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Money, Income, and Prices in Saudi Arabia

By Mohamed Abdel Rahman Salih
Taibah University, Saudi Arabia

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Strictly as per the compliance and regulations of:

Money, Income, and Prices in Saudi Arabia

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I. Introduction

The relationship between income, money and prices has been a subject of controversy between economists for a long time. Specifically, the role of money in determining income and prices has been debated extensively. The Monetarists claim that money plays an active role in determining income and prices. In terms of causality, this indicates that both income and prices are mainly caused by changes in the stock of money supply. In other words, there is a unidirectional relationship running from money supply to income and a unidirectional relationship running from money supply to prices.

Keynesians, on the other hand, held the view that money does not play an active role in determining income and prices. According to them changes in the stock of money supply affects the interest rate and hence investment and consumption. That is to say, changes in the stock of money supply, affects income only indirectly. On the other hand, contrary to the Monetarists' view, changes in income cause changes in the stock of money supply through changes in the demand for money, given sticky interest rates. This indicates a unidirectional relationship running from income to money supply. Similarly, according to the Keynesians, prices are determined by the demand and supply forces.

Despite this clear disagreement, it is very critical to understand the relationship between income, money and prices in an economy. Understanding this relationship is important, especially to the public policymakers, in conducting effective stabilization policies. Due to this, a large body of literature in economics deals with income, money, and prices. In particular, the causal relationships between money and income and between money and prices have been an active area of research in economics particularly after the influential paper by Sims (1972). Based on Granger causality, Sims develops a test of causality and applies it to data from the United States to examine the causal relationship between money and income. He finds evidence of unidirectional causality from money to income supporting the Monetarists' claim.

While there is a large amount of empirical literature on the long run relationships between income, money, and prices; there is moderate done work in the context of developing economies. Among the studies pertaining to developing countries are the works of Ahmed and Suliman (1999), Abbas (1991), Khan and Siddiqui (1990), and Joshi and Joshi (1985). Ahmed and Suliman using time series data from Sudan find unidirectional causations running from income to prices and from money to prices. Their study does not find any causal relationship between income and money supply. Abbas (1991) using causality test between money and income for Asian countries finds bidirectional causality in Pakistan, Malaysia and Thailand. Khan and Siddiqui (1990) find unidirectional causality from income to money and bidirectional between money and prices in Pakistan. In terms of Saudi Arabia, not much work has been done to establish the long-run relationship between the three macroeconomic variables income, money, and prices. Among the few works that have been done in the context of Saudi Arabia are the works by Al-Bazai (1999) and Al-Jarrah (1996). Al-Bazai (1999) using interpolated quarterly data for the period 1971.1 to 1995.4 examines the relationship between income (log of non-oil GDP), money (log of M1), and prices (log of CPI). The monthly data in this paper is interpolated from annual data. He finds bidirectional relationship between income and money. He also finds a unidirectional causation running from money to prices and a unidirectional causation running from income to prices. He research uses the vector autoregressive (VAR) model. Al-Jarrah (1996) uses annual time series data to study the relationship between income (Real GDP), and prices. He finds unidirectional causations running from income to money, from money to prices, and from income to prices. He employs the methodology of cointegration and causality.

The present work deviates from both Al-Bazai (1999) and Al-Jarrah (1996) in three different ways. First, we conduct the unit root test with structural breaks.

Author : Department of Finance and Economics, College of Business Administration, Taibah University P. O. Box 344, Medina, Saudi Arabia. E-mail : msalih@taibahu.edu.sa

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Indeed, this is primary reason that motivated me to work on this paper. Second, we use a broader definition of money supply (M3). Third, we conduct both bivariate and trivariate VAR models to reach a definite answer on the question of the relationship between the three variables.

There are two policy tools available to macroeconomic policy makers, namely fiscal policy and monetary policy. Understanding the effect of changes in money supply on income and prices is of critical importance as to which tool is appropriate. In particular, if changes in money supply cause changes in prices, then monetary policy can be used as a policy tool to stabilize the general price movements. The Saudi Arabian Monetary Agency (SAMA) plays an important role in the Saudi Arabia economy. As such, understanding the relationship between money supply and prices and as well money supply and income is of critical importance to SAMA as well as the fiscal policy authorities in the country.

The primary objective of this paper is to study the relationships between income, money, and prices in the context of Saudi Arabia for the period 1968-2011. In particular, the causal relationship between money and income and between money and prices is investigated. The remainder of the paper is organized as follows. Section 2 describes the methodology employed. Section 3 presents the data used, the results obtained, and the discussion of the findings. Section 4 wraps the paper up with summary and conclusion.

