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## Abstract

This paper examines the suitability of the proposed monetary union among the members of the Gulf Cooperation Council (GCC). To do so, we identify the underlying structural shocks that these economies are subject to and assess the extent to which the shocks are symmetric. Additionally, we test for common trends and common business cycles among the GCC economies. We find that while the transitory demand shocks are typically symmetric, the permanent supply shocks are asymmetric. Furthermore, we do not find synchronous long-run and short-run movements in output. Despite the progress that has been made in terms of integration, our findings indicate that the conditions for forming a GCC monetary union have not as yet been met.



**Keywords:** Gulf Cooperation Council, GCC, optimal monetary union, cointegration, common cycles, structural VAR

**JEL Classification:** F33, F36

## 1. Introduction

In May 1981, six Gulf countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and UAE) signed the charter of the GCC. Among various objectives, these states sought "to coordinate their financial, monetary and banking policies and enhance cooperation between monetary agencies and central banks, including the endeavor to establish a joint currency." Progress has been made towards the implementation of these goals, and many measures have been taken to align their monetary, financial and economic systems as a prelude for a common currency to be introduced no later than January 2010. All the GCC members have already pegged their currencies to the US dollar. Furthermore, a customs union was established in 2003, and plans were set for the formation of a common market in which all barriers on the movements of goods, services, labor and capital are to be abolished by 2007. In 2005, the GCC members adopted the EU convergence criteria with respect to budget deficit, public debt, currency reserves, interest rate, and inflation. Fulfillment of most of the convergence criteria has been achieved, with inflation being the lone exception. Despite these impressive advances, many economists and analysts argue that the progress has been remarkably slow and additional steps are required for the monetary union to be effective (Dar and Humayon, 2001 and Darrat and Al-Shams, 2005 among others).

The feasibility of a potential monetary union for a block of countries is usually evaluated by weighing the benefits and costs of joining a currency union (Mundell, 1961 and McKinnon, 1963). Using a single currency leads to the elimination of transaction costs and uncertainties (monitoring exchange rates and predicting their fluctuations, costs of currency conversion, and keeping and managing reserves for intra-regional trade). On the other hand, participating in a monetary union involves losing autonomy over monetary instruments such as interest rates and exchange rates that serve as stabilizers. It has been argued that countries that are highly integrated

in terms of trade and factor mobility, that share harmonized business cycles, and subject to similar exogenous shocks are more likely to be suitable candidates for a monetary union.

This study investigates the extent to which the member states of the GCC meet the theoretical criteria for an optimal monetary union. Most previous studies have examined the feasibility of a currency union based on the observed similarities of the economies and the degrees of monetary and fiscal convergence that have been achieved. We contribute to these efforts by exploring the symmetry of the external shocks that the economies are subject to and the degree of synchronization in long-run economic activity and in short-run business cycles. To do this, we apply Blanchard and Quah's (1989) procedure for identifying demand and supply disturbances across member states. Based on the aggregate demand-aggregate supply (AD-AS) framework, we assume that demand shocks lead to temporary changes in output and permanent changes in prices, whereas supply shocks, such as those originating from changes in technology, result in permanent changes in both output and prices. For the purpose of identification, we impose the restriction that demand shocks have no long-run effect on output. Once the exogenous demand and supply shocks are recovered, we compute the correlations of the shocks across countries. If the underlying disturbances are symmetrically distributed across countries this means that the costs of a common currency are relatively small and the desirability of a monetary union is high. The procedure has been applied to several actual and potential currency unions (for example, Bayoumi and Eichengreen, 1994, Arnon and Spivak, 1996, Horvath and Ratfai, 2004, and Buigut and Valev, 2005), but has not been applied for the GCC region.

Since the degree of correlation between shocks does not accurately resemble short-run output co-movements, we complement our analysis by both testing for cointegration (to assess the existence of long-run movements in real output among countries) and for the existence of common short-run cycles as suggested by Vahid and Engle (1993). For a currency union to be

viable it is essential to have both long-run synchronous real output co-movements and short-run common business cycles. To the best of our knowledge, a similar analysis has not been conducted for the GCC.

The paper is organized as follows. Section 2 provides a detailed survey of the previous empirical studies that dealt with the GCC region and outline their shortcomings. Our methodologies and data sources are presented in section 3. In section 4, we present the results of our tests of synchronization of shocks, long-run trends and short-run business cycles. A summary and some concluding remarks are provided in section 5.

## 2. Previous Empirical Evidence

Most of the earlier studies tackling how ready the GCC region is to establish a common currency referred to the costs of forming a union based on several economic, social and political characteristics of the economies. Overall, the vast majority of studies concluded that the region is not ready to abolish their national currencies and adopt a common currency.

An early attempt to examine the readiness of the GCC to form a currency union was made by Zaidi (1990). He observed convergence in inflation rates and moderate dispersion in the growth rates of broad money. Furthermore, he found that the responsiveness of output to unanticipated money growth, and thus the inflation-unemployment tradeoffs, vary greatly among GCC members. To avoid serious consequences of the observed variations, Zaidi (1990) suggested extensive coordination of monetary policies.

In an informal assessment of the potential of a GCC monetary union, Dar and Presley (2001) pointed out the low level of integration among GCC members as illustrated by the insignificant volume of intra-regional trade. They attributed this fact to the similarity of oil-based economic structures and to economic and political factors. The authors recommended introducing

more flexible rules for intra-regional trade and FDI, enhancing the production diversification process, accelerating privatization efforts, and increasing Saudi Arabia's trade with GCC members instead of trading outside the region.

