

## Stabilization policies and the domestic output response: Evidence from Pakistan



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### ABSTRACT

IS-LM and GARCH models have been used to see the impact of important macroeconomic variables on the domestic output of Pakistan for the periods 1960 – 2012 and 1980 -2010. Money supply (M1 and M2), inflation and US income have a noteworthy connection with the output. The budget deficit and terms-of-trade have a negative impact on output. Immoderate use of money supply and inflation can have devastating repercussions for the overall health of the economy. A sound fiscal policy is essential for realizing the growth potential. Terms-of-trade will improve with exports diversification and low inflation.

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### 1. Introduction

In the simple model of Keynesian income determination equality of aggregate supply (AS) and aggregate demand (AD); and desired investment (I) and saving (S) are the two equilibrium conditions. AS is the economy's aggregate output of goods and services and AD is the society's demand for those goods and services. In this model, autonomous spending and fiscal policy are the major determinants of AD. Money supply and the central bank seem to have no role in the determination of output and employment. IS-LM model besides goods market represented by the IS curve also considers the assets market – money demand and supply-represented by LM curve that introduces an additional channel and shows how monetary policy works. The full Keynesian IS-LM model looks at an equilibrium in which aggregate output produced equals aggregate demand. Real and nominal quantities are the same because a fixed price level is assumed (Dornbusch and Fisher, 1995; Mishkin, 2007).

IS-LM model occupies an important place in modern macroeconomics. Every standard text of macroeconomics (Froyen, 2002; Abel and Bernanki, 2005; Dornbusch and Fisher 1995) carries a discussion of the model. This terminology was popularised by Hansen (1949) but the original

technique was developed by Hicks (1937), who aimed at explaining the Keynes ideas as a geographical representation. The IS-LM model is more flexible and allows us to understand economic phenomenon that cannot be analysed with the simple Keynesian model (Mishkin, 2007). By introducing monetary policy and also treating investment as endogenous, IS-LM model captures more of Keynes ideas (Hillier, 1986). According to Dornbusch and Fisher (1995), IS-LM model is commonly associated with Keynesian approach to business cycles. Classical economists, who believed in the rapid adjustment of prices and wages, would not accept IS-LM model because it is based on the assumption of fixed price level. However, IS-LM model possesses the flexibility to allow for rapidly adjusting wages and prices and this model could be used to analyse classical approach to business cycles.

The textbook version of the IS-LM model is:

$$IS \text{ curve: } Y = h(r, G, T) \quad (1)$$

$$h_1 < 0, h_2 > 0, h_3 < 0$$

$$LM \text{ Curve: } M/P = L(Y, r) \quad (2)$$

$$L_1 > 0, L_2 < 0$$

where

r = the rate of interest

G = government spending

T = taxes

L = demand for money

M = money supply

M/P = real money balances

The meeting point of IS and LM curves summarises conditions for goods and assets market equilibrium and changes in fiscal variables

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(government spending and taxes) and monetary policy (money demand and supply) disturb this equilibrium and IS and LM curves move. Therefore, IS-LM framework, though static has been used to analyse the impact of monetary and fiscal policies on output represented by gross domestic product (GDP).

One problem associated with ISLM framework is the concern that IS curve represents a flow relationship because income, investment and other components are measured over a period of time (year, quarter) while LM curve representing money demand and supply appears to be a stock concept. It is difficult to combine the two curves in a single graph. This may be resolved by assuming that the economy is in *stock* equilibrium at every point during a given period implying similar equilibrium over a period. During 1960s and 1970s, IS-LM model greatly influenced the macroeconomic policy and theoretical debates. Because of its desirable features, IS-LM model has established buoyancy (Colander, 2004; Vercelli, 1999).

