GUIDELINES FOR SAUDI ARABIAN MONETARY POLICY

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INTRODUCTION

Although the literature on the conduct of monetary policy in less developed countries has grown rapidly in the last several years, no real consensus has emerged as the optimal policy objective that should be strived for by national monetary authorities [1]. This study explores the desirability of adopting a relatively simple rule for the conduct of monetary policy in Saudi Arabia.

While most Saudi officials accept price and output stability as the appropriate stabilization objectives of monetary policy, there has been apparent agreement on the best method suited for the attainment of these objectives [2]. Should the monetary authorities -- the Saudi Arabian Monetary Agency (SAMA) [3], use their intuition and judgement [4], (discretion) in the determining of the behavior of the money supply most conducive to economic stability? Or on the other hand, do the difficulties of international price and interest rate [5] movements, pressures for massive development spending and limited knowledge of the economic forces at work in the country, make such discretion unpromising or even dangerous [6]?

More specifically, given that Saudi Arabian governmental intervention of some sort is likely to be essential if monetary is to perform its traditional functions, the analysis below attempts to determine :

1. what sort of institutional arrangements and rules are most likely to ensure the desirable behavior of money in Saudi Arabia;

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2. should the rule (if adopted) be a simple or fixed rate of growth of the money supply, or should the rate of growth in the money supply be changed at infrequent intervals to reflect underlying structural changes in the economy (i.e. improvements in the efficiency of the banking system);

3. on the other hand, might a more complex prescription for adjustments of the money supply to match shifts in its demand be more optimal? and

4. should the rules be mechanical (automatic) or rest more with the discretion of the monetary authorities?

The period selected for analysis was that from 1960 through 1979. This period is ideal for testing the possible benefits of alternative monetary policies because in general this was a period of rising government expenditures, thus providing the Saudi authorities with a good deal of leeway in controlling the level of government expenditures and also because the 1970s were a period of relative high rates of inflation (in contrast to the falling price levels experienced in most of the early-mid 1980s).

RELEVANCE OF SAUDI ARABIA

While the problems of economic stability are quite common in less developed countries, Saudi Arabia is of additional interest because the country's vast oil revenues superimposed on a largely underdeveloped private sector, particularly the financial sector create a unique environment whereby many of the standard impacts associated with economic policy are much more straightforward, and thus easy to identify [7].

More specifically, in Saudi Arabia [8]:

1. Real income is dependent upon the economy's ability to import goods and services rather than its ability to produce goods and services (other than oil);

2. Government spending, even with a budget surplus, can still imply a stimulative fiscal policy (because most government revenue comes from abroad).

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3. Stimulative fiscal policy leads directly to an increase in the money supply because of the underdeveloped state of the financial markets;

4. Due to the absence of a sell developed financial system, the government budget is the most important factor in determining the growth in reserve money (and thus the other measures of money);

5. Because government revenue comes almost exclusively from abroad (rather than from domestic taxes), the appropriate definition of a balanced budget is not the conventional one of spending equalling receipts, but one of spending equalling imports of goods, services and foreign assets;

6. This economic deficit analogy applies to the country's central bank --the Saudi Arabian Monetary Agency (SAMA). When government spending (decline in government deposits) is greater than imports (decline in foreign assets), there be an increase in reserve money. Under these circumstances, the central bank must monetize government spending in excess of imports;

7. The automatic neutralization of reserve money from government spending via imports is an important source of monetary stability. However, during the 1970s, the economic deficit increased as government spending increased faster than imorts. This led to a significant acceleration in Saudi Arabia's reserve money, currency, and inflation.

In fact Darrat [9] has shown that inflation in Saudi Arabia is essentially a monetary phenomenon. In addition his analysis indicates that external monetary factors (represented by movements in foreign interest rates) exert a significant influence upon inflation in Saudi Arabia. The implications of this finding are that monetary policy designed to counteract external effects on the domestic economy must take into account the specific response of domestic money demand to these external elements. It should be noted however, that Durrat's results show that the effects of these factors on Saudi Arabian inflation, while statically significant, are relatively small, with a long run elasticity of only O.10 Hence, there is little support for the argument that Saudi Arabia's inflation is substantially imported.

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In addition Durrat's empirical results show that inflation in Saudi Arabia has its origin largely in domestic sources. In particular, the public's expectations of higher inflation play a significant role in causing inflation in the Kingdom [10].

The main policy implications of this analysis are that the most effective tool to mitigation inflation in Saudi Arabia is restraint in the money supply growth. The acceleration of the growth of money in the 1970s, therefore can be viewed as essentially a monetary phenomena. More specifically, Durrat's results indicate that prices in Saudi Arabia quickly adjust to monetary changes whereby the total impact; of money supply growth in inflation is virtually completed in less than one year [11]. Such short-lag adjustment of the money supply growth along with a strong impact on inflation, implies that restrictive monetary policy can be an exceptionally effective measure to control Saudi inflation. Since the prime determinant of monetary growth lies in domestic government expenditures, effective control over money supply growth lies in a rationalization of government expenditures.

To summarize, an analysis of aggregate data shows that a close relationship between the domestic budget balance, liquidity expansion, and inflation in Saudi Arabia. Fiscal policy is the primary determinant of domestic liquidity and aggregate domestic demand. Ultimately the government's budget must be the primary instrument of demand management.

OIL REVENUES, THE MONEY SUPPLY AND INFLATION

The success of economic policy is rightly judged in terms of the economic objectives to which it is directed. The primary economic objective of Saudi policy makers since the oil price increase of late 1973 and early 1974 has been to secure rapid growth and development of the non-oil sector in a context of price stability. This emphasis reflects the official Saudi view that the country's longer term economic and social goals will best be achieved within a framework of reasonable financial stability.

Concern with monetary stability began soon after 1973 as the rate of domestic inflation began to accelerate well over its historical level.

Rapid and accelerating inflation was clearly imparting excessive costs to the country's growth through [12]:

1. the diversion of resources into speculative activities;

2. its adverse impact on private sector confidence, and

3. the encouragement of a relatively undiversified economy.

Output and employment were not hindered by insufficient demand, but rather by supply constraints [13]. Until these bottlenecks were eased, the primary effect of incremental domestic expenditure was increased inflation [14], reaching double digit proportions for the first time in the country's history [15].

Oil revenues and the money supply are closely related as indicated by the conventional presentation of the IMF monetary survey [16]. The rise in the net foreign assets in the Saudi banking system are shown in the survey as the primary factor responsible for the growth of liquidity during the post 1973 period. The large increase in government deposits is the main offseting factor [17].

