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Inflation Differentials in the GCC: Does the Oil Cycle Matter?

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Inflation Differentials in the GCC: Does the Oil Cycle Matter?

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Authorized for distribution by David O. Robinson

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Abstract
This paper uses a pairwise approach to investigate the main factors that have been driving inflation differentials in the Gulf Cooperation Council (GCC) region for the past two decades. The results suggest that inflation differentials in the GCC are largely influenced by the oil cycle, mainly through the credit and fiscal channels. This implies that closer coordination of fiscal policies will be key for facilitating the closer integration of the GCC economies and ahead of the move to a monetary union. The results also indicate that after controlling for cyclical factors, convergence increased even during the recent oil boom.

JEL Classification Numbers: C32, C33, E31, E50.

Keywords: Inflation differentials, convergence, oil prices, panel data, pairwise approach, monetary union, and Gulf Cooperation Council (GCC) countries.

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Contents Page

Tables

Figures

I. Introduction

Although inflation differentials between the Gulf Cooperation Council (GCC) countries have persisted for some time, they seemed to have tightened toward the end of the 1990's (Figures 1 and 2).[1] However, following the 2003 upsurge in oil prices, inflation rates in the region began to diverge once more, as fiscal policy became increasingly expansionary and contributed to rising domestic demand (Figure 3). The increase in inflation differentials is surprising given the increased integration of these economies over the last three decades, a peg to a common currency (the U.S. dollar, or in Kuwait a basket that closely follows the U.S. dollar), flexible labor markets, and open capital accounts. Moreover, minimizing inflation differentials across the GCC is a key convergence criterion in the planned GCC monetary union. In this context, it is important to understand the factors influencing inflation differentials to facilitate the closer integration of the GCC economies and ahead of a move to a monetary union.

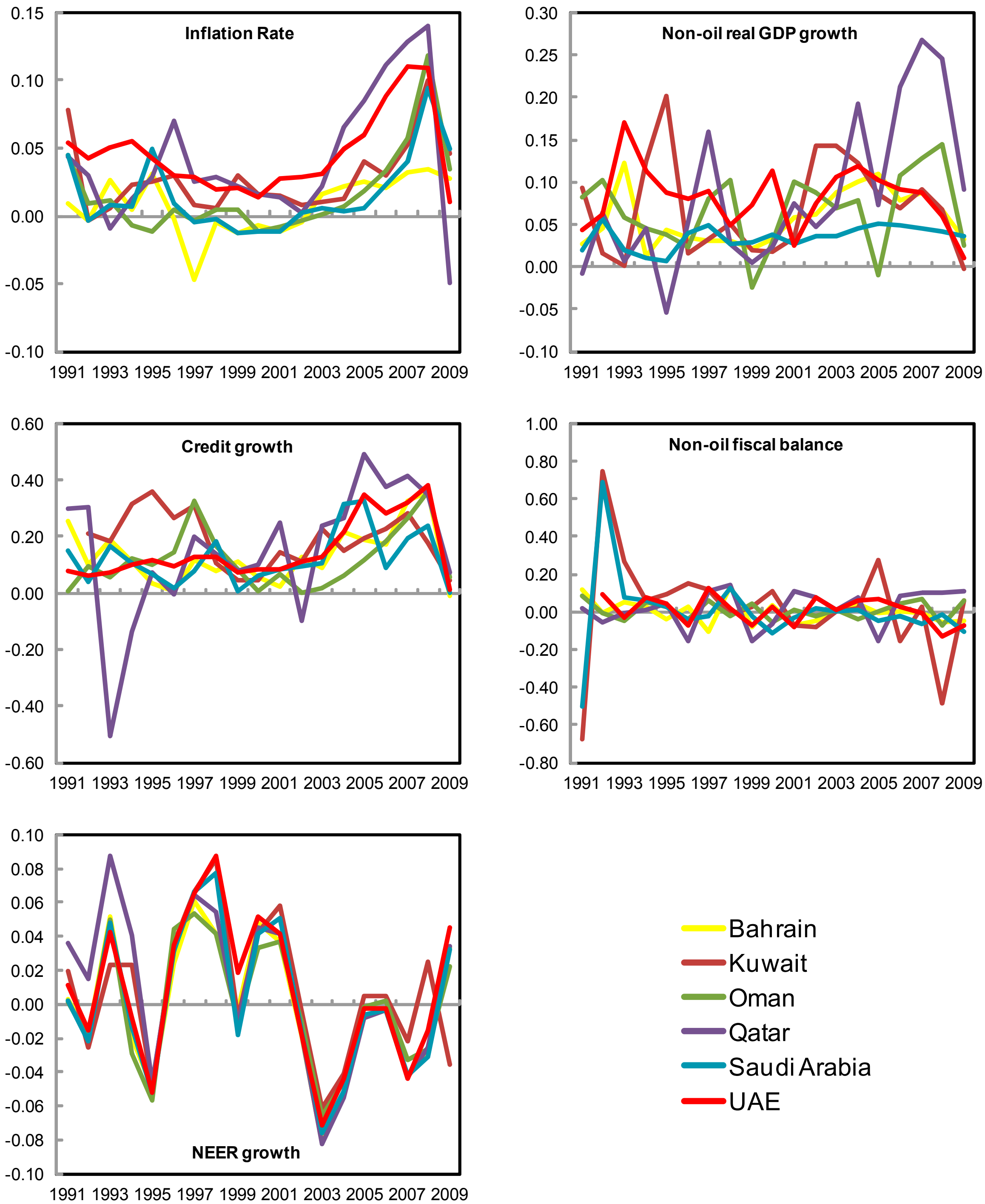
This paper investigates the factors driving inflation differentials across the GCC countries, including the role of macroeconomic policy, structural factors and the role of inertia in influencing the speed of convergence over time. To this end, we follow Pesaran et al. (2009) and develop an econometric model based on pairwise inflation differentials in a panel setting. Our approach differs from the specifications generally considered in the literature, where the focus is on the inflation differential between each country in the monetary union and the union's average. One important feature of our approach is that it relaxes the assumption of a uniform response by all countries in the monetary union to macroeconomic shocks.

The results indicate that after controlling for cyclical factors, convergence has increased even during the recent oil boom. We find that inflation dynamics in the GCC are largely driven by the oil cycle, mainly through the credit and fiscal channels. Given this result, for the proposed monetary union to be successful, closer coordination of fiscal policies will be critical. Avoiding procyclical fiscal policy is a key challenge for the proposed monetary union and will require a strong medium-term framework to reduce the risk of overheating of the economy and avoid increased divergence of inflation rates.

The rest of the paper is set out as follows: Section II gives a brief review of the relevant literature. Section III covers the econometric model and methodology and explores the convergence properties of inflation differentials in the region. Section IV discusses the evolution of inflation differentials as well as their most important determinants. In Section V, the role of a number of macroeconomic variables in determining inflation differentials for the GCC countries is investigated using both monthly and annual data. Finally, Section VI provides some policy recommendations and offers concluding remarks.

[1] The GCC is comprised of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE).

