INFLATION AND ECONOMIC GROWTH: EVIDENCE FROM FOUR SOUTH ASIAN COUNTRIES

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This paper seeks to examine the relationship between inflation and GDP growth for four South Asian countries (Bangladesh, India, Pakistan and Sri Lanka). A comparison of empirical evidence is obtained from the cointegration and error correction models using annual data collected from the IMF International Financial Statistics. The authors find evidence of a long-run positive relationship between GDP growth rate and inflation for all four countries. There are also significant feedbacks between inflation and economic growth. These results have important policy implications. Moderate inflation is helpful to growth, but faster economic growth feeds back into inflation. Thus, these countries are on a knife-edge.

The relationship between inflation and growth remains a controversial one in both theory and empirical findings.[1] Originating in the Latin American context in the 1950s, the issue has generated an enduring debate between *structuralists* and *monetarists*. The structuralists believe that inflation is essential for economic growth, whereas the monetarists see inflation as detrimental to economic progress. There are two aspects to this debate: (a) the nature of the relationship if one exists and (b) the direction of causality. Friedman (1973: 41) succinctly summarized the inconclusive nature of the relationship between inflation and economic growth as follows: "historically, all possible combinations have occurred: inflation with and without development, no inflation with and without development".

Earlier works (for example, Tun Wai, 1959) failed to establish any meaningful relationship between inflation and economic growth. A more recent work by Paul, Kearney and Chowdhury (1997) involving 70 countries (of which 48 are developing economies) for the period 1960-1989 found no causal relationship between inflation

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1 See Hossain and Chowdhury (1996) for a survey of the literature.

and economic growth in 40 per cent of the countries; they reported bidirectional causality in about 20 per cent of countries and a unidirectional (either inflation to growth or vice versa) relationship in the rest. More interestingly, the relationship was found to be positive in some cases, but negative in others. Recent cross-country studies, which found inflation affecting economic growth negatively, include Fischer (1993), Barro (1996) and Bruno and Easterly (1998). Fischer (1993) and Barro (1996) found a very small negative impact of inflation on growth. Yet Fischer (1993: 281) concluded "however weak the evidence, one strong conclusion can be drawn: inflation is not good for longer-term growth". Barro (1996) also preferred price stability because he believed it to be good for economic growth.

Bruno and Easterly's (1998) work is interesting. They note that the ratio of people who believe inflation is harmful to economic growth to tangible evidence is unusually high. Their investigation confirms the observation of Dornbusch (1993), Dornbusch and Reynoso (1989), Levine and Renelt (1992) and Levine and Zervos (1993) that the inflation-economic growth relationship is influenced by countries with extreme values (either very high or very low inflation). Thus, Bruno and Easterly (1998) examined only cases of discrete high-inflation (40 per cent and above) crises and found a robust empirical result that growth falls sharply during high-inflation crises, then recovers rapidly and strongly after inflation falls.

The purpose of this paper is to investigate the inflation-economic growth relationship for Bangladesh, India, Pakistan and Sri Lanka. The reason for this exercise is simple: these countries are under pressure from the international lending agencies (IMF, the World Bank and ADB) to reduce their inflation rates in order to boost economic growth, but two extensive recent works (Bruno and Easterly, 1998 and Paul, Kearney and Chowdhury, 1997) do not shed much light on what is the right approach. None of these countries have had high-inflation crises (except Bangladesh during 1972-1974 only); their inflation rates of 7 to 10 per cent can be regarded as moderate. Hence, Bruno and Easterly (1998) did not include India and Pakistan in their sample. Paul, Kearney and Chowdhury (1997) reported a negative relationship (economic growth to inflation) for Pakistan, but no causal relationship for India and Sri Lanka (Bangladesh was not included). These findings appear counter-intuitive as the four South Asian countries share a very similar economic structure and until very recently have followed (and are still following) roughly similar economic policies (e.g., a relatively large public sector, a nationalized financial sector and five-year plans though with varying emphasis). It is possible that the counter-intuitive results of Paul, Kearney and Chowdhury (1997) are due to methodological deficiencies. For example, Paul, Kearney and Chowdhury (1997) used the Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF) tests. The ADF tests are unable to discriminate well between non-stationary and stationary series with a high degree of autocorrelation (West, 1988) and are sensitive to structural breaks (Culver and Papell, 1997). Paul, Kearney and Chowdhury (1997) also did not include any error correction model to

