

# *Energy and the Macroeconomy*

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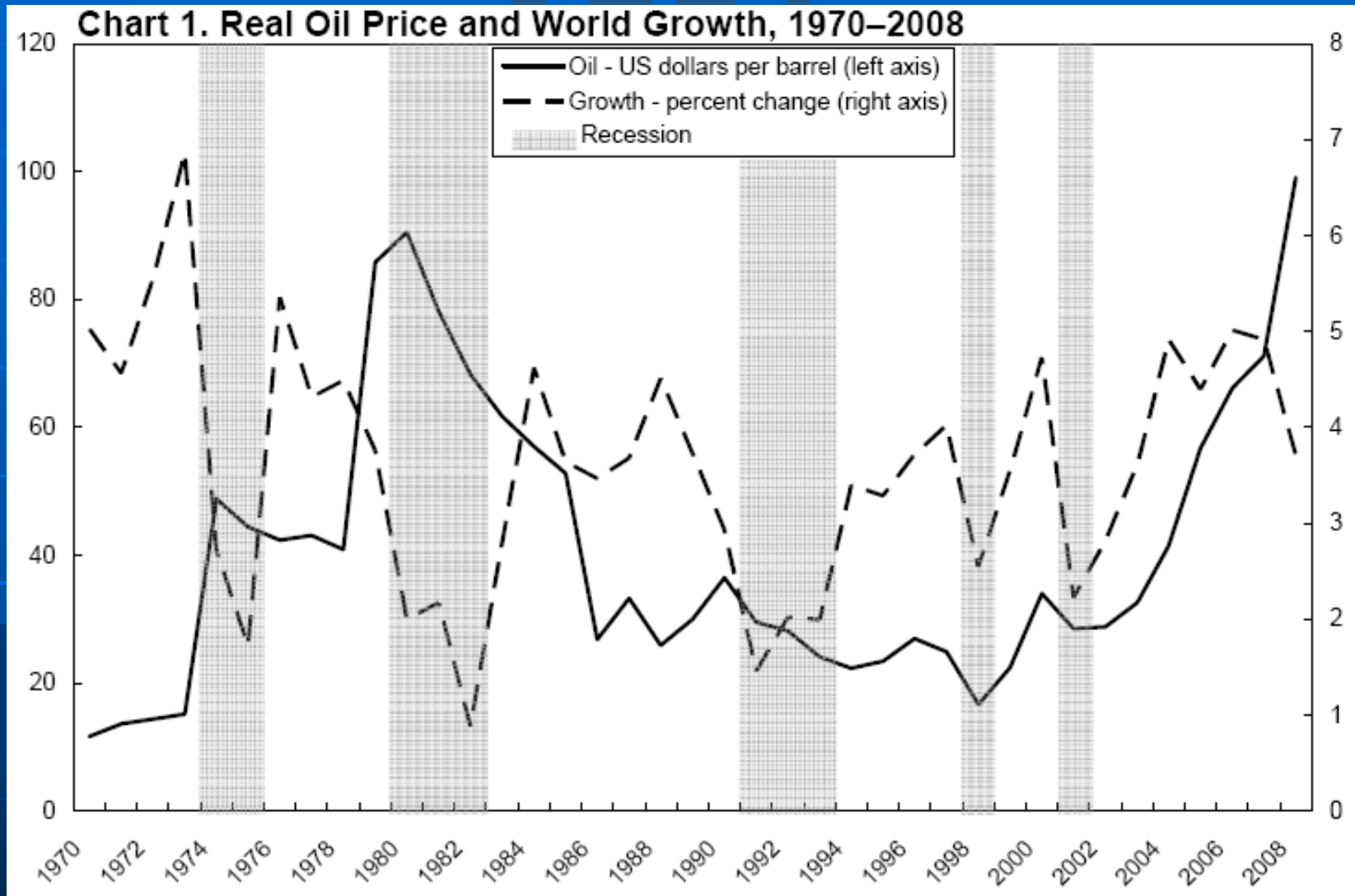
*EIA 2008 Energy Conference  
April 8, 2008*

*Happy 30<sup>th</sup> Birthday, EIA!*

*Disclaimer & Acknowledgments:*

*Views expressed are my own and should not be attributed to the IMF  
I thank Hites Ahir for excellent research assistance (and Fred Joutz for  
sharing his discussion of an earlier version of Brown, Balke and Yucel)*

# Real Oil Price and World Growth, 1970–2008



Real oil prices are defined as the nominal price deflated by the U.S. CPI.

