Trade openness and inflation: A test of Romer hypothesis for Bangladesh

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Abstract

An important prediction found in international trade is that Trade openness can affect inflation. The trade openness or trade liberalization is associated with declining prices, that is, there is negative relation between inflation and trade openness. In line with this view, Romer (1993) postulates the hypothesis that inflation is lower in small and open economies. The objective of this paper is to explore the relationship between trade openness and inflation for the small economy Bangladesh using data over 1976 -2010 period. For this purpose, Cointegration Approach and a Vector Error Correction Model (VECM) have been used. Empirical results show that there is a significant negative long-run relationship between inflation and trade openness, which confirms the existence of Romer's hypothesis in Bangladesh.

Keywords: *Inflation, Trade Openness, Bangladesh*
JEL Classifications: *E31, O53, C32*

I. Introduction

The decade of 1990s witnessed an increasing popularity of inflation-targeting policies, particularly in small countries that remain highly open to international trade. As a result, a striking feature of recent global macroeconomic performance is the substantial decline in inflation rates around the world. Thus Trade Openness association with falling prices is the most popular propositions found in international trade and there has been unique turn in favor of higher economic integration of world (Bowdler and Malik, 2006). The lower the restrictions to international trade transactions the higher level of world economic integration and benefits.

In theory, trade liberalization or openness results in productivity gains through increased competition, efficiency, innovation and acquisition of new technology. These factors in turn influence the level and composition of export and import. Trade liberalization is also considered to expand economic opportunities by enlarging the market size and enhancing the impact of knowledge spill over. These are the key theoretical components of the effects of trade liberalization.

The relevant theory on the relationship between inflationary process and openness in the closed economy context by the Monetarist School is that 'fiscal deficit' is the root cause of the inflationary process in so far as it affects money supply. Friedman argues, 'Inflation is always and everywhere a monetary phenomenon' (1963, p 17). According to the Structuralist School of thought structural rigidities (inflexibility in nominal prices, supply shocks, bottlenecks in production and distribution, a narrow tax base, and underdeveloped financial markets in developing countries) usually in the farm sector of a developing country is the crucial sources of price rise and excess demand drives up the price level triggering the inflationary process.

In the context of the open economy, these relationships are likely to undergo significant changes and the mechanisms through which openness can affect the inflation outcome is that According to the 'new growth theory' openness is likely to affect inflation through its effect on output (Jin, 2000). This link could operate through: (i) increased efficiency, which is likely to reduce costs through changes in the composition of inputs procured domestically and internationally; (ii) better allocation of resources; (iii) increased capacity utilization; and (iv) a rise in foreign investment which could stimulate output growth and ease pressure on prices (Ashra, 2002).

Bangladesh is experiencing high and significant rise in the inflation rate in the recent past and almost of the last decade not only due to price hike of electricity and fuel oils, taka's devaluation against the US dollar but also the rise in government's spending and credit growth in both public and private sectors. Increasing import prices is also a major reason in enhancing inflation and in this scenario the depreciating exchange rate can put upward pressure on prices (IMF).

In the present study we attempt to incorporate the implications of degree of openness on the domestic inflationary process in an economy. However, as the economy opens up, the fiscal and monetary authorities tend to lose their ability to control inflation through fiscal and monetary policies. Fluctuations in the exchange rate, balance of payments (BoPs), and foreign investment inflows tend to have influence on the price and quantity dynamics in the economy in various ways (Ashra, 2002). This issue is looked into empirically for Bangladesh economies using annual observations from 1976 to 2010. The rest of the paper is organized as follows. Section II describes Review of literature, the theoretical model, sources of data and estimation technique in section III. Section IV focuses on the empirical analysis. Finally and section V presents the concluding remarks.

II. Review of Literature

Since independence in December 1971 to late 1975, Bangladesh followed a development strategy of state intervention and controls (Ahmed, 2002). This was characterised by high tariffs and non-tariff barriers to trade and an overvalued exchange rate system which was supported by the import-substitution industrialisation strategy of the government. This policy was pursued with the aim of improving the balance of payment position of the country and creating a protected domestic market for manufacturing industries (Bhuyan and Rashid, 1993). However, in the face of failure of such inward-looking strategies to deliver the desired outcomes along with rising internal and external imbalances, trade policy reforms were introduced in the early 1980s.In the mid-1980s, policy of moderate liberalisation was initiated and in the early 1990s, large-scale liberalisation of trade was implemented. Since then, trade liberalisation has become an integral part of Bangladesh's trade policy. In today's world, no developing country can afford to isolate itself from the world economy. The benefits of outward-looking policies that help in taking advantage of the possibilities of international trade and capital flows are extensively discussed in the literature.

