Pakistani Broad Money Supply and Stock Price Behavior

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Abstract

This study applies Enders and Siklos' (2001) procedure to test for the long-run asymmetric co-integrating relationship and Granger causality between Pakistani monthly money supply M_2 and monthly equity index over the period June 1998 to December 2013. The empirical results suggest a long-run asymmetric co-integration relationship between the broadly defined money supply and equity index, indicating that the countercyclical monetary policies affect investors and corporations differently in different phases of business cycles. The empirical results further suggest that Pakistani equity investors are more responsive to contractionary than expansionary monetary policy measures. Thus, the Pakistani Central Bank countercyclical monetary policy is effective in influencing the equity markets. The empirical findings should be of special interest for the Central Bank in formulating and implementing its countercyclical monetary policy, for equity investors in designing their investment strategies, and for corporate executives to determine their optimal capital structures.

Key Words: Asymmetry, co-integration, market equity index, money supply, TAR Model, and Pakistan.

1. Introduction

Since the late 1930s, Keynesian fiscal policy has played a critical role in macroeconomic management in market economies. Beginning in the 1960s, changes in international economic conditions resulted in persistently large government budget deficits in economies around the world. More recently as articulated by Mishkin (1995), this fiscal policy has lost its luster due to persistent budget shortfalls, large public debts, and doubt about the political system's ability to utilize the fiscal policy instrument in a timely and effective manner to achieve desirable stabilization outcomes. Consequently, the stabilization of output and inflation has been left largely to monetary policy.

Clearly, monetary policy becomes more and more important as an instrument for macroeconomic policy-making and macroeconomic management. As pointed out by Burki and Ahmad (2011), Pakistan's banking sector has undergone structural changes as part of the phased reforms in the financial sector that were initiated in the early 1990s. These reforms authorized: (i) the opening of several new private and foreign banks, (ii) the restructuring and downsizing of state-owned banks before being privatized, and (iii) reforms relating to mergers and acquisitions that helped consolidate private and foreign banks. As reported by the State Bank of Pakistan (2004), these reforms led to a dramatic decrease in the asset share of state-owned banks, from 93 percent in 1990 to only 22 percent in 2004. In the same period, the share of private banks increased from 0.0 to 67.5 percent, and that of foreign banks increased from 6.7 to 10.4 percent. The reforms also allowed foreign banks to compete freely with domestic banks. However, formulating and implementing monetary policy in Pakistan is still very challenging due to the weaknesses of the State Bank of Pakistan and the commercial bank system which have been reported by the Pakistani Central Banks and International Monetary Fund's annual country reports.

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The standard neoclassical paradigm of financial economics assumes that investors react to noteworthy news events by adjusting their investment portfolios because these events change the risk-return profile of securities. Therefore, changes in the money supply is an indicator of changes in future macroeconomic conditions such as inflation, interest rate and unemployment, sophisticated and unsophisticated investors alike will react according to their ability to access research information and reposition their portfolios. More specifically, neo-classical economists theorized that an increase in money supply strengthens the stock prices. Conversely, a fall in money supply should slow down the stock prices.

The post-Keynesian school of economics (see Wray, 1998 for the exposition of post-Keynesian thinking) has long questioned the importance of the above hypothesized relationship. This school of thought posits that movements in money supply reflect the shift of money from long-term saving deposits and other assets to demand deposits and vice versa as a result of the preceding changes in stock prices. For example, raises in stock prices induce investors to liquidate their long-term saving deposits and other assets to use the fund to purchase stocks. In this portfolio adjustment process, demand deposits tend to increase, which in turn raises money supply. The trend is reversed when stock prices are falling. From this logic, some post-Keynesian economists argue that changes in stock prices actually cause changes in money supply and not the other way around.

Additionally, the asymmetries in financial market instruments are neither new nor novel. They have been studied extensively and documented in the literature of the indirect financing segment of the financial industry. Arak et al. (1983), Goldberger (1984), Forbes and Mayne (1989), Levine and Loeb (1989), Mester and Saunders, (1995), Dueker, (2000), and Tkacz (2001) report asymmetries in the U.S. prime lending rate. Thompson (2006) confirms that the asymmetries in the US prime lending-deposit rate spread. Cook and Hahn (1989), Moazzami (1999), and Sarno and Thornton (2003) find asymmetries in U.S. Treasury securities. Frost and Bowden (1999) and Scholnick (1999) report asymmetries in mortgage rates in New Zealand, and Canada. Heffernan (1997) and Hofmann and Mizen (2004) indicate asymmetric behavior of retail rates in the United Kingdom. Hannan and Berger (1991), and Neumark and Sharpe (1992), Diebold and Sharpe (1992) examine various deposit rates.

