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SUMMARY

It has been that the economic growth in Turkish economy has a very unstable path especially after 1980’s. It has been reached very high growth rates just after the crisis years.

In our study, the economic growth and the macro variables, which can lead to a crisis, has been studied with the framework of VAR models, which are used very often. The variables in the system are five: GNP as an indicator of growth, Money Supply (M2), Consumer Price Index, Interest Rate and US dollar as a representative of foreign currency. These variables have been studied in the form of quarter terms in 1987:01-1999:01.

According to the impulse-response functions which are provided at the end of the solution of VAR system; when a shock is applied to the interest rate and foreign currency, the results will be seen like this: the unstabilitiness of GNP has been ended; CPI has been lasted; the whole variables in the system has been lasted.

1. INTRODUCTION

One of the most important problem of the Turkish economy is the inflation which has not been able to be solved for 30 years. The inflation that has not only economic but also social results causes the instability growth dynamics. When real growth rates are investigated, it is seen that economic growth could not be realized for consecutive years and economic crisis was raised, just following year that economic growth was successful.

1 Author was born in Izmit, 1969. She graduated from Istanbul University on economics and prepared a master thesis about Budget Deficit and Public Revenue in Turkish Economy. She started working as a research assistant in department of economics of Kocaeli University, 1993 and has been still working as a research assistant in economics in that university. She has been attending thesis PhD about of VAR and SUR Models.
From this point, in order to determine the relationship between crisis and growth, this research was done by using VAR model that can give dynamic relation without putting any limits on the structural model.

1.1 CRISIS AND GROWTH

It is very obvious from the crisis definition, it can be said that cyclical fluctuation follows one for another. In these stages, payment balance sheet, current account, prices, interest rate, investment-saving ratio, growth rate, wages and profit might change.

The economists have been trying to determine the answer to the questions related to that growth in regarding to that macro scales could be. With pioneering of the Keynes theory, the long growth period until 1970 took all the attention and got focused on this subject; therefore, several growth theories were made a suggestion at that time.

The modern growth theory, which was developed making Keynes general theory dynamic by Harrod-Domar, focused all its attention on investment and the effects of investment. There will be two important results of investment effects; demand for production and increase on production capacity.

Neoclassic growth model that was made a suggestion after World War II disagree with and against the Harrod-Domar model in some points. According to the model suggested by Solow, under the diminishing capital return assumption, coefficient of capital-product will determine the income per person when saving and increase of population taken as eksojen are steady for a long period. Although, in theory, it is admitted that technological developments affect positively production, this effect can’t be defined and it is accepted as external factor.

In 1980’s according to the endojen growth theory developed by Romer, Weil and Mankiw, the economic growth is not the result of the external forces and factors but it is because of resulting in economic system progress. According to the this view, Mankiw, Rower and Weil (1992) proved empirically that neoclassic model ideas were wrong under the assumption each country has own Cobb-Douglas production function, external saving rate and population growth rate. They put some constraint t the model developed by Solow-Swan, and they estimated the model by using ordinary EKK method. They found that the sawing and population growth were statistically significant.

All these mentioned theories, the dynamics of economic growth had been reviewed and questioned.

When looking at the subject in regards to Turkish economy, it is very difficult to explain the growth rate reality for Turkish economy with a absolute growth model. Unlike the western countries, Turkey has a different culture, history and economic structure; therefore, the stabilization Turkish economy trial was not successful because stabilization method was theoretically weak and was delayed because of populist approach.

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It has been seen that the growth in Turkish economy could not continuously be realized and strangely, the high growth rate could be seen followed by a crisis period. It was decided that the more complex model includes more variables was used to determine the unstable economic growth of Turkish economy. The variables in the area of VAR model were tried to be questioned.

The VAR model which is a equality system, where each variables (taken as a endojen) own value and other variables’ deferred values are each side of the equality. The VAR model has been used often after Sims published the article called “Macro Economy and Reality” in 19801.

2. Empirical Analysis

In this application stage, growth and the variables that can cause a crisis and/or that can be a crisis indicator were chosen. These variables are interest rate, consumer price index, dollar and money supply. The data series include a three month period from 1987 to 1999. Firstly, the steady of data series was tested by generalized unit root test method and the results were presented in Table 1.

