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LONG RUN EQUILIBRIUM RELATIONSHIP BETWEEN MONEY AND PRICES IN SELECTED ASIAN COUNTRIES

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ABSTRACT

The Monetarists proposition of the relationship between the growth of money and changes in prices is investigated for eight selected Asian countries (Bangladesh, India, Indonesia, Malaysia, Pakistan, Singapore and Thailand). Specifically, the long run equilibrium relationship between growth of money stock and changes in prices is examined based on three framework of analysis; cointegration analysis, error correction model and impulse response functions of a vector autoregression analysis (VAR). The results are in favour of the Monetarists proposition. Money growth and changes in prices are shown to be cointegrated in all countries. Movement in changes in prices is subject to its deviation from long run equilibrium path determined by growth in monetary aggregate. The speed of adjustment of prices toward its long run equilibrium path and the explanatory power of growth of monetary aggregate in explaining inflation remain regardless of the measures of money employed. The impact of changes in money on prices is permanent and significant. Reactions of prices are immediate in India, Indonesia, Malaysia and Thailand but delayed in other countries. It begins to occur after some lag following monetary injection. The speed of adjustment of changes in prices toward its long run equilibrium is significant in all countries with Bangladesh recording the highest speed of adjustment of a near to complete correction. The evidence presented highlights the importance of domestic monetary controls in managing inflation in each of these countries. Monetarism is alive and valid in these developing nations of Asia.

INTRODUCTION

The positive relationship between growth of money supply and changes in price level is one of the main tenets of Monetarism. The belief that money causes inflation is summarized by the Classical quantity theory of money (QTM), that equates the product of money (M) and its velocity (V) to the nominal income (PY), i.e., MV = PY. In the classical interpretation, velocity of money is characterised to be stable in the long run largely influenced by the less frequently changed behavioural and institutional factors. Thus, an injection of money results in a proportionate change in nominal income. In the short run, increase in money growth generally affects real output (Y). However, the ability of money to affect real output is only limited for the short run. In the long run, money is neutral affecting only nominal variable. Friedman (1970) asserts, "*In the short run, monetary changes affects primarily output, but over the long run, the rate of monetary growth affects primarily prices.*" This proposition implies that over the long run changes in price level is mainly determined by the growth rate of money stock. Early evidence of the issue is reported by various researchers (Cagan (1956), Friedman (1956, 1970), Friedman and Schwartz (1963), Barro (1978), Lucas (1980), Hallman, Porter and Small (1991), Friedman and Kuttner (1992)).

This paper investigates the money-price hypothesis postulated by Monetarism within the Asian developing economies. In addition to shedding some light on the experience of these developing countries, the evidence provided also strengthen the views of Monetarism. We investigated the relevance of this proposition of Monetarism in eight selected Asian countries. The results of our analysis are in favour of the Monetarist proposition. We show that money growth and changes in price level in these countries are cointegrated and over the long run movement in prices are subject to its deviation from the long run equilibrium path dictated by money growth. With this evidence, efforts to control inflation in these countries should give greater emphasis on domestic monetary development. Monetarism is found to be valid in these Asian nations. The paper is organized as follows. Section 2 provides some related evidence on this issue. Section 3 follows with the description of data and methodology applied in the empirical analysis. The results and discussions are presented in Section 4. The paper concludes with a brief summary in Section 5.

SOME RELATED FINDINGS

Fry (1981) notes that inflation in Pacific Basin developing countries can be explained by analysing the monetary sectors of the economy. The pooled time series analysis indicates that inflationary process in this region can be explained by the difference between rates of growth of per capita nominal money supply and per capita real money demand. About 92 percent of changes in GNP deflator from 1961 to 1977 can be explained by the difference between these two rates of growth. Chow (1987) examines the effect of money supply on the price level in China based on the quantity theory of money. Using annual data from 1952 to 1983, the study concludes that changes in the ratio of money supply to real income provide high explanatory power of the variability of price level that is consistent with the quantity theory. However, the coefficient of response is less than unity. Chow explains this low response by arguing that velocity of money is negatively related to this ratio and the effect of increase in money supply is partly offsetted by reduction in velocity. A further study on China's economy by Chen (1989) supports evidence produced by Chow (1987). Causation between three monetary aggregates and macro economic variables are investigated by employing the Bayesian vector autoregression model (BVAR). A one-way causality pattern running from money growth (narrowest definition) to inflation rate was identified. Hafer and Kutan (1993) investigated the relationship between monetary growth, output and price level in China using annual observations between 1952 through 1987. Evidence of causality between money and price level is mixed and sensitive to the price measure used. Bi-directional causality is found when retail price index is used while uni-directional causation from money to price is found when national income deflator is used. The cointegration analysis indicates that over long run prices is directly related to movement in the stock of money.

