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Establishing Conversion Values for New Currency Unions: Method and Application to the planned Gulf Cooperation Council (GCC) Currency Union

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Abstract

A key issue in creating a new currency union is setting the rates to convert national currencies into the new union currency. Planned unions in the Gulf region and Africa are seeking methods to set the conversion rates when their new currencies are created. We propose a forward-looking econometric methodology to determine conversion rates by calculating the degree of misalignment in the real exchange rate, and apply it to the GCC currency union. For each GCC currency, we identify the year at which the economy is the closest to its internal and external equilibrium, and then estimate the degree of misalignment in the bilateral real exchange rate vis-à-vis the U.S. dollar based on WEO forecasts until 2013. Application of the methodology to other regions is also considered.

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Establishing Conversion Values for New Currency Unions: Method and Application to the planned Gulf Cooperation Council (GCC) Currency Union

Bassem Kamar, Jean-Etienne Carlotti, and Russell Krueger[1]

A. Introduction

1.   In creating a new currency union, a key issue is setting the rates to convert national currencies into the new union currency. The review of the related literature reveals a wide gap on this issue, and we were unable to find any clear methodology for determining the conversion rates.

2.   The experience of the European Monetary Union (EMU) presents one model but *a priori* it is unclear how much guidance it can provide to other regions. In essence, the system was based on decades' long experimentation with the European Currency Unit (ECU) that allowed market forces (operating with certain bounds and with occasional resettings of individual rates) to affect the evolution of exchange rates, leading up to the euro.

3.   The notion of a country's equilibrium exchange rate as guidance for setting the conversion rate into the euro was introduced by the European Central Bank (ECB) in the Exchange Rate Mechanism II (ERM II) for new entrants to the euro area, once it was formed. The ERM II system requires countries to hold their currencies for at least two years within specified bands around a central parity vis-à-vis the euro. It also requires that the central rate chosen should reflect the best possible assessment of the equilibrium exchange rate at the time of entry into the mechanism. This assessment should be based on a broad range of economic indicators and developments (ECB, 2003).

4.   Identifying the equilibrium exchange rate at the conversion date is therefore essential. If an exchange rate is misaligned (overvalued or undervalued) at the time of the conversion into the union currency, it will be frozen at that misalignment leading to economic distortions across the union members. An undervalued entry would give rise to a higher competitiveness for the country in comparison with its partners in the currency union, and will require a higher than average inflation rate throughout the union to reduce the misalignment. An overvalued entry could involve significant costs in terms of unemployment and bankruptcies (Wren-Lewis, 2003). Therefore, the fair assessment of the misalignment for all members of the union is crucial.

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5.　　This paper developed from an informal request to one of the authors by a member of the Gulf Cooperation Council (GCC) Secretariat for guidance on how to set the conversion values for the new GCC currency. He subsequently requested such advice from the IMF. This Working Paper describes one method that could be used for the conversion.

6.　　At first glance, the question may appear irrelevant for the GCC. As an explicit step to prepare for the union, in 2001 the GCC countries pegged their currencies to the U.S. dollar, which is widely used for commerce and for asset-holding in the region. This created a fixed relationship between the GCC currencies. Over time, the fixed relationships could allow the pricing structures in the economies to adjust to each other with virtually no exchange rate risk.

7.　　This effect has certainly occurred to some extent, but two issues were unresolved – whether the U.S. dollar monetary policy adopted as a result of the peg was appropriate for the region, and how to deal with inflation differentials between countries that change the real exchange rates between the GCC currencies. Both these issues became major concerns in the region. By late 2007, there was widespread concern that the dollar peg was contributing to overheating of the economies and causing large capital losses because of the dollar's weakness in exchange markets. Numerous proposals for change were made, such as switching to a basket or announcing a large appreciation (20-30 percent) of the GCC currencies against the dollar. At the same time, rapid inflation in Qatar and the United Arab Emirates (UAE) affected their real exchange rates vis-à-vis the other GCC countries. The new union would need to address such issues and their possible effect on the conversion of national currencies into the new union currency,[2] as is done in this paper.

8.　　Using forecasted data, we present a comprehensive approach to determine the conversion rate, taking into account the notion of exchange rate equilibrium. The methodology has an advantage of providing policy makers seeking currency union with a framework to help identify the required exchange rate adjustments in the future. This forward-looking aspect of the approach is an important value added to the literature on currency unions.

9.　　The methodology consists of three steps:

•　　The first step aims at identifying the year in which the economy was closest to its internal and external equilibrium. For that, we use the real exchange rate equilibrium approach that links the exchange rate to its long term fundamentals. The lowest deviation from equilibrium (the lowest misalignment) in the recent years is an indication of the equilibrium year.

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[2] However, counter arguments, including by the IMF, were made in defense of the peg to the dollar, These included, *inter alia*, long-term general policy stability as a result of the peg, the possibility of capital gains when the dollar weakness reversed (which happened), the heavy use of dollars in the region's export and import trade, and the low conversion cost of the GCC currencies. The GCC must decide whether such perceived pros or the perceived cons of the peg carry the bigger weight.

- The second step addresses the issue of estimating the real exchange rate equilibrium and misalignment of each currency vis-à-vis the prospective anchor currency for the union, or vis-à-vis the real effective exchange rate if the anchor is a basket of currencies or if the objective is for the new currency to float freely. We use forecasted values of the real exchange rate and its fundamentals to allow for forward looking perspectives.

- The final step consists in normalizing the equilibrium exchange rate we obtained in step two to have a value of zero in the year of equilibrium identified in step one. The forecasted real exchange rate misalignment calculated in step two will serve as a measure of the necessary nominal exchange rate (NER) adjustment for the conversion rate.

10.   These methods can be used to determine if the existing exchange rate configuration between the GCC currencies is robust or should be changed. This paper seeks to provide authorities a methodology that they should rigorously apply (alongside other methodologies and with full use of information available within the region) to help set the conversion rates for the future union.

11.   The paper also examines the possible application of the method to other prospective currency unions.[3] In this regard, we presented our method during a workshop, *The Establishment of Regional Monetary Unions*, at the European Central Bank (January 26-28, 2009), which was attended by representatives of the GCC and three planned currency unions in Africa. Participants representing all unions expressed interest in using our method to examine if it can provide guidance on setting conversion rates in their union situations.

12.   The rest of the paper is organized as follows: the following section explains the problem and reviews the example of the Euro area. Section "C" explains the details of the methodology and section "D" presents the results of the application to the GCC countries. Section "E" explores the extension of the methodology to other currency unions and section "F" concludes. Section "G" includes a series of appendices covering special topics in more detail.

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[3] In addition to the planned currency union among the GCC countries, projects are actively underway to develop unions in East, South, and West Africa. In many other regions of the world, discussions are underway about possibly building other currency unions, but they have not reached the point where projects to build unions have been launched.

B. Background

The Problem

13.   The creation of a currency union involves the creation of a new currency for the union that becomes the legal currency for all member countries. All preexisting national currencies are absorbed into the new union currency. With a single currency for all member countries there will be only one monetary policy and only one exchange rate for the union.

14.   A critical step in the process is converting the individual national currencies into the new union currency. A conversion rate must be set to redeem the national currencies for the union currency and to redenominate all values expressed in the old national currencies into the value of the union currency.

- Redemption of national currencies for the union currency involves turning in the national currency at banks or other exchange stations in exchange for the new union currency. A rate of exchange must be agreed that applies to all residents. For example, (in an union of countries known for their trees) citizens of Alder turn in 2 of their Alder dollars to receive one unit on the union currency; whereas citizens of Banyan pay 3 Banyan dinars to receive one unit. The conversion rates are thus; Alder: 2 to 1, and Banyan: 3 to 1.

- Redenomination of currency values must also occur at the same rate. Alder must redenominate all Alder dollar values used on boxes of cereal, contracts, deeds, wage agreements, tax schedules, securities, and so on into the new union currency, using the 2 to 1 rate. Banyan must do the same using a rate of 3 to 1.

- The rate for each currency must be set and must apply to all relevant transactions. It should be set by law so that all parties involved know the value they are receiving in exchange for the value they are giving up.

15.   It matters what conversion rates are used.

- The rate should be set so that the conversion itself does not create gains or losses in value for any party involved. For example, the relative value of domestic versus cross-border investments prior to the conversion should not change post conversion.

- The conversion establishes relative prices of goods and services between member countries of the union, which affects competitiveness. For example, a shirt valued originally at 20 Alder dollars would be valued at 10 units of the union currency, the price at which a consumer in Banyan could buy it. However, if the conversion value for Alder was set at a lower value of 2.5 to 1, the same shirt would then be valued at 8 units, making it cheaper for

Banyan to purchase. This directly affects the competitiveness of goods and services between the two economies.[4]

- The conversion rate affects the relative wealth of the economies and estimates of the size of the economies. Suppose, for example, that at conversion rates of 2 to 1 and 3 to 1 two citizens of Alder and Banyan, respectively, find that they have equal net worths in the union. But if the rate for Alder is 2.5 to 1, the citizen of Alder discovers he is 20 percent less wealthy than the fellow in Banyan. Applied to macroeconomic statistics, the conversion rate will determine whether Alder and Banyan are estimated to have the same size GDP or GDPs that are 20 percent different. Applied to financial accounting, the conversion rates similarly affect the value of consolidated cross border investments. Another important area affected is the value of government debt converted into the new union currency. The list can be extended to numerous other important issues, such as the sustainability of external debt positions.

- Finally, the conversion rates should not create shocks between the member economies of the union. Countries within unions will have long-standing cross-border trade and investment relationships. They are adjusted to a certain configuration of exchange rates – if a conversion rate is set out of line with the configuration it could unfairly advantage or disadvantage countries, and trade and investment relations for the entire union could be affected.

16.   Thus, it can be seen that it may matter a great deal what conversion rates are used. A method needs to be found that is methodologically robust and can deliver estimates of conversion values that all parties involved find equitable. Serious imbalances can result if the rate is not set in line with economic fundamentals.

The European Example

17.   This section reviews the process for setting the conversion rates for national currencies into the euro. This occurred in two phases – in 1999, an initial eleven countries joined the Euro area and irrevocably linked the value of their currencies to the euro; five more countries that later adopted the euro followed a revised step of procedures comprising the Exchange Rate Mechanism II, or ERM II.

18.   The process of setting the conversion values for the euro was long and convoluted, with successes and failures. The process began in 1975 by creating a unit of value (the European Unit of Account, or EUA) to handle official cross-currency business for what would later become the European Union. Even from its earliest phases, the EUA acted to establish a configuration of exchange values between the participating currencies that was roughly fixed. In 1979, the European Monetary System (EMS) was created to strengthen monetary and exchange rate stability and enhance economic cooperation. It introduced the

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[4] Prior to the start-up of the European Monetary Union, there was widespread concern that a country might suddenly devalue its currency just prior to the launch of the union in order to gain competitive advantages. (See De Grauwe, 1997 pp.156-7.) In fact, one of the first acts of the European Central Bank when set up in May 1998 was to set the members' bilateral rates at that point to prevent such competitive changes prior to the Union's formal launch on January 1, 1999.

European Currency Unit (ECU) to replace the EUA. Each participating currency fluctuated based on market conditions in a narrow band around the central parity value of the ECU, which was a weighted average of the currencies. [5] Ultimately, in 1999, the ECU evolved into the euro, with each currency being irrevocably converted into euros using conversion rates derived from the ERM system. In total, 24 years of preparations occurred before national currencies were converted into euros. Over that long period, rates of exchange between the European currencies, although subject to numerous shifts in value and evolving policy regimes, were deeply integrated into the macroeconomic and financial situations of the European countries.

19.   The ERM had a rocky history, with some notable failures, but the 1991 Maastricht Treaty to set up the European Monetary Union adopted the ECU and the ERM structure as the basis for setting the value of the euro and conversion of national currencies into the euro. The ratio of the value of the individual national currencies to the euro was defined as the "irrevocable conversion rates" that had to be used for all transactions between national currencies and the euro.

20.   Countries that joined the Euro area later used an abbreviated version of the ERM called ERM II in which they set bands around a central parity vis-à-vis the euro. The central rate chosen had to reflect the best possible assessment of the equilibrium exchange rate at the time of entry into the mechanism (ECB, 2003). Countries had to remain within their bands for at least two years to be eligible to adopt the euro, but the system also provided for specific procedures to formally review the exchange rates, if needed. [6]

21.   Horváth and Komárek (2006) estimated the real exchange rate equilibrium for the new EU members and concluded that the misalignment for their currencies compared to the central parity vis-à-vis the euro is low and does not require any adjustment, at the time of their research. They also recommend adjusting the central parity only if the real exchange rate misalignment exceeds 10%.

22.   Future unions may choose to follow the European model of using a precursor unit of account such as the ECU. For example, a currency unit called the ECO has been considered in West Africa. Appendix 1 – *Setting the rates for conversion into the euro* – describes the European approach in more detail for planned unions that may wish to follow that approach.

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[5] The ECU is a basket currency, constructed on different quantities of national currencies. The weights for each currency were based on the importance of the economy based on GDP, export trade, and countries' quotas in the European Monetary Cooperation Fund.

[6] The ERM II Resolution stipulates that all parties may initiate a procedure aimed at reconsidering central rates. Such realignments may be necessary, for example, if equilibrium exchange rates evolve over time. (ECB, 2003)

The Gulf Cooperation Council

23.   The Gulf Cooperation Council consists of six Arab countries along the Arabian Gulf comprising Saudi Arabia and smaller countries along the coast – Kuwait, Bahrain, Qatar, the United Arab Emirates, and Oman. The countries share many historical and cultural ties and hope to develop more diversified intra-union trade over time. There has been an urge for greater union since the 1980's. Plans were made in 2000 to set up a monetary union and work towards it has gradually proceeded. In 2002, the states agreed to peg each of their currencies to the U.S. dollar as a step towards creating a common currency.

• The choice of the dollar peg reflects heavy earnings of dollars because of exports of oil and natural gas, which are denominated in dollars. The dollar peg sets the external value of each currency against the dollar, which also establishes the bilateral exchange rates between each of the member currencies. The external peg and the heavy reliance on the dollar have meant that the region has imported U.S. monetary policy. For example, interest rates in national currencies closely parallel movements in U.S. interest rates. This has led to complaints in the past that U.S. monetary policy is not appropriate for the region, especially around 2006 and 2007 when some local economies were overheating, but dollar-based interest rates remained low.

• Rapid price increases in Qatar and the UAE, with fixed nominal exchange rates, caused rapid appreciation of their real exchange rates against the other GCC currencies in 2007 and 2008.

• In June 2007, Kuwait formally depegged from the dollar and announced that it would peg its exchange rate to a basket of currencies. This potentially complicates the conversion of the GCC currencies to a new union currency. For example, the Kuwaiti dinar depreciated rather sharply against the dollar in early 2009, which affected the bilateral rates of the dinar against the other GCC currencies.

• Oman in December 2006 and UAE in May 2009 announced that they had decided to not enter the GCC currency union for the time being.[7] Therefore, we focus our analysis on the four remaining candidates for the currency union; Bahrain, Kuwait, Qatar, and Saudi Arabia.

