

Oil Prices and the Global Economy: Is It Different This Time Around?

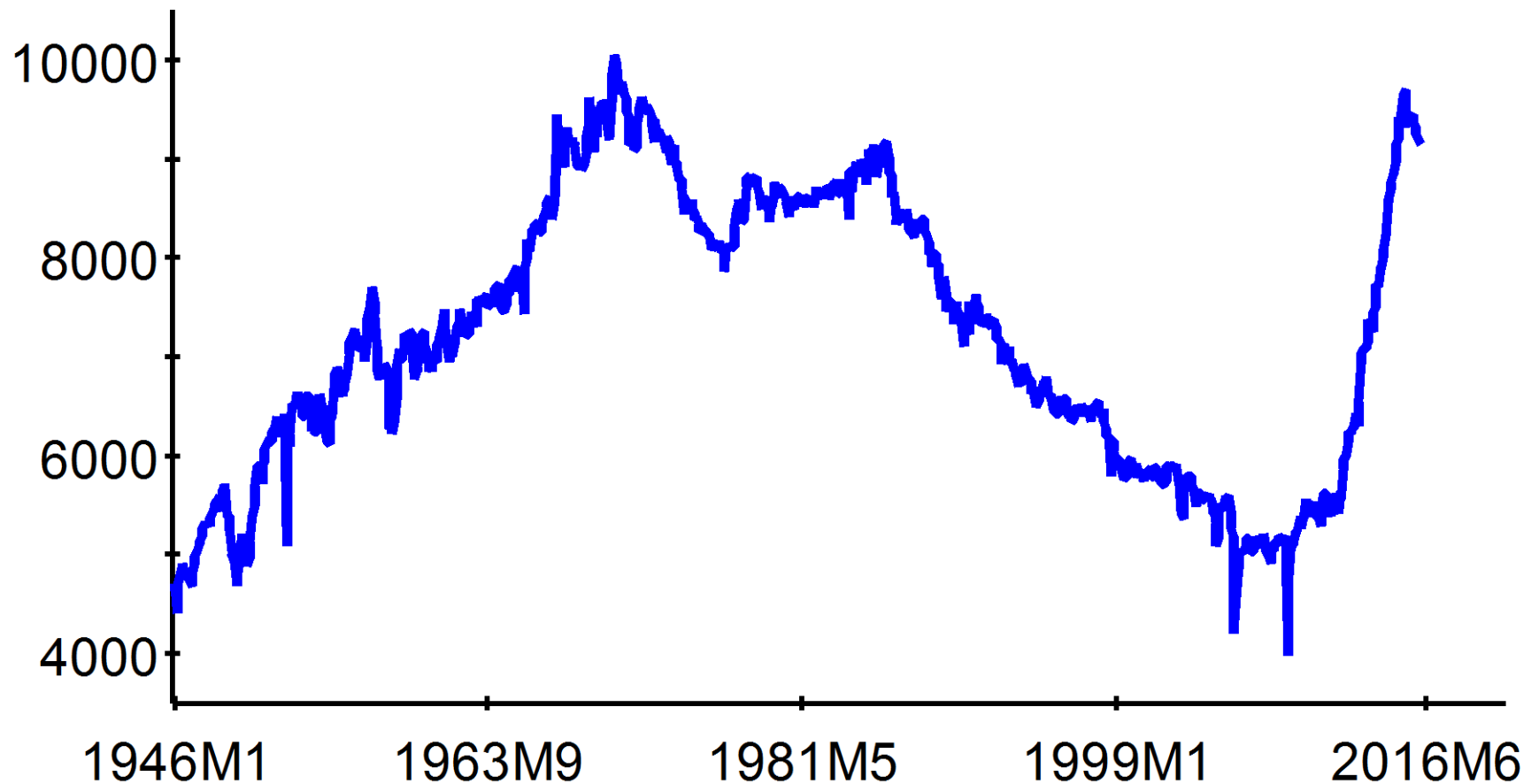
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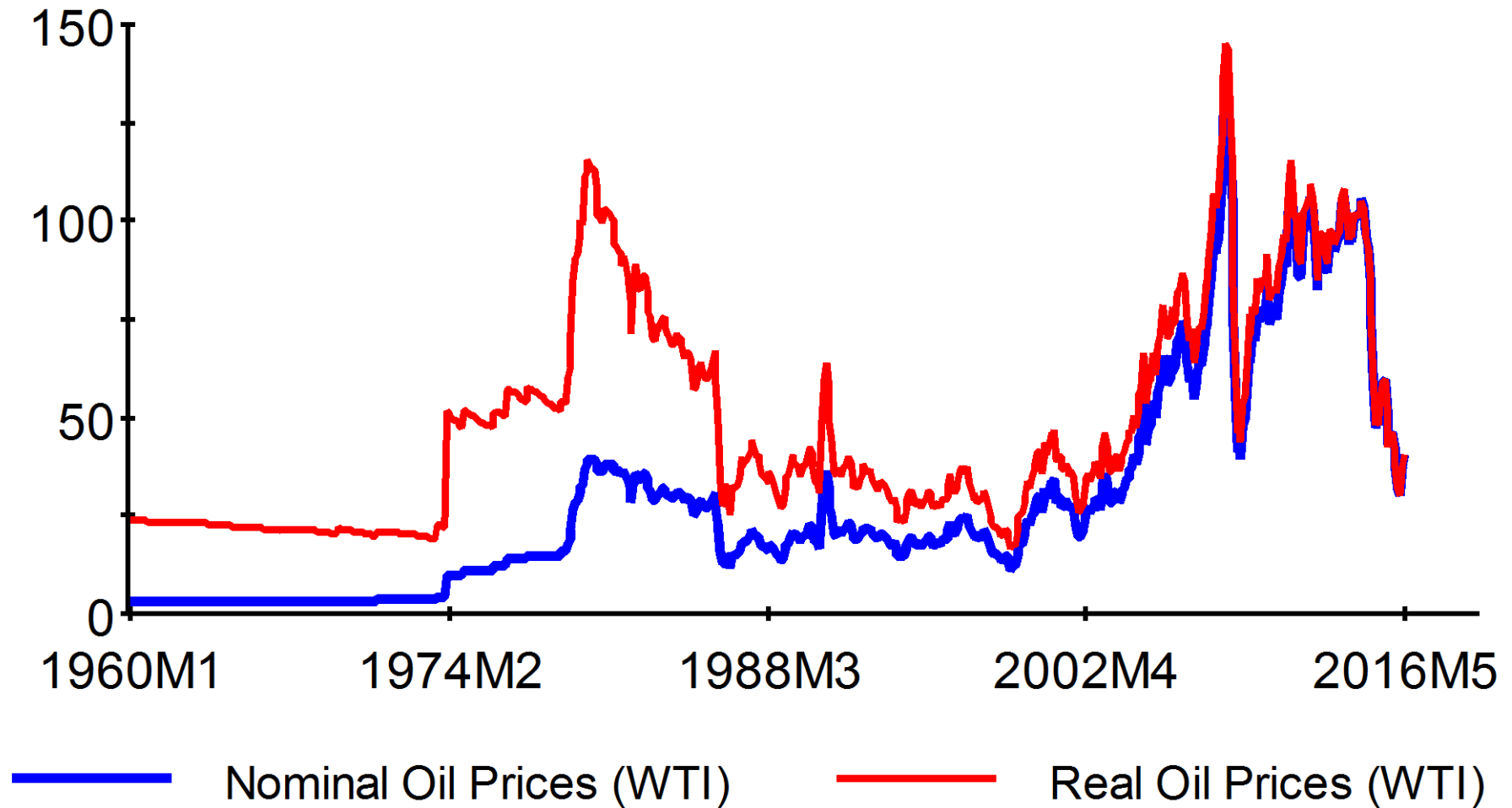
Introduction

- Oil markets have experienced frequent episodes of boom and bust, ever since oil was produced in large commercial quantities in Pennsylvania back in 1859.
- Oil prices (in 2015 US dollar) have fluctuated between highs of \$145 to lows of \$15 per barrel (p/b).
- The control of oil markets by the "seven sisters" (backed by UK and US governments) meant low and relatively steady oil prices until late 1960s.
- A new era began with the foundation of OPEC in 1960, the 1968 coup in Libya which led to new agreements (initially with the independent oil companies) and then with the seven sisters across all major oil producers in the Middle East and elsewhere, not to mention the start of a downward trend in US oil production in 1971.
- Oil markets entered a new phase -- the seven sisters lost control to markets and oil producers, oil prices quadrupled, ushering in an era of high oil price volatility and frequent periods of boom and bust often triggered by military and political events.

