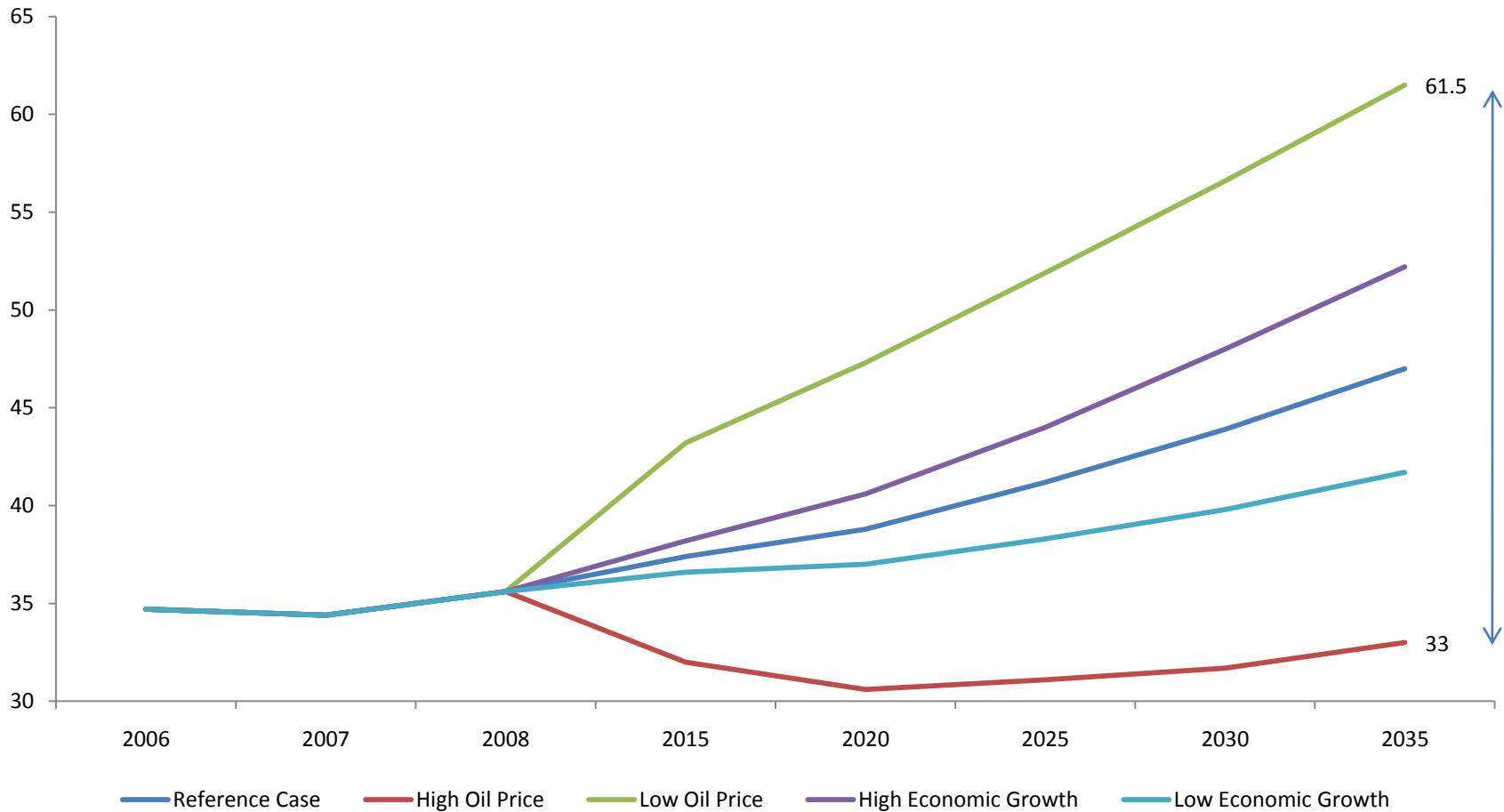


Oil Market and OPEC Behaviour: Looking Ahead

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1. Setting the Scene

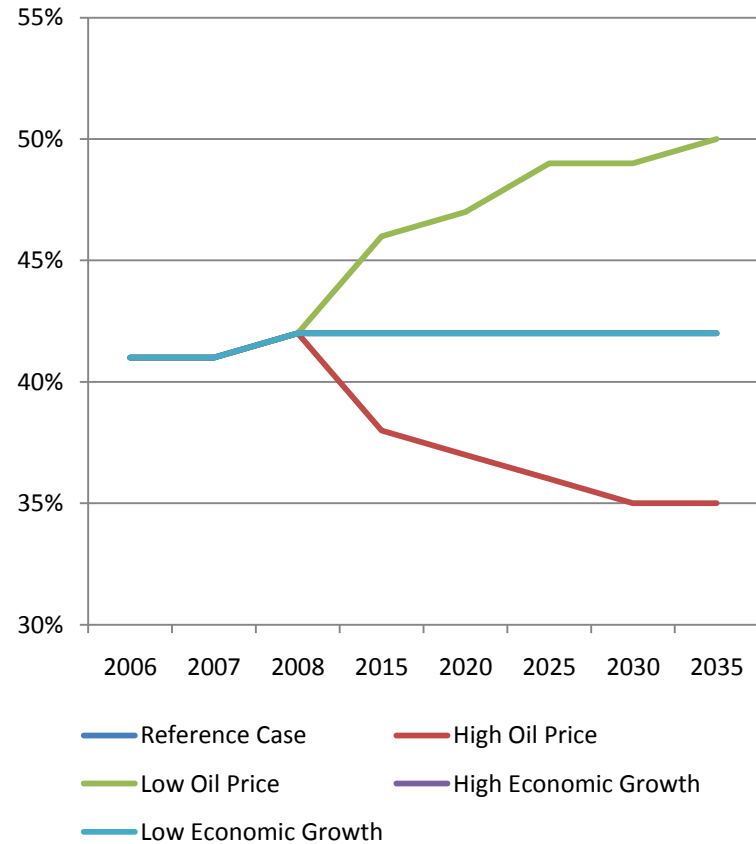
Projections of OPEC of Total Liquids Production (mb/d)



Underlying Assumptions

- Estimates based on “call on OPEC”
 - OPEC adjust its output and market share by filling gap between world oil demand and non-OPEC supply
 - OPEC output treated as ‘residual’ in projections
- Underlying key assumptions:
 - OPEC/producers within OPEC are passive players
 - Not sensitive to fluctuating market share
 - OPEC doesn’t or can’t behave strategically
 - Symmetric behaviour
 - Behaves symmetrically in a rising and falling markets