Bairam (1990) rejects the Monetarist hypothesis that inflation is linked to monetary growth. Domestic money growth is not a significant factor that contributes to the increase in domestic price level. Out of 10 developed OECD countries only US, UK, and Canada show coefficients that are significantly different from zero. The world inflation rate reflecting the weighted average of domestic inflation rate of the 10 countries under study was found to be a significant factor that explains changes in domestic price level. He claims that the world price level is inversely related to the world money supply. Bairam's evidence rejects the Monetarists explanation of inflationary process. A reexamination by Gibson (1992) later shows that the model used by Bairam (1990) is mis-specified. Using a statistically specified model he shows that the Monetarists proposition is valid, i.e., increase in the world money supply causes world inflation rate to be higher.

Dhakal and Kandil (1993) examined the determinants of inflationary process in six developing Asian countries (Bangladesh, India, Malaysia, Pakistan, Singapore and Korea). The monetarist model adjusted for other external factors (domestic and foreign interest rates and import prices) is used in determining the sources of inflation. They concluded that growth of money stock is an important determinant of inflation in Bangladesh, Malaysia and Singapore. The uni-directional causation from money to prices is identified in the analysis. However, growth in money supply is not a major source of inflation in these countries. Other external factors play more important roles in determining inflationary process in these economies. Beltas and Jones (1993) study the causality between money and inflation in Algeria from 1970 to 1988. The Granger test indicates that there is a one-way causation running from money to inflation but no feedback causation from inflation to money exists.

Aghevli and Khan (1977) tested the feedback model, which suggested a bi-directional causation between money and price in the Indonesian economy. A higher money supply causes a higher price level and the higher price level causes a further increase in the money supply through their impact on the government budget. Parikh (1990) investigated the endogeneity of money supply in Indonesia. In constructing an econometric model for the Indonesian economy, the level of money supply is specified as a function of forces that are not in the control of the monetary authorities. Changes in money supply are decomposed into three sources that are due to the level of foreign assets, the government sector and the private sector. Changes in price levels affect government expenditure and revenue and in turn affect money supply. In this regard there is a feedback mechanism between money supply and price level and therefore led money to be endogenously determined.

Rolnick and Webery (1996) examined the relationship between money and inflation and between money and output between economies operating under a commodity and fiat standards in over 15 countries. It was shown that the growth of various monetary aggregates (M1 and M2) is highly correlated with inflation and is higher in countries under the fiat standard economies. The study suggests a linear relationship between money growth and inflation. In contrast they found no evidence of a relationship between the growth rates of M1 and M2 under a commodity standard episode. Masih and Masih (1998) studied the money-price causality direction based on a bi-variate analysis and found a strong causation between money supply to price in Thailand, Malaysia, Singapore and the Philippines. In a tri-variate context, where the external sectors appears to have played the leading role in most cases, their substantive conclusions on the money-price causality direction based on bi-variate tests hold in a tri-variate model as well. Several other studies that employ data of developing nations

(see Darrat (1998) on three African countries, Ramachandra & Sharma (1984) on India and Yusoff (1988) on Malaysia) investigating this proposition concluded with mixed results. The issue with respect to this Monetarist proposition is still unresolved. In this paper we provide new evidence supporting the proposition for the Asian developing nations.