The rationale for incorporating the possible asymmetric adjustment process of the stock prices to the long-run equilibrium can be attributed to the seemingly opposite effects of the efficient market hypothesis and the countercyclical monetary policy over different phases of business cycles. For instance, during the contractionary phases of business cycles, the countercyclical monetary policy would usually increase the money supply reducing market interest rates, while the information from that state of the economy would precipitate investors to resist adjusting their required rate of return on the stock market portfolio downward because their perceived market portfolio risk increases. Thus, the stock prices only increase slowly. By the same logic, it may be argued that, during the expansionary phases of business cycles, investors are less likely to resist adjusting their required rate of return on the stock market portfolio downward while the Central Bank is expected to reduce the growth in the money supply, raising market interest rates. It is expected that stock prices would adjust downward faster when the cycles are closer to their peaks.

The asymmetric response of the stock prices to the changes in the money supply, if it exists and is different from the behaviors of instruments in the direct financing segment of the financial market, may make equity (debt)-market-dependent firms more financially vulnerable to business cycle fluctuations than firms with access to other sources of financing. Thus, policymakers should be aware that counter-cyclical monetary policy may have different effects due to stock price asymmetries in their formulation of monetary policy. Additionally, keeping pace with the age of globalization, the equity market has been

increasingly internationalized. Thus, modeling the asymmetry in the stock prices may provide a better understanding of the countercyclical monetary policy and the equity market worldwide.

The above discussions imply the hypothesis of an asymmetric co-integrating relationship and Granger causality between stock prices and the money supply. To formally investigate these possibilities, this study utilizes Enders and Siklos' (2001) procedure to test for an asymmetric co-integrating relationship and Granger causality between the Pakistani stock prices and the monthly money supply. The remainder of this paper is organized as follows: The next section briefly discusses the Pakistani equity market and banking industry; the section that follows describes the data for this study and some descriptive statistics; the following section briefly describes the methodology used in the investigation; the next section reports the empirical test results; and the final section provides some concluding remarks.

2. Pakistani Equity Market and Banking Sector

As to the development of the Pakistani equity market, Hussain and Qasim (1997) articulated that the Karachi Stock Exchange (KSE) was established in September 1947, soon after Pakistan became independent, and was subsequently incorporated as a company limited by guarantee in March 10, 1949. At that time, the KSE has 90 members and 5 listed companies with paid-up capital of Rs 37 million.

The first index introduced in the KSE was based on fifty companies and was called the KSE 50 index. Trading used to be carried out on an open out-cry system. With the growth in the number of listed companies and trading activities, there was a need for a true representative index and a computerization of trading activities. As a result, the KSE 100 Index was introduced on November 1, 1991 with the base value of 1,000 points. The computerized trading system, called the Karachi Automated Trading System (KATS), was introduced in 2002 with a capacity of 1.0 million trades per day and the ability to provide connectivity to an unlimited number of users.

Additionally, the all-share index was introduced in 1995 which became operational on September 18, 1995. Also, to address the needs of the investor community, two other indexes were also introduced later on, called the KSE 30 Index and the KMI 30 Index. Both the KSE 100 and the KSE–All share indices are calculated using the market capitalization method while the KSE 30 and KMI 30 indices are calculated using the "Free-Float Capitalization" method. The free-float methodology refers to an index construction methodology that takes into account only the market capitalization of the free-float shares of a company for the purpose of index calculation.

Additionally, Pakistan has two other Stock Exchanges: the Lahore Stock Exchange (Guarantee) Limited and the Islamabad Stock Exchange (Guarantee) Limited. The Lahore Stock Exchange is Pakistan's second largest stock exchange after the Karachi Stock Exchange. It came into existence in October 1970, under the Securities and Exchange Ordinance of 1969 by the Government of Pakistan in response to the needs of the provincial metropolis of the province of Punjab. It initially had 83 members. The Lahore Stock Exchange (Guarantee) Limited was the first stock exchange in Pakistan to use the internet and currently 50 percent of its transactions are carried out via internet. The Islamabad Stock Exchange is the youngest of the three stock exchanges of Pakistan. The Islamabad Stock Exchange was incorporated as a guarantee limited Company on October 25, 1989. It was licensed as a stock exchange on January 7, 1992.

Historically, the stock exchanges of Pakistan were operating as non-profit companies with a mutualized structure wherein members had ownership as well as trading rights. This structure created the potential for a conflict of interest as members predominantly controlled

the affairs of stock exchanges and it was not conducive for an appropriate corporate governance in a self-regulatory organization. The corporatization and demutualization of stock exchanges entailed converting their structures from non-profit, mutually owned organizations to for-profit entities owned by shareholders. Demutualization is designed to create increased transparency at the Karachi Stock Exchange and greater balance between the interests of various stakeholders by clear segregation of commercial and regulatory functions as well as the separation of trading and ownership rights. Demutualization is a well-established global trend and a number of stock exchanges worldwide operate in demutualized set up.

