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Does Monetary Policy Affect Economic Growth in Jordan? Evidence from Ordinary Least Square Models

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Abstract

The main objective of this paper is to analyze equilibrium and dynamic causality relationships between monetary policy tools and economic growth in Jordan for the period (1990-2017). For this purpose, it considers the autoregressive distributed lag (ARDL) and vector error correction (VEC) models estimations. The results of ARDL approach show that monetary policy variables (i.e., real interest rate and money supply) have positive impact on economic growth in long-run and short-run except inflation rate. In addition, the results of VECM indicate bidirectional causal relationships between economic growth and monetary policy variables in long-run and short-run.

Keywords: econometrics, Jordan, macroeconomics, monetary

1. Introduction

The aim of this paper is to examine equilibrium and dynamic causality relationships between monetary policy instruments and economic growth in Jordan. However, Jordan is an upper middle income developing kingdom with a population of 9.904 million (World Bank, 2018). Appendices A, B, C, and D show that economic growth rate (gross domestic product (GDP)), real interest rate (IR), money supply (M2), and inflation rate (IFR) registered an annual growth rate of 5%, 8.5%, 9.6%, and -2%, respectively. Recently, the government of Jordan has implemented Jordan economic growth plan 2018-2022 to stabilize the macroeconomic indicators. This will be achieved through a 5% growth rate (USD 1.8 billion of growth per year) in top five contributors sectors to GDP which are finance, government services, transport, manufacturing, and tourism & hospitality (Jordan Economic Growth Plan Report 2018-2022, 2018).

Different studies examined the impact of monetary policy tools on economic growth. The results of some studies confirmed that there is no impact of monetary policy on economic growth (see for example Kamaan, 2014; Monteil et al., 2012; Lashkary & Kashani, 2011; Buigut, 2009). On the other hand, the findings of other studies confirmed that monetary policy is vital for economic growth (i.e., Havi & Enu, 2014; Fasanya et al., 2013; Kareem et al., 2013; Vinayagathasan, 2013; Chaudhry et al., 2012; Coibion, 2011; Amarasekara, 2009; Suleiman et al., 2009; Ali et al., 2008; Rafiq & Mallick, 2008; Khabo & Harmse, 2005).

The efficiency of monetary policy is a key of an energetic financial system. The larger the financial system, the more sensitive interest rate will be in production and cumulative demand. Thus, economic growth stability is based on monetary policy instruments (i.e., IR, M2, and IFR). The leading contribution of this study differs from other studies in Jordan (see for example Obeid & Awad, 2017; Soufan, 2013). That is, in this study, effects of the monetary policy on economic growth are investigated using vector error correction (VEC) and autoregressive distributed lag (ARDL) models. In addition, the hypotheses of equilibrium (long-run and short-run) relationships and dynamic causality analysis between monetary policy variables (i.e., IR, M2, and IFR) and economic growth are examined. In this study, after the introduction, data and empirical model are presented. Following methodology and results estimates, conclusions and policy recommendations are explained.

2. Data and Empirical Model

This paper analyses the equilibrium and dynamic causality relationships between economic growth and monetary policy instruments in Jordan, particularly interest rate, money supply and level of inflation. Due to the availability of data, the range of the analysis will be annual time-series data for the (1990-2017) period, establishing a small sample size of 28 observations. The GDP in local currency unit (i.e., Billions JD) is used to measure economic growth in Jordan.

Interest rate (IR) is a major monetary policy instrument and measured by real interest rate. The money supply is measured by the broad monetary aggregate (M2, Billions JD) as a proxy of the total monetary aggregates available in the Jordan's economy. Inflation rate (IFR) refers to consumer prices (annual %). Data used in this study is taken from the World Bank (2018). The variables are transformed into a natural logarithmic form (i.e., LogGDP, LogIR, LogM2, and LogIFR).

Following the analysis of Akapler and Duhok (2018), the empirical model is formulated as the following:

$$LogGDP_t = \beta_0 + \beta_1 LogIR_t + \beta_2 LogM2_t + \beta_3 LogIFR_t + \varepsilon_t \quad (1)$$

Where, ε_t is the residual term distributed with zero mean and constant variance ($\varepsilon_t \sim N(0, \sigma^2)$). Based on financial and economic theories, the signs of coefficients are expected to be as follows: β_1, $\beta_2 > 0$, and $\beta_3 < 0$ (see, *inter alia*, Friedman, 1970; Mundell, 1963; Fisher, 1930; Keynes, 1930).

