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Yemen: Exchange Rate Policy in the Face of Dwindling Oil Exports

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Abstract

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This paper investigates the likely implications of declining oil production on Yemen's equilibrium exchange rate, and discusses policy options to ensure a smooth transition to a non-oil economy. The empirical results suggest that, as oil production and foreign exchange earnings fall, the Yemeni rial will have to adjust downward in real effective terms to keep pace with the equilibrium exchange rate. In light of strong pass-through from exchange rate depreciation to domestic inflation, this could entail a substantial depreciation in nominal terms. Given the nature of the adjustment, a floating exchange rate regime appears to be the best option, if supported by appropriate macroeconomic policies. However, given public fixation on a exchange rate stability, a softly managed float would be a better option for Yemen whereby the central bank may have to lead the market toward the equilibrium exchange rate.

Contents   **Page**

I. INTRODUCTION

Yemen faces an adjustment challenge of tremendous magnitude in the coming decade as its relatively small reserves of crude oil—the main source of exports and government revenue—are exhausted. An essential element of a successful transition to a non-oil economy will be a smooth adjustment of the exchange rate. While the Central Bank of Yemen (CBY) espouses a floating rate system, the CBY has a clear preference for stability of the rial vis-à-vis the U.S. dollar. As oil production declines—and with it, foreign exchange receipts and government revenue—greater flexibility will be needed to allow the nominal rate to play its role in facilitating the shift to a new internal and external equilibrium.

The main objective of this paper is to examine what kind of exchange rate policy Yemen should adopt to smooth the transition to a non-oil economy over the next decade, and whether there is a need to guide the exchange rate toward its equilibrium value. The remainder of this paper is structured as follows: Section B briefly outlines recent exchange rate developments and the likely path of oil production over the medium term; Section C discusses the theoretical arguments for estimating the equilibrium exchange rate; Section D provides a quantitative assessment of the real exchange rate and its determinants in Yemen, and offers some estimation of how the coming decline in oil production is likely to impact the equilibrium real effective exchange rate over the medium and long term; Section E then addresses questions regarding the appropriate choice of exchange rate regime.

II. BACKGROUND AND MACROECONOMIC OUTLOOK

Yemen's current approach to the exchange rate might best be described as a tightly managed float. There is no announced target for the rial, but the operations of the CBY reveal an implicit desire for stability vis-à-vis the U.S. dollar. Some measure of flexibility is allowed, but the CBY is generally keen to avoid day-to-day fluctuations of any great magnitude.[2] The CBY's principle tool in exchange rate management has been foreign exchange auctions, but other measures (such as increasing the reserve requirement on foreign currency deposits) have been utilized during periods of stronger pressure. Yemen's capital account is open and free of restrictions.

Yemen's (CPI based) real effective exchange rate (REER) has appreciated significantly since 1998 (Figure 1). The divergence between the nominal and real effective exchange rates indicates that inflation in Yemen has, among other factors,[3] contributed to the appreciation of the real exchange rate during this period. By contrast, in neighboring GCC countries (where the currency is pegged to the U.S. dollar), real effective exchange rates remained broadly

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[2] The average daily fluctuation in the rial/dollar rate has been roughly 0.01 percent per day for the past year.

[3] Other factors could include (i) reversion to the mean, following the large depreciation of the 1990s (following civil war and reunification); and (ii) higher government spending out of oil revenues.

constant over the same time period—suggesting that domestic inflation rates were kept in line with those in partner countries (Figure 2). Given the low base of non-oil exports in Yemen, it is difficult to measure the adverse impact of an appreciating REER on the non-oil tradable sectors (primarily fish, processed food, and raw materials). Some exports (e.g. fish) have steadily increased, while others (manufacturing) have stagnated.

Figure 1. Yemen: Exchange Rate and Inflation Developments
**January 1998 - June 2006**
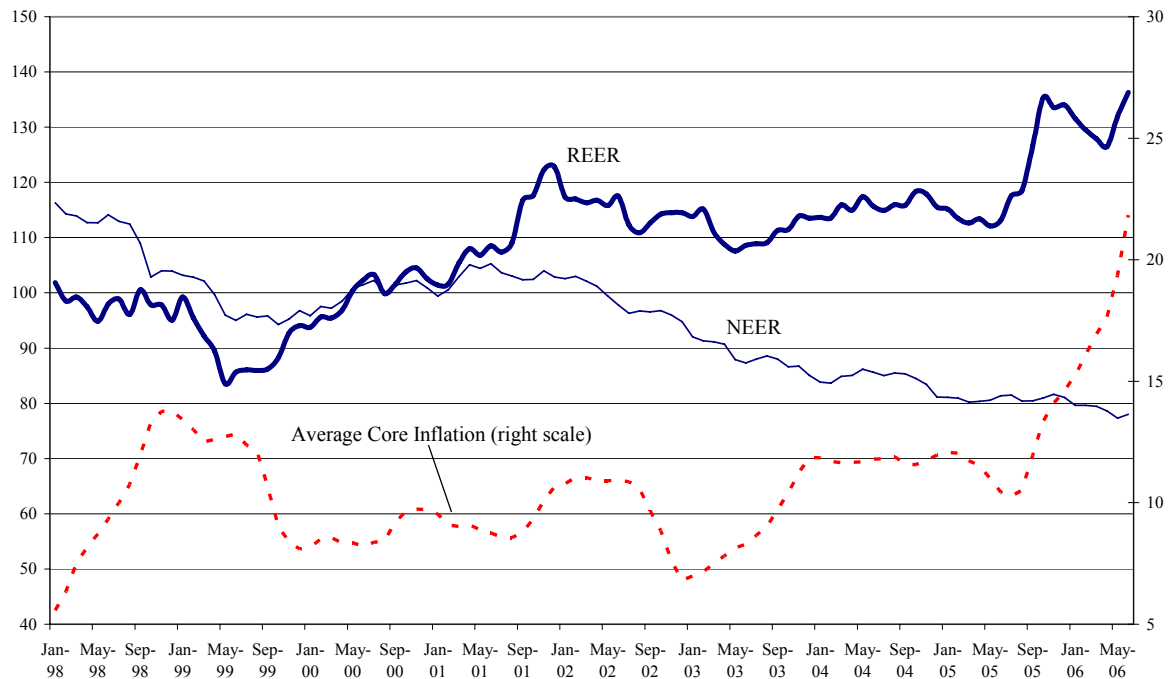
Sources: Central Bank of Yemen; and Fund staff estimates.