Table 1: Market Capitalization of Listed Companies as Percentage of Gross Domestic Product

Advanced Markets	2009	2010	2011	2012	Asian Emerging Markets	2009	2010	2011	2012
Australia	136.3	127.8	86.6	84.6	Bangladesh	7.9	15.6	21.0	15.1
Canada	125.7	137.0	107.2	110.7	People's Rep. of China	100.3	80.1	46.3	44.2
France	75.3	75.6	56.4	69.8	India	86.4	94.4	54.2	68.6
Germany	39.3	43.5	32.9	43.7	Malaysia	126.6	166.3	137.2	156.9
Japan	67.1	74.6	60.0	61.8	***Pakistan***	20.5	21.6	15.5	18.9
Rep. of Korea	100.3	107.3	89.2	104.5	Philippines	47.6	78.8	73.8	105.6
New Zealand	57.6	51.4	45.1	47.7	Sri Lanka	19.3	40.2	32.8	28.7
Singapore	160.1	170.4	125.8	150.8	Thailand	52.4	87.1	77.7	104.7
United States	108.5	118.9	104.3	119.0	Vietnam	*21.8*	*19.2*	*14.8*	*23.2*
Average	96.7	100.7	78.6	77.1	*Average*	53.6	67.0	52.6	62.9

Source: *World Bank, World Development Indicators. Market capitalization is the share price times the number of shares outstanding. Listed domestic companies are domestically incorporated companies listed on the country's stock exchange at the end of the year (2012). Listed companies do not include investment companies, mutual funds, or collective investment vehicles.*

The enactment of the 2012 Stock Exchanges (Corporatization, Demutualization & Integration) Act has brought Pakistan's capital market up to par with other international jurisdictions such as India, Malaysia, Singapore, USA, UK, Germany, Australia, Hong Kong and Turkey among others. It has provided a framework for the corporatization, demutualization and integration of stock exchanges. The said Act has enabled the demutualization of stock exchanges, which is expected to result in expanding market outreach, attracting new investors, improving liquidity and enabling the stock exchanges to attract international strategic partners. It should also facilitate the consolidation of brokers leading to financially strong entities. As to the efficiency of the Pakistani equity market, empirical studies using parametric and non-parametric methods suggested that the Pakistani equity market is efficient, at least in the weak-form of the efficient market hypothesis (Akber & Muhammad, 2013; Mamood & Rehman, 2007; Tariq, 2013)

As of February 21st, 2014 there are 579 companies listed on the KSE and the total market capitalization is Rs. 6,537.064 billion. The listing is done on the basis of strict rules and regulations laid out by the Securities Exchange Commission of Pakistan and the Karachi Stock Exchange (Guarantee) Limited. However, Table 1 indicates, the Pakistani equity market is still relatively small as a percentage of its GDP at the end of 2012.

As to the Pakistani banking industry, the IMF Country Report No. 05/157 (2005) posited that the structure of the Pakistani banking sector has substantially changed in the last two decades, particularly following the privatization of the state-owned banks. In 1990, the banking system was dominated by five commercial banks which were all state-owned. The 1990 amendments to the Banking Companies Ordinance launched the process of financial sector reforms by allowing privatization of the state-owned banks. During the first round of

reforms, two of the state-owned banks, the Muslim Commercial Bank and the Allied Bank, were privatized between 1991 and 1993. The reform process was subsequently delayed for several years and resumed significantly only in the early 2000s.

As articulated by Burki and Ahmad (2011), Pakistan's reforms in the financial sector introduced prudential regulations that authorized: (i) the opening of several new private and foreign banks, (ii) the restructuring and downsizing of state-owned banks before being privatized, and (ii) the reforms relating to mergers and acquisitions that helped consolidate private and foreign banks. These reforms led to a dramatic decrease in the asset share of state-owned banks, from 93 percent in 1990 to only 22 percent in 2004. In the same period, the share of private banks increased from 0.0 to 67.5 percent, and that of foreign banks increased from 6.7 to 10.4 percent (State Bank of Pakistan, 2004). The reforms also allowed foreign banks to compete freely with domestic banks.

However, formulating and implementing monetary policy in Pakistan is still very challenging due to the weaknesses of the State Bank of Pakistan and the commercial bank system which have been reported by the Pakistani Central Bank and International Monetary Fund's annual country reports. Internally, the State Bank of Pakistan's November 2013 Monetary Policy Statement articulated that government borrowing from the banking system has remained the key driver of monetary expansion during the 2013 fiscal year. The same trend continues in 2014 fiscal year. Also, in its Monetary Policy Statement, September 2013, the State Bank of Pakistan stated that in terms of controlling growth in money supply, its efforts of curtailing liquidity injections did not experience much success. It is because these were offset by an increase in direct fiscal borrowings from the State Bank of Pakistan. Specifically, from the outstanding level of Rs 691 billion at end-January 2013, the liquidity injections by the State Bank of Pakistan through open market operations declined to Rs 208 billion by end-June 2013. During the same period, the fiscal authority borrowed Rs 687 billion from State Bank of Pakistan on a flow basis.