US oil production (1000 b/d) peaking in 1971 and 2015



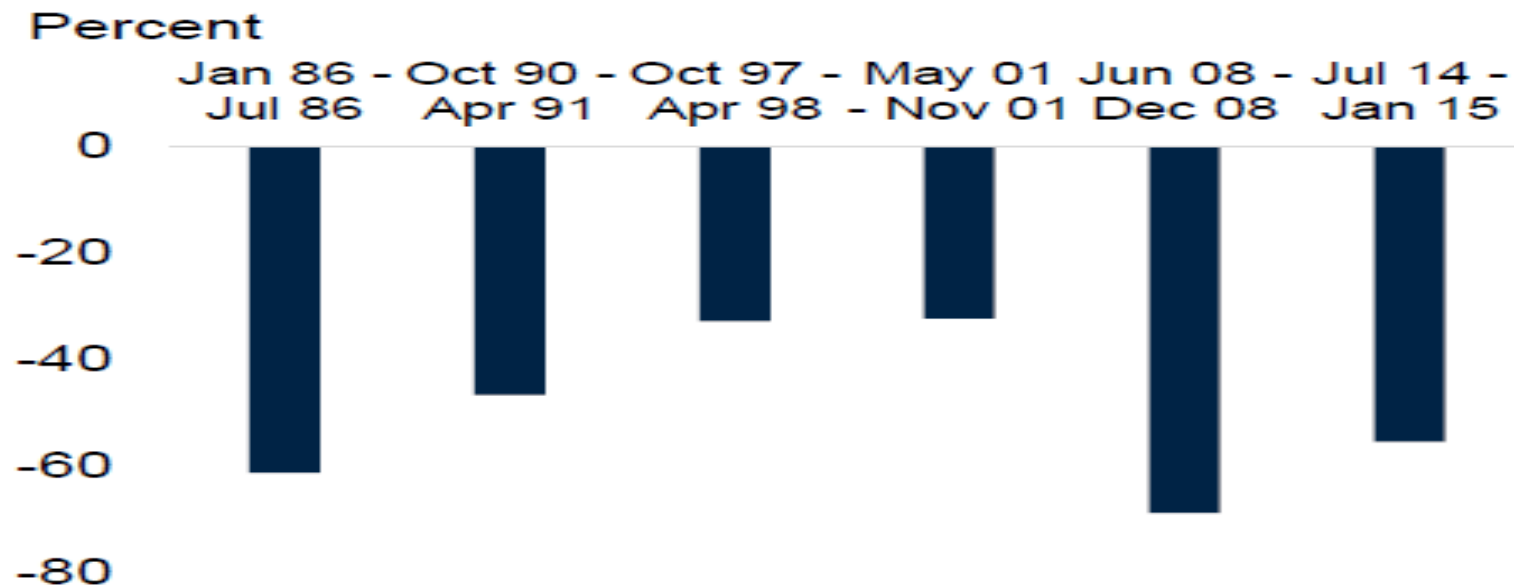
Nominal (WTI) and Real (2015 US dollars) Oil Prices



Recent Plunge in Oil Prices

- While the fall in oil prices since June 2014 is large, it is by no means unprecedented.
- 6 periods of sharp oil price declines (30% or more), in a relatively short period of time (within 7 months), and with relatively large effects on the global economy can be identified over the period 1986-2014.

Magnitude of significant oil price drops²



Oil prices and the global economy I

- The collapse of oil prices from around \$114 in June 2014 to \$27 in January 2016 (back up to \$50 in June 2016), has led to a lively debate regarding the reasons for this steep oil price drop and its macroeconomic implications.
- Most of the analyses are largely descriptive in nature and written mainly by international organizations (e.g. the IMF blog by Arezki and Blanchard, 2014), investment banks (such as GS's report on "The New Oil Order"), various (energy) economists, and internal reports by oil and gas companies.
- But there are also a number of papers, that consider more formal econometric analysis. Notable examples are Baumeister and Kilian (2015) who argue that demand factors have been most important in explaining the recent behavior of oil prices, while Baffes et al. (2015), Husain et al. (2015), and Mănescu and Nuño (2015) argue that it is supply (rather than demand) factors that played the largest role. In another study Morana (2016) examines the effects of falling oil prices on euro area economies, taking account of the QE and zero lower bound rates.

Oil prices and the global economy II

- More broadly, While there is a large body of literature investigating the effects of oil shocks on the macroeconomy, most studies have focused on a handful of industrialized/OECD countries with the analysis being mainly carried out in isolation from the rest of the world. Baumeister and Peersman (2013a, 2013b) and Kilian and Murphy (2012, 2014)
- Furthermore, the focus of those analyses has predominantly been on net oil importers--- see, for example, Hamilton (2009), Kilian (2009), and Peersman and Van Robays (2012).
- An exception is the work of Cashin et al. (2014), who look at the differential effects of oil demand and supply shocks on the global economy, Esfahani et al. (2014), who analyse the direct effects of oil-revenue shocks on domestic output for 9 major oil exporters, Kilian et al. (2009), who examine the effects of different types of oil-price shocks on the external balances of net oil exporters/importers, and Mohaddes and Pesaran (2015), who examine the effects of country-specific shocks on the world economy, and Mohaddes and Raissi (2016) who look at the effects on MENA countries.

Oil prices and the global economy III

- These studies suggest that:
- The initial impacts of oil price changes differ widely across different countries, with oil importers benefiting from the fall in oil prices (once we control for demand conditions) and oil exports losing from the price fall.
- But the net overall outcome is far more complicated and depends on domestic political economy considerations and the feedback effects of oil price changes on global energy demand, interest rates, financial markets and world trade.
- There are many channels through which oil prices can affect real and financial variables.

Modelling interlinkages using the GVAR modelling approach

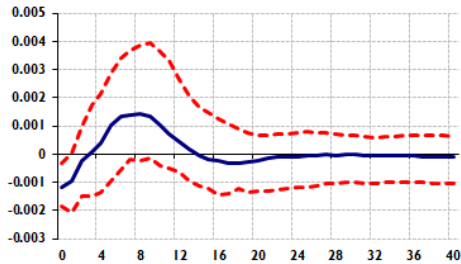
- To capture the complicated patterns of global economic interactions I, together with a number of collaborators, have developed the global modelling framework known as the GVAR (Global Vector autoregressive) model.
- The GVAR is a multi-country framework which links country-specific models in a coherent manner using time series and panel data techniques.
- Individual country models are estimated separately using time series techniques, conditional on the global variables, and then linked up and solved simultaneously.
- GVAR models have been used in bank stress testing, the analysis of China's emergence on the rest of world economy, international transmission of real and financial shocks, and forecasting.

Short term effects of oil price changes

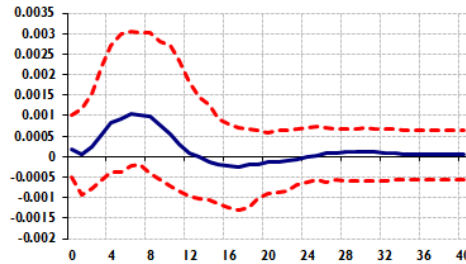
- Here I use the GVAR-Oil model developed in Mohaddes and Pesaran (2015, Dallas Fed Working Paper) to investigate the effects of oil price shocks. The model covers 34 countries, comprising 90% of world output. Most major economies are included in the model as well as major oil producers.
- The euro area is considered as a single economy (8 economies are combined into one). The model is estimated using quarterly observations over 1979Q1-2013Q1.
- 27 country/region models are linked through trade weights.
- Each country model includes real output, inflation, short and long-term interests, real equity prices, oil production, and oil prices.
- **Negative oil price changes tend to reduce interest rates and inflation, and increase real equity prices. The effects of oil price changes on real output are not as clear cut.**

Effects of a negative (short-term) shock to oil prices using the GVAR-Oil Model (Mohaddes and Pesaran, 2015)