## 2. Literature review

### 2.1. Fiscal policy

Pakistan's economy seen in its historical perspective has witnessed significant and noticeable fluctuations in the growth of output caused by both domestic and international factors. Pakistan has used diverse monetary and fiscal policies in response to domestic and international conditions. During 1960s, 1970s and 1980s, Pakistan pursued an expansionary fiscal policy as the country received generous aid and massive remittances in 1980s. This, on one hand, burdened the country with heavy debt and on the other hand, inflation and fiscal deficit plagued the unpalatable macroeconomic situation. The higher growth during the 2<sup>nd</sup> plan (1960-65) was due to the increased inflow of foreign aid to finance industrial development. During the 2<sup>nd</sup> plan foreign aid almost tripled. It financed 42% of development expenditure and more than 50% of the import bill (Brecher and Abbas, 2005). Easy monetary policy also encouraged adoption of capital-intensive techniques in production and thus discouraged employment opportunities. During 1960s Pakistan's economy experienced impressive growth rates in all sectors of the economy.

Huge public sector investment, massive devaluation in the history of the country in 1972, gap between revenue and expenditure, increasing non-development expenditure and oil-price hike of October 1973 deeply affected the economy during 1970s. External factors like world demand, commercial policies of the developed countries, relative price competitiveness and exchange rate fluctuations severely affected Pakistan's exports. During seventies inflation was a worldwide phenomenon but its incidence in Pakistan was most serious and phenomenal. Oil price, inflation and recession in the developed countries in the early

1970s severely affected the balance of payments (BoPs) position of oil-importing developing countries and forced them to borrow heavily or reduce reserves. Pakistan also suffered from these international events of exceptional nature, which imposed severe strains on its BoPs and resulted in marked increase in the degree of international indebtedness and debt servicing (Afzal, 2011).

Keeping in view double-digit inflation in 1970s, government of Pakistan (GOP) pursued price stabilization policies in 1980s both from the supply and demand management sides. The government succeeded in bringing down double-digit inflation to single digit in 1980s despite mounting fiscal deficit. Economic growth was 6.5% per year and the government followed a policy of steady economic reforms. However, structural weaknesses of the economy continued: inelastic tax system, high current expenditure coupled with inadequate development expenditure leading to fiscal imbalance, financial-repression coupled with government ownership and credit control, and high and growing debt-burden ensuing from heavy dependence on borrowing to finance the growth in the 1980s (Khan et al., 1994).

In 1990s has not been a good decade in respect of inflation in Pakistan's history. Inflation imposes both economic and social costs because it serves as a major threat to macroeconomic stability, discourages savings, reduces international competitiveness and thus acts as a sinking weight on export performance and reduces the purchasing power of all particularly fixed income groups. A number of studies on inflation in Pakistan, though these differ on emphasis of factors contributing to inflation, have attributed inflation to the growth in money supply, the supply-side constraints, imported inflation, inflation in government-administered prices, increase in indirect taxes and inflationary expectations (Khan et al., 1996).

During 1990-99 average GDP, growth was 4.59%, which was even less than the 1970s (4.85%). Compared to 1960s and 1980s the economy did not perform well in 1990s. During 2001-2007 and 2008-2011, average GDP growth was 5.7% and 3.7% respectively. During latter half of 2000s, economy has witnessed a depressing growth. The solid macroeconomic stability achieved by following a prudent fiscal policy in the past years disappeared in 2007-08. The imbalances have increased the debt burden in recent years, which was on descending footing until recently. Investment and growth fell leading to decline in foreign exchange reserves that put severe strain on exchange rate. Pakistan has suffered from financial indiscipline in the past and also in future if fiscal discipline is not adopted to achieve the macroeconomic stability.

Exchange rate plays not only an important role in the balance of payments but also in allocation of resources. The managed floating exchange rate set up in 1982 remained in operation till May 1999 when a unified floating exchange rate was introduced. Pakistan's exchange rate has remained

unrealistic and overvalued for the most part of the economic history that besides having income and employment implications has discouraged exports as these were relatively overpriced and less competitive compared to Pakistan's trading partners. Pakistan's economy experienced frequent devaluations during 1990s. During 1993-1996, rupee was devalued in 1993 (9.5%), 1995 (7.5%) and 1996 (3.79%) apart from normal depreciation under managed float (Afzal, 2011).

