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Fiscal Break-Even Prices Revisited: What More Could They Tell Us About OPEC Policy Intent?

This commentary by Ali Aissaoui, Senior Consultant at APICORP, is published concurrently in the Middle East Economic Survey (MEES) dated 13 August 2012. The views expressed are those of the author only. Comments and feedback may be sent to <aaissaoui@apicorp-arabia.com>.

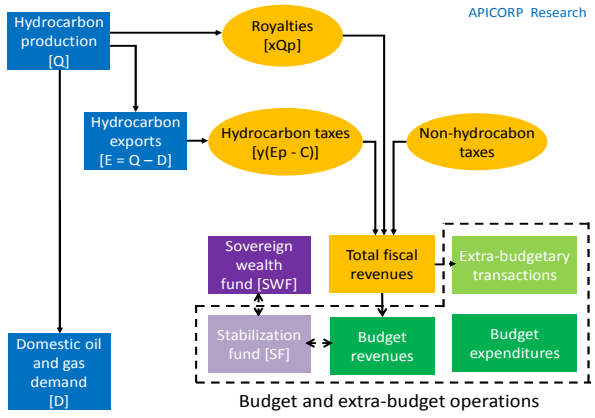
1. Unarguably, oil producing countries' fiscal positions are far from being a determinant of international prices. Yet energy economists – especially oil market analysts – are tempted to embrace the concept of a fiscal break-even price, realizing that it could provide a useful guide to price and production policies within the Organization of the Petroleum Exporting Countries (OPEC). In this context the concept is commonly defined as the oil price that balances government's budget.

2. In light of significant budgetary changes in key OPEC member countries, in particular the expansion of spending programs in Saudi Arabia and the contraction of fiscal revenues in Iran, we have updated our previous findings.[1] While focusing our efforts on improving the underlying modeling assumptions, as well as data collection and interpretation, we have kept to the methodological framework developed in the past. This consists of articulating short term and long term approaches to assess current fiscal positions and future fiscal sustainability.

Current fiscal positions

3. The fiscal sphere is of particular concern to OPEC governments, as revenue receipts and public spending have a major impact on their national economies. Figure 1 suggests that governments' budget and extra-budget spending are mostly funded from hydrocarbon rent. The rent – simply defined as revenue above industry costs and returns – is captured through royalty and hydrocarbon taxes. It flows to the fiscal sector together with non-hydrocarbon fiscal revenues as well as investment income from current account surpluses put in a sovereign wealth fund (SWF). All or part of these revenues are spent on public goods, ie security, health, education, social infrastructure and other welfare programs, not to mention public debt servicing.

Figure 1: A Typical OPEC Government's Fiscal Sector



4. Accordingly, a fiscal break-even price is the oil price that contributes to balancing the budget and extra-budget operations illustrated in Figure 1. Starting with the simple identity that government's expenditures should equal hydrocarbon fiscal revenues (HFR) plus non-hydrocarbon fiscal revenues (NHFR) plus any contribution from a SWF, we derive from Equation 1 in Box 1 a fiscal break-even price in Equation 2. In doing so, we assume no exchange rate effect. It is worth noting in this regard that hydrocarbon exports, from which derive the bulk of fiscal revenues, are generally denominated and paid in dollars, while government budgets are run in national currencies. Therefore, the effects of exchange rate on balancing the budget should not be ignored in other contexts.

Box 1: Modeling The Fiscal Break-Even Price

Using the framework described in Figure 1, we derive annual government's budget revenues (GBR) as:

$$GBR = xQ\alpha p + y[E\alpha p - C] + NHFR + rSWF + \Delta SF \quad [1]$$

Where:

- Q is commercial production of hydrocarbon;
- E is hydrocarbon export;
- C is the hydrocarbon industry's full-cycle cost;
- NHFR is non-hydrocarbon fiscal revenue;
- r is the return on SWF;
- SWF is the value of financial assets accumulated in a Sovereign Wealth Fund;
- ΔSF is the flow to and from a Stabilization Fund;
- x is hydrocarbon production-weighted royalty rate;
- y is the average rate of hydrocarbon taxation;
- p is the average oil export price.

