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Monetary Policy and Asset Price Channel: Recommendations for the Policy Makers of Developing Countries

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Abstract
Given the lack of strong institutional framework and relatively unstable political situation in developing countries, it is very essential to come up with a different and suitable monetary policy for those countries. A longstanding macroeconomic issue is how monetary policy affects the real economy. Asset price channel is one of the most important channels of monetary transmission mechanism. In this study, we explored the asset price channel of monetary transmission mechanism in a developing country's setup. We carried out our analysis in the framework of Vector Auto Regression while taking account of all the limitations of time series data. Our benchmark model accounts for simultaneity and interdependence among variables. We tested for both short and long term relationships. Our data set contains quarterly data for twenty years. We applied Johansen Co integration test, Vector Error Correction Model and Granger causality. We came across some puzzling and alarming results. Our analysis reveals that stock prices have a negative long run relationship with investment and output while it is generally expected that a tight monetary policy is linked with decrease in prices. This kind of puzzling results should be taken into consideration by the central bank. Further, the analysis of the long term relationship between investment and other variables reveal that there is negative long run relationship between investment and interest rate; therefore, the central bank should be cautious while taking monetary policy actions. Interest rate is not causing any of the variables included in the asset price channel which means that interest rate is a weak policy tool as for as its effect in the asset price channel is concerned.
Keywords: Asset price channel, monetary transmission mechanism, money supply, stock prices, economic policies.

1. Introduction

The main aim of the economic policies of government is to enhance the welfare of the public. Monetary policy gives support to this broader aim of economic policies by bringing stability in prices (Javid & Munir, 2010). Monetary policy is counted in one of the most effective instrument that the central bank has in its control. The central bank uses this tool frequently in order to control the real activity in the economy (Maskay, 2007).

Testing the effects of monetary policy on the economy has been under study for a long time. Monetary policy is not easy to understand. A lot of researchers tried to find an absolute answer for an optimum monetary policy but still they hold the view that it is a hard question. (M & Schwartz, 1963) can be termed a pioneer work in this area. Policy makers should have knowledge regarding the different transmission mechanisms of money which influence the economy because monetary policies is a powerful instrument and it can result in unwanted outcomes (Mishkin, 1995). On the other hand, little consensus is there on how actually monetary policies bring changes into the economy and studies that revealed that changes in output are caused by changes in monetary policy were not able to reveal that what happens in the middle and thus (Bernanke & Gertler, 1995) declared monetary transmission mechanism as "Black Box". This is because monetary policy works through different channels at the same time. Somewhat similar are the thoughts presented in (Gerlach & Smets, 1995) which says a lot of work has been done on this matter but still researchers differ in their ideas regarding how exactly monetary policy impacts the economy and how it brings changes across different countries.

Although a lot of authors hold the view that monetary policy still can't be understood completely yet there are scholars who have established the fact that monetary policy significantly affect output in the case of developed economies. Studies that conclude this fact are (Bernanke & Blinder, 1992), Romer and Romer (1989), Blanchard (1990), (Bernanke & Gertler, 1995) and Freidman (1995). Even though developing countries are connected to developed countries via trade, yet the challenges faced by developing countries in terms of monetary policy are unique basically due to the underdeveloped financial market (Prasad, Hammond, & Kanbur, 2009). In the presence of a good working financial system, the monetary policy can significantly affect the price levels in the economy (Gerlach & Smets, 1995). Studies on monetary transmission mechanism in developing countries are (Bhattacharya, Patnaik, & Shah, 2011), (Floerkemeier & Dabla-Norris, 2006), (Hussain, 2009), (Agha, Ahmed, Mubarik, & Shah, 2005; Baig), (K. C. Cheng, 2006), (Omoke & Ugwuanyi, 2010), (Al-Mashat & Billmeier, 2008), (Naik, 2013), (CAMBAZOĞLU & GÜNEŞ) and (Vinayagathasan, 2013).