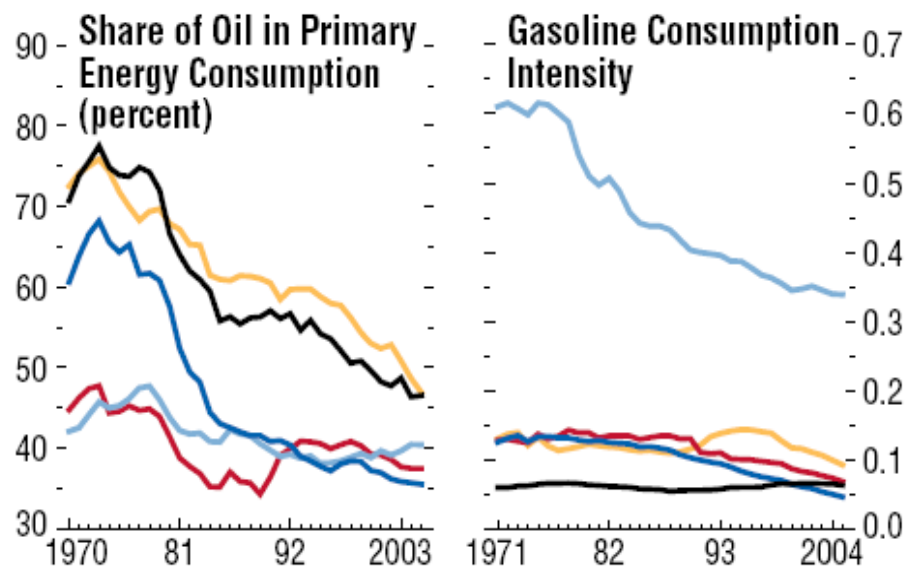
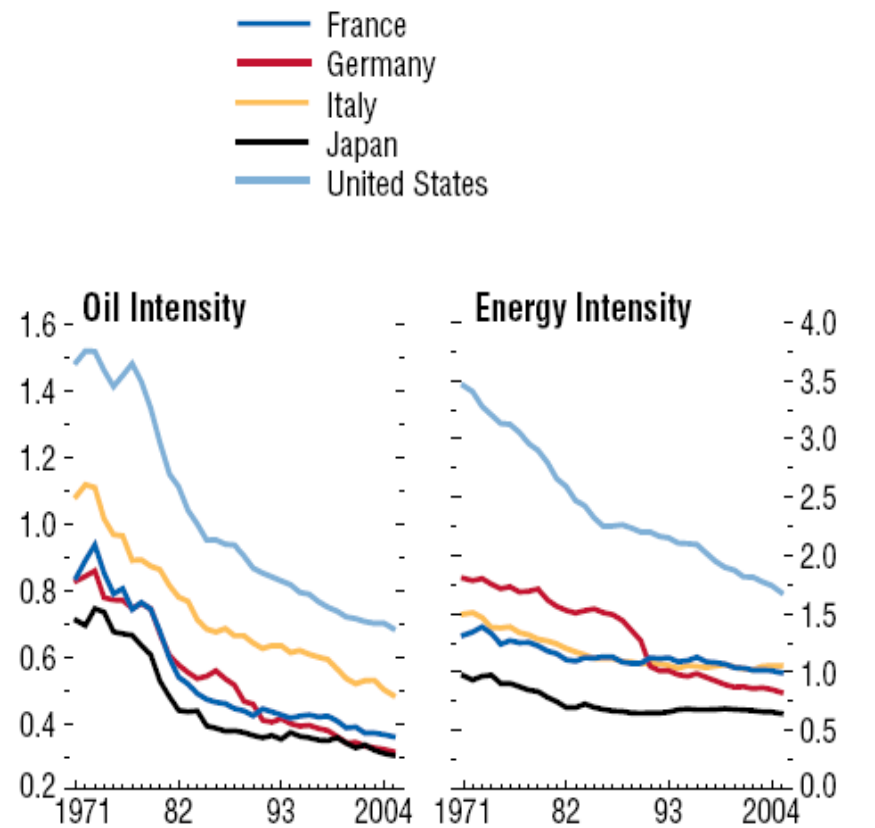
# Oil Price-Macroeconomy Relationship

Not a surprise that it's a moving target:

- Gains in energy efficiency
- Learning by central banks
- Oil prices driven by global demand for energy
- "Greater transparency and integrity of [energy] data" (Sec. Bodman yesterday)
  - EIA's key role; JODI