II. Methodology

In time series analysis, the properties of standard estimation and testing techniques depend crucially on the assumption that the variables under consideration are stationary. Regression analysis conducted on non-stationary series can produce misleading results. This is referred to as "spurious regression" by Granger and Newbold (1974). Indeed, they maintain that spurious regression "produces statistically significant results between series that contain a trend and otherwise random". Phillips (1986) shows that when the series are not stationary, the ordinary least squares (OLS) estimator is not consistent and the t and F statistics do not follow the known standard distributions. Given the mean and variance of a series are constant over time, then the series is said to be stationary i.e. no unit root. If the series is non-stationary, differencing techniques are normally used to transform a series from non-stationary to stationary. In most cases, the first difference of the series will be stationary. A series could be stationary could be stationary in levels, with or without intercept and/or trend If a series is stationary without the process of differencing, it is denoted by I(0), or integrated of order 0. On the other hand, if a series is stationary after the first difference, it is denoted by I(1), or integrated of order 1. In general, if a series is stationary after thep^{th} differencing, then it is denoted by I(p), or integrated of order . In what follows, we briefly discuss the unit root tests that will be used in this paper. Obviously, the results of these tests will dictate whether a cointegration test is needed or not. If all the series are stationary in levels, then there is no need to proceed with the cointegration test. Furthermore, if the series are not cointegrated, then it is appropriate to use the vector autoregressive (VAR) model as opposed to the error correction model (ECM). The ECM requires the series to be of the same order of integration and requires cointegrating relationship(s) to exist.

a) *Unit Root Tests*

Several methods are proposed in the literature to test for unit roots. These include, but not limited to, Dickey-Fuller (DF) test, Augmented Dickey-Fuller (ADF) test, and Phillips-Perron (PP) test. These are standard tests that do not allow for the presence of structural breaks in the data.

i. *The ADF Test*

The ADF and PP test sare used to test the stationarity of a series. In equations (1) and (2) below the series of interest is y. The symbol Δ indicates the first difference of the series y, and t in equation (2) is a time trend.

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{i=1}^{k} c_{1i}\, \Delta y_{t-i} + e_t \tag{1}$$

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^{k} c_{1i}\, \Delta x_{t-i} + e_t \tag{2}$$

For the ADF test, the null hypothesis is $\gamma = 0$ and the alternative hypothesis $\gamma < 0$. Rejection of the null hypothesis is an indication that the series y is stationary. In equation (1) the alternative hypothesis indicates the series is a mean-stationary and in equation (2) it indicates the series is a trend-stationary. The lagged dependent variables are included in the original DF test to make sure e_t is white noise.

ii. *The PP Test*

The PP unit root test is an extension of the DF test. This test corrects for any serial correlation and heteroskedasticity in the error term of the DF test. The PP test estimates the following equations. Equation 3 includes a constant and equation 4 includes a constant and a trend.

$$y_t = \alpha + \gamma y_{t-1} + u_t \qquad (3)$$

$$y_t = \alpha + \beta t + \gamma y_{t-1} + u_t \qquad (4)$$

Apart from correcting any serial correlation or heteroskedasticity that might be present in the error term of the DF test; the PP test has another advantage. That is, we do not need to specify the length of the lag in the PP test.

iii. *Unit Root Tests with Structural Breaks*

The DF, ADF, and PPtests have been criticized due to the fact thatthey do not allow for the presence of structural breaks. It is possible for these tests to reject the unit root hypothesis if the series have structural breaks. Perron (1989) shows that failing to allow for an existing break, leads to a bias that reduces the ability to reject the unit root hypothesis, which is otherwise false. In other words, there is a possibility to commit Type II error. Several authors have proposed to overcome this problem by endogenously determining the breaks. See e.g. Zivot and Andrews (1992), Perron and Vogelsang (1992), Perron (1997), Lumsdaine and Papell (1997), Clements et al (1998), and Lee and Strazicich (2003).

