Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.7, No.3, 2016

Effectiveness of Monetary Policy in Economic Growth: An Empirical Evidence from Pakistan

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Abstract
The Taylor rule (1993) focuses only on two objectives: output and inflation. In practice, the central bank's loss function (especially in developing countries) contains objectives other than these two, like the interest rates smoothing, exchange rate stabilisation, etc. In this study, the monetary policy reaction function has been estimated. We used the variables as: interest rate as monetary policy reaction function as a dependent variable and exchange rate, money supply and inflation as an independent variables of monetary policy objectives in Pakistan. The main hypothesis of the study is the relationship between the variables of monetary policy objectives in Pakistan using the data for the period 1991-2010 for Pakistan. The econometric framework used in the study is that of VECM. The data was checked for stationarity and was found to be integrated of order one I (1) under the Augmented Dickey-fuller (ADF) test. We found that there is negative impact of exchange rate and positive impact of money supply and inflation on interest rate as monetary policy reaction function.Our results suggest a short-run positive relationship between the variables of monetary policy objectives in Pakistan. There is also found an effectiveness of the variables of monetary policy objectives in Pakistan in the long-run.

INTRODUCTION

Monetary policy plays an important role in the economic growth of a country. Since the seminal work by Taylor (1993) on using monetary policy rules in a practical way, researchers have been trying to explore the policy reaction function for different countries. According to this rule there are only two objectives of monetary policy: output and inflation. In practice central bank have objectives other than these two like interest rate smoothing and exchange rate stabilization. This issue becomes more important in developing countries where exchange rate is not flexible and governments depend heavily on revenues due to limited effort to generate revenues other sources and heavy budget deficits. So the point here is that before suggesting any rule to a central bank, one should be very clear on monetary policy objectives in the country**.**

In estimating monetary policy reaction function, researchers have included variables other than the output and inflation in their estimation procedure like the interest rate smoothing factor, exchange rate, stock prices, government debt, oreign interest rate and foreign exchange reserves.

In estimating response of central banks to different variables, researchers miss-specify the reaction function. The problem arises because of not including the variables in the reaction function that have important information about the variable used as monetary policy instrument. This issue is important if instrument (for which central banks set operational target) of monetary policy is determined in the market. Deviation of policy rate from target is possible because of factors affecting the instrument but they are not the monetary policy objectives. For instance foreign exchange reserves and government borrowing from the entral bank explain the behaviour of interest rate, though they are not policy objectives. Hence the reaction function would be miss-specified if estimated without these variables. These other factors serve as control variables in estimating reaction function.

PROBLEM STATEMENT:

In estimating monetary policy reaction function, researchers have included variables other than the output and inflation in their estimation procedure like the interest rate smoothing factor, exchange rate, stock prices, government debt, foreign interest rate and foreign exchange reserves. The problem arises because of not including the variables in the reaction function that have important information about the variable used as monetary policy instrument.

OBJECTIVES OF THE STUDY:

The Taylor rule (1993) focuses only on two objectives: output and inflation. In practice,the central bank's loss function (especially in developing countries) contains objectives other than these two, like the interest rates smoothing, exchange rate stabilisation, etc.

We used the variables as: interest rate as monetary policy reaction function as a dependent variable and exchange rate, money supply and inflation as an independent variables of monetary policy objectives in Pakistan.

HYPOTHESIS OF THE STUDY:

The main hypothesis of the study is the relationship between the variables of monetary policy objectives in Pakistan using the data for the period 1991-2010 for Pakistan. In this study, the monetary policy reaction function has been estimated. We found that there is negative impact of exchange rate and positive impact of money supply and inflation on interest rate as monetary policy reaction function. Our results suggest a short-run positive relationship between the variables of monetary policy objectives in Pakistan. There is also found an effectiveness of the variables of monetary policy objectives in Pakistan in the long-run.

The present study focuses on the estimation of monetary policy reaction function for Pakistan to find the monetary policy objectives. Another objective is to find variables, other than monetary policy objectives, that affect the behavior of interest rate. The motivation behind this study is estimation of the Taylor rule for Pakistan in Malik and Ahmed (2007) and have estimated the Taylor rule and found that SBP had not been following such a rule. They have found very low values of R^2 and DW statistics: both show that there are missing variables in the equation. It means there are certain objectives of monetary policy, other than output and inflation that the SBP focuses on.