2. Channels of Monetary Transmission Mechanism:

A number of monetary transmission mechanism channels can be traced back in economics literature. These channels include interest rate channel, exchange rate channel, asset price channel, credit channel, expectation channel and government expenditure channel. These channels are not mutually exclusive. The relative importance of these channels may vary from country to country depending upon many factors. A number of empirical studies have been carried out in this area in developed economies but not a lot of studies can be traced back in literature for developing and emerging countries especially in case of Pakistan.

2.1. Asset Price Channel:

In a monetarists' view; as soon as the money supply decreases in the economy, people realize that they have lesser money than they wish and thus they try to cut their spending. One option available to public is to cut their spending in stock market which results in a decreased demand for stocks and thus the prices of equities are decreased. While a Keynesian suggests that as soon as the interest rate rises in the economy, bonds become more attractive to public than the stocks and thus the prices of stocks are lowered. Collectively these views suggest that a fall in money supply brings a rise in interest rate which brings a fall in stock prices which results in lowering investment spending and thus resulting in lower output. (Mishkin, 2001), (Cassola & Morana, 2004), (Agha et al., 2005) and (Al-Mashat & Billmeier, 2008) also support the view of importance of asset price in monetary transmission mechanism.

3. Theoretical Background

The assumption of this study is that fluctuations in monetary policy bring fluctuations in interest rate. The fluctuations in interest rate affect Stock prices. Changes in stock prices are passed on to changes in Investment and then on to Industrial production.

A loose monetary policy will lead to lower interest rates. Decrease in interest rate decrease the required rate of return and the value of assets is affected positively. In particular, an investor will try to change his portfolio with the fall in interest rate by adding more stocks to it and removing bonds from it. Resultantly, it is expected that stock prices will be increased (Hashemzadeh & Taylor, 1988). Higher stock prices will result in higher Tobin's Q which will cause higher investment. An increase in Investment will cause higher Industrial Output (Mishkin, 1996).

Symbolically,

$$\uparrow MoneySupply \rightarrow \downarrow InterestRate \rightarrow \uparrow Stock\,\mathrm{Pr}ices \rightarrow \uparrow Investment \rightarrow \uparrow IndustrialOutput$$

4. Research Methodology:

Five variables including money supply, interest rate, stock prices, investment and output are used to examine the role of this channel. Quarterly data ranging from 1993:1 to 2013:4 is used for the purpose of analysis. The econometric methodology includes stationarity test, optimal lag selection, Johansen co integration test, Vector Error Correction Model and Granger causality test.

As we are dealing with time series data therefore we will test properties of the respective time series. After testing stationarity, we need to choose the optimal lag length. Lag lengths are determined through different criterion such as Akaike Information Criterion (AIC) and Schwartz Information Criterion (SIC). (Enders, 2008) argued that Engle and Granger methodology is easy to implement yet it has some drawbacks. Practically, co integration can be evident in a regression while no co integration can be found if we reverse the order. This characteristic of the methodology is highly undesirable. This issue becomes more complex when we are using more than two variables because we can put any of these variables on the left hand side. Furthermore, this methodology does not provide any procedure for multiple co integrating vectors. Engle Granger methodology has another defect that it operates in two steps. In the first step, residuals are generated and in the second step regression is estimated using these residuals. Therefore, if one makes an error in the first step, that error is passed on to the next step. Luckily Johansen (1988) methodology accounts for the limitations of Engle and Granger methodology. In our analysis if we detect co integration, this implies that a long term relationship is present between the variables. In order to examine the short term dynamics of the series we use Vector Error Correction Model (VECM). In case we don't get co integration between the series, then we don't need VECM and we directly go for VAR Granger causality in order to evaluate the causal relationship between the variables.

4.1 The Model:

The analysis in this paper relies mainly on vector auto regression. Use of VAR for testing the effect of monetary policy in the economy was pioneered by (Sims & A, 1980). (Agha et al., 2005) argued that as there is little consensus on how the monetary policy works in Pakistan, the VAR methodology puts lesser restrictions about the procedure of monetary policy affecting the economy, which can be considered a distinct advantage. The VAR methodology also identifies simultaneity between macro economic variables and monetary policy.