• We believe that our methodology could be a useful tool to guide Oman and UAE on the appropriate rate of conversion of their respective currencies if they decide to join the GCC currency union at a later date.[8]

• As a result of following the U.S. policy lead, local mechanisms for monetary and exchange policy research and policy development are weak and monetary policy instruments are underdeveloped..

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[7] Conversely, Yemen is interested in joining the GCC, but this may not occur for several years.

[8] We also applied the methodology to Oman and UAE. Results are available upon requests from the authors.

24.   The GCC has now agreed that a Monetary Council will be set up in Riyadh to make arrangements for the planned currency union. One task of the Council will be to set the rates for conversion of national currencies into the new currency. This paper is intended to contribute to that effort.

African Unions

25.   There are three active currency unions in Africa and several regions are moving actively to create currency unions. Building of currency unions in Africa is likely to be one of the most important transforming trends in African development and institution building during the next decade.

26.   There are three existing arrangements;

- **CEMAC (Economic and Monetary Community of Central African)** – An union using the African Financial Community (CFA) franc comprised of six mostly francophone countries in Central Africa. (Members include Equatorial Guinea, Central African Republic, Chad, Republic of Congo, Cameroun, and Gabon.)[9] The CFA is pegged to the euro, and many administrative arrangements are through the French Treasury.

- **CMA (Common Monetary Area) -** An arrangement between South Africa, Lesotho, Namibia, and Swaziland in which the national currencies are at par with the South African rand and can circulate freely. Monetary policy and arrangements are dominated by the South African Reserve Bank.

- **WAEMU (West African Economic and Monetary Union) -** WAEMU comprises eight francophone countries in West Africa (Benin, Burkina Faso, Cote d'Ivoire, Mali, Niger, Senegal, Togo, and Guinea-Bissau). It also uses the CFA franc, under arrangements similar to CEMAC. Because the CEMAC and WAEMU currencies are both linked to the euro with the same exchange rate, and with convertibility guaranteed by the French Treasury, the two unions are often considered to comprise a single currency zone.

27.   There are several active programs to build new unions.

- **East African Community (EAC)** – Five countries in East Africa are actively working to build a currency union. Tanzania, Uganda, Kenya, Rwanda, and Burundi currently have their own currencies and will face the issue of setting conversion rates.

- **Southern African Development Community (SADC)** – This group is working to create a currency union by 2016. It will absorb the CMA and may ultimately include about 15 countries (CMA plus Angola, Botswana, Democratic Republic of Congo, Madagascar,

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[9] The membership of current and future currency unions in Africa is subject to change. For example, CEMAC may expand in the future to include the Democratic Republic of the Congo and the Democratic Republic of São Tomé and Príncipe. It is possible that the unions in Africa may initially form around a small nucleus of countries and expand later. Also, countries have been suspended from union-building activities because of coups. For such reasons, the listing of countries in each union or planned union is as of mid-2009, and is subject to change.

Malawi, Mauritius, Mozambique, Seychelles, Tanzania, Zambia, and Zimbabwe.)[10] The countries within the CMA will have adjusted to a common currency value, but the conversion rates for the other currencies will need to be set.

- **West African Monetary Zone (WAMZ)** – Five mostly Anglophone countries in West Africa are now accelerating their push for a currency union. Gambia, Ghana, Guinea, Nigeria, and Sierra Leone have not established pegs to each other. They are considering setting up a virtual currency similar to the ECU, called the ECO, which would allow the national currencies to adjust to a common value. However, there is also interest in exploring other methods to set the conversion rates to the union currency, including the method discussed in this paper.

- **ECOWAS (Economic Organization of West African States)** – This is a West African regional organization that encompasses both the WAEMU and WAMZ regions. It is considering merging the regions into a single currency union. Methods to set the conversion rates are relevant for this region.

C. Methodology to Set Conversion Values[11]

28.   The convergence rate should reflect the best possible assessment of the equilibrium exchange rate at the time of entry into the mechanism. This assessment should be based on a broad range of economic indicators and developments (ECB, 2003).

29.   If the exchange rate is misaligned at the time of the conversion (overvalued or undervalued) it would be frozen at that misalignment leading to economic distortions across the members. As the date of the conversion is an event that will occur in the future, the assessment of the misalignment should have a forward-looking perspective based on forecasted data.

30.   Our proposed methodology to set the conversion values for currency unions consists of three main steps: (1) Identifying the year the economy is at equilibrium to serve as a guide for the initial appropriate exchange rate level, (2) measuring the real exchange rate (RER) yearly deviation from equilibrium (RER misalignments) using forecasted values, (3) adjusting the initial exchange rate in step one by the rate of misalignment in step two to estimate the conversion value in any prospective year.

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[10] However, the Democratic Republic of the Congo and Tanzania may join CEMAC or the EAC, respectively.

[11] This methodology is an extension of the methodology presented in Kamar and Ben Naceur (2007). That paper examined long-run behavioral equilibrium exchange rates of the GCC countries and concluded that they had converged significantly since 1980 and tended to move roughly as a group during the past eight years or so, excepting some overheating in several economies during the past few years. This paper re-estimates series with more recent data, identifies periods of domestic and external equilibrium for the GCC currencies, and then estimates the degree of change in real exchange rates of each GCC currency from the equilibrium periods.

Step One – Identifying periods of equilibrium

31.   In order to set a conversion value for a currency, either in the context of a multilateral monetary union or bilateral peg to a single currency, the authorities need first to determine the most recent year(s) in which the economy has been the closest to an equilibrium level. By equilibrium, we mean both external equilibrium or balance of payments equilibrium and low exchange rate volatility, and internal equilibrium where the economy is growing at sustainable rate, inflation is under control, and the budget deficit and debt levels are at acceptable standards.

32.   Several methodologies exist to assess exchange rate equilibrium and misalignment; each having its pros and cons:

- One common approach is to analyze the macroeconomic indicators of each country and judge the year(s) in which the economy seems closest to both internal and external equilibrium, taking into consideration any potential lagged effect of any internal or external shocks. The application of this judgmental approach to the GCC countries is available in Appendix 2. The advantage of this judgmental method is that it is easy to implement and does not require any econometric expertise. The disadvantage is that it is not precise as the indicators might diverge from each other without pointing to a certain year. It is also prone to criticism as it depends on the analyst's subjective judgment.

- Another approach is the CGER methodology for exchange rate assessment developed by the IMF as part of its core mandate to promote the stability of the international monetary system[12]. The CGER methodology supports Article IV analysis of countries while fostering cross-country consistency (Appendix 3 taken from Abiad *et al* (2009), briefly describes the three methods used in the CGER). Based on the use of multi-country panel data, the CGER approach is designed to be easy for IMF staff economists to apply to countries under investigation, but it might not be ideal to tackle the issue under investigation in our paper. As recognized by its authors[13], assessments of exchange rate misalignment will always need to be informed by country specific factors that are difficult to incorporate into studies based on large cross-country datasets. Moreover, for the particular case of oil exporting countries, the application of the CGER methodology is a difficult exercise[14] and often can yield a wide range of results (Appendix 4 presents results from CGER assessments of the exchange rate alignment of the GCC countries during several recent years). This is in part due to the importance of intertemporal aspects (as the real exchange rate may affect the optimal/equitable rate of transformation of finite

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[12] IMF Research Department, 2006, "Methodology for CGER Exchange Rate Assessments", International Monetary Fund, Washington DC.

[13] Lee, Milesi-Ferretti, Ostry, Prati, and Ricci, 2008 "Exchange Rate Assessments: CGER Methodologies", IMF Occasional Paper N. 261, International Monetary Fund, Washington DC.

[14] IMF Middle East and Central Asia Department, 2008, "The GCC Monetary Union—Choice of Exchange Rate Regime", IMF, Washington D.C.

resource wealth into financial assets), as well as risk considerations given the relatively high volatility of commodity prices. (Enders, 2009)

33.　In order to be able to identify with precision the years of equilibrium and the years in which the exchange rate is misaligned, we need a robust and reliable econometric technique that reflects the best the specificity of each economy. Therefore, we use the equilibrium real effective exchange rate (REER) approach, applied to each country separately.

34.　Since our aim is to determine the conversion rate within prospective currency unions, we use the long-term fundamental values of the determinants of the REER behavior to identify its level of equilibrium and its yearly misalignment (deviation from equilibrium). This methodology due to Clark and MacDonald (1998) is widely used in the REER literature.[15]

35.　The year at which the REER is the closest to its fundamental equilibrium (the lowest misalignment level) will be considered as the equilibrium year. This approach should be applied to each country individually using the most reliable data, preferably coming from the same database to avoid discrepancies. In our analysis of the GCC, we will have a separate equilibrium equation for each country based on the specific determinants of the behavior of its REER. This requires applying time series cointegration techniques, such as Engle and Granger (1987) two step error correction models (which is what we apply in this paper), or also Johansen cointegration and VAR analysis approaches[16], depending on data availability.[17] Using panel data techniques is unadvisable as the resultant coefficients usually point to the similarity of the impact of the REER determinants across the panel, which masks the specificity of each individual country that we are seeking to capture in order to identify the appropriate equilibrium year for each country.

36.　The determinants of the REER behavior commonly used in the literature are the terms of trade (TOT), productivity (PROD), government consumption to GDP (GCON), capital flows to GDP (CAPF), the degree of openness of the economy (OPEN), the budget balance to GDP (BUDG), and the money supply to GDP (LIQ). Other variables could be included in the equation to test for the significance of their impact on the REER behavior on a case-by-case basis. Also, different proxies for each of the determinants could be tested alternatively to identify the most appropriate for each country. In cases where proxies have nearly identical impacts, it is advisable to keep in the model the proxies that witness significance in the majority of the countries under investigation. For a detailed explanation of the calculations and the expected impacts of each variable, refer to Appendix 5.

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[15] See for example, Elbadawi (1994, 1997); Clark and MacDonald (1998); Baffes, Elbadawi, and O'Connell (1999); Dufrenot and Yehoue (2005); Kamar and Bakardzhieva (2005); Kamar (2006).

[16] For more details on the cointegration techniques see Johansen and Juselius (1990) and Juselius (2007).

[17] Data availability is often a handicap for using Johansen's methodology as it requires a large number of observations, which are hardly available for many Middle Eastern and African countries.

Box 1 - Measuring the Misalignment: Why the Choice of the Real Exchange Rate Matters

Misalignment is defined as a deviation from a certain level of RER equilibrium. The multilateral REER misalignment identifies the period (year) in which the overall economy is closest to internal and external equilibrium, in comparison with its trading partners, and will inform about any deviation from that level of equilibrium in any other year. When the misalignment is equal or close to zero, the economy is at equilibrium, and if the misalignment points to an overvaluation (undervaluation), a devaluation (revaluation) is necessary to correct the rate for conversion to the union currency at the conversion date.

If the new currency were to float or to be pegged to a basket of currencies, the measured REER misalignment would be a good indicator for the required adjustment in the conversion rate. The use of forecasted data for the REER could inform about the misalignment in the future at the date when the union is to take place.

However, if the new currency is to be pegged to a single currency, the REER misalignment might not give a precise measure of the required adjustment. Equilibrium vis-à-vis the anchor currency might take place in a different year and the misalignment might be of different magnitude.[*]

Instead, the use of the bilateral RER equilibrium gives an indication of the misalignment vis-à-vis a single trading partner. Thus, the RER equilibrium alone is not sufficient to identify the period (year) in which the economy is closest to its overall internal and external equilibrium.

In our methodology, we consider that the conversion rate is optimal when the economy is at its internal and external equilibrium. Therefore, using the REER approach is essential as a first step to determine the equilibrium year. In the second step, if the conversion is to be set vis-à-vis an anchor currency, the US dollar for example, the misalignment should be seen as the deviation from a bilateral RER at the date of the entry. A separate forward looking estimation of the RER misalignment is then required to calculate the conversion rate.

The third step consists of using the identified equilibrium year in step one to normalize the misalignment calculated in step two. The deviation of the bilateral RER after this equilibrium year will be an indication of the required adjustment in the conversion rate.

Therefore, the choice between the RER and REER misalignment has to be made case by case depending on the prospective exchange rate regime decided for the new currency.

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[*] For example, consider the case of a country pegging to the US$ with two equal trading partners, USA and the EMU at 50% each. If the REER is misaligned by 30% in 2008, does it follow that the peg to the US$ should be devalued by 30%? But what would be the case if the national currency is not misaligned vis-à-vis the US$? For example, the US$ could be overvalued vis-à-vis the euro. We don't think there is a need to devalue vis-à-vis the US dollar in this case as this might create even more economic distortions.

The Econometric Approach

37.   The application of the cointegration technique requires some preliminary statistical analysis of the data to test if the dependent and independent variables are non-stationary (the presence of unit roots). We use the standard Augmented Dickey Fuller or ADF (1979) and Phillips-Perron (1988) tests in order to determine the order of integration of the individual data series.[18] All variables should be nonstationary at the level, and stationary at the first difference; i.e. integrated of order one, I(1).[19] Next, we estimate the long-run relationship, which requires a test for the cointegration of the variables, either by the Engle and Granger (1987), or by the Johansen methodology. The Johansen procedure assumes the definition and the estimation of a well-specified full system of equations, which makes estimations more difficult. Moreover, in applying that technique, we are limited by the size of our sample. As pointed out by Baffes, Elbadawi, and O'Connell (1997), evidence suggests that the Johansen procedure deteriorates dramatically in small samples, generating estimates with "fat tails".

38.   Therefore, we proceed to the first step in the Engle-Granger cointegration method, which is applying Ordinary Least Squares (OLS) to a static regression relating the levels of the real exchange rate and the variables that determine its behavior.

39.   We assume that the long-run static relationship provided by theory is a linear composition of the logarithmic transformations of the variables (V) chosen:

$$lnE_t = c + \beta^1 * lnV^1_t + \beta^2 * lnV^2_t + \ldots + \beta^N * lnV^N_t + \varepsilon_t \qquad (1)$$

where E is the real exchange rate, β are the coefficients that we are looking to estimate, V are the N independent variables, c is a constant, and ε is an i.i.d., mean-zero, stationary random variable (the *residual*). Bearing in mind our small sample[20] and the consequent insufficiency of degrees of freedom, we test subsequently several proxies of openness and capital flows.

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[18] However, the ADF and PP tests can be less robust in the presence of breaks in the level or in the slope of the trend function. In some cases, when graphic observations and correlograms indicate that the series are not stationary in their levels but ADF and PP tests indicate the contrary, we also applied the Kwiatkowski-Phillips-Schmidt-Shin (1992), the Ng-Perron (2001) and the Dickey Fuller-GLS (1996) tests and used the most recurrent outcomes as our unit root results.

[19] Identifying the correct order of integration is essential for the correctness of the equilibrium estimation. The case of the GCC requires special handling of the ADF test as the data include several structural breaks and shifts induced by the oil price fluctuation. Therefore, for the purpose of our study, we applied in some cases the ADF test manually and included dummy variables to capture the breaks in the data. We used the Dickey-Pantula (1987) strategy that consists in testing first the null hypothesis of presence of a unit root in the first difference series. If the null hypothesis is rejected - the series is stationary - we test the null hypothesis for the series in its level. If the null hypothesis is accepted, the series is I(1) because it was necessary to differentiate it one time to make it stationary.