check the existence of any long-run relationship. The Error Correction Model (ECM) test is essential to see whether an economy is converging towards equilibrium in the long run or not. The ECM also shows short-run dynamics.

Thus, in addition to the DF and ADF tests, this paper uses the Phillips-Perron (PP) test (Phillips and Perron, 1988), which gives robust estimates when the series has a structural break. It also supplements the results by the maximum likelihood test suggested by Johansen (1988) and Johansen and Juselius (1990). The Johansen-Juselius test indicates the possibility of the existence of a third cointegrating vector. The rest of the paper is organized as follows: section I describes the econometric model; the description of data and the analysis of empirical results are given in section II; and concluding remarks are contained in section III.

I. COINTEGRATION AND ERROR CORRECTION MODEL

To examine the extent to which economic growth is related to inflation and vice versa, the theory of cointegration and Error Correction Models (ECM) is applied. With the help of this procedure it is possible to examine the short-run and long-run relationships between two variables. The Engle-Granger (1987) two-step cointegration procedure is used to test the presence of cointegration between the two variables. If both time series are integrated of the same order then it is possible to proceed with the estimation of the following cointegration regression:

$$y_t = a_{11} + b_{11}\, p_t + \mu_t \quad -- \quad -- \quad -- \quad \text{(ia)}$$

$$p_t = a_{21} + b_{21}\, y_t + \eta_t \quad -- \quad -- \quad -- \quad \text{(ib)}$$

where y_t = economic growth rate, p_t = inflation rate at time t, and μ_t and η_t are random error terms (residuals). Residuals μ_t and η_t measure the extent to which y_t and p_t are out of equilibrium. If μ_t and η_t are integrated of order zero, I(0), then it can be said that both y_t and p_t are cointegrated and not expected to remain apart in the long run. If cointegration exists, then information on one variable can be used to predict the other.

There are few other techniques for testing for and estimating cointegrating relationships in the literature. Of these techniques, the Johansen (1988) and Johansen and Juselius (1990) maximum-likelihood test procedure is the most efficient as it tests for the existence of a third cointegrating vector. This procedure gives two likelihood ratio tests for the number of cointegrating vectors: (a) the *maximal eigen value test*, which tests the null hypothesis that there are at least r cointergration vectors, as against the alternative that there are r+1, and (b) the *trace-test*, where the alternative hypothesis is that the number of cointegrating vectors is equal to or less than r+1.

In principle, there can be a long-run or equilibrium relationship between two series in a bivariate relationship only if they are stationary or if each series is at least

integrated of the same order (Campbell and Perron, 1991). That is, if two series are integrated of the same order, I (d) for d = 0, 1, 2,… then the two series are said to be cointegrated and the regression on the same levels of the two variables is meaningful (not spurious) and on long-run information is lost. Therefore, the first task is to check for the existence of stationarity property in the series for growth rate (y) and inflation rate (p).

To determine the non-stationary property of each variable, the authors test each of the series in the levels (log of real GDP and log of CPI) and in the first difference (growth and inflation rate). First, the DF test is used (Dickey and Fuller, 1979) and then the ADF test (Dickey and Fuller, 1981) with and without a time trend. The latter allows for higher autocorrelation in residuals. That is, the authors consider an equation of the form:

$$\Delta Xt = \beta 1 + \pi 1 Xt - 1 + \sum_{i=1}^{n} \rho 1 \Delta Xt - i + e1t \quad \ldots \ldots \ldots \ldots \qquad (ii)$$

However, as pointed out earlier, the ADF tests are unable to discriminate well between non-stationary and stationary series with a high degree of autoregression. It is therefore possible that inflation, which is likely to be highly autocorrelated, is in fact stationary although the ADF tests show that it is non-stationary. The ADF tests may also incorrectly indicate that the inflation series contain a unit root when there is a structural break in the series (Culver and Papell, 1997). A casual observation of the series indicates that there was a slight structural break in the Sri Lankan data during the early 1980s.

