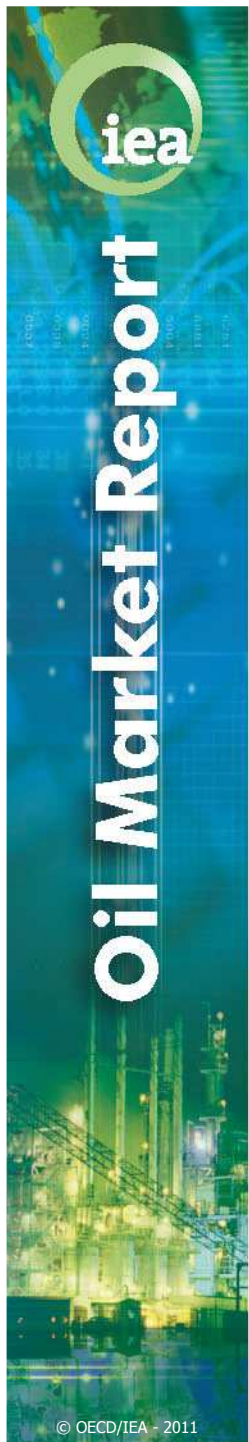# Oil Market Report

The Price of Oil:
Fundamentals v Speculation
and
Data v Politics

Bahattin Buyuksahin
Senior Oil Market Analyst, IEA
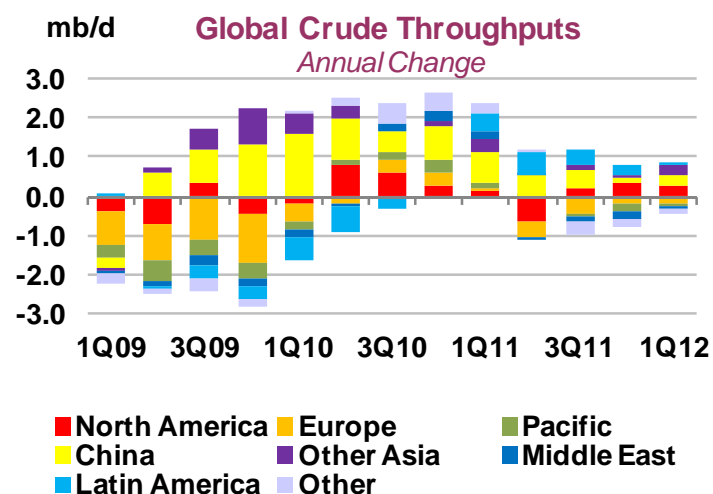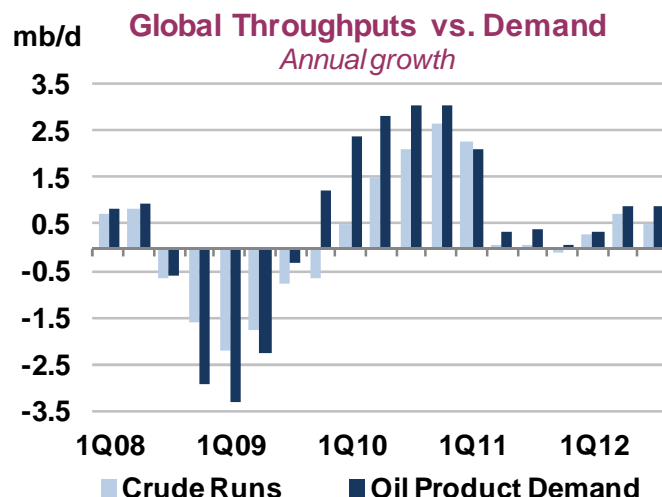
International Energy Agency

iea

Outline

- **Overview of Oil Market**
- **Determinants of Oil Price**
- **Inter-Commodity Linkages**
- **The Role of Speculators**
  - **Herding**
  - **Granger Causality**
  - **Markov Switching Model**
- **Cross Market Linkages**
- **OPEC Fair Price Announcements**

Quick Overview of Oil Market:

- **Exceptional volatility in crude oil prices: down in most of June** amid worsening euro zone crisis and higher crude oil supplies, **then a sharp rebound** on Iran and Norway.

- **Muted economic recovery in 2013 supports a 1.0 mb/d rise in oil demand to 90.9 mb/d**. While stronger than estimated 0.8 mb/d gain envisaged for 2012, growth remains well below the pre-credit crunch trend. Non-OECD demand overtakes that expected for the OECD in 2013, with 2Q13 the potential inflection point.

- **OPEC crude supply falls by 0.1 mb/d,** to 31.8 mb/d in June on reduced production in Angola and Iran.

- **Non-OPEC supply grew by 0.6 mb/d annually in 1H12, as geopolitical and technical outages dent growth in the Americas.**

- **Unplanned outages reach around 1.3 mb/d in 2Q12**

- **May OECD industry oil stocks rose by 15.4 mb to 2 672 mb**, lagging a five-year average build of 25.1 mb. Forward demand cover fell by 0.8 days to 58.9 days from April. Preliminary data indicate a 7.2 mb decline in June.

- **Global throughputs set to rise 1.4 mb/d from 2Q12 low point of 74.4 mb/d,** to 75.8 mb/d in 3Q12

- **Weak refinery margins could persist in 2012-2013 as refinery capacity additions again surpass expected demand growth** – unless more closures announced.

Oil Market Report

Rebounding Demand in 2H12 Supports Growth
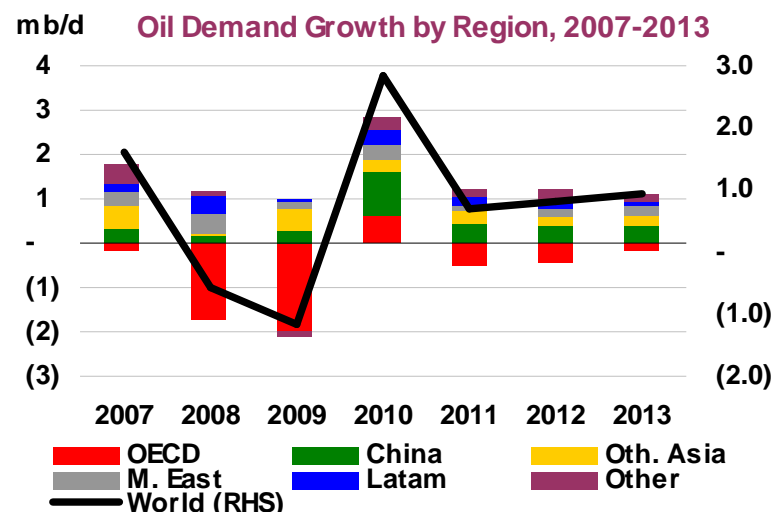
Global oil demand growth rise to 1.0 mb/d in 2H12, compared to 0.6 mb/d in 1H12 and 0.2 mb/d in 2H11

Global Throughputs vs. Demand
Annual growth

mb/d

Crude Runs   Oil Product Demand

Global Crude Throughputs
Annual Change

mb/d

1Q09   3Q09   1Q10   3Q10   1Q11   3Q11   1Q12

North America   Europe   Pacific
China   Other Asia   Middle East
Latin America   Other

- **Since 2Q11 global refinery crude runs growth slows to only 70 kb/d on average**, as growth in oil product demand is eroded

- **2Q12 and 3Q12 still sees growth in throughputs rebounding to 600 kb/d annually.**

- **3Q12 growth in throughputs could be stronger than projected here**, but demand also met by products bypassing refining system (NGLs, biofuels, GTLs and products from storage)

- **Throughput growth comes from China**, Other Asia and in part from North America, on expanding capacity, robust demand and export opportunities

Source: IEA *Oil Market Report*

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Oil Market Report

Oil Demand Growth +1.0 mb/d in 2013
Supported by Modest Uptick in Underlying Economics

Oil Demand Growth by Region, 2007-2013

Legend:
- **OECD** (red)
- **China** (green)
- **Oth. Asia** (yellow)
- **M. East** (gray)
- **Latam** (blue)
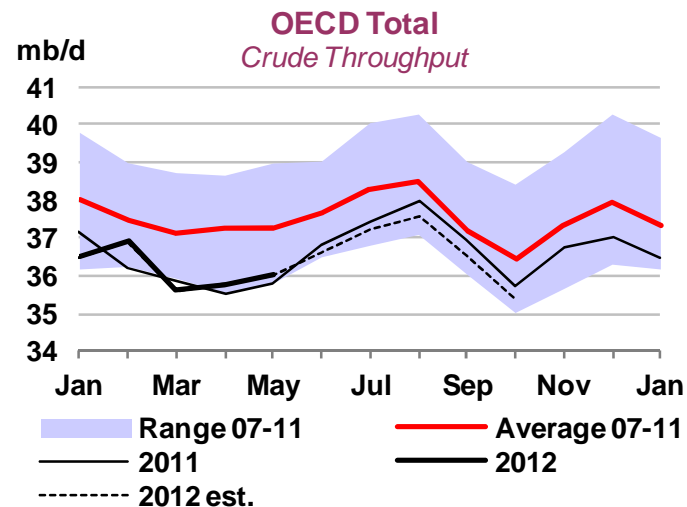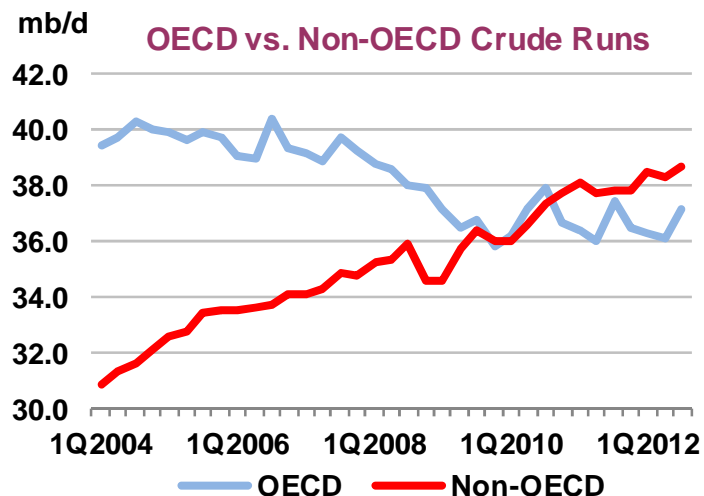- **Other** (purple)
- **World (RHS)** (black line)

- **Accelerating from anticipated growth of 0.8 mb/d in 2012**

  - **Chiefly on account of strengthening economic backdrop**

  - **Gaining support from lower futures prices**

- **Global consumption of 90.9 mb/d assumed in 2013**

Real GDP Growth OMR dated 12 July 2012			Current vs. Previous OMR dated 12 July 2012		
% change	2012	2013		2012	2013
WORLD	1.1	1.5	WORLD	(0.7)	(0.5)
OECD	1.6	2.4	OECD	(1.1)	(0.8)
Non-OECD	2.6	3.3	Non-OECD	(0.0)	(0.1)

Sources: IMF, IEA

Source: **IEA** *Oil Market Report*
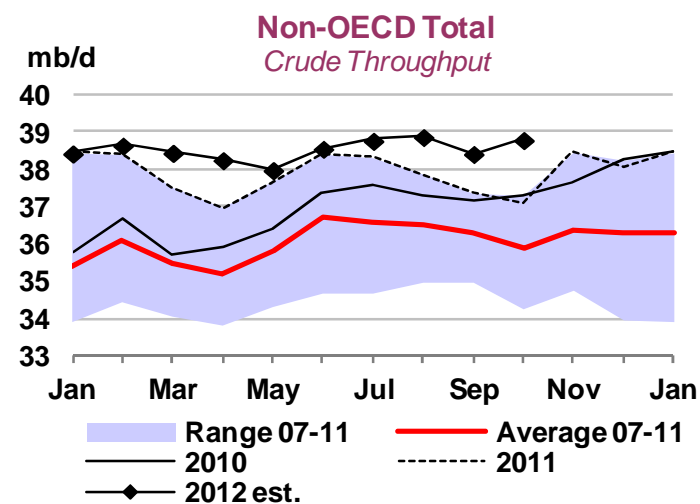
Tale of Two Markets Persist
While OECD refiners struggle, non-OECD booms ahead

OECD vs. Non-OECD Crude Runs

mb/d

Legend: OECD, Non-OECD

OECD Total
Crude Throughput

mb/d

Legend: Range 07-11, Average 07-11, 2011, 2012, 2012 est.

Non-OECD Total
Crude Throughput

mb/d

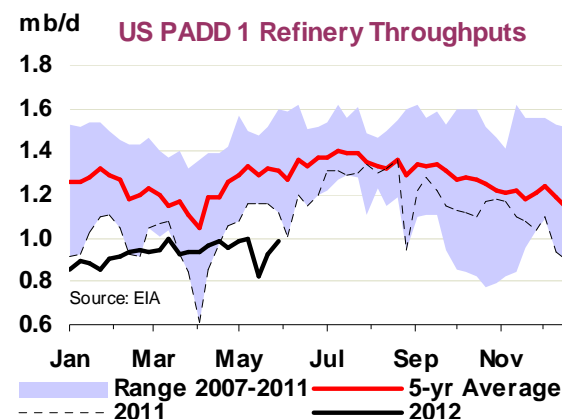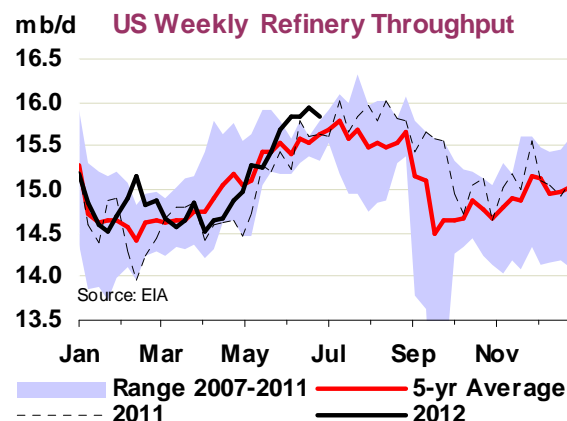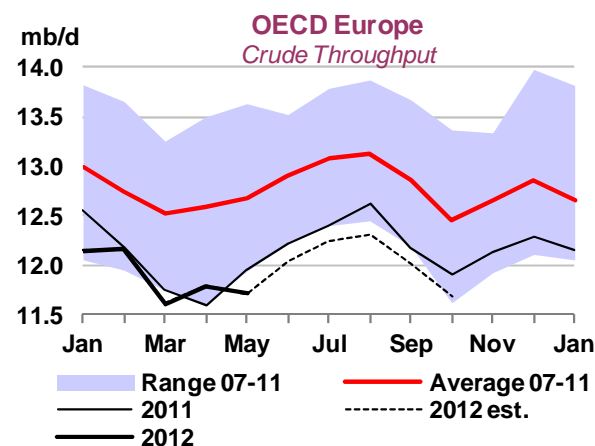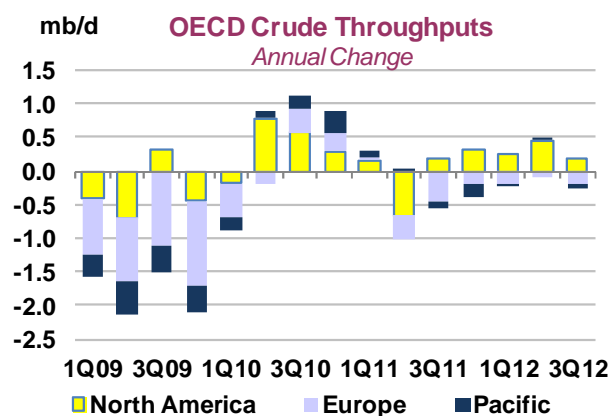Legend: Range 07-11, Average 07-11, 2010, 2011, 2012 est.

- **OECD refiners struggle** with structural decline in demand and poor economics
- **3.5 mb/d of OECD capacity is shut or committed to shut** since economic downturn
- **Non-OECD refiners, on the other hand, build, expand and able to run at higher rates**

Oil Market Report

OECD also See Diverging Trends

While Europe struggles with weak demand – US surges ahead

OECD Crude Throughputs
Annual Change

OECD Europe
Crude Throughput

US Weekly Refinery Throughput

Source: EIA

US PADD 1 Refinery Throughputs
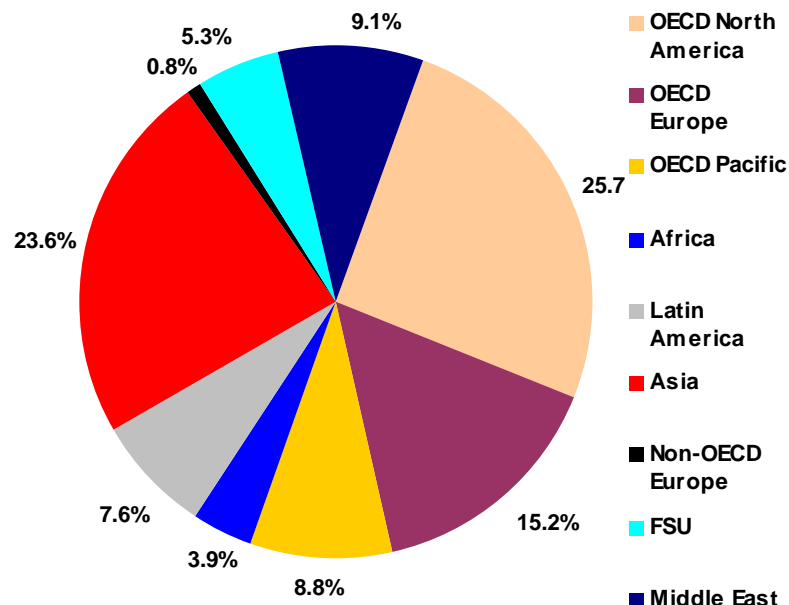
Source: EIA

- **US surge in runs despite shutdown of Motiva's new 325 kb/d crude unit in early June. Runs supported by strong product exports**. Cheap crude supports Midwest runs, while PADD1 face same problem as Europe (more expensive feedstocks and less efficient plants

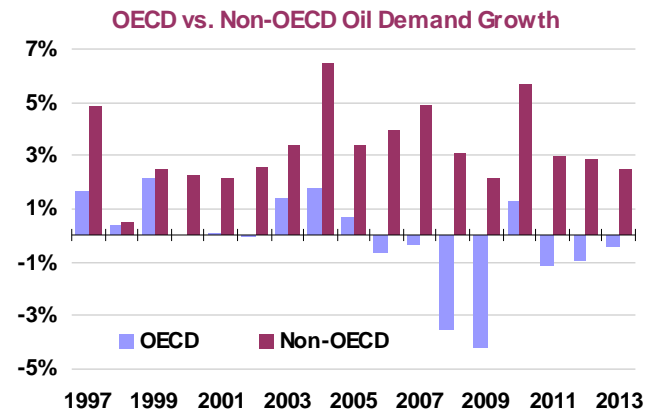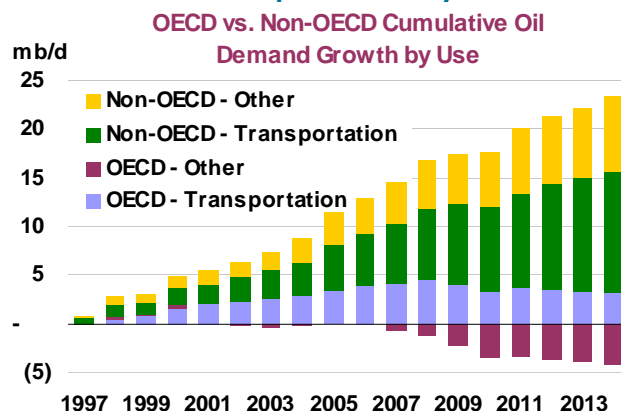- Delta purchase of Marcus Hook Refinery refinery will lift US East Coast runs again after summer

Oil Market Report

Non-OECD Set to Overtake OECD in 2013
2Q13 the Potential Inflection Point

World: Total Demand by Region, 2013

Legend:
- OECD North America
- OECD Europe
- OECD Pacific
- Africa
- Latin America
- Asia
- Non-OECD Europe
- FSU
- Middle East

Pie chart values: 9.1%, 5.3%, 0.8%, 23.6%, 25.7, 15.2%, 7.6%, 3.9%, 8.8%

■ **Non-OECD oil demand will finally exceed OECD, 2013,**
accumulated impact of years of more rapidly expanding consumption

OECD vs. Non-OECD Cumulative Oil Demand Growth by Use

mb/d

- Non-OECD - Other
- Non-OECD - Transportation
- OECD - Other
- OECD - Transportation

1997 1999 2001 2003 2005 2007 2009 2011 2013

OECD vs. Non-OECD Oil Demand Growth

- OECD
- Non-OECD

1997 1999 2001 2003 2005 2007 2009 2011 2013

Source: IEA *Oil Market Report*

Oil Market Report

Global Oil Supply fell by 500 kb/d in June
non-OPEC crude supplies accounted for 75% of the decline

OPEC and Non-OPEC Oil Supply
Year-on-Year Change

Legend: OPEC Crude, Non-OPEC, OPEC NGLs, Total Supply

OPEC and Non-OPEC Oil Supply

Legend: Non-OPEC, OPEC NGLs, OPEC Crude - RS
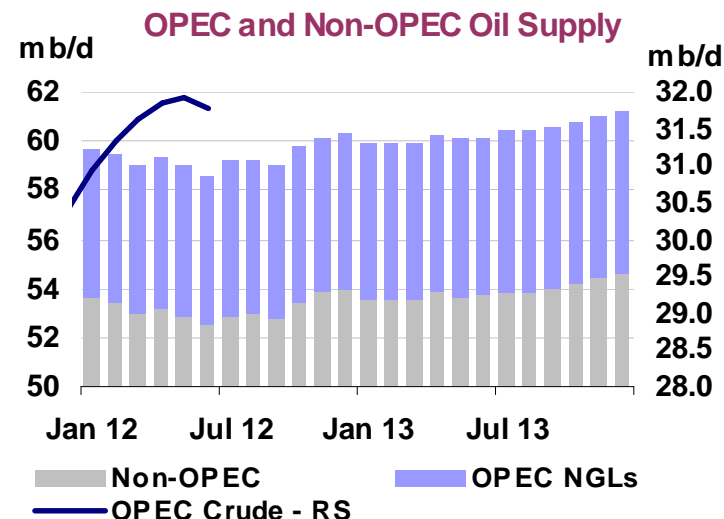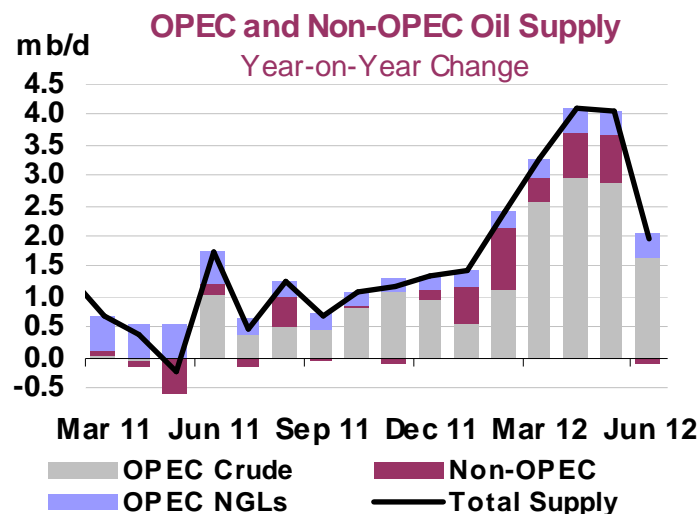
- **Compared to a year ago, global oil production stood 2.0 mb/d higher**

- **All of increase stemmed from higher output of OPEC crude and NGLs**

- **Risk of outages worldwide persists**

Oil Market Report

OPEC Crude Supply Edges Lower In May
Output Still Near 4-Year Highs
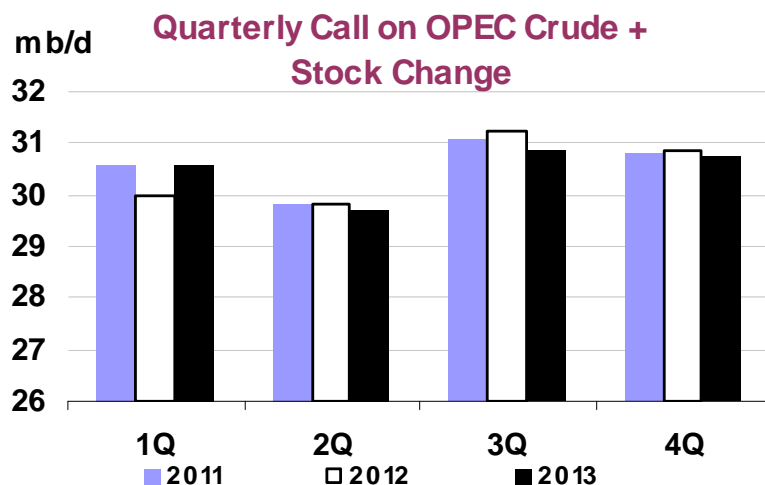
Quarterly Call on OPEC Crude + Stock Change

mb/d

Entire series based on OPEC Composition as of January 2009 onwards (including Angola & Ecuador & excluding Indonesia)

OPEC Crude Oil Production

mb/d
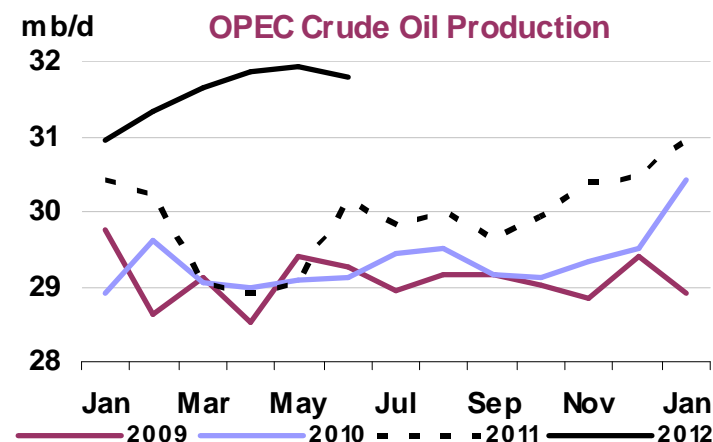
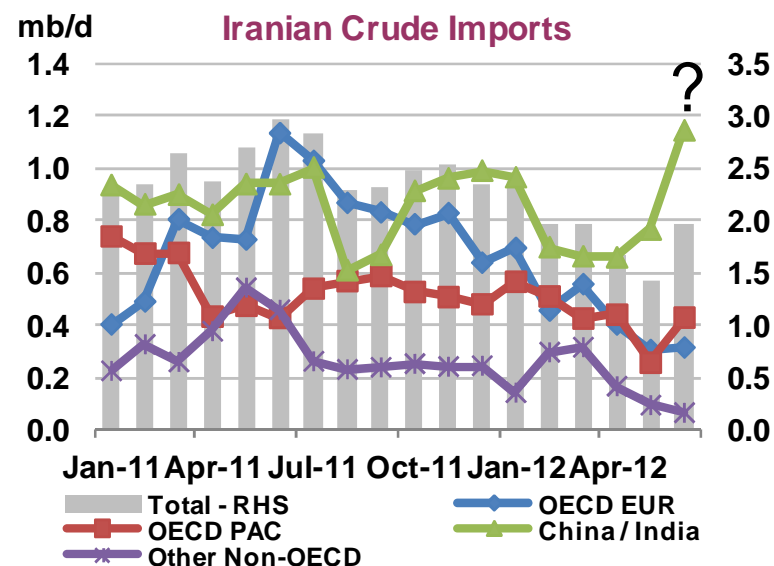Entire series based on OPEC Composition as of January 2009 onwards (including Angola & Ecuador & excluding Indonesia)

- **OPEC crude oil supplies fell by 0.1 mb/d in June to 31.8 mb/d.**
  - Angola and Iran posted the largest declines and offset near-record production of 10.15 mb/d from Saudi Arabia

- **The 'call on OPEC crude and stock change' for 2012 is unchanged at 30.5 mb/d**
  - The call is not expected to increase in 2013

Iran Oil Exports Lower In May, up in July?