[20] However, the power of unit root tests depends on the span of the data more than the mere size of the sample, as noted in Gujarati (2004).

40.   To finalize this first step of the cointegration test, we shall test the residual (ε) from the regression of equation (1) for stationarity. If the residual term is stationary, then we could conclude that our variables are cointegrated.

41.   The last step estimates a dynamic version of our model in order to verify the short-run effects of our variables on the RER. The traditional ECM form is as follows:

$$\Delta lnE_t = b + \alpha * \varepsilon_{t-1} + \gamma^1 * \Delta lnV^1_t + \gamma^2 * \Delta lnV^2_t + \ldots + \gamma^N * \Delta lnV^N_t + u_t \qquad (2)$$

Where α is the error correction term[21], ε_{t-1} is the residual from regression (1), calculated as the difference between the actual and the fitted values of the real exchange rate, and u_t is a mean-zero, stationary random variable.

42.   Using our model, we proceed to construct indexes of REER equilibrium (REERE) and REER misalignment (REERMIS), using the following approach:[22]

- Assume that the real exchange rate at any time t is given by $\log e_t = \hat{\alpha} + \hat{\beta}'F_t$, where F stands for the fundamentals and the corresponding parameters are the estimated regression coefficients;
- Using time series decomposition (e.g. Hodrick-Prescott procedure[23]) decompose the fundamentals into permanent ($\widetilde{F}$) and transitory ($F - \widetilde{F}$) components;
- Construct the equilibrium REER: $\log\widetilde{e}_t = \overline{\alpha} + \hat{\beta}'\widetilde{F}_t$, where $\hat{\beta}'$ are the coefficients estimated in the long-run regression and $\overline{\alpha}$ is the intercept that reflects the specificity of each country, only when significant;
- The REER misalignment is given by $reermis(t) = (\log e_t - \log\widetilde{e}_t).100\%$, where positive (negative) values indicate REER overvaluation (undervaluation).

43.   Finally, the year at which the misalignment is the lowest, meaning that the REER is the closest to equilibrium, will be considered the equilibrium year at which the exchange rate could be used as the initial conversion rate. The evolution of the fundamentals after this year

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[21] Elbadawi (1997) uses this error correction term to calculate the speed of adjustment of the exchange rate towards its long-term equilibrium path.

[22] See, for example, Elbadawi (1994); Elbadawi and Kamar (2005).

[23] The choice of the smoothing parameter (Lambda) can affect the calculation of the misalignment. If the parameter is too high,(higher than 500) the calculated equilibrium exchange rate will be too smoothed and can lead to higher misalignments. If Lambda is too small (lower than 10), the equilibrium exchange rate will not be smoothed and will fit to the observed REER, leading to minor misalignment. We used different values for lambdas in our paper and the results were not significantly affected (the misalignments varied by only + or – 2%). We recommend using the error correction parameter in the dynamic equation as a guide for the appropriate Lambda for each country.

should determine the deviation of the conversion rate, from this initial level, requiring therefore further adjustment at the date of the establishment of the common currency.

Step Two – Measuring real exchange rate misalignments

44.　　The conversion to the new union currency is a prospective event that will occur in the future. Thus, the methodology relies on forecasted data for all the variables and proxies in the models. Depending on the expected exchange rate regime of the currency union, we could either use the bilateral RER if the objective is to peg to a single currency, or to use the REER of the aggregated economic partners of the members of the union if the objective is to peg to a basket of currencies.

45.　　In the case of the GCC currency union, odds are high that the new currency will be pegged to the US dollar at least for the first year of its launch. Therefore, we use the bilateral RER vis-à-vis the US dollar expressed as a logarithm. Ratios are constructed using their respective US equivalents. For example, government consumption to GDP in Qatar is divided by government consumption to GDP in the US. The ratios are expressed as logarithms. This is the case for the series GCON, PROD, TOT, and OPEN. When the series contain negative data, the US series is subtracted from the national one and the ratio is not expressed as logarithm. This is the case for the series BUDG, TKF, NKF, and CAPF. The variables used are listed in Table 1 and discussions of each variable are in Appendix 5.

46.　　We use the forecasts provided in the WEO database as they are available for all the countries for the coming five years in a harmonized fashion.

47.　　The steps we follow to determine the equilibrium and misalignment of the RER are the same as those used in step one to determine the equilibrium and the misalignment of the REER as explained above. We start with the unit root tests of the newly constructed variables and proxies and we integrate the I(1) variables in a long-run model. We check for the validity of the model using the adjusted R square and the Durbin-Watson statistics. We test for the stationarity of the residual and we then include it lagged in our dynamic model where all the variables are I(0). We make sure the error correction coefficient is significant, negative, and between 0 and 1. We calculate the equilibrium RER and its misalignment, as explained above.

Step Three – Adjustments to conversion rates

48.　　The last step consists of determining the deviation of the exchange rate from its initial rate that we identified in points one and two, using the macroeconomic indicators or/and the REER equilibrium. We normalize the equilibrium bilateral RER to equal zero at the predetermined equilibrium year, and we add to it the misalignment to get the required percentage of adjustment for each year following the initial established rate. For example, if the REER was at equilibrium in year 1996, and the misalignment in year 2010 is +27% (i.e., overvalued by 27%), 23% in 2011, and 17% in 2012, the exchange rate needs to be devalued by 27% if the currency union takes place in 2010, by 23% if the currency union takes place in 2011, and by 17% if the common currency in established in 2012.

Table 1: RER behavior determinants

Variable	Definition	Source
REER	Real Effective Exchange Rate Index	WEO database
RER	Real Exchange Rate Index = ratio of the national consumer price index multiplied by the nominal exchange rate[24] to the foreign consumer price index (US)	Authors' Calculation based on WEO data
GCON	Government Consumption = Public Consumption Expenditure / GDP (current, local currency)	Authors' Calculation based on WEO data
BUDG	Budget Balance = General government balance / GDP (current, local currency)	Authors' Calculation based on WEO data
LIQ	Liquidity = Broad Money / GDP (current, local currency)	Authors' Calculation based on WEO data
OPEN	Degree of Openness = (Imports of good and services) / GDP (Current, US dollar)	Authors' Calculation based on WEO data
TOT	Terms of Trade (Price of Exports to the Price of Imports)	WEO database
CAPF	(Current Account Balance / GDP) (Current, USD)	Authors' Calculation based on WEO data
TKF	Total Capital Flows (Net) / GDP (Current, USD)	Authors' Calculation based on WEO data
NKF	Net Capital Flows = - (Balance on goods and services) (resource balance) / GDP (Current, USD)	Authors' Calculation based on WEO data
NFA	Net Foreign Assets /GDP (current, local currency) IFS – 2008	Authors' Calculation based on WEO data
RES	Stock of reserves at year-end / GDP (Current, USD)	Authors' Calculation based on WEO data
USNEER	US Nominal Effective Exchange Rate(against Major Currencies)	Federal Reserve
EURUSD	EUR/USD Exchange Rate	ECB

49.   The methodology has the advantage of providing policy makers seeking currency union with a framework to help identify the required adjustments in the future. This forward looking aspect of the approach is an important value added to the literature on the currency unions. It is therefore highly recommended that the authorities regularly update the forecasted conversion rates using the most updated statistics forecasts, for example, using the semi-annual WEO updates. This would also allow the authorities to expand the forward looking horizon.

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[24] Indirect quotation of the national currency

D. Application to the GCC Countries

50.   As explained above, it is crucial to determine with precision the year in which the economy has been closest to internal and external equilibrium in the recent years. We are seeking to identify a recent period of noninflationary economic growth – internal equilibrium – and sustainable capital flows. Because of the structural changes in the GCC during the last decade, the equilibrium year to use as a benchmark should be fairly recent.

51.   The concept of "sustainability" has to be put into perspective due to the unique features of the GCC economies. They are oil exporting countries with a fixed exchange rate regime against the US dollar. Such a situation generally means on the internal side that maintaining an independent monetary policy is challenging and on the external side that a current account surplus is reflected mostly in increases in foreign reserves that reduce the potential impact on the real exchange rate.

Background: Approach of Kamar and Ben Naceur

52.   In a previous study, Kamar and Ben Naceur (2007) reviewed the success of convergence of the GCC countries by taking independent actions in preparation for the union. They used a panel analysis of variables possibly related to behavior of real exchange rates to identify common determinants of inflation differentials, which provided information on real exchange rate convergence given the common currency peg to the U.S. dollar. They identified a set of five significant variables and found increased convergence in their real exchange rate indices. The period of high convergence coincided with apparent domestic and external equilibrium around the 2003 or 2004 period. They concluded that this provided an important prerequisite for the planned union.

53.   Their study however did not focus on the level of the equilibrium real exchange rate, but only used it as a benchmark for calculating the apparent misalignment of the individual currencies and whether the degree of misalignment narrowed over time. They showed that overall misalignments declined by 50 percent over the 1991 – 2005 period, with the most extreme initial misalignment (between Saudi Arabia and the UAE) decreasing by about three-quarters by 2005.[25]

54.   This study extends the earlier results to update the analysis to more recent periods, when inflationary bursts (most strongly in Qatar) might have affected the results, and to move from the panel analysis to more rigorously examine conditions in individual countries in order to pin down periods of internal and external equilibrium and the degree of misalignment. Increased misalignment of a currency could provide a basis for adjusting its bilateral relationship against the exchange rates of the other GCC currencies. The following pages present the analysis of the conditions in the individual countries.

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[25] Their results might be compatible with a hypothesis that the combination of similar economic structure and exports and *de facto* policy harmonization amongst the countries provides a basis for effective operation of a loose monetary union, in contrast to the degree of centralization in the European Monetary Union. This hypothesis of course needs to be rigorously tested.

Step One: The REER equilibrium approach to determine the equilibrium year

55.   The methodology to determine the equilibrium year that will serve as a base for calculating the required adjustment in the nominal exchange rate relies on the identification of the lowest misalignment in the REER in comparison to its equilibrium values. The equilibrium is calculated using the permanent components of the fundamental determinants of the REER behavior as explained in the methodology section.

56.   We use the Engle and Granger (1987) cointegration to identify the fundamental determinants of the REER behavior that we will use to calculate the equilibrium. We applied all the necessary unit root tests to confirm that all the variables we incorporate in our models are I(1). The results are available in Appendix 6.

57.   Next, we started incorporating the theoretical determinants of the REER behavior one by one first, and we kept in the model the most statistically significant variables, and for which the R^2 and the DW statistics were the most appropriate. We then included one by one the other theoretical determinants of the REER behavior, and again kept those most statistically significant, and for which the R^2 and the DW statistics were the most appropriate. This approach provided us with the best specification for our models. We tried several combinations of variables that all provided coherent economic explanations of the REER behavior and also presented acceptable statistics values. The final model for each country is a representation of the long run relation between the REER and its determinants[26].

58.   We then tested the stationarity of the residual[27] we obtained from our long run model and incorporated it lagged in the error correction model where all the other variables are also stationary (I(0)). For the cointegration to hold, the lagged residual in this dynamic model should be significant and of negative sign, and its absolute value should be between 0 and 1. Appendix 7 presents the results that verify this prerequisite.

59.   The model we retained for each country (Table 2) shows that the REER behavior in all countries is affected by almost the same determinants, with the same expected signs in almost all cases, yet with different magnitudes.

60.   The main determinants are the terms of trade, the foreign reserves, the broad money, the trade openness, the net capital flows, the government consumption and in the case of Qatar - the US nominal effective exchange rate.

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[26] Another approach could be that all the relevant variables be used initially then specific variables can be dropped based on statistical significance. We followed this approach at the end of the exercise to harmonize the determinants across countries and limit the disparity of the variables used in our specifications. Both approaches account for possible interaction between the variables to identify the optimal specification.

[27] The residual should be stationary. The critical values for ADF test should be those of Mckinnon (1995), which are not provided in the usual econometric software programs like Eviews. The use of the critical values provided in the ADF results using Eviews are misleading.

Table 2: OLS Estimations of the long-run determinants of the REER

	Bahrain	Kuwait	Qatar	Saudi-Arabia
Sample	1982-2007	1980-2007	1980-2007	1980-2007
Observations	26	28	28	28
TOTS		0.067570* (1.794583)	0.197090*** (10.72244)	0.320610*** (6.891403)
RES	0.956453*** (12.00120)	0.249772*** (5.955200)		0.104313*** (3.976523)
OPENMS		0.242880*** (3.133298)	0.168733*** (4.885028)	
NKF	0.193444*** (7.658254)			0.053594*** (13.26792)
GCON	-1.727869*** (-6.564755)	-0.226340*** (-5.514604)	-0.161979*** (-10.95386)	
LIQ	0.455554** (2.741018)		0.193990*** (6.568090)	-0.477913*** (-11.92426)
USNEER			0.553627*** (9.253821)	
C	5.089198*** (8.516104)	4.523622*** (16.10013)	1.040280*** (3.657749)	4.800039*** (16.15558)
D9192	-0.342153*** (-6.319965)			
D9092				-0.197183*** (-5.973684)
D90_92		0.150392*** (3.141780)		
R²	0.933012	0.786430	0.941246	0.975126
Adj. R²	0.916265	0.737891	0.927893	0.969473
DW	2.238343	1.755969	1.688216	1.934486
ADF	-5.604480***	-4.466805**	-4.294952*	-4.945126**

Note: Data in brackets indicate the *t-Student*.
***, ** and * denote a significance of the coefficient at the 1%, 5% and 10% levels
The ADF test in the last row refers to the *t-statistic* of the residual series from each regression. *t-satistics* are compared to the McKinnon critical values table (1991).

61.   TOT has a positive significant effect on REER in all countries except Bahrain. The positive sign is in line with the theoretical explanation provided in Appendix 5. The non-significance of TOT in the case of Bahrain could be explained by the fact that oil exports represent a minor component of its total exports, so oil prices do not play such an important role as in the other five GCC countries.

62.   The RES variable is also positive and significant in all cases except for Qatar. An increase of the reserves in the context of a fixed exchange rate regime can lead to the increase of money supply in the absence of sterilization, leading to higher inflation and translating into REER appreciation. We controlled for money supply by including LIQ in our models and it seems that it captured this effect in the case of Qatar, but not in the cases of the other GCC countries. For example, LIQ still has a positive significant effect in the case of Bahrain, with the presence of RES in the equation. On another hand, LIQ has a significant and negative effect in the case of Saudi Arabia, which contradicts our theoretical intuition. Broad Money/GDP has been relatively stable in Saudi Arabia during the period under investigation, while the REER was depreciating due to a very low inflation. We might

consider that in this particular case the Saudi Arabian authorities relied on sterilization to offset the impact of the increase in reserve on money supply and inflation, while achieving their nominal exchange rate peg objective.