Taylor (1993) developed the simple instrument policy rule and has become a popular tool for evaluating monetary policy of central banks. Besides numerous papers on the behaviour of the Federal Reserve and other central banks, some authors have applied this rule as a policy guide for the European Central Bank (ECB) in advance of the introduction of the euro in 1999. Since then, the Taylor rule has been used mainly as a rough guide for the evaluation of the ECB policy by many ECB watchers in several periodicals such as 'Monitoring the ECB' by the CEPR. In contrast to that evidence and despite the end of term of ECB's first president, Mr. Duisenberg, an extensive empirical analysis of the ECB's past behaviour still seems to be in its infancy. Referring to its short history, most papers on ECB monetary policy have estimated a Bundesbank or a hypothetical ECB reaction function prior to 1999 and then, e.g. by testing for out-of-sample stability, compared the implied interest rates with actual ECB policy.

Fourcans and Vranceanu(2002), Gerdesmeier and Roffia (2003) and Ullrich (2003), have actually estimated an ECB reaction function. Croushore and Stark (1999) and Swanson et al. (1999) show that data revisions in the case of the US affect policy analysis and economic forecasts to a substantial degree. In his influential paper, Orphanides (2001) shows that estimated policy reaction functions obtained using the ex-post revised data can yield misleading descriptions of historical policy in the case of the US.

Dantuma and De Haan (2003), we explore whether data revisions contain similar problems for the euro area. In this line of argument, the use of survey data which are rarely being revised in the course of time, readily available, and timely (as opposed to most official data) can be very helpful. A second important aspect of survey data is its prevalent forward-looking perspective. It is well known that central banks not only respond to past information, but use a broad range of information. In particular, they consider forecasts of inflation and output in their decision process. The theoretical justification for such a forward-looking approach is given by, e.g. Clarida et al. (1999) within a New Keynesian model. In addition to investigating policy reaction functions based on survey data, we follow Clarida et al. (1998, 1999, 2000) and estimate forward-looking Taylor rules in order to compare the relevance of real-time versus forward-looking aspects.

With respect to actual ECB policy the story looks rather different; the results of Gerdesmeier and Roffia (2003) and Ullrich (2003) – who use standard output gap measures based on Hodrick-Prescott-filtered industrial production as described above – contradict those of Fourçans and Vranceanu (2002) – who take annual growth rate of industrial production as business cycle measure – and the literature on Taylor rules for both Germany and the hypothetical euro area. While Fourcans and Vranceanu (2002) find the ECB to react strongly to variations in the inflation rate and much less to output variations, both Gerdesmeier and Roffia (2003) and Ullrich (2003) estimate small reactions to inflation movements suggesting a destabilising role of the ECB – and (both in relative and in absolute terms) strong replies to output deviations.

Furthermore, Ullrich (2003) observes a structural break between pre-1999 and post-1999 monetary policy in the euro area. Shortland and stasavage (2004) and Chang (2000) estimated response of discount rate to other variables. High interest rate might be good if it results from higher demand for investment and not because of the tight monetary policy[Poole (1999)]. Interest rate stability is important because it creates the stable demand for investment. Too high interest rate discourages investment resulting in higher unemployment. High interest rate also reduces public support for the central bank independence if people percieve high interest rate as a result of too tight monetary policy [Mishkin (2001)].

In estimating monetary policy reaction function researchers included variables other than output and inflation in their estimation procedure. Two of them, exchange rate and interest rate smoothing variable-lagged interest rate are more widely used [Hsing and Lee (2004); Chang (2000) for both and Assane and Malamud (2002); Gerlach and Smets (2000); Amonde (2006); Setlhare (2004) for exchange rate, among others for recent review]. Another potential variable that is included in the monetary policy reaction function is asset prices. Central banks respond to stock market indicators by including deviation of asset prices from the normal trend in

their policy reaction function [Bernanke and Gertler (1999).

