485
7/31/2006	1,929,041	929,099	1863.357	2.590897	19,257,550	26,869,120	18,820,000	62.13	9.224125357	13,032.44	1,486
8/31/2006	1,983,459	1,155,442	1919.727	2.691038	21,938,206	32,293,996	19,440,000	64.06	9.339749297	14,266.79	1,488
9/30/2006	1,952,560	1,543,771	1975.93	2.791618	24,742,634	36,980,609	19,145,000	59.37	9.44787128	14,579.62	1,488
10/31/2006	1,823,294	1,942,109	2031.969	2.892586	27,352,221	41,441,677	19,538,000	52.79	9.548801759	14,794.39	1,485
11/30/2006	1,804,268	2,114,544	2087.846	2.993892	30,206,873	45,047,874	19,658,000	49.12	9.642846338	13,951.09	1,463
12/31/2006	1,783,338	2,402,937	2143.563	3.095485	38,806,679	49,055,545	21,080,000	52.14	9.730305767	19,741.69	1,396
1/31/2007	1,798,914	2,771,767	1433.021	2.805965	1,350,445	3,093,583	18,329,063	50.15	8.994614893	19,283.59	1,318
2/28/2007	1,838,729	3,298,346	1469.121	2.895498	3,084,154	5,432,384	18,521,249	48.87	9.063528378	17,750.37	1,298
3/31/2007	1,898,701	3,234,100	1505.118	2.985153	4,946,238	8,930,537	18,677,529	50.56	9.127205416	18,051.47	1,290
4/30/2007	1,524,395	3,233,720	1541.012	3.074888	7,473,210	12,580,359	19,144,052	55.45	9.185903931	19,900.57	1,284
5/31/2007	1,986,318	3,792,123	1576.803	3.164662	11,251,064	16,466,089	18,147,866	57.39	9.239877397	20,642.57	1,274
6/30/2007	1,485,045	4,514,616	1612.49	3.254432	13,101,040	20,325,291	18,791,275	61.17	9.289374844	21,463.73	1,269
7/31/2007	1,528,639	4,667,253	1648.073	3.344158	16,008,157	24,745,620	19,577,348	64.76	9.334640852	23,783.24	1,260
8/31/2007	1,517,369	5,130,326	1683.55	3.433797	18,617,390	29,969,998	20,301,736	66.87	9.375915554	24,171.56	1,253
9/30/2007	1,575,567	5,497,050	1718.921	3.52331	23,147,986	34,173,676	22,524,744	66.10	9.413434638	23,947.05	1,249

DATE	FI	II	IMS	EXS	EXP	IN	M2	OI	GDPS	GF	ER
10/31/2007	1,482,053	5,197,216	1754.182	3.612656	26,411,509	39,321,208	23,444,731	72.05	9.447429342	25,051.15	1,245
11/30/2007	1,553,761	4,663,392	1789.334	3.701794	28,960,902	44,846,186	23,522,876	78.11	9.478126457	27,102.67	1,240
12/31/2007	2,447,922	3,864,737	1824.372	3.790687	39,031,232	54,599,451	26,956,076	84.49	9.505748329	31,584.37	1,214
1/31/2008	1,540,911	3,028,832	2648.362	4.728656	1,607,046	2,573,093	27,037,186	83.86	9.963173793	31,912.70	1,225
2/29/2008	1,447,203	2,717,629	2697.939	4.836267	4,995,678	13,167,767	25,349,193	81.76	9.986298642	32,715.65	1,225
3/31/2008	1,559,650	2,237,622	2747.345	4.943434	7,975,770	19,855,874	25,910,917	92.19	10.00687806	34,734.32	1,222