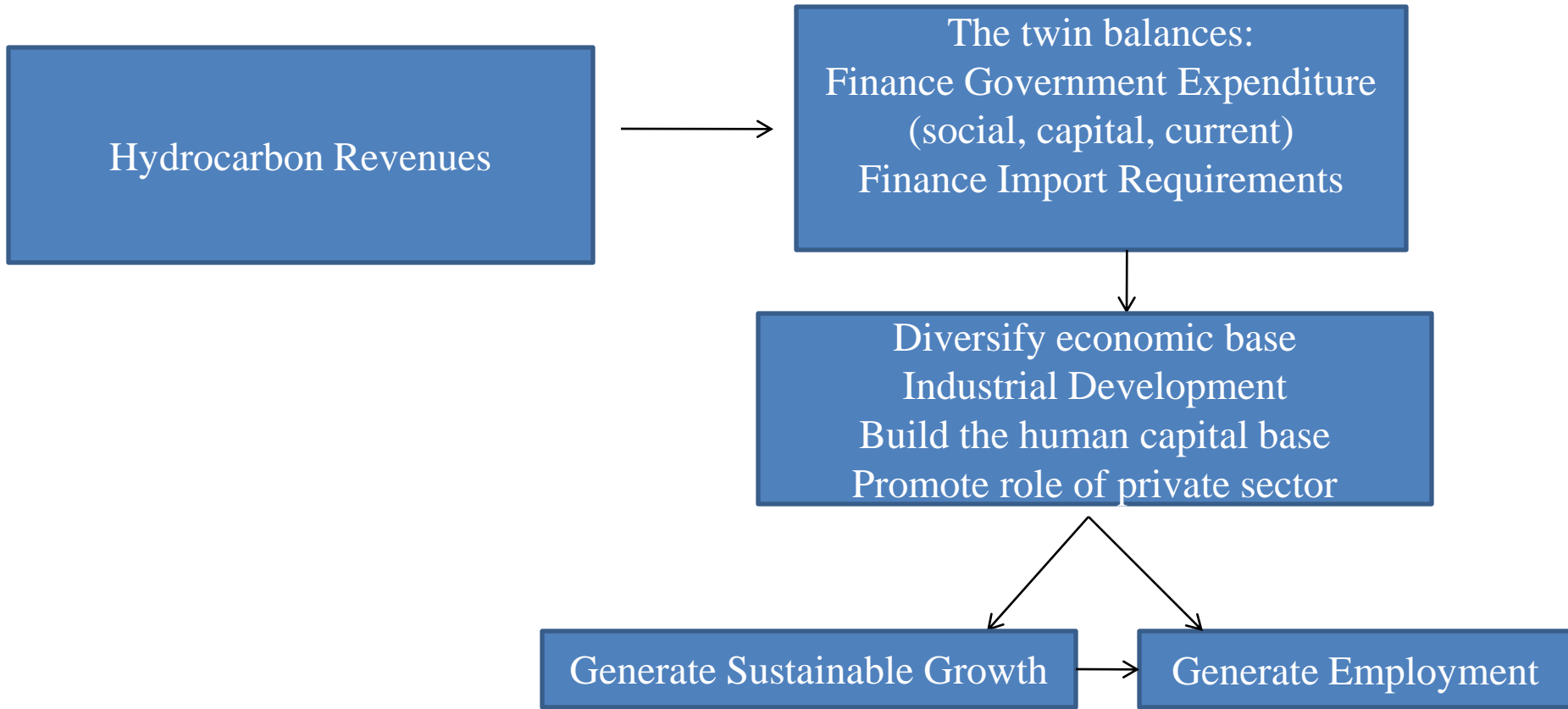
OPEC Market Share



Alternative Framework

- Simplifying assumption based only on fact that bulk of world's proven reserves concentrate in countries within OPEC
- No attempt to model behaviour of OPEC or key producers within OPEC despite the various theoretical models
- Alternative assumptions:
 - OPEC behaviour is far from passive
 - Oil revenues power engine of economic growth through public expenditure channel
 - Oil revenues lie at basis of development model, long-term industrialisation strategy and diversification
- OPEC behaviour is far from static
- OPEC behaviour is not symmetric

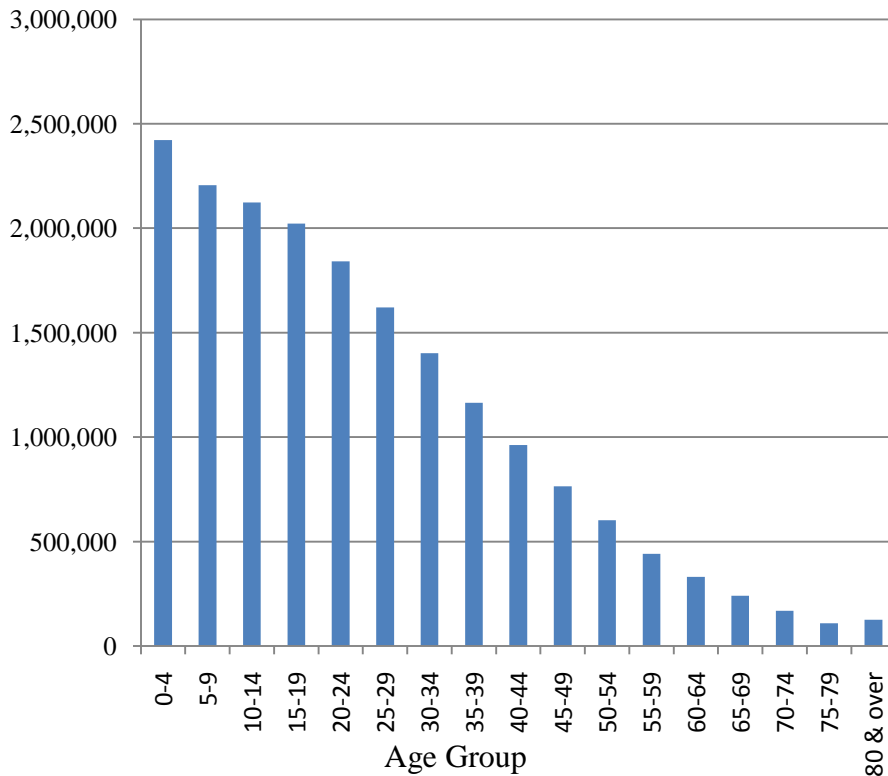
Oil Exporters' Economic Development Model



Oil revenues key for long term economic political and social stability
Oil revenues key for improving standards of living
Oil revenues key for transition from 'depletion-led' development to 'sustainable development'

The Demographics and Employment Challenge

Population Age Structure (Saudi's Only)



Sixty six percent of population less than age of 30

Saudi Arabia Official Unemployment rate (percent)

Year	Saudis			Non-Saudis			Total		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
2002	7.57	21.70	9.66	0.82	0.62	0.79	4.21	11.51	5.27
2003	8.00	23.18	10.35	0.80	0.79	0.79	4.36	12.51	5.56
2004	8.39	24.40	10.97	0.77	0.93	0.80	4.49	13.36	5.82
2005	8.74	25.41	11.52	0.75	1.06	0.80	4.60	14.07	6.05
2006	9.07	26.27	12.02	0.74	1.17	0.80	4.71	14.69	6.25
2007	8.30	24.70	11.05	0.40	0.50	0.43	4.24	13.21	5.63
2008	6.90	24.90	9.80	0.40	0.60	0.40	3.50	13.00	5.00
2009	6.90	28.40	10.50	0.30	0.70	0.30	3.50	15.90	5.40

Source: Central Department of Statistics and Information, Ministry of Economy and Planning

