

Bangladeshi Narrow Money Supply and Equity Returns: An Asymmetric Co-Integration Analysis

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This study applies Enders and Siklos (2001) procedure to test for the long-run asymmetric co-integrating relationship and Granger causality between Bangladeshi monthly money supply M1 and monthly share price over the period 1999:1 to 2010:1. The empirical results suggest a long-run asymmetric co-integration relationship between the narrowly defined money supply and share price index, indicating that the counter cyclical monetary policies affect investors differently in different phases of business cycles. The empirical results further reveal a weak exogeneity from money supply to share price index using Granger causality tests suggesting the lack of central bank credibility in influencing share prices; thus, its short-run counter-cyclical monetary policy is totally ineffective in influencing the equity markets. In the context of Bangladeshi economy, it appears that strong political will and commitment would be needed to establish a more competitive and efficient market economy, whereby among other things, the Bangladesh Bank's credibility can be established, that would be conducive for economic progress.

Field of Research: Financial Economics.

1. Background of the Study

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, particularly Narrow money (M1), are important indicators of changes in future macroeconomic conditions such as inflation, interest rate and unemployment, and so on that may affect share prices; sophisticated and unsophisticated investors alike will react according to their ability to access and understand research information and to 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. In this framework, money supply will serve as a cause variable to affect share prices. Capital market in Bangladesh is mainly dominated by share market as bond market is not yet well developed.

The post-Keynesian school of economics, based on its view that individuals allocate their wealth among the narrowly defined money and other financial assets (Froyen 2009, p. 100), questioned the directional causality of the above hypothesized

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relationship. This school of thought posits that movements in narrow money supply reflect the shift of money from liquidating other assets to transaction 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 other assets to use the fund to purchase stocks and other financial assets. In this portfolio adjustment process, transaction deposits tend to increase, which in turn raises money supply. The trend is reversed when assets and stock prices are falling. As a result of this, some post-Keynesian economists argue that changes in stock prices actually cause changes in money supply and not the reverse.

The article considers narrow money supply as broad money supply's component time deposit is being rarely used in the share market. It may be noted that in Bangladesh capital market is mainly dominated by equity market as bond market is yet to be developed. Also, another peculiarity of the share market of Bangladesh is that it is largely bank dominated.

The rationale for theoretically hypothesizing 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 counter-cyclical monetary policy over different phases of business cycles. For instance, during the contractionary phases of business cycles, the counter-cyclical 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 risk premium 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 risk premium on the stock market portfolio downward while monetary authority is expected to reduce the growth in the money supply, raising market interest rates. Therefore; the stock prices more likely react to monetary policy actions asymmetrically over different phases of business cycles. Thus, if a corporation only relies on stock as the only source of capital, the monetary policy would affect its cost of capital differently. Based on the above analysis, it is hypothesized that the stock prices would more likely react to monetary policy actions asymmetrically over different phases of business cycles.

The asymmetric response of the stock prices to the changes in the money supply, if 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, in their formulation of monetary policy, the policymakers should be aware of the fact that the countercyclical monetary policy may have different effects due to stock price asymmetries. Additionally, keeping pace with the age of globalization, the equity market has been increasingly internationalized. Therefore, modeling the asymmetry in the Bangladeshi stock prices may provide a better understanding of the relationship between countercyclical monetary policy and the equity markets in the context of poor and developing counties.

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In light of the aforementioned, this study empirically investigates neoclassical and post-Keynesian co-integrating relationships and the nature of the causality between the Bangladeshi money supply and stock prices. To formally investigate these possibilities, this study utilizes Enders and Siklos (2001) procedure to test for asymmetric co-integrating relationship and Granger causality between the Bangladeshi narrow money supply and share prices using monthly data. This is to be noted here that such relationships were not examined before for Bangladesh or other poor developing countries. Further, the data set used is high frequency (monthly) data for Bangladesh for most recent periods available, which were not used before for this type of study. The findings of this study should be of much benefit to policy makers, bankers, home and foreign investors, academics and researchers in both rich and poor countries.

The remainder of this paper is organized as follows: The next section reviews the current literature; the following section summarizes the Bangladeshi financial sector; the section that follows describes the data for this study and some descriptive statistics; the following section briefly describes the methodology that will be used in the investigation; the next section reports the empirical test results for co-integration allowing for asymmetric adjustment to a threshold; the section that follows presents the results of the co-integration and asymmetry tests; the next section examines the results of the asymmetric error-correction model to determine the Granger causality between money supply and share prices; and the final section provides some concluding discussion, policy implications and some limitations of the study.