4/30/2008	1,596,680	2,669,807	2796.573	5.050112	12,954,951	26,682,483	26,081,245	95.68	10.02512589	35,342.71	1,216
5/31/2008	1,583,147	2,612,633	2845.62	5.156254	17,400,673	36,912,497	26,580,025	104.28	10.04125132	38,554.72	1,212
6/30/2008	1,549,737	2,877,012	2894.48	5.261815	22,952,019	45,762,082	28,481,094	115.98	10.05545889	39,019.45	1,205
7/31/2008	1,334,443	3,020,477	2943.147	5.36675	27,721,807	54,976,044	29,825,484	123.73	10.06794851	40,184.50	1,202
8/31/2008	1,329,367	3,400,990	2991.615	5.471012	31,612,445	60,449,222	30,879,575	113.05	10.07891541	39,296.28	1,196
9/30/2008	1,381,991	3,895,030	3039.877	5.574559	38,556,973	67,230,278	32,536,077	101.74	10.08855019	44,522.79	1,188
10/31/2008	1,366,745	3,464,679	3087.927	5.677346	43,450,505	72,769,996	31,294,688	83.70	10.09703879	42,964.34	1,185
11/30/2008	1,331,321	3,566,555	3135.756	5.779329	49,385,768	76,498,131	33,579,985	59.03	10.10456252	45,768.93	1,183
12/31/2008	1,261,697	3,055,803	3183.358	5.880466	59,403,375	80,252,182	34,919,675	43.97	10.11129803	50,305.71	1,180
1/31/2009	1,239,949	2,685,415	3207.076	3.019878	2,129,132	2,584,767	36,057,912	34.88	10.35892081	46,636.80	1,178
2/28/2009	1,228,084	2,459,853	3253.853	3.070026	4,687,280	5,053,218	37,659,037	37.14	10.36472656	43,627.17	1,178
3/31/2009	1,257,846	3,152,044	3300.378	3.119683	7,573,558	8,285,472	36,973,388	37.83	10.3702393	41,885.24	1,178
4/30/2009	1,253,328	2,446,040	3346.643	3.168827	10,659,729	11,552,920	36,720,694	43.85	10.37562086	41,442.14	1,179
5/31/2009	1,265,963	2,671,634	3392.638	3.217438	14,480,889	15,577,385	36,957,496	48.93	10.38102829	40,895.15	1,187
6/30/2009	1,295,121	2,737,795	3438.352	3.265495	19,308,998	20,263,399	37,811,325	56.30	10.3866139	41,633.20	1,180
7/31/2009	1,325,976	2,517,368	3483.776	3.312979	23,562,094	25,317,228	38,806,875	64.49	10.39252525	43,422.63	1,184
8/31/2009	1,336,357	2,404,376	3528.898	3.359869	27,604,557	31,894,860	39,690,346	64.16	10.3989051	42,180.63	1,184
9/30/2009	1,342,040	2,911,827	3573.707	3.406145	33,073,579	39,251,341	42,982,641	68.16	10.40589148	40,136.72	1,183
10/31/2009	1,513,607	2,974,988	3618.193	3.451787	38,198,670	44,156,826	42,921,266	65.74	10.41361766	43,023.59	1,183
11/30/2009	1,528,246	2,975,291	3662.342	3.496777	43,521,533	49,350,292	43,813,715	71.50	10.42221214	45,002.51	1,183
12/31/2009	1,550,025	3,304,308	3706.143	3.541095	52,567,025	55,209,353	45,437,918	74.02	10.43179866	44,636.05	1,185
1/31/2010	1,537,010	6,158,947	3448.805	4.062145	3,861,589	5,028,681	46,211,046	73.37	10.95855232	45,478.66	1,185
