# Inflation and Economic Growth Link – Multi-Country Scenario

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**ABSTRACT**

This paper inspects the intercommunication between inflation and economic growth for ten (10) selected countries using annual data series collected from World Bank Development Indicator. GDP and CPI data are used in this regard. Series are found to be stationary at level 1. Residual and Johansen Cointegration tests confirm the long-run relationship between variables. Short-run dynamics are checked by the Error Correction Model. Desired negative signs are contained in the ECT for all sequences, and absolute values are <1. Except for the UK data, the inflation imbalance will be adjusted by economic growth for all countries and vice versa. The ECT of India is observed to be high −0,736 and −0862, suggesting that 73% and 86% of imbalances would converge in long-term equilibrium owing to shifts in inflation and economic growth, respectively. The sensitivity of inflation to growth and vice versa varies from country to country. The study also shows that the association between inflation and economic growth is favorable for some countries and the opposite for other countries. Such outcomes lead policymakers to enact policies to regulate the economy in the context of macroeconomic management.

**Keywords:** Multi-countries, Consumer Price Index, Economic Growth Rate, Cointegration, Error Correction Model
**JEL Classifications:** E20, E31, E32, O5, O40, O47

## 1. INTRODUCTION

This paper conducts a multi-national empirical examination of the pattern and relation of inflation and economic growth in a sample of 10 nations using yearly data. This sample includes developed, developing, and emerging economies over the world. Inflation and economic growth are two significant macroeconomic variables for the policymakers. Durable high growth rate and mild inflation are the two major goals of the conventional macroeconomic strategies. Inflation is the rate of change in prices (Dornbusch et al., 2014). If we have the last year price level $P_0$ present year price level $P_1$ then inflation ($Y$) is measured by $Y = \dfrac{P_1 - P_0}{P_0}$ (Dornbusch et al., 2014).

There are several measures of inflation, among them consumer price index (CPI) will be used for this study. CPI calculates the expenditure of purchasing a specific bundle of commodities by the town people (Dornbusch et al., 2014). On the other hand, an increasing trend in market values (after inflation adjustment) of

commodities and services produced by an economy over the year is called economic growth. It is usually assessed as the growth rate of real gross domestic product, or GDP (Munyeka, 2014). Many factors can influence economic growth; inflation is one of them (Švigir and Miloš, 2017). It is globally recognized that primary factors for the inflationary growth are considered as an extended level of economic activity. So, potent economic activity arise lofty price and infirm economic activity reduces the hike. Thus inflation has a significant impact on the economic fixity of a nation (Munyeka, 2014).

Empirical studies found that the association between economic growth and inflation is a complex one, it may be positive, negative or neutral (Švigir and Miloš, 2017). Studies conducted in rising countries have observed a positive link, and for industrial and developed countries, it is noticed an inverse relation between inflation and economic growth (Švigir and Miloš, 2017). Inflation has a positive impact on capital creation that will leads to the finer economic growth (Munyeka, 2014). On the other hand, the growth

rate is subject to the scale of return and inflation reduces this scale of return, hence economic growth has inverse link with inflation (Gultekin, 1983). Growth is negatively associated with inflation by dropping capital stock and productivity (Fischer, 1993). There is a dispute between two schools of economics, i.e., Structuralists and Monetarists regarding this issue. Structuralists contemplate inflation as an essential element of a country's economic growth while Monetarists exposed that inflation has the power to determine economic progress (Mallik and Chowdhury, 2001). Empirical studies also observed mix type of ties between inflation and economic growth - unidirectional causality, bi-directional causality or no causality.

The concern about inflation and growth is a controversial and restrained topics in the process of the development of the nation, which is very dominant for taking macroeconomic goals and consideration of stable economy (Aydın et al., 2016). Now a day, a mentionable theoretical and experimental study has scrutinized the exchange of inflation-growth. Along with these studies mentioned above this study is an effort which tried to examine inflation-growth ties among 10(ten) countries.

## 2. LITERATURE REVIEW

There have been a lot of researches on price hike and economic development cooperation. Some researchers have tried to check this relationship for a single country; others wanted to test in many countries. This present research would like to inquire the relation of inflation and economic growth in multi-countries. Thus the paper only reviewed the literature of cross countries related works.

Fischer (1993) used cross-sectional, and panel regression and found inflation reduce growth by reducing investment and productivity growth. In different exceptional cases, he showed little price-hike is not required for towering progress even over a long period high inflation is not correlative with stable development.

