INTERACTION BETWEEN MONETARY AND FISCAL POLICY IN JORDAN

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ABSTRACT

This paper has investigated the dynamic interaction between monetary and fiscal policy in Jordan. The aim of this study is to evaluate how and to what extent both policies are responding to each other on one hand and to the movements in output growth and inflation on the other.

By employing the Vector Error Correction Model (VECM), this research confirms the perception that monetary policy and fiscal policy are relatively dependent. Concerning output growth, it shows no significant reaction to monetary contraction or deficit expansion. In contrast, a positive shock in the growth rate of output triggers a rise in the interest rate and a decline in the deficit.

As for inflation, it shows a significant reaction to deficit expansion or monetary tightening only after two to three quarters. Alternatively, a positive shock to inflation leads to an increase in both nominal interest rate and deficit.

INTRODUCTION

A large body of literature suggests that the discretionary regime of monetary and fiscal policy produces on average an inefficiently high amount of inflation and budget deficit. This suggests that optimal monetary and fiscal policy may be dynamically inconsistent.

Three approaches have been introduced in the literature to address the inconsistency problem. First is establishing an independent monetary policy with its main mandate centered on price stabilization (Rogoff 1985). Second is conducting monetary and fiscal policy by a technique centered on inflation and deficit targeting (Bernank and Mishkin (1996) and Sevensson (1997). Third is applying pre-set monetary and fiscal rules when responding to the state of the economy (Taylor, 1993, 2000), and McCallum (1997). Enhancing the credibility of both monetary and fiscal policy is a common theme of the three approaches.

Generally speaking, many studies have found an inverse relationship between monetary policy independence and average level/variability of inflation. Furthermore, a number of studies have found that targeting techniques and pre-set policy rules could improve welfare by lowering inflation and deficit. For other studies, however, the gains from monetary policy independence have been examined in isolation from the actions of the fiscal policy. And, it is argued that once the fiscal policy actions are taken into account, the goal of stabilizing prices of monetary policy may cause some welfare loss--in the form of lower output and increased fluctuations in the state of the economy. However, beginning with Sims (1980), a parallel line of empirical research on the effect of monetary and fiscal policy within the context of macroeconometric models has been accumulated in the literature. Applying the different forms of Vector Autoregression (VAR) models has been the dominant methodology.

In fact, an enormous amount of work has been done on the macroeconomic effect of monetary policy within the context of VAR models. On the other hand, the work on fiscal policy has received relatively less consideration in the context of VAR empirical analysis. Even less attention has been devoted to estimating the dynamic interaction between monetary and fiscal policy.

This paper empirically examines the dynamic interaction between monetary and fiscal policy in Jordan, and thus fills a void in the literature particularly for emerging countries. The main focus of this paper is how and to what extent both monetary and fiscal policy responds over time to each other and to the movements in the state of the economy. The empirical analysis undertaken in our work was based on VAR analysis where Vector Error Correction Model (VECM) is suggested by the data. Generalized impulse response functions (GIRF) developed by Koop, Pesaran, and Potter (1996) and Persaran and Shin (1998) constituted the primary tools of analysis in this paper.

These tools of analysis were chosen to overcome the identification problem incorporated in the VAR model. It is important to note that solving the identification problem in modeling the interaction between monetary and fiscal policy amounts to imposing a number of restrictions on the effects of monetary and fiscal policy. In fact, there is a well-known common pattern in identifying the restrictions on the effects of monetary policy, but there is a critical lack of consensus about identifying restrictions on the effects of fiscal policy. Therefore, by using our techniques, we attempted to avoid imposing restrictions on the effects of monetary and fiscal policy. Likewise, the GIRF was chosen not only to detect the direction and the duration of the impacts and/or responses between monetary and fiscal policy (Enders (1995), but also to overcome the ordering problem for the selected endogenous variables.

The rest of this paper is organized as follows: in the next section, the selected variables used to study the mutual interaction between monetary and fiscal policy were introduced. Section 3 surveys some of the background discussions of the existing theoretical transmission mechanisms between the selected variables, and outlines some of the key predictions. Section 4 describes the empirical framework. Section 5 includes a discussion of the empirical results, and the last section contains the summary and conclusions.

THE SELECTED VARIABLES

THE THEORETICAL TRANSMISSION MECHANISMS

The Relationship between the Short-run Interest Rate and the Other Variables

The Role of Inflation

In the standard IS/LM analysis, a decrease in price level, given the nominal money supply, increases the real cash balances. Thus, a lower interest rate is needed to clear the money market. In modern Keynesian analysis, as a respond to higher inflation, the interest rate through the effects on aggregate demand and aggregate supply is expected to be higher. According to the standard interest rate rule specification, when inflation deviates from its target level, the nominal short-run interest rate should be higher than its trend. This setting is consistent with the Fisher hypothesis: when inflation increases, expected inflation adjusted upwards, thus nominal interest rate goes up.

The Role of Budget Deficit

Generally speaking, higher government borrowing requirements resulting from a growing budget deficit could lead to an increase in net credit demands in the economy. If this is accommodated by a sustained increase in money supply, this will probably increase the interest rate. This is known as the accommodation hypothesis. Moreover, a loanable funds model suggests that increases in government borrowing demand places upward pressures on interest rates. Standard arguments suggest that interest rates and budget deficit should be positively correlated. However, empirical evidence is still lacking.

The Role of Output

Traditional arguments suggest that when output increases, the demand for money also increases. Increases in the demand for money implies an increase in the supply of other assets, i.e., bonds, thereby causing bond prices to fall and the interest rate to rise. Additionally, with stronger output growth, businesses have a stronger demand for funds to finance new projects and consumers may save less if they anticipate their incomes to rise. Consequently, real output growth may place pressure on interest rate to rise.

The Relationship between the Government Deficit and the Other Variables

The Role of Inflation

The main arguments in the inflation-deficit link are: the Tanzi effect, the Patinkin effect and the Barro hypothesis. The central point of the Tanzi argument lies in the fact that the time of tax obligations' accrual and the time of actual payment do not match, with payment usually made at a later date. High inflation during such time lags may affect tax revenues, depending on the lag time. As for the Patinkin effect, high inflation actually has an impact not only on tax revenue but also on expenditures. Indexation could be used against these arguments, but because indexation is imperfect and linked to past inflation, the real effect of inflation on deficit may be an important factor in the direction of the deficit. With respect to the Barro hypothesis, the government may increase nominal deficit in order to keep pace with the rate of inflation.