Assuming returns from SWFs are re-invested and ignoring, as justified in the text, ΔSF, we derive the fiscal oil break-even price, from equation 1, as:

$$p = \alpha^{-1} (EXP - NHFR + yC)/(xQ + yE) \quad [2]$$

Where:

- EXP is budget and extra-budget expenditures
- α is an oil-natural gas price adjustment factor relative to the value of OPEC basket of crudes.

5. Assuming returns from SWF are re-invested and budgets are balanced (no flows to and from the stabilization fund SF), government's budget revenues are reduced to hydrocarbon fiscal revenues (royalties and hydrocarbon taxes) plus non-hydrocarbon taxes. In this case, and as indicated in Equation 2 (Box 1), the break-even price can be presented as a quotient of two elements. The numerator is the algebraic sum of government expenditures, non-hydrocarbon fiscal revenues and the portion of costs incurred by the hydrocarbon industry, pro-rata share of taxes. The denominator is the sum of pro-rata share of royalty and taxes of respectively commercial production and exports. Furthermore, as the break-even price is expressed in terms of the value of the OPEC basket of crudes, an adjustment factor α is introduced to take into account the price differentials of crude oil, oil products and natural gas, relative to that value.

[1] *MEES,* 14 March 2011.

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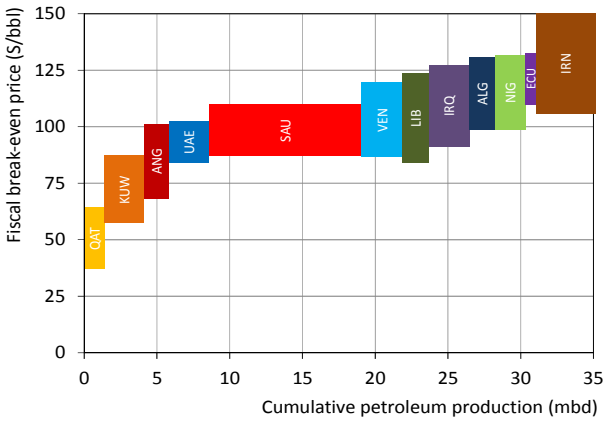
6. The above model is relatively straightforward to implement. However, gathering and analyzing the needed data can be tedious and frustrating. In particular, fiscal data are tied to the tracking of budget revisions found in supplementary and complementary budgets. They further depend on the degree of transparency of extra-budgetary transactions that prevailing institutional arrangements fail to capture entirely.[2] Just as problems with cost data arise from the need to develop a full life-cycle cost view of hydrocarbon production. In addition to the cost of producing and supplying hydrocarbons to the markets, this should factor in the costs of finding and developing new reserves to replace those produced.

7. Once countries' break-even prices are computed, it is easy to generate a fiscal cost curve. As shown in Figure 2, a reasonable approximation to such a curve is obtained by ranking each OPEC country output (oil, NGLs and GTL), from lowest to higher price. The curve provides timely insight into the fiscal challenge facing some countries (or the investment opportunities offered to others) when market prices are lower (or higher) than their break-even prices. It also provides some hints about the production policy options available to different members within OPEC, which are examined further below. Before that, the large inter-country variations and intra-country estimate ranges displayed in Figure 2 require some explanation.

Figure 2: Fiscal Cost Curve for 2012

[Bar width: country's production; bar heights: price estimate ranges]



8. Median estimates of fiscal break-even prices for 2012 vary from $53 per barrel for Qatar to $127 per barrel for Iran. In between, Saudi Arabia's break-even price is estimated at $94 per barrel, slightly lower than the OPEC output-weighted average of $99 per barrel. Explanations for these inter-country variations include differences in the structure and cost of the hydrocarbon industry as well as the degree non-hydrocarbon fiscal revenues contribute to balancing budgets. Additionally, different structures of exports translate, in the current market context, into a price adjustment factor (α) varying from basically 1 for non-gas exporters, such as Saudi Arabia, to about 1.35 for Algeria and 1.45 for Qatar. Furthermore, intra-country sensitivity analysis reflects revenue and spending uncertainty, which is, obviously, greater in the case of Iran.

9. These individual differences notwithstanding, OPEC's weighted average fiscal break-even price stays within a relatively narrow range of $90-110 per barrel. Evidence that the most influential member, Saudi Arabia, lies within that range strengthens the chances of making the fiscal break-even price a reliable predictor of price preference for OPEC as a group.

