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THE EFFECT OF INFLATION ON ECONOMIC GROWTH IN AGCC: A COINTEGRATION AND ERROR CORRECTION MODEL ANALYSIS

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ABSTRACT

This main purpose of this paper is to examine the relationship between inflation and economic growth in six Arab countries (UAE, Qatar, Bahrain and Kuwait, Oman and Saudi Arabia) of Arab Gulf Cooperation Council (AGCC). A comparison of empirical evidence is obtained from the co integration and error correction models (ECM).Using annual data set on real GDP and CPI for the period of 1985 to 2011. The main finding is there is a positive relationship between GDP growth rate and inflation for all six countries in the long-run. 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.

KEY WORDS: *Inflation, Growth, AGCC, Long run versus short run, Trade-off*
JEL classifications: E31, E32, E61, O40, O55

1.1. INTRODUCTION

This study investigates the relationship between inflation and economic growth in six Arab countries (UAE, Qatar, Bahrain and Kuwait, Oman and Saudi Arabia) of Arab Gulf Cooperation Council (AGCC). Two empirical findings are reported to be at the origin of this interest, that is a negative association between inflation and economic growth (Barro,1995)) and a positive relationship between the development of the financial system and economic growth. These two strands of the empirical literature (the finance-growth and inflation-growth relationship) have lived separate lives but one obvious link is that inflation might be affecting economic growth trough the financial sector.

Huybens and Smith (1998,1999) argue that an increase in the rate of inflation could have at first negative consequences on financial sector performance through credit market frictions before affecting economic growth.

The relationship between inflation and growth remains a controversial one in both theory and empirical findings (Hossain and Chowdhury 1996). Friedman (1973) 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".

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 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) revealed 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).

The purpose of this paper is to discuss the inflation-economic growth relationship for six Arab countries (*UAE, Qatar, Bahrain and Kuwait, Oman and Saudi Arabia)* None of these countries have had high-inflation crises*;* their average inflation rates of 0.2 to 2.4 per cent during the period under consideration can be regarded as moderate**.**

The remainder of this paper is organized as follows: Section 2 reviews the empirical literature on inflation and economic growth. Section 3 provides information about the historical trends of inflation and economic growth in AGCC. Section 4 discusses the co integration and Error Correction Model Section 5 provides data sources and estimated results on inflation and economic growth, and finally, section 6 presents a summary of the main conclusions.

1.2. LITERATURE REVIEW

With inflation under control in most countries, and with anti-inflationary monetary policy firmly established at the world's major central banks, the debate over tradeoffs between growth and inflation which characterized the 1970s and early 1980s has all but disappeared. This is especially true in the United States, whose high-growth, low-inflation, low-unemployment economy seems to demonstrate the efficacy of conservative fiscal and monetary policies. There are still, however, economists in government and academe who question the sagacity of continued central bank concern about price stability, often to the exclusion of other goals, such as low unemployment and high rates of economic growth. Even New York Federal Reserve Bank President William McDonough has argued that price stability does not necessarily require zero inflation, and has expressed concern that overreaction to inflation on the part of the Fed could risk tipping the U.S. economy into deflation and negative economic growth .

Yatrakis 1997 studied the long-run relationships between growth and inflation in 23 industrialized countries during the period between 1986 and 1995 and found evidence that the most rapid economic growth occurred in countries with the lowest inflation This relationship was most pronounced among the largest industrial economies, the so-called Group of Seven. An empirical study of correlation between inflation and unemployment in the United States found that declining unemployment since 1992 has been accompanied by a decrease in inflation (Corrigan and Yatrakis 1998). An analysis of growth/inflation relationships in 12 developing countries of the Caribbean Basin likewise concluded that those with the lowest inflation also experienced the most rapid economic growth (Yatrakis 1998a, 1998b), as did a cross-section study of 19 island nations (Yatrakis 1999a). Finally, a study of fifteen transition economies in Central Europe, Asia and the former Soviet Union (Yatrakis 1999b) found similar negative correlations between inflation and growth.