- **Iranian crude supply declines slightly to** 3.2 mb/d in June, around 300 kb/d below end-2011 levels of 3.5 mb/d

- **Preliminary tanker data show imports rebounded sharply in June, led by China, to 1.95 mb/d compared with an estimated 1.42 mb/d in May.**

Iranian Crude Imports

mb/d

Legend:
- Total - RHS
- OECD PAC
- Other Non-OECD
- OECD EUR
- China / India

X-axis: Jan-11 Apr-11 Jul-11 Oct-11 Jan-12 Apr-12

- **Implementation of full sanctions is assumed to ultimately lead to a cut of some 1 mb/d in Iranian supplies** in 2H12 as storage tanks both onshore and offshore reach maximum capacity unless the country finds alternative outlets

- **The US has exempted 20 countries from sanctions effective 28 June** after demonstrating that they have significantly reduced imports of Iranian crudes

  - 180-day waiver intended to allow countries more time to reduce imports from Iran further

Oil Market Report

OPEC Spare Capacity Pegged at 2.38 Mb/d
Saudis Hold Near 80% of Spare Capacity

- **OPEC's 'effective' spare capacity at 2.38 mb/d,** with Saudi Arabia accounting for 1.88 mb/d

- **3Q12 OPEC sustainable production capacity expected to increase by 380 kb/d** to 35.4 mb/d versus 34.97 mb/d in 2Q12

  - **Iraq, Angola and Venezuela bring onstream new production**

  - **Smaller increases also seen in Nigeria and Libya**

OPEC Spare Capacity

mb/d

Legend: OPEC Effective Spare Capacity ■ Iraq ■ Ven/Nig ■ Libya ■ Iran

Oil Market Report
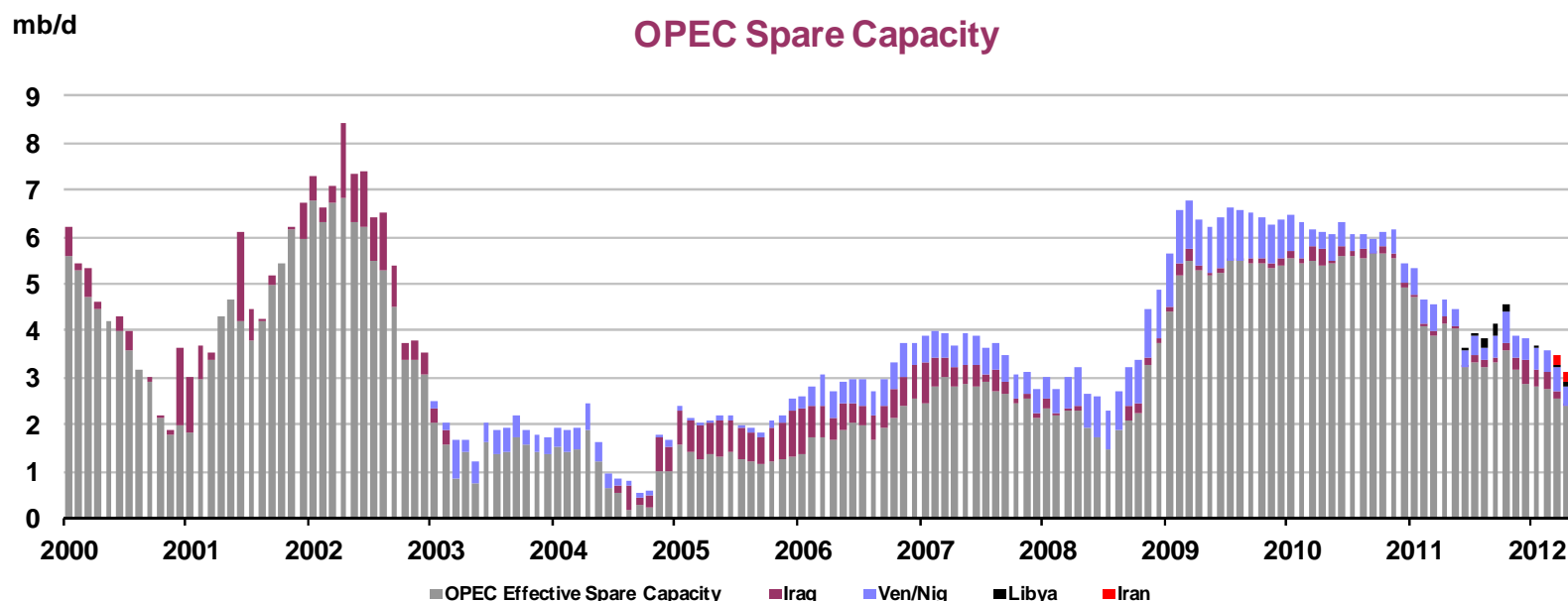
North American Supplies Supporting Non-OPEC growth

- **Supplies fell by 0.5 mb/d in Q2 from prior year on seasonal decline in global biofuels, unplanned outages**

- **Unplanned outages reach around 1.3 mb/d in 2Q12**
  - Mechanical, weather-related outages in the North Sea and Canada
  - continued unrest and additional sanctions in Syria,
  - pipeline sabotage and labour strikes in Colombia, Oman, and Yemen
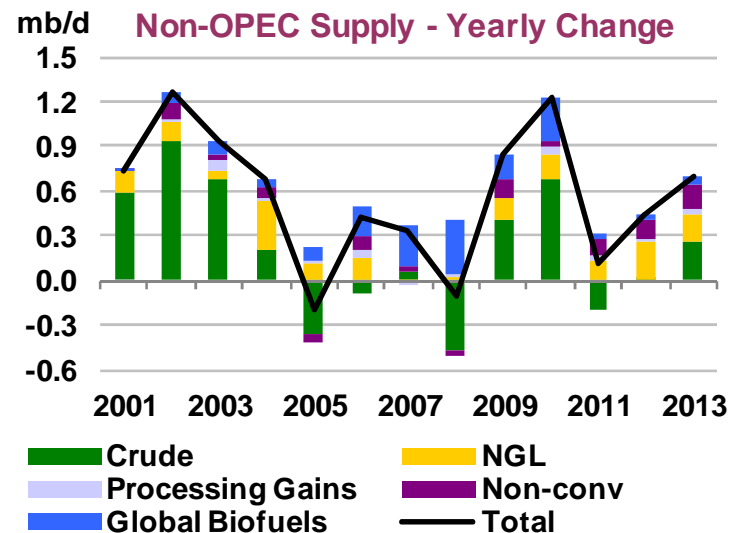 - Transit dispute and military unrest between Sudan and South Sudan.

- **North American supplies should support non-OPEC supply growth of** 0.4 mb/d in 2012
  - Downward revision this month due to Norway labor strike, processing gains

Non-OPEC Selected Shut-ins & Maintenance

kb/d

1Q11 2Q11 3Q11 4Q11 1Q12 2Q12 3Q12 4Q12

-320
-750
-540
-760
Unplanned outages
-1210
-1260
-1180
-1020

- North Sea planned maintenance
- Unplanned Outages (N.Sea)
- Other Unplanned Outages

BFOE* Crude

kb/d

BFOE falls under .65 mb/d

2010   2011   2012   2013

*Includes Brent, Ninian, Forties, ETAP, Ekofisk, Oseberg

Oil Market Report

Source: IEA *Oil Market Report*

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Non-OPEC Supply to Grow By 0.7 mb/d in 2013
Are 2011 & 2012 the new norm?

Non-OPEC Supply - Yearly Change (mb/d)

Legend: OECD, FSU, Non-OECD Asia, LAM, Other, Total

X-axis: 1Q12, 3Q12, 1Q13, 3Q13

Non-OPEC Supply - Yearly Change (mb/d)

Legend: Crude, NGL, Processing Gains, Non-conv, Global Biofuels, Total

X-axis: 2001, 2003, 2005, 2007, 2009, 2011, 2013
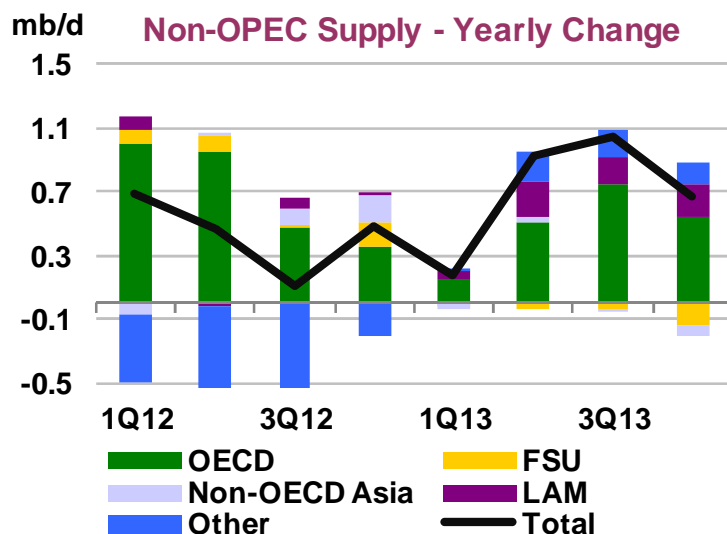
- **US Light Tight Oil (LTO), Canadian Oil Sands, Brazilian Deepwater production** largest contributors to growth

- **LTO supply from selected plays should reach 1.6 mb/d,** a growth of 0.4 mb/d from 2012, and leads to similar growth in total US crude and condensate output to 6.6 mb/d.

- **Non-OPEC oil supply projected to rise 0.7 mb/d to 53.9 mb/d in 2013**, a return to the magnitude of growth seen in 2009/2010 and 2000-2004

Oil Market Report

OECD Commercial Oil Inventories Rose in May but Declined in June

OECD Total Oil Stocks

mb

Range 2007-2011 — Avg 2007-2011 — 2011 — 2012

OECD Total Oil Stocks
Days of Forward Demand

days

Range 2007-2011 — Avg 2007-2011 — 2011 — 2012
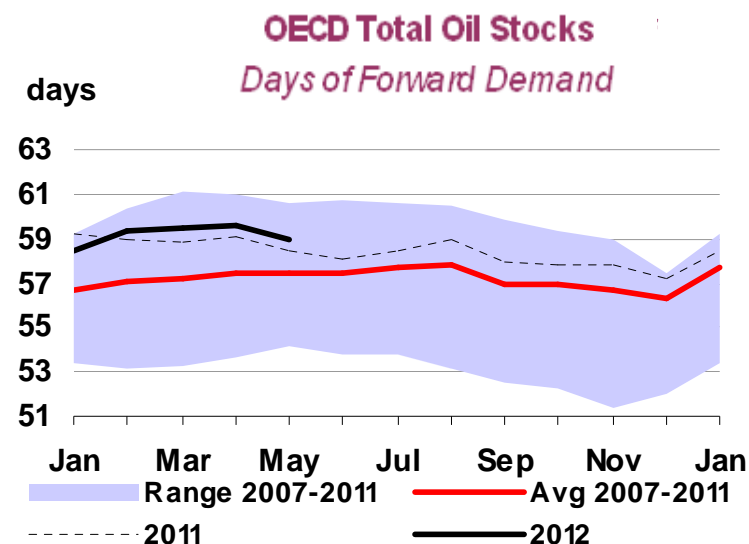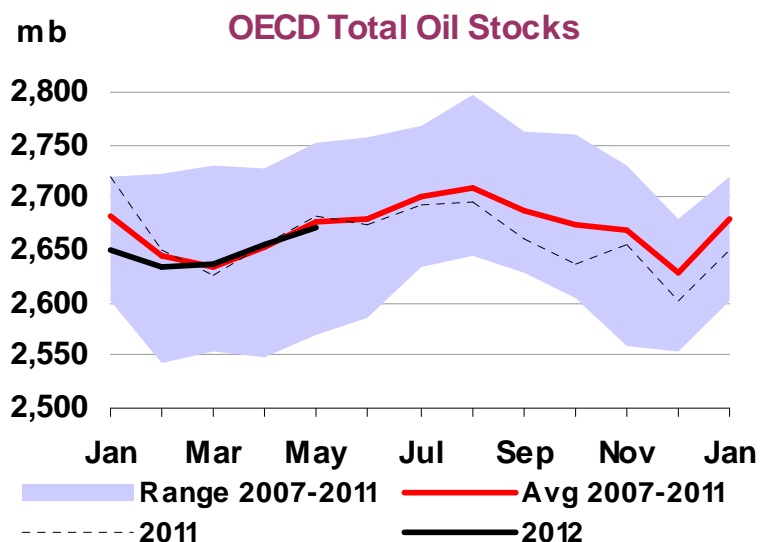
- **May OECD industry stocks rose by 15.4 mb, to 2 672 mb, a milder increase than the five-year average of 25.1 mb**
  - OECD commercial oil stocks have risen since February 2012, in line with seasonal trends
  - Days of forward demand cover fell by 0.8 day to 58.9 days m-o-m, but still 1.4 days above the five-year average
  - Crude and product inventories increased by 8.0 mb and 8.3 mb, respectively
- **Preliminary data indicate a 7.2 mb decrease in June OECD industry inventories**

Source: IEA *Oil Market Report*

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North American Industry Oil Inventories Rose both in May and June

OECD North America Total Oil Stocks (mb)
Legend: Range 2007-2011 — Avg 2007-2011 — 2011 — 2012

US Weekly Cushing Crude Stocks (mb)
Source: EIA
Legend: Range 2007-11 — 5-yr Average — 2011 — 2012
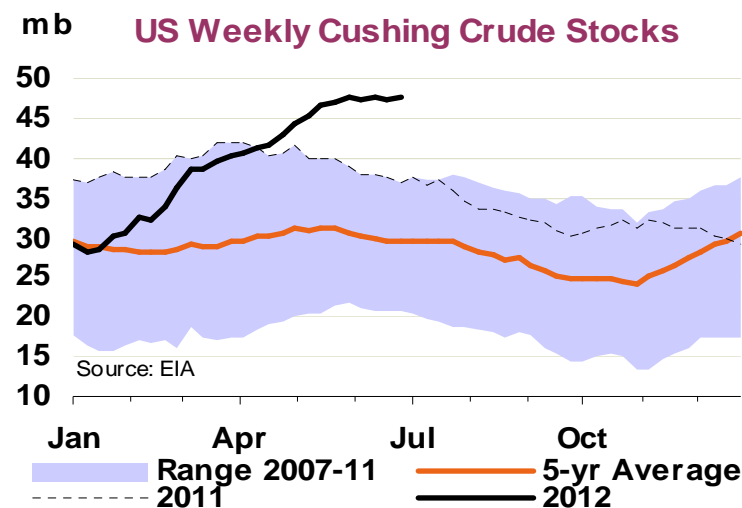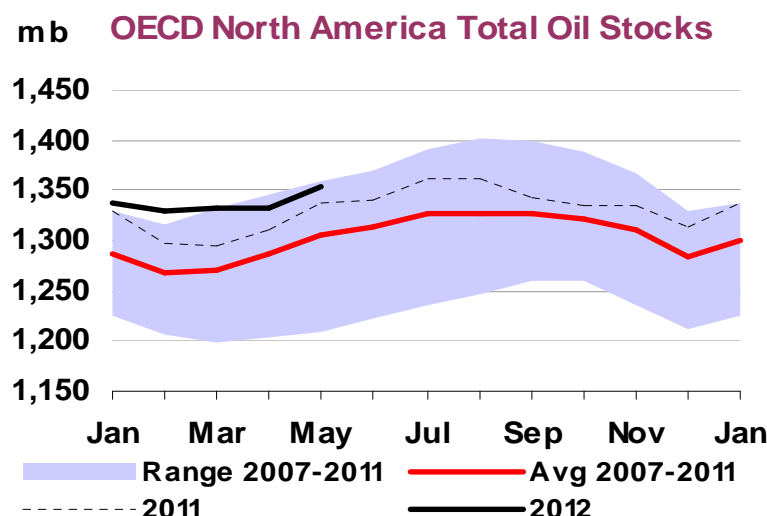
- **May North American industry oil stocks rose by 21.4 mb to 1 353 mb, in line with a seasonal build of 18.0 mb**
  - Crude and product inventories increased by 6.7 mb and 14.7 mb, respectively
- **US oil inventories increased by 10.8 mb in June**
  - Crude oil inventories declined by 1.7 mb while refined product inventories rose by 13.8 mb
  - Crude levels at Cushing edged down by 0.1 mb but remained just shy of recent record highs

European Commercial Inventories decreased both in May and June

mb

OECD Europe Total Oil Stocks

OECD Europe Total Oil Stocks
Days of Forward Demand

days
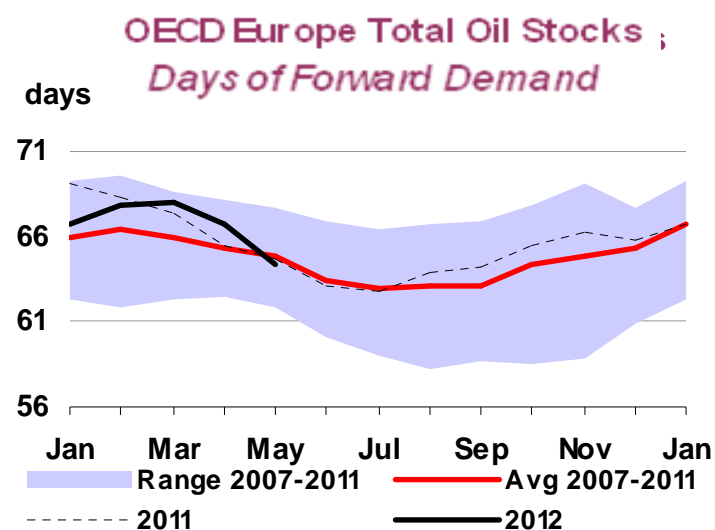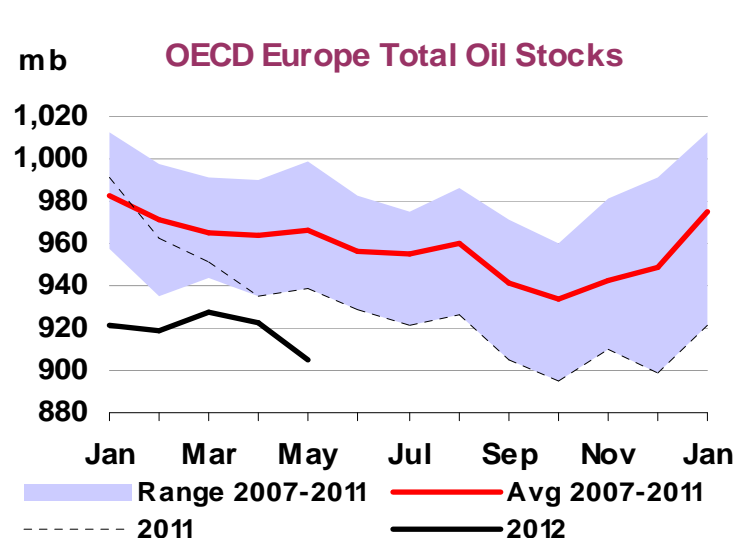
- ■ **May European Industry oil stocks fell by 18.6 mb to 904 mb, in contrast with a five-year average 2.6 mb build**
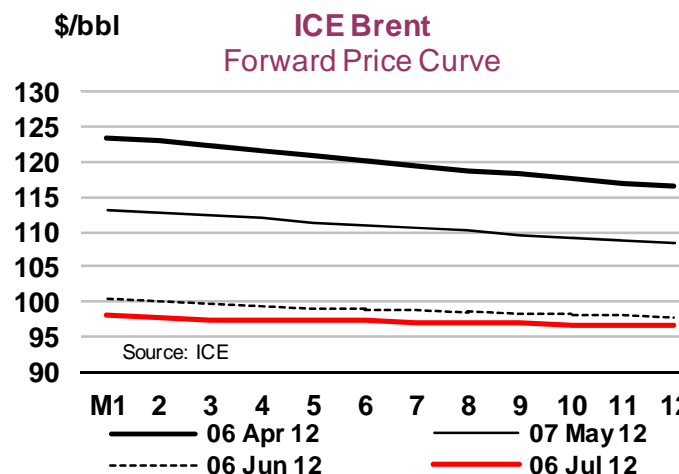 - ● Moreover, forward demand cover in Europe has tightened after nine months at above traditional seasonal levels
  - ● Crude and product inventories fell by 6.4 mb and 10.8 mb, respectively
- ■ **June preliminary data show a 12.5 mb stock draw**
  - ● Crude and product inventories fell by 7.1 mb and 5.4 mb, respectively

Futures Markets Exceptionally Volatile in June

Crude Futures
Front Month Close

$/bbl

Source: ICE, NYMEX

— NYMEX WTI   — ICE Brent

ICE Brent
Forward Price Curve

$/bbl

Source: ICE

—— 06 Apr 12   —— 07 May 12
---- 06 Jun 12   —— 06 Jul 12
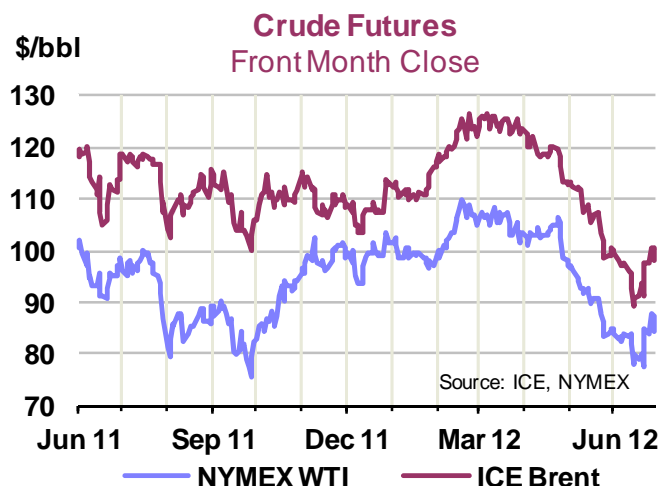
- **Downturn in crude oil prices in most of June,** amid worsening euro zone crisis and rising global inventory. In the third week of June, Brent touched 18-month lows below $90/bbl, while WTI fell below $80/bbl for the first time since October 2011

- **This trend reversed towards the end of the month and early July** on rising tensions between Iran and the international community and a threat of Norwegian offshore production shutdown due to workers' strike

Brent Futures in Contango
Brent M1-M12 Down to $-2.17/bbl in the Third Week of June

Crude Futures Forward Spreads — $/bbl

Source: ICE, NYMEX

WTI M1-M12 — Brent M1-M12

NYMEX WTI vs S&P 500 — US$/bbl / Index

Source: NYMEX

NYMEX WTI — S&P 500 (RHS)
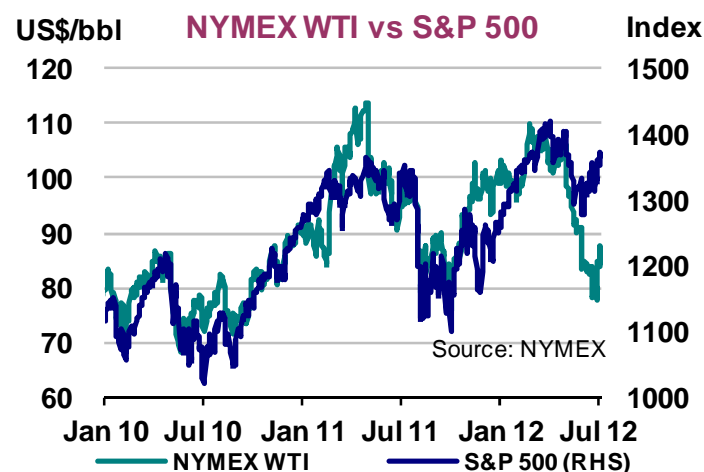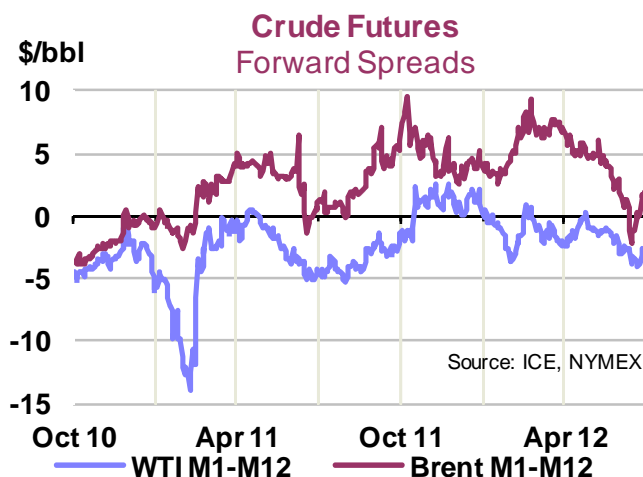
- **Brent futures contracts flipped to contango for about 10 days after trading in backwardation for more than 15 months**

  - Brent M1-M12 backwardation narrowed sharply in June, before rebounding in the first week of July to an average $1.58/bbl

  - Increased crude supplies in Europe from West Africa, Libya, Iraq and Saudi Arabia, continue to add downward pressure on the front end of the forward curve for Brent

- **The sharp downturn in oil prices over the month also saw a decoupling from key financial indicators such as the S&P**

Source: IEA *Oil Market Report*

Oil Market Report

Spot Crude Oil Prices Down and Up in June

Benchmark Crude Prices ($/bbl) — WTI Cushing, N. Sea Dated, Dubai. Copyright © 2012 Argus Media Ltd

Urals Differentials to North Sea Dated ($/bbl) — Urals (NWE), Urals (Med). Copyright © 2012 Argus Media Ltd
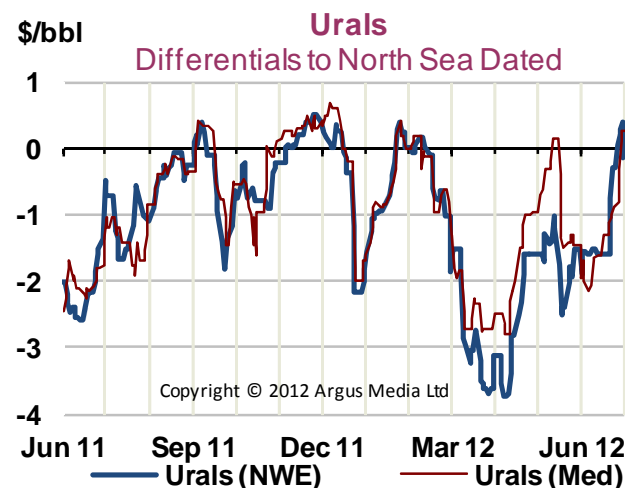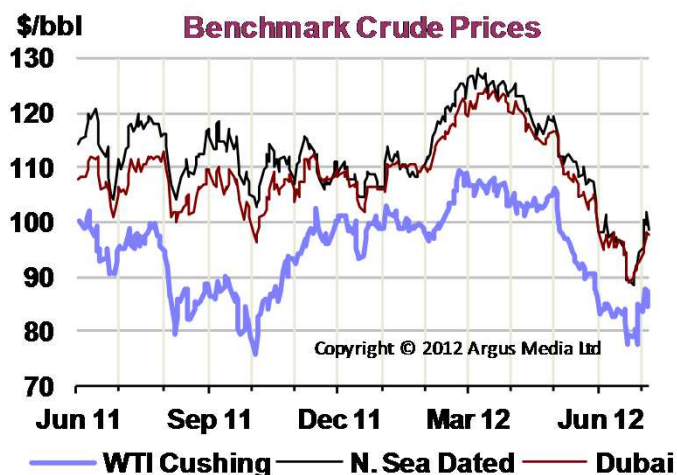
- **Spot crude oil prices continued their trend from May and plummeted by around $13-17/bbl in June** on rising global oil supplies and worsening economic outlook

- **North Sea Dated fell by $15.45/bbl, to an average $94.80/bbl,** supported by plentiful supplies of African light crudes in Europe **before rebounding to above $100/bbl** on fears of a complete shutdown in the Norwegian North Sea

- **Implementation of Iran sanctions on 1 July triggered an increase in demand for Urals crude.** The discount for Urals to Brent in the Mediterranean narrowed to just -$0.10/bbl in the first week of July

Source: **IEA** *Oil Market Report*

Products Crack Spreads upwards in June
Naphtha Being an Exception

Naphtha
Cracks to Benchmark Crudes

$/bbl

Copyright © 2012 Argus Media Ltd

Legend: NWE, SP, Med, ME Gulf

Gasoline
Cracks to Benchmark Crudes

$/bbl

Copyright © 2012 Argus Media Ltd

Legend: NWE Prem Unl, USGC 93 Conv, Med Prem Unl, SP Prem Unl
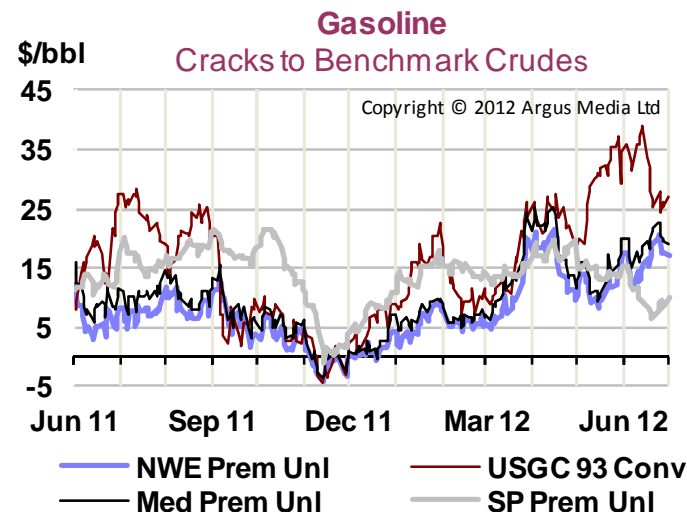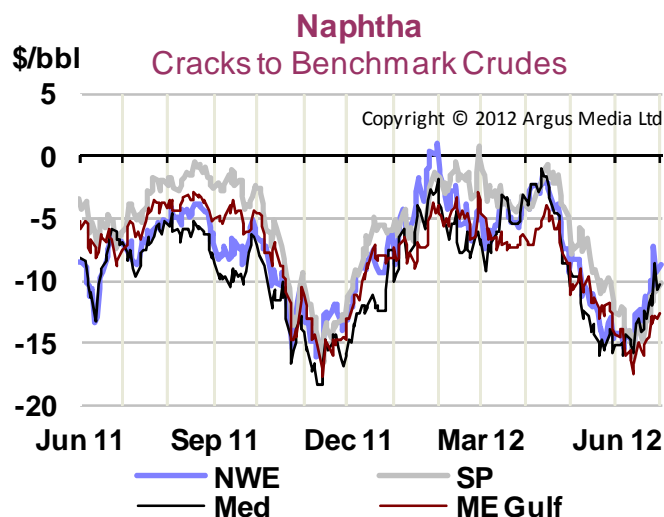
- **Naphtha cracks fell** as the fall in product prices lagged the decline in benchmark crude prices and petrochemical demand was weak, but rebounded toward the end of June due to higher demand for gasoline

- **Light distillate crack spreads strengthened in the Atlantic Basin** (barring naphtha) due mainly to unplanned refinery outages

- **Middle distillate crack spreads strengthened in all regions in June bar Singapore** supported by refinery outages in Europe and the US Gulf coast and by strong demand from West Africa

- **Fuel oil crack spreads in all regions improved,** supported by strong power utility and bunker fuel demand

Source: **IEA** *Oil Market Report*

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Oil Market Report

Trade Activities in Futures Markets
Open Interest Tested Fresh Records in May

- **The ratio of Brent futures in London ICE to New York and London WTI oil positions declined by almost 2%** to 63.5% between 29 May and 3 July 2012 due to a 3.6% decline in ICE Brent open interest over the same period.