Motley (1994) has studied the impact of inflation on real growth using data from a cross-section of countries over 30 years period. There finding suggested that a 5% decrease in inflation leas the growth increase between 0.1% and 0.5%.

Barro (1996) conducted a survey on one hundred countries for the period of 1960 to 1990 and discovered that if inflation is increased by 10% yearly it decline the yearly growth rate 0.2 % to 0.3% he also shows the impact of another factors of growth addition to inflation.

Paul et al. (1997) found a complicated relationship between inflation and economic growth. This study has included 70 countries for the period of 1960-1989. After analysis, 40% of countries have to be found no causal relationship; nearly 20% of countries are shown a bidirectional causality, and the rest of the countries showed unidirectional relation between inflation and economic growth. Their study also reveals that the less inflationary country will on stable redistribute real growth chances far away from the developing nations unto the developed countries.

There is a direct association between inflation and economic growth when inflation is mild but it move to negative for lofty inflationary countries (Ghosh and Phillips, 1998). Their study investigates 145 countries. Using the decision-tree technique, inflation is found one of the most critical elements of growth.

Khan and Ssnhadji (2001) studied 140 industrialized and developing countries for the period ranging from1960 to 68 and found that inflation slows the growth after 12% for the developing countries and 3% for industrial nations.

Using data of four South Asian countries Mallik and Chowdhury (2001) observed a positive long run relation between price hike and economic growth. Their study also suggested that medium inflation helps in rapid economic growth.

Pollin and Zhu (2006) found some exciting result while studying 80 countries over the period 1961-2000. They categorize the sample by income and decade wise. In OECD countries, the pattern of the variables is not evident. In the case of middle and low-income countries, the coefficient of inflation is found positive, but middle-income countries they are found to be insignificant. With the groupings by decade, this relation is found highly correlated.

Vinayagathasan (2013) used dynamic panel threshold regression to investigate the inflation-economic growth nexus in 32 Asian countries for the period of 1980-2009. He found inflation hurts growth where it exceeds 5.43% but has no effect below this level.

Aydın et al. (2016) found a non-linear relationship between inflation and growth rate in five Turkish Republic. Their study expose that up to 7.97% inflation has a positive influence on economic growth, and above this percentage, it will be detrimental for growth.

Švigir and Miloš (2017) investigated the economic growth and inflation tie in Austria and Italy. They use two types of analyses in their study-comparative data analysis and regressive analysis. From the data analysis, their study found, between 1980 and 1984, Italy faced a low level of economic growth when inflation rates were high. In 1985-1996 inflation rate was moderate, but the growth rate was relatively small. Low inflation could not find a sufficient factor to growth in the period of 1997-2016 even it was negative since 2009. Through the regressive analysis, the correlation between inflation and growth rates is found weak in Italy, and 51% increase in inflation will lead to 0.213% increase in economic growth while it is found to be statistically insignificant. Again for mid-1980s and 1990s, comparative data analysis is found that inflation had coincided with favorable growth rates in Austria when inflation was in declining trends or low. From the regression analysis, a statistically significant effect of inflation didn't found in Austria. Inflation can explain only 11.88% variation of growth rate in Austria between the study time.

N'dri (2017) investigate the tie between inflation and economic growth in Cote d'Ivoire using annual data from 1985 to 2010. The study has found an exciting result that inflation imparts a significant positive economic growth in the long-run, but in the short run, the relation is found to be negative but insignificant.

# 3. DATA DESCRIPTION

This article employs the cointegration and error correction model (ECM) to detect the inflation-economic growth ties in 10 countries over the world. This work is motivated by seminal work of (Mallik and Chowdhury, 2001) where they studied on four south Asian countries. This study has used secondary sources of data collected from the world bank development indicator (WDI). Name of the countries, the number of observations, and duration of data are listed in the Table 1.

# 4. METHODOLOGY AND RESULT ANALYSIS

The study aims to check the inflation and growth relation in some selected countries. GDP and consumer price index data at constant 2010 US$ are collected primarily from World Bank data set. Growth and inflation are measured by the of log GDP and log CPI, respectively for all countries (Mallik and Chowdhury, 2001). For the convenience, economic growth is denoted by X, and the inflation is denoted by Y variable. The descriptive statistics are presented in Table 2.

In principle, an equilibrium (or long-run) relationship between two series exists if they are stationary (unit root problem does not appear) or if all series are at integrated anyway in equal order (Campbell and Perron, 1991).