On the surface, Saudi Arabia fiscal policy, and in particular its monetary implications, appear contradictory. However, the monetary survey conceals the fact that the government's fiscal operations constitute the primary determinant of changes in money and quasi-money. Clearly, the receipt of oil revenues by the government is the main factor underlying the rise in the country's holdings of foreign assets. In contrast to the usual situation in most countries, foreign assets do not, however, haves an immediate monetary impact in Saudi Arabia (since they directly offset a rise in government deposits). Only to the extent that the Saudi government injects this revenue into the domestic income stream through public sector domestic expenditures will the inflow of foreign exchange be translated into domestic liquidity [18].

More precisely, the impact of fiscal policy (and thus monetary policy) on domestic economy of Saudi Arabia (where a substantial volume of external receipts and payments passes directly through the government's budget) can be best seen by examining the domestic budget balance, rather than the overall budget balance. Using this approach [19], Saudi

Arabia's money supply identity can be depicted as:

$$\Delta M = (\Delta Cp + BPp) + (Gd - Rd - Ld) + \Delta A$$

where: ΔM = change in domestic liquidity (money plus guasi money)

ΔCp = change in claims of the banking system on the private sector

BPp = balance of payments of the private sector

Gd = government domestic expenditures

Rd = government domestic revenues.

Ld = government borrowing from domestic non-bank sector

ΔNUA = change in the net unclassified assets of the banking system

IMPLICATIONS FOR MONETARY AND FISCAL POLICY

Based on the previous discussion it is apparent that the main determinants of the Saudi Arabian money supply are:

1. the domestic budget position of the public sector;

2. the balance of payments deficit of the private sector; and

3. the change in domestic bank credit to the private sector.

Note that government external transitions do not appear in the identity (reflecting the fact they do not contribute directly to the monetary creation process).

Saudi oil revenues, therefore, do not, in general, create many of the monetary stabilization problems that normally facing developing countries. Because oil revenues accrue directly to the government (rather than the private sector), they are automatically sterilized. The relevant transmission mechanism is not, therefor, the familiar one operating through movements in the balance of payments, but rather the government budget. Hence, the surge in oil revenues in 1974 did not, in itself, generate a rise in domestic liquidity. Similarly, the recent leveling off and decline in oil revenues has not per se directly reduced private sector liquidity. Such a reduction has resulted only to the extent that there has been a deceleration in net government domestic spending.

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Clearly the country's oil revenues could have remained in excess of government spending indefinitely, with no acceleration in domestic liquidity. Excess revenues could have always been invested in riskless interest earning foreign assets. In theory, official decision as to how much oil to produce and how much excess revenue to acquire should not depend on domestic stabilization needs, but rather whether or not the interest rate on foreign assets was better or worse than the return of appreciation in value of oil in the ground; i.e. the decision should be on whether or not the future price of oil will change by more than the current level of interest [20].

At the practical level, however, the excess of revenue over spending in the 1970s and early 1980s tended to create a major political problem for the government (since the only way that individual citizens could benefit from the increased foreign exchange earnings was through the government's domestic budget allocations). As in most OPEC countries, the substantial budget surplus in Saudi Arabia in the 1970s created strong incentives to increase public spending. During this period, the number of projects proposed in the budget easily exceeded the number which could be carefully planned. Projects also tended to be more elaborate and costly that would otherwise have been the case. At the same time, the resulting increase in aggregate demand led to a higher than optimal rate of inflation, rate [21].

In short, many of Saudi Arabia's stabilization problems stem from the fact that developments in international oil markets have tended to progress much more rapidly than the country's domestic institutions have evolved.

In particular, the Saudi Arabian Monetary Agency, the country's central bank, has relatively narrow functions. It is not able to conduct open market operations because of the lack of a domestic government securities market. Also, its charter prohibits it from lending to the commercial banking system (or the government); i.e. using the discount rate. While lacking many of the tools used by most cental banks [22], SAMA was able to maintain a steady expansion of the money supply until 1973. For a number of years after that time increased government expenditures and the rapid expansion of the domestic banking system made monetary control extremely difficult [23].

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Sooner or later the country must develop a level of financial management more compatible with the transformed economic situation. Without institutional improvements in the fiscal and monetary policy machinery and in the monitoring of policy execution, the capacity of the country to devise and implement efficient stabilization programs will remain somewhat limited.

OPTIONS FOR SAUDI ARABIAN MONETARY POLICY

While it is becoming clear that Saudi Arabia; must adopt a more sophisticated approach to the conduct of monetary and fiscal policy to assure optimal utilization of its oil revenues, considerable general disagreement still exists in the economics profession as to the proper conduct of monetary policy. Some economists believe that the monetary authority should be passive in its policy stance, merely making sure that the money supply grows steadily from year to year. Others believe that the monetary authority should pursue an active monetary policy in which the money supply may grows very rapidly one year and very slowly in the next (depending on the over all economic climate and the objectives of policy). Typically this issue is summarized as the "rules vs discretion" debate [24].

In justifying discretion, R.S. Sayers [25] observed that the very

essence of central banking is discretionary control of the monetary system...And working to rule is the antithesis of central banking. A central bank is necessary only then the community decides that discretionary element is desirable.

In contrast, Sargent and Wallance contend that

There is no longer any serious doubt about whether monetary policy should be conducted according to rules or discretion. Quite appropriately, it is widely agreed that monetary policy should obey a rule [26].

This conflict of views is, however, probably more apparent than real. For example, Sayers feels discretion is exercised whenever there is any intervention in the free market's provision of the means of payment,

while Sargent and Wallace insist that monetary policy be guided by a systematic interpretation of events and their consequences--i.e. an economic model.

Resolution of the debate over rules versus discretion in the conduct of monetary policy appears to hings the solution of two separate, but related problems [27]:

1. Determining the most appropriate model to apply to describe the relationship between monetary instruments and economic aggregates; and

2. determining the appropriate decision rules to be followed by policy makers when setting their instruments (given their goals and their model of the economy).

This paper is primarily interested in the decision rule problem and is only indirectly concerned with question of whose model is best.

The major claim made by proponents of a Friedman-type [28] rule is that the implementation of the type of policy will result in the rate of growth of income becomeing more stable [29]. For this result to apply to Saudi Arabia, there must be a stable demand for money in that country; i.e. that the velocity of money is stable [30]. In the Friedman framework, it is assumed that a stable relationship exists between real money balances and real permanent income. Short term fluctuations in velocity are explained in terms of discrepancies between measured and permanent income. It follows that velocity rises when measured income exceeds permanent income, and falls when permanent income exceeds measured income. This explanation is consistent with the observed tendency in the United States for felicity to increase in an upswing and to fall during a downswing [31].