2. Literature Review

This paper will examine possible asymmetric behavior in the response of stock prices to monetary policy shocks. Such asymmetries in financial market instruments 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 the existence of 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 and found asymmetries in various deposit rates. Nguyen and Islam (2010) find asymmetries in the Thai lending-deposit rate spread and attributed it to oligopolistic nature of the Thai banking industry.

There have been a number of studies on the Bangladeshi equity index behavior, but the empirical findings are contradictory. Hossain and Moosarof (2006) reported that growth rate of GDP, amount of import, amount of export, amount of foreign exchange reserve, rate of inflation, volume of money supply and interest rate on advance affected the DSE index. Moreover, Khan (2010) reports that his regression analyses revealed a strong correlation between certain interest rates and DSE index. On the other hand, using the

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co-integration methodology, Ahmed and Imam (2007) found that only changes in T-bill rate Granger causes equity indices. However, neither T-bill rate nor exchange rate is co-integrated with other macroeconomic variables such as industrial production index, broad money supply and GDP growth. These authors interpreted this finding as the evidence of information inefficient nature of the market.

Moreover, Barua and Rahman (2007) argue that even in the short run, the effect of interest rates on stock prices is less clear-cut, and in a less developed capital market like Bangladesh, stock prices do tend to respond to such rates. Mohiuddin, Alam and Shahid (2008) articulate that the hypothesis of macroeconomic factors having significant relationship with stock market returns may have strong intuitive appeal but almost no empirical support in context of the economy of Bangladesh. Nguyen and Ali (2011) observe in Dhaka Stock Exchange market of Bangladesh that due to the common characteristics associated with poor developing countries, their equity markets are not even weakly efficient. This is not viewed positively given that most well developed countries have efficient equity markets.

3. The Bangladeshi Financial Sector: A Brief Overview

The financial sector of Bangladesh is generally small and underdeveloped. This sector consists of a banking segment and an emerging but still nascent capital/equity market segment. The banking segment in the country is relatively more developed than the equity market segment, even though both are quite underdeveloped in international comparison. A brief discussion of the two segments is given below, with the banking segment discussion first followed by a discussion of the equity market segment.

In the banking segment, immediately after the independence of the country in 1971, the then government nationalized the commercial banks (except a few foreign banks) and organized them into six distinct banks by the Bangladesh Bank (the central Bank of the country) nationalization order 1972. As saving and investment in the country is very low, in order to channel saving and investment through the formal sector and to expand banking services in the remote areas of the country, the nationalization of the banking sector was considered as one of the major objectives at that time. The central bank, known as the Bangladesh Bank (BB) is the central body to oversee the banking sector of the country and at that time, the BB directly controlled the interest rates (both lending and deposit rates) by fiat.

During this time, bank branches have expanded rapidly, particularly in the rural areas. On the positive side, the expansion of bank branches reduces transaction costs associated with the mobilization and transfer of funds and to thereby to increase savings and investments, and deposit creation. But due to corruption, mismanagement, and government interference, many branches of the commercial banks cannot work properly and some branches incurred heavy losses, and some of these branches were subsequently closed down. To overcome these problems, financial sector reform program has started in earnest since 1990. These reforms include flexible interest rate, convertibility of 'taka', introduction of 91 days bill, recapitalization of banks, and new procedures for loan classification system, introduction of REPO in the money market,

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and strengthening of money and capital markets. Although before 1990, open market operations and bank rate policies were hardly used, currently they are getting emphasis due to change in the post-reform policy environment.

In the initial years after independence, six nationalized commercial banks (NCB's) dominated the banking segment. In the post reform period, the structure of the banking system has changed significantly. As part of the reform program, some NCB's were privatized, foreign ownership of banks has been opened up, and additional new commercial banks were allowed to start and operate. Consequently, the banking system in the country consists of forty-seven banks including several NCB's along with a number of home based privately owned commercial banks (PCB's), some foreign owned commercial banks (FCB's), some privately owned Sharia compliant Islamic banks (IB's) and some state owned specialized financial institutions (SFI's) such as the Krishi (agricultural) Bank and Bangladesh Development Bank Ltd. (industrial), all under the supervision of the Bangladesh bank (Central Bank of Bangladesh).

In spite of many different kinds of banks operating side by side, and even though the central bank no longer directly control the lending or deposit rates in the post-1990's reform period; however, a strong competitive and efficient banking system has not yet developed. The banking system is mired in corruption, mismanagement, and direct interference from government in power. Further, the commercial banks still do not determine interest rate under competitive environment. Rather they are determining interest rates (both lending and deposit rates) within an oligopolistic framework, possibly following some collusive or cartel type arrangements. This is perhaps true for all types of banks, nationalized banks, domestic private banks and foreign owned banks.

