

Estimating the Energy Security Benefits of Reduced Oil Use and Imports

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Energy/Oil Security and Dependence: International, Urgent, and Long-term

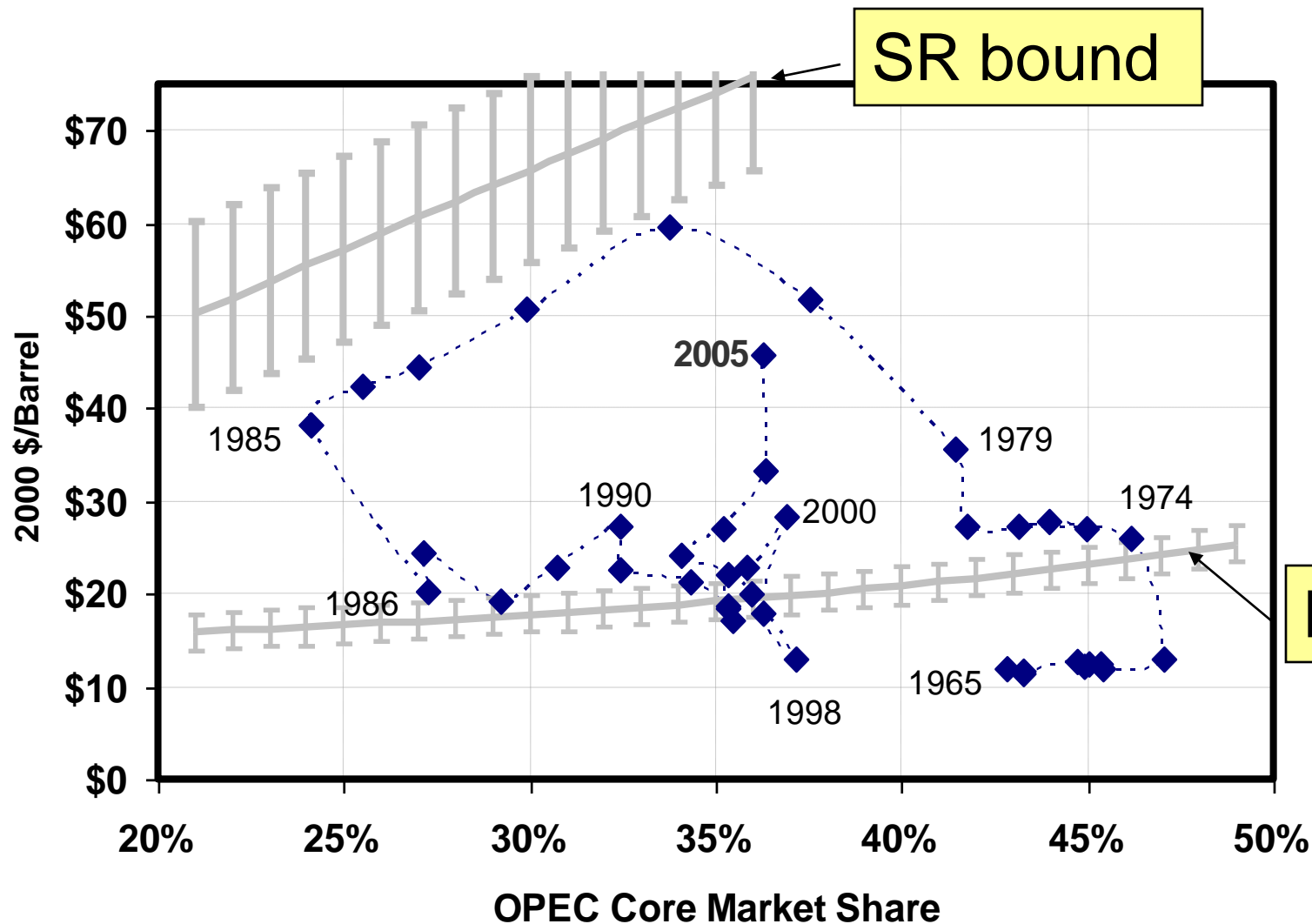
- Like Peter Schwarz on climate change
 - “[ENERGY SECURITY] is **an issue of war and peace**, not of Prius’s versus [SUVs]”.
- Again, we, **need to build consensus on reality and the urgency** of action.
- Problem **involves public good** (security and energy cost) with some global spillover
 - But national/regional winners and losers are clearer

Nature of Oil Security Concerns: Two Key Market Failures

- **Non-competitive oil supply** (sustained cost)
 - Entails opportunity cost of US monopsony pwr
- **Exposure to global oil supply/price shocks where shock protection is public good**
 - Concentrated supply in volatile region
 - Inflexibility of demand, in short run
 - Limited substitutes (inelastic demand)
 - Importance of oil to economy
 - Particularly transportation sector)
 - High oil import levels

OPEC Behavior: Consistent with Clumsy Cartel, Optimal Price Markup is Bounded by Short- and Long-run Elasticities

Cartel Market Share and World Oil Prices: 1965-2005

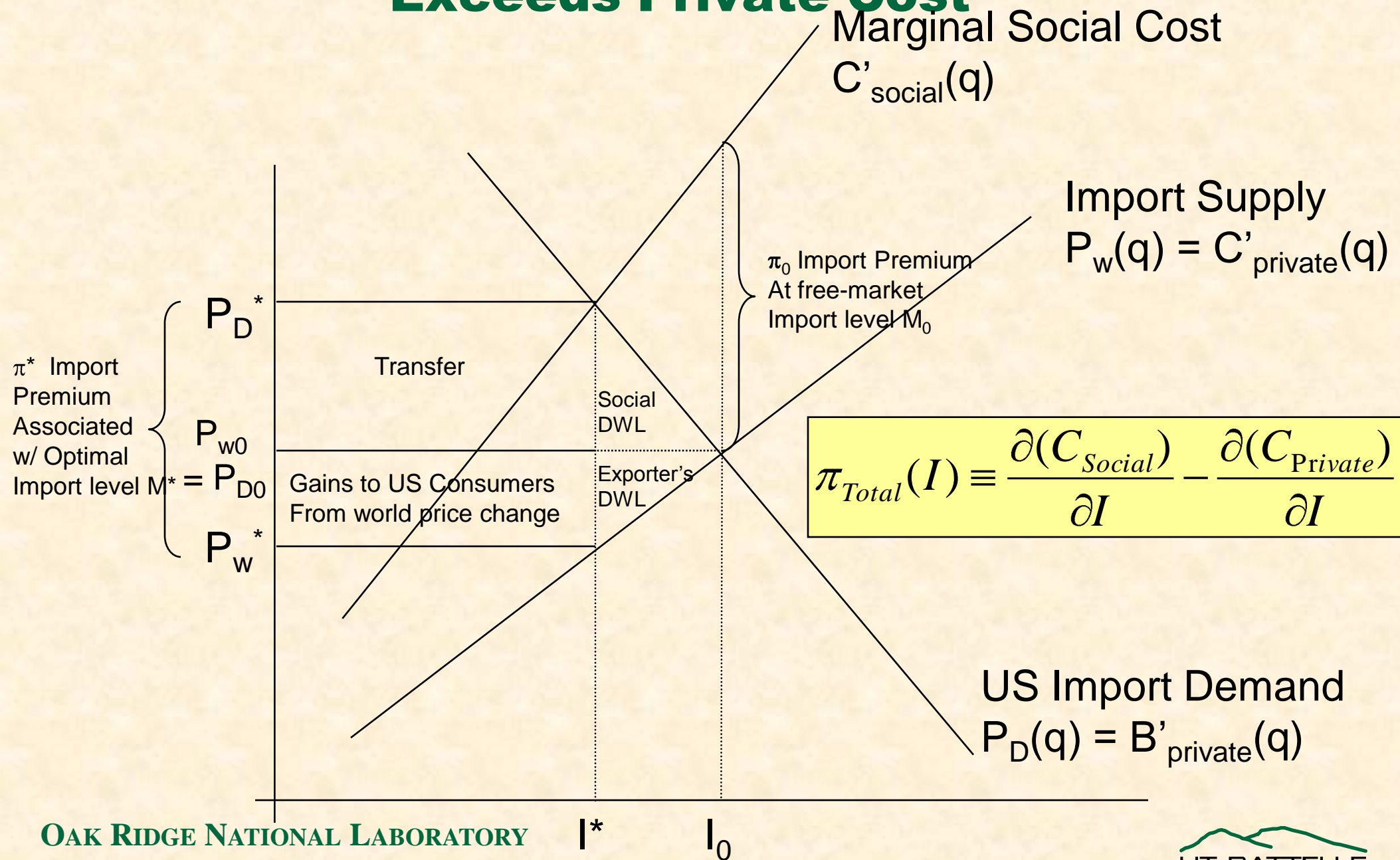


Key Assumptions:
 Linear lagged adj.
 Supply Elasticities:
 L.R. = 0.60
 S.R. = 0.06
 1-lambda = 0.90
 Demand Elasticities β :
 L.R. = -0.70
 S.R. = -0.10
 1-lambda = 0.85
 Competitive price = \$13/bbl.