A detailed examination of the progress in integration efforts of GCC members is provided by Laabas and Limam (2002). They conducted a formal test based on the generalized purchasing power parity and found the exchange rates to be closely related and to share the same stochastic trend. By examining various eligibility criteria for currency union including openness, factor mobility, commodity diversification, production structure, price and wage flexibility, similarity of inflation rates, degree of policy integration, and political factors, they concluded that not all the prior conditions are favorable for a currency union. In particular, they referred to a lack of production diversification, limited intra-regional trade, slow convergence in macroeconomic fundamentals, and unsynchronized business cycles. On the other hand, the authors maintained that the failure to meet the prior conditions does not necessarily mean that the region is not ready for the formation of a monetary union. As in the case of the European Union, the eligibility criteria are generally fulfilled ex-post rather than ex-ante. Launching a currency union could result in the alignment of business cycles and an increase in the volume of intra-regional trade. To boost the odds for a successful union, the authors called for the elimination of restrictions on free movement of goods and production factors and to a larger degree of political integration.

A similar examination of the readiness of GCC countries for a common currency was carried out by Jadresic (2002). He weighed the possible benefits and costs incurred as a result of replacing individual GCC currencies with a common regional currency and concluded that the success of such a union is conditional on a broader set of measures including the removal of domestic and cross-border distortions that hamper trade and foreign investments, coordinating policies that ensure macroeconomic stability, and enhancing the process of political integration.

Fasano and Schaechter (2003) had an overall favorable view of the GCC monetary union. They asserted that such a union when combined with the appropriate macroeconomic and structural policies can improve efficiency of financial services, lower transactions costs, increase transparency in prices of goods and services, facilitate proper investment decisions, and promote the allocation of resources within the region.

Unlike most of the previous studies, Darrat and Al-Shamsi (2005) concluded that the failure of the GCC members to achieve full economic and financial integration is not the outcome of economic and financial incompatibility among the region's countries but more likely the product of sociopolitical differences that may have hindered the progress towards a viable common block. The authors reached these conclusions by testing for cointegration among the GCC countries' GDP, inflation, exchange rate, money stock and monetary base. They found that the Gulf countries share a common long-run trend linking their economic activity, financial markets, and monetary policies. The existence of cointegration does not, however, imply that the short-run business cycles are synchronized. Both synchronous long-run real output trends and short-run common business cycles are essential for the formation of a successful currency union.

Sturm and Siegfried (2005) carried out a comprehensive study in which they evaluated the progress that the Gulf countries have made in their quest for a common currency. As in earlier studies, their results showed a remarkable monetary and structural convergence but a sluggish fiscal convergence. For the proposed monetary union to be credible and sustainable, they called upon GCC members to establish a supranational monetary institution that will be responsible for the design of monetary and exchange rate policies geared to the conditions of the region as whole rather than coordinating national policies.

A recent study by Hebous (2006) highlighted the significant progress that the GCC countries have made in terms of convergence if the European convergence criteria is taken as a

reference. He emphasized the similarities among the GCC countries as the main factor leading to reduced costs of forming a currency union.

## 3. Methodology and Data

### 3.1 Structural VAR

In order to understand the theoretical foundations for the restrictions needed to identify the underlying structural shocks we use the familiar aggregate demand (AD), short-run aggregate supply (SRAS) and long-run aggregate supply (LRAS) system. A positive demand disturbance (Figure 1) causes AD to shift from AD to $AD_1$ thus reaching a new short-run equilibrium at $E_1$ in which both the output ($y$) and price level ($p$) increase. Pressures in the labor market result in rising wages that in the long-run lead to a new equilibrium along the LRAS at ($E_2$). Thus, the impact of a permanent demand shock is a temporary rise in output in the short-run followed by convergence to the initial output level, but with a permanent impact on price levels.

On the other hand, a positive supply shock (Figure 2) causes both SRAS and LRAS to shift to the right. In the short run a new equilibrium at ($E_1$) in which $p$ falls and $y$ rises is reached. Eventually, we move to a new long-run equilibrium at ($E_2$) in which $p$ continues to fall and $y$ to rise. Thus, the impact of a supply shock is permanent on both output and prices.

In order to identify the underlying shocks we apply the Blanchard and Quah (1989) SVAR identification scheme. Assuming that the logs of output $\{y_t\}$ and the price level $\{p_t\}$ have unit root but their first difference is stationary, we can represent the vector of the first differences, of these two variables, $X_t$, as an infinite moving-average representation:

$$X_t \equiv \begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \ldots = \sum_{i=0}^{\infty} L^i A_i \varepsilon_t = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} \\ a_{21i} & a_{22i} \end{bmatrix} \begin{bmatrix} \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix} \quad (1)$$

where $L$ is the lag operator, $A_i$ are 2x2 matrices representing the impulse response functions of the shocks to the elements of $X_t$, and $\varepsilon_{dt}$ and $\varepsilon_{st}$ are independent white noise demand and supply shocks.

To enable us to identify the shocks, we assume, based on the AD-AS model, that demand shocks have no permanent effect on output while supply shocks do have. Thus, the cumulative effect of demand shocks on $\Delta y_t$ is zero:

$$\sum_{i=0}^{\infty} a_{11i} = 0 \tag{2}$$

The model can be estimated using the following finite reduced form VAR:

$$X_t = B_1 X_{t-1} + B_2 X_{t-2} + ... + B_p X_{t-k} + e_t \tag{3}$$

which takes the following infinite moving average representation:

$$X_t = \left(I - B(L)\right)^{-1} e_t = \left(I + B(L) + B(L)^2 + ...\right) e_t = e_t + D_1 e_{t-1} + D_2 e_{t-2} + ... = \sum_{i=0}^{\infty} L^i D_i e_t \tag{4}$$

where the $B$'s represent the estimated coefficients of regressing $\Delta y_t$ and $\Delta p_t$ on lagged values of both $\Delta y_t$ and $\Delta p_t$, and $k$ is the optimal lag length that ensures white noise residuals, $e_t$. Writing the relation between the reduced form disturbances, $e_t$, and the structural shocks, $\varepsilon_t$, as

$$e_t = C\varepsilon_t \tag{5}$$

four restrictions on the system are needed to identify the four elements of matrix $C$. The first two restrictions are normalization of the variances of $\varepsilon_{dt}$ and $\varepsilon_{st}$ to unity, the third is the orthogonality condition $E(\varepsilon_{dt}, \varepsilon_{st}) = 0$, and the fourth is the restriction imposed in equation (2). Substituting equation (5) into equation (4), the restriction imposed in equation (2) takes the following form:

$$\sum_{i=o}^{\infty} D_i C = \sum_{i=0}^{\infty} \begin{bmatrix} d_{11i} & d_{12i} \\ d_{21i} & d_{22i} \end{bmatrix} \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix} = \begin{bmatrix} 0 & . \\ . & . \end{bmatrix} \tag{6}$$