63.   Trade Openness proxied by imports to GDP has a significant positive impact on the REER in Kuwait and Qatar, and no impact in the cases of Bahrain and Saudi Arabia. As explained in Appendix 5, trade openness can lead to an improvement in trade balance and an appreciation of the REER (Egert, 2003) as we see in Kuwait and Qatar. We also included in our tests the USNEER variable to capture the implication of the peg to the US dollar on inflation. An appreciation of the US dollar vis-à-vis the rest of the world's currencies would lead to a similar appreciation of the GCC currencies and of their REER. We couldn't include the USNEER variable in all our models as it is highly correlated with the REER[28], except in the case of Qatar where the correlation was sufficiently low (0.60). As expected, USNEER has a positive impact on REER in both countries and is very important for the stability of the long-run cointegration. We also included NKF to control for capital flows and we obtained significant and expected positive results in Bahrain, and Saudi Arabia, and nonsignificant coefficients in Kuwait and Qatar.

64.   Government Consumption shows negative impact on REER, which is an indication of the dominance of tradable goods in both public and private spending. In addition to these variables, we used tailor-made dummies that fit the specificity of each country, especially when dealing with the first Gulf war. The dummy for Bahrain takes the value of zero in all years except 1991 and 1992 where it takes a value of 1, and it has a negative sign. The dummy for Saudi Arabia also has a negative sign but it has a value of 1 in 1990, 1991 and 1992. For Kuwait, the country that was the most exposed to the shock, the dummy takes a value of 1 in 1990 and -1 in 1992, reflecting the capital flight in 1990 right before and during the Iraqi attack, and a return of the capital after the end of the crisis. These dummies are important for fine-tuning the coefficients in the equation in order to get the most robust estimation of the REER equilibrium.

65.   Once we finalized the estimations of the long-run relations, we applied the HP filter to separate the transitory components of these determinants and used the permanent components to recalculate the REER using the coefficients in our equation to obtain the so-called equilibrium REER. The difference between the REER and the equilibrium REER is the REER misalignment shown in Figure 1.

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[28] The correlation for Bahrain is 0.88, for Kuwait 0.88, and for Saudi Arabia 0.80.

Figure 1: REER Misalignment
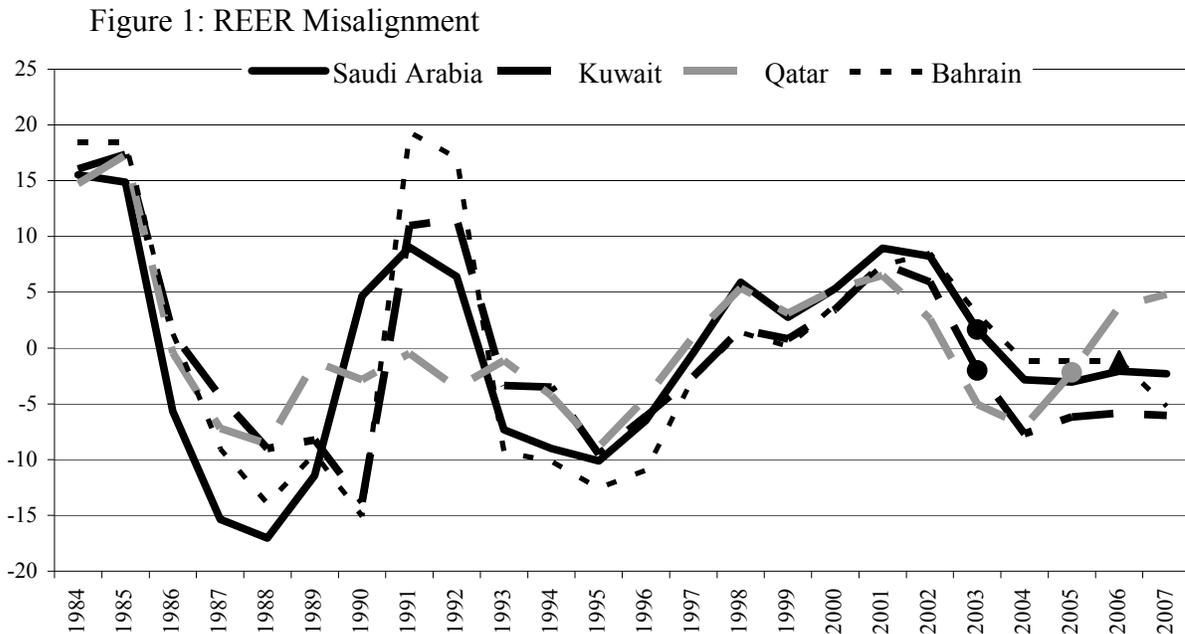
Authors' calculation

66. Figure 1 shows that the years 1997 to 2006 are those where the misalignment is relatively low. Since we are looking for the most recent year, we will consider 2003 as being the equilibrium year for Saudi Arabia and Kuwait, 2005 for Qatar, and 2006 for Bahrain. These results are consistent with what we found in our macroeconomic analysis; yet more precise. When calculating the adjustment required for each currency in the final stage of our paper, we will use these years as the equilibrium ones.

67. The observation of Figure 1 also highlights the fact that the misalignments declined significantly over the period. This is an indication of overall convergence and more harmonization and policy coordination between the GCC countries, as observed by Kamar and Ben Naceur (2007).

Step Two: The bilateral RER misalignment between each GCC currency and the US dollar forecasted until 2013

68. In this step, we apply the same methodology we already used to calculate the REER misalignments, but with some adjustments. The bilateral RERs use the CPI from the WEO from 1970 to 2013, with the assumption that the nominal exchange rates vis-à-vis the US dollar will remain fixed at their 2008 values. When using bilateral RER, all variables we incorporate in our model should be calculated in relation to their equivalent in the USA.

Figure 2: The Bilateral Real Exchange Rates
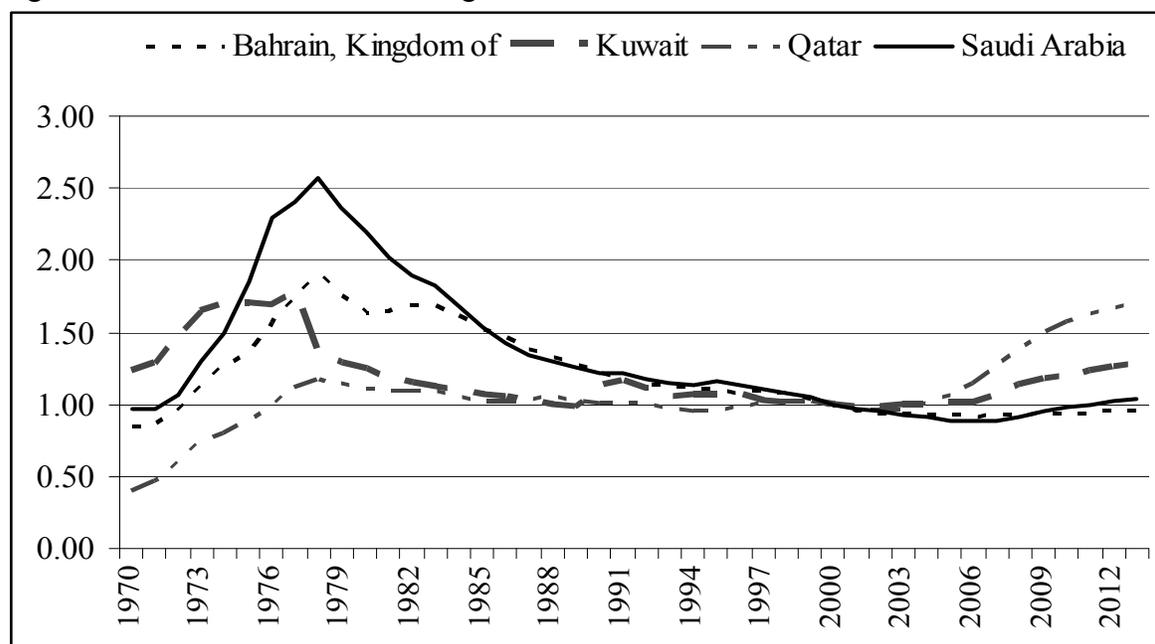
Authors' calculation based on WEO data, September 2008.

69.	Figure 2 suggests that the GCC countries' RERs witnessed a sharp appreciation after the first oil shock in the second half of the 1970s, followed by a gradual depreciation during the 1980s and 1990s. After a period of relative stability, RERs started appreciating again since 2005/2006, especially for Qatar. The forecasted RERs from 2008 onward point towards a clear divergence, with Bahrain and Saudi Arabia showing minor RER appreciation, while the expected appreciation in Kuwait, and Qatar is 27.5%, and 60.1% respectively in comparison with their 2005 values.

70.	In this case, using the simple inflation differential adjustment to correct the nominal exchange rate parities could be misleading since inflation could result from the behavior of the economic fundamentals, which might not necessarily require any nominal exchange rate adjustment. Therefore, the assessment of the misalignment based on a derived RER equilibrium using the economic forecasted values of the economic fundamentals could be more accurate. To calculate the misalignment, we apply the same econometric approach used to assess the REER equilibrium in the previous section.

71.	The results of the unit root tests are available in Appendix 8. Again, all the variables we use in our models are I(1). The long run relations between the RERs and their respective determinants are available in Table 3, and the error-correction model is available in Appendix 9.

72.	The main determinants are the trade openness, the foreign reserves, the terms of trade, the government consumption, the net capital flows, and the euro/dollar exchange rate.

Table 3: OLS Estimations of the long-run determinants of the RER

	Bahrain	Kuwait	Qatar	Saudi-Arabia
Sample	1985-2013	1984-2013	1976-2013	1986-2013
Observations	29	30	38	28
GCON	0.254500*** (3.445104)		-0.089024*** (-3.777828)	-0.085310* (-1.892516)
OPENMS	0.409847*** (8.604324)	0.180006*** (9.638112)	0.121229*** (3.077298)	0.171534*** (7.653251)
TOTS		0.148089*** (7.648818)	0.150141*** (10.88924)	
RES	0.135563*** (7.072934)	0.090369*** (10.40477)	0.172941*** (6.809258)	
NKF				0.058184*** (18.75023)
EURUSD		0.203578*** (7.761728)	0.190148*** (3.728487)	
C	-1.137261*** (-12.2426)	-0.472176*** (-11.76104)	-0.454448*** (-5.097038)	
D9192	-0.163669*** (-4.74469)			
D90		0.077480*** (3.335428)		
D91		-0.242567*** (-6.309526)		-0.131968*** (-4.102496)
D92		-0.084510*** (-3.620091)		-0.096769*** (-3.071681)
D0205			-0.146203*** (-6.778735)	
R²	0.939389	0.950544	0.950021	0.960484
Adj. R²	0.929287	0.934808	0.940348	0.953612
DW	1.727984	1.970905	1.997064	1.610879
ADF	-4.426931	-5.289818	-5.992595	-6.019447

Note: the ADF test refers to the t-statistic of the residual series from each regression.
t-Student are in brackets.
***, ** and * denote a significance of the coefficient at the 1%, 5% and 10% levels

73.   OPEN has a positive significant effect on REER in all countries. Calvo and Drazen (1998) showed that trade liberalization of uncertain duration could lead to an upward jump in consumption and, hence, real appreciation. The positive sign we obtain for all countries would thus reflect an upward jump in consumption including nontradables through within-period optimization (Edwards, 1989).

74.   TOT has the expected positive sign in Kuwait and Qatar. The non-significance of TOT in the case of Bahrain could be explained by the fact that oil exports represent a minor

component of its total exports, so oil prices do not play such an important role as in the other five GCC countries. Saudi Arabia could be a different case. Since Saudi Arabia does not invest its oil surplus abroad through sovereign wealth funds like Kuwait, an increase in oil revenue will translate into an increase in reserves and net foreign assets, because of the peg to the US dollar. The authorities therefore might decide to sterilize the impact of the increase in reserves on money supply and inflation, by reducing their net domestic assets.

75.   The RES variable is also positive and significant in all cases except in Saudi Arabia, possibly for the same reasons as above. An increase of reserves in the context of a fixed exchange rate regime can lead to increase of money supply in the absence of sterilization, causing higher inflation and translating into RER appreciation.

76.   We also included NKF to control for capital flows and we obtained the expected positive results in Saudi Arabia and non significant coefficients in the other three countries. Still, the magnitude of the coefficients is relatively small (0.05) in comparison with the other determinants.

77.   Government consumption shows negative impact on RER in the cases of Qatar and Saudi Arabia, which is an indication of the dominance of tradable goods in both public and private spending. On another hand, GCON has a positive sign in Bahrain, which is an indication of a dominance of nontradables in government consumption.

78.   We also included in our tests the EURUSD variable to capture the implication of the peg to the US dollar on imported inflation. EURUSD has a positive impact on RER in Kuwait and Qatar. An appreciation of the US dollar vis-à-vis the Euro (the currency of a major trading partner) would lead to a similar appreciation of the GCC currencies and of their RER.

79.   In addition to these variables, we used tailor-made dummies that fit the specificity of each country, especially when dealing with the first Gulf war. The dummies take zero values in all years with the exception of a specific year(s) where they take value 1. The dummies for Bahrain and Saudi Arabia have a negative sign and take the value of one in 1991 and 1992. For Kuwait, the dummies take values of 1 in 1990 (positive), in 1991 and in 1992 (both negative). Qatar was a special case where a dummy for years 2002 to 2005 is unavoidable for the stability of the equation.

80.   We followed the same procedure as explained above to calculate the RER equilibrium for each country, using the permanent values of the fundamentals. We then calculated the misalignment presented in Figure 3 as the difference between the calculated RER and the equilibrium RER.

Figure 3: RER Misalignment
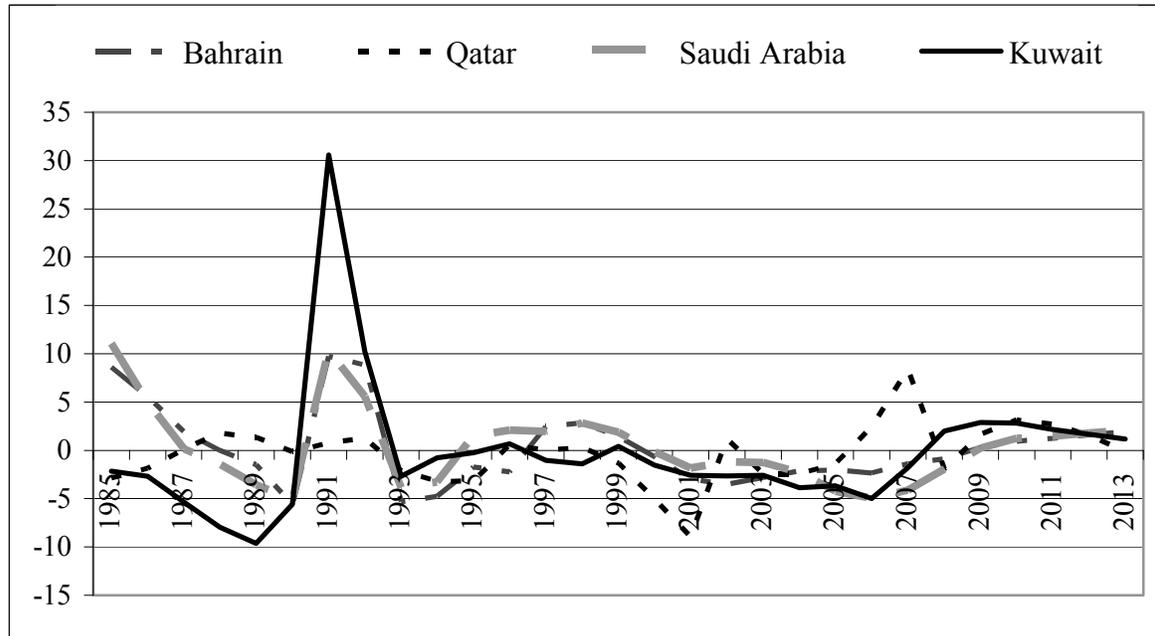
Step Three: Identifying the new conversion rates

81.   The last step consists in normalizing the misalignment obtained in step 2 to have a value of zero in the equilibrium year we identified in step 1, for each country. Given the forward-looking nature of our approach, our methodology can inform the policy makers on how much the adjustment of their respective nominal exchange rate should be in order to eliminate the misalignment.

