

**JACOBS CONSULTANCY**

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Trends in North American  
Refining

for

**AICHE - Chicago Symposium 2006**

October 10<sup>th</sup>, 2006

Ed Arnold

# Contents

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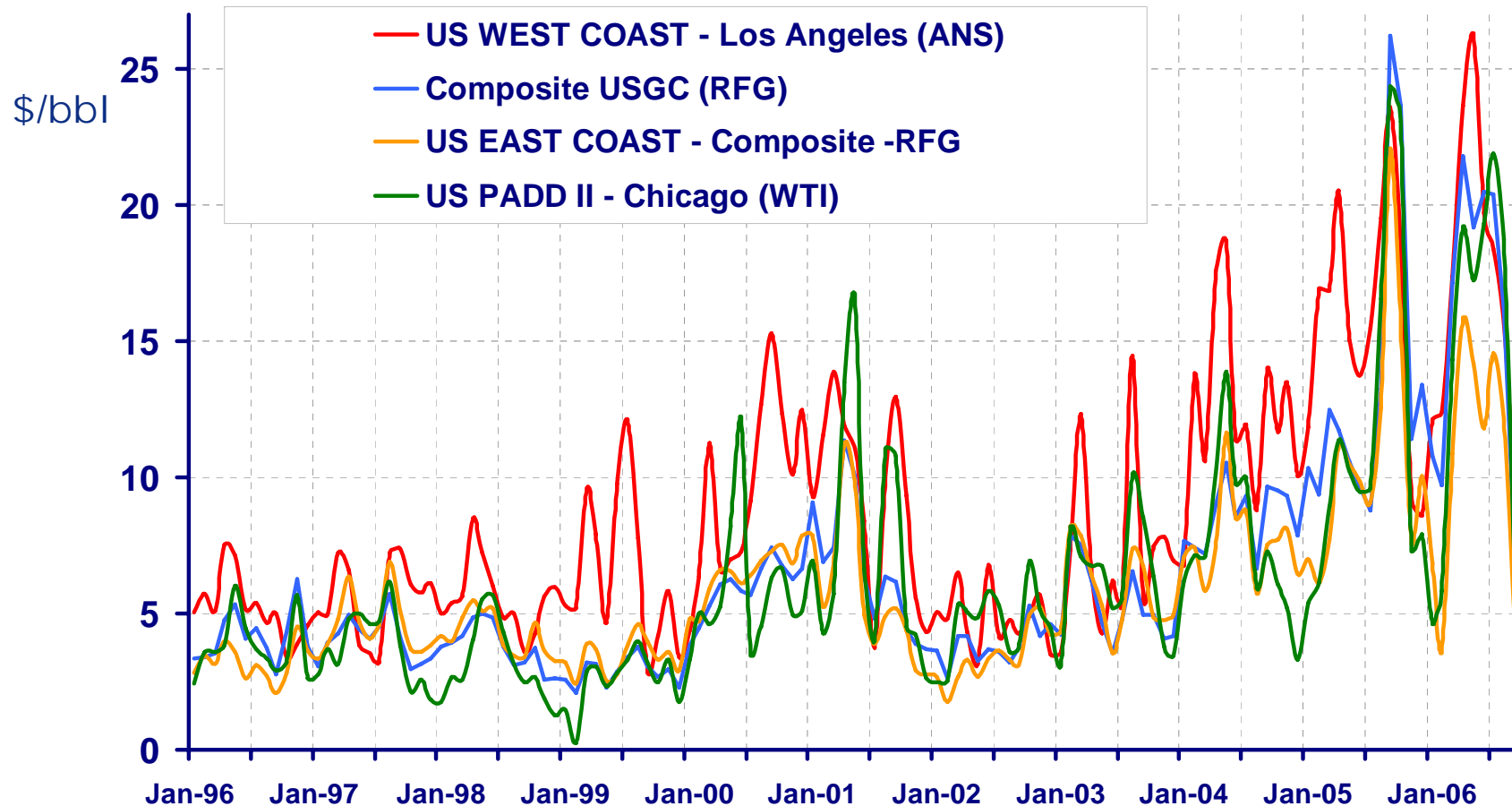
- The key metrics for analysis and forecasting
- Where have we been?
- Where are we today?
- Where may we be going?
- Game changers?