Sustained low inflation has been a stylized fact of the late 1990s and early 2000s, both in advanced and increasingly in emerging markets (Mukhtar, 2010).The relationship between inflation and openness has been the subject of research, theoretical as well as empirical. The

literature in economics on inflation and openness is relatively scant. A striking feature of recent global macroeconomic performance has been the substantial decline in inflation around the globe (Bowdler and Malik, 2006). This decline has taken place not only in developed and less developed countries but also similar trends have been observed in other advanced OECD countries (Blanchard and Simon 2001

Triffin and Grudel (1962), and Whiteman (1969) had looked into economic performance of EEC and observed that more open economies tended to experience lower price inflation. Their explanation was that openness served as a safety valve and the domestic inflationary pressure spilled over into the BoPs in the open economy. Romer (1993) proposed a hypothesis of a negative relation between inflation and trade openness and he further tested the hypothesis by using cross-section data of 114 economies over the Post-Bretton Woods period (From 1973 to the early 1990s), and concluded strong and robust negative link between inflation and trade openness.

Several studies have tested Romer's argument in different ways and have supported the conventional view of the negative relationship between trade openness and inflation. Thus empirical findings of Lane (1997), Bleaney (1999), Ashra (2002) ,Sachsida *et al.* (2003), Yanikkaya (2003), Gruben and Mcleod (2004), Kim and Beladi (2004), Daniels et al.(2005), Razin and Loungani (2005), Bowdler and Malik (2006) Aron and Muellbauer (2007), Granato et al. (2007) Badinger (2007), Bowdler and Nunziata (2006) all validate Romer's argument.

However, Romer's argument has been challenged. For example, Temple (2002) empirically challenges Romer's (1993) negative openness inflation relation on empirical grounds as he established a link between trade openness and the slope of the Phillips curve and the results provide little support for the theoretical prediction of a correlation between openness and standard measures of the output-inflation trade-off.

Terra (1998) argues that the negative relationship between openness and inflation across countries is driven by a group of severely indebted countries in Latin America. Gruben and Mcleod (2004) show that there does not existing any significant openness–inflation relationship among OECD economies.

Most studies of the role of openness have focused on the estimation of cross-country averages of many different levels of economies. Little work has been done on the dynamics of the impact of openness on inflation at a country level. The literature on the trade openness-inflation relation in Bangladesh is scarce. Ashra (2002), has reported evidence of a positive relationship between trade openness and inflation for Bangladesh using a panel data framework. Raihan (2008) has estimated a 'trade liberalisation–inflation' model in line with Romer (1993), for the Bangladesh economy for the period 1980 to 2005 by adding control variables in three different models. In all the models, though the trade liberalisation variable has expected negative signs, they are statistically insignifican. However, the empirical literature in Bangladesh does not report openness to be a significant factor in explaining the inflation outcome. The objective of this paper is to investigate the relationship between trade openness and inflation in Bangladesh including trade openness as an exogenous variable to verify how it affects the inflation.

III. Methodology and Data

III.1 The Econometric Model

The most common empirical method of examining the trade openness inflation relationship has been to employ a single equation model for inflation, treating trade openness as an exogenous variable among others.

Following Solomon and de Wet (2004), Romer (1993), Jin (2002), Agarwal and Narayanan (2003), Kim and Beladi (2005), Mukhtar (2010), Menghan (2008) and Badinger (2007), Munir, S. and Kiani, A.K. (2011); this study has taken real effective exchange rate (REER), real GDP (RGDP), trade openness (TO) measured as Trade as percentage of GDP, money supply (M_2). Financial market openness (FMO) measured as FDI net inflows as percentage of GDP as exogenous variable. Therefore, the empirical model of interest of the study is

$$P = \int (REER, RGDP, TO, FMO, M2) \qquad (1)$$

The function based on equation (1) is expressed in log-linear form for estimation, incorporating the disturbance term (u) which according to standard time-series model is assumed to be white-noise process. Where P indicate inflation (CPI) in this paper and adding time subscripts (t) the estimating equation becomes

$$lnP_t = \beta_0 + \beta_1 lnREER_t + \beta_2 lnRGDP_t + \beta_3 lnTO_t + \beta_4 lnFMO_t + \beta_5 lnM2_t + U_t \qquad (2)$$

Equation (2) outlines the long-run relation between inflation and the other variables affecting inflation. The short-run dynamics has been incorporated by specifying equation (2) in an error-correction modelling format of Vector Autoregressive (VAR) model. The empirical analysis has been done following standard time-series econometric techniques.