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADF Value</th>
<th>Critical Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest rate</td>
<td>-3.9682(1)</td>
<td>-3.5066(%1)</td>
<td>Trend stationary</td>
</tr>
<tr>
<td>CPI</td>
<td>-5.1325(1)</td>
<td>-2.6143(%1)</td>
<td>Two differences stationary</td>
</tr>
<tr>
<td>DOL</td>
<td>-3.5755(1)</td>
<td>-2.6143(%1)</td>
<td>Two differences stationary</td>
</tr>
<tr>
<td>M2</td>
<td>-4.3330(1)</td>
<td>-2.6143(%1)</td>
<td>Two differences stationary</td>
</tr>
<tr>
<td>Y</td>
<td>-6.0443(1)</td>
<td>-3.5745(%1)</td>
<td>Stationary with constant</td>
</tr>
<tr>
<td>LCPI</td>
<td>-5.4559(1)</td>
<td>-3.5778(%1)</td>
<td>One differences stationary</td>
</tr>
<tr>
<td>LDOL</td>
<td>-4.4325(1)</td>
<td>-3.5778(%1)</td>
<td>One differences stationary</td>
</tr>
<tr>
<td>LM2</td>
<td>-4.5734(1)</td>
<td>-3.5778(%1)</td>
<td>One differences stationary</td>
</tr>
<tr>
<td>LY</td>
<td>-6.2691(1)</td>
<td>-2.9286(%5)</td>
<td>Stationary with constant</td>
</tr>
</tbody>
</table>

2.1. ADVANCED DICKEY-FULLER TEST

According to the error margin assumption, the average of the series in the course of time, if its variance and its otocovariance are constant and finite, the series has steady covariance or is just steady. However, most of the time series are not steady, so the variance changes in the course of time period. In other words, the series has a trend.

\[ Y_t = f(t) + u_t \]  

(2.1.1)

In that regression, where \( f(t) \) is trend and the expected value of \( u_t \) is steady. If we assume that \( F(t) \) function is linear, the following equation is found.

\[ Y_t = \alpha + \beta_t + u_t \]  

(2.1.2)

This model (2.1.2) called steady trend model (TSP).

\[ Y_t = y_0 + \beta_t + \sum \varepsilon_j \]  
(2.1.3)

This is the difference steady (DSP).

\[ Y_t = \alpha + \beta Y_{t-1} + u_t \]  
(2.1.4)

If \( r \) is equal to 1, it is called “unit root”. The most common methods used for determining unit root are Dickey-Fuller (DF) and Advanced Dickey-Fuller (ADF)\(^1\).

Dickey-Fuller test is applied following regression;

\[ \Delta y_t = \mu + \delta t + \gamma Y_{t-j} + \sum \alpha_j \Delta Y_{t-j} + e_t \]  
(2.1.5)

\[ \Delta y_t = \mu + \gamma Y_{t-j} + \sum \alpha_j \Delta Y_{t-j} + e_t \]  
(2.1.6)

\[ \Delta y_t = \gamma Y_{t-j} + \sum \alpha_j \Delta Y_{t-j} + e_t \]  
(2.1.7)

If \( \gamma \delta \) is equal to 0 it is a evidence that there is a unit root. If error margin is consecutive dependent;

\[ \Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-j} + \alpha_j \sum_{j=1}^{m} \Delta Y_{t-j} + \Sigma_{t} \]  
(2.1.8)

the equation can be summarized as above. This is called “Dickey-Fuller Trial”. The existence of unit root can be tested by using F test developed by Dickey-Fuller\(^2\).

The degrees of steady of variables were presented in Table I.

Once the steady test was done, in order to determine the structure of the VAR model, firstly, Granger causality test was done. When the causality test was applied to among the variables, the following equations were found.

### 2.2. GRANGER CAUSALITY TEST

The test used for determining the destination of the relation among the variables and the lag structure is called “Granger Causality Test”. When we thought two time series like \( x(t) \) and \( y(t) \), if the ex-values of the both series affect the \( y(t) \) and \( x(t) \) is a reason of Granger of \( y(t) \).

\[ Y_t = \sum_{i=1}^{k} a_i Y_{t-i} + \sum_{i=1}^{k} B_i Y_{t-i} + u_t \]  
(2.2.1)

If \( \ldots \beta_i = 0 \) (i=1,2,...k), \( x(t) \) is not be reason of Granger of \( y(t) \)\(^1\).

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Sargent (1976) and Granger (1969) made some simple changes on the original test and they suggested that F test or Lagrange Multiplier (LM) test could be used for determining the a and b coefficients. The LM test is;

$$ LM = T \cdot R^2 $$

where T is sample volume, R square is regression determination coefficient and x^2(k) will be tested under the Q assumption.

The F test developed by Wald may be used for determining the significance of the variables.

$$ X_t^* = \sum_{j=1}^{k} \delta_j y_{t-j} + v_{1t} $$

$$ Y_t^* = \sum_{j=1}^{k} \gamma_j X_{t-j}^* + v_{2t} $$

Therefore, constrained models are estimated from unconstrained models and the calculated square sum of error terms in order ΣΣt and Σe(t) and ΣΣ2t and Σ02t are compared. Therefore F test can be calculated from the following equation.

$$ F_{(t-2k)}^* = \frac{(\Sigma \epsilon_1^2)/(\Sigma \epsilon_1^2 + \Sigma \epsilon_2^2)/k}{(\Sigma \epsilon_1^2)/(k-2k)} $$

Where t is sample volume and k is the common defer level and t-2k is the degrees of the freedom. The calculated F value is then compared to the table F value and the result is obtained.

When the causality structure among the variables is questioned, the following flow outline is obtained.

