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Evaluation of Systematic Monetary Influences in Pakistan's Perspective

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ARTICLE DETAILS	ABSTRACT
History: Accepted 14 December 2021 Available Online December 2021	<i>Traditional macroeconomic theories establish relationship among certain macroeconomic variables based on assumptions of perfect competition and resulting flexible prices. Theories based on these assumptions might not hold for developing economies due to imperfect market structure and fragile financial institutions. This study attempts to analyze the quantity theory of money (QTM) and Phillips curve (PC) relationship from long-run perspective for economy of Pakistan. QTM relates complete absorption of money growth effect into inflation, and PC establishes negative relationship between inflation and unemployment. In the long-run, money is assumed to have only inflationary or nominal effect. Therefore, presence of any long-run tradeoff between inflation and unemployment, once inflation is a pure monetary phenomenon in the long-run, cast serious doubts regarding long-run neutrality of money. Autoregressive distributed lag (ARDL) modelling approach is opted to analyze long-run impact of money growth on inflation, and long-run effect of inflation on unemployment. The long-run relationship between inflation and unemployment is statistically insignificant for economy of Pakistan. Furthermore, results of this study show that inflation, even in the long-run, does not adjust as theorized in QTM.</i>
Keywords: Quantity Theory of Money, Phillips Curve, Money Supply, Inflation, Unemployment	
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1. Introduction

Developing economies are marred with political structure that favors the rich and results in weak and corrupt institutions (Khan, 1998). Therefore, incidences of tax evasion leads to prevalence of indirect taxes in developing countries (Tanzi & Davoodi, 2000; Stiglitz, 2010). As a result, governments in these economies fail to collect sufficient direct tax revenues (Bird & Zolt, 2014). Consequently, reliance on indirect taxes and printing of new money remain the main sources of revenues in developing economies (Tanzi, 1986; Bird, 1992). Printing of new money comes at the cost of inflation and its excess use can lead to hyperinflation (World Bank, 2010). Furthermore,

imperfect market structure along with fragile financial system are also hallmarks of these economies (Rodrik, 1988; Tybout, 2000; Kose et al. 2003).

Pakistan being a developing country is also facing above mentioned problems¹. Then acceptance of standard economic theories based on assumptions more suitable to developed economies without testing can lead to erroneous policy making. Quantity theory of money (QTM) is one of those theories that are based on the assumptions of perfectly competitive labor, product and asset markets (Patinkin, 1965). QTM establishes one-to-one relationship between growth of money supply and price growth given constant velocity of money and output (Newcomb, 1885; Foville, 1907; Fisher, 1911; Friedman, 1956). Therefore, the role of expansionary monetary policy is supposed to be inflationary without real effects² (Friedman, 1970; Lucas, 1980; Berentsen et al. 2008).

The assumption of instantaneously clearing markets is based on the assumption of perfect competition. Monopolistic competition is more prevalent market structure in real world as compared to perfect competition (Kirzner, 1973). Therefore long-run clearing markets are more plausible especially when economy under consideration is a developing one. Moreover, conditions of constant velocity of money and output are more likely to hold in the long-run rather than in short-run. Therefore, there is more consensus regarding long-run neutrality of money as compared to short-run money neutrality among competing economic paradigms (Wallace, 2005).

One crucial channel of expanding output beyond full-employment level is inflation-unemployment tradeoff implied in the Phillips curve (Phillips, 1958; Samuelson & Solow, 1960; Lipsey, 1960). When actual inflation is not predicted correctly by workers then they make a forecast error about inflation. For example, when workers are assuming zero inflation then an increase in nominal wage is considered as an increase in real wage. Firms know their actual prices, and hence can increase nominal wage less proportionally than price increase. Since real wage in this situation decreases and firms increase their demand for labor. Workers tend to increase their labor supply assuming that there are being overpaid when actual situation remains converse.

Consequently, a negative relationship between unemployment and inflation arises in the shape of Phillips curve. If there exists a menu to choose a tradeoff between inflation and unemployment then policy makers can be lured towards this option to achieve short-run above average growth objectives. Unemployment and inflation comes with a negative sign in the welfare function of the policy maker therefore increase of employment at the cost of inflation is not an easy choice. For a developing economy like Pakistan, political ambition can win over policy wisdom once some gainful tradeoff exists. Although, continuous discretionary role of monetary policy to achieve ambitious goal of higher employment at the cost of inflation is not aligned with stable growth of the economy. (Friedman, 1968; Phelps, 1968).