The four restrictions allow us to uniquely identify the matrix *C*, and recover the demand and supply shocks from the estimated reduced-form disturbances, and the structural impulse responses. Once the series of shocks are calculated for all the countries in our sample, we compute the correlation coefficients between the shocks to assess how synchronized they are.

## 3.2 Common Trends and Common Cycles

To assess whether the GCC countries share synchronous long-run movements in their economic activity, which would imply the feasibility of forming a monetary union we test for cointegration among all possible pairs of GCC countries using the Johansen (1988) maximum likelihood method.

Let us consider the following VAR model of order *k*:

$$X_t = \mu + A_1 X_{t-1} + .... + A_{k-1} X_{t-k} + \varepsilon_t \tag{7}$$

where *X* is a vector of *n* endogenous variables. If all the variables are *I(1)* in their levels, we say that these variables are cointegrated if a non-trivial stationary linear combination of these variables exists. For *n* endogenous variable there can be at most *n-1* distinct cointegration vectors. In case that these variables are cointegrated, then by the Granger representation theorem, the VAR model can be expressed as the following VECM:

$$\Delta X_t = \mu + \Gamma_1 X_{t-1} + .... + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-1} + \varepsilon_t \tag{8}$$

where $\varepsilon_t$ is a vector of white noise residuals. If the matrix $\Pi$ is of rank $1 \le r < n-1$, then it can be decomposed into $\Pi = \alpha \beta'$, where $\alpha_{(rxn)}$ and $\beta_{(rxn)}$, and equation (8) can be reformulated as:

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + .... + \Gamma_{k-1} \Delta X_{t-k+1} + \alpha(\beta' X_{t-1}) + \varepsilon_t \tag{9}$$

where the rows of $\beta$ are interpreted as distinct cointegration vectors, and the $\alpha$'s are the adjustment coefficients to long-run equilibrium. Johansen's (1988) cointegration technique allows

us to test and determine the number of cointegrating relationships (the rank of matrix Π) between the nonstationary variables in the system using the maximum likelihood procedure.

The existence of cointegration implies that countries share synchronous long-run movements in their economic activity, which indicates a higher likelihood for forming a monetary union. Nonetheless, even if a long-run relationship exists, short run business cycles in GDP might be asynchronous and require country specific monetary policies. In this case, the feasibility of forming a monetary union could be low.

To test for common cycles in the presence of common trends, we use the procedure developed by Vahid and Engle (1993). This procedure amounts to finding the sample canonical correlations between $\Delta X_t$ and $W(k) \equiv (\Delta X_{t-1}, \Delta X_{t-2}, ..., \Delta X_{t-k}, \Delta Z_{t-1})$, where $k$ is the lag order of the system in differences (one less than the lag order of the VAR in levels) and $Z_{t-1}$ is the error correction term. Specifically, the test statistic for the null hypothesis that the number of common cycle vectors is at least $s$ is:

$$C(k,s) = -(T-k-1)\sum_{i=1}^{s} \log(1-\lambda_i^2) \tag{10}$$

where the $\lambda_i^2$'s are the s smallest squared canonical correlations between $\Delta X_t$ and $W(k)$. Under the null hypothesis, the statistic $C(k,s)$ has a $\chi^2$ distribution with $s(s + nk + r - n)$ degrees of freedom, where $n$ is the dimension of the system and $r$ is the number of cointegration vectors.

## 3.3 Data

Data on output and prices for member states of the GCC were obtained from the World Development Indicators website (http://devdata.worldbank.org/dataonline), International Financial Statistics 2003 CD ROM as well as from the websites of the statistical bureaus and central banks of GCC countries. Output refers to real GDP in local currencies, while the price

level is the GDP deflator. All samples terminate in 2003, but start in different years as follows; Bahrain – 1975, Kuwait – 1962, Oman – 1963, Qatar – 1970, Saudi Arabia – 1968, and United Arab Emirates – 1973.

## 4. Empirical Results

Some indications of synchronization or rather a lack of it can be drawn from looking at the raw data of real GDP growth and inflation. Table 1 displays the means and standard deviations for these measures from which it is clear that the long run growth rates vary greatly. While Kuwait, Qatar, and Saudi Arabia experienced modest annual growth rates ranging from a mere 0.65% (Kuwait) to 2.63% (Qatar), the rest of the countries displayed impressive performances. Furthermore, some of the economies (Kuwait, Qatar, and UAE) are characterized by especially volatile economic activity compared with the rest. From inflation figures we get a different picture. All GCC members have relatively low rates of inflation, though of a volatile nature. Additional supporting evidence is depicted in Table 2 which presents the correlations of real GDP growth and inflation. While the GCC countries do not exhibit significant correlations of GDP growth except for between Qatar and Kuwait and Saudi Arabia and UAE, inflation rates are highly correlated in all other cases. Hence, we gather that inflation rates exhibit a great deal of convergence whereas economic activity does not. Now that we have some idea of the nature of the relationships among the GCC economies we can conduct a rigorous formal assessment of these relationships based on recovering the correlations of the demand and supply shocks and on examining the existence of common trends and business cycles.