III.2 The Data

Annual data of the variables of the model over 1976 – 2010 period of Bangladesh are collected from various secondary sources. Data on Money Supply (M_2) and Real Effective Exchange Rate (REER) are taken from various issues of Bangladesh Economic Review and the *International Financial Statistics 2011* CD-ROM of IMF. The data on Consumer Price Index (CPI), which is taken as the measure of Inflation in this study denoted as (P), is obtained from International Financial Statistics 2011 CD-ROM of the IMF. The data on Financial Market Openness (FMO) and Trade Openness (TO) are collected from World Development Indicator 2011 (WDI). For this study, each of the series of data is taken in natural logarithmic form so that their first differences approach the growth rates.

IV. Empirical Results

IV.1 Augmented Dickey-Fuller (ADF) Unit Root Test

Following standard practice, empirical analysis starts with the test of stationarity of variables of the model (2), using unit root test procedures. The Augmented Dickey-Fuller (ADF) test has been used to perform the unit root test in all the series of the model and examine their order of integration.

The test has employed automatic lag length selection by *EViews 5.1* statistical software using a Schwarz Information Criterion (SIC). Schwarz Information Criterion (SIC) is considered to be more appropriate for studies with small numbers of observations like this study. It shows that all the variables incorporated in this study are found to be stationary at first difference I (1). Test statistics of the variables in the model at level and in first differences are presented in *appendix-A.1.*

IV.2 Cointegration

The co-integration analysis is performed to infer the long-run relationship among variables in the model. The cointegration relationship among P, REER, RGDP, TO, FMO, and M2 has been investigated assuming no deterministic trend in the data, and an intercept in the cointegrating equation using the Johansen Maximum Likelihood technique to a vector autoregressive (VAR) version with an optimum lag length of 1 as determined by all lag selection criteria (LR, FPE, AIC, SC and HQ), is presented in *appendix-A.2.*

Both the Trace statistics and Maximum Eigen statistics reject the null hypothesis of no cointegrating relationship between variables of the model of equation (2). Trace test indicates 3 cointegrating eqn(s) at the 0.05 level and Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level. This result implies that the price level, real effective exchange rate, real GDP, trade openness, financial market openness, and M2 establish a long-run equilibrium relationship in Bangladesh.

The parameter estimates representing the cointegration between the inflation and its determinants is specified as:

$$\ln(P_t) - 4.96 \ln(REER)_t + 3.81 \ln(RGDP)_t - 0.46 \ln(FMO)_t - 1.21 \ln(M_{2)t} + 5.47 \ln(TO)_t - 58.54 = 0$$

$$\underset{}{Or,}\ \ln(P_t) = \underset{(-2.13)}{4.96 \ln(REER)_t} - \underset{(1.24)}{3.81 \ln(RGDP)_t} + \underset{(-4.50)}{0.46 \ln(FMO)_t} + \underset{(-1.16)}{1.21 \ln(M_{2)t}} - \underset{(5.98)}{5.47 \ln(TO)_t} + \underset{(-1.31)}{58.54} \qquad (7)$$

The cointegrating equation (7) is normalized for lnP to obtain meanings from the coefficients. Equation represents Cointegration coefficients with T value (the values of the numbers in parentheses). The coefficients of all the logarithmic variables may be interpreted in terms of elasticity it shows that except two variables all the independent variables reflect significant relationships at 5 percent level of significance.

The coefficient of real ER carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real ER brings about 4.96 percent increase in inflation rate. This finding is not supported by the results of Agarwal and Narayanan (2003) that the fixed exchange rate regime has significant negative effect on inflation if the dataset is analysed in two different time spans indicating that it is a short-run phenomenon. But, Mukhtar (2010) found a significant positive relationship between inflation and ER such that a 0.38 percent increase in the inflation is associated with a 1 percent increase in ER. Rogoff (1985) proposed that increased inflation has an extra cost and the optimal rate

chosen by monetary authorities was lesser as the deteriorating effect on exchange rate increases.