Rigobon and Sack (2003) among others for including stock prices in the reaction function]. Debt accumulated by the government and government borrowing from the central bank are also included in the response function of central bank. We have found single study for each, Sheehan (1985) for debt and Shortland and Stasavage (2004) for government borrowing.

Romer (2001), while discussing possible changes in Taylor rule, suggests inclusion of exchange rate and lagged interest rate in the rule. Inter bank offered rate also known as call money rate is equivalent to federal funds rate in U.S. the issue at hand including Taylor (1993); Goodfriend (1993); Clarida, *et al*. (1998; 2000) among others. Stock price stabilisation is important because it has the wealth effect that changes private consumption and investment [Mishkin(1995) and Bernanke and Gertler (1995)].

International financial markets have become increasingly integrated. This process of financial globalisation is reflected in the rapid expansion of the external balance sheets of countries which records cross-border ownership of assets and liabilities (Lane and Milesi-Ferretti (2006) and Lane and Shambough (2009)). In this world of interlinked balance sheets, exchange rate movements can give rise to large valuation effects. In fact, recent shifts in US and UK external positions have been attributed to currency movements (Higgins et al (2007) and Astley et al (2009)).

Lane and Shambough (2010) present evidence that the covariance between nominal exchange rates and output fluctuations is an important determinant of foreign currency exposure. In particular, they tend that countries where domestic currency tends to depreciate in bad times are associated with longer foreign currency positions in their external balance sheets. At the sametime, Clarida and Waldman (2007) show how monetary policy regimes affect the covariance between inflation and output.

Nominal bond portfolios have been analysed before by, among others, Devereux and Sutherland (2008) and Engel and Matsumoto (2009). In a model where monetary policy is specified as a Taylor rule that reacts to PPI inflation, Devereux and Sutherland (2008b) tends a negative position in foreign bonds under incomplete markets.

Engel and Matsumoto (2009), under a similar money-growth rule tend that the negative foreign currency position would still be optimal when asset markets are complete. Devereux and Sutherland (2008), Benigno and Nistico (2009), Benigno and Kucuk-Tuger (2010) and Coeurdacier and Gourinchas (2009) are other examples of open economy DSGE models with endogenous nominal bond portfolios. The valuation channel of monetary policy has been explored in earlier literature.

Dornbusch and Fischer (1980) and Svensson (1989) and later Kim (2002) examine the implications of net foreign asset positions for the transmission mechanism of monetary policy in a setting in which portfolio positions are exogenous. Until recently, the analysis of optimal portfolio choice was mostly restricted to partial equilibrium models.

New methodological contributions (Devereux and Sutherland (2008), Tille and van Wincoop (2007) and Evans and Hnatkovska (2007)) have now allowed us to analyse optimal portfolio choice in general equilibrium models.

Therefore, in this paper we revisit the old insights from Dornbusch and Fischer (1980) and Svensson (1989) in a two-country general equilibrium model where agents can choose optimally among home and foreign nominal bonds. Neumeyer (1998) analyses how a monetary union affects welfare by changing the hedging properties of currencies in an incomplete market setting with nominal securities and mean-variance preferences. Doepke and Schneider (2006) look at the effects of inflation on the redistribution of wealth between old and young generations in a closed economy model with trade in nominal assets. We focus on valuation effects caused by unanticipated movements in the nominal exchange rate. Devereux and Sutherland (2010) show that anticipated valuation effects (risk premia) are small.

THEORETICAL BACKROUND:

In estimating monetary policy reaction function researchers included variables other than output and inflation in their estimation procedure. Two of them, exchange rate and interest rate smoothing variable-lagged interest rate are more widely used [Hsing and Lee (2004); Chang (2000) for both and Assane and Malamud (2002); Gerlach and Smets (2000); Amonde (2006); Setlhare (2004) for exchange rate, among others for recent review]. Another potential variable that is included in the monetary policy reaction function is asset prices. Central banks respond to stock market indicators by including deviation of asset prices from the normal trend in their policy reaction function [Bernanke and Gertler (1999); Rigobon and Sack (2003) among others for including stock prices in the reaction function]. Debt accumulated by the government and government borrowing from the central bank are also included in the response function of central bank. We have found single study for each, Sheehan (1985) for debt and Shortland and Stasavage (2004) for government borrowing. The latter study also includes foreign reserves in the response function of central bank. If capital mobility is important for an economy then monetary Policy, while setting interest rate, focuses on foreign interest rate as well [Shortland and Stasavage (2004)].

