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Without Oil, How Do Gulf Countries Move? Non-hydrocarbon Business Cycles

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Abstract

This paper investigates the empirical characteristics of business cycles and the extent of cyclical comovement in the Gulf Cooperation Council (GCC) countries, using non-hydrocarbon GDP (excluding crude oil and natural gas sectors) and constituents of aggregate demand during the period 1990~2010. Although *hydrocarbons* still account for an overwhelming share of export earnings and fiscal revenues in the GCC countries leading to a higher degree of business cycle synchronicity at an aggregate level, this is driven largely by external factors influencing the price of crude oil and natural gas. By applying the Christiano-Fitzgerald asymmetric band-pass filter and a mean corrected concordance index, the results show that low level of synchronization in *non-hydrocarbon* business cycles across the GCC economies and a decline in the degree of synchronicity in the 2000s if Kuwait is excluded from the sample. It is partly because of divergent fiscal policies. The GCC countries do not appear to efficiently coordinate policies, let alone forming an optimal currency area.

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I. Introduction

This paper investigates the empirical characteristics of business cycles and the extent of cyclical comovement in the Gulf Cooperation Council (GCC) countries, using various measures of synchronization for non-hydrocarbon GDP and constituents of aggregate demand during the period 1990~2010. While some significant differences exist, the GCC countries share similar economic endowments and institutional structures.[1] Along with hydrocarbon dependence which exposes them to the volatility of oil prices, the GCC countries have long maintained exchange rate regimes pegged to the U.S. dollar that limit the scope of discretionary monetary policy to manage domestic aggregate demand. Although hydrocarbons still account for an overwhelming share of export earnings and fiscal revenues in the GCC countries, resulting in a higher degree of business cycle synchronicity at an aggregate level, economic diversification efforts have led to the emergence of other vibrant sectors in recent years. As reported in national accounts, non-hydrocarbon GDP excludes the production of crude oil and natural gas and includes agriculture, commerce, construction, banking and other financial services, manufacturing, telecommunication, transportation, tourism, and social services. Accordingly, the share of non-hydrocarbon sectors have increased from about 55 percent of GDP in 2000 to above 62 percent by the end of 2010.[2]

Since its establishment in 1981 as a regional cooperation platform, the GCC has moved towards closer economic integration, aiming to establish a monetary union.[3] From a theoretical point of view, an important criterion for participation in a currency union is the synchronization of business cycles. According to the theory of optimum currency area developed by Mundell (1961), McKinnon (1963), and Kenen (1969), the more synchronized the business cycles of the members within the currency union

[1] The GCC consists of six countries along the Arabian Gulf—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (U.A.E.).

[2] Oil price fluctuations tend to influence the share of hydrocarbon-based and non-hydrocarbon sectors in GDP. Lower oil prices may lead to a higher share of non-hydrocarbon GDP, holding everything else constant.

[3] The GCC countries remain committed to monetary integration, but Oman and the U.A.E. have opted out at this stage and the launch of the single currency has been postponed for an unspecified period.

are, the lower the probability of asymmetric shocks, and the less dramatic the loss of monetary and exchange rate policy. Even if cycle phases coincide perfectly, cross-country differences with respect to the amplitude of the business cycle can still impede the implementation of a common monetary policy. For that reason, business cycle symmetry among member countries is a necessary condition for the effectiveness of a common monetary framework and the long-term sustainability of the currency union, as recently highlighted by emerging tensions within the euro area.

The empirical results show that the degree of non-hydrocarbon business cycle synchronization across the GCC countries, measured by the contemporaneous bilateral correlation coefficients of the cyclical components from each national non-hydrocarbon business cycle *vis-à-vis* others, was low during the period 1990~2010. Further, cross-country correlations declined in the 2000s compared to the preceding decade if Kuwait is excluded from the sample. At the disaggregated level, components of aggregate demand also show a low degree of cyclical comovement among the GCC countries. Likewise, the concordance index, an alternative measure of synchronicity, indicates diverging non-hydrocarbon business cycles over time. Another key result is that foreign impulses play a more prominent role than regional factors.

The country-specific asymmetric shocks have a number of implications. First, the low degree of comovement in real non-hydrocarbon GDP and also in the components of aggregate demand, suggests that the GCC countries tend to be exposed to asymmetric shocks, and that country-specific factors and spillovers from the rest of the world are far more important than regional interlinkages in explaining the cyclical fluctuations. Second, the extent of non-hydrocarbon cyclical comovement among the GCC countries is also lower than the degree of synchronicity among European economies prior to the establishment of the euro area. Third, although a limited level of intra-regional trade and financial integration certainly contribute to business cycle desynchronization across the region, another important factor is the heterogeneous fiscal policy impulses. Therefore, with a limited degree of business cycle synchronization at this juncture, the GCC countries do not appear to be an optimum currency area and the cost of a monetary union may outweigh its benefits.