3. Methodology and Results Estimates

3.1 Unit Root, Co-integration, and Equilibrium Relationships

This paper employs the ARDL approach proposed by Pesaran et al. (2001) to examine equilibrium relationships between monetary policy variables (i.e., IR, M2, and IFR) and GDP. Before estimating the ARDL approach, it is necessary to test unit root and co-integration. Table 1 shows that the variables are stationary at the first difference (i.e., I(1)). The advantage of the ARDL approach is that it allows the nonlinear relationship among the GDP, the IR, the M2, and the IFR. The model is specified as follows:

$$\begin{aligned}\Delta LogGDP_t = {} & \alpha_0 + \alpha_{1t} LogGDP_{t-1} + \alpha_{2t} LogIR_{t-1} + \alpha_{3t} LogM2_{t-1} + \alpha_{4t} LogIFR_{t-1} \\ & + \sum_{s=1}^{h} \alpha_{5s} \Delta LogGDP_{t-s} + \sum_{s=0}^{h} \alpha_{6s} \Delta LogIR_{t-s} + \sum_{s=0}^{h} \alpha_{7s} \Delta LogM2_{t-s} \\ & + \sum_{s=0}^{h} \alpha_{8s} \Delta LogIFR_{t-s} + \varepsilon_t \end{aligned} \quad (2)$$

Where Δ is a lag operator; α_0 is constant; ε_t is assumed to be $N(0, \sigma^2)$; α_1 α_2 α_3 α_4 are for long-run estimates, while other coefficients: α_5 α_6 α_7 α_8 are for short-run estimates. For ARDL approach, the first step is to test Eq. (2) by ordinary least square. The null hypothesis of no co-integration is H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$ against alternative H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$. The bounds F-statistics test is used to check the existence of co-integration among variables. Critical values for F-statistics test are given by Pesaran and Pesaran (2009). Pesaran et al. (2001) argued that if the calculated F-statistics value is higher than the upper bound, i.e., I(1), then, the H_0 of no co-integration is rejected and concludes the existence of co-integration. If the calculated F-statistics value is below the lower bound, i.e., I(0), then, the H_0 of no co-integration is accepted. Thus, there are no long-run relationships among variables. If the calculated F-statistics value is between I(0) and I(1), then results are unsettled.

The vector autoregressive (VAR) model is used to find lag order that was two through Akaike information criterion and Schwarz Bayesian criterion. Table 2 shows the results of co-integration test. The calculated F-statistics value (5.20) is higher than the upper bound (5.12) at 1% significance level, showing a co-integration between economic growth and monetary policy instruments. The result of co-integration is consistent with result obtained for Nigeria (Sulaiman & Migiro, 2014).

Table 1. Results of Unit Root Test

Variable	t-statistic		Critical-value		
	I(0)	I(1)	1%	5%	10%
$LogGDP_t$	-1.31	-5.10^{*}			
$LogIR_t$	-2.22	-3.25^{***}	-4.20	-3.52	-3.19
$LogM2_t$	-1.71	-3.56^{**}			
$LogIFR_t$	-2.47	-3.36^{***}			

Notes. (1) $^{*, **, ***}$ represent the significance at 1%, 5%, and 10% levels, respectively. (2) The analysis of unit root test is conducted using Augmented Dickey-Fuller test. (3) Source: Author's estimations using E-views software package 9.0.

Table 2. Results of Co-integration Test

Empirical model	Calculated F-statistics value	Tabulated F-statistics values					
		1%		5%		10%	
		I(1)	I(0)	I(1)	I(0)	I(1)	I(0)
$LogGDP_t = f\ (LogIR_t, LogM2_t, LogIFR_t)$.	5.20^{*}	5.12	3.82	4.05	2.85	3.57	2.43

Notes. (1) The tabulated F-statistics values were retrieved from Pesaran and Pesaran (2009, Case II: intercept and no trend, p. 544). (2) * denotes the significance at 1% level. (3) The computed F-statistic value was obtained from Micro−Fit software package 5.1.

Once co-integration is well-known, the next step is to estimate equilibrium relationships between economic growth and monetary policy variables. In Table 3, the long-run and short-run results show that all variables have positive impact on economic growth except inflation rate. These results are similar to the results obtained for Vietnam (Anwar and Nguyen, 2018), Canada (Champagne and Sekkel, 2018), and Turkey (Varlik and Berument, 2017).

