"The Impact of Interest Rate Movement on Consumption and Output"

Assoc. Prof. Dr. Mohamed Abdelgany
Head of the Economics Department

Faculty of Politics and Economics, Beni-Suef University

Abstract

Interest rate is considered one of the most important tools of monetary policy in Egypt, and it is the most used to maintain price stability and tackle inflation, here we study its effect on consumption and income in an econometric technique. This research is concerned with the study of the impact of interest rate shocks as an indicator of monetary policy on household consumption and Income in Egypt during the period from 1980 to 2018.

The research applies the quantitative analysis approach and uses the econometric model to deduce results and uses a Small Structural Vector Autoregressive Model (SVAR). The research concludes that one standard deviation shock in interest rate shrinks consumption, but this very small and fast decrease is almost insignificant, while income initially increases in response to this positive shock. On the other hand, a negative shock in consumption causes a reduction in interest rate. the research also indicated a mutual relationship between consumption and income.

Key Words: Interest Rate, Consumption, Income, SVAR, Egypt

الملخص

يعتبر سعر الفائدة من أهم أدوات السياسة النقدية في مصر، وهو الأكثر استخدامًا للحفاظ على استقرار الأسعار ومعالجة التضخم، وهنا ندرس تأثيره على الاستهلاك والدخل بطريقة الاقتصاد القياسي. يهتم هذا البحث بدراسة تأثير صدمة أسعار الفائدة كمؤشر للسياسة النقدية على الاستهلاك والدخل في مصر خلال الفترة من ١٩٨٠ إلى ٢٠١٨. يطبق البحث نهج التحليل الكمي، ويستخدم نموذج الاقتصاد القياسي لاستنتاج النتائج، من خلال استخدام نموذج الانحدار لقياس التأثير المتبادل (SVAR). وخلص البحث إلى أن صدمة عند وحدة انحراف معيارية في سعر الفائدة تقلص الاستهلاك، لكن هذا الانخفاض صغير جدًا وسريع تقريبًا، بينما يزداد الدخل في البداية استجابة لهذه الصدمة الإيجابية. ومن ناحية أخرى، تؤدي الصدمة السلبية في الاستهلاك إلى الانخفاض في سعر الفائدة.

الكلمات المفتاحية: سعر الفائدة، الاستهلاك، الدخل، SVAR، مصر.

1. Introduction

Consumption estimates have attracted the attention of many policymakers and researches in Egypt. Since, household final consumption constitutes about three-quarters of output, where it ranges between 60 to 85 % in the period of 1980 to 2018 (world bank database, 2019) and it is believed to have the major influencers to many variables like output, investment, and unemployment. But little attention has been paid to the link between policy decisions and consumption particularly the monetary policy.

The researches in Egypt always concentrated on the impact of monetary policy on investment and output (Shokr, & et al, 2017, and Lemaire, T., 2018), and don't concern with consumption.

Although the household decision whether to consume or to postpone for the future is largely dependent on both the household and the government through the interest rate. Where higher interest rate according to intertemporal substitution theory is anticipated to compressed current consumption for the future. However, the impact of interest rate on private consumption relies on two competing effects which are income and substitution.

The interest rate can modify consumption through three main channels:

a) Wealth Effect emerging from stock and housing market channels where household consumption is affected by house prices and real interest rates. Based on the life-cycle hypothesis, consumers are anticipated to augment their consumption as a result of increase in the wealth (Brumberg and Modigliani 1954, 1980; & Ando and Modigliani, 1963).

b) credit channel where the increase in interest rate induces arise in cost of financing of households;

c) deposit channel since when the central bank raise interest rate, households shift to higher-yield products instead of liquid cash, postponing their current consumption (Agarwal, S. & et al., 202).

So, in this research, we are going to concentrate on the responsiveness of household consumption to shocks in the interest rate that is considered one of the main tools of the monetary policy in Egypt. Especially that it gets urgent to comprehend the monetary policy mechanisms in Egypt.

After central bank decision on November 3, 2016, to liberate the exchange rate, the nominal exchange rate witnessed a quick downgrading from 8.8 to 13 EGP per US Dollar (US$). This deterioration proceeded within the next days and arrived at a worth better than 17 EGP per US$ (IMF, 2017b). At the same time, the government has taken decisions to

significantly reduce energy subsidies. thus, Egypt like any developing country suffers from high inflation rates.