# Gains in Energy Efficiency

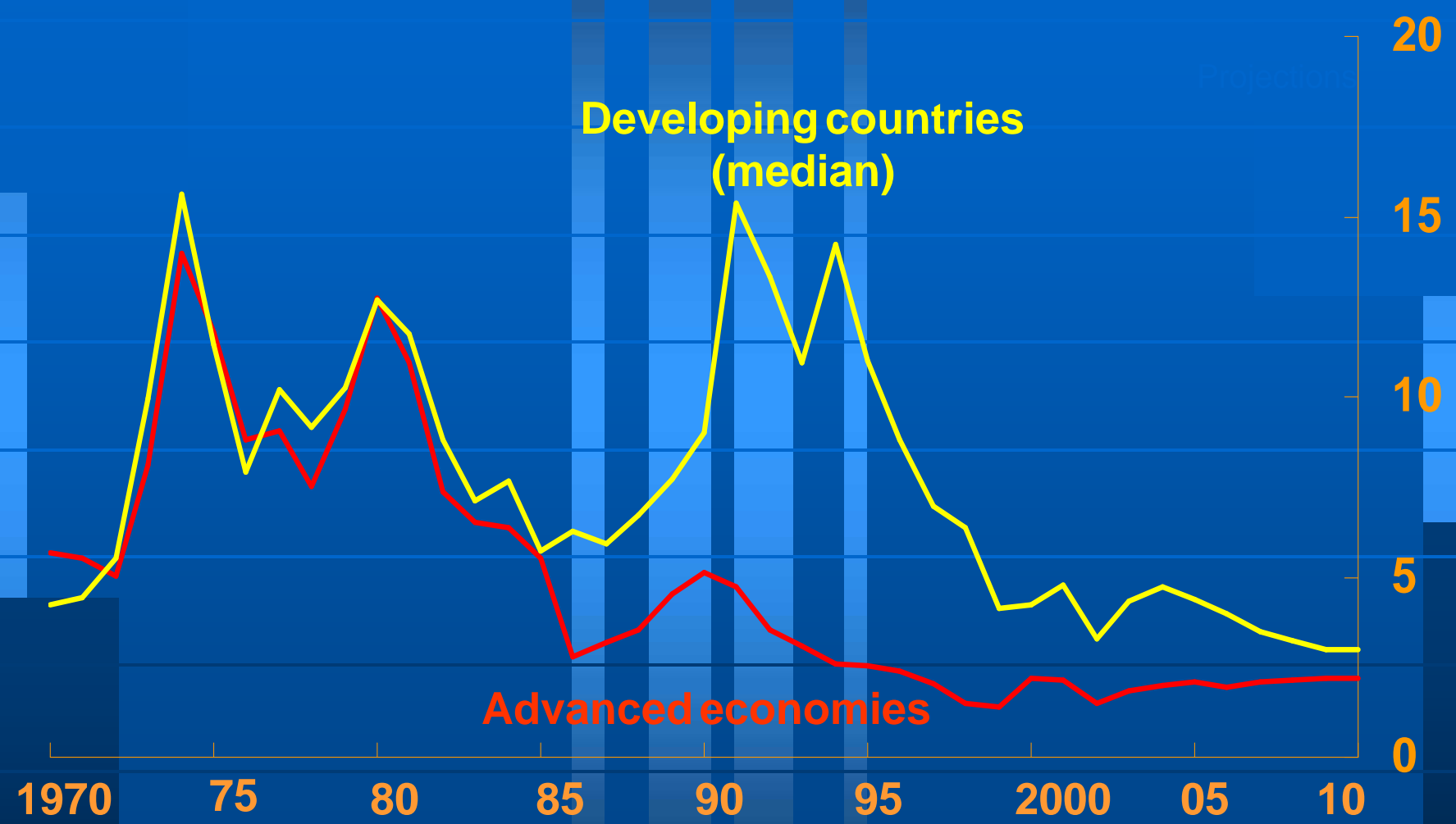
(Million barrels of oil equivalent per GDP in billions of 1995 dollars, unless otherwise noted)



Sources: *British Petroleum Statistical Review* (2006); International Energy Agency; and IMF staff calculations.