In this paper we pursue the Perron's test since this test is readily available in statistical packages such as Eviews.The Perron's unit root test includes both the time trend (t) and the time at which structural change occurs (DT^b). He specifies what he refers to as the "Innovational Outlier" 1 and 2 and "Additive Outlier" Models. These models are shown, respectively, in equations (5) - (7) below.

$$y_t = \mu + \gamma y_{t-1} + \beta t + \delta DU_t + \alpha DT_t^b + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_{1t} \qquad (5)$$

$$y_t = \mu + \gamma y_{t-1} + \beta t + \delta DU_t + \Theta DT_t + \alpha DT_t^b + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_{2t} \qquad (6)$$

$$y_t = \mu + \beta t + \Theta DT_t + \breve{y}_t + e_{3t} \qquad (7)$$

$$\text{Where} \quad \breve{y}_t = \gamma \breve{y}_{t-1} + \sum_{i=1}^{k} c_i \Delta \breve{y}_{t-i}.$$

Again, as is the case with the ADF test, the null hypothesis in the above three models (5)-(7) is $\gamma = 0$ and the alternative hypothesis $\gamma < 0$. Rejection of the null hypothesis indicates the series is stationary with one structural break present in the data. The break date is endogenously determined.

Recently, alternative test methods have been proposed for unit root test allowing for multiple structural breaks in the data series, see e.g. Lumsdaine and Papell (1997) and Bai and Perron (2003). In order to substantiate the results of Perron's unit root test of one structural break point, we also supplement the results with the Bai and Perron test and identify the number of break points in the data.

As will see later in this paper, the three series are drift and/or trend stationary at their levels. As a result of this, we proceed with the VAR model that is briefly described in the next section.

b) The VAR Models

Once we have verified that the series are not cointegrated and have the same order of integration, we can proceed with the VAR model. Let the three series under consideration be denoted by y_t, m_t and p_t then the trivariate VAR models of the following form can be specified:

$$\boldsymbol{z_t} = \alpha_0 + \alpha_1 \mathrm{t} + \sum_{i=1}^{k} \boldsymbol{\beta}_i \, \boldsymbol{z}_{t-i} + e_t \qquad (8)$$

Where $z_t = (y_t, m_t, p_t)'$ is a vector of the three endogenous variables income, money, and prices, respectively. Needless to mention that the specifications of the bivariate VAR models are similar to the trivariate models except that we have two variables instead. The length of lags k should be appropriately chosen by one of the known criteria of selecting the number of lags. The VAR models can be viewed as reduced form equations in which each endogenous variable is a function of its own past values and the past values of the other endogenous variables in the system. It is worth mentioning here that these models do not allow one to make statements about the causal relationships between the endogenous variables. Even though, after estimation of the models, one can see which coefficients are significant and which ones are statistically insignificant. Therefore, it is essential to conduct causality tests separately. This is the topic of the next section.

c) Granger Causality and Block Exogeneity test

Granger Causality test is a test of whether one time series contributes to the prediction of another time series. The test is based on comparing the mean squared error of the model with and without the variable on the right hand side.

The block exogeneity test is based on the significance of the estimated coefficients. For instance, Y is block exogenous to X and Z if the estimated coefficients associated with Y are significant in X and Z equations. On the other hand, the set of the series Y and X is block exogenous to Z if the estimated coefficients associated with Y and X are significant in the Z equation.

d) Impulse Response and Variance Decomposition

The impulse response functions show the effects,over time,of an exogenous shock to the endogenous variables in the VAR model. In fact, these impulse response functions provide a means to analyze the dynamic behavior of the target variable due to an exogenous shock in the policy variable(s). In other words, the impulse response functions trace the reaction of all the variables in the VAR system to shocks in one of the variables. Following Koop, et al (1996) and Pesaran and Shin (1998), we denote the known history of the economy up to time t-1 by the non-decreasing information set I_{t-1}. Then the generalized impulse response function of z_t at horizon h is defined as follows:

$$\mathrm{GI}(\mathrm{h}, \delta, I_{t-1}) = \mathrm{E}[z_{t+h}|e_t=\delta, I_{t-1}] - \mathrm{E}[z_{t+h}|I_{t-1}] \tag{9}$$

Where δ is the one time exogenous shock. Equation (9) says that the impulse response function equals the expected value of current and future values of an endogenous variable given the shock and past information minus the expected value of the endogenous variable given past information. In essence, it is the effect of the shock on the current and future values of the endogenous variable.

An alternative approach to the impulse response is the variance decomposition, which shows the dynamic structure of the VAR model. The variance decomposition can be viewed as showing the portion of variance in the prediction of each endogenous variable in the system that is due to its own innovations and to shocks to the rest of the endogenous variables in the system.Unlike the impulse response, the variance decomposition seeks to achieve information about the forecasting ability of the VAR model.

