Analyzing the Dynamic Relationship between Budget Deficit, Inflation, and Interest Rate (A Case from Jordan)

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Abstract
This study, gathered the most important economic variables that influence different countries interest rate such as, inflation and public deficit. Interest rate and inflation play an important role in monetary policy, and influence different countries decisions making regarding economic practices. Also, budget deficit can be used as a tool to measure governments' financial performances. This study comes to investigate the dynamic relationship between budget deficit, inflation, and interest rate in Jordan for the period span from 1992 to 2015. Through employing more advanced methodologies such as, Johansen Co Integration Test, and Granger Causality Test.Taking into consideration the econometrics analysis and johansen co integration test our study reported for a long-term relationship between budget deficit, inflation, and interest rate. Also according to the VECM model which refers to refers to there is a long run causality running from interest rate and inflation rate toward budget deficit. Also the results report for a short run causality running from inflation rate, and interest rate toward budget deficit. Finally according to the Granger Causality Test confirm only for a single directional causality running inflation rate to budget deficit. This result imply for short-run impact between budget deficit, and inflation. Finally, Granger Causality Test confirms a single directional causality when comparing running inflation rate to budget deficit, and this result implies for short-term impact between budget deficit, and inflation.
Keywords: Budget Deficit, Interest Rate, Inflation Rate, VAR Model, VECM Model.

1. Introduction

Budget deficit is one of the most popular economic problems that faces a lot countries all over the globe, and there are many interpretations for it. Many economists point of views that, budget deficit has deleterious effect on the economy for any country, and occurs when the expected expenditures exceeds the expected revenue. Governments' expenditures include money spending on all projects regardless the goal of these projects such as, transportation, education, defense, and civil administration ..etc. Government revenue, is the money that is obtained from different sources, whether these revenues from taxes or non-taxes. Revenue from taxes can be direct such as, corporations' taxes, contributions of social security, and income tax, or indirect taxes such as, consumption taxes. Another kind of revenues is the non-tax revenue, which involves income from government property, fee, and royalty etc. See (Al-Adayleh et al ,2015; Khumalo, J. 2013).

In order to eliminate the gap between expenditures and revenues, and to finance the deficit in the budget there are more than one source of income are available for countries such as, internal or external resources.

In order to fill up the gap between expenditures and revenues, and to finance the physical deficit in the budget there are more than one type of income that is available for different countries to use countries such as, internal resources such as, selling government securities or external resources such as, loans from international agencies. These ways of financing the deficit are either with cost or no cost arising from using it through interest rate paid against source of financing.

There are two types of financing, (debt with interest and debt with no interest,) which has various implication for any economy. When governments get loans from commercial banks this will increasing the loans demands which will cause in raising the interest rate. This approach will increase the cost of lending thereby will have a negative impact on investment and the economic activities. See (Al-Omar et al ; 2013).

There is controversy among some economists and financial analysts about some financial policies priorities, where the interest of the national economy of calling can increased government spending, which will boost economic growth rates even if it led to increasing budget deficit, and the second group invites to adjust the budget deficit even if it led to failure to achieve the desired economic growth rates.

The first group vision is based on that if Government increased public spending (especially capital expenditure) this will increase economic activity and encourage private sector investment which reflected positively on increasing economic growth rates. therefore this would also lead to an increase local revenue from tax, and thus reduce the budget deficit. This Panel also finds that reducing government spending (especially capitalist), this will reduce investment ventures and negative impact on economic growth.

The second group vision is based on that if Government increased public spending without taking into account the budget deficit, this will be accompanied with many risks, most notably increase the indebtedness reached high levels so close to 90% of GDP this year. also Increased demand on domestic liquidity would lead to a crowding out of the private sector in obtaining funding for investment projects.

regarding for the economic impact of budget deficit, there are three schools of notions Ricardo,

Neoclassical, and Keynesian . the classical school built on the principle of neutrality of the State, non-interference in economic activity, and not to resort to public deficit. The deficit in the budget elevate the total consumption by shifting the taxes to next generations, therefore decreasing the saving, and therefore there is shortage in private capital accumulation. Keynesian school believes in the effectiveness of the public budget, the lack of impartiality of the fiscal policy, and the possibility of create deficit in the budget towards achieving general balance of the national economy. In Accordance to Ricardian thought (Ricardian equivalence), consumption is a function of dynastic resources. Deficit transform the taxes burden to next generations. See (Fatima et al 2012)

Inflation became more common in the contemporary economic phenomena, and inflation rates have varied from year to year and from an era to another, The world economy has experienced since the end of World War II a constant rise in price levels. Inflation is one of the main problems afflicting the world economy at the moment. Many studies have investigate the possibility of a relationship between budget deficit, and the inflation budget. Deficit financing is a major cause of inflation. Budget deficit, interest rate, and inflation have been considered some of the significant factors that effecting on the growth of economy and development in Jordan.