As to the capital market segment, Bangladesh is still at a nascent stage of capital market development. It is well documented in the literature that a well-functioning capital market is of great significance for a developing country like Bangladesh which is expected to help the country's development by channeling domestic saving to productive investments, attracting foreign investors to the market, and allocating the national savings most efficiently, among others. However, as in many other developing country equity markets, the Bangladesh equity market is relatively underdeveloped, it is small, the market is thin and non-transparent, and it is quite inefficient (Bashar, Hassan and Islam (2007).

Bangladesh has two major exchanges, the Dhaka Stock Exchange (DSE) and the Chittagong Stock Exchange (CSE). The DSE is the larger of the two stock exchanges in the country. Formal trading on the DSE began in 1956 two years after the establishment of the East Pakistan Stock Exchange Ltd. on April 28, 1954. It was renamed as the East Pakistan Stock Exchange Limited on June 23, 1962, and finally came to be known by its present name of the Dhaka Stock Exchange (DSE) Limited on May 14, 1964.

Prior to the independence of Bangladesh in 1971, there were 196 securities listed on the DSE with a total paid-up capital of about Taka 4 billion and the daily average transaction of shares during that period was about 20,000 (Basher, Hassan and Islam 2007). Trading activity of the Exchange remained suspended since the start of the war

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of liberation in 1971 until it restarted in 1976. When the DSE restarted in 1976, the DSE had only 9 listed companies with a paid-up capital of approximately Taka 137.52 million and at the end of that year total market capitalization of listed securities was about Taka 146.73 million. By 2002-03, the number of listed companies has grown to 251 companies listed with the DSE having total issued capital of Taka 35,537 million (US\$ 612 million) and total market capitalization of Taka 72,167 million (US\$ 1,244 million). In 2008, the number of listed companies is about 295 with a market capitalization of about US\$ 7,067 million (Basher, Hassan and Islam 2007).

The second stock exchange, the Chittagong Stock Exchange (CSE) was established in 1995 and started its operation in that year with 30 listed securities. Like the DSE, the CSE has been registered as a public limited company and is a self-regulated non-profit organization. It has currently 129 members even though there is a provision for up to 500 memberships. The foreigners can also become member of the CSE. But unlike the DSE, every member of the CSE has to be a corporate body. On September 30, 2003 there were 187 listed securities with the CSE. On the same day, the total issued capital and market capitalization of all listed securities with the CSE stood at Taka 33,085 million (US\$ 570 million) and Taka 59,855 million (US\$ 1,032 million), respectively (Basher, Hassan and Islam (2007).

In terms of regulatory structure, the capital markets of Bangladesh received its first legal backing with the passage of Securities and Exchange Ordinance in 1969. More than two decades later, in 1993, the Securities and Exchange Commission (SEC) was established under the Securities and Exchange Act, 1993. The functions of the SEC include regulation of equity trading, protection of investors, ensure legislative and regulatory compliances, and promote a fair, transparent and efficient security markets. To supervise and regulate the activities of the capital markets in Bangladesh, the SEC does it by performing constant real time monitoring and post-trading analysis of transactions in the DSE and the CSE.

The underdeveloped and non-transparent nature of the capital market in Bangladesh provides ample opportunities for unethical and even illegal manipulations resulting in market crashes as happened in 1996 (as reflected by a steep decline of the market capitalization value in US\$ shown in Figure 1 below). Such unwarranted crashes usually cause severe financial damages to investors, particularly many small investors and erode confidence in the markets. This painful episode occurred at both stock exchanges in summer and fall of 1996. During this episode, DSE index increased from 832 in January 1996 to its peak at 3,567 on November 14, 1996 and back down to 507.33 in November 1999. To control the damages caused by the 1996 crash and with the support from Asia Development Bank (ADB), Bangladesh government introduced the Capital Market Development Program in November 20, 1997 with several objectives such as to (i) strengthen market regulation and supervision, (ii) develop the stock market infrastructure, (iii) modernize stock market support facilities, (iv) increase the limited supply of securities in the market, (v) develop institutional sources of demand for securities in the market, and (vi) improve policy coordination.