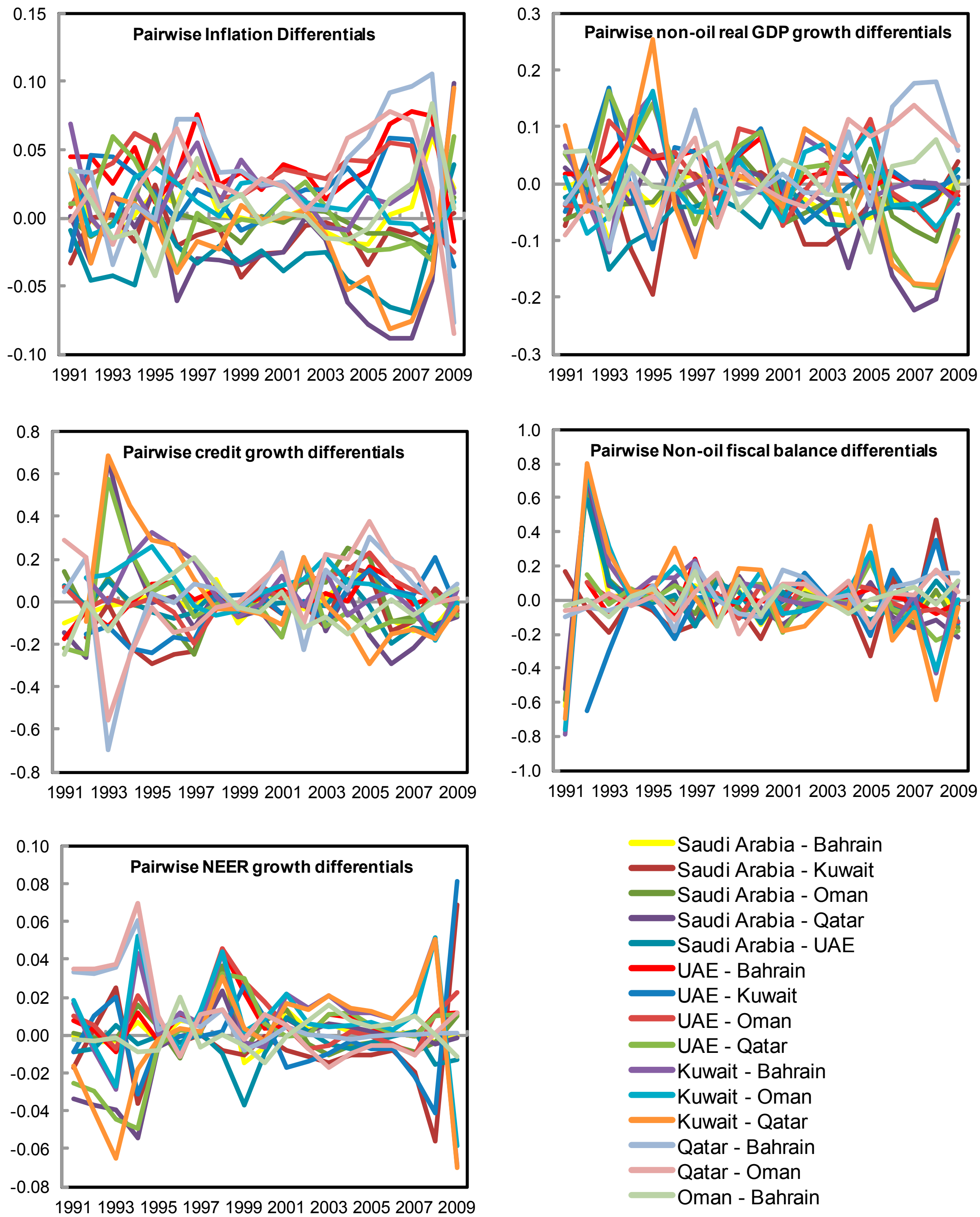
Figure 1. GCC Countries Macro Variables, 1991–2009
(Percent)



Notes: Authors' calculations; for sources see Table 2.

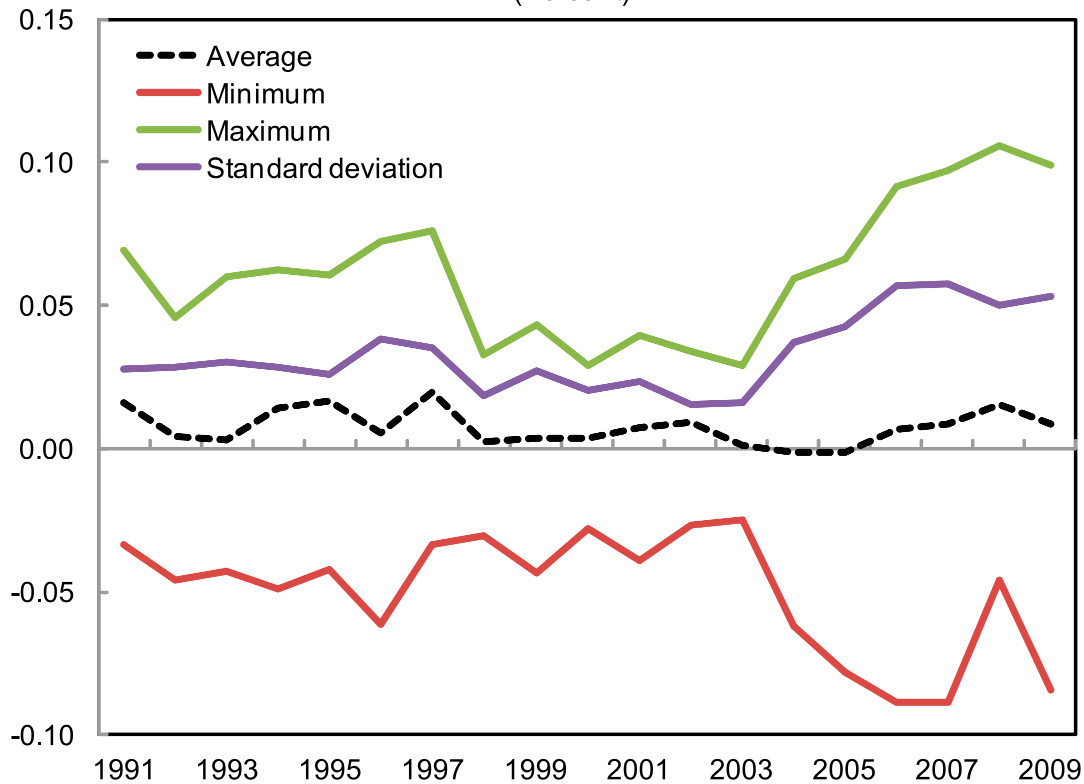
Figure 2. Pairwise Differentials in GCC Countries Macro Variables, 1991–2009

(Percent)



Notes: Authors' calculations; for sources see Table 2.

Figure 3. Pairwise Inflation Differentials, 1991–2009
(Percent)



Notes: Authors' calculations based on data from International Monetary Fund (2010b).

II. Literature Review

Since the launch of the Euro in 1999, a growing empirical literature on inflation differentials in the European Monetary Union (EMU) emerged, see Andersson et al. (2009) for a recent survey. Honohan and Lane (2003) were among the first to look at the determinants of inflation differentials in the euro area, arguing that nominal effective exchange rate and business cycle fluctuations are the key drivers behind these differentials.

While a small number of articles try to explain the observed source of inflation differential between a particular member country and the EMU, see Rabanal (2009), or try to determine whether inflation rates in the EMU are converging or not, see Busetti et al. (2007), most papers in the literature tend to follow Honohan and Lane (2003), for instance Licheron (2007) and Andersson et al. (2009).

However, this strand of the literature begins by specifying an econometric model which investigates the deviation of key macroeconomic variables of each member country from the union average, a time dummy is then introduced to capture common movements in inflation and the explanatory variables across all euro area countries in any given year. This would be an ideal strategy to model inflation differentials if the effect of the unobserved factors on inflation differentials, which the time dummy is meant to capture, was the same for all members. However, there is no reason why this should be the case even in a monetary union where prices are converging given that countries respond differently to shocks, as illustrated during the most recent financial crisis (see the detailed discussion in Section III.B).

Another strand of the literature relevant to our paper examines the long-run determinants of inflation in the GCC region as well as its short-run dynamics. Hasan and Alogeel (2008) estimate an error correction model for Kuwait and Saudi Arabia using annual data from 1980 to 2007. They show that trading partners' inflation as well as the exchange rate pass-through effect and oil prices are the main driving force for inflation in these countries. Overall these results are also supported by Kandil and Morsy (2009), who estimate an error correction model for each of the six GCC countries. In contrast to the above studies, Basher and Elsamadisy (2010) use a panel approach (the mean group estimator) to investigate the long-run determinants of inflation in the GCC countries and find that the nominal effective exchange rate, foreign prices, and the money supply are significant determinants of inflation in the long run.[2]

To our knowledge there are no papers studying the convergence properties of the GCC inflation rates or attempting to model and explain the inflation differentials in the region. In addition, while there are a few panel studies covering the inflation process in the six Gulf countries, most of them do not address the endogeneity issues inherent to their models. These are some of the shortcomings addressed in this paper.

III. Econometric Model and Methodology

This section studies the convergence properties of the pairwise inflation rates in the GCC countries. It then describes the econometric model employed in this paper and outlines the main differences between our model and that of Honohan and Lane (2003), which is the specification generally considered in the literature. Finally, we briefly review the Generalized Method of Moments (GMM) methodology used for estimations.

[2] See also Basher and Elsamadisy (2010) for a recent review of country specific studies of the inflation process in the GCC region.