III. Data, Results, and Discussion

In this section the data used is described and the results obtained are presented. We also provide a brief discussion of the findings obtained in the results section. The results obtained are generated using the Eviews software.

a) Data

Data on the money supply (M3), the non-oil gross domestic product (GDP) and the consumer price index (CPI) are obtained from the 48th annual report of SAMA. The money supply and the non-oil GDPare measured in millions of Saudi Arabian riyals.The base year for CPI is 1999. We take the natural logarithm of all three variables i.e. non-oil GDP, M3 and CPI and use them in the analysis. We take this step to minimize any serial correlation that might present in the error terms. In the subsequent sections, we denote these three variables by Y, M, and P, respectively.

b) Results

In this section we display the results of the various tests conducted. Whenever possible, each test uses at least two different methods in order to reach a definite conclusion.

i. *Unit Root Tests*

The results of the three unit root tests considered in the methodology section are shown below. Table 1 displays the results of the ADF and PP tests. Both tests consistently indicate that the three series are second difference stationary. That is to say, they are integrated of order 2. The results also suggest that income and money are drift and trend stationary in their levels per the AFD test. However, this is not the case with the PP test. As we have indicated above, these standard tests may produce misleading results when there are structural breaks in the data. As a result, we will delay making a conclusion on stationarity until the tests of unit roots with structural breaks are presented.

Table 1 : The ADF and PP Tests

	ADF		PP	
Variable	Intercept	Intercept & Trend	Intercept	Intercept & Trend
Y-Level	-2.6305	-3.7227*	-2.6708	-1.8855
Y-1St Difference	-1.6661	-1.8465	-1.6661	-1.8465
Y-2nd Difference	-4.3493**	-4.2920**	-4.2137**	-4.1501*
M-Level	-3.0119*	-6.2997**	-2.7306	-1.9992
M-1st Difference	-2.1338	-2.2357	-2.3149	-2.4269
M-2nd Difference	-6.6522**	-6.5600**	-6.6541**	-6.5607**
P-Level	-2.8275	-3.4331	-2.4375	-2.0277
P-1st Difference	-2.1338	-2.2357	-2.3149	-2.4269
P-2nd Difference	-4.8410**	-4.7778**	-4.7513**	-4.6302**

(**) and (*) indicate significant at the level of significance 1% or lower and 5% or lower.

To have an idea how the trends of the three variables look like graphically, we display Chart 0 for this purpose. It can be clearly seen from the Chart that the second difference appears to be stationary for all three variables. It is also interesting to note that the three variables move together over time. The level and first difference of the three variables indicate spikes around 1975. This appears to be the effect of the oil prices shock of 1973.