The Role of Interest Rate

Generally, the interest rate-deficit links are organized in the literature under several effects. The expenditure effect says that higher interest rates may cause the level of output to be lower than expected. This may lead the government to increase output by expanding expenditures which leads to higher budget deficit. The revenue effect says that in the short run, higher interest rate may lead to slower output growth. If so, tax revenues might be reduced, thus leading to a rise in the government budget deficit.

The debt effect says that higher short-term interest rates may positively affect medium- and long-term rates. As a result, servicing even a constant level of government debt becomes more costly, and these costs may increase the deficit. On the other hand, this later issue may cause the government to decrease the total debt and expenditures if they find that they are positively related with interest rate, thus leading to a decrease in the deficit. Finally, based on the government budget constraint, the effect of interest rate on government deficit operates through the present value of aggregate investment spending, taxes, and interest payment on domestic and external debt. Higher interest rates reduce these present values. Thus, the evidence on the interest rate-deficit relationship is mixed.

The Role of Output

Given that the government desires to minimize the associated tax-revenue distortions on output, and given that such distortions increase with a higher tax rate, steady moderate tax-smoothing rates are a preferable form of tax policy. As a result, tax revenues are not compatible with government purchases. Thus, budget deficit may increase. On the other hand, in the traditional analysis, higher output allows collection for more taxes, and results in less pressure on government to increase transfer payments to beneficiaries.

The Relationship between the Real Output and the Other Variables

The Role of Interest Rate

Given the microeconomic foundations of the temporary nominal price and/or wage rigidity, lowering the short-term nominal interest rate will decrease the cost of borrowing used to finance both firms' and households' purchases of investment and durable goods. As a result, planned aggregate expenditures and thus output are expected to increase.

In recent literature, investment decisions are generally viewed as more closely linked to medium- and long-term interest rates. That is, changes in the short-term interest rate will affect investment if longer-term rates are affected. According to the expectation theory of the term structure of interest rates, the longer-term rates are an average of current short-term rates and expected future short-term rates, which partly depends on inflation expectations. Therefore, as long as changes in short-term rates are not completely balanced by the expected inflation, real output is likely going to increase when the short- term interest rate decreases.

The Role of Inflation

Given some kind of market imperfection, the short-run relationship between inflation and output is primarily represented by the upward sloping aggregate supply curve. According to the three traditional models, the sticky-wage/price model, the worker-misperception model, and the imperfect-information model, the unexpected increase in inflation is associated with higher output. The main route of transmission is that inflation decreases the real wage, thus making it optimal for firms to demand more labor and increase the production of goods and services. Recently, the inflation output tradeoff has been formulated using the expectations-augmented version of the Phillips curve, i.e., output is higher than its natural level when inflation is higher than its expected level. In modern Keynesian theories, the expected level of inflation has different formulations with different implications on the inflation-output link.

By contrast, it has been argued that inflation may distort the consumption-leisure choice of households and may distort capital income on investment. Therefore, elimination of such distortion by reducing inflation would lead to a higher labor supply and more investment, resulting in higher levels of output. Consequently, various strategies have been suggested in the literature for achieving the goal of controlling inflation. Interest rate rules, inflation targeting and forward-looking preventative monetary policy[17] are examples of these strategies.

The Role of Budget Deficit

Note that deficit-financed expenditures directly increase the level of aggregate demand. By contrast, deficit-financed tax-cut and transfer payments increase aggregate demand indirectly as households adjust the level of their spending in accordance with changes in disposable income.

The conventional wisdom on the impact of deficit expansion is largely dominated by the Keynesian view where a mix of higher expenditures and tax reductions will increase the economy's aggregate expenditures and output. However, higher government borrowing requirements resulting from a growing budget deficit could lead to an increase in the net credit demands in the economy. The resulting excess demand on credit drives the interest rate up and then may crowd out private sector investment, hence lowering output. Thus, the net effect on output is ambiguous. In sharp contrast, for many empirical studies on some European Countries (e.g., Denmark, Sweden) during the 1990s, the deficit reduction was found to be expansionary in the form of higher output. Credibility of fiscal policies and long lags in government responses to shocks are among the arguments that explain the expansionary effects of deficit reduction.

The Relationship between Inflation and the Other Variables

The Role of Deficit

According to the standard Keynesian view, a government deficit stimulates aggregate demand, thus placing inflationary pressures on the economy. As for the monetarist analysis, deficits cause inflation if they are monetized. Sargent and Wallace (1981) argued that the accumulated government debt has to be monetized by the central bank. Thus, the money supply will be higher in the economy leading to inflation. According to the fiscal theory of price level determination, households' expectations about the present value of government deficit/surplus may increase inflation. A decrease in the present discounted value of expected future government surpluses increases current prices not only because of increasing the path of the expected inflation but also because of making households feel wealthier, which may increase aggregate demand and inflation (Woodford, 2001).

The Role of Output

Higher output necessitates higher employment and may lead to increases in wages and thus cost of production, both of which drive up inflation. Moreover, demand-led growth places inflationary pressures on the economy.

The Role of Interest Rate

A fall in the interest rate stimulates aggregate demand through firms' investment and consumers' purchases, particularly of durable goods. As a result, aggregate demand is higher, leading to inflationary pressures. Additionally, as the domestic interest rates falls, the exchange rate depreciates. A falling domestic currency raises net export and demand, which produces inflationary pressures.

THE EMPIRICAL FRAMEWORK

The Data

The VAR model consists of two macroeconomic (non-policy) variables and two policy variables. The macroeconomic variables are: inflation rate, based on the consumer price index (CPI), and real output, based on real gross domestic product (GDP). The policy variables are: overnight interbank rate (IR), defined as the interest rate at which commercial banks borrow overnight, and government budget deficit, measured as ratio to real gross domestic product (DF). CPI and GDP variables are converted to natural logarithms, while IR and DF are held in their level form. All variables based on quarterly data comprising 1996:Q4-2011:Q1. Data are driven from the Central Bank of Jordan, Monthly Statistical Bulletin. The four variables are depicted in Figure 1 and descriptive statistics for the variables are provided in Table 1.

Figure (1): Plot of the Sample Series, 1996:Q4-2011:Q1.