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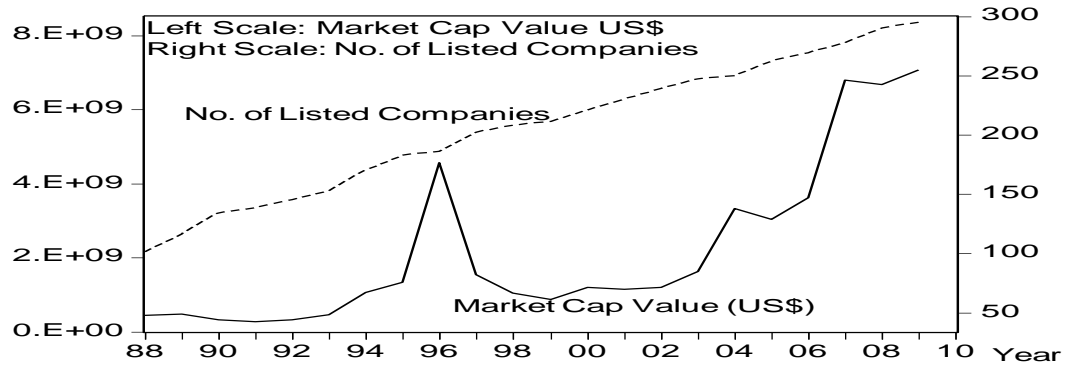
Ali and Wise (2007) argued that growth of Bangladesh's capital markets in recent years has not been strong but there are indications emerging that this is changing. To encourage the development of a healthy and prosperous capital market the country needs to encourage a good number of well reputed and financially viable industries and business enterprises to procure capital from the primary market by engaging in initial public offerings. Given that a corporate financing gap needs to be filled in Bangladesh, local policies, regulations, and business practices become increasingly important in attracting investment. Success is reliant on the key players, which include government, making innovative adjustments that reflect the realities surrounding investment in initial public offerings.

As recently as of November 2007, Bepari and Mollik (2008) argue that the DSE is still in the primitive stage of development. They reported a total of 273 listed companies. Out of these listed companies and as measured by the percentage of the total market capitalization, market share of the banking sector, share of the largest five sectors in the economy, and share of the five largest corporations are reported to be about 58.8 percent, 87.41 percent, and 22.37 percent respectively. These statistics clearly suggest market concentration and the dominance of the equity market by the banking industry shares. Further, the banking sector has only a few foreign banks in operation and the magnitude of foreign portfolio investment in the equity markets remains low at around only 2.83% of total market capitalization (ADB 2009; Ali, Islam and Wise 2011). This relatively low foreign exposure in fact acted as a blessing in disguise in that these sectors were relatively less exposed to the toxic asset values arising from the GFC. However, this also reflects severe weakness of the financial sector of the country in terms of its inability to attract much needed foreign private investments in the country. Moreover, Bangladesh Bank has continuously failed to achieve target of monetary policy declared by itself which creates distortions in the economy.

4. The Data and Some Preliminary Descriptive Analysis

As mentioned earlier, Bangladesh capital market is not yet well-developed. Figure 1 shows the time trend of the number of listed companies along with the market capitalization in US\$ from 1988 to 2008. This graph suggests that the stock market has grown rapidly from 101 companies with a market capitalization of US\$ 430 million in 1988 to 295 companies with market capitalization of US\$ 7,067 million in 2009, an

Figure 1: Listed companies and Market Capitalization in Bangladesh: 1988-2009

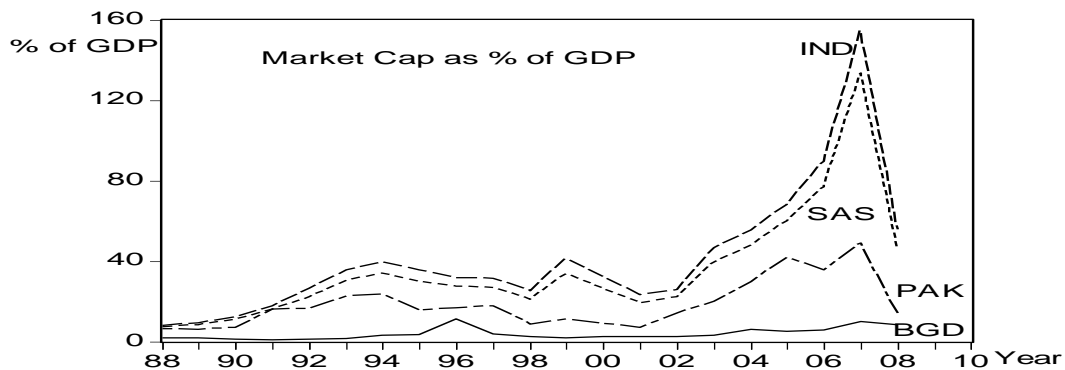


Source: World Bank: World Development Indicators CD Rom database

impressive growth rate of 1,543% in market capitalization value over about 20 year time period. But the even with this growth rate, the market capitalization as the percentage of GDP is still quite low compared to international standard.

