Managing Oil Price Risk

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Main Strategies

- Stabilisation Policy:
  - **goal:** reduce the vulnerability to oil price shocks and smooth fluctuations of oil revenues over short to medium term
    - minimum cost
    - tolerance to downside risk
- Hedge downside risk:
  - **full hedging**: hedge position is of the same volume and specification but in opposite direction as real commodity.
  - **selective hedging**: hedge position taken similar but not identical product and not in the full amount.
  - **active hedging**: decision whether to hedge made based on current market position
- Do not hedge

Stabilisation Policy

- **Strategy**:
  - Oil revenues above a given reference point (e.g. above production cost) are saved in a fund. The fund ensures stable income based on a referenced point.
- **Example**:
  - The production cost of *Kazakh Oil Ltd* is USD 60 / barrel.

    * Oil produced when oil price is above USD 70 / barrel is saved in a stabilisation fund and invested in a diversified portfolio of financial assets.
    * When oil price falls under USD 60 / barrel, losses are taken from the stability fund.

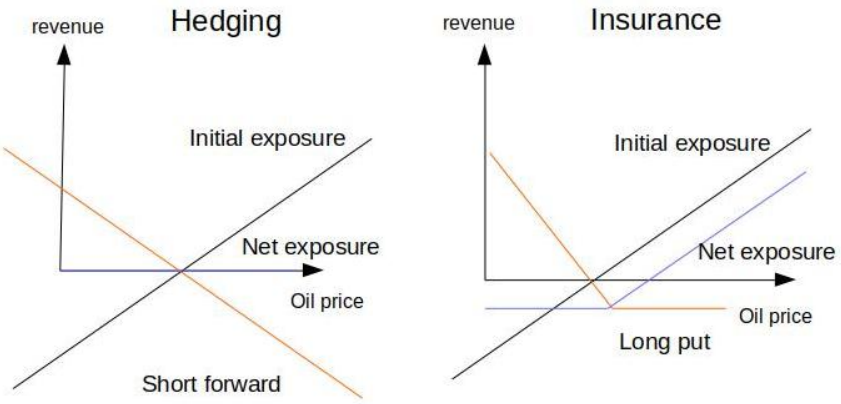
Risk Management Techniques

- There are essentially three ways to mitigate risk:
  - **Diversification**: accumulation of small and uncorrelated exposures
  - **Hedging**: offset of exposure to a market variable by creating a position with opposite sign.
  - **Insurance**: keep the initial exposure, buy an insurance and get compensated in case of adverse evolution of the market variable.

Basic Derivatives Instruments

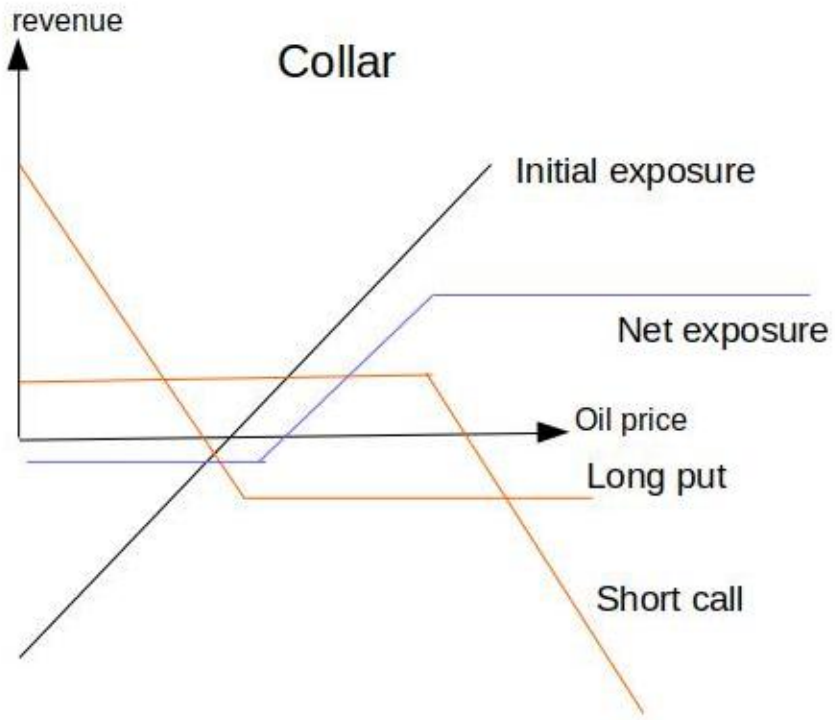
- **Forward**: A forward sale contract with a commodity dealer is an OTC agreement to deliver oil in the future at a pre-determined price. Physically or cash-settled.
- **Futures**: A futures is an exchange-traded standardised forward agreement.
- **Swap**: A stream (series of) forward contracts
- **Options**: Right to buy or sell (call or put) the underlying oil in the future at a pre-determined price.

Forward and Put payoffs



Collar hedging

- **costless collar**: combination of long put and short call, resulting in both a floor and a ceiling
  - the premium received from the short call position covers the cost of the long put.



- A **short costless collar** reduces uncertainty of oil consumers (e.g. Airlines): long call + short put

Example: Collar hedging for oil producer

- Assumptions: oil producer needs to be hedged against December crude prices trading below $40 / barrel.
  - Long put December Brent crude oil APO (Asian) with strike at $40. Cost: $1.50 / barrel.
  - Short December Brent crude oil APO with strike of $59. Premium received:$1.50 / barrel.
    - If average oil prices during December less than $40: hedging gain
    - If average oil prices during December above $59: hedging loss
    - If oil price within $40 and $59, no gain no loss.

Capacity of Oil derivative markets

- The capacity of derivative markets caps the maximum volume that can be hedged.
  - Limitation on the number of barrels / year:
    - using linear products (Forward / futures)
    - options

Value of Fixed-Price Forward Contract

- Evaluate, at any given time t, a contract for delivery of a commodity at some future month in exchange for a fixed payment of X \$/unit of commodity.
- Let $F_{t,T}$ the price at time t of a futures contract maturing at time T.
- The value at time t of the fixed-price forward contract is $V(t, F_{t,T}) = e^{-r(T-t)}(X - F_{t,T})$.
- At maturity the forward price equals the spot price S_T: $F_{T,T} = S_T$

Forward hedging strategy

- A hedging strategy offers the ability to:
  - **manage market risk**: with a good hedge it is possible to lock in the initial value of a deal despite adverse market movements.
  - **value deals**
  - **agree on fair pricing** of the deal: the future price $F_{t,T}$
- The fair price of a forward contract at any time t is $X = F_{t,T}$ where X is time t expected spot price at maturity: $E_t(S_T) = X$
- The expected value is most likely the result of statistical analysis of historical data or the product of numerous forecasting models.