In consequence, the Phillips-Perron (PP) test (Phillips and Perron, 1988) is applied. The PP test has an advantage over the ADF test as it gives robust estimates when the series has serial correlation and time-dependent heteroscedasticity, and there is a structural break. For the PP test the authors estimate equation (iii).

$$\Delta Xt = \alpha + \pi 2 Xt - 1 + \phi \left(t - \frac{T}{2}\right) + \sum_{i=1}^{m} \varphi i \Delta Xt - i + e2t \ldots \ldots \ldots \ldots \text{(iii)}$$

In both equations (ii) and (iii), Δ is the first difference operator and e_{1t} and e_{2t} are covariance stationary random error terms. The lag length n is determined by Akaike's Information Criteria (AIC) (Akaike, 1973) to ensure serially uncorrelated residuals and m (for PP test) is decided according to Newley-West's (Newley and West, 1987) suggestions.

The null hypothesis of non-stationarity is tested using the t-statistic with critical values calculated by MacKinnon (1991). The null hypothesis that y_t and p_t are non-stationary time series is rejected if π_1 and π_2 are less than zero and statistically significant for each. Given the inherent weakness of the unit root test to distinguish between the null and the alternative hypotheses, both DF-ADF tests are applied

following Engle and Granger (1987) and Granger (1986), and subsequently supplemented by the PP test following West (1988) and Culver and Papell (1997). These tests are carried out for both variables by replacing X_t with y_t and p_t in equations (ii) (for the DF-ADF tests) and (iii) (for the PP test).

DF-ADF-PP unit root tests are also applied for residuals μ_t and η_t (from equations (ia) and (ib)) by respecifying equations (ii) and (iii) in terms of μt and η_t instead of X_t. When μ_t and η_t are found to be integrated of order zero then it can be concluded that these two series are cointegrated. If the hypothesis of no integration is rejected, a stable long-run relationship exists between economic growth and inflation.

According to Engle and Granger (1987), when y_t and p_t are found to be cointegrated then there must exist an associated error correction mechanism (ECM) that may take the following form:

$$\Delta y_t = \phi_{10} + \sum_{j=0}^{s} \phi_{11j}\Delta p_{t-j} + \sum_{i=1}^{q} \phi_{12i}\Delta yt - i + \rho_1\mu_{t-1} + e_{3t} \text{ ———————— } (iva)$$

$$\Delta p_t = \phi_{20} + \sum_{j=0}^{s} \phi_{21j}\Delta y_{t-j} + \sum_{i=1}^{q} \phi_{22i}\Delta pt - i + \rho_2\eta_{t-1} + e_{4t} \text{ ———————— } (ivb)$$

where Δ denotes the first difference operator, μ_{t-1} and η_{t-1} are error correction terms, s and q are the number of lag lengths (determined by AIC) and e_{3t} and e_{4t} are random disturbance terms. Here i begins at one and j begins at zero in order for the series to be related within a structural ECM (Engle and Yoo, 1991). The error correction terms μ_{t-1} and η_{t-1} (which are the residual series of the cointegrating vector normalized for y_t and p_t) measure deviations of the series from the long-run equilibrium relations. For the series to converge to the long-run equilibrium relation, $0 \leq \rho_1, \rho_2 \leq 1$ should hold. However, cointegration implies that not all ρ_1, ρ_2 should be zero.