The coefficient of real GDP carries a negative sign but statistically insignificant at 5 percent level of significance and shows that a 1 percent increase in real GDP brings about 3.81 percent decrease in inflation rate. This finding is in line with Agarwal and Narayanan (2003) which shows that GDP has a significant negative effect without dummies for country, time and exchange rate regimes. Mukhtar (2010) also supported the significant negative relationship between inflation rate and GDP such that a 0.42 percent decrease in the inflation is associated with a 1 percent increase in GDP. While Menghan (2008) found a positive long run relationship between GDP and prices.

FMO carries a positive sign at 5 percent level of significance and shows that a 1 percent increase in FMO brings about 0.46 percent increase in inflation rate. Our results are not supported by Jin (2002) which shows significant negative short-run effects of financial market openness on the growth rates of the price level. Badinger (2007) also found that increase in financial openness by one percentage point leads to a decrease in inflation by 0.36 percent.

The coefficient of $\ln M_2$ carries a positive sign but statistically insignificant at 5 percent level of significance which shows that a 1 percent increase M2 brings about 1.21 percent increase in inflation rate. This finding is consistent with the empirical findings of Agarwal and Narayanan (2003) and Ashra (2002) and supports the theoretical arguments of the monetarists. Broad monetary policy increases GDP and depreciates the exchange rate, and the latter adjustment puts up import prices and inflation in proportion to the openness of the economy (Romer, 1993).

The coefficient of Trade Openness carries expected negative sign and statistically significant at 5 percent level of significance in the long-run which shows that a 1 percent increase in trade openness brings about a 5.47 percent decrease in the inflation rate and it is the interest of this study. This finding is consistent with the empirical findings of Romer (1993), Kim and Beladi (2004), and Gruben and Mcleod (2004), among others. This finding confirms the existence of Romer's hypothesis in Bangladesh: inflation is lower in small and open economies. Furthermore, it indicates that the traditional closed economy explanation for the inflationary process remains valid, and adding the openness variable to the analysis is an important component to the empirical analysis of these macroeconomic phenomena.

IV.3 Error Correction Estimates

The error correction term (ECT) represents the percentage of correction to any deviation in the long-run equilibrium price in a single period and also represents how fast the deviations in the long-run equilibrium are corrected. The coefficient of the ECT of inflation variable for Bangladesh is (-0.11) and carries the correct sign (negative) but insignificant in the analysis at 5 percent level of significance with the speed of convergence to equilibrium of 10.94 percent (*appendix-A.3*). This means that, whenever there is any disturbance in the system in the long run, in every short-run period, a 11 percent correction to disequilibrium will take place. More specifically, ECT coefficient shows that a deviation from the long run equilibrium value in one period is corrected in the next period by the size of the coefficient.

The coefficients of the ECTs of FMO is statistically insignificant and TO is statistically significant but they carry a negative sign This means that, in case of any disturbance, convergence into the equilibrium path will take place and the whole system can be brought to equilibrium position in each case. While, REER and M2 are statistically insignificant and RGDP is statistically significant but they carry a positive sign. This means that, in case of any disturbance, divergence from the equilibrium path will take place and the whole system cannot be brought to equilibrium position in each case.

The values in parentheses represent the *t*-statistics for the respective coefficients (equation 8). No significant effects of the variables REER, M2, RGDP, TO, and FMO of the model have been found on inflation in the short-run. That is the variables do not have any impact on inflation rate in Bangladesh in the short-run but REER, FMO, and TO have significant impact on inflation rate in Bangladesh in the long-run as seen from equation (7) While no significant impact of RGDP and M2 are found both in short-run and long-run on inflation rate in Bangladesh.

An increase in trade openness growth leads to a statistically significant decrease in inflation rate in the long-run, whereas no response of inflation to trade openness is found in the short-run in Bangladesh. This finding is consistent with the empirical findings of Romer (1993) that trade openness generate inflation is lower in small and open economies and adding the openness variable is an important component for empirical macroeconomic analysis.