Percentage of Brent to WTI Open Interest

Source: ICE, CFTC

Brent/WTI (ICE+CME)　　Brent/WTI (CME)
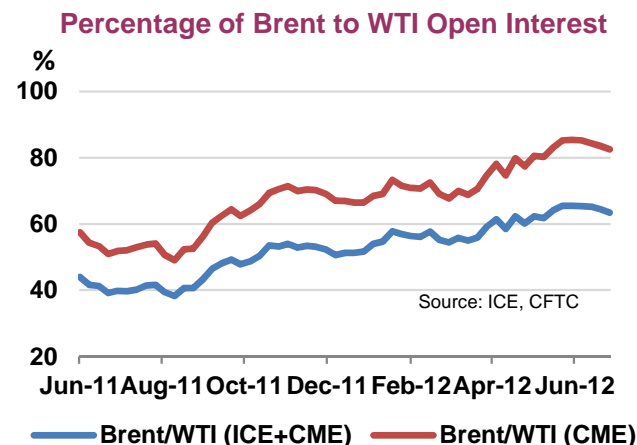
- **Open interest in all major oil futures contracts declined in June while open interest in options contracts increased.**

- **Money managers cut their bets on rising WTI crude oil prices for a fourth consecutive month** reaching 99 765, the lowest level since early September 2010

- **Similarly, money managers further reduced their bets on rising Brent prices** to 37 816 futures contracts as of 26 June 2012, the lowest level since October 2011

- **Index investors' long exposure in commodities in May 2012 declined by $38.2 billion to $269.9 billion in notional value.** The number of long futures equivalent contracts declined to the lowest level since December 2008 to 529 000, equivalent to $46.0 billion in notional value.

Source: IEA *Oil Market Report*

Global Crude Refinery Demand

Seasonal low less so than normal, runs still set to rise sharply through August

Global Refining *Crude Throughput* (mb/d)

Global Crude Runs *Quarterly Change* (mb/d)

Range 07-11 — Average 07-11 — 2011 ---- 2012 est.

2005 2006 2007 2008 2009 2010 2011 2012
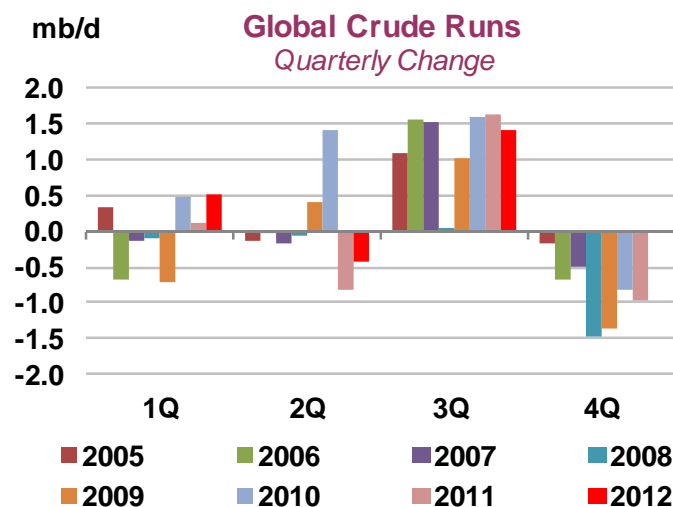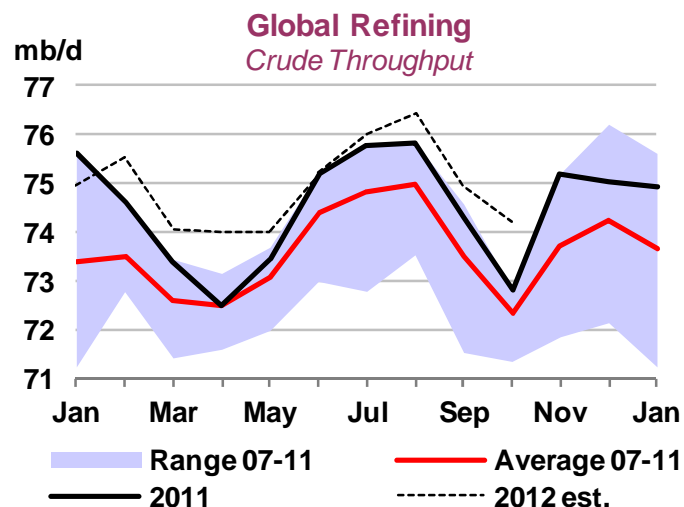
- **Global refinery crude throughputs were revised higher for April(+300 kb/d) ,** now show less of a dip than normal

- **Global crude demand still set to rise sharply through 2Q, by 2.4 mb/d from April to August**

- **In all, global throughputs are seen averaging 74.4 mb/d in 2Q12,** rising to 75.8 in 3Q12

- A quarterly increase of 1.4 mb/d from 2Q12 shoulder season to 3Q12 peak is in line with historical trends (bar 2008/2009 recession years).

2012-2013 Refinery Capacity Overhang Suggest Weak Margins for Some

Crude Distillation Additions

mb/d

Legend:
- OECD (yellow)
- Other Asia (dark red)
- Latin America (cyan)
- Net Additions (black diamond)
- China (light purple)
- Middle East (blue)
- Other Non-OECD (green)

Years: 2011, 2012, 2013

Refinery Capacity Additions vs Demand Growth

mb/d

- Capacity increase (light purple)
- Demand Growth (dark red)

Years: 2011, 2012, 2013
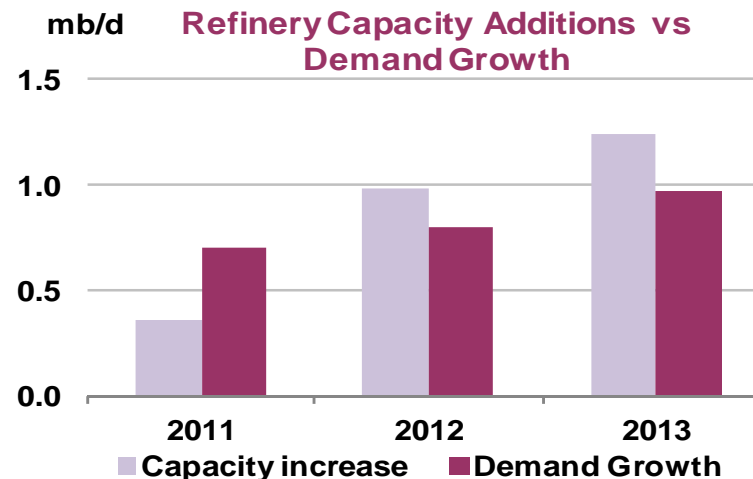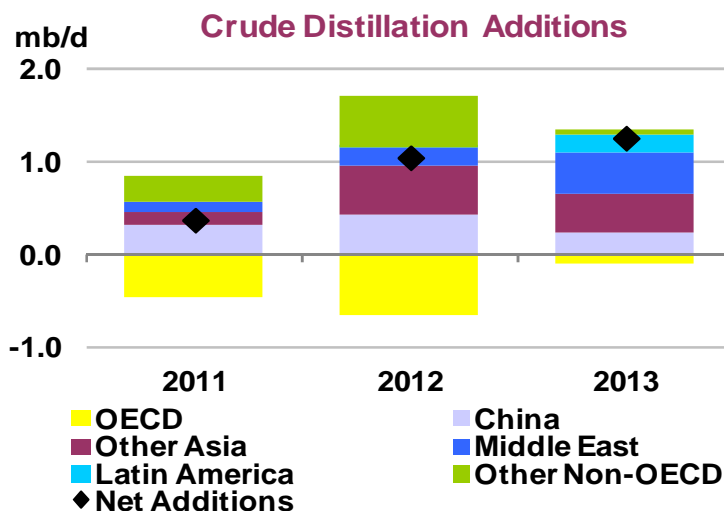
- **After relatively little net refinery capacity growth in 2011 (0.4 mb/d), 2012 and 2013 see 1 mb/d and 1.3 mb/d new distillation capacity added, respectively.**

- **OECD rationalisation continues, Europe shut total of 1.6 mb/d since 2008, 3.5 mb/d total OECD.**

- **Additions largely surpass expected demand growth, suggesting weak margins to remain, unless further closures are announced or demand surprise to the upside**

- **Upgrading and desulphurisation capacity additions add 2.6 mb/d and 2.8 mb/d, respectively, in the two year period.**

Oil prices feed off multiple influences

- **Commodity financial markets aren't a primary price driver, but amplify physical market impacts**

- **Financial impacts very short term compared to fundamentals**

- **Price inelasticity of supply & demand is key**

- **So too the influence of downstream factors**

- **3* demand multiplier if incremental barrels sourced from simple refining capacity**
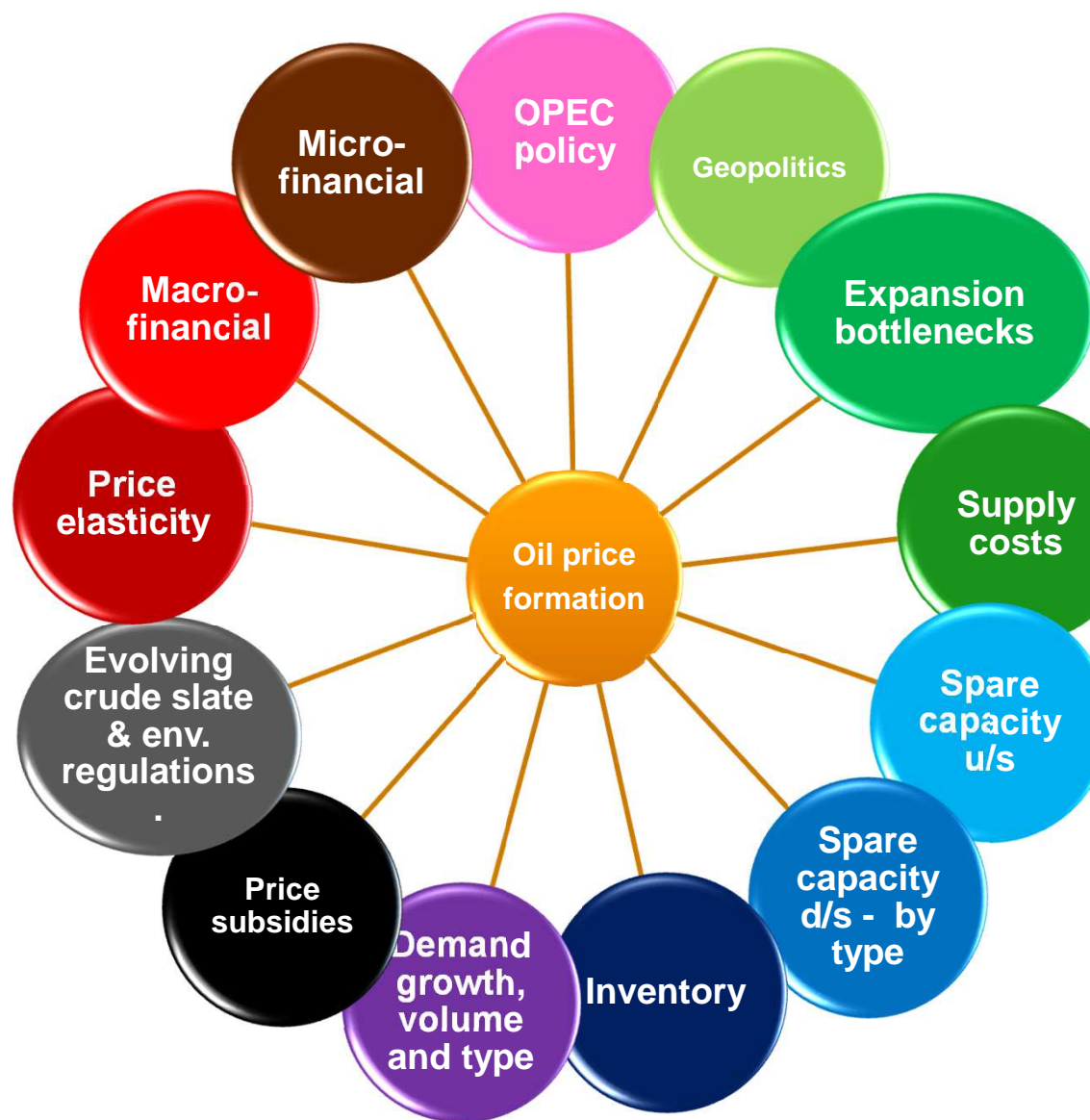
Can +70% Price Change Be Justified by Fundamentals?
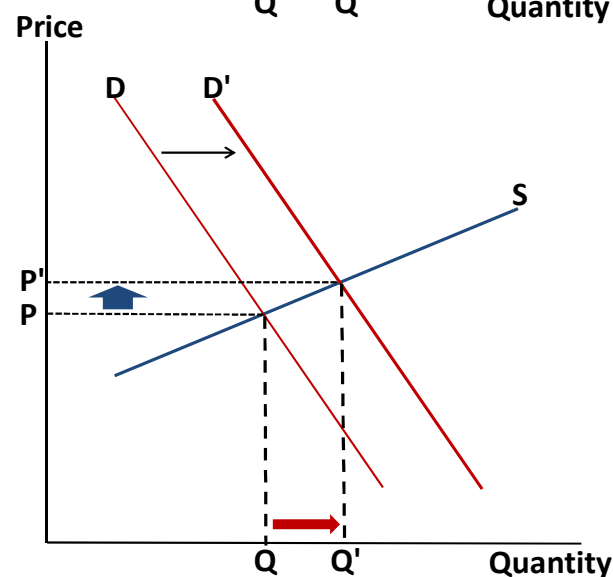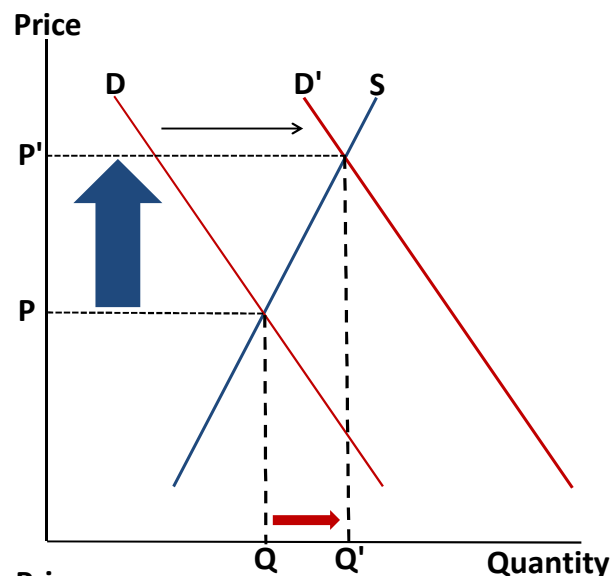
- **"Prices cannot fall by 75% when you have a decline in demand of only 5%. Clearly, prices are driven by something other than fundamentals, i.e. speculation"**

- **But a highly inelastic supply curve can mean a tiny demand fluctuation causes highly volatile price changes**

- **Equally, inelastic demand means a small disruption or curtailment in oil supply could cause prices to move substantially**

Oil Market Report

Highly Inelastic Oil Demand & Supply

A Schematic Illustration of the Short-Term Demand and Supply Curves

The range "P" indicates that price "level" is set by fundamentals, but vertical shape of demand and supply curves within the range ensures that other forces may dictate daily clearing prices.
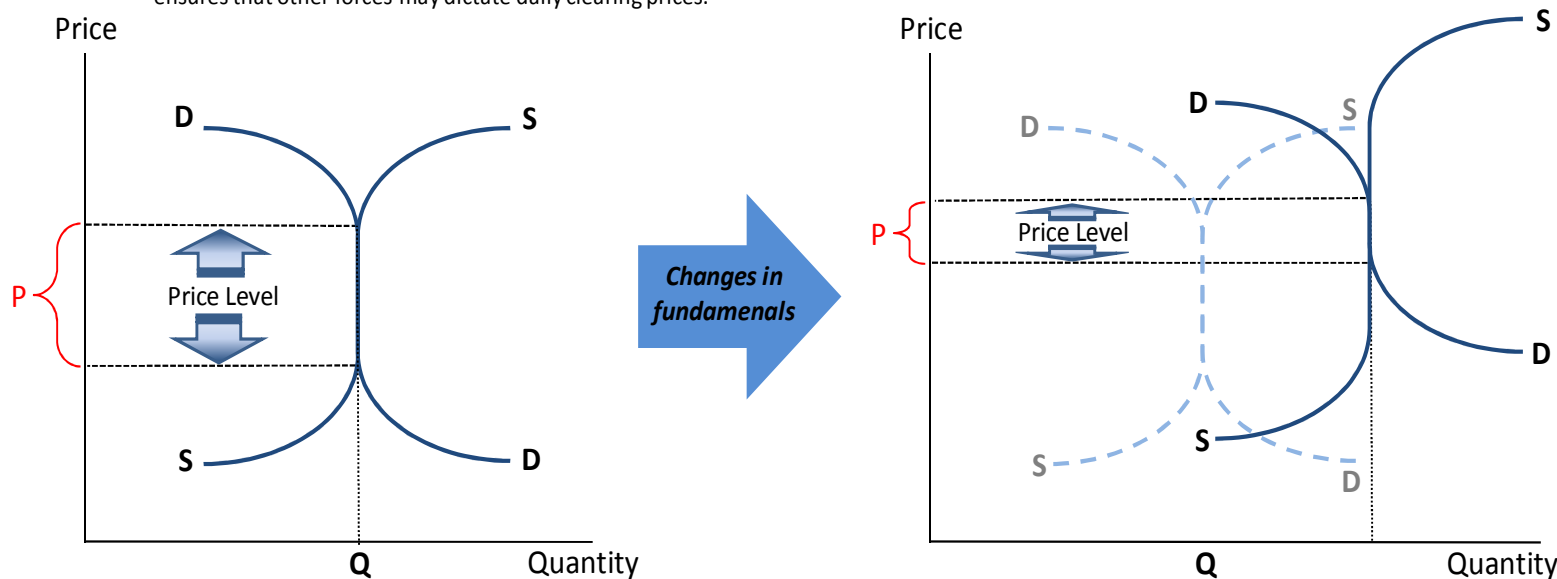
- **Oil demand and supply likely to be completely inelastic due to the structure of the oil market and pricing practice in the industry in the short run**
- **This ensures that factors other than fundamentals can drive the price**
- **But the "sustainable" price "level" is always set by fundamentals**

Will commodities remain an asset class in their own right?

- Investor commodity exposure rises → inflation & dollar hedge

- Driven by traditional rel. for commodities/other assets, commods./inflation

- Recent +ve correlation for commodities & other assets raises questions over asset class theory, portfolio diversification

- Will investor appetite for commodities sustain co-movements?

Institutional and retail commodity asset under management (AUM)

Source: Barclays Capital

- Medium term notes
- Exchange traded products
- Commodity index swaps
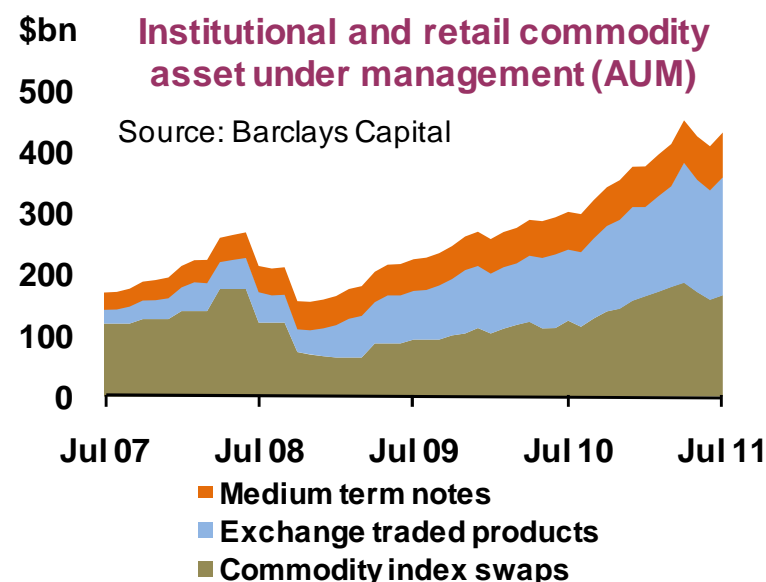
Weekly Returns Correlations (1991-2008: Upper Triangle; 2008-2011: Lower Triangle)

	WTI Crude Oil	Treasury Bill	Treasury Bond	GSCI	GSCI Energy	S&P 500
WTI Crude Oil	1.000	-0.027	-0.027	0.840	0.883	-0.020
Treasury Bill	-0.109	1.000	0.650	-0.013	-0.007	0.063
Treasury Bond	0.017	0.312	1.000	-0.008	-0.005	0.053
GSCI	0.877	-0.180	0.022	1.000	0.965	-0.008
GSCI Energy	0.891	-0.148	0.054	0.987	1.000	-0.013
S&P 500	0.522	-0.221	0.015	0.689	0.653	1.000

Oil Market Report

Do Exchange Rates Matter?

■ **US dollar weakness in recent years is frequently cited as one reason for high oil prices.** Empirically, there is clearly an inverse correlation between oil prices and exchange rates – that is, other things being equal, oil prices rise if the dollar falls.

Correlation Between Oil Price and Effective Exchange Rate

Source: EIA and FRB

— 100-day Moving Average Correlation

■ **However, this explanation is challenged by the empirical observations that** (a) a change in oil price tends to lead to a change in the exchange rate as predicted by economic theory and (b) the oil price has risen regardless of what currency unit one uses to measure the price of oil.
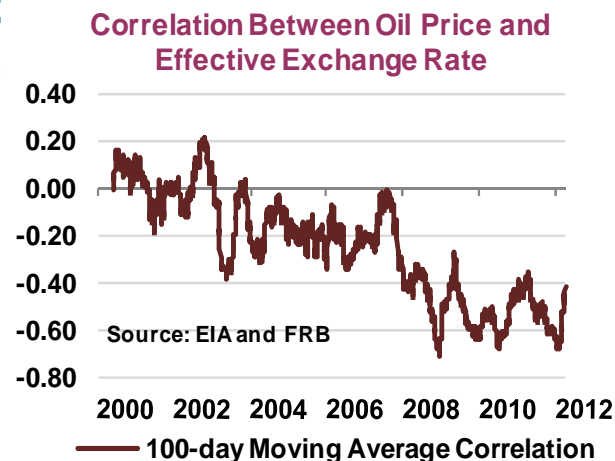
Do Exchange Rates Matter?

- **Inverse correlation between oil prices and exchange rates** has been relatively strong in recent years, although the negative correlation has been declining in recent months.
  - However, the direction of causality tends to run from oil prices to exchange rate. This is consistent with the traditional terms of trade argument on the relationship between exchange rates and oil prices.
- **However, reverse causation is possible**
  - A weaker dollar might lead to an increase in the demand for oil in non-dollar economies
  - Investors increase demand for commodities as a hedge against inflation when the dollar falls
  - Or, both exchange rate and oil prices might be reacting to some other common factor, e.g. expansionary monetary policy

Oil Market Report

Do Exchange Rates Matter?

- **The price of oil in different currencies provides** further support to the notion that weakness in the US Dollar cannot be the main reason behind the high oil prices.

- **The price of oil measured in different national currencies** has followed very similar directional movement with oil prices measured in US Dollars.

- **The currency in which oil is priced** would have no significant or sustained effect on the price of oil when translated into dollars, euros, yen, or any other currency.

- **The equilibrium price** is determined by supply and demand; it is irrelevant which currency oil is priced in.

- **The decline of the US Dollar** has little to offer as an explanation to the increase in oil prices.

- **High and rising price of oil does,** contribute to the decline of the dollar through the terms of trade effect.

World Brent Oil Price
Jan 2000=100

Source: EIA and FRB

600	
500	
400	
300	
200	
100	
0	

2000 2002 2004 2006 2008 2010 2012

— USD   — EUR   — GBP

World Brent Oil Prices
Jan 2000=100

600	
500	
400	
300	
200	
100	
0	

Source: EIA and FRB

2000 2002 2004 2006 2008 2010 2012

— BRL   — CAD   — CNY
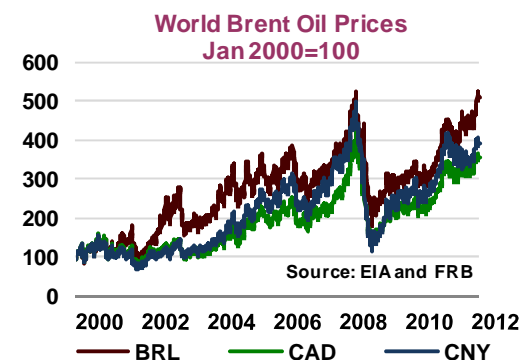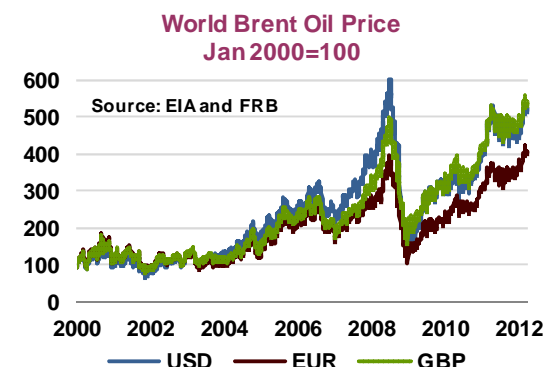
Volatility in Crude Oil Prices

- **Prices for oil, like those for many other commodities, are inherently volatile and volatility itself varies over time**
- **Examination of historical patterns shows volatility observed during 2008-2009 is actually lower than the peak observed in 1990-1991**
- **Pattern: Volatility increasing as oil prices decline and volatility declining as oil prices increase,**
  - **is consistent with the empirical evidence in the stock market**

Prices and Return Volatility: Brent Crude Oil

Source: EIA

Volatility (GARCH(1,1))   Brent Price
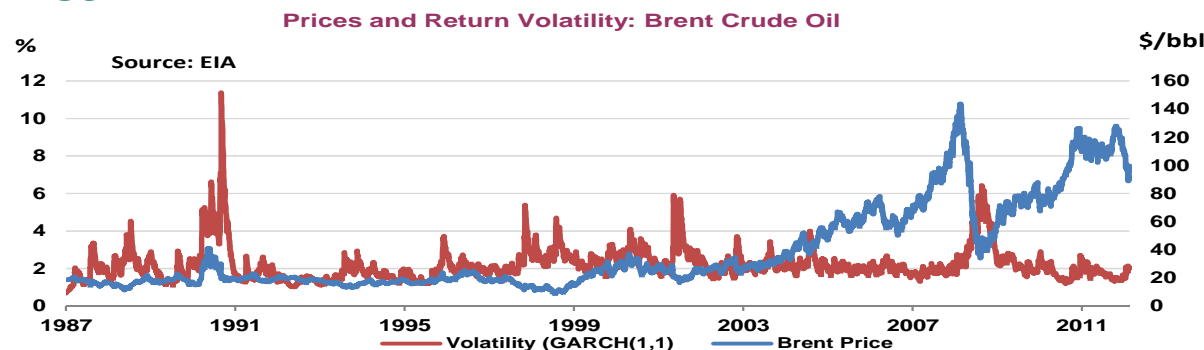
- **Conditional volatility estimation also suggests that the increase in volatility observed during 2008-2009 was a temporary phenomenon and that volatility in the oil market remains consistent with historical averages**
- **The apparent increase in the volatility of oil prices during 2008-2009 raises questions about the determinants of volatility in oil markets**
  - It has been argued that the emergence of a new class of financial traders, as well as increased participation of non-commercial traders in crude oil derivatives markets, has transformed the oil market into an intrinsically more volatile market.

Oil Market Report

Volatility: Not Unique to Exchange-Traded Commodities

Performance of Crude Oil and Non-Exchange-Traded Commodities

Cadmium
Rhodium
Cobalt
Crude Oil
Coal
Manganese
Tungsten
Rice

Source: Bloomberg

Δ%   0   1000   2000   3000

■ Highest-to-Lowest Price (2000-2010 period)
■ Price Change (Over 2000-2010 Period)
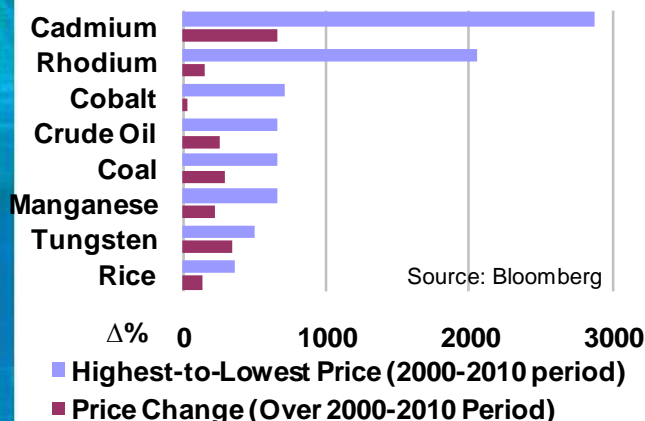
Non-Exchange-Traded Commodity Prices vs Crude Oil Prices

Source: Bloomberg
Base Year: 2005=100

300

200

100

0

2000   2002   2004   2006   2008   2010

—— Crude Oil
—— Non-Exchange-Traded Commodity Index
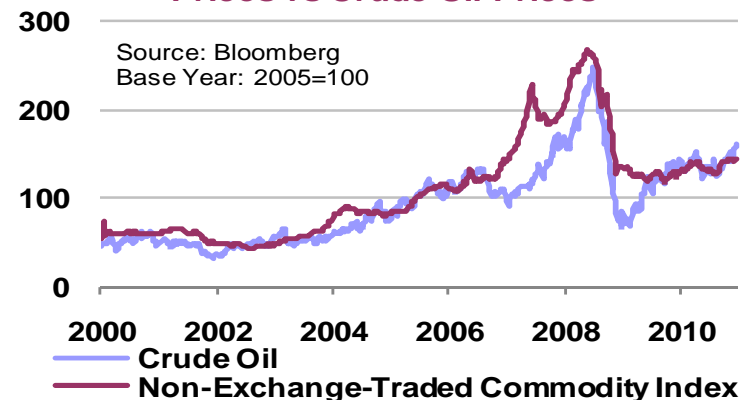
■ **A comparision of non-exchange-traded commodity price index, as well as crude oil price series, supports the notion that, starting in 2003 and more strongly after 2004, a demand shock pushed upward the prices of most commodities.**

- Prices for non-exchange-traded commodities rose faster than crude oil prices between 2006 and 2008

- Commodity prices (of both crude oil and non-exchange-traded commodities) declined sharply amid the economic contraction of autumn 2008 and stabilised after 2009.