The advocates of monetary rules, therefore, believe that economies implementing policy along these lines will suffer only minor fluctuations; i.e. fluctuations in income growth will be less the more stable the expansion of the money supply. Similarly, economies will experience major fluctuations if the monetary authorities engage in discretionary monetary policy. Friedman's basic position is that more often than not,

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monetary authorities unintentionally cause destabilizing movements in economic activity. Proponents of discretionary monetary policy, on the other hand, contend that monetary authorities by delicately manipulating the growth in money can prevent their economies from falling into massive recession (or getting caught up in an accelerating inflation). Discretionary policy advocates admit that authorities may make mistakes, and that when they do, the entire economy will suffer. However they insist there is no evidence that indicates a monetary rule would out perform discretionary policy in terms of stabilizing the economy with a high level of employment and acceptable price behavior (32).

The more important criticisms made of the advocates of the use of discretionary monetary policies in developing countries can be grouped under the following four broad headings (33):

1. The relative ineffectiveness of monetary measures in regulating or controlling aggregate demand as compared with direct controls and fiscal measures. The claim that monetary policy takes a relatively long time to produce results falls under this heading.

2. The relative uncertainty of the impact of monetary measures owing to the complex relationship between the supply of money and aggregate demand, it is more difficult to predict the effect of monetary measures on demand than it is the effect of direct controls and fiscal measures.

3. The relative bluntness of monetary measures which connot be applied as selectively as fiscal measures and direct controls to influence the patterns of production, investment and consumption.

4. The irrelevance of monetary measures to many of the problems related to internal and external equilibrium. Monetary measures whether effective or not are directed at regulating aggregate effective demand. The resort to such measures in order to resolve the problems of internal and external disequilibrium (inflation, unemployment and balance of payments difficulties) is thus based on the presumption that these problems are caused primarily by a deficiency or an excess of aggregate demand. It is argued that in many cases the

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problems of disequilibrium are caused by economic and social factors not related to aggregate demand.

Which is appropriate monetary policy for a growing economy such as Saudi Arabia's? Ultimately this becomes an empirical issue, whereby past economic performance can be simulated and assessed in terms of alternative policy strategies. The relevant issues, then, include:

1. the specification of alternative policy designs to contrast the economic impacts that presumably would have resulted if a rule had been in effect, with those associated with actual discretionary policy; and

2. A statical criteria for unambiguously determining the superiority of one of the policy designs [34].

THE USE OF RULES IN THE CONDUCT OF SAUDI ARABIAN MONETARY POLICY

In examining the applicability of rules to the conduct of monetary management in Saudi Arabia, the first proposal that comes to mind is of course Friedman's suggestion of a constant growth of the money stock [35]. This type of rule is not claimed to be optimal in any sort of linear programming sense. It is only contended by Friedman and his followers [36], that the lags in response of the economy to variations in monetary policy are so long and variable in length and the ability to forecast future events so limited, that pursuit of an active anti-cyclical monetary policy may (and probably will) give results which are inferior to that produced by a constant increase in the money supply.

On the other hand, Friedman himself has cautioned against the adoption of this type of rigid monetary expansion in the context of less developed countries [37]:

> A small country...that seeks to maintain fixed rates of exchange between its own currency and currencies of most other countries without using foreign exchange controls or their equivalent has little leeway with respect to monetary policy. Its stock of money must be whatever is required to maintain external equilibrium.

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This argument, however, presumes that:

1. the country will, for periods of time encounter sizable balance of payments deficits (due to an excessive rate of monetary expansion);

2. the money supply is greatly influenced by actions in the private sector.

Since neither of these conditions are likely to be present in Saudi Arabia, the major theoretical objection usually given to the adoption of a rule is not as strong as would usually be the case for many developing countries.

In addition, the adoption of a simple constant growth rate rule of money expansion in the Suadi Arabia context is not necessarily irresponsible because of the fact that:

1. the empirically observed stability in the country of the demand for money [38].

2. the difficulty of collecting and interpreting economic data with sufficient speed to implement an activist discretionary policy;

3. the political temptation to over spend oil revenues.

In sum, the constant growth rate rule does have several advantages that recommend its use in the Saudi Arabian context:

1. in principle the country should, because of the stability in the demand for money, be able to control its domestic money supply; and

2. given the country's still abundant oil revenues, there is no reason why balance of payments equilibria would not be possible with whatever domestic price level results from the application of a monetary rule over a reasonable range of growth rates.

In terms of the actual rate of monetary increase under a rule, Friedman argues for one yielding a low or negative rate of inflation. A rule yielding this result is attractive in Saudi Arabia's case. Inflation is a tax imposed on the holding of cash. Clearly if prices fall, cash yields a positive return. If the public could be encouraged with such a positive return to satisfy a large part of their liquidity needs for money balances,

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fewer real assets would need to be diverted into providing other generally more costly forms of liquidity [39]. In addition, because money is the dominant form of financial wealth in Saudi Arabia, the rate of inflation can have a significant effect on the development of financial instruments and hence ultimately the efficiency of resource allocation in the kingdom [40].

Several technical issues would need to be addressed before a monetary rule could be implemented in Saudi Arabia. First is the argument that the authorities may not have sufficient control over the money supply to be able to implement the rule. As noted, the authorities can not influence the money supply directly through open market operations or the discount rate, but they can change the reserve ratio. The critical question is, therefore, whether SAMA has sufficient power to offset fluctuations in the money supply caused by such factors as:

1. changes in the desired currency to deposit ratio;

2. changes in the banks desired excess cash to deposit ratio; and

3. movements in deposits to Bahrain and other off shore accounts.

Because money enters the economy largely through government expenditures, changes in base money, shifts in the currency deposit ratio, the excess cash to deposit ratio, and movements of deposits from off shore financial centers, there will have to be close coordination between SAMA and the Ministry of Finance if monetay growth targets are to be met.

Although money supply control does pose difficulties for the adoption of a rule, it is also true, however, that any lack of control over the money supply presents equally serious difficulties for discretionary policy. Clearly if the rule cannot be precisely followed neither can effective discretionary policy be implemented.