The remainder of this paper is structured as follows. Section II discusses conceptual issues regarding business cycle analysis and describes the empirical methodology. Section III provides an overview of data used in the analysis. Section IV summarizes the estimation results, and Section V identifies the factors contributing to business cycle desynchronization. Section VI offers concluding remarks, focusing on the reforms

that would facilitate a greater degree of trade, financial integration, and business cycle synchronization.

II. Empirical Methodology

In a pioneering work, Burns and Mitchell (1946) analyzed business cycles in terms of expansions and contractions in the level of economic activity. This paper follows Lucas (1977) and Kydland and Prescott (1990) in defining business cycles as deviations from trend. Based on the empirical methodology outlined by Frankel and Rose (1998), Kose, Prasad, and Terrones (2003),and Baxter and Kouparitsas (2005), the cyclical component of the fluctuations in *real non-hydrocarbon GDP* is extracted to estimate the degree of business cycle synchronization between pairs of GCC economies using various approaches. Additionally, the cyclical component of the oscillations in *aggregate demand* variables comprised of *government's* consumption and investment spending, *private sector's* consumption and investment spending, non-hydrocarbon exports and imports and the pairwise correlation coefficients are estimated to determine which aggregate demand component is mostly responsible for the comovement of non-hydrocarbon business cycles across the GCC countries.

Real non-hydrocarbon GDP and its components are decomposed into trend and cyclical components using a non-parametric filter. The theory of the spectral analysis forms a foundation for analyzing different frequency components of the data, with a number of different ways to define the business cycle and to decompose the behavior of a time series into its trend and cycle components.[4] Different filtering techniques may lead to different business cycle patterns, both qualitatively and quantitatively, especially with a short time series, as it is the case for the GCC countries.[5] To extract the cyclical components of macroeconomic variables, this paper utilizes the band-pass filter proposed by Christiano and Fitzgerald (2003). Unlike several other low-pass filtering techniques such as the best known and widely applied Hodrick-Prescott filter, the advantage of the Christiano-Fitzgerald full sample asymmetric filter is that it can be used to isolate the component of a time series that lies within a particular band of

[4] Estrella (2007) provides a comprehensive review and comparative analysis of several commonly applied time-series filters in macroeconomic research.

[5] Canova and Dellas (1993) and Canova (1998) discuss various detrending methods and issues that may affect the empirical results.

frequencies, hence allowing the extraction of any preferred cycle range.

According to Stock and Watson (1999), the band-pass filter is preferable from a theoretical point of view since it eliminates both high-frequency oscillations, which might arise from measurement errors and noise, and low frequency oscillations, which tend to reflect the long-term growth component. Given observed values of series x, the required cyclical component of x with a period of oscillation between p_l and p_u, where $2<p_l<p_u<\infty$, is filtered as a new series y. In practice, the values of this true unobserved series, denoted as $\hat{y}$, are only an estimate. The optimal band-pass filter therefore approximates y by $\hat{y}$ in optimal projection context, in the sense that the mean squared error criterion, $E[(y-\hat{y})^2|x]$, is minimized by changing the set of optimal band-pass filter weights. In frequency, domain representation, the optimal solution for the generalized band-pass filter problem requires minimizing the sum of squared deviations between the ideal and approximate filter and weighting those deviations by the spectral density of x. For the random walk case, the estimated values of $\hat{y}$ for the periodic oscillation between p_l and p_u are given as,

$$\hat{y}_t = B_0 x_t + B_1 x_{t+1} + \cdots + B_{T-1-t} x_{T-1} + \tilde{B}_{T-t} x_T + B_1 x_{t-1} + \cdots + B_{t-2} x_2 + \tilde{B}_{t-1} x_1 \quad (1)$$

for $t = 3, 4, ..., T-2$

$$\frac{2\pi}{p_u},\ b = \frac{2\pi}{p_l},\ B_0 = \frac{b-a}{\pi} \text{ and } B_j = \frac{sin(jb)\ sin(ja)}{\pi j},\ j \geq 1$$

$\tilde{B}_{T-1}$ and $\tilde{B}_{t-1}$ are obtained as simple linear functions of B_j as,

$$\tilde{B}_{T-t} = -\frac{1}{2} B_0 - \sum_{j=1}^{T-t-1} B_j \quad (2)$$

for $t = 3, ..., T-2$ and $\tilde{B}_{t-1} = -[B_0 + B_1 + ... + B_{T-1-t} + \tilde{B}_{T-1} + B_1 + ... + B_{t-2}]$

In this application, x corresponds to the natural logarithm of real non-hydrocarbon GDP in each country, and $\hat{y}$ stands for the filtered cyclical component of series x.