- Fall in crude prices to below $40/bbl in early 2009 was something of an under-shoot, and that subsequent recovery has been more in line with the strengthening evident across commodities in light of the economic recovery

Volatility in commodities rose sharply after 2006

- **Non-exchange-traded commodities' index volatility experienced a large spike in early 2007 while crude oil prices were still relatively stable**
- **Unusually high volatility in commodity markets post-2007 does not appear unique to crude oil traded on exchanges**
- **Other commodities that are not traded in exchanges experienced similar fluctuations and price surges in the second part of 2000s.**
- **Volatility declined for both crude and non exchange-traded commodities once again through 2010.**
- **This is not to say that the trading of futures and derivatives contracts on exchanges has no impact on price levels and volatility.**
- **However, it does suggest that a more holistic and refined set of policy responses than simply 'driving out the speculator' may be needed to achieve more stable and predictable markets.**

Hedgers, Speculators and 'Excessive' Speculation

- **Speculators provide immediacy and facilitate the needs of hedgers by mitigating price risk, add to overall trading volume, which contributes to more liquid and well-functioning markets**

- **Even when speculators trade with one another, the greater liquidity resulting from this 'excess speculation' should decrease hedgers' trading costs**

- **Optimal level of speculation?**

- **If long and short hedgers' positions in a given commodity futures market were exactly balanced, speculators would not be needed in that market**

WTI Crude Oil Speculative Index

- **Because long and short hedgers do not always trade simultaneously or in the same quantity, however, speculators must step in to fill the unmet hedging demand**

- **Also, speculators hold a range of views about the future and take positions on both sides of the market**

- **As a result, speculative activity almost always substantially exceeds the level required to offset any unbalanced hedging**
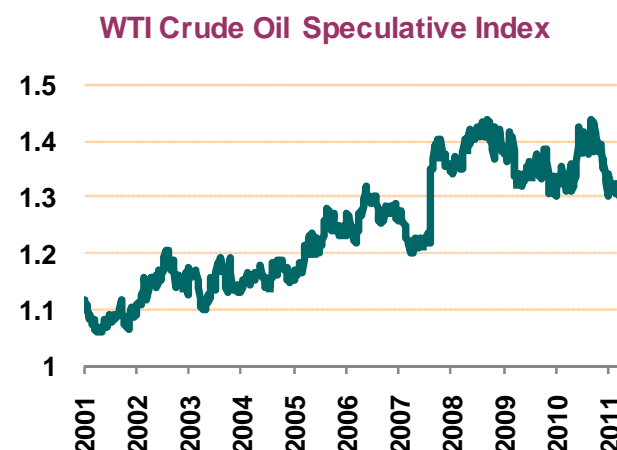
Hedgers, Speculators and 'Excessive' Speculation

- **The "Working" speculative index value has risen over time to an average of 1.40 in 2008, implying that speculation in excess of minimal short and long hedging needs reached 40%**
- **While this rise in the speculative index to 1.40 may appear alarming, in fact it is comparable to historical index numbers observed in other commodity markets**
- **Further, while a sharp rise in the speculative index was visible at the time crude prices rose to record highs in 2008, such a relationship is much less apparent for the 2010/2011 period**
- **Academic opinion remains highly polarised on the respective roles of hedgers and speculators, and on the concept of 'excessive' speculation in the crude oil market**
  - **Some argue that speculative activity in crude oil futures markets does not lead price changes, but reduces volatility by enhancing market liquidity (Buyuksahin and Harris (2011), Buyuksahin, Brunetti and Harris (2011), Irwin and Sanders (2011))**
  - **Others find significant impact of investment flows by non-user participants on prices and volatility of commodities (Singleton (2011), Xiong and Tang(2010), Mou (2010)**
- **However, both groups agree on the fact that cross-market linkages (commodity-commodity, commodity-equity) have remained very high or exceptionally strong since autumn 2008**

Oil Market Report

Physical and Financial Market Linkages

- **Price discovery generally takes place in derivatives markets,** which themselves use perceptions on current physical demand and supply conditions as well as expectations of future conditions

- **Increased correlations among commodities and equities**
  - They might be responding to common shocks, such as expectation of higher growth in China and other emerging countries
  - Or investment by institutional investor help bring these two different markets into sync

- **Empirical studies generally show no causal linkages from speculators' futures market position to prices**
  - However, the lack of information about OTC markets make these studies' finding questionable.
  - The increased forays by both physical and financial market players into each others' market make these two markets dependent, and estimating relative importance in price formation almost impossible.

Economic Studies I: Inter-Commodity Linkages

- **"Fundamentals, Trader Activity and Derivative Pricing"**
  - **Buyuksahin, Haigh, Harris, Overdahl, and Robe**
- **Focus on Swap Dealer participation**
  - **From commodity index trading in nearby futures**
  - **From OTC positions in back-dated futures**
- **Cointegration of Crude Oil futures prices**
  - **Result in "better" pricing for hedgers in 1-year and 2-year contracts**
- **Supports the notion that markets should encourage broad participation**

Oil Market Report

Overview

- **Do ST and LT commodity futures move in sync?**
  - ◆ Theory: yes (cost of carry relation → stable relation)
  - ◆ **Empirics:**   requires long series of backdated futures prices
    - ➢ **We focus on WTI sweet crude oil futures**

- **What do we find?**
  - ▪ ST and MT prices (<9 months) cointegrated since early 1990s
  - ▪ **LT contracts (>1 year):**
    - ➢ Before 2002:   not cointegrated with nearby
    - ➢ Since mid-2004:   cointegration!
      - ● + survives crisis

- **Why the transformation?**
  - ◆ Changes in level & structure of **market activity?**   Yes
  - ◆ Role of "**fundamentals**"?   Yes

Oil Market Report

NYMEX Crude Oil Futures (WTI)

Nearby, 1-yr and 2-yr Prices: 2000-2011
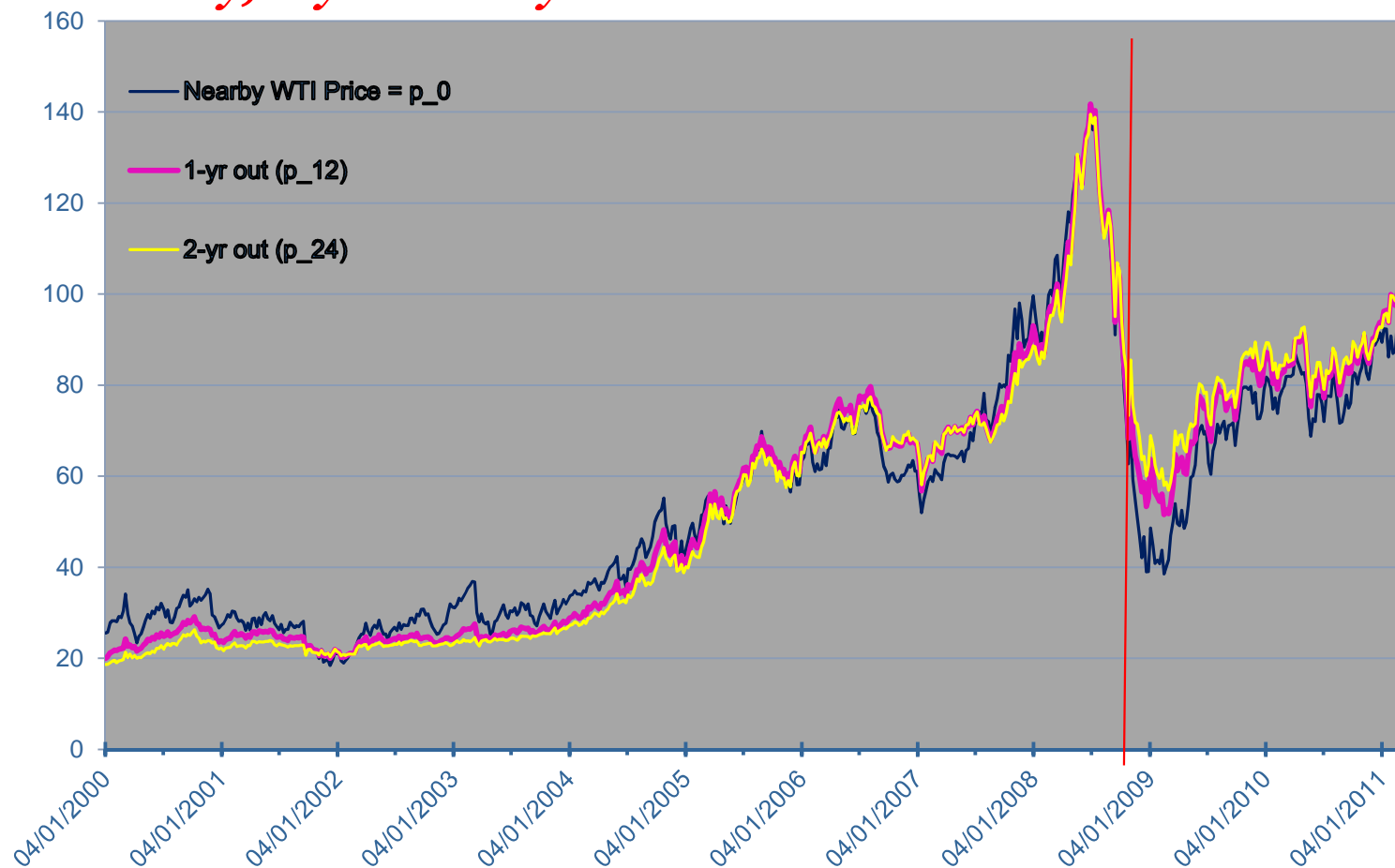
Cointegration – Idea

- **<u>Futures prices should be cointegrated</u>** (i.e., there ought to be a stable LT relationship between different-maturity futures), simply <u>through</u> the <u>cost-of-carry</u> model:

$$F_t = S_t \, e^{(r+u-y)t}$$

Where r = Interest rate

u = Storage costs

y = Convenience yield

t = Time to maturity

- **Cointegration tests for a statistically significant** link between futures prices (F_t) at different horizons (t)

Data

- ## Our focus:

  - ### Nearby, 1- and 2-year WTI futures prices ("LT with nearby")

    - #### Also, check 2 to 9 months futures ("ST or MT with nearby")

- ## Prices

  - ### Tuesday settlement prices (weekly analysis)

- ## Time period

  - ### Prices for up to 1-year futures: March 1989 to May 2011

  - ### Prices of 2-year futures: July 1995 to May 2011

Table 3A: Order of Co-integration

Panel A: Trace tests on order of cointegration

λ_{trace} test statistic	H_O:	critical value (p-value)
50.93	r = 0	34.10 (0.000)
22.91	r ≤ 1	19.87 (0.020)
4.72	r ≤ 2	8.47 (0.323)

■ **At most one co-integrating vector**

● **Robust to using 1995-2008 *vs*. 1995-2011 data**

Table 3B: LT & ST Parameter Tests

Panel B: Tests for exclusion from the cointegrating vector

	H_O:	$\chi^2_{(1)}$	value (p value)
Nearby	$\beta_N = 0$		3.115 (0.078)
1 yr contract	$\beta_1 = 0$		0.969 (0.325)
2 yr contract	$\beta_2 = 0$		0.468 (0.494)

Panel C: Tests for weak exogeneity

	H_O:	$\chi^2_{(1)}$	value (p value)
Nearby	$\alpha_N = 0$		0.198 (0.656)
1 yr contract	$\alpha_1 = 0$		6.63 (0.01)
2 yr contract	$\alpha_2 = 0$		6.08 (0.01)

- **Cannot reject that the 1-yr and 2-yr prices are not part of the cointegrating relationship (economic reasons to keep them)**

- **Nearby is weakly exogenous**

  - **w.r.t. the short-run adjustment to the long-run relation, the 1- and 2-yr prices do all of the adjusting to perturbations in the cointegrating space**

Identifying Changing Cointegration

■ **Recursive Cointegration Analysis**

- **Hansen & Johansen (1993)**

- **Highlights changes in LT relationship between the three price series (one co-integrating vector)**

- **Steps to recover the "R representation" (ECM)**

  - ◆ **1. Use full sample to estimate ST parameters (α)**

  - ◆ **2. Keeping ST estimates fixed, re-estimate LT parameters (β)**

    - ▪ **Start with a 3 years ("burn-in") period to calculate initial trace**

    - ▪ **Adding one week at a time, recalculate trace; then, repeat**

Trace Statistics

- **Different for shorter-dated contracts**
  - ◆ **Short-dated contracts cointegrated with nearby much earlier**

Legend:
- Trace_0_1_2
- Trace_0_6_9
- Trace_0_12
- Trace_0_24
- Trace_0_12_24

March 2003

July 2004

Oil Market Report
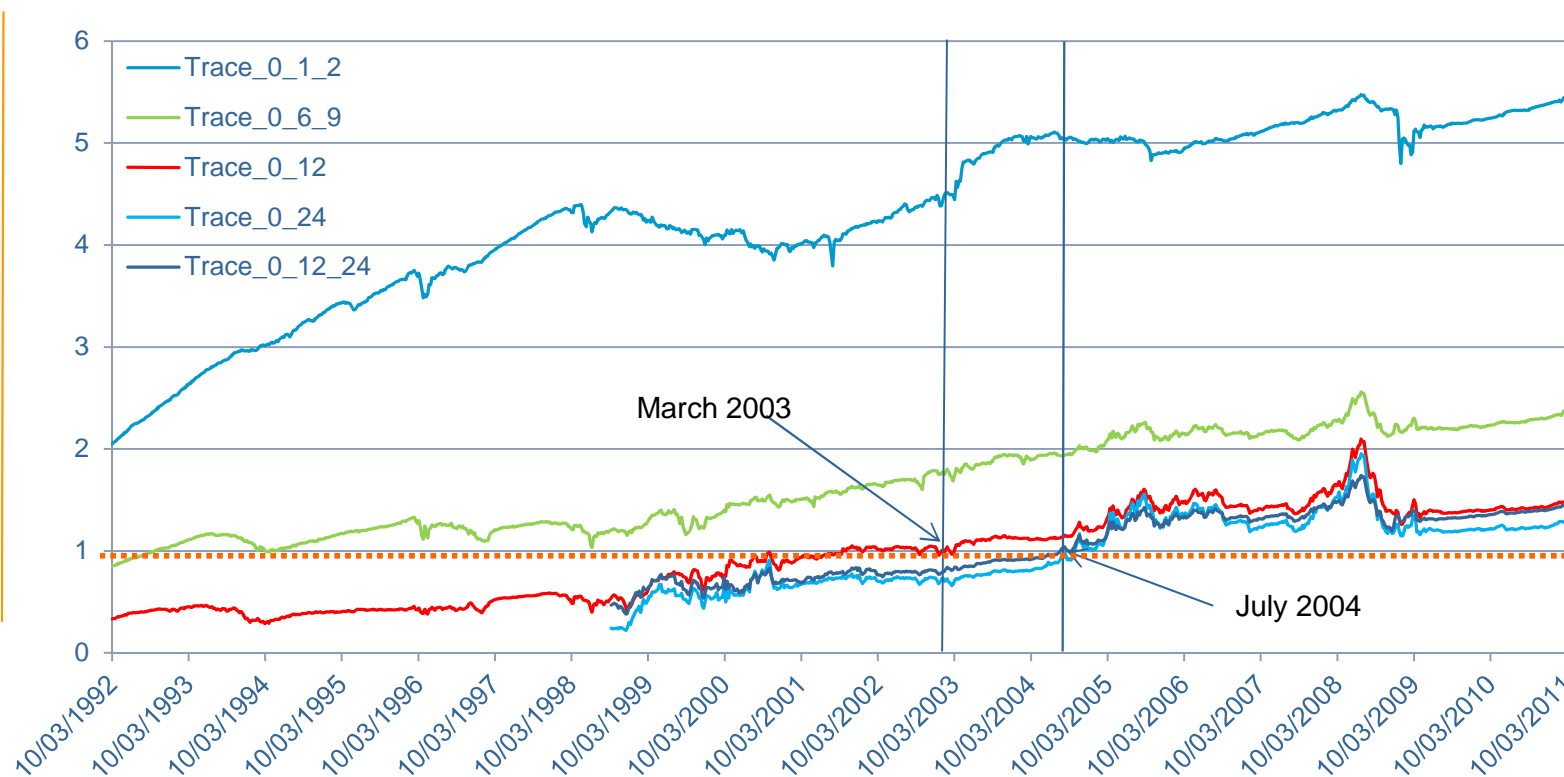
Idea #1

Cointegration stems from cost-of-carry relation:

$$F_t = S_t \, e^{(r+u-y)t}$$

→ **Fundamentals may have changed**, affecting

- either the stochastic process driving the spot price

  ➢ **Bessembinder *et al*, JF '95**

- or the process for the net cost-of-carry

  ➢ **Brenner & Kroner, JFQA '95**

Hyp.#1: Demand Shock for Commodities?
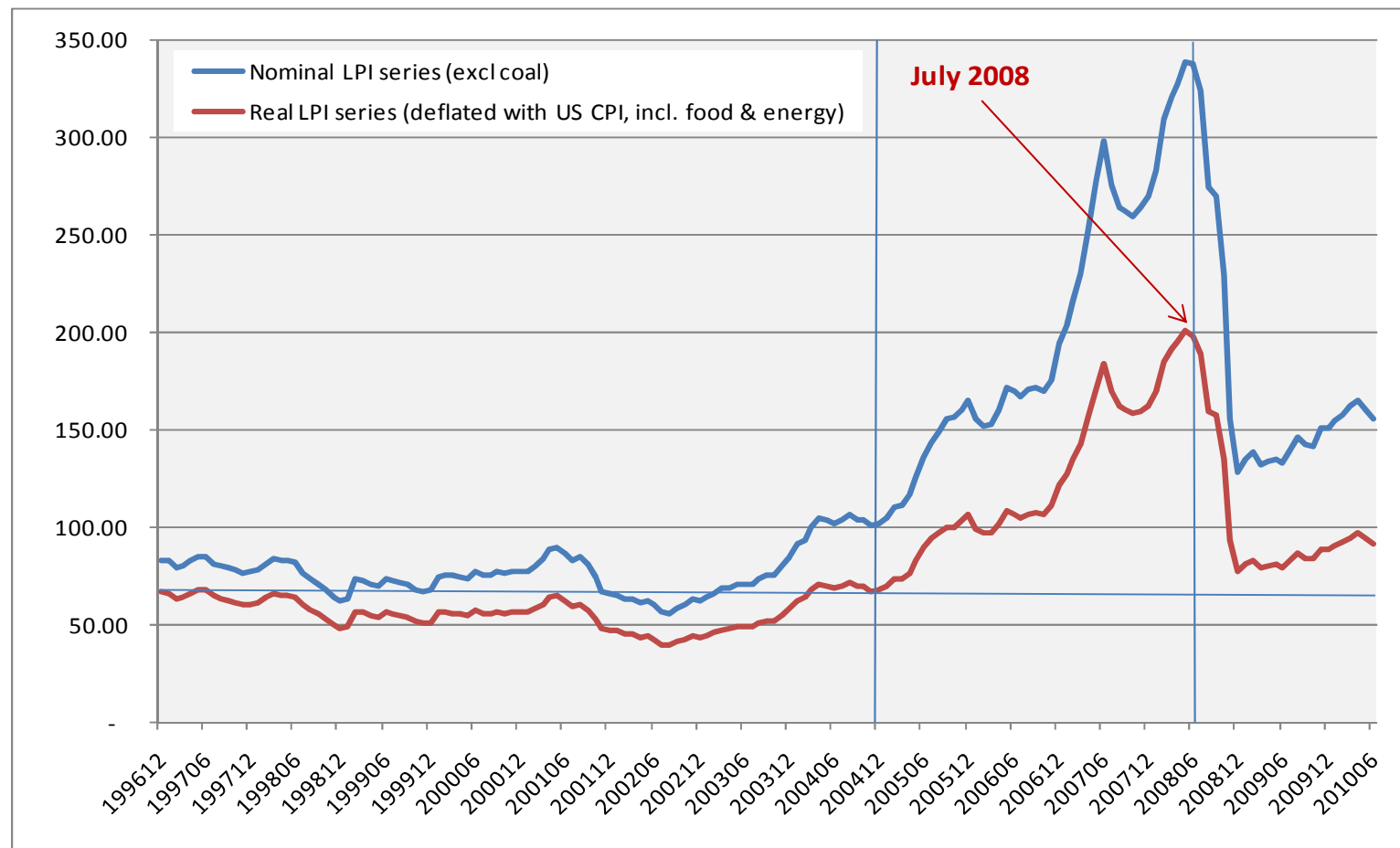
Price index using equally-weighted average return on 8 non-exchange-traded commodities (1990 = 100)

Hyp.#2: Structural Break in Oil Market?

WTI Spot Price _v._ Non-Saudi Crude Oil Spare Production Capacity (1995-2010)

Legend:
- Jan.1995 - Feb. 2004
- Mar.2004 - Jul. 2008
- Jan. 2009-Aug. 2010
- Aug. 2008-Dec. 2008

Y-axis: WTI Spot Price (monthly average, USD per barrel)

X-axis: Surplus Capacity (monthly EIA estimate, million barrels per day)

Robe and Buyuksahin 2010
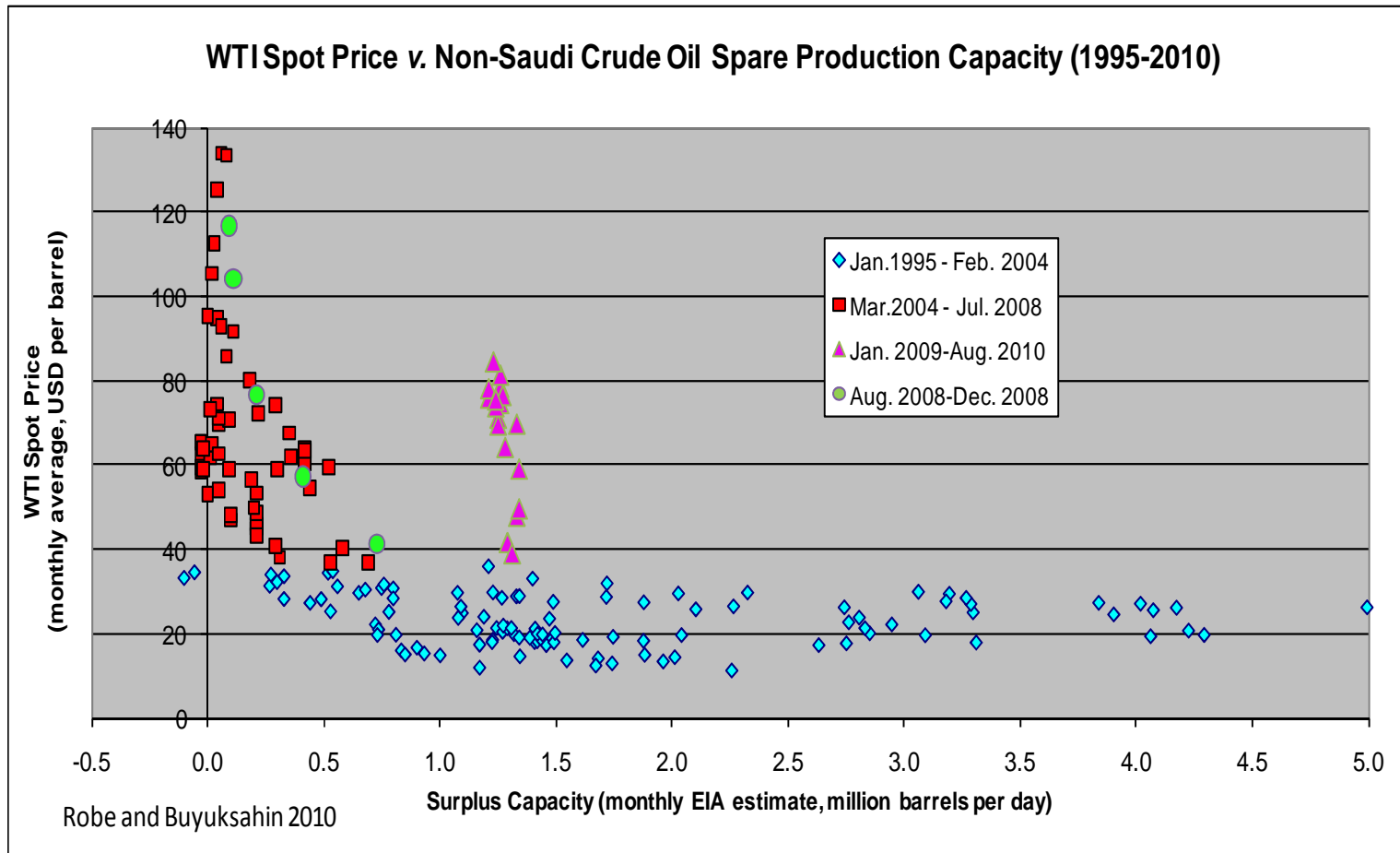
Monthly data on crude oil spot prices and spare production capacity outside Saudi Arabia

(Source: EIA)

Hyp.#3: Storage?

Net cost of carry: positive after 2004, massively so post-Lehman
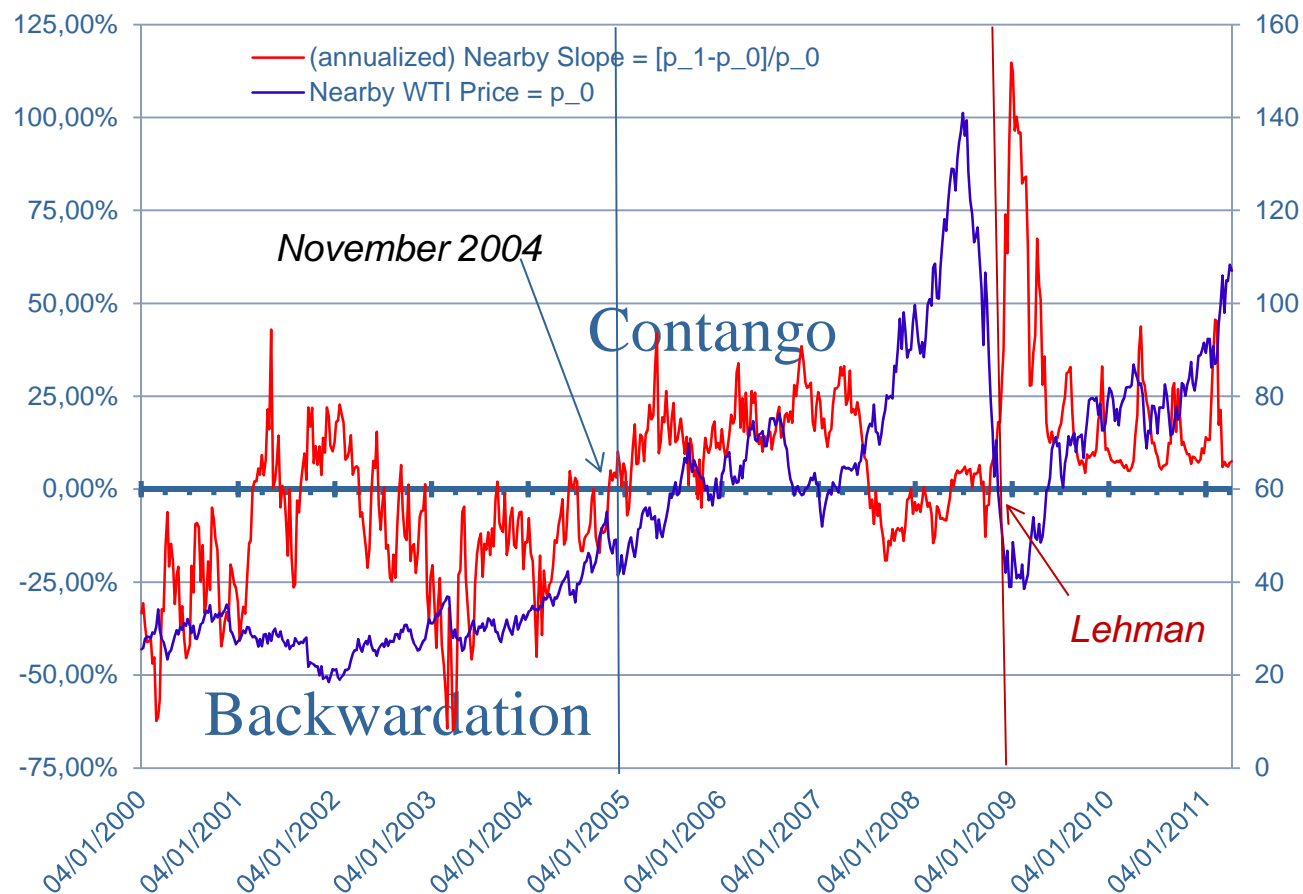
Idea #2

Cointegration requires trading activity that exploits perceived pricing aberrations:

Has arbitraging become easier and/or more prevalent?