We have used the short interest rate (inter bank offered rate or call moneyrate, CMR) as monetary policy instrument. The main reason for using thisvariable instead of using the discount rate is the fact that discount rate is only a policy tool to achieve operational target for the instrument that can also be achieved by other policy tools like open market operations and changes in the required reserve ratio. This is consistent with most of the empirical literature on the issue at hand including Taylor (1993); Goodfriend (1993); Clarida, *et al*. (1998; 2000) among others.

As for as the objectives of monetary policy are concerned, we have included in our estimation the inflation (inf), money supply(M2), exchange rate (ER) . It is well established in the literature on monetary policy that price stability is the prime objective of any central bank. This has been taken as one of the objectives in the Taylor (1993) rule and all empirical studies on the estimation of monetary policy objective function.

High and variable inflation creates uncertainty making it harder to interpret the message conveyed by the price changes. This uncertainty creates problem for consumers and investors in making optimal decisions. So price stability is the prime target of monetary policy in almost all of the countries. The second most important objective that enters the loss function of most of the central banks is the output stability around the potential or the normal level as the central banks are not, according to King (1997), 'inflation nutters'. So, even the inflation targeting countries do care about output fluctuations in conducting monetary policy. Again this variable has been included in almost all of the empirical studies onthe central bank's reaction function. This objective is important to keep unemployment on the natural rate.

Other than variables in the Taylor rule, interest rate smoothing has been widely accepted as monetary policy objective and is included in estimation of policy reaction function in a number of studies. Interest rate stability is important because it creates the stable demand for investment.

Too high interest rate discourages investment resulting in higher unemployment. High interest rate also reduces public support for the central bank independence if people perceive high interest rate as a result of too tight monetary policy [Mishkin (2001)]. In open economies, especially with the fixed or managed floating exchange rate regime, exchange rate stabilisation becomes important for both exports as well as for domestic monetary objectives like inflation. Low exchange rate makes domestic products less competitive in the world market. This results in lesser exports demand and ultimately in the slow economic growth. On theother hand, high exchange rate makes terms of trade against the home country and increases inflation in the domestic economy.

ECONOMETRICS METHODOLOGY:

We have estimated monetary policy reaction function for Pakistan for the period 1991-2010. Data on all the variables are taken from World Development Indicator (WDI).

The reaction function can be estimated by ordinary least square (OLS), two stage least square (TSLS), generalised method of moment (GMM), vector auto regression (VAR), vector error correction method (VECM), probit and logit models etc. The most frequently used technique is the vector autoregression (VAR) approach, with which the analysis of monetary policy is done by estimating impulse response functions and variance decomposition of forecast error of policy instrument rate, [Amonde (2006); Chang (2000); Hsing and Lee (2004) among others for recent studies]. Some studies estimated Taylor rule by simple OLS and Recursive OLS techniques, [see for example Judd and Rudebusch (1998); Plantier and Scrimgeour (2002)]. Shen and Chen (1996) applied binary nonlinear models on time series data by making dependent variable binary by some categorisation. Following Shen and Chen (1996), Shortland and Stasavage (2004) estimated reaction function by multinomial logit. Following Romer (1989), Boschen and Mills (1995); Shen, Hakes and Brown(1999) estimated monetary policy reaction function by binary probit models, making narrative index for policy stance. Clarida, Gali and Gertler (1998) used generalised method of moment (GMM) technique for estimating forward looking monetary policy reaction function for six countries.

Although some studies have estimated Taylor rule by simple OLS, it is not the appropriate technique if contemporaneous values of variables on right hand side are taken. However there are estimation techniques that deal with endogeniety issues like two stage least squares (TSLS) or generalised method of moments (GMM). But finding instruments and classifying variables into endogenous and exogenous variables is not an easy job.