The main source of increase in public debt during 2008-09 had been a fast increase in the foreign currency component which accounted for 63 percent of the total increase in public debt. This component grew by Rs 1,013 billion (37 percent) because of rising foreign public debt inflows and significant depreciation of the rupee vs. the US dollar. The rupee lost about 20 percent of its value against the US dollar during 2008-09. An increase of Rs 633 billion, around 39.6 percent of the total increase in TPD (total public debt), was exclusively because of depreciation of the rupee against the US Dollar.

The USA subprime catastrophe that originated in the second half of 2007 was ultimately transformed into a worldwide economic dilemma over a period of less than a year. Pakistan underwent a phase of fiscal tightening and a stringent monetary position. The worldwide financial crisis and the policy responses of the governments around the world demonstrated the potential role for fiscal policy to stabilize the global economy and to avert an unemployment scenario of the great depression. However, the present global economic environment is characterized by a frail financial system, high public deficits and increasing debts.

The global financial crisis did not seriously affect Pakistan's economy because of its lower exposure to international finance. However, Pakistan faced multifaceted challenges on external and internal fronts notably fight against extremism, shaky law and order situation, energy crisis and uncertain external inflows. Furthermore, the unparalleled disaster of floods in 2010 and torrential rain in Sindh in 2011 added fuel to the stress on the frail economy. Government of Pakistan asserted that the fiscal situation was well contained due to managing the fiscal deficit within acceptable level due to an expenditure management strategy, austerity measures and reforms in public sector enterprises. The budget deficit decreased from 7.6 percent in 2008 to 5.9 percent in 2010-11.

GOP in 2011-2012 admitted that for over a decade the low tax to GDP ratio had been a chief economic issue faced by Pakistan. The overall tax to GDP ratio oscillated between 9.5 and 11.4 percent mostly due to structural deficiencies in the tax and administration system. Pakistan has the lowest tax to GDP ratio in the region as well as other countries. Presently Pakistan is confronting untenable fiscal deficits and unabated debt service charges due to both external and internal challenges including electricity and gas shortages that have limited the overall growth of the economy. Similarly, inadequate

external inflows have resulted in increased dependence of government on domestic resources.

## 2.2. Monetary policy

During 1950-60, lending to private sector was not significant (Janjua, 2005). Public sector accounted for more than 70% lending from the banking system. Most of the monetary expansion resulted from credit to the public sector. While during 1961-72, more than 75% credit went to private sector because of towering growth rates of investment and production and large inflow of external resources. Since 1949-59 interest rate as an instrument of monetary policy was not often used as the State Bank of Pakistan (SBP)<sup>†</sup> believed that an increase in the interest rate would unfavourably affect the investment environment. During 1959-72, the SBP made widespread use of selective credit controls to achieve the objectives of monetary policy. This was a period of relative price stability. This resulted from high growth rate that averaged 6.78% during 1960-70 due to liberal import policy, and current account deficit.

Before 1972, monetary policy was conducted through indirect methods of credit control. In the post 1970s era reliance was made on additional direct methods by controlling the volume, the cost and allocation of credit in the economy. At macro level, credit planning and ceiling were effective instruments of monetary policy that facilitated development process without generating unmanageable inflation. However, during 1970s massive public sector investment was made in the mega public sector projects that enormously benefited the military regime in 1980s.

During 1973-79, annual monetary growth was over 20% with average GDP growth of 4.6% and average price increase of 18% and the corresponding figures were 6.6% and 7.3% respectively in military regime in 1980s. Since early 1970s the government has enjoyed control over the management of monetary policy. Before the introduction of financial sector reforms in early 1990, the SBP had adopted monetarist approach to monetary policy that was based on targeted growth rate, inflation target and expected behaviour of foreign sector. It was in late 1990s that the market based monetary management was adopted. Monetary policy and exchange rate were fully integrated. This marked the beginning of the fourth and final stage. This review of monetary policy shows that Pakistan has followed mainly easy monetary policy in the country's history of economic development and growth.