So, central bank decided to conduct contradictory monetary policy by raising the interest rate from 7.85% in 2016 to 12.09 % in 2017, encouraging Egyptian households to increase their deposits that augmented with 15% from 60.418 % of GDP in 2015 to 69.49 % in 2016, reaching 75.557 % in 2017 (Global Financial Development database).

Also, after the Egyptian government attempts in the recent years to make some improvements in the mortgage finance sector by further facilitating of home loan restrictions in 2014, the central bank of Egypt (CBE) re-propelled with interest rate beginning with 7% to the low income and 8% to the middle-income groups.

In 2017, the CBE re-proposed the initiative with a large media campaign and this time, the minister of investment had reported that those changes had prompted an expansion in the percentage of finance contracts by 77% during the first half of 2017 contrasted with the first half of 2016. This means an expansion in the mortgage market in Egypt (Mokhtar, 2018).

At present, researches on the validity of responsiveness of consumption to interest rate shocks in Egypt are scanty (if not totally unavailable).

This paper is sorted out as follows: section ii present literature review and section iii deal with the main data used and the econometric methodology; while section iv and v present and findings and conclusion.

2. Literature review

There are many channels through which the interest rate and the monetary policy affect consumption. Some researches concentrate on wealth effect channels like debt burden channels, like:

- Loukoianova, Wong, & Hussiada, (2019) proved that as the level of household debt burden increases, the vulnerability of household consumption increases but this depends on household past consumption, type of debt, and income.

- Georgarakos & Tatsiramos, (2019) studied how monetary policy affects consumption through debt channel. They proved that mortgagors are the most affected category by monetary authority decisions especially those who have low access to finance and high debt-income ratio. Also, they studied if interest rate affects the level of household financial stress and they find that interest rate inversely affects savers financial stress, unlike mortgagors and renters.

- Lettau, Ludvigson, & Steindel (2002) studied the impact of monetary policy on consumption through the wealth effect. They studied first how a change in the federal fund rate affects asset values and how will that affect consumption and they studied once again the direct effect of interest rate on consumption. They found that change in consumption in both cases is indifferent. This indicates the wealth effect needs a large boom in the asset market to be effective like the 1990s stock market boom. On the other hand, they proved that asset values are affected by inflation.

- Cloyne, Ferreira, & Surico (2020) believed that limited access to liquidity and an increase in income could explain the heterogeneity in households' responsiveness to monetary policy. They also proved that private investment provides some funds to the household to spend.

- Holm, Paul, & Tischbirek (2020) studied how heterogeneity in household's ownership of liquidity can affect their response to monetary policy. The research divided the households in Norway into equal samples according to their liquidity and they proved that households with low liquidity respond controversy to households with high liquidity, where households at the bottom level of the

distribution decrease their consumption, while the latter follow inter-temporal consumption theory.

- Maggio, M., & Ramcharan (2014) Concentrated on the direct effect of monetary policy through income, the research proved that a reduction in interest rate augments consumption even before the interest rate adjustment by a month, along with an increase in MPC.

- Owusu-Sekyere, (2017) studied the cost of credit effect channel in illustrating the impact of monetary policy on consumption using the time-variant VAR model, he found that a rise in interest rate decrease consumption during the inflation targeting period in South Africa. But during the global financial crisis 2008, Consumption increases at a low rate when interest rate increases. Although we can find that this effect is strong in the short run but is dwindling over time.

- The paper of Kapoor & Ravi (2009) studied the effect of interest rate on consumption by studying the impact of Indian government decisions to allow commercial banks to provide more interest on deposits to seniors. The study found that an increase in interest rate by 50 basis points decrease consumption by 12% primarily in nonfood, non-essential items while consumption on essential

goods remain stable. However, this decrease in consumption is decreasing in the long run.

However, some researchers have not found a significant relationship between the interest rate and consumption.

- The researches of Hammed, et al. (2017) and Manasseh, et al. (2018) have found that interest rate cannot justify the changes in consumption in Nigeria where the former found that size of credit provided to the private sector by banks plays a significant role. So, the research recommended that the government should take measures that improve the country's business climate. while the latter found that inflation is important.

At present, researches on the validity of responsiveness of consumption to interest rate shocks in Egypt are scanty (if not totally unavailable).

3. Methodology

3.1. Data and Variables

In this research, we used Egypt`s annual data from 1981 to 2018. All data are collected from the World development bank.

Table No. (1) illustrate the variables name, abbreviation, description, and data resources.

