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On the feasibility of monetary union among Gulf Cooperation Council (GCC) countries: does the symmetry of shocks extend to the non-oil sector?

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Abstract GCC countries' output is heavily dichotomized into oil and non-oil. Oil shocks have similar effects on all member countries but little is known about their responses to non-oil shocks. This paper sets out to determine (1) whether aggregate demand (AD) and non-oil supply shocks (AS) are symmetrical across these countries to justify their suitability for monetary union; and (2) whether there is any commonality of shocks with the United States and the three major European countries, namely France, Germany, and Italy, which can warrant the choice of either the US dollar or the Euro as the anchor for the expected common currency of the bloc. We use bivariate structural vector autoregression models identified with long-run restrictions to extract the shocks. Our results show that (a) AD shocks are unequivocally symmetrical but non-oil AS shocks are weakly symmetrical across GCC countries thereby suggesting a monetary union is feasible, but not overwhelmingly; (b) neither AD nor AS shocks are symmetrical between GCC countries and the selected European countries; (c) GCC's AD shocks are symmetrical with the US but non-oil AS shock are not. Furthermore, there are no significant changes in the results when we aggregate the GCC countries as a bloc. We therefore surmise that the US dollar is a more appropriate anchor for the new currency than the Euro since US monetary policy can at least help smooth demand shocks in GCC countries.

Keywords GCC · Monetary Union · Shocks Symmetry · Currency Anchor

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1 Introduction

In this paper we address two key empirical questions. First, to what extent do the non-oil sectors of the GCC countries, namely Bahrain, Kuwait, Qatar, Oman, Saudi Arabia, and the United Arab Emirates (UAE), satisfy the prerequisite of common shocks for monetary union?[1] Second, does the degree of shocks symmetry or asymmetry between the GCC countries and the United States (US) and/or the three largest European economies (France, Germany, and Italy) warrant the choice of either the US dollar or the Euro or a combination of the two as the anchor for the newly proposed single currency? This paper is motivated by the upcoming signing of a monetary union by GCC countries and the issuance of a single currency, which is to be pegged to the US dollar. Also, since the recent decline in the value of the dollar relative to the Euro and other major currencies has rekindled the debate on the merit of the dollar as a solid anchor; we are particularly interested in determining how suitable of an alternative the Euro or a basket could be for these countries.

There is an abundant literature on the choice of exchange rate regimes and the dollarization of economies. Most notably is the seminal paper of Mundell (1961) on optimum currency areas (OCAs) along with subsequent works by McKinnon (1963), Kenen (1969), and Tower and Willet (1976) that stress the importance of relative economic sizes, labor mobility, degree of openness, trade concentration, and similarity of shocks. These contributions constitute the workhorse for assessing the suitability of fixed, flexible exchange rate regimes, and prospective monetary unions. The determination of the degree of symmetry between shocks across countries has been thus far the most popular criterion used in empirical works to evaluate OCAs. According to this approach, one needs to examine whether AD and AS shocks are correlated across member countries to conclude on the desirability of monetary union, ceteris paribus. In this paper, not only are we interested in the suitability of either the US dollar or the Euro, or an index based on the two currencies as the principal anchor for the new GCC currency, but we also examine the symmetry of shocks both across and between member countries and possible anchor countries.

The debate on whether fixed regimes are better than floating regimes, vice-versa, is a very old one. Under a fixed exchange rate regime, monetary policy is imported and provided that fiscal and monetary disciplines are in order at home, inflation and output tend to be stable. The ensuing costs are forgone potential seignorage revenue and the inability to respond to asymmetric shocks, among others. Under flexible exchange rate systems, countries usually experience higher inflation and lower growth but are better equipped to respond to economic shocks since the conduct of monetary policy rests with their central banks. However, the theory of OCAs is clear on its prescriptions regarding the choice of exchange rate regime. Countries that are subjected to idiosyncratic shocks are better off in retaining monetary policy independence while those that are subjected to symmetric shocks may opt for a

[1] It is worth noting that the government of Oman has officially pulled out of the monetary union initiative in 2007 due to their inability to meet inflation targets.

fixed exchange rate system. In this regard, it is the symmetry of shocks that dictates whether the Euro or the dollar or a basket is the suitable anchor to peg the new currency to.