Two series are said to be cointegrated if they are integrated in the identical order, and then regression on the equal levels of series are cabalistic (Mallik and Chowdhury, 2001). Thus, the main job is to examine whether the series are stationary. This research examines the stationary properties of the log value of GDP and CPI series, and their first differences. However, the sequence of this analysis is observed to be non-stationary at the level but stationary at the beginning of the differences. Result of unit root tests are reported in (Table 3a and b):

Inflation and growth of Malaysia, Thailand, Pakistan, India, and Bangladesh are found to be stationary in all tests. Inflation data of USA is found stationary in only DF test (at constant) and ADF test (at constant and trend), on the other hand growth, is found stationary in all tests. Time series of Japan have found stationary in the first three tests, but the growth is observed non-stationary in KPSS test. UK inflation is found stationary only in KPSS test, but the growth is stationary in all tests. China data shows the diversified results, both inflation and growth are found stationary in DF test, KPSS result has shown stationary in constant and non-stationary in constant and trend, but in PP tests they are found non –stationary. Thus, anyway we can say that inflation and growth of the sample countries are stationary at level that is I(1). Thus the empirical link between the variable X and Y of sample countries would not be spurious (Mallik and Chowdhury, 2001).

Now the study checks the cointegration relation between economic growth and inflation of the selected countries. Cointegration

**Table 1: Data introduction**

| S. No. | Name of the country | Observation period | Number of observations |
|--------|---------------------|--------------------|------------------------|
| 1. | Malaysia | 1961-2017 | 57 |
| 2. | USA | 1961-2017 | 57 |
| 3. | Thailand | 1961-2017 | 57 |
| 4. | Singapore | 1961-2017 | 57 |
| 5. | Pakistan | 1961-2017 | 57 |
| 6. | UK | 1961-2017 | 57 |
| 7. | Japan | 1976-2017 | 42 |
| 8. | India | 1961-2017 | 57 |
| 9. | Bangladesh | 1987-2017 | 31 |
| 10. | China | 1987-2017 | 31 |

Real GDP and consumer price index (CPI) at constant 2010US($) used as the proxies of economic growth and inflation respectively of the nations

**Table 2: Descriptive statistics (authors calculation using E-views 9)**

| | Variables | Maximum | Minimum | Mean | Stdev |
|--------|-----------|---------|---------|------|-------|
| Malaysia | Y | 15.981 | −0.409 | 3.026 | 2.733 |
| | X | 11.065 | −7.644 | 6.134 | 3.233 |
| USA | Y | 12.706 | −0.356 | 3.710 | 2.660 |
| | X | 7.007 | −2.814 | 2.977 | 2.041 |
| Thailand | Y | 21.793 | −0.904 | 4.191 | 4.263 |
| | X | 12.476 | −7.940 | 5.784 | 3.489 |
| Singapore | Y | 20.186 | −1.859 | 2.482 | 3.764 |
| | X | 14.185 | −3.749 | 7.047 | 4.021 |
| Pakistan | Y | 23.636 | −0.517 | 7.606 | 4.799 |
| | X | 10.753 | 0.467 | 5.032 | 2.252 |
| UK | Y | 21.678 | 0.367 | 5.017 | 4.525 |
| | X | 6.387 | −4.277 | 2.375 | 2.024 |
| Japan | Y | 8.960 | −1.362 | 1.473 | 2.362 |
| | X | 6.564 | −5.568 | 2.207 | 2.277 |
| India | Y | 25.152 | −7.941 | 7.275 | 4.604 |
| | X | 9.767 | −5.380 | 5.187 | 2.979 |
| Bangladesh | Y | 10.791 | 1.987 | 6.106 | 2.202 |
| | X | 7.031 | 2.387 | 5.125 | 1.185 |
| China | Y | 21.718 | −1.411 | 4.903 | 5.932 |
| | X | 13.305 | 3.832 | 9.037 | 2.375 |

between the 2-time series is examined by Engle-Granger two-step procedure using the following equations (Engle and Yoo, 1987):

$$X_t = \alpha_0 + \alpha_1 Y_t + \vartheta_t \tag{1}$$

$$Y_t = \beta_0 + \beta_1 X_t + \tau_t \tag{2}$$

Where $\vartheta_t$ and $\tau_t$ are the residual terms which measure in what extent $X_t$ and $Y_t$ are divergence from equilibrium. If $\vartheta_t$ and $\tau_t$ are integrated of zero order, i.e. I(0), then it is said that $X_t$ and $Y_t$ are cointegrated and the information of one series can use to forecast the other which leads a stable long term nexus between growth and inflation (Mallik and Chowdhury, 2001). The unit root tests for residuals $\vartheta_t$ and $\tau_t$ are checked by DF-ADF-PP tests. (Table 4a and b) is reported the outcomes of unit root test for residuals and the estimates of the cointegrating coefficients:

The estimated results reject the null hypothesis for all tests that is the time series of all countries are cointegrated, and a long run relationship exists between growth and inflation . However, an interesting finding regarding the coefficients that-coefficients of economic growth and inflation of the USA, Pakistan, UK, and

**Table 3a: Unit root test (DF and ADF) (authors calculation using E-views 9)**

| Countries | Variables | C | C and T | C | C and T |
|---|---|---|---|---|---|
| Malaysia | Y | −3.563*** | −4.001*** | −4.309*** | −4.303*** |
| | X | −6.258*** | −6.759*** | −6.366*** | −6.640*** |
| USA | Y | −1.663* | −1.980 | −2.000 | −3.515** |
| | X | −5.132*** | −5.582*** | −5.222*** | −5.835*** |
| Thailand | Y | −3.541*** | −3.901*** | −3.744*** | −4.202*** |
| | X | −4.175*** | −4.724*** | −4.167*** | −4.928*** |
| Singapore | Y | −2.930*** | −5.495*** | −5.544*** | −5.726*** |
| | X | −5.342*** | −5.983*** | −5.303*** | −5.948*** |
| Pakistan | Y | −2.714*** | −3.156* | −3.377** | −3.291* |
| | X | −5.583*** | −6.319*** | −5.682*** | −6.274*** |
| UK | Y | −2.011** | −2.308 | −2.030 | −2.567 |
| | X | −5.237*** | −5.387*** | −5.193*** | −5.310*** |
| Japan | Y | −2.333** | −3.442** | −2.442 | −3.504** |
| | X | −0.499 | −5.453*** | −3.878*** | −5.873*** |
| India | Y | −4.155*** | −4.972*** | −5.672*** | −5.622*** |
| | X | −6.333*** | −8.404*** | −6.572*** | −8.346*** |
| Bangladesh | Y | −3.477*** | −3.936*** | −4.117*** | −4.284** |
| | X | −2.109** | −4.956*** | −2.307 | −4.785*** |
| China | Y | −2.282** | −4.292*** | −3.666** | −2.798 |
| | X | −2.417** | −3.973*** | −3.923*** | −3.913** |

***, **, and * indicate the rejection of null hypothesis at 1%, 5% and 10% level of significance

**Table 3b: Unit root test (PP and KPSS) (authors calculation using E-views 9)**

| Countries | Variables | C | C and T | C | C and T |
|---|---|---|---|---|---|
| Malaysia | Y | −4.372*** | −4.359*** | 0.127 | 0.111 |
| | X | −6.376*** | −6.615*** | 0.327 | 0.055 |
| USA | Y | −2.389 | −2.540 | 0.357* | 0.142* |
| | X | −5.182*** | −5.672*** | 0.528** | 0.065 |
| Thailand | Y | −3.789*** | −3.876** | 0.302 | 0.118 |
| | X | −4.119*** | −4.947*** | 0.531** | 0.065 |
| Singapore | Y | −3.939*** | −3.895** | 0.217 | 0.121* |
| | X | −5.329*** | −5.948*** | 0.507** | 0.048 |
| Pakistan | Y | −3.409** | −3.318* | 0.093 | 0.074 |
| | X | −5.783*** | −6.290*** | 0.445* | 0.053 |
| UK | Y | −2.118 | −2.514 | 0.439* | 0.116 |
| | X | −5133*** | −5.118*** | 0.261 | 0.041 |
| Japan | Y | −2.436 | −3.577** | 0.72** | 0.093 |
| | X | −3.878*** | −5.883*** | 0.869*** | 0.156** |
| India | Y | −5.072*** | −5.004*** | 0.063 | 0.062 |
| | X | −6.651*** | −10.700*** | 0.948*** | 0.082 |
| Bangladesh | Y | −4.136*** | −4.288** | 0.175 | 0.112 |
| | X | −2.008 | −4.739*** | 0.704** | 0.062 |
| China | Y | −2.076 | −2.600 | 0.450 | 0.182** |
| | X | −2.471 | −2.327 | 0.157 | 0.151* |