II. DATA AND EMPIRICAL EVIDENCE

Economic growth rates (y) are calculated from the difference of logs of real gross domestic product (real GDP at 1990 prices). Likewise, inflation rates (p) are calculated from the difference of logs of CPI (1990 = 100) for all four countries. Annual data from the IMF *International Financial Statistics* CD-ROM have been used. Owing to abnormality immediately after the independence of Bangladesh, the 1972-1973 period has been excluded from the analysis (this period was included in the Bruno-Easterly 1998 study of high-inflation crises).

Results of unit root tests are reported in tables 2A and 2B. They show that both growth rate (y) and inflation (p) are integrated of order zero for Bangladesh, India and Pakistan when only DF and ADF tests are considered. But for Sri Lanka, while the growth rate is integrated of order zero, the inflation rate is integrated of

Table 1. Average inflation and growth rates

	Bangladesh		*India*		*Pakistan*		*Sri Lanka*	
	Inf	*Gr*	*Inf*	*Gr*	*Inf*	*Gr*	*Inf*	*Gr*
Mean	9.67	4.59	7.73	4.50	7.44	4.72	9.13	4.60
Stdev	8.52	2.61	5.25	3.35	5.23	2.98	5.40	1.70

Notes: Inf = inflation; Gr = economic growth; Stdev = standard deviation.
Period of study: Bangladesh 1974-1997; India 1961-1997; Pakistan 1957-1997; Sri Lanka 1966-1997. The periods of analysis are determined by data availability.

Table 2A. Unit root test with AD and ADF

Country	*Variables*	*DF*		*ADF*	
		(c)	*(c & t)*	*(c)*	*(c & t)*
Bangladesh	y	-8.25*	-8.06*	-2.83***(1)	-2.47 (1)
(1974-1997)	p	-3.36**	-3.00	-4.02* (1)	-4.22** (1)
India	y	-6.37*	-7.13*	-4.50* (1)	-5.47* (1)
(1961-1997)	p	-4.50*	-4.58*	-5.02* (1)	-5.19* (1)
Pakistan	y	-6.72*	-6.75*	-3.93* (1)	-3.94** (1)
(1957-1997)	p	-2.90***	-3.32***	-3.04** (1)	-3.40***(1)
Sri Lanka	y	-3.65**	-3.62**	-2.82***(1)	-2.84 (1)
(1966-1997)	p	-3.52**	-3.86**	-2.81***(1)	-3.16 (1)

Table 2B. Phillips Perron test for unit root

Country	*Variables*	*PP*	
		(c)	*(c & t)*
Bangladesh	y	-3.82* (2)	-7.66* (2)
	p	-3.48 (2)	-3.00 (2)
India	y	-6.38* (3)	-7.59* (3)
	p	-4.43* (3)	-4.42* (3)
Pakistan	y	-6.72* (3)	-6.74* (3)
	p	-2.93***(3)	-3.38***(3)
Sri Lanka	y	-3.67* (3)	-3.62** (3)
	p	-3.43** (3)	-3.80** (3)

Notes for tables 2A and 2B:
DF, ADF and PP tests were performed using Econometric Views Package.
Figures within parentheses indicate lag lengths.
*, ** and *** indicate significant at 1 per cent, 5 per cent and 10 per cent levels respectively comparing critical t statistics as computed by MacKinnon (1991).
c = y-intercept and c & t = intercept and the time trend.

order one when a time trend is included, a result consistent with Paul, Kearney and Chowdhury (1997). As mentioned earlier, this may be due to the possibility of structural change. Thus, when the PP test is applied (table 2B), both inflation and the growth rate are found to be I(0) for Sri Lanka. Therefore, any estimated relationship between the growth rate and inflation for Bangladesh, India, Pakistan and Sri Lanka would not be spurious.

Next, the authors examine the cointegrating relationship between economic growth and inflation. First, cointegrating equations (ia) and (ib) are estimated.