### 4.1 Correlation of Shocks

Before recovering the exogenous demand and supply shocks in the VAR system of output and prices, we examine the time series properties of our two variables, the natural logarithm of

real GDP ($y$) and the natural logarithm of the GDP deflator ($p$). The Augmented Dickey-Fuller (ADF) unit root tests presented in Table 3 reveal that the hypothesis of a unit root cannot be rejected at conventional significance levels for both $y$ and $p$ for all countries. When taking the first differences of the variables, our tests show that the null hypothesis of a unit root is rejected in all cases. Thus, we conclude that $y$ and $p$ are integrated of first order, *I(1)*. The Lagrange multiplier test for up to fourth order serial correlation in the residuals does not indicate the presence of serial correlation.

Next, the underlying demand and supply shocks are recovered. Panel (a) of Figures 3 and 4 depict the impulse responses of the price level to demand and supply shocks, their magnitude and the speed of adjustments to such shocks. The higher the magnitudes of the shocks and the slower the adjustment, the higher are the costs of maintaining a currency union. We see that the implicit over-identifying restriction that positive demand shocks lead to permanently higher prices is fulfilled in all cases (Figure 3). However, the second over-identifying restriction, that positive supply shocks lead to permanently lower prices is not satisfied in all cases with the exception of Kuwait (Figure 4). The rise in prices following a supply shock is negligible in four cases and substantial only in the case of Saudi Arabia. This anomaly has also been reported by Bayoumi and Eichengreen (1994) for three North American regions that are heavy producers of raw materials (Western Canada, North West U.S. and South West U.S.). These American regions are similar in their economic structure to the GCC economies in that they also rely heavily on production of oil and natural gas. Due to the economic structure of the GCC countries, a positive supply shock could be accompanied by a positive demand shock that offsets the impact of the supply shock and consequently leads to higher prices.

It is worth noting that convergence of the price level following demand and supply shocks are very fast, especially after demand shocks. On the other hand, the magnitude of the response of

the price level to shocks varies greatly across the GCC countries. This observation is clearly evident in relation to demand shocks—while UAE and Bahrain's price responses to demand shocks are modest, the responses of the price level are relatively large in the rest of the countries.

The impact of demand and supply shocks on output is presented in panel (b) of Figures 3 and 4, respectively. Our restriction that demand shocks have no permanent effect on output is fulfilled in all cases (Figure 3). As the AD-AS framework suggests, following a demand shock, the output of all countries rises temporarily but the effect wanes relatively quickly. On the other hand, a positive supply shock leads to higher output, however, with varied degrees (Figure 4).

Our next step is to calculate the correlation coefficients between the identified demand and supply disturbances among the GCC countries. The more symmetric the shocks (positive correlations), the more feasible for group pf countries to form a currency union. Supply shocks are likely to reflect exogenous factors such as oil price shocks while demand shocks reflect both exogenous factors and macroeconomic policies. Bayoumi and Eichengreen (1993) argue that supply shocks serve as better indicators of the symmetry or asymmetry of the underlying disturbances following a change in the exchange rate regime. The pairwise and common sample correlation coefficients are reported in Tables 4 and 5.

From Table 4 we can see that, generally speaking, the contemporaneous supply shocks are asymmetric. Among the fifteen pairs of countries the correlation coefficients are either negative or positive but statistically insignificant in all instances. In fact, the supply shocks of Kuwait and Qatar are negative and significant (-0.42 and -0.46 using pairwise and common samples, respectively). Correlations of supply shocks of the leading GCC country, Saudi Arabia, with those of the other countries are mostly positive correlations though statistically insignificant. These asymmetric supply disturbances do not lend support to the establishment of a viable currency union among the GCC countries. Still such low and negative correlations have been

documented among the industrial European Union countries and Southern European members where currency union is considered to be quite viable. (Bayoumi and Eichengreen, 2003 and Buigut and Valev, 2005).

When we turn to the demand shocks (Table 5) we find that, in contrast to supply shocks, the correlation coefficients among the paired countries are positive and highly significant in most cases except for UAE with Kuwait, Oman and Saudi Arabia. This finding indicates that contemporaneous demand shocks faced by the GCC countries, unlike supply shocks, are generally symmetric. The correlations are generally higher and more significant than those reported for EU and NAFTA regions by Bayoumi and Eichengreen (1993). This finding can be explained by the fact that GCC economies are dominated by public sector that boosts demand during episodes of high oil prices and reduces demand during episodes of low oil prices.

Our tests were conducted also with the inclusion of dummy variables in the VAR system for some major exogenous events that affected the region, particularly the oil crises of 1973, 1979 and the Gulf War in 1991. However, we did not observe significant changes in our results.

The above findings show that while supply shocks are asymmetric, demand shocks are symmetric. Since supply shocks are more crucial in gauging the costs of forming a monetary union we can conclude that the GCC countries are not ready to establish a currency union that would prove viable. To further reinforce our findings, we examine whether GCC countries share synchronous long-run and short-run economic activity.

## 4.2 Common Trends and Common Features

To test whether GCC members share a common long-run trend in their output, we conducted cointegration tests for fifteen possible pairs of countries. The unit root tests show that the real output is integrated of order one in its level, but stationary in its first difference for all

countries (Table 3). The results of the cointegration tests are presented in Table 6. Among the fifteen combinations of countries we find that a long-run common trend exists in four cases regardless of the rank determination test. The signs in the cointegration vector ($\beta$ in Table 6) are positive as expected. Additionally, the error correction coefficients (the $\alpha$'s in Table 6) are significant at least in one of the two equations for every pair of countries for which we detected cointegration. This implies that divergence from a long-run equilibrium is short-lived and real GDP adjusts to the long-run common trend.