DATA AND METHODOLOGY

We conducted the analysis for eight selected developing countries in Asia: Bangladesh, India, Indonesia, Malaysia, Pakistan, Singapore, Sri Lanka and Thailand. Data used in this study is downloaded from the International Financial Statistics (IFS) CD-ROM compiled by International Monetary Fund (IMF). It involves monthly observations for a period of twenty-six years beginning from 1970 to 1995, except for Indonesia (1970 to 1993) and Sri Lanka (1975 to 1995). We employed the narrow definition of money (M1 money-denote as M) and also the broader definition of money (quasi money-denote a QM) as measures of monetary aggregate. Testing the hypothesis on the narrow and broader money definitions enlightens the issue with respect to the choice of monetary aggregates in the conduct of monetary policies. The evidence based on the experience of developed nations, argue, that a narrow money definition no longer depicts the relationship portrayed by the Monetarists and therefore recommend a broader monetary aggregate for the implementation of monetary policies and our analysis broaden this issue on a developing economy. The consumer price index (CPI) proxies the price level. Our analysis centres on the relationship between the growth of monetary aggregates and changes in prices (in other words inflation). These growth series are represented by the first difference of the log of the actual data set.

The Dickey-Fuller Unit Root Test and Engle-Granger Cointegration Test

The stochastic process of time series used in the analysis affects the validity of regression of money growth on changes in prices. Asymptotic results cannot be applied if any of the variables in a regression model is generated by a non-stationary process. In such a case the matrix n^{-1} (X'X) does not tend to a finite, positive definite matrix as sample size tends to infinity. It is therefore crucial to determine the stationarity of these series prior to further investigation. The Dickey-Fuller unit root test as suggested by Dickey and Fuller (1979) is used in examining the stationarity of these series. The test is based on the following ordinary least squares (OLS) estimation:

$$\Delta X_t = \alpha X_{t-1} + \sum_{I=1}^{K} \varphi_i \Delta X_{t-i} + \mu_t \quad (1)$$

where, Δis the first-difference operator; X_t is the series tested; and μ_t is a covariance stationary random error. Inclusion of lagged first difference of the tested series as independent variables removes autocorrelations in error term. The optimal number of lagged first difference (*k*) to be included in Equation 1 is determined by Akaike Information Criteria (AIC) due to Akaike (1970). We run this test on the money and price growth series in line with the view that the growth of money is a critical factor that affect movement in prices. The null hypothesis of unit root, $|\alpha| = 0$, is tested against the alternative of stationarity, $|\alpha| < 0$. The critical values for the test are developed by MacKinnon (1991). The 95 percent significance level is used throughout the analysis.

The long run relationship between growth of money and changes in prices is examined based on the two-step cointegration test described by Engle and Granger (1987) (denotes as EG). Cointegration analysis proposed by EG is compelling in analysing the long run relationship between growth of monetary aggregates and changes in prices for two reasons. First, many economic time series are non-stationary, i.e. *I* (1) (termed as difference stationary series). Granger and Newbold (1974) and Phillips (1986) showed that the presence of unit root in time series led to the possibility of spurious regression, invalidating results of ordinary regression analysis usually employed in examining the relationship among economic variables. However, as shown by EG, it is possible for two variables to be nonstationary yet a linear combination of these variables to be stationary (*I* (0)). If that is the case the two variables are said to be cointegrated. If two variables are cointegrated, they must obey an equilibrium relationship in the long run, although they might diverge from the equilibrium path momentarily. Secondly, the hypothesized relationship might not be observed in the short run. Price stickiness in the short run and lags in monetary transmission mechanisms tend to obscure the long run relationship between growth in money and changes in prices. The cointegration method allows variables to drift away from long run equilibrium temporarily and still identifies the long run relationship if one exists. Cointegrated series adjust based on its deviation from the long run equilibrium path. Thus, modelling based on the cointegration method led us to correctly identify the relationship between the growth of money and changes in prices in the long run. Subject to the unit root test performed, findings that support non-stationarity in the money and price growth series (i.e. if both are *I (1) series)* allow us to perform the EG two step cointegration analyses. The EG cointegration test calls for testing the stationarity of the error term from a cointegration regression as follows:

$$\Delta P_t = \beta_0 + \beta_1 \Delta M_t + \upsilon_t \quad (2)$$

$$\Delta P_t = \beta_0 + \beta_1 \Delta QM_t + \varepsilon_t \quad (3)$$

Equations 2 and 3 are cointegration regressions of the growth of the two monetary aggregates, narrow and broader money, on changes in prices. Stationarity of the error terms υ_t and ε_t in equations 2 and 3 imply that the rate of growth of monetary aggregates and changes in prices are cointegrated. Tests for stationarity of the error term are based on the Dickey-Fuller test as described earlier (Equation 1). Rejection of the null hypothesis of unit roots in these error series supports the cointegration relationship between money growth and changes in prices. Evidence of cointegration between money growth and inflation indicates that the two vectors are linked by a long-run equilibrium relationship.