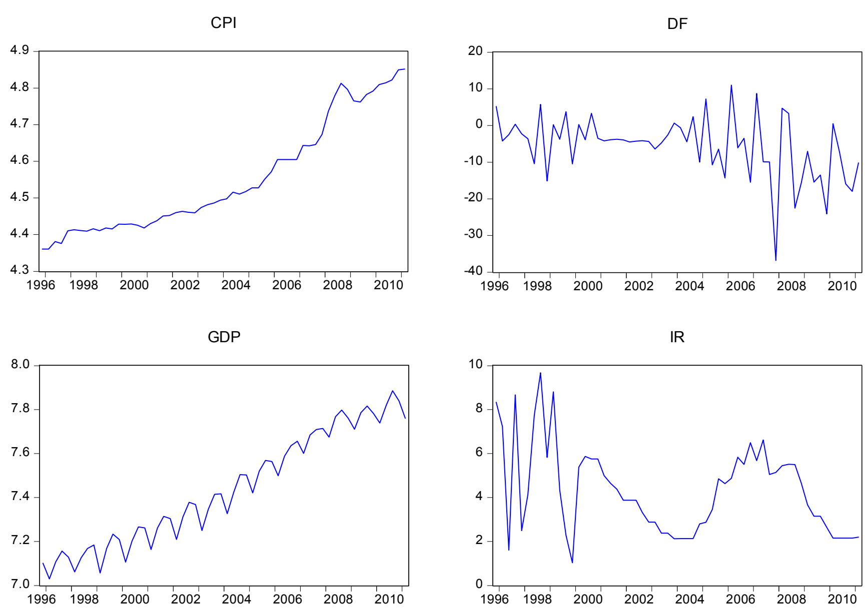


Table (1): Summary Statistics of the Natural Logarithm of Consumer Price Index (CPI), Natural Logarithm of Real Gross Domestic Product (GDP), Government Budget Deficit, Measured as Ratio to Real Gross Domestic Product (DF), and the Interbank Rate (IR), 1996:Q4-2011:Q1.				
	CPI	GDP	DF	IR
Mean	4.5	7.4	-5.5	4.3
Median	4.5	7.4	-4.2	4.2
Maximum	4.8	7.9	11.8	9.7
Minimum	4.4	7.0	-36.8	1.0
Std. Dev.	0.1	0.2	8.5	2.0
Skewness[1]	0.7	0.2	-0.93	0.7
Kurtosis[2]	2.0	1.7	4.92	2.9
Jarque-Bera[3]	6.8	4.3	17.30	3.3
Probability	[0.03]	[0.1]	[0.00]	[0.12]

[1] Skewness $sk = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i-\bar{y}}{\hat{\sigma}}\right)^3$: is a measure of asymmetry of the distribution of the series around its mean, $\hat{\sigma}$ is an estimator for the standard deviation.

[2] Kurtosis: $sk = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i-\bar{y}}{\hat{\sigma}}\right)^4$ is a measure of the peakedness or flatness of the distribution of the series.

[3] jarque-Bera (1979), $JB = \frac{n-k}{6}\left[(sk)^2 + \frac{(ku-3)^2}{4}\right]$ is a test for the H_0: the series is normally distributed, where ku is skewness, ku is kurtosis, and k is the number of estimated coefficients.
The P-Value is in [ ].

The VAR Model

As pioneered by Sims (1980), the vector Autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach treats every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The mathematical representation of a VAR(P) is Enders (2004):

$$Y_t = m + \alpha_1 Y_{t-1} + \ldots\ldots + \alpha_p Y_{t-p} + \varepsilon_t \ldots\ldots\ldots\ldots(1)$$

$$\begin{bmatrix} GDP_t \\ CPI_t \\ DF_t \\ IR_t \end{bmatrix} = \begin{bmatrix} \alpha_{01} \\ \alpha_{02} \\ \alpha_{03} \\ \alpha_{04} \end{bmatrix} + \begin{bmatrix} \alpha_{111} & \alpha_{121} & \alpha_{131} & \alpha_{141} \\ \alpha_{211} & \alpha_{221} & \alpha_{231} & \alpha_{241} \\ \alpha_{311} & \alpha_{321} & \alpha_{331} & \alpha_{341} \\ \alpha_{411} & \alpha_{421} & \alpha_{431} & \alpha_{441} \end{bmatrix} * \begin{bmatrix} GDP_{t-1} \\ CPI_{t-1} \\ DF_{t-1} \\ IR_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} \alpha_{11p} & \alpha_{12p} & \alpha_{13p} & \alpha_{14p} \\ \alpha_{21p} & \alpha_{22p} & \alpha_{23p} & \alpha_{24p} \\ \alpha_{31p} & \alpha_{32p} & \alpha_{33p} & \alpha_{34p} \\ \alpha_{41p} & \alpha_{42p} & \alpha_{43p} & \alpha_{44p} \end{bmatrix} * \begin{bmatrix} GDP_{t-p} \\ CPI_{t-p} \\ DF_{t-p} \\ IR_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix}$$

where Y_t is a k vector of endogenous variables [GDP_t CPI_t DF_t IR_t], , $\alpha_1, \ldots\ldots, \alpha_p$ are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables (Rukel, 2009).

Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Even though the innovations ε_t may be contemporaneously correlated, OLS is efficient and equivalent to GLS.

The specific vector we considered in our research contains Y, = [IR, DF, Logarithm of CPI, Logarithm of GDP]. Thus, in our case, Y, is 4 x 1 vector of the endogenous variables, m is 4x1 vector of constants, α_1 are 4x4 matrices of lag coefficients of Y_t, up to some lag length P, and ε_t is 4x1 vector of shocks. The components of ε_t vector are each white noise process with zero mean, constant variance, and are individually serially uncorrelated. However, they could be contemporaneously correlated.

With this setting, the VAR model consists of four equations one for each endogenous variable. The interest rate equation may be described as an interest rate policy rule; the deficit equation could be described as an IS-type relationship. Output and inflation equations could be described as the adjustment mechanisms for the state of the economy when policy variables have changed. The lags included in the formulation of endogenous variables make the VAR a better tool for analyzing the process of monetary and fiscal transmission mechanisms. This latter point is based on the idea that monetary policy and fiscal policy take time to have effects on the macroeconomic outcomes.