So we have estimated monetary policy reaction function for Pakistan with the VECM model, which is more frequently used in estimation of the reaction function and takes care of endogeniety issue in the estimation. Vector error correction model is a special type of Vector Autoregressive (VAR) Model which is used in the case of co-integrated vectors. The error correction model is used as a dynamic system having the characteristics which turns the deviation of the current state from its long-run relationship will be served into its short-run dynamics. An error correction model does not correct the error in other model but itself. These models are a part of multiple time series models which estimates directly the speed of equilibrium of the dependent variable (Y) after a change in the independent variable (X). Error correction models are very helpful in estimating the long-run and short-run effects of different time series on one another. ECMs are very useful when we are dealing with

the integrated data, and it can also be used for stationary data. After knowing that there is co-integration present in the variables and hence there is a long-run relationship among the variables, the next step is to investigate the dynamic nature of the model by specifying and estimating the VECM including the error correction term. Our regression model as we formulated earlier will be of the following form:

r-ib=f(m2, er, infl)……..(1)

$Log\ (r\text{-}ib) = \beta_0 + \beta_1 log\ (m2) + \beta_2 log_(er) + \beta_3 log\ (infl) + u\ldots\ldots\ldots(2)$

DATA SOURCE:

Data has been taken from World Development Indicator (WDI) and Economics survey of Pakistan. We have used the data of monetary policy reaction function for Pakistan for the period 1991-2010. And the type of data which has used is the time series data.

VARIABLES:

As for as the objectives of monetary policy are concerned, we have included variables in our estimation are: interest rate (r_ib) inflation (inf), money supply(M2), exchange rate (ER). We used the variables as: interest rate as monetary policy reaction function as a dependent variable and exchange rate, money supply and inflation as an independent variables of monetary policy objectives in Pakistan.

Exchange rate (Er) is the value of foriegn currency in responce to domestic currency, Money supply (M2) is the pumping of money in the market, Inflation (Infl) is the rise of general price level and Inter-Bank rate as interest rate (r_ib)

DATA ANALYSIS

UNIT ROOT TEST:

In the time series data analysis it is advocated to use the unit root test before considering the appropriate econometric framework of the model to be used. In order to decide which technique should be used it is important to investigate whether the time series data is co-integrated of some order not and also it is advocated to check the univariate properties of all the data series. A unit root test check whether a time series variable in an autoregressive model is non-stationary or stationary. Augmented Dickey Fuller (ADF) is used in the case of large samples and is very good in this case. John Denis and AlokBhargava tests for unit root are valid for the optimal finite samples.There are so many ways to check the unit root in the data but here we are going to check the data using the Augmented Dickey Fuller (ADF) (1979) unit root test. All the variables were checked by applying the ADF test in the level form and also in the first difference. The ADF test shows that all the variables used in the model are non-stationary in their level form. Again they were tested in their first difference log form and the results shows that all the variables are stationary in the first difference form.

Table 1: Summary results of unit Root tests in log level form: ADF Test

Variables in log form	R-IB	M2	ER	INF
Augmented Dickey Fuller	-2.30	-0.26	-2.29	-2.18
Critical Value	-2.97	-2.96	-2.96	-2.96

Table 2: Summary results of Unit Root Tests in 1st difference: ADF Test

Variables in log form	R-IB	M2	ER	INF
Augmented Dickey Fuller	-4.39	-4.85	-4.16	-6.03
Critical Value	-2.96	-2.96	-2.96	-2.96

Exchange rate (Er) is the value of foriegn currency in responce to domestic currency, Money supply (M2) is the pumping of money in the market, Inflation (Infl) is the rise of general price level and Inter-Bank rate as interest rate (r_ib) and critical value is the value of H_0.