Error Correction Model

In addition to the cointegration test, we also performed two other analyses that trace the dynamics of the impact of changes in the growth of money on price change movements. As discussed earlier, it is possible for two cointegrated variables to diverge from their long run equilibrium path momentarily. Evidence of cointegration confirms that over the long run, movement in the changes in prices is subject to its deviation from the long run equilibrium path. We investigated the dynamic of inflation with respect to its deviation from the long run equilibrium path dictated by monetary growth. In a sense, this is an 'error correction' analysis that specifies the speed of adjustment as well as the pattern of causality between money growth and inflation. We estimate the two-error correction model (ECM) as follows:

$$\Delta P_t = \theta + \gamma \upsilon_{t-1} + \sum_{j=1}^{p} \varnothing_{P,j} \Delta P_{t-j} + \sum_{j=1}^{q} \delta_{M,j} \Delta M_{t-j} + \nu_t, \quad (4)$$

$$\Delta P_t = \chi + \tau \varepsilon_{t-1} + \sum_{j=1}^{p} \lambda_{P,j} \Delta P_{t-j} + \sum_{j=1}^{q} \delta_{M,j} \Delta QM_{t-j} + \zeta_t, \quad (5)$$

Equations 4 and 5 are ECMs that explain the dynamics of price changes with respect to changes in the narrow and broader monetary aggregates respectively. In each error correction equation we regress the one period lag of the error series derived from the cointegration regression (Equations 2 and 3) and lagged first difference of changes in prices and money growth on the first difference of changes in prices. The optimal lag

for the lagged terms, p and q, are determined based on a sequential process similar to Hsiao (1979a, 1979b). First we estimated an autoregressive process with only the lagged dependent variables entering the equation and choosing the optimal number of lags, p that minimizes AIC. With p chosen, the equation is expanded to include lagged values of money growth and lag length q is determined in the same manner as described. The sequential process minimizes the computational difficulties to search for optimal lag length.

Two forms of analysis are derived from the estimated error correction equations. The first two coefficients of interest are γ and τ, which reflect the proportion of previous error corrected by current movement in the changes in prices. These coefficients can also be interpreted as the speed of adjustment of changes in prices toward its long run equilibrium path dictated by money growth. Null hypothesis that these speed parameters are zero is tested. Rejection of the null hypothesis indicates that changes in inflation are significantly influenced by its previous deviation from the long run equilibrium path. In our analysis, support for the Monetarists proposition requires the adjustment parameter to be significantly different from zero and carries negative value consistent with the correction adjustment (i.e. positive deviation form long run equilibrium path in period *t-1* requires negative changes in the following period *t* and vice versa). Secondly, the estimated ECM can also be used to represent the short run causal impact between money growth and inflation as defined by Granger (1969). The significance of the coefficients for lagged differences of money growth $\delta_{M,j}$'s and $\delta_{QM,}$'s in Equations 4 and 5 respectively, provides evidence of short run causality from money growth to changes in prices. The F-statistics are provided to test the null hypotheses that these lagged coefficients are equal to zero, i.e. no short run causation running from money growth to changes in prices. Rejection of the null hypothesis favours the Monetarists proposition