# Learning by Central Banks

*(Annual percent change)*

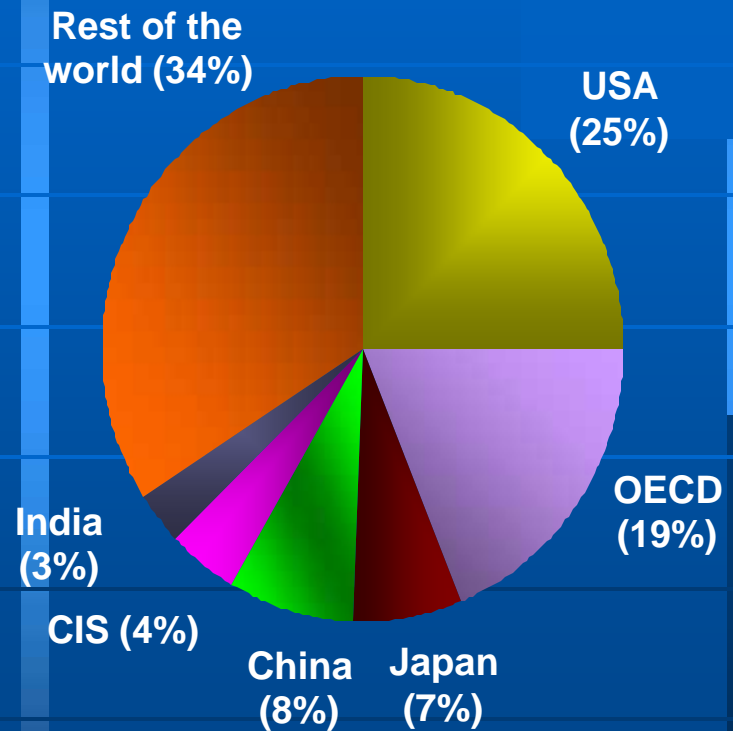
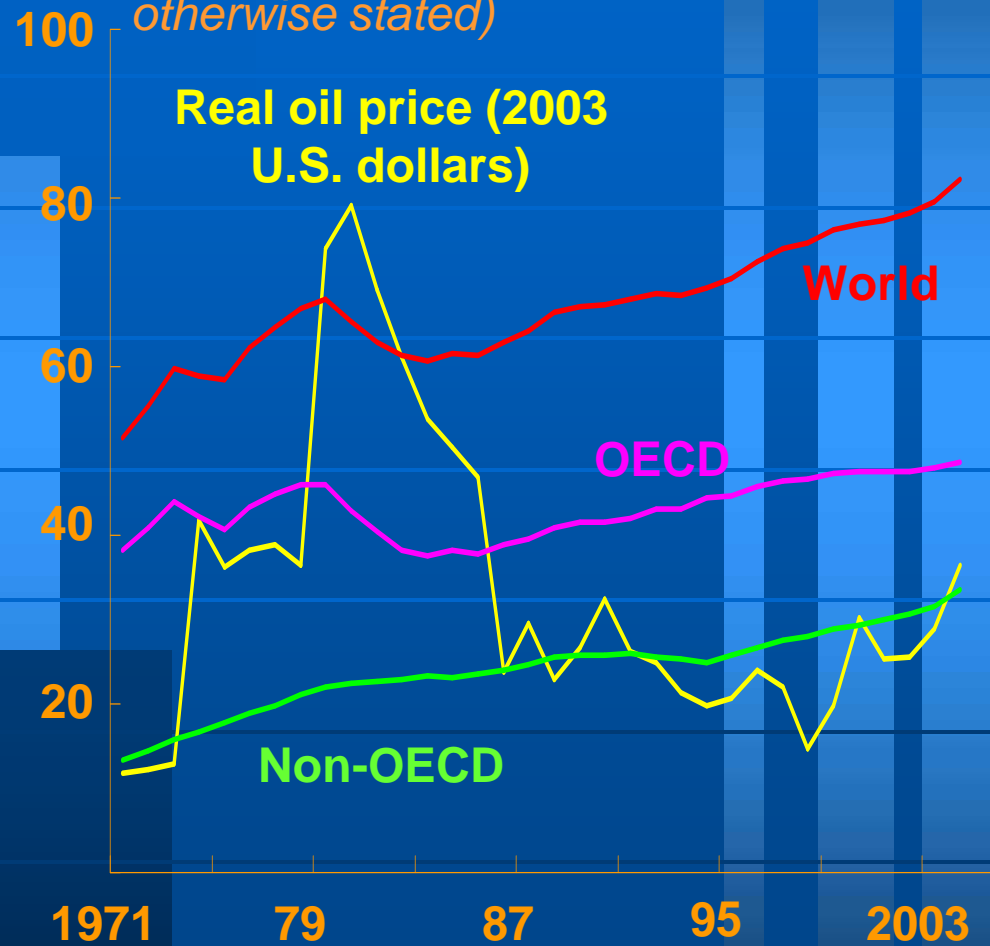


Source: IMF staff estimates. Will be updated April 9, 2008

# Demand-driven growth in Oil Prices

**Global Oil Demand and Real Oil Price**  
*(Millions of barrels a day, unless otherwise stated)*

**Consumption by Countries and Regions, 2004**



Sources: International Energy Agency; U.S. Department of Energy; and IMF staff calculations.

# Energy-macroeconomy modeling “then” and “now”

## ■ Modeling of oil price

- ˘ Exogenous, supply-driven
- ^ Endogenous, affected by many factors, particularly global demand

## ■ Role of monetary policy

- ˘ Not always prominent in early work (exception: Bohi, Darby)
- ^ Monetary policy reaction to oil prices a critical feature

## ■ Modeling of “rest of the world” (ROW)

- ˘ Imported oil the only U.S. link to ROW
- ^ Explicit modeling of ROW; demand shocks in ROW important both for understanding oil price movements and U.S. variables

# Energy-macroeconomy modeling “then” and “now”

As a result:

- Role of oil shocks in recessions
  - ~ Viewed as quite important, sometimes only source of recessions
  - ^ Other large shocks viewed as main causes of recessions; oil shocks play a smaller, often negligible, role
- Asymmetric effects of oil prices on economy
  - ~ Viewed as important
  - ^ Evidence in favor of symmetry



# Comments on Brown, Balke & Yucel (BBY): Exogenous shocks galore

- Shock to oil production
  - Too persistent to act like a sudden supply disruption?
  - How large is the shock? (How much of a drop in world petroleum production does it represent?)
- Shock to the production of oil reserves
  - Not clear why it's needed
  - Doesn't seem to play a big role
- Interpretation of "oil wedge" (between marginal product and relative price of oil)
  - "policies that affect either the true price to firms of using oil (for example taxes or environmental regulations) or changes in energy efficiency"
- Big role for "labor wedge"
  - "fluctuations in the wedge between the marginal rate of substitution and the marginal product of labor"

# Comments on BBY (2): Model Solution and Estimation

- Calibration vs. Bayesian estimation of parameters: pros & cons?
- Estimated elasticities
  - intertemporal elasticity of substitution is “lower than typically assumed in the macroeconomic literature”
  - elasticity of substitution between domestic and foreign good is “substantially lower than that assumed in Backus and Crucini”
- Implied oil price elasticity of real GDP
  - “about -0.023, which is within the -0.012 to -0.12 range suggested by previous empirical research for the United States” [Jones, Leiby and Paik, Energy Journal, 2004]
  - Questions: How does implied oil price elasticity of real GDP depend on values of the estimated elasticities? How does this implied elasticity change if intertemporal elasticity of substitution and elasticity of substitution between domestic and foreign good are set equal to ‘conventional’ values?