82.   The results for the GCC countries are presented in Table 4. As can be seen, if hypothetically the GCC decides to establish the new currency in its original planned date, 2010, Saudi Arabia would need to revalue its currency by 2.94% vis-à-vis the US dollar, Kuwait by 5.15%, Qatar by 4.54%, and Bahrain by 1.09%. The methodology provides an estimate of the required adjustment for each currency if the conversion is to take place in 2011, 2012, or 2013.

Table 4: The required percentage change in nominal exchange rates vis-à-vis the US dollar

	Saudi Arabia	Kuwait	Qatar	Bahrain
2010	2.49	5.41	4.54	3.30
2011	2.73	4.75	4.11	3.60
2012	3.04	4.25	2.93	3.95
2013	3.35	3.75	1.30	4.295

83.   The results presented in Table 4 reflect a low rate of misalignment (the highest is 5.41% for Kuwait in 2010) in all countries in the different forecasted years. Given these low estimates of the degree of misalignment, the GCC authorities might choose to not modify their current parity vis-à-vis the U.S. dollar, nor the relative configuration of the GCC currencies.

84.   Bolstering the case for not adjusting the configuration of currencies in cases of small misaligments, agents in the economy are highly sensitive to exchange rate variation, especially after a long period of strong peg. In addition, if information of possible adjustments filters to the market, the agents might undertake speculative attacks that might undermine the exchange rate adjustment and could harm the creation of the new currency.

E.   Application to Other Currency Unions

85.   The methodology applied to the GCC countries can potentially be used in other new unions or when countries seek to join existing unions. At the time of writing, this means mainly in Africa.

- The method first determines the factors underlying the evolution of the real exchange rate for the countries. The process may be simpler in the GCC case because of the peg of the GCC currencies to the dollar, which makes real exchange rate changes a function of changes in inflation differentials against the United States, but in principle the method can be applied elsewhere.

- The divergence and convergence trend of each currency against some benchmark can be estimated. This could be done vis-à-vis the largest economy in each prospective union.[29]

- The panel approach used in Kamar and Ben Naceur (2007) permits estimating the convergence to an estimated long-run equilibrium real exchange rate.

- In the GCC case, we could define a specific period of internal and external equilibrium. In other unions, such a period may not exist, and thus policy makers will only be able to establish an econometrically determined equilibrium. In either case, it is possible to define a conversion rate for the individual currencies.

- The conversion rates should take into consideration changes in the real exchange rates at the time of actual conversion, or in the projected rates as we did for the GCC in this paper.

86.   If the new currency is to float or to be pegged to a basket of currencies, the use of the REER misalignment would be more appropriate, as explained in Box 1. With this regard, alternative methodologies to assess exchange rates misalignment, mainly the CGER

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[29] For SADC and WAMZ, this would mean the South African rand and the Nigerian naira. However, if the WAMZ seeks to merge with the West African Economic and Monetary Union whose franc is pegged to the euro, then the benchmark should be the franc or the euro. The benchmark for the East African Community needs to be determined. Possible entrants to CEMAC should use the CEMAC franc or the euro as the benchmark.

methodologies, could be useful and complementary to get more information on the macro-balance and external sustainability of the members to the union.

87.   Some unions may create a virtual currency similar to the ECU with central rates set for each member country currency. The rates may differ in the degree to which they are market determined. The method proposed here remains applicable in such cases to determine if there are apparent imbalances requiring policy responses, to check if the central rate for a currency needs adjusting, and to help determine the final conversion rate into the new currency.

88.   Each prospective union will face challenges to its credibility and the new union currency may be subject to speculative attacks. Information from this method can impart a view to the public that exchange rates are based on fundamentals, which may contribute to greater stability for the currencies.

89.   In all regions, data issues will present challenges. Historical time series going back well before the planned start-up date for the union will be needed. For this reason, programs to compile the relevant statistics under common standards should begin in all potential member countries early in the process of developing the union. A centralized database is required to make use of the data to estimate the conversion factors.

90.   Finally, decision makers should address the issue of manipulation of bilateral conversion rates just prior to setting up the union. The application of the method in this paper can provide independent information that may be relevant to help avoid possible manipulation.

91.   The process described above requires some intense and sophisticated data collection, estimation, and analysis. Each prospective union needs to undertake such investigations, ideally starting well before the official beginning date of the currency union. In our view, the application of the method described here will make a positive contribution to the convergence and policy oversight process leading up to the union by providing a framework for policy research and analysis, and establishing requirements for statistics compilation. The information generated will provide key insights on the convergence process that can help evaluate the process of union building. One possibility is to apply different scenarios to the underlying parameters to reflect possible policy or exchange rate regime options.

92.   We recommend regular publication of convergence reports as part of the union building process that can use information from this analysis.

F. Conclusions

93.   The paper addresses a crucial issue for currency unions by providing a practical forward-looking methodology to determine the conversion rates for each of the members' currencies, over a medium term horizon. We applied it to the GCC countries, but we believe that it can be extended to other planned unions.

- The first step of the methodology identifies the year at which the economy is the closest to its internal and external equilibrium. It considers the period with the least deviation from equilibrium (the lowest misalignment) in the recent years as an indication of the

equilibrium year. This requires measuring the real exchange rate equilibrium based on the long-term component of the macroeconomic fundamentals. We calculated the REER misalignment for each of the GCC currencies and identified the year 2003 as the equilibrium year for Kuwait and Saudi Arabia; 2005 for Qatar, and 2006 for Bahrain. The theoretical determinants of the REER equilibrium vary across countries and are summarized as the terms of trade, openness, foreign reserves, government consumption, net capital flows, broad money, and the U.S. nominal effective exchange rate.

- The second step addresses the issue of calculating the real exchange rate equilibrium and misalignment of each currency vis-à-vis the prospective anchor currency for the union, or vis-à-vis the real effective exchange rate if the anchor is a basket of currencies or if the new currency will be freely floating. We used forecasted values of the real exchange rate vis-à-vis the U.S. dollar and its fundamentals to allow for forward-looking estimations. The determinants of each bilateral RER are government consumption, openness, terms of trade, foreign reserves, net capital flows, and the euro-dollar exchange rate.

- The final step consists in normalizing the misalignment from the bilateral RER equilibrium equations we obtained in step two to have a value of zero in the year of equilibrium identified in step one. The forecasted real exchange rate misalignment calculated in step two serves as a measure of the necessary nominal exchange rate adjustment for the conversion rate in the coming years.

94.   Our calculations suggest that only a small nominal exchange rate adjustment (less than 5%) is needed for the GCC currencies to establish the conversion at the closest level to equilibrium; moreover, the adjustment tends to decline from 2010 to 2013. We recommend that the GCC authorities rigorously apply our proposed method (alongside other methodologies and with full use of information available within the region) to test these results to help set the conversion rates for the future union.

95.   In a broader perspective, we recommend a regular update of the forecasted misalignment using the bi-annual WEO publications, in order to monitor the conversion rate and make sure it is still the closest to the equilibrium value. It could also be useful to calculate the RER equilibrium and misalignment using forecasts from other databases, like the Economist Intelligence Unit database, or using the national agencies' forecasts.

96.   The methodology also allows for using different scenarios by creating forecasted variables that reflect different shocks. For the example of the GCC, one option would be to construct several terms of trade variables that would reflect different oil prices and use these variables to calculate the RER misalignment to see how the different currencies would deviate from the equilibrium, and calculate the required exchange rate adjustment if any of the scenarios is to occur.

97.   Since the entire methodology and the macroeconomic analysis rely on the assumption that the data are accurate, the creation of a reliable and harmonized database for all variables is an essential step towards the creation of a currency union.

98.   The methodology we propose can be used as a single tool to estimate conversion rates. However, whenever possible, policy makers should use it in conjunction with other

methods such as the CGER, the macro-indicators judgmental analysis, surveys of purchasing power parity in prospective union members, or divergences in movements of consumer prices. In addition, we feel that it is advantageous (if schedules for setting up new unions permit) for planned unions to use an ECU-like virtual currency arrangement in which member countries establish a conversion grid so that the rates can be tested against market forces and the configuration of bilateral rates can be embedded into the national macroeconomic frameworks.

99.   Finally, the methodology is applicable elsewhere. The multiple union-building efforts in Africa are potential users of the method, and the tests can apply to other regions too. Conditions will be different and perhaps more challenging and some interesting innovations to the method may result. We have great interest in seeing the directions and results of such work.

G. Appendices

Appendix 1: Setting the Rates for Conversion into the Euro

100.   The econometric method for setting conversions rates described in the text of this paper can be used to go directly from national currencies into a union currency. However, the process leading to the creation of the euro was very different in which precursor regimes worked to establish relatively stable relationships between member currencies, including by creating a virtual currency called the ECU – European Currency Unit. Future unions may choose to follow the European model described below. However, we emphasize that conditions in Europe, and the long gestation time for the European system, differ in important ways from conditions in the GCC region and in other planned unions, and thus future unions may choose other methods to set the conversion rates into the new union currency.

101.   The process of setting the conversion values for the euro was long and convoluted, with successes and failures. Work to create a unit of value for what would become the European Union began in 1975, and thus there were 24 years of preparations before national currencies were converted into euros. Over that long period, rates of exchange between the European currencies, although subject to numerous shifts in value and evolving policy regimes, were deeply integrated into the macroeconomic and financial situations of the EU countries.

102.   The European Unit of Account (EUA) was created in 1975 as a standardized accounting value for multicountry EU projects. After the end of Bretton Woods, countries lacked fixed exchange rates to denominate transactions between countries or for community-wide purposes.[30] A common measure was needed to set the European Economic Community budget, make settlements between countries, administer the Common Agricultural Policy, and provide a measure of investment costs and returns over time. (European Communities 1984). The EUA was based on an average value of the component currencies (or central rate), based on agreement that each national currency could not vary more than a certain percent (± 2.25 percent) from the central rate. Official transactions were denominated in terms of the EUA, but settlements were in domestic currencies. Important aspects of the EUA were recognizing that an accounting measure of value was needed to carry out core activities of the community, and even establishing a configuration of exchange values that was roughly fixed from its earliest stages.

103.   In 1979, the European Monetary System (EMS) was created to strengthen monetary and exchange rate stability, and enhance economic cooperation. The European Currency Unit (ECU) replaced the EUA. The EMS was built around the Exchange Rate Mechanism (ERM) in which the value of each participating currency was fixed around the central parity value of

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[30] Under Bretton Woods country exchange rates were fixed. Thus, the bilateral exchange rates for all countries were set, and the problem of setting conversion rates was much less complex than once rates were allowed to fluctuate in markets.

the ECU.[31] A "parity grid" established bilateral rates between all currencies in the system, with a fluctuation band of ± 2.25 percent.[32]

104.   The ERM had a rocky history, but by the mid-1980's witnessed greater success through policy convergence and greater economic stability within a number of the participating economies and *de facto* alignment of currencies against the Deutsche Mark as the anchor currency. A period with no realignments lasted from 1987 through 1992, but continuing inflation differentials between countries and the opening of capital mobility at the start of Stage One of the European Monetary Union resulted in strong real exchange rate pressures and speculative attacks.[33] Under these pressures, the ERM changed its fluctuation bands to a very wide ± 15 percent. In practice, such wide bands hardly defined stable relationships between the currencies. Thus, the ERM was effectively a very weak instrument at the time that work began to create the European Monetary Union.

105.   Despite the rather ignominious end game of the ERM, the 1991 Maastricht Treaty to set up the European Monetary Union adopted the ECU and the structure of the ERM as the basis for setting the value of the euro and for conversion of national currencies into the euro. The Maastricht Treaty called for setting up the European Monetary Institute (EMI) to make the arrangements for the new union, but also gave the EMI responsibility for overseeing the operation of the ERM and for oversight of the economic policies of the ERM countries to support exchange rate stability and convergence. Thus, there was common oversight of the exchange rate policies of countries and their integration into the new monetary union.

106.   In May 1998, the European Central Bank (ECB) was created and absorbed the functions of the EMI. At this time, two important steps in setting up the union occurred – the initial eleven members of the Euro Area were announced[34], and it was agreed by the members' finance ministers and central bank governors that the ECU would be converted into the euro at a one-to-one rate and a grid of exact bilateral exchange rates was set between the currencies based on the ECU central weights.[35] The use of central rates was considered to

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[31] The ECU was a basket currency, constructed on different quantities of national currencies. The weights for each currency were based on the importance of the economy, based on GDP, export trade, and countries' quotas in the European Monetary Cooperation Fund.

[32] Except for a 6-percent band for Italy. In 1990, Italy's band was narrowed to ± 2.25 percent to match the other countries.

[33] In short order in 1992 and 1993, Italy and the United Kingdom left the ERM, and the Spanish peseta, Portugese escudo, and Irish pound were devalued.

[34] Membership was based on countries' adherence to a set of "convergence criteria", which are macroeconomic indicators that give assurance that the country will fit well into the union and its common monetary and exchange policies.

[35] Some adjustments were needed because the countries participating in the ECU basket were not identical to the countries in the initial group adopting the euro.

be acceptable to markets based on the established values, "the financial markets will very likely accept the central-rate method as a realistic and viable solution in tune with economic fundamentals."[36] Coherence with fundamentals was considered useful to prevent speculative attacks.

Box 2: The Strange Case of the Italian lira

The lira left the ERM in September 1992, when a wave of speculation led to a 7% devaluation. Although the political commitment to the exchange rate target was strong, markets viewed the central rate of 760 lira/DM was unsustainable given the Italian employment situation and inflation rate. The lira/DM rate depreciated as far as 1239 per DM, before recovering to around 1000 per DM by late 1996.

Membership in the ERM was a requirement for entry into the Euroarea, which was scheduled to begin on January 1, 1999. The Maastrict Treaty requires "*the observance of the normal fluctuation margins provided for by the exchange-rate mechanism of the European Monetary System, for at least two years, without devaluing against the currency of any other Member State*." Therefore, the lira had to re-enter the ERM before the end of 1996 to be eligible to adopt the euro in 1999.

Negotiations opened on the rate at which the lira should rejoin the ERM. The lira traded at about 996 per DM at the time. The Italian government and manufacturers sought a rate above 1000 per DM, but the Bundesbank sought a rate as low as 970 per DM. Germany and France reportedly fought for a rate to reverse the Italian export advantage gained when the lira depreciated. A rate of 990 per DM was agreed upon and the Italian lira was readmitted in November 1996.