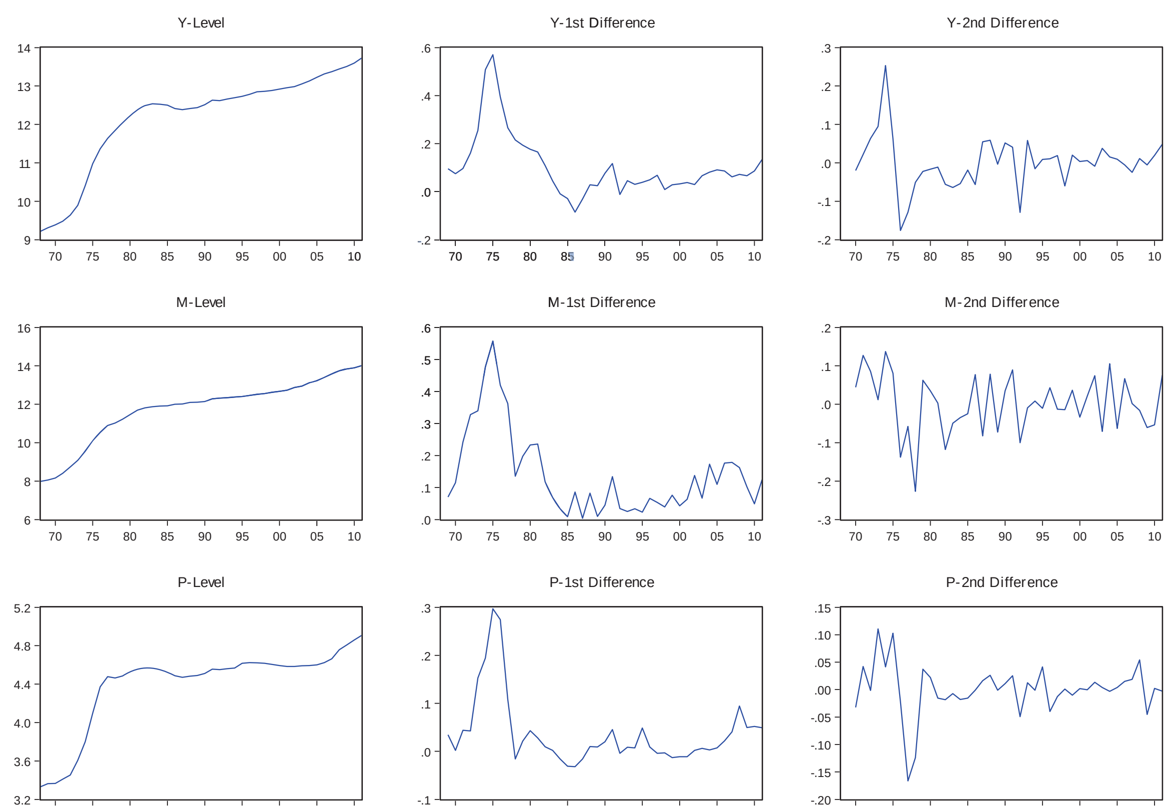

Chart 0 : Y, M, and P in levels, 1stdifferences, and 2nddifferences

Table 2 shows the results of the Perron's unit root test with one endogenous structural break. We note that when a drift, a trend, or both are included, all the three variables are stationary in their levels. Notice that both Y and M are drift or drift and trend stationary with the presence of a structural break. However, P is only drift and trend stationary with the presence of a structural break. The results also suggest that the three series are stationary in second difference. However, we disregard the second difference stationarity result as being over-differencing. There is a consensus among econometricians that with the situation of over-differencing, the autoregressive representation does not exist and hence a VAR would be misspecified. Therefore, it is essential to make sure the stationarity of the series is looked at very carefully.

Table 2 : Perron's Unit Root Test with One Endogenous Structural Break

		Intercept		Trend		Both
Variable	TB	t-Statistic	TB	t-Statistic	TB	t-Statistic
Y-Level	1991	-6.2925**	2005	-3.831	1994	-6.0677*
Y-1^{St} Difference	1992	-4.6590	1981	-3.1495	1983	-4.5349
Y-2^{nd} Difference	1974	-7.0573**	1978	-5.2523	1974	-7.0655*
M-Level	2003	-7.6784**	2004	-4.1667	2003	-7.7101**
M-1^{st} Difference	1977	-4.3633	1989	-3.8843	1977	-4.2757
M-2^{nd} Difference	1975	-9.0500**	1978	-8.6465**	1978	-9.7744**
P-Level	1979	-4.9176	1980	-4.7317	1979	-6.3941**
P-1^{st} Difference	1976	-3.8251	1986	-2.8899	1976	-8.0472*
P-2^{nd} Difference	1977	-6.9456**	1978	-5.5719**	1977	-6.2918**

(**) and (*) indicate significant at the level of significance 1% or lower and 5% or lower.

We have also conducted the Bai-Perron unit root test with multiple structural breaks. When using levels, the test suggests that there are four break points in Y, four break points in M, and three break points in P.

ii. *VAR models and Granger Causality and Block Exogeneity Tests*

In order to make sure the conclusions reached at are consistent and definite, we estimate both bivariate and trivariate VAR models. We also report the Granger Causality and Block Exogeneity tests based on these models. Table 3 below shows the results of the bivariate VAR models.The length of lags was determined on the Schwarz Information criterion. In the first set of equations Y and M, we observe that the estimated coefficients associated with the lagged values of Y in both equations are significant. The coefficients of the lagged values of M are significant in M equation. In the second set of equations Y and P, again the estimated coefficients associated with lagged values of Y are significant in both equations. While the estimated coefficients associated with lagged values of P are significant in P equation, they fail to be significant in the Y equation. In the last set of equations M and P, the lagged values of M affects both M and P. However, the estimated coefficients of the lagged values of P fail to be significant in the M equation.

Table 3 : Bivariate VAR Models

		Intercept		Trend		Both
Variable	TB	t-Statistic	TB	t-Statistic	TB	t-Statistic
Y-Level	1991	-6.2925**	2005	-3.831	1994	-6.0677*
Y-1^{St} Difference	1992	-4.6590	1981	-3.1495	1983	-4.5349
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P-2^{nd} Difference	1977	-6.9456**	1978	-5.5719**	1977	-6.2918**

(**) and (*) indicate significant at the level of significance 1% or lower and 5% or lower.

While it is possible to detect of the relationships between the three variables from the results of the above Table, it is essential to conduct the Granger causality and Block Exogeneity test. Table 7 reports the results of this test. It is seen from the results of the test that M Granger causes Y, Y Granger causes M, Y Granger causes P, and M Granger causes P. The p-values those are greater than are 0.05 are considered insignificant in this paper.