## Comments on BBY (3): Results on Understanding Oil Price Movements

- Historical decompositions are great but variance decompositions would be useful too
- Can supply-driven component of oil price increases be mapped to 'observable' shocks?
- Post-2002 run-up in oil prices explained in large part by decline in oil wedge
  - Interpretation? Scaling back of taxes and environmental regulations? Declines in energy efficiency?

## Comments on BBY (4):

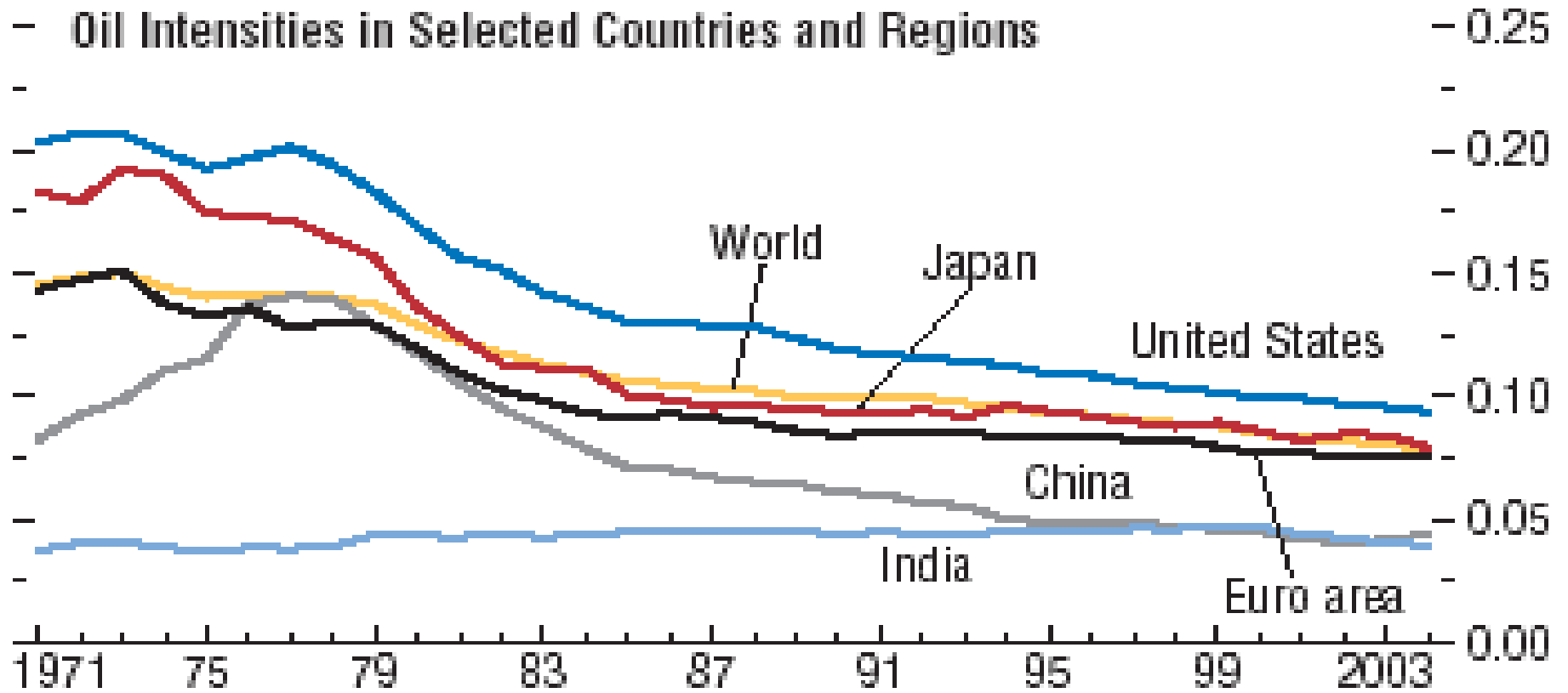
### Results on Understanding U.S. Real GDP fluctuations

- Oil shocks (production + reserves + wedge) play a limited role
  - Variance decompositions would be useful to compare to previous DSGE literature on contribution of oil to output fluctuations
- What 'observable' changes could account for dramatic post-2000 increase in labor wedge?