LR bound

$$P = \frac{C}{1 + \frac{1}{\beta_D} \sigma \left[\frac{\partial q_{row}}{\partial Q_o} + 1 \right]}$$

“Oil Premium” is Amount by Which Full Economic Cost to Society of One More Barrel Exceeds Private Cost



What are the Components of the Oil Security/Dependence Premium?

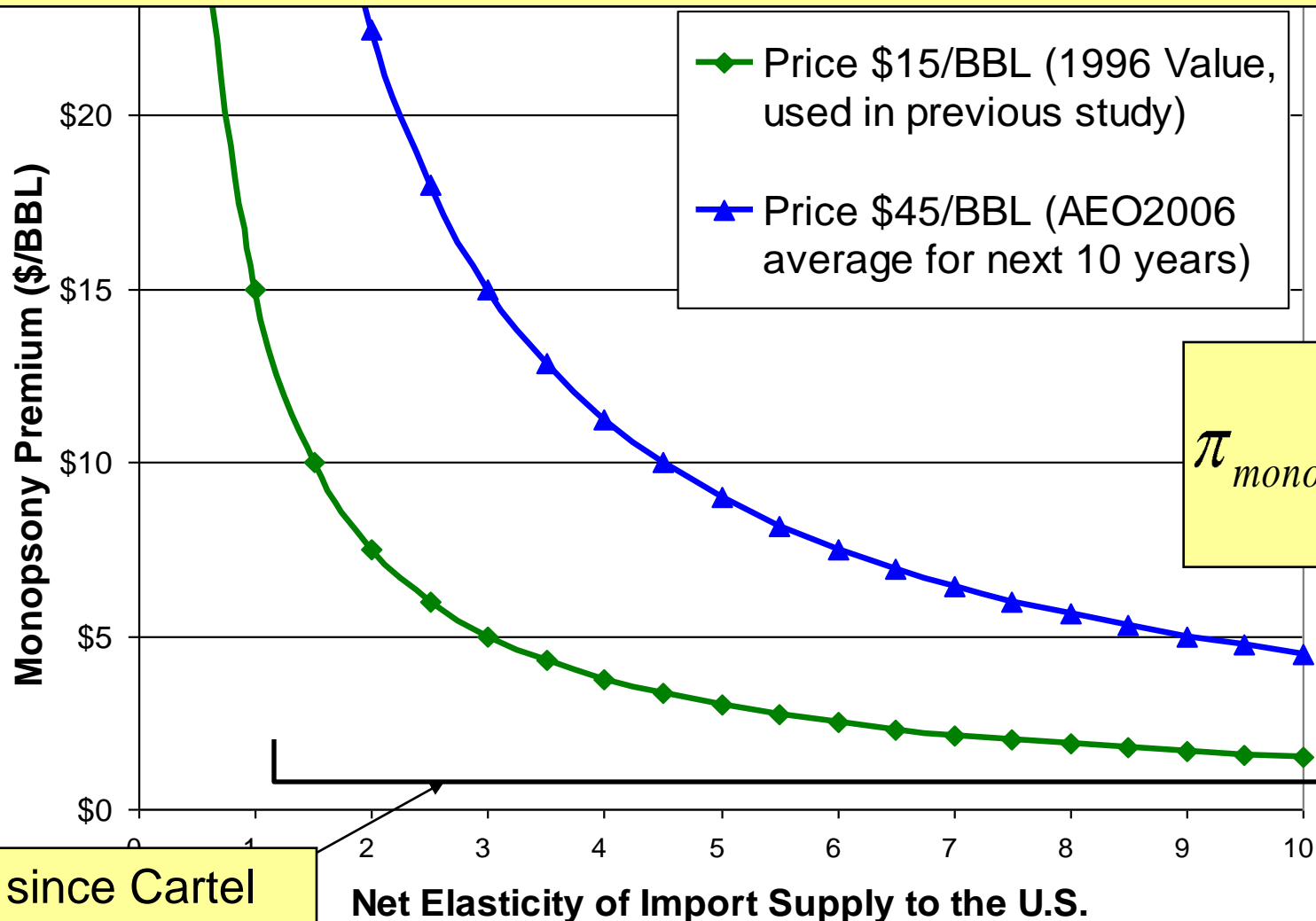
- Two major components to oil security premium:
 - **Monopsony (Demand) Effect**
 - (recoverable) cartel rents
 - Macroeconomic **Disruption/Adjustment Costs**
- Determine *marginal* variation in these components with import level
- Generally excluded but important: military costs, diplomatic/geopolitical costs

Monopsony (Demand) Component

- Like a monopolist, a monopsonist (large consuming country or region), can influence price
 - If U.S., or other large demander of oil reduces imports
 - Then world demand for oil and price would likely drop
 - *The quantity of oil imported times the drop in price is the monopsony effect*
 - Represents a economic benefit to the U.S. *and other oil importing nations, recapturing wealth tranferred*
- **Range of estimates is wide** because of possibility of strategic behavior
 - OPEC options, e.g. can reduce exports in response to demand decrease, keeping price per barrel high
 - Or they can defend market share, and let price decline

The (Long-run) Monopsony Portion of the Premium Depends on Import Supply Responsiveness/Elasticity and Price Level

Long-run Monopsony Premium reflects influence of oil import level on long-run, undisrupted oil price and total import costs.



$$\pi_{monop} = \frac{P_i}{\epsilon_{i-to-US}}$$

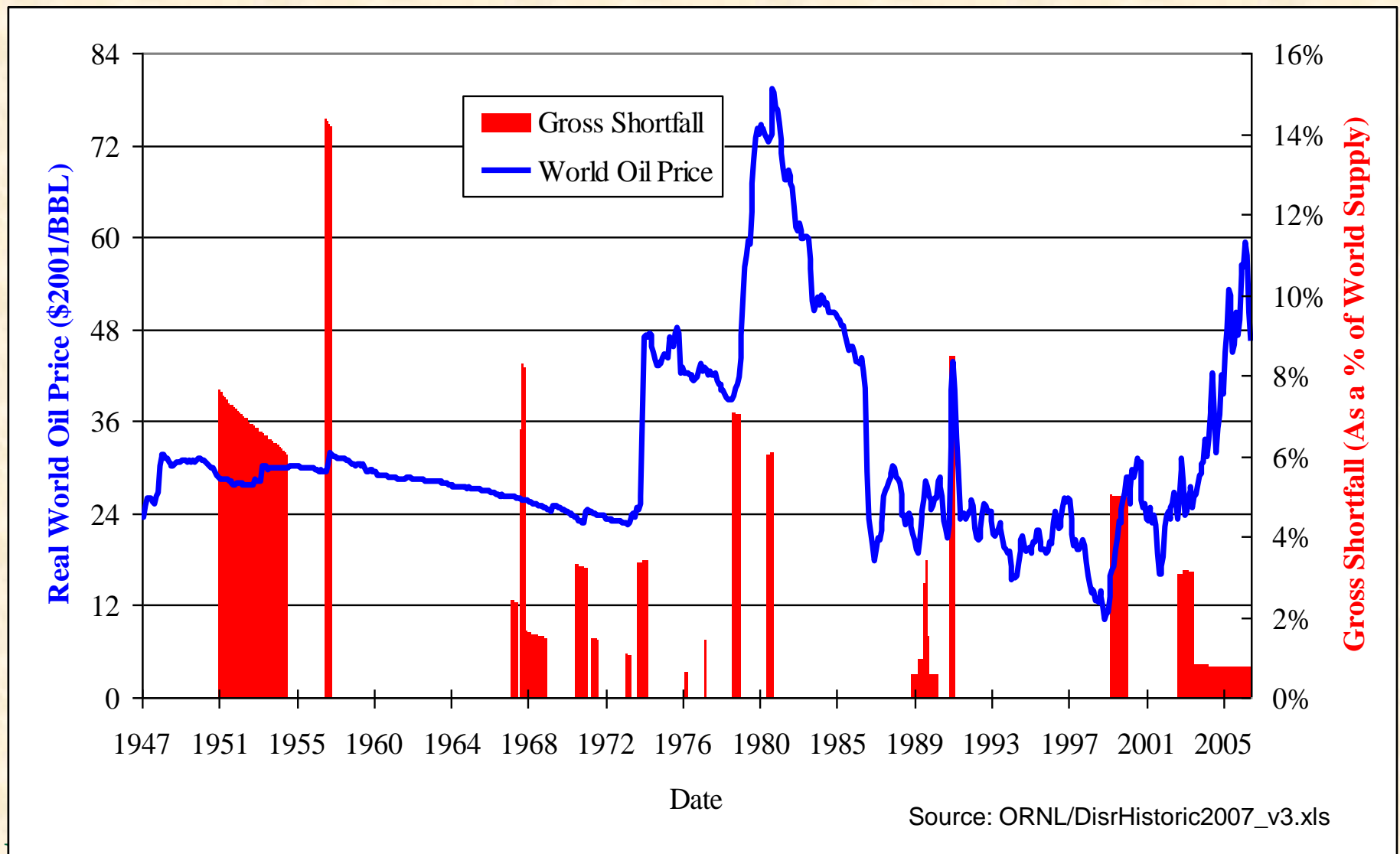
Wide range since Cartel response uncertain