Mallik and Chowdhury (2001) examine the short-run and long-run dynamics of the relationship between inflation and economic growth for four South Asian economies: Bangladesh, India, Pakistan, and Sri Lanka. Applying co-integration and error correction models to the annual data retrieved from the International Monetary Fund (IMF) *International Financial Statistics* (IFS), they find two motivating results. First, the relationship between inflation and economic growth is positive and statistically significant for all six countries. Second, *the sensitivity of growth to changes in inflation rates is smaller than that of inflation to changes in growth rates*. These results have important policy implications, that is, although moderate inflation promotes economic growth, faster economic growth absorbs into inflation by overheating the economy. Therefore, these four countries are on the turning point of inflation-economic growth relationship.

Khan & Senhadji (2001) analyzed the inflation and growth relationship separately for industrial and developing countries. What made this investigation

particularly interesting from a methodological point of view is the use of new econometrical tools. The authors re-examine the issue of the existence of "threshold" effects in the relationship between inflation and growth, using econometric techniques initially developed by Chan and Tsay (1998), and Hansen (1999, 2000). The paper specifically focused on the following hypotheses:

- Is there a statistically significant threshold level of inflation above whichinflation affects growth differently than at a lower rate?
- Is the threshold effect similar across developing and industrial countries?
- Are these threshold values statistically different?
- How robust is the Bruno-Easterly finding that the negative relationship between inflation and growth exists only for high-inflation observations and high-frequency data.

The data set included 140 countries (comprising both industrial developing countries) and generally covered the period 1960-98. The authors stated that some data for some developing countries had a shorter span. As such, analysis had to be conducted by them using 'unbalanced panels'. The data came primarily from the World Economic Outlook (WEO) database, with the growth rate in GDP recorded in local currencies at constant 1987 prices and inflation measured by the percentage change in the CPI index.

This Study test for the existence of a threshold effect, a log model of inflation was estimated. The log of inflation was preferred, as the inflation-growth relationship was relatively more apparent. The authors suggested that regressions of real GDP growth on the level of inflation instead of the log, would give greater weight to the extreme observations, with the potential to skew the results. They proposed that the log transformation eliminated, at least partially, the strong asymmetry in the inflation distribution. With the threshold level of inflation unknown, the authors estimated it along with the other regression parameters. The estimation method used in their case was the non-linear least squares (NLLS).

Furthermore, since the threshold level of inflation enters the regression in a non-linear and non-differentiable manner, conventional gradient search techniques to implement NLLS were inappropriate. Instead, estimation was carried out with a method called conditional least squares.

The paper suggests that while the results are important, some caution should be borne in mind. The estimated relationship between inflation and growth does not provide the precise channel through which inflation affects growth, beyond the fact that, because investment and employment are controlled for, the effect is primarily through productivity. This also implies that the total negative effect may be understated. The results in this paper provide strong evidence for supporting the view of low inflation for sustainable growth.

Michael Sarel (1995) examines the possibility of non-linear effects on economic growth, it finds evidence of a significant structural break in the function that relates economic growth to inflation. The study was conducted to confirm the changing view, from the 1970s and 80s, that inflation had a negative effect on growth. The transformation in views raised three important questions:

- Why did it take so long to uncover the link between inflation and growth?
- As the estimated effects of inflation on growth are relatively small, should the results of these studies affect policy priorities and institutional arrangements?
- If a specific range for inflation is adopted as a policy target, what should this range be?

The study uses data on population, GDP, consumer price indices, terms of trade, real exchange rates, government expenditures and investment rates. The CPI and terms of trade data are used in order to reduce the problem of negative correlation between inflation and growth that is not directly caused by inflation effects on growth. A joint panel database was produced combining continuous annual data from 87 countries, during the period 1970 -1990. The 20-year sample is divided into four equal periods of five years each, obtaining a total of 248 observations.