AN ANALYTICAL FRAMEWORK

The simple Cambridge version of the quantity theory of money is the basis of the original framework for monetary rules [41]. According to the Cambridge theory, the nominal demand for money (Md) is a stable function (which is normally assumed to vary inversely with the market

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rate of interest) of nominal income (Y). Since nominal income is the expressed product of real output (Y) and the price level (p), it follows that:

(1) $Md = kY = kyp$

If we further assume that the supply of money Ms is determined by the authorities so that $Ms = Md$, then the equilibrium condition that the supply and demand for money must be equal means that the public will respond to produce:

(2) $Ms = kyp$

Equation (2) states that given the value of k and y, the money supply determines the price level; i.e. that real output is independent of the money supply in the long run. In the short run, however, the monetary sector is likely to affect output because the price level will usually not fully adjust instantaneously to eliminate discrepancies between the supply and demand for money. Also, since not all prices are likely to change at the same rate, relative price and the pattern of production may also be distorted in the short run.

Equation (2) suggests that Saudi Arabian monetary policy should concentrate on manipulating the money supply so as to foster the desired behavior of output and the price level. This in turn requires off-seting any changes in the proportion of income held in monetary balances (k) which in turn may threaten to create undesirable movements in the money demand-supply relationship.

Since growth in output over time takes place as population, labor, productivity, capital and technology increase, equation (2) is best for-mulated as percentage rates of change of all the variables in equation (2):

(3) $gm = gk + gy + gp$

As noted, monetary growth (gm) is best targeted at the rate of growth of full employment output (gy) plus the desired rate of inflation (gp) plus or minus the rate at which the demand for money (gk) might be changing.

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Operational Tests

It is possible to hypothesize the behavior of velocity for (gk) in equation (3) and then examine the behavior of nominal income implied by some monetary rule. This is the approach (albeit with significant differences) taken by Bronfenbrenner and Modigliani.

The Bronfenbrenner Test

Bronfenbrenner's guidelines [42] for monetary policy are derived from equation (3) above. This approach assumes that neither the growth in real income nor the rate of change in velocity is sensitive to relatively small veriations in the rate of change in money. From this it follows that the ideal rate of monetary growth, dMo/Mo, is:

(4) $dMo/Mo = dY/Y - dV/V = dM/M - dP/P$

The rate of inflation dPr/Pr due to the operation of a smaple rule of constant monetary growth is:

(5) $dMr/Mr = dPr/Pr + dY/Y - dV/V$

where dMr/Mr represents some constant rate of increase in money. If dY/Y and dV/V are known, the equation can be solved for dPr/Pr.

The errors in the actual monetary gorwth would be:

(6) $dM/M - dMo/Mo = dM/M - dYo/Yo + dV/V$

where dYo/Yo represents the growth in full capacity output. Substituting (1) for dM/M:

(7) $dM/M - dMo/Mo = dP/P - (dYo/Yo - dY/Y)$

Since (dYo/Yo) − (dY/Y) represents the output slack, the error in actual monetary growth is equal to the actual rate of inflation less the differences in output.

The judgement rule can now be contrasted with that obtained with the application of a simple monetary growth rule by comparing the errors in (5) with those obtained in (4).

Bronfenbrenner's monetary tests can be grouped into three broad areas:

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1. a judgment rule;

2. the constant growth rule; and

3. a lag formula.

As its name suggests, only the judgement rule allows the monetary authority to use its own discretion in response to a given monetary situation. Given the historical growth of real non-oil GDP, the requirements of the inflaxible growth rule probably require (in the Saudi context) a 10 or 12 percent annual rate of growth of the money supply.

Bronfenbrenner's lag formula specifies the rate of growth of money supply to be adjusted in accordance with the prior year's fluctuations in the growth of real output and income velocity.

Using the above framework for the non-discretionary cases, Bronfenbrenner computes a hypothetical rate of price change as:

$$(8)\ d_i = (dP/P)_i = (dM/M)_i - (dM/M)_o$$
$$= (dM/M)_i = (dY/Y - dV/V)$$

where $(dP/P)_i$, $(dM/M)_i$ and $(dM/M)_o$ are again the respective rates of growth in prices, the actual money stock, and the ideal stock of money. dV/V is, of course the rate of change in income velocity of money.

The lag rule can be represented as:

$$(9)\ (dM/M)_t = (dY/Y - dV/V)_{t-1}$$

In using these rules, the most logical type of test for superiority is the mean algebraic deviations of alternative monetary growth rates from the target growth (the rate of growth which generates a zero rate of price increase). This can be computed as:

$$(10)\ P = \sum_{i=1}^{n} (d_i/N)$$

where n is the number of observations and P denotes the algebraic deviation from the target figure.

According to this test, the rule under consideration out performes its rivals if it has a smaller P (in addition to a smaller standard deviation).

Bronfenbrenner's analysis is best seen as a comparison of how closely an economy would have approached the ideal of stable prices in the past under various alternative rules of monetary expansion as compared with how closely stable prices were actually achieved. In order to judge how the price level would have behaved under monetary policies other than those actually employed, it is explicitly assumed that aggregate real income and the income velocity of money are not affected by changes in the quantity of money (or by its level). Based on the quantity theory, this implies that the appropriate monetary policy can maintain the price level absolutely constant (although we may be unable to determine until later that the appropriate monetary policy would have been).

Without any a priori judgment as to the best measure of income or money, simulations with two income measures--non oil gross domestic product, and gross domestic product, together with four measures of money: currency (MC), currency plus demand deposits (M1), (M1) plus quasi money (M2), (M2) plus government deposits (M3), and M3 plus other net items in the International Monetary Fund monetary survey (M4), were used in the analysis.

The results of aplying Bronfenbrenner's criteria to the Saudi Arabian economy reveal several distinct patterns (Table 1 and 2):

1. The relationship between M1 and M2 and the ideal pattern is somewhat similar. On the other hand, M3 and M4 also follow a similar pattern, but one quite different from M1, and M2. MC follows its own separate pattern, but one closet to M1 and M2 rather than M3 and M4.

2. In terms of the standard deviation test, MC, M1 and M2 are much more stable than M3 and M4 with MC in theneral the most stable for the 1960-79 period.

3. In general, the discretion rule out performs the lag rule in terms of its stability; with the lag rule, M1 and M2 are slightly below the rate of growth consistent with price stability, while M3 and M4 are only a bit over one percent greater than the ideal rate.