A. Convergence of Inflation Rates

Let p_{it} denote the logarithm of the consumer price index (CPI) at time t in country i, where $t = 1,...,T$ and $i = 1,...,N$. The deviation of the price level between country i and j can then be written as:

$$\begin{aligned} x_{ijt} &= \ln(CPI_{it}) - \ln(CPI_{jt}) \\ &= p_{it} - p_{jt}, \end{aligned} \tag{1}$$

implying that the inflation differential between country i and j is given by:

$$\begin{aligned} \Delta x_{ijt} &= \Delta p_{it} - \Delta p_{jt} \\ &= \pi_{it} - \pi_{jt.} \end{aligned} \tag{2}$$

Before proceeding to evaluate the factors that determine short-run deviations of inflation between countries i and j, we must first establish that pairwise inflation rates in the GCC region are in fact converging, i.e. stationary, otherwise any inference on the estimations of Δx_{ijt} on its short-run determinants would be invalid. Unit root tests are used to determine whether pairwise inflation rates are in the process of converging. A model testing whether the inflation rates are converging will be asymptotically stationary, satisfying the condition that:

$$\lim_{\tau \to \infty} E\left(\Delta x_{ijt+\tau} \mid \Delta X_{ijt}\right) = \alpha_{ij}, \tag{3}$$

where ΔX_{ijt} denotes the current and past observations. Convergence is said to be absolute if $\alpha_{ij} = 0$, otherwise it is conditional or relative, see Durlauf and Quah (1999). A very simple convergence model is the $\text{AR}(1)$ process:

$$\Delta x_{ijt} - \alpha_{ij} = \phi_{ij}\left(\Delta x_{ijt-1} - \alpha_{ij}\right) + \xi_{ijt}, \tag{4}$$

where ξ_{ijt} is a martingale difference innovation and Δx_{ij0} is a fixed initial condition. Writing equation (4) in error correction form:

$$\Delta^2 x_{ijt} = \gamma_{ij} + \left(\phi_{ij} - 1\right)\Delta x_{ijt-1} + \xi_{ijt}, \tag{5}$$

where $\gamma_{ij} = \left(1 - \phi_{ij}\right)\alpha_{ij}$, we can see that after allowing for a permanent difference, α_{ij}, the expected growth rate in the price level in the current period is a negative fraction of the gap in the two countries. A test for convergence can then be done by performing a unit root test, in other words $H_0 : \phi = 1$ against the alternative $H_1 : \phi < 1$. For a richer dynamic we will consider an AR(p) process:

$$\Delta^2 x_{ijt} = \gamma_{ij} + (\phi_{ij} - 1)\Delta x_{ijt-1} + \sum_{l=1}^{p_{ij}} \gamma_{ijl} \Delta^2 x_{ijt-l} + \xi_{ijt}, \tag{6}$$

on which an Augmented Dickey-Fuller (ADF) test is based. While in many cases we would consider investigating both absolute and conditional convergence, it is implausible that there should exist permanent inflation differentials across the GCC countries. We test for absolute convergence by verifying whether pairwise inflation differentials, Δx_{ijt}, in the GCC are converging without there being a permanent and persistent influence on the inflation differentials. Absolute convergence is also ultimately the aim in a monetary union, and forms the basis for a convergence criterion on inflation rates before a country can join a monetary union.

To investigate the convergence properties of inflation rates in the GCC, we obtain monthly CPI data from the International Monetary Fund (2010b), between January 1991 and June 2010. The pairwise combinations are ordered by countries according to their GDP weights in the GCC area and are listed in Table 1. Table 2 provides a definition of the variables used in this paper as well as their sources. After constructing pairwise inflation differentials, unit root tests were performed by estimating equation (6). The results of the ADF tests reported in Table 3 show that for all of the 15 pairwise combinations we can reject the null of a unit root when investigating absolute convergence, $\alpha_{ij} = 0$. Moreover, all but two pairwise combinations (Saudi Arabia with the U.A.E. and Qatar with Oman) are also stationary when we allow for $\alpha_{ij} \neq 0$. Given that for these two combinations we cannot reject the null of non-stationarity we also perform a stationarity test as proposed in Kwiatkowski et al. (1992), denoted as KPSS and reported in Table 3, which shows that for these two particular combinations the more strict null of stationarity cannot be rejected. Therefore, the empirical evidence points to absolute convergence in the GCC pairwise inflation differentials over the period 1991 to 2010.

Table 1. List of the GCC Countries and the Pairwise Combinations

GCC Countries	Pairwise Combinations				
Bahrain (BHR)	SAU - UAE	UAE - KWT	KWT - QAT	QAT - OMN	OMN - BHR
Kuwait (KWT)	SAU - KWT	UAE - QAT	KWT- OMN	QAT - BHR	
Oman (OMN)	SAU - QAT	UAE - OMN	KWT - BHR		
Qatar (QAT)	SAU - OMN	UAE - BHR			
Saudi Arabia (SAU)	SAU - BHR				
United Arab Emirates (UAE)					

Notes: GCC stands for the Gulf Cooperation Council. The pairwise combinations are ordered by countries according to their GDP weights in the GCC area.

Table 2. Definitions and Sources of Variables Used in the Regression Analysis

Variable	Definition and Construction	Source
CPI	Consumer price index (2000=100).	Authors' calculation using data from International Monetary Fund (2010b) World Economic Outlook (WEO).
Inflation rate	Annual percentage change in the CPI.	
GDP	Gross Domestic Product (GDP) at current prices.	
Non-oil GDP	GDP excluding oil at current prices.	
Non-oil real GDP	GDP excluding oil at constant prices.	
Rent weight	The weight of rent and utilities in the CPI.	Authors' construction using data from Country Authorities and IMF Article IVs.
NEER	Nominal effective exchange rate, index (2000=100).	Authors' calculation using data from IMF INS.
Non-oil fiscal balance	Ratio of non-oil central government fiscal balance to non-oil GDP at current prices.	Authors' construction using data from International Monetary Fund (2010b) and International Monetary Fund (2010c) Regional Economic Outlook.
Government expenditure	Ratio of central government expenditure to GDP at current prices.	
Credit	Nominal credit to the private sector.	Authors' calculation using data from International Monetary Fund (2010d) International Financial Statistics (IFS).
Oil production value	The quantity of oil produced multiplied by the average price oil.	Authors' construction using data from International Monetary Fund (2010d) IFS and United States Department of Energy (2010) Energy Information Administration.

Table 3. Unit Root and Stationarity Tests on Pairwise Inflation Differentials, 1991M1–2010M6

Pairwise Combinations	ADF, no intercept		ADF, with intercept		KPSS, with intercept	
	Statistic	Reject	Statistic	Reject	Statistic	Reject
Saudi Arabia - Bahrain	-16.56	1%	-16.62	1%	0.403	10%
Saudi Arabia - Kuwait	-10.52	1%	-10.57	1%	0.220	*
Saudi Arabia - Oman	-16.23	1%	-16.22	1%	0.175	*
Saudi Arabia - Qatar	-1.98	5%	-2.67	10%	0.264	*
Saudi Arabia - UAE	-2.06	5%	-2.23	*	0.229	*
UAE - Bahrain	--2.80	1%	-3.67	1%	0.123	*
UAE - Kuwait	--5.00	1%	-9.44	1%	0.327	*
UAE - Oman	--2.00	5%	-15.90	1%	0.590	5%
UAE - Qatar	--4.00	1%	-4.04	1%	0.259	*
Kuwait - Bahrain	-9.56	1%	-9.74	1%	0.367	10%
Kuwait - Oman	--8.90	1%	-8.99	1%	0.150	*
Kuwait - Qatar	-5.07	1%	-5.42	1%	0.192	*
Qatar - Bahrain	-2.58	1%	-2.97	5%	0.199	*
Qatar - Oman	-2.17	5%	-2.43	*	0.262	*
Oman - Bahrain	-16.06	1%	-16.03	1%	0.579	5%

Notes: ADF refers to the Augmented Dickey—Fuller test while KPSS is the Kwiatkowski-Phillips-Schmidt-Shin test. A * indicates that the null hypothesis cannot be rejected. Authors' calculations based on data from International Monetary Fund (2010b).

B. Econometric Model

A fairly general specification for inflation in country i can be written as:

$$\pi_{it} = \alpha_i + (\phi_i - 1)\left[p_{it-1} - p^*_{it-1}\right] + \boldsymbol{\beta}_i' \mathbf{z}_{it} + u_{it}, \tag{7}$$

for $i = 1,2,...,N$ and $t = 1,2,...,T$

where p^*_{it-1} is the long-run equilibrium price level in country i, α_i is the country-specific effect, and $\mathbf{z}_{it}$ includes those macroeconomic variables that exert short-term influence on the inflation process in country i. We assume that the error term, u_{it}, has the following multi-factor error structure:

$$u_{it} = \boldsymbol{\theta}_i' \mathbf{f}_t + \varepsilon_{it}, \tag{8}$$

where $\mathbf{f}_t$ is a vector of unobserved common shocks, which can be stationary or nonstationary, see Kapetanios et al. (2011). The impacts of these common components on each country are governed by the idiosyncratic loadings in $\boldsymbol{\theta}_i$. The individual-specific errors, ε_{it}, are distributed independently across i and t; they are not correlated with the unobserved common factors or the regressors; and they have zero mean, variance greater than zero, and finite fourth moments.