Non-hydrocarbon business cycle frequency varies across the GCC countries, but appears to be shorter than those in the advanced economies. A typical range of business cycle frequency is 6 to 32 quarters with quarterly data or 2 to 8 years with annual data, but these boundaries should not be viewed as carved in stone. Developing

countries tend to experience more frequent regime shifts and shocks to trend growth than advanced economies (Aguiar and Gopinath 2007). As a result, the volatility of trend growth influences the cyclical pattern, making it incompatible to use a rule-of-thumb approach developed for business cycle analysis in the U.S. and other advanced countries. It is therefore necessary to compute the average duration of non-hydrocarbon cycles in the GCC countries and ascertain a typical range of business cycle frequencies. Analyzing business cycles in terms of expansions and contractions in the level of economic activity à la the Burns-Mitchell methodology shows that contractions in real non-hydrocarbon GDP are rare and short-lived, whereas expansions run for a long period. During 1990~2010, Bahrain, Saudi Arabia, and the U.A.E. did not experience a decline in real non-hydrocarbon GDP, while the average length of expansions was 12.7 years in the case of Kuwait, Oman, and Qatar. On the other hand, defining business cycles as deviations from trend shows that the periods of below-trend growth is no longer a rare event and the episodes of above-trend growth range from 2.3 to 4.5 years which is significantly shorter than the range derived from the classical business cycle analysis. This appears to be consistent with the empirical evidence on the nature and characteristics of business cycles in other developing countries (Rand and Tarp 2002). Accordingly, the filtering calculations in this study are based on a 2~5 year cycle with annual data.

The degree of non-hydrocarbon business cycle synchronization is estimated with three different approaches. First, the comovement of business cycles is estimated by the cross-country correlation of the cyclical components of non-hydrocarbon GDP. The higher the correlation coefficient, the stronger the synchronization of business cycles across the GCC countries.[6] Second, the extracted cyclical component of real non-hydrocarbon GDP in one country is regressed on the cyclical component for another country to confirm the findings based on correlation coeffecients. Third, following the methodology developed by Harding and Pagan (2002), the degree of non-hydrocarbon business cycle synchronization is gauged by the concordance index, which measures the average percentage of time in which two series coincide in the same phase of the cycle.[7] The concordance statistic is based on the binary series (0, 1) for each country, in which

[6] Since the strength of any relationship does not automatically imply its statistical significance, the significance of the correlation coefficient is tested against the null hypothesis of being zero. In the tables presented in the following section, the pairwise correlation coefficients that are statically significant at the five percent level are highlighted in bold.

[7] For the empirical application of the concordance index, see Artis, Kontolemis, and Osborn (1997), Cashin, McDermott, and Scott (1999), McDermott and Scott (2000), Nadal-De Simone (2002), Avouyi-Dovi and Matheron (2003), and Claessens, Kose, and Terrones (2011).

zero represents a period of below-trend growth and one represents above-trend growth. Considering that $C_{x,t}$ is one when the business cycle in country x is positive and zero when the cycle is negative, and $C_{y,t}$ is defined in the same way, thus the concordance index for the business cycles of country x and country y is defined as,

$$CI_{xy} = \frac{1}{T}\left\{\sum_{t=1}^{T}\left(C_{x,t}.C_{y,t}\right) + \sum_{t=1}^{T}\left(1-C_{x,t}\right).\left(1-C_{y,t}\right)\right\} \quad (3)$$

in which T represents the sample size. Even though analyzing a binary variable wastes potentially useful information, the concordance index allows detecting linear and non-linear relationships between business cycles. The concordance index ranges between zero and one, with zero indicating complete disconcordance, 0.5 denoting the lack of systematic relationship between the two variables, and one representing complete concordance of the cyclical behavior. While the concordance statistic is useful in studying linear and non-linear relationships between two cycles, it could be misleading when the series go through an extended period of above-trend or below-trend phase. Therefore, to deal with this potential measurement bias, it is necessary to calculate a mean corrected index of concordance:

$$MCCI_{xy} = \frac{2}{T}\left\{\sum_{t=1}^{T}\left(C_{x,t}-\bar{C}_x\right).\left(C_{y,t}-\bar{C}_y\right)\right\} \quad (4)$$

in which $C_{x,t}$ and $C_{y,t}$ are defined as above and $\bar{C}_x$ and $\bar{C}_y$ represent the mean for country x and country y, respectively, over the sample period. The mean corrected concordance index ranges from -1 (complete disconcordance) to +1 (complete concordance). Although this adjustment improves the concordance index's informational content, it still requires a test statistic for the significance. Various approaches are used in literature to assess the statistical significance of the concordance index. Per Harding and Pagan (2006), the coefficients, ρ, in the regression below are proportional to the mean corrected concordance index as,

$$\left(\frac{c_{y,t}}{\sigma_{C_y}}\right) = \eta + \rho\left(\frac{c_{x,t}}{\sigma_{C_x}}\right) + u_t \quad (5)$$

This implies that a null hypothesis of non-concordance between $C_{x,t}$ and $C_{y,t}$ corresponds to a null hypothesis of ρ being zero. In order to test the significance of

the mean corrected concordance index with the correct *t*-statistic, it is necessary to compute standard errors corrected for heteroskedasticity and autocorrelation. Hence, the Generalized Method of Moments (GMM) approach is employed to obtain a heteroskedasticity and autocorrelation consistent covariance matrix, using the mean corrected concordance index for the U.S. economy as the instrumental variable in the GMM estimations.