Disruption Component: Key Issues and Driving Factors

- **Disruptions Cause Costs:**
 - GDP Losses due to dislocation +
 - Increased Import costs
- **Disruption Risk**
 - Likelihood of oil shocks
 - Price effect of supply shocks
- **Disruption Consequences**
 - Economic costs of price spikes
 - Degree to which shock costs internalized by US consumers and producers
- **Policy Relevance**
 - How do these costs vary with imports?

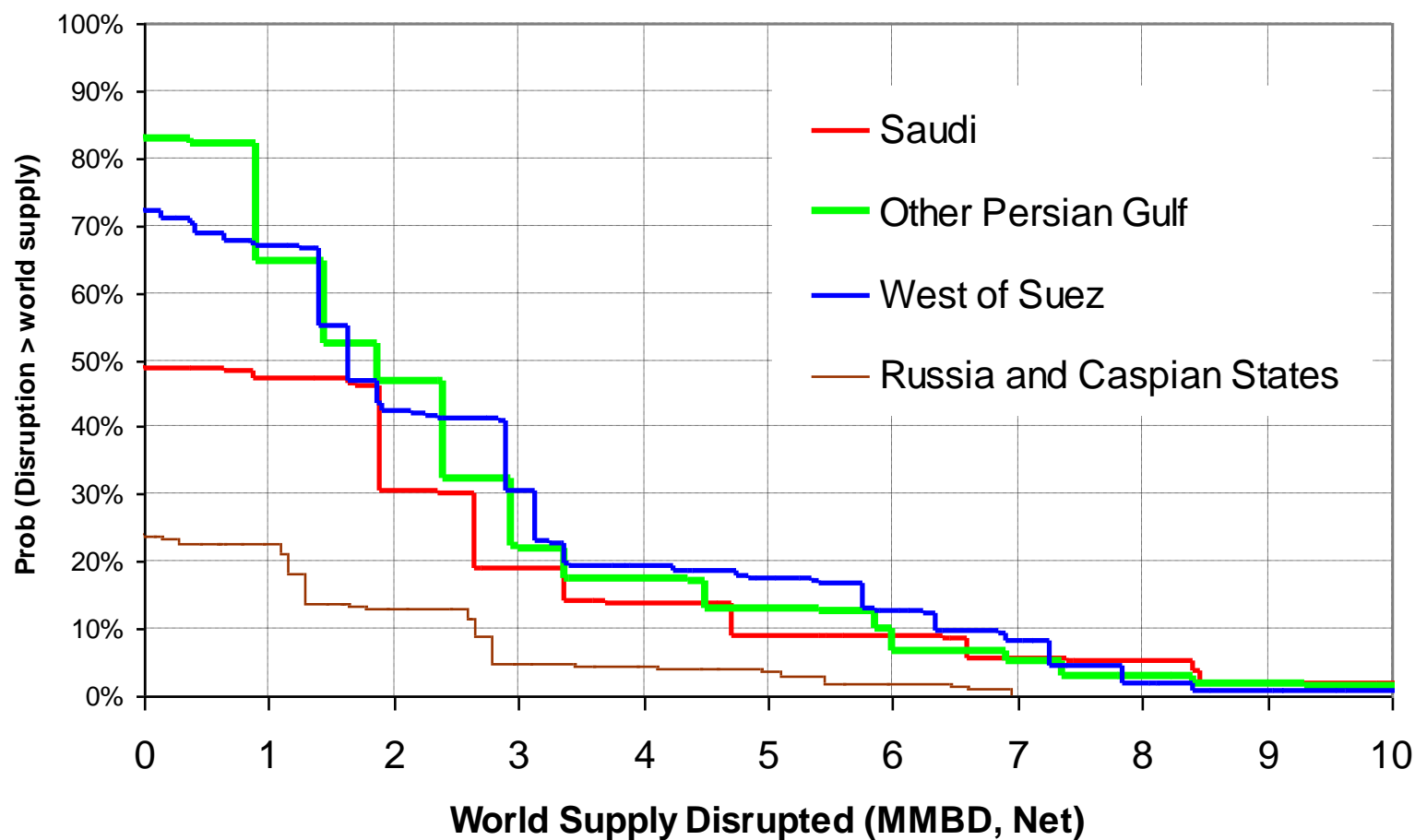
Past Disruptions in Oil Supplies Have Created (Differing) Oil Price Spikes

(disruptions as % of World supply, nominal oil price)