TABLE 1

TEST OF THE BRONFENBRENNER MONETARY MODEL FOR SAUDI ARABIA

(Gross Domestic Product)

	1960 – 1979			1960 – 1969			1970 – 1979		
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Rule = 8%									
MC	-3.35	15.71	-0.71	-2.40	5.86	-1.30	-1.10	22.58	-0.41
M1	-5.09	17.72	-1.25	-0.46	4.67	-0.30	-10.82	24.72	-1.31
M2	-5.28	15.65	-1.47	-2.11	4.24	-1.50	-9.30	22.28	-1.25
M3	-10.59	23.68	-1.94	-5.53	20.30	-0.82	-16.49	27.84	-1.78
M4	-11.55	19.93	-2.52	-7.63	18.92	-1.21	-16.27	22.07	-2.21
Rule = 10%									
MC	-1.35	15.71	-0.38	-0.41	5.86	-0.21	-3.10	22.57	-0.41
M1	-3.09	17.72	-0.76	1.53	4.67	0.99	-8.82	24.72	-1.07
M2	-3.28	15.65	-0.91	-1.13	4.24	-0.08	-7.30	22.28	-0.98
M3	-8.59	23.68	-1.58	-3.53	20.30	-0.52	-14.49	27.84	-1.56
M4	-9.55	19.93	-2.09	-5.63	18.91	-0.89	-14.27	22.07	-1.94
Rule = 12%									
MC	0.64	15.71	0.17	1.59	5.86	0.82	-1.10	22.58	-0.15
M1	-1.09	17.23	-0.27	3.53	4.67	2.27	-6.82	24.72	-0.83
M2	-1.28	15.65	-0.36	1.89	4.24	1.34	-5.30	22.28	-0.71
M3	-6.59	23.68	-1.21	-1.53	20.30	-0.23	-12.49	27.84	-1.35
M4	-7.54	19.93	-1.65	-3.63	18.92	-0.58	-12.27	22.07	-1.67

(Continued)

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(Non-Oil GDP)

	1960 – 1979			1960 – 1969			1970 – 1979		
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Rule = 14%									
MC	2.65	15.71	0.73	3.59	5.86	1.84	0.90	22.58	0.12
M1	0.91	17.71	0.22	5.54	4.67	3.58	-4.82	24.72	-0.59
M2	0.72	15.65	0.20	3.89	4.24	2.75	-3.30	22.28	-0.44
M3	-4.59	23.68	-0.85	0.47	20.30	0.07	-10.49	27.84	-1.13
M4	-5.55	19.93	-1.21	-1.63	18.92	-0.26	-10.27	22.07	-1.40
Rule = 8%									
MC	-2.86	9.11	-1.37	-2.20	5.60	-1.18	-4.47	11.97	-1.12
M1	-4.20	8.84	-2.07	-0.27	4.71	-0.17	-9.33	9.57	-2.92
M2	-4.62	7.31	-2.75	-1.89	4.25	-1.34	-8.32	8.30	-3.01
M3	-15.64	48.52	-1.41	-5.14	20.32	-0.76	-27.69	67.61	-1.22
M4	-15.88	44.20	-1.57	-7.21	18.91	-1.14	-25.99	61.79	-1.26
Rule = 10%									
MC	-0.86	9.11	-0.41	-0.20	5.60	-0.11	-2.47	11.97	-0.62
M1	-2.20	8.84	-1.08	1.73	4.71	1.10	-7.33	9.58	-2.30
M2	-2.62	7.31	-1.56	0.11	4.25	0.08	-6.32	8.30	-2.28
M3	-13.63	48.51	-1.23	-3.14	20.32	-0.46	-25.69	67.61	-1.14
M4	-13.88	44.20	-1.37	-5.21	18.92	-0.83	-23.99	61.79	-1.16

(Continued)

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(Non-Oil GDP)

	1960 – 1979			1960 – 1969			1970 – 1979		
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Rule = 12%									
MC	1.14	9.11	0.55	1.80	5.60	0.97	-0.47	11.97	-0.12
M1	-0.19	8.84	-0.10	3.73	4.71	2.37	-5.33	9.58	-1.67
M2	-0.62	7.31	-0.37	2.11	4.25	1.49	-4.32	8.30	-1.56
M3	-11.64	48.52	-1.05	-1.14	20.32	-0.17	-23.69	67.61	-1.05
M4	-11.87	44.20	-1.17	-3.21	18.92	-0.51	-21.99	61.79	-1.07
Rule = 14%									
MC	3.14	9.11	1.50	3.80	5.60	2.04	1.53	11.97	0.38
M1	1.80	8.84	0.88	5.73	4.71	3.65	-3.33	9.58	-1.04
M2	1.38	7.34	0.82	4.11	4.25	2.90	-2.32	8.30	-0.84
M3	-9.64	48.51	0.86	0.86	20.32	0.13	-21.68	67.61	-0.96
M4	-9.88	44.21	-0.97	-1.21	18.92	-0.19	-20.00	61.79	-0.97
Rule = 16%									
MC	5.14	9.11	1.96	5.80	5.60	3.62	3.53	11.97	1.22
M1	3.80	8.83	1.88	7.73	4.71	4.92	-1.33	9.58	-0.42
M2	3.37	7.31	2.01	6.11	4.25	4.31	-0.32	8.30	-0.12
M3	-7.64	48.52	-0.69	2.86	20.32	0.42	-19.69	67.61	-0.87
M4	-7.80	44.20	-0.78	0.79	18.91	0.13	9.48	20.06	1.42

(Continued)

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(Non-Oil GDP)

| | 1960 – 1979 | | | 1960 – 1969 | | | 1970 – 1979 | | |
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Discretionary Policy									
MC									
M1	5.97	8.89	2.92	1.40	1.86	2.27	10.97	11.00	2.99
M2	6.21	9.45	2.86	1.29	1.88	2.05	11.61	11.62	2.99
M3	-4.10	31.89	-0.56	-1.46	6.61	-0.66	-7.33	47.15	-0.47
M4	-2.67	29.75	-0.39	-1.44	6.28	-0.69	-4.30	-44.11	-0.29
Lag Policy									
MC									
M1	0.02	9.81	0.01	-0.23	7.80	-0.08	-0.56	12.83	0.12
M2	-0.07	8.75	0.03	0.10	6.75	0.04	0.74	11.47	0.18
M3	1.36	66.21	0.09	3.76	29.20	0.36	6.91	97.09	0.20
M4	1.41	61.81	0.09	3.85	27.26	0.40	5.14	91.14	0.16
Rule = 16%									
MC	4.65	15.71	1.35	5.59	5.86	4.14	2.90	22.58	1.27
M1	2.91	17.71	0.72	7.54	4.67	4.84	-2.82	24.72	-0.34
M2	2.72	15.65	0.76	5.89	4.24	4.17	-1.30	22.28	-0.18
M3	-2.59	23.68	-0.48	2.47	20.31	0.37	-8.49	27.84	-0.91
M4	-3.54	19.93	-0.77	0.37	18.92	0.06	-8.27	22.07	-1.12