Oil has been the predominant force shaping macroeconomic performance, policies, and exchange rate developments in Yemen. The oil sector accounted for about 13 percent of real GDP in 2005. It also contributed about 67 percent of government budgetary revenue and 88 percent of exports during the same year. Exceptionally high international prices have reversed (at least temporarily) a recent decline in oil production, as the additional price incentive has made deep-drilling and new fields economically viable. Nevertheless, with output from the largest two blocks—contributing more than 70 percent of total oil production—expected to decline by 70–75 percent within the next decade, the overall downward trend is clear, as projected new oil discoveries (less than 50 million barrels) will not be able to replace losses from the larger fields. Yemen is likely to become a net fuel importer by 2011, and to fully exhaust its reserves of crude oil by 2018.

In view of Yemen's high dependence on imports, and the expected decline in oil production and exports (which constitute the main source of foreign exchange proceeds), the question is not whether the exchange rate will depreciate, but rather, by how much and at what pace. Any depreciation should be guided by the equilibrium real effective exchange rate, which

would reflect both current and expected changes in fundamentals. In the next section, we review the theoretical arguments governing exchange rate determination in order to estimate the equilibrium rate for Yemen.

Figure 2. Yemen and GCC Countries, Real Effective Exchange Rates, January 1995--June 2006
(2000 = 100)
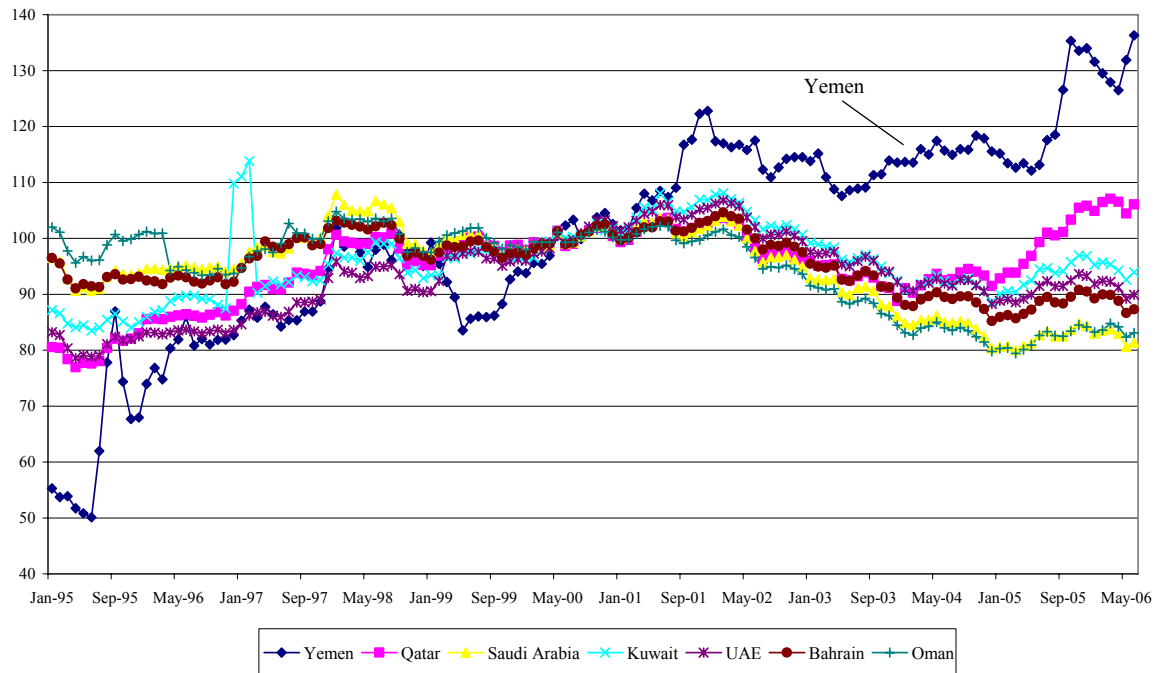
Source: Fund staff estimates.

III. ESTIMATING THE EQUILIBRIUM EXCHANGE RATE

There is a vast body of empirical literature on the determinants of the long-run equilibrium real exchange rate.[4] The general consensus in the literature is that purchasing power parity (PPP) performs poorly in explaining movements in the real exchange rate in light of the slow mean reversion of the real exchange rate. Recent work focuses on the relationship between the real exchange rate and such fundamental factors as productivity, terms of trade, capital flows, and net foreign assets (NFA).

Although most of the early work on equilibrium real exchange rates was done for industrial countries, Edwards (1986 and 1994) developed an equilibrium exchange rate model for developing countries. Taking the real exchange rate as the price of nontradables to tradables, Edwards defined the ERER as the level where the internal and external equilibrium are attained simultaneously. Edwards' approach attempts to capture the long run co-movements

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[4] For a good survey of the literature, see McDonald (1995) and Rogoff (1996).

of the equilibrium exchange rate with variables such as the terms of trade, trade openness, the fiscal balance, net foreign assets, and productivity growth.