The paper, first attempts to uncover nonlinear features in the function that relates economic growth to inflation. For this test, the observations were divided into 12 equal groups with dummy variables assigned to each group. Then, an OLS regression was estimated for the growth rate on the inflation dummies and others.

The paper also introduces additional tests as variations to the main test, with the inclusion of other explanatory variables. This was done largely to better understand the effects of inflation on growth, and to use changes in the specifications of the regression to check the robustness of the main test results, regarding the nonlinear effects of inflation on growth.

It finds that the structural break is estimated to occur when the inflation rate is 8 percent. Below that rate, inflation does not have any effect on growth or it may even have a slightly positive effect. When the inflation

rate is above 8 percent, however, the estimated effect of inflation on growth rates is negative, significant, robust and extremely powerful. This study also demonstrated that when the structural break is taken into account, the estimated affect of inflation on economic growth increases by a factor of three. The results suggest that the existence of a structural break also suggests a specific numerical target for policy: keep inflation below the structural break.

Robert J. Barro(1995) This paper attempts to find from empirical analysis the estimated effects of inflation on growth. The analysis provides a presumption that inflation is a bad idea, but the case is not divisive without supporting empirical findings. The paper considers the effect on growth of inflation, and of "other determinants" such as fertility, education etc. Once the effects of the other determinants are removed, the residual growth is plotted against inflation. This plot is at the core of the study by Barro. The paper explores the inflation – growth relationship in a large sample over 30 years.

The data set covers over 100 countries from 1960 to 1990. Annual inflation rates were computed in most cases from consumer price indices. Data was also collated for the other determinants of growth, which included the growth rate of real GDP per capita, and the ratio of investment to GDP for the three decades.

Bruno and Easterly (1995) examine the determinants of economic growth using annual CPI inflation of 26 countries which experienced inflation crises during the period between 1961 and 1992. In their empirical analysis, an inflation rate of 40 percent and over is considered as the threshold level for an inflation crisis. They find inconsistent or somewhat inconclusive relationship between inflation and economic growth below this threshold level when countries with high inflation crises are excluded from the sample. In addition, the empirical analysis suggests that there exists a temporal negative relationship between inflation and economic growth beyond this threshold level. The robustness of the empirical results is examined by controlling for other factors such as shocks (e.g., terms of trade shocks, political crises, and wars). Finally, they find that countries recover their pre-crisis economic growth rates following successful reduction of high inflation and there is no permanent damage to economic growth due to discrete high inflation crises. His empirical findings indicate that there exists a statistically significant negative relationship between inflation and economic growth if a certain number of the country characteristics (e.g., fertility rate, education, etc.) are held constant. More specifically, an increase the average inflation by 10 percentage points per year reduces the growth rate of real per capita GDP by 0.2 to 0.3 percentage points per year. In other words, his empirical analysis suggests that the estimated relationship between inflation and economic growth is negative when some reasonable instruments are considered in the statistical process. Finally, he added that there is at least some reason to consider that higher long-term inflation reduces economic growth.

Malla (1997) conducts an empirical analysis using a small sample of Asian countries and countries belonging to the Organization for Economic Cooperation and Development (OECD) separately. After controlling for labor and capital inputs, the estimated results suggest that for the OECD countries there exists a statistically significant negative relationship between economic growth and inflation including its first difference. However, the relationship is not statistically significant for the developing countries of Asia. The crucial finding of this empirical analysis suggests that the cross-country relationship between inflation and long-term economic growth experiences some fundamental problems like adjustment in country sample and the time period. Therefore, inconclusive relationship between inflation and economic growth can be drawn from comparing cross country time-series regressions with different regions and time periods.