- **More uninformed traders into the trading stream?**
    - **"thick market" (Admati & Pfleiderer, 1988; Roll *et al*, 2007)**
    - **Commodity-index investment flows?**
- **Arrival of new kinds of traders?**
    - **Less constrained (Başak & Croitoru, JFE '06)**
    - **Hedge funds, other financial traders?**

Oil Market Report

Oil Market Report

Our Detailed Data: Sub-Categories

- **Non-commercials**
  - **Hedge Funds** (includes Commodity Pool Operators (CPOs), Commodity Trading Advisors (CTAs), Associated Persons who control customer accounts, and other Managed Money traders)
  - **Floor Brokers & Traders**
  - **Non-Registered Participants** (Traders not registered under the Commodity Exchange Act (CEA) – mostly non MMT financial traders)

- **Commercials**
  - **"Traditional"**
    - **Producers**
    - **Manufacturers** (refiners, fabricators, etc.)
    - **Dealers** (wholesalers, exporter/importers, marketers, shippers, etc.)
  - **Commodity Swap Dealers** (includes arbitrageurs)

Research Questions

Oil Market Report

- **Describe today's Crude Oil futures market**
  - What is the "maturity structure"?
  - What is the "participant structure"?
  - Do these interact?

- **Pricing Analysis**
  - Are near- and far-month futures prices co-integrated?
  - If so, why?
    - Do fundamentals matter for cointegration?
    - Does trading activity matter for cointegration? If so, whose?

Results: Maturity Structure

- **Growth was strongest in long-dated contracts**

Open Interest In WTI Crude Oil Futures and Adjusted Option Positions

Legend:
- > 3 yrs
- 12-36 months
- 3-12 months
- < 3 months
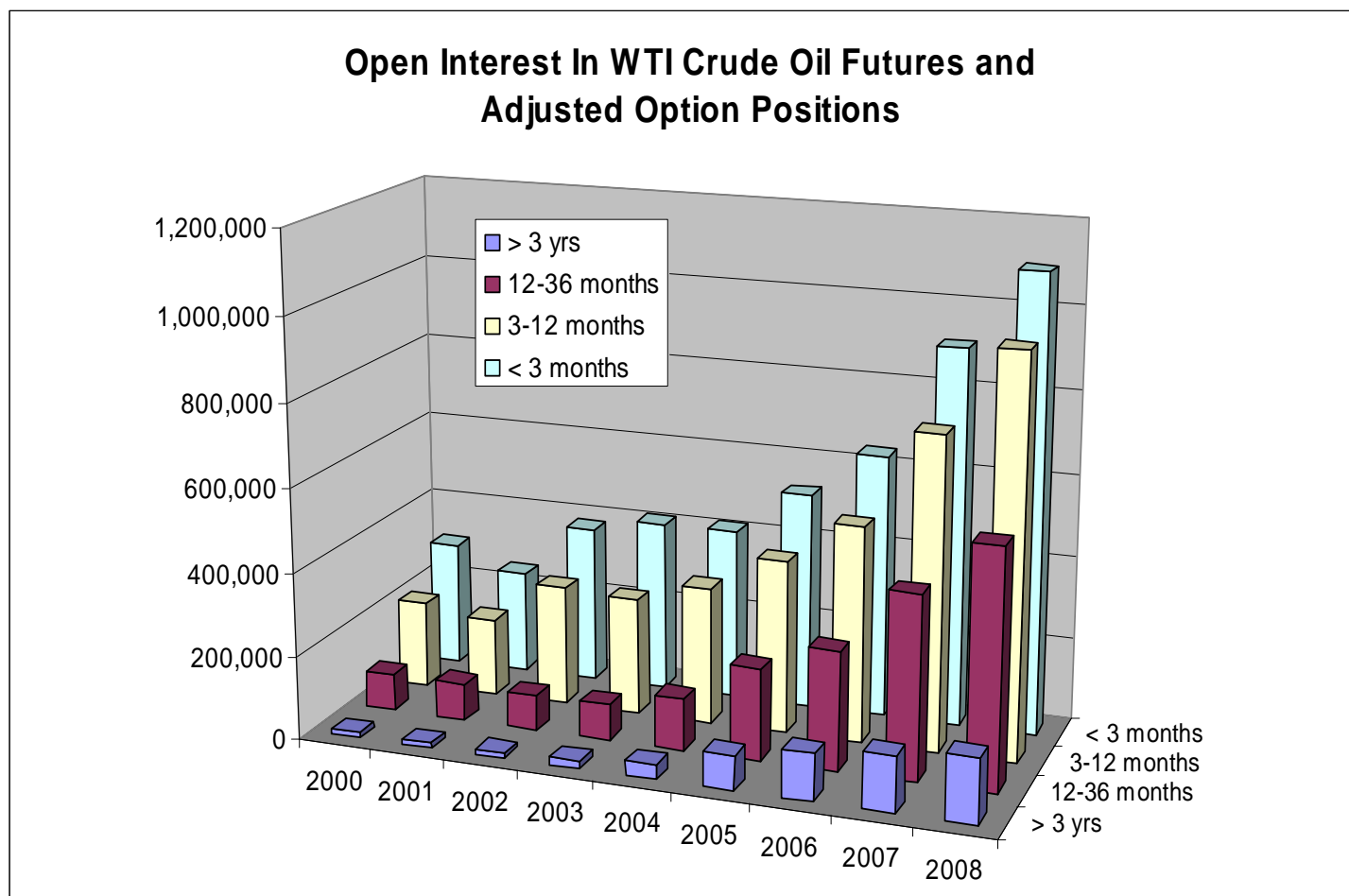
Results: Participant Structure

- Financial traders are way up *(MMT, CIT & other FI)*

Contribution to the WTI Futures & Futures-equivalent Open Interest:
All Maturities, July 2000 - June 2009
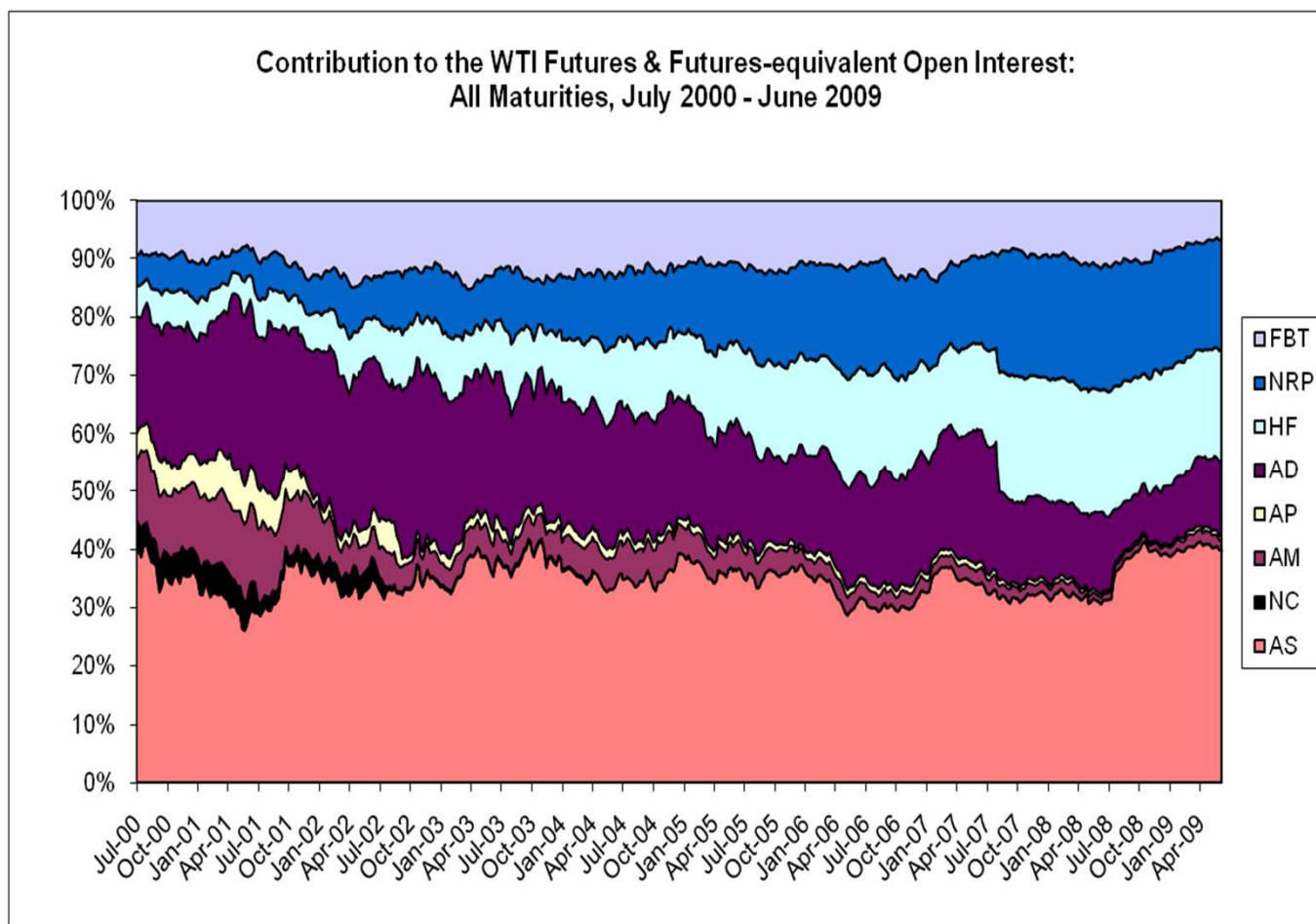
Heterogeneity within Broad Categories

o Good idea to break out Swap Dealers & Hedge Funds *(CFTC 2009)*
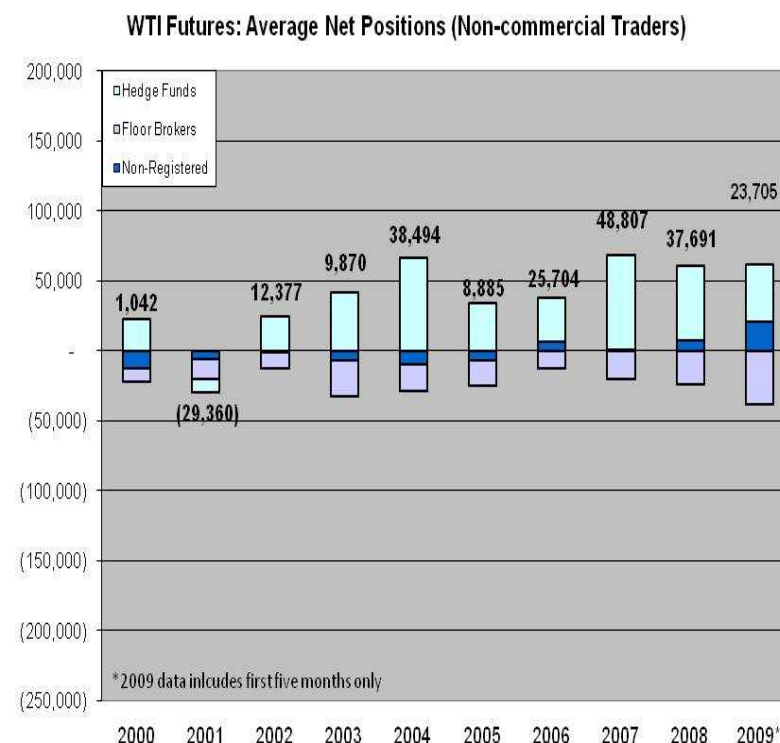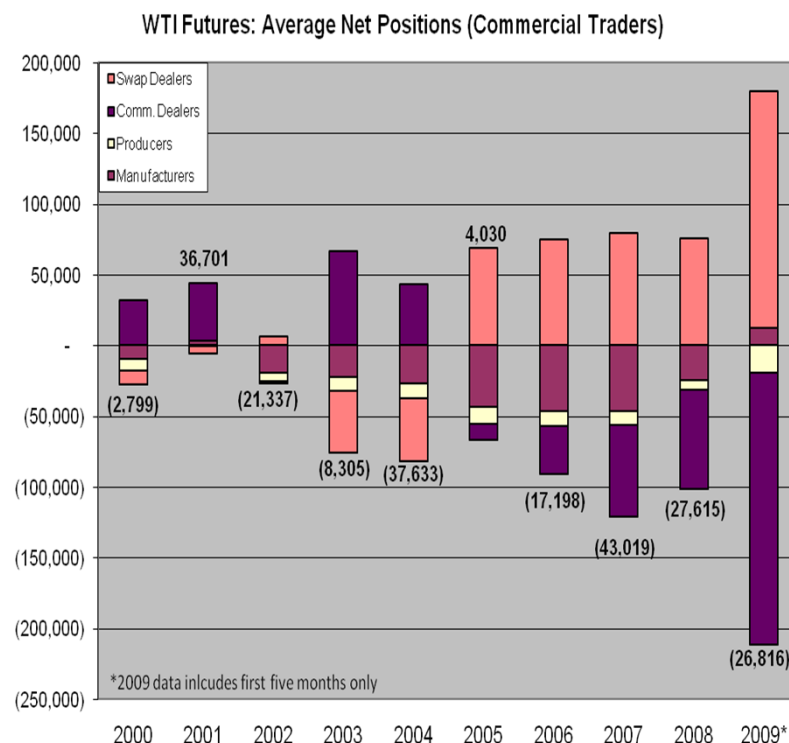
Results: Participant Structure

- Swap trading: Structural change in mid-2004

Swap Dealers: net long "nearby" / net short "backdated"
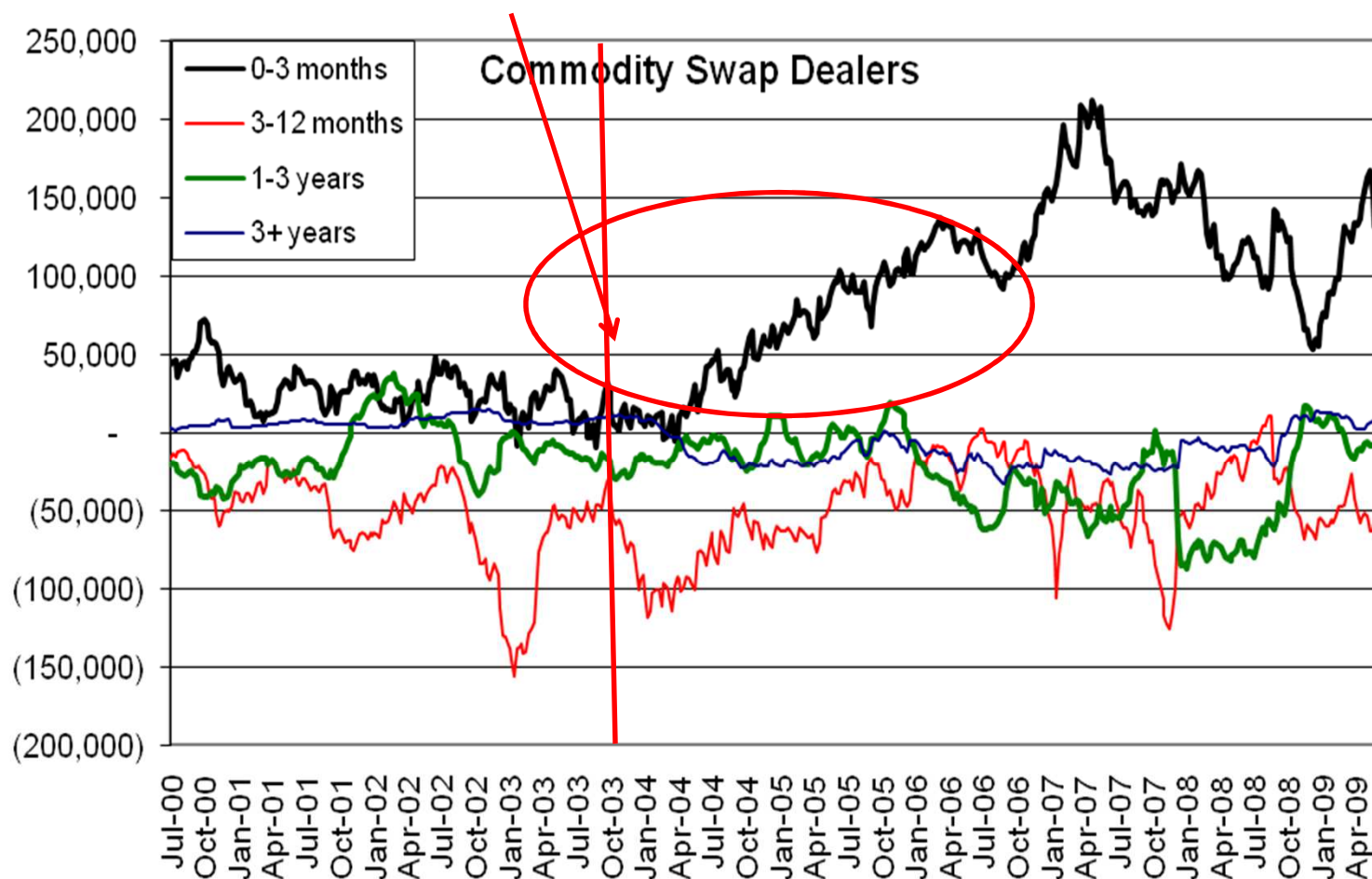
Results: Participant Structure

- Hedge funds seem to follow
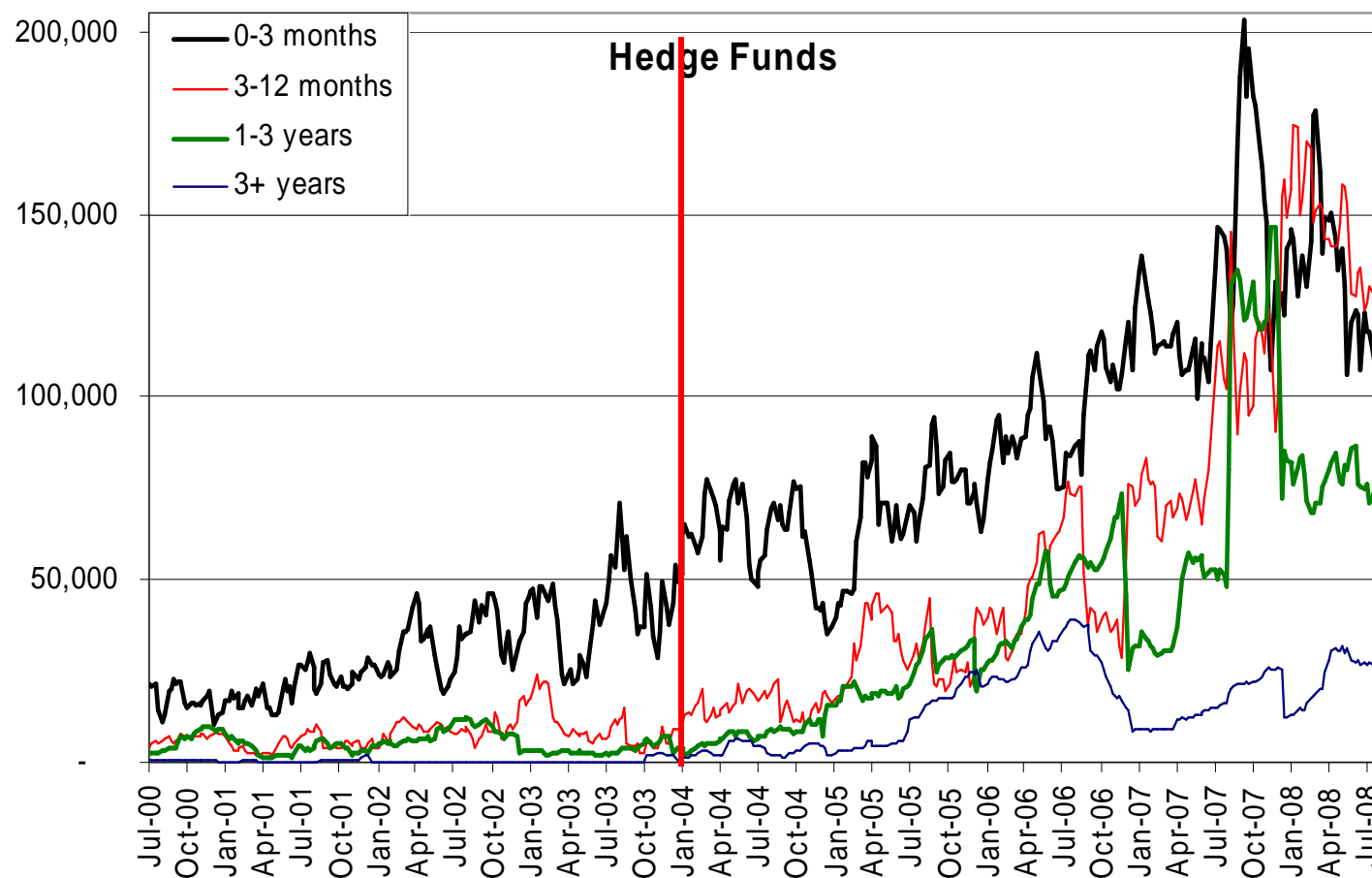
Explaining Convergence

- ## Tables 8-9-10: Regress the Trace statistic on…

  - ### …trader position data
    - Each trader category entered separately
      - Nearby *vs*. 1-yr plus 2-yr
    - Market share *vs*. total number
  - ### …real-sector variables
  - ### …controls for exog. changes (e-trading, Dec & June)

- ## Technical issue

  - Some series are I(0), others I(1); also, endogeneity?

    → Pesaran-Shin (1999) IV approach to cointegration

Oil Market Report

Table 9.1: "Financials"

		Model 1 (Market Shares)			Model 2 (Positions)		
		Coefficient		p value	Coefficient		p value
Constant		**0.3944**	**	0.0117	**0.5433**	***	0.0003
Spare Capacity		**(0.0434)**	**	0.0260	**(0.0465)**	**	0.0134
Slope		**3.4561**	***	0.0037	**3.9456**	***	0.0069
TOI (Total Open Interest)		**7.81 E-07**	***	0.0076	**6.95 E-07**	**	0.0131
Electronic Trading		**(0.5281)**	***	0.0000	**(0.6465)**	***	0.0000
December		0.1302		0.3488	0.0163		0.9088
June		0.1423		0.1773	0.0264		0.7822
Floor Brokers & Traders	Nearby	(2.0397)		0.1665	-7.09 E-07		0.8713
	(1-year + 2-year)	0.7341		0.8823	1.26 E-06		0.9107
Hedge Funds	Nearby	0.0168		0.9768	-9.12 E-07		0.5030
	(1-year + 2-year)	**2.6162**	*	0.0735	2.53 E-06		0.3391
Non-registered participants	Nearby	**3.6755**	**	0.0476	**7.44 E-06**	**	0.0348
	(1-year + 2-year)	8.2870		0.1371	2.41 E-05		0.1402
Commodity Swap Dealers	Nearby	0.7819		0.2177	1.22 E-06		0.2801
	(1-year + 2-year)	**(3.6009)**	**	0.0422	-6.22 E-06		0.1768

Table 9.2: "Hedgers"

		Model 1 (Market Shares)			Model 2 (Positions)		
		Coefficient		p value	Coefficient		p value
	Constant	1.2188	***	0.0008	0.5134	***	0.0055
	Spare Capacity	(0.0348)	**	0.0212	(0.0381)	**	0.0422
	Slope	4.9582	***	0.0001	4.2750	***	0.0060
	TOI (Total Open Interest)	7.04 E-07	***	0.0004	8.17 E-07	***	0.0004
	Electronic Trading	(0.3683)	***	0.0005	(0.4727)	***	0.0003
	December	0.2855	**	0.0253	0.1091		0.5299
	June	0.1021		0.2018	(0.0186)		0.8269
Manufacturers	Nearby	(1.9859)	*	0.0560	-3.17 E-06		0.3653
	(1-year + 2-year)	2.4473		0.3285	8.03 E-08		0.9900
Producers	Nearby	1.1362		0.4592	8.85 E-06		0.1563
	(1-year + 2-year)	(22.5346)	**	0.0455	-7.59 E-05	*	0.1041
Commercial Dealers	Nearby	(1.4558)	***	0.0097	-5.76 E-07		0.6550
	(1-year + 2-year)	(3.7662)	*	0.0786	7.31 E-08		0.9857
Commodity Swap Dealers	Nearby	0.2253		0.6172	2.24 E-06	*	0.0841
	(1-year + 2-year)	(1.6968)		0.2249	7.74 E-07		0.7899

Market Structure

- **Participants**
  - Change in the relative importance of (non) financial traders
  - Different types of traders behave very differently
  - Direction of net positions often varies with maturity
    - Commodity swap dealers are often short in LT contracts

- **Pricing and Hedging**
  - Market for 1+ year contracts is now much larger than the total market in 2000
  - Prices up to 2 years are now co-integrated with shorter-term contracts
    - Growth of financial trading helps explains this positive change
    - Hedging ability is improved

Oil Market Report

Explaining Cointegration

- **Fundamentals matter**
  - **Spare capacity & Slope**
  - **Demand for all industrial commodities**

- **Trading activity matters as well**
  - **Commodity swap dealers in nearby contracts**
    - **Not further-out positions**
  - **Financial traders in nearby and backdated contracts**
    - **Hedge funds *(MMT)*, others *(NRP)***

Do Speculators Drive Crude Oil Prices?

A simple question

- **Is speculative activity destabilizing markets?**
  - **Is speculative activity moving prices?**

  Theory: Stabilizing Speculation
  - Profitable speculation must involve buying when the price is low and selling when the price is high (Friedman, 1953)
  - Speculators fill hedgers' demand-supply imbalances and provide liquidity to the market (Keynes, 1923)
  - Speculative activity reduces cost of hedging (Hirshleifer, 1990 and 1991)

  Theory: Destabilizing Speculation
  - Shleifer and Summers (1990) note that herding can result from investors reacting to common signals or overreacting to recent news.
  - Long et al. (1990) show, rational speculators trading via positive feedback strategies can increase volatility and destabilise prices.

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Economic Studies II: Herding and Positive feedback trading

- **"The Prevalence, Sources and Effects of Herding"**

  Buyuksahin, Boyd, Harris, Haigh

  - Test for herding by assessing the degree of correlation across hedge funds and/or FBTs in buying and selling of futures.

  - Also, we test for positive feedback trading by looking at the demand and past performance of futures product.

  - Finally, we test for excess demand and price changes.

- **Empirical Findings**

  - Overall herding measure for nearby contract is 0.07 for hedge fund and 0.06 for FBTs (for nearby and first deferred it is 0.09 for hedge funds and .07 for FBTs).

  - No indication of positive feedback trading by hedge funds or FBTs.

  - When prices are falling (20 out of 32 markets) , hedge funds may be herding, but they are buying which implies a stabilization effect on prices.

Causes of Herding and What we do

- **Large traders might have greater incentive to herd due to:**
  - Perception that other agents might have superior information and infer information about the quality of investment holdings from one another's trade.
  - The basis of performance evaluation between institutions
  - Reaction to the same exogenous shock

- **In this paper, we study the trading behavior of two groups of traders (hedge funds and floor brokers) to examine:**
  - Herding between hedge funds as well as between FBTs
  - Positive feedback trading across the groups

- **Questions to be addressed here today:**
  - Does herding occur among hedge funds? If so, does their trading pattern have a stabilizing or destabilizing effect on market prices?
  - Does herding occur among floor brokers? If so, does their trading pattern have a stabilizing or destabilizing effect on market prices?

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Herding: Empirical Results

Overall Herding for Hedge Funds and Floor Broker/Traders: Metal and Energy Commodity Contracts
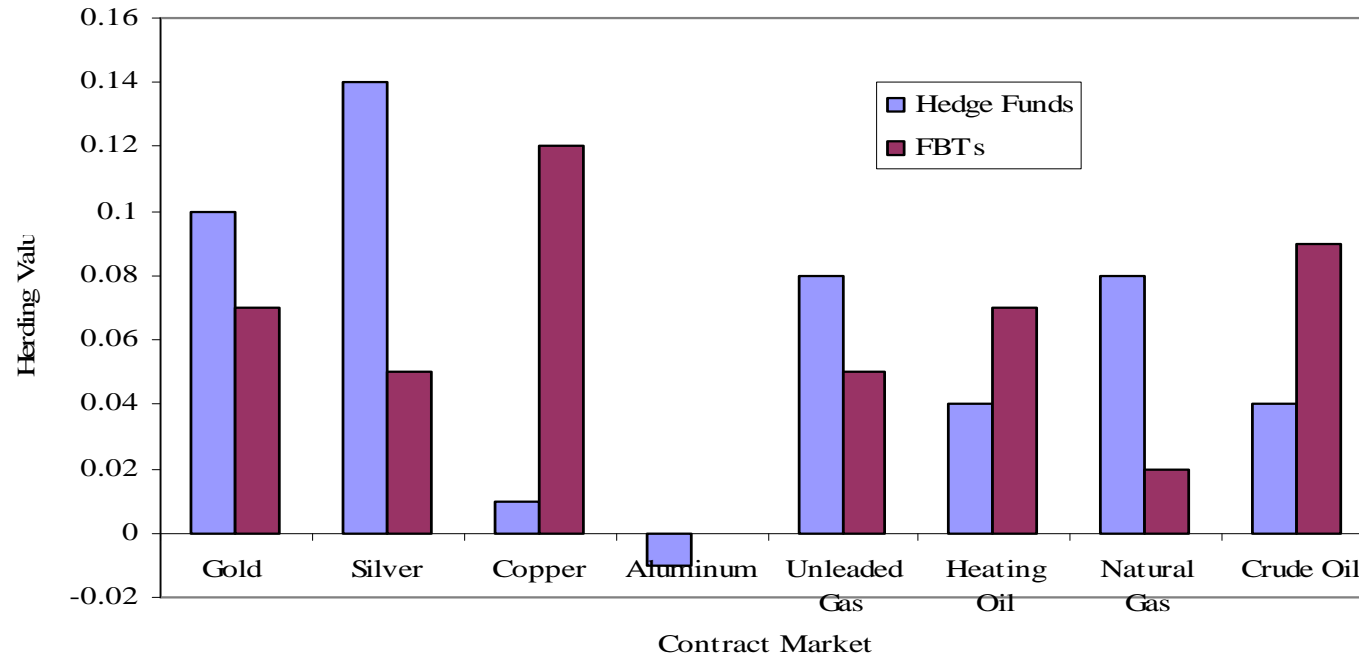
Economics Studies III: Role of Financial Players

- **More investment money in commodity futures markets**
  - **Thousands of hedge funds, commodity index funds, etc.**
  - **Assets under Management (AUM):**
    now exceed $400bn, inflows = $350bn in 10 years
    (Barclays, Nov. 2011)

- **What could this development mean for...**
  - **Energy Price Levels? Buyuksahin and Harris (2011)**
  - **Oil Market Volatility? Buyuksahin, Brunetti and Harris (2011, 2011)**
  - **Cross-Market Linkages? Buyuksahin and Robe (2010, 2011)**

Nice Data – Show us it matters!