The State Bank of Pakistan's January 2014 Monetary Policy Statement reported that as a result of excessive fiscal borrowings from the banking system and a weak external position, the net domestic assets to net foreign assets ratio of the banking system has increased sharply to 177 as of the 27th of December 2013 from 32 at the end June 2013. This deterioration clearly highlights the risk of the substitution of domestic assets with foreign assets, which may have adverse implications for the exchange rate as well as the inflation outlook.

Externally, the IMF Country Report No. 12/35: Pakistan 2011 Article IV Consultation and Proposal for Post-Program Monitoring argued that strengthening central bank autonomy and increasing monetary policy effectiveness should aid in achieving sustained disinflation. The current legal structure, especially the absence of a strong framework for direct government financing, significantly impairs central bank independence. The legal reforms to increase SBP independence are critical. In addition, increasing financial deepening by fostering competition in the banking sector and improving the functioning of financial markets are important for strengthening monetary policy effectiveness

The 2013 Article IV Consultation and Proposal for an Extended Arrangement under the Extended Fund Facility, the IMF Country Report No. 13/287, argued that the Pakistani financial system is dominated by banks that have been relatively healthy but nonperforming loans remain high. Overall capital adequacy remained well above the statutory minimum capital requirement, at 15.1 percent at the end of March 2013. The banking system as a whole is liquid and profitable and deposit growth has remained strong (nearly 16 percent) in recent years. Nevertheless, nonperforming loans are high (14.7 percent), and a few banks are operating below the minimum capital requirement. The high concentration of assets in public

debt (around 37 percent of total assets) at a time of weak public finances is another source of risk. While non-performing loans are relatively well-provisioned for the system as a whole (over 70 percent), the slowdown in economic activity and pressures on the balance of payments continue to affect bank soundness.

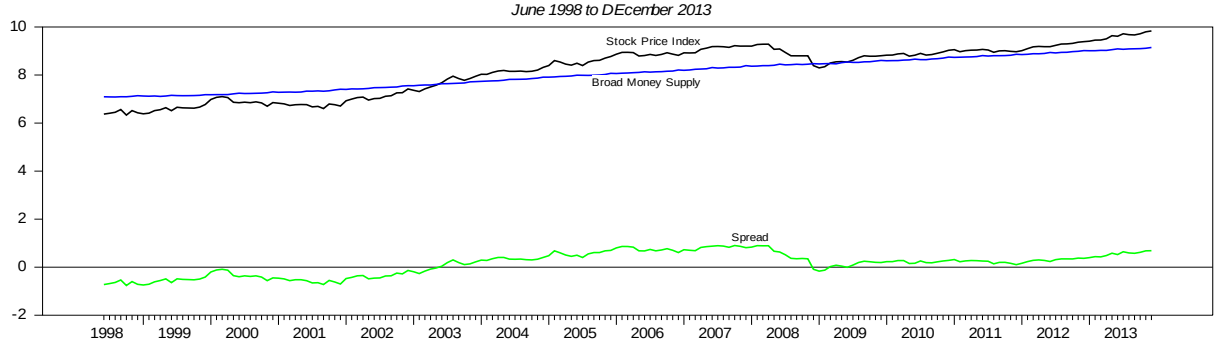
The May 2005 IMF Country Report No. 05/157, Pakistan—Financial Sector Assessment Program—Technical Note— Condition of the Banking System, reported that Pakistan has made efforts in recent years to promote Islamic banking services. In particular, the State Bank of Pakistan exempted Islamic commercial banks from the moratorium on the establishment of new banks, and the first full-fledged Islamic bank, Meezan Bank, was licensed in 2002. Several conventional banks have also opened branches that provide only Islamic financial services. The size of these Islamic banking institutions remains very small. Although legal ambiguities remain regarding the process of Islamization of the financial system of Pakistan, the establishment of new Islamic banking institutions is likely to continue in the coming years. Additionally**,** IMF staff urged the authorities to amend the Bank of Pakistan Act in order to establish an independent, decision-making monetary policy committee, which is a pre-requisite for an optimal design and implementation of monetary policy. IMF staff stressed that full independence would help pave the way for improved price stability, as the Bank of Pakistan's primary objective, and the elimination of future direct financing of fiscal deficits.

3. Data

This study uses data on the monthly equity market index and the broad money supply (in billion rupees) from the Bank of Pakistan over the period from June 1998 to December 2013. The monthly market equity index and the broad money supply are expressed in natural logarithmic values. The natural logarithmic values of the monthly market equity index and the money supply are denoted by EP_t and MS_t, respectively. Throughout this study, EP_t and MS_t are referred to as the stock price index and the money supply. The difference between EP_t and MS_t is defined as the basis or the spread between stock price index and the money supply and is denoted by SP_t. Moreover, given a level of the stock price index, a decrease in the broad money supply, would widen the spread between the stock price and the money supply: a widening of the basis. The opposite is true if the money supply changes in the other direction. The descriptive statistics reveal that the mean money supply during the sample period is 8.06 ranging from 7.09 to 9.15 with standard deviation being 0.64, while the mean stock price is 8.20, ranging from 6.33 to 9.83 with is standard deviation being also 1.03. Their correlation is 94.20.