Mohaddes and Williams (2011) use a pairwise approach to examine the main factors that drive inflation differentials in the GCC region. The results show that GCC inflation differentials are largely influenced by the oil cycle, mainly through the credit and fiscal channels. The results also suggest that after controlling for cyclical factors, convergence increased even during the recent oil boom.

Hasan and Alogeel (2008) estimate an error-correction model for Kuwait and Saudi Arabia to examine the long-run determinants of inflation in the GCC region as well as its short-run dynamics. They find that trading partners' inflation as well as the exchange ratepass-through effect and oil prices are the main driving forces of inflation in these countries. Overall, these findings are supported by Kandil and Morsy (2009) who estimate an errorcorrection model for each of the six GCC countries. They find that Inflation in major trading partners appears to be the most relevant foreign factor. In addition, oil revenues have reinforced inflationary pressures through growth of credit and aggregate spending. In the short-run, binding capacity constraints also explain higher inflation given increased government spending. Nonetheless, by targeting supply-side bottlenecks, the increase in government spending is easing capacity constraints and will ultimately help to moderate inflation.

Basher and Elsamadisy (2010), employing a panel approach, examine the short-run and long-run determinants of inflation in the GCC countries. They find that the money supply stands out as a significant determinant of inflation both in the short- and long-run. Both foreign prices and the nominal effective exchange rate are shown to be more successful in explaining inflation in the long-runthan the short-run

1.3. CONCEPTUAL MODEL

To examine the extent to which economic growth is related to inflation and vice versa, the theory of co integration 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 co integration procedure is used to test the presence of co integration 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 co integration regression:

$$\Delta LRGDP_t = \sim_1 + \ _1 \Delta LCPI_t + £_1 \quad (1)$$

$$\Delta LCPI_t = \sim_2 + \ _2 \Delta LRGDP_t + £_2 \quad (2)$$

Where $\Delta LRGDP_t$ = economic growth rate, $\Delta\ LCPI_t$ = inflation rate at time t, and $£_1$ and $£_2$ are random error terms (residuals). Residuals $£_1$ and $£_2$ measure the extent to which $\Delta\ LRGDP_t$ and $\Delta\ LCPI_t$ are out of equilibrium. If $£_1$ and $£_2$ are integrated of order zero, I(0), then it can be said that both $\Delta\ LRGDP_t$ and $\Delta\ LCPI_t$ are co integrated and not expected to remain apart in the long run. If co integration exists, then information on one variable can be used to predict the other.

There are few other techniques for testing for and estimating co integrating 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 co integrating vector. This procedure gives two likelihood ratio tests for the number of co integrating 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 co integrating 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 co integrated 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 stationary property in the series for growth rate $\Delta LRGDP_t$ and inflation rate $\Delta LCPI_t$

To determine the non-stationary property of each variable, the paper 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.

Agumented Dickey-Filler for level

$$\Delta Y_t = \beta_0 + \beta_1 time_t + \beta_2 Y_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta Y_{t-i} + \varepsilon_3 \quad (3)$$

Agumented Dickey-Filler for first difference forms

$$\Delta\Delta Y_t = \beta_3 + \beta_4 time_t + \beta_5 \Delta Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta\Delta Y_{t-i} + \varepsilon_4 \quad (4)$$

However, as pointed out earlier, the ADF tests are unable to discriminate well between non-stationary and stationary series with a high degree of auto regression. It is therefore possible that inflation, which is likely to be highly auto correlated, 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).

In consequence, the Phillips-Perron (PP) test (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 (5).

$$\Delta Y_t = \alpha + \beta_{11} Y_{t-1} + \phi(t - T/2) + \sum_{i=1}^{n} \phi_i \Delta Y_{t-i} + \varepsilon_5 \qquad (5)$$

In equations (3 to 5), Δ is the first difference operator and, ε_3 , ε_4 and ε_5 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 for PP test is decided according to Newley-West's (Newley and West, 1987) suggestions. The null hypothesis of non-stationary is tested using the t-statistic with critical values calculated by MacKinnon (1996). The null hypothesis that ΔLRGDP and ΔLCPI are non-stationary time series is rejected if β_2, β_5 and β_{11} 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 Y_t with ΔLRGDP and ΔLCPI in equations (3 and 4) (for the DF-ADF tests) and (5) (for the PP test).