Source: SAMA

Six Key Questions

1. In a falling market how tolerant is OPEC or some of its players to a decline in market share?
 - Dimension of OPEC versus non-OPEC
 - But equally or even more important dimension: within OPEC
 - Directly related to distribution of oil rents
2. Will OPEC remain passive to oil substitution policies as a result of energy security and climate change agendas? If not, how would OPEC respond?
- 3 & 4 Assumption that OPEC has potential to increase output
 - Willingness: Does OPEC has the incentive to increase market share?
 - Capability: Can OPEC increase production capacity to fill gap? What are some of barriers to investment in oil sector?
5. Is OPEC behaviour symmetric to rising and falling market?
6. What is the impact of OPEC investment policy on oil market structure and price formation process?
 - Financial markets paradigm

2. OPEC's Evolving Role and Endogenous Shifts

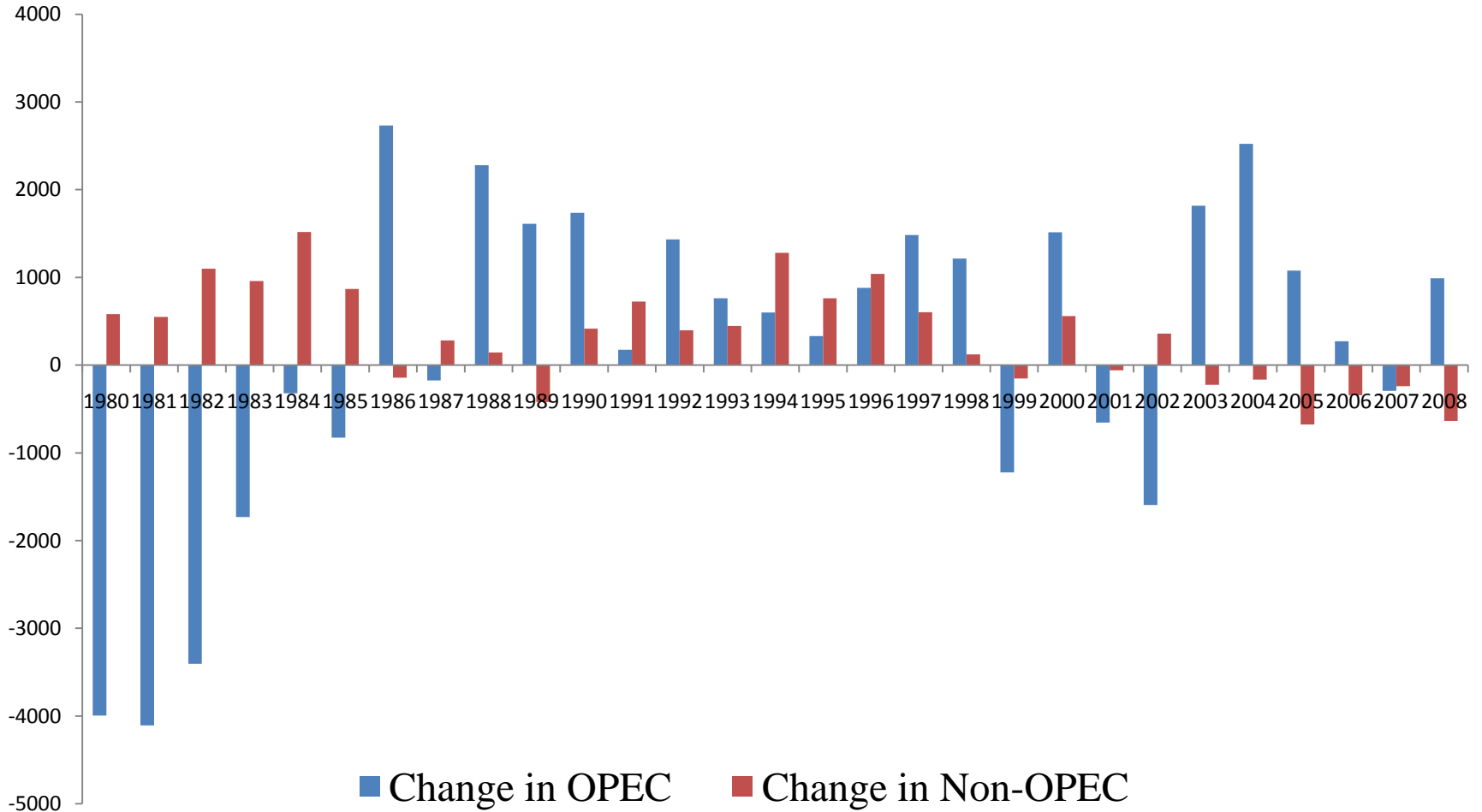
- OPEC behaviour evolves over time
 - Protect income of members, price administrator, swing/residual producer, spare capacity manager, inventory manager, price signaller,.....
- OPEC as a residual producer
 - Non-OPEC suppliers produce at maximum capacity
 - OPEC takes non-OPEC supply as given and adjusts its output through the quota system to keep prices above a 'certain floor'; the price not necessarily maximise OPEC revenue
 - "... the revenue maximization objective which theory postulates and core producers would dearly like to achieve is not credible. One has to become content with a second best: to obtain through the pricing policy more revenues than would have accrued under a competitive market structure. This more may be much better than nothing but is likely to be very different from the optimum" (Mabro, 1992)
- Non-OPEC has strategic advantage; OPEC squeezed both from supply and demand side
 - Decline in demand affects call on OPEC
 - Rise in non-OPEC supply affects call on OPEC
 - Deal with uncertainty on the demand and the supply side
- OPEC can be described as a residual producer but.....
 - Switch in residual producer status possible
 - Switches instigated by market conditions, change in strategic interest, response in behaviour of other market players
 - Switches associated with sharp price movements