Many authors have tailored Edwards' methodology to make it more amenable to individual country experience, as data availability and structural issues often vary widely from country to country.[5] The common key variables identified in such works generally include commodity price (or terms of trade), productivity differential vis-à-vis trading partners to capture the Balassa-Samuelson effect, some measure of fiscal policy (expenditure or fiscal balance to capture domestic demand), and net foreign assets.[6] Most of the findings conclude that the equilibrium real exchange rate generally appreciates with increases in these variables. The relative significance of various fundamentals differs, however, reflecting the economic structure of each country.

One strand of literature—focusing on the real exchange rate in commodity exporting countries—is particularly relevant for Yemen. MacDonald and Ricci (2003) analyzed the case of South Africa and found that real commodity prices, trade openness, the fiscal balance, net foreign assets, real interest rate differentials, and relative per capita GDP explain the long-run behavior of the real exchange rate. Given the limited financial linkages between Yemen and the global economy, the real interest rate differential would not be a key determinant of the real exchange rate. Cashin, Cespedes, and Sahay (2002) showed that there exists a long-run relationship between the real exchange rate and real commodity prices. Koranchelian (2005) showed that there is a time-varying real exchange rate in Algeria that can be explained by the real commodity prices and the Balassa-Samuelson effect.

IV. EQUILIBRIUM EXCHANGE RATE IN YEMEN

The projected decline in oil production is expected to have serious implications for the domestic economy, the conduct of macroeconomic policies, and the equilibrium exchange rate. To analyze the path of the equilibrium exchange rate in Yemen, we use the methodology of Edwards (1989). It is assumed that the path of the ERER will be affected by both current fundamentals and expected changes to these fundamentals.

We consider four fundamental variables that are expected to influence the ERER in Yemen: (i) external terms of trade; (ii) level and composition of government consumption; (iii) technological progress; and (iv) capital accumulation.

- ***External terms of trade:*** Given Yemen's heavy dependence on oil, oil price fluctuations have a major impact on the terms of trade and thus on the equilibrium

REER. Over the short run, high international oil prices will act as a buffer against declining Yemeni oil production—allowing for a more gradual depreciation of the ERER path. Similarly (and keeping in mind the ever-present potential for volatility in oil markets), a reversal of the recent oil price trend would have a large impact on the terms of trade and the equilibrium real exchange rate. Over the medium and long term, however, oil exports will play a progressively smaller role in the overall terms of trade relative to other commodities and basic manufactures.

- *Government spending:* The largest (structural) impact of the decline in oil production on the equilibrium real exchange rate path is expected to come from decreases in government expenditure.[7] Given that a relatively larger share of government outlays is spent on nontradable goods, increases in government spending have resulted in appreciation of the ERER in many developing countries. The expected secular decline in Yemen's oil revenues and the associated drop in government outlays (assuming the government reacts to declining revenues by curtailing expenditures), on the other hand, are likely to have the opposite effect. As government spending declines, the resulting relative excess supply in the nontradable goods markets will require a decline in nontradable goods prices for these markets to clear (i.e., to return to equilibrium). In terms of the ERER (measured by the ratio of the price of tradable to nontradables), this will result in a depreciation of the ERER of the rial.

- *Productivity and non-oil GDP growth:*[8] As discussed above, the decline in government spending, particularly on infrastructure and basic services, could (in the absence of a sufficient supply response generated by exchange rate depreciation) lead to lower productivity. This would in turn lead to downward pressure on the ERER via Balassa-Samuelson effects.

- *Capital accumulation:* the projected deterioration in government finances—due to the decline in oil exports and budgetary revenues—will increase competition for resources between the government and the private sector, both in the domestic market and for the purpose of financing international transactions. Domestically, this is expected to lead to upward pressure on real interest rates. On the external front,

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[7] The path of government expenditures as a percentage of GDP would have been expected to be much higher, if expectations of oil production levels were much higher for the outer period and the long run.

[8] The impact of change in productivity on the ERER is similar, from an analytical point of view, to that of the technological progress, or lack of it, identified by Edwards.

competition for increasingly scarce foreign exchange reserves will rise, which will lead to lower imports—including (potentially) purchases of capital equipment.[9]

Thus, the ERER path is likely to be affected by permanent changes in these four key areas. The increase in the oil price over the past two years has helped Yemen accumulate more reserves, which could be used as a cushion in difficult times. But the recent decline in the oil price (by close to $20 per barrel over a two-month period) serves as a reminder of the degree of volatility in this market. If the decline in oil production is accompanied by low oil prices, then this will have a sharper and more rapid impact on the exchange rate as it affects all the variables that determine the exchange rate. But even if the oil price remains high, the declines in government spending, productivity, and capital accumulation will dominate the medium- to long-term trend, leading to a depreciation of the ERER.

A. Data and variables

The real effective exchange rate and its key determinants are displayed in Figure 3.[10] As is true for many developing countries, the selection of time period in the study is dictated by the availability of reliable data and the fact that Yemen only started exporting a significant amount of crude oil in 1996. The following pattern emerges from the data during the period of 1996–2004:

- The real effective exchange rate has appreciated significantly since 1995 (consistent with the production and export of oil).

- Despite volatility in crude oil prices, oil production registered a secular increase until 2001 and then followed a declining path reflecting the aging of existing oil fields and only limited new discoveries.

- The accumulation of net foreign assets is broadly consistent with the pattern of oil production.

- The progress in expenditure restraint achieved during 1997–2000 has reversed itself in subsequent years.

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[9] The decline in NFA will lead to a deterioration of the ERER (net foreign asset channel based on Milesi-Feretti (2001–02), and Giavazzi and others (1988)).

[10] The variable definitions and data sources are listed in Appendix I.

