

Lecture at ESCP Europe

Has oil finally become a 'real' market?

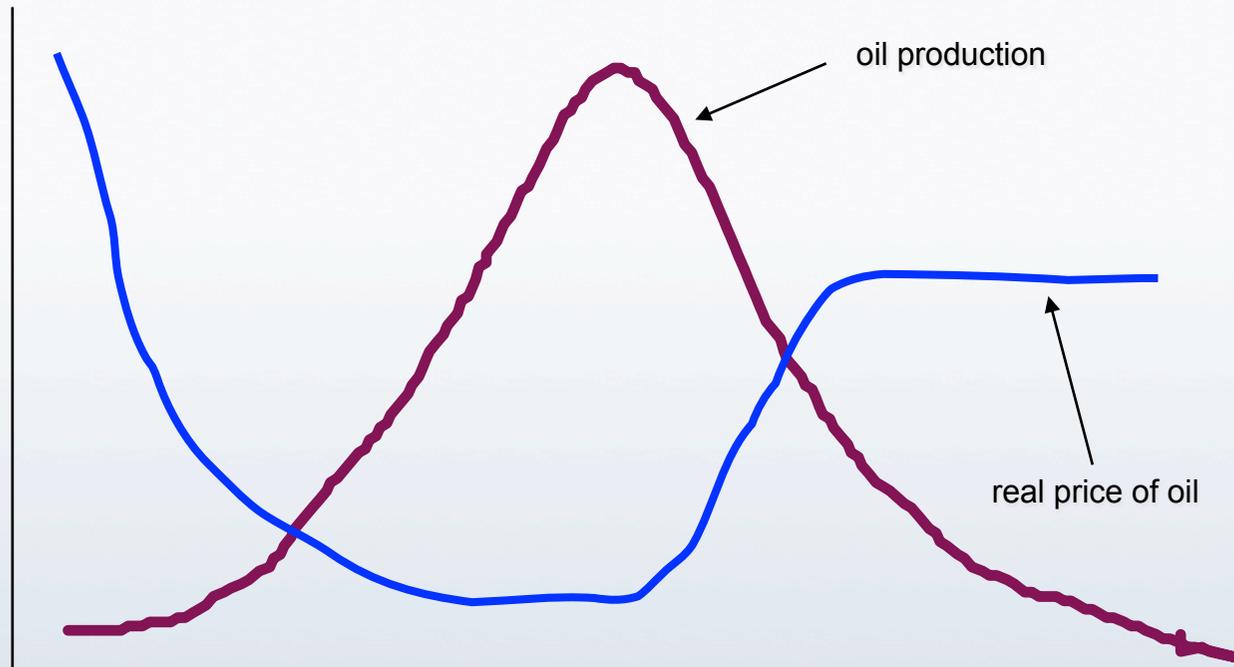
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ESCP, London
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Key issues

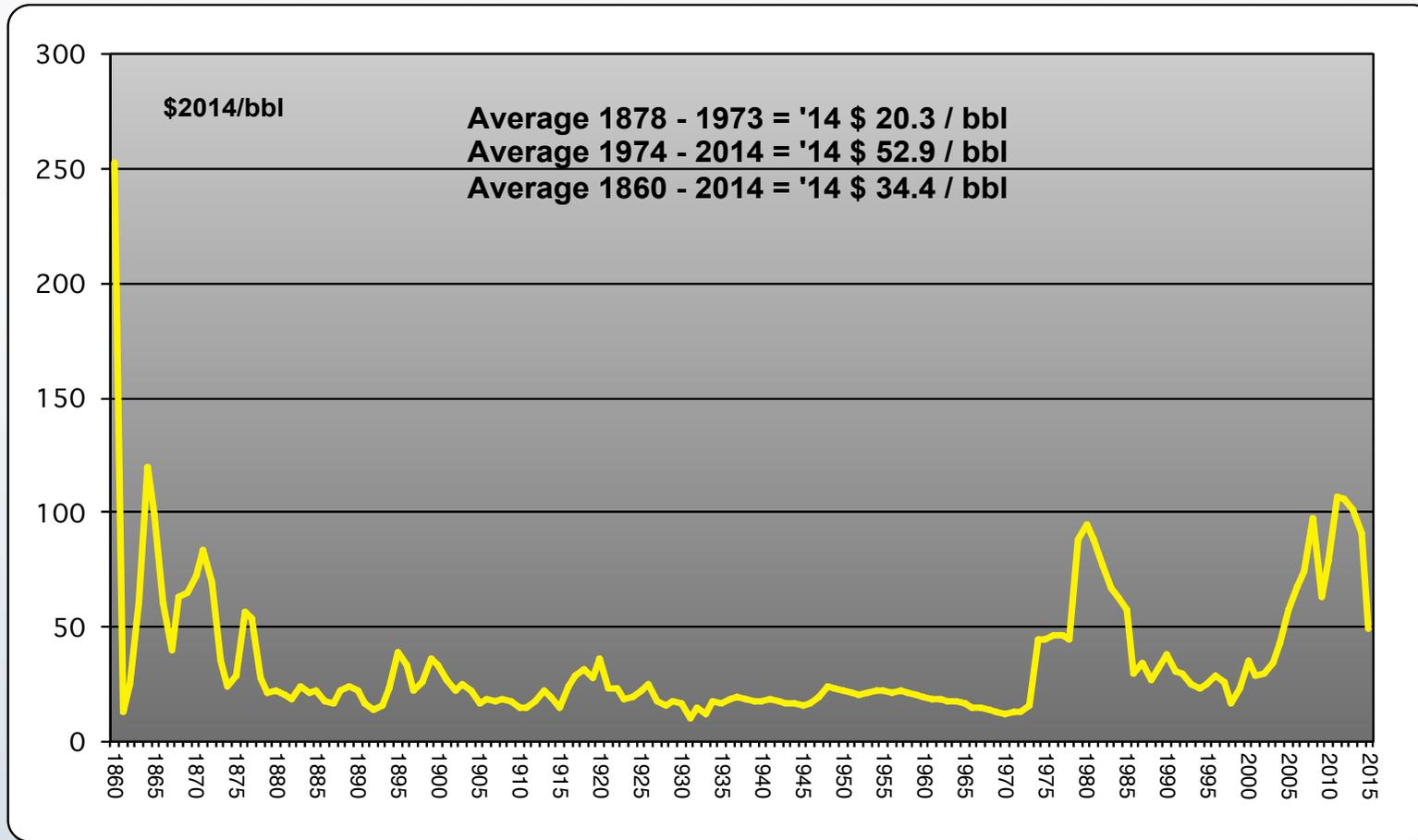
- **When was the oil market a 'real' market and what were its characteristics?** – the 'free for all' of the early years in the US; boom and bust cycles and extreme price volatility; rapid depletion due to lack of 'unitisation'; the 'law of capture'.
- **How did the industry cope with oil price volatility?** – John D. Rockefeller's vertical integration model: control of refining, transportation and, ultimately, of production; despite the Sherman Act (1911), concentration persists in the industry; the advent of the Seven Sisters and the Gulf plus principle (1928); the Texas Railroad Commission and oilfield unitisation (1930).
- **OPEC enters stage left** – OPEC is established in Sept. 1960, but is ineffectual until 1970; flexing its muscles in the 1970s; official government selling prices (OGSPs) become the first control mechanism; OGSPs give way to production controls after 1986; the 'market' sets prices but OPEC controls the 'marginal' barrel; fiscal and political considerations predominate.
- **OPEC finally gives up the ghost?** – after almost four years of keeping prices relatively stable above \$100/bbl, Saudi Arabia - OPEC's de facto leader - decided in late November 2014 not to push for output cuts in the face of a supply glut caused primarily by the US shale revolution. The oil price falls by over 50% in six months and there is talk of the cartel's final demise.