The effectiveness of monetary policy lies in the beliefs that either prices are sticky in short-run or consumers and workers make some forecast errors regarding prices or wages. Plausible sources of price stickiness are forecast errors about wages or prices due to adaptive expectations (Fisher, 1930; Cagan, 1956 and Friedman 1957), wage contracts for more than one periods (Phelps and Taylor, 1977), menu cost (Akerlof & Yellen 1985a, Akerlof & Yellen 1985b and Mankiw, 1985), and asymmetric information between consumers and producers (Mankiw & Romer, 1991). All above

¹ For reference, see Pasha (1995), Kemal (2001), Zaidi (2005) and Malik (2007).

² This inflationary effect is assumed when money supply is used as a policy instrument.

mentioned sources of nominal rigidities lead to economic decisions that are suboptimal. There is some evidence that points to price rigidity in Pakistan³. Hence, testing of long-run money neutrality seems to be a more valid case for this economy. The model for the economy of Pakistan is developed to test validity of QTM along with existence of Phillips curve relationship for economy of Pakistan.

The specific objective of the study is.

To prove the non-neutrality of money for economy of Pakistan by estimating its long-run negative relationship between inflation and unemployment to prove be a monetary phenomenon.

2. Review of Literature

2.1 Literature on Monetary Growth and Inflation

The first subsection provides studies regarding relationship between money supply and inflation. Second subsection is devoted to studies regarding effects of inflation for real economy. The review of literature that is done below is succinct, but provides directions of previous works.

There is a great amount of literature available for developed economies regarding relationship between money and inflation. Some earlier examples for U.S. economy are Cagan (1956), Friedman (1956, 1960, 1971), and Lucas (1980) indicated inflation as a monetary phenomenon for U.S. economy. On the other hand, studies of Sargent and Wallace (1973), Frenkel and Johnson (1977) and Jacobs (1977) showed that causation runs from inflation to money growth when governments support expenditure through money creation. MacCandless and Weber (1995) found positive correlation between money supply and inflation using time series data for 110 countries. Herwartz and Reimers (2006) using panel data for 110 countries validated the presence of money-inflation relationship for countries with high inflation.

Studies on Pakistan's economy also indicate existence of relationship between money and inflation. Chaudhary and Ahmad (1995) showed covering of budget deficit by borrowing from banking system as a source of inflation. Malik (2006) found money supply as a granger cause of inflation. Qayyum (2006) validated positive relationship between money supply and inflation. Yasmin et al. (2013) showed bidirectional causality between inflation and money supply.

2.2 Literature on Money Neutrality

Lashkary and Kashani (2011) showed absence of any significant relationship between money supply, output and employment for Iranian economy. Asongu (2013) validated the presence of long-run money neutrality for 34 African countries. Rahman and Qayum (2013) found evidence for money neutrality when M2 was used as a measure of monetary stock while no evidence could be supported when they used M1 for economy of Bangladesh. Bhatia (2015) found evidence in favor of significant relationship between money supply and economic activity for Indian economy.

Studies on Pakistan show significant influence of inflation for real economy. Hassan (1988) concluded long-run relationship between inflation and labor demand as a valid case for economy of Pakistan. Zaman et al. (2011) showed presence of negative long-run causality between inflation and unemployment rate. Satti et al. (2007) found significant role of inflation for real economic activity and expected inflation. Malik (2010) showed inflation and unemployment as important factors for GDP growth of this economy.

³ For reference, see Hassan (1988), Satti et al. (2007), Haider (2008), and Malik (2010).

The literature review clearly shows that there is no unanimity about anticipated monetary effects for real variables for developing economies, but case of Pakistan is different. On the other hand, more consensus is available regarding the effects of systematic monetary influences on nominal variables. This study will assess the tradeoff between inflation and unemployment in an augmented model that evaluates long-run quantity theory of money.

3. Research Methodology

The first subsection provides the details of data sets, and their sources. The second subsection deals with methodology that is employed to obtain the results for this study.

3.1 Data Source

The tradeoff between inflation and unemployment along with nominal effect of money growth on inflation is evaluated by constructing a model that involves rate of inflation, unemployment gap and growth rate of money supply (g_{M2}). Time series data on level form of all variables are taken from various issues of the Pakistan Economic Surveys and handbook of statistics published by the State Bank of Pakistan. Time span of these data sets is from year 1973 to year 2016.