The noteworthy role and success of monetary policy appeared more explicit in the 2000s when the results of financial sector reforms materialized in the form of a better market based foreign exchange and money markets. The SBP changed the expected rate of inflation during the year 2005 implying that the

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<sup>†</sup>Pakistan's central Bank

central bank had not kept in view the ground realities. When increase in inflation became unmanageable, SBP had no choice but to follow a tight monetary policy. The tight monetary policy did not influence the private sector demand for credit that reached Rs.362 billion in April 2005 compared to the real and revised estimates of Rs.200 and 350 billion. The private sector continued borrowing from the banking system even at high interest rate, though negative in real terms.

Mishkin (1995) says that both economists and politicians have supported the use of monetary policy for stabilization of output and inflation because the significance of fiscal policy has vanished since its popularity in 1960s and monetary policy has assumed added importance in macroeconomic policy making. He has briefly discussed transmission mechanisms that include interest rate channel, the exchange rate channel, asset prices effects (notably Tobin's q theory of investment and wealth effects on consumption), and the credit channel. He has shown that the understanding of monetary transmission mechanisms is crucial to answering a broad range of policy options regarding the conduct of monetary policy.

Dohmen (2002) critically assesses several model accounts written in the 1990s by epistemologists and philosophers of science by relating them to a specific but crucial example of model building, namely Hicks (1937) construction of the first version of the IS-LM model, and examines how far these accounts apply to this case. The paper contributes to answering why and how economists build models. The view crystallizes that economists build models not only to facilitate the conceptual exploration of theory, but also to inform our understanding of the world. Elements of model building, such as analogies, metaphors, stories, theoretical notions, empirical findings and mathematizations, but also the mode of representation, shape the model and largely determine how much can be learned about theory and the real world by using the model as a tool.

Gali (1992) used US Post-War data for money, interest rates, prices and GNP and also four exogenous variables (money demand and supply, IS, aggregate supply shocks ) which have been used to be identified as four sources of fluctuations in the IS-LM-Phillips curve model. The dynamic properties of the estimated model have been analysed and it has been shown that these match most of the stylised predictions of the model. Taylor (1995) has provided an overview of monetary transmission mechanism describing the impact of changes in monetary policy on real GDP. Changes in financial market prices including the long-term interest rates and exchange rates are the main factors for transmission of policy. His framework incorporates rational expectations and policy rules is emphasised. Bernanke and Gertler (1995) have analysed the responses of GDP and its components to monetary policy shocks and have shown how the credit channel helps explain the facts. The balance sheet and bank lending channels

are the two main components emphasised in their analysis.

### 3. Methodology

GARCH model is used to analyse the impact of monetary and fiscal policies on the real GDP of Pakistan. Conventional econometric models assume that the disturbance term is homoscedastic. This assumption is the focal point of ARCH/GARCH models (Engle, 2001; Engle, 1982; Patterson, 2000; Enders, 2008). Many economic time series demonstrate that large volatility periods are followed by periods of calmness. In such situation the assumption of homoscedasticity does not hold and the regression coefficients for an ordinary least squares are still unbiased but standard errors and confidence intervals are too narrow leading to a false sense of precision. In modelling volatility, the conditional variance is of tremendous importance. This may affect the conditional mean giving rise to regression model for the mean that includes some function of the conditional variance.

Shocks like discovery of oil-fields, OPEC price-hike, 9/11 events, October 8, 2005 earthquake, the so-called war-on-terror etc., can potentially affect the economy and its output. Engle (1982) answered that volatility could be modelled so that it responds to different shocks by an ARCH (autoregressive conditional heteroscedasticity) process. The key distinction is between the unconditional variance and the conditional variance. The former can be a constant while the latter is time varying. Time varying conditional heteroscedasticity was suggested by Engle (1982). In the simplest case  $\sigma_t^2 = \alpha_0 + \alpha_1 \mu_{t-1}^2$ . A major breakthrough in econometric modelling was the discovery that, for many families of econometric models, linear and nonlinear alike, it is possible to specify a stochastic process for the error terms and predict the average size of the error terms when models are fitted to empirical data. This is the essence of ARCH modelling introduced by Engle (1982).