10. Member countries' contrasting preferred prices are a reflection of their heterogeneous and, for some, uncertain fiscal positions. Those whose fiscal break-even prices are higher than market price should not be expected to be comfortable with status quo. They would try and persuade the opposite side to lower the aggregate production ceiling and individual output quotas either pro-rata or otherwise. The expectation would be for market prices to increase to meet their higher break-even prices, even if that means losing some volume. The problem, however, would not so much be of implementation. After all, OPEC members have grown fairly skilled at handling complex bargaining. Rather, it is how to validate and justify it in the first place.

11. The ultimate truth is that no OPEC member can set expenditures which depend on other members surrendering market share. Furthermore, countries would just spend what they could afford. As stated by John V Mitchell, high spenders have no escape but to adjust their fiscal policies and bring their spending closer to their revenues. As a matter of fact, their preferred prices are more an indication of their preferred spending than any price they are likely to achieve.[3]

Future fiscal sustainability

12. In contrast to the short term approach, where break-even prices have tentatively been estimated on a country-by-country basis, the long term approach models OPEC as a group. Furthermore, instead of computing new fiscal break-even prices, we hold constant the weighted average range of $90-110 per barrel found previously to determine whether it could sustain future stable levels of spending for the group.

13. From this perspective, our assessment of fiscal sustainability derives from Milton Friedman's permanent income hypothesis (PIH). In its usual formulation, PIH states that the choices made by consumers regarding their consumption patterns are determined not by current income but by their longer term income expectations. Translated to governments – provided they are forward looking – Dr Friedman's premise would mean that their spending is akin to consumption and therefore would be determined in a similar way. Under this assumption, sustainable government spending would be approximated by the annuity value of expected revenues. Formally, such a stable spending would be determined using Equation 3 in Box 2. It is the net return on both financial assets (stemming from current account surpluses) accumulated in a SWF and the net present value of fiscal revenues, the bulk of which are expected from the exploitation of the remaining proven reserves.

[2] Richard Allen and Dimitar Radev, "Extrabudgetary Funds", IMF, Technical Notes and Manuals, Fiscal Affairs Department, June 2010.

[3] Paraphrased from an email sent by John V. Mitchell, co-author with Paul Stevens of "Ending Dependence - Hard Choices for Oil-Exporting States", Chatham House, London: 2008.

14. It should be noted that alternative models exist. While adhering to a permanent income that relates producers' fiscal policy to their hydrocarbon wealth, our preference goes to the aforementioned model. This is in contrast to using the non-hydrocarbon balance as a key indicator of long term fiscal sustainability. Indeed, the different definitions of the non-oil balance adopted, which depend on the purpose for which this indicator is used, make estimates hardly comparable.[4]

Box 2: Fiscal Sustainability – Using PIH

The economic literature on the use of Milton Friedman's Permanent Income Hypotheses (PIH) is extensive, but dominated by the IMF's empirical case studies.

PIH provides a simple framework for assessing fiscal sustainability. Accordingly, sustainable government spending (GC), at any time t, is determined by the annuity value of expected financial and hydrocarbon revenues as expressed in equation 3:

$$GC_t = GC = r\,[SWF_{t-1} + \sum_{n=0,N} HFR_{t+n}\,(1+d)^{-n}] \quad [3]$$

Where:

- $SWFt_{-1}$ is the value of financial assets accumulated in a sovereign wealth fund at the end of the previous year, in constant prices;
- FR_n is the fiscal revenue in period n, both hydrocarbon (captured through royalty and taxes) and non- hydrocarbon, in constant real prices;
- r is the expected real rate of return on SWF;
- d is the discount factor,
- N is the number of years until hydrocarbon reserves are depleted.

15. The main determinant involved for calculating the annuity value (sustainable government spending) is OPEC depletion policy and the resulting production profile. Despite revising its projections downward on concerns of lower demand growth and further uncertainty about the extent of non-OPEC supply from unconventional sources, OPEC does not anticipate a plateau for its crude oil, NGLs and GTL before 2035. At that horizon, the call on OPEC would be 49.3mn b/d in the 'Reference Case',[5] slightly higher than the 48.7 mbd of the IEA's central scenario – the 'New Policies Scenario'.[6]

16. Other important determinants of fiscal revenues include export prices, governments' fiscal take, discount factor and long term population dynamics. They are calibrated as summarized in Table 1 and briefly expounded upon below.