Stationarity of the Variables

Running the VAR model using nonstationary variables will produce hazardous results (Sims, Stock, and Watson (1990). Therefore, we first checked for stationarity of the variables in their level form. The graphical representation in figure 1 suggests that the time series for all variables are not stationary. More formally, the augmented Dickey-Fuller (AD-F) unit root test was performed; the results are presented in Table 2, which shows that the hypothesis of unit root was not rejected for the four variables at the 5% level of significance. Hence, on the basis of the graphical analysis and Dickey-Fuller test all variables in their level form are nonstationary; i.e. contain a unit root.

Table (2): Augmented-Dickey-Fuller (AD-F) Unit Root Test Results of the Natural Logarithm of Consumer Price Index (CPI), Natural Logarithm of Real Gross Domestic Product (GDP), Government Budget Deficit, Measured as Ratio to Real Gross Domestic Product (DF), and the Interbank Rate (IR), 1996:Q4-2011:Q1.

Variable	ADF Results	
	With intercept	With Time
GDP	0.015	-2.48
CPI	0.55	-1.56
DF	-1.52	-2.73
IR	-2.25	-2.23

*, **, Denotes that the null hypotheses that the variable contains a unit root is rejected at1%, and 5%, significance level, respectively. The asymptotic critical values (with time) are: 1%, -4.1; 5%, -3.5; and the asymptotic critical values (with intercept) are: 1%, -3.6; 5%, -2.9. Since the distribution of the AD-F statistic is non-standard and requires the use of critical values tabulated by MacKinnon (1996).

Bringing together the facts that the variables are nonstationary in their level form, the standard econometric literature recommends transforming the variables to stationary series by first differencing. Since CPI and GDP variables are in natural logarithm, their first differences amount to percentage changes. As for the interbank rate and the deficit variables, their first difference amounts to policy changes.

Table (3): Results of Johansen's Cointegration Test on the Natural Logarithm of Consumer Price Index (CPI), Natural Logarithm of Real Gross Domestic Product (GDP), Government Budget Deficit, Measured as Ratio to Real Gross Domestic Product (DF), and the Interbank Rate (IR), 1996:Q4-2011:Q1.

Hypothesized No. of CE(s) [1]	Trace Statistic [2]	5% Critical Value	1% Critical Value
R=0	74.0	47.9	54.7
R=1	26.5	29.8	35.5
R=2	10.84	15.5	19.9
R=3	0.05	3.8	6.6
Hypothesized No. of CE(s)	Max-Eigen Statistic [3]	5% Critical Value	1% Critical Value
None	47.5	27.6	32.7
At most 1	15.67	21.1	25.9
At most 2	10.80	14.3	18.5
At most 3	0.05	3.8	6.6

[1]Stands for hypothesized cointegrating vectors.
[2]Denotes the trace statistics test.
[3]Denotes maximum eigenvalue statistic test

Table (4): Unit Root Test Results of the changes in: Natural Logarithm of Consumer Price Index (CPI), Natural Logarithm of Real Gross Domestic Product (GDP), Government Budget Deficit, Measured as Ratio to Real Gross Domestic Product (DF), and the Interbank Rate (IR), 1996:Q4-2011:Q1.

Test Variable	ADF[1]		p-p[2]	
	With intercept	With Time	With intercept	With Time
ΔGDP[2]	-3.0**	-2.91**	-15.6*	-14.88*
ΔCPI[2]	-5.6**	-5.61*	-5.4*	-5.47*
ΔDF[3]	-12.81*	-7.98*	-39.5*	-39.8*
ΔIR[5]	-4.9*	-4.86*	-12.71*	-12.54*

Δ denotes to the changes in the variables as defined in Table 1.
[1]AD-F: denotes the Augmented-Dickey-Fuller (1979).
[2]P-P: denotes the PhiIlips-Perron (1988).
*, **, and ***, denotes that the null hypotheses that a variable contains a unit root is rejected at 1%, 5%, and 10% significance level, respectively. Asymptotic critical values (with time) are: 1%, -4.1; 5%, -3.5; 10%, - 3.2; and the asymptotic critical values (with intercept) are: 1%, -3.6; 5%, -2.9; 10%, -2.6.

Both the AD-F and Phillips-Perron (P-P) unit root tests were performed on the first difference of the four variables (the first difference operator is denoted by Δ). As shown in Table 4, the hypothesis that there is a unit root was easily rejected at 1% level of significance for the variables ΔIR, ΔDF, and ΔCPI. ΔGDP index only passes the AD-F (with intercept) test at a 5%

level of significance, while when performing the P-P test, the hypothesis of a unit root test was rejected at 1% level of significance.

Given these results, our research proceeded with the assumption that the variables are integrated with the same order, i.e., I (1), and thus, all variables were entered into the VAR model based on their rates of change. The first differences of the four variables are depicted in Figure 2, and the descriptive statistics for the variables are provided in Table 5.

Figure (2): Plot of the Sample Series, 1996:Q4-2011:Q1.

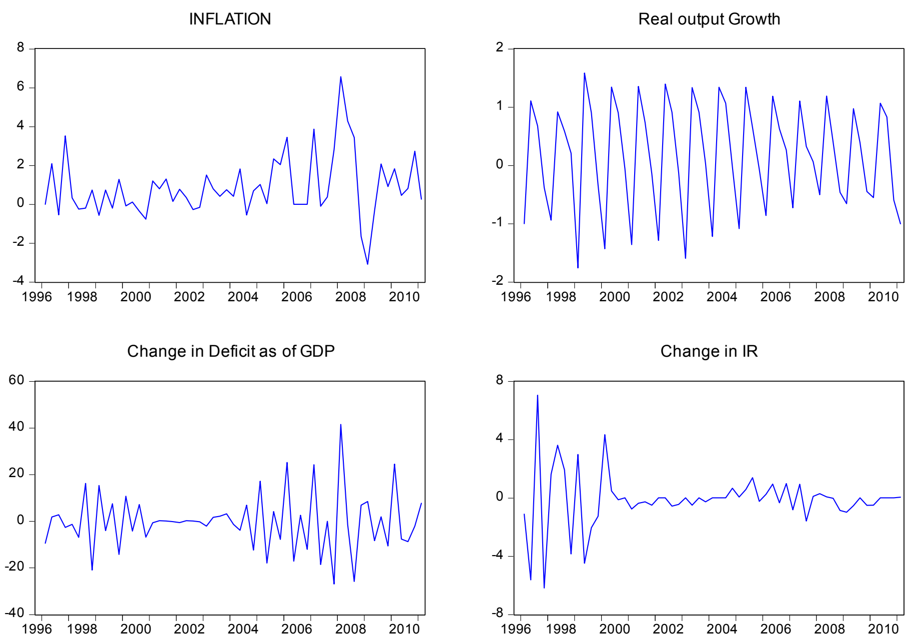


Table (5): Summary Statistics of the Sample Series Used in the VAR model 1996:Q4-2011:Q1.[1]