III. Data Overview

The dataset consists of annual time series for the GCC countries, China, Japan, the U.S. and regional aggregates for Asia and the euro area. All the series are obtained from the IMF's *World Economic Outlook* database covering the period of 1990~2010, as dictated by the availability of the data. Although business cycle analysis based on higher-frequency data tends to be more robust, providing a wider spectrum of insights, the GCC countries do not publish quarterly national accounts, with the exception of Bahrain since 2008 and Qatar since 2005. There are also no high frequency proxies such as the industrial production index.

Real GDP, real non-hydrocarbon GDP, and components of aggregate demand are used in estimating cyclical patterns and analyzing the extent of comovement. Using the Augmented Dickey-Fuller (ADF) unit root test, all the series are found to be non-stationary and integrated of order one.

IV. Estimation Results

After extracting the cyclical component of real non-hydrocarbon GDP for each GCC economy over the period 1990~2010, the degree of synchronization is estimated by the contemporaneous bilateral correlation coefficients of the cyclical components from each national non-hydrocarbon business cycle *vis-à-vis* others. The results, presented in Table 1, show that the pairwise correlation coefficients of the cyclical component of real non-hydrocarbon GDP was 0.13, on average, among the GCC countries, while excluding Kuwait from the sample because of the first Gulf War in the early 1990s raises the

average correlation coefficient to 0.17 over the entire sample period. Although the test results indicate that these aggregated estimates are not statistically significant at the five percent level, a few of the pairwise correlation coefficients come out to be statistically significant which are highlighted in bold in the following tables. Over the period 1990~2010, the highest degree of non-hydrocarbon business cycle comovement was observed between Oman and Qatar (0.64), Bahrain and the U.A.E. (0.42), and Qatar vis-à-vis Saudi Arabia (0.38) and the U.A.E. (0.49). In contrast, partly because of war-related distortions, Kuwait's non-hydrocarbon business cycle was negatively correlated with that of Bahrain and Saudi Arabia, and the degree of synchronicity between Saudi Arabia and the U.A.E. was virtually non-existent and statistically insignificant.

Table 1. Correlations of the Cyclical Component of Real Non-Hydrocarbon GDP

1990~2010	**average = 0.13** (0.17 when excluding Kuwait)					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	-0.37	1.00				
Oman	0.13	0.36	1.00			
Qatar	0.19	-0.01	0.64	1.00		
Saudi Arabia	0.23	-0.60	0.02	0.38	1.00	
U.A.E.	0.42	0.02	0.07	0.39	0.07	1.00
Sub-period 1990~1999	**average = 0.02** (0.19 when excluding Kuwait)					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	-0.61	1.00				
Oman	0.10	0.12	1.00			
Qatar	0.19	-0.53	0.35	1.00		
Saudi Arabia	0.26	-0.82	-0.02	0.66	1.00	
U.A.E.	0.73	-0.59	-0.16	0.46	0.23	1.00
Sub-period 2000~2010	**average = 0.27** (0.12 when excluding Kuwait)					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	0.37	1.00				
Oman	0.27	0.61	1.00			
Qatar	0.30	0.49	0.81	1.00		
Saudi Arabia	-0.03	0.13	0.17	-0.02	1.00	
U.A.E.	0.07	0.58	0.21	0.35	-0.31	1.00

(Notes) (i) The pairwise correlation coefficients are computed using the cyclical component of frequency-filtered real non-hydrocarbon GDP in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

The comparison of sub-periods reveals interesting trends in business cycle comovement among the GCC economies. The average correlation coefficient increased from 0.02 in the 1990s to 0.27 between 2000 and 2010, suggesting closer synchronization of non-hydrocarbon business cycles over the past decade. However, excluding Kuwait, the pairwise correlation coefficient showed a decline from 0.19 in the 1990s to 0.12 in the 2000s. While the contemporaneous bilateral correlation coefficients declined in some cases like Bahrain and Saudi Arabia from 0.26 in the 1990s to -0.03 in the 2000s,