Overall, since only a few long-run relationships were detected among the possible pairs of economies we may infer that the economic activity of the GCC countries in most cases is not linked and more efforts are needed to increase the degree of compatibility among these countries. The only supporting factor for forming a GCC currency union is that three GCC countries share a long-run trend with Saudi Arabia, which is the largest and most dominant economy in the region.

As mentioned earlier, the existence of a long-run trend is necessary but insufficient when assessing the degree of synchronization of economic activity. Short-run business cycles, if idiosyncratic, may require country-specific policies that are infeasible under the regime of currency union. To account for business cycles synchronization we applied the Vahid and Engle (1993) procedure to test for common serial correlation of business cycles for the four pairs of countries in which cointegration was detected. The results reported in Table 7 demonstrate that the null hypothesis of at least one common cycle vector is not rejected in three cases, while the null hypothesis of at least two common cycle vectors is rejected in all cases. Thus, we may conclude that in three out of the four cases the pairs of countries share common business cycles and react symmetrically to shocks. Since a necessary requirement for viable currency union is

sharing common long-run trend and short-run cycles, our findings again lend no support for a establishing a currency union among the GCC members.

## 5. Summary and Concluding Remarks

We examine whether the six members of the GCC are ready to form a viable currency union applying three different methods. First, the Structural VAR procedure of Blanchard and Quah (1989) for identification of demand and supply disturbances. Imposing the restriction of the demand shocks having no permanent impact on output enables us to identify both demand and supply shocks. The presence of significant positive shocks correlations among the prospective economies may indicate a low cost for forming a currency union. We find that while supply shocks are asymmetric (no significant positive correlations), demand shocks are symmetric. Since supply shocks are the product of external factors and not domestic policies, they constitute better indicators of the costs of forming a monetary union. Thus, lack of significant correlations lends no support for the readiness of the GCC countries to establish a viable currency union.

Second, we test for the existence of long-run relationships of real GDP among all the possible pairs of countries by conducting the Johansen cointegration tests. Sharing a common trend signifies lower costs of establishing a currency union. Among the fifteen possible pairs of countries we find that only four pairs are cointegrated while the rest are not. Hence, it seems that the economic activities of the GCC members are not linked and more is to be done to enhance their compatibility.

Third, since sharing a long-run common trend does not necessarily imply a short-run synchronization we conduct the Vahid and Engle ( 1993) test for common serial correlation of the business cycles for the four pairs of countries for which cointegration was detected. Common business cycles are found in three cases. Since sharing common long-run trends and short-run

business cycles is vital for a feasible currency union we conclude on the grounds of our findings that the requirements for a successful union are not yet met.

Inline with most of the previous studies, the three methods employed here provide no evidence of the readiness of the GCC members to establish a lasting and well functioning currency union. Despite the remarkable progress that has been made in aligning monetary policies and adopting the European convergence criteria, significant efforts are needed to align the fiscal, financial, and political systems. Undoubtedly, the firm commitment of the leaders of the GCC countries to further enhance economic integration among member states is considered one of the key factors that would boost the likelihood of success of the currency union.

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**Table 1 – Real GDP Growth and Inflation – Means and Standard Deviations**

| | Common Sample | | | | Individual Samples | | | |
|---|---|---|---|---|---|---|---|---|
| | Growth | | Inflation | | Growth | | Inflation | |
| | Mean | Std | Mean | Std | Mean | Std | Mean | Std |
| **Bahrain** | 5.17 | 3.85 | 1.52 | 7.41 | 5.17 | 3.85 | 1.52 | 7.41 |
| **Kuwait** | 0.65 | 20.76 | 3.26 | 14.08 | 1.36 | 17.18 | 5.54 | 18.85 |
| **Oman** | 6.78 | 5.51 | 1.53 | 12.89 | 9.63 | 13.22 | 4.78 | 19.35 |
| **Qatar** | 2.63 | 8.81 | 3.97 | 16.34 | 3.66 | 8.29 | 6.57 | 15.76 |
| **S. Arabia** | 2.40 | 4.71 | 2.63 | 11.20 | 4.80 | 7.13 | 6.62 | 16.88 |
| **UAE** | 4.18 | 9.51 | 2.48 | 4.98 | 4.53 | 9.52 | 2.81 | 5.19 |

**Table 2 – Correlations of Real GDP Growth and Inflation**

| | Bahrain | Kuwait | Oman | Qatar | S. Arabia | UAE |
|---|---|---|---|---|---|---|
| **Bahrain** | | -0.092 | 0.129 | -0.108 | 0.146 | 0.046 |
| **Kuwait** | 0.673* | | -0.078 | 0.395* | -0.231 | -0.103 |
| **Oman** | 0.550* | 0.844* | | -0.256 | -0.090 | -0.117 |
| **Qatar** | 0.789* | 0.772* | 0.763* | | 0.078 | -0.002 |
| **S. Arabia** | 0.680* | 0.839* | 0.803* | 0.771* | | 0.445* |
| **UAE** | 0.553* | 0.682* | 0.647* | 0.691* | 0.569* | |

Correlation coefficients for real GDP growth are on the upper triangle and inflation correlation coefficients are on the lower triangle.
* Significant at the 10% level.