(Continued)

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(Gross Domestic Product)

	1960 – 1979			1960 – 1969			1970 – 1979		
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Discretionary Policy									
MC									
M1	5.07	14.05	1.57	1.21	0.55	6.46	9.48	20.06	1.42
M2	5.55	14.13	1.71	1.07	0.55	5.87	10.62	19.84	1.61
M3	0.94	7.80	0.52	-1.84	6.69	-0.83	3.87	8.58	1.35
M4	1.66	6.99	1.04	-1.86	6.34	-0.88	5.43	6.25	2.60
Lag Policy									
MC									
M1	-0.26	22.76	-0.05	-0.09	7.80	-0.03	-1.49	34.47	-0.12
M2	-0.21	20.12	-0.04	0.26	6.88	0.11	-1.39	30.47	-0.13
M3	1.14	30.47	0.16	3.97	29.28	0.38	4.11	35.01	0.33
M4	1.17	26.16	0.19	4.10	27.38	0.42	2.39	28.69	0.24

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TABLE 2

SAUDI ARABIA: APPLICATION OF THE BRONFENBRENNER MONETARY MODEL

(Percent)

	12% Rule				Discretionary Policy				Lag Policy			
	M1 GDP	M1 Non-Oil GDP	M2 GDP	M2 Non-Oil GDP	M1 GDP	M1 Non-Oil GDP	M2 GDP	M2 Non-Oil GDP	M1 GDP	M1 Non-Oil GDP	M2 GDP	M2 Non-Oil GDP
1961	8.25	8.41	5.22	5.48	1.41	1.56	1.40	1.66	—	—	—	—
1962	2.71	1.21	3.10	1.63	0.89	−0.60	0.94	−0.54	−5.54	−2.12	−7.20	−3.85
1963	−5.22	−4.85	−5.23	−4.86	0.33	0.71	0.33	0.70	−7.94	−8.34	−6.07	−6.49
1964	9.76	11.00	6.48	7.90	2.14	3.38	1.98	3.40	14.99	11.72	15.85	12.76
1965	4.45	3.43	2.31	1.28	1.12	0.10	0.93	−0.11	−5.31	−4.16	−7.57	−6.62
1966	0.14	−0.02	−3.15	−3.36	0.93	0.78	0.42	0.20	−4.32	−5.46	−3.45	−4.64
1967	3.33	3.42	1.04	1.12	1.74	1.83	1.43	1.52	3.19	4.19	3.44	4.45
1968	0.84	4.42	−0.08	3.50	1.57	5.15	1.49	5.07	−2.49	−1.12	1.01	2.38
1969	7.56	6.55	7.30	6.29	0.73	−0.28	0.70	−0.31	6.71	7.37	2.12	2.78
1970	8.03	10.65	6.42	8.13	0.17	1.98	0.15	1.80	1.78	−0.88	4.11	1.84
1971	15.53	4.36	12.52	0.81	12.96	1.80	13.05	1.35	6.70	6.10	−6.29	−7.31
1972	−16.93	−21.91	−15.33	−20.14	0.97	−4.02	1.58	3.23	−32.46	−27.84	−26.28	20.95
1973	−1.64	−12.64	1.77	−8.70	14.91	3.89	15.72	5.25	15.29	9.26	17.09	11.44
1974	41.25	−5.33	39.60	−8.33	58.53	11.95	58.85	10.92	42.88	7.32	37.84	0.37
1975	−24.94	−3.35	−17.30	2.32	10.31	31.90	14.90	34.53	−66.19	1.98	−56.91	10.65
1976	−39.07	−6.30	−35.30	−3.56	−9.49	23.27	−7.34	24.40	−14.13	−2.95	−17.99	−5.88
1977	−28.11	−13.10	−24.58	−10.02	−3.30	11.72	−1.57	12.99	10.96	−6.79	10.72	−6.47
1978	−11.16	1.45	−10.49	2.00	−1.21	11.39	−0.99	11.50	16.95	14.54	14.09	12.02
1979	3.65	8.82	1.38	6.73	1.69	6.85	1.41	6.76	14.81	7.37	11.87	4.73

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4. For M1 and M2, the constant growth rate out performs both the discretion rule and the lag rule over the 1960-79 period. The mean for a 14 percent constant growth of the money supply is much closer to zero for M1 and M2 than the case for competing rules, with the standard deviation on the whole a bit lower for M2, and only slightly higher for M1.

5. For both M1 and M2, a constant growth of 14 percent would, in general, have been the best policy in terms of maintaining price stability and minimizing erratic fluctuations in the money supply. A 12 percent rate would have been best for currency.

6. If the constant rate rule were not adopted, discretionary policy would have been superior to some sort of a lag rule.

7. The results are best for non-oil gross domestic product. This measure of income should, therefore, be used by the Saudi authorities in implementing stabilization policy.

It should be noted, however, that two fairly distinct sub-periods are present, 1960-69 and 1970-79. The rates of optimal money growth vary considerably between these periods with the earlier period associated with a much more stable environment and lower optimal rates of growth. In general, however, a constant rate of growth in the money supply would have been preferable in each sub-period.

A number of objections may be raised against Bronfenbrenner's test. One is the assumption that both real output and velocity are not affected by changes in money; another is the absence of any distributed lag impact that monetary policy may have on output. Most serious is the representation of ideal money in terms of the price level alone with no reference to ideal output or employment levels. There is also some question as to the relevance for future policy guidelines of the pre-1973 years in any test of rules versus discretion. Another difficulty with Bronfenbrenner's test is that the simple rule is assumed to be superimposed in each year on top of the actual money supply obtaining at the beginning of the year; yet if the rule had in fact been implemented in the earlier years, the money supply would have been quite different from that actually prevailing at the start of the year.

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According to Modigliani [43], the monetary authority is confronted with the double objective of obtaining price stability and full employment. To assess the performance of the monetary authority, Modigliani developes a measure of target money supply (the ideal money supply in his mode). Next, this is compared with the actual money supply or supply dictated by a monetary rule. Stated symbolically, the target money supply is given by:

(11) $Mo = (Pt)(Yo)/V = Zt/V$

Where Mo is the target money supply, P is the target price level, Yo the target real income, V the income velocity of circulation, and Z the target money income. Implementing tests of the principal variations of this formula involves one principal problem--finding the empirical approximations of each of the above variables.