# The Key Metrics & Issues

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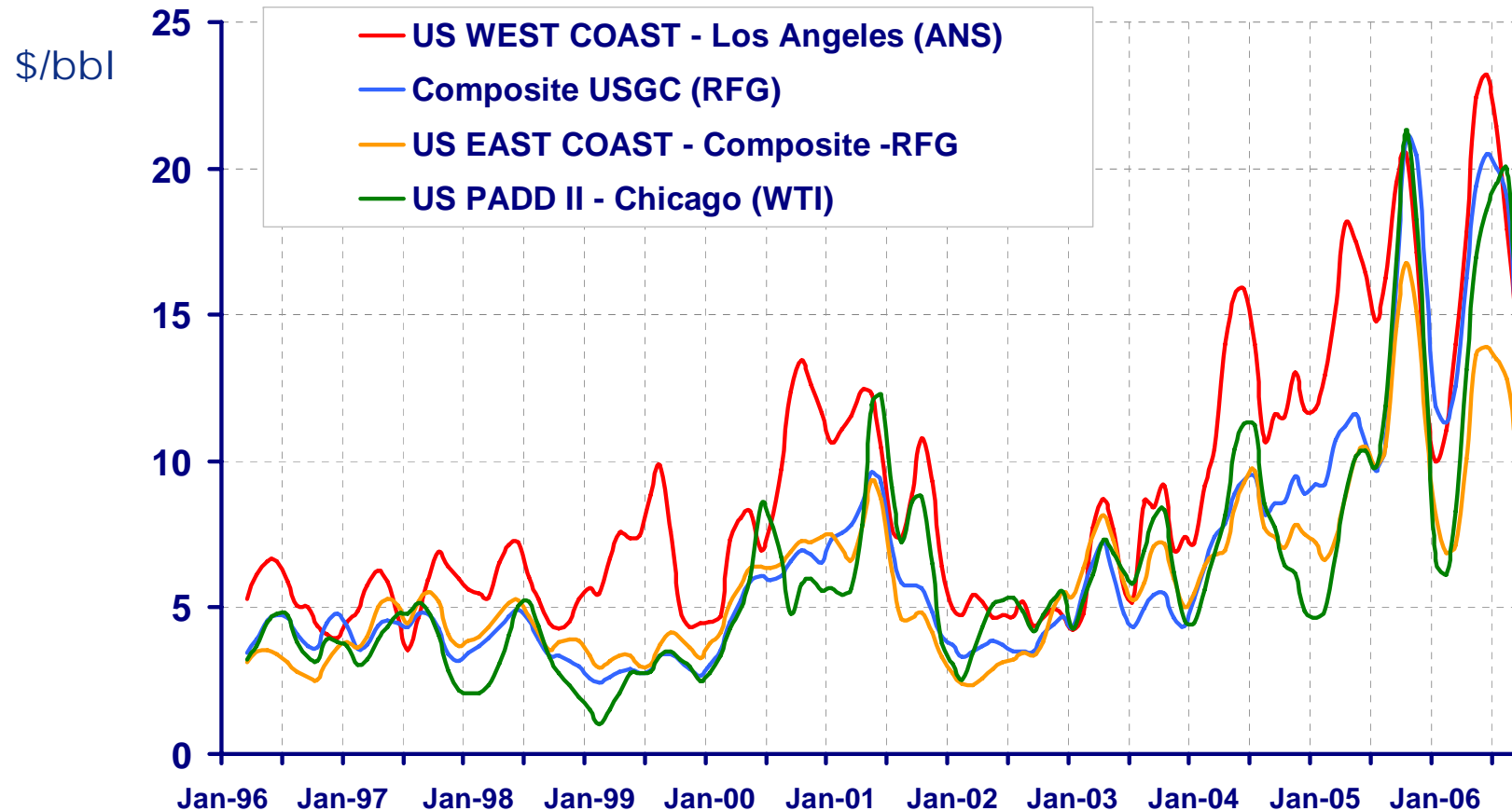
- Refinery Margins
  - Feedstock costs
  - Product demand
- The Economy
- Regulations
- Cost of Investment

# North American Refining Margins Have Been Volatile Over Past 3 Years



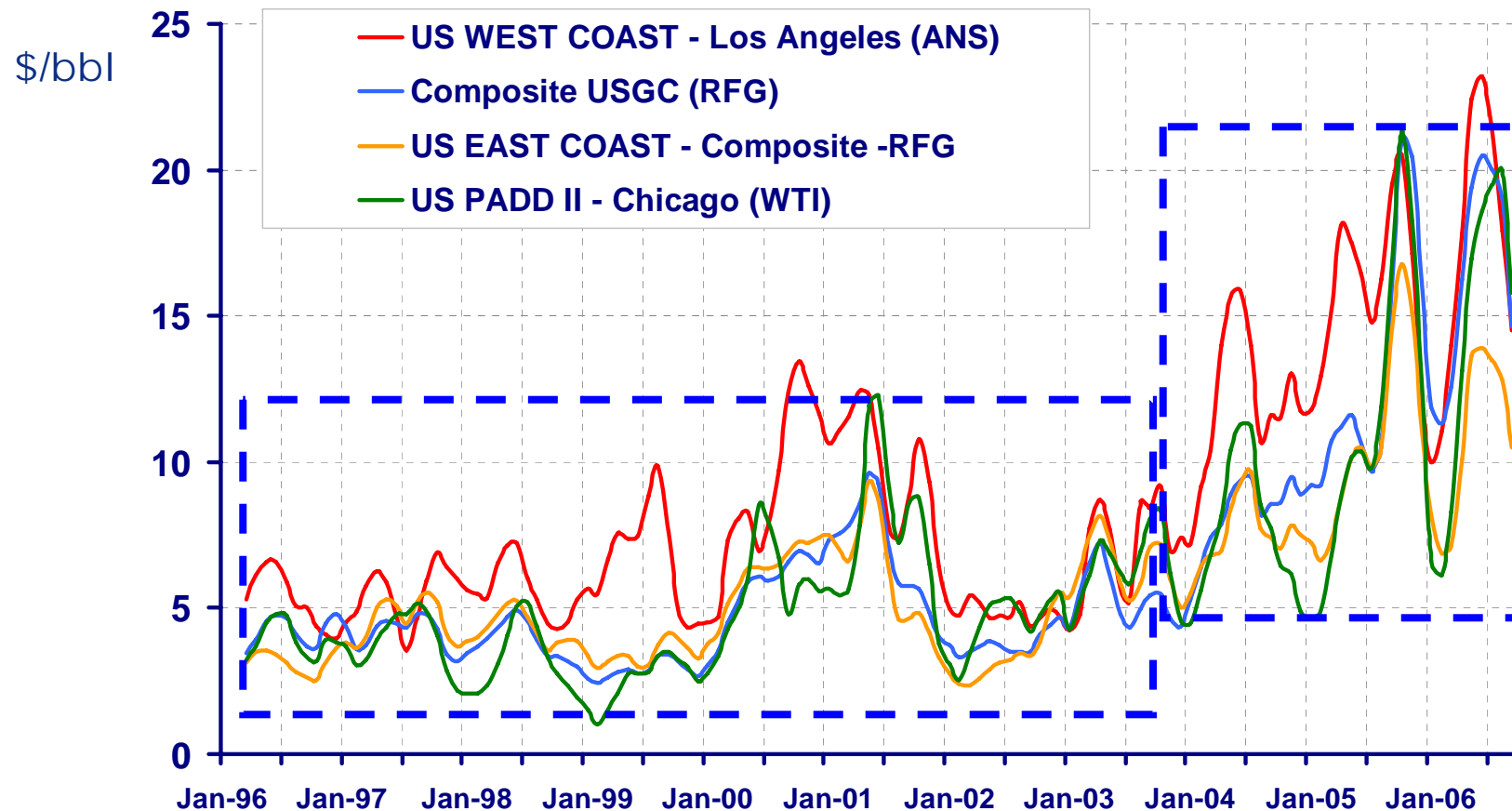
# Smoothing The Data Helps to Visualize the General Trends