Results of cointegration tests and estimates of the cointegrating parameters are reported in tables 3A and 3B. They show that growth rates and inflation rates for all four countries are cointegrated. The empirical evidence also implies that there is a long-run relationship between growth rates and inflation rates in all four countries. Two interesting findings, consistent for all four countries, need to be emphasized: (a) the relationship between inflation and growth rates is positive and (b) the estimated elasticities (at mid-point) for inflation rates (p_t) are larger than those for growth (y_t). Estimated elasticities are presented in table 4.

Table 3A. Unit root test for the residuals and the coefficients of the dependent variables from equation (ia)

Country	*Coefficient of p_t*	*Unit root test of 'μ_t'*		
		DF	*ADF*	*PP*
Bangladesh	0.1017	-7.50*	-2.48 (1)	-7.08* (2)
India	0.0095	-6.34*	-4.47* (1)	-6.35* (3)
Pakistan	0.0851	-6.63*	-3.78* (1)	-6.66* (3)
Sri Lanka	0.0903	-3.60**	-2.94***(1)	-3.58**(3)

Table 3B. Unit root test for the residuals and the coefficients of the dependent variables from equation (ib)

Country	*Coefficient of y_t*	*Unit root test of 'η_t'*		
		DF	*ADF*	*PP*
Bangladesh	1.0867	-4.98*	-4.56* (1)	-4.92* (2)
India	0.0232	-4.60*	-5.16* (1)	-4.48* (3)
Pakistan	0.2627	-2.82***	-2.93***(1)	-2.85***(3)
Sri Lanka	0.9095	-3.68*	-3.17** (1)	-3.60** (3)

Notes for table 3A and 3B:

DF, ADF and PP tests were performed using Econometric Views Package.

Figures within parentheses indicate lag lengths.

*, ** and *** indicate significant at 1 per cent, 5 per cent and 10 per cent levels respectively comparing critical t statistics as computed by MacKinnon (1991).

Table 4. Estimated elasticities at mid-points

Country	*Growth elasticity (with respect to inflation)*	*Inflation elasticity (with respect to growth)*
Bangladesh	0.214	0.516
India	0.016	0.014
Pakistan	0.134	0.167
Sri Lanka	0.179	0.458

Relatively smaller coefficients (of both y and p) and elasticities for India may be explained by greater price controls.

These findings have important policy implications – inflation is helpful rather than harmful to growth, and faster economic growth is likely to be inflationary. While this is very much in line with the structuralist position, caution is needed since higher inflation may trigger inflationary spirals beyond a safe level as implied by larger inflation elasticities. As Bruno (1995: 38) puts it, "chronic inflation tends to resemble smoking; once you get the habit, it is very difficult to escape a worsening addiction".

Table 5 reports eigen values and the likelihood-ratio statistics for determining the number of cointegrating vectors k using Johansen's maximum-likelihood approach. The authors systematically test the null hypothesis of no cointegration (k = 0) against the alternative of k<=1 and k<=2. The results show that the null hypothesis of no cointegration (k = 0) is not rejected for all four countries. Therefore, it can again be confirmed that y and p are cointegrated in all four countries. However, Johansen's tests also indicate that there could be a third integrating vector in the inflation-growth relationship for India and Sri Lanka.

Table 5. Johansen's maximum-likelihood procedure

Cointegration LR test based on maximum eigen value of the stochastic matrix y & p				
Country	*Eigen value*	*Null*	*Alternative*	*Likelihood-ratio statistics*
Bangladesh	0.52	k = 0	k = 1	15.36**
	0.20	k <= 1	k = 2	4.68
India	0.51	k = 0	k = 1	24.42*
	0.25	k <= 1	k = 2	9.91**
Pakistan	0.33	k = 0	k = 1	15.18**
	0.12	k <= 1	k = 2	4.75
Sri Lanka	0.38	k = 0	k = 1	14.01***
	0.22	k <= 1	k = 2	7.05***

*, ** and *** indicate significant at 1 per cent, 5 per cent and 10 per cent levels respectively.