Table No. (1) Variables

Variables	Description	Source
HH Consumption per capita growth	Households and NPISHS Final consumption expenditure per capita growth (annual %)	World Bank: World Development Indicators.
Real interest rate (ri)	Real interest rate (%)	World Bank: World Development Indicators.
Broad money	Broad money growth rate	World Bank: World Development Indicators.
GDP per capita growth (y)	GDP per capita growth	World Bank: World Development Indicators.

3.2. Unit Root Tests

According to Augmented Dickey-Fuller (ADF) and Philips Perron test results for our four variables; all variables under study are stationary at the level, which is Compatible with VAR assumption, as can be seen in table No. (1) in the appendix

3.3. Optimal Lag

In order to determine the optimal lag length, we used information criteria. Most of them (LR: sequentially modified LR test statistic, FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn

information criterion) have the lowest values at 2 lags which means second-order VAR is the favored model.

3.4. Autocorrelation

According to the LM test, we can find that the value of each of the LRE statistics is insignificant which means accepting the null hypothesis (H0), which assumes no serial correlation between residuals at the level of significance 5 %.

3.5. Stability test

The AR roots test ensures the stability of the model when all values lie within the unit circle and all modules less than one. as figure No. (2) shows.

Figure No. (2) shows
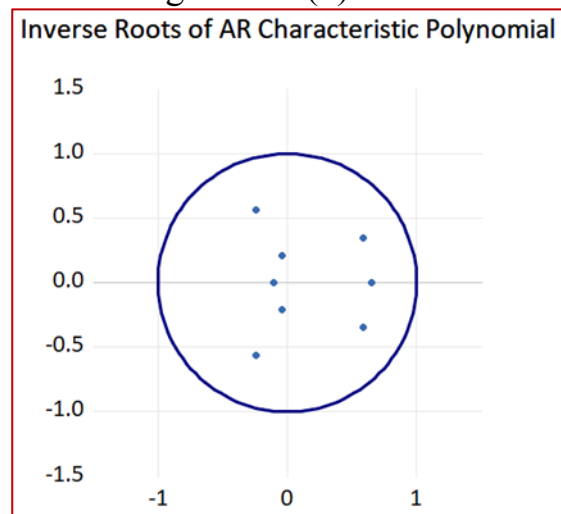
Where the stability of the VAR model guarantees a meaningful clarification to the estimated IRFs and forecast error variance decompositions (FEVD)

3.6. VAR Model

Structural VAR has been widely used by researchers and policymakers in understanding variables response to policy shocks like shock in the interest rate or tax rate (Walsh, 2017)

The researchers focus on SVAR returns to Impulse response function d (.). Equation 1 represents the response of variable (Y) for example output or investment with n observations to economic shocks (ωt) over time (T) to shocks like technology, government policies, etc. Supposing that these shocks follow a normal distribution with zero mean and variance-covariance matrix Σ:

$$Y = d(\omega^t)$$

So, mapping the impulse response function show the optimal behavior of agents in equilibrium under constraints.

The shocks can be divided into:

a) The systematic shocks can be anticipated by rational people, having no impact on the economy (Lucas, 1976) and

b) nonsystematic shocks, which is the core of the study of the SVAR

So, in this research, we are going to use a small structural VAR (SVAR) model to study the unexpected changes in Y_t.

$$A_0 y_t = \gamma_0 - b_1 y_{t-1} + b_2 y_{t-2} + b_3 y_{t-3} + \ldots\ldots\ldots + b_p y_{t-p} + u_t$$

Where y_t is a vector of endogenous variables where $y_t = (C_t, y_t, ir_t, cr_t)$ and γ_0 is a vector of intercepts, b_i is a vector of parameters in 4 equations, A_0 represents the contemporaneous relationships between endogenous variables and u_t Denotes structural innovations imposed on endogenous variables and must be serially uncorrelated and uncorrelated by each other with mean zero and variance covariance matrix I (identity matrix). The coefficients in A_0 and b are the parameters of attention.

If we multiply both sides of the equation by A_0^{-1}, we get the following equation:

$$Y_t = c_0 - \varphi_1 y_{t-1} + \varphi_2 y_{t-2} + \varphi_3 y_{t-3} + \ldots\ldots\ldots + \varphi_p y_{t-p} + \mathcal{E}_t$$

Where: $c_0 = A_0^{-1} \gamma_0$

                 $\Phi_s = A_0^{-1} b_s$ for $s = 1; 2; 3; \cdots; p$

                 $\mathcal{E}_t = A_0^{-1} u_t$

However, the number of parameters in SVAR exceeds sampling information (Gottschalk, 2001).