The life cycle of the world oil industry and the real price of oil



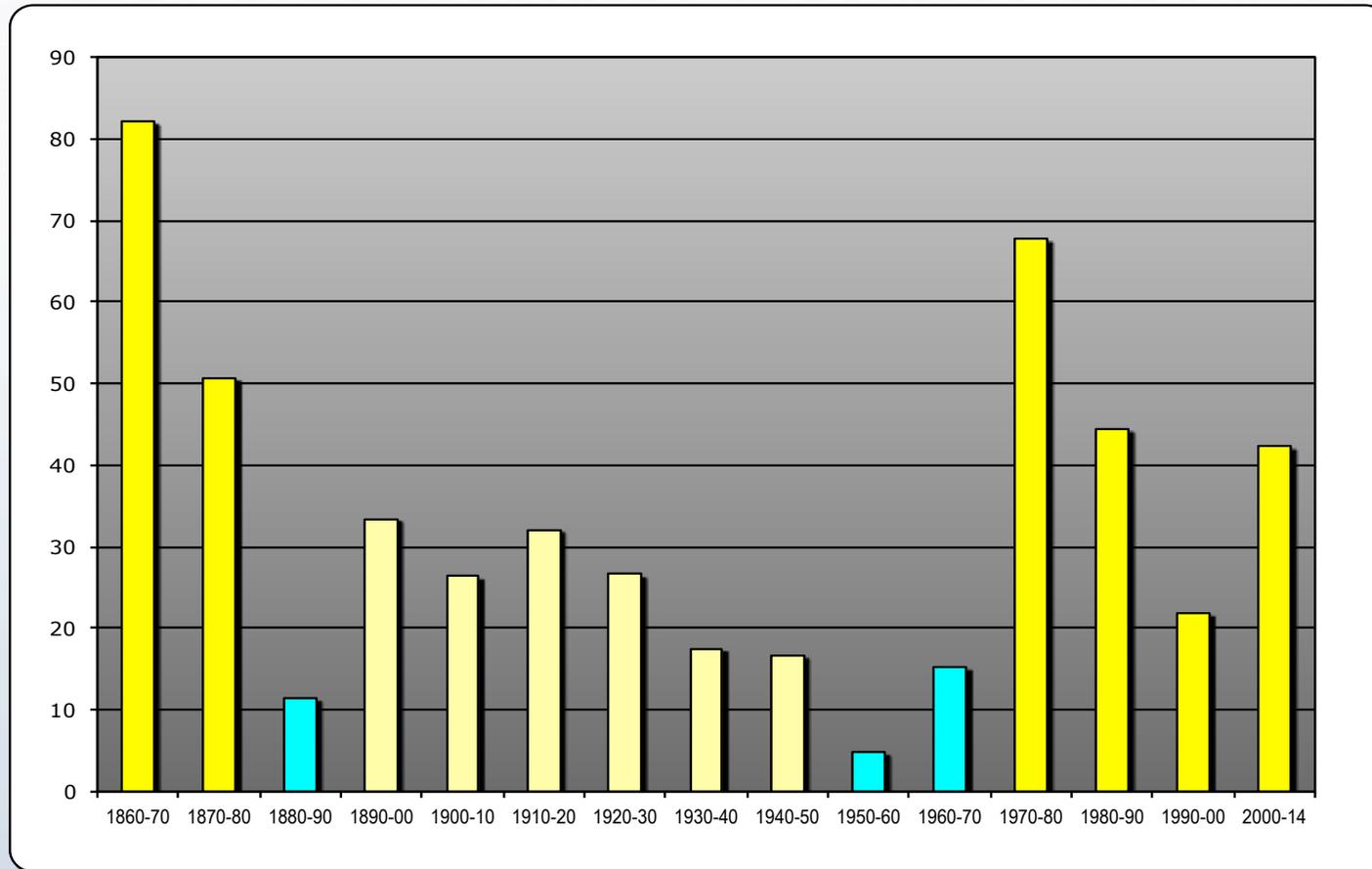
- **first phase** -----> **rapid fall in the price of oil**
- **second phase** ----> **steady decline to long-lasting floor**
- **third phase** -----> **strong rise in real oil price**
- **fourth phase** -----> **price at plateau; back-stop technology**