The Impulse Response Functions

Our second dynamic analysis is based on the vector auto regression (VAR) model introduced by Sims (1980). A two-variable VAR system that includes growth of money and prices is used. Let $X_t = \{\Delta M_t, \Delta CPI_t\}$ be the 2 x 1 vector of variables. The VAR system is specified as follows:

$$AX_t = B(L)X_{t-} + \nu_t \quad (6)$$

where A is a 2 x 2 matrix of impact multipliers, B(L) is a k^{th}-order matrix of structural polynomials in the lag operator L, $B(L) = B_1L + B_2L^2 + \ldots\ldots + B_kL^k$, υ_t is a 2 x 1 vector of structural disturbances with zero mean, $E[\upsilon_t] = 0$, and covariance matrix $\sum_\upsilon = E[\upsilon_t \upsilon_t']$ for all t, and υ_t's are serially uncorrelated. The estimation of a VAR system is simplified by the autoregressive specification. Since all of the right-hand-side variables are predetermined and the same for each equation, ordinary least square (OLS) yields a consistent and asymptotically efficient estimator. The lag length to be used in the VAR is chosen by minimizing the Akaike's AIC following Lutkepohl (1982).

We derive the impulse response function (IRF) that depicts the reactions of changes in prices towards monetary injection. Conceptually, IRF traces the sign and magnitude of the system's response over time to the shocks of a variable in the system. It is derived by specifying the VAR system (6) in the vector moving average (VMA) representation as follows:

$$X_t = C(L)\nu_t = \sum_{s=0}^{\infty} C_s \nu_{t-s} \quad (7)$$

where $C(L) = A^{-1}[I - B(L)]^{-1}$ and I is the identity matrix. The elements of C_s provide a dynamic response among the variables in the system. Plotting the element of C_s against time yields the impulse response functions. The IRF will provide insights into the plausibility of responses of prices to money innovation.

RESULTS AND DISCUSSIONS

Results of Dickey-Fuller unit root test for money growth and changes in prices and their first differences are shown in the first six columns of Table 1.

Table 1: Dickey-Fuller Unit Root Test on Growth of Money, Growth of Prices and Residuals of Cointegration Regressions

Country	M1	ΔM1	QM	ΔQM	CPI	ΔCPI	Residuals (ν_t)	Residuals (ε_t)
Bangladesh	-1.375	-5.926**	-1.244	-18.787**	-1.226	-11.847 **	-7.224 **	-6.955 **
India	-1.057	-7.323**	-1.049	-7.249 **	-1.116	-6.370 **	-3.226 **	-3.541**
Indonesia	-1.072	-6.173**	-1.638	-6.490 **	-0 972	-4.182 **	-2.662 **	-2.673 **
Malaysia	-1.226	-6.787**	-0.817	-8.232 **	-1.208	-5.812 **	-4.105 **	-4.114 **
Pakistan	-0.936	-7.143**	-1.852	-5.957 **	-0.871	-5.578 **	-2.886 **	-2.687 **
Singapore	-1 789	-6.681**	-1.005	-5.899 **	-1.830	-7.113 **	-3.959 **	-3.946 **
Sri Lanka	-1.151	-6.049**	-0.751	-7.268 **	-0.672	-7.266 **	-5.134 **	-5.129 **
Thailand	-0.872	-7.662**	-0.661	-5.524 **	-1.089	-5.150 **	-2.846 **	-2.774 **

Notes:

1. M, QM and CPI are growth rate of M1 money, Quasi money and prices. Residuals (ν_t and ε) are derived from cointegration regressions (Equations 2 and 3).
2. Δ denotes first difference.
3. Double asterisks (**) denote significant at 95 percent level.

Overall, the results indicate that the null hypothesis of unit root cannot be rejected for the growth series in all eight countries. However, the first differences of the series are stationary. Money growth and changes in prices in these countries can therefore be classified as *I* (1) series. In line with EG, despite being *I* (1), there is a possibility that the linear combination of money growth and changes in prices to be *I* (0) thus fulfilling the condition for cointegration. Cointegration regressions (Equation 2 and 3) are performed using money growth series as independent variables and changes in prices as dependent variables. Results of the Dickey-Fuller unit root test on the error series from these cointegration regressions are shown in the last two columns of Table 1. The null hypothesis that the error series are non-stationary can be rejected at 95 percent level for all countries implying cointegration between money growth and inflation. The null hypothesis of no cointegration is rejected for both narrow and broad monetary aggregates. The findings of cointegration between money growth and changes in prices support the validity of the Monetarists proposition in these Asian countries. In the long run, money growth and changes in prices are tied to an equilibrium relationship. Domestic monetary development is therefore critical in managing domestic prices. In addition, our results show no weaknesses of the narrow monetary aggregate. Cointegration is supported regardless of the money measures employed.