Modigliani's approach is easily more ambitious than Bronfenbrenner's. In effect it attempts to deal with the major objection to the Bronfenbrenner test; i.e. that it overlooks the employment target and defines the ideal money supply with reference to the Price level alone. Using Bronfenbrenner's framework, Modigliani defines (dMo/Mo) in terms of a zero rate of inflation as well as a satisfactory level of employment. The critical equation in the Modigliani test is:

(12) $dMo/Mo = dYo/Yo - dV/V$

where the rate of inflation is again set at zero, dYo/Yo represents the rate of growth of real output consistent with near full employment of resources. As in the Bronfenbrenner test, velocity is again assumed to be invariant to the rate of change in the money supply. The errors in this test are simply the difference between the ideal money supply and the money supply dictated by the rule (constant growth rates).

(13) $dMr/Mr - dMo/Mo = dMr/Mr - dYo/Yo + dV/V$

These errors can be calculated for each period, since dMr/Mr, dYo/Yo and DV/V are all known.

In order to define the target price level, we need to operationally

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define Modigliani's rather vague notion of "stabilizing the price level". Following, Modigliani, we define this concept operationally by identifying the target price level in period (t) with the level ruling at the beginning of the period; i.e. the price level ending the previous time (year) period.

Taken to its logical conclusion, this assumption would imply that in the short run--here a year--SAMA should refuse to supply and validate price increases above the opening price level (even though this policy might lead to less than full utilization of the kingdom's economic potential during the time period). At the same time, if prices have nonetheless changed in the year--whether through cost push and seller's inflation or from errors in the money supply--then the new price level should be accepted as a fait accomplil. It would become the new line to be held in the following period, no attempt being made at adjusting prices to the previous target level. Based on the above considerations, the target supply can also be depicted as:

(14) $Mt = (Xt)(Pt)/mt = Yt/mt$

where $Y = (Xt)(Pt)$, and denotes the target nominal income or target aggregate demand, and

(15) $m = Yt/Mt$

is the ratio of target income to the money supply needed to achieve that income level.

It follows that the empirical estimate of income can be defined as real non oil GDP multiplied by the previous year's non-oil gdp deflater. The target money supply then becomes the empirical estimate of income times the observed income velocity of money (again on the assumption that velocity is independent of the money supply).

Given that the country's explicitly stated policy objective is one of full employment with price stability, the target money supply stock, Mt, should be thought of as the stock of money that would have been needed in period t to transact full employment income (Xt) at the target price level for the period (Pt).

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The results of Modigliani's procedure (Tables 3 and 4) for 1960-79 are in general supportive of those found in the Bronfenbrenner method:

1. Again, M3 and M4 are clearly poorer candidates than MC, M1 or M2 for monetary control. Non-oil GDP in general gives superior results to GDP. In any case, on theoretical grounds, it should be used as the income target.

2. For the 1960-79 period, a constant expansion of the money supply from 12 to 14 percent seems to produce a mean fairly close to zero and a significantly lower standard deviation for M2.

3. The rule is thus again superior to discretion. It should be noted that the Modigliani formulation precludes the test of a lag rule.
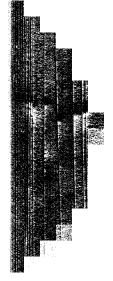
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TABLE 3

TEST OF THE MODIGLIANI MONETARY MODEL FOR SAUDI ARABIA

(Gross Domestic Product)

	1960 – 1979			1960 – 1969			1970 – 1979		
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Rule = 8%									
MC	-1.29	19.28	-0.29	-2.89	5.80	-1.50	-0.20	28.21	-0.02
M1									
M2	-3.29	17.82	-0.80	-2.71	4.24	-1.92	-4.43	26.30	-0.51
M3	-6.92	17.59	-1.72	-3.29	16.04	-0.61	-10.91	20.13	-1.63
M4	-8.70	14.89	-2.55	-5.58	14.34	-1.17	-12.25	16.31	-2.25
Rule = 10%									
MC	0.54	19.63	0.12	-1.09	5.90	-0.55	1.65	28.73	0.17
M1	-0.72	19.94	-0.16	0.78	4.80	0.49	-3.00	29.28	-0.31
M2	-1.50	18.15	-0.36	-0.91	4.32	-0.63	-2.66	26.78	-0.30
M3	-5.20	17.92	-1.26	-1.51	16.34	-0.28	-9.26	20.51	-1.35
M4	-7.01	15.17	-2.01	-3.83	14.61	-0.79	-10.63	16.61	-1.92
Rule = 12%									
MC	2.37	19.99	0.52	0.71	6.01	0.35	3.49	29.25	0.36
M1	1.08	20.30	23.29	2.61	4.88	1.60	-1.24	29.81	-0.12
M2	0.29	18.48	6.94	0.89	4.39	0.61	-0.89	27.27	-0.10
M3	-3.48	18.25	-0.83	0.28	16.64	0.05	-7.61	20.88	-1.09
M4	-5.31	15.44	-1.50	-2.08	14.87	-0.42	-9.00	16.91	-1.60

(Continued)

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(Gross Domestic Product)

	1960 – 1979			1960 – 1969			1970 – 1979		
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Rule = 14%									
MC	4.20	20.34	0.90	2.51	6.11	1.23	5.34	29.77	0.54
M1	2.89	20.67	0.61	4.44	4.97	2.68	0.52	30.34	0.05
M2	2.09	18.81	0.48	2.70	4.49	1.81	0.88	27.76	0.09
M3	–1.75	18.57	–0.41	2.08	16.93	0.37	–5.96	21.25	–0.84
M4	–3.62	15.72	–1.00	–0.33	15.14	–0.06	–7.38	17.22	–1.29
Rule = 16%									
MC									
M1	4.69	21.03	0.97	6.28	5.06	3.72	2.29	30.87	0.22
M2	3.88	19.14	0.88	4.50	4.55	2.97	2.65	28.24	0.28
M3	–0.03	18.90	–0.007	3.87	17.23	0.67	–4.31	21.62	–0.60
M4	–1.93	15.99	–0.53	1.42	15.41	27.59	–5.75	17.52	–0.99
Discretionary Policy									
MC	12.10	26.38	2.00	1.43	0.54	7.82	24.12	35.45	2.04
M1	12.10	26.38	2.00	1.43	0.54	7.82	24.12	35.45	2.04
M2	12.10	26.38	2.00	1.43	0.54	7.82	24.12	35.45	2.04
M3	12.10	26.38	2.00	1.43	0.54	7.82	24.12	35.45	2.04
M4	12.10	26.38	2.00	1.43	0.54	7.82	24.12	35.45	2.04

(Continued)