DF-ADF-PP unit root tests are also applied for residuals ε_1 and ε_2 (from equations (1) and (2)) by specifying equations (3 to 5) in terms of ε_3 , ε_4 and ε_5 instead of Y_t. When ε_1 and ε_2 are found to be integrated of order zero then it can be concluded that these two series are co integrated. 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 $\Delta LRGDP_t$ and $\Delta LCPI_t$ are found to be co integrated then there must exist an associated error correction mechanism (ECM) that may take the following form:

$$\Delta LRGDP = \alpha_1 + \sum_{J=0}^{n} \beta_1 Lag_1 \Delta LCPI + \sum_{i=1}^{s} \beta_2 Lag_1 \Delta LRGDP - \beta_4 E_{C\,t-1} + e_1 \qquad (6)$$

$$\Delta DLCPI = \alpha_1 + \sum_{J=0}^{n} \beta_2 Lag_1 \Delta LRGDP + \sum_{i=1}^{s} \beta_3 Lag_1 \Delta LCPI - \beta_5 \mu_{C\,t-1} + e_2 \qquad (7)$$

Where Δ denotes the first difference operator, E_{Ct-1} and $\mu_{C\,t-1}$ are error correction terms, n and s are the number of lag lengths (determined by AIC) and e_1 and e_2 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). Finally, $0 \leq \beta_4$, $0 \leq \beta_5$ should hold for the series to converge to the long run equilibrium relation. According to this approach , three lags of both the explanatory and dependent variables and one lag of the residual from the co integration regression have been included. The error correction terms E_{Ct-1} and $\mu_{C\,t-1}$ (which are the residual series of the co integrating vector normalized for $\Delta LGRGDP_t$ and $\Delta LGCPI_t$) measure deviations of the series from the long-run equilibrium relations. For the series to converge to the long-run equilibrium relation, $0 \leq \beta_4$, $\beta_5 \leq 1$ should hold. However, co integration implies that not all β_4, β_5 should be zero.

1.4. DATA AND MODEL RESULTS

The empirical models have used annual data set on real GDP and CPI for the period of 1985 to 2011 retrieved from the IMF International Financial Statistics have been used.

For the first part of the empirical analysis, i.e., the relationship between inflation and economic growth, logs of real GDP (LRGDP) and CPI (LCPI) have been considered. Further, Economic growth rates RGDP are calculated from the difference of logs of real gross domestic product Δ LRGDP (real GDP at 2005 prices). Likewise, inflation rates CPI are calculated from the difference of logs of Consumer Price Index $\Delta\ LCPI_t$ (2005 = 100).

For the second part of the analysis. The summary statistics for *LRGDP* and are reported in Table 1 where the total number of observations used in the empirical analysis, means and standard deviations of variables during the time period are given.

Table (1): Average Inflation and Economic Growth in Six AGCC

Country		Mean	Standard Deviation
UAE	Inflation	1 .3	2.7
	Economic.Gowth	-1.4	5.2
Qata	Inflation	2.2	2.1
	Economic.Gowth	7.1	4.4
BHR	Inflation	0.4	0.1
	Economic.Gowth	13.0	7.1
Oman	Inflation	0.2	-0.1
	Economic.Gowth	57.1	5.8
Kuwait	Inflation	2.4	1.6
	Economic.Gowth	8.2	7.7
Saudi Arabia	Inflation	0.8	0.52
	Economic.Gowth	34.8	4.4

Period of study: United Arab Emirates 1985-2011;Qatar 1993-2011; Bahrain 1990-2009; Oman 1990-2011; Kuwait 1985-2010; Saudi Arabia 1996-2011. The period of analysis are determined by data availability.