	ΔCPI	ΔGDP	ΔDF	ΔIR
Mean	0.008	0.011	-0.26	-0.114
Median	0.005	0.020	-0.82	0.000
Maximum	0.063	0.112	41.49	7.060
Minimum	-0.031	-0.126	-26.8	-6.170
Std. Dev.	0.016	0.068	12.5	2.064
Skewness1	0.943	-0.317	0.61	0.047
Kurtosis1	5.32	1.662	4.44	7.094
Jarque-Bera1	19.26	4.03	8.48	39.126
Probability	[0.000]	[0.133]	[0.014]	[0.000]

[1]The definitions of the variables are reported in Table 1, the Δ denotes to the changes in the variables.

Cointegration

While (AD-F) and (P-P) suggest that the variables are nonstationary in their level form when considered individually, it is possible that these variables share a common stationary relationship. In this case, the variables are said to be cointegrated. In the presence of cointegration, it is necessary to estimate the VAR model in an error correction model form so as to avoid throwing away information concerning the comovement in the variables.

To check for evidence of cointegration, the Johansen's cointegration tests were performed, and the results are presented in Table 3. As shown by the table, both trace and max-eigenvalue rank tests indicate that the hypothesis of no cointegrating relations is rejected among the set of the variables at both 5% and 1% level of significance.

Generalized Impulse Response

Combining the facts that the variables are nonstationary series and cointegrated in their level form, a vector error correction (VEC) model is a restricted VAR designed for use with such case. The VEC has cointegration relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

The impulse response functions can be used in the analysis of interactions between variables. Impulse response functions make it possible to study the impact of exogenous shocks on the variables. This allows the determination of the impacts of monetary policy and fiscal policy shocks as well as price and real output shocks. The maximum value of GIRFs represents the peak effect while the time horizon for the graph gave the timing of the variable effect on other variables.

Despite its popularity, the orthogonalized impulse response function (OIRF) analysis of structural vector autoregressive (VAR) models is subject to the so-called Wold-ordering problem. Pesaran and Shin (1998) propose an ordering-invariant approach, the generalized impulse response function (GIRF), based on the work of Koop et al. (1996).

THE EMPIRICAL RESULTS AND THE GENERALIZED IMPULSE RESPONSE FUNCTIONS

First difference of the variables was entered in the estimated VEC model and used to generate the GIRFs. Each variable was regressed on four lags of all endogenous variables over the period 1996:Q4-2011:Q1 with constant and without trend. The choice of four lags is supported by Akaike's Information Criteron (AIC), Final Prediction Error (FPE) criterion and Schwartz Information Criterion (SC) as shown in Table 6. The estimated VEC (4) is reported in Table 7. The residuals of the system are plotted in Figure 3. Table 8 reports the stability test for the estimated model, suggesting that the VAR (4) satisfies the stability condition and converging with dampened oscillations. In fact this result bear a reasonable resemblance to the actual behavior of the economy as can be seen in Figure1. Thus, we may conclude that the dynamic structure of the model is representative of the actual economy and the model may be useful as a forecasting tool. Table 9 provides the serial correlation test for the estimated model, indicating that the VAR (4) is free of serial correlation since all the probability values are high.

Table (6): Lag Order Selection Criteria on the Length of Lags.

Lag	FPE [1]	AIC [2]	SC [3]
0	0.02961	7.83	7.98
1	0.00010	2.13	2.88
2	0.00010	2.12	3.46
3	0.00003	1.05	2.98
4	0.00001*	-0.87*	1.66*
5	0.00001	-0.76	2.36

[1]FPE denotes final prediction error.
[2]AIC denotes Akaike Information Criterion (1974).
[3] SC denotes Schwartz Information Criterion (1978).
*Indicates lag order selected by the criterion.

Table (7): Vector Error Correction Estimates, 1996:Q4-2011:Q1

Eq:	CointEq1			
D(GDP(-1))	1.000000			
D(CPI(-1))	-0.267878	(0.38801)	[-0.69039]	
D(DF(-1))	-0.019662	(0.00369)	[-5.33459]	
D(IR(-1))	-0.043995	(0.00588)	[-7.47934]	
C	-0.017633			
Error Correction:	D(GDP,2)	D(CPI,2)	D(DF,2)	D(IR,2)
CointEq1	-0.251916	0.055721	55.18724	33.43886
	(0.10262)	(0.08863)	(43.6441)	(7.79916)
Cointegrating	[-2.45492]	[0.62867]	[1.26448]	[4.28749]
D(GDP(-1),2)	-0.976109	0.037468	-38.54380	-1.297731
	(0.17055) [-5.72320]	(0.14731) [0.25435]	(72.5380) [-0.53136]	(12.9625) [-0.10011]
D(GDP(-2),2)	-1.053522	0.078271	-40.71082	6.701956
	(0.16257) [-6.48047]	(0.14041) [0.55743]	(69.1423) [-0.58880]	(12.3557) [0.54242]
D(GDP(-3),2)	-1.103228	0.075045	-3.788576	16.57567
	(0.15867) [-6.95304]	(0.13705) [0.54759]	(67.4835) [-0.05614]	(12.0592) [1.37452]
D(GDP(-4),2)	-0.229794	0.048359	-15.89590	26.44652
	(0.15892) [-1.44598]	(0.13726) [0.35231]	(67.5902) [-0.23518]	(12.0783) [2.18959]
D(CPI(-1),2)	0.430307	-0.252827	179.1896	0.537082
	(0.20791) [2.06968]	(0.17958) [-1.40791]	(88.4264) [2.02643]	(15.8017) [0.03399]
D(CPI(-2),2)	-0.038077	-0.324002	241.9181	-19.19699
	(0.22698) [-0.16775]	(0.19605) [-1.65265]	(96.5383) [2.50593]	(17.2513) [-1.11278]
D(CPI(-3),2)	-0.051597	-0.333157	-20.96092	17.56411
	(0.18454) [-0.27960]	(0.15939) [-2.09021]	(78.4859) [-0.26707]	(14.0254) [1.25231]