***, **, and * indicate the rejection of null hypothesis at 1%, 5% and 10% level of significance

**Table 4a: Unit root test for residual for equation-1 (authors calculation using E-views 9)**

| Countries | Coefficient of inflation (Y) | DF | ADF | PP |
|---|---|---|---|---|
| Malaysia | 0.2036 | −6.233*** | −6.652*** | −6.627*** |
| USA | −0.1479 | −4.957*** | −5.280*** | −5.313*** |
| Thailand | 0.0187 | −4.191*** | −4.226*** | −4.182*** |
| Singapore | 0.1815 | −5.455*** | −5.502*** | −5.512*** |
| Pakistan | −0.0881 | −6.039*** | −6.058*** | −6.119*** |
| UK | −0.1357 | −5.138*** | −5.144*** | −5.172*** |
| Japan | 0.4292 | −4.279*** | −4.607*** | −4.593*** |
| India | −0.0101 | −6.336*** | −6.663*** | −6.739*** |
| Bangladesh | 0.1037 | −2.064** | −2.500** | −2.266** |
| China | 0.1244 | −2.604** | −2.722*** | −2.563** |

***, **, and * indicate the rejection of null hypothesis at 1%, 5% and 10% level of significance

**Table 4b: Unit root test for residual for equation-2 (authors calculation using E-views 9)**

| Countries | Coefficient of growth (X) | DF | ADF | PP |
|---|---|---|---|---|
| Malaysia | 0.1455 | −3.626*** | −4.544*** | −4.493*** |
| USA | −0.2512 | −2.043** | −2.436** | −2.449** |
| Thailand | 0.0279 | −3.557*** | −3.801*** | −3.847*** |
| Singapore | 0.1591 | −3.016*** | −5.842*** | −4.076*** |
| Pakistan | −0.4004 | −2.991*** | −3.716*** | −3.664*** |
| UK | −0.6782 | −1.879* | −1.907* | −1.746* |
| Japan | 0.4615 | −1.849* | −4.324*** | −4.322*** |
| India | −0.0241 | −4.164*** | −5.741*** | −5.245*** |
| Bangladesh | 0.3576 | −3.402*** | −4.336*** | −4.336*** |
| China | 0.7760 | −2.474** | −2.475** | −2.404** |

***, **, and * indicate the rejection of null hypothesis at 1%, 5% and 10% level of significance

India have found negative and other countries have a positive sign. It is a remarkable finding that in Malaysia, Thailand, Singapore, Japan, Bangladesh and China inflation and economic growth are positively correlated and in the USA, Pakistan, UK and India these two variables are negatively correlated. Sensitivity of inflation to changes in growth is high for Malaysia and Singapore. On the other hand sensitivity of growthto change in inflation is high for Thailand, Japan, Bangladesh, China, USA, Pakistan, UK, and India.

Table 4c reports eigenvalues, maximum-eigenvalue statistic, and trace-statistic to check the cointegration. The empirical outcomes show that the null hypothesis: Unit root is present is not accepted for all countries i.e., Y and X are cointegrated for all countries. The UK has only a cointegrating vector, but other all countries have at least two integrating vectors since alternative hypothesis cannot be rejected for these countries.

When two series are cointegrated, then a combine error correction mechanism (ECM) must be subsisted (Engle and Granger, 1987) which may be express as following form:

$$\Delta X_t = \rho_{10} + \sum_{i=0}^{m} \rho_{11i}\Delta Y_{t-i} + \sum_{j=1}^{n} \rho_{12j}\Delta X_{t-j} + \gamma_1\vartheta_{t-1} + \varepsilon_t \quad (3a)$$

$$\Delta Y_t = \rho_{20} + \sum_{i=0}^{m} \rho_{21i}\Delta X_{t-i} + \sum_{j=1}^{n} \rho_{12j}\Delta Y_{t-j} + \gamma_1\vartheta_{t-1} + \varepsilon_t \quad (3b)$$