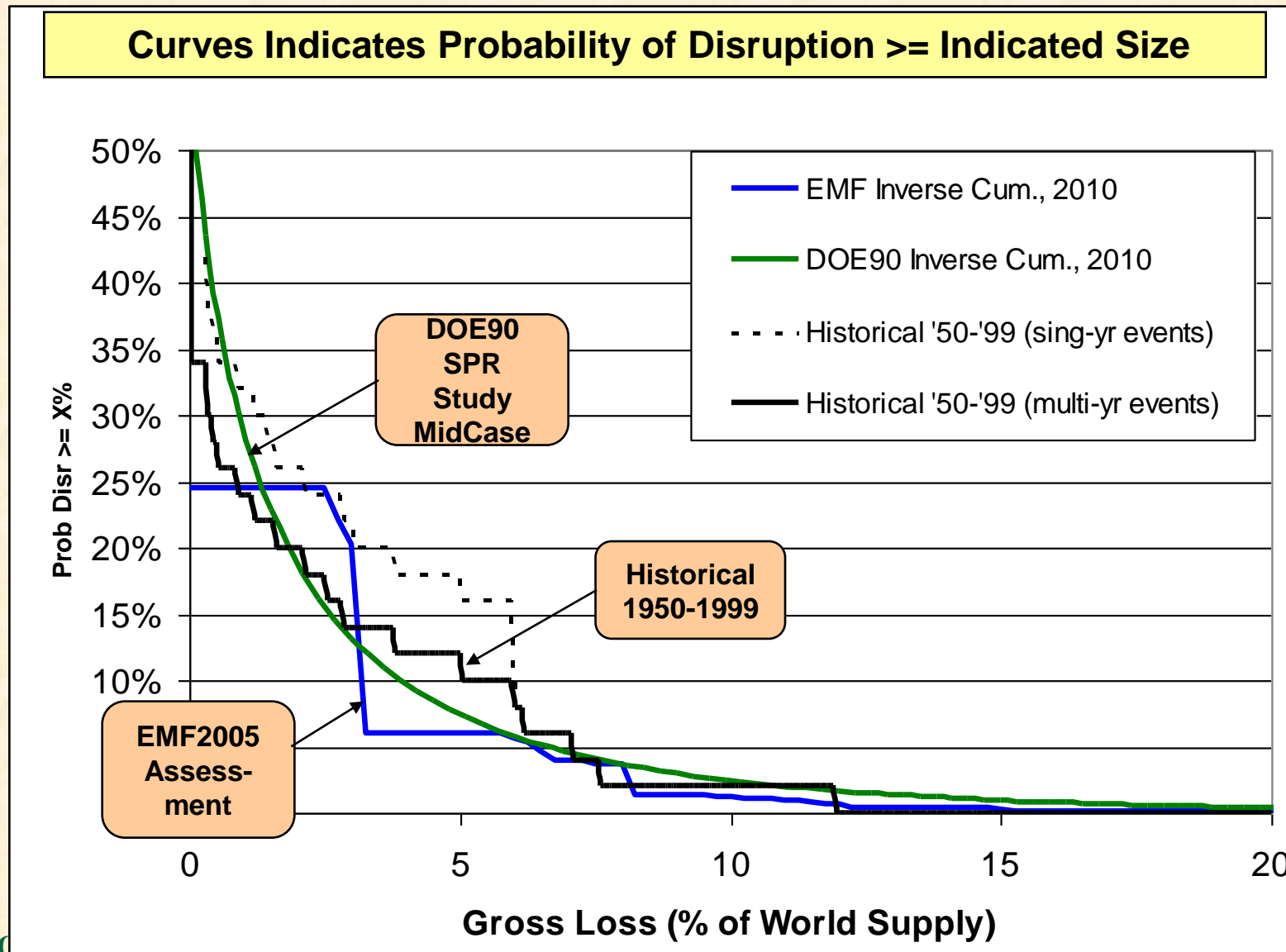


EMF 2005 Study Assessed *Decadal, Net* Disruption Distributions By Region (summarized in this analysis)

Short Duration (1-6 mo) Disruptions

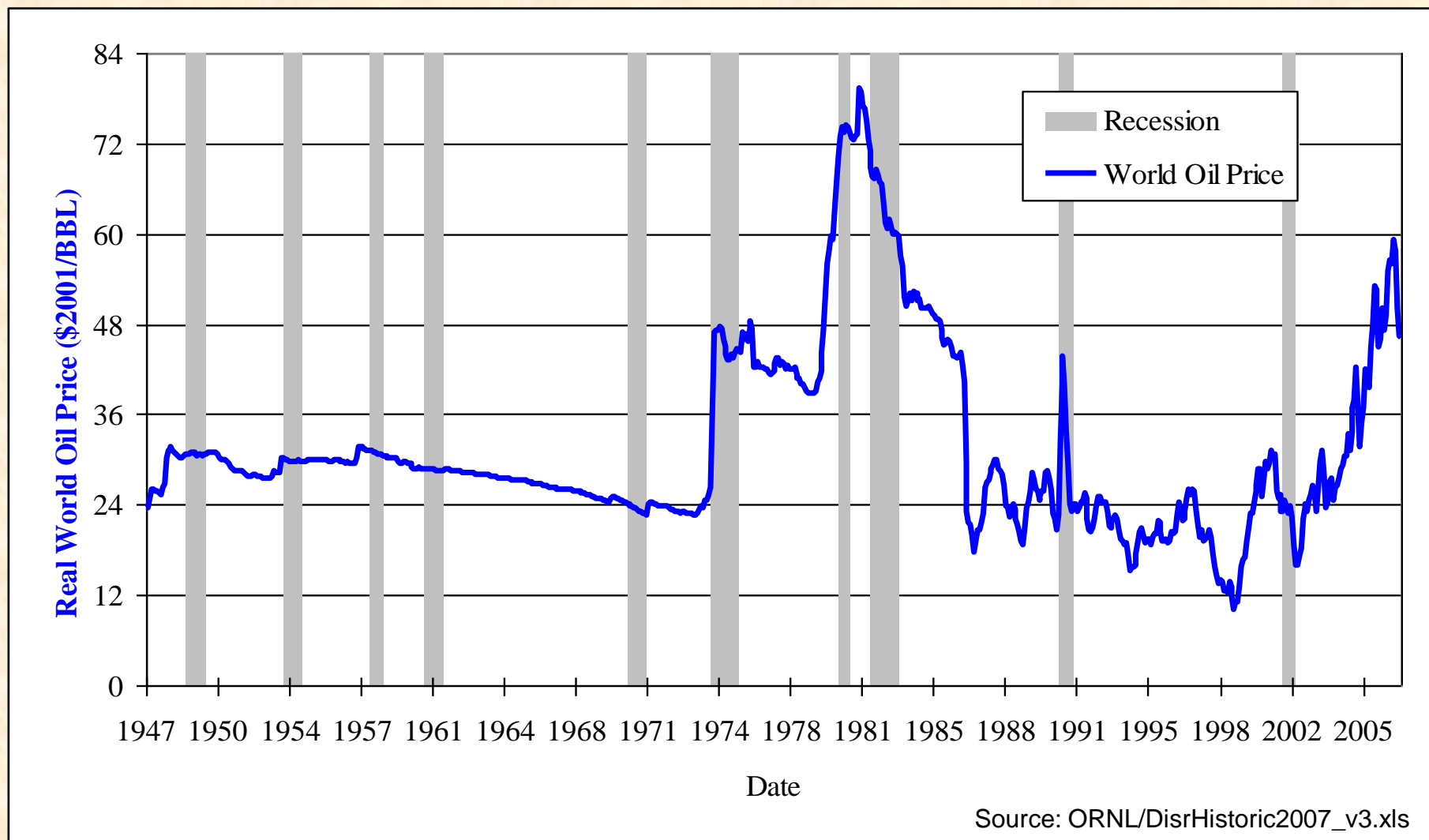


Annual Probability Distributions for Gross Disruptions



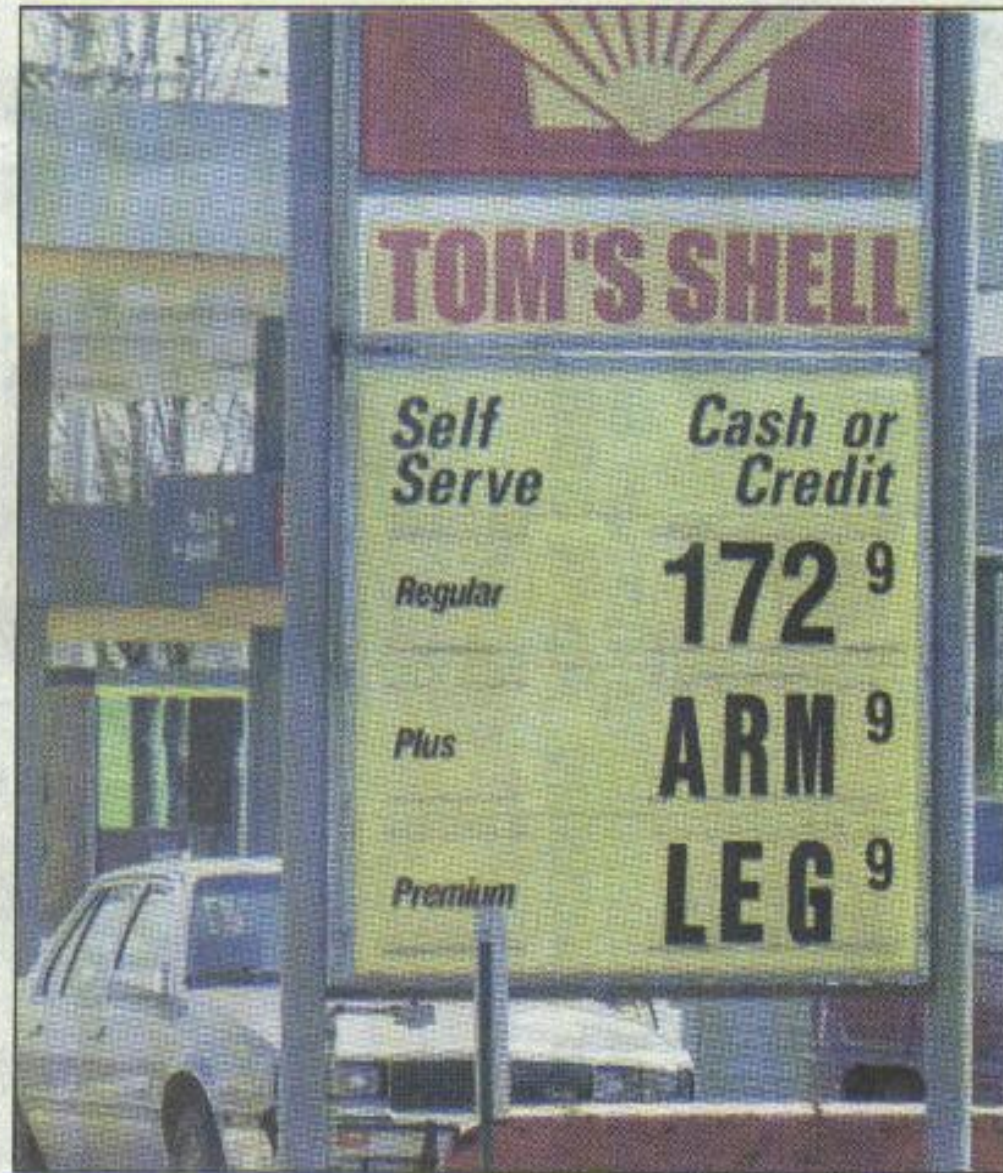
Past Oil Price Spikes Correlated With Periods of Recession. Issue is What this Means for Future Shocks