Like other developing countries, Jordan was still depends mainly on foreign aid to finance development projects, since the last century has suffered so far from the economic and political difficulties in terms of declining workers remittances, slipped in Arabic assistance synchronized with the rise in budget deficit , and balance of payments. Jordan suffers from a permanent fiscal deficit from past decades. Where revenues received by the government from various sources are less than total public expenditure on the various aspects of the necessary spending. Since Jordan is a developing country with limited resources this constitutes economic burden especially with regard to infrastructure projects.

The Jordanian economy is still one of the most important markets in the Middle East, where there is a lack of studies that tested the dynamic relationship between budget deficit, inflation, and interest rate. So that this study came to investigate the dynamic relationship between budget deficit, inflation, and interest rate in Jordan for the period span from 1992-2015 through adopting an advanced methodologies; Johansen Co integration test, and Granger Causality Test.

The rest of our paper organized as follows: relevant literature in section two, section three report methodology used followed by empirical results, and finally section five report the conclusion.

2. Literature Review

Many scholars concentrated their efforts to explore the relationship between budget deficit, interest rate, and inflation in different countries whether developing or developed. They found a different results, but the nature of this relationships in the literature still inconclusive. We'll review some of financial literature in the different periods regarding this study variables.

Miller (1983) indicate that the budget deficit will lead to produce inflationary pressure to economy. Shabbir, T and A. Ahmad (1994) found that the deficit of budget has a positively and significantly impact on the rate of inflation and also has an indirect effect on the general price. Also Narayan et al. (2006), Saleh and Harvie. (2005), and Darrat. (2000) reached the same result.

Ghura and Hadjimichael (1996) have proved that there is an inverted relationship between the growth of the economy and the rate of inflation rate . Deficit not only can cause inflation but the next generations will impose burden in term of taxes.

Hondroyiannis and Papapetrou (1997) tested the effect of the deficit on the budget on the inflation rate which is direct or indirect in Greece, and they found for indirect effect between budget deficit and inflation. However, they also found that increasing in inflation will lead to increase in budget deficit.

Cebula (1998) examine the impacts of the budget deficit on the interest rates during the period 1973-1995 for the United States. The result of this study showed that the budget deficit in the United States has a covariant and statistically significant on the interest rate on 10-year bonds, and thus the private capital formation is influenced by interest rate sensitive and accurate way. Onwioduokit, (1999) employ Granger Causality Test to examine the causal relationship between budget deficit and inflation in Nigeria for the period span from 1970 to 1994. He found an evidence that the deficit of budget deficit caused inflation. Kuehlwein and Samalapa (1999) examine the relationship between interest rate and budget deficit in Thailand, and reached the conclusion that the deficit of budget raised real interest rates.

Aisen and Hauner (2008) tested the impact of budget deficits on interest rates for the period 1970-2006, a group of developed and emerging countries amounted to 60 countries. The study concluded that there is a positive and statistically significant impact of budget deficits on interest rate and this effect differs from one country to another and from one time period to another time period. The results also indicated that fiscal policy be more effective when the first budget deficit and debt level low and when the level of financial openness and financial pressure shall. Chimobi and Igwe (2010) employ two advanced methodologies Vector Error Correction (VECM) and e Granger causality to inspect causality between budget deficit, inflation rate , money supply, and growth rate . The result confirm for bilateral causality between inflation and budget deficit.

Ezeabasili and Mojekwu (2011), through employing OLS Two-Stage approach to explore the relationship between deficit of budget and the interest rate. they found that the deficit of budget push the interest rate to upward.Through using Granger causality test and vector error correction model Ndashau (2012) confirm the presence of a causality effect from inflation to budget deficits but not statistically significant.

Bakare et al. (2014) investigates the long term relationship between the deficit of budget , inflation, and money supply in Nigeria for the period 1975 to 2012. they reported for causal relationship between budget deficit and the inflation rate in Nigeria.

Depending on previous literatures review results our contribution for this study became from that our study testing investigate the dynamic relationship between budget deficit, inflation, and interest rate in Jordan which is still one of the most important emerging markets in the Middle East, and employed two advanced methodologies; Johansen Co integration test, and Granger Causality Test.