Results of unit root tests are reported in table 2 and 3. They show that both growth rate of economic and inflation are integrated of order zero I(0)

Table 2: Unit root Test with DF , ADF and Phillips Perron (PP)

Country	Variable	DF		ADF		PP	
		With Constant	With Trend and Constant	With Constant	With Trend and Constant	With Constant	With Trend and Constant
UAE	ΔLCPI	-6.30*	-5.09*	-3.37*	-3.71**	-4.79 *	- 4.97*
	Δ LRGDP	-6.88*	-7.27**	-2.91***	-2.92***	- 4.59*	4.59*
Qatar	Δ LCPI	-2.42*	-4.57*	-1.92*	-4.16*	-4.63*	-4.28**
	Δ LRGDP	3.89-*	-4.44*	4.17**	-4.07***	-6.87*	- 6.83*
BHR	Δ LCPI	-2.86*	-5.51*	-2.50	-2.89*	-5.31*	-6.09*
	Δ LRGDP	-3.21**	-3.55**	-3.28**	-2.50	-5.83*	-5.63*
Oman	Δ LCPI	-4.45*	-5.75*	-3.11***	-3.29	-7.01*	-7.16*
	Δ LRGDP	-5.91*	-5.96*	-8.11*	-9.58*	-6.74*	-6.28*
Kuwait	Δ LCPI	-9.47*	-9.53*	-9.21*	-8.99*	-17.33*	-16.99*
	Δ LRGDP	-6.69*	-6.96*	4.31*	-4.60*	-8.03*	-7.74*
Suadi Arabia	Δ LCPI	-9.47*	-8.34*	-10.41*	-9.93*	-13.42*	-12.81*
	Δ LRGDP	-5.50*	-1.06	-2.20	--2.10	-4.65*	-4.28**

Notes:

, ** and * indicates significant at 1%, 5% and 10% level respectively. Computing critical t-Statistics as computed by Mackinnon (1996)*

DF, ADF and PP test were performed using EviewS for Econometrics package version 5.0.

Results of Co-integration tests and estimates of the Co-integrating parameters are reported in table 3 and 4. They show that economic growth rates and inflation rates for all six AGCC countries are Co-integrated. The empirical evidence also implies that there is a long- run relationship between growth rates and inflation rates in all six countries.

Table 3: Unit root Test for Residuals and coefficients of the dependent variable from equation 1.

$$\Delta LRGDP_t = \sim_1 + \ _1 \Delta LCPI_t + £_1 \qquad (1)$$

Country	Coefficient of Δ LCPI	Unit root test of $£_1$		
		DF	ADF	PP
UAE	-1.121	-7.16*	-7.24*	-18.69*
Qatar	0.131	-4.43*	-4.15**	-8.77*
BHR	-4.26	-6.21*	-6.03*	-0.23
Oman	10.47	-5.74*	-5.51*	-11.34*
Kuwait	-0.013	-4.20*	-4.57*	-5.05*
Suadi Arabia	4.93	-9.52*	-10.75*	-16.83*

Notes:

, ** and * indicates significant at 1%, 5% and 10% level respectively. Computing critical t-statistics as computed by Mackinnon(1991)*

DF, ADF and PP test were performed using Eviews for Econometrics package version 5.0.

Table 4: Unit root Test for Residuals and coefficients of the dependent variable from equation 2.

$$\Delta LCPI_t = \sim_2 + \ _2 \Delta LRGDP_t + £_2 \qquad (2)$$

Country	Coefficient of Δ LRGDP	Unit root test of $£_2$		
		DF	ADF	PP
UAE	-0.074	-6.54*	-5.22*	-16.16*
Qatar	-0.00115	-4.56*	-4.49*	-4.74*
BHR	-0.017	-1.69***	-6.46*	-6.78*
Oman	0.00067	-4.20*	-3.42**	-9.03*
Kuwait	-0.199	-4.20*	-4.30*	-4.30*
Suadi Arabia	0.00145	-5.51*	-5.32*	-24.23*

Notes:

**, indicates significant at 1% level. Computing critical t- statistics as computed by Mackinnon(1996)*

DF, ADF and PP test were performed using Eviews for Econometrics package version 5.0.