The market capitalization as the percentage of GDP increased from 1.68% in 1988 to about 8.39% in 2008, also an impressive growth. But this rate for Bangladesh (BGD) compares quite poorly compared to India (IND), Pakistan (PAK), and South Asia (SAS) as shown in Figure 2, which shows BGD line is at the bottom of Figure 2 below the other reference countries. In fact, the ratio for India and South Asia reached around 150% and 125% of GDP respectively in 2007, just before the crash of the markets due to the 2007-09 global financial crisis. It is worth noting that the Bangladesh capital market showed resilience in the face of this massive crisis. However, given the relatively low market capitalization-GDP ratio of 8.39% in 2008, it appears that Bangladesh capital market needs much more development in order to catch up even with its comparable neighboring countries.

Figure 2: Market Capitalization as % of GDP: 1988-2009



Source: World Bank: World Development Indicators CD Rom Database

As aforementioned, this study examines the relationship between Bangladesh money supply and the share price index. To carry out this task, this paper utilizes monthly data on Bangladesh narrow money supply (M1 money) and the country's share price index,

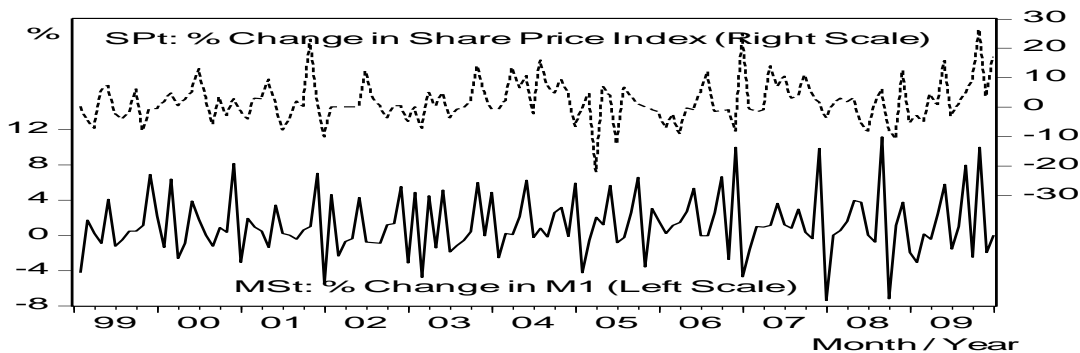
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as a proxy for the market stock prices. The data were collected from the International Financial Statistics published by the IMF. The data covers the period from 1999:1 to 2010:1 for which monthly data were available. The monthly share price index and the money supply are expressed in annualized percentage monthly changes. The annualized percentage monthly changes of the stock price index and the monthly money supply are denoted by SP_t and MS_t , respectively. Throughout this study, SP_t and MS_t are referred to as the stock price changes and the money supply changes using the M1 definition of money. The difference between SP_t and MS_t is the concept of “basis” used in this study which is defined as the difference between changes in the stock price index and changes in money supply.

Moreover, for a given level of the stock price index, a decrease in the monthly money supply M1 would widen the “basis”, i.e. the difference between annualized percentage changes of the share price index and the changes in monthly money supply. The opposite is true if the money supply changes in the other direction. The descriptive statistics reveals that the mean annualized percentage monthly changes of the share price index during the sample period is 2.425, ranging from -23.846 to 36.264 with the standard deviation being 8.935, while the mean annualized percentage monthly changes of the money supply M1 is 1.423, ranging from -8.623 to 14.129, with the standard deviation being 4.140.

Figure 3 shows the two monthly percentage change series MS_t and SP_t and the vertical distance between the two series representing the “basis” as defined in the preceding paragraph from 1999.01 to 2010.01. This Figure shows that both series has displayed significant month to month fluctuations. Further, the apparent synchronized co-movement of the two series gives preliminary indications that the two series would likely be co-integrated. The difference between the two series is the “basis” and that the “basis” seems to be stationary, a further indication that the SP_t and MS_t series could be co-integrated. More elaborate tests of co-integration will be provided below after the Methodology section.