Oil prices in the long run in 2014 US Dollars



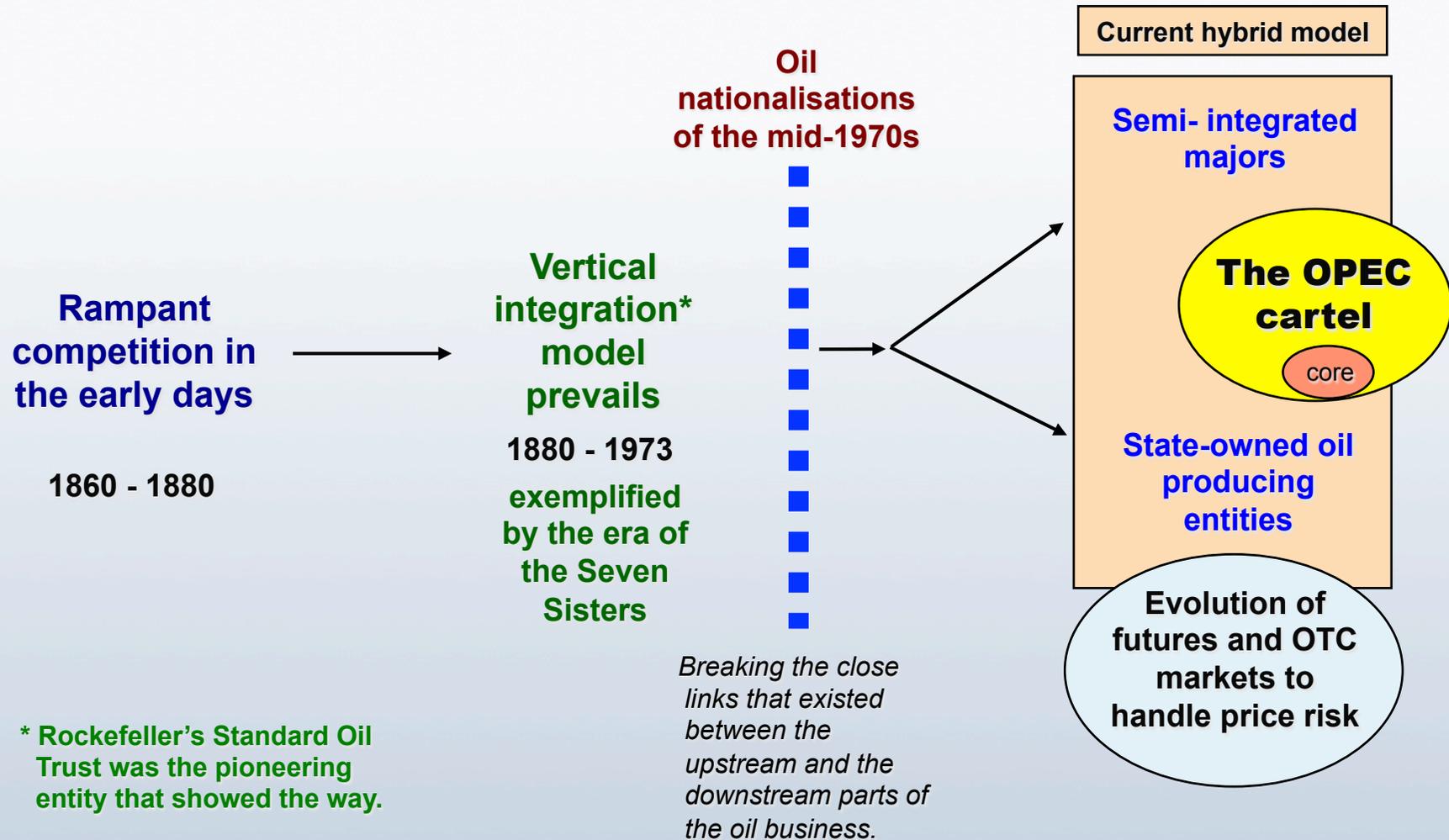
The global oil industry has experienced three major oil price phases. The first, from 1860 to 1880, was characterised by extremely volatile prices until Rockefeller consolidated the industry around his Standard Oil Trust. Although the trust was dismembered by law in 1911 (Sherman Antitrust Bill), its daughter companies became integrated majors and ensured relative price stability (the era of the Seven Sisters) from 1920 till 1973 – constituting the second phase. In the third phase, from 1974 to 2014, OPEC tried to control and stabilise the market, but with limited success until seemingly abandoning this effort in Nov-14.

Oil price volatility by decade in real terms (percentage coefficients of variation in 2014 US Dollars)

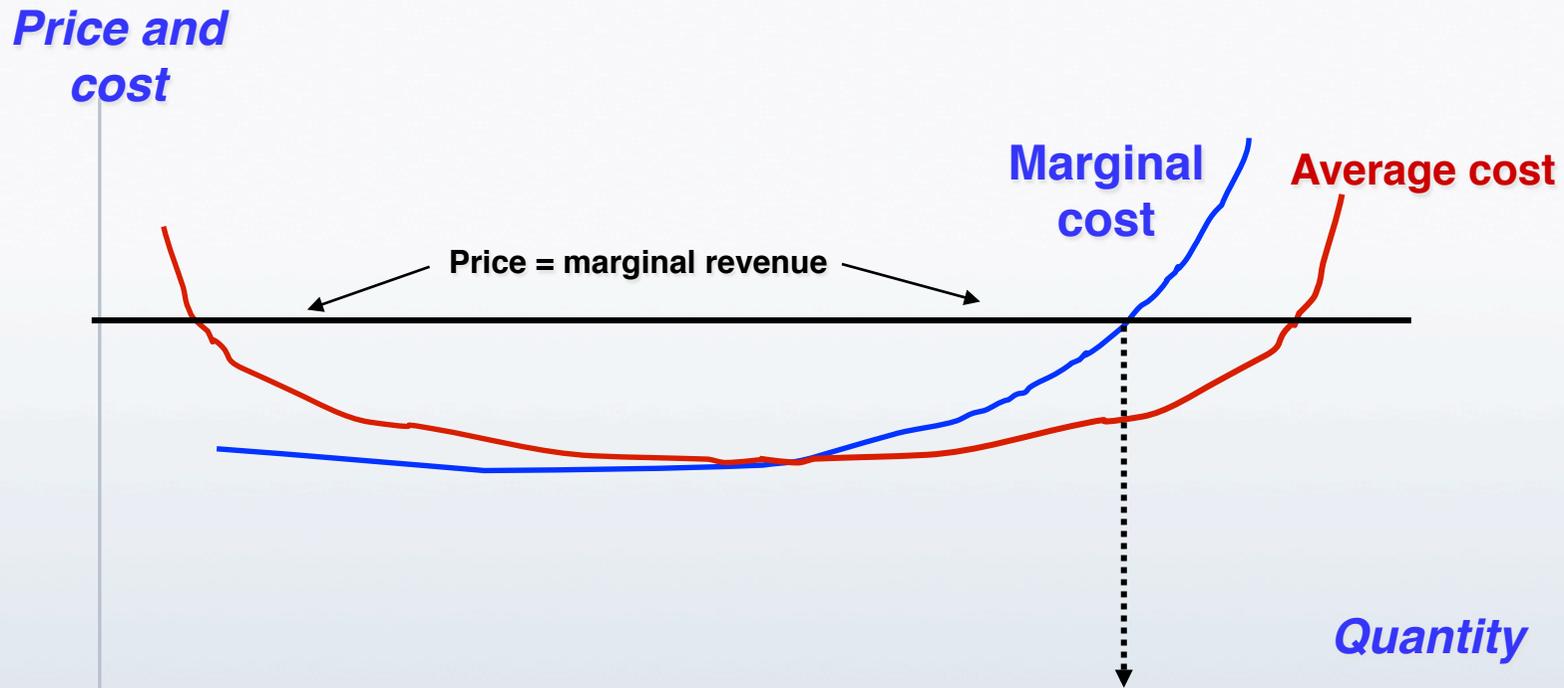


Price volatility was extremely high during the first two decades of the oil industry's existence and in the aftermath of the oil price crises of the 1970s and 1980s. Prices were reasonably stable during the 1990s, but volatility flared up again between 2000 and 2014. If Saudi Arabia has truly abandoned its role as price stabiliser, then there is every likelihood that oil price volatility will remain high.