2/28/2010	1,536,389	7,090,382	3488.417	4.110779	7,688,959	9,447,768	47,666,215	73.99	10.97106433	43,892.75	1,185
3/31/2010	1,361,809	9,304,441	3527.672	4.158587	11,624,023	16,583,140	49,264,741	72.98	10.984977	42,923.92	1,185
4/30/2010	1,413,430	9,142,084	3566.557	4.20555	15,931,096	23,322,826	51,224,102	76.46	11.00040022	43,410.69	1,185
5/31/2010	1,641,402	9,891,999	3605.061	4.251647	21,249,373.26	28,341,752	53,050,750	79.93	11.01743887	41,310.72	1,185
6/30/2010	1,613,288	8,706,263	3643.168	4.296857	26,691,602	34,339,563	55,851,298	73.32	11.03619283	42,431.47	1,185
7/31/2010	1,675,474	9,229,299	3680.866	4.341161	32,432,019	39,441,639	55,873,827	71.07	11.056757	42,821.02	1,185
8/31/2010	1,572,032	8,067,252	3718.14	4.384539	37,881,009	44,288,704	56,388,061	72.08	11.07922126	43,227.34	1,185
9/30/2010	1,692,920	8,465,120	3754.976	4.426971	42,410,560	51,082,931	56,213,464	71.65	11.10367052	46,178.48	1,185
10/31/2010	1,694,460	8,760,586	3791.359	4.468439	47,319,988	56,774,979	57,299,232	73.25	11.13018468	46,616.03	1,185
11/30/2010	1,544,722	8,962,474	3827.274	4.508922	51,839,037	62,377,046	58,201,459	77.59	11.15883865	47,591.58	1,185
12/31/2010	1,514,834	6,228,635	3862.704	4.548402	64,351,984	69,521,117	60,386,086	80.74	11.18970235	50,652.39	1,185
1/31/2011	1,511,243	5,581,601	3808.866	6.381708	3,583,740	7,337,215	60,808,829	86.44	11.64205631	51,467.61	1,185
2/28/2011	1,493,234	5,647,763	3842.496	6.433771	7,539,833	14,848,018	59,739,929	91.09	11.67885425	50,620.97	1,185
3/31/2011	1,508,885	5,794,005	3875.607	6.484362	12,735,146	24,046,963	58,452,768	97.75	11.71813095	50,403.93	1,185
4/30/2011	1,529,036	5,268,718	3908.18	6.533458	17,828,846	32,607,727	59,265,111	107.84	11.75993819	53,665.32	1,187
5/31/2011	1,506,485	5,167,941	3940.199	6.581033	22,951,921	42,576,070	59,602,270	114.77	11.80432259	54,331.59	1,196
6/30/2011	1,501,047	5,023,153	3971.646	6.627064	28,861,159	50,815,526	62,321,706	108.34	11.85132558	54,351.18	1,197
7/31/2011	1,461,013	5,310,130	4002.505	6.671526	35,791,501	59,239,035	64,438,666	105.32	11.90098341	53,521.14	1,197
8/31/2011	1,470,375	5,189,236	4032.756	6.714398	41,786,546	67,868,691	65,125,368	109.21	11.95332716	57,219.93	1,199
9/30/2011	1,471,031	5,100,354	4062.382	6.755655	46,753,668	76,201,593	65,110,706	104.71	12.0083827	56,915.67	1,200
10/31/2011	1,438,286	4,980,739	4091.364	6.795275	53,102,654	84,634,781	67,148,300	104.95	12.06617075	57,930.84	1,200

DATE	FI	II	IMS	EXS	EXP	IN	M2	OI	GDPS	GF	ER