JOHANSON CO-INTEGRATION TEST:

Co-integration methods used are very popular tools in economic work from the time they are introduced. The Johanson co-integration test is used to find out whether or not there is co-integration among the variables of the model. If two or more series are co-integrated in the time series but there is some lower order co-integration in linear combination of them, then the data is said to be co-integrated. The presence or absence of co-integration is necessary in order to decide about the technique to test the hypotheses concerning the relationship between two variables having unit root i.e. they are integrated of order one at least.In order to find out which technique should be used we run the Johanson co-integration test in the E-views.Johanson co-integration test is used to find out the long run relationship by checking the co-integrating relation among the variables. To do so, first the order of the VAR is selected for the variables and then a multivariate co-integrating VAR is used and specified in k, trans, non-trans and I including an intercept too. A VAR of order 1 is used according to the

SchwarzBayesianCriterion(SBC). These tests are particularly conditional upon the long run presence of a linear or constant deterministic trend. The results of both the Trace statistics and the Maximal Eigenvalue tests show that there is at most a single co-integrating vector in the model or there are two independent stochastic trends within the equation. This states that at the 5% level of significance the trace value and the maximum eigenvalue both shows the presence of co-integrating vector and indicates that the underlying variables are co-integrated. The results of Johanson test are as follows:

Table 3: Test results from Johanson Procedure

	Null Hypothesis	Alternative Hypothesis	Test Statistics	Critical Value 5%	Probability P-value
Maximal Eignvalue of the Stochastic matrix	None* At most 1 At most 2 At most 3	r=1 r=2 r=3 r=4	47.08557 10.57589 7.547854 1.366291	27.58434 21.1362 14.26460 3.841466	0.0001 0.6894 0.4265 0.2424
Trace of the Stochastic matrix	None* At most 1 At most 2 At most 3	r=1 r=2 r=3 r=4	66.57561 19.49004 8.914145 1.366291	47.85613 29.79707 15.49471 3.841466	0.0004 0.4581 0.3734 0.2424

On the basis of results, for our analysis it is believed that a Vector Autoregressive (VAR) model would be the best. The VAR model has a very good background in describing the active behavior of the time series data and forecasting. It is believed that the VAR model may give good forecast values than those from univariate time series models and also can elaborate theory based simultaneous equations. VAR is very useful in the case of endogeneity and causality issues. Selecting a VAR model is very useful in order to analyze the effect of openness on the economic growth of the country, any causality relation if exist between growth and openness, and also it is useful in finding out the indirect relation between the two. In short the VAR model is best in analyzing the relationship between openness and economic growth.

Since the variables in our model are stationary only in the first difference form and they are also having co-integration so we estimate a VAR in an error correction model.

LAG LENGTH CRITERIA:

The lag length criteria are used in the time series data analysis in order to decide about the number of lags to be included in the data variables.Most of the economic data are time series in nature and the time series model mostly used is the autoregressive(AR).the application of the AR model is not something else than the determination of autoregressive length.There are many lag length selection criteria employed in economic study to determine the Autoregressive (AR) lag length of time series variables. A lag length AR process *p* shows a time series in which the current value of the variables is dependent on its first *p* lagged value and is shown by AR (*p*). this AR lag length *p* is always unknown and it has to be estimated by lag length criteria namely the Aikaike's Information criterion (AIC), Schwarz Information Criterion (SIC), Hannan Quinn Criterion (HQC), Final Prediction Error (FPE), and Bayesian Information Criterion (BIC) (see Liew (2000)). The criteria mostly preferred in economic studies are the Aikaike's Information Criterion (AIC).

Table 4: Lag-Length Criteria

Lag	LogL	LR	FPE	AIC	SC
0	45.46550	NA	5.45e-07	-3.071519	-2.879543
1	188.9885	233.8894	4.38e-11	-12.51767	-11.55779*
2	211.8350	30.46192*	2.88e-11*	-13.02481	-11.29703
3	230.6642	19.52666	2.97e-11	-13.23439	-10.73870
4	252.4203	16.11557	3.34e-11	-13.66076*	-10.39717

In the given time series data all the lag selection criteria are applied and their results are given below. Here the sequential modified LR test statistics (each test at 5% level), FPE, AIC, SIC and HQ all shows that there should be 2 lags selected of each variable and used in the analysis of the data.