## Table 4c: Cointegration test (authors calculation using E-views 9)

| Countries | Null hypo | Alter. hypo | Eigenvalues | Max-Eigen Statistic | Trace statistic |
|---|---|---|---|---|---|
| Malaysia | r=0 | r>0 | 0.2612 | 16.347*** | 25.931*** |
| | r≤1 | r>1 | 0.1626 | 9.583*** | 9.583*** |
| USA | r=0 | r>0 | 0.2865 | 18.571*** | 22.919*** |
| | r≤1 | r>1 | 0.0760 | 4.347** | 4.347** |
| Thailand | r=0 | r>0 | 0.2360 | 14.538** | 21.314*** |
| | r≤1 | r>1 | 0.1179 | 6.776*** | 6.776*** |
| Singapore | r=0 | r>0 | 0.2525 | 15.717*** | 24.057*** |
| | r≤1 | r>1 | 0.1431 | 8.339*** | 8.339*** |
| Pakistan | r=0 | r>0 | 0.2321 | 14.263* | 23.066*** |
| | r≤1 | r>1 | 0.1504 | 8.803*** | 8.803*** |
| UK | r=0 | r>0 | 0.2645 | 16.589** | 18.517** |
| | r≤1 | r>1 | 0.0350 | 1.928 | 1.928 |
| Japan | r=0 | r>0 | 0.2516 | 15.942** | 19.072** |
| | r≤1 | r>1 | 0.0553 | 3.130* | 3.130* |
| India | r = 0 | r>0 | 0.3551 | 23.691*** | 33.942*** |
| | r≤1 | r>1 | 0.1729 | 10.252*** | 10.252*** |
| Bangladesh | r=0 | r>0 | 0.4174 | 15.668** | 19.661** |
| | r≤1 | r>1 | 0.1286 | 3.992** | 3.992** |
| China | r=0 | r>0 | 0.3347 | 11.414 | 17.077** |
| | r≤1 | r>1 | 0.1831 | 5.664** | 5.664** |

## Table 5a: Error correction estimate (authors calculation using E-views 9)

| Variables | Malaysia | | USA | | Thailand | |
|---|---|---|---|---|---|---|
| | 3a | 3b | 3a | 3b | 3a | 3b |
| Constant | −0.0723 (−0.163) | 0.0755 (0.234) | −0.060 (−0.246) | 0.0347 (0.167) | −0.0812 (−0.185) | 0.0220 (0.045) |
| ECT | **−0.823*** (−3.281)** | **−0.478*** (−2.794)** | **−0.493** (−2.436)** | **−0.147* (−1.832)** | **−0.398** (−2.397)** | **−0.491*** (−3.317)** |
| $\Delta Growth_t$ | --- | 0.078 (0.815) | --- | −0.096 (−0.844) | --- | −0.152 (−1.005) |
| $\Delta Growth_{t-1}$ | −0.045 (−0.225) | 0.0796 (0.734) | −0.195 (−1.032) | 0.113 (0.888) | −0.105 (−0.622) | 0.072 (0.461) |
| $\Delta Growth_{t-2}$ | −0.167 (−1.158) | 0.0897 (0.919) | −0.058 (−0.410) | 0.026 (0.255) | −0.102 (−0.683) | −0.133 (−0.874) |
| $\Delta Inf_t$ | 0.421** (2.258) | --- | −0.003 (−0.018) | --- | −0.012 (−0.099) | --- |
| $\Delta Inf_{t-1}$ | −0.141 (−0.803) | 0.052 (0.341) | −0.528*** (−2.944) | 0.224 (1.363) | −0.093 (−0.806) | 0.206 (1.306) |
| $\Delta Inf_{t-2}$ | 0.181 (0.985) | −0.149 (−1.067) | −0.185 (−0.893) | −0.224 (−1.311) | 0.005 (0.046) | −0.017 (−0.123) |
| $R^2$ | 0.502 | 0.338 | 0.481 | 0.250 | 0.265 | 0.283 |
| DW | 1.975 | 1.919 | 2.033 | 2.054 | 1.983 | 2.025 |
| SC (Prob) | 0.9312 | 0.7221 | 0.3519 | 0.3234 | 0.4953 | 0.6803 |
| FF (Prob) | 0.2729 | 0.0539 | 0.8565 | 0.1751 | 0.2357 | 0.0093 |
| Normality (Pro) | 0.000 | 0.000 | 0.1371 | 0.0358 | 0.0098 | 0.0001 |
| Heter. (Prob) | 0.8631 | 0.008 | 0.0093 | 0.1342 | 0.0658 | 0.0156 |