Figure 3: Relations Between MS_t and SP_t : 1999.01-2010.01



Source: Graph compiled using data obtained from IMF: International Financial Statistics database

5. Methodology

An important implicit assumption of the Dickey-Fuller standard unit root tests and its extension is that the adjustment process is symmetric. However, if the adjustment process is asymmetric, then the implicitly assumed restrictive symmetric adjustment is indicative of model misspecification. Enders and Granger (1998) and Enders and Siklos (2001) developed the threshold autoregressive (TAR) model that tests for cointegration with asymmetric adjustments and unit roots. More importantly, the TAR VEC model specified below differs from the conventional error-correction models by allowing asymmetric adjustments toward the long-run equilibrium; thus, it is most appropriate for the empirical investigation of this study. The threshold autoregressive model allows the degree of autoregressive decay to depend on the state of the difference between share price changes and the money supply changes, defined as the basis or the spread, (i.e. “deepness” of cycles). For instance, if the autoregressive decay is fast when the basis is above the long-run threshold and slow when the basis is below the long-run threshold, troughs will be more persistent than peaks. Likewise, if the autoregressive decay is slow when the basis is above the threshold and fast when the basis is below the threshold, peaks will be more persistent than troughs. In this specification, the null hypothesis that the share price index and the monthly money supply basis contains a unit root can be expressed as $\rho_1 = \rho_2 = 0$ (This is an alternate Dickey-Fuller standard unit root tests for the basis), while the hypothesis that the basis is stationary with symmetric adjustments can be stated as $\rho_1 = \rho_2$, i.e., failure to reject the hypothesis that $\rho_1 = \rho_2$ indicates that the adjustment is symmetric.

The first step in the Enders-Siklos (2001) procedure is to estimate the following long-run relationship between the stock price and the money supply using ordinary least squares:

$$SP_t = \beta_0 + \beta_1 MS_t + \varepsilon_t \quad (1)$$

where SP_t and MS_t are the percentage changes in the Bangladeshi share price index and monthly money supply M1, respectively. The saved residuals, ε_t from the estimation of equation (1), denoted by $\hat{\varepsilon}_t$, is then used to estimate the following TAR model:

$$\Delta \hat{\varepsilon}_t = I_t \rho_1 \hat{\varepsilon}_{t-1} + (1 - I_t) \rho_2 \hat{\varepsilon}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \hat{\varepsilon}_{t-i} + \hat{u}_t \quad (2)$$

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:

$$I_t = \begin{cases} 1 & \text{if } \hat{\varepsilon}_{t-1} \geq \tau \\ 0 & \text{if } \hat{\varepsilon}_{t-1} < \tau \end{cases} \quad (3)$$

The threshold value, τ , is endogenously determined using the Chan's (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 these 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.

6. Results of Cointegration Tests with Asymmetric Adjustment

This section empirically examines whether or not the percentage changes in the Bangladeshi share price index and the money supply are co-integrated when allowing for asymmetric adjustments. Specifically, equation (1) is estimated using the SP_t and the MS_t series. The residuals from these estimations are used to estimate the TAR model specified by equations (2) and (3). The estimation results for the TAR model are reported in Exhibit 1.

Exhibit 1: Unit Root and Tests of Asymmetry, 1999:01 to 2010:01

ρ_1	ρ_2	τ	$H_0 : \rho_1 = \rho_2 = 0$	$H_0 : \rho_1 = \rho_2$	aic
-0.8930*	-1.8980*	-4.5564	$\Phi_\mu = 28.9082^*$	$F = 8.1253^*$	1,448.1873
Q(10)=9.094 [0.5232]		ln L = -462.1659		$F_{(4,125)}=32.9350^*$	

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 $n = 100$). * indicates 1 percent level of significance. 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. $Q_{(10)}$ denotes the Ljung-Box Q-statistic with 10 lags.

Over all, The calculated statistic $\Phi_\mu = 28.9082$ indicates that the null hypothesis of no co-integration, $\rho_1 = \rho_2 = 0$, should 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, p. 14) pointed out that this simple finding of stationarity is consistent with the two underlying series comprising the basis (the percentage changes in the Bangladeshi share price and monthly money supply) being co-integrated in the conventional, linear combination sense.

Additionally, the empirical results reveal that the null hypothesis of symmetry, $\rho_1 = \rho_2$, rejected at the 1 percent significant level, based on the partial $F = 8.1253$, indicating statistically that adjustments around the threshold value of the basis -- the difference between the annualized percentage monthly changes of the stock price index and the monthly money supply M1 -- are asymmetric.

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These test results support the long-held theoretically articulated co-integrating relationship between the stock price and money supply. The estimation results further reveal that both ρ_1 and ρ_2 are statistically significant at 1 percent level. In fact, the point estimates suggest that the spread tends to decay at the rate $|\rho_1|=0.8930$ for $\hat{\varepsilon}_{t-1}$ above the threshold, $\tau = -4.5564$, and at the rate of $|\rho_2|=1.8980$ for $\hat{\varepsilon}_{t-1}$ below the threshold.