LM SERIAL CORRELATION TEST:

LM serial correlation test is used to find out is there any serial correlation between a given variable and itself over various time intervals. LM test is used to avoid the drawbacks if any in the Durbin Watson d-test of autocorrelation. Breusch and Godfray constructed this LM test in order to check for autocorrelation and it allows for: (a) non-stochastic regressors i.e. lagged values of regressands; (b) higher order autoregressive schemes such as AR1 and AR2 (Gujrati 2004).

Table 5: BreuschGodfray Serial Correlation LM Test

F Statistics	1.329063	Probability	0.2861
Observed *R square	3.258317	Probability	0.1961

Here the LM test shows that there is no serial correlation in the variables and their lagged values. The results are given above.

HETEROSCADESTICITY TEST:

The White Heteroscadesticity Test is used to determine whether the residuals in a model are homoscedastic or not. White test is statistical test that establish whether the residual variance of a variable in the given model is constant or not, that is it checks for the homoscedasticity. It can be used for both the heteroscadesticity and the specification error or one of them (Gujarati 2004).

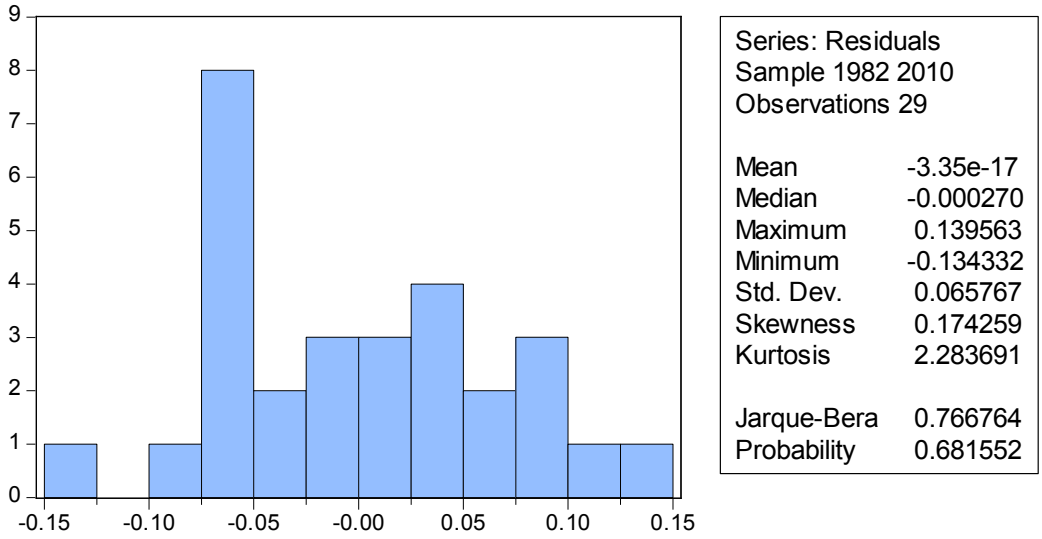
Table 6: Heteroscadesticity test: Breusch-Pagan-Godfray

F Statistics	1.370486	Probability	0.2680
Observed *R square	10.26850	Probability Chi-Square	0.2467
cale explained SS	4.145693	Probability Chi-Square	0.8437

The data was tested for the heteroscadesticity by applying the test and the results shows that there was no heteroscadesticity present mean the residuals of the data are homoscedastic. The results are shown above:

JARQUE-BERA TEST:

The Jarque-Bera Test is the test for the detection of normality. It is used in statistics in order to know goodness-of-fit whether the sample data is normally distributed, mean if the data have the kurtosis and skewness same to the normal distribution. The Jarque-Bera test shows that the residuals are normally distributed. Results are shown below:



VECTOR ERROR CORRECTION MODEL ESTIMATES:

Vector error correction model is a special type of Vector Autoregressive (VAR) Model which is used in the case of co-integrated vectors. The error correction model is used as a dynamic system having the characteristics which turns the deviation of the current state from its long-run relationship will be served into its short-run dynamics. An error correction model does not correct the error in other model but itself. These models are a part of multiple time series models which estimates directly the speed of equilibrium of the dependent variable (Y) after a change in the independent variable (X). Error correction models are very helpful in estimating the long-run and short-run effects of different time series on one another. ECMs are very useful when we are dealing with the integrated data, and it can also be used for stationary data. After knowing that there is co-integration present in the variables and hence there is a long-run relationship among the variables, the next step is to investigate the dynamic nature of the model by specifying and estimating the VECM including the error correction term.