Figure 3. Real Effective Exchange Rate and its Key Determinants
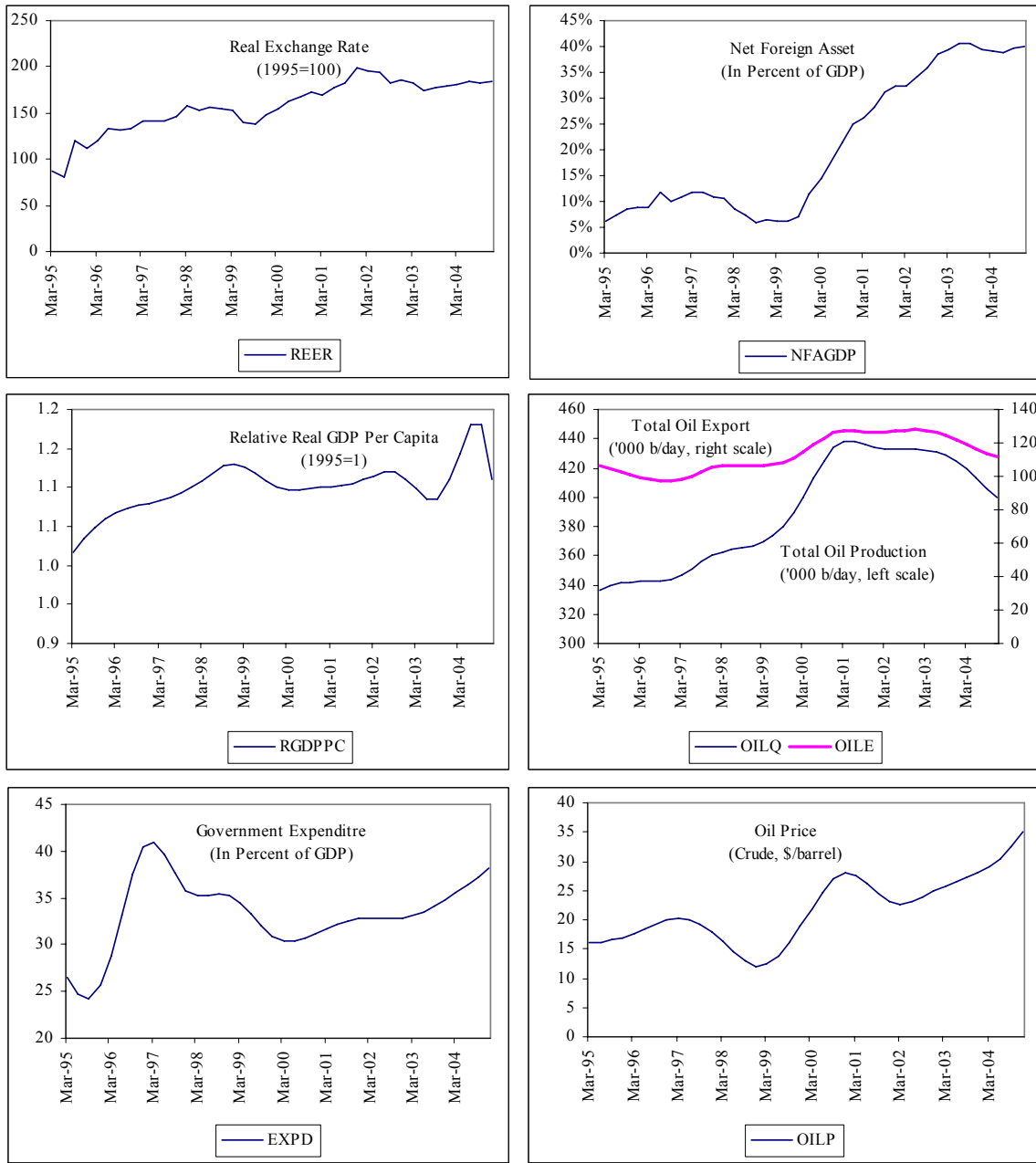
Sources: Yemeni authorities; and Fund staff estimates.

The limited availability of data (both the short sample period and the low frequency of observations) poses challenges for any estimation of the ERER.[11] The short sample period also dictates the choice of lag lengths used in the estimation method and limits the choice of sensitivity tests for the results.

B. Methodology

The existence of a long-run relationship between the real effective exchange rate in Yemen and the fundamental factors noted above can be estimated using a vector error-correction mechanism (VECM) specification based on the Johansen (1995) maximum likelihood estimator. The co-integrating vectors provide estimates for the effect of individual determinants of the equilibrium real exchange rate.

The Johansen methodology can be described as follows. Suppose a vector x_t has a VAR representation of the form below:

$$x_t = \eta + \sum_{i=1}^{p-1} A_i x_{t-i} + \varepsilon_t \,,$$

where x_t = [LREER, NFAGDP, EXPD, RGDPPC, LOILP]', η is a (nx1) vector of deterministic variables, the error term ε satisfies the standard assumption, and A_i represents a matrix of the appropriate (nxn) dimension. The VEC representation of the above relationship can be expressed as follows:

$$\Delta x_t = \eta + \Pi x_t + \sum_{i=1}^{p-1} \Gamma_i \Delta x_{t-i} + \varepsilon_t$$

where

$$\Pi = \sum_{i=1}^{p-1} A_i - I \,, \; \Gamma_i = -\sum_{i=1}^{p} A_i \,.$$

The rank of matrix Π indicates the presence of cointegration among the variables. If matrix Π has zero or full rank, there is no cointegration (log-run relationship) among the variables. For a reduced rank matrix, the number of cointegration relationships can be determined by using various statistical concepts such as trace statistics or maximum eigenvalue statistics.

