


Evaluating Fiscal Regimes
for Resource Projects:
An Example from Oil Development


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Design and execution of an upstream taxation regime for natural resources (2)
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Purpose and Outline

- Challenges for fiscal regime design (*where private investment involved*)
- Criteria for evaluating fiscal regimes
- Indicators for measuring criteria
- A summary approach
- Current terms for “Mozambique”
- Evaluating an alternative
- International benchmarks




Coverage

- Evaluation from viewpoint of government
- Task closely related to company appraisal of projects
- Using building block of field development, from which to “solve backwards” to exploration decisions (exploration decisions require probabilities for development outcomes, and failure.)
- What does fiscal regime imply about “prospectivity”? (IMF staff not attempting geological assessment!)
- Procedure at this stage similar for mining, while exploration issues differ
- Focus on regimes in Africa, with other comparisons
- “Mozambique” taken as stylized example
- Health warnings about comparisons.

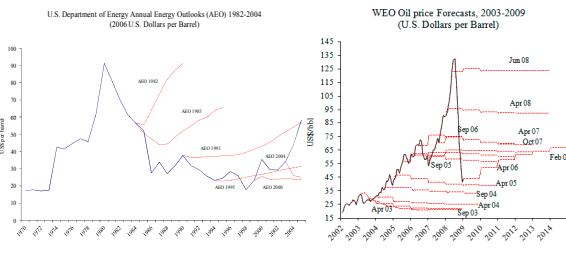


Resource Sector Characteristics

- *Resource Rent*: value minus all necessary costs
- *Uncertainty* about value of resource and timing of revenues
- *Instability* caused by volatility of oil prices
- *Time inconsistency / obsolescing bargain*: high sunk costs and long production periods → temptations to governments, under-investment
- *Asymmetric information*: government initially less well-informed on efficiency of firms or quality of deposits




Two Oil Price Booms Oil Prices: Spot and Projections




Sources: U.S. Department of Energy Outlook (1982, 1985, 1991, 1995, 2000 and 2004) and IMF World Economic Outlook (2003, 2004, 2005, 2006, 2007, 2008, and 2009). After Osoowski et al. (2008)

Note: Solid lines on the left chart are spot WTI oil prices, on the right chart are WEO average of WTI, and Fetch. The dashed lines are price projections.




Resource Taxation: Criteria

- Neutrality
- Revenue raising potential
- Risk to government (stability and timing)
- Effects on investor perception of risk
- Adaptability and progressivity
- Interactions.




Indicators for Measurement

- *Tax analysis measures*
 - Average effective tax rate
 - Marginal effective tax rate
- *DCF methods and alternatives*
 - Hurdle rates
 - Internal rate of return
 - Criticisms
- *Sensitivities and probability distributions*




<i>Evaluation Criterion</i>	<i>Key Indicators</i>
<i>Neutrality</i>	ΔETR (government take in a profitable case) METR (wedge between pre and post-tax IRR, as % of pre-tax) Breakeven price
<i>Revenue Raising Capacity</i>	Time profile of revenue Share of rent to government
<i>Adaptability / Progressivity</i>	Tax share of total benefits
<i>Risk to Government</i>	Variance of NPV of revenues (coefficient of variation) Proportion of revenues in first n years
<i>Investor Perceptions of Risk</i>	Dispersion of expected IRR (Coefficient of variation of IRR) Probability of below-target returns Value of negative returns Cumulative probability distribution of outcomes
<i>Relating Revenue Yield to Investor Risk</i>	Compare expected yield index with expected risk index
<i>"Prospectivity Gap"</i>	Present value to equalize mean PV to investor Present value to equalize PV of negative returns



A Fiscal Regime in "Mozambique"

- Stylized example assumed in frame of Mozambique model EPCC for 3rd Licensing round (end-07)
- Country with one gas project in production, other discoveries, and active exploration
- Task is to broaden portfolio of developments and improve revenue yield – especially to encourage "deep water" activity
- Comparable with numerous other countries (Ghana, Uganda, Namibia, Mauritania, etc.)