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According to this flow outline, it is seen that there is a one sided relation between CPI and interest rate and inflation affects the interest rates because inflation causes the uncertainty. It could not be found any causal relationship between exchange rate and interest rate. However, interest rate determines the money supply. There is a mutual causal relationship between gross national income and interest rate. The interest rate affects the investment decision and increasing investment leads to economic growth. CPI has a causal effect on money supply. There is a mutual relationship between CPI and gross national income. This result is true because inflation and growth model are used in Turkish economy. There is a one sided relationship between exchange rate and money supply and the most important variable (factor) is exchange rate.

The causal relation between gross national income and exchange rate makes possible the relationship between gross national income obtained by production and exchange rate true. Under the light of this flow outline, the following VAR model was written.

\[
\begin{bmatrix}
    DLCPI \\
    INT. RATE \\
    DLDOL \\
    LY \\
    DLM 2
\end{bmatrix}
\begin{bmatrix}
    \alpha \\
    \alpha' \\
    \alpha^* \\
    \alpha''
\end{bmatrix}
D_t +
\begin{bmatrix}
    a_1 & \theta_1 & \gamma_1 & \beta_1 & \Phi_1 \\
    a_2 & \theta_2 & \gamma_2 & \beta_2 & \Phi_2 \\
    a_3 & \theta_3 & \gamma_3 & \beta_3 & \Phi_3 \\
    a_4 & \theta_4 & \gamma_4 & \beta_4 & \Phi_4 \\
    a_5 & \theta_5 & \gamma_5 & \beta_5 & \Phi_5
\end{bmatrix}
\begin{bmatrix}
    DLCPI_{t-i} \\
    FAL_A_{t-i} \\
    DLDOL_{t-i} \\
    LY_{t-i} \\
    DLM2_{t-i}
\end{bmatrix}
\begin{bmatrix}
    u_{t1} \\
    u_{t2} \\
    u_{t3} \\
    u_{t4} \\
    u_{t5}
\end{bmatrix}
\]

The Schwarz criteria were used for choosing appropriate deferred VAR model. Corresponding Schwarz values to the VAR models were presented.

<table>
<thead>
<tr>
<th>Models</th>
<th>Lag</th>
<th>Schwartz Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAR(1)</td>
<td>1</td>
<td>-18.12</td>
</tr>
<tr>
<td>VAR(2)</td>
<td>2</td>
<td>-18.59*</td>
</tr>
<tr>
<td>VAR(3)</td>
<td>3</td>
<td>-17.84</td>
</tr>
</tbody>
</table>

(*) Min. value.

2.3. IMPULSE – RESPONSE FUNCTION ANALYSIS AND VARIANCE DECOMPOSITION

Since it is very difficult to make a comment on the results obtained from VAR models, the responses of the other variables corresponding to the each variables error margins called impulse (shock) in the system are evaluated. This procedure is called Impulse-Response Analysis and mostly seen as Multi Analysis Method in the literature.

The impulse-response graphs for VAR system were presented as follows.
According to these graphs, when a impulse is given to the interest rate and exchange rate, all variables in the system are made zero. It can be said that the inflation problem will be able be got down a reasonable rate approximately at the end of 2 years and economy will be stabilized.

Numerical effects of each variables’ expected error variances’ statistic impulses on variables will be seen. According to the variance decomposition, consumer price index is explained with consumer price index, interest rate is explained with interest rate and consumer price index, exchange rate is explained with consumer price index and index rate, growth is explained with growth, and money supply is explained with money supply and interest rate.

3. RESULTS

The growth in Turkish Economy and the relationship among the macro variables that could be a crisis indicator were investigated by VAR model. According to the impulse-response functions obtained from VAR model analysis, the impulse politics that will be applied on the interest rate and exchange rate can get damped the variables in the system. According to the result, interest rate and exchange rate can be used as politics variables.
When the impulse and response functions of the variables were investigated, it was concluded that interest rate can be used as a political variable. According to these results, the VAR model gives much better results than two other systems especially making damped gross national income. Especially when the effects on gross national income were investigated, it was found that the variable can be damped in a very short time. The same results were found when the impulse was applied to the exchange rate. The variables in the system got into the balance when both interest rate and exchange rate politics were used together. Especially the fluctuation of gross national income a sign of a growth indicator was flatten and became a balance.

It was found that our findings were smaller to the Republic of Turkish Central Bank interest rate and exchange rate data taken in December 9, 1999. The expected inflation rate, interest rate and exchange rate for first 18 months (until June 2001) were determined. It is known that the main problem is uncertainty of economy caused by inflation. Since the expected interest rate, exchange rate and inflation rate was already determined, that will remove the uncertainty. However this can be realized by taking positive politics decisions and supporting the economic program. It was found that CPI would be decreased at the end of 2 years. The irregular fluctuations in gross national income will be smaller and the economy will be steady state at that time. However, the other macro politic decisions should be applied and all the support should be given in order to accomplish mentioned goals above.

REFERENCES