# Future Work

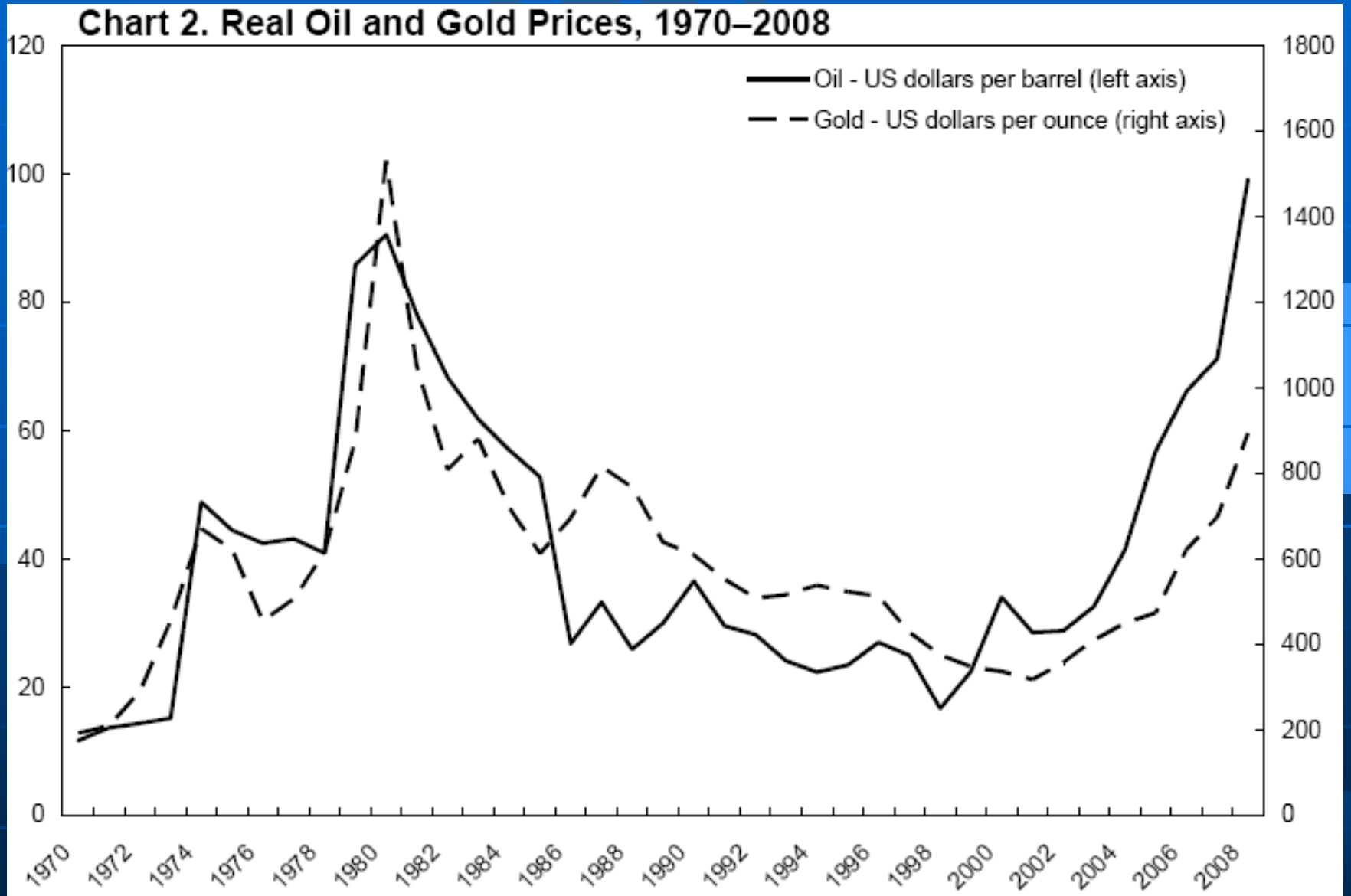
- Modeling of ROW
  - Does it represent Europe or China & India?
  - China & India:
    - Implications for energy intensity
    - A labor supply shock? Changes in relative factor prices?
- Oil as a financial asset
  - Not just 'speculation'
  - Yergin yesterday: "distinctive asset class for financial investors"; CALPERS
- Don't ignore 'geopolitical' risks to oil markets
  - Yergin yesterday: "Strait of Hormuz has not moved"

Thank you!



Sources: International Energy Agency; OECD analytical database; and IMF staff calculations.