Tables 6A and 6B present estimated coefficients of the error correction term (long-run effects) and the lagged values of the two series (short-run effects). The results show the existence of a significant feedback relationship between inflation and economic growth for all four countries. The estimated coefficients of the error correction term (ρ_1 and ρ_2) are significant at the 1 per cent level (except for Pakistan, significant at the 10 per cent level) from growth rates to inflation and vice versa with appropriate (negative) signs. This means that if the two series are out of equilibrium, as specified in the cointegrating regression (ia) and (ib), growth rates will adjust to reduce the equilibrium error and vice versa in all four countries. The estimated value of the coefficient of the error correction term shows that the system corrects its previous

Table 6A. Error correction model

Variables equation	*Bangladesh*		*India*	
	(iva)	*(ivb)*	*(iva)*	*(ivb)*
Const.	-0.0542	0.1380	0.0014	0.0044
	(-3.84)*	(-4.16)*	(0.25)	(0.55)
Time	0.0016	-0.0045	-------	-------
	(3.58)*	(4.26)*		
EC Term	-0.82	-0.72	-1.33	-0.99
	(-3.86)*	(-4.98)*	(-5.07)*	(-4.78)*
Δy_t	-----	0.29	------	-0.0014
		(1.60)***		(-0.0065)
Δy_{t-1}	-0.65	-------	0.11	-0.58
	(-3.27)*		(0.65)	(-2.13)**
Δy_{t-2}	-0.38	----	------	-0.63
	(-2.77)*			(-2.25)**
Δy_{t-3}	-------	-------	-------	-0.39
				(1.82)**
Δp_t	-0.14	-----	-0.16	-----
	(-1.30)		(-1.51)***	
Δp_{t-1}	-----	----	-0.11	0.26
			(1.13)	(1.57)***
Δp_{t-2}	------	0.27	-0.28	------
		(2.52)**	(-2.83)*	
$\bar{R}^2$	0.8851	0.5418	0.5886	0.5091
DW	1.9641	2.1142	1.8042	2.0307
SC	0.0011	0.1998	0.3147	0.0386
FF	0.1125	0.6631	0.7165	1.1215
Normality	1.5054	2.4086	0.6076	5.6240
Het.	0.3519	0.3789	0.2083	0.1366

Table 6B. Error correction model

Variables equation	*Pakistan*		*Sri Lanka*	
	(iva)	*(ivb)*	*(iva)*	*(ivb)*
Const.	-0.0005	0.0079	-0.0015	0.0056
	(-0.10)	(1.28)	(-0.51)	(0.62)
EC Term	-0.44	-0.53	-0.76	-0.68
	(-1.66)***	(-3.85)*	(-4.23)*	(-3.57)*
Δy_t	-----	0.58	------	0.98
		(-2.62)*		(2.05)**
Δy_{t-1}	-0.66	0.81	------	-----
	(-3.01)*	(3.00)*		
Δy_{t-2}	-0.39	0.52	0.22	0.32
	(-2.70)*	(2.22)**	(1.26)	(0.61)
Δp_t	0.30	-----	0.07	-----
	(2.77)*		(1.47)***	
Δp_{t-1}	-----	0.16	------	-----
		(1.01)		
Δp_{t-2}	------	------	-0.04	-0.68
			(-0.74)	(-0.27)
$\bar{R}^2$	0.6292	0.3550	0.3835	0.3337
DW	1.9051	2.0567	1.7783	1.9625
SC	0.0853	1.9724	0.4381	0.0004
FF	0.7948	7.4479	0.0006	0.0230
Normality	4.3374	2.56	0.4840	0.2579
Het.	0.0257	0.78	0.6422	0.8857

Notes for tables 6A and 6B:

Figures in parentheses are t-statistics.

*, ** and *** indicate significant at 1 per cent, 5 per cent and 10 per cent levels respectively comparing critical t statistics from standard t-table.