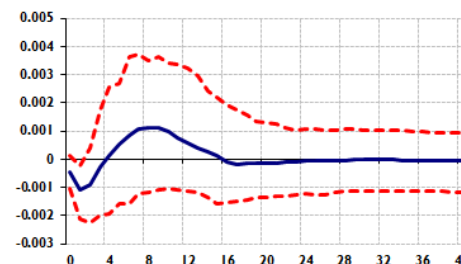
US GDP



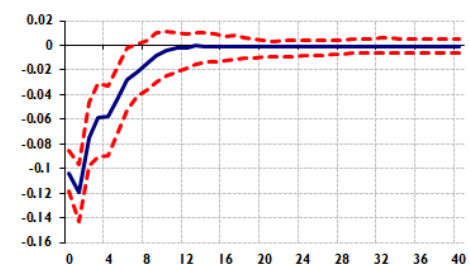
UK GDP



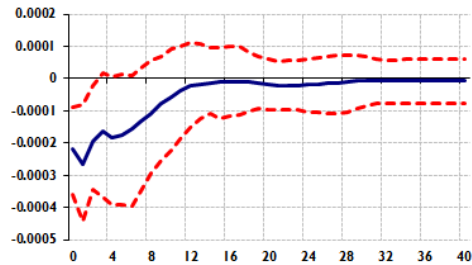
Euro Area GDP



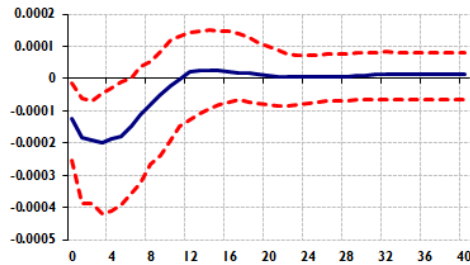
Oil Prices



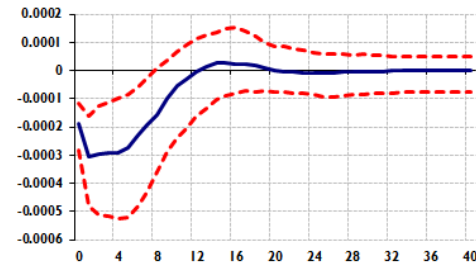
US Long-Term Interest Rate



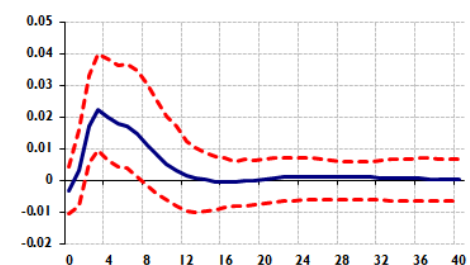
UK Long-Term Interest Rate



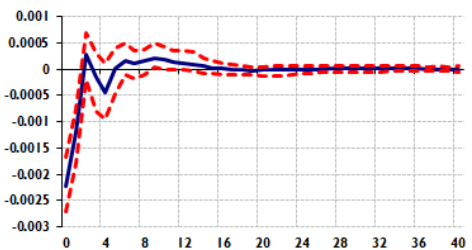
Euro Area Long-Term Interest Rate



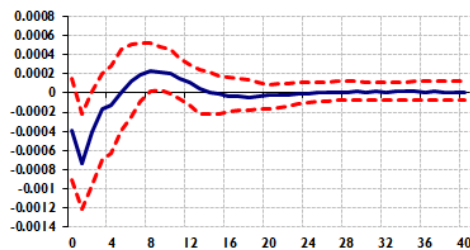
Global Equity



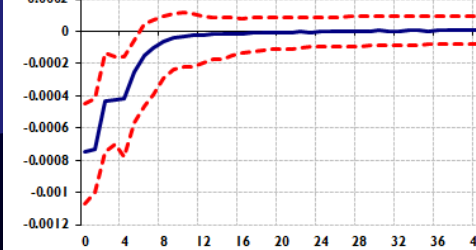
US Inflation



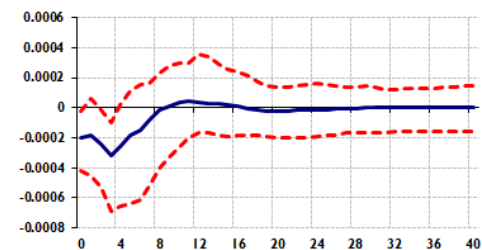
UK Inflation



Euro Area Inflation



US Short-Term Interest Rate



Oil price changes and the US economy

- The recent plunge in oil prices has brought into question the generally accepted view that lower oil prices are good for the global economy.
- It has been argued that near zero interest rates in most industrialised economies, and the fact that US has become a net oil exporter, have altered the traditional channels through which the benefit of lower oil prices gets transmitted to the real economy.
- The evidence on this view is mixed. It is true that the movement of real equity prices and real oil prices have become very much aligned during the Great recession and to a lesser extent thereafter. But this does not mean that lower oil prices are no longer beneficial for the US and the world economy.

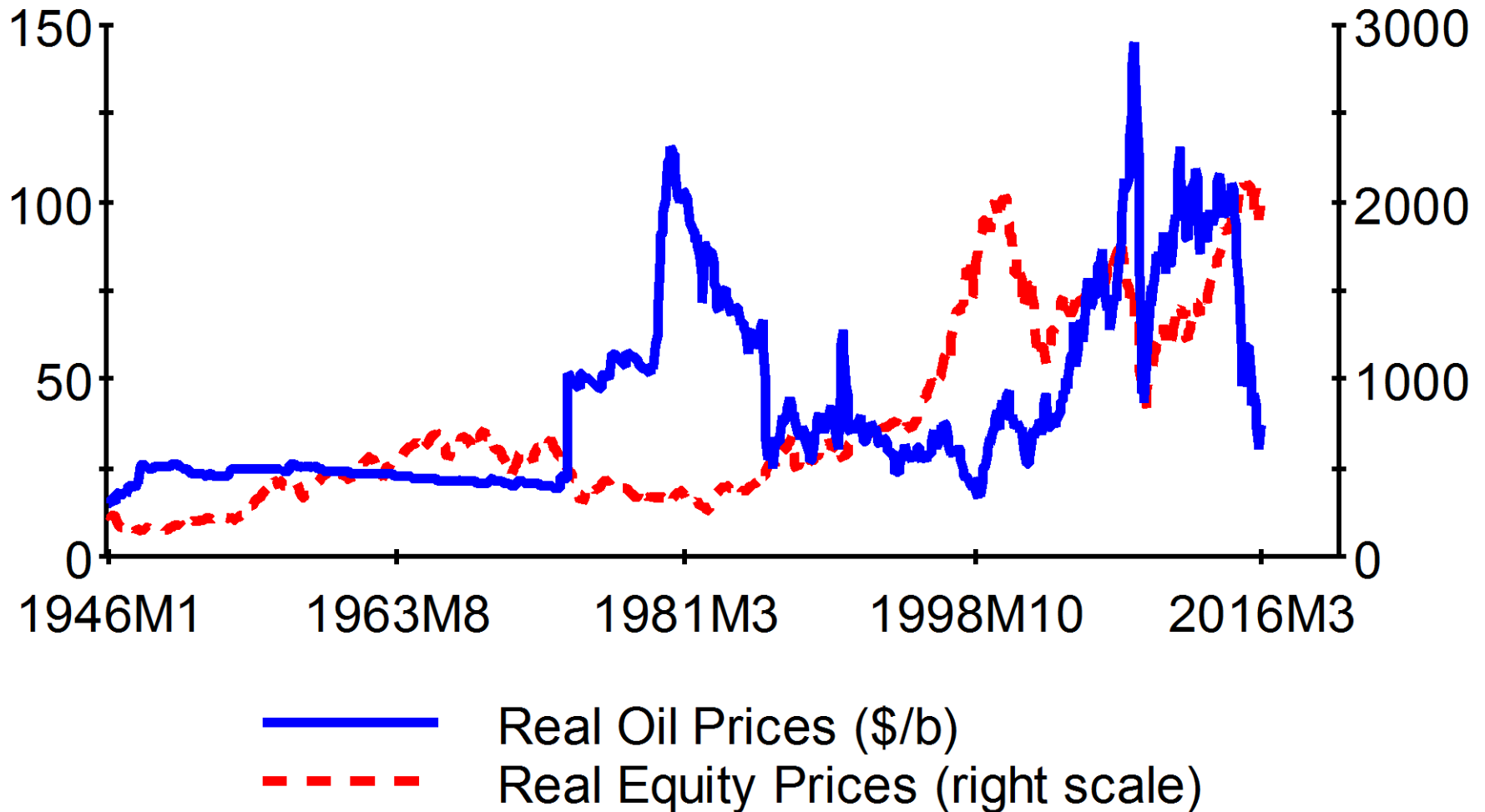
Low oil prices and the US economy

- In what follows I shall focus on the effects of lower oil prices on the US economy for two reasons
 - US economy has not been dependent on oil imports as much as other industrialised economies. In fact US started oil exports in January 2016 after a 40-year ban.
 - thanks to advances in hydraulic fracturing and directional drilling, oil production has significantly expanded in the US over the past 10 years. US oil production has risen from 5 million b/d in January 2008 to 9.2 millions b/d in January 2016, around 84% increase.
- It is, therefore, important to re-examine the effects of low oil prices on the US economy, particularly over the post 2008 period. Due to the short sample (2008-2015), we consider bivariate relationships between oil prices, equity prices and dividends.

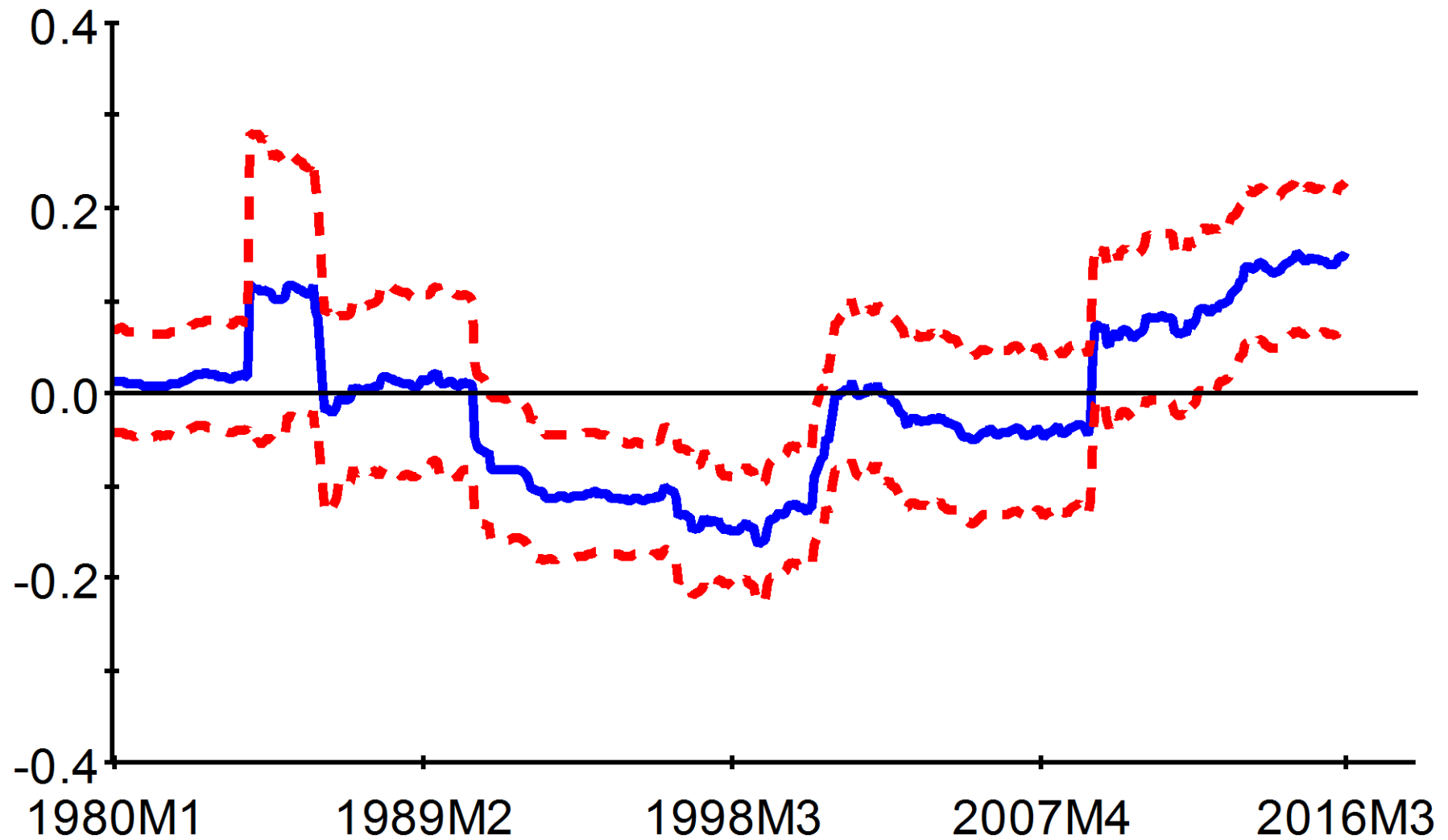
Historical evolution of the correlations between changes in real oil prices and real equity prices