Absolute convergence then requires that:

$$\alpha_i = \alpha_j,\ \ \beta_i = \beta_j,\ \ \phi_i = \phi_j, \tag{9}$$

and under the assumption that $\boldsymbol{\theta}_i \mathbf{f}_t \sim I(1)$ it is also required that:

$$\boldsymbol{\theta}_i = \boldsymbol{\theta}_j. \tag{10}$$

See Pesaran (2007) for an extensive explanation of these conditions when applied to cross-country output convergence. Thus, given convergence in inflation rates in the long-run, any short-run deviations of inflation across the countries are explained by deviations of the variables in $\mathbf{z}_{it}$ from $\mathbf{z}_{jt}$.

Using equation (7) together with the conditions in (9) and (10), we can write an equation for inflation differentials between countries i and j:

$$\Delta x_{ijt} = \pi_{it} - \pi_{jt}$$

$$= (\phi - 1)\left[\left(p_{it-1} - p^*_{it-1}\right) - \left(p_{jt-1} - p^*_{jt-1}\right)\right] + \boldsymbol{\beta}'\left(\mathbf{z}_{it} - \mathbf{z}_{jt}\right) + \left(\varepsilon_{it} - \varepsilon_{jt}\right). \tag{11}$$

Given that the GCC countries are in the process of establishing a monetary union, already have a set of convergence criteria in place, have a common peg to the dollar, and have taken several steps as mentioned in Section I to move to this goal, we can assume that the GCC countries share a common long-run price level, $p^*_{it} = p^*_{jt}$, but we allow for short-run deviations in their price levels:

$$\Delta x_{ijt} = (\phi - 1)x_{ijt-1} + \boldsymbol{\beta}'\left(\mathbf{z}_{it} - \mathbf{z}_{jt}\right) + \left(\varepsilon_{it} - \varepsilon_{jt}\right). \tag{12}$$

Our model for inflation differentials then requires that Δx_{ijt} is stationary, which we have shown to be the case, otherwise estimations of equation (12) are not valid. In fact, given that we have absolute convergence in inflation differentials in the GCC region, thus implying that the price levels are converging to the same level across the countries (see Table 3), the assumption of $p^*_{it} = p^*_{jt}$ seems justified.

The main difference between our model and most others used in the literature is that we look at the pairwise inflation differentials, using a similar approach as in Pesaran (2007) and Pesaran et al. (2009), as opposed to the deviation of each country from a monetary union benchmark. For instance, Honohan and Lane (2003) investigate a similar specification to ours for the initial twelve countries that joined the euro area, but assuming $p^*_{it} = p^*_{jt} = p^{u*}_t$ (in which p^{u*}_t is the long-run union price level) they define inflation differentials as the deviation of country i from the Union:

$$\Delta p_{it} - \Delta p^u_t = (\phi - 1)\left(p_{it-1} - p^u_{t-1}\right) + \boldsymbol{\beta}'\left(\mathbf{z}_{it} - \mathbf{z}^u_t\right) + \varepsilon_{it}, \tag{13}$$

where a superscript u defines the Union variables which is just the simple average of all the countries considered. They argue that the Union variables can be combined into a time dummy, δ_t, and so equation (13) can be rewritten as:

$$\Delta p_{it} = (\phi - 1)p_{it-1} + \boldsymbol{\beta}'\mathbf{z}_{it} + \delta_t + \varepsilon_{it}. \tag{14}$$

Although they estimate equation (14), it is unclear why the estimated coefficients of ϕ and $\boldsymbol{\beta}$ in equations (13) and (14) are identical and measure the same effects of differentials in macro variables on inflation differentials unless some strict assumptions are satisfied. Specifically it requires that the effect of unobservables which are captured in δ_t is identical for each of the countries, in other words $\delta_{it} = \delta_t$. This is quite a strong assumption which may not hold in reality given that countries in any monetary union are likely to be diverse. This is true even for the euro area, just comparing the German experience with that of the Greek or the Irish will underline the importance of a model in which δ_{it} should be allowed to be different in the cross-section. Note that the strong assumption of homogeneity can of course not be tested due to the fact that δ_{it} is unobserved.

Another general problem with estimating differentials as deviations from a union mean is that there is no particular reason why an equal weight of $1/N$ on the macro variables of the countries in our sample would apply, as it is completely plausible that some countries should be given a larger weight in the union. Thus an equation such as (14) seems more likely to be estimating individual country inflation equations, like that of equation (7) but allowing for time effects, as opposed to inflation differentials.[3]

Our pairwise approach on the other hand, equation (11), explicitly estimates ϕ and $\boldsymbol{\beta}$ as measuring the effects of differences in country i and j's macro variables on explaining the different dynamics in the inflation rates for those countries. In addition, our approach does not depend on assigning an arbitrary weight on each country to generate Monetary Union macro variables, which is needed to estimate equation (13). Finally, estimation of equation (14) requires that Δp_{it} is stationary which in some cases might not be valid, see for instance Garratt et al. (2006) in which Δp_{it} is $I(1)$ for the UK. Our approach on the other hand requires that the inflation differentials between the countries are stationary, which is shown to be valid in Table 3.

C. GMM Methodology

We begin with a basic specification that can nest much of the existing work on inflation differentials:

$$\Delta x_{ijt} = (\phi - 1)x_{ijt-1} + \boldsymbol{\beta}'(\mathbf{z}_{it} - \mathbf{z}_{jt}) + (\varepsilon_{it} - \varepsilon_{jt}), \tag{15}$$

where all the variables are as defined in Section III.B. Traditional panel data estimators such as fixed and random effects are not consistent in the present context due to the inclusion of lagged dependent variables in our regressions, e.g. the initial level of price differentials. Moreover, these estimators are rendered inconsistent should the errors show either heteroscedasticity or serial correlation.

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[3] A number of other studies of inflation differentials in the euro area, such as Licheron 2007, also use the model proposed by Honohan and Lane (2003).

To correct for the bias created by lagged endogenous variables and the simultaneity of short-run inflation determinants, we use the GMM estimators developed for dynamic panel data models. Following Anderson and Hsiao (1982), and Arellano and Bond (1991), we take first-differences of equation (15), thus yielding:

$$\Delta x_{ijt} - \Delta x_{ijt-1} = (\phi - 1)\Delta x_{ijt-1} + \boldsymbol{\beta}' \Delta(\mathbf{z}_{it} - \mathbf{z}_{jt}) + \Delta(\varepsilon_{it} - \varepsilon_{jt}). \tag{16}$$

The first-differences of equation (15) give the transformed error a moving-average structure that is correlated with the differenced lagged dependent variable. Assuming that the error term, $(\varepsilon_{it} - \varepsilon_{jt})$, is not serially correlated and that the explanatory variables $(\mathbf{z}_{it} - \mathbf{z}_{jt})$ are weakly exogenous,[4] the difference GMM estimator uses the following moment conditions:

$$E[x_{ijt-s}, \Delta(\varepsilon_{it} - \varepsilon_{jt})] = 0 \quad \text{for} \quad s \geq 2 \quad \text{and} \quad t = 3, \ldots T,$$

$$E[(\mathbf{z}_{it-s} - \mathbf{z}_{jt-s}), \Delta(\varepsilon_{it} - \varepsilon_{jt})] = 0 \quad \text{for} \quad s \geq 2 \quad \text{and} \quad t = 3, \ldots T.$$

However, in inflation regressions where the explanatory variables are persistent over time, lagged levels are often weak instruments for difference equations.[5] To reduce the potential biases and imprecision associated with the GMM difference estimator, we employ a system estimator that in addition to the system of first differenced equations (16) also includes the original equation (15) in levels, but with the lagged differences of the endogenous variables as instruments (see Arellano and Bover (1995) and Blundell and Bond (1998)). Therefore, the additional moment conditions for the regression in levels are:

$$E[\Delta x_{ijt-s}, (\varepsilon_{it} - \varepsilon_{jt})] = 0 \quad \text{for} \quad s = 1,$$

$$E[\Delta(\mathbf{z}_{it-s} - \mathbf{z}_{jt-s}), (\varepsilon_{it} - \varepsilon_{jt})] = 0 \quad \text{for} \quad s = 1.$$

The moment conditions effectively give us $T-1$ equations in first differences followed by T equations in levels. The solutions to these equations are then weighted by the inverse of a consistent estimate of the moment condition covariance matrix in a two-step method. To test the validity of the instruments and therefore the consistency of the GMM estimator, we consider two specification tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). The first is a Hansen test of over-identifying restrictions, which tests the overall validity of the instruments and the second test examines the

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[4] The explanatory variables are assumed to be uncorrelated with future realizations of the error term.

[5] For further details see Blundell and Bond (1998) and Alonso-Borrego and Arellano (1999).

hypothesis that the error term, $(\varepsilon_{it} - \varepsilon_{jt})$, is not serially correlated.[6] Finally, we compute robust two-step standard errors following the methodology suggested by Windmeijer (2005) to correct for small sample biases.