Table 5 reports eigen value and likelihood-ratio statistics for determining number of co-integrating vectors (r)using Johansen's maximum-Likelihood approach.

The alternative r = 1 and r <= 2. The results shows that the null hypothesis of no co-integration (r=0) is not rejected four AGCC (i.e. UAE, Kuwait, Oman and Saudi Arabia) except for Bahrain and Qatar shows that the null hypothesis of no co-integration (r =0) is rejected. Therefore, it can again be confirmed that Δ LRGDP and LCPI are co-integrated in four AGCC. However, Johansen's test also indicates that there could be a third integrating vector in the inflation-growth relationship for UAE, Oman and Kuwait.

Table 5: Johansen's maximum-Likelihood procedure

Cointegration LR test based on maximum eigen value of the stochastic matrix Δ LCPI and Δ LRGDP				
Country	**Eigen value**	**Null**	**Alternative**	**Likelih ood-Ratio statistics**
UAE	0.48	r = 0	r=1	19.97*
	0.36	$r \leq 1$	r=2	7.99**
Qatar	0.64	r = 0	r=1	13.11
	0.25	$r \leq 1$	r=2	2.84
BHR	0.50	r = 0	r=1	12.52
	0.23	$r \leq 1$	r=2	3.43
Oman	0.91	r = 0	r=1	45.91**
	0.67	$r \leq 1$	r=2	14.60**
Kuwait	0.56	r = 0	r=1	22.41**
	0.34	$r \leq 1$	r=2	7.57**
Suadi Arabia	0.94	r = 0	r=1	43.08**
	0.068	$r \leq 1$	r=2	1.06

** and ** indicates significant at 1% and 5% level respectively .*

Table 6 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 four AGCC (i.e. UAE, Kuwait, Oman and Saudi Arabia). The estimated coefficients of the error correction term ($_4$ and $_5$) are not significant (except for Oman significant at 5 percent level) from growth rate to inflation and vise-versa with appropriate (negative) signs. This means that if the two series are out of equilibrium , as specified in the Co-integrating regression 1 and 2, growth rates will adjust to reduce the equilibrium error and vice versa in all four countries except for Bahrain and Qatar respectively. The estimated value of the coefficient of the error correction term shows that the systems correct its previous period's level of disequilibrium. For instance, the error correction term -0.17 implies that 17 percent of the adjustment towards the long run equilibrium relation for UAE occurs within a year through change in growth rates. However the error correction term for Oman calculated from equation (1) of -1.33 could be interpreted in such a way that the error tends to be overcorrected.

Table 6: Error Correction Model

	UAE		KUWAIT		Oman	
Variables Equation	**Δ LCPI**	**Δ LRGDP**	**Δ LCPI**	**Δ LRGDP**	**Δ LCPI**	**Δ LRGDP**
Constant	0.014 (0.63)	0.0053 (0.075)	0890. (0.31)	0.011 (1.19)	-0.0029 (-1.16)	1.002 (2.09)
$E C_{t-1}$	-0.17 (-0.59)	-0.10 (-0.38)	-0.35 (-1.08)	-0.80 (-0.40)	-0.20 (-0.49)	-1.30 (2.46)*
RGDP Δ LAG1	0.046 (-0.62)	-0.11 (-0.43)	-0.49 (0.53)	-0.026 (0.10)	-0.0009 (0.69)	-0.27 (-1.06)
Δ LCPI	-	-1.05 (-0.98)		-0.010 (-0.09)		140.42 (1.93)
LAG1 Δ LCPI	-0.195 (-0.67)	-0.18 (-0.15)	-0.68 (-3.51)**	-0.056 (-1.51)	0.199 (1.32)	128.52 (2.19)
Δ LRGDP	0.070 (-0.97)	-	-0.38 (-0.63)	-	0.0010 (0.84)	-
LAG Δ 2LCPI	0.21- (-0.79)	-0.19 (-0.17)	-	-	-	-
Adjusted R^2	0.16	0.081	0.35	0.020	0.32	0.54
D.W.Statistics	1.70	1.80	1.95	202.	2.56	1.53
Serial Correlation		5.84	830.	0.065	0.0004	-0.51
Ramesy Test		300.	0.088		1.31	27.84
Normality		94.3	0.23	7.20	1.54	0.61
Heteroscedasticity		0.59	0.96	-	0.71	-