Following the work of Bayoumi and Eichengreen (1994), output and prices are two key macroeconomic variables whose dynamics have been intensely scrutinized to gauge AD and AS shocks. However, in the case of GCC countries, it is well-known that output is heavily dichotomized. About 54% of total output for the group comes from the non-oil sector while the oil sector contributes the remaining 46%. An important feature of these economies is that they already face symmetric shocks in the oil sector which partially justifies the undertaking of currency unification and eventually the pegging of that currency to the US dollar. Since oil output is traded in US dollar in the international market, they all react similarly to shocks tributary to that sector. Whether they themselves produce those shocks by curtailing production via the Organization of Petroleum Exporting Countries (OPEC) or respond to those shocks emanating from increase or decrease in demand.

Recently, there have been renewed efforts from GCC governments to reduce their reliance on the oil sector through reinvestment of oil revenues in infrastructure, tourism, construction, and other services in an attempt to further diversify their economies. In essence, the fundamental issue we address in this paper is whether the growing importance of the non-oil sector for these economies likely to impose substantial adjustment costs if their responses to shocks are not synchronized.

The case of the GCC countries is peculiar. All member countries but Kuwait have had their currencies pegged to the US dollar since the 1970s. With the apparent downfall of the US dollar as a reserve currency and the rise in inflation, there have been calls for a revaluation of individual currencies with respect to the dollar, and in some cases, for even a de-peg of the currency to the US dollar in favor of either the Euro or a basket peg. Since the GCC countries plan to achieve a monetary union by 2010 and peg their new currency to the US dollar, it is imperative to test whether GCC countries and the US are subjected to similar macroeconomic shocks, notwithstanding, it is monetary policy from the US that will shape the path of non-oil output and prices in these countries as an economic bloc. Since the Euro or a basket peg with major currencies such as the Euro and the dollar has been suggested as alternatives, it is a natural extension while we are extracting the shocks to look into the suitability of these alternative anchors. In view that the Euro would play the same role as the dollar for the GCC countries, we investigate whether shocks from the GCC countries and the core European economies are symmetric. Our hypothesis is that if both demand and supply shocks are symmetric between the GCC countries and the US (core European countries), then the US dollar (Euro) is qualified as the suitable anchor. However, if, say, supply (demand) shocks are symmetric between the GCC countries and the US but demand (supply) shocks are symmetric between the GCC countries and the core European countries, then it may make sense for a basket with these two major currencies to be the appropriate anchor. The choice of an anchor here is only guided by the underlying principle that the costs of forming a currency union tend to be relatively small when shocks are synchronized across countries. In this vein, it is preferable for a country to adopt the currency of another country with which they share at least one common shock as opposed to none, of course, other factors such as political and cultural affinities remain the same.

The approach taken in this paper is in line with previous works in the literature (Bayoumi and Eichengreen 1994; Horvath and Rátfai 2004) that employ bivariate structural vector autoregression (SVAR) of output growth and inflation identified with long-run restrictions *à la* Blanchard and Quah (1989). We compute these variables using data on non-oil output, real GDP, and GDP deflator for the period 1970–2006 from the United Nations Statistical Databases—National Accounts Main Aggregates. In the case of GCC countries, our SVARs contain non-oil GDP growth and inflation. For the prospective anchor countries, we use data on real GDP, since we have no compelling reason to disaggregate their output into oil and non-oil components. Non-oil GDP can be seen as a proxy for industrial production, which is a subcomponent of real GDP. Therefore, there is no great loss of information from calculating the correlation between shocks originating from SVAR with non-oil output growth and those emerging from real GDP growth. We use the long-run restriction that only supply shocks can have long-term effects on non-oil output (output) to identify our model though it may be quite possible that "positive shocks to the oil sector may spill over substantially to the non-oil sector through for example increased spending on education and infrastructure."[2] Our results show at the 5% significance level that: (a) although demand as well as supply shocks are symmetric for the core European countries, these shocks are mostly asymmetric with shocks affecting the GCC countries; (b) GCC supply shocks to the non-oil sector are asymmetric with US supply shocks; (c) with the exception of the UAE, demand shocks are mostly symmetric between the GCC countries and the US; (d) On average supply shocks to the non-oil sector as well as demand shocks are symmetric across GCC countries, with the latter showing a tighter link. These results conspicuously suggest that there are major adjustment costs involved for GCC countries if they chose to anchor their new currency with the Euro. Despite its continuous decline vis-à-vis other currencies, the US dollar remains an optimum choice since monetary policy from the US can smooth demand shocks both at home and in the GCC countries.

The rest of the paper is organized as follows. Section 2 discusses the empirical background. Section 3 presents the underlying theory and the SVAR methodology. Section 4 describes and analyzes the data in details. Section 5 discusses the empirical results and Section 6 concludes the paper.