Table 7: The Vector Error Correction Model Estimates

CointegratingEq:	CointEq1			
LOGR_IB(-1)	1.000000			
LOGER(-1)	0.453545			
	[0.98389]			
LOGM2(-1)	-0.313486			
	[-1.24861]			
LOGINF(-1)	-0.442461			
	[-3.49393]			
C	2.666672			
Error Correction:	D(LOGR_IB)	D(LOGER)	D(LOGM2)	D(LOGINF)
CointEq1	-0.714249	0.043360	-0.015096	0.156315
	[-7.97927]	[1.40519]	[-0.56704]	[0.77677]
D(LOGR_IB(-1))	0.310456	0.022722	0.009114	-0.052403
	[2.82497]	[0.59978]	[0.27885]	[-0.21211]
D(LOGER(-1))	2.684810	0.064030	0.034579	-2.113130
	[4.13410]	[0.28601]	[0.17903]	[-1.44735]
D(LOGM2(-1))	-2.465304	-0.410029	0.016883	2.073813
	[-3.19870]	[-1.54328]	[0.07366]	[1.19688]
D(LOGINF(-1))	-0.272456	0.019779	0.002003	-0.168921
	[-2.72944]	[0.57479]	[0.06747]	[-0.75273]
C	0.074578	0.051095	0.058067	-0.054374
	[1.55724]	[3.09492]	[4.07682]	[-0.50503]

Our VECM result shows that in long run if there is an increase of 1% in interest rate (r_ib) there will be decrease of 0.45% in exchange rate (Er) and increase of 0.31% in money supply (M2) and increase of 0.44% in inflation (Infl). Similarly in short run if there is an increase of 1% in interest rate (r_ib) there will be decrease of 2.68% in exchange rate (Er) and increase of 2.46% in money supply (M2) and increase of 0.27% in inflation (Infl). The values of short run is always greater than in long run but in this case the value of exchange rate (Er) and money supply (M2) in short run is greater than in long run but the value of inflation (Infl) in short run is less than in long run.

CONCLUSIONS:

In this research, an attempt is made to analyze the monetary policy Effectiveness in Pakistan. This study has investigated the relationship between different variables of monetary policy objectives in Pakistan during the time period 1991-2010 using the VECM framework. The data used was secondary data and we know that most of the secondary data i.e. time series data are non-stationary. The econometric framework adopted was the Granger Causality and Co-integration test. The stationarity properties of the data and the integration order of the data were checked by adopting the unit root test. The Augmented Dickey-Fuller (ADF) test was used to find out the order of integration and stationarity of the data. The results showed that all the variables were non-stationary in their level forms, and become stationary at first differences. This showed that they are integrated of order one I (1). After knowing the integration order the Johanson multivariate approach to co-integration test was used in order to test the variables whether they have some long-run relationship between them or not. The results of the Johanson co-integration test showed the presence of two (2) co-integrating vectors, thus confirming that there exists long-run relationship among the core variables. Since the variables were stationary at their first differences and there were two co-integrating vectors found so we go for the VAR having restrictions that is the Error correction model (VECM). There were found negative impact of exchange rate (ER) and positive impact of money supply (M2) and inflation (INFL) on the monetary policy reaction function of Pakistan in the long-run. In shot-run the impact of exchange rate (ER) is negative and money supply (M2) and inflation (INFL) is positive on the monetary policy reaction function of Pakistan . This result indicates that monetary policy reaction function is an important part of monetary policy objectives in Pakistan in the short-run but in the long-run it may cause a decrease. In the present study we have been found that short-run and long-run the results of the VECM shows a unidirectional both are same positive impact. Another important and notable result of VECM table is that exchange rate indirectly related and inflation and money supply both directly related to the monetary policy

reaction function of monetary policy objectives in Pakistan.

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