3.2 Econometric Model

There are different models that are employed by different researchers to estimate either the relationship between money supply and inflation or unemployment and inflation. We will incorporate the variable of money growth in one of the key equations that is used for assessing the tradeoff between inflation and unemployment.

$$\pi_t = \alpha(L)\pi_{t-1} + \beta(L)UN_{gap,t} + \epsilon_t \dots (1)$$

Where, π_t is the rate of inflation in period t .

$UN_{gap,t}$ is the unemployment gap which is equal to actual rate of unemployment minus natural rate of unemployment. The unemployment gap is computed by Hodrick-Prescott filter that decomposes a series into a trend and a cycle.

If there exists a valid tradeoff between inflation and unemployment then the coefficient of unemployment gap should be statistically different from zero with negative sign. Inclusion of money growth variable into equation (1) will allow simultaneous testing of relationships between unemployment and inflation, and money supply and inflation.

$$\pi_t = \alpha(L)\pi_{t-1} + \beta(L)UN_{gap,t} + \gamma(L)g_{M2} + \epsilon_t \dots (2)$$

The one-to-one relationship between monetary growth and price growth would mean the coefficient of money growth should be statistically significant with magnitude of plus one. Therefore, equation (2) is a nested model that takes equation (1) as its special case. The cointegration technique can be employed to estimate long-run coefficients of unemployment gap and growth rate of money supply.

Concept of integrated variables (Granger, 1981) and thus cointegration analysis (Engle & Granger, 1987, 1991) proved to be the cure of spurious regression. Widely used techniques of cointegration are, the Granger (1981), Engle and Granger (1987), Johansen's (1988) cointegration

4 Zaman et al. (2011) used this model to evaluate inflation-unemployment tradeoff for economy of Pakistan.

technique, and Pesaran and Shin' (1999) and Pesaran et al' (2001) Autoregressive distributed lag (ARDL) cointegration technique also knows as bound test of cointegration. This study will use Pesaran and Shin's (1999) and Pesaran et al. (2001) ARDL technique. Detail of ARDL modelling approach technique is given below.

3.3 Autoregressive Distributed Lag Model (ARDL)

There is one major cointegration technique that is available to study short-run dynamics and long-run steady state relationships among variables of interest, especially when variables under consideration are integrated of different orders. The modeling framework that tests and allows estimation of cointegrating relationship is known as Autoregressive distributed Lag Model.

An ARDL model specifies relationship between dependent and independent variables that are linked contemporaneously and historically as well. Hence, this type of model presents current value of dependent variable as a function of current values of explanatory variables as well as lags of dependent and explanatory variables. This type of model can be specified as:

$$y_t = a_0 + a_1 t + \sum_{i=1}^p \gamma_i y_{t-i} + \sum_{j=1}^k \sum_{l_j}^{q_j} \beta_{j,l_j} x_{j,t-l_j} + \epsilon_t \quad (3)$$

Where, a_0 is constant of the model, a_1 is the coefficient of linear trend in above model, γ_i and β_{j,l_j} are the coefficients of lags of dependent variable (y_t) and lags of k independent variables ($x_{j,t}$). Where $j=1, \dots, k$. Equation (3) can be shown in terms of lag-operator as:

$$\gamma(L)y_t = a_0 + a_1 t + \sum_{j=1}^k \beta_j(L)x_{j,t} + \epsilon_t \quad (4)$$

Where L denotes lag operator, and $\gamma(L)$ and $\beta_j(L)$ are lag polynomials. These lag polynomials can be presented as:

$$\gamma(L) = 1 - \sum_{i=1}^p \gamma_i L^i$$

And

$$\beta_j(L) = 1 - \sum_{l_j=1}^{q_j} \beta_{j,l_j} L^{l_j}$$

The specification presented by equation (3) or (4) are very general representations to define relationship between dependent and independent variables. The special specification of ARDL model extracted from equation (4) is widely used in applied work. This representation is popular in applied work as it allows to test cointegration by reducing an autoregressive model into a conditional error correction (CEC) form. This representation is actually an ARDL model with one-to-one correspondence with model presented by equation (4). Equation (4) can also be written as:

$$\Delta y_t = a_0 + a_1 t + \gamma(1)y_{t-1} + \sum_{j=1}^k \beta_j(1)x_{j,t-1} + \left(\tilde{\gamma}^*(L)\Delta y_{t-1} + \sum_{j=1}^k \tilde{\beta}_j(L)\Delta x_{j,t-1} \right) + \sum_{j=1}^k \beta_j(L)\Delta x_{j,t} + \epsilon_t \quad (5)$$