Table 3. ARDL Estimation Results

Variable	Coefficient
Constant term	-2.501 (0.596)
Long-run:	
$LogIR_{t-1}$	8.132^{*} (0.009)
$LogM2_{t-1}$	7.506^{**} (0.015)
$LogIFR_{t-1}$	$- 3.546^{***}$ (0.053)
Short-run:	
$\Delta LogIR_{t-1}$	2.126^{**} (0.011)
$\Delta LogM2_{t-1}$	3.461^{**} (0.025)
$\Delta LogIFR_{t-1}$	$- 5.799^{***}$ (0.059)

Notes. (1) P-values in parentheses. (2) $^{*, **, ***}$ represent 1%, 5%, and 10% levels of significance, respectively. (3) Source: Author's estimations using E-views software package 9.0.

Table 4. Results of Diagnostic Tests

Diagnostic tests	Null Hypotheses (H_0)	F-statistics value	Decision
Normality	Error terms aren't N $(0, \sigma^2)$	6.52^{**} (0.022)	Reject H_0
Ramsey reset	Empirical model isn't correctly specified	4.51^{**} (0.034)	Reject H_0
Homoscedasticity	Heteroskedasticity problem	7.76^{*} (0.010)	Reject H_0

Notes. (1) P-values in parentheses. (2) * and ** represent 1% and 5% levels of significance, respectively. (3) Source: Author's estimations using Micro−Fit software package 5.1.

Inflation is a double-edge sword, that it can be beneficial to economic growth but at the same time, it may adversary affect. Thus, it's necessary to follow the strategy of moderation to control inflation in order to have a positive effect on economic growth. The mechanisms used by central bank are money supply and interest rate. That is, money supply is the main economic engine, while interest rate is considered an important tool to motivate investors. Results of diagnostic tests in Table 4 confirm that Eq. (2) is free from heteroskedasticity problem, correctly specified, and residuals are normally distributed.

3.2 The VECM Granger Causality

Once co-integration is confirmed among variables, it is necessary to employ the VECM instead of VAR model. The negative and significant error correction term (Ect) shows long-run causal relationships, while the F-statistics test illustrates the short-run causality. Eq. (2) can be transformed into an error correction model:

$$\begin{bmatrix} \Delta LogGDP_t \\ \Delta LogIR_t \\ \Delta LogM2_t \\ \Delta LogIFR_t \end{bmatrix} = \begin{bmatrix} \alpha_{1t} \\ \alpha_{2t} \\ \alpha_{3t} \\ \alpha_{4t} \end{bmatrix} + \sum_{s=0}^{h} \begin{bmatrix} \delta_{11t} & \delta_{12t} & \delta_{13t} & \delta_{14t} \\ \delta_{21t} & \delta_{22t} & \delta_{23t} & \delta_{24t} \\ \delta_{31t} & \delta_{32t} & \delta_{33t} & \delta_{34t} \\ \delta_{41t} & \delta_{42t} & \delta_{43t} & \delta_{44t} \end{bmatrix} \begin{bmatrix} \Delta LogGDP \\ \Delta LogIR \\ \Delta LogM2 \\ \Delta LogIFR \end{bmatrix}_{t-s} + \begin{bmatrix} \beta_{1t} \\ \beta_{2t} \\ \beta_{3t} \\ \beta_{4t} \end{bmatrix} [Ect]_{t-1} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \varepsilon_{4t} \end{bmatrix} \quad (3)$$

Where α_{it} (i= 1,….. 4) denote the intercept terms; δ_{ijt} (i,j= 1,…… 4) represent the coefficients to test the H_0 of no Granger causality in short-run; β_{it} (i= 1,….. 4) denote the coefficients of (Ect_{t-1})s. These coefficients test the H_0 of no Granger bidirectional causality in long-run. The results of VECM Granger causality analysis are given in Table 5. There are bidirectional causal relationships between economic growth and monetary policy tools in long-run and short-run. These results are same to the results obtained by Srithilat and Sun (2017) for Laos. The highly significance and negative error correction term confirms the co-integration among variables. For the first model (i.e., economic growth), the error correction term is highly significance at 1% level and register -0.80.