Simultaneity is when monetary policy is dependent on other macroeconomic variables and when macro economic variables are dependent on monetary policy. The use of VAR is also due to the existence of literature which used the same methodology for examining transmission mechanism of money in various countries. For example, (Agha et al., 2005), (Floerkemeier & Dabla-Norris, 2006), (Al-Mashat & Billmeier, 2008), (Baig), (Hussain, 2009), (L. Cheng & Jin, 2013), (Lovrinović & Benazić, 2004), (Morsink & Bayoumi, 2001), (Barakchian & Crowe, 2013), (Poddar, Khachatryan, & Sab, 2006), (Bjørnland & Leitemo, 2009), (MahdiBarakchian & ChristopherCrowe, 2013), (Vinayagathasan, 2013) To examine the simultaneity and interdependence among these variables, we start from our basic benchmark reduced form vector auto regression model in matrix form as follows:

Let x_t represents the matrix of all macro variables under study i.e.

x_t = [yt pt m2tRtIt]', and

x_{t-i} = [yt-i pt-i m2t-iRt-i It-i]'

be the matrix of lag values of all macro variables included in the analysis and
eit represents the matrix of reduced form error, where

Y	=	Gross Domestic Product (National Output)
P	=	Stock prices (KSE-100 Index)
M2	=	Money Supply
MMR	=	Interest rate (Real interest rate)
I	=	Gross Total Investment

Starting from the benchmark VAR model as follows:

$$
\begin{aligned}
y_t &= \beta_{10} - \beta_{11}p_t - \beta_{12}R_t - \beta_{13}I_t - \beta_{14}M2_t + \gamma^i_{11}M2_{t-i} + \gamma^i_{12}p_{t-i} + \gamma^i_{13}MMR_{t-i} + \gamma^i_{14}y_{t-i} + \gamma^i_{15}I_{t-i} + u^y_t \\
p_t &= \beta_{20} - \beta_{21}M2_t - \beta_{22}I_t - \beta_{23}y_t - \beta_{24}MMR_t + \gamma^i_{21}M2_{t-i} + \gamma^i_{22}p_{t-i} + \gamma^i_{23}MMR_{t-i} + \gamma^i_{24}y_{t-i} + \gamma^i_{25}I_{t-i} + u^p_t \\
M2_t &= \beta_{30} - \beta_{31}p_t - \beta_{32}MMR_t - \beta_{33}y_t - \beta_{34}I_t + \gamma^i_{31}M2_{t-i} + \gamma^i_{32}p_{t-i} + \gamma^i_{33}MMR_{t-i} + \gamma^i_{34}y_{t-i} + \gamma^i_{35}I_{t-i} + uM2 \qquad (1) \\
MMR_t &= \beta_{40} - \beta_{41}M2_t - \beta_{42}p_t - \beta_{43}y_t - \beta_{44}MMR_t + \gamma^i_{41}M2_{t-i} + \gamma^i_{42}p_{t-i} + \gamma^i_{43}MMR_{t-i} + \gamma^i_{44}y_{t-i} + \gamma^i_{45}I_{t-i} + u^{MMR}_t \\
I_t &= \beta_{50} - \beta_{51}p_t - \beta_{52}I_t - \beta_{53}M2_t - \beta_{54}y_t + \gamma^i_{51}M2_{t-i} + \gamma^i_{52}p_{t-i} + \gamma^i_{53}MMR_{t-i} + \gamma^i_{54}y_{t-i} + \gamma^i_{55}I_{t-i} + u^I_t
\end{aligned}
$$