- Overall, taking a relatively long historical perspective, there seems little evidence of a stable relationship between oil prices and real equity prices (levels or changes).
- Using rolling regressions of the rate of change of real equity prices (measured by SP 500 equity index) on the rate of change of real oil prices, estimated with 10 years windows, we find sub-periods where changes in real oil prices and real equity prices are unrelated, as well as sub-periods over which they are negatively and positively correlated.
- Since the 2008 financial crises, a significantly positive relationship between oil and equity prices has emerged, which has become the subject of discussions (see Bernanke's blog at Brookings on February 2016 and Obstfeld et al. IMF blog on March 2016).

Real Oil Prices and Real US Equity Prices (SP 500)



Effects of changes in oil prices on equity prices



Sovereign wealth funds and equity-oil price relationship

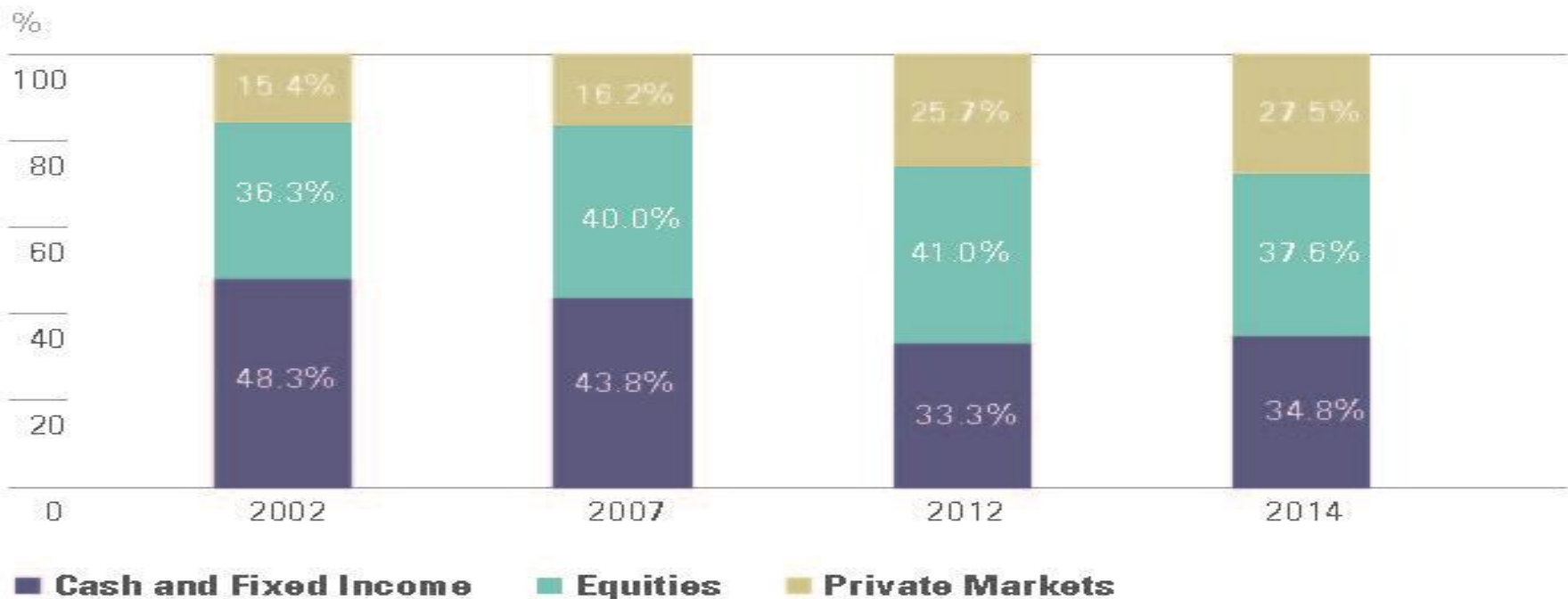
- Sovereign wealth funds have come to play a major role in reserve management of oil revenues. The prominent examples are:
 - Norway's Government Pension Fund (\$830),
 - Abu Dhabi Investment Authority (\$773),
 - Saudi Arabia's Fund (SAMA) (\$685),
 - Kuwait Investment Authority (\$592),
 - Qatar Investment Authority (\$256).

With the exception of Norway all figures refer to June 2015.

- During periods of rising oil prices, these funds are topped up with equity purchases, to be reversed during low or falling oil prices. On average 65% of SWF assets are held in public and private equities (60% Norway; 72% SAMA; 63% Kuwait; 68% Qatar; 62% Abu Dhabi—figures based on 2014).
- The equity transactions of SWF in turn induce an unintended positive correlation between oil and equity prices.
- Whilst it is true that such effects might not be that large, they could trigger larger effects due to known market over-reactions.

SWF portfolio allocation

Figure 4: Average SWF Asset Allocation, 2002–2014

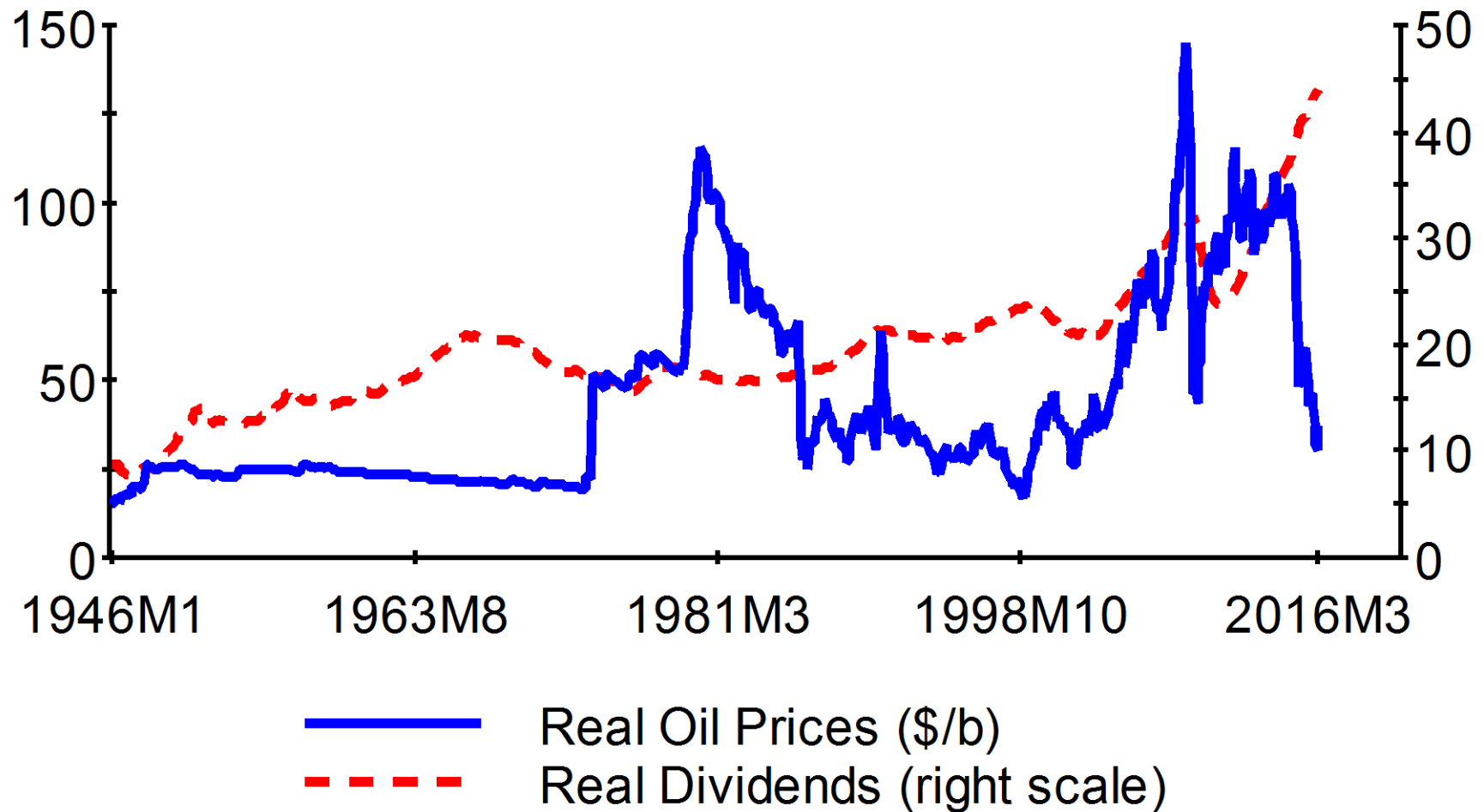


Source: SSGA research using Sovereign Wealth Centre data set. Allocations are as of the date indicated, are subject to change, and should not be relied upon as current thereafter.