3. Methodology

Our study used annual time series data for the variables under the study at the macro level, and our test period span from 1992 to 2015. All data taken from Central Bank of Jordan(CBJ).

Following Vuyyuri and Sesahiah (2004) and Georgantopoulos and Tsamis (2011), we adopt Vector Error Model (VECM) as econometric methodology to investigating the dynamic relationship between the variables of our study:

- Budget Deficits (BDF) occurred when the expected government revenues are less than its expenditures .

- interest rate (IR) we adopted weighted average interest rate on loans and advances.

- inflation rate (FR) which measured through annual percentage change in Consumer Price Index (CPI) .Through using the following expression:

$$BDF_t = \oint (IR_t, FR_t) \tag{1}$$

Specifying Vector auto regression (VAR) model as below:

$$LBDF = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} LBDFL_{t-i} + \sum_{i=1}^{k} \alpha_{2i} LIR_{t-i} + \sum_{i=1}^{k} \alpha_{3i} LFR_{t-i} + \varepsilon_{1t} \tag{2}$$

Where LBDF: refer to the natural logarithm of budget deficit, LIR: refer to the natural logarithm of interest rate, and FR: refer to the natural logarithm of inflation rate.

After we made estimation for all the endogenous variables in the mode through Vector Error Correction Model (VECM) we can employed it to perform tests like Granger causality tests over the long and short run.

The estimation of VECM equation is as bellows:

$$\Delta LBDF = \sum_{i=1}^{k} \alpha_{1i} \Delta LBDFL_{t-i} D_{t-i} + \sum_{i=1}^{k} \alpha_{2i} \Delta LIR_{t-i} + \sum_{i=1}^{k} \alpha_{3i} \Delta LFR_{t-i}$$
$$+ \alpha_4 D_t + \beta_1 (\gamma_0 LBDF_{t-i} + \gamma_1 LIR_{t-i} + \gamma_2 LFR_{t-i}) + \varepsilon_{1t} \tag{3}$$

From Equation number 3 they are a vectors of exogenous variables.

4. Empirical Results

Based upon previous literature our research assumes a nested relation among the variables under study, so this research is an attempt to demonstrate this relationship trends and measurement, as well as to determine the nature of the relationship in the long term (whether long or short term).

Firstly we started with the descriptive statistics that reported in table 1.

It has been shown depending on the results Jarque-Bera (JB) test for all variables under study through rejection the null hypotheses of normality, and that was shown through values (Skewness as well Kurtosis).

Table (1) Reports the Descriptive Statistics Results

	BDF	IR	FR
Mean	5.706893	2.276673	1.057192
Median	5.858093	2.227078	1.162662
Maximum	7.508568	2.556452	2.701361
Minimum	2.66026	2.026832	-0.51083
Std. Dev.	1.333685	0.146861	0.746485
Skewness	-0.59457	0.452275	-0.41013
Kurtosis	2.51445	2.275736	3.327717
Jarque-Bera	1.64979	1.342771	0.78023
Probability	0.438281	0.511	0.676979

Stationarity in the time series one of the most important issues in the field of econometrics because in the absence of a stationarity this leads to non-trusty results of the study. So that we moved to investigate the stationarity or unit root tests of every time series under study in order to avoid the spurious regressions. In order to achieve that we employed two tests, the first one Augmented Dickey-Fuller (1979) (ADF), and the second one Phillip Perron (1988) (PP).

Table (2) Report the Results of Unit Root Tests

Variables	ADF Statistics		PP Statistics	
BDF	Level	-1.533	-1.984	
	First Difference	-8.903*	-11.217*	
	Second Difference	-7.280*	-20.306*	
FR	Level	-3.834*	-3.8771*	
	First Difference	-8.001*	-8.1105*	
	Second Difference	-4.995*	-12.634*	
IR	Level	-1.473	-1.0168	
	First Difference	-2.611	-2.634	
	Second Difference	-5.358*	-5.372*	

- * Refer to the 5 % level of significance.

Table,2 point out for the results of two unit root tests ADF, and PP. For all of the time series our results refer for reject the null hypothesis of the unit root tests at level 5% in second differences, thus we can see that all of the variables in this article are stationary and integrated in the level of order 2, I(2) .

Before estimating the VAR we must choose the appropriate lag length, and we chose the lag 1 the appropriate lag depending on the results of five criteria as it presented in table 3: (LR: refer to sequential modified LR test statistic, SC refer to Schwarz information criterion, FPE refer to the Final prediction error, AIC refer to the Akaike information criterion, and HQ refer to the Hannan-Quinn information criterion .