# Real Oil and Gold Prices, 1970–2008



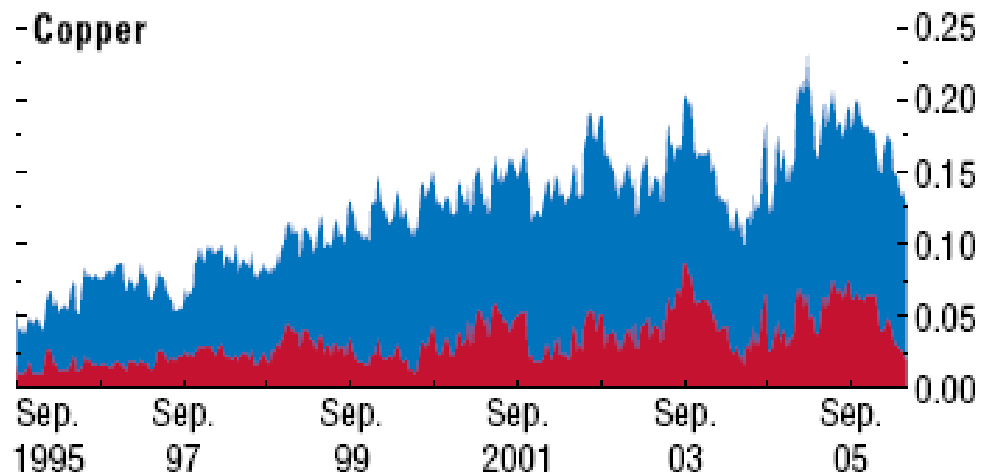
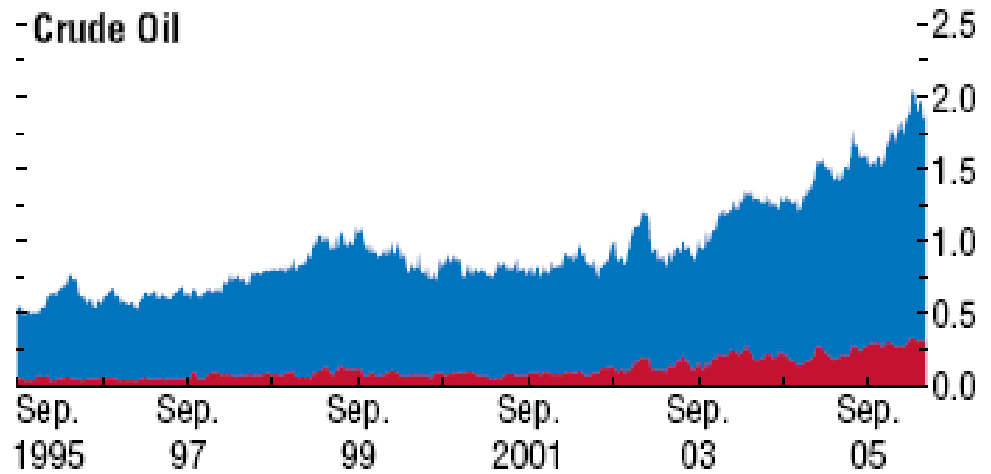


# Speculation?

## Number of Positions in Commodity Markets

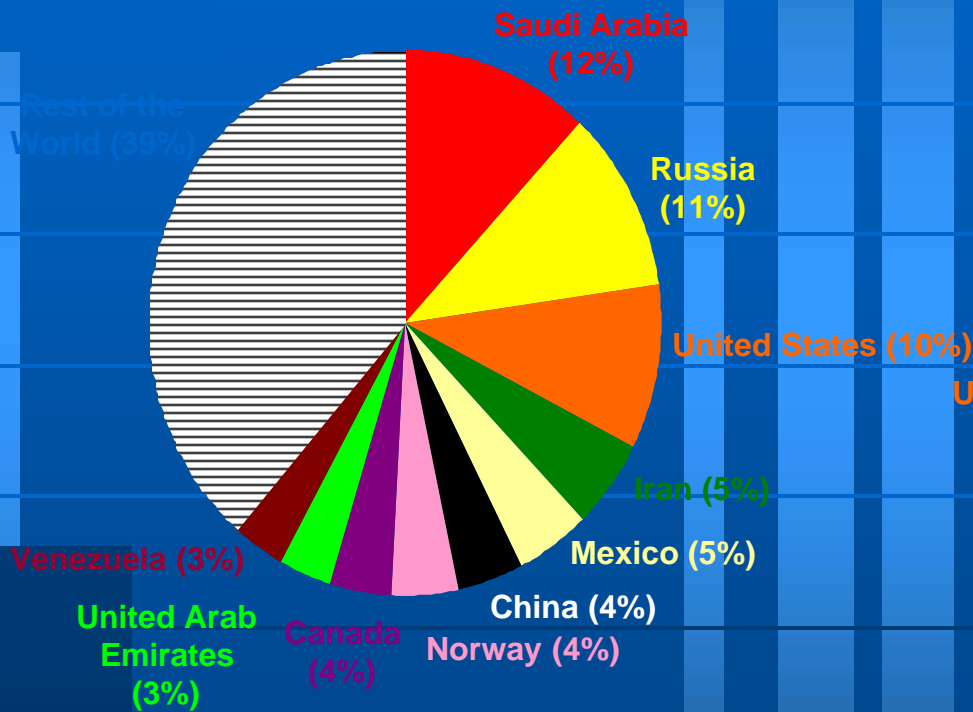
*(Long plus short; in millions of contracts)*