The estimated equation of the model in error correction form including the *lnTO* to capture the effects of trade openness on inflation of Bangladesh is:

$$\Delta \ln(P_t) = \underset{(-0.35)}{-0.07}\,\Delta \ln(P_{t-1}) \underset{(-1.94)}{-0.42}\,\Delta \ln(P_{t-2}) + \underset{(1.39)}{8.03}\,\Delta \ln(REER_{t-1}) - \underset{(-1.02)}{5.64}\,\Delta \ln(REER_{t-2})$$

$$\underset{(-0.64)}{-9.98}\,\Delta \ln(RGDP_{t-1}) + \underset{(0.92)}{11.48}\,\Delta \ln(RGDP_{t-2}) + \underset{(1.49)}{3.02}\,\Delta \ln(TO_{t-1}) + \underset{(0.66)}{1.21}\,\Delta \ln(TO_{t-2})$$

$$\underset{(1.58)}{+4.43}\,\Delta \ln(M2_{t-1}) \underset{(-0.76)}{-2.16}\,\Delta \ln(M2_{t-2}) + \underset{(0.48)}{0.09}\,\Delta \ln(FMO_{t-1}) \underset{(-0.49)}{-0.08}\,\Delta \ln(FMO_{t-2})$$

$$\underset{(-0.61)}{-0.11}[\underset{(-2.13)}{-4.96}\ln(REER)_t + \underset{(1.24)}{3.81}\ln(RGDP)_t \underset{(-4.50)}{-0.46}\ln(FMO)_t \underset{(-1.16)}{-1.21}\ln(M_2)_t + \underset{(5.48)}{5.47}\ln(TO)_t \underset{(-1.31)}{-53.21}]$$

(8)

V. Conclusion

The decade of 1990s witnessed an increasing popularity of inflation-targeting policies, particularly in small countries that remain highly open to international trade and in the early 1990s, large-scale liberalisation of trade was implemented. Since then, trade liberalisation has become an integral part of Bangladesh's trade policy. Since Inflation creates uncertainty in the

economy that can adversely affect economic growth, it has always been a concern for policymakers. Maintaining noninflationary stable economic growth has been at the core of macroeconomic policies in Bangladesh as in many other developing countries. The concern with inflation stems not only from the need to maintain overall macroeconomic stability, but also from the fact that inflation hurts the poor in particular as they do not possess effective inflation hedges.

An important debate has centered on the effects of openness (in the trade-flow sense) on inflation. Theoretically, two alternative views have been espoused concerning the issue. One of these states that openness causes a slower rate of inflation, while the other states that openness causes a faster rate of inflation. Many empirical studies have been performed to test these hypotheses. However, there is inconclusive evidence in support of these two views.

However there is no significant empirical evidence whether trade openness causing inflation increase or decrease in Bangladesh or not. In this paper an initiative is taken and tries to explore the empirical relationship between trade openness and inflation in Bangladesh by applying the cointegration approach in order to reexamine whether the hypothesis proposed by Romer (1993), that there is a negative relationship between inflation and trade openness, holds for Bangladesh using annual time series data set of Bangladesh for the period of 1976 to 2010. The empirical result suggests that, there exists corroborate Romer's proposition and this study further supports the results obtained by Romer (1993). The relationship is significant in the long run, but no relationship is found between them in the short-run. Results also indicate that any shock in the short-run inflation gradually adjusted to the long-run equilibrium. Thus, whatever its cause, that greater openness to trade is associated with lower inflation and that trade liberalization will help to maintain macroeconomic stability in Bangladesh.

Reference

Agarwal, A. and Narayanan, B.G. (2003), *"Inflation-Openness relationship: A panel approach for developing countries"*

Ahmed, Sadiq (2002), The Political Economy of Reforms in South Asia: Bangladesh and Pakistan, South Asia Region Internal Discussion Paper Number 183, World Bank, Washington D.C.

Aron, Janine. And Muellbauer, John. (2007), "*Inflation dynamics and trade openness: with an application to South Africa*," CSAE Working Paper Series no.11.

Ashra, S. (2002)," *Inflation and openness: a study of selected developing economies,"* Working Paper No. (84), Indian Council for Research on International Economic Relations, New Delhi, India.

Badinger, H. (2007), *"Globalization, the Output-Inflation Tradeoff, and Inflation"*. Althanstrasse 39-45, A-1090 Vienna.

Barro, R.J. and Gordon, D.B. (1983). *"A positive theory of monetary policy in a natural rate model."* Journal of Political Economy 91, 589–610.