ARCH models are widely used in various branches of econometrics. He suggested that it is better to model the mean and variance of a series simultaneously when we suspect that the conditional variance is not constant. The ARCH (1) will simultaneously model the mean and the variance of the series with the following specification:

$$Y_t = X_t' \beta + \mu_t \quad (3)$$

where  $X_t$  is  $k \times 1$  vector of regressors at time  $t$  and  $\beta$  is a  $k \times 1$  vector of coefficients. It is assumed that  $\mu_t \sim \text{iid } N(0, \sigma_t^2)$ . The above is ARCH (1) model such that

$$\sigma_t^2 = \alpha_0 + \alpha_1 \mu_{t-1}^2 \quad (4)$$

Accordingly the conditional variance depends on one period lag of the squared error term  $\mu_{t-1}^2$  and this is an ARCH (1) process applied to the dependent variable. The disturbance term  $\mu_t$  has a constant



mean but  $\sigma^2_t$  varies with time and follows an autoregressive process of order q. Thus an ARCH (q) process is given by:

$$\begin{aligned} \sigma_t^2 &= \alpha_0 + \alpha_1 \mu_{t-1}^2 + \alpha_2 \mu_{t-2}^2 + \dots + \alpha_q \mu_{t-q}^2 \\ \sigma_t^2 &= \alpha_0 + \sum_{j=1}^q \alpha_j \mu_{t-j}^2 \quad j = 1, 2 \dots q \end{aligned} \quad (5)$$

Eqs. 3, 4 and 5 are the mean and variance equations respectively for ARCH (1) and ARCH (q).

Bera and Higgins (1993) noted that ARCH models are simple and easy to handle, and take care of clustered errors, nonlinearities and changes in the econometrician's ability to forecast. However, ARCH models are difficult to estimate since negative estimates of  $\alpha_i$  coefficients are obtained. To take care of this problem, Bollerslev (1986) developed the generalized ARCH (GARCH) model that allows the conditional variance to be an ARMA (autoregressive moving average) process in which the conditional variance of  $\mu_t$  ( $\sigma^2_t$ ) not only depends on lagged  $\mu^2_t$  but also on lags of  $\sigma^2_t$  itself. This is given by

$$\begin{aligned} \sigma_t^2 &= \alpha_0 + \alpha_1 \mu_{t-1}^2 + \alpha_2 \mu_{t-2}^2 + \dots + \alpha_q \mu_{t-q}^2 + \beta_1 \mu_{t-1}^2 + \\ &\dots + \beta_j \mu_{t-p}^2 \end{aligned} \quad (6)$$

Eq. 6 can be written as follows:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^q \alpha_i \mu_{t-i}^2 + \sum_{j=1}^p \beta_j \mu_{t-j}^2 \quad i = 1, 2 \dots q \quad j = 1, 2 \dots p \quad (7)$$

The generalised ARCH (p, q) model given by (7) is called GARCH (p, q) model and includes both autoregressive and moving average components in the heteroscedastic variance. Eq. 7 suggests that the value of the variance  $\sigma^2_t$  now depends on past values of the shocks represented by the lagged squared residual terms and past values of itself given by lagged  $\sigma^2_t$  terms.

In the GARCH (p, q), p refers to the lag on  $\sigma^2_t$  and q to the lag on  $\mu^2_t$ . If in Eq. 7,  $\beta_j$  is zero, GARCH (p, q) is equivalent to ARCH (q) model. In the GARCH (p, q) process necessary and sufficient condition for stationarity is that the sum of  $\alpha$  and  $\beta$  coefficients in Eq. 7 is less than one. In the widely applied GARCH (1, 1) model,  $\sigma^2_t = \alpha_0 + \alpha_1 \mu_{t-1}^2 + \beta_1 \sigma_{t-1}^2$ , the sum of estimated  $\alpha$  and  $\beta \sim 1$ , or even greater than one.

Engle and Bollerslev (1986) have shown that if  $\alpha_1 + \beta_1 \geq 1$ , the conditional variance is persistent to shocks. GARCH (1, 1) has only three unknown parameters  $\alpha_0, \alpha_1$  and  $\beta_1$ . Since many economic series show periods of volatility and tranquillity and for a stable process, the conditional variance will eventually decay to the long-run (unconditional) variance, ARCH and GARCH models can capture the instability and tranquillity. Parsimony is the major advantage of GARCH over ARCH model because the former captures the complicated patterns of time-variability in the conditional variance using fewer parameters than an ARCH model.