Tables 2 and 3 report the error correction equations (Equations 4 and 5) for the narrow and broader monetary aggregates respectively. The dynamics of price changes are shown to be in line with the Monetarists proposition. In all countries, the error correction coefficients (γ and τ) that reflect the significance and speed of adjustment are significantly different from zero and carry negative signs as expected. This indicates that movement in changes in prices takes into account its previous error from the long run equilibrium path as dictated by monetary growth. For the narrow M1 money, the absolute size of the error correction coefficients ranges from 0.281 (Thailand) to 0.951 (Bangladesh). The average absolute coefficients of adjustment are about 0.497. This implies that on average 49.7 percent of the deviations of changes in prices from its long run equilibrium in the previous period is corrected in the following period. Qualitatively the size of the error correction coefficients derived when the quasi money (Table 3) is used is similar. The average absolute size of the adjustment parameter for the estimations that employ quasi money is 0.494. Individually, speed of adjustment for Bangladesh, Malaysia, and Indonesia is slightly greater when the quasi money is employed. Nevertheless the difference is relatively small retaining the importance of narrow money measures in the conduct of monetary policy.

Table 2: Estimates of Error Correction Equations (Money: M1 money)

$$\Delta P_t = 0 + \gamma v_{t-1} + \sum_{j=1}^{p} \phi_{P,j} \Delta P_{t-j} + \sum_{j=1}^{q} \delta_{M,j} \Delta M_{t-j} + v_t,$$

Country	Lags (p, q)	Error Correction Coefficient (θ)	Lagged Coefficients ($\delta_{M.j}$'s)	R^2
Bangladesh	(4, 6)	-0.988 ** (-6.380)	2.301 ** (0.035)	0.482
India	(9, 1)	-0.285 ** (-3.257)	0.551 (0.459)	0.286
Indonesia	(8, 1)	-0.443 ** (-3.853)	0.437 (0.509)	0.399
Malaysia	(5, 1)	-0.378 ** (-4.377)	4.316 ** (0.039)	0.419
Pakistan	(5, 10)	-0.693 ** (-6.101)	3.170 ** (0.001)	0.472
Singapore	(9, 1)	-0.370 ** (-3.916)	0.491 (0.484)	0.498
Sri Lanka	(5, 6)	-0.569 ** (-4.966)	1.951 (0.073)	0.444
Thailand	(6, 10)	-0.252 ** (-3.123)	5.370 ** (0.000)	0.475

Notes:

1. Reported figures are derived based on Equation 4.
2. Double asterisks (**) denote significant at 95 percent level.
3. Figures in parentheses in the first column are optimal lags for lagged differences in the ECM equations.
4. Figures in parentheses in the second column are t-ratios for the null hypothesis that the Error correction coefficient is equal to zero.
5. Figures in parentheses in the third column are the significance level for the F statistics for the null hypothesis that all lagged money growth differences ($\delta_{M.j}$'s) is equal to zero.

Table 3: Estimates of Error Correction Equations (Money: Quasi money)

$$\Delta P_t = \chi + \tau\varepsilon_{t-1} + \sum_{j=1}^{p} \lambda_{P,j} \Delta P_{t-j} + \sum_{j=1}^{q} \delta_{QM,j} \Delta QM_{t-j} + \xi_t,$$

Country	Lags (p, q)	Error Correction Coefficient (θ)	Lagged Coefficients ($\delta_{QM,j}$'s)	R^2
Bangladesh	(8, 2)	-0.951 ** (-5.641)	23.70 ** (0.000)	0.545
India	(9, 1)	-0.303 ** (-3.450)	0.010 (0.459)	0.289
Indonesia	(8, 7)	-0.417 ** (-3.725)	2.656 ** (0.011)	0.435
Malaysia	(5, 1)	-0.353 ** (-3.993)	0.414 (0.520)	0.391
Pakistan	(5, 4)	-0.696 ** (-6.316)	2.538 ** (0.040)	0.433
Singapore	(9, 1)	-0.375 ** (-3.924)	0.360 (0.549)	0.498
Sri Lanka	(5, 1)	-0.577 ** (-5.070)	1.099 (0.295)	0.421
Thailand	(6, 7)	-0.281 ** (-3.393)	2.277 ** (0.029)	0.415