$$
\begin{bmatrix} 1 & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & 1 & \beta_{23} & \beta_{24} & \beta_{25} \\ \beta_{31} & \beta_{32} & 1 & \beta_{34} & \beta_{35} \\ \beta_{41} & \beta_{42} & \beta_{43} & 1 & \beta_{45} \\ \beta_{51} & \beta_{52} & \beta_{52} & \beta_{54} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ p_t \\ M2_t \\ I_t \\ MMR_t \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \\ \beta_{40} \\ \beta_{50} \end{bmatrix} + \begin{bmatrix} \gamma^i_{11} & \gamma^i_{12} & \gamma^i_{13} & \gamma^i_{14} & \gamma^i_{15} \\ \gamma^i_{21} & \gamma^i_{22} & \gamma^i_{23} & \gamma^i_{24} & \gamma^i_{25} \\ \gamma^i_{31} & \gamma^i_{32} & \gamma^i_{33} & \gamma^i_{34} & \gamma^i_{35} \\ \gamma^i_{41} & \gamma^i_{42} & \gamma^i_{43} & \gamma^i_{44} & \gamma^i_{45} \\ \gamma^i_{51} & \gamma^i_{52} & \gamma^i_{53} & \gamma^i_{54} & \gamma^i_{55} \end{bmatrix} \begin{bmatrix} y_{t-i} \\ p_{t-i} \\ M2_{t-i} \\ I_{t-i} \\ MMR_{t-i} \end{bmatrix} + \begin{bmatrix} u^y_t \\ u^p_t \\ u^{M2}_t \\ u^I_t \\ u^{MMR}_t \end{bmatrix} \qquad (2)
$$

Let B be the matrix representing the coefficients of the variables whom responses we want to check in each equation in the VAR model and B0 represents the matrix of intercepts, γ represents the coefficient matrix of lag dependent and independent values of x_{t-i} = [yt-i pt-i M2t-iIt-iRt-i]' and Uit represents the matrix of structural error.

$$\Rightarrow BX_t = B_0 + \gamma^i X_{t-i} + u_t \qquad (3)$$

Multiplying B-1 on both sides

$$\Rightarrow X_t = B^{-1}B_0 + B^{-1}\gamma^i X_{t-i} + B^{-1}u_t \qquad (4)$$

Assume that A0 = B-1B0,Ai = B-1γi and et = B-1ut , equation (2) can be written in the following form:

$$\Rightarrow \quad x_t = A_0 + \sum_{i=1}^{p} A_i x_{t-i} + e_t \qquad (5)$$

In standard form the reduced Vector auto-regression can be written as:

$$\Rightarrow \quad x_t = A_0 + A_1 x_{t-1} + A_2 x_{t-2} + \ldots\ldots\ldots A_p x_{t-p} + e_t \qquad (6)$$

Where, A0 = B-1B0, Ai = B-1γiandet= B-1ut
With the assumptions that:
E(ejt) = 0
Var(ejt) = σj2,

4.2 Data:
Quarterly data for M2, Money market rate, Stock prices, Gross total investment and GDP is used in this study. The annual time series will be taken from the official website of State Bank of Pakistan which in turn, will be converted into quarterly time series using E views statistical package. The data period ranges from 1993:1 to 2013:4.

5. Analysis
The analysis in this paper is carried out in the following steps.
5.1 Augmented Dickey FullerTest:
Table 5.1 Unit Root Test

Variable	Trend	Lag Length	T-Value/Critical Value	Order of Integration
lgdp	No	2	-0.94 (-2.58)	I(1)
Δlgdp	No	1	-3.63*** (-3.52)	I(0)
mmr	No	6	-1.71 (-2.90)	I(1)
Δmmr	No	5	-3.54** (-2.90)	I(0)
lgti	No	2	-0.02 (-2.58)	I(1)
Δgti	No	1	-3.79*** (-3.52)	I(0)
lkse	No	0	-0.33 (-2.58)	I(1)
Δkse	No	0	-6.21*** (-2.58)	I(0)
lm2	No	2	-0.862 (-2.58)	I(1)
Δlm2	No	1	-3.01** (-2.90)	I(0)

'***' ** and * Implies that the series is stationary at 1%, 5% and 10% respectively
Results of Augmented Dickey Fuller test suggest that all the variables are non stationary in level form. However, all of these variables are stationary at first difference. It also shows that these time series are integrated of order 1. These results suggest that Johansen (1988) analysis should be performed to analyze the long term relationship between variables.