2 Background

There are few studies in the literature that focus on the issue of monetary union between GCC countries. Although these studies report different results, they all follow the same methodology and approaches as those applied to studies prior to the formation of the European Union. These studies typically look at the suitability of monetary union from a standpoint of costs and benefits for each country. The focus

[2] We thank an anonymous referee for stressing out this point, It is worth reiterating that we concentrate on the non-oil sector for the GCC countries. Therefore the term 'aggregate supply shock' used in the whole of the paper refers to both non-oil supply shocks and oil supply shocks that can find their ways to the non-oil sector via government spending.

is mostly on the convergence criteria, primarily, the comparisons of inflation, real GDP growth, fiscal imbalances, tariff structures, current accounts, debt to GDP ratio, non-oil fiscal deficits, intra-regional trade volume and movement in real effective exchange rate across countries (Sturm and Siegfried 2005; Pattanaik 2007; Dar and Presley 2001; Jadresic 2002; Iqbal and Fasano 2003; Fasano and Schaechter 2003; Fasano and Iqbal 2002; 2003; Hebous 2006; Laabas and Limam 2002; Oman Economic Review, 2002; Abed et al. 2003; and Ibrahim, 2004). The most comprehensive of all these studies is Sturm and Siegfried (2005). Although these authors address the similarity of economic structures among member states, and conclude that these structures are largely dominated by the production of oil and gas, they did not focus on the responses of these countries to similar macroeconomic shocks.

The most thorough empirical study in the literature on GCC monetary union thus far is Abu-Bader and Abu-Qarn (2006). These authors use bivariate SVARs of total output and prices identified with long-run restrictions to extract AD and AS shocks for the GCC countries. They also rely on correlation analysis along with cointegration and common cycle tests to assess the long-run movements in real output across countries and to uncover the existence or lack thereof of common short-run cycles. Their results indicate that while the transitory demand shocks are typically symmetric, the permanent supply shocks are asymmetric. It is worth noting that these authors did not find synchronous long-run and short-run movements in output for GCC countries.

Besides Buiter's (2007) reservations on the use of long-run restrictions, it is important to note that there are two key shortcomings to Abu-Bader et al.'s (2006) paper. The first is related to the use of aggregate instead of non-oil output to measure macroeconomic shocks, which makes it difficult to disentangle symmetry from asymmetry of supply shocks. Since output is subject to both oil-and non-oil supply shocks, it is the relative magnitude of these shocks that can determine the overall disturbances to the economy of each member country. Oil-related supply shocks are most likely common to all GCC countries, but what we do not know for sure is whether the non-oil sectors across these countries are subjected to the same shocks, and there are no empirical studies thus far on this issue. As Buiter also reported, the empirical studies cited earlier present overwhelming statistical and econometric evidences on the differing structure of these economies. Moreover, Bayoumi and Eichengreen (1994, p.10) noted that for countries where output is dominated by the production of oil (or other raw materials), a rise in the price of oil is likely to increase both total output (due to the boost in oil production) and AD (through the impact of oil revenues on real incomes). As they emphasized, it may be difficult for oil-producing countries to distinguish between AD and AS disturbances caused by a change in oil prices.

The second shortcoming to Abu-Bader and Abu-Qarn's paper is that their analysis is mute on the choice of currency anchor for the GCC countries, which, in our view, is crucial. In the current state of economic integration between these countries, does it really matter whether supply shocks are not symmetric if there are no other objectives beyond forming the monetary union? Five of the six countries have their currencies pegged to the US dollar. Whether external factors give rise to more serious supply shocks or not, the tools these countries currently possess to neutralize the effects of those shocks would be the same after entering the monetary union

since they have decided to peg their unified currency to the US dollar. Hence, the pertinent question rather is whether the choice of the US dollar as the preferred anchor is more appropriate than the option of adopting the Euro or a market basket or a free float.

Our paper represents an improvement over Abu-Bader and Abu-Qarn's in the two aspects mentioned above. We consider our approach of incorporating non-oil output instead of total output in the SVAR and allow for demand shocks to possibly account for the impact of oil shocks on real incomes is relatively new to the literature. In addition, following Horvath and Rátfai (2004), we use France, Germany, and Italy as core for the EuropeanUnion countries to determine whether supply and demand shocks from these countries are synchronized with those of GCC countries, which could justify the use of the Euro as an alternative anchor currency.