To identify the sampling information in the data set. We start by computing parameters of unrestricted VAR. The unrestricted VAR can be written as follows:

$$Y_t = \gamma_0 - b_1y_{t-1} + b_2y_{t-2} + b_3y_{t-3} + \ldots\ldots + b_py_{t-p} + \varepsilon_t$$

Where y_t is a vector of endogenous variables where $y_t = (c_t, y_t, ir_t, cr_t)$ and γ_0 is a vector of intercepts, b_i is vector of parameters in 4 equations, ε_t innovations imposed on endogenous variables and must be serially uncorrelated and uncorrelated by each other with mean 0 and variance covariance σ

Then we impose restrictions since the number of known parameters estimated from unrestricted VAR fewer than the number of parameters in SVAR. So, we impose restrictions on matrix A0 (the matrix of the contemporaneous relationships among endogenous variables of the structural model). So, if VAR has m endogenous variables, we are going to impose m (m-1)/2 restrictions in order to study SVAR.

3.7. Structural VAR model for Egypt

In our research , we seek to study the impact of innovations in the interest rate on household consumption by using small structural var model with 4 endogenous variables: Household consumption per capita growth (c), GDP per capita growth (y), real interest rate (ir) and Domestic credit to the private sector by banks (% of GDP) (cr)– where GDP per capita growth is the main explainer to household consumption.

The real interest rate is the main policy instrument used by monetary authorities in developing countries. According to Kimberly Beaton large variations in credit availability affect consumption. Also, credit is one of the outcomes of monetary policy where it also shows the degree of response of the financial sector to changes in monetary policy.

We choose this model to build an impulse response function –which shows the outcome of a one-time shock in one of the Innovations on present and forthcoming values of the endogenous variables- to study the dynamic reaction of consumption to innovation on the interest rate.

The VAR is estimated using constant and 2 lags as specified by FPE: Final prediction error, sequential modified LR test statistic (LR), AIC: Akaike information criterion (AIC), Hannan-Quinn information criterion (HQ).

Regarding restrictions on A_0, since we are not interested in studying the impact of innovations on broad money growth. We are going to sweep out this variable.

Following (Nguyen, Papyrakis, & Van Bergeijk, 2019) and (Lettau, Ludvigson, & Steindel, 2002), we assume that real economy cannot respond instantaneously to developments in the monetary policy. So, we are going to assume that $b_{34} = 0$ and $b_{24} = 0$.

As assumed by (Vinayagathasan, 2013), we assumed that GDP does not respond instantly to innovation in broad money. So, we are going to assume that $b_{21} = 0$.

These 2 assumptions allow us to identify the structural innovations u_t, Where A_0 will take the following form:

$$A_0 = \begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & B_{23} & 0 \\ B_{31} & B_{32} & 1 & 0 \\ B_{41} & B_{42} & B_{43} & 1 \end{vmatrix}$$

3.8. Granger Causality

As shown in Table No. (2), growth in GDP per capita and growth in household consumption does not Granger Cause broad money (M2) and interest rate.

On the contrary broad money (M2) and interest rate, Granger Cause GDP per capita and growth in household consumption and this happened because we reject the null hypothesis that states that interest rate Granger doesn't cause GDP per capita and growth in household consumption.

Table No (2) Granger Causality

Dependent variable: BROAD_MONEY_GROWTH	
Variable	Prob.
GDP_PER_CAPITA_GROWTH	0.8490
HH_GROWTH_PERCAPITA	0.8766
REAL_INTEREST_RATE	0.6906
Dependent variable: GDP_PER_CAPITA_GROWTH	
Variable	Prob.
BROAD_MONEY_GROWTH__ANNU	0.0074
HH_GROWTH_PERCAPITA	0.0006
REAL_INTEREST_RATE	0.0246
Dependent variable: HH_GROWTH_PERCAPITA	
Variable	Prob.
BROAD_MONEY_GROWTH__ANNU	0.0082

GDP_PER_CAPITA_GROWTH	0.0000
REAL_INTEREST_RATE	0.0026
Dependent variable: REAL_INTEREST_RATE	
Variable	Prob.
BROAD_MONEY_GROWTH__ANNU	0.0781
GDP_PER_CAPITA_GROWTH	0.2370
HH_GROWTH_PERCAPITA	0.1235

3.9. Robustness analysis

We also checked additional specifications of the VAR system studied above to check the robustness of our results.

We conducted our experiments using the inflation rate instead of growth in broad money. Nothing of our main deductions is different.