Finally as mentioned above, the finding of $|\rho_1| < |\rho_2|$ indicates a *slower* convergence for positive disequilibrium than for negative disequilibrium. Furthermore, $\hat{\varepsilon}_{t-1} > -4.5564$ is indicative that the decline in the money supply, signaling the tight monetary policy, has widened the difference between the annualized percentage monthly changes of the stock price index and the monthly supply M1. This widening of the basis, initiating a downward adjustment in the stock price, implies that the stock price adjusts slower to the threshold value when the Bangladeshi monetary authority tightens the monthly money supply, compared to when the authorities ease the monetary policy, narrowing the basis. These findings suggest that the stock price movements are less responsive to signals of possible contractionary monetary policy as reflected in the decline of money supply.

7. Results of the Asymmetric Error-Correction Models

The positive results of the above asymmetric co-integration tests allow the use of the TAR VEC (Threshold Autoregressive Vector Error Correction) model to further investigate the asymmetric dynamic behavior between the share price and money supply. The estimation results of this model can be used to study the nature of the Granger causality between the share prices and the money supply. This estimated direction of Granger causality will help to evaluate empirically the contradicting neoclassical and post-Keynesian hypotheses regarding the relationship between money supply and stock prices in the context of the Bangladeshi financial market. Additionally, the TAR VEC model given below differs from the conventional error-correction models by allowing asymmetric adjustments toward the long-run equilibrium.

$$\Delta SP_t = \alpha_0 + \rho_1 I_t \hat{\varepsilon}_{t-1} + \rho_2 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{11}(L) \Delta SP_{t-i} + A_{12}(L) \Delta MR_{t-i} + u_{1t} \quad (4)$$

$$\Delta MR_t = \tilde{\alpha}_0 + \tilde{\rho}_1 I_t \hat{\varepsilon}_{t-1} + \tilde{\rho}_2 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{21}(L) \Delta SP_{t-i} + A_{22}(L) \Delta MR_{t-i} + u_{2t} \quad (5)$$

where $u_{1,2t} \sim i.i.d.(0, \sigma^2)$ and the Heaviside indicator function is set in accord with (3).

This model specification recognizes the fact that the stock prices (reflecting the behavior of the investors, because the investors collectively determine the stock prices) respond differently depending on whether the basis is widening or narrowing (i.e. contractionary or expansionary monetary policy.)

Following are the estimation results for the TAR VEC model specified by equations (3), (4) and (5) using the annualized percentage monthly changes in the Bangladeshi share price index and the monthly money supply. In the reported estimation results, the

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coefficients $A_{ij}(L)$ represent the first-order polynomials in the lag operator L . The F_{ij} represents the calculated F -statistics with the p-value in squared brackets testing the null hypothesis that all coefficients of A_{ij} are equal to zero. The t -statistics are reported in parentheses with “*” indicating the 1 percent significant level. $Q(12)$ is the Ljung-Box statistics and its significance is in squared bracket, testing for the first twelve of the residual autocorrelations to be jointly equal to zero. Further, $\ln L$ is the log likelihood. The overall F -statistic with “*” indicate the significance level of 1 percent.

EXHIBIT 2: Bangladeshi Share Prices and Money Supply M1, 1999:01 to 2010:01

$$\Delta SP_t = -0.1163 - 0.5517I_t \hat{\varepsilon}_{t-1} - 0.7463(1 - I_t) \hat{\varepsilon}_{t-1} + A_{11}(L)\Delta SP_{t-i} + A_{12}(L)\Delta MS_{t-i} + u_{1t}$$

(-0.1152) (-2.0992*) (2.45649*) $F_{11}=1.3847[0.2547]$ $F_{21}=1.3207[0.2539]$
 $Q(10) = 3.614[0.9631]$ $\ln L = -446.0363$ $F_{(14,110)\text{-statistic}} = 8.5843^*$

$$\Delta MS_t = 0.3500 - 0.0544I_t \hat{\varepsilon}_{t-1} + 0.0757(1 - I_t) \hat{\varepsilon}_{t-1} + A_{21}(L)\Delta SP_{t-i} + A_{22}(L)\Delta MS_{t-i} + u_{2t}$$

(1.1321) (-0.9355) (1.0460) $F_{21}=0.8776[0.4189]$ $F_{22}=60.6768[0.000]$
 $Q(10) = 16.357[0.0898]$ $\ln L = -283.5624$ $F_{(15,104)\text{-statistic}} = 47.1013^*$

An analysis of the overall empirical results indicates that the estimated equations (4) and (5) are absent of serial correlation and have good predicting power as evidenced by the Ljung-Box statistics and the overall F -statistics, respectively.