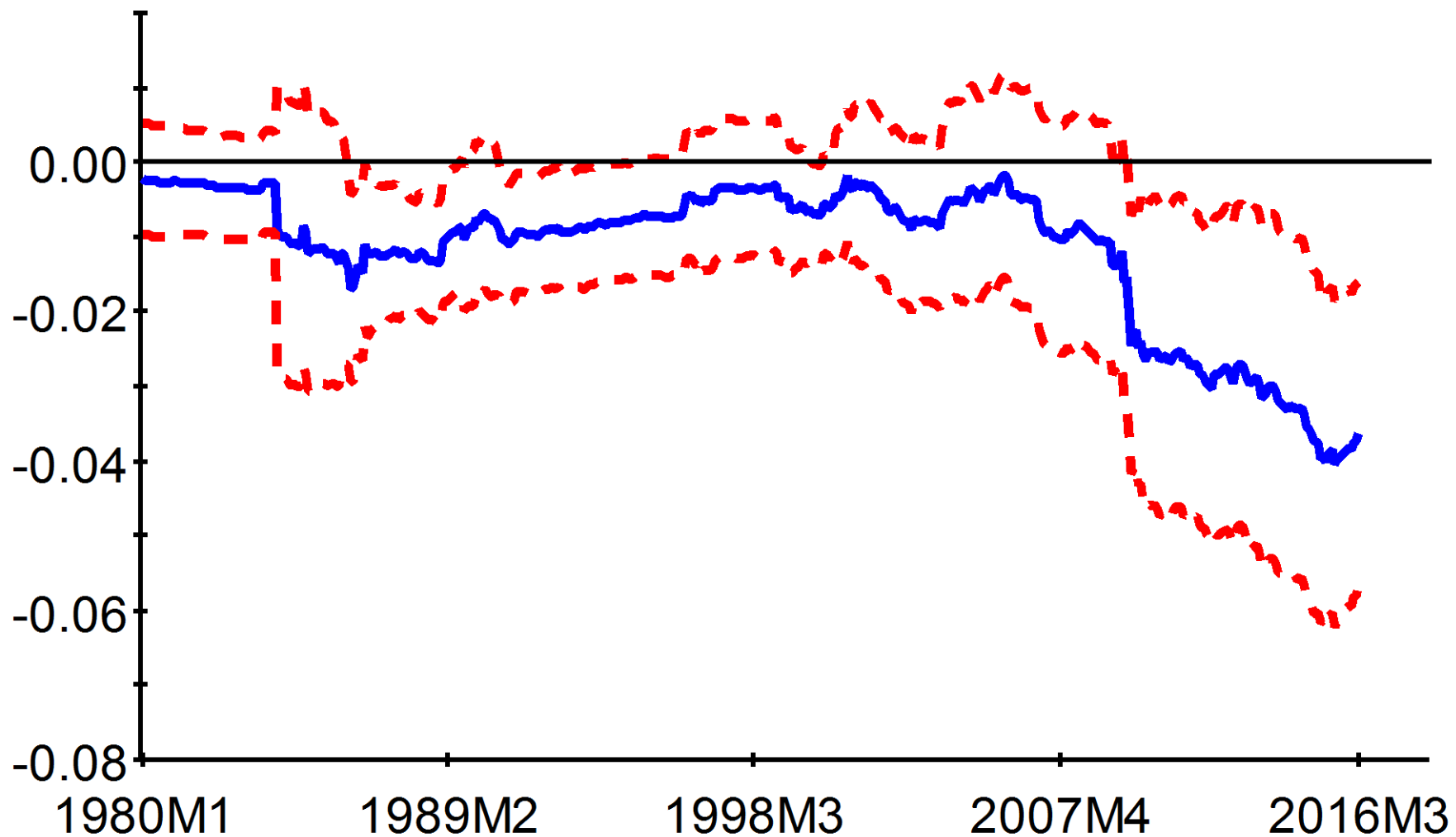
Real oil prices and dividends

- Ideally we need to consider how oil prices and the real activity are related.
- Unfortunately, there are no reliable monthly observations on aggregate real activity.
- Quarterly GDP series that exist are not sufficiently long for a reliable analysis of output-oil price relationship over different sub-periods, particularly the post 2008 crisis period.
- A number of investigators have used monthly measures of US manufacturing output, which are not sufficiently representative of an economy such as that of the US.
- Here we use real dividends on SP 500 as a proxy for economic activity. Dividends tend to be smoother than real output but exhibit similar patterns.

Real Oil Prices and Real Dividends on SP 500



Effects of changes in oil prices on dividends



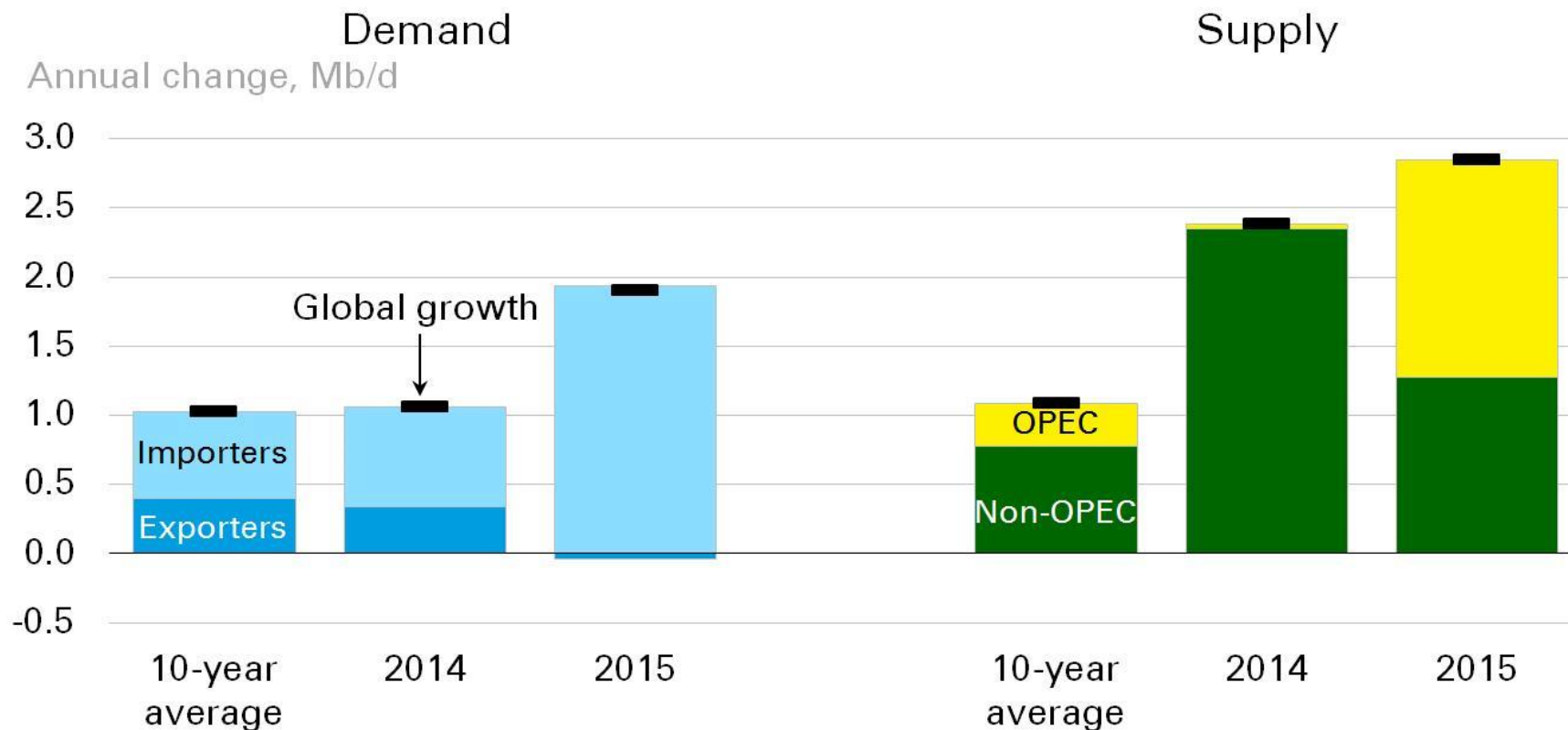
Correlations between changes in real oil prices, real equity prices and dividends

Full period	Oil and Real equity prices	Oil and Real dividends
1946m2- 2016m3	0.008 (0.034)	-0.106* (0.034)
Sub-Periods		
1960m1-1980m12	0.018 (0.063)	-0.075 (0.063)
1981m1-2000m12	-0.139* (0.064)	-0.162* (0.063)
2001m1-2016m3	0.199* (0.072)	-0.252*(0.070)
Sub-Sub-Periods 2001m1-2007m12	-0.144 (0.108)	-0.088 (0.110)
2008m1-2016m3	0.404* (0.085)	-0.330* (0.091)

Lower oil prices have been beneficial even for the US economy

- The results in the above graphs and table clearly show a negative relationship between changes in real oil prices and dividends over all sub-periods.
- The relationships are statistically significant for the full sample – 1946-2016 as well as the two sub-samples, 1981-2000 and 2011-2016, but not for the sub-period 1960-1980.
- Most importantly we find changes in real oil prices are negatively related to changes in real dividends over the post 2008 crisis period, and this relationship is also highly statistically significant.
- Overall, we conclude that lower oil prices have been beneficial for the US economy, even if we consider the post 2008 crisis.