Bhuyan, A.R. and M.A. Rashid (1993), Trade Regimes and Industrial Growth: A Case Study of Bangladesh. Bureau of Economic Researh, University of Dhaka, Dhaka.

Blanchard, Olivier and John Simon (2001). .The Long and Large Decline in U.S. Output Volatility..Brookings Papers on Economic Activity, 135-64.

Bleaney, M. (1999), "the disappearing openness inflation relationship: a cross country analysis of inflation rates", IMF working paper 161.

Bowdler, Christopher and Luca Nunziata (2006). .Trade Openness and In.ation Episodes in the OECD..Journal of Money, Credit and Banking, 553-63.

Bowdler, C and Malik, A. (2006), *"Openness and Inflation Volatility: Panel Data Evidence"*. Nuffield College, University of Oxford. The 20th Annual Congress of the European Economic Association in Amsterdam and the 2006 Royal Economics Society.

Daniels, J. P., Nourzad, F. and VanHoose, D.D. (2005): *"*Openness*, Central Bank Independence, and the Sacrifice Ratio,"* Journal of Money, Credit, and Banking, 37(2), 371-379.

Fischer (1993),'The role of macroeconomic factors in growth' Journal of Monetary Economics, p 485-512.

Friedman, Milton (1963), 'A Monetary History of the United States', NBER, Princeton

University Press, New Jersey.

Granato, J., Lo, M., and Wong, M. C. Sunny (2007). “A note on Romer’s openness-inflation relation: the responsiveness of AS and AD to economic openness and monetary policy.” Applied Economics 39, 191–197.

Gruben, C.Williams. And McLeod, D. (2004), "*the Openness-Inflation Puzzle Revisited"*. Applied Economics Letters, 11: 8, 465 - 468.

IMF (1990),’World Economic Outlook: A survey by the Staff of International Monetary Fund’, May, Chapter 4.

Jin, Jang (2000),’Openness and Growth: An Interpretation of Empirical Evidence from East Asian Countries’ Journal of International Trade and Economic Development, 9, p 5-17.

Kim, M., and Beladi, H. (2005), *"Is Free Trade Deflationary*"? Economic Letters: 89, 343-349.

Lane, Philip, R. (1997),’Inflation in Open Economies’ Journal of International Economics, 42, p 327-347**.**

Mukhtar, T. (2010)*," Does Trade Openness Reduce Inflation? Empirical Evidence from Pakistan*". The Lahore Journal of Economics: pp.35-50.

Munir, S. and Kiani, A.K. (2011).Relationship between Trade Openness and Inflation: Empirical Evidences from Pakistan (1976–2010). *The Pakistan Development Review*, 2011, vol. 50, issue 4, pages 853-876.

Nunziata, L. and Bowdler, C. (2006), *"Trade Openness and Inflation Episodes in the OECD*". Journal of Money, Credit, and Banking, Vol. 38, No. 2. pp 553-563.

Raihan,S. (2008),Trade Liberalisation, Growth Employment and Poverty in Bangladesh, pp 1-61.

Razin, A., Loungani, P. (2007),"*Globalization and Equilibrium Output-Inflation Trade-Offs*," NBER International Seminar on Macroeconomics (September).

Rogoff, K. (1985), *“Can International Monetary Policy Cooperation Be Counterproductive,”* Journal of International Economics, 18.vol, 3.no, 4. pp 199–217.

Rogoff, K. (2003). Globalization and the Global Disinflation. Paper presented to the Federal Reserve Bank of Kansas, Jackson Hole Conference.

Romer, D. (1993)*," Openness and inflation: theory and evidence*". Quarterly Journal of Economics: vol. 108, no. 4, p. 869-903, Nov. 1993.

Solomon, M., and de Wet, W.A. (2004). The Effect of a Budget Deficit on Inflation: The Case of Tanzania. *South African Journal of Economic and Management Sciences*, 7 (1), 100-116.

Sachsida, A., Carneiro, F. G., Loureiro, P., 2003. Does greater trade openness reduce inflation? Further evidence using panel data techniques. Economics Letters, 81, 315-319

Triffin, R. and Grudel, H. (1962). "The Adjustment Mechanism to Differential Rates of Monetary Expansion among the Countries of the European Economic Community." Review of Economics and Statistics 44, 486-491.

Temple, J. (2002), *"Openness, inflation and the Phillips Curve: a puzzle*". Journal of Money, Credit and Banking, 34: 450-68.