Price Wars and Collusion

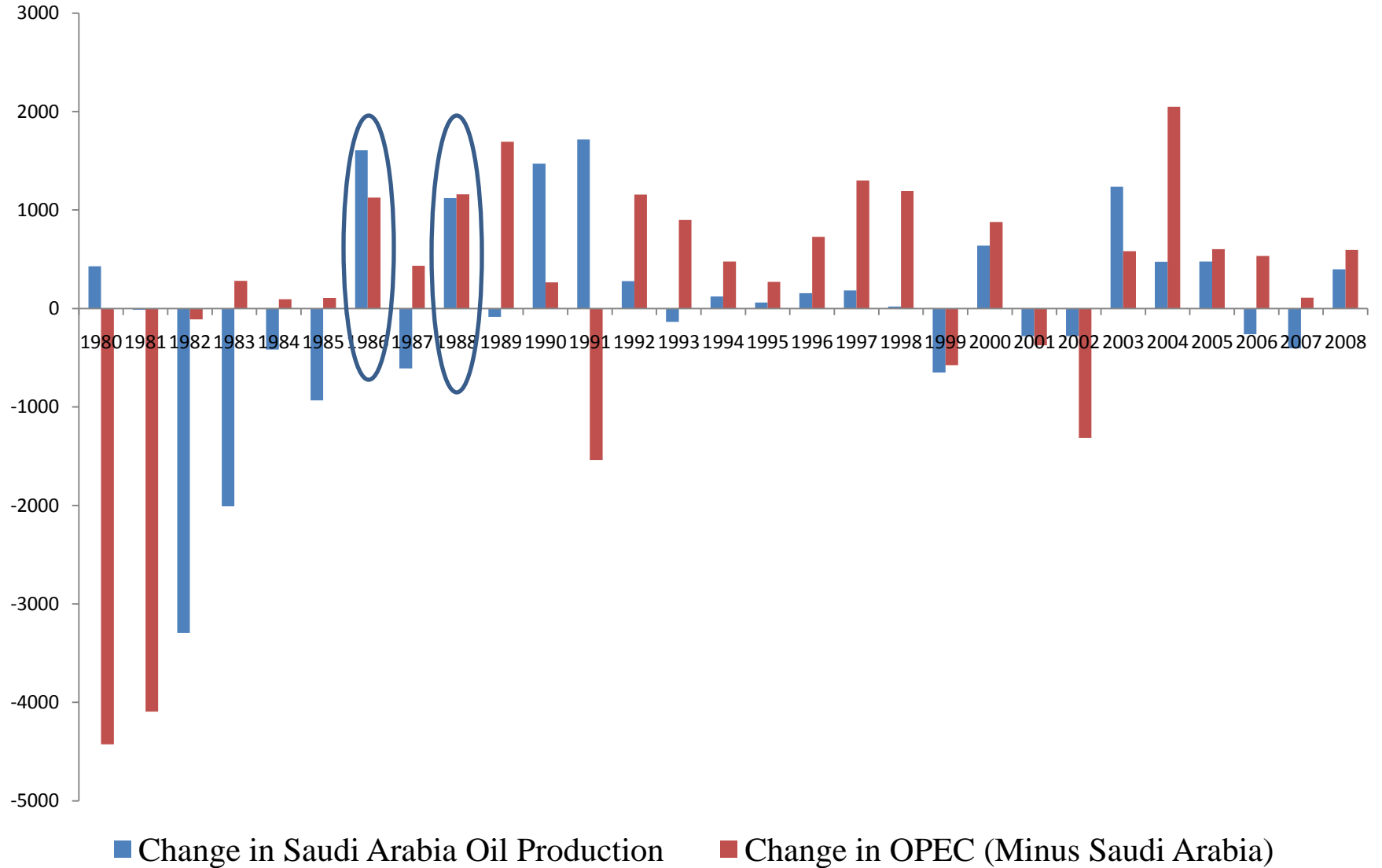
- Stigler (1964): Price wars often signal collapse of collusion
- Modern games theory (Green and Porter, 1984): Price wars are ‘equilibrium punishments’ aimed at stabilizing collusion
 - Solution to problems of imperfect information (not able to observe compliance)
 - inability to monitor compliance among members
- Price wars can be of ‘strategic’ nature
 - No ambiguity: some members publicly announce they would like to increase production above quota (positive shock: large finds, low cost reserves, change in political regime; etc)
 - Previously collusive agreement no longer stable
 - Country can signal this by instigating a price war
 - Players respond by cutting output to accommodate new low cost producer
 - Price war: method of credible communication/signaling among colluding firms
- Price wars method of allowing for a different distribution of rents
 - Possible to have two collusive equilibria
 - Instigate a price war to cause players to move from one equilibrium to another
 - No new information but signal used to alter expectations and beliefs to achieve a different distribution of rents