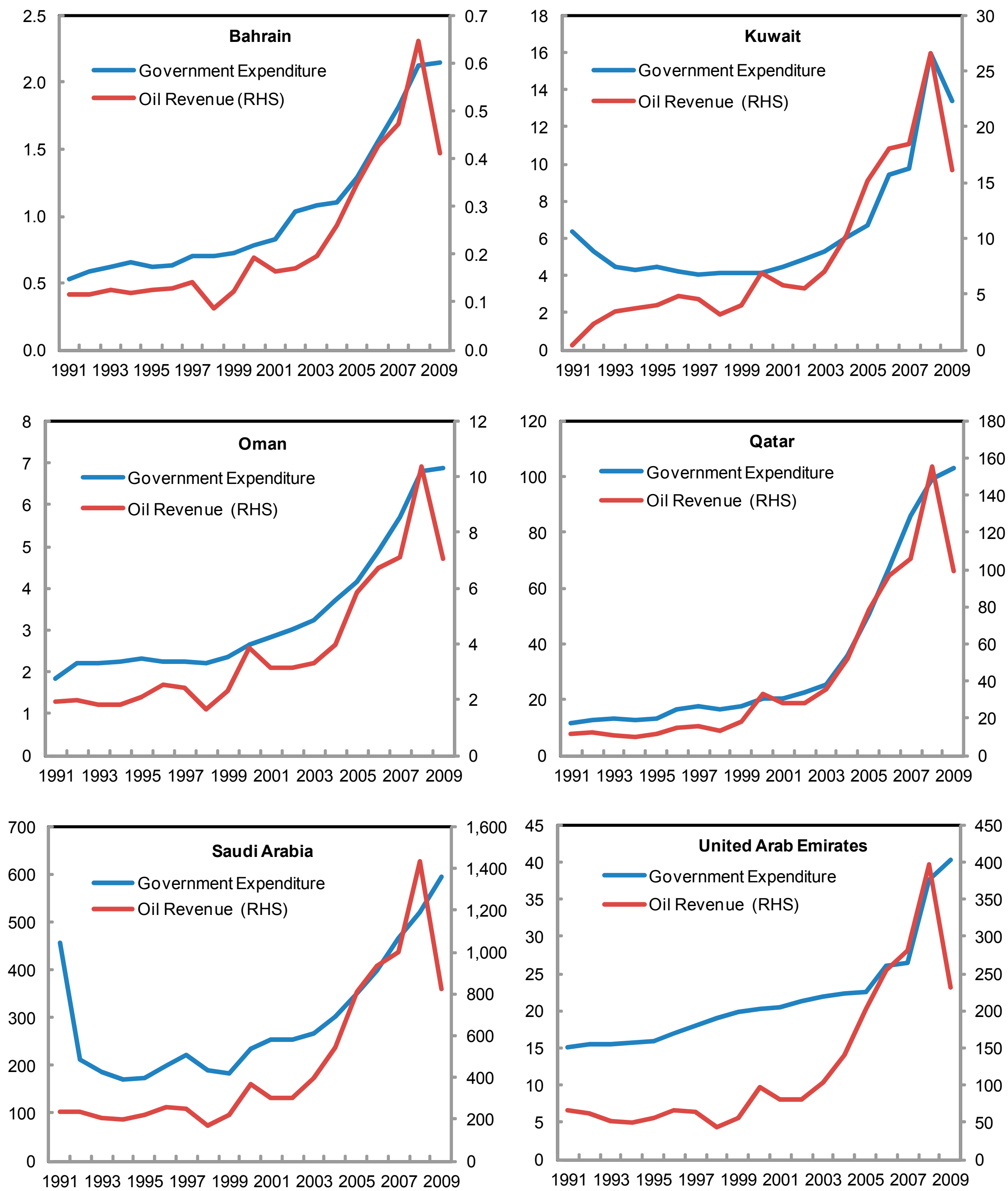
IV. Macroeconomic Trends

GCC countries in recent decades implemented a number of policies and initiatives to foster economic and financial integration with a view to establishing a monetary union based on the euro area model. As discussed in Section III.B we are interested in explaining pairwise inflation differentials and so compute inflation differentials for the 15 GCC country pairs. We use annual data between 1991 and 2009 from various IMF databases. Monthly data starting in January 1995 on the CPI index, the nominal effective exchange rate (NEER) index, the level of credit to the private sector, the weight of rent in the CPI basket, and oil revenues are used to estimate a monthly model. Given that oil revenues drive fiscal spending and hence economic activity, see Figure 4, in the absence of monthly fiscal expenditure and output data, we construct a variable representing oil revenues to proxy for the role of fiscal policy. Before estimating equation (12) we explore its determinants using annual data between 1991 and 2009. Tables 4, 5, and 6 provide summary statistics for inflation differentials and highlight how the mean differentials increased sharply between 2003 and 2009, especially for those associated with Qatar and the U.A.E.

[6] We test whether the differenced error term is second-order serially correlated as by construction, it is most likely first-order serially correlated even if the original error term is not.

Figure 4. Government Expenditure and Oil Revenue (right-scale), 1991–2009

(Billions of national currency)



Notes: Authors' calculations based on data from International Monetary Fund (2010b) and the United States Department of Energy (2010).

Table 4. Inflation Differentials Summary Statistics, 1991–2009

Pairwise Combinations	Mean	Standard Deviation	Minimum	Maximum
Saudi Arabia - Bahrain	0.74	2.08	-1.95	5.94
Saudi Arabia - Kuwait	-1.25	1.59	-4.35	2.42
Saudi Arabia - Oman	-0.05	1.80	-2.46	6.06
Saudi Arabia - Qatar	-2.60	4.43	-8.90	9.92
Saudi Arabia - UAE	-3.03	2.54	-6.99	3.93
UAE - Bahrain	3.76	2.45	-1.74	7.82
UAE - Kuwait	1.78	2.53	-3.57	5.83
UAE - Oman	2.98	2.20	-2.47	6.22
UAE - Qatar	0.43	2.83	-4.08	5.99
Kuwait - Bahrain	1.98	2.46	-1.99	6.89
Kuwait - Oman	1.20	1.62	-1.89	3.64
Kuwait - Qatar	-1.35	4.07	-8.13	9.56
Qatar - Bahrain	3.33	4.52	-7.73	10.55
Qatar - Oman	2.55	3.73	-8.46	7.80
Oman - Bahrain	0.79	2.71	-4.22	8.40
GCC Pairwise Average	*0.75*	*3.50*	*-8.90*	*10.55*

Notes: As opposed to Figures 2 and 3, inflation differentials are in percent per annum. Authors' calculations based on data from International Monetary Fund (2010b).

Table 5. Inflation Differentials Summary Statistics, 1991–2002

Pairwise Combinations	Mean	Standard Deviation	Minimum	Maximum
Saudi Arabia - Bahrain	0.81	1.69	-1.75	4.27
Saudi Arabia - Kuwait	-1.40	1.82	-4.35	2.42
Saudi Arabia - Oman	0.33	1.98	-1.83	6.06
Saudi Arabia - Qatar	-1.77	2.40	-6.14	2.01
Saudi Arabia - UAE	-2.83	1.60	-4.91	0.65
UAE - Bahrain	3.63	1.68	1.19	7.61
UAE - Kuwait	1.43	2.11	-2.46	4.54
UAE - Oman	3.16	1.56	0.86	6.22
UAE - Qatar	1.06	2.54	-4.08	5.97
Kuwait - Bahrain	2.20	2.54	-1.99	6.89
Kuwait - Oman	1.72	1.58	-1.27	3.64
Kuwait - Qatar	-0.37	2.15	-4.02	3.50
Qatar - Bahrain	2.57	2.96	-3.46	7.27
Qatar - Oman	2.09	2.12	-2.01	6.52
Oman - Bahrain	0.48	2.26	-4.22	4.34
GCC Pairwise Average	*0.88*	*2.70*	*-6.14*	*7.61*

Notes: As opposed to Figures 2 and 3, inflation differentials are in percent per annum. Authors' calculations based on data from International Monetary Fund (2010b).