Notes: 1. Figures in parentheses are t-value and .

** and **denotes rejection of null hypothesis at 5% and 1% significance level*

2. For diagnostics, Godfrey's (1978a, 1978b) LM test for serial correlation, Ramsey's (1969, 1970) RESET test for functional form, White's (1980) general heteroscedasticity test for heteroscedasticity and for normality, Jarque-Bera (1980) and Bera-Jarque (1981) tests have been performed.

Table 7: Error Correction Model

	BAHRAIN		SAUDI ARABAI		QATAR	
Variables Equation	**Δ LCPI**	**Δ LRGDP**	**Δ LCPI**	**Δ LRGDP**	**Δ LCPI**	**Δ LRGDP**
Constant	0.0020 (0.92)	0.168 (10.55)**	0.015 (0.28)	0.66 (2.14)*	0.022 (188.16)**	0.166 (1.28)
$E C_{t-1}$	0.80 (3.89)**	1.02 (19.14)**	-0.12 (-0.156)	-0.74 (-0.12)	1.000 (207.66)**	-0.33 (-0.88)
Δ LAG2 RGDP	-	--	-	-	-0.00026 (-0.61)	-0.40 (-0.88)
Δ LAG1 RGDP	--	-	0.043 (0.14)	-6.07 (-3.35)**	-	-
Δ LAG3 RGDP	-	0.071- (-1.04)	-	-	-	-
Δ LCPI	-	-	-	-	-	-1.09 (-0.21)
LAG1 Δ LCPI	0.26 (1.37)	-1.11 (-0.61)	-1.02 (-1.57)	-	-0.0024 (-0.52)	-2.13 (-0.45)
Δ LRGDP	-	-	0.0098 (0.36)	-	-	-
LAG2 Δ LCPI	0.117- (-0.62)	-1.05 (1.78)	-0.83 (-1.51)	-	-	-
LAG31 Δ LCPI	0.041 (0.38)	0.46 (0.52)	-0.33 (-0.94)	-	-	-
Adjusted R^2	0.76	0.97	0.75	-	0.99	0.39
D.W.Statistics	1.59	2.72	1.12	-	1.92	1.77
Serial Correlation	2.69	8.00	11.4	7.52	0.39	0.087
Ramesy Test	0.16	0.55	785.1	32.29	0.41	1.37
Normality	0.56		3.35	6.57	3.85	0.63
Heteroscedasticity				362.9	0.25	

See notes on table 6

1.5. CONCLUDING REMARKS

This paper examines the co-integration and error correction models to examine long-run and short-run dynamics of the inflation-economic growth relationship for *six Arab countries (UAE, Qatar, Bahrain and Kuwait, Oman and Saudi Arabia) of Arab Gulf Cooperation Council (AGCC),* using annual data (1985-2011). 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 paper 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).The findings of other empirical studies, however, provide some guidance for AGCC policy-makers on the importance of maintaining low inflation, in order to foster higher economic growth. For its part, the Reserve Banks of AGCC will need to maintain monetary policy consistent with low inflation and inflation expectations.

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