4. Findings

The following graphs show the impulse response of the variables: Household consumption per capita growth (c), GDP per capita growth (y) and real interest rate (ir) to one standard deviation shock in each of the variables.

The interest rate shock is transitory where we can find that:

- ▪ As we see in **Figure No. (3)**, income initially increases in response to positive shock at an interest rate until it reaches peak which means that there are a GDP per capita growth rate increases at first

as a result of contradictory monetary policy. But after a year and half the former declines and then this effect is repeated but at a lower degree until it vanishes after 6 years, but the overall effect is positive.

Figure No. (3) GDP per capita growth to real interest rate

Response of GDP_PER_CAPITA_GROWTH to REAL_INTEREST_RATE
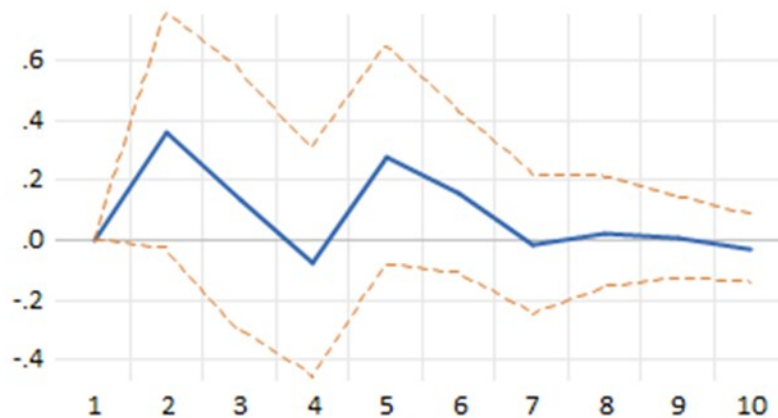
Consumption decreases in response to positive shock in the real interest rates. But this effect is temporary, where it only lasts for 3 years until it begins to die out.

Figure No. (4) depicts consumption behavior in response to the positive shock to interest rate.

Figure No. (4) household consumption growth per capita to real interest

Response of HH_GROWTH_PERCAPITA to REAL_INTEREST_RATE
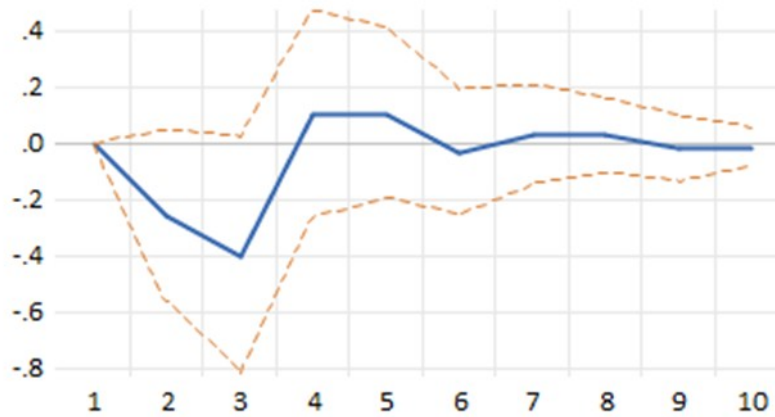
We can find that there is a mutual relationship between consumption and income

- Where consumption is affected positively by shock on GDP per capita for 3.5 years until it dies out.

Figure No. (5) depicts consumption behavior in response by shock on GDP per capita.

- Also, income increases at first due to positive shock in consumption until it reached a peak after about 2 years then it started to decrease until it stabilizes.

Figure No. (6) depicts income behavior in response by shock on positive shock in consumption.

Figure No. (5) household consumption growth per capita to GDP per capita to

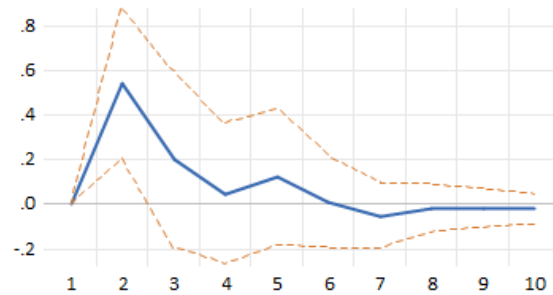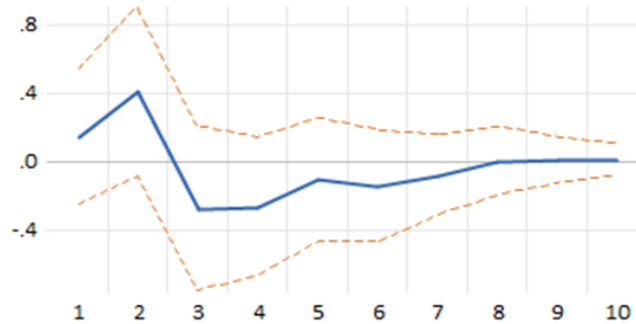Response of HH_GROWTH_PERCAPITA to GDP_PER_CAPITA_GROWTH