3 Theory and methodology

The underlying theoretical framework of this paper is the AD-AS model.[3] The short-run AS curve is upward sloping allowing for changes in AD to influence output. The long-run AS (LRAS) curve is vertical denoting potential output and prevents AD shocks to have long-term real effects on the economy. AD curve is downward sloping. In a price-output space, full employment equilibrium is achieved when all three curves intersect at once. A positive supply shock shifts both AS and LRAS to the right giving rise to an increase in output and a decrease in price permanently. A positive demand shock, though permanent, can only affect output temporarily due to its impacts first on prices, then on real wages and other price-sensitive determinants of AS. More precisely, this implies that output and prices move in the same direction when demand shocks hit the economy, and in opposite directions due to supply shocks. However, actual data for GCC countries may not display these impulse response patterns since these economies' output is largely dominated by oil, as pointed out by Bayoumi and Eichengreen (1994). In other words, for countries with oil as a large share of their output, an increase in oil prices has also the real potential to insulate aggregate demand as oil revenues find their ways in other sectors and thereby increase real incomes. Since it might be "… difficult to distinguish between AS and AD shocks caused by a change in oil prices", impulse responses may be counter intuitive or even misleading, the price puzzle issue discussed in Giordani (2004) and Hanson (2004) among others.

We use a bivariate SVAR model with the right-hand side variables being the log differences of the non-oil output times 100 (Δy_t) and the log differences of prices times 100 (Δp_t). Each of these variables is driven by both a supply shock (e_{st}) and a demand shock (e_{dt}). Using the lag operator L, the infinite moving average representation of the structural model can be represented as:

$$\begin{bmatrix} \Delta y_t \\ \Delta p_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} \alpha_{11,i} & \alpha_{12,i} \\ \alpha_{21,i} & \alpha_{22,i} \end{bmatrix} \begin{bmatrix} e_{st} \\ e_{dt} \end{bmatrix} \quad (1)$$

[3] The diagram is not reported here as in Bayoumi and Eichengreen (1994) and Abu-Bader and Abu-Qarn (2006) due to space consideration.

The model is identified with a long-run restriction *à la* Blanchard and Quah (1989). We therefore assume that only supply shocks can have long-run effects on non-oil output. This implies the cumulative effects of demand shocks on the growth rate of non-oil output (Δy_t) are zero. That is,

$$\sum_{i=0}^{\infty} \alpha_{12,i} = 0 \tag{2}$$

Since the SVAR methodology is standard in the literature, we do not provide further details regarding the procedures of extracting the unobserved structural shocks.[4] There is also the controversy surrounding the interpretation of shocks with permanent impact on output as supply disturbances, and shocks with temporary effects on output as demand innovations, found in Buiter (2007). However, we do not enter into this debate because there is always a reason to argue in favor or against specific restrictions. The SVAR methodology has lent itself to this criticism. Nevertheless, it is worth emphasizing that our identification scheme that only supply shocks can influence non-oil output in the long run does not necessarily mean that positive shocks to the oil sector cannot have spillover benefits to other sectors of the GCC economies as governments spend a portion of their oil revenues to foment investment in education, health care, and infrastructure, among others.

4 Data and estimation

The annual data set used for the empirical analysis covers the period 1970–2006. The series include non-oil GDP at constant 1990 prices in US dollar calculated as the total value added of all sectors but mining and quarrying; GDP deflator with 1990 as base year due to unavailability of consumer price index (CPI). All were taken from the United Nations Statistical Databases—National Accounts Main Aggregates. We take the GCC member countries as if they were a union already and construct the non-oil output and GDP deflator variables for this bloc, namely GCC, by taking the averages of the respective member countries' non-oil output and GDP deflator.[5] This enables us to anticipate their reactions to shocks from the US and Europe. The series were then tested for unit roots using the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and the more robust DF-GLS tests and were found to be integrated of order 1 or non-stationary.[6]

As a prelude to the empirical estimation, it is conventional to examine the statistical properties of the data at first in order to determine the possible relationship among the variables. Table 1 presents information about the magnitudes of the economies under consideration. The US is the largest economy of all. The three core European countries combined represent only 60 percent of the US total output. Saudi Arabia is the largest country in the GCC region. On aggregate the GCC economy

[4] The interested readers may wish to consult Hamilton (1994), Bayoumi and Eichengreen (1994), Enders (2004), Amisano and Giannini (1997) among others.

[5] Although Saudi Arabia is the largest economy of all GCC countries and the remaining members differ in terms of economic sizes, we did not take a weighted average.