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

## Table 5b: Error correction estimate (authors calculation using E-views 9)

| Variables | Singapore | | Pakistan | | UK | |
|---|---|---|---|---|---|---|
| | 3a | 3b | 3a | 3b | 3a | 3b |
| Constant | −0.1001 (−0.192) | 0.0449 (0.110) | −0.062 (−0.208) | 0.1967 (0.397) | −0.0278 (−0.115) | −0.0098 (−0.032) |
| ECT | **−0.592*** (−2.820)** | **−0.540*** (−3.237)** | **−0.633*** (−2.909)** | **−0.549*** (−3.528)** | **−0.456** (−2.362)** | **−0.101 (−1.360)** |
| $\Delta Growth_t$ | --- | 0.118 (1.137) | --- | −0.018 (−0.082) | --- | −0.581*** (−3.814) |
| $\Delta Growth_{t-1}$ | −0.088 (−0.472) | 0.067 (0.596) | −0.157 (−0.743) | −0.019 (−0.069) | −0.143 (−0.793) | −0.227 (−1.287) |
| $\Delta Growth_{t-2}$ | −0.110 (−0.757) | −0.024 (−0.235) | −0.014 (−0.077) | −0.4841* (−1.903) | −0.093 (−0.641) | −0.053 (−0.325) |
| $\Delta Growth_{t-3}$ | --- | --- | 0.092 (0.642) | −0.312 (−1.442) | --- | --- |
| $\Delta Inf_t$ | 0.397** (2.358) | --- | 0.013 (0.159) | --- | −0.309** (−2.905) | --- |
| $\Delta Inf_{t-1}$ | −0.293* (−2.001) | 0.364** (2.609) | 0.115 (1.414) | 0.247 (1.594) | −0.275** (−2.261) | −0.158 (−0.984) |
| $\Delta Inf_{t-2}$ | 0.168 (0.987) | −0.225 (−1.598) | −0.138* (−1.750) | 0.162 (1.055) | 0.078 (0.647) | −0.025 (−0.163) |
| $\Delta Inf_{t-3}$ | --- | --- | 0.036 (−0.299) | 0.061 (0.403) | --- | --- |
| $R^2$ | 0.443 | 0.464 | 0.485 | 0.318 | 0.503 | 0.285 |
| DW | 1.709 | 1.891 | 1.917 | 2.072 | 1.975 | 1.965 |
| SC (Prob) | 0.1550 | 0.2843 | 0.1397 | 0.2115 | 0.9507 | 0.7376 |
| FF (Prob) | 0.0642 | 0.0184 | 0.0079 | 0.3063 | 0.0303 | 0.3964 |
| Normality (Pro) | 0.0421 | 0.0000 | 0.4841 | 0.0015 | 0.0047 | 0.0082 |
| Heter. (Prob) | 0.9438 | 0.9451 | 3530 | 0.0205 | 0.7350 | 0.0004 |

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

**Table 5c: Error correction estimate (authors calculation using E-views 9)**

| Variables | Japan | | India | | Bangladesh | | China | |
|---|---|---|---|---|---|---|---|---|
| | 3a | 3b | 3a | 3b | 3a | 3b | 3a | 3b |
| Constant | −0.1722 | −0.2936 | 0.092 | 0.2619 | 0.1902 | −0.190 | 0.1539 | −0.4144 |
| | (−0.516) | (−1.603) | (0.229) | (0.461) | (1.201) | (−0.464) | (0.612) | (−0.767) |
| ECT | **−0.447*** | **−0.436*** | **−0.736*** | **−0.862*** | **−0.361**** | **−0.906*** | **−0.500*** | **−0.334**** |
| | **(-1.935)** | **(−3.247)** | **(−3.367)** | **(−4.069)** | **(−2.200)** | **(−3.838)** | **(−2.952)** | **(−2.590)** |
| $\Delta Growth_t$ | --- | 0.0131 | --- | 0.022 | --- | 0.575 | --- | 0.313 |
| | | (0.145) | | (0.115) | | (1.230) | | (0.789) |
| $\Delta Growth_{t-1}$ | −0.276 | −0.071 | −0.208 | −0.363* | −0.219 | −0.121 | 0.481** | 1.147*** |
| | (−1.242) | (−0.586) | (−1.089) | (−1.709) | (−1.188) | (−0.267) | (2.163) | (2.988) |
| $\Delta Growth_{t-2}$ | −0.145 | 0.015 | −0.179 | −0.318* | --- | --- | 0.0214 | 0.217 |
| | (−0.818) | (0.156) | (−1.243) | (−1.716) | | | (0.066) | (0.522) |
| $\Delta Inf_t$ | 0.295 | --- | −0.127 | --- | 0.052 | --- | 0.086 | --- |
| | (1.017) | | (−1.448) | | (0.817) | | (0.989) | |
| $\Delta Inf_{t-1}$ | −0.431* | −0.056 | −0.025 | 0.242 | 0.041 | 0.174 | −0.124 | 0.092 |
| | (−1.803) | (−0.415) | (−0.305) | (1.508) | (0.648) | (0.922) | (−1.428) | (0.464) |
| $\Delta Inf_{t-2}$ | −0.077 | −0.275** | −0.195** | 0.022 | --- | --- | 0.033 | 0.114 |
| | (−0.298) | (−2.076) | (−2.346) | (0.152) | | | (0.489) | (0.736) |
| $R^2$ | 0.400 | 0.418 | 0.530 | 0.487 | 0.335 | 0.436 | 0.559 | 0.965 |
| DW | 2.023 | 2.137 | 1.817 | 1.966 | 2.223 | 1.934 | 1.958 | 2.083 |
| SC (Prob) | 0.4617 | 0.2784 | 0.3752 | 0.4343 | 0.1166 | 0.7908 | 0.3281 | 0.1772 |
| FF (Prob) | 0.0276 | 0.8245 | 0.8709 | 0.3895 | 0.7638 | 0.0354 | 0.0934 | 0.1257 |
| Normality (Pro) | 0.4647 | 0.0004 | 0.1603 | 0.00056 | 0.9348 | 0.8096 | 0.720 | 0.000 |
| Heter. (Prob) | 0.1404 | 0.1309 | 0.2344 | 0.7026 | 0.3759 | 0.8396 | 0.3828 | 0.4976 |