Figure 1

THE LOGARITHMS OF PAKISTANI STOCK PRICE INDEX, THE BROAD MONEY SUPPLY, AND THEIR SPREAD



Source: *Pakistani Central Bank and calculations by the author.*

4. Methodological Issues and Analytical Framework

4.1 Structural Break

Over time, every economy would experience many business cycles caused by internal and external shocks; therefore, countercyclical monetary policy measures would be used to bring the economy back to its long-run path. Consequently, the spread between the stock price index and the money supply is most likely to suffer some structure breaks. To search endogenously for the possibility of any structural break in the basis, this study utilized Perron's (1997) endogenous unit root test function with the intercept, slope, and the trend dummy, as specified by equation (1), to test the hypothesis that the spread between stock price index and the money supply has a unit root.

$$SP_t = \mu + \theta DU + \alpha t + \gamma DT + \delta D(T_b) + \beta SP_{t-1} + \sum_{i=1}^{k} \psi_i \Delta SP_{t-i} + \upsilon_t \quad (1)$$

where $DU = 1(t > T_b)$ is a post-break constant dummy variable; t is a linear time trend; $DT = 1(t > T_b)$ is a post-break slope dummy variable; $D(T_b) = 1(t = T_b + 1)$ is the break dummy variable; and ε_t are white-noise error terms. The null hypothesis of a unit root is stated as $\beta = 1$. The break date, T_b, is selected based on the minimum t-statistic for testing $\beta = 1$ (see Perron, 1997, pp. 358-359).

4.2 Threshold Autoregressive (TAR) model

To further investigate the nature of the Granger causality between the Pakistani equity index and the money supply, this study uses the threshold autoregressive (TAR) model, developed by Enders-Siklos (2001), that allows the degree of autoregressive decay to depend on the state of the spread between the logarithm values of the Pakistani market equity and the money supply or the basis, i.e. the "deepness" of cycles. The estimated TAR model would empirically reveal if the basis tends to revert back to the long-run position faster when the spread is above or below the threshold. Therefore, the TAR model indicates whether troughs or peaks persist more when shocks or countercyclical monetary policy actions push the basis out of its long-run equilibrium path. In this model's specification, the null hypothesis that the basis contains a unit root can be expressed as $\rho_1 = \rho_2 = 0$, while the hypothesis that the basis is stationary with symmetric adjustments can be stated as $\rho_1 = \rho_2$.

The first step in the Enders-Siklos' (2001) procedure is to regress the basis or the spread between the logarithms of the stock price index and the money supply, SP_t , on a constant, a linear trend and an intercept dummy (with values of zero prior to the structural break date and values of one for the structural break date and thereafter), as specified by equation (2).

$$SP_t = \beta_0 + \beta_2 trend_t + \beta_3 Dummy_t + \varepsilon_t \quad (2)$$

The saved residuals, ε_t from the estimation of equation (2), denoted by $\hat{\varepsilon}_t$, are then used to estimate the following TAR model:

$$\Delta\hat{\varepsilon}_t = I_t \rho_1 \hat{\varepsilon}_{t-1} + (1 - I_t)\rho_2 \hat{\varepsilon}_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta\hat{\varepsilon}_{t-p} + \hat{u}_t \quad (3)$$

where $\hat{u}_t \sim i.i.d.(0, \sigma^2)$, and the lagged values of $\Delta\hat{\varepsilon}_t$ are meant to yield uncorrelated residuals. As defined by Enders and Granger (1998), the Heaviside indicator function for the TAR specification is given as:

$$I_t = \begin{cases} 1 & if\ \hat{\varepsilon}_{t-1} \geq \tau \\ 0 & if\ \hat{\varepsilon}_{t-1} < \tau \end{cases} \quad (4)$$

The threshold value, τ, is endogenously determined using the Chan (1993) procedure which obtains τ by minimizing the sum of squared residuals after sorting the estimated residuals in an ascending order, and eliminating 15 percent of the largest and smallest values. The elimination of the largest and the smallest values is to assure that the $\hat{\varepsilon}_t$ series crosses through the threshold in the sample period. Throughout this study, the included lags are selected by the statistical significances of their estimated coefficients as determined by the *t-statistics*.