[6] The unit root results are available upon request

Table 1 The magnitudes of the economies

	Real GDP (in billions of 1990 US dollars)											
Year	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE	GCC	France	Germany	Italy	Core European Countries	USA
2002	7.31	30.17	20.67	16.71	155.28	60.14	290.28	1557.45	2137.26	1356.83	5051.55	8158.50
2003	7.80	35.00	21.06	17.24	166.93	67.03	315.06	1574.39	2132.61	1356.60	5063.61	8364.30
2004	8.50	38.39	22.14	20.59	175.57	73.77	338.97	1613.29	2158.37	1377.38	5149.04	8669.58
2005	9.22	42.39	23.42	21.88	185.15	80.04	362.09	1643.87	2175.04	1386.42	5205.32	8924.84
2006	9.95	45.04	25.18	24.21	191.12	87.29	382.78	1680.31	2239.43	1414.65	5334.40	9172.84
	Country Size Relative to the USA											
2002	0.09	0.37	0.25	0.20	1.90	0.74	3.56	19.09	26.20	16.63	61.92	100.00
2003	0.09	0.42	0.25	0.21	2.00	0.80	3.77	18.82	25.50	16.22	60.54	100.00
2004	0.10	0.44	0.26	0.24	2.03	0.85	3.91	18.61	24.90	15.89	59.39	100.00
2005	0.10	0.47	0.26	0.25	2.07	0.90	4.06	18.42	24.37	15.53	58.32	100.00
2006	0.11	0.49	0.27	0.26	2.08	0.95	4.17	18.32	24.41	15.42	58.15	100.00
	Country Size Relative to the Core European Countries											
2002	0.14	0.60	0.41	0.33	3.07	1.19	5.75	30.83	42.31	26.86	100.00	161.50
2003	0.15	0.69	0.42	0.34	3.30	1.32	6.22	31.09	42.12	26.79	100.00	165.18
2004	0.17	0.75	0.43	0.40	3.41	1.43	6.58	31.33	41.92	26.75	100.00	168.37
2005	0.18	0.81	0.45	0.42	3.56	1.54	6.96	31.58	41.78	26.63	100.00	171.46
2006	0.19	0.84	0.47	0.45	3.58	1.64	7.18	31.50	41.98	26.52	100.00	171.96

represents 4 and 6.5% of the US and the core European economies, respectively. Table 2 reports the mean and standard deviations for real non-oil output growth and inflation for all GCC countries, the GCC bloc, the US and the three core European countries. It shows that all the GCC countries have experienced higher growth and higher inflation rates than the US and the core European countries. However, when volatilities are considered, their non-oil output growth is at least 3 times less stable than that of the US and the European countries. Inflation appears to follow a similar pattern but with a lesser gap in relative variability to the selected European countries. The same holds for the GCC countries as a bloc while the US is considerably the most stable economy. This table indicates that a move of the GCC countries away from the US dollar as their principal anchor currency towards the Euro is a move from a low-to a high-inflation shelter, which is suboptimal, since there is no accompanying gain in employment.[7]

Table 3 presents the cross-country correlations of the GCC real non-oil output growth with the USA and the core European countries. We could only find two significant positive co-movements in non-oil output growth: Bahrain with France and Bahrain with Italy. These might be due to Bahrain status as an offshore country. Overall, the GCC countries' non-oil output is not correlated with either the US or the three core European Countries. Table 4 depicts the cross-correlations of inflation. It shows that all the GCC countries' inflation save the UAE is significantly correlated with the US's. But the same cannot be said in relation with the core European countries. Not a single correlation is significant. Again, there is no gain for the GCC countries in switching to the Euro, despite the tighter trade links with Europe. It is also worth noting that the correlation of inflation between the GCC countries and the US may stem from the long history of the dollar peg in the region whose basic purpose is to warrant price stability.

Table 5 summarizes the cross-country correlations of real non-oil output and inflation among the GCC countries. With the exception of the UAE where a significant co-movement is detected with only Bahrain and Qatar, inflation is significantly correlated among member countries. We are only able to uncover two positively significant correlations when we examine the output linkages: Qatar with Bahrain, and the UAE with Saudi Arabia. Therefore, non-oil output growth is mostly not correlated among GCC countries.

5 Empirical results

We estimate a bivariate SVAR for each of the 10 countries with 2 lags despite in some cases the optimal lag length recommended for some countries is higher. According to Enders (2004), OLS estimates are asymptotically efficient and consistent provided that the independent variables are the same in each equation. We extract the AD and AS shocks for each country and compute the bilateral correlations. Positive correlation indicates symmetry while negative correlation indicates asymmetry of shocks.