The representation presented by equation (5) has made use of Beveridge-Nelson's decomposition to obtain following expression:

$$\gamma^*(L) = \sum_{i=1}^p \gamma_i L^i$$

$$\sum_{i=1}^p \gamma_i L^i = \left(\sum_{i=1}^p \gamma_i L^{i-1} \right) L = (\gamma^*(1) + (1-L)\tilde{\gamma}^*(L))L$$

The CEC form can be rewritten as:

$$\Delta y_t = a_0 + a_1 t + \gamma(1) \left(y_{t-1} - \sum_{j=1}^k \beta_j(1)x_{j,t-1} \right) + \left(\tilde{\gamma}^*(L)\Delta y_{t-1} + \sum_{j=1}^k \tilde{\beta}_j(L)\Delta x_{j,t-1} \right) + \sum_{j=1}^k \beta_j(L)\Delta x_{j,t} + \epsilon_t \quad (6)$$

$$\Delta y_t = a_0 + a_1 t + \gamma(1)EC_{t-1} + \left(\tilde{\gamma}^*(L)\Delta y_{t-1} + \sum_{j=1}^k \tilde{\beta}_j(L)\Delta x_{j,t-1} \right) + \sum_{j=1}^k \beta_j(L)\Delta x_{j,t} + \epsilon_t \quad (7)$$

Where, *EC* is the error correction term and used to verify cointegrating relationship between variables of interest.

Pearan et al. (2001) demonstrated the robustness of ARDL approach as it allows to test cointegration among variables in presence of $I(0)$ and $I(1)$ variables in a single model. The bounds test for cointegration is discussed by Pesaran et al. (2001) to test parameter significance in the cointegrating relationship of the conditional error correction model. The parametric significance is tested by standard F or Wald test. The null and alternative hypotheses can be written as:

$$H_0: (\gamma(1) \cap \{\beta_j(1)\}_{j=1}^k) = 0$$

$$H_1: (\gamma(1) \cap \{\beta_j(1)\}_{j=1}^k) \neq 0$$

The test statistic for the above posed null and alternative hypotheses is computed and compared with two asymptotic critical values that belongs to opposite cases of all variables either belong to $I(0)$ or $I(1)$. If the test statistic falls below lower critical value then null hypothesis of no cointegrating relationship is accepted. On the other hand, when test statistic exceeds upper critical value then null hypothesis is rejected and cointegration is assumed to exist between dependent and independent variables.

5 For reference, see Beveridge and Nelson (1981).

The knowledge of the level of integration of a variable is not required for either of these two cases. The test remains inconclusive only when test statistic falls between lower and upper critical values. In this condition, level of integration is required to be known to the researcher in order to proceed further. Presence of cointegration implies that variables on both sides of ARDL model are stationary. Therefore, estimation in presence of cointegration is done by the estimation technique of ordinary least squares (OLS).

4. Results and Discussion

This section is devoted to results and estimation of ARDL representation of model presented by equation (2). First step in the estimation of an ARDL model is the selection of appropriate model. Selected model is estimated and if estimated model produces residuals that are in accordance with normality conditions then cointegration among respective variables is tested. Lastly, inference about parameters based on estimates of the model is made.

4.1 Results of Model Selection and Post Diagnostics

Model is selected by employing information criterion. The Akaike Information Criterion (AIC)⁶ selects an ARDL (1, 1, 1) model for this economy. Hence, one lag of dependent variable and one lag for each independent variable is included in the model. The Jarque-Bera⁷ (JB) test statistics has round off value of 0.55 with probability of 76%. Therefore, the null hypothesis that “residuals are normally distributed” from ARDL (1, 1, 1) model can be accepted with 76% probability as this probability exceeds 5% level of significance.

The residual serial correlation test is conducted by employing the Breusch-Godfrey⁸ (BG) serial correlation langrage multiplier test. The value of test statistics is 0.83 and corresponding probability is 66%. Hence the null hypothesis of “no residual serial correlation” can be accepted with 66 percent probability as this value is also greater than 5% level of significance.

The conditions of normality such as distributional normality of residuals along with no residual serial correlation are met by ARDL (1, 1, 1) model for economy of Pakistan. Next step is testing of cointegration which is performed by bounds testing approach.