Graph 2: Co-movement of oil prices and speculative activity

US$/b | '000 Contracts

Managed money net long positions — WTI
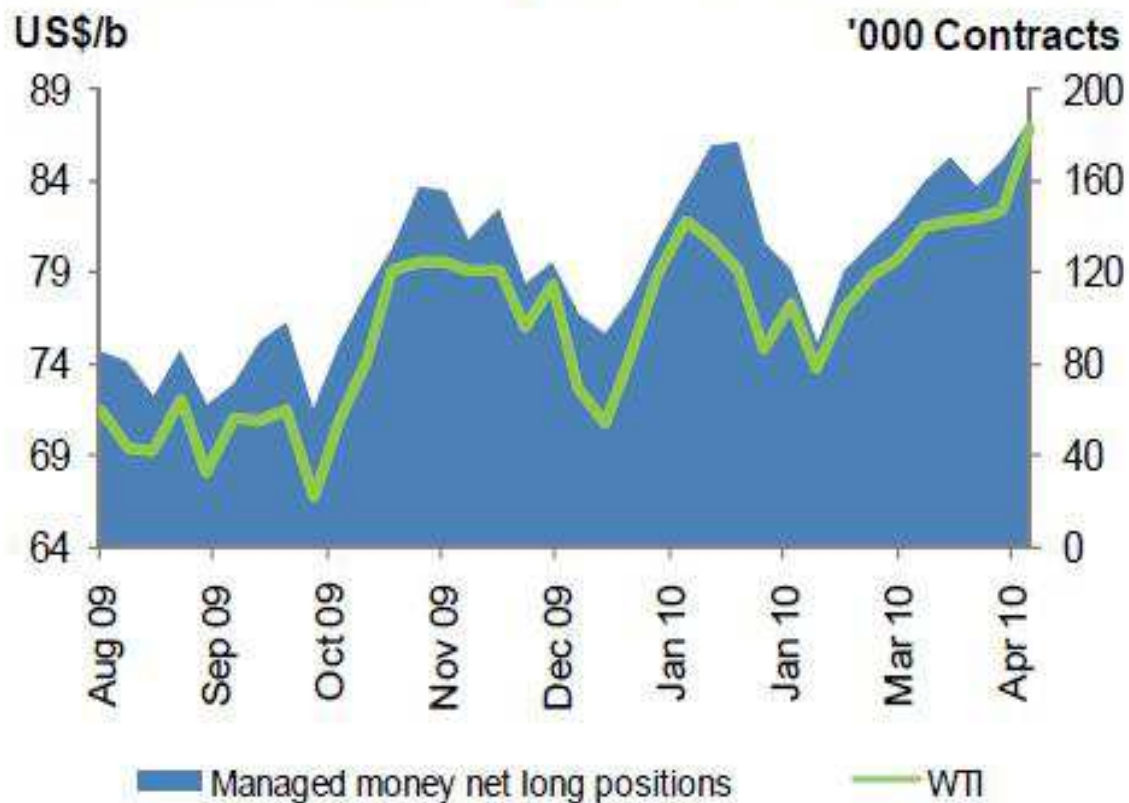
2010 OPEC "observation":

Strong positive correlation between net hedge fund positions and crude oil prices

Data and Findings

- **For each category we consider:**
  - **Level of Net Futures Position**
  - **Change in Net Futures Position**
  - **Level of Net Total Position (Futures plus futures equivalent options)**
  - **Change in Net Total Position**
- **Trading Activity is measured at**
  - **Daily and multiple day intervals**
- **What we found:**
  - **Speculative activity does not Granger-cause prices**
  - **In general, on the other hand, we find the reverse causality to hold, i.e. position change is Granger caused by price change.**

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Net Futures Positions (Nearby Contract)
Settlement Price
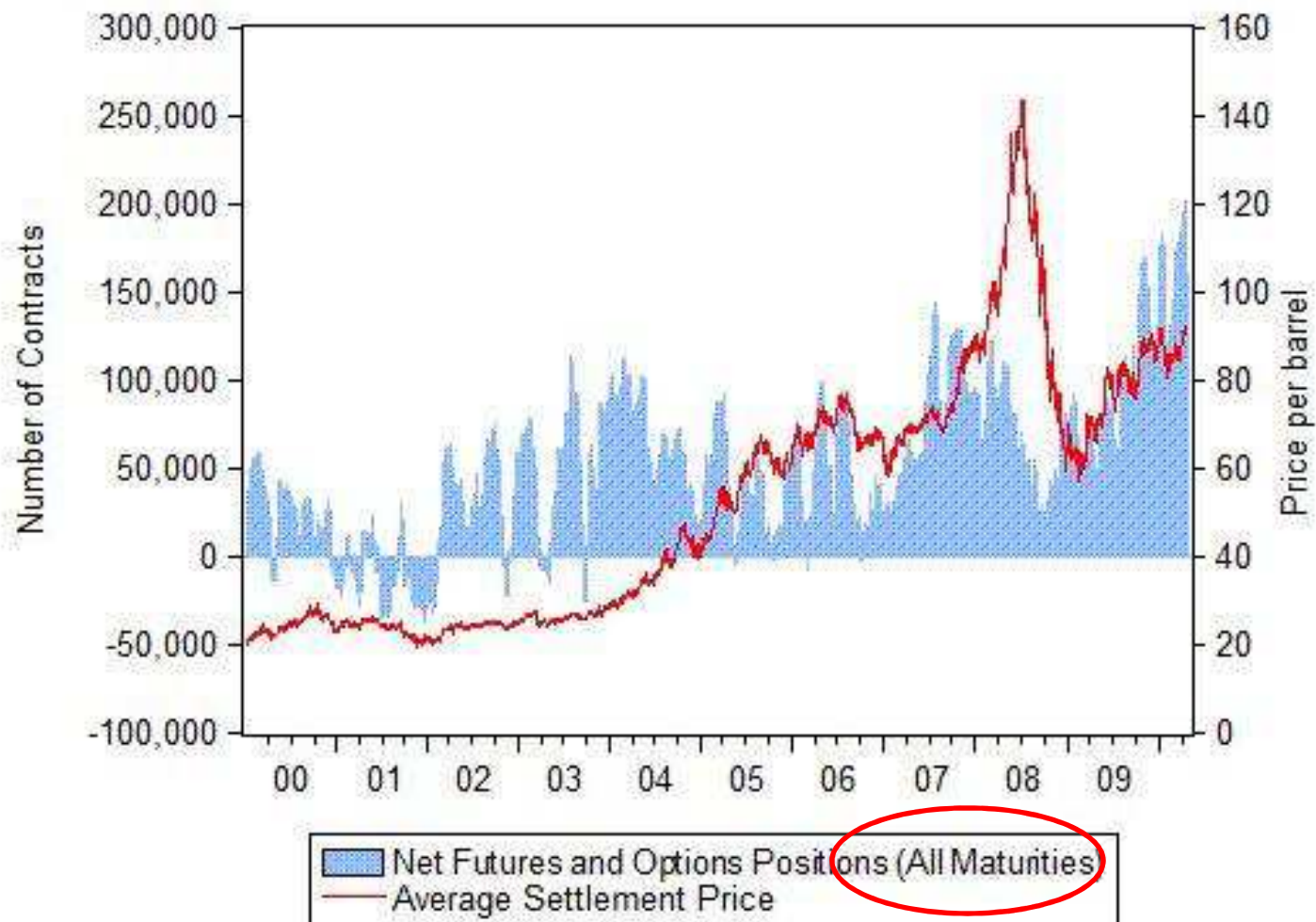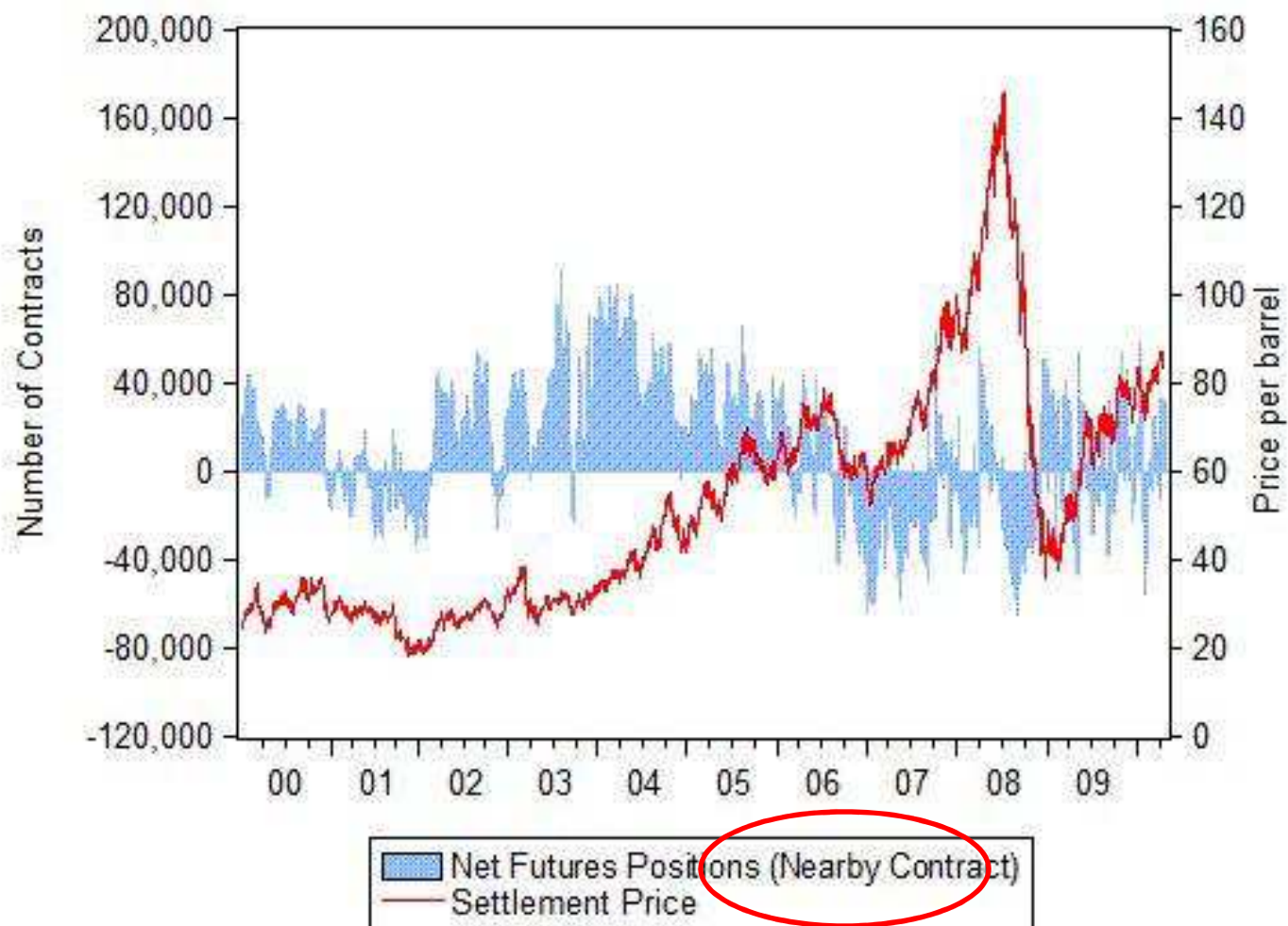
Multivariate Granger Causality and Contemporaneous Effects Findings
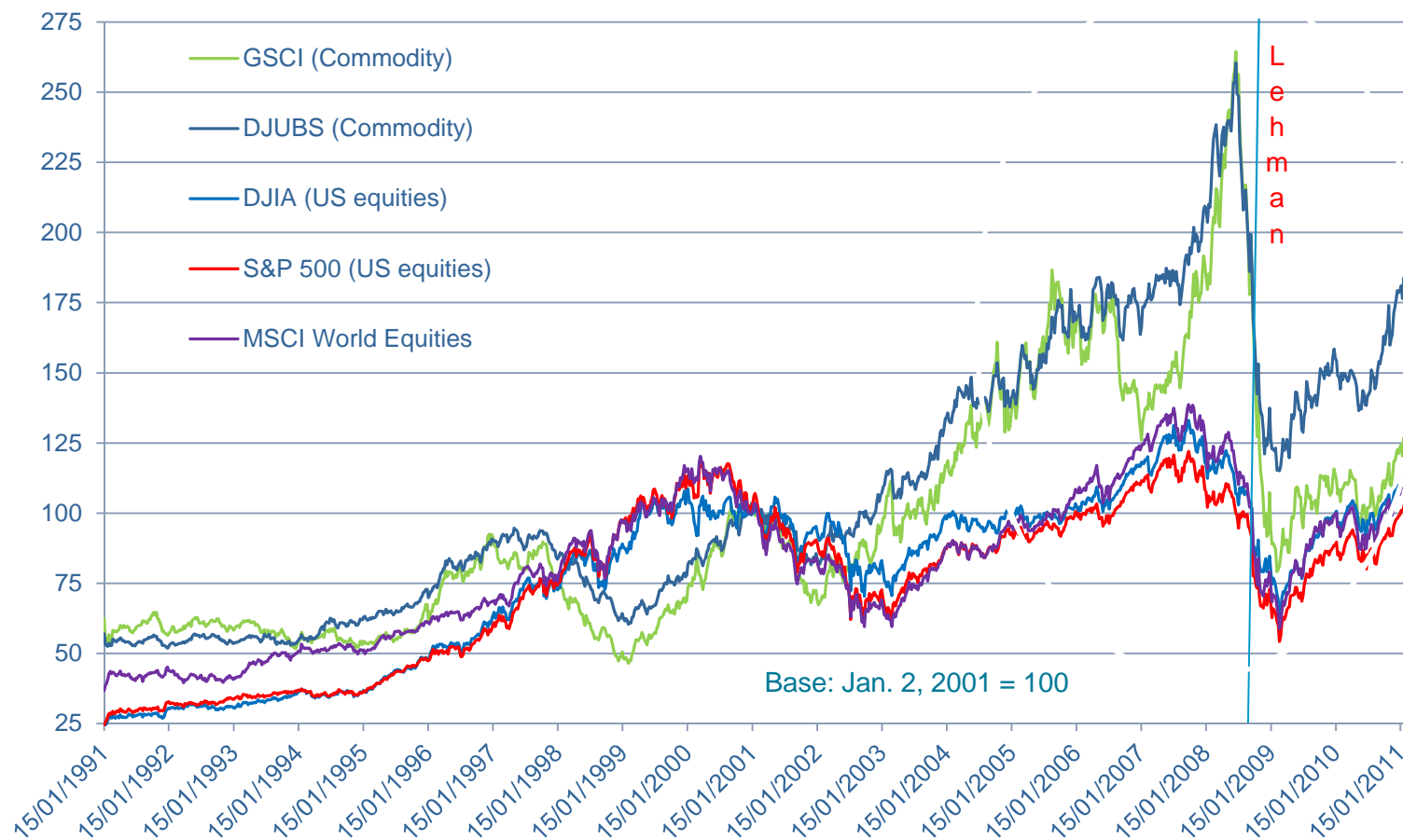
- **Multivariate Granger Causality-Empirical Results:**
  - **Returns are not Granger-caused by positions (including those of swap dealers and hedge funds)**
  - **Hedge fund activity**
    - **does not cause any variable in the system**
    - **is caused by all the variables in the system**
    - **reacts to market conditions and provides liquidity**
    - **Reduces volatility**
  - **Swap dealer activity**
    - **Generally reduces volatility**
- **Contemporaneous Effects**
  - **Hedge funds are reacting to market conditions and providing liquidity to the market; i.e. there is a uni-directional causation from change in price to change in MMT's position**
  - **Interestingly, Swap dealers change in position is preceded by change in prices**
  - **More transparent information on composition of open interest is needed to have better understanding of role of different market participants on prices and observed high volatility in commodity derivatives markets**

Economics Studies IV: Cross-Market Linkages
The "Marching in Step" – after Lehman

GSCI (Commodity)
DJUBS (Commodity)
DJIA (US equities)
S&P 500 (US equities)
MSCI World Equities

Base: Jan. 2, 2001 = 100

Lehman

A "Market of One" – Really?

- **Büyükşahin, Haigh & Robe (JAI 2010):**
  - **Not so fast:**
    - **Let's look at return correlations, not price levels**
      - **On average, return correlations between passive equity and energy investments were about zero (1991 to August 2008)**
      - **No secular increase in dynamic conditional correlations (DCC)**
  - **General result?**
    - **Yes**
      - **True at daily, weekly & monthly frequencies**
      - **True regardless of index choice (GSCI or DJ-UBS; S&P or DJIA)**
    - **And yet...**

SP500 & GSCI Correlation (DCC), 1991-2011
DCC estimates average close to Ø, fluctuate substantially over time

Egypt protests

Lehman collapse

DCC_MR_GSENTR_SP
DCC_MR_GSENTR_MXWO

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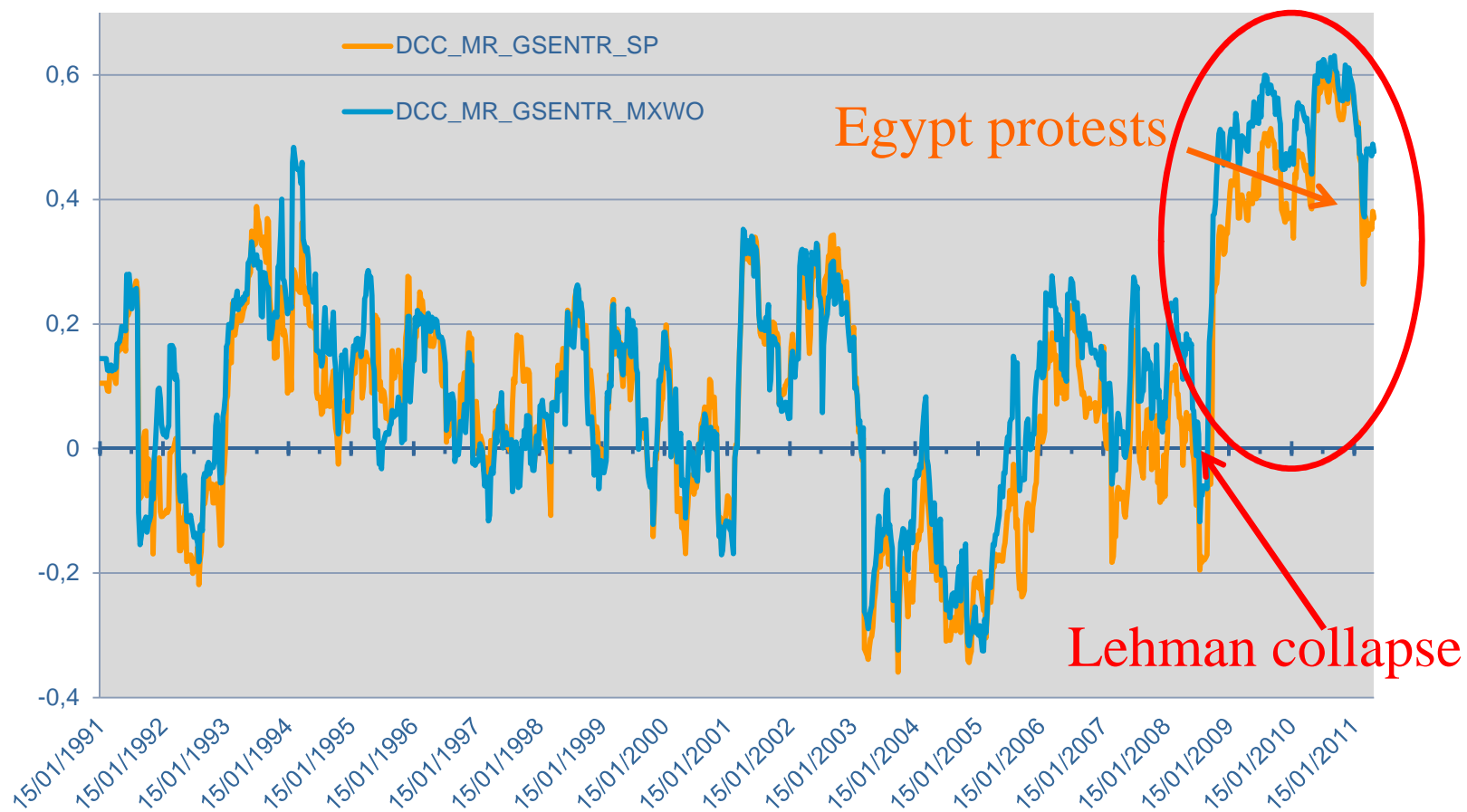
SP500 & GSCI Correlation (DCC), 1991-2011
Importance of accounting for volatility changes

▶ *Rolling*
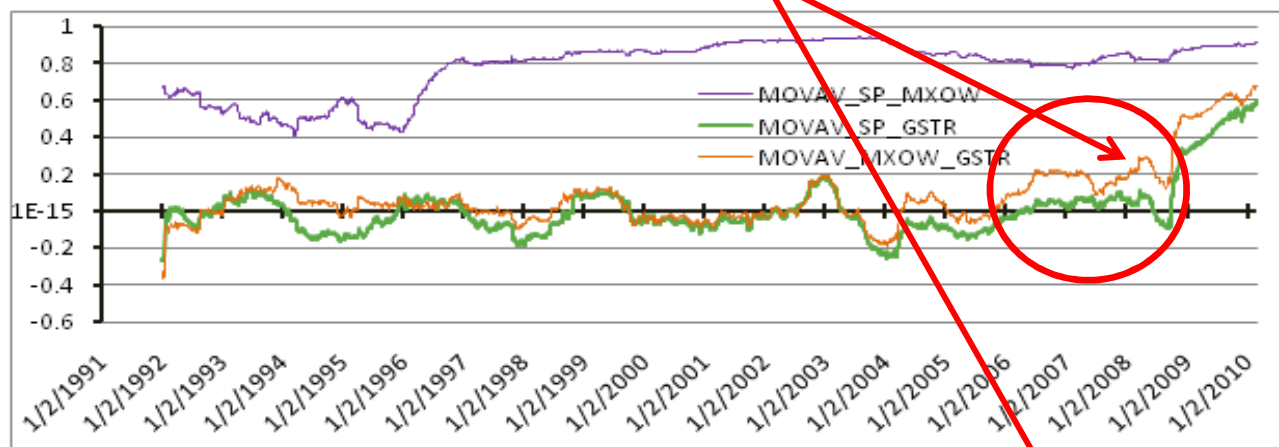
vs.

▶ *DCC*
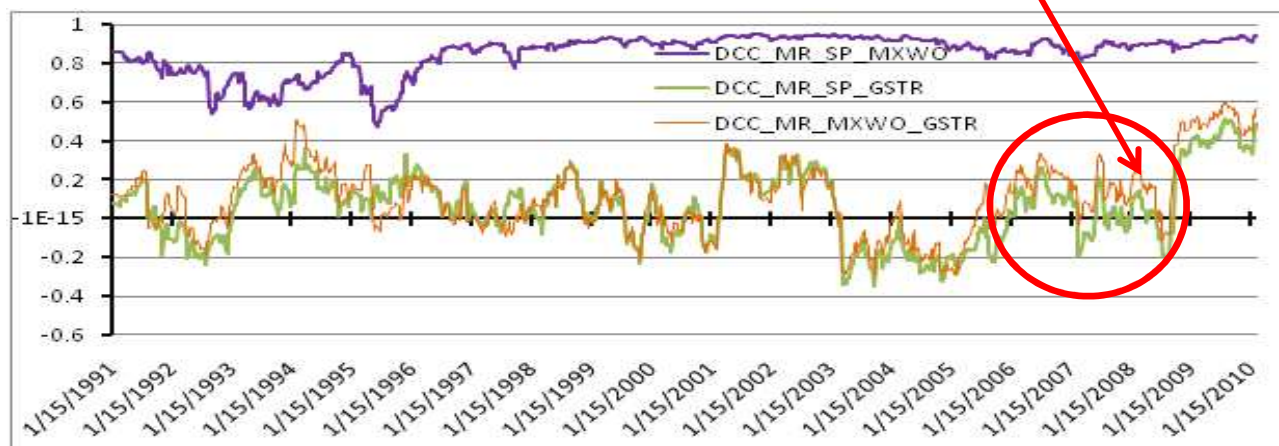
Financialization in Pictures

- **Overall speculation is up**
  - **From about 10% excess spec till 2002 to 35-50% after 2005**
- **Commodity Index Trading is Up**
  - **Swap Dealer positions account for about 35% of futures OI**
- **Hedge Funds are Up**
  - **From 5-10% of the futures OI till 2002 to 25-30% after 2005**
- **Cross-Market Trading is Up**
  - **Tripled since 2002**
  - **Pattern does not follow other hedge funds**

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Energy Speculation
Working's *T*, January 2000 to March 2010
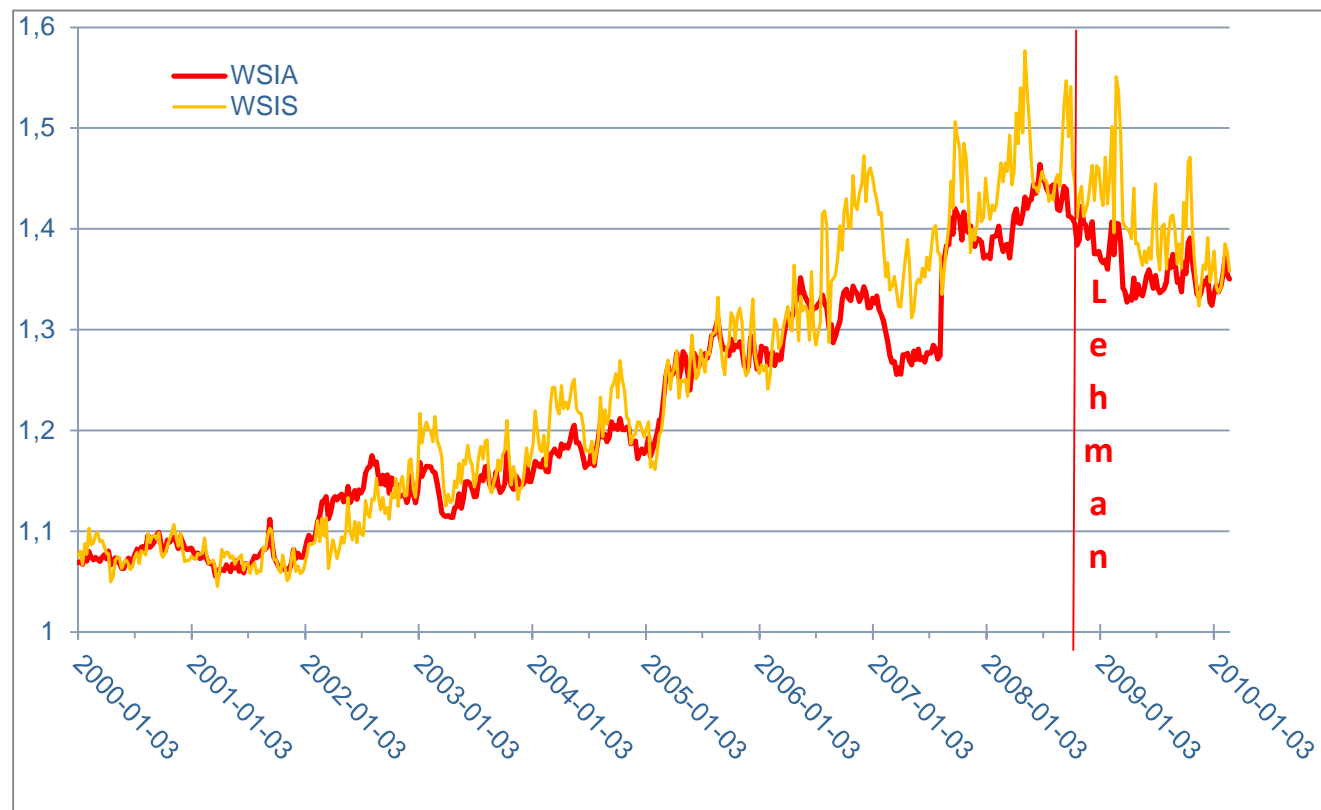
Swap Dealing & Commodity Index Trading