Qatar and Saudi Arabia from 0.66 to -0.02, and Saudi Arabia and the U.A.E. from 0.23 to -0.31, there were significant increases in other areas like Bahrain and Kuwait from -0.61 to 0.37, Kuwait and Oman from 0.12 to 0.61, Kuwait and the U.A.E. from -0.59 to 0.58, and Oman and Qatar from 0.35 to 0.81 over the same period. Taking into account the small sample characteristics of the data, the analysis show that even though some of these sub-period estimates are statistically significant, the majority of pairwise correlation coefficients are insignificant and distorted by Kuwait-specific shocks in the early 1990s. Furthermore, regressing the extracted cyclical component of real non-hydrocarbon GDP in one country on the cyclical component for another country shows similar results, highlighting low and heterogeneous business cycle synchronicity across the GCC countries outside the hydrocarbon economy.

In addition to analyzing the cyclical behavior of non-hydrocarbon GDP at an aggregate level, this paper also extracts cyclical component of *aggregate demand* variables—government consumption and fixed investment spending, private consumption and fixed investment spending, non-hydrocarbon exports and imports—and calculates the bilateral correlation coefficients of each national cycle *vis-à-vis* others.

As presented in Table 2, the average pairwise correlation of the cyclical component of real government consumption among the GCC countries was 0.05 for both including and excluding Kuwait over the entire sample period. The highest degree of comovement in real government consumption was observed between Qatar and Saudi Arabia (0.64) and Oman and Qatar (0.39), while others have low or negative correlation.

Table 2. Correlations of the Cyclical Component of Real Government Consumption

1990~2010	**average = 0.05**					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	0.37	1.00				
Oman	**-0.51**	0.07	1.00			
Qatar	-0.31	-0.38	0.39	1.00		
Saudi Arabia	-0.05	-0.24	0.28	0.64	1.00	
U.A.E.	-0.25	0.15	0.17	0.35	0.10	1.00

(Notes) (i) The pairwise correlation coefficients are computed using the cyclical component of frequency-filtered real government consumption in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

In the case of real government fixed investment, Table 3 indicates that the degree of synchronization is virtually non-existent, and still very low (0.02) when excluding Kuwait. While a few pairs of countries have relatively high correlation coefficients, such as Qatar and the U.A.E. (0.43), Bahrain and Qatar (0.23), and Qatar and Saudi Arabia (0.22), most country pairs have low or negative correlation.

Table 3. Correlations of the Cyclical Component of Real Government Investment

1990~2010	average = 0.00					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	0.13	1.00				
Oman	-0.33	0.07	1.00			
Qatar	0.23	-0.09	-0.07	1.00		
Saudi Arabia	-0.07	-0.02	0.07	-0.17	1.00	
U.A.E.	-0.18	-0.27	0.10	**0.43**	0.22	1.00

(Notes) (i) The pairwise correlation coefficients are computed using the cyclical component of frequency-filtered real government investment spending in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

The average correlation coefficient of the cyclical components of real private consumption, presented in Table 4, indicates that the extent of synchronization was also significantly low (0.09) across the GCC countries (0.14 when excluding Kuwait). The highest degree of cyclical synchronicity in private consumption is between Oman and Saudi Arabia (0.59), Saudi Arabia and the U.A.E. (0.52), and Oman and the U.A.E. (0.46), while Kuwait has negative correlation *vis-à-vis* all GCC countries except Bahrain (0.09).

Table 4. Correlations of the Cyclical Component of Real Private Consumption

1990~2010	average = 0.09					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	0.09	1.00				
Oman	-0.17	0.06	1.00			
Qatar	0.08	-0.15	0.13	1.00		
Saudi Arabia	-0.15	-0.35	**0.59**	0.13	1.00	
U.A.E.	0.02	-0.18	**0.46**	**0.45**	**0.52**	1.00

(Notes) (i) The pairwise correlation coefficients are computed using the cyclical component of frequency-filtered real private consumption in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

In terms of real private fixed investment spending, the average correlation coefficient of the cyclical components is -0.14 (-0.08 when excluding Kuwait), as shown in Table 5. While Bahrain and Kuwait has a relatively higher degree of synchronicity in private fixed investment spending (0.30), other countries have either low or significantly negative correlations.

Table 5. Correlations of the Cyclical Component of Real Private Investment

1990~2010	average = 0.14					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	0.30	1.00				
Oman	-0.26	0.09	1.00			
Qatar	**-0.55**	**-0.71**	0.26	1.00		
Saudi Arabia	**-0.48**	**-0.51**	0.09	0.26	1.00	
U.A.E.	-0.13	-0.11	-0.38	0.26	-0.22	1.00

(Notes) (i) The pairwise correlation coefficients are computed using the cyclical component of frequency-filtered real private investment in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

In the case of real non-hydrocarbon exports, the average pairwise correlation of the cyclical components across the GCC countries, as shown in Table 6, is 0.05 (0.08 excluding Kuwait). While only Bahrain and Qatar have relatively high and statistically significant synchronization, negligible and negative correlations are found for the rest.