Table 5. Results of VECM Granger Causality Analysis

Dependent variables	Sources of causation				
	Short-run				Long-run
	$\Delta LogGDP_t$	$\Delta LogIR_t$	$\Delta LogM2_t$	$\Delta LogIFR_t$	Ect_{t-1}
$\Delta LogGDP_t$	-	5.75^{*} (0.01)	6.65^{*} (0.01)	5.3^{**} (0.02)	-0.80^{*}(.01)
$\Delta LogIR_t$	9.3^{*} (0.01)	-	7.4^{*} (0.01)	5.2^{**} (0.02)	-0.70^{*}(.01)
$\Delta LogM2_t$	8.1^{*} (0.01)	6.3^{*} (0.01)	-	4.4^{**} (0.02)	-0.60^{*}(.01)
$\Delta LogIFR_t$	2.3^{**} (0.03)	4.3^{**} (0.02)	1.3^{**} (0.04)	-	-0.50^{*}(.01)

Notes. (1) P-values in parentheses. (2) * and ** represent 1% and 5% levels of significance, respectively. (3) Source: Author's estimations using E-views software package 9.0.

4. Conclusions and Policy Recommendations

The current paper analyzes equilibrium and dynamic causality relationships between economic growth and monetary policy variables (i.e., real interest rate, money supply, and inflation rate). It employs ARDL and VEC models over the (1990-2017) period. The results show the existence of co-integration between economic growth and monetary policy variables. While the results of ARDL approach show that monetary policy variables have positive impact on economic growth in long-run and short-run except inflation rate. In addition, the results of VECM indicate bidirectional causal relationships between economic growth and monetary policy variables in long-run and short-run. A rising from these findings, this paper recommends the following:

- The growth of the economy should be the topmost consideration when implementing monetary policy. Strong macroeconomic policies (i.e., Jordan economic growth plan 2018-2022) should be followed to stabilize the economy.
- The financial sector in Jordan should be more regulated and supervised by ministry of finance and central bank in order to achieve the efficiency of monetary policies.

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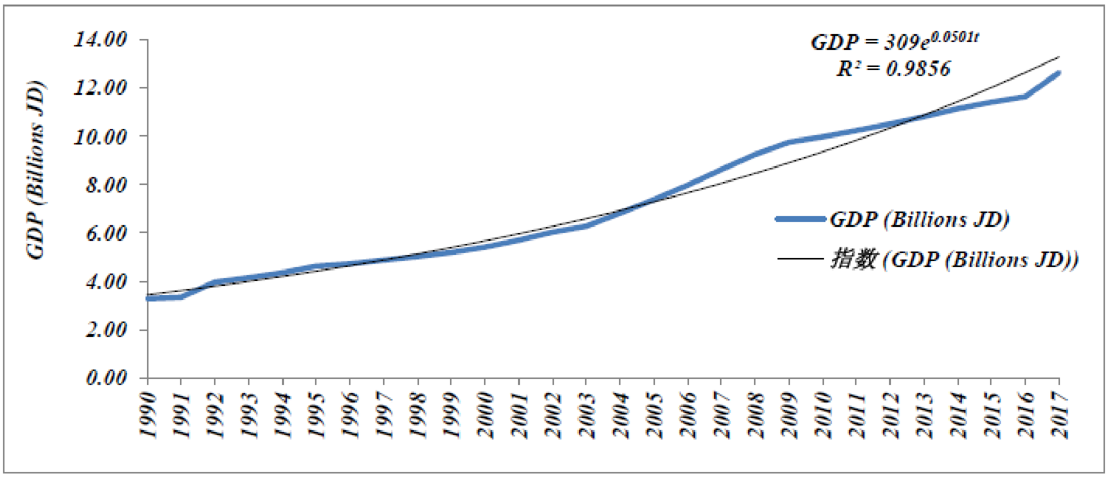
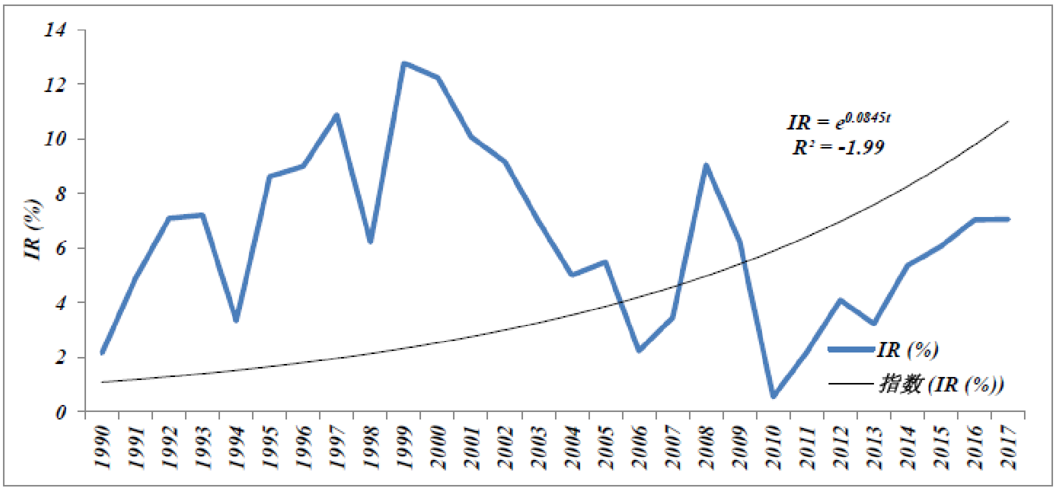
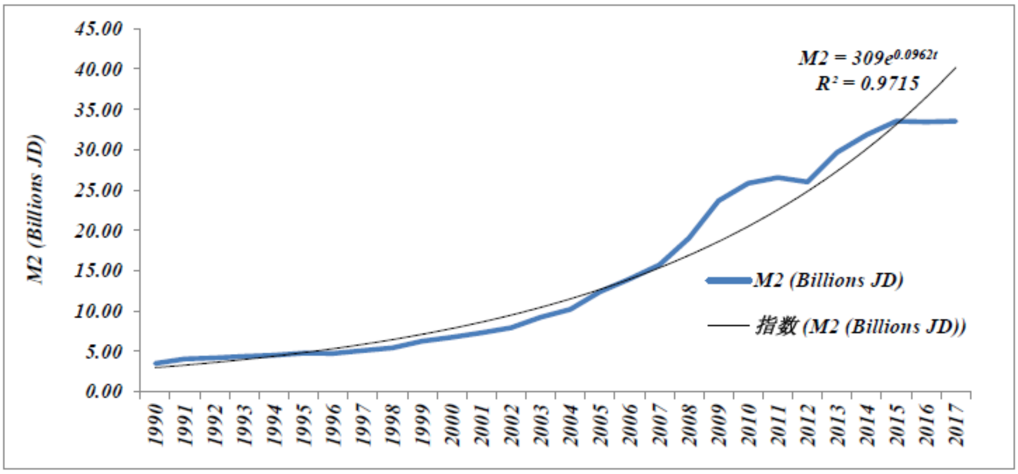
Appendix A. Time Trend of Economic Growth Rate in Jordan over the (1990-2017) period