## 3 Month Moving Average

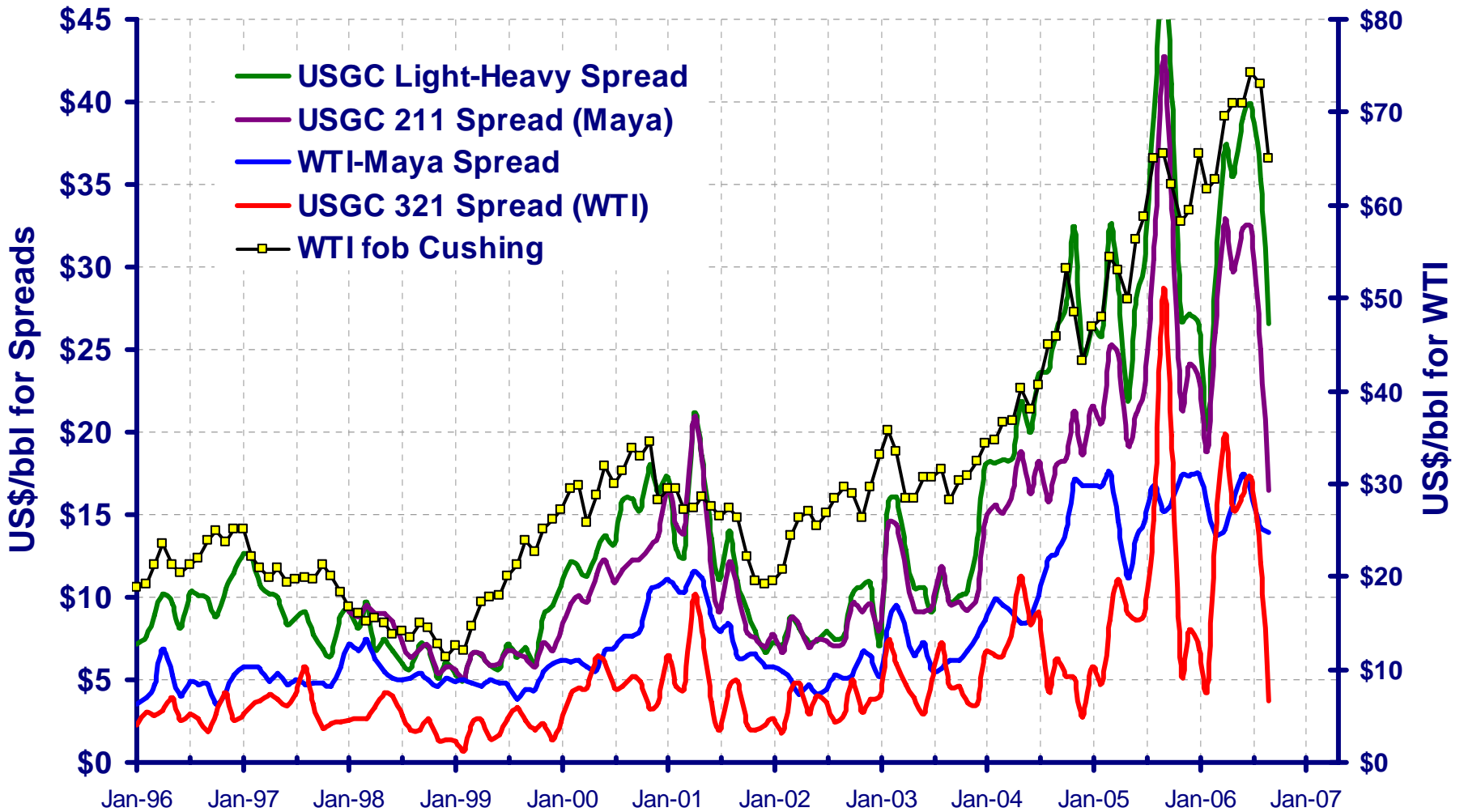


# Smoothing The Data Helps to Visualize the General Trends

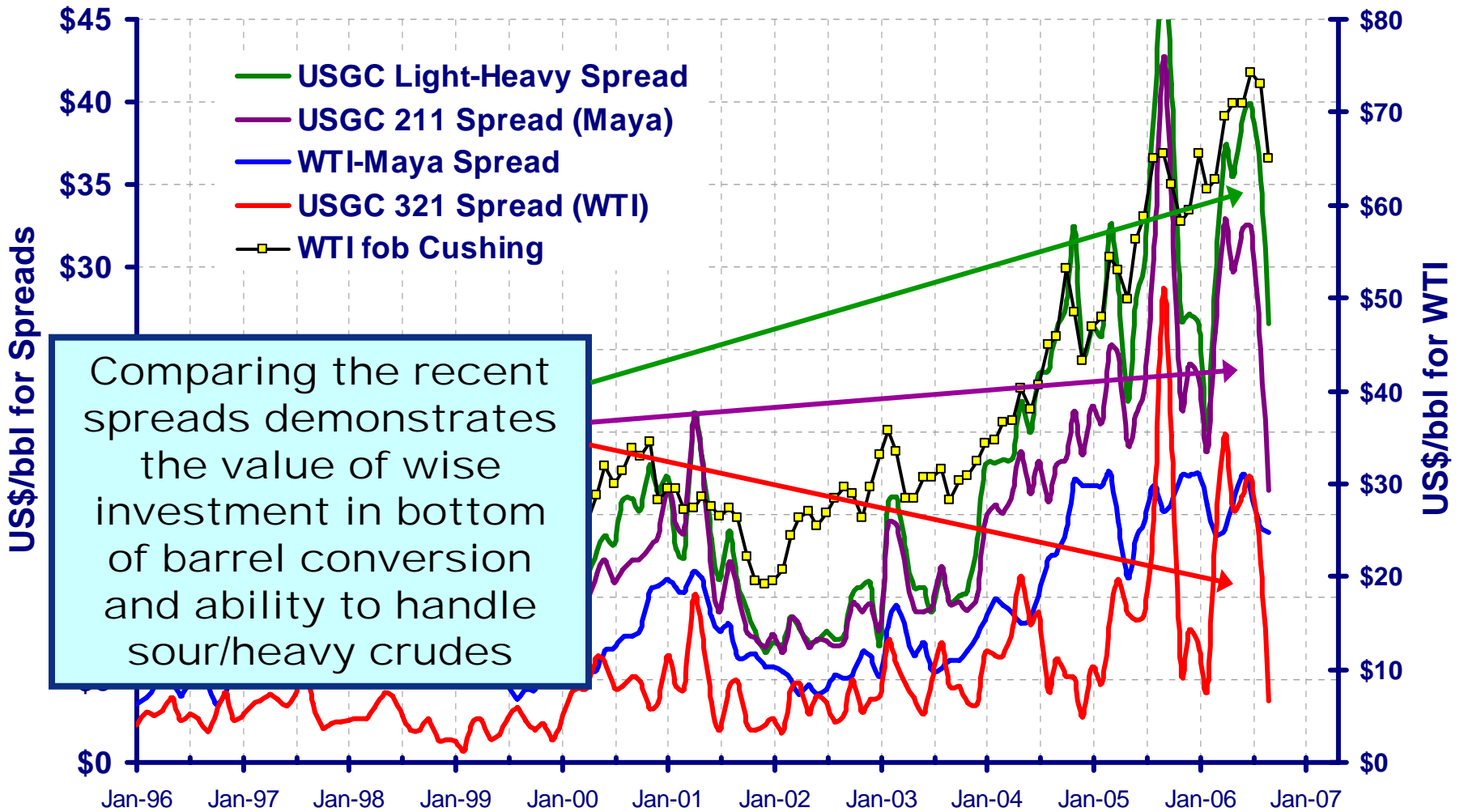
## 3 Month Moving Average



# The Spreads Tell the Margin Story

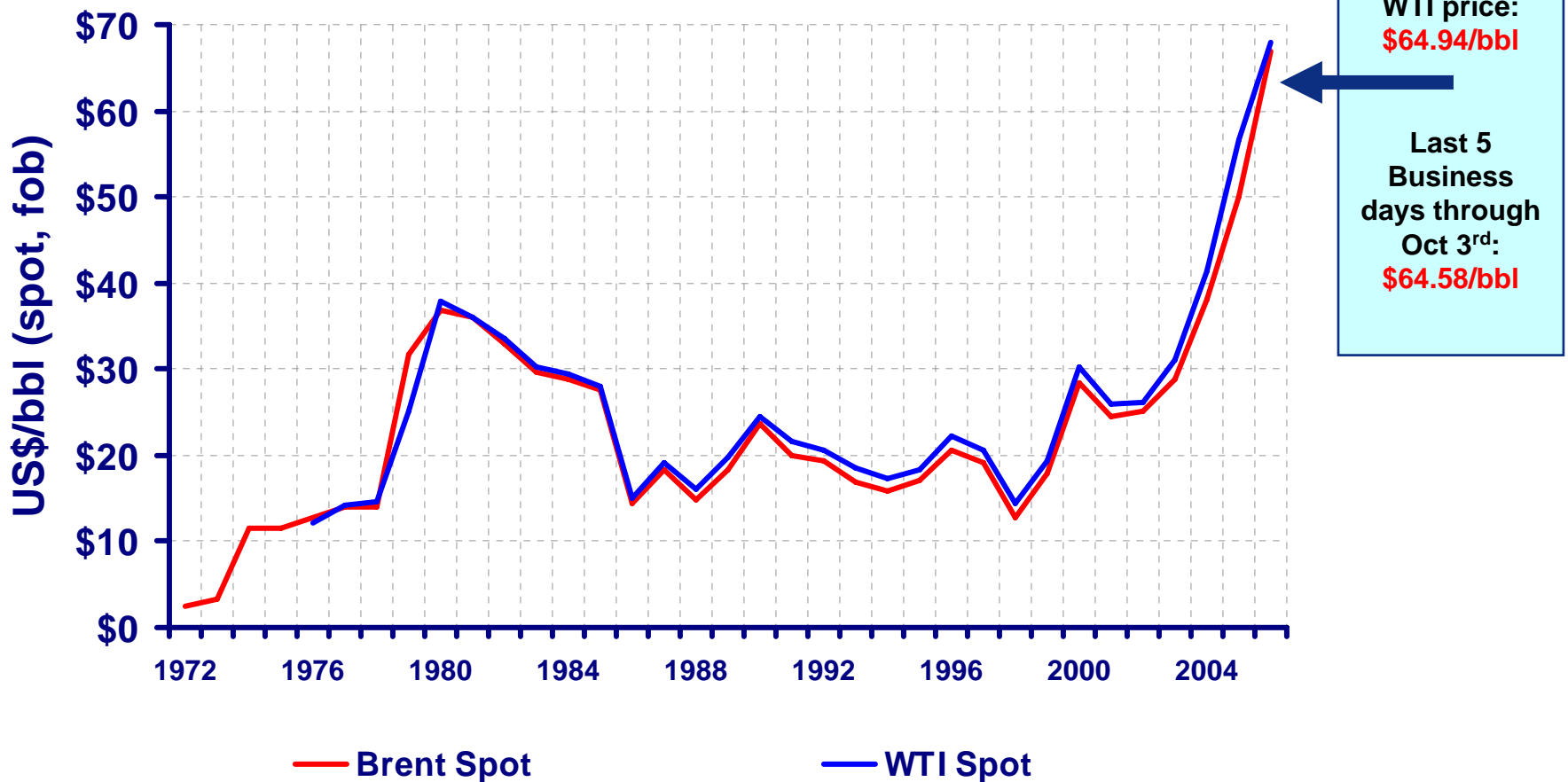


# The Spreads Tell the Margin Story

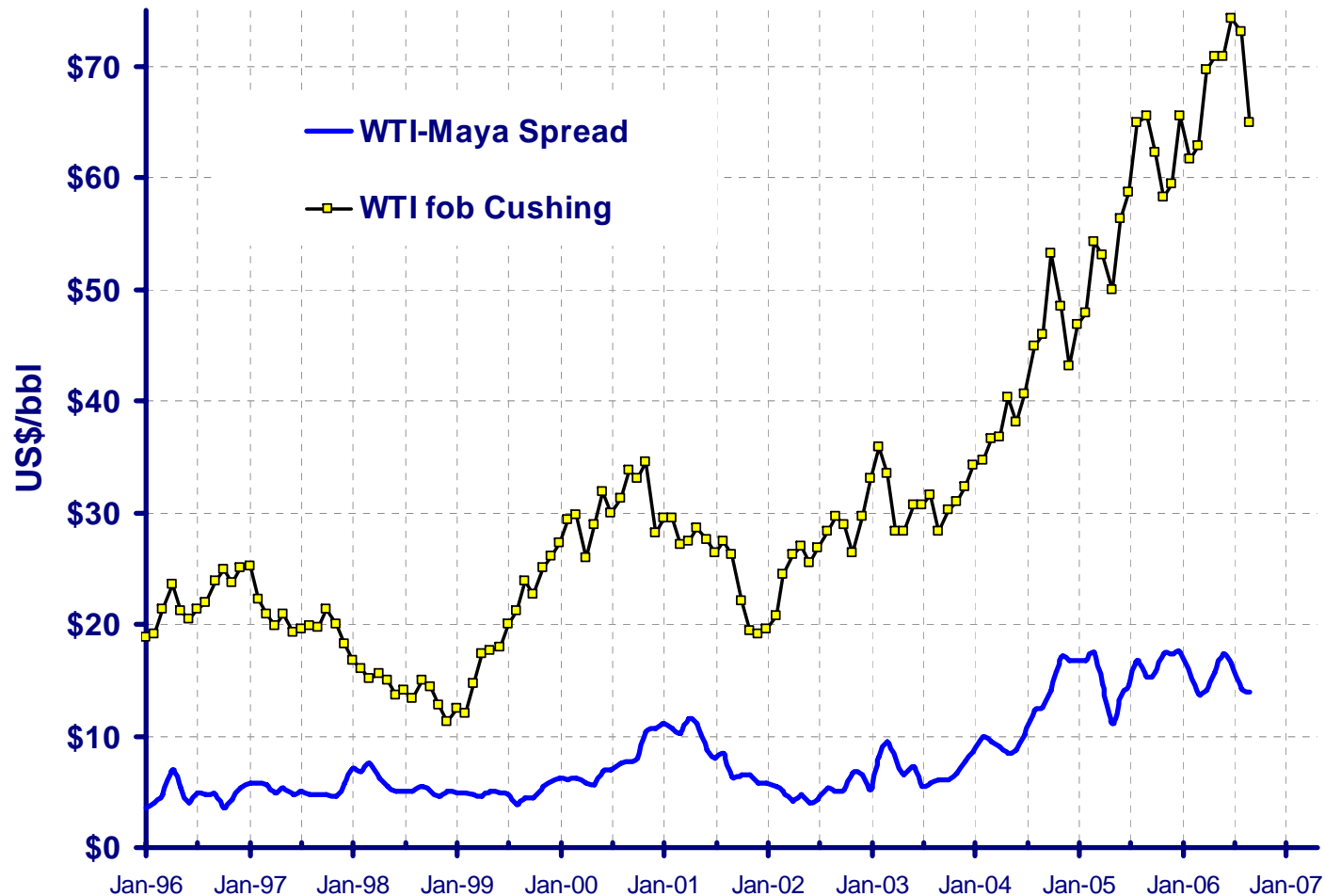