Oil market in 2014 and 2015



Oil price changes and oil exporters

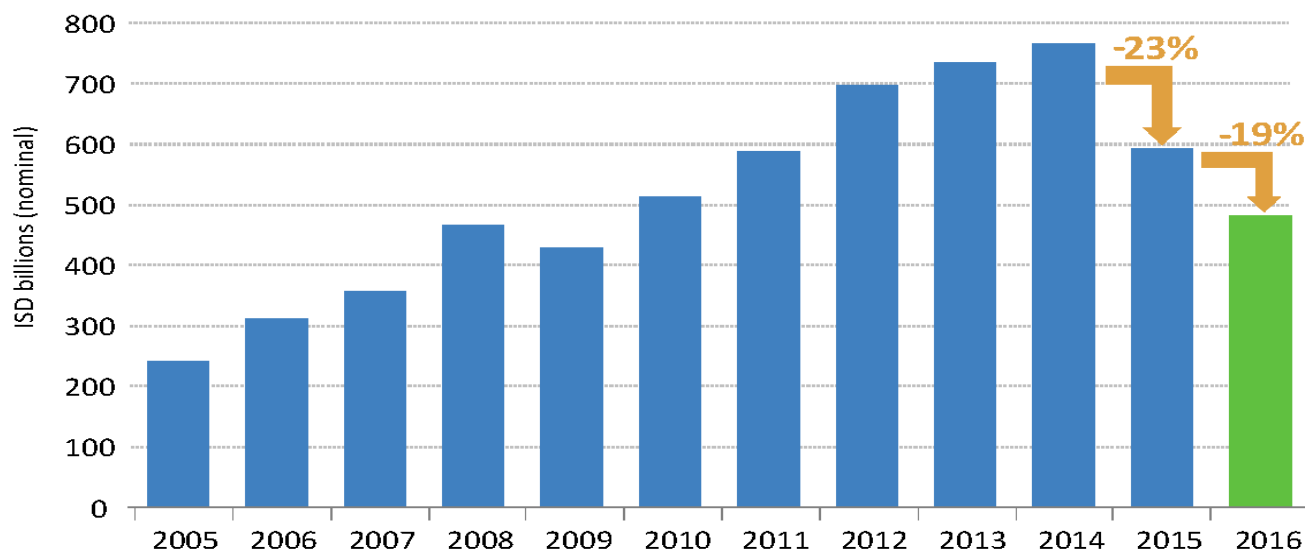
- The plunge in oil prices has hit the major oil exporters the hardest.
- This has been particularly due to the fact that almost all oil exporters substantially expanded their welfare programs during the period of unusually high oil prices that preceded the current price falls.
- Post 2011, GCC countries increased their social spending by around \$150 bn.
- Saudi Arabia increased government employees pay and benefits by \$93 bns.
- Similar increases in welfare were put into effect by UAE, Qatar, Oman and Bahrain.
- In Iran (despite the sanctions and the threat of more sanctions) Ahmadinejad's government initiated monthly cash payments to all households irrespective of their income or wealth, and raided the oil stabilisation fund (rather than enhancing it) to partly pay for the program.
- The falling oil prices have forced oil exporters to cut back on their welfare programs, withdraw from their oil funds, and attempt to diversify their economies.

Oil prices and oil supplies

- Response of oil supplies to oil price changes tends to differ markedly across different oil producers.
- Non-OPEC oil exporters, particularly US oil producers, tend to respond reasonably quickly and positively to oil price rises.
- As noted earlier, US production had been rising since 2008, but peaked around September 2015 (at 9.45 millions b/d) and since then, with continued low oil prices, has fallen to 8.80 millions b/d in the first week of this month (May 2016).
- Unconventional oil (which now forms around half of US oil output) tends to respond to oil price changes very much like any other manufacturing process.
- US oil production is expected to gradually adjust downward if the current low oil prices prevail over the next year or so.
- Upstream oil and gas investment has also been falling.

Global investment in oil and gas

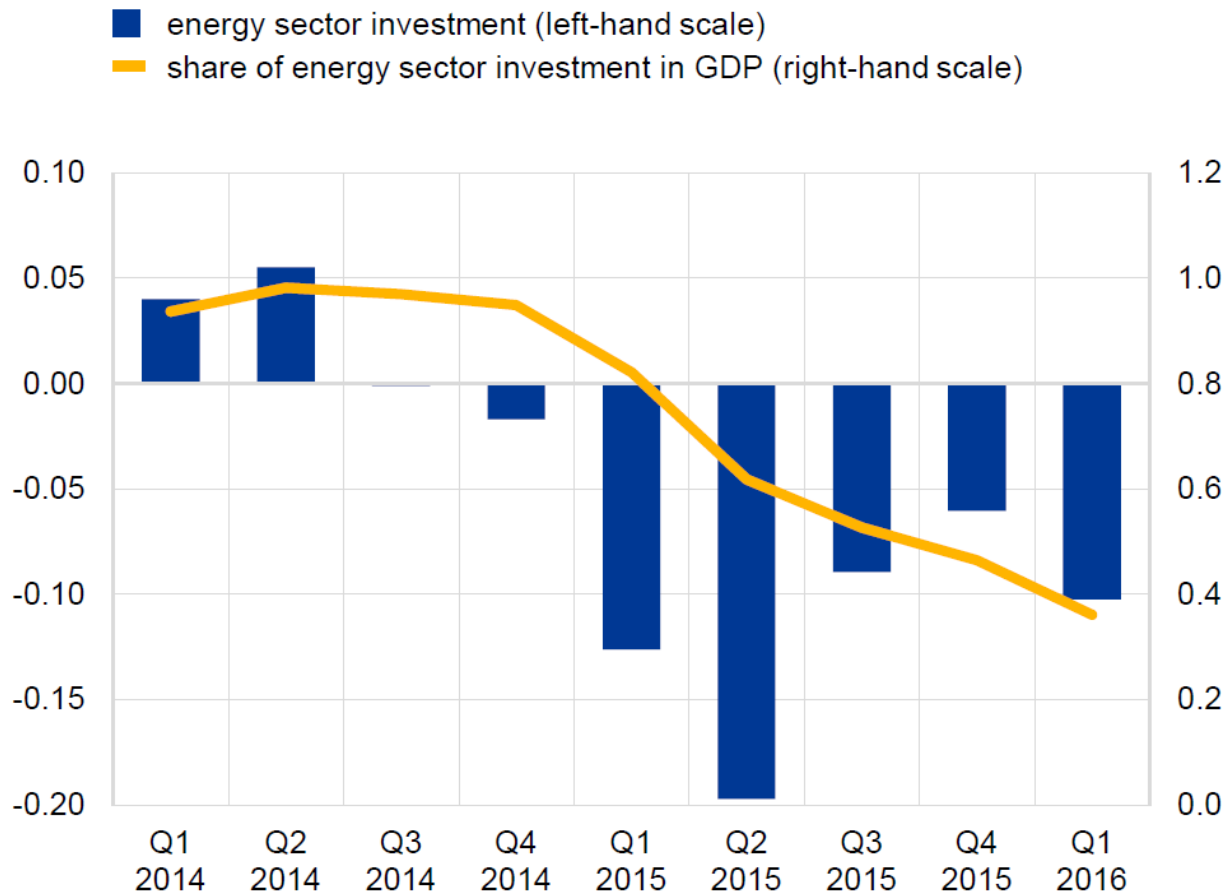
World upstream oil and gas investment continues to fall



World upstream oil and gas investment continues to fall; raising the prospect of increasing reliance on the Middle East in the future