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(Non-Oil GDP)

| | 1960 – 1979 | | | 1960 – 1969 | | | 1970 – 1979 | | |
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Rule = 8%									
MC	-2.94	8.35	-1.54	-2.62	5.57	-1.41	-4.20	10.73	-1.18
M1	-4.31	7.93	-2.37	-0.77	4.67	-0.49	-9.06	8.09	-3.36
M2	-4.89	6.47	-3.29	-2.43	4.11	-1.77	-8.32	6.89	-3.62
M3	-5.09	25.33	-0.88	-2.94	16.67	-0.53	-7.62	33.94	-0.67
M4	-7.27	21.69	-1.46	-5.22	15.01	-1.04	-9.80	28.62	-1.03
Rule = 10%									
MC	-1.15	8.50	-0.58	-0.82	5.68	-0.43	-2.43	10.93	-0.67
M1	-2.53	8.70	1.37	1.07	4.76	0.68	-7.38	8.24	-2.69
M2	-3.13	6.59	-2.07	-0.61	4.18	-0.45	-6.63	7.02	-2.83
M3	-3.33	25.80	-0.56	-1.14	16.98	-0.20	-5.91	34.57	-0.51
M4	-5.55	22.09	-1.09	-3.47	15.28	-0.68	-8.13	29.15	-0.84
Rule = 12%									
MC	0.65	8.66	32.79	0.99	5.78	0.51	-0.65	11.13	-0.18
M1	-0.77	8.22	-0.40	2.91	4.84	1.80	-5.69	8.39	-2.04
M2	-1.37	6.70	-0.89	1.18	4.26	0.83	-4.93	7.15	-2.07
M3	-1.57	26.27	-0.26	0.66	17.29	0.11	4.20	35.20	-0.36
M4	-3.83	22.49	-0.74	-1.72	15.56	-0.33	-6.46	29.68	-0.65

(Continued)

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(Non-Oil GDP)

	1960 – 1979			1960 – 1969			1970 – 1979		
	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0	Mean	Standard Deviation	T: Mean = 0
Rule = 14%									
MC	2.45	8.81	1.21	2.79	5.88	1.42	1.12	11.32	0.30
M1	1.00	8.36	0.52	4.75	4.93	2.89	-4.01	8.54	-1.41
M2	0.40	6.82	0.25	3.00	4.34	2.07	3.23	7.28	-1.33
M3	-2.11	22.89	-0.40	0.04	15.83	0.007	-4.79	30.21	-0.48
M4									
Rule = 16%									
MC	4.25	8.97	2.06	4.59	5.99	2.31	2.89	11.52	0.75
M1									
M2	2.16	6.95	1.35	4.80	4.41	3.26	-1.53	7.40	-0.62
M3	1.94	27.21	0.31	4.25	17.91	0.71	-0.78	36.46	-0.06
M4	-0.39	23.30	-0.07	1.79	16.12	0.33	-3.12	30.74	-0.30
Discretionary Policy									
MC	10.41	16.02	2.83	1.74	1.82	2.87	20.02	19.41	3.09
M1	10.41	16.02	2.83	1.74	1.82	2.87	20.02	19.41	3.09
M2	10.41	16.02	2.83	1.74	1.82	2.87	20.02	19.41	3.09
M3	10.41	16.02	2.83	1.74	1.82	2.87	20.02	19.41	3.09
M4	10.41	16.02	2.83	1.74	1.82	2.87	20.02	19.41	3.09

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TABLE 4

SAUDI ARABIA: APPLICATION OF THE MODIGLIANI MONETARY MODEL

(Non-Oil GDP)

	10% Rule		12% Rule		14% Rule		Discretionary Policy	
	M1	M2	M1	M2	M1	M2	M1	M2
1961	5.57	2.20	7.49	4.06	9.41	5.92	1.19	1.19
1962	−1.20	0.82	0.59	0.98	2.39	2.79	0.00	0.00
1963	−7.18	−7.19	−5.49	−5.50	−3.80	−3.82	2.35	2.36
1964	8.81	5.26	10.79	7.17	12.77	9.09	3.45	3.45
1965	0.47	−1.68	2.29	0.11	4.12	1.90	0.00	0.00
1966	−3.00	−6.09	−1.24	−4.38	0.52	−2.68	1.11	1.11
1967	0.71	−1.52	2.54	0.27	4.37	2.63	2.19	2.19
1968	1.16	0.18	3.00	2.00	4.84	3.83	5.38	5.38
1969	4.31	4.05	6.21	5.95	8.10	7.84	0.00	0.00
1970	8.50	5.81	10.48	7.73	12.45	9.66	2.04	2.04
1971	1.62	−1.86	3.47	−0.08	5.31	1.71	2.00	2.00
1972	−19.10	−17.97	−17.63	−16.48	−16.16	−14.99	4.90	4.90
1973	−14.05	−10.94	−12.49	−9.32	−10.93	−7.70	9.34	9.34
1974	−8.24	−10.80	−6.58	−9.18	−4.91	−7.56	17.95	17.95
1975	−6.23	−0.83	−4.53	0.98	−2.83	2.78	61.59	61.59
1976	−9.79	−7.29	−8.16	−5.61	−6.51	−3.92	40.36	40.36
1977	−14.95	−12.52	−13.40	−10.93	−11.86	−9.34	22.36	22.36
1978	−1.81	−1.25	−0.03	0.54	1.76	2.34	14.36	14.36
1979	6.19	3.83	8.12	5.72	10.05	7.61	7.31	7.31

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CONCLUSIONS

In summarizing the results obtained above:

1. The foregoing evidence suggests that in Saudi Arabia's case, discretionary monetay policy (inasmuch as it is realized that it is really fiscal policy that controls the money supply) is inferior to a fixed and steady expansion of the money supply (government expenditures);

2. The fixed expansion rule is superior irrespective of the method of analysis; and

3. The results seem to be in contrast to those of the United States where Modigliani favored discretion (although Bronfenbrenner's favored rules in the conduct of United States monetary policy).

   The policy rules analyzed here are, however, only intended to be suggestive, with the burden of proof of discretionary policy placed on it's advocates. The point of the exercises presented above was simply to illustrate how rules of thumb might be used--not to suggest an optimal rule. It should also be stressed that rules of thumb are just that; they are not great principles to which the Saudi policy makers would want to always mechanically adhere. If economic events in the country clearly indicated the desirability of abandoning a rule, then that should be the prerogative of the decision makers. What the results do say is that Saudi Arabian policy makers should be made aware of the desirability of stability and continuity in the conduct of policy.