**Table 3 – ADF Unit Root Test Results (with intercept and trend)**

| | Levels | | | First Difference | | |
|---|---|---|---|---|---|---|
| | **ADF** | **p** | **LM(4)** | **ADF** | **p** | **LM(4)** |
| **Real GDP** | | | | | | |
| **Bahrain** | -3.22 | 1 | 0.12 | -5.40*** | 1 | 1.00 |
| **Kuwait** | -2.75 | 0 | 6.10 | -4.61*** | 3 | 1.47 |
| **Oman** | -2.37 | 1 | 7.02 | -3.64*** | 0 | 3.81 |
| **Qatar** | -0.95 | 0 | 4.69 | -5.13*** | 0 | 1.98 |
| **S. Arabia** | -3.32 | 0 | 2.30 | -3.08** | 0 | 3.87 |
| **UAE** | -2.38 | 1 | 3.09 | -3.92*** | 0 | 1.64 |
| **GDP Deflator** | | | | | | |
| **Bahrain** | -2.94 | 1 | 3.61 | -4.07*** | 0 | 3.48 |
| **Kuwait** | -1.15 | 0 | 2.73 | -5.70*** | 4 | 2.58 |
| **Oman** | -1.19 | 0 | 3.89 | -4.99*** | 0 | 4.08 |
| **Qatar** | -2.39 | 0 | 1.72 | -4.58*** | 0 | 1.16 |
| **S. Arabia** | -1.80 | 0 | 6.96 | -3.53** | 0 | 0.44 |
| **UAE** | -3.02 | 0 | 2.67 | -5.64*** | 0 | 3.24 |

Notes:
p is the optimal lag chosen by the SIC. Maximum lag allowed is 4.
*, **, *** indicate significance at 10%, 5%, 1%, respectively.
LM(4) is the Lagrange Multiplier test for up to fourth-order serial correlation in the residuals, which is asymptotically distributed $\chi_4^2$.

**Table 4 – Correlation Matrix of Supply Shocks[§]**

| | Bahrain | Kuwait | Oman | Qatar | S. Arabia | UAE |
|---|---|---|---|---|---|---|
| **Bahrain** | | 0.291 | 0.076 | 0.008 | 0.049 | -0.107 |
| **Kuwait** | 0.291 | | 0.051 | -0.419* | -0.040 | 0.095 |
| **Oman** | 0.076 | -0.046 | | -0.107 | -0.102 | -0.113 |
| **Qatar** | 0.008 | -0.457* | -0.123 | | 0.102 | 0.004 |
| **S. Arabia** | 0.049 | 0.131 | -0.041 | 0.039 | | 0.057 |
| **UAE** | -0.107 | 0.085 | -0.218 | 0.061 | 0.081 | |

[§] Pairwise correlations are on the upper triangle and common sample correlations are on the lower triangle.
* Significant at the 10% level.

**Table 5 – Correlation Matrix of Demand Shocks**[§]

| | Bahrain | Kuwait | Oman | Qatar | S. Arabia | UAE |
|---|---|---|---|---|---|---|
| **Bahrain** | | 0.569* | 0.621* | 0.815* | 0.658* | 0.415* |
| **Kuwait** | 0.569* | | 0.758* | 0.456* | 0.374* | 0.280 |
| **Oman** | 0.621* | 0.755* | | 0.514* | 0.680* | 0.276 |
| **Qatar** | 0.815* | 0.595* | 0.704* | | 0.533* | 0.406* |
| **S. Arabia** | 0.658* | 0.697* | 0.775* | 0.794* | | 0.234 |
| **UAE** | 0.415* | 0.281 | 0.306* | 0.406* | 0.262 | |

[§] Pairwise correlations are on the upper triangle and common sample correlations are on the lower triangle.
* Significant at the 10% level.

**Table 6 – Johansen Cointegration Tests**

| Country Pairs | *p* | Trace | $\lambda_{max}$ | $\beta$ | $\alpha_i/\alpha_j$ |
|---|---|---|---|---|---|
| **Bahrain-Kuwait** | 3 | 7.83 | 7.83 | | |
| **Bahrain-Oman** | 2 | 7.23 | 6.47 | | |
| **Bahrain-Qatar** | 1 | 8.57 | 8.56 | | |
| **Bahrain-S. Arabia** | 4 | 19.44** | 19.44** | 2.26*** | 0.04/0.32*** |
| **Bahrain-UAE** | 4 | 12.39 | 11.9 | | |
| **Kuwait-Oman** | 1 | 14.38 | 8.66 | | |
| **Kuwait-Qatar** | 2 | 25.84*** | 25.71*** | 0.25* | -0.58***/0.12 |
| **Kuwait-S. Arabia** | 3 | 17.71** | 14.90** | 1.50*** | -0.07/0.89*** |
| **Kuwait-UAE** | 2 | 10.66 | 9.62 | | |
| **Oman-Qatar** | 1 | 5.57 | 5.5 | | |
| **Oman-S. Arabia** | 3 | 24.03*** | 17.99** | 1.90*** | -0.19***/0.12 |
| **Oman-UAE** | 2 | 12.13 | 9.39 | | |
| **Qatar –S. Arabia** | 2 | 7.62 | 7.51 | | |
| **Qatar-UAE** | 1 | 11 | 10.66 | | |
| **S. Arabia-UAE** | 1 | 14.09 | 11.3 | | |

Notes:
The hypotheses for the trace tests are: $H_0$: r=0 $H_1$: r>0 while for the maximal eigenvalue test the hypotheses are: $H_0$: r=0 $H_1$: r=1, where r denotes the number of cointegration vectors.
p is the optimal lag chosen by the SIC. Maximum lag allowed is 4.
*, **, *** indicate significance at 10%, 5%, 1%, respectively.

**Table 7 – Test Results for Common Feature**

| Country pair | S | Degrees of Freedom | Canonical statistic λ | Common Feature statistic C(p,s) | Critical values (5%) |
|---|---|---|---|---|---|
| **Bahrain-S. Arabia** | 1 | 6 | 0.64 | 9.48 | 12.59 |
| | 2 | 14 | 0.79 | 27.29*** | 23.68 |
| **Kuwait-Qatar** | 1 | 2 | 0.19 | 0.97 | 5.99 |
| | 2 | 6 | 0.75 | 23.85*** | 12.59 |
| **Kuwait-S. Arabia** | 1 | 4 | 0.37 | 4.23 | 9.49 |
| | 2 | 10 | 0.75 | 27.70*** | 18.31 |
| **Oman-S. Arabia** | 1 | 4 | 0.51 | 8.37* | 9.49 |
| | 2 | 10 | 0.80 | 37.52*** | 18.31 |

Notes:
S denotes the number of common features.
*, **, *** indicate significance at 10%, 5%, 1%, respectively.