Project Examples

- Onshore oil, 100 million bbl, exploration & development costs: \$5.5/bbl */
- Shallow offshore oil, 151 million bbl, exploration and development costs: \$13.6/bbl
- Deep water oil., 1 billion bbl, exploration and development costs: \$11.8/bbl */


(This presentation shows the deep water case alone.)

**/ Onshore and deep water examples supplied by Wood Mackenzie*

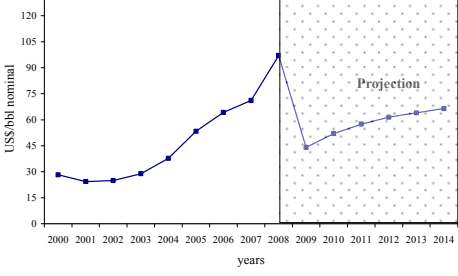


Summary of Simulated "EPCC" Terms


Royalty	10%
Cost Recovery Limit	65%
R-factor based profit petroleum sharing	
R-factor <1	10%
1 < R-factor <2	20%
2 < R-factor <3	30%
3 < R-factor <4	40%
R-factor > 4	50%
CIT rate	32%
Dividend and interest withholding tax (WT)	20%
State equity participation	10%

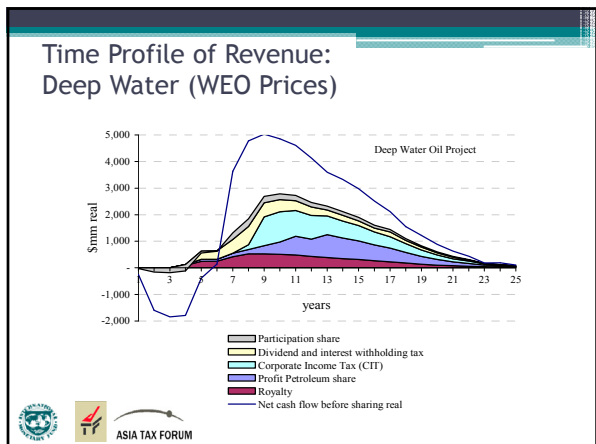


WEO Price Forecast, February 09



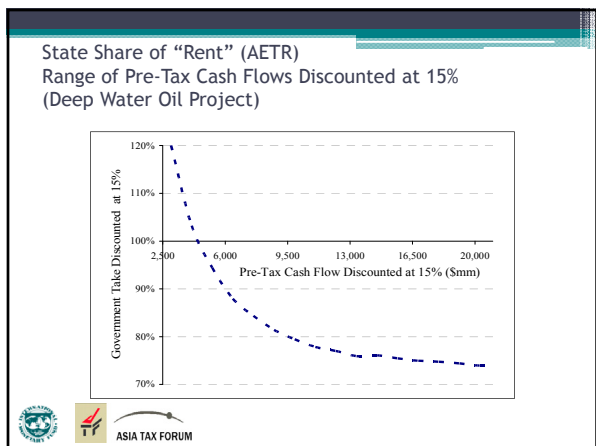
Year	Price (US\$/bbl nominal)
2000	28
2001	25
2002	25
2003	28
2004	38
2005	50
2006	62
2007	70
2008	95
2009	45
2010	50
2011	55
2012	58
2013	62
2014	65

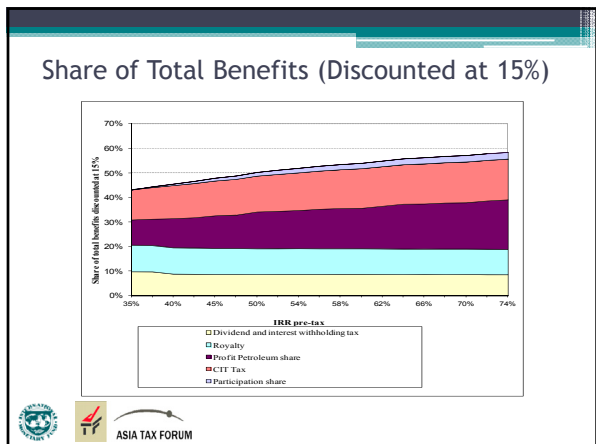




Summary Results for the "Current Terms" in Deep Water Project (WEO Prices)