Table (3): Report the Lag-Length Selection through Different Criterion

Lag	Log L	LR	FPE	AIC	SC	HQ
0	-42.48179	NA	0.018964	4.548179	4.697539	4.557336
1	-11.30651	49.88044*	0.002098*	2.330651*	2.928091*	2.447278*
2	1.573038	3.943579	0.002279	2.337054	3.382573	2.541150
3	9.218264	5.351659	0.004630	2.842797	4.336295	3.134262

 * refer to the lag order that selected by criterion

Before analyzing the variables through the VECM model, it require investigation whether the variables under study are co-integrated (long term relationship). So that we employ Johansen co integration test , and the result of this test reported in table 4. The results of trace, and maximum Eigen value tests confirm for there are at least one co integrating equations at 5% level of significance . So that our conclusion report for existence of a long-run relationship between the variables of our study and the variables tied together in the long run each other. Based on this result, there is a need to introduce VECM model for estimation.

Table 4: Reports the Johansen Co integration Test.

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	Critical Value 5%	Prob.*
None *	0.792693	81.63698	29.68	0.0116
At most 1*	0.786525	47.01876	15.41	0.1431
At most 2*	0.447323	13.04558	3.76	0.3119

* denotes for reject the null hypothesis at the level 5%

No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.792693	34.61822	21.13162	0.0004
At most 1 *	0.786525	33.97318	14.26460	0.0000
At most 2 *	0.447323	13.04558	3.841466	0.0003

in order to see if the VAR model we deal with it satisfy diagnostic tests for stability, serial correlations, and basically normality. so that we estimate the VAR model with lag 1 which is the optimal one depending on the pervious criterions. In order to see whether this model has any statistical error we conduct three test serial correlation: LM test, Heteroscedasticity Test, an normality test. The results of three tests that reported in appendix 1 to 3 shown for the residuals of this model has no serial correlation normal distributed, no heteroscedasticity, and normal distributed. That is a good sign for this model.

Depending on the results of VECM model and the target model which reported respectively in table 5, and 6 refers to there is a long run causality running from interest rate and inflation rate toward budget deficit. Also the results report for a short run causality running from inflation rate, and interest rate toward budget deficit. These results reveal that the deficit in the government budget   leads to increasing in the interests rate, and the interpretation of result because the Jordanian Government directed their effort for internal borrowing instead of external borrowing which is became more limited and more expensive.

Table (5) Report the Results of VECM

Co integrating Eq:	CointEq1	CointEq2	
B(-1)	1	0	
F(-1)	0	1	
I(-1)	-86.3097	-0.90681	
	-82.4664	-0.65548	
	(-1.04660)	(-1.38342)	
C	42.84334	0.089272	
Error Correction:	D(B)	D(F)	D(I)
CointEq1	-2.66979	-0.00535	7.00E-05
	-0.3857	-0.00359	-0.00064
	(-6.92187)	(-1.49036)	-0.10965
CointEq2	63.20594	-2.82874	0.009093
	-49.3628	-0.45934	-0.08175
	-1.28044	(-6.15827)	-0.11123
D(B(-1))	0.626869	0.003329	0.00022
	-0.23323	-0.00217	-0.00039
	-2.6878	-1.53386	-0.57062
D(F(-1))	-34.83	0.545897	-0.01072
	-25.6777	-0.23894	-0.04252
	(-1.35643)	-2.28466	(-0.25205)
D(I(-1))	66.55825	-0.19752	-0.36458
	-134.663	-1.25309	-0.223
	-0.49426	(-0.15763)	(-1.63488)
C	79.00128	0.411778	0.014151
	-109.371	-1.01774	-0.18112
	-0.72232	-0.4046	-0.07813

Table (6) Report the Estimation of Target Model Depending on VECM

Dependent Var: D(BDF)
Method: L SS (Gauss-Newton / Marquardt steps)
Date: 08/24/16   Time: 14:45
Sample (adjusted): 3 24
Included observations: 22 after adjustments
D(BDF) = C(1)*(BDF(-1) - 95.1791902613*FR(-1) + 34.3465318387) +
     C(2)*(IR(-1) - 1.1027634841*FR(-1) - 0.0984456053001) + C(3)
     *D(BDF(-1)) + C(4)*D(IR(-1)) + C(5)*D(FR(-1)) + C(6)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2.669785	0.385703	-6.921869	0.0000
C(2)	173.1124	63.45511	2.728108	0.0149
C(3)	0.626869	0.233228	2.687797	0.0162
C(4)	66.55825	134.6627	0.494259	0.6278
C(5)	-34.83000	25.67765	-1.356432	0.1938
C(6)	79.00128	109.3712	0.722323	0.4805