5.2 Optimal Lag Selection
In order to analyze the asset price channel of monetary policy in Pakistan, we need to select the optimal lag length. As we are using quarterly data in our analysis, which results into low sample size thus, we would prefer Schwartz Information Criterion (SIC) as identified by literature. The following table shows the results of SIC.

Table: 5.2 Var Lag Order Selection Criteria

	LogL	LR	FPE	AIC	SC	HQ
0	-4.4	NA	0	0.28	0.45	0.35
1	658.02	1206.19	0	-18.75	-17.76	-18.36
2	862.6	341.99	0	-24.11	-22.274*	-23.392*
3	891.54	44.05	0	-24.23	-21.59	-23.18
4	922.54	42.57	0	-24.4	-20.95	-23.04
5	959.49	45.22	0	-24.76	-20.48	-23.07
6	997.19	40.513*	1.227*	-25.17*	-20.04	-23.12

It is evident from Table 5.2 that the optimal leg length is 2.

5.3 Cointegrating Vectors

Identification of the number of co integrating vectors in our analysis is the next step after determining optimal lag length. For this purpose, trace statistics and maximum eigen value statistics are applied. The test results are presented in Table 5.3.

Table 5.3 Johansen Co integration Test Based on Maximum Eigenvalue and Trace Statistics

Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statistic
None *	98.36518	37.15432
At most 1 *	61.21086	28.60366
At most 2	32.6072	15.96903
At most 3	16.63817	11.49397
At most 4	5.144198	5.144198

Trace test indicates 2 co integrating eqn(s) at the 0.05 level * denotes rejection of the hypothesis at the 0.05 level
It can be concluded from our empirical results that there are two co integrating vectors in our analysis as evident from Table 5.3.

5.4 Normalized Co integration Equations:

The co integration analysis shows that there are two co integrating vectors. In order to examine the long run co integrating relationship between GDP and other variables and between GTI and other variables, two steps are followed. In the first co integrating relationship, the first co integrating vector is normalized on GDP. In the second co integrating relationship, the second co integrating vector is normalized on Investment. The first normalized co integrating stable relationship shows the long run relationship between GDP, M2, KSE and interest rate as presented in Table 4.4. The second normalized co integrating shows the long run relationship between Investment, KSE, M2 and interest rate as presented in Table 5.4.

Table 5.4 Johansen Long Run Co Integration Results

Lag Variables	CointEq1	CointEq2	SE eq 1	T-value eq1	SE eq2	T-value eq2
LGDP(-1)	1	0	---	---	---	---
LGTI(-1)	0	1	---	---	---	---
LKSE(-1)	3.809635	10.55208	-1.02857	3.70382**	-3.25229	3.24451**
MMRR(-1)	3.97268	1.231641	-0.07904	5.02635**	-0.24991	4.92831**
LM2(-1)	-1.255675	-2.650334	-0.33465	-3.75218]**	-1.05815	-2.50468*
C	-7.473279	-8.401916	-3.82683	-1.95286*	-12.1003	-0.69436

The long-run co integrating relationship can be shown by reduced form equations. The reduced form equations are given by;

LGDP= -7.47 -3.8LKSE - 3.97 MMR + 1.25LM2 (7)
(-1.95)* (3.70)** (5.02)** (-3.75)**

The co integration test shows significant long run relationship between output, stock prices, interest rate and