(shaded areas denote US recessions, real oil price in 2001\$)



Finding: Context of Price Increase Matters For its Perception and Damage (How Quickly We Forget)

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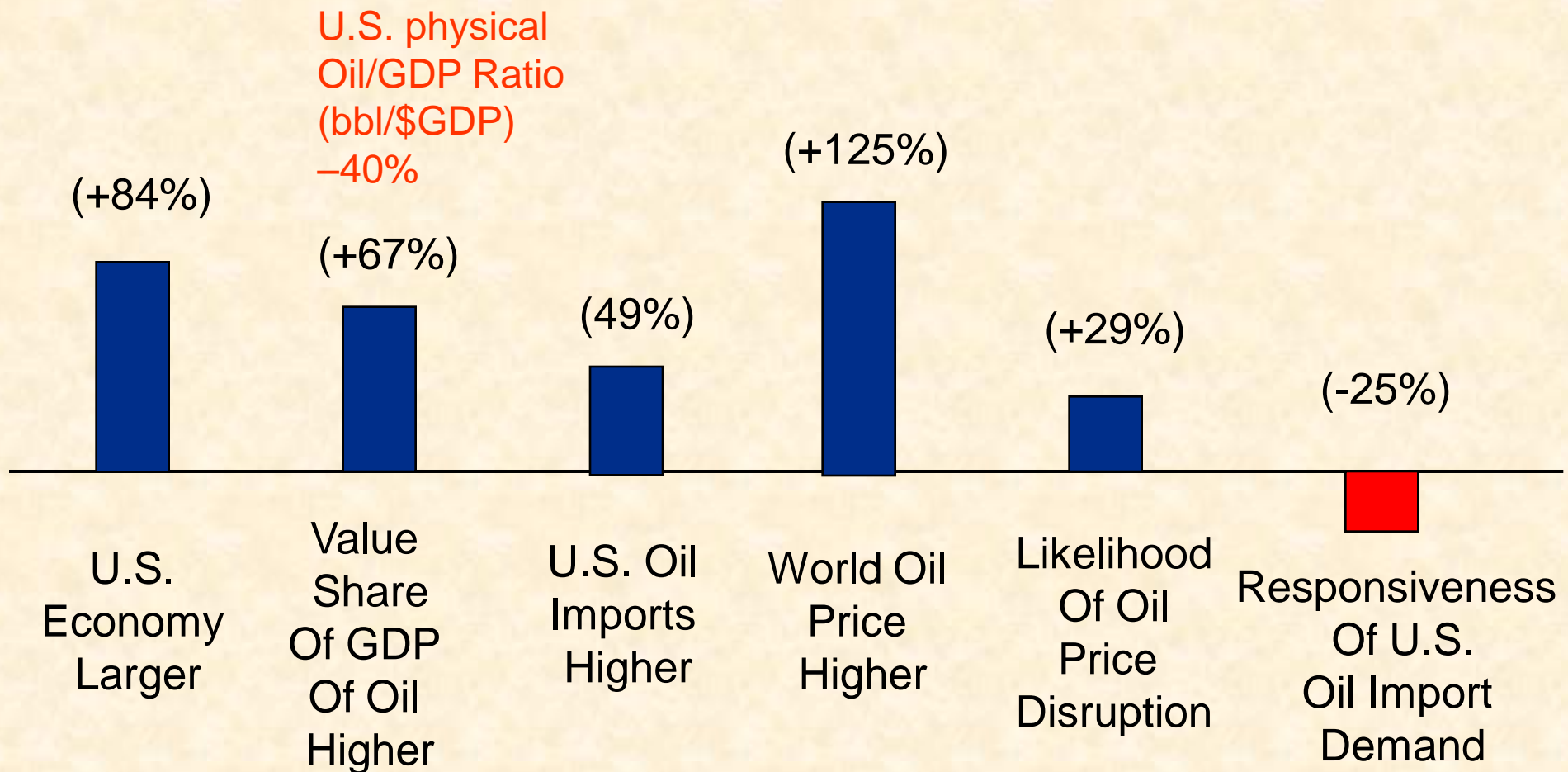


Truth in marketing?

Tom Jones, owner of Tom's Shell, in Madison, Wis., posted a catchy gas price sign. The sign is a cheeky gas price idiom. Jones says customers want to make the

**Fuel Price Sign,
April 26, 2001**

Why has the Oil Security Premium Increased Over Last Decade? (Change in Indicators for U.S.)



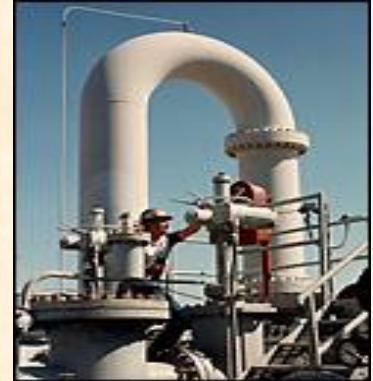
Approach Accounts for Factors that Mitigate Disruption Costs

- **Strategic Petroleum Reserve (SPR)**

- Analysis takes into account possible SPR release, providing surge supply, dampening price increases
- Considers two SPR management strategies
 - Idealized SPR use, prompt and full offset of all major supply shocks, to the extent of SPR capabilities
 - A more cautionary SPR strategy in which SPR is applied to shocks in half of the events

- **Futures Market and Other Precautionary Behavior**

- At best, futures market only partially internalizes the costs of disruptions



Comparison: 1996 NHTSA-Adopted, 2006 ORNL Updated

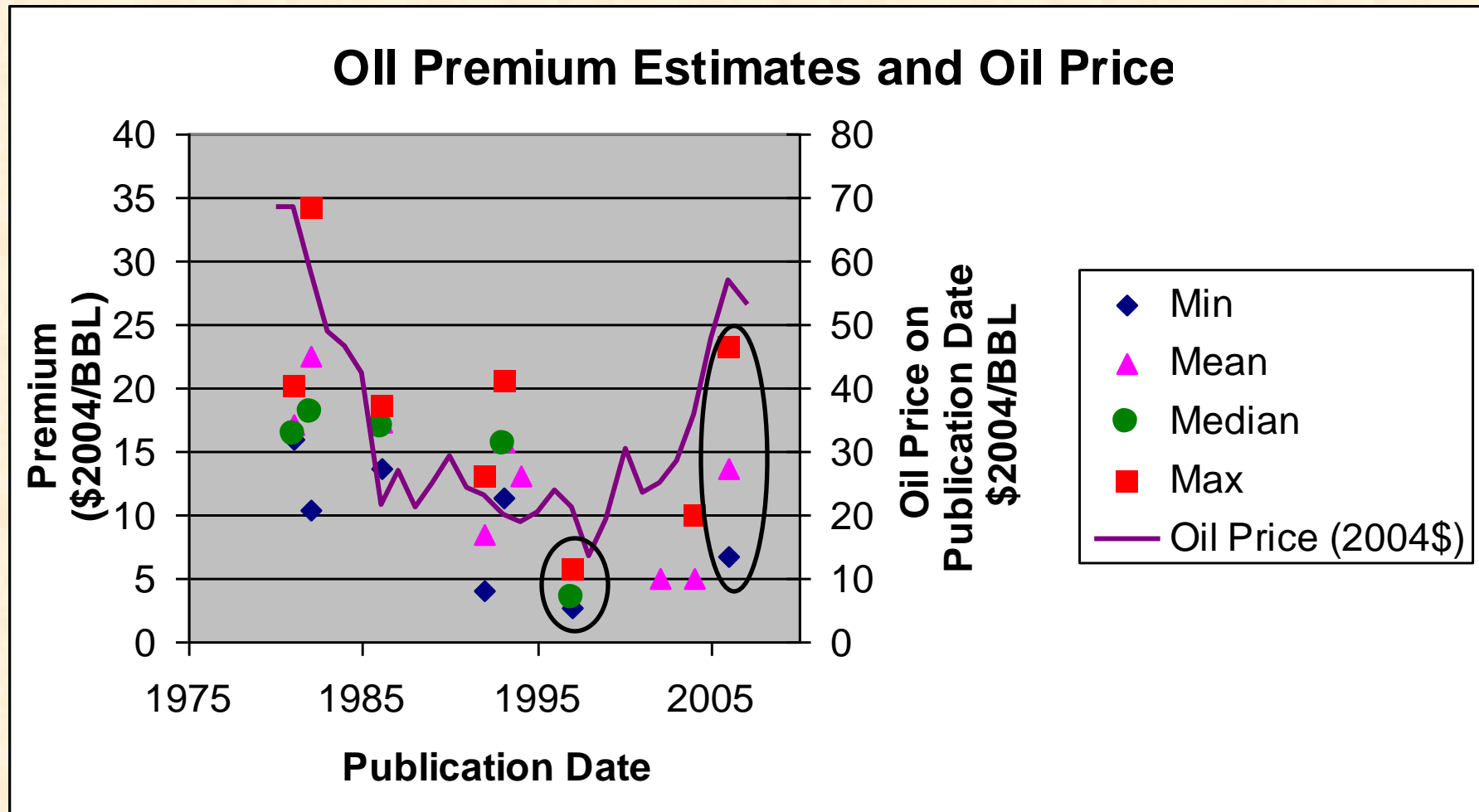
Effect / Study	NHTSA-Adopted* (\$/barrel)	ORNL Updated* (2004\$/barrel)
Monopsony	\$2.57 (\$1.54 - \$3.59)	\$8.90 (\$2.91 - \$18.40)
Macroeconomic Disruption/Adjustment Costs	\$1.03 (\$1.03 - \$2.05)	\$4.70 (\$2.18 - \$7.81)
Total Mid-point	\$3.60 (2.57 - \$5.64)	\$13.60 (\$6.71 - \$23.25)