In this case, political considerations were strong in setting the conversion rate. The Italian case stands as a sharp exception to the reliance of other countries on the ERM central rates as a reliable, market-based, and time-tested basis for setting the conversion rate.

(New York Times. *Italian lira re-admitted into European Union.* November 25-26, 1996.)

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107.   The central banks in the agreement vowed that they would adhere to the bilateral rates and would intervene if needed to maintain the rates. The external rate of the basket continued to fluctuate in markets. This final set of procedures resulted in a very simple conversion from rates used in the ECU basket to the conversion rates used in the euro. The bilateral rates used were well established and no major resetting was involved in setting the conversion values. The economic strength of the countries and market confidence in the willingness of the central banks to defend the arrangement allowed the bilateral grid to be maintained without difficulty until the start of the union.

108.   The final step in the process was to set the external value of the euro itself. Each of the component currencies of the euro fluctuated (as a group) in exchange markets. Their exchange values against the dollar were measured at the end of 1998, and the weighted

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[36] Becker, W, and A. Walter. *Central rates as a link to the euro?* EMU Watch. No. 39. Deutsche Bank Research, November 13, 1997.

average of these values became the external value of the euro when it was created on January 1, 1999. The ratios of the value of the individual national currencies to the euro were defined as the "irrevocable conversion rates", which were specified to 6 significant digits. Thus, for example, the Austrian schilling was converted into euros at a rate of 13.7603 to one; and the Italian lira at a rate of 1936.27 to one. These rates had to be used for all transactions between national currencies and the euro, which was only an accounting value from 1999 through 2001. In 2002, when physical euro banknotes and coins were issued, these rates were also used to redeem national currencies for physical euros.

109. The process followed in Europe described above was drawn out and had many detailed steps, but the key factor was that the conversion values were basically market-determined. It worked well in the European context, but it may have only limited relevance in other regions.

Exchange Rate Mechanism II – handling later entrants to the Euroarea

110. Countries later joining the Euroarea faced a different situation. They did not have long histories within the ERM during which their relationships with other European currencies were established. Many indeed were former planned economies in East Europe that were undergoing fundamental restructurings of their economies. A new method was needed to set the conversion factors for these currencies into the euro when they ultimately joined the union. A new system called Exchange Rate Mechanism II (ERM II) was created based on the ERM.

111. ERM II placed the euro at its center. It set fixed central rates of each currency against the euro with a fluctuation band of ±15 percent. The band can be narrowed if countries begin to converge with the Euro area and seek to create a more stable exchange rate relationship. The candidate countries are required to treat their exchange rate policies as a matter of common interest with other EU countries, and thus the ECB General Council monitors the operation of the system and promotes coordination of monetary and exchange-rate policies.

112. Countries volunteer to enter ERM II but when they do they commit to the central rate (but with the wide fluctuation band). The countries must use macroeconomic, fiscal, and structural policies to stay within the band. The ability to maintain a country's currency within the band without extraordinary intervention or policy actions for at least two years was set as a requirement to join the union. Thus, the bilateral conversion rate is tested for two years before the country adopts the euro. However, with the expectation of adopting the euro in the near future, it can be expected that many businesses and households will begin gradually shifting to using the euro based on the ERM II central rate.

113. The ERM II system was designed to;

• Prevent exchange rate fluctuations between the euro and other EU currencies from disrupting economic conditions in the Euro area

• Help potential member countries prepare to join the currency union. Operating within ERM II successfully for two full years is considered confirmation that once in the Euro area the country can manage policy successfully within the Euro area.

• Help reduce exchange rate pressures on the currencies because the markets will recognize the unequivocal commitment of the country to respect and maintain the central rate, and because of the possibility of coordinated intervention involving the Eurosystem.

• Provides time to test whether the central rate is appropriate to use to fix the irrevocable rate of the currency to the euro. Adherence to the central rates is seen as promoting convergence of the economy to the Euro area conditions.

114.   Thus, it can be seen that the ERM II system captures common elements with the original system to set the exchange rate for the euro. Countries have time to experiment with exchange rates and observe market movements, but ultimately a commitment must be made to a central rate. Adherence to the central rate will be monitored. The central rate will be retained long enough to have some confidence that it reflects economic fundamentals. The central rate then becomes the conversion rate.

Relevance of the European Experience

115.   The European experience has some relevance to other unions, although the time frame and institutional arrangements are very different.

116.   One relevant lesson is that the ERM experienced severe stress in the early 1990s from shifts in real exchange rates that affected the relative competitiveness of the economies. Thus, stability of nominal exchange rates is not sufficient – movements in real rates must also be considered. Indeed, maintaining a fixed parity can lead to competitiveness differentials between the European Monetary System partners due to inflation differentials - and thus to an increase in the unemployment of the less competitive members. When macroeconomic divergence among the EMS participants rose too high, the absence of devaluation might have lowered the credibility of a fixed nominal peg rather than raise it. Monetary authorities unable to resist real exchange rate movements might not be able to prevent nominal exchange rates from departing from the central parities. Thus, the adjustment towards the anchor disappears and exchange rates become unstable. As Bessec (2003) argued, realignments can drag back the exchange rates based on their purchasing power parity (PPP). Indeed, in the face of accumulated inflation differentials, devaluations with reference to the PPP can re-establish competitiveness and restore the credibility of the system. It means that a second anchor can be achieved by interventions that prevent the nominal exchange rate from moving too far away from the PPP and thus lower the competitiveness differentials between the countries participating in the EMS.[37]

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[37] This mechanism is also consistent with the model of policy credibility of Drazen and Masson (1994). According to this model, a policymaker's reputation for pursuing a hard nominal currency peg and a durably lower unemployment are both necessary to convince markets of the sustainability of the European Exchange Rate Mechanism. The former requires a short-to-medium run fixing of nominal exchange rates and the later a

(continued…)

117.   A second experience is the reliance on market-based rates of conversion discovered by holding countries' currencies within a parity grid for a period of time. The case of Italy was an outlier, but overall the experiment seems to have worked reasonably well. Of course, an issue is how long a period is needed to embed relative exchange rates into the price structures of countries seeking to join an union. *De jure*, at least, two years is judged to be sufficient.

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long-run constancy in real exchange rates. This implies an alternative convergence towards two different equilibria: the central parity and the PPP.

Appendix 2: The Macro-Indicators Approach Applied to GCC Countries

118.   The macro-indicators approaches uses judgemental analysis to assess the internal and external equilibrium of an economy. The GCC's economies are oil-exporting countries, in a context of fixed exchange rate regime against the US dollar and oil price volatility. Such a situation generally means on the internal side that monetary policy is not effective and on the external side that in most cases increases in foreign reserves offset a large part of the current account surplus. We conduct our analysis of the approach using the WEO data (Appendix 5), various issues of IMF Article IV Consultation mission reports, and country reports of the Institute of International Finance.

119.   In order to smooth oil price volatility and to take into account the growing share of non oil sector in the GCC countries (in 2007 it represented about 70% in Saudi Arabia, 65% in Kuwait, 50% in Qatar and 90% in Bahrain), we consider internal equilibrium in the light of both total real GDP and non-oil real GDP output gaps.[38] We also analyze the inflation rate and find that most of the countries witnessed a period of low and well-contained inflation in 2003 and 2004. Inflation began rising in 2005 in most countries fueled in large part by food and rental prices. Fiscal balance is usually at equilibrium, witnessing relative surpluses in recent years.

120.   Current account, net foreign assets, and external debt among other indicators show that the period between 2003 and 2006, except for Kuwait from 2004, can be considered as pointing towards external equilibrium.

121.   Taking both internal and external analysis into account, the equilibrium date can be estimated at 2003 for Saudi Arabia, Kuwait, and Qatar, and 2004 for Bahrain.

122.   The brief review of the countries conditions shows a high degree of similarity across the GCC countries with little apparent pressure on exchange rates. For the purposes of this paper, these conditions also provide a basis for believing that the grid of bilateral exchange rates between the member countries was broadly stable and supportive of the generally favorable conditions.

123.   As explained earlier, the limitation of this method is that it is not precise. It identifies a period at which the economy is at equilibrium but not precisely a specific year. In the case of the GCC where almost all the countries share common economic characteristics and are prone to similar shocks, this might not be an issue. But in the case of other currency unions, countries might have different economic characteristics and could react differently to shocks, which requires a robust methodology to identify for each country the year at which the economy is at equilibrium, to serve as a base for the determination of the conversion rate.

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[38] Estimating the potential GDP as a function of production is difficult notably because of the lack of data. Therefore, we simply calculate the potential output using a Hodrick-Prescott (HP) filter from the total real output and the non-oil real output.

Key Macroeconomic Indicators in the GCC Countries

Oil: Spot Crude Price - Dubai (US dollars per barrel)

Source WEO

Real GDP growth

Source WEO

Inflation (annual growth)

Source WEO

Central government balance (Percent of GDP)

Source WEO

Public consumption expenditure (Percent of GDP)

Source WEO

Broad money (Percent of GDP)

%

Foreign Assets (Net) (% of GDP)

%

Current Account (% of GDP)

%

Stock of reserves at year-end (% of GDP)

%
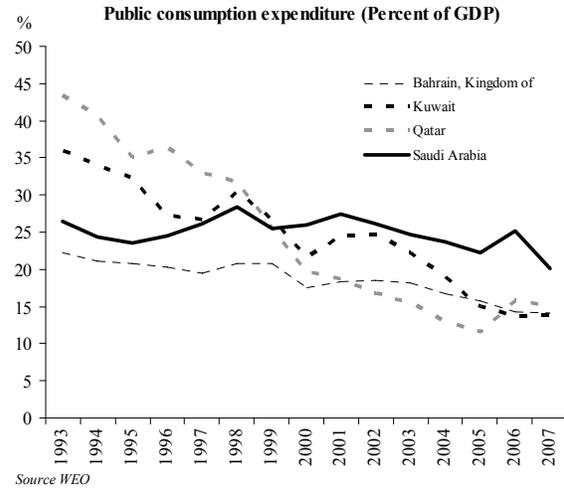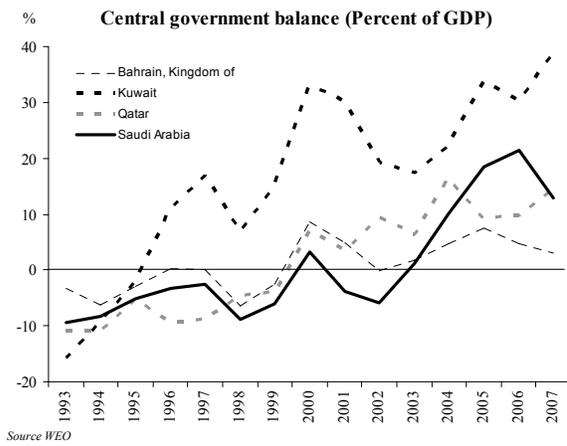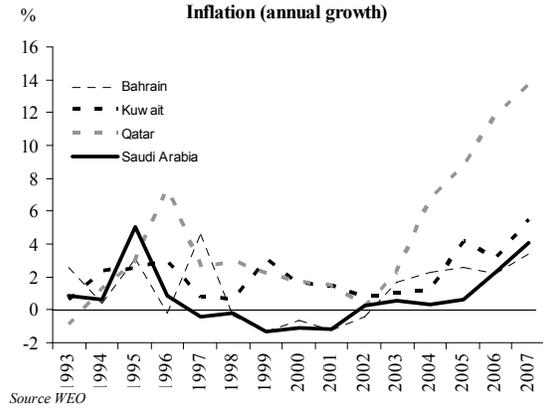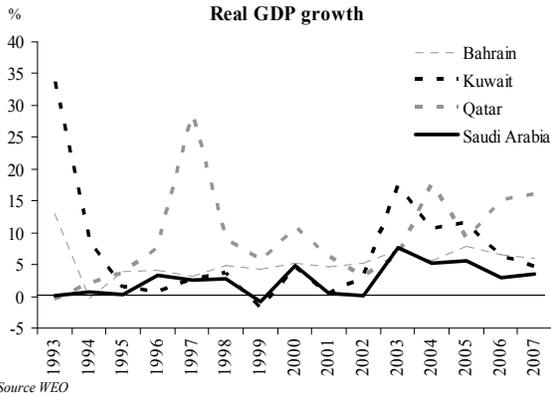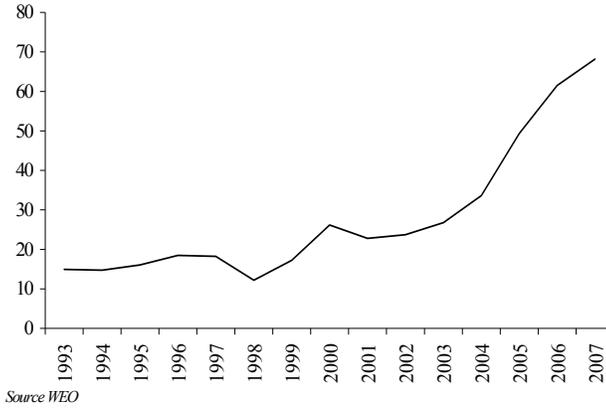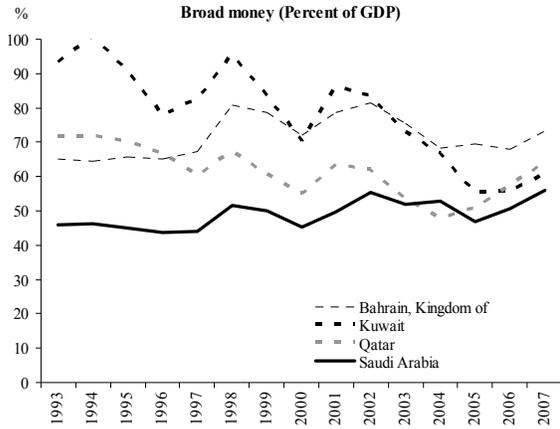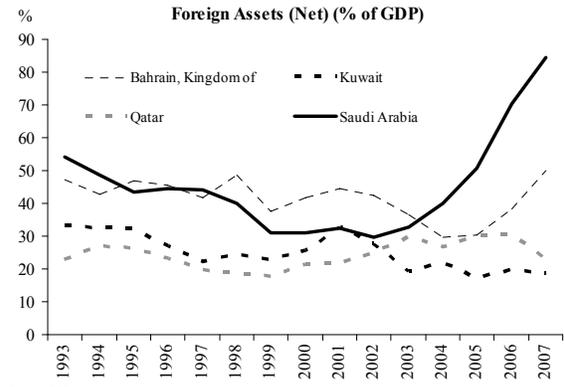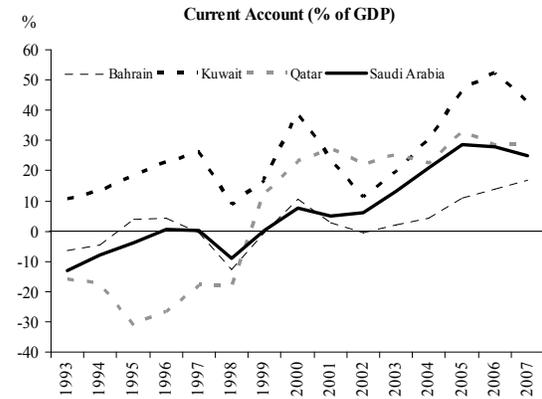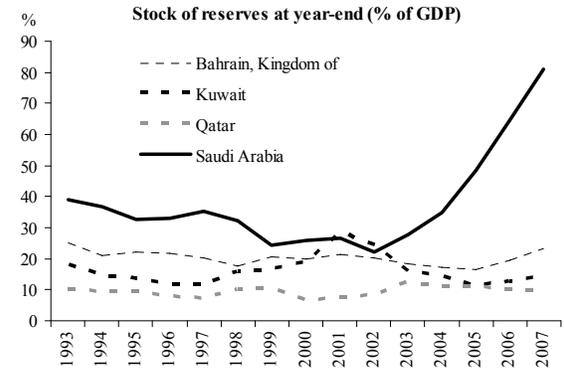
Output gaps. Real GDP growth and non oil (NOIL) real GDP growth