4.2 Results of Cointegration Testing

Table (1.1) presents the results from the bounds test for testing of cointegration between inflation, unemployment gap and growth rate of money supply. The value of computed F-statistic is roughly equal to 8.96 for asymptotic sample size. It can be seen that computed value of the F-statistic is greater than critical values of upper bound of I (1) at 10%, 5% and 1% levels of significance. Therefore, the null hypothesis of no cointegrating relationship between inflation, unemployment gap and growth rate of money supply can be rejected.

⁶ The AIC estimates the tradeoff between goodness of fit and simplicity of a model. The model that provides best quality relative to other models, in a given set of models, is selected. For further reference, see Akaike (1969).

⁷ The result, that a normally distributed random variable has zero skewness and kurtosis equal to three, is the basis of the Jarque-Bera test.

⁸ LM test of Breusch and Godfrey allows testing of higher order autoregressive disturbances (Godfrey, 1988).

Table 1: Results from Bounds Test for Testing of Cointegration				
F-Bounds Test for Null Hypothesis: No levels relationship				
Asymptotic: n=1000				
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	8.963399	10%	2.17	3.19
K	2	5%	2.72	3.83
		1%	3.88	5.3

Source: Pakistan Economic Surveys

Since null hypothesis of no cointegration among rate of inflation, unemployment gap and growth rate of money supply is rejected at conventional levels of significance, therefore estimation of long-run parameters of unemployment gap and growth rate of money supply for inflation is done to evaluate the strength of this relationship.

4.3 Estimation Results for Long-Run Parameters

The estimated constant of long-run specification turned out to be statistically insignificant. Hence, estimation is done without involving a constant. Furthermore, dummies for years 1997, 2005 and 2008 are included as these years are outliers in residuals⁹.

The coefficient of unemployment gap ($\hat{\varphi}_1$) has the roundabout value of -0.95 with value of -0.54 for t-statistic. Although, negative sign of unemployment gap is as expected, but its value of t-statistic show that unemployment gap is not statistically different from zero. Hence, it seems that no tradeoff exists between inflation and unemployment in the long-run for the economy of Pakistan.

Table 2: Estimated Results for Long-Run Specification of Inflation for Economy of Pakistan			
Long-Run Specification: $Inf_t = \varphi_1 UN_{gap,t} + \varphi_2 g_{M2,t} + v_t$			
Variable	Coefficient	t-Statistic	Prob.
$\hat{\varphi}_1$	-0.9462	-0.5352	0.5961
$\hat{\varphi}_2$	0.4449	5.3751	0.0000

Source: Authors' data analysis results

The long-run estimated coefficient of the growth rate of nominal money supply (M2) is ($\hat{\varphi}_2$). It has round-off value of 0.45 (Table, 1.2). The value of t-statistic for this coefficient is roughly 5.38. Probability of accepting the null hypothesis of "no long-run effect of nominal money supply on price inflation" is zero. This implies that nominal money supply has a statistically significant effect on price inflation. Furthermore, the coefficient also shows that one percentage point increase in growth of nominal money supply increases inflation level by 0.45 percentage points in the long-run.

Even though, the growth effect of money supply on GDP deflator is statistically significant, but not equal to unity in the long-run. Therefore, one to one relationship between growth of aggregate monetary stock and inflation predicted by the quantity theory of money seems not to hold, even in the long-run, for the economy of Pakistan.

⁹ These years were marked by higher growth rates of GDP deflator for economy of Pakistan. Sudden surges in inflation was experienced in these years when growth of GDP deflator reached from 8.3 in year 1996 to 14.6 in 1997, growth of GDP deflator in year 2004 was 4.5 and in year 2005 it rose to 10.7, similarly, its growth in year 2007 was 9.4 and it surged to 18.4 in year 2008.

5. Conclusion

The purpose of this study is to investigate relationship between inflation, unemployment and growth rate of money supply. ARDL modelling approach to cointegration is opted to model above mentioned relationships from long-run perspective for economy of Pakistan. Results from selected ARDL model seem to refute any potential tradeoff between inflation and unemployment. Relationship between growth rate of money supply and inflation is statistically significant, but not equal to unity even in the long-run.

The inflation does not seem to absorb all growth of money supply in the long-run. It appears that despite the nominal rigidities, there exists no tradeoff between inflation and unemployment. Hence, the claim of inflation-unemployment tradeoff in presence of nominal rigidities for economy of Pakistan can be refuted on based of results obtained in this study. Lastly, the one-to-one relationship between growth rate of money supply and inflation theorized in the quantity theory of money (QTM) is invalidated by the results of this study from the long-run perspective.

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