Evolution of the oil industry

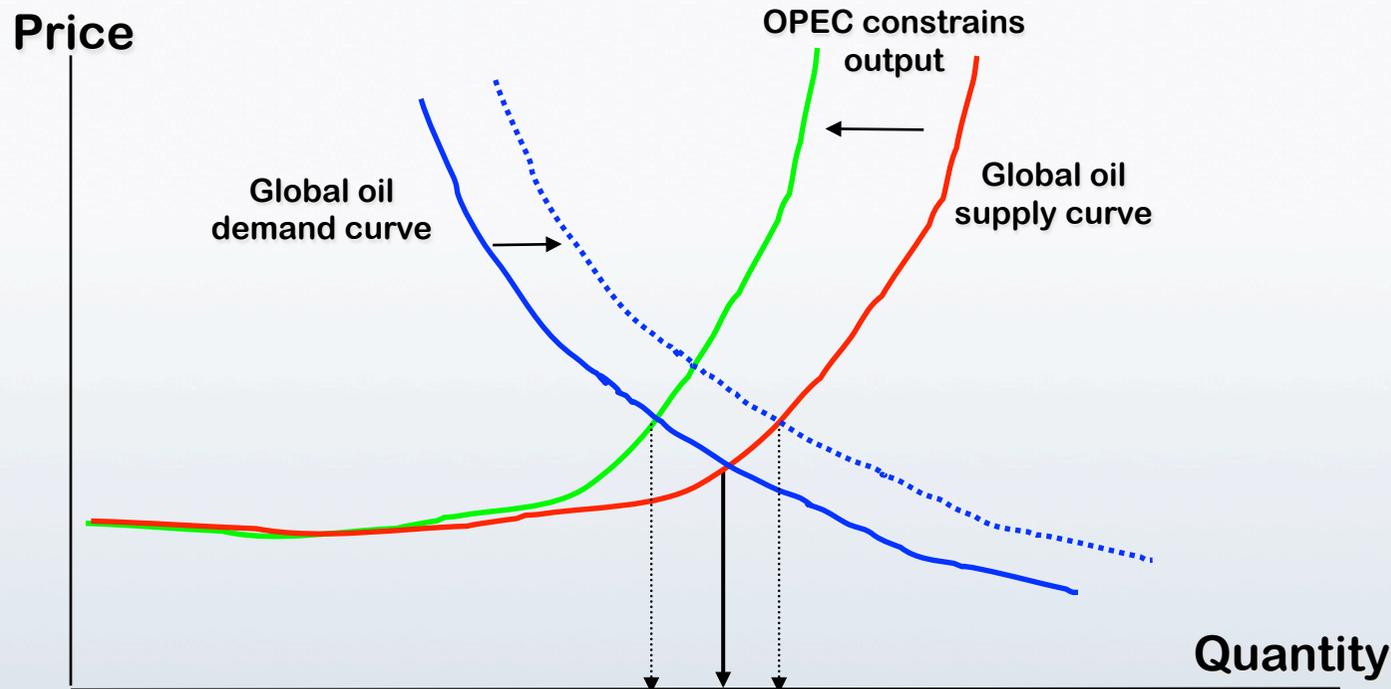


The upstream sector : marginal and average cost curves



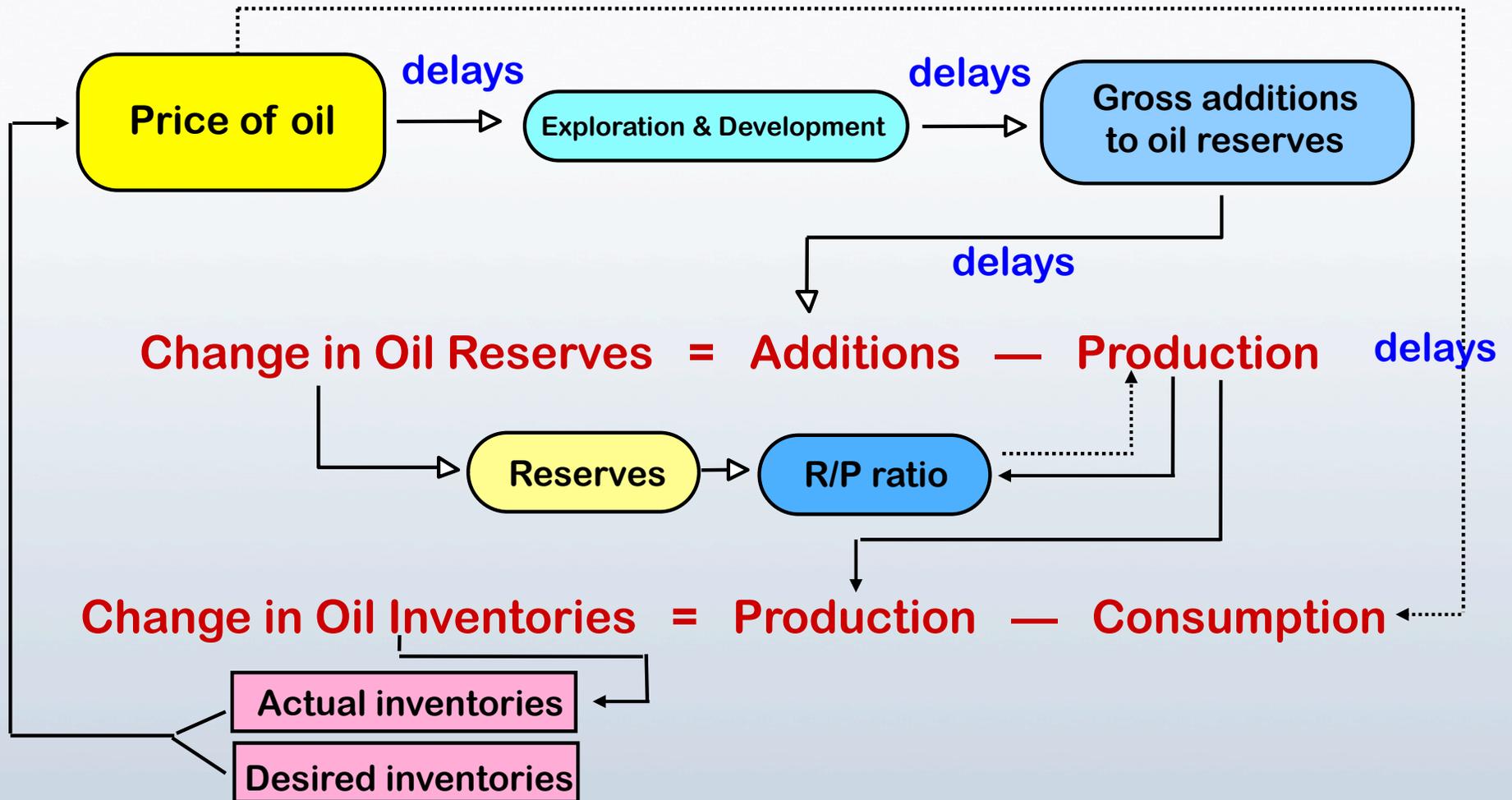
- Oil and gas fields tend to have flat average and marginal cost curves over most of their production range. This leads – under conditions of free competition – to relatively high levels of profit-maximising output, relatively high rates of depletion and fairly swift exhaustion of the fields unless investments are made in enhanced recovery systems and/or technology comes to the rescue.
- As the price varies, the marginal cost curve becomes the individual producer's supply curve. The industry's marginal cost curve is its supply curve too.