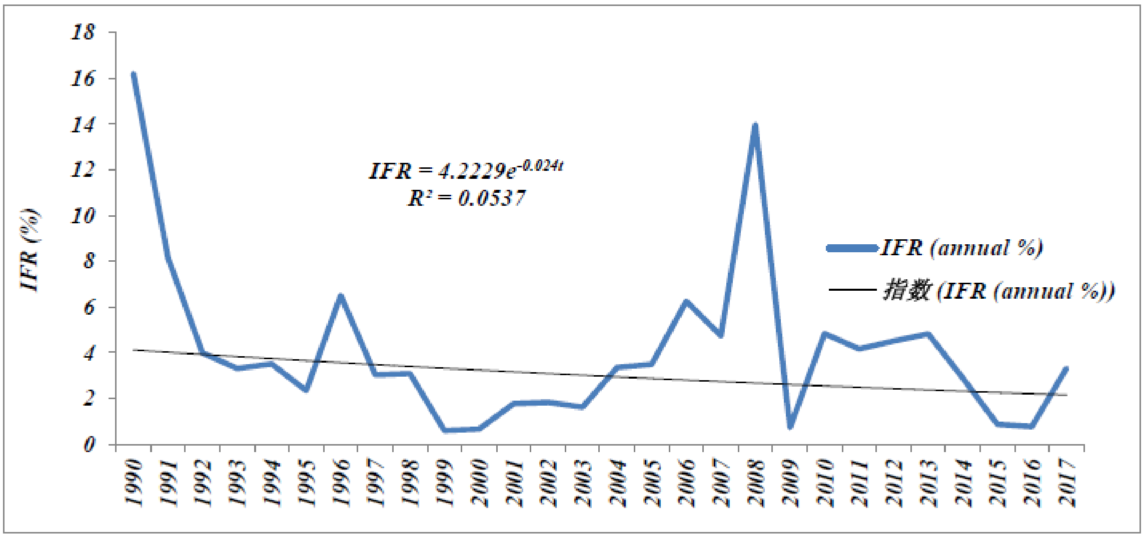
Appendix B. Time Trend of Real Interest Rate in Jordan over the (1990-2017) period



Appendix C. Time Trend of Money Supply in Jordan over the (1990-2017) period



Appendix D. Time Trend of Inflation Rate in Jordan over the (1990-2017) period



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