**Figure 1 – A positive demand shock in the AD-AS model**

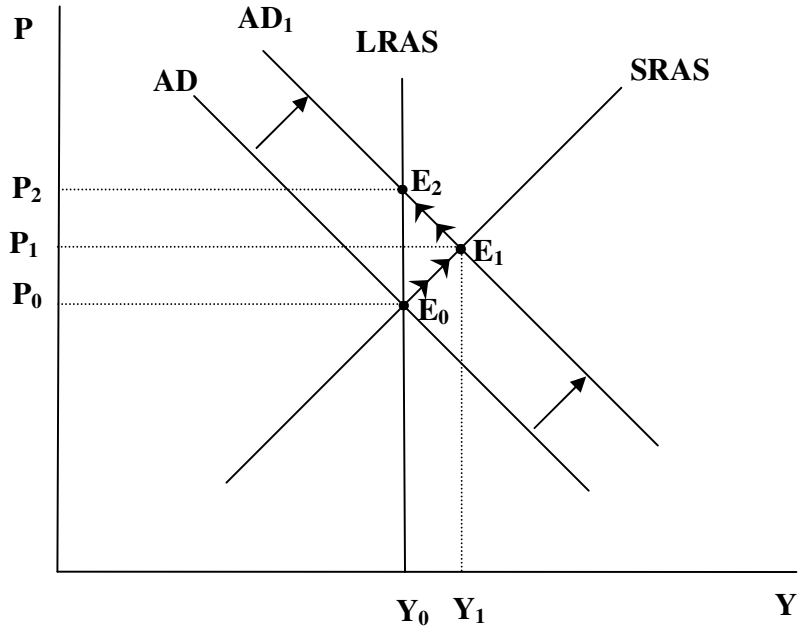


**Figure 2 – A positive supply shock in the AD-AS model**

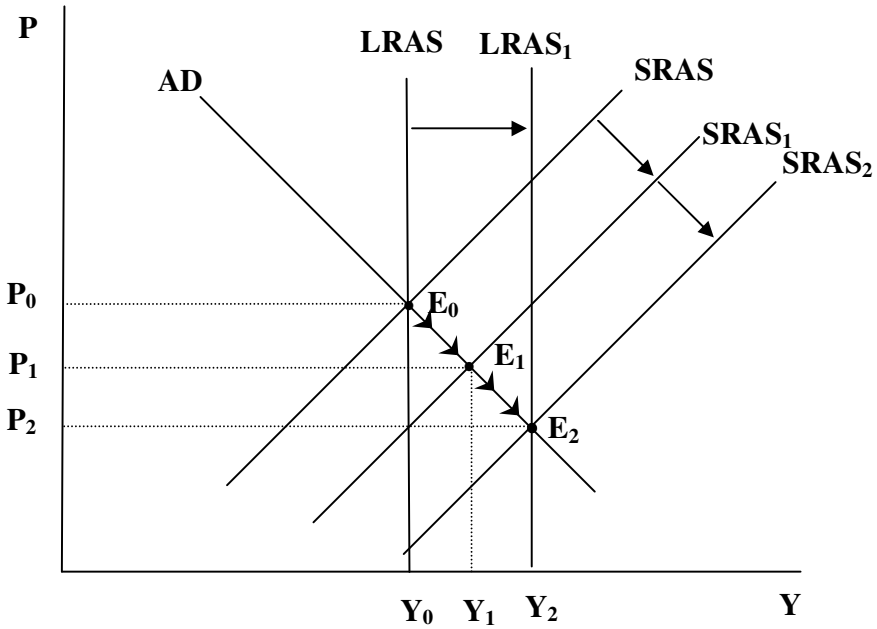
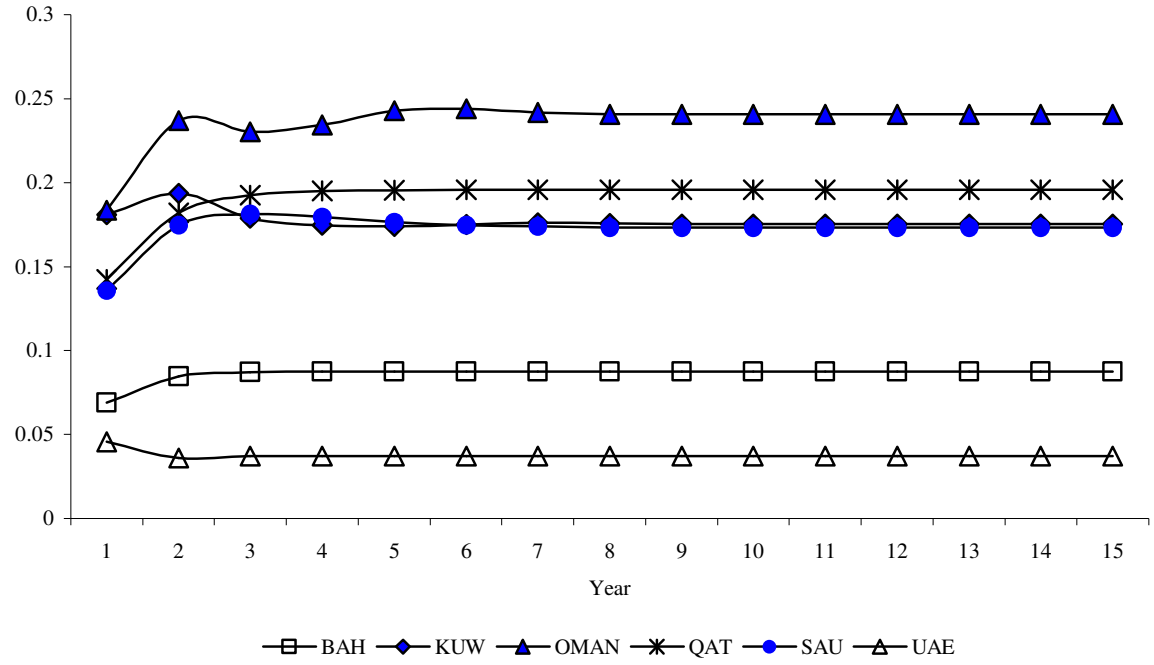