Table (7): Vector Error Correction Estimates, 1996:Q4-2011:Q1

D(CPI(-4),2)	0.197738	-0.178972	142.4501	-2.276949
	(0.18868) [1.04799]	(0.16297) [-1.09819]	(80.2489) [1.77510]	(14.3404) [-0.15878]
D(DF(-1),2)	-0.003701	0.000693	-0.701152	0.581591
	(0.00184) [-2.00750]	(0.00159) [0.43520]	(0.78404) [-0.89428]	(0.14011) [4.15103]
D(DF(-2),2)	-0.002327	0.000498	-1.031205	0.428690
	(0.00140) [-1.65872]	(0.00121) [0.41125]	(0.59670) [-1.72818]	(0.10663) [4.02037]
D(DF(-3),2)	-0.001363	-7.75E-05	-1.104486	0.258605
	(0.00092) [-1.48774]	(0.00079) [-0.09804]	(0.38952) [-2.83553]	(0.06961) [3.71526]
D(DF(-4),2)	-0.000278	-0.000167	-0.622030	0.107865
	(0.00046) [-0.60666]	(0.00040) [-0.42258]	(0.19461) [-3.19626]	(0.03478) [3.10161]
D(IR(-1),2)	-0.006786	0.003865	2.606358	0.552922
	(0.00393) [-1.72845]	(0.00339) [1.13976]	(1.66979) [1.56089]	(0.29839) [1.85301]
D(IR(-2),2)	-0.006677	0.000313	2.142775	0.416560
	(0.00338) [-1.97606]	(0.00292) [0.10713]	(1.43708) [1.49106]	(0.25681) [1.62208]
D(IR(-3),2)	-0.005853	-0.001128	1.101289	0.448107
	(0.00241) [-2.43231]	(0.00208) [-0.54269]	(1.02353) [1.07597]	(0.18290) [2.44996]
D(IR(-4),2)	-0.003193	-0.001616	1.598777	0.325653
	(0.00143) [-2.23730]	(0.00123) [-1.31151]	(0.60692) [2.63425]	(0.10846) [3.00263]
C	-3.57E-06	-0.000126	-0.081439	-0.033326
	(0.00251) [-0.00142]	(0.00217) [-0.05829]	(1.06857) [-0.07621]	(0.19095) [-0.17452]
R-squared	0.980260	0.476975	0.927710	0.715165
Adj. R-squared	0.970390	0.215462	0.891564	0.572747
Sum sq. resids	0.011011	0.008215	1991.818	63.60557
S.E. equation	0.017996	0.015544	7.653946	1.367754
F-statistic	99.31804	1.823908	25.66619	5.021605
Log likelihood	146.1773	153.7955	-168.5694	-79.02269
Akaike AIC	-4.929898	-5.222904	7.175744	3.731642
Schwarz SC	-4.254468	-4.547474	7.851175	4.407073
Mean dependent	-0.000221	-1.21E-05	0.174893	-0.030385
S.D. dependent	0.104583	0.017549	23.24339	2.092501

[1]The definitions of the variables are reported in Table 1. The Δ denotes the changes in the variables, numbers in [ ] are t-statistics.
[2] Log-L, AIC, and SIC are, respectively, the Log-likelihood value, the Akaike Information Criterion (1974), and Schwartz information Criterion (1978).

Figure (3): Plot of the Estimated Residuals

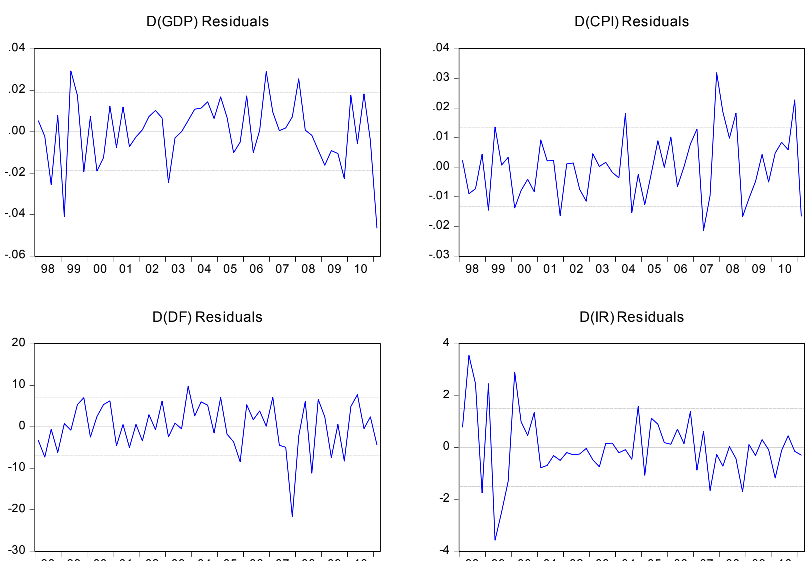


Table (8): Root and Modulus of the Characteristic Polynomial Endogenous Variables.	
Root	Modulus
0.000200 - 0.996942i	0.996942
0.000200 + 0.996942i	0.996942
0.983936	0.983936
-0.976284	0.976284
0.857853 - 0.045508i	0.85906
0.857853 + 0.045508i	0.85906
0.033050 - 0.821000i	0.821665
0.033050 + 0.821000i	0.821665
0.512454 - 0.616251i	0.801483
0.512454 + 0.616251i	0.801483
-0.547615 - 0.077251i	0.553037
-0.547615 + 0.077251i	0.553037

The GIRFs trace the intertemporal consequence of a positive one standard deviation shock to one of the disturbances contained in the ε_t vector. Since the shock is positive it represents a contractionary monetary policy in the interest rate equation and represents an expansionary fiscal policy in the deficit equation. Therefore, plotting the GIRFs provides information about how both interbank rate and government deficit respond over time to each other and to real output growth and inflation. Also, it provides information on how output growth and inflation respond to interbank rate and fiscal deficit shocks.

Impulse Response Functions for the interaction between monetary and fiscal policy

The dynamic effects of contractionary monetary policy in the form of higher interbank rate are reported in Figure 4. The deficit responds positively to the interest rate shock at the initial period and becomes less significant for the rest of the period indicating a short-run positive impact of contractionary monetary policy on the deficit. Generally, the interest rate - deficit links are organized in the literature under several effects. The expenditure effect says that higher interest rates may cause the level of output to be lower than expected. This may lead the government to increase output by expanding expenditures which leads to higher budget deficit. The revenue effect says that in the short run, higher interest rate may lead to slower output growth. If so, tax revenues might be reduced, thus leading to a rise in the government budget deficit. Another important effect is that the increase in the deficit will be financed by local and global borrowing. Consequently, the more the need for financing, the higher the burden on the budget in terms of higher debt services. Our results support the idea that monetary policy has a short run impact on the fiscal policy.