Table 6. Correlations of the Cyclical Component of Real Non-Hydrocarbon Exports

1990~2010	average = 0.05					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	0.07	1.00				
Oman	-0.14	-0.05	1.00			
Qatar	**0.57**	0.30	0.17	1.00		
Saudi Arabia	0.20	**-0.87**	0.11	-0.10	1.00	
U.A.E.	0.28	0.09	-0.10	0.21	-0.02	1.00

(Notes) (i) The pairwise correlation coefficients are computed using the cyclical component of frequency-filtered real non-hydrocarbon exports in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

The results for real imports, presented in Table 7, show that the average correlation of cyclical components is 0.17 (0.12 excluding Kuwait). While Oman has relatively high and statistically significant synchronization *vis-à-vis* Bahrain and the U.A.E., other pairs of countries have low and negative correlation coefficients. Nevertheless, these results suggest that imports, along with private fixed investments, are the components of aggregate demand mostly responsible for the comovement of non-hydrocarbon cycles.

Table 7. Correlations of the Cyclical Component of Real Imports

1990~2010	average = 0.17					
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	0.29	1.00				
Oman	**0.51**	0.33	1.00			
Qatar	0.17	-0.38	-0.14	1.00		
Saudi Arabia	0.03	0.13	0.13	0.07	1.00	
U.A.E.	0.33	**0.45**	**0.57**	-0.24	0.37	1.00

(Notes) (i) The pairwise correlation coefficients are computed using the cyclical component of frequency-filtered real imports in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

The mean corrected concordance indices also indicate that non-hydrocarbon business cycles of the GCC countries are not synchronous. In addition to the cross-correlation coefficients among the deviation cycles, the degree of comovement in non-hydrocarbon business cycles is also estimated by a concordance index that measures the average percentage of time wherein two series coincide in the same phase of the cycle. This non-parametric index ranges from zero to one, with zero indicating complete disconcordance between the two cycles, 0.5 indicating non-concordance, and 1 representing complete concordance of the cyclical behavior. Since long periods in any given phase of the cycle can cause an upward bias, it is necessary to calculate a mean corrected version of the concordance index. As presented in Table 8, the adjusted concordance indices for the cyclical component of real non-hydrocarbon GDP show that the GCC economies were contracting or expanding in tandem only 6 percent of the time during the period 1990~2010. Although calculating the concordance statistics for sub-periods is problematic because of data limitations, the average concordance index appears to increase from zero percent in the 1990s to 11 percent in the 2000s, implying a relatively higher degree of synchronization of non-hydrocarbon business cycles across the GCC countries in recent years.

Table 8. Mean Corrected Concordance Indices

1990~2010			average = 0.06			
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	-0.22	1.00				
Oman	0.12	0.07	1.00			
Qatar	0.21	-0.04	0.21	1.00		
Saudi Arabia	0.17	-0.24	0.08	0.10	1.00	
U.A.E.	0.02	0.07	0.02	0.21	0.08	1.00
Sub-period 1990~1999			**average = 0.00**			
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	-0.21	1.00				
Oman	0.00	0.10	1.00			
Qatar	0.28	-0.20	0.00	1.00		
Saudi Arabia	0.12	-0.40	0.00	0.12	1.00	
U.A.E.	0.20	-0.30	-0.10	0.20	0.20	1.00
Sub-period 2000~2010			**average = 0.11**			
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	U.A.E.
Bahrain	1.00					
Kuwait	-0.22	1.00				
Oman	0.23	0.04	1.00			
Qatar	0.15	0.10	0.40	1.00		
Saudi Arabia	0.22	-0.10	0.15	0.08	1.00	
U.A.E.	-0.14	0.40	0.13	0.22	-0.03	1.00

(Notes) (i) The mean corrected concordance indices are computed using the cyclical component of frequency-filtered real non-hydrocarbon GDP in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

Pairwise concordance indices show low but converging non-hydrocarbon business cycles among the GCC countries over time. On a bilateral basis, the highest degree of concordance in non-hydrocarbon business cycles was observed between Oman and Qatar (moving together 21 percent of the time), Bahrain and Qatar (21 percent of the time), and Bahrain and Saudi Arabia (17 percent of the time). In contrast, the cyclical behavior of Kuwait's non-hydrocarbon GDP was in disconcordance *vis-à-vis* Bahrain, Qatar, and Saudi Arabia, while other pairs of countries had significantly low concordance indices. Even though none of these findings is statistically significant, the

mean corrected concordance indices also confirm heterogeneous but slightly concordant patterns of non-hydrocarbon business cycles across the GCC countries over time. For example, while the degree of disconcordance between Bahrain and Kuwait increased from 21 percent in the 1990s to 22 percent in the 2000s, the level of disconcordance between Kuwait and Saudi Arabia declined from 40 percent to 10 percent and the relationship between Kuwait and the U.A.E. moved from disconcordance to concordance of 40 percent over the same period. However, it should be noted that data limitations make sub-period calculations less informative, if not immaterial, since the concordance statistics cover a small number of cycles even for the full sample period.