Table 4 : Bivariate VAR: Granger Causality/Block Exogeneity Test

Null Hypothesis	df	Chi-Square Statistic	P-value
Y does not Granger cause M	2	06.8740	0.0322
M does not Granger cause Y	2	09.6510	0.0080
Y does not Granger cause P	2	22.1906	0.0000

P does not Granger Cause Y	2	00.0647	0.9668
M does not Granger Cause p	2	14.9069	0.0006
P does not Granger Cause M	2	01.5044	0.4713

We next turn to the trivariate VAR models, Granger causality, and Block Exogeneity test. Table 8 reports the results of the trivariate VAR models. The lagged values of Y are significant in all three equations. In the income equation, the money lagged one period is significant. In the money equation, money lagged one period is significant and price lagged one period is just significant at the 10% level. In the price equation, price lagged one period is quite significant.

Table 5 : Trivariate VAR Models

	Y_t	M_t	P_t
Y_{t-1}	1.5400 (7.35)	0.6721 (2.91)	0.4196 (3.85)
Y_{t-1}	-1.0262 (-5.14)	-0.6666 (-3.02)	-0.5123 (-4.93)
M_{t-1}	0.3431 (2.02)	1.2910 (6.90)	0.0914 (1.04)
M_{t-2}	0.0153 (0.09)	-0.2204 (-1.17)	0.1257 (1.42)
P_{t-1}	-0.4500 (-1.57)	-0.5103 (-1.61)	0.8187 (5.48)
P_{t-1}	0.5642 (1.90)	0.1587 (0.48)	-0.2015 (-1.30)
C	1.3365 (4.66)	0.7301 (2.30)	0.4325 (2.90)
T	-0.0044 (-1.20)	-0.0013 (-0.31)	-0.0075 (-3.95)
Adjusted R^2	0.998	0.998	0.995

Figures in parentheses are the t-statistics values.

Table 6 shows the results of Granger causality and Block Exogeneity test. Looking at the p-values, it is clear that P does not Granger cause Y and P does not Granger cause M. In the rest of the results, the null hypothesis is rejected at 1% level of significance or lower. That is to say, Y Granger causes M, M Granger causes Y, Y Granger causes P, and M Granger causes P. These findings coincide with the results obtained from the bivariate VAR models.

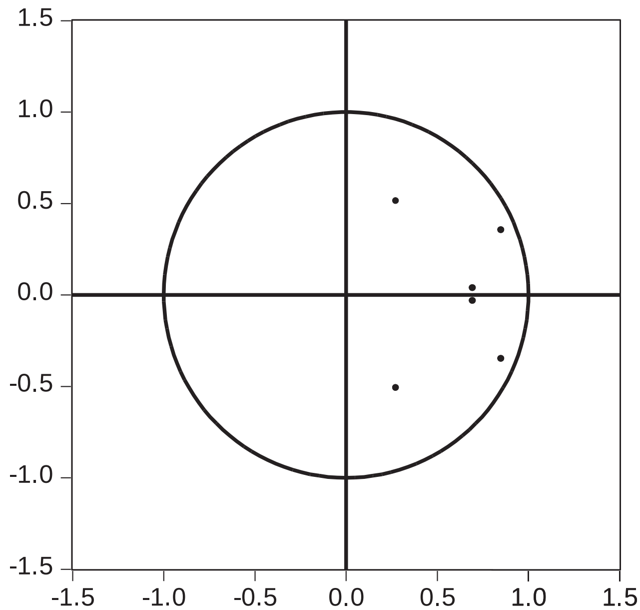
Table 6 : Trivariate VAR: Granger Causality/Block Exogeneity Test

Null Hypothesis	df	Chi-square Statistic	P-value
M does not Granger cause Y	2	13.6034	0.0011
P does not Granger cause Y	2	03.6100	0.1645
Y does not Granger cause M	2	10.0104	0.0067
P does not Granger Cause M	2	04.4985	0.1055
Y does not Granger Cause P	2	24.3050	0.0000
M does not Granger Cause P	2	17.006	0.0002