# Feedstock Prices Steadily Trending Higher

## Yearly Average Marker Crude Prices

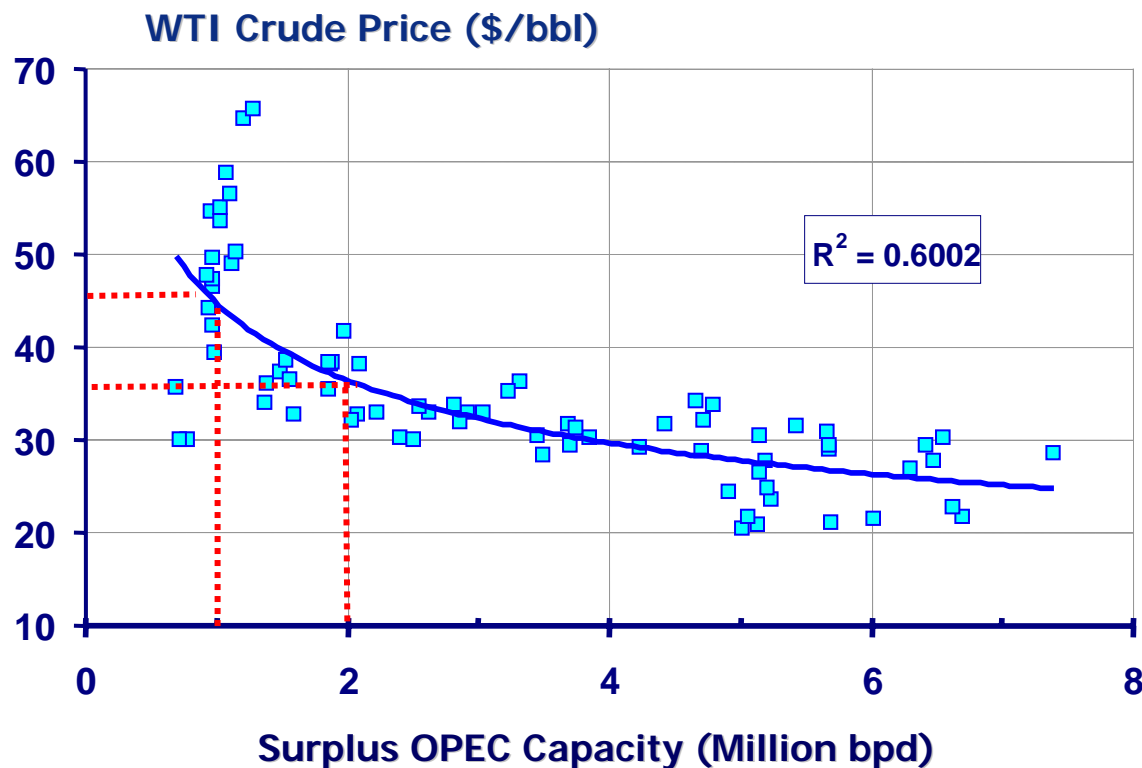


# However, Current Crude Price Drop is Not an Obvious Turning Point



# Spare Capacity: A Key Driver For Oil Prices ?

## Available Crude Surplus Production Capacity Correlates With Crude Price



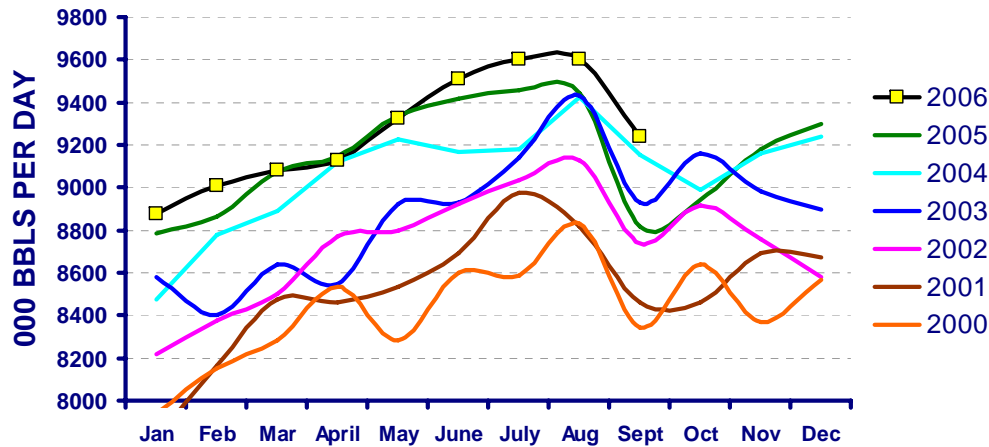
- Chart shows a “fair” relationship between crude oil prices and surplus production capacity since 1999 \*