As to the long-run adjustment, consistent with the TAR model results, the estimation results of the TAR VEC model reveal that both ρ_1 and ρ_2 are statistically significant at 1 percent level. Further, consistent with the estimation results of the TAR model, the finding that $|\rho_1| < |\rho_2|$ in equation (4) indicates that the stock price asymmetrically responds faster to negative than positive spreads, i.e., the share price reverses to the long-run equilibrium path slower when the authority tightens the money supply, widening the basis compared to easing monetary policy actions. With regard to the long term adjustment of the money supply, the estimation results of equation (5) also show $|\tilde{\rho}_1| < |\tilde{\rho}_2|$. 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 difference between share price and the money supply.

With regard to the Granger causality between stock price and the money supply, the partial F -statistics in equation (4) reveals that Bangladeshi share price does not respond to either its own lagged changes or lagged changes of money supply. Moreover, the partial F -statistics in equation (5) indicates that money supply M1 responds to only its own lagged changes but not lagged changes of share price. These empirical results reveal the weak exogeneity is from money supply to share price and are consistent with results articulated by Mohiuddin et al. (2008), Ahmed et al. (2007, and Berua et al. (2007). Economically, this finding of weak exogeneity is very important because this exogeneity indicates that the Bangladeshi counter-cyclical monetary policy is not effective in influencing the market equity index in the short run.

8. Discussions, Policy Implications and Limitations

As to the long run co-integrating relationship, the results of this study empirically confirm the co-integration relationship between the stock price index and the narrowly defined money supply. In fact their co-integrating relationships are asymmetric. This asymmetric relationship indicates that the counter cyclical monetary policies affect the cost to raise new financial resources of corporations differently in different phases of business cycles in the long-run. More specifically, the results reveal that the stock price adjusts more slowly to the threshold value when the Bangladeshi monetary authority eases the money supply widening the basis than when the Bangladeshi monetary authority tightens the monetary policy, narrowing the basis. These findings suggest that the stock price is more responsive to signals of possible contractionary monetary policy as reflected in the decline money supply M1.

The empirical results in turn 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 counter-cyclical 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.

With regard to the short-run dynamic co-integration as measured by the Granger causality between stock price and the money supply, the partial *F-statistics* in equations (4) and (5) reveal the weak exogeneity from Bangladeshi money supply M1 to market portfolio index. This finding indicates that the short-run counter-cyclical monetary policy is ineffective in stimulating or cooling down the equity market i.e., the stock price responds to monetary policy action in the long-run but not in the short run. These empirical result suggest the lack of central bank creditability, i.e., investors do not believe that central bank can carry out its policy objectives; thus, they wait and see.

The Bangladesh Bank may personally persuade the commercial bankers to change their rate setting behavior because there are few of them, and there may be some incentives for banks to listen. The Bangladesh Bank authority cannot utilize the same tactic to deal with investors because there are more of them and they may not have any incentive to listen. Clearly, the root causes of the Bangladeshi financial sector are the lack of market economy disciplines. Excessive government intervention and political connections, insider trading, market manipulation, management corruptions, inefficiency and ineffectiveness are part of a vicious circle that inhibits economic development, industrialization, and social progresses in poor and developing countries in general and in Bangladesh in particular.

Additionally, Bangladesh Bank seems to be unable to guide commercial banks properly in recent times particularly since 2009 for which commercial banks are charging higher interest rates, even cross the limit of margin requirements, maintaining high spread between buying and selling rates of foreign exchange as well as recent devaluation of

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Bangladesh Taka against US Dollar. As such, inflation rate is rising and purchasing power of the people has been declining. Moreover, commercial banks are investing in the equity market to gain short term profit since 2005, making depositors' deposits riskier. Also, in Bangladesh, if any bank fails, there is no insurance system in place from which depositors can get their deposits back. These embedded problems cannot be corrected without the infrastructure of a more modernized banking sector and a reasonably independent central bank with more appropriate and specialized staffing in the top management level, i.e. among the Deputy Governor posts, one having sound macroeconomic specialization and the other with an in-depth knowledge in practical commercial banking and in developing an effective and efficient banking sector. Moreover, government should take appropriate steps to develop a well-functioning bond market so that it can contribute to the overall growth of the domestic economy.

Finally, capital market should facilitate long-term financial investment. In the current environment, well-built political determination, obligation, free from nepotism and appointment of relatives in higher positions of the ruling party who may be in power and effective implementation of reforms and strategies would be needed to establish a more competitive and efficient economy, whereby among other things the Bangladesh Bank's credibility. The credibility of the central bank makes the monetary policy credible which would be conducive for effective monetary management and economic progress.

Usually, the limitations of single equation models are that these models deal with partial equilibrium; therefore, their results only allow for some limited policy recommendations. This empirical investigation is no exception.

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