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

Where $\Delta$ marks the 1st difference operator, $\vartheta_{t-1}$ and $\tau_{t-1}$ both are error correction terms, and $\varepsilon_t$ and $\theta_t$ both are random disturbance terms. Here $\gamma_1$ and $\gamma_2$ are measured the deviation of the series from the long term equilibrium associations. If $0 \leq \gamma_1, \gamma_2 \leq 1$ is held, the series converge to the long-run equilibrium relation. But cointegration does not exposes that all $\gamma_1, \gamma_2$ should be zero.

Table 5a-c represents the error correction estimate of two series. The estimated outcomes reveal that for all sample countries (except the UK) a meaningful responsive association between inflation and growth is present. Except the UK, we can say that if the series are in disequilibrium, as it is said in the cointegration regression, the economic growth will be adjusted to lessen the imbalance and vice versa. In case of the UK, the inflation will reduce the imbalance but not vice versa. The estimated value of the coefficient of ECT shows that the system corrects its previous periods level of disequilibrium by $100\gamma_1\%$ (or $100\gamma_2\%$) in a year. For example, ECT for Malaysia (Column 2 and 3 of Table 5a) −0.823 and −0.478 implies for a given year, a change in inflation will correct the long run equilibrium by 82.3% in Malaysia and 47.8% correction will be taken place for changes in growth. Other remarkable findings of the study that all absolute values of ECT are <1 i.e., there are no possibilities for overcorrection.

The ECT terms of Bangladesh are −0.361 and −0.906 (column 3 and 4 of Table 5c) indicates that 36.1% and 90.6% disequilibrium will converge to the equilibrium in long-run due to the change of inflation and economic growth respectively. The overall speed of adjustment is found high for India (−0.736 and −0.862).

## 5. CONCLUSION

This empirical study examines the long-term and short-term nature of the inflation and economic growth nexus for ten selected realms using yearly data series. Cointegration and error correction models are employed to check these dynamics. The aim of the study is to examine the relationship between economic growth and inflation in some selected countries with their nature. Four impressive significant results are found. First, the connection of inflation and economic growth is direct in Malaysia, Thailand, Singapore, Japan, and Bangladesh. Secondly, this relation is found negative in the USA, Pakistan, UK, and India. Third empirical result exhibits higher sensitivity of inflation to changes in growth than the sensitivity of growth to inflation for Malaysia and Singapore. Fourthly, the data of Thailand, Japan, Bangladesh, China, USA, Pakistan, UK, and India show higher sensitivity of growth to change in inflation than the sensitivity of inflation to change in growth.

The policymakers of the respective countries should consider the above findings before the policy taking. Interestingly industrial countries like the USA, UK have negative coefficients of inflation and growth. Further research is needed to investigate the reasons behind it. Developing countries like Bangladesh, Malaysia are showing the positive magnitude of inflation and economic growth.

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