Classical economics meets the OPEC cartel



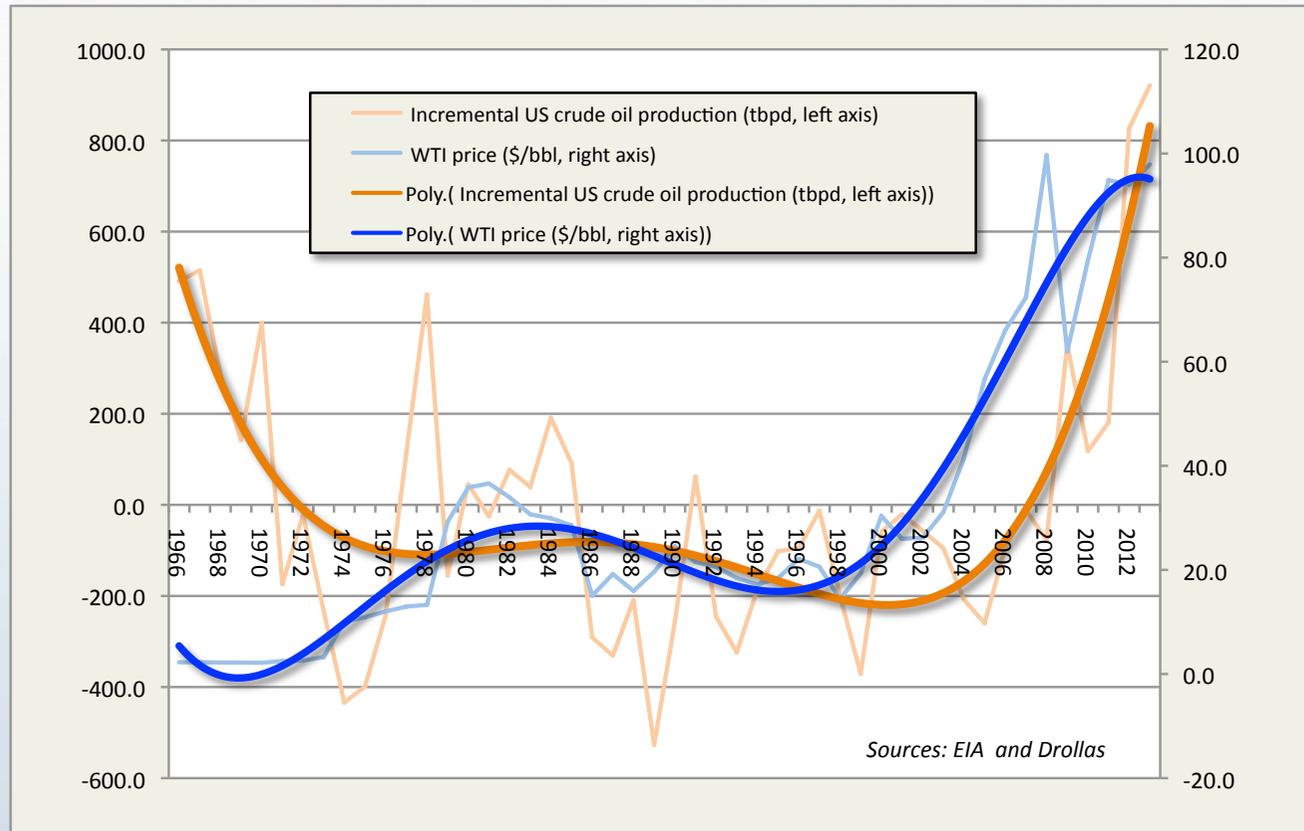
- **Classical market-clearing economic theory under competitive conditions requires all low-cost production capacity to be fully utilised. All producers must be willing to supply the market up to the limit of their production capacity.**
- **When OPEC constrains output to push up prices, it is shutting in low-cost capacity; this action results in oil prices becoming indeterminate. Oil prices are susceptible to decisions based on other considerations (e.g., fiscal needs, geopolitics, et al).**

The road to non-OPEC supplies



Oil prices and incremental US oil output

Incremental US oil production and the price of WTI (or equivalent for the earlier years), 1966 to 2013



The US' oil industry has evolved in such a way as to respond to price incentives. When the price of oil was low in the 1960s and early 1970s, incremental production kept on declining until surging oil prices during the crises of the 1970s and early 1980s arrested the rate of decline. Weakening prices caused the rate of decrease of US output to accelerate once more until surging prices from 2002 onwards sent incremental US production soaring with a lag of around six years.