Early 1980s: OPEC Being Squeezed

Thousand barrels per day

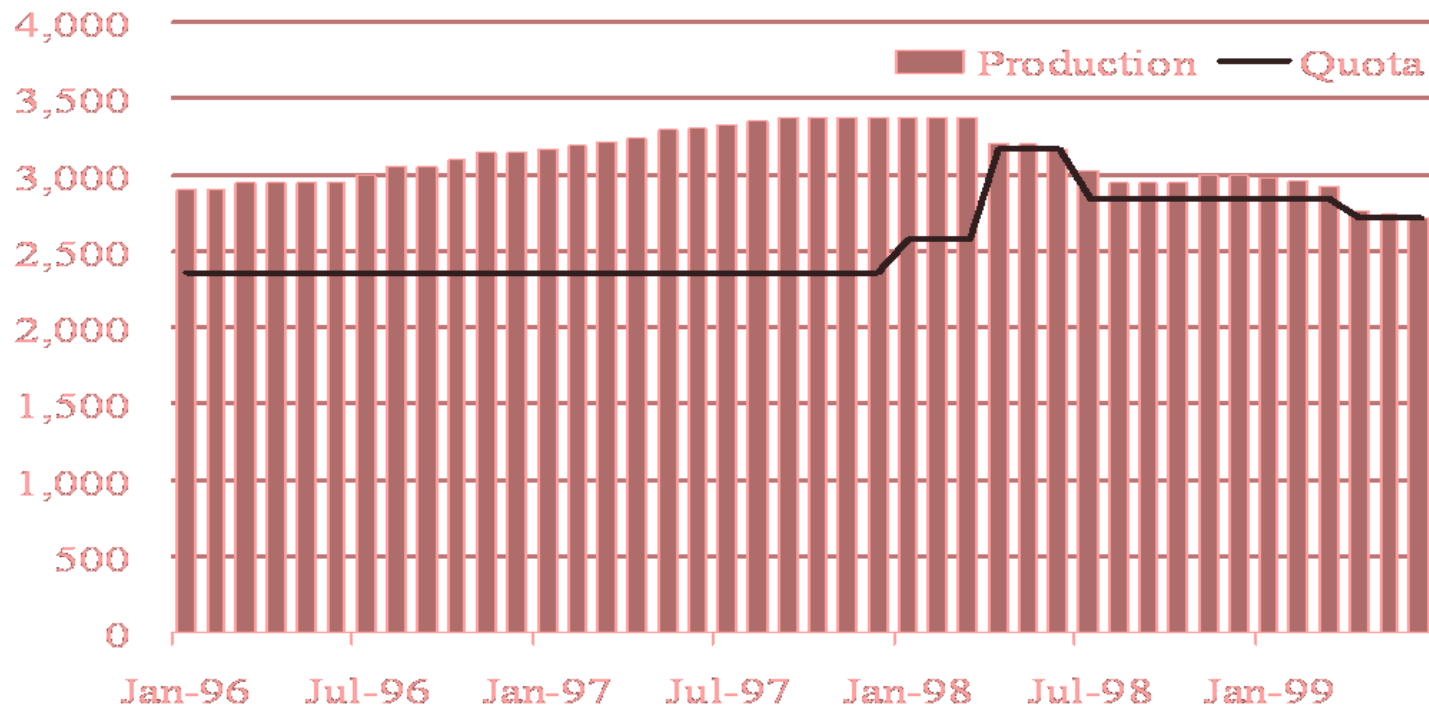


The First Price War: 1986-1988



Venezuela's Challenge

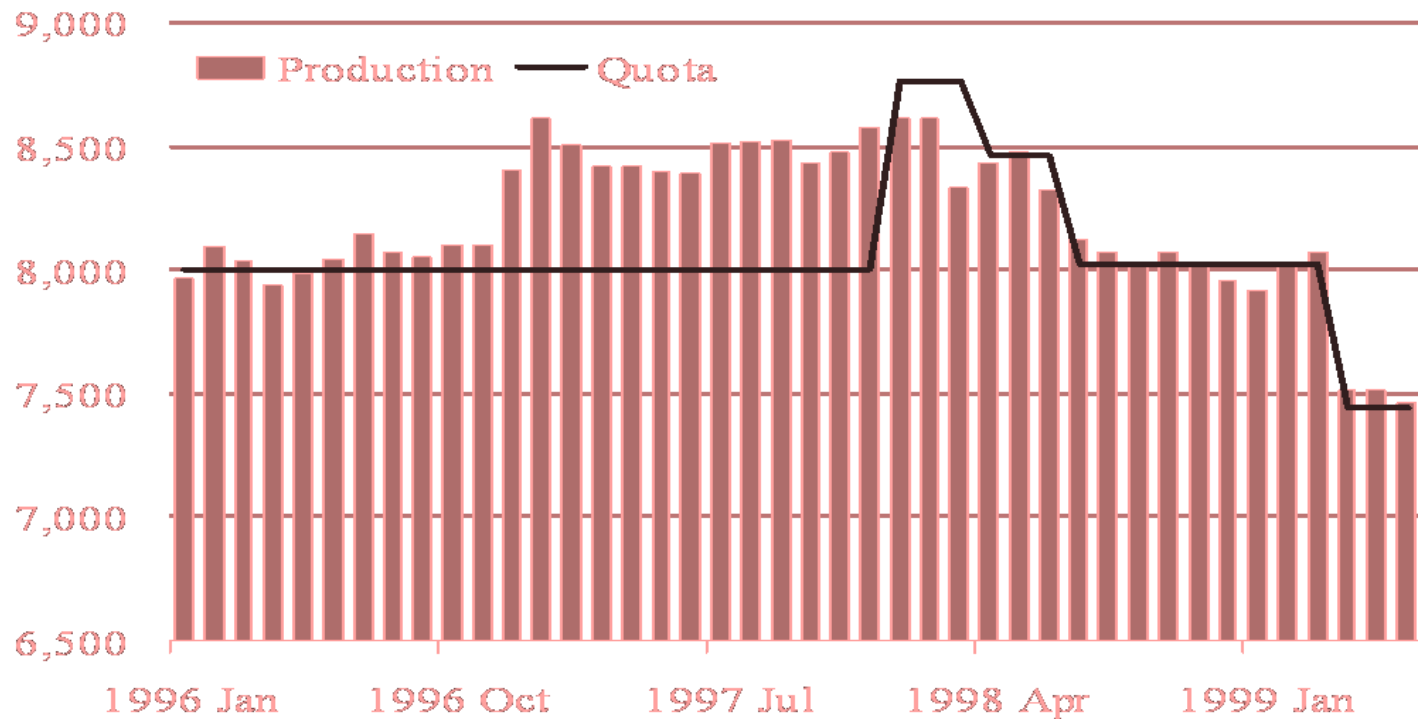
Venezuela production vs Quota (000 b/d)



Source: Energy Intelligence Group OMI data, Morse (2007)

Saudi Arabia's Strategic Response

Saudi Arabia production vs Quota (000 b/d)



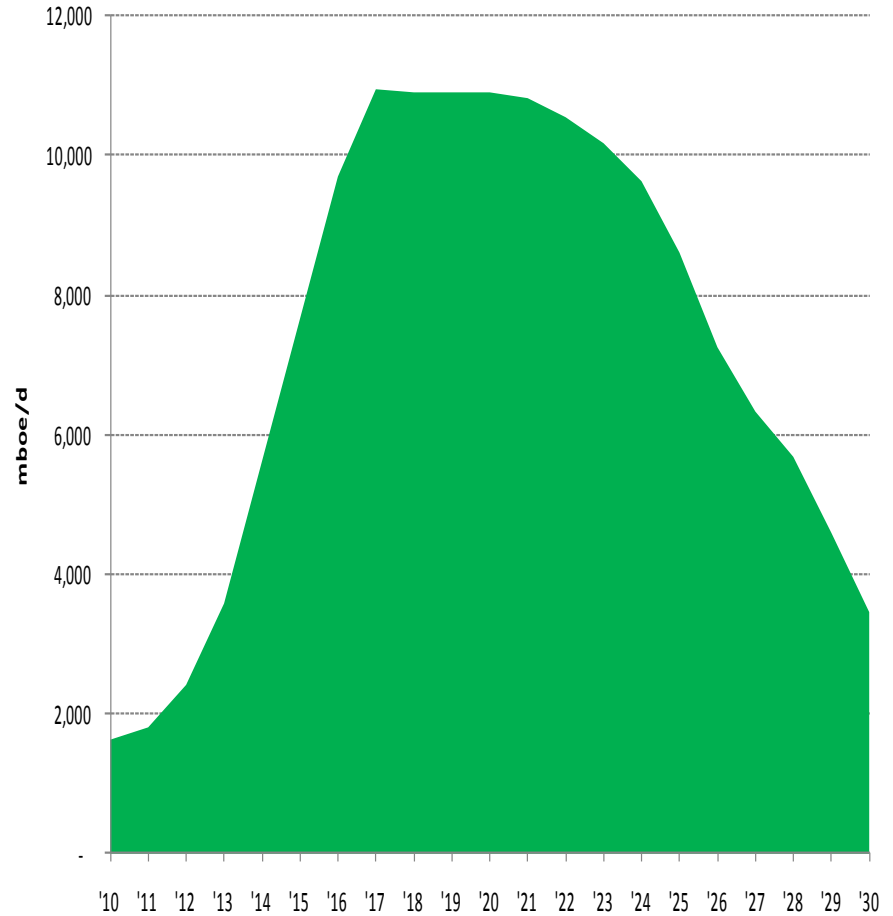
Source: Energy Intelligence Group OMI data, Morse (2007)

Is Iraq the New Challenge for OPEC in the 2000s?

Will entry of Iraq instigate a strategic price war?

- Mixed signals so far
- Cross the bridge once when we come to it

Iraq Production: The Official Target



Obstacles to Collusion

- Three critical problems that any collusion must solve if it is to endure
 - Coordination
 - Entry
 - Cheating
- The issue of entry easiest
 - OPEC protected by barriers to entry that stem from ownership and control of low-cost oil reserves
 - Production of crude oil from non-OPEC sources does expand when OPEC cuts production and pushes prices up but scope become more limited
 - Entry from within OPEC remains an issue

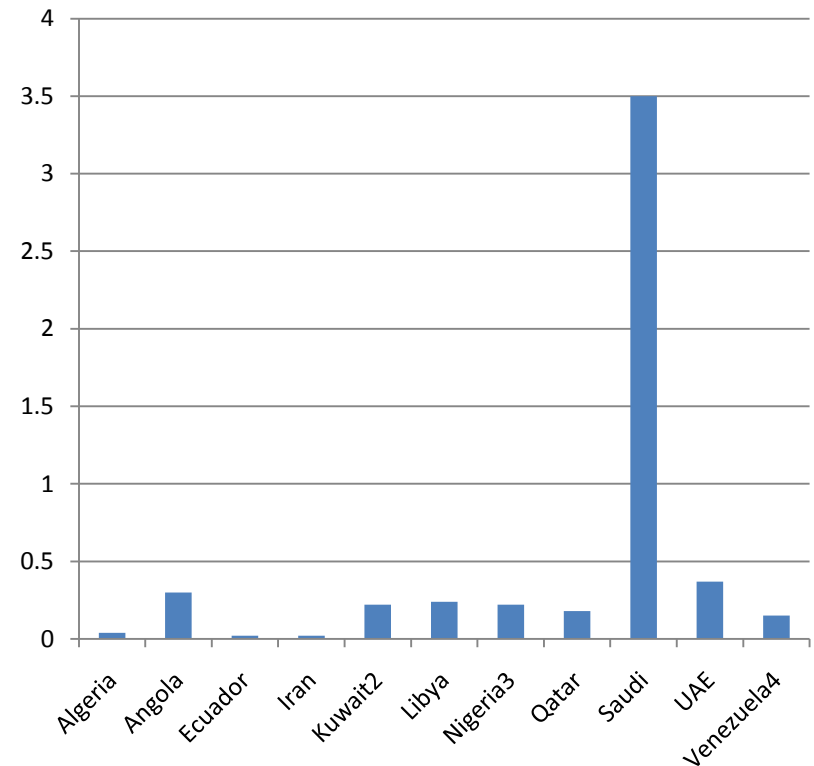
OPEC as a Heterogonous Entity & Coordination