4.3The Asymmetric Error-Correction Models

Moreover, to investigate the short-run asymmetric dynamic behavior between the stock price index and the money supply, this study specifies and estimates the following asymmetric error-correction model. The estimation results of this model can be used to discern the nature of the Granger causality between the stock price index and the money supply. The empirically determined nature of the Granger causality will help to empirically evaluate the neoclassical and post-Keynesian hypotheses regarding the relationship between money supply and the stock price index in the last decade of the Pakistani financial markets. Additionally, the following TAR-VEC model differs from the conventional error-correction models by allowing asymmetric adjustments toward the long-run equilibrium.

$$\Delta EP_t = \alpha_0 + \rho_1 I_t \hat{\varepsilon}_{t-1} + \rho_2 (1 - I_t)\hat{\varepsilon}_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta EP_{t-i} + \sum_{i=1}^{q} \gamma_i \Delta MS_{t-i} + u_{1t} \quad (5)$$

$$\Delta MS_t = \tilde{\alpha}_0 + \tilde{\rho}_1 I_t \hat{\varepsilon}_{t-1} + \tilde{\rho}_2 (1 - I_t)\hat{\varepsilon}_{t-1} + \sum_{i=1}^{n} \tilde{\alpha}_i \Delta EP_{t-i} + \sum_{i=1}^{q} \tilde{\gamma}_i \Delta MS_{t-i} + u_{2t} \quad (6)$$

where $u_{1,2t} \sim i.i.d.(0, \sigma^2)$ and the Heaviside indicator function is set in accord with (4). This model specification recognizes the fact that the stock price index (i.e. the investors, because the investors collectively determine the stock prices) respond differently depending on whether the basis is widening or narrowing, i.e. contractionay or expansionary monetary policy.

5. Empirical Results

5.1 Results of the Test for Structural Break

The estimation results of Perron's endogenous unit root tests are summarized in Exhibit 1. An analysis of the empirical results reveals that the post-break intercept dummy variable, *DU*, and the post-break slope dummy variable, *DT*, are negative and insignificant at any conventional level. The time trend is positive and is significant at the 1 percent level. The empirical results of these tests suggest that the spread between the logarithm values of the Pakistani market equity index and the money supply or the basis followed a stationary trend process with a break date of March 2008, which may be attributable to the consequence of the US subprime mortgage debacle, resulting in a financial crisis of international dimension. However, the $t(\alpha = 1) = -4.0836$ is not sufficiently large to confirm the structural break. To definitely affirm this break, the Chow's test was carried out and the result confirms the suggested date of the structural break of basis.

Exhibit 1: Perron's Endogenous Unit Root Test, Pakistani Monthly Data, 1998:06 to 2013:12

$$SP_t = -0.1116 - 00985DU + 0.00227t - 0.0005DT + 0.1382D(T_b) + 0.8641SP_{t-1} + \upsilon_t$$

(-3.1515*) (-1.0705) (3.7464*) (-0.7170) (1.6583***) (25.9637*)

No. of augmented lags: $k = 6$ Break Date: March 2008 $t(\alpha = 1) = -4.0836$

Notes: *Critical values for t-statistics in parentheses: Critical values based n = 100 sample for the break-date (Perron, 1997). "*" and "***" indicate significances at 1 and 10 percent levels.*

5.2 Results of Cointegration Test with Asymmetric Adjustment

To examine whether or not the logarithmic values of the stock price index and the money supply are co-integrated when allowing for asymmetric adjustments, the basis or the spread between the logarithms of stock price index and the money supply is regressed on a constant, a linear trend and an intercept dummy with values of zero prior to march 2008 and values of one for March 2008 and thereafter. The estimation results are reported in Exhibit 2.

Exhibit 2: Estimation Results for Equation, Pakistani Monthly Data, 1998:06 - 2013:12

$$SP_t = -0.7496 + 0135Trend_t - 1.0156Dummy_t + \varepsilon_t$$

(-18.9523*) (23.9865*) (-16.1193*)

ln L = 12.4165 R^2 = 0.7705 DW statistic(a) = 0.2432 $F_{(2,184)}$ = 313.2683*

Notes: *"*" indicates significance at 1 percent level.*

(a) *As articulated by Enders and Siklos (2001, p. 166), in this type of model specification, ε_t may be contemporaneously correlated.*

The residuals from these estimations are used to estimate the TAR model specified by equations (3) and (4). The estimation results for the TAR model are reported in Exhibit 3. Over all, the empirical results reveal that the null hypothesis of symmetry, $\rho_1 = \rho_2$, is soundly rejected at the 1 percent significant level based on the partial $F = 4.6101$, indicating statistically that adjustments around the threshold value of the basis, the difference between the natural logarithmic values of the Pakistani stock price index and the money supply - the basis, are asymmetric.

Additionally, The calculated statistic $\Phi_\mu = 6.5130$ indicates that the null hypothesis of no co-integration, $\rho_1 = \rho_2 = 0$, should also be rejected at the 1 percent significance level, confirming that the basis is stationary. With regard to the stationarity of the basis, Ewing, et al. (2006) pointed out that this simple finding of stationarity is consistent with the two underlying series comprising the basis being co-integrated in the *conventional, linear combination sense*.