Overall *vs.* Near-dated Swap Dealer Positions (% of OI), 2000-2010
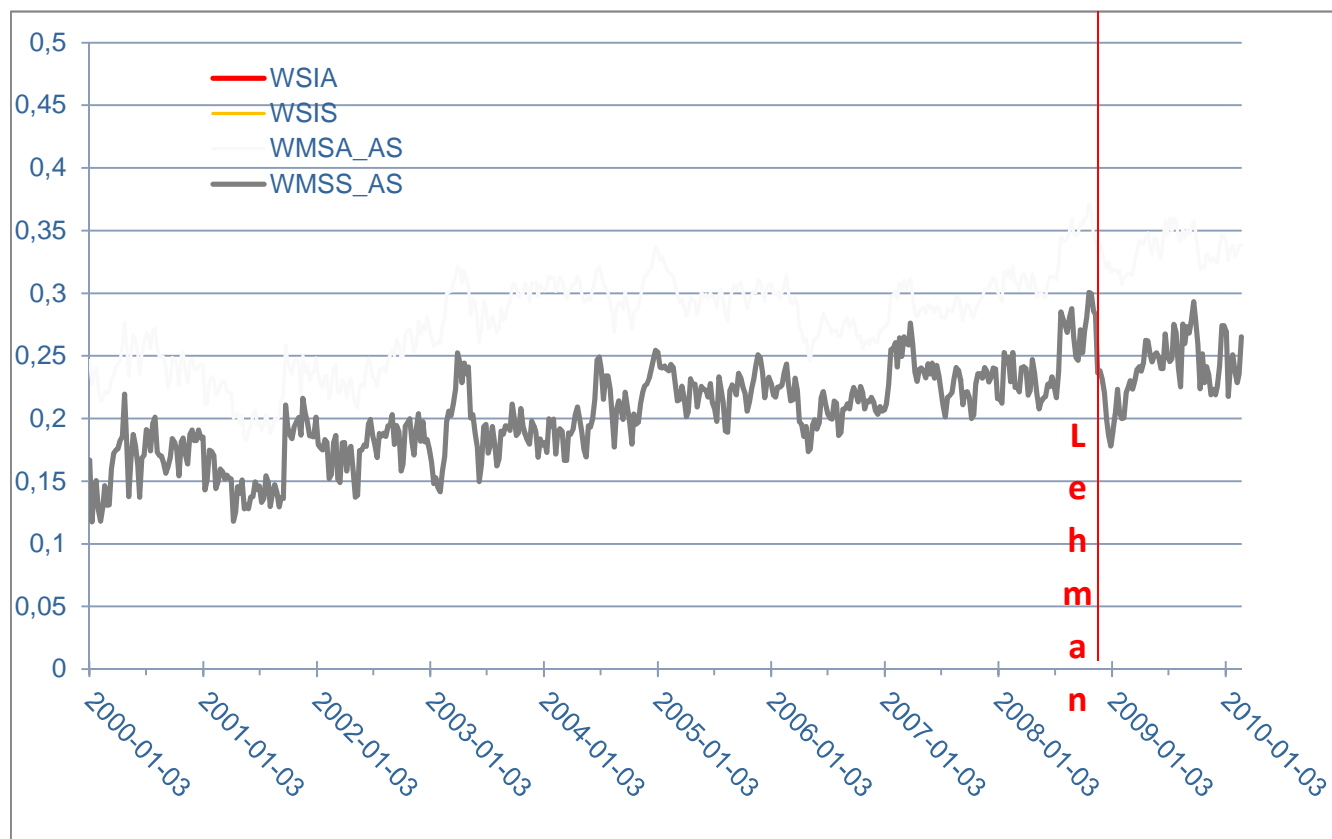
Hedge Funds *and* Cross Traders

Hedge funds' share of Energy Futures Open Interest, 2000 to 2010
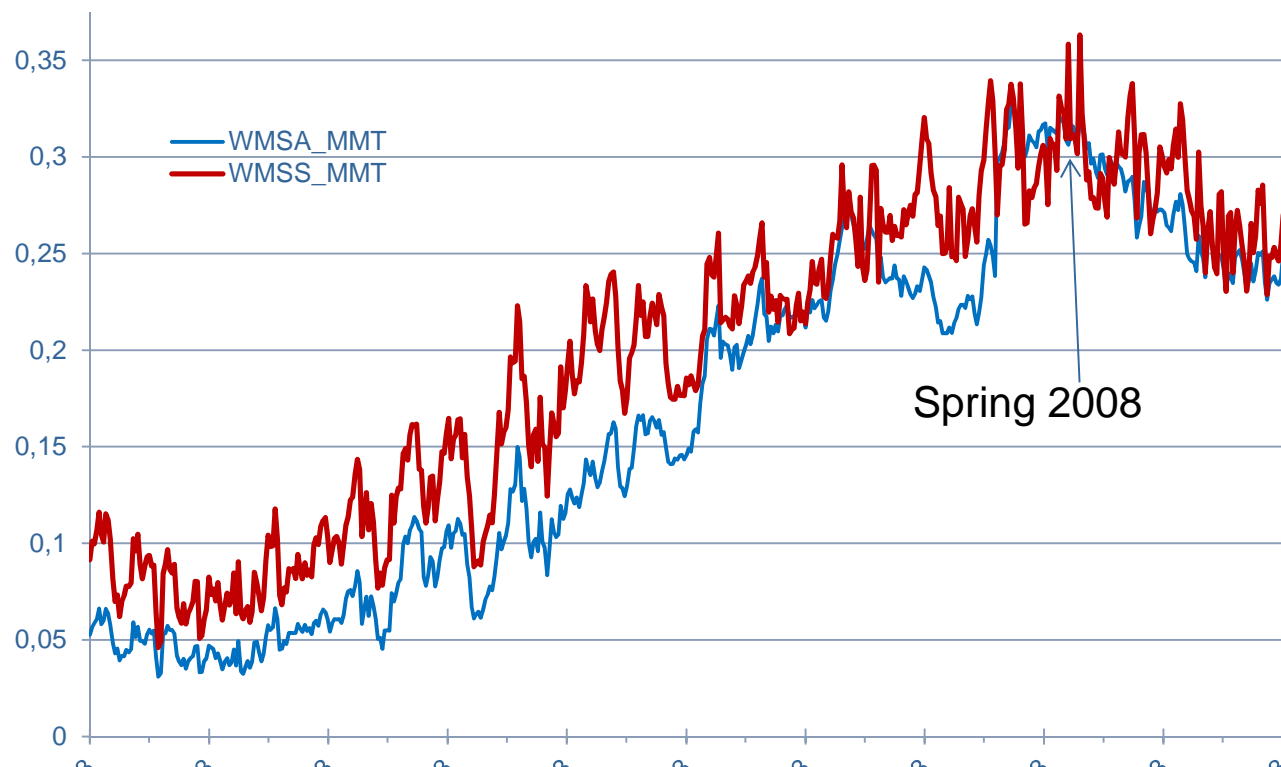
Hedge Funds *and* Cross Traders

- **Hedge funds that Trade both Energy and Equity Futures, 2000-2010**
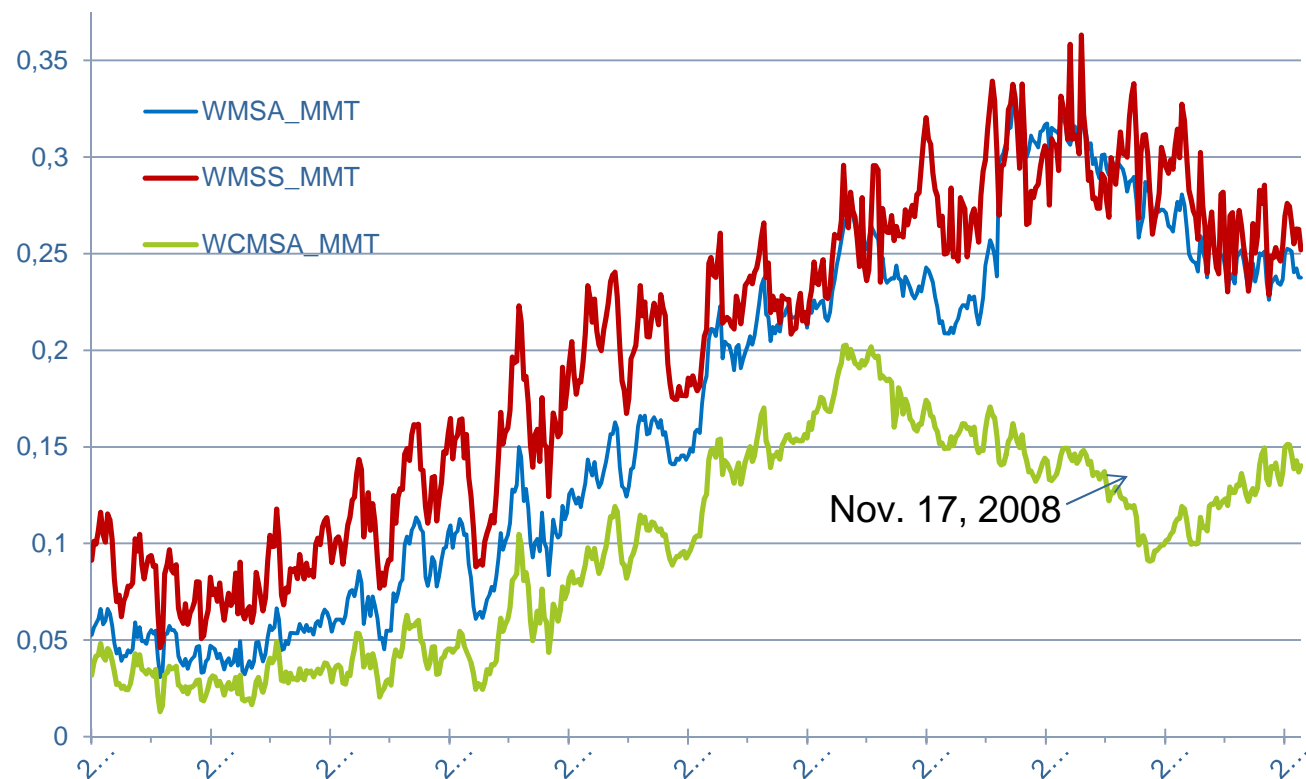
Should It Matter Who Trades?

- **Should *trader identity* matter for asset pricing?**
  - **Theoretical reasons to believe trader identity matters**
    - Models show that less-constrained traders link asset markets
    - During financial stress periods, contagion or retrenchment?

  - **Who is a "candidate" for enhancing linkages?**
    - Traditional commodity users, etc.? → Unlikely
    - Index traders? Only insofar as they provide liquidity
    - Hedge funds? → More likely
      - Seek to exploit perceived mis-pricing
      - Levered/subject to borrowing limits/wealth effects under stress

Oil Market Report

Hedge Funds and Stress Interact

Constant	-0.826467	***	-1.96763	***	-2.56901	**	-3.17242	**
	(0.2323)		(0.7290)		(1.057)		(1.273)	
SPARE	0.154870	***	0.135986	***	0.121034	***	0.107117	***
	(0.03576)		(0.03237)		(0.03185)		(0.03093)	
UMD	0.0710231	*	0.0727269	*	0.0579558	*	0.0586289	*
	(0.04025)		(0.03981)		(0.03378)		(0.03274)	
TED	1.77734	***	4.60514	***	1.38053	***	3.39324	**
	(0.5081)		(1.485)		(0.4230)		(1.346)	
WMSS_MMT	2.37960	***			5.22120	***		
	(0.8664)				(1.523)			
WMSS_AS					0.896538		-0.949729	
					(1.624)		(1.275)	
WMSS_TCOM					2.82919	**	1.07074	
					(1.358)		(0.9123)	
WSIA			1.32955	**			2.21413	***
			(0.5596)				(0.7198)	
INT_TED_MMT	-5.51366	***			-4.30584	***		
	(1.676)				(1.402)			
INT_TED_WSIA			-3.20403	***			-2.37744	**
			(1.064)				(0.9594)	
DUM	0.347098	***	0.350655	***	0.445824	***	0.380342	***
	(0.09457)		(0.09879)		(0.09043)		(0.08412)	
Log likelihood	881.086		871.939		884.97		875.182	

Cross-Trading Hedge Funds Matter

	2000-2010		2000-2010		2000-2010		2000-2010		2000-2010		2000-2010	
Constant	-0.778333	***	0.210448		-0.971063		-0.783793	***	0.315275		-0.675490	
	(0.2196)		(0.4022)		(0.8296)		(0.2277)		(0.4216)		(0.8831)	
ADS							0.0381775		0.0536956		0.0631063	
							(0.06174)		(0.05042)		(0.04728)	
SPARE	0.178190	***	0.129834	***	0.104834	***	0.179592	***	0.126999	***	0.102546	***
	(0.04215)		(0.03684)		(0.03318)		(0.04372)		(0.03755)		(0.03384)	
UMD	0.0722604		0.0565843		0.0645123	*	0.0715149		0.0540846		0.0602626	*
	(0.04570)		(0.03696)		(0.03534)		(0.04713)		(0.03760)		(0.03580)	
TED	1.37460	***	1.01301	***	3.29099	**	1.46240	***	1.07753	***	3.14341	**
	(0.4684)		(0.3643)		(1.400)		(0.5075)		(0.3831)		(1.427)	
WCMSA_MMT	5.10806	***	3.92980	***			5.13408	***	3.76414	***		
	(1.717)		(1.358)				(1.783)		(1.392)			
WCMSA_AS			-3.73983	**	-2.86410	*			-4.14034	**	-3.40879	**
			(1.543)		(1.567)				(1.629)		(1.653)	
WSIA					1.08753	**					0.946378	*
					(0.5081)						(0.5354)	
INT_TED_CMMTA	-9.82038	***	-6.96981	**			-10.2754	***	-7.13595	**		
	(3.644)		(2.862)				(3.853)		(2.950)			
INT_TED_WSIA					-2.26677	**					-2.11807	**
					(1.005)						(1.028)	
DUM	0.214922	*	0.370933	***	0.431396	***	0.230696	*	0.418018	***	0.496860	***
	(0.1120)		(0.1067)		(0.1017)		(0.1226)		(0.1196)		(0.1197)	
Log likelihood	881.802		885.162		875.116		882.31		885.943		876.387	

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Findings

- **"Co-movements"**
  - **Time variations in correlations, but no upward trend till crisis**
  - **Extreme-events analysis: commodity umbrella leaks**
- **"Speculation" in cross-section of energy paper mkts**
  - **Increase in speculation + hedge fund activity + cross-mkt activity**
- **Impact of hedge funds in energy markets**
  - **Hedge fund activity helps link markets**
  - **Market stress matters, too**
  - **Interaction – contagion through wealth effects?**
- **Information on OI composition is payoff-relevant**
  - **CFTC decision to disaggregate more**
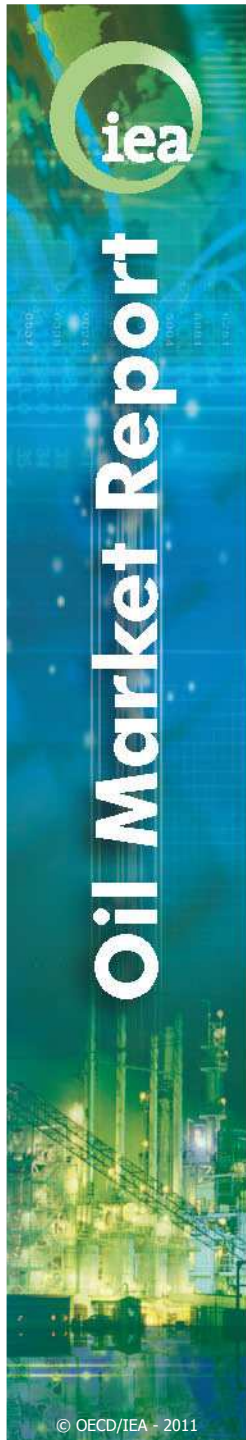
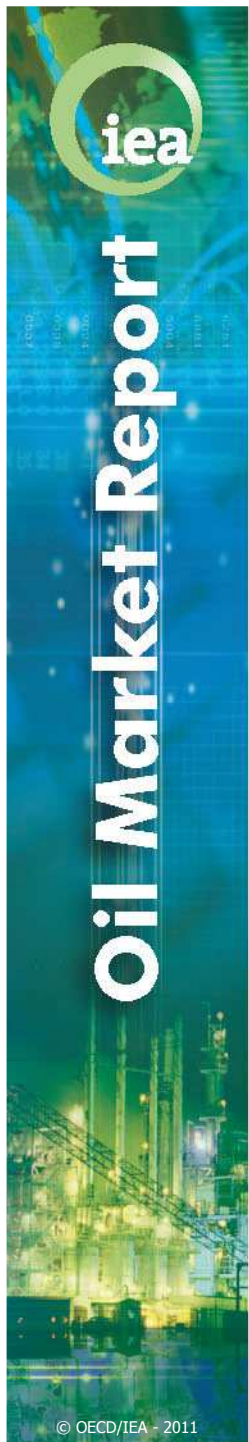# Economics Studies V: Do OPEC Members Know Something the Market Doesn't?

Oil Market Report

Some Quotes

" 'We expected at the start of the year oil prices between $75 and $80 a barrel, this is a fair price... Oil prices (...) might rise reasonably', (Saudi Arabia's King Abdullah) said. On Thursday, U.S. oil crude futures rose $1.38 to $78.05."

Reuters, December 26, 2009

"WTI (prices) stabilized between $70 to $80 per barrel since the middle of last year. This range is consistent with the 'fair price' range for crude oil proposed by King Abdullah of Saudi Arabia at the beginning of 2009."

EIA Short-Term Energy Outlook, U.S. DoE, Feb. 2010

Oil Market Report

Oil Market Report

# Does OPEC have Information the Market Doesn't?

- As these quotes illustrates, news agencies, market commentators and even oil analysts often make references to OPEC pronouncements about crude oil prices.

- During the oil price surge of 2008, pundits and politicians instead used "fair price" statements by OPEC-linked officials as evidence that sky-high prices were "not caused by physical supply and demand factors".

- Implicit in such views is an implicit assumption that OPEC-related "fair price" pronouncements contain information not already reflected in market prices.

OPEC "Fair Price" Announcements' Impact on the Futures Market Price of Crude Oil

- **OPEC members, individually or collectively, often comment on what the "fair price" for crude oil should be**
  - We construct a sample of all fair price pronouncements in 2000-10.

- **No definition of "fair price" in classical economics**
  - We define the "fair price" to be the price that a particular OPEC producer would like to see prevail in the market.

- **We investigate whether "fair price" statements contain any new information (i.e., news content not already absorbed in the market) & the price effect of such pronouncements.**

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Related Literature

- **OPEC's ability to influence the price of crude oil**
  - **Efficiency of OPEC's "official prices" (1970's to mid-1980s):**
    - E.g., Gately et al, *EER*-77; Verleger, *REStat*-82; Hubbard, *QJE*-86, ...
  - **Impact of production-related OPEC conferences announcements → do they influence market prices, returns, or implied volatility?**
    - Loderer, *JF*-85; Wirl & Kujundzic, *EnJ*-04; Horan *et al*, *EnJ*-04; Wang *et al*, *JFutM*-08; Demirer & Kutan, *EE*-10.

- **Efficiency of energy-derivatives markets**
  - **Do energy futures market react to OPEC conference news?**
    - Draper, *JFutM*-84; Deaves & Krinsky, *JFutM*-92.

- **Impact of verbal interventions on markets**
  - **Extant work focuses on communications in forex (see Blinder *et al*, *JEL*-08) or on interest rate markets (e.g., Fratzscher, *EJ*-08, *JIE*-09)**
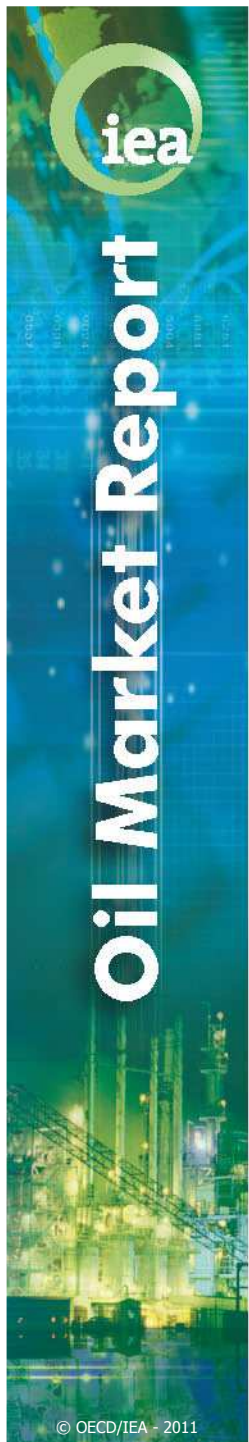
Our Paper

■ **Contribution to the empirical literature**

- **We focus on OPEC statements related to prices, not on statements related to production.**

- **Whereas OPEC conferences and meetings are publicized ahead of time (and are thus predictable), "fair price" pronouncements are not timed with any predictability, and are thus not likely to be forecasted ahead of time.**

- **Methodological contributions**
  - **Adapt Kalman-filter and ADL methodologies to oil issues**
  - **Enhance the event-study methodology used in extant oil literature.**

Our Findings in a Simple Picture
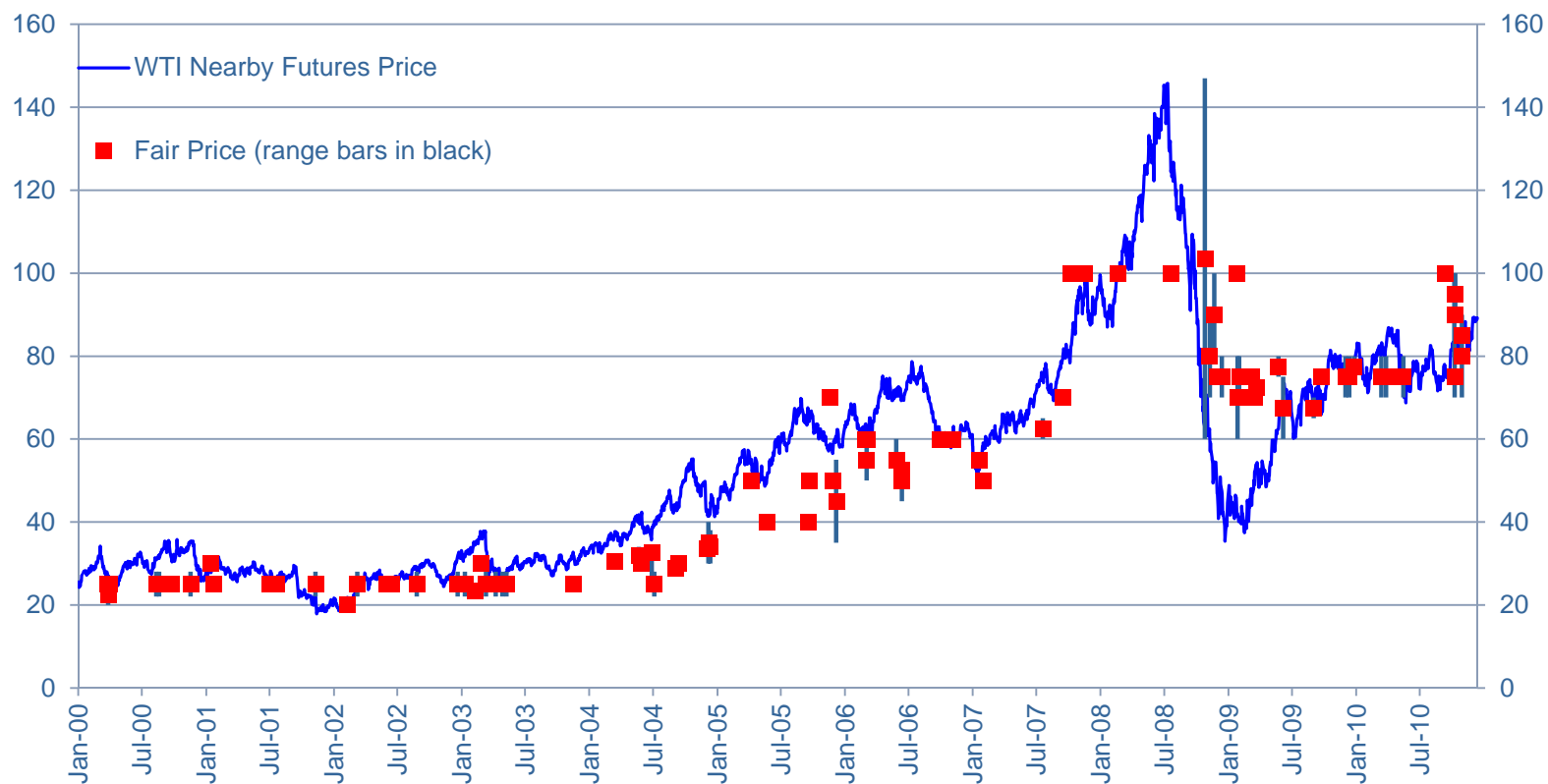
Our Findings in Words

- **<u>If</u> "fair price" pronouncements contained news for non-OPEC market participants,**
  - **e.g., signals of physical market conditions**
  - **e.g., signals of a country's or OPEC's strategies**

- **<u>Then</u>, we should observe an impact on crude oil futures prices.**

- **In fact, we find that "fair price" announcements**
  - **add little to pre-existing information in the market**
  - **have little impact on the futures market price of crude oil.**

"Fair Price" Series

- **"Fair Price" Data –**
  - **Hand-collected time series of quotes made by OPEC officials or senior government officials from OPEC countries:**
    - <u>Source</u>: news articles in the Lexis-Nexis Academic *and* Westlaw databases
      - Search Criteria: "fair price" or "just price";
    - Over 1,000 articles returned over a 10-year period
    - Total of 120+ events
    - Filtering leaves 78 unique observations (1st, March 2000; last, Nov. 2010)

  - **Information compiled *(cross-checked with industry newsletters)***
    - Release date of the story
    - Statement date (when the official stated the "fair price")
    - Country of origin of the OPEC official
    - "Fair price" level or range
    - When available –
      - whether the official agreed with the current market price of oil
   - the benchmark crude referenced

Market Price Series

- **Market Price Data –**
  - **West Texas Intermediate (WTI) light sweet crude oil futures contract traded on the NYMEX.**
    - World's most liquid crude oil contract.
    - Settlement price of the nearby-futures contract is used
      - = "closest-to-delivery contract with the highest open interest".
    - Sample period – January 2000 to December 2010.