Terra, C. T. (1998), *"Openness and inflation: a new assessment"*. Quarterly Journal of Economics, pp. 641-648, May 1998.

Yanikkaya H. (2003). Trade Openness and Economic Growth: A Cross- Country Empirical Investigation. *Journal of Development Economics*, 72, 57-89.

Appendix

Table-A.1: ADF Unit Roots Statistics

Variables	Levels, I(0)		First Differences, I(1)	
	t-ADF	P-Value	t-ADF	P-Value
Intercept				
ln (P)	-3.72	0.00	-6.19	0.00
ln (FMO)	-1.48	0.53	-6.51	0.00
ln (M2)	-1.13	0.68	-4.45	0.00
ln (REER)	0.53	0.98	-6.97	0.00
ln (RGDP)	4.35	1.00	-4.18	0.00
ln (TO)	0.11	0.96	-7.24	0.00
Intercept and Trend				
ln (P)	-3.97	0.01	-6.20	0.00
ln (FMO)	-2.60	0.28	-5.61	0.00
ln (M2)	-3.05	0.13	-4.34	0.00
ln (REER)	-1.367	0.85	-7.59	0.00
ln (RGDP)	0.19	0.99	-5.86	0.00
ln (TO)	-2.26	0.44	-7.50	0.00

Notes: (i) ADF Statistics at I (0) indicate acceptation but ADF Statistics at I (1) indicate rejection of the unit root hypothesis at the 1%, 5% and 10% respectively level of significance. (ii) ADF Statistics at I (0) and I (1) represent the optimal lag length (MAXLAG=8) as determined by Schwarz information criteria. (iii) The Phillips–Perron test also gives the similar results

Table-A.2: The Co-integration Analysis

Trend assumption: No deterministic trend (restricted constant)
Included observations: 32 after Sample adjustments (1978 - 2009)
Series: LNP LNM2 LNFMO LNREER LNRGDP LNTO
Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigen value	Unrestricted Cointegration Rank Test *(Trace)*			Unrestricted Cointegration Rank Test *(Maximum Eigenvalue)*		
		Trace Statistic*	Critical Value 0.05	Prob.***	Max-Eigen Statistic**	Critical Value 0.05	Prob.***
None	0.81	143.18	103.84	0.00	53.81	40.95	0.00
At most 1	0.64	89.36	76.97	0.00	33.06	34.80	0.07
At most 2	0.51	56.29	54.07	0.03	23.46	28.58	0.19
At most 3	0.44	32.82	35.19	0.08	18.93	22.29	0.13
At most 4	0.25	13.89	20.26	0.29	9.28	15.89	0.40
At most 5	0.13	4.611	9.16	0.32	4.61	9.16	0.32

* Trace statistics indicate that none, at most 1 and at most 2, rejection of the hypothesis at the 0.05 level. ** Max-Eigen statistics indicate that none, rejection of the hypothesis at the 0.05 level. ***MacKinnon-Haug-Michelis (1999) p-values

Table-A.3: Error Correction Estimates

Included observations: 31 after Sample adjusted: 1979 2009
Standard errors in ( ) & t-statistics in [ ]

Error Correction:	**D(LNP)**	**D(LNFMO)**	**D(LNM2)**	**D(LNREER)**	**D(LNRGDP)**	**D(LNTO)**
CointEq1	-0.10	-0.11	0.022	0.00	0.01	-0.05
	(0.17)	(0.29)	(0.01)	(0.00)	(0.00)	(0.01)
	[-0.61]	[-0.38]	[1.40]	[0.61]	[4.22]	[-2.87]
R-squared	0.43	0.43	0.52	0.55	0.62	0.50
Adj. R-squared	0.06	0.06	0.21	0.25	0.37	0.17
Sum sq. resids	9.67	26.17	0.07	0.02	0.00	0.12
S.E. equation	0.73	1.20	0.06	0.03	0.01	0.08
F-statistic	1.16	1.16	1.67	1.84	2.50	1.53
Log likelihood	-25.93	-41.36	48.65	66.90	105.79	41.89
Akaike AIC	2.51	3.50	-2.30	-3.47	-5.98	-1.86
Schwarz SC	3.11	4.10	-1.69	-2.87	-5.38	-1.26
Mean dependent	-0.04	0.08	0.11	0.01	0.04	0.02
S.D. dependent	0.75	1.24	0.07	0.04	0.013	0.09