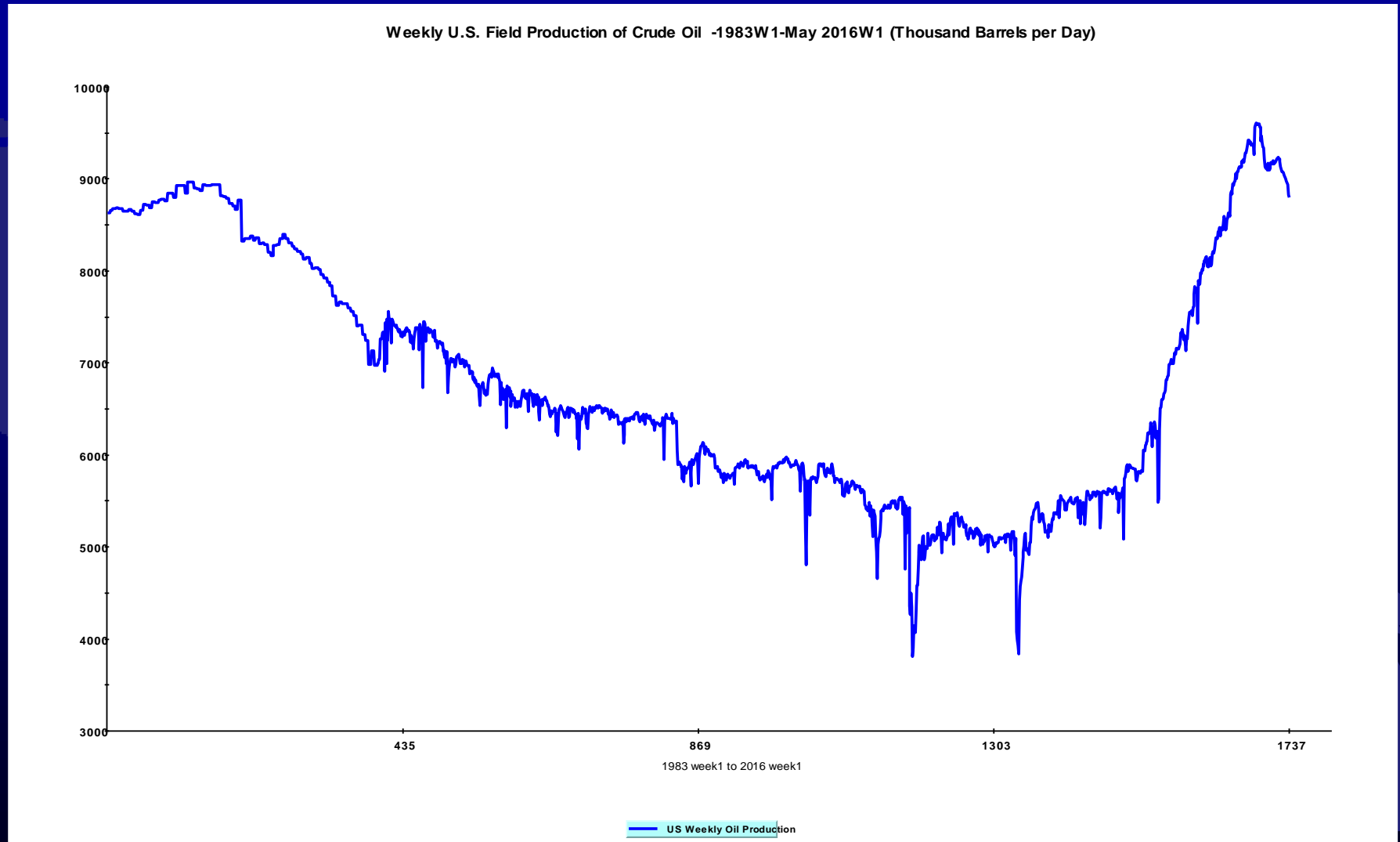
US Energy Sector Investment

(left-hand scale: percentage point contribution to quarterly real GDP growth; right-hand scale: percentage of GDP)



Sources: US Bureau of Economic Analysis and ECB staff calculations.

Weekly US Production of Crude Oil (1000 b/d)



The Hotelling Model (1931, The Economics of Exhaustible Resources)

- Hotelling considers an idealistic set up where oil is treated as an asset which can either be kept in the grounds in anticipation of further prices rises, or sold with the proceeds invested.
- Hotelling showed that the oil price changes (net of marginal extraction costs) must be equal to the prevailing rate of interest.
- The theory assumes oil markets are efficient and more importantly abstract from the significant heterogeneity that exists across oil fields in different regions, from Middle East to North Sea and from liquid oil to tar sands.
- Hotelling theory focusses on inter-temporal optimization and ignores heterogeneity of production costs across oil fields.

The Target Revenue Model

- Target revenue (TR) models were proposed in the aftermath of the first oil crisis during 1973/74, and lies at the other extreme to the Hotelling model. e.g. Cremer and Weitzman (1976) and Cremer and Salehi-Isfahani (1980).
- It primarily applies to major oil exporters with a nationalized oil sector, and has been used to explain the behavior of some OPEC member countries.
- It postulates that major oil exporters that heavily depend on oil revenues, set their production to achieve a given level of oil revenues, and as a result respond perversely to price changes.
- According to the target revenue model the oil supply curve is backward bending, and accentuates oil price fluctuations.
- TR is not a general model of oil prices, and its relevance is much reduced in view of the falling share of OPEC and the advent of sovereign wealth funds (SWF).

Ricardian-Hotelling model

- Hotelling model can be modified to allow for the high degree of heterogeneity that exists in exploration, development and production costs across oil resources (liquid oil fields, tar sands, shale oil).
- There is an important analogy between the Ricardian theory of rent on agricultural land and modelling of oil prices. Ricardo (1817) observed that rent rises as land of lower quality are brought under cultivation in conditions of rising demand for the agricultural products.
- In the same way, profit from productive oil fields rise as more costly fields are brought into production.
- Hotelling model focusses on intertemporal optimization, whilst Ricardo considers the implications of cross-sectional differences in production costs (due to differences in land quality).

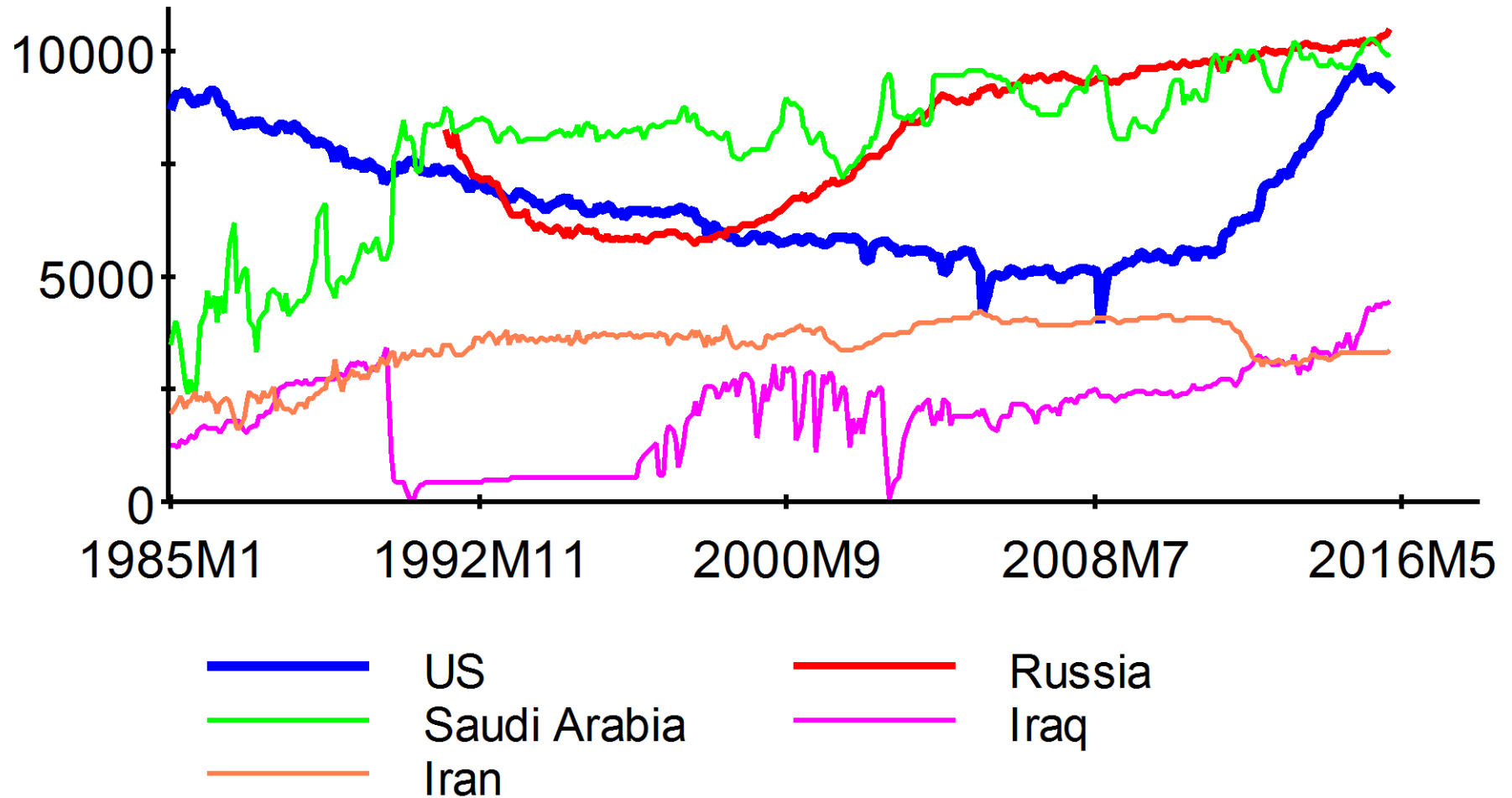
OPEC Supply Responses to Oil Prices

- In contrast to the US, oil production from OPEC is likely to be less responsive to price changes, with political factors playing a significant role in the process.
- It has long been argued (dating back to the first oil crisis of 1973/74) that major oil exporters that heavily depend on oil revenues, set their production to achieve a given level of oil revenues, and as a result respond perversely to price changes.
- The result is a backward-bending supply curve where a sustained fall in oil prices can lead to increased oil production from some OPEC member countries who own large reserves of low cost oil, a demanding welfare program, and a fragile political system.