Notes:

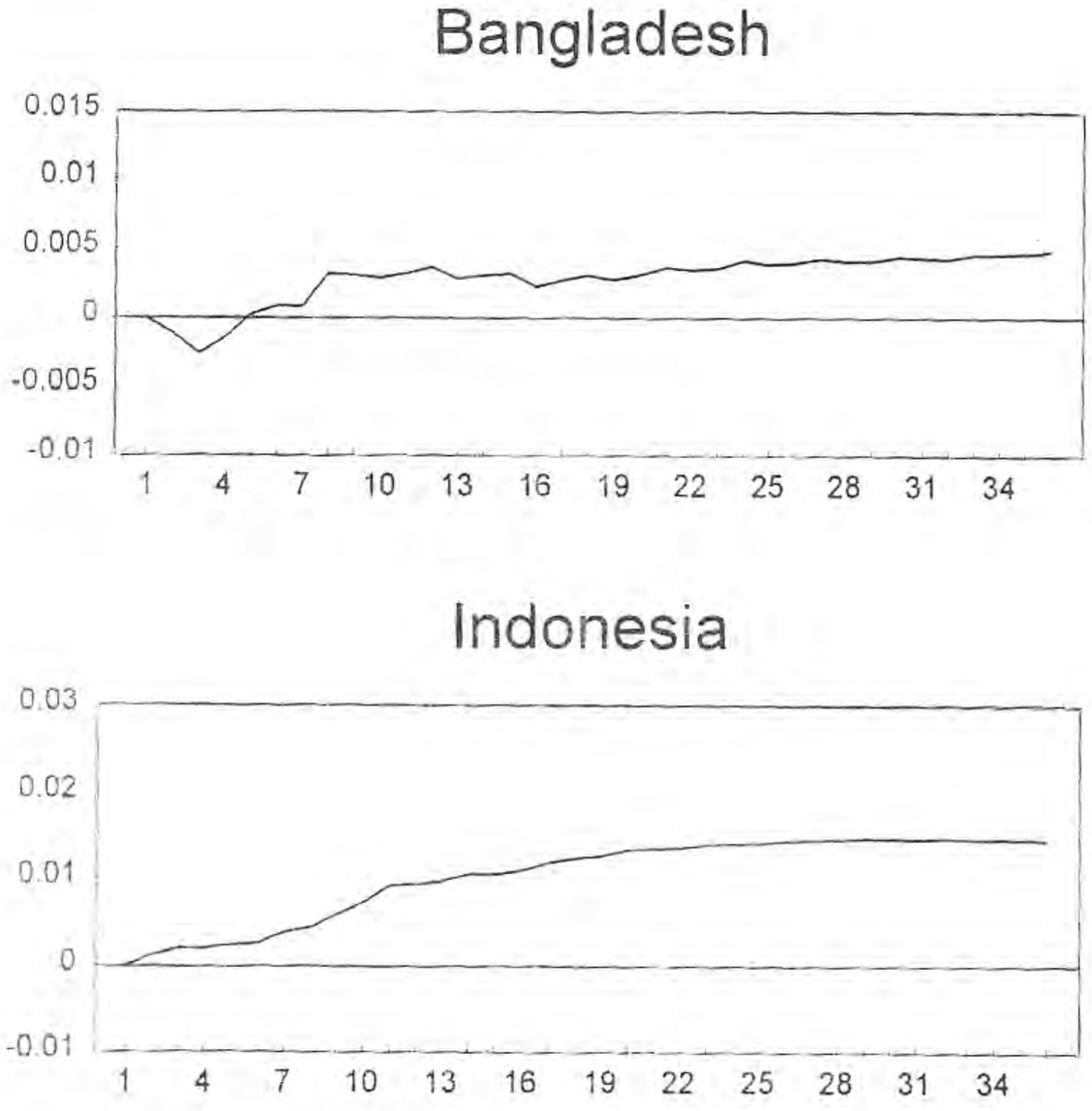
1. Reported figures are derived based on Equation 5.
2. Double asterisks (**) denote significant at 95 percent level.
3. Figures in parentheses in the first column are optimal lags for lagged differences in the ECM equations.
4. Figures in parentheses in the second column are t-ratios for the null hypothesis that the error correction coefficient is equal to zero.
5. Figures in parentheses in the third column are the significance level for the F statistics for the null hypothesis that all lagged money growth differences ($\delta_{QM,j}$'s) is equal to zero.