- Economic and demographic heterogeneity
 - Interests of individual OPEC members do not naturally align behind a single “correct” price or production target
- Agreement not only about total amount of oil to be produced by OPEC but how to divide it between individual members
 - Any given set of quotas determines not only overall profit of OPEC, but also individual revenues that accrue to each member
 - Limited means by which to redistribute earnings among members
- Low-cost, long-lived reserves, and long-horizons
 - Reluctant to pursue severe output cuts since too-high prices would induce technological development and new forms of energy
- Smaller reserves and shorter horizons
 - Prefer deeper production cuts and rise in oil price to maximize revenues
 - Manifested in many instances (including disruptions within OPEC like in 1990s)
- “Price hawks” with little power versus “price makers”
- Emergence of clear leadership of Saudi Arabia, professionalization of decision in recent years makes coordination effort easier

Excess Capacity and Coordination

- Countries producing below capacity less incentive to reach agreements on production cuts
 - Incentive to cheat becomes high especially for exporting countries with large need for revenues
- Easier to negotiate and reach agreements on preferred utilization rates as many of the member countries would be producing close to or at their maximum capacity
- Excess capacity has two effects on collusion
 - Increases incentive for firms to cheat and deviate from agreement
 - But implies a more severe punishment for deviating firm and hence less incentive to cheat
 - Trade-off works under assumption of power symmetry
- Benign environment for collusion
 - Price hawks producing close to capacity
 - The ability to punish concentrated within the hands of the leader

Spare Capacity vs Dec 2010 Supply

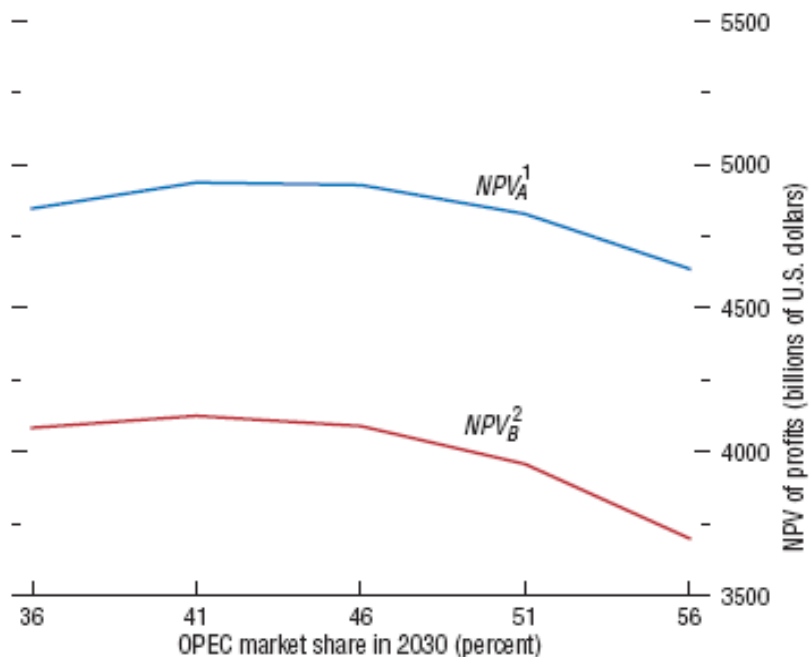


3. Climate Change Agenda, Demand Reduction, and OPEC Response

- Literature on climate change/carbon tax implicitly assumes passive behaviour from producers to oil substitution policies & energy taxes induce only a small loss of welfare as tax revenues kept in domestic economy
- More realistic: producers do not act passively, want to maximise share of rent
- Potential responses
 - Will divert part of the rent to their pockets through raising prices at front which in turn will accelerate demand reduction
 - Remaining oil demand high inelastic (demand destroyed first is the easiest) and OPEC would then decrease its supply and increase oil prices so as to take full advantage of the ‘captive’ residual oil demand
 - OPEC will increase its quotas and thus provoke a decrease of oil prices in order to induce a rebound of global oil demand and drive out non-OPEC supply
 - Some simulation results not clear on effectiveness of policy (Loulou et al 2008)
 - OPEC would derive no advantage in flooding the oil market
 - OPEC’s profits are lower even if drives out non-OPEC supply
 - OPEC strategies have almost no impact on the global emissions and climate with and without a climate constraint
- Area in need of further research

4. Does OPEC have Incentive to Increase Market Share?

Profitability of Various OPEC Market Strategies



Source: Gately (2005).

¹ NPV_A^1 corresponds to the NPV of discounted profits in the baseline scenario, with the International Energy Agency non-OPEC supply path.

² NPV_B^2 corresponds to the NPV of discounted profits in the baseline scenario, with the U.S. Department of Energy non-OPEC supply path.