11/30/2011	1,495,117	4,703,991	4119.682	6.833235	58,146,385	92,723,237	68,973,332	104.42	12.12670683	57,748.04	1,200
12/31/2011	1,461,656	4,733,657	4147.318	6.869515	69,639,523	99,998,776	72,177,951	106.97	12.19000127	60,785.63	1,217
1/31/2012	1,479,851	4,414,120	4769.022	7.686136	3,843,468	8,755,156	69,885,181	106.05	13.09144738	60,663.67	1,205
2/29/2012	1,460,741	4,655,659	4798.969	7.722709	9,032,673	14,310,770	70,477,394	109.13	13.1649598	58,906.15	1,236
3/31/2012	1,455,970	4,572,960	4828.067	7.75734	13,879,760	23,185,972	72,033,527	113.73	13.24141853	57,436.44	1,240
4/30/2012	1,402,532	4,738,410	4856.292	7.790005	21,146,963	38,321,604	73,626,039	118.47	13.32081248	60,597.01	1,263
5/31/2012	1,420,408	4,498,339	4883.621	7.820681	29,653,611	51,276,138	71,239,024	116.41	13.403125	58,989.02	1,249
6/30/2012	1,425,970	4,547,152	4910.03	7.849347	37,979,778	60,515,609	71,196,848	102.66	13.48833394	64,264.62	1,240
7/31/2012	1,407,496	4,681,360	4935.492	7.875981	46,132,256	68,238,271	71,436,153	90.59	13.57641159	62,944.54	1,254
8/31/2012	1,404,711	4,917,121	4959.984	7.900561	53,576,997	73,482,049	72,361,531	97.50	13.66732472	62,713.48	1,248
9/30/2012	1,407,493	4,838,398	4983.479	7.923066	60,540,661	46,959,216	72,331,986	107.05	13.76103456	60,921.17	1,228
10/31/2012	1,413,741	4,548,953	5005.951	7.943476	67,880,750	97,785,541	72,912,569	108.12	13.8574968	68,263.60	1,200
11/30/2012	1,447,609	4,360,017	5027.373	7.96177	75,091,126	108,695,043	73,271,164	105.21	13.9566616	64,599.70	1,207
12/31/2012	1,487,537	4,303,740	5047.72	7.977929	90,374,783	119,466,403	75,466,360	104.86	14.05847358	68,772.16	1,222
1/31/2013	1,440,519	4,120,888	4871.563	7.458146	4,470,874	9,782,994	75,779,199	104.10	13.962076	66,739.96	1,226
2/28/2013	1,439,871	1,769,167	4888.977	7.469186	9,491,016	18,439,753	77,212,385	105.38	14.06747823	70,593.10	1,232
3/31/2013	1,535,391	2,419,339	4905.275	7.478179	16,788,178	28,716,265	78,464,563	108.11	14.17529359	67,440.04	1,255
4/30/2013	1,509,904	2,735,459	4920.432	7.485109	24,036,601	37,554,522	82,004,490	103.00	14.28544567	70,198.02	1,268
5/31/2013	1,567,901	2,943,301	4934.42	7.489959	32,741,459	47,145,051	82,594,086	98.00	14.3978526	71,434.79	1,269
6/30/2013	1,541,865	2,970,422	4947.209	7.492712	41,687,042	55,091,931	84,175,204	97.00	14.51242703	70,812.29	1,236
7/31/2013	1,575,357	2,656,732	4958.773	7.493353	48,892,341	62,877,997	83,699,411	97.41	14.62907619	70,626.55	1,217
8/31/2013	1,633,533	2,114,267	4969.081	7.491865	60,192,555	74,619,204	82,686,053	102.93	14.74770182	72,095.70	1,209