Figure (4): Impulse Response Functions to a Shock in IR

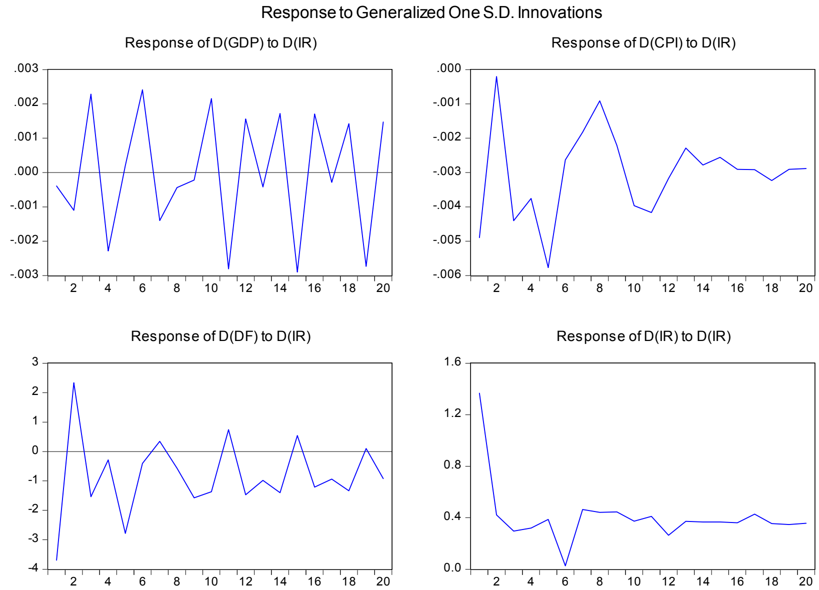
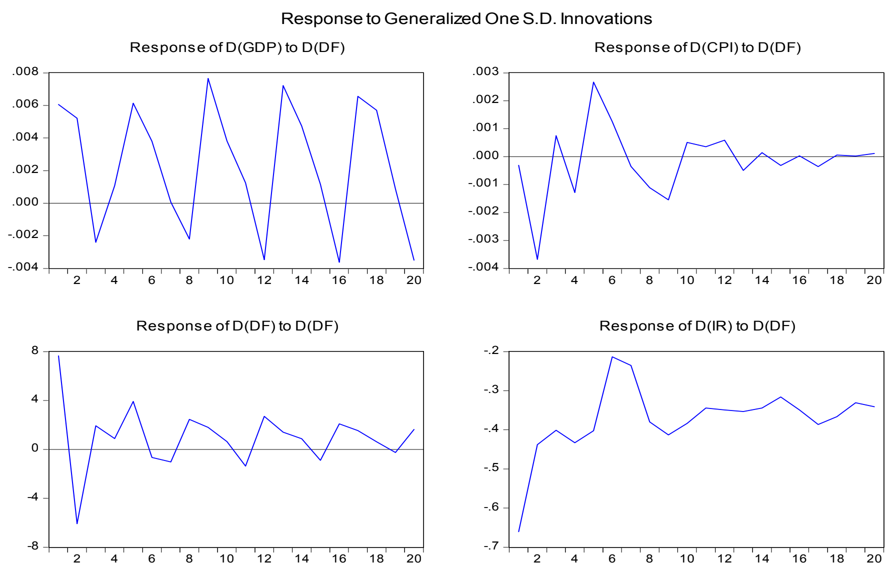


Figure (5): Impulse Response to a Shock in the Budget Deficit



The dynamic effects of expansionary fiscal policy in the form of higher deficit are reported in Figure 5. Initially, deficit expansion caused an increase in the interest rate, which maintained to approach its peak in the 6th quarter. In fact, the continuous demand for funds to finance the chronic deficit in the government budget causes the interest to increase over time. This result is consistent with the crowding out effect argument. Our results authenticate the perception that monetary policy and fiscal policy are relatively dependent since a significant response is also estimated in interest rate to a deficit expansion.

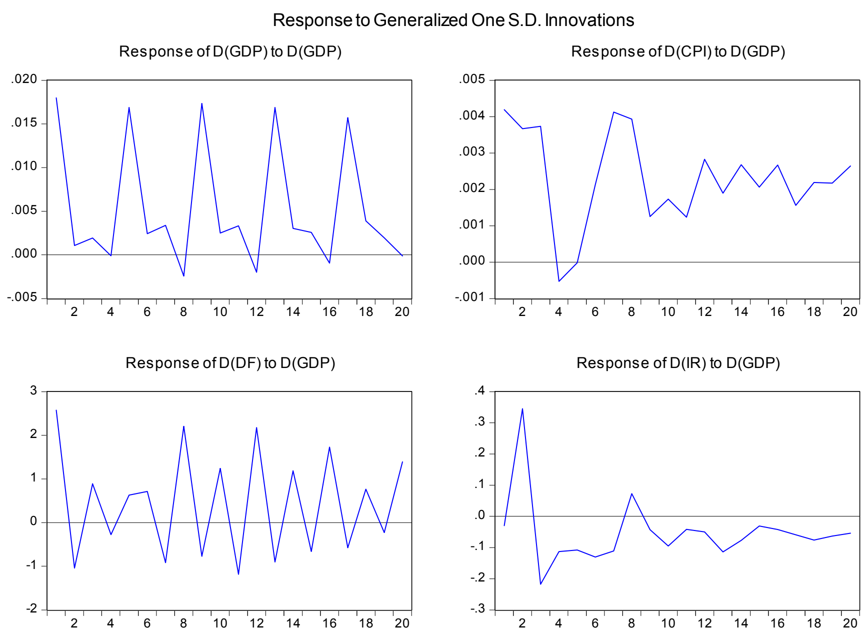
Impulse Response Functions of monetary policy and fiscal policy to the state of the economy

Output

The response of output to a positive shock in the interest rate and a deficit is always insignificant indicating no real impact of either monetary or fiscal policy on output (Figure 4 and 5). That is, output growth shows no response to monetary contraction or deficit expansion. Essentially, the fundamentals of output growth in Jordan are exports, FDI, worker remittances, tourism income and grants. All of them actually are determined by regional and global factors and they are not linked directly to domestic interest rate or deficit.