Saudi Arabia

SAUDIA_GDP ----- SAUDI_GDP_HP

SA_NOIL_GDP ----- SA_NOIL_GDP_HP

Kuwait

KW_GDP ----- KW_GDP_HP

KW_NOIL_GDP ----- KW_NOIL_GDP_HP

Qatar

QA_GDP ----- QA_GDP_HP

QA_NOIL_GDP ----- QA_NOIL_GDP_HP
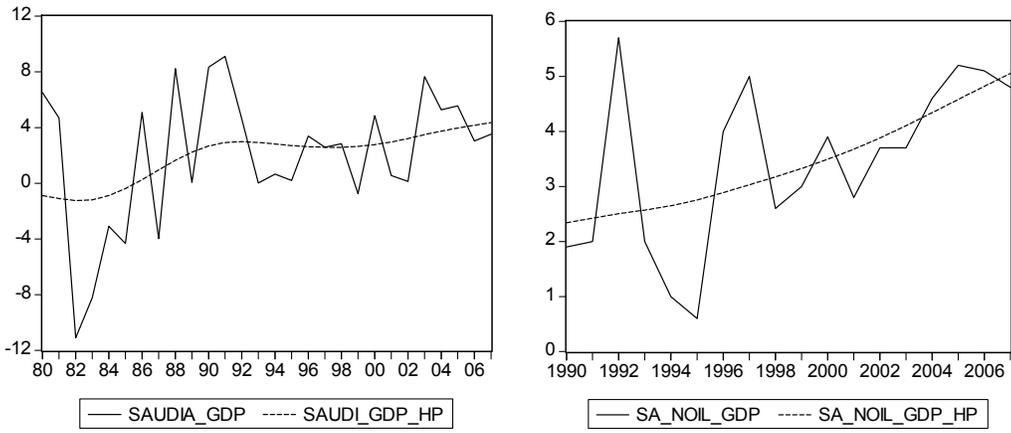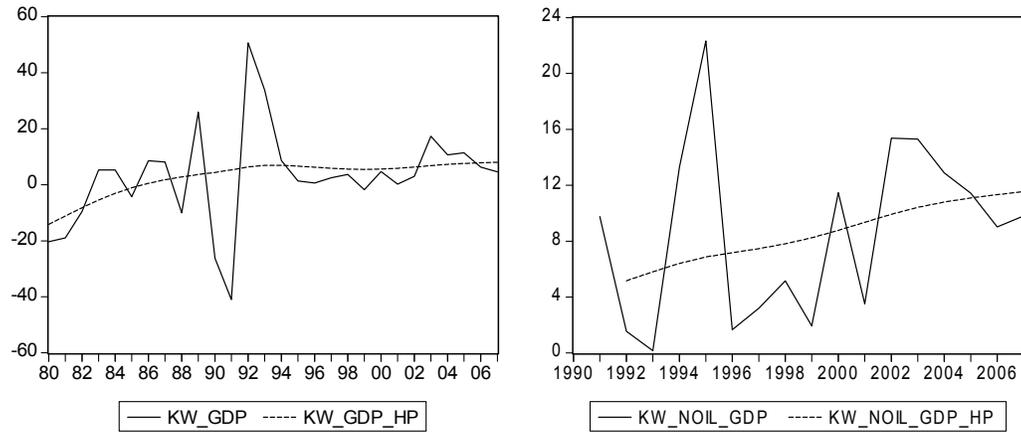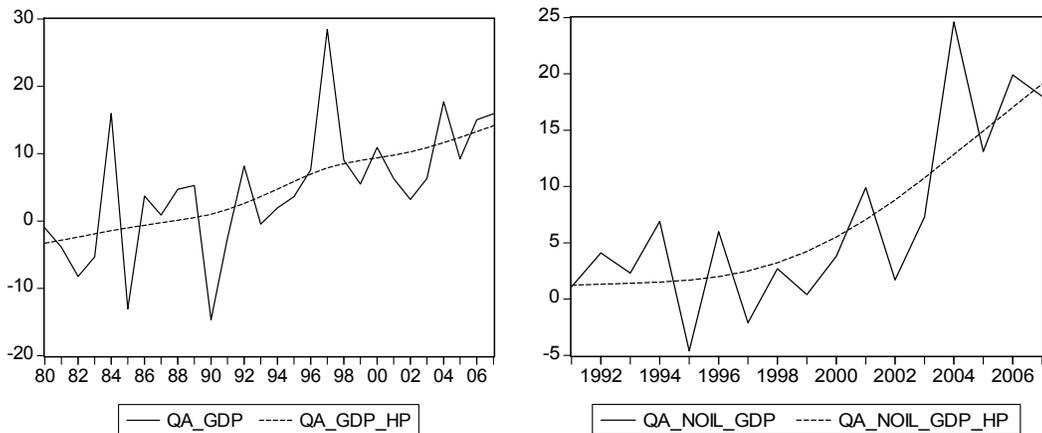
Bahrain
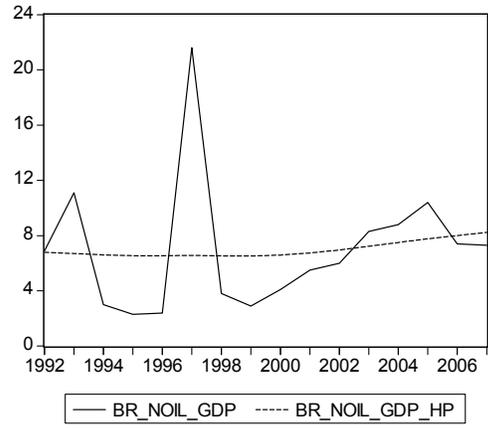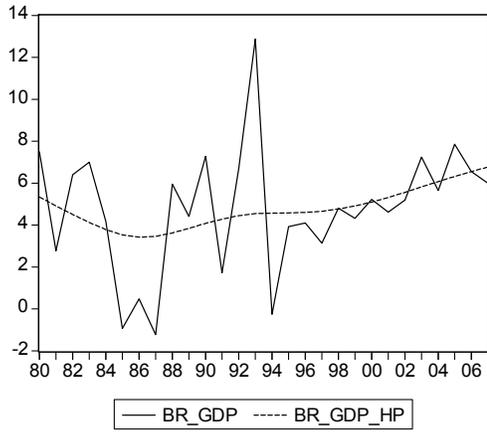
Appendix 3: Overview of CGER Exchange Rate Assessment Methodologies

Abiad *et al* (2009) provide a description (below) of the CGER methodology approach pointing out that it is articulated around three complementary approaches: the macroeconomic balance approach, a reduced form equilibrium real exchange rate approach, and an external sustainability approach.

The **macroeconomic balance (MB) approach** calculates the difference between the current account balance projected over the medium term at prevailing exchange rates, and an estimated equilibrium current account balance or "CA norm." The latter is a function of medium-term determinants of the savings-investment balance, such as demographic factors (population growth and old-age dependency), the fiscal balance, and level and growth rate of output per capita. The exchange rate adjustment that would eliminate this difference over the medium term—a horizon over which domestic and partner-country output gaps are closed and the lagged effects of past exchange rate changes are fully realized—is obtained using country-specific elasticities of the current account with respect to the real exchange rate.

The reduced-form **equilibrium real exchange rate (ERER) approach** estimates an equilibrium statistical relationship between the real exchange rate for each country and macroeconomic fundamentals, such as the net foreign asset (NFA) position of the country,relative productivity differentials between the tradable and nontradable sectors, and the terms of trade. The exchange rate misalignment is then calculated as the difference between the estimated equilibrium real exchange rate, based on medium-term projections of the fundamentals, and its current value.

The **external sustainability (ES) approach** calculates the difference between the current account balance projected over the medium term at prevailing exchange rates, and the balance that would stabilize the NFA position of the country at some benchmark level. Using the same elasticities as in the MB approach, this difference is translated into the real exchange rate adjustment that—over the medium term—would bring the current account balance in line with its NFA-stabilizing level.

The three misalignment estimates are then combined to give an **overall assessment**, using simple criteria. If the average of the three misalignments is within five percent of zero, or if each of the three misalignments are less than 10 percent in absolute value, then the currency is assessed to be broadly in line with fundamentals. Otherwise, the approximate midpoint of the three estimates (when all three estimates are within 10 percentage points of each other) or a range encompassing all three estimates (when the estimates are at least 10 percentage points apart) is used as the assessment.

Appendix 4: CGER assessments of selected GCC exchange rates in recent years:

	MB*	ERER	ES	Reference
Bahrain	Undervalued (average 2000-2007 is 8%)	Undervalued	N/A	Khan, 2009
Kuwait	Overvalued in 2008, but by 2013 the KD will slightly be undervalued.	2007 – 11% Undervaluation; End-2008 – 6 % overvaluation; 2009 – Expected to be broadly in line with its equilibrium level	The projected current account surplus is too low relative to the norm, suggesting overvaluation.	IMF: Article IV Consultation—Staff Report, IMF, 2006, 2008, 2009.
	Undervalued (average 2000-2007 is 8%)	Slightly undervalued	N/A	Khan, 2009
Qatar	No misalignment in 2007 and some undervaluation in 2008.	No misalignment in 2006	Overvaluation	IMF: Article IV Consultation—Staff Report, IMF, 2007, 2008.
	Slightly undervalued (average 2000-2007 is 2.2%)	No misalignment in 2006	N/A	Khan, 2009
Saudi Arabia	Undervalued (average 2000-2007 is 17.8%)	No misalignment in 2006	Overvalued	Khan, 2009

* These results should be interpreted cautiously, given that estimates of current account norms are subject to large margins of error, especially in oil-producing countries. (Qatar article IV consultation 2007, Box 2).

Appendix 5: RER Behavior Determinants

124.   REER is the multilateral CPI-based real effective exchange rate calculated by the IMF World Economic Outlook (WEO) database, where an increase reflects an appreciation for the home country's currency.

125.   BUDG is the central government balance as a percent of GDP. We used the WEO database to calculate the ratio. The effect of a change in the fiscal balance on real exchange rate is mixed. Ricardian equivalence is not borne out empirically. Thus, a deterioration of the fiscal balance is not necessarily offset by an increase in private savings and therefore can lead to demand pressures and a real exchange rate appreciation. On the contrary, the GCC countries generally witness fiscal surpluses thanks to oil exports which can lead to demand pressures and so also to a real exchange rate appreciation. But such fiscal surplus can also alleviate the central bank's claims on the government, leading to a decrease in the monetary base. Therefore, a depreciation of the real exchange rate can also occur.

126.   GCON is the log of the public consumption expenditure as a percent of GDP. There is an ambiguity about the relationship between GCON and BUDG in GCC due to oil price changes. Theoretically, an increase in government spending would deteriorate the fiscal balance and is therefore liable to put downward pressure on the exchange rate. But GCC countries have a fixed exchange rate regime and the real exchange rate can be affected in an endogenous way only by prices. However, the impact of public expenditure on real exchange rate is ambiguous. It would be necessary to determine if the public spending is oriented more towards tradable or nontradable goods. Empirical studies tend to confirm that government expenditure is biased toward nontradable goods and so a public spending increase leads to a real exchange rate appreciation. But in non industrialized countries, increases in public wages may come from public spending and GCON can indirectly depreciate the real exchange rate if the rise in private spending due to the higher wages falls stronger on tradable goods.

127.   LIQ is a proxy equal to the ratio of the log of broad money to GDP. GCC countries are major commodity exporting countries with a fixed exchange rate regime. This context implies that money supply can increase (decrease) sharply, notably in times of oil price rising (declining). Such a move can have an important effect on inflation and therefore the real exchange rate. Monetary authorities and governments intervene with an aim to limit the monetary base increase (thus sterilization operations and use of sovereign wealth funds are key elements of monetary policy within the region). The expected sign for LIQ is positive because an increase in money supply leads to inflation and real exchange rate appreciation.

128.   OPEN describes the degree of openness. Usually, the main proxy for OPEN is the ratio of the sum of exports and imports to GDP ratio. OPEN's impact on real exchange rate is mixed in the literature. Egert (2003) drew up an overview of the real exchange rate determinants from empirical studies and their coefficient's expected sign. If we consider openness as an indicator of trade liberalization, an improvement in openness must lead to a depreciation of the real exchange rate. Besides, supply capacity can be improved by openness and this leads to an improvement in the trade balance and an appreciation of the exchange rate. The case of the GCC countries is somewhat specific, as their exports are largely a function of oil exports. A sharp increase in oil prices can be misinterpreted as an

improvement of openness. Even if exports, imports, and GDP are expressed in volume, oil exports can result from exogenous factors (world oil demand) that are not linked to openness. Consequently, to avoid misinterpretation, we use imports to GDP ratio to proxy openness.

129.   PROD - Many proxies exist in the purpose to assess productivity. For example, the ratio of the Consumer Price Index (CPI) to the Producer Price Index (PPI) is often used in the literature (Edwards, 1989; and Clark and McDonald, 1999) but two drawbacks make this proxy unusable in the case of the GCC countries. Concerning CPI, some components are partly subsidized by some governments and concerning PPI, an important share of the GDP consists of hydrocarbon products. Another productivity proxy for the case of the GCC is the real GDP to employment ratio, but we could not use it because of the absence of official employment data. We thus use the real GDP per capita divided by the same series in the OECD countries (REER model) or in the USA (RER model). It is largely admitted in the literature (Egert 2004, Lee, Milesi-Ferretti, and Ricci 2008) that a rise in productivity leads to an appreciation of the real exchange rate. The expected sign is thus positive.

130.   USNEER is the nominal effective exchange rate of the US dollar. This index is a weighted average of the foreign exchange values of the U.S. dollar against a subset of currencies in the broad index that circulate widely outside the country of issue. We use it in the REER model when there is no correlation between it and the real effective exchange rate of the considered country. With the GCC currencies being pegged to the U.S. dollar, an appreciation of the USNEER will lead to an appreciation of the GCC countries' RER. The series is calculated by the U.S. Federal Reserve. In the RER model we use EURUSD which is the euro/dollar exchange rate. To proxy the euro before its launch in 1999, the European Central Bank has aggregated pre-1999 currency data. Data for EURUSD are from the ECB.

131.   TOT expresses the log of terms of trade which is the ratio of export to import prices. It is thus the relative price of exports to imports. In the GCC's case, an oil price rise can create a positive wealth effect which would lead to an appreciation of the real exchange rate. The expected sign of the coefficient is thus positive.