•Results in 2004\$. 2006 column reports mean and range including 90% of results

Summary and Omissions from Premium Estimate

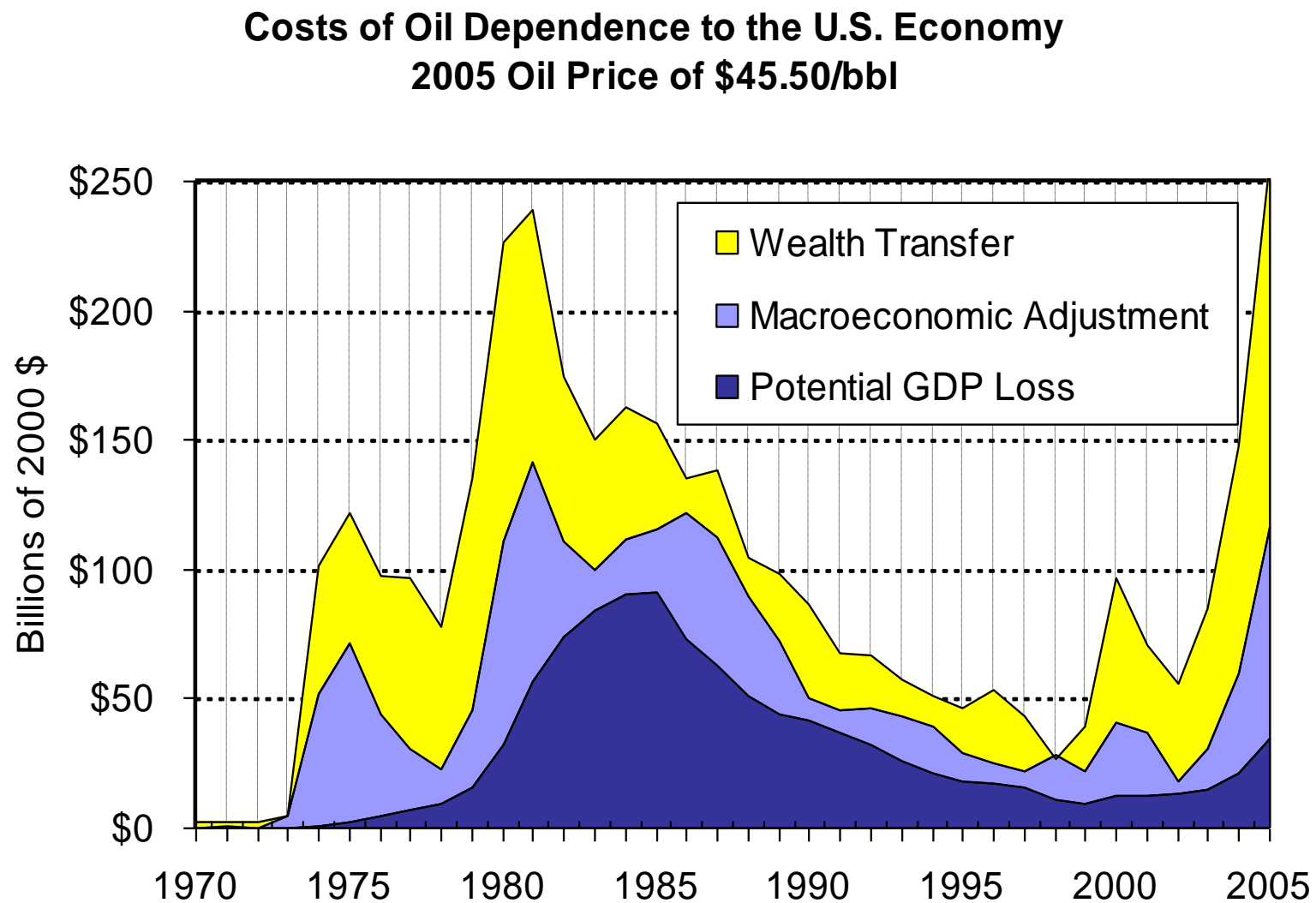
- Analysis focuses on quantifiable, *expected marginal* economic benefits
- Furthermore, following factors ***Omitted***
 - ***risk reduction*** (insurance value) or other national security considerations
 - Possible ***changes in SR/LR demand flexibility*** from policy (fuel substitution, new technology?)
 - Possible ***deterrence*** effects of energy security measures
 - Foreign policy, military and ***national security considerations***
 - ***Spillover benefits to allies*** (est. OECD premium ~3X higher)

New estimates higher than 10 years ago, but consistent with past estimates under similar market conditions



Interpretation: we have passed through a brief period of comparatively low energy security and dependence costs

Estimated Total Economic costs of Oil dependence have been very large.



Energy Security and Climate Change – Synergies and Tradeoffs

- Security concerns
 - Provide **added motive** for early action on energy/climate
 - Are a **Shared interest** for *most* major energy-using nations
 - **Imply winners and losers** but is *NOT* a global-zero-sum game
 - **Can “Distort” fuel choice** from climate-efficient mix

Energy Security and Climate Change – Getting Best Fuel/Tech Mix

- **Climate concerns call for**
 - **Efficiency/conservation**
 - (fuel economy, HEVs, VMT reduction)
 - **Substitution to low-C fuels (low-C biofuels, H2, CNG)**
 - **C-capture & Sequestration**
- **Security/Dependence costs call for**
 - **Efficiency/conservation**
 - **Substitution to**
 - **domestic vs imported fuels**
 - **competitively-supplied vs cartelized fuels**
 - **any domestic biofuels, H2, *not* imported gas, unconventional oils**
 - **Fuel demand and supply technologies which are flexible (price elastic) in SR and LR**
 - **Dual/flex fuel vehicles, P-HEVs**
 - **Flexible bio-refineries?**
 - **Fuels which are storable at low cost (buffer stocks)**

Energy Security analysts in the trenches: “Daddy’s going off to defeat terrorism [and prevent war] in subtler, economic ways.”



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“Daddy’s going off to defeat terrorism in subtler, economic ways.”