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[11] To address the frequency problem, quarterly data is derived using cubic spline interpolation where quarterly data are not available.

C. Econometric Results

The econometric results of the alternative VECM specifications are presented in Table 1. The first column represents the specification suggested by the empirical literature mentioned earlier and includes the following variables: the real exchange rate in logarithmic terms (LREER), government expenditure as a percent of GDP (EXPD), real per capita GDP relative to trading partners (to capture the Balassa-Samuelson effect—RGDPPC), the logarithm of the Yemeni crude oil price (LOILP), the logarithm of total oil production (LOILQ), the logarithm of total oil export (LOILE), and net foreign assets as a percent of GDP (NFAGDP).

As noted in previous sections, the key policy challenge for Yemen stems from the rapid depletion of oil reserves. It is, therefore, imperative to understand how the level of oil production or export affects the exchange rate. The second, third, and fourth columns of Table 1 illustrate the impact of oil production and export, respectively, by replacing net foreign assets with oil production and export data.

All of the above specifications pass the relevant econometrics tests. At both the 5 percent and 1 percent level of significance, according to both the trace statistics and maximum eigenvalue statistics, there appears to be a unique co-integrating vector. In other words, the long-run relationship between the real exchange rate and the specified fundamentals is unique.

Table 1. Selected Results of the VEC

Regression	I	II	III	IV
Number of cointegrating vectors:				
Trace Statistics				
5 percent	1	1	1	1
1 percent	1	1	1	1
Eigenvalue Statistics				
5 percent	1	1	1	1
1 percent	1	1	1	1
Estimates of the cointegrating relationship with the real exchange rate				
LREER(-1)	1	1	1	1
EXPD	**-0.06**	**-0.02**	**-0.02**	**-0.02**
	[-4.55]	[-4.47]	[-7.68]	[5.78]
RGDPPC	-0.89	**-1.90**	**-2.07**	**-2.28**
	[-0.51]	[-3.92]	[-6.15]	[-6.27]
LOILP	0.03		-0.04	
	[0.41]		[0.93]	
NFAGDP	**-2.97**			
	[-4.71]			
LOILQ		**-1.52**		
		[-11.32]		
LOILE			**-1.78**	**-1.45**
			[-14.52]	[-14.19]
C	-1.51	6.61	6.32	4.88

Note: t-statistic are in square brackets. Bold numbers are at 1 percent level of significance.

D. Equilibrium (long-run) Relationship

The long-run relationship between the real exchange rate and its fundamentals can be summarized as follows:

- An increase (decrease) in net foreign assets by 1 percent of GDP is associated with an appreciation (depreciation) of the real effective exchange rate of about 3 percent. It should be noted that the relatively high coefficient of net foreign asset partly reflects the fact that Yemen's export base is rather undiversified.[12]

- Under an alternative specification, an increase (decrease) of total oil production by 1 percent is associated with an appreciation (depreciation) of the real effective exchange rate of about 1.5 percent. The result is very comparable (between 1.5-1.8 percent appreciation) when oil exports are used instead of total oil production (regressions III and IV, Table 1).

- An increase (decrease) in government expenditure of 1 percent of GDP is associated with an appreciation (depreciation) of the real exchange rate of 0.02 percent.

- Oil price does not appear to be statistically significant. This is most likely due to the fact that net foreign assets already incorporate the impact of higher oil prices on the real effective exchange rate.

E. Impact of Declining Oil Production on the REER

Declining oil production will have a significant structural impact on the economy. The very nature of the structural break warrants careful judgment in applying the results noted above for predictive purposes.[13] Nevertheless, even a preliminary assessment of the economic outlook over the medium term raises the prospect of a significant adjustment in the level of exchange rate.

- Oil production is expected to decline by some 25 percent over the next 5 years. Even under a conservative calculation using the coefficients cited above (regressions II–IV, Table 1), such a decline in production translates into a depreciation of the real exchange rate by around 40 percent.[14] A real exchange rate depreciation of this magnitude will likely require a substantial decline in the nominal exchange rate,

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[12] For other commodity exporting countries that have a comparatively more diversified export base, this coefficient can be expected to be smaller. For example, MacDonald and Ricci (2003) reports that, in South Africa, an increase of net foreign assets by 1 percent of GDP is associated with an appreciation of the real exchange rate by 1 percent.

[13] It is assumed that the system estimated in Table I-1 is in equilibrium over the long run.

[14] The inclusion of LNG production does not significantly change the outlook for this period.

given limits as to how much inflation can be reduced by using restrictive macroeconomic policies. Given the pass-through of depreciation to domestic inflation (see the twin working paper on an alternative monetary policy framework), it is unlikely that most of the future depreciation in the real exchange rate would come through reduced inflation.

- Similar results emerge if the co-integrating vector with net foreign assets is used instead of oil production (regression I in Table 1). A decline in net foreign assets—from 40 percent of GDP in 2004 to about 15 percent in 2010—would be associated with a decline in the real effective exchange rate of over 70 percent.

- One interesting implication of the above result is that a decline in the real exchange rate by, for example, 50–60 percent over the next five years as the economy runs out of oil will bring the real exchange rate to pre-1995 levels, when oil production was minimal. This finding echoes the theoretical claim in Giavazzi (1998) that the real exchange rate appreciates following a resource discovery, then gradually declines as the economy runs out of the resource.

F. Impact on the Nominal Exchange Rate: An Illustrative Exercise

Depreciation of the real exchange rate would need to come either through a fall in the nominal value of the rial, a reduction in inflation, or both. However, these two channels are not independent given the high degree of exchange rate pass-through effects on inflation. Given limits as to how much inflation can be reduced through macro policies (including through a restrictive fiscal policy), it is useful to illustrate the implications of the required depreciation of the REER (with an assumed level of inflation) on the nominal exchange rate.