Table 6. Inflation Differentials Summary Statistics, 2003–09

Pairwise Combinations	Mean	Standard Deviation	Minimum	Maximum
Saudi Arabia - Bahrain	0.62	2.79	-1.95	5.94
Saudi Arabia - Kuwait	-0.99	1.18	-3.41	0.36
Saudi Arabia - Oman	-0.70	1.33	-2.46	1.46
Saudi Arabia - Qatar	-4.02	6.67	-8.90	9.92
Saudi Arabia - UAE	-3.37	3.80	-6.99	3.93
UAE - Bahrain	3.99	3.57	-1.74	7.82
UAE - Kuwait	2.38	3.22	-3.57	5.83
UAE - Oman	2.67	3.14	-2.47	5.50
UAE - Qatar	-0.65	3.18	-3.09	5.99
Kuwait - Bahrain	1.61	2.47	-0.97	6.51
Kuwait - Oman	0.29	1.31	-1.89	2.20
Kuwait - Qatar	-3.03	6.01	-8.13	9.56
Qatar - Bahrain	4.64	6.48	-7.73	10.55
Qatar - Oman	3.32	5.69	-8.46	7.80
Oman - Bahrain	1.32	3.48	-1.55	8.40
GCC Pairwise Average	*0.54*	*4.56*	*-8.90*	*10.55*

Notes: As opposed to Figures 2 and 3, inflation differentials are in percent per annum. Authors' calculations based on data from International Monetary Fund (2010b).

A. Determinants of Inflation Differentials

As discussed widely in the literature, see for instance Honohan and Lane (2003) and Hasan and Alogeel (2008), there are a number of important domestic and external channels that help determine inflationary pressures in the short run and as such are potential determinants of inflation differentials. Figure 1 plots four of the main determinants of inflation: output, credit, non-oil fiscal balance, and NEER growth rates. The sign of the estimated coefficients on output and credit is expected to be positive given their impact on domestic demand. On the other hand, the sign of the non-oil fiscal balance and the NEER coefficients is expected to be negative. As the nominal exchange rate cannot adjust to the movements in the U.S. dollar, we expect that most of the adjustments occur through domestic prices and inflation rates and are captured through the nominal effective exchange rate channel (Table 7). A contractionary fiscal stance through its effect on domestic demand would have a dampening effect on inflation as would an appreciation in the NEER. However, we also explore the effect of government expenditure on inflation differentials which is expected to be opposite to that of the non-oil fiscal balance due to its impact on domestic demand and crowding in of credit to the private sector. There are major differences in the growth of non-oil real output and non-oil fiscal balances as well as credit growth among the GCC countries, with Qatar and the U.A.E. being generally the ones with the highest growth rates. The difference in the evolution of growth rates of these variables appears to follow a similar trend to that of the inflation rate, in which higher growth rates were experienced before the mid-1990's and after 2003.

Table 7. GCC Direction of Trade, 1991–2009
(Percent)

	USA	Europe	Asia	Middle East and North Africa
Bahrain	9	26	22	36
Kuwait	14	34	36	15
Oman	6	22	35	33
Qatar	11	37	30	16
Saudi Arabia	16	35	32	8
United Arab Emirates	9	30	44	8
GCC Average	*11*	*31*	*33*	*19*

Notes: Authors' calculations based on data from the International Monetary Fund (2010a).

In order to account for the role of structural factors, the share of rent in the CPI basket is included as an explanatory variable. This variable represents the associated inflationary pressures due to supply bottlenecks in the housing market, which have been particularly acute during the recent oil boom. These supply constraints are mainly due to inadequate investments in the past which led to shortages in commercial office space and residential housing. Additional demand pressures arose from opening up the real estate markets to foreign investors in Qatar and the U.A.E. and the inflows of expatriate labor to all GCC countries. A snap-shot of the latest weights used in each country's CPI basket is reported in Table 8, illustrating the wide differences in the weight assigned to housing.

Table 8. Share of Food and Rent in the CPI Basket
(Percentage)

	Food, Beverage, and Tobacco	Rent and Utilities	Other
Bahrain	21.0	24.4	54.6
Kuwait	19.0	26.7	54.3
Oman	30.4	21.4	48.2
Qatar	18.1	20.7	61.2
Saudi Arabia	27.7	17.7	54.7
UAE	14.1	39.3	46.5

Notes: Data provided by country authorities as well as authors and IMF staff calculations.

Thus, given the above discussion, the macroeconomic variables that exert short-term influence on the inflation process in country i, $\mathbf{z}_{it}$ in equation (12), is defined as:

$$\mathbf{z}_{it} = \left[\Delta neer_{it}, \Delta y_{it}, rent_{it}, \Delta credit_{it}, \Delta fiscal_{it}\right]',$$

where $\Delta neer_{it}$ is the growth rate of the nominal effective exchange rate, Δy_{it} is the growth rate of non-oil GDP, $rent_{it}$ is the share of rent in the CPI basket, $\Delta credit_{it}$ is credit growth, and $\Delta fiscal_{it}$ is the growth rate of non-oil fiscal balances. Economic theory, as discussed above, predicts that non-oil output growth, rent, and credit growth will widen the inflation gap between the countries, while an increase in the growth rates of NEER and non-oil fiscal balances will lead to closing the inflation gap.

V. Empirical Results

This section presents the results from estimating equation (12) by applying the GMM methodology described in Section III.C to both monthly and annual data.

A. Analysis Using Monthly Data

We use the proposed system GMM estimator described above to estimate inflation differentials using monthly data:

$$\Delta x_{ijt} = (\phi - 1)x_{ijt-1} + \boldsymbol{\beta}'(\mathbf{z}_{it}^{m} - \mathbf{z}_{jt}^{m}) + (\varepsilon_{it} - \varepsilon_{jt}), \tag{17}$$

where $\mathbf{z}_{it}^{m}$ denotes the variables used in the monthly estimations and is defined as:

$$\mathbf{z}_{it}^{m} = [\Delta neer_{it}, \Delta oil_{it}, rent_{it}, \Delta credit_{it}]', \tag{18}$$

where oil_{it} is oil revenues and the rest of the variables are as defined before. The variables in $\mathbf{z}_{it}^{m}$ are annualized growth rates. As we have already performed unit root tests on Δx_{ijt} and confirmed that inflation differentials are in the process of converging, see Section III.A and Table 3, we proceed by estimating equation (17).[7]

Regression $[1.2]$ in Table 9 reports the estimation results using monthly data between January 1995 and June 2010. Oil revenues are a highly significant determinant of inflation differentials, with a ten percentage point increase in oil revenue differentials leading to about a five percent increase in the inflation gap between countries. This effect is indeed expected to explain a large proportion of inflation differentials in the region given the diverse endowments of oil across the six countries. Moreover, this result illustrates the importance of managing the spending of oil revenues over the business cycle to avoid overheating the economy.

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[7] Unit root tests were also performed on all the variables in $\mathbf{z}_{it}^{m}$. As expected all the ADF tests (both with and without an intercept) rejected the null of a unit root for the 15 individual pairwise series at the one percent level. These results are not reported in the paper but are available upon request.

Table 9. GCC Inflation Differentials, 1995M1–2010M6

Start date:	1995M1	1995M1	2003M1	2003M1
Variables in differentials	[1.1]	[1.2]	[1.3]	[1.4]
Lagged price level, in logs	-0.226***	-0.170**	-0.242**	-0.280**
	(0.047)	(0.062)	(0.112)	(0.098)
NEER growth	-0.447	-0.502	-0.541	-0.361
	(0.385)	(0.376)	(0.353)	(0.362)
Oil revenue growth	0.442**	0.497***	0.625***	0.453**
	(0.156)	(0.162)	(0.185)	(0.170)
Rent weight	0.281**	0.211*	0.504*	0.381*
	(0.116)	(0.103)	(0.251)	(0.180)
Lagged credit growth		0.065*		0.147***
		(0.031)		(0.043)
No. observations	2790	2786	1350	1346
Specification tests (p-values)				
(a)Hansen Test	0.877	0.575	0.807	0.763
(b)Serial correlation				
First-order	0.036	0.028	0.102	0.072
Second-order	0.475	0.200	0.496	0.426

Source: Authors' estimations.

Notes: The estimation method is two-step system GMM with Windmeijer (2005) small sample robust correction. Standard errors are presented below the corresponding coefficients in brackets. Symbols ***, **, and * denote significance at 1%, 5%, and at 10% respectively. The dependent variable is the inflation rate differential between country i and country j; the 15 pairwise combinations are listed in Table 1. All right hand side variables are defined as deviations of country i from country j.

The coefficient on the rent weight, used as a proxy for the supply constraints in the housing market, is also significant and positive. It thus leads to a widening of the inflation differentials in the region. Furthermore, credit growth differentials result in larger inflation differentials, with a ten percent increase in credit growth explaining about a one percentage rise in the inflation gap between countries. The effect of credit for the full sample is notably smaller relative to the period since the onset of the oil boom.

Given that inflation differentials seem to have widened since 2003, we re-estimate our model using monthly data from 2003M1 to 2010M6. Regression [1.4] reports the estimation results for this subsample, from which it is clear that the coefficients of most of our variables in equation (17) are significant and more importantly much larger compared to those in the full sample in regression $[1.2]$. In particular, the coefficients of the rent weight and credit growth are now twice as large as before. These results are in line with the expectations that since 2003 supply constraints in the housing market have been a major factor putting pressure on inflation. Thus, investment in the expansion of the supply of both commercial and residential housing is critical to reduce inflation differentials. Moreover, a 10 percent increase in credit growth leads to a 1.5 percent increase in inflation differentials even after controlling for the effects of fiscal policy on growth. Thus, the rapid credit growth in the region, especially at a much faster pace in Qatar and the U.A.E., was an important factor contributing to a widening in inflation differentials post-2003.