9/30/2013	1,712,637	2,007,316	4978.105	7.488234	70,225,129	85,766,757	84,670,382	104.77	14.86820022	75,417.24	1,211
10/31/2013	1,689,053	2,324,071	4985.814	7.482444	79,434,769	93,490,839	85,124,634	104.87	14.99046224	75,415.09	1,220
11/30/2013	1,708,647	2,607,376	4992.18	7.474481	87,274,923	102,124,772	85,288,597	102.99	15.11437325	73,874.50	1,218
12/31/2013	1,696,685	3,122,958	4997.171	7.46433	106,873,027	113,767,395	87,679,504	102.62	15.2398132	77,597.41	1,222
1/31/2014	1,641,166	3,312,499	4899.601	7.231971	3,858,545	10,018,999	88,523,462	104.61	14.24582877	76,366.13	1,222
2/28/2014	1,697,837	3,460,358	4901.707	7.217834	8,647,883	19,238,478	86,631,187	101.99	14.36459989	76,566.25	1,222
3/31/2014	1,461,286	3,287,910	4902.374	7.201535	13,035,950	26,290,853	86,822,445	102.50	14.48442412	75,460.88	1,222
4/30/2014	1,458,562	3,305,813	4901.572	7.183061	17,347,076	35,897,988	87,961,828	101.15	14.60516991	74,094.85	1,218
5/31/2014	1,455,577	3,672,670	4899.269	7.1624	22,215,339	45,202,821	86,457,274	100.55	14.72670065	81,546.12	1,222
6/30/2014	1,482,179	3,807,631	4895.433	7.13954	27,602,713	54,637,661	86,582,775	101.30	14.84887469	79,175.89	1,213
7/31/2014	1,461,162	4,109,170	4890.031	7.11447	31,470,255	60,104,939	87,264,177	102.61	14.97154528	76,101.79	1,215
8/31/2014	1,477,027	4,634,103	4883.031	7.087179	36,274,228	72,157,589	86,411,920	102.33	15.09456065	75,494.15	1,213
9/30/2014	1,553,172	4,774,288	4874.399	7.057656	41,474,407	80,082,465	87,462,640	98.71	15.21776395	73,335.64	1,204
10/31/2014	1,549,034	4,845,866	4864.102	7.02589	47,857,507	88,087,480	88,973,740	92.58	15.34099329	72,912.67	1,207
11/30/2014	1,568,088	4,471,573	4852.106	6.991872	56,938,729	97,495,434	88,025,046	83.41	15.46408169	72,502.45	1,200
12/31/2014	1,654,900	5,494,051	4838.376	6.955593	83,556,226	105,386,623	90,727,801	71.19	15.58685715	66,339.67	1,206
1/31/2015	1,986,277	7,501,844	4111.97	4.448973	2,826,894	6,418,737	87,062,056	58.40	14.69801115	65,852.97	1,221
2/28/2015	1,982,892	9,612,156	4097.22	4.422711	5,823,480	10,141,718	85,963,178	44.88	14.81179668	66,494.93	1,241
3/31/2015	1,805,697	9,623,355	4080.903	4.394976	11,237,128	14,697,552	88,943,832	47.65	14.92477817	67,653.76	1,270
4/30/2015	2,994,139	9,877,657	4062.988	4.365764	16,135,540	19,016,200	89,480,769	48.80	15.03677573	67,926.37	1,297
5/31/2015	2,994,519	9,728,416	4043.444	4.335069	21,570,927	24,139,937	90,621,091	51.78	15.14760476	66,235.28	1,309