Under a long-run inflation assumption of 5 percent for Yemen and 2 percent (consistent with the WEO inflation for advanced countries) for its trading partners, a cumulative decline of the real exchange rate of 40 percent over the next five years implies an annual nominal depreciation of the rial by 14 percent. Obviously, in the absence of supportive fiscal policy, inflation could turn out to be higher, which would significantly increase the required nominal depreciation associated with a certain level of real exchange rate. This estimate also does not take into account the impact of the depreciation on the rate of inflation, and is therefore only a first-round impact.

The findings above highlight the policy challenges facing Yemen, especially with regard to the exchange rate regime, as the authorities prepare for "life after oil." The depletion of the principal source of export and fiscal revenue will induce a large depreciation of the real exchange rate over the long run. Since a large part of this adjustment will likely take place through movements in the nominal exchange rate, any sustained effort to persistently stabilize the exchange rate will lead to growing and unsustainable imbalances—possibly leading to sharp and painfully large depreciations in the nominal exchange rate. The following section examines some of the policy implications associated with such adjustments, particularly with regard to the most appropriate exchange rate regime.

V. EXCHANGE RATE REGIME OPTIONS

The analysis above illustrates the clear need for a significant depreciation of the rial in real effective terms as Yemen transitions to a non-oil economy. The key question remaining is how to best accomplish such a depreciation over the medium term. The immediate risk is if the monetary authorities continue to tightly manage the exchange rate even in the face of declining oil production—in which case a forced and perhaps disorderly adjustment at some point in the future may be inevitable. A more appropriate policy stance would be to enable a more gradual adjustment over time, and in conjunction with clear signals to the economy to adjust to the new reality. The sooner such adjustment begins, the less change would be needed in the future.

The central bank's approach to managing the exchange rate shows clearly a revealed preference for stability—although never explicitly mentioned as such. This preference is not without its own logic. The stability of the rial is, in and of itself, important in maintaining price stability given the high degree of pass-through from exchange rate depreciation to inflation. Further, in Yemen, as with a number of countries in the region, the relative stability of the exchange rate weighs far more heavily in the public's perception of policy performance than other macroeconomic indicators—creating an environment where economic success is perceived as synonymous with keeping the exchange rate stable. As demonstrated in earlier periods of exchange rate instability, public criticism tends to sharpen (and market confidence tends to wane) when the value of the rial declines too quickly.

This preference for a steady nominal value of the rial notwithstanding (and given practical limits on how far macroeconomic policies can be tightened) the magnitude of the coming adjustment to a non-oil economy strongly suggests that the exchange rate must bear part of the burden. While some countries in the region have managed to ride out real shocks while maintaining a fixed or exchange rate, the nature and magnitude of the shock confronting Yemen from dwindling oil reserves argues strongly in favor of downward flexibility. In the face of negative real shocks, a depreciation of the exchange rate would help improve competitiveness and external sustainability, and develop non-oil sectors to compensate at least partially for the loss of oil production over the long term. A credible nominal anchor, such as an inflation objective (see Chami et al, 2006), could be used to guide monetary policy while allowing shifts in external and internal balances to determine the appropriate exchange rate.

The key question thus becomes what kind of exchange rate regime is best, in the Yemeni context, to smoothly move the real effective exchange rate to its long-term equilibrium value. Given the difficulty in estimating the real effective exchange rate, it would be ideal to let market forces lead the movement in the exchange rate. Thus, a freely floating exchange rate is the natural choice in this context of severe real shocks. But given the shallow and immature exchange market, which is dominated by the central bank, and the continuous need to manage the exchange rate—given its importance politically and its impact on inflation—a freely floating exchange rate may not be acceptable to policy makers and thus not a practical solution. In addition, given the public fixation on exchange rate stability, the CBY would

need to lead the market in line with changes in economic fundamentals. The question thus becomes whether the CBY should follow a crawling peg or a managed float.

While Yemen's approach to exchange rate management might best be described as a managed float, recent performance might also suggest something akin to a crawling peg vis-à-vis the U.S. dollar. Although the CBY does not announce a target for the value of the rial, central bank operations would seem to suggest a strong preference for keeping day-to-day changes in the exchange rate within a very narrow band (Figure 4). The end result is effectively equivalent to setting a forward-looking target, and calibrating foreign exchange auctions in such a way as to lead the market toward this target.

Figure 4. Yemeni Rial -- Daily Exchange Rate* Versus US Dollar
January-August, 2006

*Some data extrapolated due to incomplete reporting.