The US' shale oil resources and well costs

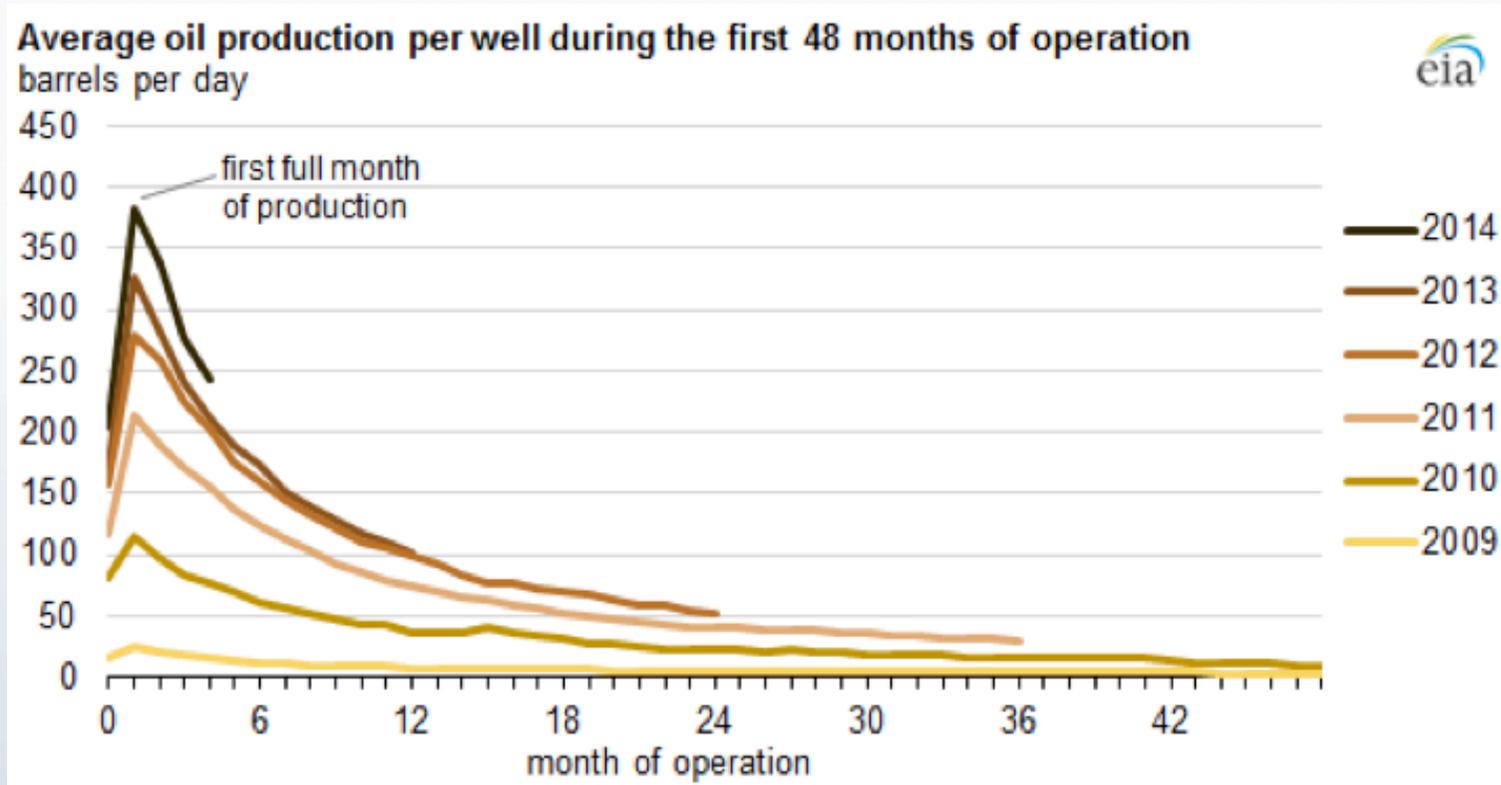
Sources: EIA and CGES

| | Technically recoverable | Well costs |
|----------------------------|-------------------------|---------------------|
| | bn bbls | \$ million per well |
| Bakken | 3.59 | 5.5 to 8.5 |
| Eagle Ford | 3.35 | 4 to 6 |
| Avalon/Bone Springs | 1.58 | 3 to 5 |
| Monterey/Santos | 15.42 | 5 to 7 |
| Total and average | 23.94 | 5.8 |

The Bakken's challenges

- Severe winter weather (-40 deg C) causes wells to be shut in; drilling is stopped and completions are halted.
- The cost of drilling has increased significantly; according to the N. Dakota Petr. Association the cost per well (\$5.6mn in 2009) has doubled.
- The time from spudding the well to production has also doubled.
- It is costly to bring the oil to refineries because the necessary infrastructure is lacking, adding up to \$15/bbl to the wellhead price.
- Sustainable oil prices are needed, along with take-away pipeline capacity.

Well productivity in the Eagle Ford Basin

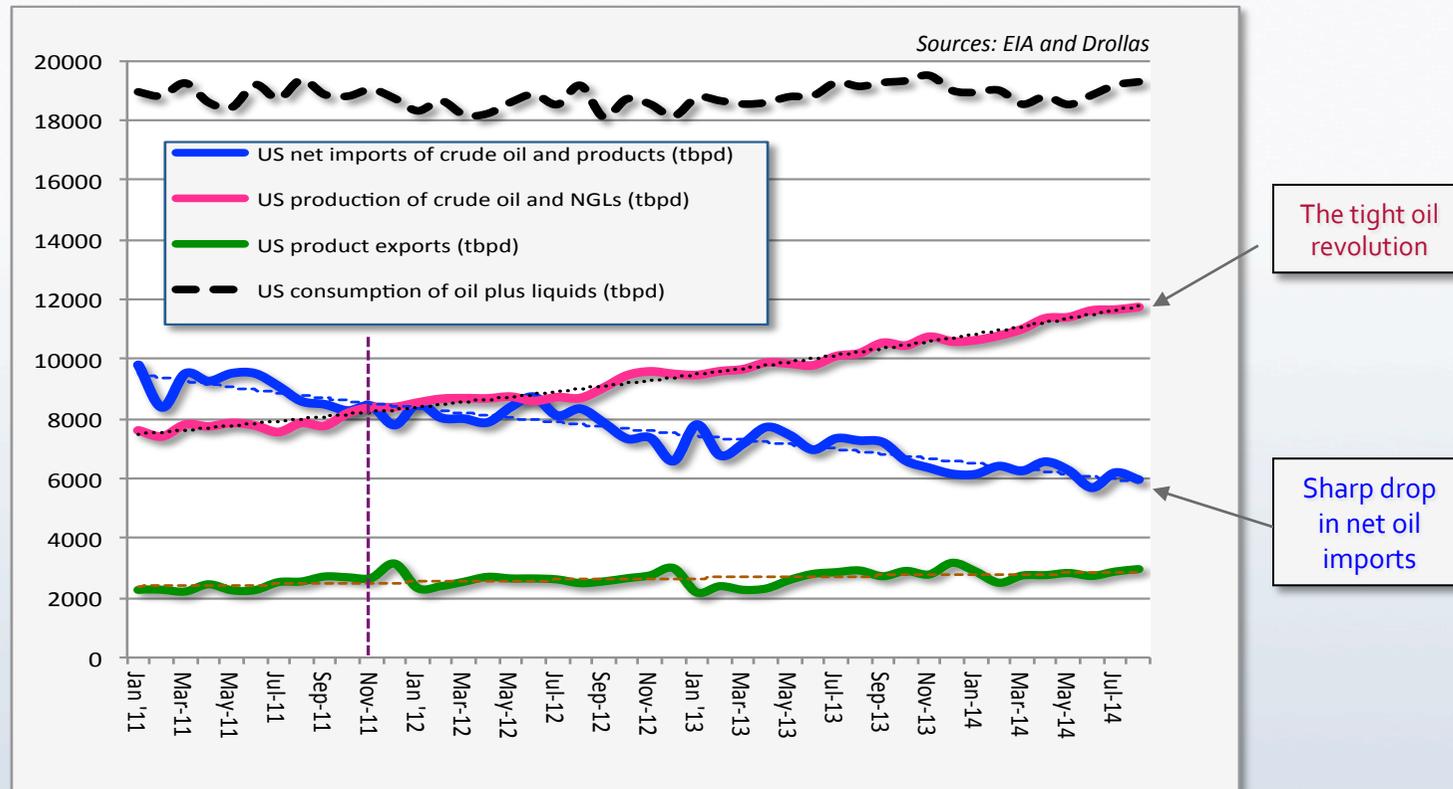


Most of the US' tight oil is produced in two basins – the Williston in North Dakota and the Eagle Ford in Texas.

Tight oil's key problem is the rapid decline in well productivity (see figure above), which requires the repeated drilling of wells in order to maintain production. Technological progress has dramatically increased output per well, but the time taken for well productivity to halve has in turn halved between 2009 and 2014.

Impact of the US' tight oil revolution

The US' net imports of crude oil and products : January '11 to August '14



US oil consumption has been fairly static since the beginning of 2011, whereas US net imports of crude oil and products have declined dramatically over the same period. This has been entirely a consequence of the tight oil and gas revolution in the US, which has resulted in almost 4 mbpd of additional production of crude oil and NGLs, leading to an almost equal drop in net imports of crude and products since January 2011.