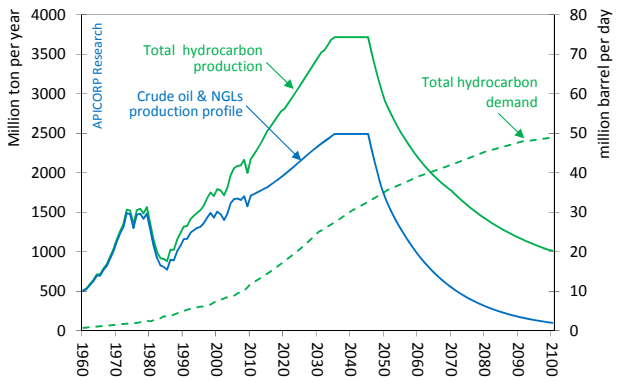
Table 1: Basic Assumptions for OPEC Revenue Simulations

Reference date: 2011	Assumptions	Remarks
Proven hydrocarbon reserves	254 Gtoe + 25% reserve growth and Y-to-F	Y-to-F: Yet to find from undiscovered resources
R/P ratio	113 years	Simulation horizon : 2100
Petroleum production profiles	Crude oil & NGLs	Tuned to OPEC's Reference Case to 2035 (2011 WOO)
Hydrocarbon export prices	0.70 of OPEC basket vakue	Prices moving together in the long run
Domestic pricing	At average cost	No rent extracted on domestic consumption
Governments' take	70% of export take	Past 5-year calibration, declining to 60% in 2035
Discount factor	5% real	Up-pricing of risks - Long term horizon
Population	410 million, doubling in 2050	Dynamics depends on labor imports in OPEC's GCC
APICORP Research using statistics from OPEC, IEA, BP and own assumptions		

- OPEC proven hydrocarbon reserves have been revised upward to 254 billion tons of oil equivalent (toe), at the end of 2011. These reserves are 66% crude oil and NGLs and 34% natural gas. Yet-to-find would raise proven reserves by 25%.
- The R/P ratio (proven reserves over production) is about 113 years at the end of 2011. As it is static, this ratio is not used to indicate a time to depletion but to justify the long-term timeframe for the analysis up to 2100.
- Hydrocarbon exports are valued at international prices. The ratio of the average export price to the value of the OPEC basket of crudes, taken as a reference price, is 0.70.
- Domestic energy supply of oil products and natural gas is valued at cash cost.
- As a result of rising costs, government's fiscal take is assumed to decline from 70% of the total value of exports in 2011 to 60% in 2035 for OPEC as a whole.
- The discount factor of 5%, which reflects both time preference and risk, is concurrent with a very long-term horizon.
- Finally, to factor in the effect of population dynamics, our calculations and results are expressed in per capita terms. In this regard, despite a continuously decreasing rate of growth, OPEC's population is expected to double by mid-century from the current level of some 410 million.

17. On this basis, Figure 3 illustrates a baseline scenario, tuned to current OPEC's 'Reference Case'. Combined oil and natural gas production profile reaches a maximum of 3.715bn toe in 2035, beyond which aggregate hydrocarbon exports start to decline. The falling off after a 10-year plateau is moderated by the greater weight of gas production in the long term. Another critical time occurs when domestic demand exceeds production around 2065 and, as a consequence, hydrocarbon rents dry out. Obviously, some member countries would face declining exports much sooner than 2035.