Table 9. Correlations of the Frequency-Filtered Cyclical Components

1990~2010	**Real GDP**				
Real non-hydrocarbon GDP	Asia	China	Japan	Euro Area	U.S.
Bahrain	0.15	0.25	-0.05	-0.24	0.10
Kuwait	-0.20	-0.15	0.13	0.39	0.10
Oman	-0.06	0.27	0.10	0.30	0.20
Qatar	0.29	0.31	0.18	0.17	0.31
Saudi Arabia	**0.48**	0.42	0.20	0.00	0.24
U.A.E.	0.29	0.17	0.12	-0.02	0.22
1990~1999	**Real GDP**				
Real non-hydrocarbon GDP	Asia	China	Japan	Euro Area	U.S.
Bahrain	0.16	0.34	-0.29	**-0.84**	0.18
Kuwait	-0.46	-0.38	-0.16	**0.72**	-0.13
Oman	-0.44	0.24	-0.57	-0.12	0.25
Qatar	0.46	0.55	-0.19	-0.37	0.50
Saudi Arabia	0.54	0.48	0.16	-0.44	0.25
U.A.E.	0.55	0.33	-0.04	-0.58	0.13
2000~2010	**Real GDP**				
Real non-hydrocarbon GDP	Asia	China	Japan	Euro Area	U.S.
Bahrain	0.19	0.12	0.29	0.18	0.06
Kuwait	0.18	0.14	0.35	0.32	0.27
Oman	0.30	0.32	0.41	0.46	0.18
Qatar	0.16	0.15	0.34	0.35	0.23
Saudi Arabia	0.52	0.57	**0.59**	**0.73**	0.56
U.A.E.	0.09	0.04	0.19	0.14	0.26

(Notes) (i) Bilateral correlation coefficients are computed using the cyclical component of filtered real non-hydrocarbon GDP for the GCC and real GDP for trading partners in logarithmic form.
(ii) The bold figures indicate statistical significance at the 5 percent level.

(Source) Author's calculations

Correlation coefficients suggest that foreign impulses play a more prominent role than intra-regional synchronicity. The degree of business cycle synchronization between the GCC countries and their main trading partner countries and blocks, as shown in Table 9, indicates a greater degree of contemporaneous correlation, on average, compared to intra-regional synchronicity during the period 1990~2010. For example, the highest degree of business cycle comovement was observed between Saudi Arabia and Asia (0.48), while the non-hydrocarbon business cycles of Bahrain and Kuwait were negatively correlated with the cyclical component of real GDP in the Eurozone (-0.24) and in Asia (-0.20), respectively. The comparison of sub-periods shows a greater degree of business cycle synchronization in the 2000s compared to the preceding decade. For example, in the case of Saudi Arabia, the contemporaneous bilateral correlation coefficients *vis-à-vis* China, Japan, the Eurozone and the U.S. increased from 0.48, 0.16, -0.44, and 0.25, respectively, in the 1990s to 0.57, 0.59, 0.73, and 0.56 during the period 2000~2010. The correlation coefficient of Bahrain *vis-à-vis* the Euro area evolved from -0.84 and 0.18 over the same period likewise. In contrast, the U.A.E.'s non-hydrocarbon business cycle turned less synchronized with Asia, particularly China, over the past decade compared with the 1990s, while its correlation coefficient *vis-à-vis* the Euro area and the U.S. showed a marked increase.

V. Factors of Business Cycle Desynchronization

The limited extent of business cycle synchronization is related to the low level of intra-regional trade and financial integration. While a high degree of sectoral specialization in hydrocarbons can explain business cycle comovement at the aggregate level, the empirical results demonstrate significant differences in non-hydrocarbon business cycles. The GCC countries are highly open according to total international trade as a share of GDP, which is mainly due to hydrocarbon exports and imports. Despite the establishment of a free trade area in 1983 and a custom union in 2003, the share of intra-regional trade remains relatively low at less than 5 percent of the total trade. This compares unfavorably with the EU (above 70 percent) and the NAFTA (about 50 percent), reflecting hydrocarbon dependence and weak sectoral complementariness among the GCC economies, leading to business cycle desynchronization. Nevertheless, country pairs that have closer trade linkages tend to have higher degree of non-

hydrocarbon business cycle comovement on average, which is consistent with the empirical evidence from a plethora of studies.[8] On the other hand, the regional financial interlinkages remain limited, in spite of an increase in bilateral asset holdings as indicated by an increase in stock market correlations between the GCC countries.[9]