The Middle East and West Africa's oil pivot to Asia

Percentage shares of oil exports to the US, Europe and Asia-Pacific

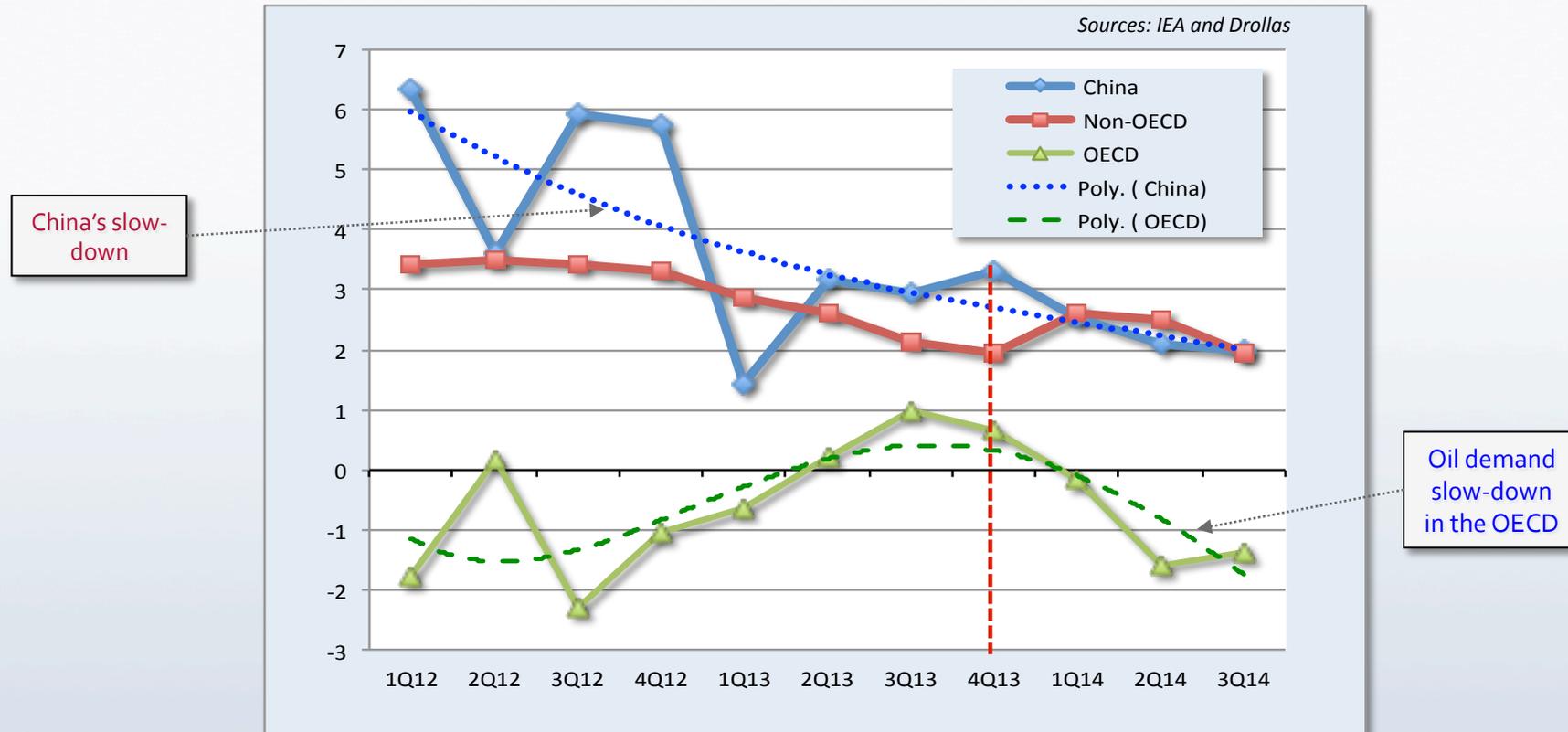
Sources: BP and Drollas

| from | | to US % | to Europe % | to Asia-Pac % |
|--------------|------|------------|----------------|------------------|
| Middle East | 2013 | 10.3 | 10.6 | 76.1 |
| | 2005 | 11.8 | 15.9 | 66.6 |
| North Africa | 2013 | 8.3 | 67.5 | 15.9 |
| | 2005 | 17.8 | 63.8 | 5.9 |
| West Africa | 2013 | 14.2 | 32.8 | 44.6 |
| | 2005 | 44.6 | 16.0 | 32.2 |

The decline in US oil imports due to the tight oil revolution has affected mainly the oil trade with West Africa and to a lesser extent with N. Africa. Displaced light-sweet barrels that had been heading to the US from West Africa are now going east to China, India and the rest of the Asia-Pacific region. In 2005, 45% of West African oil exports went to the US and 32% to Asia-Pacific; by 2013 the share to the US had dropped to 14% and to Asia-Pacific had risen to 45%. Interestingly, the share of the Middle East's oil exports going to the US has hardly changed; instead, the share of its oil exports to Europe has declined by 5 percentage points.

The slowing down of oil demand growth

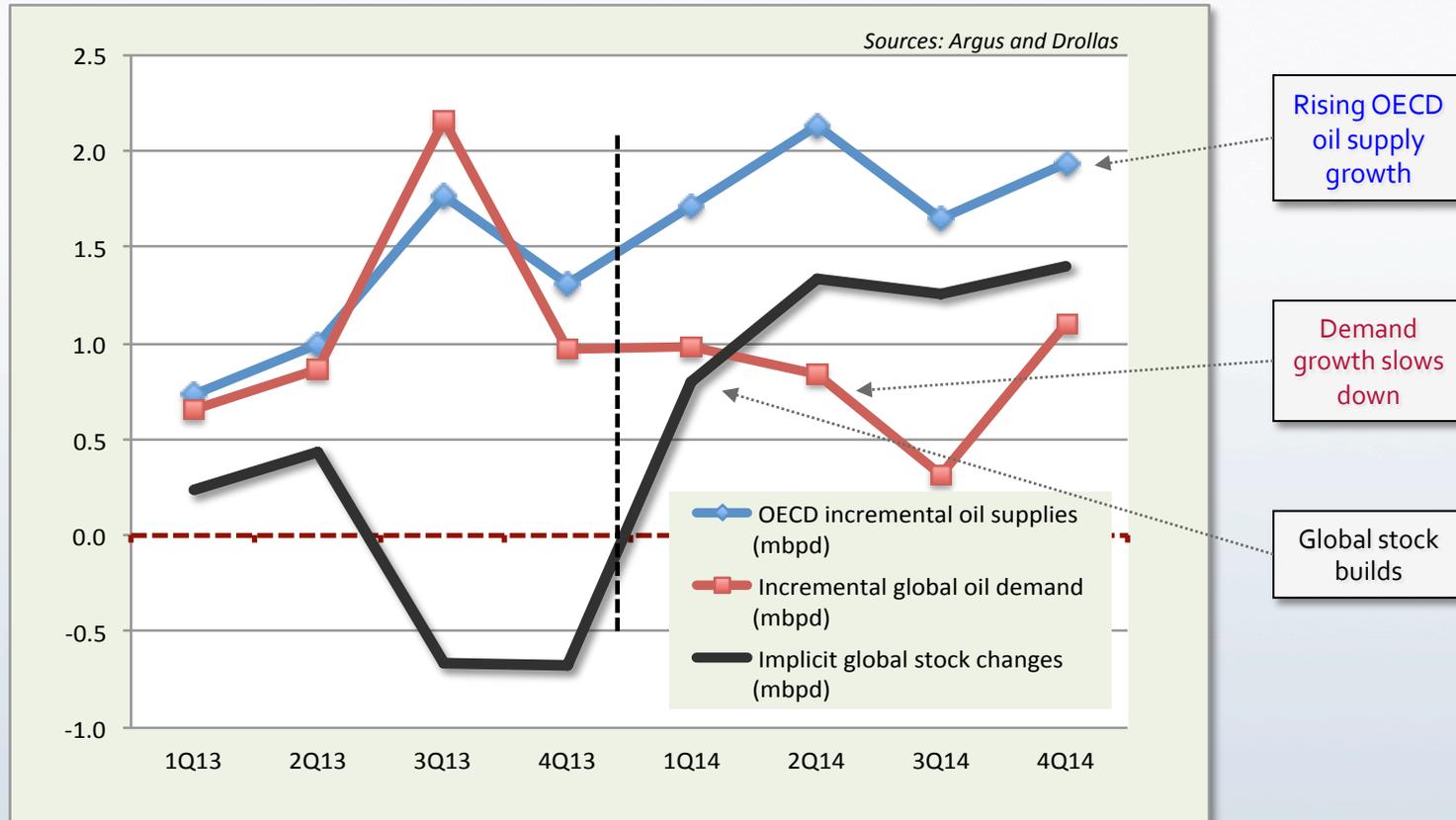
Percentage rates of growth, year-on-year