- On average, the price rises nearly \$10/barrel as surplus capacity drops from ~ 2 million barrels per day to ~ 1 million barrels per day
- Keep this in your sights

slide 11

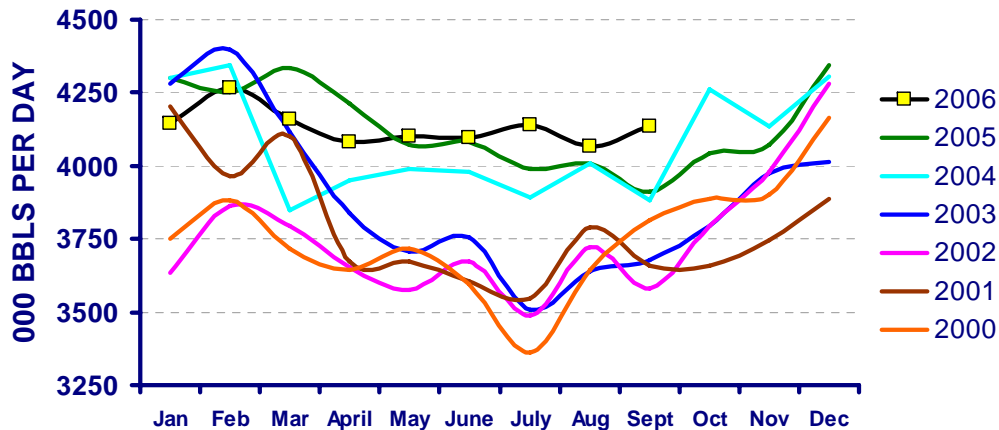
\* 1999 was when we saw prices “shift” up top around \$30/bbl, as Source: EIA Data.

# Gasoline and Diesel Demand are Still Relatively Strong

## U.S. Total Gasoline Demand



## U.S. Total Distillate Demand



## Gasoline

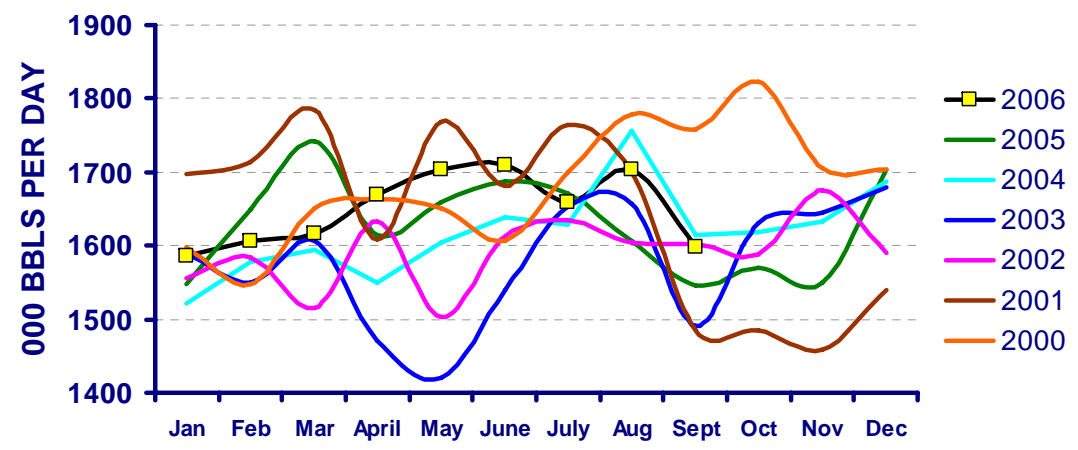
- Despite higher prices gasoline demand was strong
- Jan. through Sept. gasoline demand up by over 1% compared to 2005
- **Recent drop of gasoline prices** at pump will be good for demand

## Distillate

- Jan. through Sept. distillate demand essentially flat compared to 2005
- However, seeing high on-road diesel margins, and these will likely continue