money supply. The equation suggests that one percent increase in output causes a 3.8 percent decrease in stock prices. A unit increase in output decreases the interest rate by 3.97 units and one percent increase in output brings 1.25 percent increase in money supply. All the parameters estimate elasticities due to logarithmic transformation except interest rate. The negative relationship between stock prices and output can be justified on the reason that increase in stock prices will discourage investment in the stock market which in turn, will cause decline in output. However, our results contradict (Agha et al., 2005) who argued that higher stock prices bring a rise in the market value of company as compared to replacement cost of capital and thus will encourage investment. The negative long run relationship between interest rate and output is justifiable on the fact that a rise in interest rate causes a rise in the user cost of capital which in turn, brings a decline in investment. A decline in investment brings a fall in output level in the country by the multiplier effect. The positive long run relationship between money supply and output can be justified on the grounds that a rise in money supply brings a decline in interest rate which in turn causes Tobin's q to increase and thus investment. A rise in investment brings a rise in output. Our results are in line with (Mishkin, 1995) and (Agha et al., 2005) And

LGTI = -8.4 – 10 LKSE - 1.23 MMR + 2.65LM2 (8)
(-0.69) (3.24)** (4.92)** (-2.50)*

Equation 5.2 suggests a long run relationship between investment, stock prices, interest rate and money supply. The equation further shows that one percent increase in investment brings 10 percent decrease in stock prices. A unit increase in investment causes 1.23 units decrease in interest rate and one percent increase in investment increases the money supply by 2.65 percent. The negative relationship between investment and stock prices can be justified on the reason that increase in stock prices will discourage investment in the stock market. However, our results contradict (Agha et al., 2005) who argued that higher stock prices bring an increase in the market value of firm as compared to replacement cost of capital and thus will encourage investment. The negative long run relationship between interest rate and investment is justifiable on the fact that a rise in interest rate brings a rise in the user cost of capital which in turn brings a decline in investment. The long run positive relationship between money supply and investment can be justified on the grounds that a rise in money supply causes a decline in interest rate which in turn causes Tobin's q to increase and thus investment. Our results are in line with (Mishkin, 1995) and (Agha et al., 2005).

5.5 Vector Error Correction Model:

Introducing vector error correction model in the stable long run relationship can improve the results of asset price channel of transmission mechanism of money. The shocks in monetary policy in Pakistan may bring fluctuations in the long run relationship among variables. Granger representation theorem argues that the existence of co integration leads to the existence of error correction. The error correction methodology helps us to understand adjustments in short run in the long run relationship among variables after the shocks in monetary policy. In our analysis, two error correction models are presented in Table 5.5 and Table5.6 respectively.

Table 5.5 Vector error correction in long run relationship 1

	Error correction	ΔLGDP	T value
	C	-7.47	[-1.95]
	ΔLGDPt-1	1.31	[7.37928]
	ΔLGDP t-2	-0.46	[-2.70391]
	ΔLGTI t-1	-0.14	[-1.46015]
	ΔLGTI t-2	-0.02	[-0.20019]
	ΔLKSE t-1	-0.02	[-1.02886]
	ΔLKSE t-2	-0.01	[-0.68361]
	ΔMMRR t-1	0.00	[2.47142]
	ΔMMRR t-2	0.00	[-2.41188]
	ΔLM2 t-1	-0.06	[-0.28343]
	ΔLM2 t-2	0.08	[0.36773]
	ECT (-1)	0.09647	[3.37005]
R-squared	0.861643	Mean dependent var	0.02468
Adjusted R-squared	0.835402	S.D. dependent var	0.015268
S.E. of regression	0.006194	Akaike info criterion	-7.175539
Sum squared resid	0.002225	Schwarz criterion	-6.790083
Log likelihood	263.1439	Durbin-Watson stat	2.167759

Table 5.5 shows the short term elasticities of lag values in the error correction model because of log transformation. The error correction coefficients should possess a minus sign and should have significant t- value for error correction. Granger's representation theorem argues that a policy shock creates disequilibrium but a

certain percentage of the disequilibrium can be corrected in the coming period (Engle & Granger, 1987). It is evident from the table that investment in the first lag is the most important variable that plays its role in the error correction produced by the policy shocks in the output vector. Stock prices also plays role in the error correction in output vector while all the other variables remain silent in the error correction.