The subcomponents of non-hydrocarbon GDP show different cyclical behaviors, with negative and positive correlation coefficients over the sample period. Although a systematic analysis of the cyclical patterns of fiscal policy and the behavior of real non-hydrocarbon GDP is beyond the scope of this paper, a preliminary investigation suggests that fiscal policy heterogeneity have a considerable effect on the cyclical variability of non-hydrocarbon output across the GCC countries. Over the full sample period, varying fiscal reaction functions, measured by the cyclically adjusted non-hydrocarbon fiscal balance, resulted in the significant share of non-hydrocarbon output variability. This is not an unexpected finding since government's consumption and fixed investment spending account for almost 32 percent of GDP and over 47 percent of non-hydrocarbon GDP, on average. Furthermore, private consumption and imports exhibit procyclical behavior, along the lines of the fiscal impulse, whereas exports are relatively countercyclical.

While fiscal convergence would lead to a higher degree of business cycle synchronization by purging idiosyncratic fiscal policy shocks, asymmetric fiscal behavior reduces the synchronicity of business cycles.[10] Even though hydrocarbons account for a large share of fiscal revenues in all GCC countries, the extent of discretionary policy reaction functions vary greatly, which in turn shape the cyclical behavior of non-hydrocarbon output at the national level and the comovement of non-hydrocarbon business cycles at the regional level. The low pairwise correlations of the cyclical components of real government consumption and investment spending among the GCC countries indicate that diverging fiscal impulses are likely to be one of key factors to business cycle desynchronization.

[8] Although Krugman (1993) notes that trade integration may lead to greater specialization and hence cyclical desynchronization, Frankel and Rose (1998) and Baxter and Kouparitsas (2005) show that countries that have closer trade linkages tend to have more closely synchronized business cycles. Similarly, Clark and van Wincoop (2001) find that states within the U.S. are more closely synchronized than countries within the EU, indicating a greater extent of trade linkages within the U.S. compared with European countries. Nevertheless, as Kose, Prasad and Terrones (2003) suggest, business cycle oscillations in developing countries tend to be driven by country specific shocks and therefore exhibit a low degree of synchronization with other business cycles.

[9] Using interest rate and equity price data, Espinoza, Prasad, and Williams (2010) investigated financial integration in the GCC countries and found evidence of regional convergence and integration.

[10] Bower and Guillemineau (2006) show that the homogenization of fiscal policies has been one of the main determinants of business cycle synchronization in the euro area, while Akin (2006) highlights the significance of common fiscal shocks as a determinant of cyclical convergence in a broader set of countries.

VI. Conclusion

The empirical analysis shows that the degree of non-hydrocarbon business cycle synchronization, as measured by the contemporaneous correlation coefficients of the cyclical components from each national non-hydrocarbon business cycle *vis-à-vis* others, remained low and heterogeneous during the period 1990~2010. Even though cross-country correlations show an increase in the 2000s compared to the preceding decade, the results excluding Kuwait suggest a decline in the degree of business cycle synchronicity. This is also the case for components of aggregate demand, indicating a significantly low, if not negative, degree of synchronization in cyclical oscillations. Likewise, the mean corrected concordance statistics indicate that real non-hydrocarbon GDP's in the GCC countries are barely synchronized, contracting or expanding in tandem for only 6 percent of the time during the full sample period. Another key empirical regularity is that global impulses play a more prominent role than regional factors. The extent of business cycle synchronization between the GCC countries and their main trading partner countries indicates a greater degree of contemporaneous correlation compared to intra-regional synchronicity.

Our findings have a number of policy implications, especially in view of divergent fiscal impulses. First, the low degree of comovement in real non-hydrocarbon GDP and also in components of aggregate demand suggest that the GCC countries have been exposed to asymmetric shocks, and that country-specific factors and spillovers from the rest of the world are far more important than regional interlinkages in explaining the cyclical fluctuations. Second, the extent of non-hydrocarbon cyclical comovement among the GCC countries is lower than the degree of synchronicity among European economies prior to the establishment of the euro area (Artis, Krolzing, and Toro 2004; Camacho, Perez-Quiros, and Saiz 2004).[11] Third, although a limited level of intra-regional trade and financial integration contribute to business cycle desynchronization across the region, heterogeneous fiscal policy impulse is another or consequently important factor. With this limited degree of business cycle synchronization at this juncture, the GCC countries do not appear to efficiently coordinate macroeconomic policies, let alone forming an optimum currency area.

[11] The level of business cycle synchronization—both in terms of GDP and aggregate demand components—among the EU countries has increased steadily in the post-war period and especially after the introduction of the single currency.

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