New Yorker,
17 Mar, 2003



**Thank you very much!
For More Information:**

**See our website on
“Energy Security, Oil Shocks and the
Strategic Petroleum Reserve (SPR)”:**

www.oilsecurity.org

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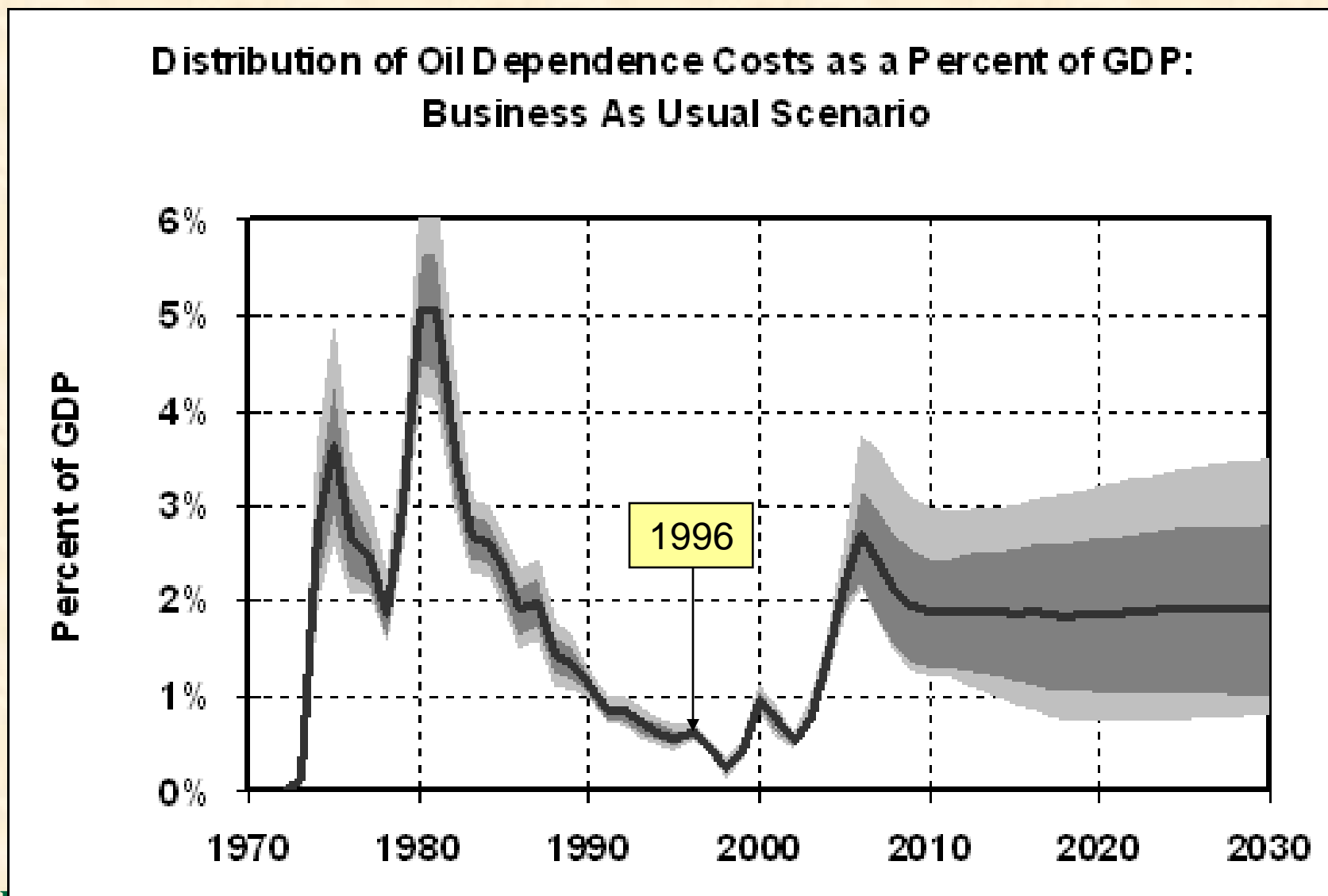
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Supplemental Slides

Results of *Oil Security Metrics Model* Also Highlight Late-1990s as Period of Low Security/Dependence Costs



Recent Estimates of the Price Elasticity of Oil Demand Support Low Short-run Elasticity (-0.02 to -0.06) Slow Adjustment Rate (0.8 – 0.9)

Author	Short-Run	Long-Run	Adjustment Rate	Region
Kalymon (1975)	--	-0.5	--	various
Brown and Philips (1980)	-0.08	--	--	
Dahl (1993)	-0.05 to -0.09	-0.16 to -0.23	0.6 to 0.7	various
Peseran, et al. (1998)	-0.03	-0.48	0.9	
Gately & Huntington (2002)	-0.05	-0.59 to -0.64	0.9	OECD
Gately & Huntington (2002)	-0.03	-0.16 to -0.27	0.8 to 0.9	non-OECD
Cooper (2003)	0.0 to -0.11	0.0 to -0.53	0.8	23 countries
Cooper (2003)	-0.024 to -0.069	-0.18 to -0.45	0.8 to 0.9	G-7
Hunt & Ninomiya (2003)	--	-0.08 to -0.12	--	Japan, UK

Source: Atkins, Frank J. and S. M. Tayyebi Jazayeri 2004. "A Literature Review of Demand Studies in World Oil Markets," University of Calgary, Department of Economics, Discussion Paper 2004-07, April.

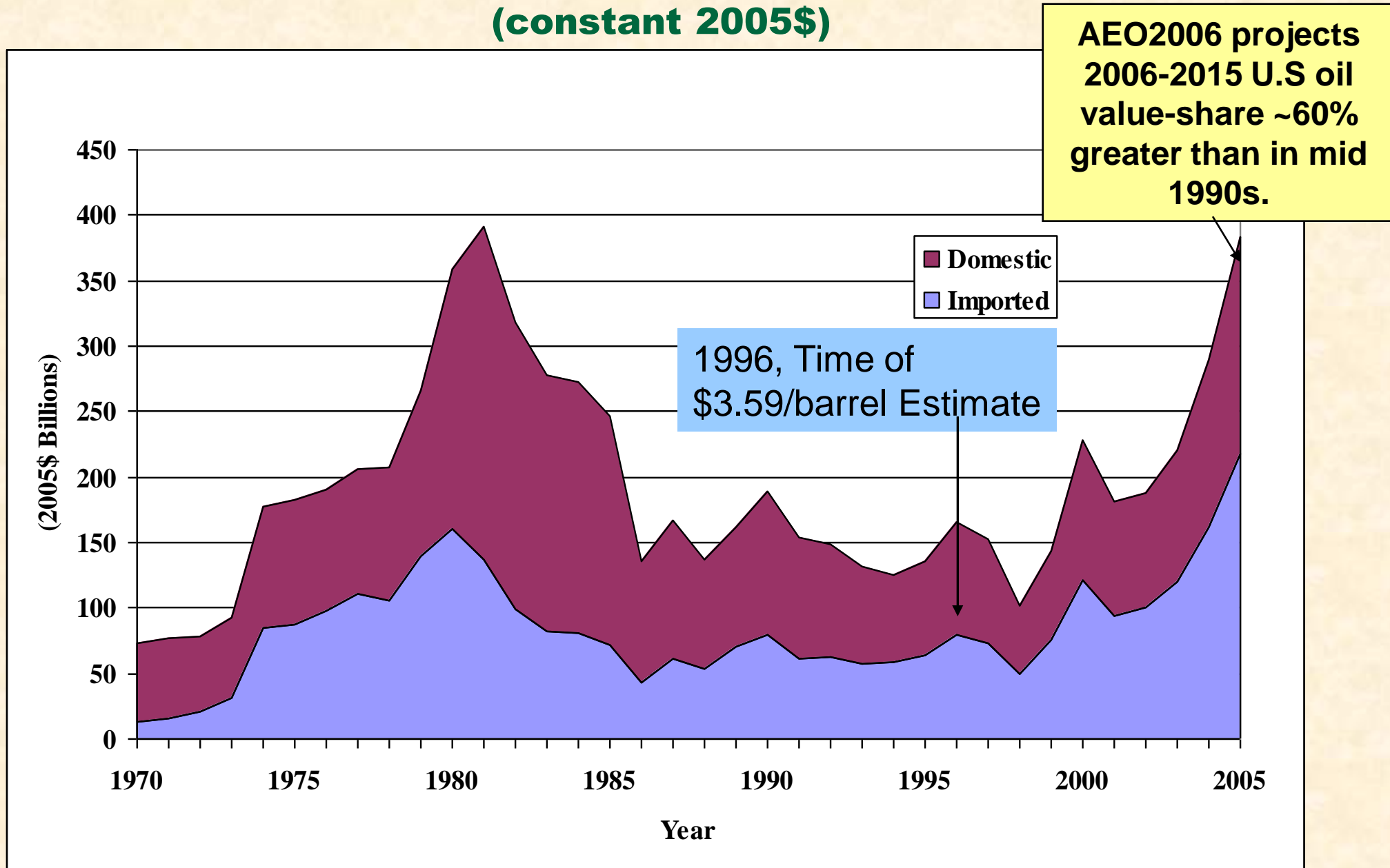
Issues and Factors to consider in Oil Import Premium – Disruption Component