R -sq.	0.906074	Mean dep var	43.23182
Adjusted R-sq.	0.876723	S.D. dependent var	1446.583
S.E. of reg	507.9077	Akaike info criterion	15.52548
Sum squared res	4127524.	Schwarz criterion	15.82303
Log likelihood	-164.7803	Hannan-Quinn criteria.	15.59557
F-stat	30.86954	Durbin-Watson stat	2.446393
Prob(F-stat	0.000000		

Finally in order to examine the causality direction between possible relationship among the variables under study we adopted Granger Causality Test.

Table No. 7 reported the result Granger Causality Test which confirm only for a single directional causality running inflation rate to budget deficit. This result imply for short-run impact between budget deficit, and inflation .

Table (7) Reports the Result of Granger Causality Test

Pairwise Granger Causality Tests			
Date: 08/24/16 Time: 18:04			
Sample: 1 24			
Lags: 1			
Null Hypotheses:	**Obs**	**F-Stat**	**Prob**
FR doesn't Granger Cause BDF	23	4.07174	0.05722
BDF doesn't Granger Cause FR		0.03366	0.85627
IR doesn't Granger Cause BDF	23	0.47519	0.49853
BDF doesn't Granger Cause IR		0.15592	0.69712
IR doesn't Granger Cause FR	23	0.39237	0.53814
FR doesn't Granger Cause IR		0.53687	0.47223

5.   Conclusion and Recommendations

This study gathered the most important economic variables in any country interest rate, inflation and budget deficit. where interest rate and inflation play an important role in monetary policy, and also influencing on the decisions of the whole economy . in another side, the budget deficit which measure the government financial performance. In this study we investigate the dynamic relationship between budget deficit, inflation, and interest rate in Jordan for the period span from 1992-2015 through employing more advanced methodologies Johansen Co integration test, and Granger Causality Test.

Based upon econometrics analysis our study report firstly, according to the Johansen co integration test for existence of a long-run relationship between the variables of our study and the variables tied together in the long run between each other's. Secondly, according to the VECM refers to there is a long run causality running

from interest rate and inflation rate toward budget deficit. Also the results report for a short run causality running from inflation rate, and interest rate toward budget deficit. Finally according to the Granger Causality Test confirm only for a single directional causality running inflation rate to budget deficit. This result imply for short-run impact between budget deficit, and inflation .

Depending on the previous results we recommended the following points to the economic policy makers in our country:

1. Reconsidering the policy of external borrowing, and linking the external loans with productive projects without creating a burden on the national economy.
2. Studying and modifying the sectoral distribution of the government loans and should focusing on the productive sectors rather than services sectors. where continuing in the current policy will increasing the indebtedness problem and will adversely effect on the different economic activities.
3. Studying the possibility of cutting down the budget deficit by trying to reduce public spending and increase Public revenues mainly from direct revenue.

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APPENDICES
Appendix 1: Report Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	0.084499	Prob.		0.774284
Obs*R-squared	0.100972	Prob.		0.750667
Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 08/23/16 Time: 15:39				
Resample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
BDF	-0.00532	0.140041	-0.03796	0.9701
IR	-0.07507	1.287038	-0.05833	0.9541
C	0.199504	3.412466	0.058463	0.954
RESID(-1)	0.067405	0.231883	0.290687	0.7743

Appendix 2: Report Heteroskedasticity Test:

White Heteroskedasticity Test:				
F-statistic	0.941552	Probability		0.478099
Obs*R-squared	4.975665	Probability		0.418857
Test Equation:				
Dependent Variable: RESID^2				
Method: Least Squares				
Date: 08/23/16 Time: 15:43				
Sample: 1 24				
Included observations: 24				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-41.9251	40.76233	-1.02853	0.3173
BDF	4.077979	3.698781	1.10252	0.2848
BDF^2	-0.12408	0.107776	-1.15125	0.2647
BDF*IR	-1.0821	1.206061	-0.89722	0.3814
IR	24.2816	32.48935	0.747371	0.4645
IR^2	-3.44447	6.925462	-0.49736	0.625

Appendix 3 : Report Normality Test.

Series: Residuals	
Sample 1 24	
Observations 24	
Mean	-1.76E-16
Median	0.030908
Maximum	1.640644
Minimum	-1.451420
Std. Dev.	0.717961
Skewness	-0.101863
Kurtosis	3.020585
Jarque-Bera	0.041928
Probability	0.979254