Therefore, the purpose of this paper is to see the response of domestic output (GDP) in Pakistan to

changes in money supply ( $M_1$  and  $M_2$ ), terms of trade, fiscal deficit, and inflation besides world economic conditions proxied by the US income. The use of OLS (ordinary least squares) may provide unreliable results and inefficient estimates. We, therefore, apply IS-LM model and use GARCH (1, 1) process to estimate the error variance. Using IS-LM model, we have the following specification:

$$\ln y_t = \alpha \ln m_{1t} + \beta \ln fd_t + \theta \ln \pi_t + \psi \ln tot_t + \delta \ln US_{yt} + \mu_{1t} \quad (8)$$

$$\ln y_t = \alpha \ln m_{2t} + \beta \ln fd_t + \theta \ln \pi_t + \psi \ln tot_t + \delta \ln US_{yt} + \mu_{2t} \quad (9)$$

where

ln = natural logarithm

y = GDP of Pakistan

$m_1$  =  $M_1$  money supply

$m_2$  =  $M_2$  money supply

fd = government fiscal deficit

$\pi$  = inflation

tot =  $uvx/uvm$

uvx = unit value of exports

uvm = unit value of imports

$US_y$  = US income

$\mu_{1t}$  and  $\mu_{2t}$  = disturbance terms

The expected sign of each coefficient is difficult to anticipate exactly *a priori*. An increase in money supply will lower the interest rate and if investment is sensitive to the interest rate, it will be stimulated that will raise the GDP. According to the Keynesian view, money is not neutral in the short-run and therefore, increased money supply causes output and employment to rise and the real interest rate to fall. Classical economists hold the view that money is neutral even in the relatively short-run. The impact of fiscal deficit though not certain is expected to increase output. According to Dornbusch and Fisher (1995) expansionary fiscal policy tends to raise consumption through multiplier but would be likely to reduce investment through the induced increase in the interest rates. Therefore, a dominant view is that fiscal policy should not be used as a tool for demand management.

There is divergence of opinion regarding the desirability of fiscal deficit. One view is that fiscal deficit in the short-run will raise aggregate demand and hence GDP. According to Ricardian equivalence proposition, tax cuts do not affect required consumption and hence needed saving given no change in current or planned government purchases because people know that they will pay higher taxes in future because the government has to pay its debt in the form of higher taxes that means lower future disposable income. The Ricardian equivalence proposition may not apply if consumers fail to take into consideration the expected future tax increases in their planning. A tax cut in this situation will increase consumption and reduce saving (Abel and Bernanki, 2005). Barro (1974) is of the view that the Ricardian equivalence proposition may also apply

even if the current generation receives the tax cut and future generations bear the burden of repaying the government debt.

The Ricardian proposition implies that deficit-financed government spending may have neutral impact in the long-run (Barro, 1989). Blanchard (1985) and Bernheim (1987) argued against the Ricardian equivalence proposition. Both classical and Keynesian approaches imply that fiscal deficit can cause aggregate demand to rise more quickly than aggregate supply leading to inflation. However, fiscal policy changes cause only a one-time increase in aggregate demand and it is not expected that that this would cause a sustained rise in the prices. It is the sustained growth in money supply that leads to a continuing rise in prices.

Terms of trade also play a significant role in the economic growth. Favourable terms of trade (TOT) benefit a country as its exports fetch more goods in exchange and its capacity to import increases. Adverse TOT implies that the real opportunity cost of a unit of import rises when its export prices decline relative to its import prices. The adverse TOT drains out the resources because to maintain old level of imports more exports are needed and unfavourable TOT are an important factor in the balance of trade deficit (Afzal and Ali, 2008).