DW = Statistic for testing residual serial correlation.

SC = Godfrey's (1978a, 1978b) test for residual serial correlation.

FF = Ramsey's (1969, 1970) RESET test functional form.

Normality = Jarque – Bera test for skewness and excess kurtosis of the residuals (Jarque and Bera 1980 and Bera and Jarque, 1981).

Het. = Heteroscedasticity (Koenker, 1981).

period's level of disequilibrium by $100\rho_1$ per cent (or $100\rho_2$ per cent) a year. For instance, the error correction term -0.53 (column 2 of table 6B) implies that 53 per cent of the adjustment towards the long-run equilibrium relation for Pakistan occurs within a year through changes in growth rates. However, the error correction term for India calculated from equation (iva) of -1.33 (column 3 of table 6A) could be interpreted in such a way that the error tends to be overcorrected.[2]

III. CONCLUDING REMARKS

In this paper, the authors used cointegration and error correction models to empirically examine long-run and short-run dynamics of the inflation-economic growth relationship for four South Asian countries using annual data. The main objective was to examine whether a relationship exists between economic growth and inflation and, if so, its nature. In addition to significant feedbacks between inflation and economic growth, the authors found two interesting results. First, inflation and economic growth are positively related. Second, the sensitivity of inflation to changes in growth rates is larger than that of growth to changes in inflation rates. These findings have important policy implications. Contrary to the policy advice of the international lending agencies, attempts to reduce inflation to a very low level (or zero) are likely to adversely affect economic growth. However, attempts to achieve faster economic growth may overheat the economy to the extent that the inflation rate becomes unstable. Thus, these economies are on a knife-edge. The challenge for them is to find a growth rate which is consistent with a stable inflation rate, rather than beat inflation first to take them to a path of faster economic growth. They need inflation for growth, but too fast a growth rate may accelerate the inflation rate and take them downhill as found by Bruno and Easterly (1998).

[2] We thank Professor N. Cameron, University of Manitoba, Canada for pointing this out.

REFERENCES

Akaike, H., 1973. "Information theory and the extension of the maximum likelihood principle", in B.N. Petrov and F. Csaki, eds., *Proceedings of the Second International Symposium on Information Theory,* Budapest, pp. 267-281.

Barro, R., 1996. "Inflation and growth", *Federal Reserve Bank of St. Louis Review,* vol. 78, pp. 153-169.

Bera, A.K. and C.M. Jarque, 1981. "An efficient large-sample test for normality of observations and regression residuals", *Australian National University Working Papers in Econometrics*, 40, Canberra.

Bruno, M., 1995. "Does high inflation really lower growth?", *Finance and Development,* vol. 32, pp. 35-38.

Bruno, M. and W. Easterly, 1998. "Inflation crises and long-run growth", *Journal of Monetary Economics,* vol. 41, pp. 3-26.

Campbell, J. and P. Perron, 1991. "Pitfalls and opportunities: what macroeconomics should know about unit roots", in O.J. Blanchard and S. Fischer, eds., *NBER Macroeconomics Annual 1991* (Cambridge: MIT Press).

Culver, E.S. and H.D. Papell, 1997. "Is there a unit root in the inflation rate? Evidence from sequential break and panel data models", *Journal of Applied Econometrics,* vol. 12, pp. 435-444.

Dickey, D.A. and W.A. Fuller, 1979. "Distribution of the estimators for auto-regressive time series with a unit root", *Journal of the American Statistical Association,* vol. 74, pp. 427-431.

_____, 1981. "Likelihood ratio statistics for auto regressive time series with a unit root", *Econometrica,* vol. 49, pp. 1057-1072.

Dornbusch, R., 1993. *Stabilization, Debt, and Reform: Policy Analysis for Developing Countries,* New York: Harvester Wheatsheaf.