**Figure 3 –Price Level and Real GDP Cumulative Response to Demand Shocks**

**(a) Price Level**




**(b) Real GDP**

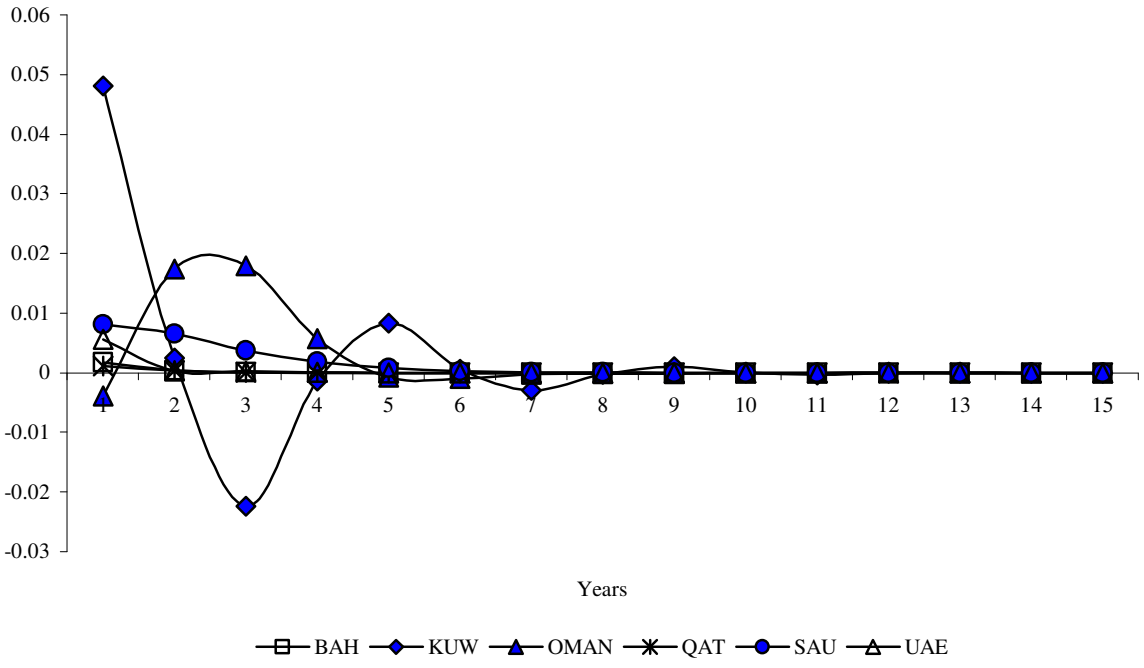
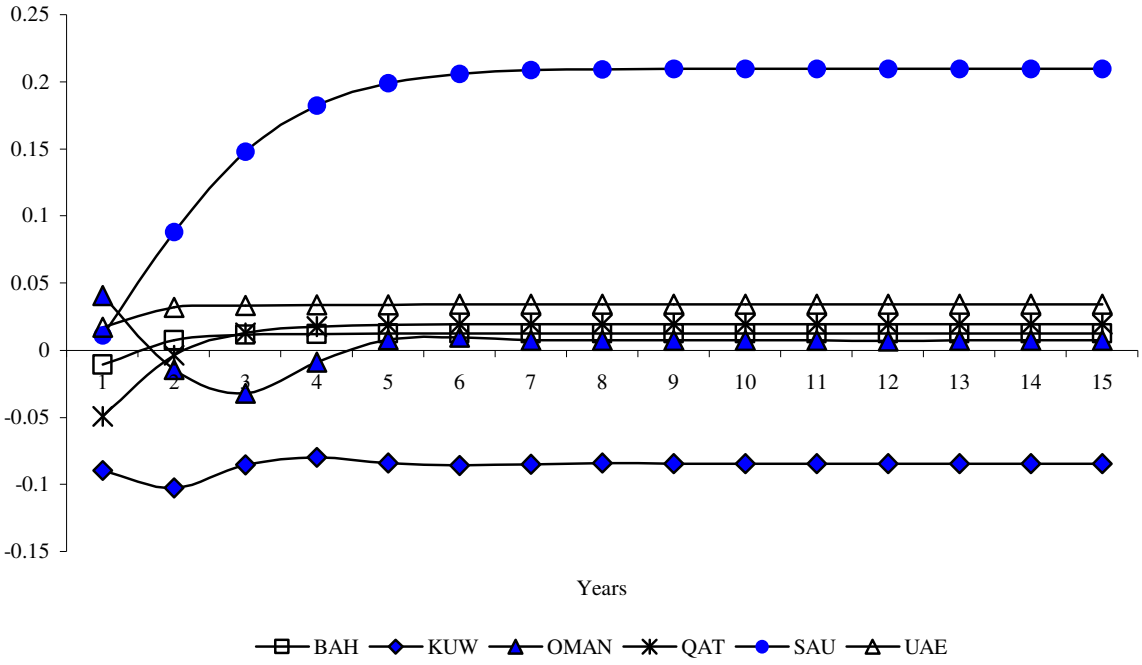


**Figure 4 – Real GDP and Price Level Cumulative Response to Supply Shocks**

**(a) Price Level**




**(b) Real GDP**