Furthermore, the coefficient of oil revenues is significant and in line with the estimations using the full sample. The upsurge in oil prices from 2003 onwards increased oil revenues which allowed the GCC countries to spend more on infrastructure and social services, which contributed to the overheating of these economies, but to different degrees depending on their utilization of oil wealth.

In addition, there is evidence of convergence across the countries with the coefficient on the lagged price level being significant for both samples, see regressions $[1.1]$ to $[1.4]$. The speed of convergence also increased over the sample suggesting that even though differentials increased since the onset of the oil boom (Figure 3 and Tables 4–6), they reverted much faster. The coefficient of the nominal effective exchange rate was of expected sign but insignificant. Finally, in both regressions, the Hansen and second order serial correlation test statistics, which examine the validity of the instruments used, are well above the conventional significance levels.

B. Analysis Using Annual Data

Results for the full sample (1991–2009)

We use the GMM dynamic panel data approach to estimate the following equation using annual data:

$$\Delta x_{ijt} = (\phi - 1)x_{ijt-1} + \boldsymbol{\beta}'(\mathbf{z}_{it} - \mathbf{z}_{jt}) + (\varepsilon_{it} - \varepsilon_{jt}). \qquad (19)$$

In order to evaluate whether or not the impact of macro variables on inflation differentials is driven by any one particular variable, the model was estimated with the lagged price level, x_{ijt-1}, and a subset of the variables in $\mathbf{z}_{it}$, namely: differentials of the nominal effective exchange rate (NEER) growth, $\Delta neer_{it}$, non-oil output growth, Δy_{it}, and the weight of rent in the CPI basket, $rent_{it}$. Additional variables were then systematically included subject to the subset of variables that served as controls. Table 10 presents the results, which shows that in contrast to the monthly estimation in regressions [1.1]–[1.4] the coefficient on NEER growth has a negative and significant effect on inflation differentials as expected. In addition, non-oil real output growth leads to a significant widening of the inflation differentials.

Table 10. GCC Inflation Differentials, 1991–2009

Variables in Differentials	[2.1]	[2.2]	[2.3]	[2.4]	[2.5]	[2.6]
Lagged price level, in logs	-0.150**	-0.100*	-.0.130*	-0.091*	-0.122*	-0.110**
	(0.063)	(0.049)	(0.067)	(0.048)	(0.060)	(0.038)
NEER growth	-0.568***	-0.652**	-0.580***	-0.557***	-0.821**	-0.632**
	(0.190)	(0.254)	(0.165)	(0.140)	(0.354)	(0.227)
Non-oil GDP growth	0.297***	0.254***	0.275***	0.302***	0.297***	0.278***
	(0.081)	(0.060)	(0.091)	(0.083)	(0.071)	(0.087)
Rent weight	0.293	0.200**	0.304**	0.209***	0.240**	0.236**
	(0.170)	(0.082)	(0.131)	(0.060)	(0.098)	(0.087)
Lagged credit growth		0.102**			0.086*	0.066*
		(0.042)			(0.042)	(0.037)
Non-oil fiscal balance growth	-		-0.020*		-0.032*	
			(0.011)		(0.017)	
Government expenditure growth		-		0.018***		0.039
				(0.005)		(0.022)
No. observations	285	275	280	280	271	271
Specification tests (p-values)						
(a)Hansen Test	0.653	0.254	0.917	0.362	0.597	0.607
(b)Serial correlation						
First-order	0.005	0.006	0.006	0.005	0.011	0.005
Second-order	0.176	0.865	0.146	0.101	0.376	0.311

Source: Authors' estimations.

Notes: The estimation method is two-step system GMM with Windmeijer (2005) small sample robust correction. Standard errors are presented below the corresponding coefficients in brackets. Symbols ***, **, and * denote significance at 1%, 5%, and at 10% respectively. The dependent variable is the inflation rate differential between country i and country j; the 15 pairwise combinations are listed in Table 1. All right hand side variables are defined as deviations of country i from country j.

By including credit growth in our analysis, regression [2.2], it is noteworthy that while the effects of non-oil output and NEER growth on inflation differentials remain the same, credit growth has a significant positive effect on widening inflation differentials. A 10 percent increase in the credit growth differential will on average increase inflation differentials by 1 percent. Furthermore, adding non-oil fiscal balances to regression [2.1], we see that as predicted by theory an improvement in fiscal balances has a significant negative effect on inflation differentials, with the magnitude of the effects of NEER and non-oil output being the same as in regression [2.1].

To make sure that our results are not driven by the particular fiscal variable used, we replace fiscal balances with government expenditure growth and re-estimate regression $[2.3]$. The effects of all the variables are in line with that of earlier estimations with government expenditure growth having a significant positive effect on inflation differentials, see regression $[2.4]$. Looking at the influence of rent weight differentials as a proxy for supply constraints in the housing market on inflation differentials, we see that a 1 percent increase in this increases the inflation gap in the region by between 0.2 and 0.3 percent, depending on which of the four regressions we consider.

The results for the core regression $[2.1]$ remain robust to including the growth rates of credit and both fiscal variables separately, with all of the coefficients being significant and having the right sign as predicted by economic theory. We proceed by estimating our preferred model given by equation (19) in which:

$$\mathbf{z}_{it} = \left[\Delta neer_{it}, \Delta y_{it}, rent_{it}, \Delta credit_{it}, \Delta fiscal_{it}\right]'. \tag{20}$$

The results suggest that a 10 percent increase in NEER growth will lead to almost an 8 percent decrease in inflation differentials while a 10 percent increase in non-oil output growth differentials will increase inflation differentials by about 3 percent, see regression $[2.5]$. These effects are in fact quite large, in particular given that non-oil real GDP growth differentials of 5 percent as well as NEER growth of 1 percent are often observed in our sample between 1991 and 2009, see Figure 2.

Moreover, as expected a higher rent weight differential widens the inflation gap between countries; a 10 percent difference in rent weights leads to a 2.4 percentage difference in inflation rates. Furthermore, a 10 percent credit growth differential corresponds to widening the inflation gap by about 1 percent. Finally, a tightening in non-oil fiscal balances by 10 percent results in the reduction of the inflation gap by 0.3 percent.

The above results are robust to including government expenditure growth instead of fiscal balances in regression $[2.5]$, with the effects of most variables being the same as before, except for NEER growth which now has a slightly smaller impact on inflation differentials, see regression $[2.6]$. In all six regressions in Table 10 the lagged price level is significant and negative, thus confirming that the GCC inflation rates are in the process of converging. Moreover, the Hansen and second-order serial correlation test statistics in all regressions are well above the conventional significance levels, confirming the validity of the instruments and the lack of second-order serial correlation in the error terms.

Results for the subsample (2003–09)

Given the widening of inflation differentials (see Figure 2) and the acceleration in growth of a number of key macro variables (such as credit growth) since 2003, we split the sample and re-estimate regressions [2.1] to [2.6] using data from 2003 to 2009.

The results of regressions [3.1] to [3.3] in Table 11 generally reflect those in Table 10. As illustrated before, the coefficients are all significant and have the right signs as predicted by theory, but the magnitude of the effects of the individual variables on the inflation differentials is now much larger, in line with the monthly estimations in Table 9.

To check the robustness of the above results we use data on government expenditure as opposed to fiscal balances in our regressions. While the impact of the other variables remains more or less the same, the effect of government expenditure growth is now significantly larger, with a magnitude of around ten-fold that observed in the full sample, see regression [3.4]. Higher oil prices since 2003 increased the size of the oil windfall for the GCC countries, which pushed the governments to spend more on infrastructure and social services. This in turn led to an overheating of the economy, resulting in higher inflation. The inferences from the results in regression [3.4] reaffirm those from regression [1.4] using monthly data where oil revenues proxied government expenditure.

In estimating equation (19), an increase in non-oil output growth or rent weight by 10 percent has a similar effect, with both increasing inflation differentials by about 4 percent. On the other hand, a 1 percentage increase in NEER seems to reduce inflation differentials by almost 1 percent. Thus, the more recent divergence in NEER growth rates in the region (see Figure 2) seems to explain quite a large fraction of the inflation gap between the countries since 2003. Furthermore, we see from regression [3.5] that every 10 percent increase in credit growth corresponds to a 2 percent increase in inflation differentials. Given that credit growth differentials have on average been above 10 percent (see Figure 2), it seems that more recently the credit channel is an important one in explaining the widening of the inflation gap.