China, and more generally the non-OECD countries, have been the key drivers of oil demand growth. However, China's rate of growth of oil consumption has been weakening for the last couple of years, ratcheting down further in 2014 to the 2% p.a. level. As for the OECD group of countries, after recording somewhat anaemic growth in 2H13, oil demand contracted once again in the middle quarters of 2014.

The massive global stock build in 2014

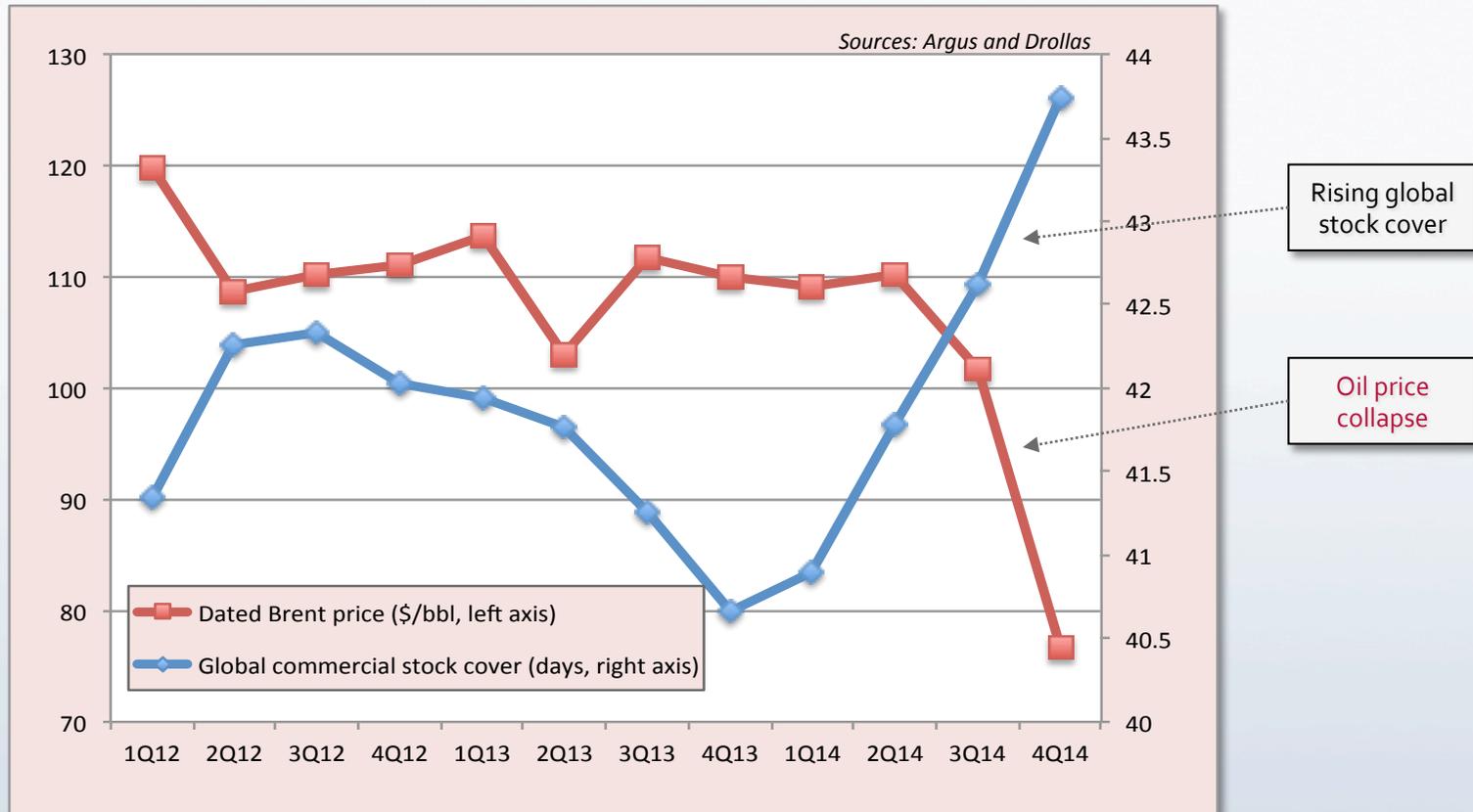
(in millions of barrels per day, year-on-year)



OECD oil supply growth has been accelerating due to surging US oil production, while global oil demand growth decelerated in the middle of last year. For its part, OPEC increased its rate of production in the second half of 2014, helping to keep global inventory builds well above 1 mbpd and exacerbating an oil glut that had been growing since the summer of last year. OPEC's decision in late Nov-2014 not to cut its output means that oil prices are left entirely to the vagaries of the market.

Stock cover and the price of oil

Dated Brent and global commercial inventory cover



In general, when stock cover is high, prices are low and vice versa, but the relationship between the two is not as straightforward as might first appear to be the case, because what determines oil prices is the disequilibrium between desired and actual stock cover and not the level of cover on its own. At times oil prices may not change much (e.g., during the period 3Q13 to 2Q14), despite a fall in the world's commercial inventory cover. However, the recent price collapse was clearly the result of rising global commercial stock cover.

Closing remarks

- Despite the recent price rally, conditions in the oil market remain very bearish.
- Without OPEC acting collectively to curb production, a market-driven solution to the problem of over-supply will take time.
- Global oil demand growth will eventually accelerate due to weaker oil prices, but it will take almost a year for this to be noticeable.
- For oil production in the US shale plays to stop rising oil prices will need to fall - and stay - below \$40/bbl.
- What happens next depends on who blinks first - OPEC or the US shale producers.
- History tells us that a 'real' market for oil should lead to greater price volatility, which would be good for traders but not so desirable for consuming entities and oil producers, who need stability for planning purposes in an industry focussed on the long run.

However, remember the impact of political events on the price of oil