Figure No. (6) GDP per capita growth to household consumption growth per capita

Response of GDP_PER_CAPITA_GROWTH to HH_GROWTH_PERCAPITA

- Finally, the **figure No. (7) and Figure No. (8)** demonstrate that innovation in consumption affects real interest rates negatively but

in a decreasing manner unlike income whose effect on interest rate is positive but the income shock on interest rate is temporary for 2 years only and small that innovation in consumption affects real interest rates negatively but in a decreasing manner unlike income whose effect on interest rate is positive but the income shock on interest rate is temporary for 2 years only and small.

Figure No. (7) real interest to household consumption growth per capita

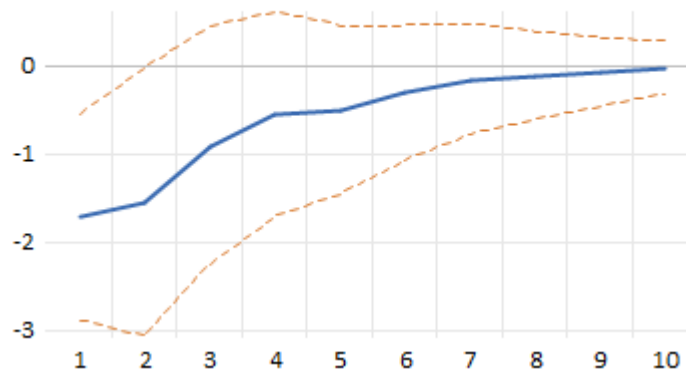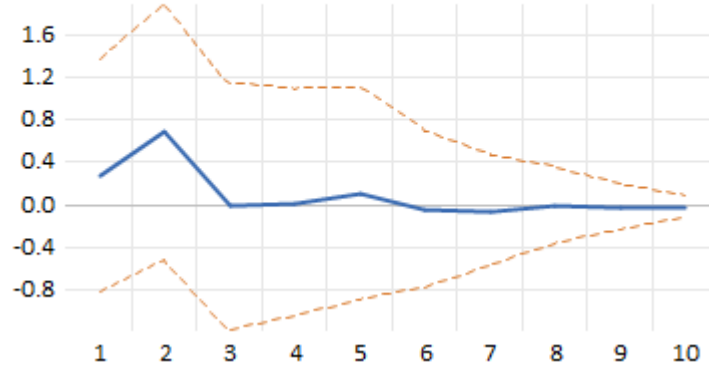Response of REAL_INTEREST_RATE to HH_GROWTH_PERCAPITA

Figure No. (8) real interest to GDP per capita growth

Response of REAL_INTEREST_RATE to GDP_PER_CAPITA_GROWTH

5. Conclusion

The research concludes that one standard deviation shock in interest rate shrinks consumption, but this very small and fast decrease is almost insignificant, while income initially increases in response to this positive shock. On the other hand, a negative shock in consumption causes a reduction in interest rate. the research also indicated a mutual relationship between consumption and income.

In other words, we can conclude that the interest rate is a driver for growth in the short run as proved by many researchers. Although the increase in interest rate does not negatively affect investment only but also consumption.

So, policymakers should put the impact of interest rate on consumption in their consideration during the process of policymaking. Also, we proved that consumption affects interest rates in the short run as consumption is inversely related to savings and so the number of deposits in the banks (supply of funds).

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Appendix

Table No. (1): Unit root tests

Test		GDP per capita growth		HH_consumption per capita		Real interest rate		Broad money growth	
		Trend	No trend	Trend	No trend	Trend	No trend	Trend	No trend
Augmented dickey fuller	T- statistics	-3.0937	-3.097	-4.1873	-4.5379	-5.2463	-5.2734	-3.571322	-3.623
	Probability	0.1234	0.0360	0.0110	0.0008	0.0007	0.0001	0.0464	0.0099
Philips perron	T-statistics	-3.8765	-3.724	-4.1873	-4.57233	-5.56669	-5.5572	-3.471559	-3.5222
	Probability	0.023	0.0077	0.0110	0.0008	0.0003	0.0000	0.0575	0.0128