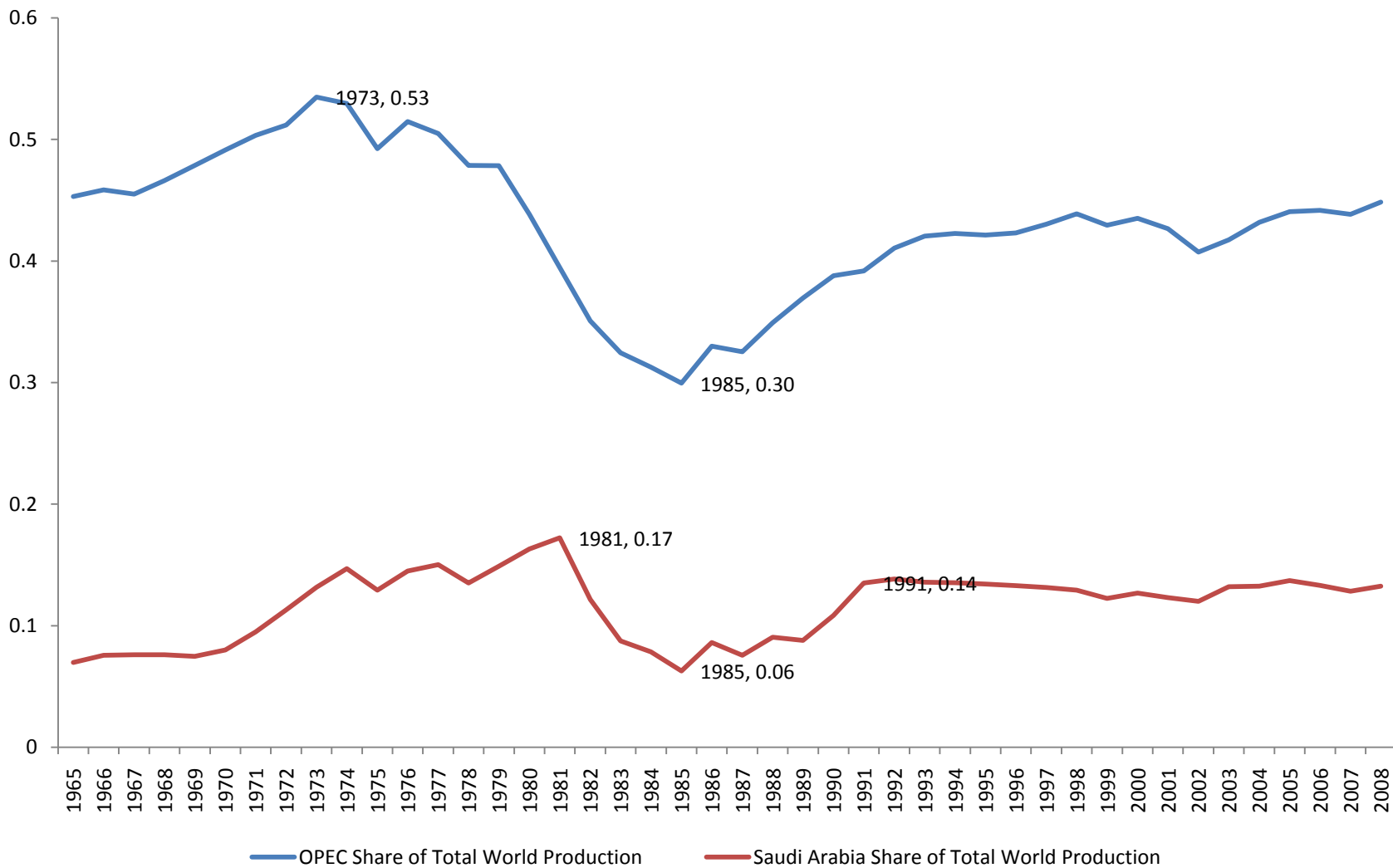
Source: IMF (2005)

- ❑ The more OPEC increases its market share the lower the payoff
 - Higher output offset by lower prices
- ❑ Does not have incentive to let market share rise rapidly
 - High oil prices compensate for the lower market share

Al-Qahtani (2004): Neither Saudi Arabia nor OPEC fully exercises market power

- Could realize higher economic profits by producing less and driving up crude prices
- Reasons behind the deviation from the optimal production levels may include an array of social and political objectives

OPEC Market Share Stable in Recent Years



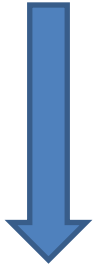
5. Does OPEC has Capability to increase Production?

- OPEC is not an organisation to decide or coordinate investment plans among member countries
 - Decision left completely to individual countries
 - Affected by general market conditions and local factors
- Determinants of investment in OPEC
 - Under-ground factors
 - Above ground constraints
 - *Wars and conflict*
 - *Sanctions*
 - *Organisation of the oil sector & capability of National Oil Company*
 - *Relationship between government and NOC & flow of funds back into industry*
 - *Fiscal system and openness to foreign investment*
 - Inter-generational considerations and optimisation of the reserve base
 - Call on OPEC
 - ‘Security of demand’ vs ‘security of supply’

Key Middle East Players and Supply Potential

Limited Growth Potential

- Qatar
- Algeria
- Abu Dhabi
- Kuwait



Marginal Players
Predictable pattern
of supply growth

Medium Growth Potential

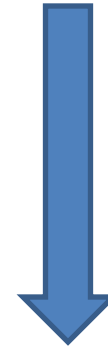
- Iran
- Libya



Unpredictable
pattern of supply
growth but likely
to be marginal in
short to medium
term

High Growth Potential

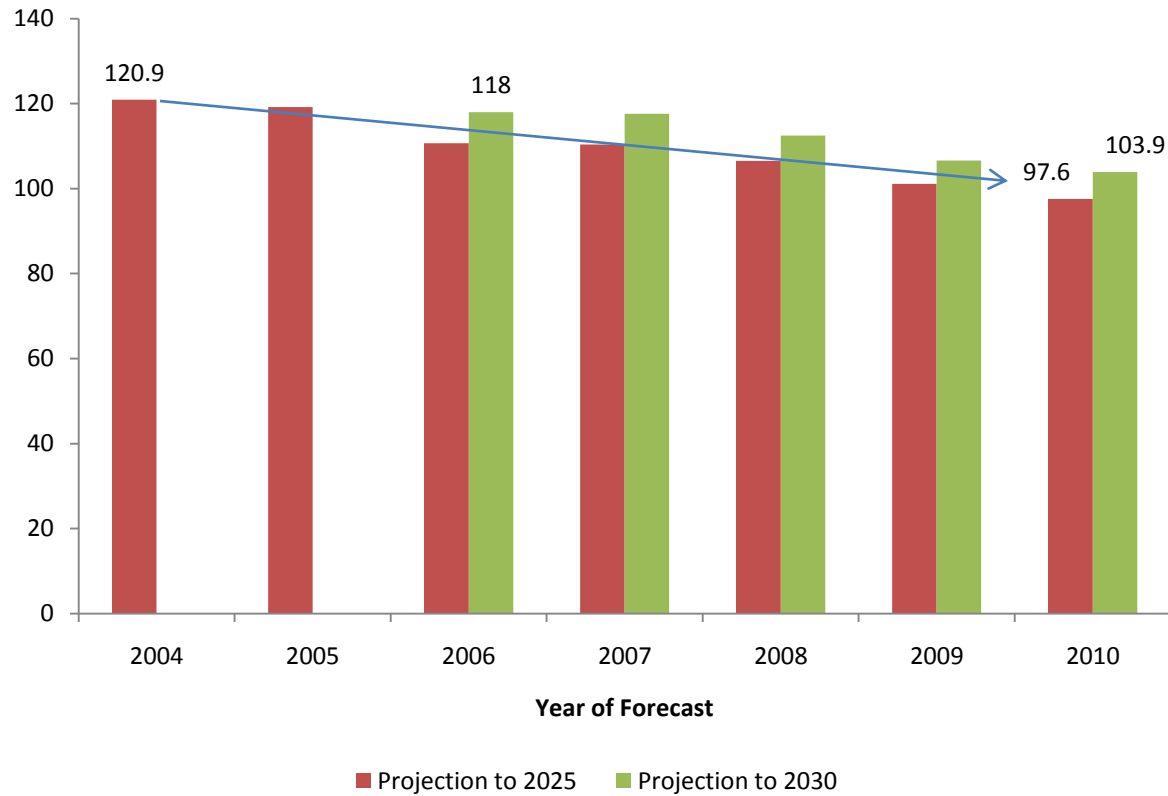
- Saudi Arabia
- Iraq



Game changers

Demand Uncertainty Key

Revisions in Oil Demand Projections for 2025 and 2030 (Reference Scenario, mb/d)