Dornbusch, R. and A. Reynoso, 1989. "Financial factors in economic development", *American Economic Review (Papers and Proceedings), vol. 79, pp. 204-209.*

Engle, R.F. and. B.S. Yoo, 1987. "Forecasting and testing in co-integrated systems", *Journal of Econometrics,* vol. 35, pp. 143-159.

Engle, R.F. and B.S. Yoo, 1991. "Cointegrated economic time series: an overview with new results", in R.F. Engle and C.W.J. Granger, eds., Long-Run *Economic Relationships,* Oxford: Oxford University Press, pp.237-266.

Engle, R.F. and C.W.J. Granger, 1987. "Co-integration and error correction: representation, estimation and testing", *Econometrica,* vol. 55, pp. 1-87.

Fischer, S., 1993. "The role of macroeconomic factors in economic growth", *Journal of Monetary Economics,* vol. 32, pp. 485-512.

Friedman, M., 1973. *Money and Economic Development,* Toronto: Lexington Books.

Godfrey, L.G., 1978a. "Testing against general autoregressive and moving average error models when the regressors include lagged dependent variables", *Econometrica,* vol. 46, pp. 1293-1301.

_____, 1978b. "Testing for higher order serial correlation in regression equations when the regressors include lagged dependent variables", *Econometrica,* vol. 46, pp. 1303-1310.

Granger, C.W.J., 1986. "Developments in the study of co-integrated economic variables", *Oxford Bulletin of Economics and Statistics,* vol. 48, pp. 213-228.

Hossain, A. and A. Chowdhury, 1996. *Monetary and Financial Policies in Developing Countries,* London: Routledge.

Jarque, C.M. and A.K. Bera, 1980. "Efficient tests for normality, homoscedasticity and serial independence of regression residuals", *Economics Letters,* vol. 6, pp. 255-259.

Johansen, S., 1988. "Statistical analysis of cointegration vectors", *Journal of Economic Dynamics and Control,* vol. 12, pp. 231-254.

Johansen, S. and K. Juselius, 1990. "Maximum likelihood estimation and inference on cointegration-with the application to the demand for money", *Oxford Bulletin of Economics and Statistics,* vol. 52, pp. 169-210.

Koenker, R., 1981. "A note on studentizing a test for heteroskedasticity", *Journal of Econometrics,* vol. 74, pp. 119-147.

Levine, R. and D. Renelt, 1992. "A sensitivity analysis of cross-country growth regressions", *American Economic Review,* vol. 82, pp. 942-963.

Levine, R. and S. Zervos, 1993. "What have we learned about policy and growth from cross-country regressions?", *American Economic Review,* vol. 83, pp. 426-430.

MacKinnon, J., 1991. "Critical values for cointegration tests", in R.F. Engel and C.W.J. Granger, eds., *Long Run Economic Relationships: Readings in Cointegration,* Oxford: Oxford University Press.

Newley, W.K. and K.D. West, 1987. "A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix", *Econometrica,* vol. 55, 703-8.

Paul, S., C. Kearney and K. Chowdhury, 1997. "Inflation and economic growth: a multi-country empirical analysis", *Applied Economics,* vol. 29, pp. 1387-1301.

Phillips, P.C.B. and P. Perron, 1988. "Testing for a unit root in time series regression", *Biometrika,* vol. 75, pp. 335-346.

Ramsey, J.B., 1969. "Test for specification errors in classical linear least square regression analysis", *Journal of the Royal Statistical Society B,* pp. 350-371.

Ramsey, J.B., 1970. "Models, specification error and inference: a discussion of some problems in econometric methodology", *Bulletin of the Oxford Institute of Economics and Statistics,* vol. 32, pp. 301-318.

Tun Wai, U., 1959. "The relation between inflation and economic development: a statistical inductive study", *IMF Staff Papers,* vol. 7, pp. 302-317.

West, Kenneth D., 1988. "On the interpretation of near random walk behavior in GNP", *American Economic Review,* vol. 78, pp. 202-209.