[7] All GCC countries import foreign labor from the rest of the world. The short-run Phillips curve prediction of a tradeoff between unemployment and inflation may not hold for these countries.

Table 2 Real non-oil output growth and GDP deflator: means and standard deviations

	Real non-oil output		GDP deflator	
	Mean	St. Dev	Mean	St. Dev
Bahrain	2.91	4.96	2.61	4.05
Kuwait	1.46	7.07	3.79	9.11
Oman	3.92	4.96	2.81	9.12
Qatar	2.13	4.29	3.33	6.28
Saudi Arabia	2.31	3.45	3.23	7.82
United Arab Emirates	5.61	8.22	1.93	3.41
GCC	1.02	2.43	2.95	5.73
USA	0.77	1.09	1.74	1.02
France	1.06	0.53	2.21	4.77
Germany	0.94	0.71	2.23	4.90
Italy	1.00	0.85	2.42	4.68

Variables are measured in first log differences times 100

Table 6 presents the correlation of GCC countries' non-oil supply shocks with overall supply shocks from the US and the core European countries. We also explore the correlation of supply shocks between the core European countries to test whether our SVAR models are capable of producing results similar to Bayoumi and Eichengreen (1994). We report a stronger statistically significant correlation of supply shocks at the 5% level: 0.90 for France with Germany; 0.85 for France with Italy, and 0.81 for Germany and Italy.[8] Surprisingly, we could only detect two significant correlations of supply shocks between GCC countries and the core European countries at the 10% level: Qatar with France displaying symmetry and the UAE with France exhibiting asymmetry. The results for the correlation of supply shocks between the US and the GCC countries are ambiguous and statistically insignificant; Bahrain, Qatar, and Saudi Arabia display a positive but weak co-movement whereas Kuwait, Oman, and the UAE show a negative but weak correlation . This can be explained by the fact that oil shock is a large component of supply shocks in the US and in Europe while it is mostly a demand shock for the GCC countries (Bayoumi and Eichengreen 1994).

Table 7 presents the correlation coefficients of demand shocks. It shows that the three core European countries respond similarly to demand disturbances but they are not synchronized with the GCC countries. A different picture, however, emerges in relation with the US. With the exception of the UAE, demand shocks are mostly symmetric between the GCC countries and the US. These relationships are statistically significant. Moreover, when we consider the GCC countries as a bloc, the same relationships resurface, suggesting that at least monetary policy from the US can potentially serve the purpose of smoothing demand shocks. Unfortunately,

[8] It appears that 13 years of data since the publication of Bayoumi and Eichengreen's work have made a great difference but also this is a sign that economic integration has contributed to the synchronization of the countries in response to disturbances.

Table 3 Correlations of GCC's real non-oil output growth with USA and core European Countries output growth

	USA	France	Germany	Italy
Bahrain	0.04	0.34[a]	0.17	0.37[a]
Kuwait	0.11	0.04	−0.20	−0.04
Oman	−0.20	−0.09	−0.03	−0.30
Qatar	0.04	0.20	0.04	0.09
Saudi Arabia	−0.30	0.08	−0.20	0.11
United Arab Emirates	−0.19	0.00	−0.08	0.04
GCC	−0.20	0.02	−0.20	−0.08

Variables are measured in first log differences times 100

[a] Significant at the 5% level

the same cannot be said for European monetary policy on the basis of what we could infer from the three major European Union members.

We report in Table 8 the correlations of both supply and demand shocks among GCC countries. We place the correlation coefficients for supply shocks on the upper triangle while those of demand shocks are on the lower one. Demand shocks are mostly symmetrical among GCC countries. Twelve or 80% of the fifteen coefficients are positive and statistically significant at the 5% level. UAE's linkages with Kuwait, Oman, and Saudi Arabia are not significant at any conventional statistical levels. These results are by and large consistent with Abu-Bader and Abu-Qarn (2006). However, we could not agree with their conclusion that supply shocks are mostly asymmetric, hence their stance on the readiness of the Gulf countries to form a monetary union. Six or 40% of the possible fifteen pairwise correlations are positive and statistically significant while only one of the coefficients (UAE-Bahrain,−0.47) is significantly negative. Interestingly enough, Saudi Arabia which has the largest economy shares common supply shocks with all but the UAE.[9] Percentage-wise, we cannot conclude that non-oil supply shocks, and to that effect, supply shocks are asymmetric when it is evident that oil shocks affect these countries in a similar way. Nevertheless, we shall acknowledge that there is a tighter relationship between the GCC countries in response to demand shocks.