# Different Demand Stories in 2006 for Jet and Resid

U.S. Total Kerosene-Jet Fuel Demand



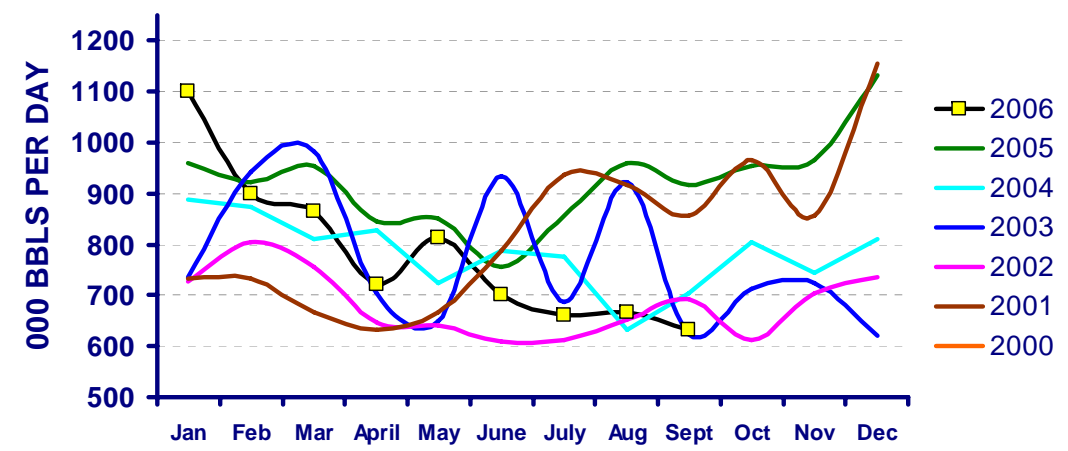
## Kero-Jet Fuel

- Jan. through Sept. jet demand up by over 0.6% compared to 2005

## Resid

- Dramatic drop in resid demand follows light-heavy spread trends
- Jan. through Sept. resid demand down by over 9% compared to 2005
- **Great times for high-conversion refineries (running heavy/sour crudes)**

U.S. Total Residual Fuel Oil Demand



# The U.S. Economy - Two Current Points of View

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- “Were coming in for a landing? Recession is imminent. The only question is whether the landing will be soft or hard.”

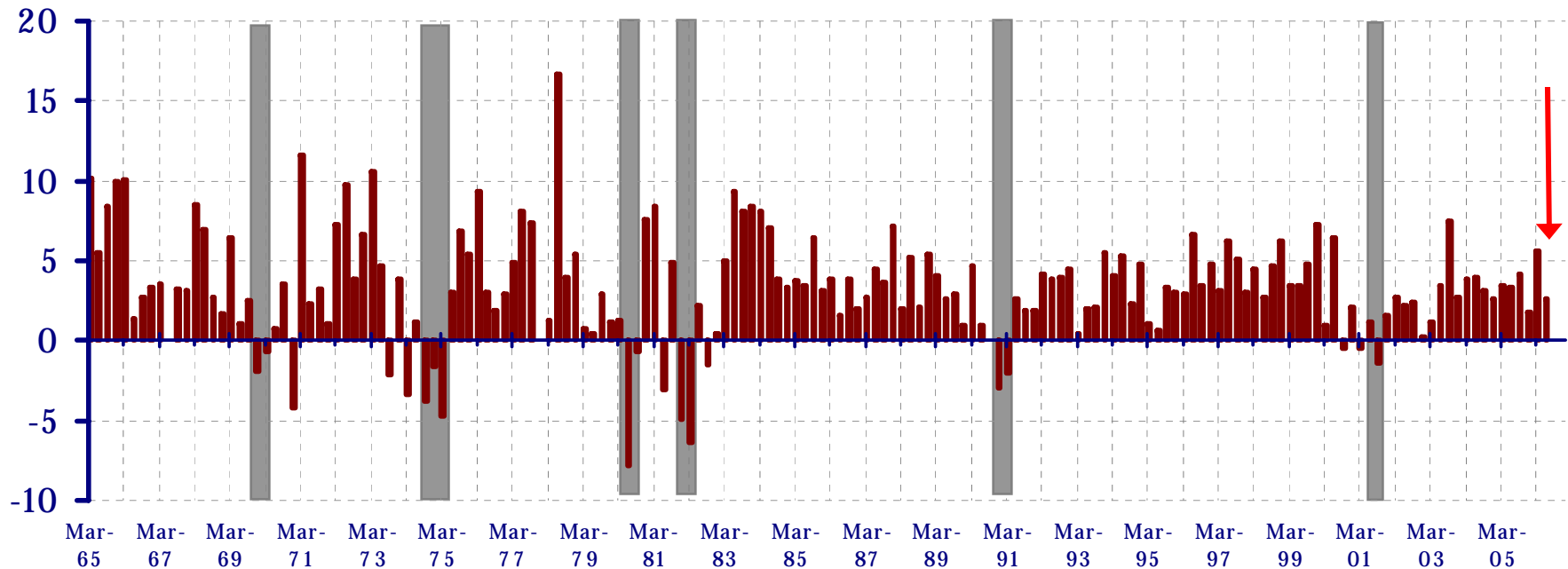
Or

- “We have a good chance of experiencing another long term economic expansion such as we saw in the 1991 to 2001 period.”