■ Total    ■ Noncommercial

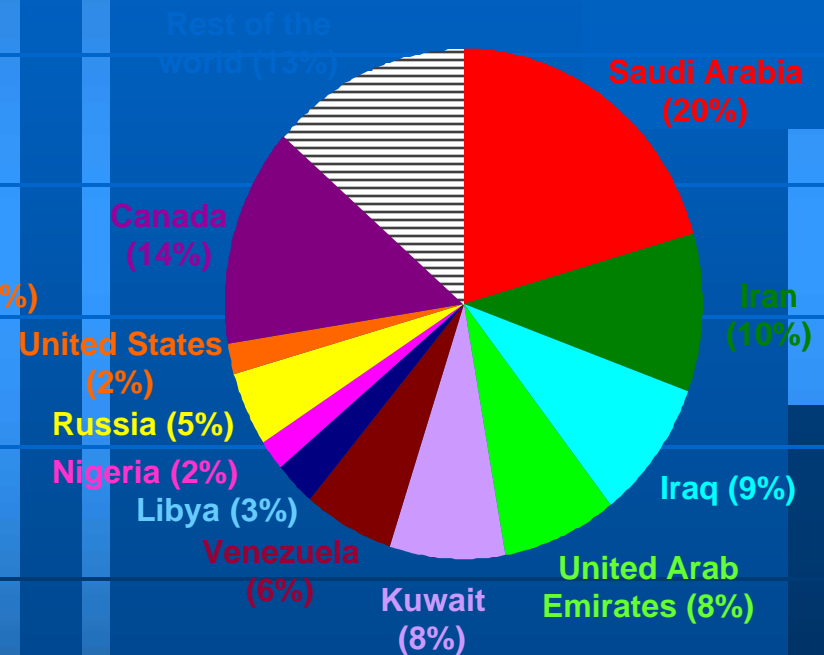


# Geopolitical events can cause major supply disruption ...

## Main Oil Producers, 2003



## Proven Oil Reserves; end-2003 (Total 1,266 billion barrels)



Sources: International Energy Agency; *British Petroleum Review*; *Oil and Gas Journal*; and IMF staff calculations.

# Views of James Hamilton, my Guru on Oil



James Hamilton: "My evidence showed that six of the seven U.S. recessions since 1947 were preceded by a sharp increase in the price of petroleum."

## HAMILTON:

*"Oil is a very important part of the calculations for buying lots of stuff—like what kind of car to buy or what type of machinery will be cost-efficient. People read about events in the Middle East and realize that these events have implications for oil prices. And because they understand the importance of oil in virtually every activity in the economy, they become concerned. **It may be that these psychological effects are what's important in disrupting patterns of consumption and investment spending.**"*

(Source: James Hamilton, interviewed by Prakash Loungani, IMF Survey, August 18, 2003)

# James Hamilton on the 2002 oil price shock

- “ ... this oil price shock differs significantly from earlier episodes, leading me to believe that the economy will be able to adapt to the new pricing environment without a major economic slowdown.”

- “In each of the five biggest previous oil shocks, there was **a dramatic geopolitical event that cut oil flows amounting to nearly 10% of total world oil production**. By contrast, global oil production has increased steadily during the current episode. The run-up has been caused this time not by a shortage of supply but rather by booming world demand ...”

Date	Event	Percent drop in world petroleum production
Nov. 1956	Suez Crisis	10.1
Nov. 1973	Arab-Israeli War	7.8
Nov. 1978	Iranian Revolution	8.9
Oct. 1980	Iran-Iraq War	7.2
Aug. 1990	Persian Gulf War	8.8

Data: James D. Hamilton, 2003, “What Is an Oil Shock?” *Journal of Econometrics*, Vol. 113 (April), pp. 363–98.

- “Both the gradualness of the price move and the circumstances attending it have left consumers and firms substantially less nervous about the current economic situation than they were in August of 1990, with none of the postponing of spending decisions that characterizes most economic downturns.”

## Views of Dan Yergin, my other Guru on Oil



**LOUNGANI:** Your book *The Prize* said that “oil is 10 percent business and 90 percent politics.” Is that still true?

**YERGIN:** That statement is about the oil business in the 1930s, but it underlines the peculiar nature of oil. Politics is still very much a part of the business. Most of the time, oil is just another commodity. But it hasn’t lost its ability to quickly become a unique strategic commodity, because it’s tangled with geopolitics in a way no other commodity is. For the most part, we have a big, complex, and resilient oil supply system—it’s really quite amazing how large it is and how well it works. And it’s increasingly driven by the market. ... But **it’s a business that is still susceptible to politics** ...  
“The unexpected happens.” That’s a fundamental maxim of energy security. **That’s why there has been a “fear premium”** [in the oil price]

Source: Daniel Yergin, interviewed by Prakash Loungani, IMF Survey, June 24, 2002.

# Dan Yergin on the present oil price shock

- “Prices around \$60 a barrel, driven by high demand growth, are fueling the fear of imminent shortage ...”
- “Right now the oil market is tight, even tighter than it was on the eve of the 1973 oil crisis. In this high-risk market, “surprises” ranging from political instability to hurricanes could send oil prices spiking higher. Moreover, the specter of an energy shortage is not limited to oil. ”
- “Yet **this fear is not borne out by the fundamentals of supply**. Our new, field-by-field analysis of production capacity ... leads to a strikingly different conclusion: There will be a large, unprecedented buildup of oil supply in the next few years. Between 2004 and 2010, capacity to produce oil (not actual production) could grow by 16 million barrels a day -- from 85 million barrels per day to 101 million barrels a day -- a 20 percent increase.” (For IMF view on this, see “What Hinders Investment in the Oil Sector?” by Kochhar, Ouliaris and Samiei)
- “ ... **the risks are not the ‘below ground’ ones** of geology or lack of resources. Rather, **they are ‘above ground’ -- political instability, outright conflict ...**”

Source: Daniel Yergin, “It’s Not the End of the Oil Age, Washington Post, July 31, 2005