The coefficient values in the error correction model represent the degree of elasticities; suggesting the percentage change in output as compared to the percentage change in the lag values of investment, stock prices, money supply and interest rate. A 9.6 percent error correction term is evident from the analysis which can be interpreted as a 9.6 percent error correction occurs in the output co integrating vector. The analysis suggests that output is more sensitive to investment in the short run. These results are in line with (Mishkin, 1995). It is also evident from the analysis that output is sensitive to stock prices in the short run. These findings are also in line with (Mishkin, 1995).

	Error correction	ΔLGTI	T values
	C	-8.4	[-0.694]
	ΔLGDPt-1	0.03	[0.10088]
	ΔLGDP t-2	0.20	[0.75283]
	ΔLGTI t-1	0.98	[6.89615]
	ΔLGTI t-2	-0.33	[-2.43053]
	ΔLKSE t-1	-0.05	[-1.79056]
	ΔLKSE t-2	-0.04	[-1.40501]
	ΔMMRR t-1	0.00	[1.31920]
	ΔMMRR t-2	0.00	[-1.68308]
	ΔLM2 t-1	-0.24	[-0.76765]
	ΔLM2 t-2	-0.38	[-1.17502]
	ECT (-1)	-0.075732	[-5.45283]
R-squared	0.867189	Mean dependent var	0.032064
Adjusted R-squared	0.842001	S.D. dependent var	0.023859
S.E. of regression	0.009484	Akaike info criterion	-6.323672
Sum squared resid	0.005217	Schwarz criterion	-5.938215
Log likelihood	233.3285	Durbin-Watson stat	2.188758

The coefficient values in the error correction model represent the degree of elasticities; suggesting the percentage change in output as compared to the percentage change in the lag values of investment, stock prices, money supply and interest rate. A 7.5 percent error correction term is evident from the analysis which can be interpreted as a 7.5 percent error correction occurs in the co integrating vector. It is evident from the results that investment is more sensitive to stock prices. Investment is also sensitive to interest rate and money supply. These results are very much in line with (Mishkin, 1995). The minus sign with co efficient suggests that the error reduces over time.

5.6 Multivariate VECM Granger Causality Test:

The Granger causality test helps us in order to determine the weak exogeneity among variables. This test suggests us the causal relationship of one variable with the other variable. The results of VECM Granger causality test are reported in Table 5.7. The significant chi-square statistic shows that the dependent variable is Granger caused by independent variable.

Table 5.7 Multivariate VECM Granger Causality

	Independent Variables				
	ΔLGDP	ΔLGTI	ΔLKSE	ΔMMR	ΔLM2
Dependent variables	Chi-sq				
ΔLGDP	-----	2.46	6.77**	1.24	0.40*
ΔLGTI	12.14***	----	4.32	3.25	16.38***
ΔLKSE	1.21	4.00	----	0.57	3.35
ΔMMR	6.37**	2.94	3.50	----	5.65*
ΔLM2	0.14	14.25***	6.95**	3.83	----

*,**, *** implies 10%, 5% and 1% significance respectively

Table 5.7 reports the causality between variables in the framework of Vector Error Correction. It is evident from the Table that there is a bi directional causality between money supply and investment. Money supply causes interest rate to fluctuate thereby, putting pressure on stock prices and thus investment also fluctuates. The results

reveal that output is Granger caused by stock prices and money supply. It is also evident from the results that money supply causes investment. Fluctuations in money supply are passed on to interest rate which in turn causes stock prices to change thus leading to a change in investment. These results are very much in line with the literature. The results of Multivariate Granger causality reveal that investment is Granger caused by output. With the increase in output, the income of people in the economy also increases which in turn causes increase in savings of the people. As soon as savings of the people in the economy are increased, people will tend more towards investment and thus investment is fluctuated. The table reveals that interest rate is Granger caused by output. Increase in output leads to an increase in exports which causes increase in foreign exchange thus causing increase in money supply thereby, causing increase in interest rate. It is evident from Table 5.7 that there is Granger causality running from money supply to interest rate. The results also suggest that investment Granger causes output which is very in line with (Mishkin, 1995). The results of Multivariate Granger causality test reveal that stock prices are not caused by any of these variables in case of Pakistan.