Source: Central Bank of Yemen
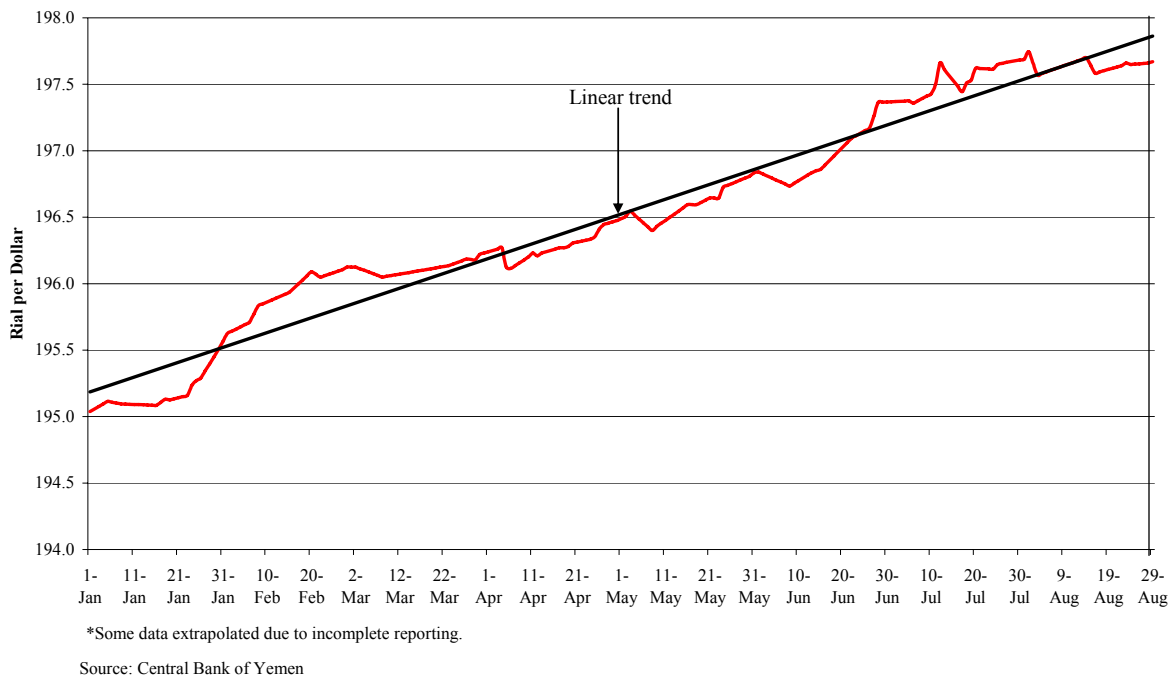
From a medium-term perspective, the objective of either a managed float or a crawling peg exchange regime should, by nature of the projected shift in underlying fundamentals, be the same. In other words, whether the rial is to move in pre-determined steps under a crawling peg, or through a more discretionary arrangement under a managed float, the end result should be a depreciation of the REER in line with the equilibrium rate. The difference between the two regimes might best be characterized in terms of public transparency and disclosure, and the institutional requirements needed to support each regime. These factors have a particular relevance for Yemen, where public understanding of the dynamics of exchange rates appears limited, and institutional capacity is relatively weak.

From a theoretical perspective, a crawling peg would seem suited to the real shock Yemen is to face as oil production declines. While short-term volatility in the price of oil (and hence the level of foreign exchange earnings and government revenue) will always represent a risk, the overall path of oil depletion can be quantified and reasonably forecast.[15] As demonstrated in the preceding section, this downward trend in oil production can then be equated to a level for the real effective exchange rate necessary to maintain internal and external equilibrium—an effective depreciation of the rial of 1.5 percent for every 1 percent decline in oil production.

The quantitative framework noted above could—in the presence of sufficient institutional capacity—provide the basis for a managed depreciation via a crawling peg. The central bank could initiate the practice of pre-announcing a periodic rate of depreciation, either as a firm number or as a function of inflation, and support the pre-announced path for the exchange rate by intervention in the foreign exchange market and by adjusting interest rates on its facilities. If implemented effectively, this approach could avoid large and persistent disequilibria between the nominal and real effective exchange rate, as well as provide a transparent framework for monetary policy. It would also provide a fairly transparent mechanism for leading the market toward the equilibrium exchange rate and, over time, accustom the market to periodic changes in the value of the rial.

While theoretically appealing, a crawling peg is not a perfect solution to managing an economic transition. Cross-country experience with crawling pegs has been mixed. Reflecting the emphasis on emerging market cases, much of the literature since the 1990s focused on cases where intermediate regimes, such as crawling pegs or exchange rate bands, had to be abandoned in the face of large capital flows.

There are, however, some lessons to be drawn from countries where intermediate regimes were used successfully, in conjunction with other macroeconomic and structural policies, to facilitate a transition from a fixed to a flexible exchange rate regime. In Chile during 1985-90, for example, the authorities moved from a fixed exchange rate to an exchange rate band in an effort to allow the peso to depreciate, stimulate the economy, and create dynamism in the export sector. The strategy was successful, but was later abandoned in favor of a floating rate regime with inflation targeting. Nicaragua also adopted a crawling peg at the beginning of 1993 in an effort to address, among other issues, a deepening balance of payments crisis. The córdoba was first devalued by 400 percent, and the exchange rate was then programmed at a nominal depreciation of about 1 percent per month against the U.S. dollar. Supported by a range of macroeconomic and structural reforms, the strategy was essentially successful.

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[15] Medium- or long-term projections become increasingly problematic given the potential for new discoveries of oil, or alternative resource exploitation (such as natural gas) that would effectively supplant some of the lost oil production and hence lessen the need for rial depreciation.

Perhaps the most important lesson from cross-country experience is that the adjustment objectives implicit in the intermediate regime (or, indeed, any regime), such as a real effective depreciation to boost economic activity and nontraditional exports, must be accompanied by supportive monetary and fiscal policies, as well as structural reforms.[16] In addition, inflationary expectations arising from the expected depreciation of the currency under a crawling peg might negate the objective of such a regime, as it prevents the depreciation of the real effective exchange rate.

From a Yemen-specific perspective, a formal crawling peg regime carries with it some distinct downside risks—partly dependent on the degree of public transparency that is attached to the regime. A number of these risks stem directly from operational concerns, which in turn arise from weaknesses in the authorities' policy framework. These include:

- Competing objectives (competitiveness via exchange rate depreciation, versus inflation control through defense of a given peg value) could complicate management.[17] Cross country experience suggests that that crawling pegs—even if not under *external* pressure—can be subject to considerable *internal* struggle between the monetary authorities and the government and/or vested interests.

- Supporting fiscal policies may be difficult to secure. Countries with successful soft pegs and other intermediate regimes have relied on complementary macroeconomic policies—particularly fiscal discipline. Yemen's record in this area (Figure 5) raises questions about the level of fiscal discipline that can be expected—particularly during a period of adjustment, when pressure for government spending will be strong.