Project pre-tax real IRR	31%
Post-tax real IRR to contractor	22%
Project pre-tax NPV at 15% (\$mm)	6,586
Contractor NPV at 15% (\$mm)	1,427
Payback period at 15% (years from start of production)	7.0
Government revenue NPV at 15% (\$mm)	6,062
Government take (AETR) at 15%	92%

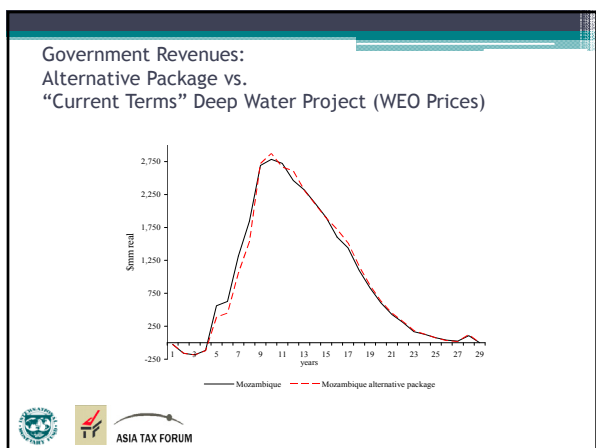




Summary of Alternative Package Terms


Royalty	10%
Cost recovery limit	90%
<i>Rate of return profit petroleum sharing</i>	
IRR < 15%	25%
15% < IRR < 20%	35%
20% < IRR < 25%	45%
25% < IRR < 30%	55%
30% < IRR < 35%	65%
35% < IRR < 40%	75%
IRR > 40%	85%
CIT rate	32%
Dividend and interest WT	10%
State equity participation	10%

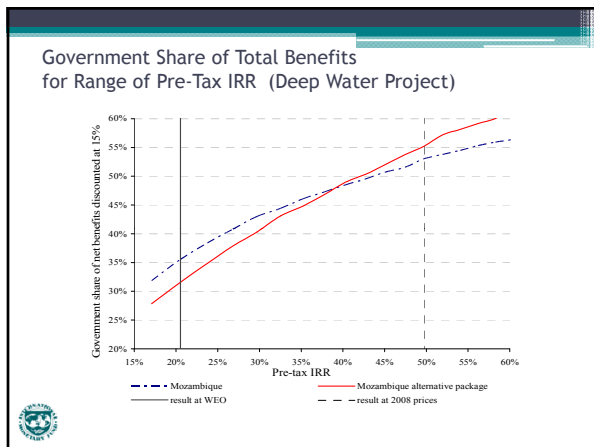
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AETR, Breakeven Price, and METR at 15% Discount Rate


Deep Water Oil Project	AETR (WEO)	Price required for 15% post-tax IRR	METR at 15% post-tax IRR
	%	\$/bbl	%
Alternative package	87	49	43
“Mozambique”	92	52	47