Like exchange rate inflation has also vague effects on the output. Rising expected inflation would lower the real rate of interest according to Fisher equation ( $i = \pi^e + i_r$ , where  $i$  is nominal rate of interest,  $i_r$  is the real rate of interest and  $\pi^e$  is the expected inflation). Similarly inflation also has many negative effects. Inflation discourages savings, breeds macroeconomic instability and uncertainty. Inflation creates balance of payments (BoPs) problems. Country loses international competitiveness vis-à-vis its important trade partners that breeds BoPs deficit. Exchange rate fluctuates considerably that further aggravates inflation. The inflation costs depend on whether the inflation is anticipated or unanticipated. The costs of anticipated inflation are relatively minor that include shoe-leather costs and menu costs. Unanticipated inflation causes unpredictable transfer of wealth among individuals and firms (Afzal and Awais, 2012).

Following literature (Cuadros et al., 2004; De Gregorio, 1992), USA GDP ( $U_{sy}$ ) is used as a proxy for world economic conditions. This is an exogenous variable that can influence the economic growth in a multiplicity of ways as is evident from the various international events of crucial importance like demise of the Bretton Woods system, oil-price rise of 1973 and 1979, 9/11 events, globalisation etc. These events can significantly influence the exports, imports and exchange rate of a country. The rising oil-prices created rising and persistent balance of payments problems for LDCs (less developed countries) in 1980s and have burdened these countries with heavy debt whose service over the years has become unpalatable and unbearable. Exceptional rise in oil prices that increased from \$55

per barrel in 2007 to over \$120 per barrel (118.18% increases) in May 2008 and depreciation of dollar against major currencies resulted in huge import cost in countries like Pakistan and passing on of this cost to consumers propelled inflation.

Since quarterly data for many variables were not available, annual data are used for the periods 1960-2012 and 1980-2010. Data on GDP, consumer price index (cpi), money supply ( $m_1$  and  $m_2$ ), and fiscal deficit (fd) were collected from Government of Pakistan (GOP), Economic Survey (various issues). The data on  $m_1$  from 1960-71 are from Kemal et al. (1980). The data for  $m_2$  were not available before 1980. Data on USA income were obtained from IMF, International Financial Statistics (various issues). All variables are nominal since IS-LM model is based on the assumption of a fixed price level and consequently nominal and real variables are the same (Besides we obtained statistically unsustainable and unreliable results with real variables).

#### 4. Analysis and discussion

Since time series data are used, the examination of stationarity/non-stationarity is important before doing any empirical work which is closely linked to the tests for unit roots. ADF unit roots test showed that all variables have unit root. The theory of cointegration provides useful information about the relationship between the variables. Cointegration between two series implies that there exists a long-run relationship between them. A lack of cointegration suggests that such variables have no long-run relationship. Johansen (1991, 1995) cointegration methodology was used. Hypothesis of no cointegration was rejected implying the underlying variables have long-run relationship. However, when Bivariate cointegration was explored, except Pakistan's GDP and US income, cointegration was absent between GDP and other variables. For space consideration results are not reported.

Two measures of money supply ( $M_1$  and  $M_2$ ) have been used in order to see the difference in their impact on the GDP. Tables 1 and 2 show the estimation results of GARCH for  $M_1$  and  $M_2$ . The coefficient of determination ( $R^2$ ) explains significant variation in the GDP.  $M_1$ ,  $\pi_t$  and  $U_{sy}$  have positive and significant impact on the GDP. This implies that the rise in these variables will increase the output in Pakistan. For example, 1 percent increase in  $M_1$  will raise GDP by 6 percent and the same explanation applies to rest of the coefficients in both Tables. The coefficients of fiscal deficit and terms-of-trade are negative and significant. Both have negative impact on the output. Therefore, fiscal discipline is answer to economic stability. In the variance equation coefficients for ARCH is insignificant while GARCH has highly significant coefficient meaning that GARCH (1, 1) process is suitable.