Exhibit 3: Unit Root and Tests of Asymmetry, Pakistani Monthly Data, 1998:06 - 2013:12

ρ_1	ρ_2	τ	$H_0 : \rho_1 = \rho_2 = 0$	$H_0 : \rho_1 = \rho_2$	aic	sic
-0.2552*	-0.0108	0.0471	Φ_μ = 6.5130*	F = 5.5558**	-4.4175	-4.3304
	$Q_{(12)}$=13.4740[0.3355]		*ln L = 151.1133*	$F_{(4,180)}$=4.6101*	DW = 2.0151	

Notes: *The null hypothesis of a unit root, $H_0 : \rho_1 = \rho_2 = 0$, uses the critical values from Enders and Siklos (2001, p. 170, Table 1 for four lagged changes and n = 500). "*" and "**"indicate 1 percent and 5 percent levels of significance, respectively. The null hypothesis of symmetry, $H_0 : \rho_1 = \rho_2$, uses the standard F distribution. τ is the threshold value determined via the Chan (1993) method. $Q_{(12)}$ denotes the Ljung-Box Q-statistic with 12 lags.*

These test results support the long held theoretical articulation of the co-integrating relationship between stock prices and money supply. The estimation results reveal that ρ_1 is significant at the 1 percent level, while ρ_2 is statistically insignificant at any conventional level. In fact, the point estimates suggest that the spread tends to decay at the rate of $|\rho_1| = 0.2552$ for $\hat{\varepsilon}_{t-1}$ above the threshold, $\tau = 0.0471$, and at the rate of $|\rho_2| = 0.0108$ for $\hat{\varepsilon}_{t-1}$ below the threshold.

Finally as mentioned above, the finding of $|\rho_1| > |\rho_2|$ indicates a *faster* convergence for positive disequilibrium than for negative disequilibrium. $\hat{\varepsilon}_{t-1} > 0.0471$ is indicative that the decline in the money supply, as a result of the contractionary monetary policy, has widened the difference between the stock price and the money supply. This widening of their basis initiates a downward adjustment in the stock price. This result implies that the stock price adjusts faster to the threshold value when the Pakistani Central Bank tightens money supply, widening the above defined basis than when the authority eases the money supply, narrowing the basis. These findings suggest that the equity investors and hence the stock prices are more responsive to contractionary monetary policy as reflected in the decline in the broad money supply. These results suggest that the monetary policy affects the Pakistani corporations and hence investors differently in different phases of the business cycles in the long run.

5.3Results of the Asymmetric Error-Correction Models

Exhibit 4 summarizes the estimation results for the TAR-VEC model specified by equations (4), (5) and (6) using natural logarithmic values of the Pakistani stock price index and the monthly broad money supply. In the summary of the estimation results, the partial F_{ij} represents the calculated partial *F-statistic* with the p-value in square brackets testing the null hypothesis that all coefficients *ij* are equal to zero. "*" indicates the 1 percent significant level of the *t-statistic*. $Q_{LB\ (12)}$ is the Ljung-Box statistic and its significance is in square brackets, testing for the first twelve of the residual autocorrelations to be jointly equal to zero. *lnL* is the log likelihood. The overall *F-statistic* with the p-value in square brackets tests the overall fitness of the model. The retained estimated coefficients α_i, γ_i, $\tilde{\alpha}_i$, and $\tilde{\gamma}_i$ are based on the 5 percent level of significance of the calculated *t-statistics*.

Exhibit 4: Asymmetric Error Correction Model, Pakistani Monthly Data, 1998:06 - 2013:12

Eq. (5)	**Independent Variables** *Overall* $F_{(10,155)} = 6.8235[0.0000]$; *lnL= 215.6186;* $Q_{(12)} = 12.9030[0.3762]$; $\bar{R}^2 = 0.2609$			
ΔEP_t	$\alpha_{15} = 0$	$\gamma_2 = \gamma_3 = \gamma_5 = \gamma_{13} = \gamma_{16} = \gamma_{17} = \gamma_{20} = 0$	ρ_1	ρ_2
	Partial F_{11} *=5.2510[0.0230]*	*Partial* F_{12} *= 4.2687[0. 0002]*	-0.1980*	-0.0220
Eq. (6)	**Independent Variables** *Overall* $F_{(11,154)} = 37.0751[0.0000]$; *lnL= 551.8933;* $Q_{(12)} = 8.4720[0.7473]$; $\bar{R}^2 = 0.7063$			
ΔMS_t	$\tilde{\alpha}_2 = \tilde{\alpha}_3 = 0$	$\tilde{\gamma}_1 = \tilde{\gamma}_5 = \tilde{\gamma}_6 = \tilde{\gamma}_{10} = \tilde{\gamma}_{12} = \tilde{\gamma}_{15} = \tilde{\gamma}_{20} = 0$	$\tilde{\rho}_1$	$\tilde{\rho}_2$
	Partial F_{21}*=7.3490[0.0009]*	*Partial* F_{22} *= 54.9273[0.0000]*	0.0024	0.0020

Notes: *Partial F-statistics for lagged values of changes in the lending rate and Central Bank discount rate, respectively, are reported under the specified null hypotheses.* $Q_{(12)}$ *is the Ljung-Box Q-statistic to test for serial correlation up to 12 lags. "*" indicates 1 percent level of significance of the t-statistics.*

An analysis of the overall empirical results indicates that the estimated equations (5) and (6) are absent of serial correlation and have good predicting power as evident by the Ljung-Box statistics and the overall *F-statistics*, respectively.