6/30/2015	5,734,523	9,523,884	4022.241	4.302887	28,186,469	31,004,279	89,629,895	55.80	15.2570759	62,652.86	1,306
7/31/2015	6,047,794	9,310,751	3999.347	4.269212	35,520,403	35,603,239	87,854,093	56.23	15.36499508	59,848.04	1,231
8/31/2015	6,051,994	9,268,882	3974.729	4.23404	41,353,105	102,597,473	85,673,205	51.02	15.47116349	59,040.37	1,217
9/30/2015	5,057,767	10,177,682	3948.357	4.197368	45,435,844	47,516,052	85,176,286	43.87	15.57537758	58,211.35	1,222
10/31/2015	4,131,627	10,237,779	3920.198	4.159191	50,680,027	52,140,339	84,751,783	42.19	15.67742907	58,206.63	1,220
11/30/2015	3,529,241	10,330,552	3890.218	4.119504	55,475,580	54,048,032	82,935,619	40.70	15.77710495	53,557.59	1,219

DATE	FI	II	IMS	EXS	EXP	IN	M2	OI	GDPS	GF	ER
12/31/2015	2,880,863	10,126,307	3858.385	4.078306	70,397,515	66,470,252	82,595,493	37.57	15.87418747	53,139.13	1,216
1/31/2016	3,438,173	8,557,682	3035.829	3.689508	2,943,531	2,311,668	82,548,317	31.46	16.95278924	50,651.01	1,235
2/29/2016	3,440,545	8,289,190	3007.54	3.649068	7,058,029	4,452,824	83,793,304	24.76	17.04963615	49,619.87	1,240
3/31/2016	3,448,588	9,227,835	2977.701	3.607238	11,687,629	6,980,143	85,394,451	23.38	17.14300619	49,836.42	1,261
4/30/2016	2,892,418	9,350,898	2946.283	3.564014	15,639,813	10,629,689	86,763,327	27.28	17.2326481	49,602.28	1,277
5/31/2016	2,714,022	9,461,493	2913.259	3.519394	23,911,618	17,546,933	87,218,760	33.48	17.31830559	49,038.66	1,284
6/30/2016	2,478,943	9,453,662	2878.602	3.473376	30,328,588	22,416,134	86,742,141	36.06	17.39971734	47,392.87	1,266
7/31/2016	2,030,764	9,902,760	2842.284	3.425959	34,459,129	26,143,175	87,585,362	39.39	17.47661701	47,450.43	1,273
8/31/2016	2,034,268	10,346,959	2804.276	3.37714	40,681,257	32,605,066	88,014,219	39.65	17.54873324	47,404.44	1,281
9/30/2016	2,034,020	10,868,081	2764.549	3.326919	45,198,901	35,766,456	88,418,153	38.89	17.61578963	46,676.17	1,289
10/31/2016	2,128,509	10,632,067	2723.076	3.275294	51,455,567	41,550,048	88,087,005	39.47	17.67750477	45,143.46	1,298
11/30/2016	2,145,706	10,578,801	2679.827	3.222264	56,131,024	46,350,430	87,139,074	41.37	17.73359222	44,157.62	1,296
12/31/2016	2,233,219	11,319,180	2634.773	3.167828	67,067,437	54,409,270	88,081,993	41.79	17.78376052	44,516.42	1,303
1/31/2017	2,063,361	11,406,506	3660.717	5.386173	4,161,531	4,711,191	88,441,059	45.03	16.69164818	44,377.25	1,292
2/28/2017	2,036,828	11,444,170	3591.753	5.287087	8,817,856	9,384,115	88,095,554	48.59	16.7266981	45,013.39	1,272