132.   NKF (net capital flows) is a proxy to express capital flows measured by the inverse sign of the balance of goods and services not related to the factors of production (Kamar, 2006). An increase of capital flows usually leads to the appreciation of the RER, unless the country is highly indebted where the impact could be negative.

133.   RES is the ratio of reserves at year-end to GDP. An increase in reserves could lead to excess money supply and appreciation of the RER, in the absence of sterilization.

134.   NFA is the log of net foreign assets as a percent of GDP and could be used alternatively with RES. The data are available notably in *IFS* (*International Financial Statistics*, IMF database). The expected sign of its coefficient is usually positive (Lee, Milesi-Ferretti and Ricci, 2008). Others get mixed results (McDonald and Wojcik, 2002; Alberola, 2003) or even negative signs (Alonso-Gamo et al., 2002; Lommatzsch and Tober, 2002; Burgess et al. 2003).

Appendix 6: Unit Root Tests for the Real Effective Exchange Rate (REER) Model

Saudi Arabia 1980-2007

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LREER	-1.59	-2.15**	0.56**	-1.69	-0.70	-0.89	1
D(LRER)	-2.66***	-2.65**	0.15	-10.38**	-2.28**	-3.11***	0
LIQ	-4.97***(C)	-5.27***(C)	0.45*	-0.25	-0.16	-1.33	1
D(LIQ)	-2.92***	-2.73***	0.40	-9.54**	-2.18**	-2.93***	0
TOTS	-0.14	-0.14	0.18	-2.55	-1.06	-1.27	1
D(TOTS)	-5.20***	-5.20***	0.43	-12.96**	-2.54**	-5.14***	0
NKF	-2.13 (T)	-2.12 (T)	0.19** (T)	-2.16 (T)	-0.80 (T)	-1.63 (T)	1
D(NKF)	-3.62***	-3.62***	0.53**	-11.81**	-2.43**	-3.66***	0
RES	-0.15	0.18	0.37*	-7.49*	-1.87*	-1.76*	1
D(RES)	-2.53**	-2.44**	0.24	-6.13*	-1.72*	-2.11**	0

Kuwait 1980-2007

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LREER	-0.52	-0.52	0.37*	-3.20	-1.22	-1.36	1
D(LREER)	-3.86***	-3.83***	0.09	-11.90**	-2.44**	-3.78***	0
GCON	-0.04	-0.07	0.18	-2.60	-1.10	-1.41	1
D(GCON)	-4.07***	-3.99***	0.37*	-12.09**	-2.46**	-3.77***	0
TOT	-3.31** (C)	-3.31** (C)	0.23	-20.43***	-3.15***	-3.14***	0- 1
D(TOT)	-4.05***	-5.10***	0.20	-13.72**	-2.61***	-4.06***	0
TOT_smooth	0.21	0.21	0.26	-3.80	-1.23	-1.35	1
D(TOT_smoo)	-4.66***	-4.64***	0.25	-12.95**	-2.52**	-4.67***	0
OPEN	0.61	-0.38	0.48**	-10.06**	-2.20**	-2.91***	1
D(OPEN)	-6.40***	-10.61***	0.37*	-13.82***	-2.61***	-7.13***	0
RES	-3.25** (C)	-2.81* (C)	0.24	-35.91***	-4.23***	-3.20***	0 – 1
D(RES)	-5.00***	-5.07***	0.08	-12.94**	-2.54**	-4.87***	0
RES_smooth	-2.66*	-0.20	0.17	-14.05***	-2.65***	-2.67***	1
D(RES_smoo)	-4.41***	-4.51***	0.08	-12.55**	-2.50**	-4.23***	0

Qatar 1980-2007

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LREER	0.10	0.44	0.15	-12.18**	-2.37**	-2.18**	1
D(LREER)	-3.37***	-3.37***	0.13	-9.51**	-2.18**	-2.97***	0
TOT	-0.60 (T)	-0.69	0.18**(T)	-1.57 (T)	-0.65 (T)	-0.85 (T)	1
D(TOT)	-4.59*** (T)	-16.90***(T)	0.14 (T)	-11.27 (T)	-2.37 (T)	-6.96*** (T)	0
OPEN	-0.62	-0.63	0.12	-5.97	-1.71	-1.94*	1
D(OPEN)	-4.55***	-4.52***	0.07	-12.88**	-2.54**	-4.54***	0
RES	-2.78* (C)	-2.76* (C)	0.30	-4.18	-1.39	-1.89*	1
D(RES)	-3.71***	-5.26***	0.21	-12.96**	-2.54**	-3.77***	0
USNEER	-0.56	-0.48	0.32	-12.25**	-2.37**	-2.18**	1
D(USNEER)	-1.23	-3.03***	0.13	-43733***	-148***	-2.22**	0

Bahrain 1982-2007

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LREER	-2.03**	-1.64*	0.61**	-1.99	-0.74	-1.15	1
D(LREER)	-2.19**	-2.72***	0.08	-1.12	-0.60	-1.93*	0
GCON	-0.96	-0.93	0.60**	-0.99	-0.40	-0.40	1
D(GCON)	-3.98***	-3.89***	0.36*	-11.62**	-2.41**	-4.05***	0
LIQ	-2.70* (C)	-2.74* (C)	0.29	-6.63*	-1.77*	-2.21**	1
D(LIQ)	-5.40***	-5.56***	0.09	-12.49**	-2.48**	-3.98***	0
RES	-1.02	-1.48	0.66**	-2.05	-0.97	-1.24	1
D(RES)	-5.03***	-5.32***	0.33	-12.36**	-2.39**	-3.32***	0
NKF	3.54	4.08	0.55**	-5.35	-1.04	0.68	1
D(NKF)	-1.94*	-1.99**	0.52**	-9.11**	-1.75**	-2.31**	0

Notes, critical value tables and comments:
In the tables above, *** (resp. ** and *) denotes that H0 is rejected at the 1% (resp. 5% and 10%) significance level. H0 is accepted above the 5% level except for particular cases.

In all tests, (T) denotes that trend and constant are included in the test equation due to the significance of the trend. In ADF and PP tests, (C) denotes that constant is included in the test equation due to the significance of the constant. No indication otherwise.

Critical value tables

ADF and PP
Dickey-Fuller Φ critical values

30 observations	1%	5%	10%
None	-2.66	-1.95	-1.61
Constant	-3.71	-2.98	-2.63
Trend and Constant	-4.36	-3.60	-3.23

H0 (Unit Root) rejected if t_Φ < critical value

KPSS critical values

	1%	5%	10%
η_μ (with constant)	0.793	0.463	0.347
η_τ (with trend and constant)	0.216	0.146	0.119

H0 (stationary) rejected if *t-statistic* > critical value

Ng-Perron critical values

	MZa C	MZt C	MZa $C\&T$	MZt $C\&T$
1%	-13.8	-2.58	-23.8	-3.42
5%	-8.1	-1.98	-17.3	-2.91
10%	-5.7	-1.62	-14.2	-2.62

H0 (Unit Root) rejected if *t-statistic* < critical value

ERS (DF-GLS) critical values

30 observations	1%	5%	10%
Constant	-3.71	-2.98	-2.63
Trend and Constant	-3.77	-3.19	-2.89

H0 (Unit Root) rejected if t_Φ < critical value

Despite the fact that ADF and PP tests can be less robust in the presence of breaks in the level or in the slope of the trend function, they are prominently used in the literature. Consequently, we gave more importance to the outcomes from these tests. In a few cases ADF or PP indicate that the series are not I(1) but in most of these specific cases, graphic observations and correlograms indicate that the series are not stationary in their levels and are I(0) in first difference. More precisely, for the level exchange rate series (for instance Saudi Arabia), a trend is found significant at a 6% level and thus not considered. Taking into account the trend makes the series non stationary. In order to be sure that all the series are I(1), we used the other unit root tests listed above. In the cases when ADF and PP do not indicate the intuitive results, those other tests confirm the series are I(1). Kuwait's case is specific due to the first Gulf war. Indeed, the outlier data in TOT and RES in the REER model and BUDG in the RER one make the series stationary in their levels. The removal of these outliers makes the series I(1).

Appendix 7: OLS Estimations of the Short-run Determinants of the REER (Error-Correction Model)

Dependant variable: D(REER)

ECM	Bahrain	Kuwait	Qatar	Saudi-Arabia
RESID(-1)	-0.138928** (-2.096549)	-0.408587* (-1.972134)	-0.525991*** (-4.761355)	-0.870907*** (-5.620615)
D(LIQ)				
D(OPENMS)			0.091975*** (4.802149)	
D(TOTS)				0.266275*** (6.902143)
D(RES)		0.118595*** (3.691067)		
D(NKF)			0.146154*** (10.46297)	-0.002621*** (-5.603233)
D(CAPF)				
D(TKF)				
D(USNEER)	0.841023*** (13.87815)		0.867633*** (20.36326)	
C	-0.018102*** (-4.350745)			-0.023742*** (-3.401323)
D90_92		0.128991*** (3.703169)		
D90				-0.105861*** (-2.841881)
R²	0.897632	0.508272	0.952459	0.757695
Adj. R²	0.888326	0.467295	0.946258	0.713640
DW	1.985855	1.553620	2.517321	1.683612

Note: Data in brackets indicate the *t-Student*.
***, ** and * denote a significance of the coefficient at the 1%, 5% and 10% levels

Appendix 8: Unit Root Tests for the Bilateral Real Exchange Rate (RER) Model

Saudi Arabia 1986-2013

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LRER	-1.69*	-0.42 (T)	0.15**(T)	-9.28 (T)	-1.88 (T)	-0.83 (T)	1
D(LRER)	-2.87***	-2.92***	0.10 (T)	-9.35 (T)	-2.16 (T)	-2.85 (T)	0
GCON	-0.99	-1.06	0.54**	-3.38	-1.19	-1.44	1
D(GCON)	-6.83***	-6.83***	0.08	-12.70**	-2.52**	-6.09***	0
OPEN	-1.81*	-2.12**	0.53**	-0.99	-0.61	-0.96	1
D(OPEN)	-4.45***	-4.48***	0.27	-13.28**	-2.57**	-4.52***	0
NKF	-0.95	-0.97	0.54**	-1.41	-0.81	-1.10	1
D(NKF)	-5.54***	-5.54***	0.25	-10.98**	-2.33**	-3.36***	0

Kuwait 1984-2013

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LRER	-0.46	-0.00	0.25	-7.35	-1.65	-1.35	1
D(LRER)	-3.54***	-3.41***	0.37*	-11.69**	-2.38**	-3.43***	0
TOT	-1.55	-1.55	0.46*	-5.81*	-1.61*	-1.81*	1
D(TOT)	-5.10***	-5.34***	0.15	-14.46***	-2.69***	-5.11***	0
OPEN	-1.77*	-1.79*	0.65**	-3.59	-1.18	-1.31	1
D(OPEN)	-7.83***	-8.90***	0.12	-12.65**	-2.51**	-8.13***	0
RES	0.48	0.71	0.51**	-2.87	-0.88	-0.95	1
D(RES)	-4.48***	-4.39***	0.37*	-14.02***	-2.64***	-4.53***	0
EURUSD	0.13	0.00	0.41*	-3.73	-1.13	-1.69*	1
D(EURUSD)	-4.05***	-3.92***	0.09	-12.06**	-2.45**	-3.74***	0

Qatar 1976-2013

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LRER	-1.04	0.76	0.34	-0.70	-0.22	-1.05	1
D(LRER)	-2.40**	-2.44**	0.23	-3.36	-1.27	-1.66*	0
GCON	-0.95	-0.95	0.64**	0.35	0.18	0.09	1
D(GCON)	-6.64***	-6.64***	0.33	-18.16	-3.01	-6.84***	0
TOT	-0.89	-0.98	0.17	-2.87	-1.16	-1.20	1
D(TOT)	-5.89***	-5.90***	0.18	-18.48***	-3.04***	-5.86***	0
OPEN	-0.92	-1.14	0.57**	-3.73	-1.23	-1.55	1
D(OPEN)	-5.38***	-5.88***	0.32	-16.76***	-2.89***	-4.51***	0
RES	1.67	5.86	0.70**	1.28	0.57	0.29	1
D(RES)	-5.46***	-5.46***	0.50**	-18.46***	-3.01***	-5.89***	0
EURUSD	0.05	0.20	0.35	-11.07**	-2.19**	-1.97**	1
D(EURUSD)	-4.44***	-4.23***	0.14	-14.78***	-2.71***	-4.39***	0

Bahrain 1985-2013

Variable	ADF	PP	KPSS	NP MZa	NP MZt	DF-GLS	Order of Integration
LRER	-3.21***	-5.18***	0.63**	-1.24	-0.64	-1.08	1
D(LRER)	-4.41***(T)	-4.40***(T)	0.10 (T)	-13.41 (T)	-2.58 (T)	-4.55***(T)	0
GCON	-2.94 (T)	-2.94 (T)	0.16**(T)	-4.85 (T)	-1.53 (T)	-2.12 (T)	1
D(GCON)	-4.25***	-4.25***	0.32	-12.75**	-2.52**	-4.27***	0
OPEN	-2.55 (T)	-2.41 (T)	0.08 (T)	-8.86 (T)	-2.10 (T)	-2.63 (T)	1
D(OPEN)	-4.58***	-4.61***	0.30	-13.98***	-2.64***	-5.03***	0
RES	1.35	1.17	0.41*	0.71	0.37	0.42	1
D(RES)	-3.83***	-3.83***	0.54**	-12.79**	-2.52**	-3.97***	0

Appendix 9: OLS Estimations of the Short-run Determinants of the RER (Error-Correction Model)

OLS Estimations of the short-run determinants of the RER. (IMF Forecasts).
Dependant variable: D(RER)

ECM	Bahrain	Kuwait	Qatar	Saudi-Arabia
Sample	1988-2013	1985-2013	1977-2013	1987-2013
Observations	26	29	37	27
RESID(-1)	-0.3180*** (-3.186047)	-0.8134*** (-3.314431)	-0.4335*** (-3.272853)	-0.5838*** (-4.205921)
D(GCON)	0.159837** (2.260275)			
D(OPENMS)			0.060971** (2.027242)	
D(TOTS)		0.072503*** (3.305571)	0.070333*** (2.996900)	
D(RES)	0.037353** (2.316921)	0.041487*** (3.109967)	0.087184*** (3.527177)	0.027955* (1.884566)
D(NKF)		0.016256*** (3.374987)		0.040699*** (5.926729)
D(EURUSD)			0.131027** (2.660826)	
C	-0.00959** (-2.274376)			-0.006528* (-1.802861)
D9192	-0.032388** (-2.405695)			
D90		0.101947*** (3.835453)		
D91		-0.17551*** (-3.402017)		-0.054698** (-2.566003)
D92		0.104590** (2.465656)		
D07			0.091296*** (9.109018)	
R²	0.451813	0.795816	0.517523	0.644775
Adj. R²	0.347397	0.740129	0.439704	0.580188
DW	1.876660	1.208452	0.884880	1.536916

***, ** and * denote a significance of the coefficient at the 1%, 5% and 10% levels

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