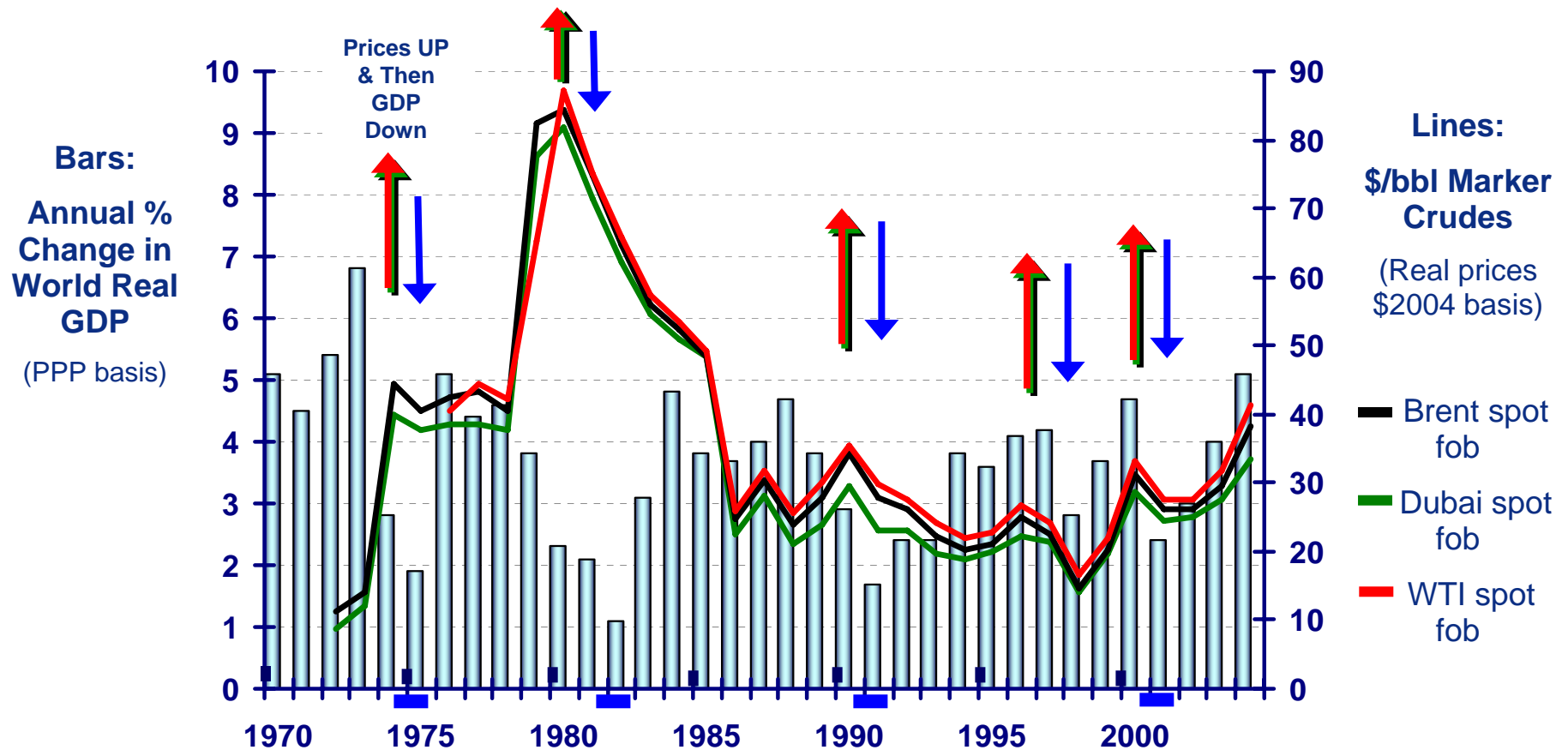
# Background: We Are in 5 years Into Current Economic Cycle

- 2nd Quarter 2006 saw a drop in GDP growth rate from 5.6% to 2.6%

Quarterly U.S. GDP (% Change based on chained 2000 dollars)



# Caution: Economic Slowdowns Often Correlated with Oil Supply Crises or Oil Supply Tightness



Underlined bars indicate periods of "major worldwide economic" slowdowns as defined by IMF. See IMF 2002 *World Economic Outlook*, Chapter 1, pages 10 - 12.

# Landing Soon or Landing Later?

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- **Negatives**

- Housing downturn\*
- Downturn in auto sales (previously an excellent predictor of recession)
- High short term interest rates
- Federal Deficit
- Growing negative Balance of Payments

- **Positives**

- Falling energy prices
- Low long term interest rates
- Growing job market & Wage increases
- Shrinking energy intensity

\* [September 2006] For first time in 11 years, monthly figures showed the median price of previously owned home falling as inventories of unsold homes rose to levels not seen in more than a decade

# Regulations

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- Clean fuels investment continues
- Gasoline spec changes
  - New benzene regulation in US – (MSAT II) – drop benzene from 1% to 0.62% on average
  - May impact import/export balances
  - Aromatics cap still possible target
  - **CAUTION:** Just looking at benzene when it's likely that there will be continuing pressure on other toxics and particulates might result in a solution that would be less than optimal going forward than if you step back and look at all the issues.
- Renewable Fuels Standards will impose complexity
- Low sulfur bunker fuel (MARPOL VI) starting in EU
  - Eventually progresses to USA waters?

# Cost of Investment

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- Rising
  - Materials shortages
  - Labor Shortages
  - Engineering shortages
  - High level of new projects in Canada, U.S. Asia and Middle East all “feed” the shortage
  - More uncertainty about future business environment
- Incidence of capital projects cutbacks is increasing

# Global Refining: Supply / Demand / Capacity

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- World refining capacity start of 2006 ~ 85 million bpd
- Current oil demand ~ 84-85 million bpd
  - Growth ~ 1.7% / year
  - Includes natural gas liquids demand (not refined) ~9 Million bpd
- Large number of announced capacity projects
  - U.S. ~ 2 million bpd
  - Middle East ~ 6.5 million bpd
  - Asia / Pacific ~ 5.5 million bpd
  - Europe / Africa ~ 2.4 million bpd
- Globally – 18 to 19 million bpd over next 5-10 years, if all built
  - With 2.5 million in up-graders, 21.5 total

# The Next 5 - 10 Years?

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- **Margins are probably headed down again**
  - Tightness in E&C, equipment, and raw materials markets may have prevented a massive overbuild in capacity this time
  - Incidence of capital projects cutbacks is increasing
- **Crude oil prices have continued to increase even with more modest demand growth, *for most of the year:***
  - Geopolitical issues / Supply concerns
  - Still have low spare production capacity
  - Crude prices started relaxing to \$60/bbl range in mid -Sept.
  - Plan on volatility. Be prepared for wide range of price scenarios.
  - Most likely mid-point range?

# The Next 5 - 10 Years... continued

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## Most Likely Scenarios:

- Differential between light & heavy products will remain high
  - Assuming continued refined product demand growth
  - *Astute investment in BOB conversion will continue to pay off*
  - If we get a significant (prolonged) recession and/or crude prices drop, these projects could be in trouble.
- Light vs. Heavy crude spread may drop from current historically record high levels, but will not return down to pre-2001 levels (see slide 10)
- Continued Refinery & Feedstock Reconfiguration Investment
  - More refineries investing to allow running cheaper, heavier, and higher TAN crude oils

# Game Changers On The Horizon, Within 5 to 10 Years

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## Certain

- Canadian Crudes (regular and synthetic) & PRODUCTS headed far South
  - thanks, in part, to recent and likely future pipeline reversals
- More ethanol and bio-diesel in our transportation fuels diet

## Pay Attention

- Significant dieselization shift noticeable within 10 years?
- CO<sub>2</sub> Controls
  - California Global Warming Solutions Act of 2006
- U.S. Federal Debt Rates and Balance of Payments
- Detroit's, Japan's & consumer's response to higher trans fuels costs
- Natural Gas prices



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