**Table 1: Model I**

	Coefficient	Std. Error	z-Statistic	Prob.
C	6.074064	0.360564	16.84602	0.0000
lnm <sub>1</sub>	0.063983	0.024342	2.628547	0.0086
lnfd	-0.063594	0.021515	-2.955845	0.0031
lnπ <sub>t</sub>	1.304582	0.055768	23.39314	0.0000
ln <sub>tot</sub>	-0.313496	0.045977	-6.818473	0.0000
lnUS <sub>y</sub>	0.469246	0.102263	4.588638	0.0000
Variance Equation				
C	0.000291	0.000385	0.756178	0.4495
ARCH(1)	0.409594	0.350741	1.167796	0.2429
GARCH(1)	0.587239	0.244438	2.402404	0.0163
R-squared	0.98	Akaike info criterion		-1.778700
S.E. of regression	0.12	Schwarz criterion		-1.444122

Dependent Variable: lny; Method: ML – ARCH; Sample: 1960 – 2012

In Table 2, like Table 1, all the coefficients are significant. However, magnitude of the coefficients has changed for all the variables. M<sub>2</sub> has a larger

coefficient than M<sub>1</sub> suggesting that the former has more robust impact on the output. Based on AIC and SC, model II appears to be a better model.

**Table 2: Model II**

	Coefficient	Std. Error	z-Statistic	Prob.
C	4.840819	0.088561	54.66097	0.0000
lnm <sub>2</sub>	0.125738	0.027158	4.629923	0.0000
lnfd	-0.088090	0.017296	-5.092975	0.0000
lnπ <sub>t</sub>	1.034908	0.032555	31.78936	0.0000
ln <sub>tot</sub>	-0.336967	0.035386	-9.522484	0.0000
lnUS <sub>y</sub>	0.776393	0.043741	17.74981	0.0000
Variance Equation				
C	6.09E-05	1.16E-05	5.268087	0.0000
ARCH(1)	-0.202604	0.317782	-0.637556	0.5238
GARCH(1)	1.155743	0.289784	3.988290	0.0001
R-squared	0.99	Akaike info criterion		-3.458270
S.E. of regression	0.03	Schwarz criterion		-3.050132

Dependent Variable: lny; Method: ML – ARCH; Sample: 1980-2010

There are several policy implications. The positive and significant coefficient of M<sub>1</sub> and M<sub>2</sub> imply that easy monetary policy will stimulate the economic growth. Comparing the coefficients of M<sub>1</sub> (0.06) and M<sub>2</sub> (0.12), the impact of M<sub>2</sub> on GDP is larger than M<sub>1</sub>. The highly significant and positive coefficient for inflation appears to have positive effect on economic growth. But this must be interpreted and applied cautiously because of various adverse impacts of inflation mentioned above.

Rising inflation rate severely affects the real exchange rate that compares the inflation rate in exporting and importing countries. High inflation in one trading country compared to its trade partners implies a deteriorating real exchange rate and therefore, devaluation of the nominal exchange rate becomes inescapable which is expected to make exports competitive. Devaluation makes imports expensive, raises international debt burden and breeds inflation and reduces standard of living. Devaluation adds fuel to the fire and the vicious circle starts. Rising inflation due to devaluation makes exports less competitive and a need for devaluation arises making the vicious circle complete (Afzal and Ali, 2008). Devaluation is successful when it is larger than necessary as it happened in 1972 devaluation when Pakistan’s exports increased by 153.6 % in terms of rupee and 40.2% in terms of dollar.

### 5. Conclusion

IS-LM approach and GARCH model have been applied to see how output (GDP) in Pakistan responds to important macroeconomic variables. In the models, money supply, inflation, and US income have a positive and significant relationship with the GDP. Fiscal deficit and terms-of-trade have an adverse impact on output in both models. The significance of the GARCH (1) in both models implies that the error variance depends on past squared error and past error variance. The use of OLS would not have provided reliable results.

The above results regarding money supply and inflation do not necessarily suggest that the government makes a relentless use of these macroeconomic variables in order to achieve rapid growth of GDP. Immoderate use of these policies can have devastating repercussions for the overall health of the economy keeping in view the adverse impact of the inadequate money supply, and inflation. The impact of fiscal deficit might not be considered unimportant. Each notably fiscal deficit is of great significance for the macroeconomic stability. A sound fiscal policy is necessary for preventing macroeconomic imbalances and realizing the full growth potential. Pakistan had seen serious macroeconomic imbalances in the 1990s mainly on account of its fiscal policy.

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