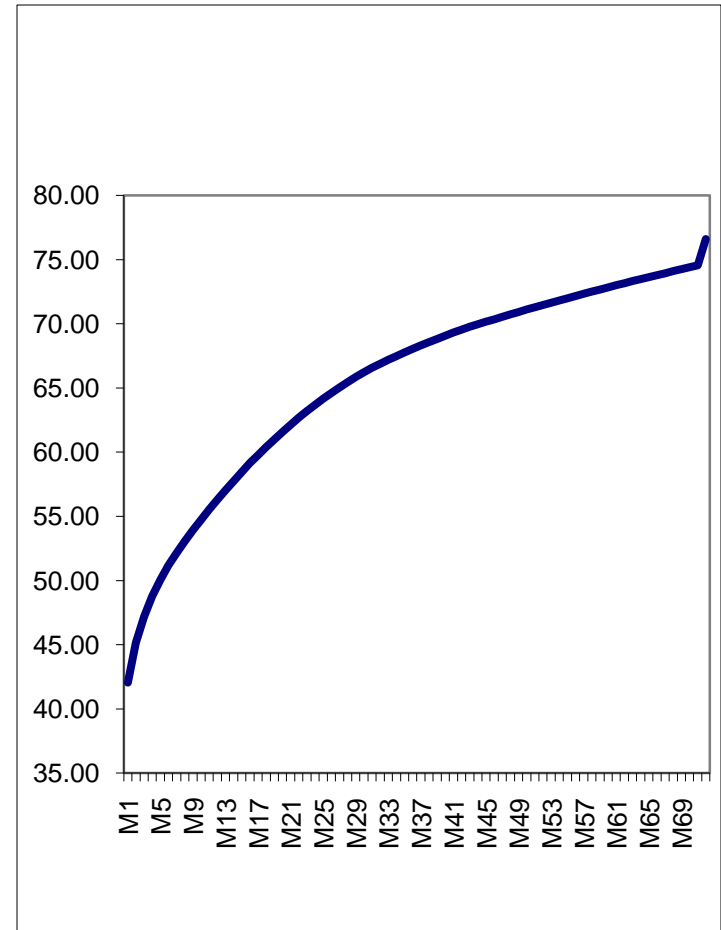
6. OPEC & Oil Market Structure

- Allows production and investment to shift towards high cost producers in non-OPEC countries and oil substitutes
- Keep a ‘floor’ on oil price so both low cost and high cost producer co-exist
 - Ali Naimi, justified \$75 target price as “price that marginal producers need to maintain investments sufficient to provide adequate supplies for future oil consumption needs”
- Implications:
 - Oil price, marginal cost and price indeterminacy
 - Very low cost floor for crude oil production in OPEC and a very high price ceiling set by production in non-OPEC and substitutes & futures market participants’ expectations
 - Market can clear at any price within a wide range depending on market conditions, perceived short-term elasticities, and interaction among market participants
 - Important implications on short term and long term price behaviour
 - OPEC’s role in influencing the oil price through signalling

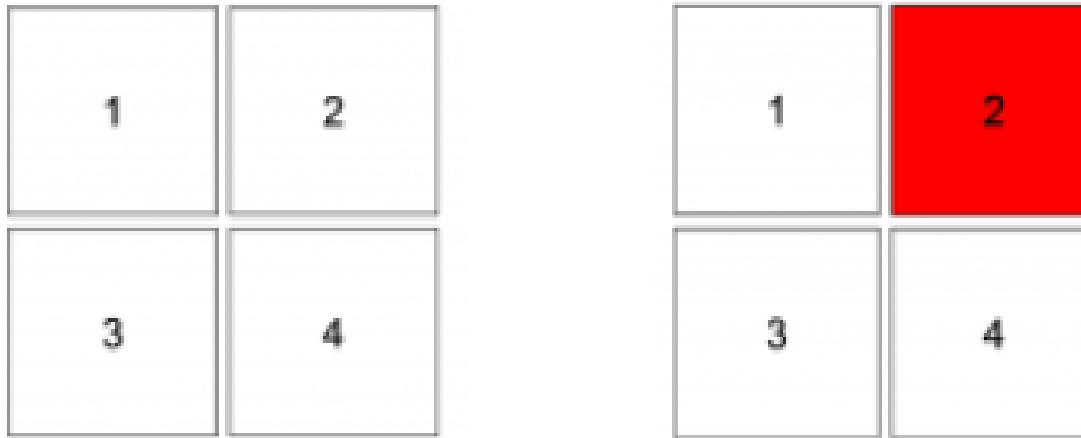
Current Fundamentals, Expectations and Signalling

- Underplay the weight of current oil market fundamentals, inventories, size of spare capacity and increase importance of future fundamentals
- Problem: Future fundamentals highly uncertain
 - Many unknown variables that can play an important role in shaping anticipations of these future fundamentals, many of which originate from outside the oil market
- But at what level should the price be set?
 - There is a wide range of prices at which the market can clear
- The issue then is how does the market converge to one price and not another
- Stabilise the market through signalling

WTI Term Price Structure (December 2008, Monthly Average)



Some Signals More Visible than others



Market players can coordinate on choosing a box without communicating with each other

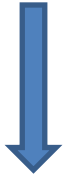
There is nothing special about the red box other than the fact that it helps players coordinate their decisions

Such an equilibrium is known as the *focal point*

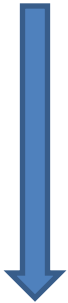
Focal Point more visible in falling markets

6. Is OPEC Behaviour Symmetric?

Too High Price



Prospects for economic growth
(especially in developing countries)



Threatens oil demand growth

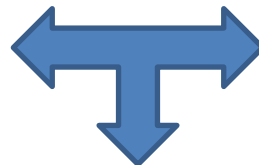
Too Low Oil Price



Undermines economic development
and social progress



Threatens oil supply growth



“necessity of being proactive under all market conditions”

Asymmetry in OPEC Response

In a Falling Market

Objective

Defend oil prices from falling below some level deemed unacceptable

Mechanism

Impose quotas and implement output cuts

Issues from Market Perspective

- How would the market respond to announcement of cuts?
- Will OPEC be able to implement the cut?

In Rising Market

Objective:

- Increase output in response to customers' demand at market determined prices
- Consider itself as price taker
- Not to impose a ceiling on oil prices
- OPEC was not created to bring prices down

Mechanism

- No mechanism exists
- OPEC does not offer discounts or auction spare capacity to bring prices down

Issues

- Internal and external political constraints
- Learning process about impact of oil price shocks on growth

Asymmetry in OPEC response

- In a rising market OPEC's role is to continue to supply upon demand
 - Learning process about the impact of oil shocks on growth
 - Lower oil intensity of GDP
 - Oil shocks just like many other things that hit the economy
 - Offsetting policy responses
 - Monetary policy response if no change in inflationary expectations
 - Budget deficits
 - Implications: Global economy can grow with persistent rise in oil price
 - OPEC does not always have the tools to bring prices down
 - Political constraints
- Implication: Feedback mechanism from OPEC absent
 - Affected market's long term expectations
 - Contributed in parallel to the parallel shift in the back end of the curve