As to the long-run adjustment, the statistical significances of the error correction terms and $|\rho_1| > |\rho_2|$ in equation (5) indicates that the stock price asymmetrically responds to negative and positive spreads. Since ρ_2 is not significant at any conventional level, the estimation results of the TAR-VEC reveal that stock price reverses to the long-run equilibrium faster when the Pakistani Central Bank tightens the money supply, widening the basis compared to ease monetary policy actions. With regard to the long-term money supply, the estimation results of equation (6) show $|\tilde{\rho}_2| < |\tilde{\rho}_1|$. However, both $|\tilde{\rho}_1|$ and $|\tilde{\rho}_2|$ are not statistically significant at any conventional level, indicating that the money supply does not respond to either the widening or the narrowing of the spread between stock price and the money supply in the long run. These empirical findings suggest that Pakistani monetary policy makers have not been sensitive to equity market in the long run.

With regard to the short-run dynamic Granger causality between stock price and the money supply, the partial *F-statistics* in equation (5) reveal a bi-directional Granger-causality from the money supply to the stock price, i.e., the stock price responds to both the its own lagged changes and the lagged changes of money supply as well. Similarly, the empirical results for equation (6), the partial *F-statistics* suggest that the money supply responds not only to its own lagged changes but also to lagged changes of the stock price in the short run. Over all, the TAR- VEC estimation results seem to lend credence to the neo-classical in the long run and the Keynesian views in the short run on the causality between the market stock price and the money supply since 1998.

6. Concluding Remarks

The standard neoclassical paradigm of financial economics assumes that investors react to noteworthy news events by adjusting their investment portfolios because these events change risk-return profile of securities. Therefore, any change in the growth rate of the broad money supply is an indicator of future macroeconomic conditions such as higher interest rate, sophisticated and unsophisticated investors alike will react according to their ability to access research information and reposition their portfolios. Consequently, the stock prices will move. The post-Keynesian school of economics posits that movements in money supply reflect the shift of money from long-term saving deposits and other assets to demand deposits and vice versa as a result of the preceding changes in stock prices. The results of this study empirically reveal both the neoclassical and the post Keynesian paradigm that there is bidirectional Granger causality between the stock price index and the narrowest defined money supply. In fact, their Granger Causality is asymmetric. This asymmetric relationship indicates that the counter cyclical monetary policies affect corporations differently in different phases of business cycles.

The empirical results also suggest that equity (debt)-market-dependent firms are more vulnerable to business cycle fluctuations (at least in regard to their cost of capital) than firms with access to other sources of financing. Thus, policymakers should be aware that countercyclical monetary policy may have different effects due to the asymmetric behavior of stock prices in their formulation of monetary policy. Additionally, keeping pace with the age of globalization, the equity market has been increasingly internationalized; these findings may provide a better understanding of the counter-cyclical monetary policy and the equity market worldwide.

More specifically, the results reveal that the stock price adjusts faster to the threshold value when the Pakistani monetary authority tightens the money supply, widening the basis

than when the Central Bank eases the monetary policy, narrowing the basis. These findings suggest that the stock price is more responsive to contractionary monetary policy as reflected in the decline in the money supply.

As to the long-run adjustment, the statistical significance of the error correction term, ρ_1, and $|\rho_1| > |\rho_2|$ in equation (5) indicate that the stock price asymmetrically responds to negative and positive spreads in the long run. In fact, estimation results of the TAR-VEC reveal that stock price reverses to the long-run equilibrium faster when the Pakistani Central Bank tightens the money supply, widening the basis compared to ease monetary policy actions. As to the money supply, the empirical results of the TAR-VEC suggest that the monetary authority responds to fluctuations in equity price index in the short run.

With regard to the long-run money supply, the estimation results of equation (6) show $|\tilde{\rho}_2| < |\tilde{\rho}_1|$. However, both $|\tilde{\rho}_1|$ and $|\tilde{\rho}_2|$ are not statistically significant at any conventional level, indicating that the money supply does not respond to either the widening or the narrowing of the spread between stock price and the money supply in the long run. These empirical findings suggest that Pakistani monetary policy makers have not been sensitive to the equity market in the long run. Over all, the estimation results seem to lend credence to the neo-classical long run view as well as the short-run dynamic Keynesian articulations on the causality between the market stock price and the money supply over the sample period.

Most of studies of Pakistani equity market are of micro-nature and detailed operations. The macro nature of the empirical results of this investigation would help policy makers to design and implement proper policy, investors to design their investment strategies and corporate executives to determine their optimal capital structures.

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