The reported coefficients of determination (R^2) in Tables 2 and 3 also support the important role of money growth in determining inflation in each country. The percentage of inflation explained by the M1 money range from 28.6 (India) to 49.8 (Singapore) percents. On average changes in M1 money growth explain about 43.4 percent of variation in prices in these countries. The same applies for the broader money measure where growth in quasi money explains about 42.8 percent of changes in prices. Comparatively, the speed of adjustment is highest for the case of Bangladesh with a near to complete adjustment shown by the speed of adjustment of close to 1. This is also true for the coefficient of determination for Bangladesh, ranking highest among the eight countries averaging at 51.4 percent for M1 and quasi money. Evidence for short run causality is slightly weaker. This is indicated by the significance of the coefficients for the lagged first difference of money growth. In Table 2, null hypothesis of no causation from growth of money is rejected in four countries (Bangladesh, Malaysia, Pakistan and Thailand). For the quasi money (Table 3), short run causality is also supported for four countries (Bangladesh, Indonesia, Pakistan and Thailand). No short run causality is supported for India, Singapore and Sri Lanka. Inability to support the short run causality in these three countries do not imply rejection of Monetarists proposition since theoretically the equilibrium relationship proposed by Monetarists is a long run phenomena that is sufficiently supported by the cointegration and error correction analysis. Overall, the results reported in Tables 2 and 3 are strongly in favour of the Monetarists proposition that claims money growth as a major determinant of inflation in the long run.

Figure 1 plots the IRF derived from the VAR estimations. Each chart includes the point estimate of the IRF (solid line) and its one-standard deviation bands (dotted lines). Generally, the response of changes in prices toward monetary shocks is consistent with the Monetarists hypothesis.

Except for Pakistan, these responses are significantly positive at 95 percent significant level. Upward movement of changes in prices in India, Indonesia, Malaysia, and Thailand occurs immediately following increase in money stock. Reactions of changes in prices in the rests occur with some lag about six to ten months later. As indicated by the impulses these responses persist over the horizon reported (36 months) suggesting a lasting impact of increased in money growth on price movement. The impact of increase in monetary growth on inflation stabilizes approximately twelve months following initial shock.

Figure 1: Response of Prices to Money Shocks



Notes:

1. The impulses are derived from a bi-variate VAR involving money and prices.
2. Thick lines are impulse response functions and dotted lines are one standard devistions bands.

Evidence presented in the preceding paragraphs is in line with the Monetarists proposition that variation in the growth of the stock of money significantly affect changes in prices. This long run relationship is valid regardless of the measures of money used. Thus, Monetarism views on the importance of domestic growth of money supply in determining domestic inflation should be given serious attention by policy makers in developing nations of Asia. Failure to effectively manage domestic monetary aggregates could bring serious harm to the domestic economy as this translates into an inflationary threat.

SUMMARY AND CONCLUSION

In this paper the Monetarists view on the long run equilibrium relationship between money growth and changes in prices is investigated. We provide three forms of analysis; the cointegration test, the error correction estimation, and the impulse response function of the VAR, in investigating the proposed relationship. The experience of eight selected Asian countries (Bangladesh, India, Indonesia, Malaysia, Pakistan, Singapore, and Thailand) supports the Monetarists proposition. Money growth and changes in prices are cointegrated in these countries. Movement in prices are subject to the equilibrium relationship dictated by changes in the growth of money. The impact of money growth on inflation persists and is significant. Thus, policy makers in developing nations should give greater emphasis on the development of domestic monetary aggregate in managing domestic inflation. Monetarism is alive and valid in these Asian nations.

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