To summarize, our results indicate that:

1) The Euro may not be the appropriate anchor for the GCC countries due to shocks asymmetry. The only meaningful positive correlation of supply shocks exists between France and Qatar, which is the second smallest economy of the GCC member countries. The correlations of demand shocks are statistically insignificant. These results therefore suggest that there are major adjustment costs involved if the GCC were to adopt the Euro as the anchor for their newly

[9] The discrepancy between the correlation of non-oil output growth results and the responses to shocks is an anomaly of the data also found in Bayoumi and Eichengreen 1994 for the case of Canada with the United States. In their case, they had used as an alternative quarterly data to confirm their findings, but in our case we cannot because such data are not available.

Table 4 Correlations of GCC's inflation with USA and core European Countries

	USA	France	Germany	Italy
Bahrain	0.69[a]	−0.04	−0.11	−0.05
Kuwait	0.49[a]	0.06	0.10	0.13
Oman	0.44[a]	0.06	0.10	0.08
Qatar	0.42[a]	0.22	0.14	0.15
Saudi Arabia	0.53[a]	0.05	0.11	0.08
United Arab Emirates	0.04	0.07	0.05	0.03
GCC	0.53[a]	0.09	0.10	0.10

Variables are measured in first log differences times 100

[a] Significant at the 5% level

proposed common currency. Since there is no clear indication of a split between the US and the core European countries in the sharing of the symmetry of shocks with the GCC countries, we cannot argue that a basket peg is appropriate. However, it may be quite reasonable for the GCC countries to opt for a basket if concerns are mounting against imported inflation arising from the depreciation of the US dollar and the huge budget deficit.

2) Despite the US's misfortune lately, the dollar remains the best option for pegging the individual GCC currencies and the expected single currency to. US monetary policy can at least help five of the six countries, including the largest economy of the region, in smoothing demand shocks.
3) The member country that is to be most concerned about the monetary union with the rest should be the UAE not Oman. UAE appears to be on a path of its own.
4) GCC countries are on average subject to similar shocks and are therefore good candidates for monetary union. They are all reliant on oil and have channeled substantial portions of their oil revenues, at a differing degree, towards development in infrastructure, manufacturing, and services. Although this is

Table 5 Correlations of real non-oil output growth and inflation for GCC countries

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	United Arab Emirates
Bahrain	–	0.68[a]	0.66[a]	0.72[a]	0.67[a]	0.39[a]
Kuwait	0.11	–	0.93[a]	0.65[a]	0.94[a]	0.25
Oman	−0.16	0.10	–	0.63[a]	0.94[a]	0.21
Qatar	0.52[a]	0.03	−0.07	–	0.64[a]	0.62[a]
Saudi Arabia	−0.03	0.00	0.09	0.13	–	0.21
United Arab Emirates	−0.15	−0.04	0.15	0.00	0.75[a]	–

The upper triangle contains the correlation coefficients for inflation whereas the lower one presents the correlation coefficients for output

[a] Significant at the 5% level

Table 6 Correlation of GCC's supply shocks with overall supply shocks from USA and core European Countries

	USA	France	Germany	Italy
Bahrain	0.13	0.18	−0.01	0.16
Kuwait	−0.11	−0.10	0.05	−0.12
Oman	−0.08	−0.09	0.06	−0.11
Qatar	0.02	0.30[b]	0.16	0.23
Saudi Arabia	0.10	−0.03	0.07	−0.04
United Arab Emirates	−0.12	−0.32[b]	−0.23	−0.14
GCC	0.07	−0.01	0.06	0.02
France		–	0.90[a]	0.85[a]
Germany			–	0.81[a]
Italy				–

[a], [b] Significant at the 5%, 10% levels, respectively

reassuring when we consider these countries have in common language, religion, and culture in general, labor mobility along with the level of intraregional trade remains some of the major hurdles in combating asymmetric shocks to the benefits of monetary union.