6. Conclusion and Policy Recommendations

6.1. Conclusion:

The analysis in this paper is backed by (Mishkin, 1995) who argued that asset prices play an important role in the monetary transmission mechanism. Moreover, (Agha et al., 2005) further analyzed the role of asset price channel in the monetary transmission mechanism and found that there is an active asset price channel in Pakistan. The current study has been designed to test the role of asset price channel in monetary transmission mechanism in Pakistan with a large and updated data set. For this purpose, Johansen co integration test, VECM and Granger causality tests were performed. The stationarity of the time series data was tested in the first step. The results of co integration test reveal that there exists a negative long run relationship between output and stock prices and between output and interest rate while positive relationship between output money supply is evident from the results of Johansen co integration test. Moreover, investment and stock prices also came out to be negatively related while positive relationship between money supply and investment appeared from the results. Existence of long term negative relationship between interest rate and investment is evident from the results of co integration test. Two co integrating vectors appeared from the results of co integration test. The first co integrating vector is normalized on output while second co integrating vector is normalized on investment. The results of Multivariate Granger causality test reveal that output is Granger caused by stock prices and money supply. These findings show the sensitivity of output to stock prices and money supply in long run in Pakistan. These findings are also evident from the co integration analysis. The multivariate Granger causality also reveals that there is Granger causality running from output to investment and from money supply to investment. The sensitivity of investment to money supply is also evident from the co integration analysis. It can be concluded from the Granger causality test results that none of the variables is Granger causing the stock prices. It also means that stock prices do not predict the performance of any of the given variables. These findings are a bit puzzling but the reason of these puzzling results may be the poor law and order situation in the country especially in the last few years of our sample period. Investors might be reluctant to invest in the country's stock exchange due to the high degree of uncertainty in the socio-political, economic and law and order situation in the country. The Granger causality test results reveal that output and money supply Granger causes interest rate. The sensitivity of interest rate to output is evident from the co integration analysis as well while the sensitivity of interest rate to money supply is quite obvious and has been empirically proved in the literature. Granger causality running from Investment to money supply and from stock prices to money supply is evident from the results. The sensitivity of money supply to output is evident from the co integration test results as well. Increase in output brings in exports which results in increase in foreign exchange and thus money supply. It is evident from the results that interest rate is not Granger causing any of the given variables.

6.2. Policy Recommendations:

The results from the analysis of long term relationship between output and other variables suggest that the central bank should stabilize interest rate as it has negative long run relationship with output. Further, the analysis of the long term relationship between investment and other variables reveal that there is negative long run relationship between investment and interest rate therefore, the central bank should be cautious while taking monetary policy actions. Our co integration analysis reveals that stock prices have a negative long run relationship with investment and output, while it is a generally expected that a tightening monetary policy is linked with decrease in prices. This kind of puzzling result was discussed by (C. A. Sims, 1992) who argued that monetary tightening has positive impact on prices. Our analysis suggests that output is responsible for causing investment and interest rate. Government should pay attention to the GDP as it has the power to fluctuate the interest rate. GDP also Granger causes investment which in turn, causes money supply. Interest rate is not causing any of the variables included in the asset price channel which means that interest rate is a weak policy tool as for as its effect in the asset price channel is concerned. The central bank should reduce the Exchange Rate

fluctuations. Decline in exchange rate causes the wealth of foreign investors to decrease in the stock market thus they will be reluctant to invest in the country. There are other determinants that influence stock price other than the variables included in the asset price channel. These determinants are war on terror and political instability. The monetary policy is active in long run while it is not active in short run. The asset price channel is not very active in Pakistan that is why we should focus on other channels of monetary transmission mechanism. Other channels of monetary policy can be explored in the future and their effect in the monetary transmission mechanism can be examined. Other developing countries can also be included in the analysis.

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