Figure 3: Baseline Production Profiles



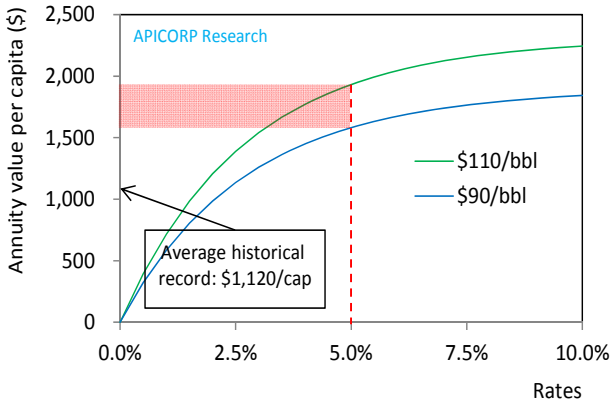
[4] For an extended discussion of this approach, see Paulo Medas and Daria Zakharova, "A Primer on Fiscal Analysis in Oil-Producing Countries", IMF Working Paper WP/09/56, March 2009.
[5] OPEC, *World Oil Outlook,* 2011.
[6] IEA, *World Energy Outlook,* 2011.

18. Notwithstanding the implicit trend that may be inferred from Figure 3, that prices might rise above inflation, the resulting simulations are based on the adopted range of $90 per barrel to $110 per barrel kept constant in real terms. As expressed in Equation 3 (Box 2), the annuity values are computed as returns on both the value of accumulated financial assets and the net present value (NPV) of hydrocarbon fiscal revenues.

19. The resulting values are plotted in Figure 4 for both oil price bounds as a function of the NPV discount factor. To simplify this figure, the discount factor has been identified with the rate of return. Otherwise, the interpretation of results would have been hampered by the co-existence of the two interest rates. However, these rates should not be confused with each other. The former, which reflects time preference, is used to discount future fiscal revenues. The latter is used to predict future returns from investing current account surpluses. Raising the first rate lowers the net present value of fiscal revenues (NPVFR) on which the annuity is based, whatever the investment return; raising the second adds to the annuity, whatever the NPVFR.

Figure 4: Annuity Values of Expected Fiscal Revenues

(Discount factor and rate of return are identified)



20. What Figure 4 attempts to capture is the difference between expected and realized income. It shows the range of per capita annuity values corresponding to a discount factor of 5% and an oil price of between $90 per barrel and $110 per barrel. Values in that range are about 50% to 70% above the historical 50-year average real per capita of $1,120. [7] This should not come as a surprise considering the long hydrocarbon industry depression that lasted from the early 1980s to the early 2000s. Furthermore, while per capita averages had been slightly lifted by recent upward trends in oil prices, returns from SWF investments were being adversely impacted by the global financial crisis and aftermath. Far more important, however, is whether the results shown in Figure 4 should be interpreted as an indication that OPEC, as a group, will be fiscally more comfortable in the long run. This question cannot reasonably be answered without a more thorough investigation into governments' future patterns of spending and revenue, which is well beyond the scope of this analysis.

[7] All real values have been computed using OPEC's inflation and currency adjustment methodology and data.

Conclusions

21. In light of significant budgetary changes in key countries, we have provided an update of fiscal break-even prices within OPEC. Keeping to our traditional two-step analytical framework we have estimated current levels, then testing whether, if held constant in real terms, they could sustain future stable governments' spending.

22. In the first part of the analysis we have re-drafted the fiscal cost curve for OPEC member countries in an attempt to shed timely light on the likely individual and group policy behavior. On the one hand, it can be claimed that fiscal break-even prices are dependable predictors of price preferences within the group. On the other hand, member countries' failure to develop a common policy may be attributed to their heterogeneous and, for some, uncertain fiscal positions. This is no matter how close to OPEC's weighted average fiscal break-even price – currently in a range of $90-110 per barrel – the most influential member, Saudi Arabia, may be.

23. In the second part we have focused on an inter-temporal fiscal sustainability analysis, assuming OPEC – taken as a group – would be investing its surplus funds in financial assets. In doing so we have implicitly admitted that the bulk of budget spending are current expenditures that yield no long term returns. The consequence is that spending is implicitly kept low to enhance future financial returns. If we assume instead that government expenditures include a non-negligible investment component then spending upfront may be a better course of action. This is valid provided the returns from domestic social and physical investment are higher than those from financial investment abroad. Using oil and gas revenues today to diversify their economies and progressively shift their reliance away from hydrocarbons may enable OPEC member countries to secure a more viable and sustainable economic development. Whatever their resulting spending patterns might be, it would affect their fiscal break-even prices and hence their oil price preferences and production policy intents. The challenge that still remains is to translate these intents into a common and credible policy.

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