iii. *Impulse Response*

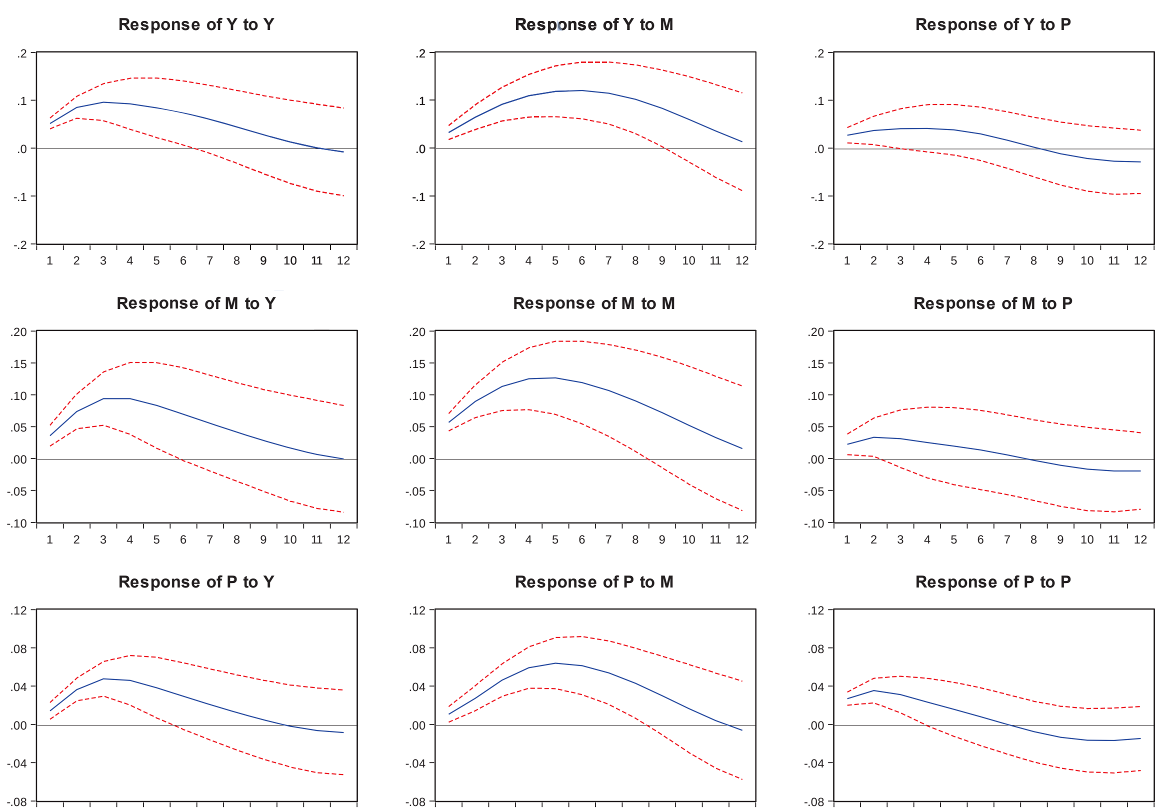
Before we proceed presenting the results of the impulse response functions, it is essential to make sure the VAR models are stable. The chart below shows the Inverse Roots of AR Characteristics Polynomial. As can be seen from the chart all the roots lie inside the unit circle confirming the stability condition of the trivariate VAR models.

Chart 1 : Inverse root of AR Characteristics Polynomial



Turing to impulse responses, the impacts of one standard deviation shock of each one of the endogenous variables Y, M, and P are shown in Figure 2 below. It is clear from the Chart below that a 1 SD innovation of Y has an impact on Y, M, and P. Similarly, a 1 SD innovation of M has an impact on M,Y and P. Furthermore, a 1 SD innovation of P has little impact on Y and M. These results also confirm the Granger causality results.