- Defending the peg could prove expensive—both in terms of foreign exchange reserves and the impact of higher interest rates on output.

- The relatively weak state of the liquidity management framework would also complicate monetary management around an exchange rate anchor—making the central bank's task even more difficult when capacity is relatively low.

A softly managed float—based on the same guiding principles as a crawling peg, but with no pre-announced target or exchange rate band—offers some advantages in the Yemen context. First and foremost is that any floating regime (managed or not) does not require the CBY to preannounce a path for the rial. While in-house analysis in the central bank should take full

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[16] Eichengreen (2000).

[17] A relevant example is Hungary, which operated a crawling peg up until 2001, when the central bank moved to inflation targeting. Prior to that shift, the government pushed for devaluation to boost exports, while the central bank favored a tighter peg to lower import prices and maintain control over inflation.

advantage of forward looking projections and the likely path of the equilibrium exchange rate, the CBY's credibility would never be publicly tied to a particular target for the rial. Rather, there would be an implicit understanding (as there may already be, given the path of the rial over the last few years) that the CBY will lead the rial through a gradual depreciation in line with economic fundamentals, while resisting unwarranted volatility.

While this approach could be taken as somewhat less transparent than a formal crawling peg regime or pre-announced exchange rate band, it reflects the realities of the current situation in Yemen. First, accurately projecting the equilibrium exchange rate and the required adjustment of the REER is difficult even in the best of circumstances. While the CBY may be able to develop sufficient capacity in this area over time, tying the central bank to public targets for the exchange rate would represent an unjustified burden at this stage. Further, the utility of "informing the market" is limited in Yemen given that: (i) the general public (at least in the short run) would generally fail to appreciate the necessary downward adjustment of the rial in the face of declining oil exports; and (ii) inflationary expectations are unduly influenced by the nominal value of the rial.

A discretionary managed float also has several other points in its favor:

- **Continuity**. The CBY has operated a managed (floating) exchange rate regime since mid-1996, and with a reasonable degree of success. The costs of shifting to a new regime, both in terms of public confidence and building new capacity, would seem high when the benefits of a soft-peg have yet to go beyond the theoretical.

- **Focus on inflation.** A more flexible exchange rate regime in the form of a softly managed float would, in principle, allow the central bank to focus more on price stability, and would facilitate the move toward supporting an inflation objective.

- **Rapid adjustment.** While a central principle should be to manage the exchange rate in such a way as to gradually guide the market toward the equilibrium rate, the CBY would be free to adjust its target more rapidly in the face of shifting economic fundamentals. This could be particularly relevant should the recent surge in crude oil prices begin to unwind.[18]

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[18] In 1998, for example, the price of crude oil declined by an average of 4 percent per month—which levied a heavy toll on Yemen's foreign exchange reserves in the face of limited exchange rate flexibility.

VI. CONCLUSIONS

The objective of this paper was to analyze the impact of the expected decline in oil production in Yemen on the equilibrium real effective exchange rate and to investigate what kind of exchange rate regime would ensure a smooth transition to a non-oil economy. Using Edwards (1994) methodology, the real effective equilibrium exchange rate was estimated on the basis of expected changes in fundamentals, such as oil production, net foreign assets oil production, and government expenditures. While estimating the real exchange rate is not an easy task especially in view of data limitations and the sensitivity of the estimation to estimation techniques, it nevertheless shows that the REER would need to depreciate significantly over the medium term.

Ideally, a floating exchange rate regime offers a viable means of facilitating the transition to a non-oil economy and a real effective depreciation of the rial. But given the shallow and imperfect exchange market, it is preferable if the central bank "lead" the market toward a path of exchange rate adjustment consistent with a medium-term internal and external equilibrium. While a crawling peg could formalize such a role, it may well be costly both in terms of the CBY's credibility and the stock of reserves in the short-to-medium term. In addition, under a crawling peg, inflationary expectations would tend to negate the impact of the nominal depreciation on the REER. A softly managed float, while somewhat less transparent, would be easier from an operational perspective, and would preserve the CBY's central mandate of maintaining price stability (albeit with limited monetary instruments to achieve this objective).

Whatever exchange regime is adopted, however, its success depends to a large extent on supporting policies. With respect to macroeconomic policies, two fundamental pillars of future stability will be a medium-term fiscal framework that can support both tighter expenditure management and better revenue collection, and a more formal monetary policy framework that allows the authorities to take a proactive approach to monetary management. On the structural side, a range of microeconomic measures aimed at improving the investment environment will be critical to boosting investment, growth, and employment.

Appendix I. Variables

The econometric analysis is based on a quarterly dataset from 1995 to 2004. Where quarterly data are not available, we generate the quarterly data from annual frequency using cubic spline interpolation method. Any variable preceded by the initial "L" is the logarithm of the variable (e.g. LOILP stands for the log of oil price, OILP).

- **LREER: Real Effective Exchange Rate**. In logarithmic terms. INS.

- **NFAGDP: Net Foreign Asset**. In percent of GDP. Net foreign asset of the Central Bank of Yemen. Source: Yemeni authorities.

- **RGDPPC: Real GDP per capita relative trading partners**. Normalized to one for each country. The real GDP for trading partners is calculated as the trade-weighted average of the individual real per capita GDP. Source: World Development Indicators, World Bank.

- **EXPD: Government Expenditure**. Total government expenditure as a percent of GDP. Source: Yemeni authorities.

- **OILP: Oil Price.** Oil price for Yemeni crude per barrel.

- **OILQ: Total Oil Production**. In thousands of barrel per day. Source: IMF

- **OILE: Total Oil Export**. In thousands of barrel per day. Source: IMF

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