- **Control Variables –**
  - **Production announcements**
    - Dates
    - Direction of production announcement
    - Only 13 of the 78 events had production announcements within 5 days of (before or after) the "fair price" pronouncement.
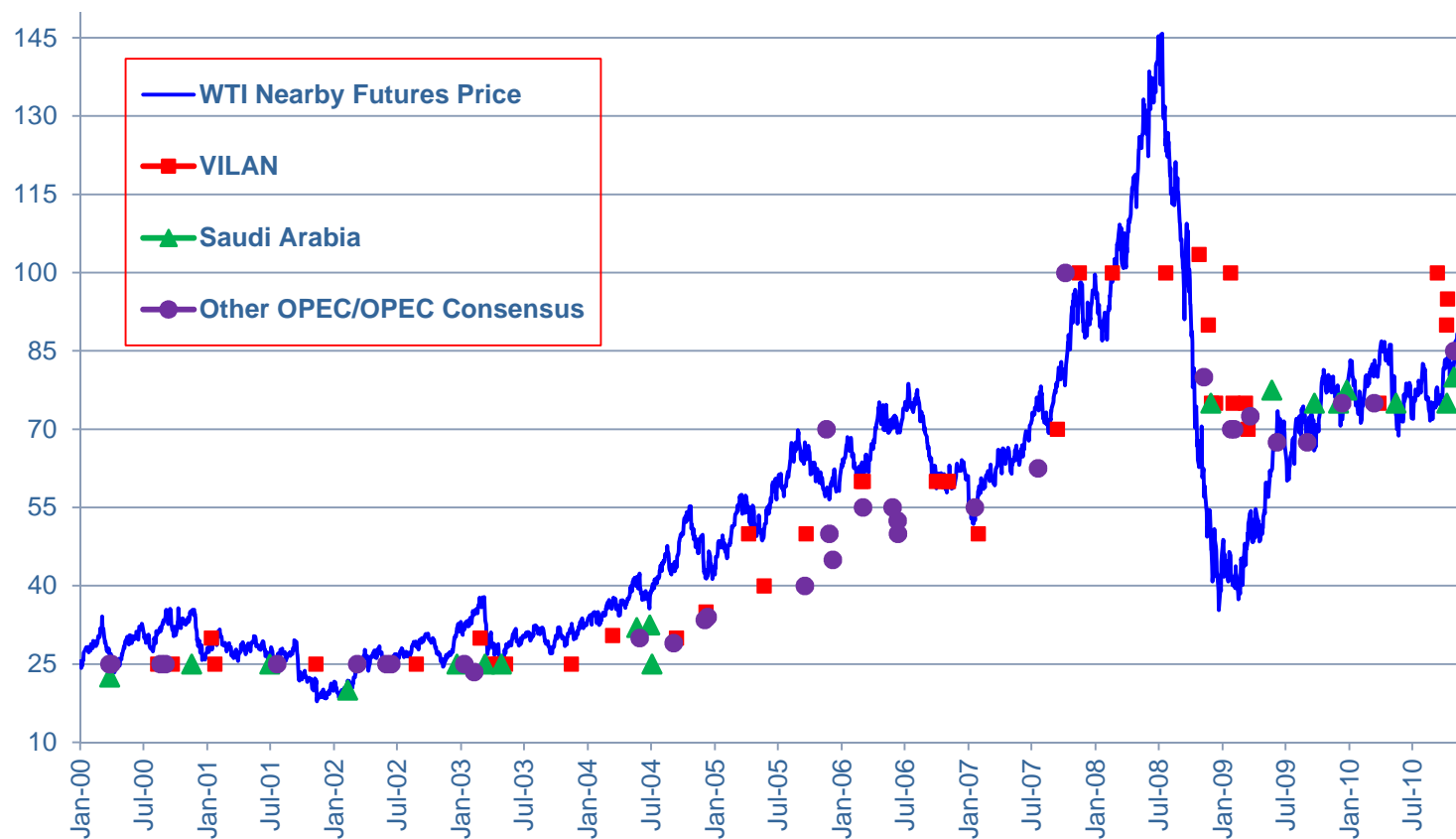 - **Survey of economists regarding production expectations**

Q1. Do "OPEC" Officials Agree with the Current Market Price?
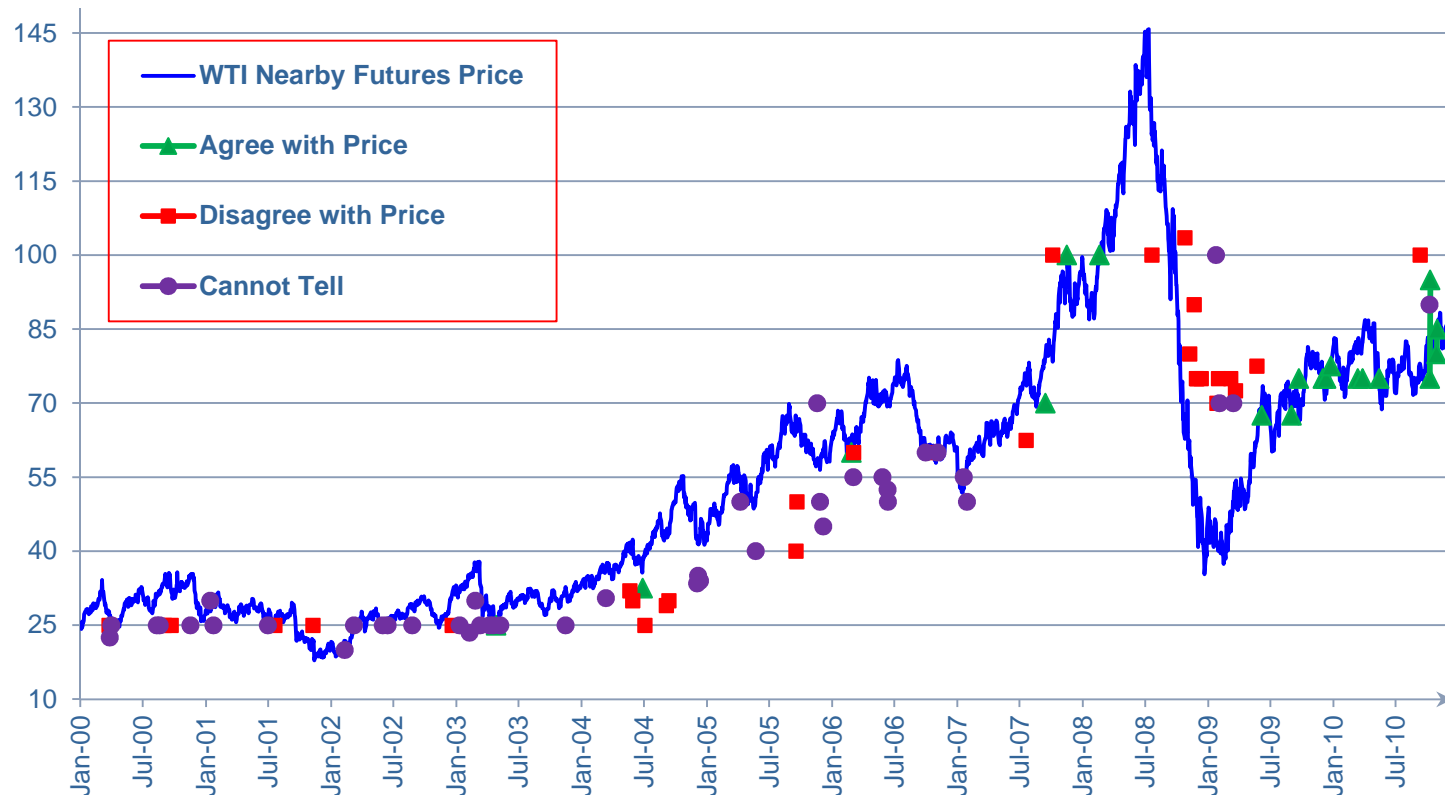
Explanation of Graphical Analysis 1

- **"Fair price" statements subdivided into 3 groups:**

  - **Official agrees with the market price 17 times (green triangles).**
    - Mostly after mid-2009

  - **Official disagrees with the market price 25 times (red dots).**
    - Mostly before mid-2009

  - **Official does not say 36 times (purple squares).**

    - The graph suggests that, even when they are not explicit about it, officials often seemed to disagree with market prices before 2009
      - From Summer 2003 to Summer 2008 – market price was viewed as "too high"
      - From Fall 2008 to Spring 2009 – market price was viewed as "too low"   (market price collapsed yet "fair price" remained in the $75-100 range).

Oil Market Report

Q2. Heterogeneity within OPEC?

Legend:
- WTI Nearby Futures Price
- VILAN
- Saudi Arabia
- Other OPEC/OPEC Consensus

Explanation of Graphical Analysis 2

- **Idea**: Country-specific factors may influence which price an individual cartel member would like to see prevail in the market.

- **OPEC Member Classification -**
  - **OPEC "hawks" (red): Venezuela, Algeria, Iran and Libya**
    - **Tend to advocate higher prices than current market prices?**
  - **Saudi Arabia (green):**
    - **With ample oil reserves, tends to advocate lower prices?**
  - **Others (purple): all remaining individual member countries or a "consensus" by OPEC**

- **The figure suggests that "hawks" do not make "fair price" statements more bullish than the other groups, yet:**
  - **Hawks more vocal in support of higher prices after price collapse at the end of 2008**
  - **Venezuela –**
    - **Favored production cuts through most of sample period**
    - **Exception – constant at $100 as "fair price" during price spike and crash of 2008**

Oil Market Report

Q3. Which moves first – "fair price" or market price?
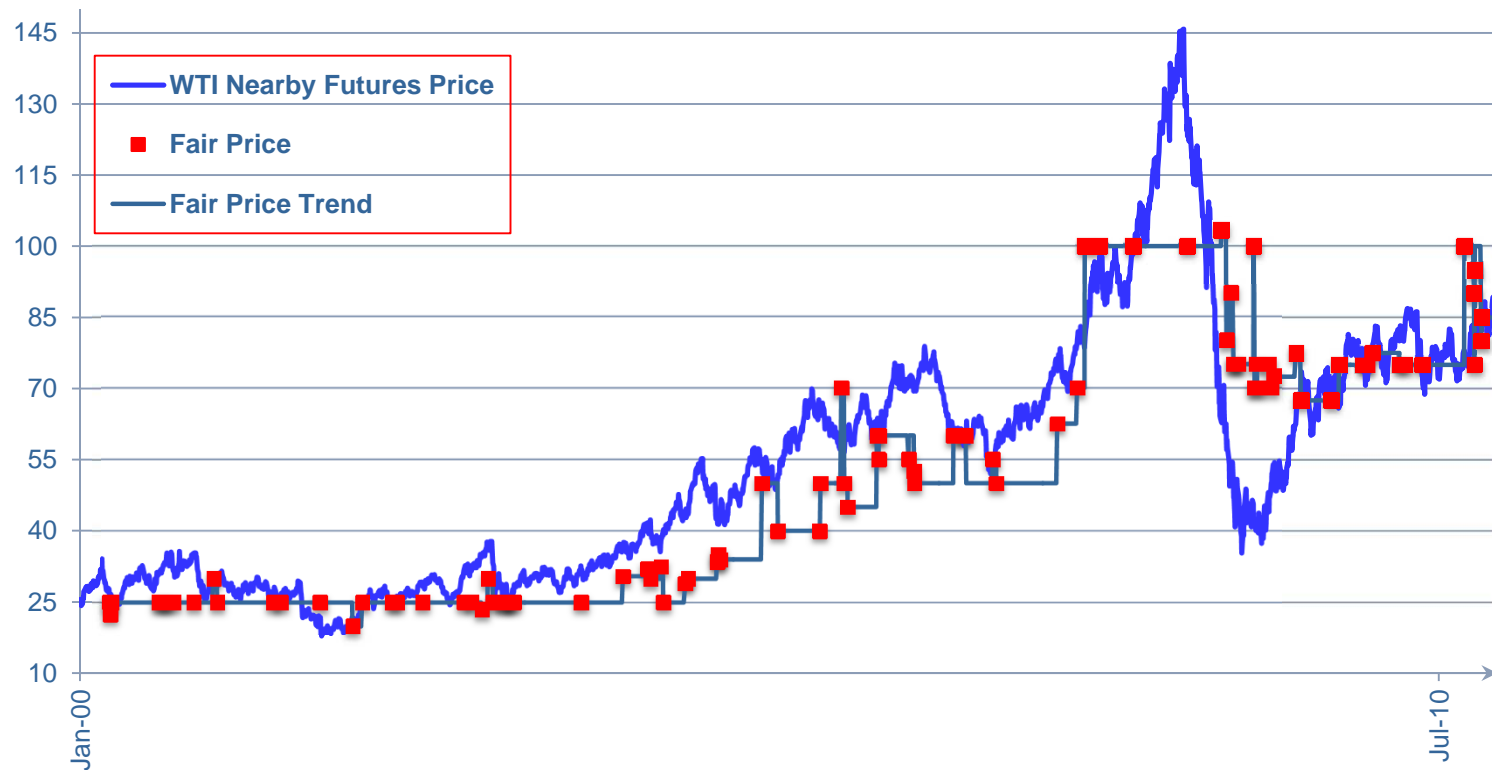
Explanation of Graphical Analysis 3

- **We ask whether "fair price" statements lead or lag market prices.**

- **The figure strongly suggests that "fair price" statements lag market prices**
  - **Interpretation: they contain no new information.**

- **We now turn to more formal analyses to test this apparent relationship between the two time series.**

1ˢᵗ Methodology - Event Study

- **Event Study (see *e.g.* MacKinlay, *JEL*-97)**

- **Our interest –**
  - **Arrival of "true news" (information content into the market)**
  - **Compare the nearby oil futures price before & after the event**
    - **We use two non-parametric tests of statistical significance**

- **Event and event window –**
  - **Event = "fair price" statement date.**
  - **The event separates all preceding and succeeding observations**
    - **captures the normal performance and after-announcement performance of the price of oil.**
  - **We use windows of 2, 3, 4, and 5 days for robustness.**

Event Study continued

- **Non-parametric tests:**
  - **Humpage, *JMCB*-99; Fatum and Hutchinson, *EJ*-03.**
    - **Criterion (1): "Direction Criterion"**
      - **"Success" = "post-announcement market price moves in the direction suggested by 'fair price' level".**
      - **Formally:**

$$\text{either } [FP_i > \bar{P}_{i-} \text{ and } \Delta\bar{P}_{i+} > 0] \quad \text{or} \quad [FP_i < \bar{P}_{i-} \text{ and } \Delta\bar{P}_{i+} < 0] \tag{1}$$

where FP_i is the "fair price" during the ith event or announcement ($i=1,\dots,63$), $\bar{P}_{i-}$ is the median market price in the pre-event window, and $\Delta\bar{P}_{i+}$ is the median daily market price change in the post-event window. In essence, if the stated "fair price" is greater (*lower*) than the lagged price and if the announcement is effective, then we should observe an upward (*downward*) movement in the market price in the post-event window.

      - **To test if the direction of futures prices is random or systematic following the event, we use a non-parametric sign test:**
        - **Null : the direction is random.**
        - **Equal probability that the post-event return is positive or negative. X⁺ stands for the # of successes.**

$$\theta = \left[\frac{X^+}{X} - 0.5\right]\frac{\sqrt{X}}{0.5} \sim N(0,1)$$

Event Study continued

- **Non-parametric tests:**
  - **Humpage, *JMCB*-99; Fatum and Hutchinson, *EJ*-03.**
    - **Criterion (2): "Smoothing Criterion"**
      - **"Success" = "the 'fair price' pronouncement smoothes prior market-price movements".**
      - **Formally: <u>if</u> it is successful according to "direction criterion" (1) <u>or if</u> :**

$$\text{either } [FP_i > \bar{P}_{i-} \text{ and } \Delta\bar{P}_{i+} > \Delta\bar{P}_{i-}] \quad \text{or} \quad [FP_i < \bar{P}_{i-} \text{ and } \Delta\bar{P}_{i+} < \Delta\bar{P}_{i-}] \qquad (2)$$

where $\Delta\bar{P}_{i-}$ is the median daily market price change in the pre-event window.

      - **Judging success on the "smoothing criterion" is only meaningful if the official marking the statement is "leaning against the wind".**
        - **i.e., he is trying to reverse or to slow a prior market price trend.**

$$\text{either } [\Delta\bar{P}_{i-} > 0 \text{ but } FP_i < \bar{P}_{i-}] \quad \text{or} \quad [\Delta\bar{P}_{i-} < 0 \text{ but } FP_i > \bar{P}_{i-}]$$

          - **First case: signal = "prices are too high or increasing too fast".**
          - **Second case: signal = "prices are too low or should not be falling".**
        - **Broad "smoothing criterion" – 75%; stricter "reversal criterion" – 50%.**

1. Event Study Analyses & Results

- **Results –**

  - "Fair price" pronouncements are not successful (*either* at affecting the direction of the market *or* at slowing down the pace of prior market price movements).
  - We cannot reject (at any statistical significance level) the hypothesis that the post-pronouncement return is random.
  - Robust results regardless of:
    - Divisions based on a concomitant OPEC oil-production announcement
    - Who is making the statements
    - Different event-window lengths (2- *vs.* 5- day)
    - Different time periods (SPARE)

- **Tables –**

  - Panel A - "direction criterion"
  - Panel B - reversals ("leaning against the wind")
  - Panel C - "smoothing criterion"

- **Robust –**

Oil Market Report

Event Study Tables

2-Day Returns; No Concomitant Production News

2-Day Returns Amid News of Production Changes

Panel A

Nonparametric Sign Test – Direction Criteria: No production cut or increase (2 Day)				
	# of Events	# of Success	z-value	p-value
FP>P-	22	13	0.8528	0.1969
FP<P-	43	15	-1.9825	0.9763
Total	65	28	-1.1163	0.8679

Panel B

Reversal Criteria Test – Leaning Against the Wind: No production cut or increase (2 Day)				
	# of Events	# of Success	z-value	p-value
FP>P-	11	7	0.9045	0.1829
FP<P-	21	5	-2.4004	0.9918
Total	32	12	-1.4142	0.9214

Panel C

Smoothing Criteria Test - Leaning Against the Wind: No production cut or increase (2 Day)				
	# of Events	# of Success	z-value	p-value
FP>P-	11	10	0.7035	0.2409
FP<P-	21	12	-1.0911	0.8624
Total	32	22	-0.4714	0.6813

Panel A

Nonparametric Sign Test - Direction Criteria: With production cut or increase (2 Day)					
	# of Events	# of Successes		z-value	p-value
FP>P-	4	2		0.0000	0.5000
FP<P-	9	2		-1.6667	0.9522
Total	13	4		-1.3868	0.9172

Panel B

Reversal Criteria Test - Leaning Against the Wind: With production cut or increase (2 Day)					
	# of Events	# of Successes		z-value	p-value
FP>P-	1	1		1.0000	0.1587
FP<P-	6	1		-1.6330	0.9488
Total	7	2		-1.1339	0.8716

Panel C

Smoothing Criteria Test - Leaning Against the wind: With production cut or increase (2 Day)					
	# of Events	# of Successes		z-value	p-value
FP>P-	1	1		0.3333	0.3694
FP<P-	6	3		-0.8165	0.7929
Total	7	4		-0.6299	0.7356

"Fair Price" Events, Production News, and Median Returns

Production News and Median Returns after all "Fair Price" Events, 2000-2009

Different regimes?

WTI Spot Price. vs. Non-Saudi Crude Spare Production Capacity (1995-2010)

Legend:
- Jan.1995 - Feb. 2003
- Mar.2003 - Jul. 2008
- Jan.2009 - Aug. 2010
- Aug. 2008 - Dec. 2008

Y-axis: WTI Spot Price (monthly average, USD per barrel)
X-axis: Surplus Capacity (monthly EIA estimate, million barrels per day)

Robe and Buyuksahin 2010
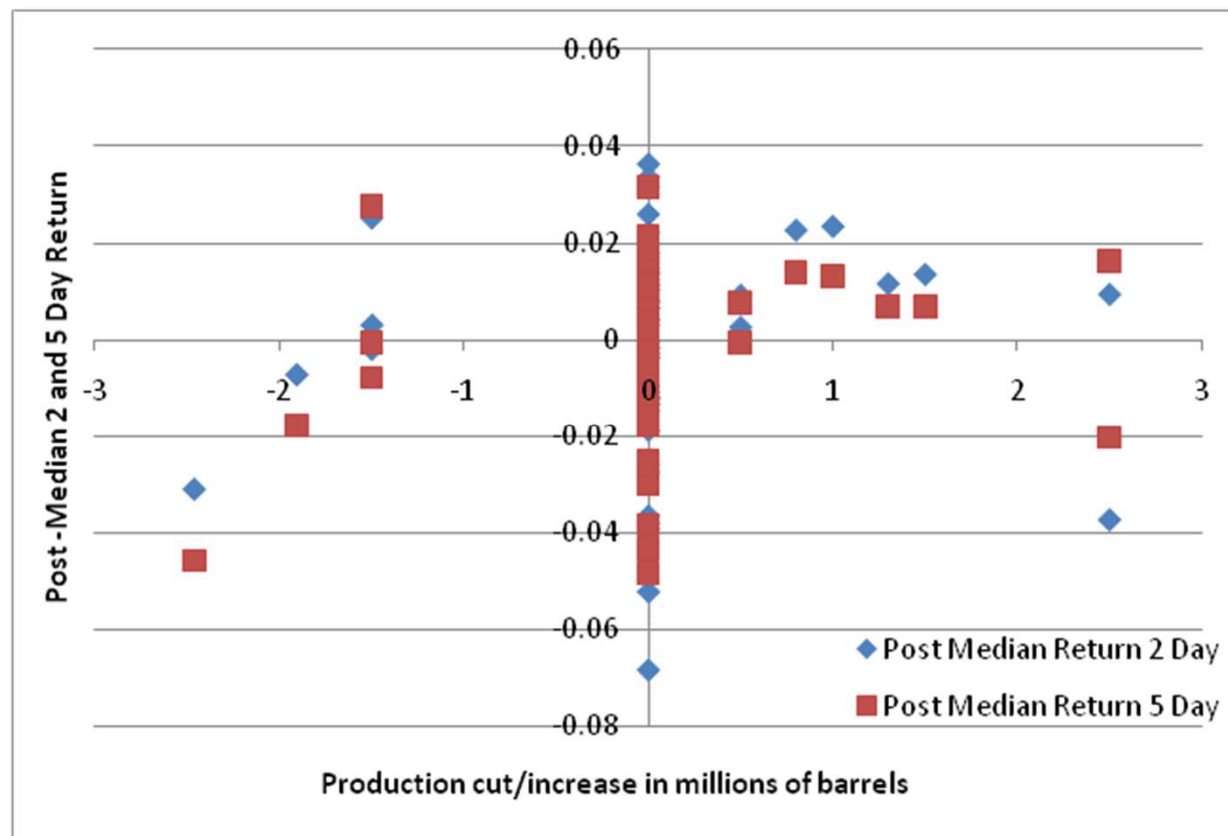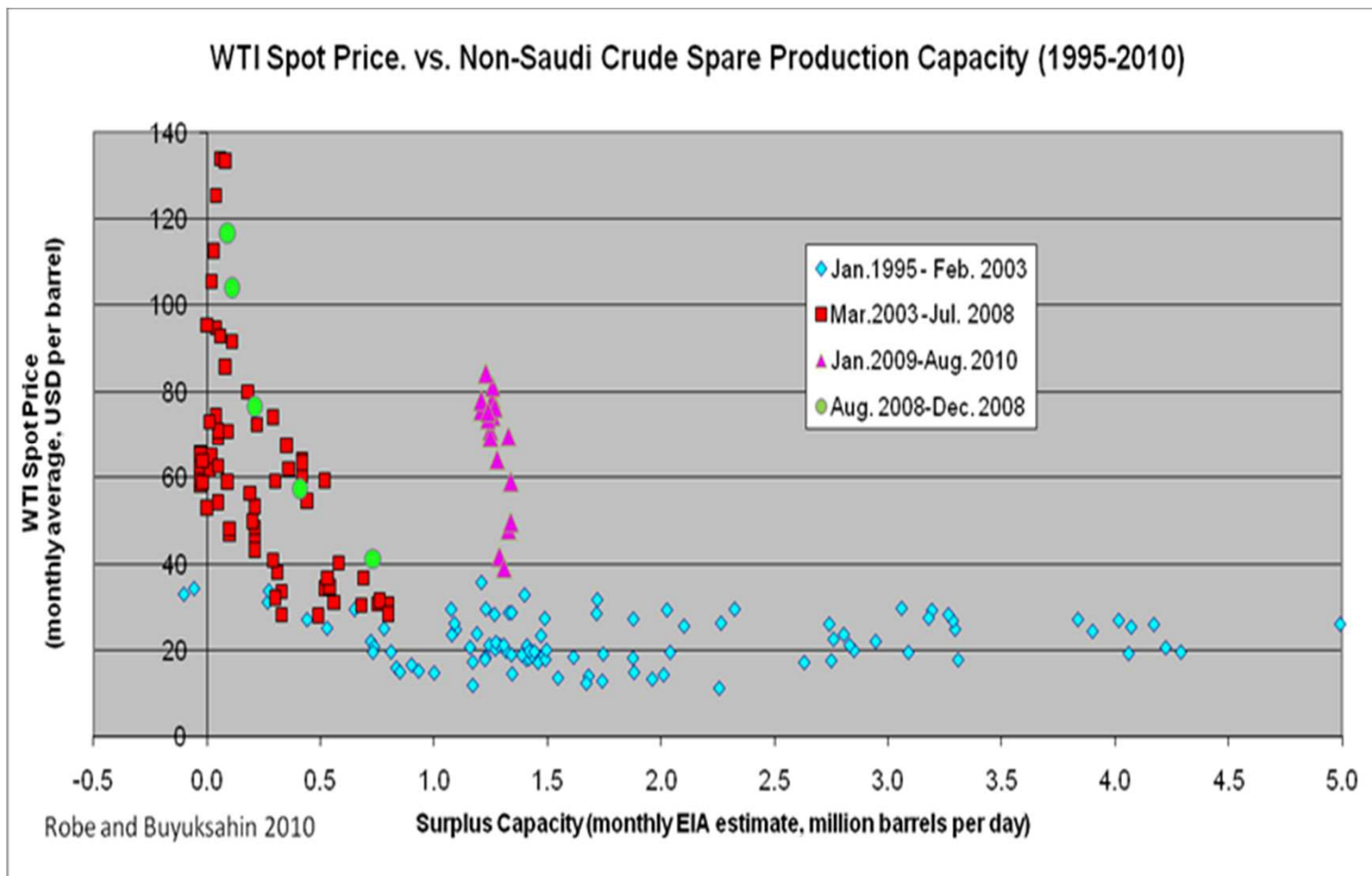
Maybe – but Results are Robust

WTI Spot Price. vs. Non-Saudi Crude Spare Production Capacity (1995-2010)

Robe and Buyuksahin 2010
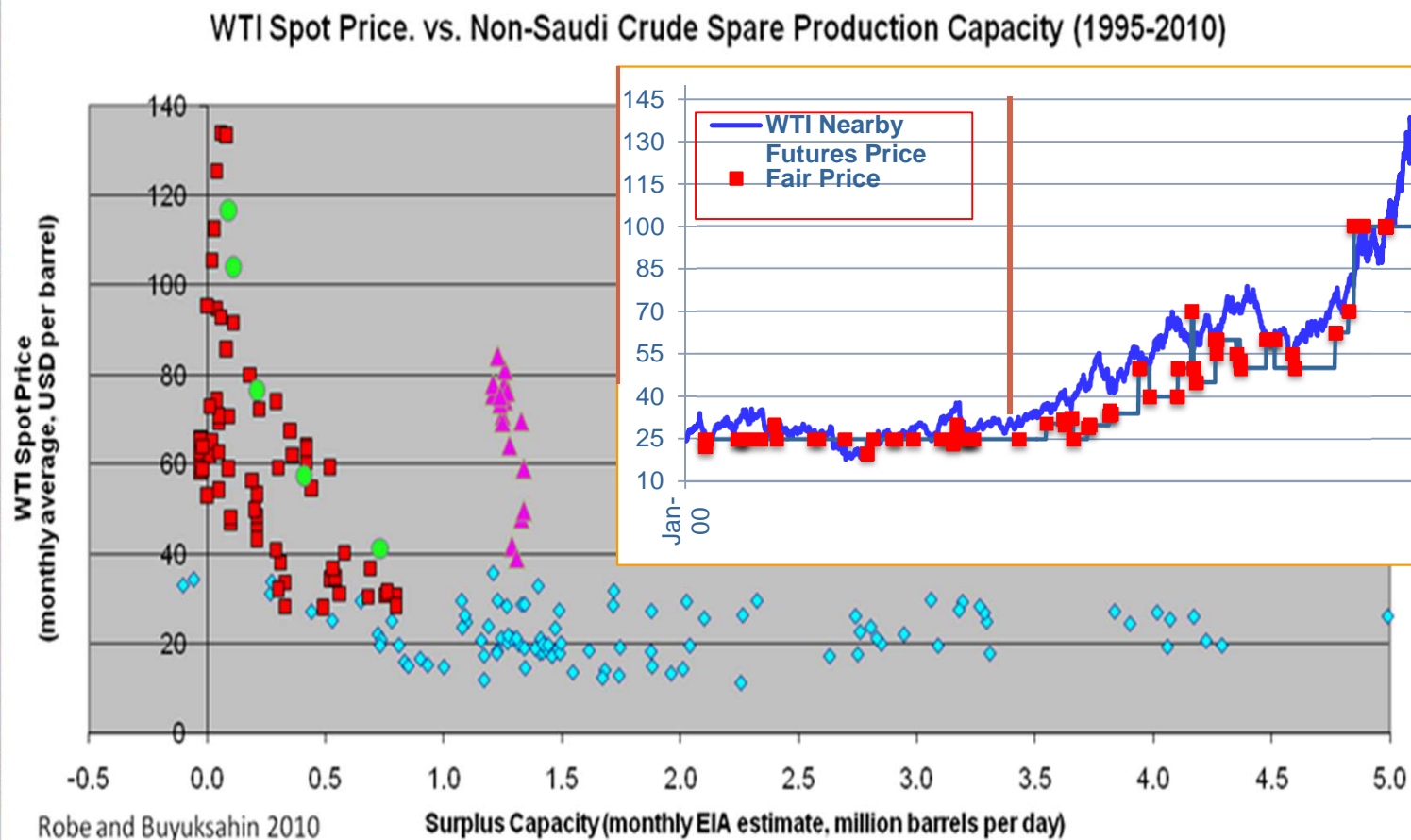
No New Information

- **"Fair price" statements seem to have little influence on crude oil futures prices.**

  - **No evidence of price reversals (not even evidence of slowing down) when "fair price" announcements "lean against the wind" (differ from the current market trend).**

- **"Fair price" events supply no extra news to oil futures market participants and no new information content to the market.**

- **Going forward –**

  Should commentators, reporters, and policy makers treat "fair price" pronouncements as informative when attempting to explain market prices or making policy decisions?

Many drivers of volatile prices, and several policy responses to cope with them

Abrupt, visible & physical causes of price changes

- <u>Technology shock :</u> shale gas revolution in the US – is the same now happening with US onshore oil?
- <u>Demand shock:</u> unchecked emerging market demand growth under the influence of buoyant economic growth and subsidised prices
- <u>Policy shock:</u> resource nationalism & impact on investment, oil products spec changes, deepwater regulation, legislation to control derivatives markets and hedging, China's late-2010 restriction on coal-fired power generation potentially boosted oil demand by 300-400 kb/d
- <u>Geopolitical shocks:</u> 1970s oil shocks, crisis in Libya, what's next? (Iran? Nigeria?)
- <u>Natural disasters:</u> Hurricanes Katrina & Rita (2005), Japanese earthquake (2011)

But longer term trends also play a role

- Creeping price inelasticity of supply/demand mean that relatively small changes in each can have an exaggerated impact on price
- Expectations for future fundamentals – uncertainty & data

Helping ensure more stable markets in future needs:

- Better transparency across both the physical and derivatives markets
- Remove market distortions via price liberalisation & level investment playing field
- Ensure market liquidity & the ability to hedge are retained
- More predictable, harmonised international policies on climate change, fuel qualities, alternative fuels, investment terms
- Promote mutual energy security via interconnections, and diversifying fuel types and sources where it is economically viable
- Finally, widespread encouragement of energy efficiency

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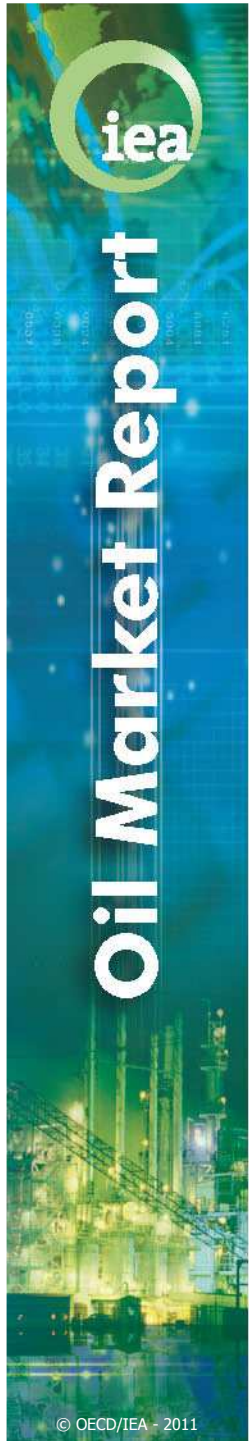
Thank you for your attention

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