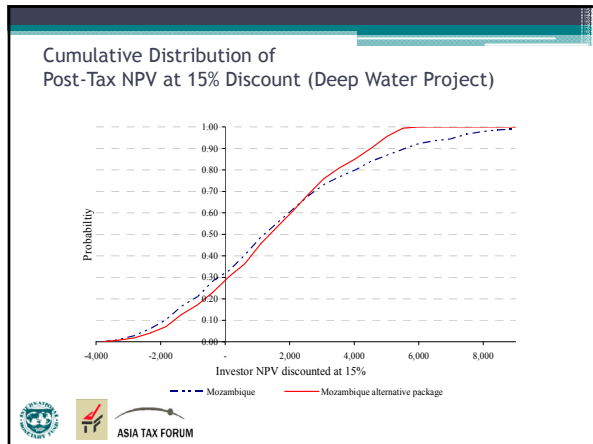


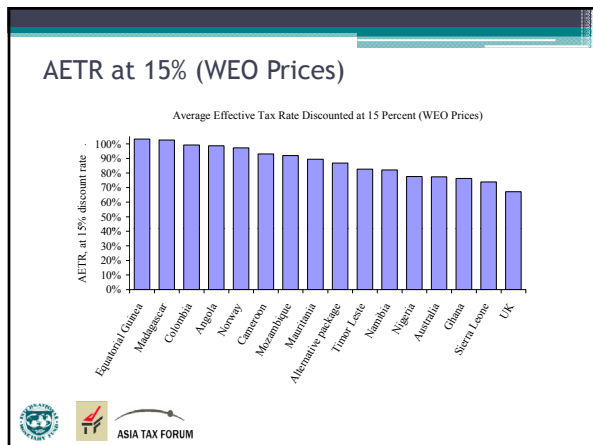


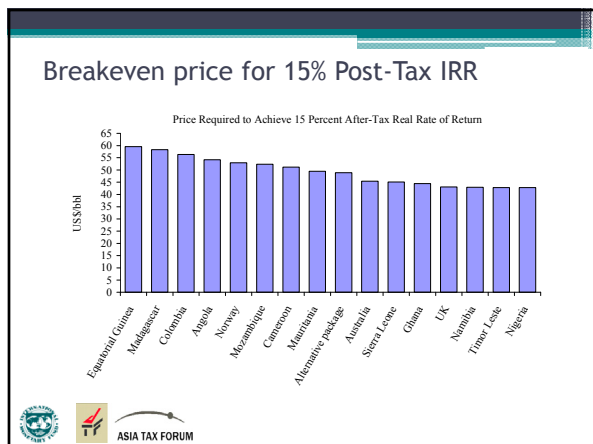
Mean Government NPV, Coefficient of Variation, and Early Share of Total Benefits discounted at 15 percent

Deep Water Oil Project	Mean Government NPV	CV	Government share of total benefits in first 10 years
	\$mm	%	%
Alternative package	8,889	74	12
“Mozambique”	8,728	66	14











Revenue Yield and Investor Risk Indexes

Deep Water Project	Expected government receipts discounted at 15%	Investor expected risk index (at 15% discount rate)	Coefficient of variation of government receipts
	Mozambique =100	Mozambique =100	Mozambique =100
UK	72	52	95
Sierra Leone	77	64	91
Nigeria	88	38	110
Ghana	89	56	108
Australia	84	52	102
Timor Leste	95	24	117
Mauritania	97	70	102
Namibia	103	41	121
Alternative package	101	74	111
Cameroon	104	63	108
"Mozambique"	100	100	100
Madagascar	105	165	87
Colombia	104	130	92
Norway	108	100	103
Angola	115	87	110
Equatorial Guinea	113	128	99




Investor Perceptions of Risk

Deep Water Oil Project	Mean expected IRR	Coefficient of variation of IRR	Probability of expected return below 15%
	%	%	%
Project pre-tax	35	43	7
After-Tax			Tax-related Mozambique=100
Mozambique=100			
UK	131	97	55
Sierra Leone	121	96	64
Nigeria	118	82	38
Ghana	116	87	36
Australia	114	87	52
Timor Leste	111	77	24
Mauritania	106	95	70
Namibia	105	63	41
Alternative package	102	86	74
Cameroon	101	93	63
"Mozambique"	100	100	100
Madagascar	90	112	165
Colombia	89	95	130
Norway	88	90	100
Angola	85	78	87
Equatorial Guinea	85	104	128



"Prospectivity Gap"

Deep Water Project	Excess over lowest mean expected NPV15 to investor	Excess over lowest expected negative NPV15 to investor
	\$mm	\$mm
Alternative package	837	(134)
Mozambique	941	69
Angola	(207)	(488)



Exploration Risk Analysis

- Development case is the building block for exploration risk analysis.
- Geological risk assessment:
 - Presence
 - Type, distribution, volume
 - Likelihood of production
- Engineering design
- Economic analysis
- EMV and prudent risk taking – EMV must be positive, and $P_f > P_m$



Conclusions

- Attempt to set out evaluation criteria
- Attach indicators or measures to them
- Provide framework for numerical analysis of risk and reward trade offs
- Relating government aims to investor perceptions of risk, and prospectivity
- An aid to judgment in setting and revising fiscal regimes (not a substitute).