On the other hand, the dynamic responses of monetary policy and fiscal policy to output growth are reported in Figure 6. A positive shock in the growth rate of output initially causes an increase in the interest rate. This result is consistent with the IS/LM model. Businesses and households have a stronger demand for funds when output growth is higher; hence, interest rate may be higher. After the second quarter, interest rate decreases gradually to its pre-shock level.

Figure (6): Impulse Response Functions to a Shock in Output



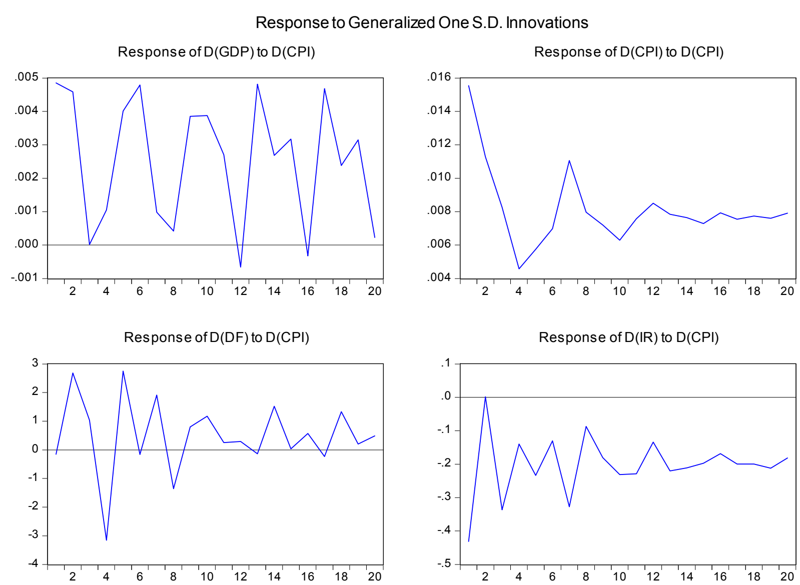
As for the deficit response, the deficit declines at the initial period and becomes insignificant for the rest of the period. Indeed, output growth increases revenues and declines the demand for expenditures required to finance social safety nets which in turn causes the deficit to decline. However, in the long run, deficit decisions in Jordan may depend on the developments and/or the interaction of revenue and expenditures which constitute another interesting area of research that may contribute to the revenue- expenditure or expenditure - revenue debate. Furthermore, the Jordanian chronicle structural deficit entails that deficit decisions are taken in isolation from output developments.

Inflation

As depicted in Figure 4, in the first three quarters, monetary contraction failed to produce any decline in inflation. This is the price puzzle: an increase in inflation in the short-run after a contractionary monetary shock. Similar results are found in Sims (1992) and Eichenbaum and Evans (1994) for the United States. Dale and Haldane (1994) found similar results for the United Kingdom. In our research, however, the price puzzle is short lived and is absent after three quarters. After three quarters, as one might expect, inflation falls gradually, supporting the idea of sticky prices. Increases in the interest rate lessen aggregate demand. As a result, inflationary pressures are expected to be lower over time.

According to the dynamic effects of expansionary fiscal policy inflation shows a significant response to deficit expansion only after two quarters (Figure 5) a result consistent with lag effect literature of the growing budget deficit.

Figure (7): Impulse Response Functions to a Shock in Inflation



Alternatively, the dynamic response of monetary policy and fiscal policy to inflation shocks is reported in Figure 7. Concerning the interbank rate response, a positive shock in inflation leads to an increase in nominal interest rate. This represents the central bank reaction function to fight inflation by higher interest rate. The peak response is about the second quarter then it declines gradually. As for the deficit response, a positive shock in inflation leads initially to an increase in deficit and turns out to be insignificant for rest of the period.

Table (9): Residual serial correlation LM tests

Lags	LM-Stat [1]	Prob [2]
1	22.30	0.13
2	21.62	0.16
3	16.41	0.42
4	22.40	0.13
5	14.74	0.54
6	12.71	0.69
7	10.61	0.83
8	14.45	0.57
9	16.44	0.42
10	6.29	0.98
11	14.58	0.56
12	16.98	0.39

[1] LM test: denotes the serial correlation LM test of Breusch-Godfrey.

[2] All probability values support the null hypothesis of no serial correlation.

Robustness of the Empirical Results

It is worth concluding this paper by stressing the robustness of our empirical results. As these results were obtained by employing a data set spanning the period 1996:4-2011:1, a criticism can be made that our empirical work does not account for possible structural or policy - regime change. However, it appears that the conclusions discussed above are robust to this criticism since the results measured over a shorter period, 2000:1- 2002:1, did not change the results in any notable way. In fact, they are qualitatively the same. This would suggest that shifts in policy regimes raise no serious difficulties for our analysis. On the other hand, since the VAR are very sensitive to the lag length selection, we imposed shorter lags as suggested by Schwartz Information Criterion (SIC) the results again yielded similar conclusions. Moreover, to face debate over the choice of vector error correction model (VECM) compared to the VAR model in case the variables are cointegrated, both models were employed and there were no significant differences related to our analysis.

CONCLUSION

This study has examined the dynamic interaction between monetary and fiscal policy in Jordan. By employing the VECM, this research measured how and to what extent both monetary and fiscal policies are responding to each other and to the movements in output growth and inflation.

The findings authenticate the perception that monetary policy and fiscal policy are relatively dependent. In contrast, output growth shows no response to monetary contraction or deficit expansion. On the other hand, a positive shock in the growth rate of output causes an increase in the interest rate. As for the deficit response to a positive shock in the growth rate of output, the deficit declines substantially at the initial period and becomes insignificant for the rest of the period.

As for inflation, in the first three quarters monetary contraction failed to produce any decline in inflation. After three quarters, as one might expect, inflation falls gradually, supporting the idea of sticky price. According to the dynamic effects of expansionary fiscal policy, inflation shows a significant response to deficit expansion only after two quarters.

Alternatively, a positive shock in inflation leads to an increase in nominal interest rate. This represents the central bank reaction function to fight inflation by higher interest rate. As for the deficit response, a positive shock to inflation leads initially to an increase in deficit and turns out to be insignificant for rest of the period.

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