3/31/2017	2,023,038	11,687,455	3520.109	5.185567	13,496,166	15,324,487	87,834,994	48.88	16.75535915	44,983.72	1,254
4/30/2017	2,035,975	12,588,665	3445.743	5.081611	17,977,964	20,460,073	86,558,754	47.89	16.77733963	44,977.23	1,251
5/31/2017	2,439,313	12,768,514	3368.612	4.975221	22,896,085	26,222,582	87,011,340	46.62	16.79234313	44,870.71	1,250
6/30/2017	3,071,420	13,048,000	3288.671	4.866397	27,924,908	31,723,093	87,582,059	46.60	16.80006851	45,398.01	1,248
7/31/2017	3,019,368	12,969,249	3205.878	4.755139			88,722,035	43.80	16.80020996	44,931.12	1,258
8/31/2017	2,981,287	13,162,000	3120.187	4.641451			88,336,026	43.34	16.79245695	46,189.27	1,254
9/30/2017	2,230,457	13,456,185	3031.555	4.525332			87,741,367	45.18	16.77649423	46,555.31	1,255
10/31/2017	2,211,931	14,123,103	2939.936	4.406786			87,632,347	48.73	16.75200189	46,538.85	1,259
11/30/2017	2,279,767	14,849,654	2845.285	4.285815			88,756,147	52.21	16.71865526	47,112.33	1,252
12/31/2017	2,575,933	14,829,012	2747.556	4.162422			89,441,338	52.32	16.67612501	48,417.23	1,251
1/31/2018	2,235,775	13,535,350	2646.728	4.036603			88,486,790	58.68	17.15351903	49,405.41	1,246
2/28/2018	2,459,717	14,783,749	2542.705	3.908375			87,641,662	61.14	17.08964314	49,382.60	1,229
3/31/2018	2,091,544	13,725,093	2435.466	3.777736			86,476,062	61.13	17.0152425	50,598.82	1,217
4/30/2018	2,310,148	13,446,984	2324.963	3.644688			86,674,769	60.06	16.92995787	52,184.97	1,202
5/31/2018	2,678,716	13,367,455	2211.149	3.509239			86,969,460	63.16	16.83342513	52,659.90	1,200
6/30/2018	3,847,643	13,452,925	2093.976	3.371391			88,220,942	67.07	16.72527532	54,475.47	1,200
7/31/2018	4,450,532	13,467,885	1973.396	3.23115			89,329,797	69.19	16.60513461	56,117.60	1,201
8/31/2018	4,632,617	13,317,728	1849.36	3.088523			90,240,763	68.49	16.47262435	57,818.10	1,206
9/30/2018	6,658,210	13,262,335	1721.82	2.943514			92,100,247	69.50	16.32736099	58,043.99	1,206
10/31/2018	6,367,226	13,618,555	1590.727	2.796131			91,512,688	72.51	16.16895616	60,098.98	1,205
11/30/2018	6,299,210	13,364,469	1456.03	2.646381			92,085,000	73.42	15.99701662	62,099.83	1,200
12/31/2018	6,492,719	13,226,802	1317.68	2.494269			93,697,131	64.71	15.81114429	63,814.72	1,195
1/31/2019								55.44		63,182.74	1,195
2/28/2019								55.95		64,473.77	1,193
3/31/2019								59.59		64,660.74	1,196
4/30/2019											1,195

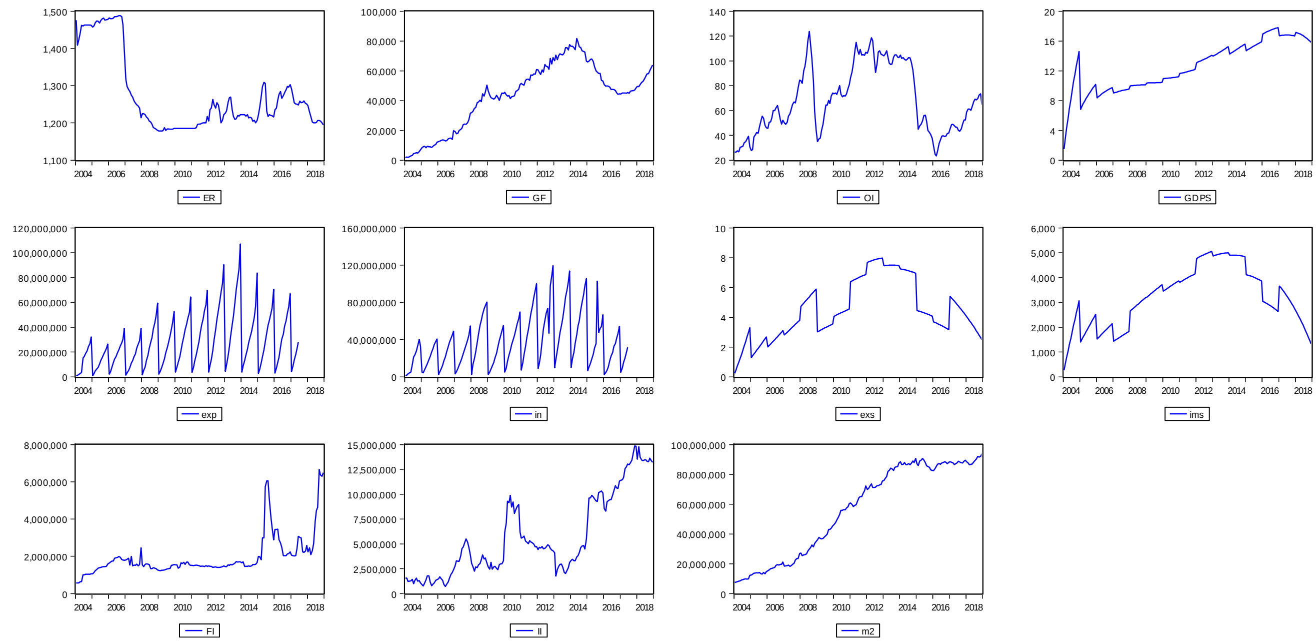

Figure (1). Graphs of Series of Variables under consideration

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