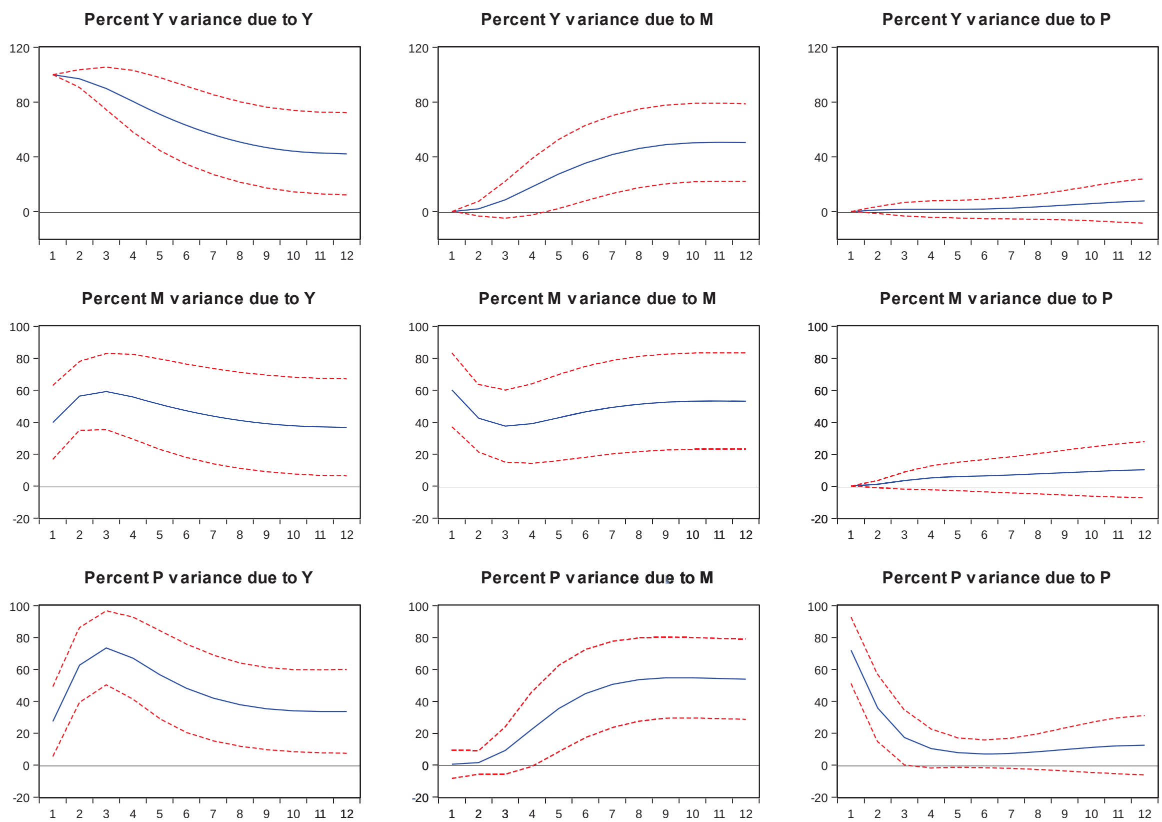
Chart 2 : Response to generalized one S.D Innovations S.E.



iv. *Variance Decomposition*

In the chart below, Chart 3, we display the variance of each one of the endogenous variables due to each one of the endogenous variables separately. The chart further supports the causality results. In particular, notice that the variances of Y and M due to P are minimal indicating that P does not granger cause Y and M. The dashed lines are the 95% confidence intervals.

Chart 3 : Variance Decomposition ± 2 S.E



c) *Discussion*

The results of the tests clearly indicate there are causal relationships between income, money, and prices. We find bidirectional relationship between money and income, a unidirectional causations running from income to prices and from money to prices. The results do seem to support the Monetarist claim that money plays an important role in determining income and prices. Money affects both income and prices as suggested by the monetarists. Changes in income appear to affect money supply through the effect of income on the money demand as hypothesized by the Keynesians. The causation running from money to income can also be explained in terms of the Keynesians economics. Changes in the money supply cause changes in nominal interest rates causing both consumption and investment to change. Changes in consumption and investment cause changes in aggregate demand and hence income. However, this effect depends on the sensitivity of investment and consumption to changes in the nominal interest rate. Specifically, if investment function is inelastic, this effect will be minimal. The causation running from money to prices also supports the Keynesians view. As prices change so does the demand for money and hence the supply of money provided that interest rates are rigid. The causation running from income to prices can also be explained by the Keynesian economics. Changes in income shifts the aggregate demand curve and hence affecting prices.

The impulse response functions and the variance decomposition support the causality results. What are the policy implications of these findings? SAMA should probably pursue monetary policy to stimulate the economy. Perhaps a policy mix should be more appropriate to control prices (inflation).

IV. Summary and Conclusion

This paper attempts to establish the relationship between income, money, and prices in the context of Saudi Arabian economy. We use data from Saudi Arabian economy for the period 1968-2011. The length of the time frame is dictated by the availability of the data. The income variable is taken as the non-oil gross domestic product. The money supply variable is taken as the broad definition M3. The price variable is consumer price index with base year 1999. We use the natural logarithms of these variables in our analysis. The methodology used is the VAR Models and the Granger causality block exogeneity tests. We find bidirectional relationship between income and money, a unidirectional causation running from income to prices and from money to prices. These results do appear to support the monetarists' contention. They also seem to support the Keynesians' view that income affects money supply through the money demand channel, especially if the interest rates are rigid. Also, the results indicate that both money and income pose pressure on prices (inflation). In terms of policy implications, SAMA should pursue monetary policy to stimulate the economy. Perhaps a policy mix would be more appropriate to control prices (inflation).

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