Non-OPEC Production Response

- Amongst the non-OPEC producers, Russia has continued to increase production – behaving very much as predicted by the target revenue model.
- Canada's production has become more volatile but continues to show a rising trend.
- Oil production in Norway and Mexico have stabilized following a downward trend since early 2000.
- Overall, despite the falling oil prices production has continued to rise world-wide, with OPEC and non-OPEC contributing to the rise, almost equally.
- Only US production from unconventional oil has been declining under pressure from lower oil prices.

Monthly oil production: USA, Russia, Saudi, Iran and Iraq

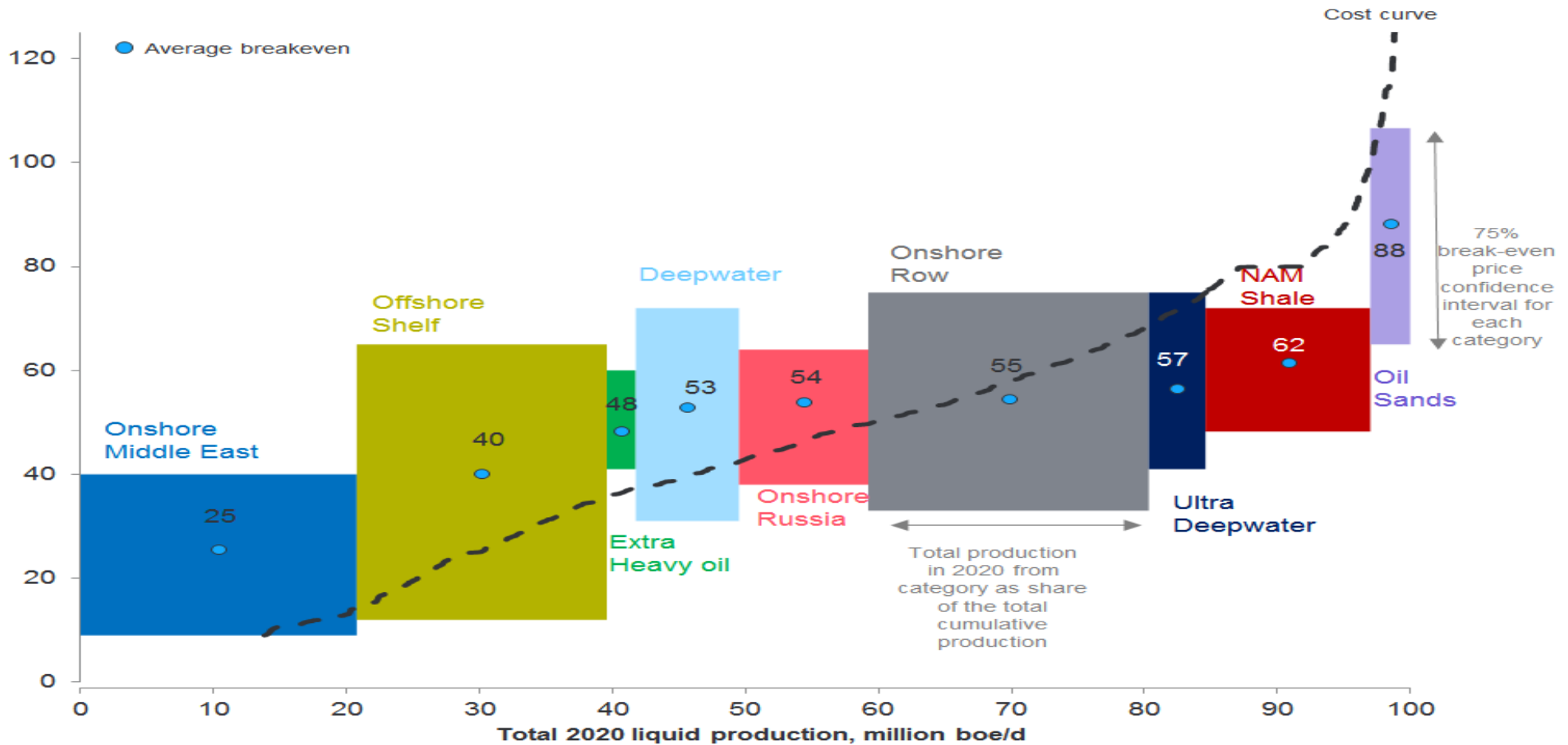


Production cost heterogeneity and oil supplies

- As the following charts show there are significant heterogeneity of breakeven production costs across fields in different parts of the world, as well as across different types of oil fields within a given region.
- It is therefore not surprising that it is the high cost unconventional oil that are first affected by lower oil prices.
- Further production cut backs from such fields are to be expected.

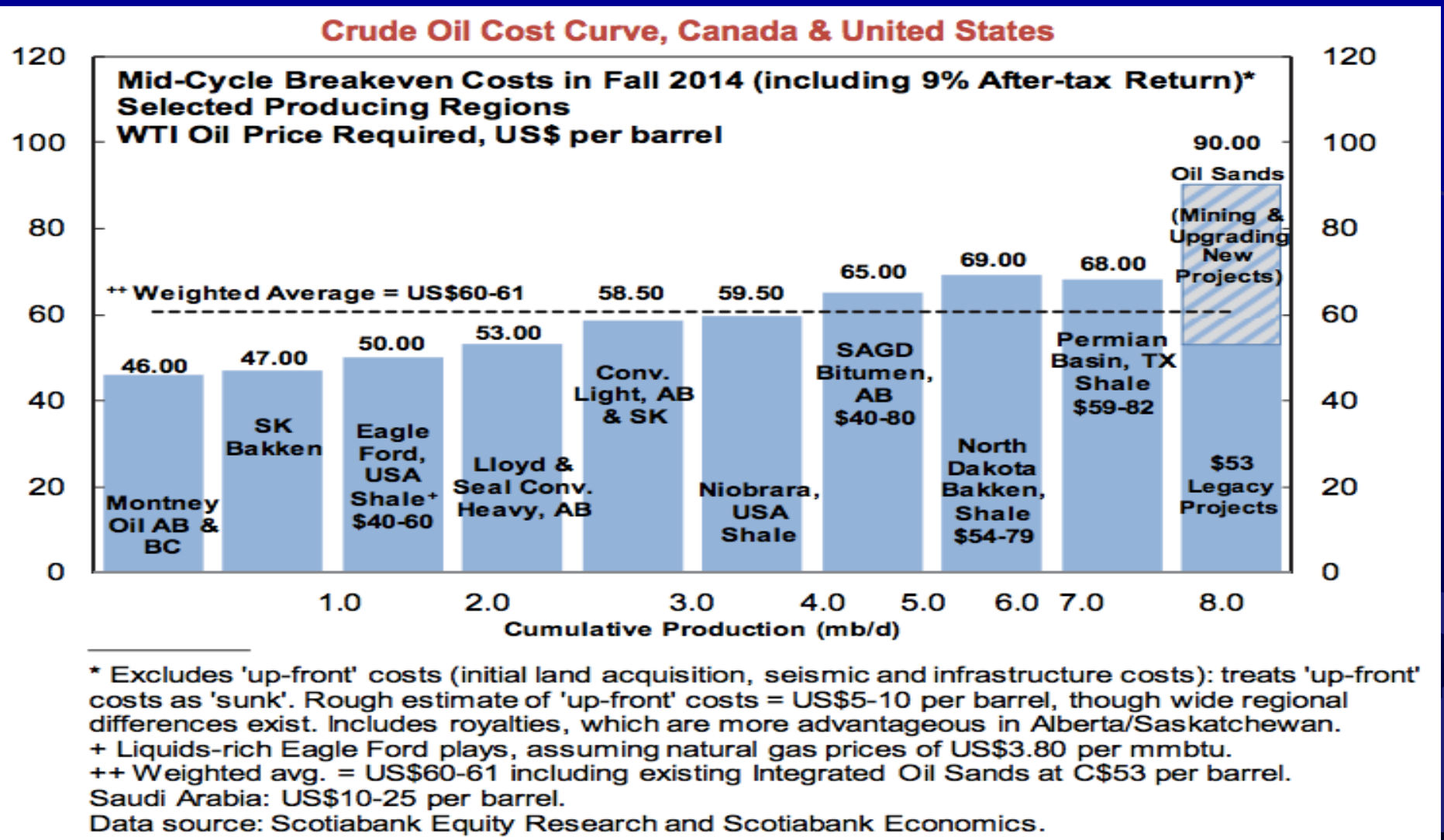
Production costs (p/b) by type and region

Global liquid supply cost curve
USD/bbl



Source: Rystad Energy research and analysis

Production costs for US and Canada



A Summary

- As with all markets, lower oil prices will eventually lead to higher demand and lower supplies.
- The beneficial income effects of lower oil prices will show up in higher oil demand by oil importers.
- The loss of revenues by oil exporters will act in the opposite direction. But the net effect is likely to be positive.
- On the supply side, the effects of lower prices are mixed and initially could be perverse as some of the major oil producers try to compensate their loss of revenues by raising production.
- Oil markets equilibrate, but very slowly, with oil prices fluctuating within a wide range. This episodic process gets further accentuated by new reserve discoveries, technological advances in oil production and alternative energy sources.

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