6 Conclusion

On the issue of monetary union between the GCC countries and the debate surrounding the choice of an appropriate anchor for the newly proposed currency of the bloc, this paper has examined the feasibility of monetary union by determining whether these countries are subject to symmetric AD and AS shocks, with emphasis

Table 7 Correlation of demand shocks between GCC and USA and core European Countries

	USA	France	Germany	Italy
Bahrain	0.69[a]	−0.04	−0.11	−0.05
Kuwait	0.44[a]	0.06	0.10	0.08
Oman	0.44[a]	0.06	0.10	0.08
Qatar	0.42[a]	0.21	0.14	0.15
Saudi Arabia	0.53[a]	0.05	0.11	0.08
United Arab Emirates	0.04	0.07	0.05	0.03
GCC	0.53[a]	0.09	0.10	0.10
France		–	0.95[a]	0.88[a]
Germany			–	0.85[a]
Italy				–

[a], [b] Significant at the 5%, 10% levels, respectively

Table 8 Correlation of supply and demand shocks among GCC countries

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	United Arab Emirates
Bahrain	–	−0.14	−0.03	0.56[a]	0.35[a]	−0.47[a]
Kuwait	0.66[a]	–	0.99[a]	−0.01	0.39[a]	0.04
Oman	0.66[a]	1.00[a]	–	0.08	0.53[a]	−0.02
Qatar	0.72[a]	0.63[a]	0.63[a]	–	0.37[a]	−0.24
Saudi Arabia	0.67[a]	0.94[a]	0.94[a]	0.64[a]	–	−0.22
United Arab Emirates	0.39[a]	0.21	0.21	0.62[a]	0.21	–

The upper triangle contains the correlation coefficients for supply shocks whereas the lower one presents the correlation coefficients for demand shocks

[a] Significant at the 5% level.

on the non-oil sector output and inflation. Since there have been a lot of discussions as to whether the Euro could have been a better alternative anchor currency due to the continuous decline of the US dollar, we have also tested the suitability of the Euro on the basis of shocks asymmetry between the three major European economies and the GCC countries. The paper follows closely the works of Bayoumi and Eichengreen (1994) and Horvath and Rátfai (2004) and employs the SVAR technique to extract the structural shocks. The SVAR models are just-identified with long-run restrictions *à la* Blanchard and Quah (1989) that demand shocks have no long-run effects on non-oil output. The overall results show that (a) AD shocks are unequivocally symmetrical but AS shocks are weakly symmetrical across the GCC countries thereby suggesting a monetary union is feasible, but not overwhelmingly; (b) neither AD nor AS shocks are symmetrical between the GCC countries and the selected European countries; (c) GCC's AD shocks are symmetrical with the US's but AS shocks are not. We therefore surmise that the US dollar is a more appropriate candidate for the new currency than the Euro since US monetary policy can at least help smooth demand shocks in GCC countries. This is the conclusion reached partially from the cross correlation analysis on non-oil output growth and inflation. Our results still hold even when we consider the GCC countries as a bloc. This paper has made a valuable contribution to the debate on the anchor currency by providing statistical evidence to GCC decision makers who have been wrestling with the dilemma of whether to revalue or to depeg their actual currencies.

It is worth emphasizing, however, that our findings partially contradict Abu-Bader and Abu-Qarn's (2006) that supply shocks are asymmetric across GCC countries. In our view, the statistical evidence does not support the conclusions of Abu-Bader and Abu-Qarn's, when we consider oil supply shocks are mostly symmetrical across these countries and oil output represents almost 50% of the average GCC country's total output. At least, it is the relative importance of these two shocks that should dictate symmetry or asymmetry. Our differences can be explained in part by the fact that these authors do not disaggregate real GDP into oil and non-oil components and also the unreliability of their dataset, which comes from various sources with differing sample sizes.

We are also aware that our finding that US monetary policy can at least help contain demand shocks affecting GCC economies is debatable. Many believe that

imported inflation resulting from the depreciation of the US dollar lately has worsened the inflation problem in these countries. We have however two arguments in response: (1) imported inflation is temporary and is a negligible share of total inflation; and (2) as the GCC economies are gearing towards more diversification, the depreciation of the dollar has the potential to boost exports and improve current account balances as long as they do not rely too heavily on imported raw materials and intermediate goods. The problem of inflation in GCC countries is mostly due to rent and food prices. A more appropriate solution is for governments to release the pressure on the prices of land they control and the fees they charge to developers so that rentals can become affordable. Our paper therefore hints that depegging or revaluing the respective currencies to curb inflation will not accomplish fully this goal and the choice of the Euro instead does not guarantee a better outcome, despite these countries' closer trade links with Europe. Moreover, although we rely solely on the dynamics of macroeconomics shocks to suggest that a monetary union is feasible among the GCC countries, labor mobility along with the level of intraregional trade remains some of the main issues that they must address if they want to reap the full benefit of the monetary union.

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