Interestingly, replacing fiscal balances with government expenditure in regression [3.5], we obtain very similar coefficients for the rest of the variables, but the effect of government expenditure growth on inflation differentials is now much larger. A 10 percent increase in the government expenditure growth differential will result in widening the inflation gap by 3 percent. This result reaffirms that inflation differentials are influenced by the oil cycle, mainly through the fiscal channel.

Moreover, the lagged price level is significant and negative in all regressions. This confirms the results using monthly data and the full sample, which show that despite an upward shift in differentials during the boom, these are still converging and that convergence has been faster since 2003. In addition, as before the Hansen and second-order serial correlation test statistics, which examine the validity of the instruments used, are well above the conventional significance levels.

To make sure that these results are not driven by the fact that we split the sample in 2003, we also estimate regressions $[3.1]$ to $[3.6]$ using data from 2002 and obtain similar results to those in Table 11. These results are not reported but are available upon request.

Thus, overall the results using annual data seem to support those obtained using monthly data. Firstly, we see that the price level and the inflation rates in the region are converging. Secondly, the effect of credit growth and rent, as well as NEER and output growth, on the inflation gap between countries seems to have become stronger since 2003. This is as expected given the larger role of credit and output growth on the domestic economies following the oil price boom.

Table 11. GCC Inflation Differentials, 2003–09

Variables in Differentials	[3.1]	[3.2]	[3.3]	[3.4]	[3.5]	[3.6]
Lagged price level, in logs	-0.116*	-0.187***	-0.094**	-0.130**	-0.166**	-0.168***
	(0.056)	(0.042)	(0.043)	(0.046)	(0.062)	(0.038)
NEER growth	-0.704**	-0.995***	-0.980***	-0.805***	-0.996***	-1.027***
	(0.252)	(0.180)	(0.255)	(0.266)	(0.283)	(0.178)
Non-oil GDP growth	0.512***	0.318**	0.543***	0.499***	0.368***	0.386***
	(0.118)	(0.111)	(0.087)	(0.093)	(0.083)	(0.072)
Rent weight	0.249*	0.325**	0.228	0.299**	0.398**	0.284**
	(0.130)	(0.117)	(0.139)	(0.104)	(0.144)	(0.113)
Lagged credit growth		0.329***			0.203***	0.244***
		(0.093)			(0.044)	(0.075)
Non-oil fiscal balance growth			-0.086**		-0.058*	
			(0.034)		(0.031)	
Government expenditure growth				0.186**		0.321**
				(0.074)		(0.148)
No. Observations	105	105	105	105	105	105
Specification tests (p-values)						
(a)Hansen test	0.194	0.248	0.471	0.285	0.507	0.354
(b)Serial correlation						
First-order	0.017	0.010	0.011	0.013	0.010	0.012
Second-order	0.827	0.139	0.527	0.182	0.223	0.279

Source: Authors' estimations.

Notes: The estimation method is two-step system GMM with Windmeijer (2005) small sample robust correction. Standard errors are presented below the corresponding coefficients in brackets. Symbols ***, **, and * denote significance at 1%, 5%, and at 10% respectively. The dependent variable is the inflation rate differential between country i and country j; the 15 pairwise combinations are listed in Table 1. All right hand side variables are defined as deviations of country i from country j.

VI. Concluding Remarks

Our results illustrate that although differences in inflation rates across the GCC have widened over the last two decades, especially since the onset of the recent oil boom, they were in fact converging after controlling for macroeconomic and structural factors. Furthermore, convergence was faster during the oil boom (2003–09) as compared to the whole period investigated (1991–2009). Domestic and external factors that contributed to rising domestic demand were found to be significant determinants of inflation differentials. In particular, inflation differentials are mainly driven by the oil cycle through the credit and fiscal channels. This underscores the need for countercyclical macroprudential policies during booms to contain excessive growth in credit. While a single central bank will coordinate monetary policies under the proposed monetary union, fiscal policy will also need to be coordinated.

Given that inflation differentials are strongly influenced by fiscal policy, policies to reduce the procyclicality of fiscal policy would also ensure convergence of inflation rates. A strong medium-term expenditure framework could anchor expectations by helping to limit procyclical responses to shocks that would amplify the impact of externally-driven volatility on the real economy. However, strengthening public financial management is an essential precondition to implement a credible fiscal framework, as the European debt crisis has highlighted the importance of robust fiscal data for monitoring compliance with the framework. Structural factors, proxied by the weight of rents in the CPI basket, are equally important. As these countries increase their diversification efforts, consideration will need to be given to the adequacy of housing to accommodate a growing domestic population and imported labor, given the weight of rents in the CPI basket.

References

Alonso-Borrego, C. and M. Arellano (1999). Symmetrically Normalized Instrumental-Variable Estimation Using Panel Data. *Journal of Business and Economic Statistics,* Vol. 17 (1), pp. 36–49.

Anderson, T.W. and C. Hsiao (1982). Formulation and Estimation of Dynamic Models Using Panel Data. *Journal of Econometrics,* Vol. 18(1), pp. 47–82.

Andersson, M., K.Masuch, and M. Schiffbauer (2009). Determininants of Inflation and Price Level Differentials Across the Euro Area Countries. ECB Working Paper Series 1129 (Frankfurt: European Central Bank).

Arellano, M. and S. Bond, (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies,* Vol. 58(2), pp. 277–97.

Arellano, M. and O. Bover (1995). Another Look at the Instrumental Variable Estimation of Error-components Models. *Journal of Econometrics*, Vol. 68(1), 29–51.

Basher, S.A. and E.M. Elsamadisy, (2010). Country Heterogeineity and Long-Run Determinants of Inflation in the Gulf Arab States. Central Bank of Qatar, Working Paper (Doha).

Blundell, R. and S. Bond (1998). Initial Conditions and Moment Restriction in Dynamic Panel Data Models. *Journal of Econometrics* Vol. 87(1), pp. 115–43.

Busetti, F., L. Forni, A. Harvey, and F. Venditti (2007). Inflation Convergence and Divergence within the European Monetary Union. *International Journal of Central Banking,* Vol. 3(2) pp. 95–121.

Durlauf, S. and D. Quah (1999). The New Empirics of Growth. In J. Taylor and M. Woodfern (Eds.), *Handbook of Macroeconomics*, pp. 235–308. New York: North-Holland.

Garratt, T., K. Lee, M.H. Pesaran, and Y. Shin (2006). *Global and National Macroeconometric Modelling: A Long-Run Structural Approach.* Oxford: Oxford University Press.

Hasan, M. and H. Alogeel (2008). Understanding the Inflationary Process in the GCC Region: The Case of Saudi Arabia and Kuwait. IMF Working Paper, WP/08/193 (Washington; International Monetary Fund).

Honohan, P. and P.R. Lane (2003). Divergent Inflation Rates in EMU. *Economic Policy,* Vol. 18(37) pp. 357–94.

International Monetary Fund, (2010a). Direction of Trade Statistics (Washington).

__________ (2010b). *World Economic Outlook* (Washington).

__________ (2010c). *Regional Economic Outlook*: Middle East, and Central Asia (Washington).

__________(2010d). *International Financial Statistics*, (Washington).

Kandil, M.E. and H. Morsy (2009). Determinants of Inflation in the GCC. IMF Working Paper WP/09/82.

Kapetanios, G., M.H. Pesaran, and T. Yamagata (2011). Panels with Non-Stationary Multifactor Error Structures. Forthcoming in *Journal of Econometrics.*

Kwiatkowski, D., and P.C.B. Phillios, P. Schmidt, and Y. Shin (1992). Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root? *Journal of Econometrics,* Vol. 54(1–3), pp. 159–178.

Licheron, J. (2007). Explaining Inflation Differentials in the Euro Area: Evidence from a Dynamic Panel Data Model. *Économie Internationale,* Vol. 112, pp.73–97.

Pesaran, M. H. (2007). A Pair-wise Approach to Testing for Output and Growth Convergence. *Journal of Econometrics,* Vol. 138(1), 312–355.

Pesaran, M. H., R.P. Smith, T. Yamagata, and L. Hvozdyk (2009). Pairwise Tests of Purchasing Power Parity. *Econometric Reviews,* Vol. 28(6), pp. 495–521.

Rabanal, P. (2009). Inflation Differentials Between Spain and the EMU: A DSGE Perspective. *Journal of Money Credit and Banking,* Vol. (41), pp. 1141–1166.

United States Department of Energy, (2010). Energy Information Administration.

Windmeijer, F. (2005). A Finite Sample Correction for the Variance of Linear Efficient Two-step GMM Estimators. *Journal of Econometrics,* Vol. 126(1), pp. 25–51.