- Portion of direct disruption costs anticipated and internalized (consider 25%-100%)
- Marginal effect of import reduction on disruption sizes (due to induced slack capacity or reduced traded volumes)
 - Assume 0% to 31% barrel-for-barrel
- Marginal effect of import reduction on disruption likelihood
 - **Assume zero** (despite Suranovic 1994, Greene 1991, Wirl 1985, Fromholzer 1981)

Range of Results Constructed, Reflecting Uncertainty on Key Factors

- All estimates for AEO2006 Base projection
 - (Otherwise, range of estimates *much* wider and higher)
- OPEC supply response elas varies from 0 to 5, with mode of 1.0
- Long-run supply and demand elasticity same as 1997 study values
- GDP Loss elasticity ranges from -0.01 to – 0.08
- Short-run elasticity of US import demand ranges from -0.087 to -0.163
- Disruption reduction w/ imports varies from 0% to 30%
- Parameter distributions taken as either uniform or triangular

Real US Expenditures on Crude Oil Returning to Historical Highs (constant 2005\$)



Oil Wealth Transfer Often Supports Regimes Which are Unfriendly to U.S. Interests: Venezuela, Russia, Iran



Admiral Vladimir Masorin, the commander of the Russian navy, that Moscow intends to re-establish a permanent naval presence in the Mediterranean. "Declaring its

adherence to pragmatism, **Moscow is in fact increasingly adopting anti-Americanism as its guiding political idea."**

Pavel Baev, Eurasia Daily Monitor, Aug 2007

"Hugo Chavez to make himself president for life. ... spent millions of dollars in oil revenue in enlarging his power base" McDermott, UK Telegraph, 16

Aug 2007

Iran, Saudi Arabia

Saudi Arabia: U.S. Ties At Odds With Expanding Regional Role?”

...As the custodian of Mecca and Medina, the Saudi royal family -- the House of Saud -- sees itself as the leader of the Sunni Muslim world. It has spent a considerable part of its oil wealth bankrolling Muslim causes worldwide.

Such efforts also center on promoting its ultraconservative official Wahabbi faith. In the 1980s, Saudi Arabia matched U.S. assistance to anti-Soviet Afghan mujahedin guerrillas and private donations from Saudis are believed to comprise the bulk of financial support for Islamist militancy worldwide.

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- “Separately, Russia has lobbied successfully to set up an energy cartel which it hopes will rival Opec. At the Shanghai Co-operation Organisation Summit in Bishkek, Kyrgyzstan, leaders of Central Asian countries, China and Russia last week agreed to create a 'unified energy market' in the region that is home to some of the biggest producers of oil and gas. Iran's President Mahmoud Ahmadinejad made clear at the conference that Tehran was prepared to join the club, which would see the world's first, second and fourth largest gas producers form a powerful bloc, potentially ranged against Western interests.” Saeed Shah and Alex Brett, London Observer, Sunday August 19, 2007




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“Worried about Putin's Russia?”

“Russia is once again a proud and assertive nation,

increasingly recognizable by its actions to historians of its czarist and Communist predecessors. Many will say that

its recovery ... rests almost totally upon the high price of oil and gas....”

International Herald Tribune, Aug 20, 2007



8/17/07: “Russia Resumes Its Long-Range Air Patrols”



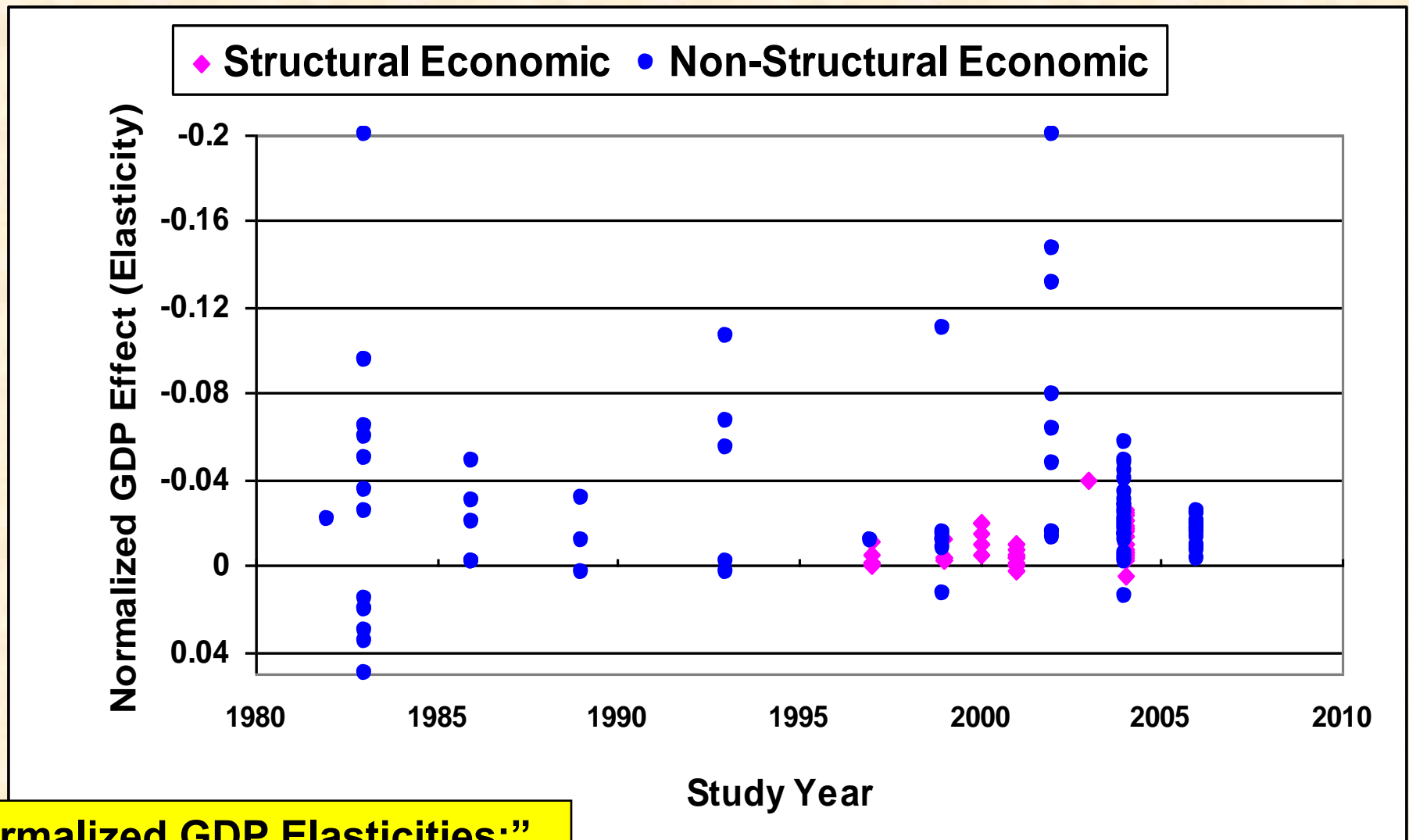
“The Russian military -- benefiting from an influx of oil income in the country -- has grown **increasingly assertive** this summer.” (Wash Post 8/17/07)

Estimating *Total* Cost of Oil Security/Dependence

- Find total cost since 1970 was \$Trillions
 - Greene & Leiby 1993 put costs from 1970-1993 at \$4 Trillion
 - Greene & Tishchishyna 2000 est 3.4 T
 - Greene & Ahmad 2005 est \$3.7 T (+/- 1 T) from 1970-2003
 - Future costs higher if oil prices high
- Can estimate Value of increased flexibility
 - Savings of \$0.5 trillion to U.S. economy (1993-2010) if the price elasticities of oil S & D could be doubled by means of advanced technology (Greene, Leiby, Jones 1998)

Published Estimates of U.S. GDP Elasticity Guide Judgment

(NORMALIZED to Effect/yr, Scatter Plot Over Time)



“Normalized GDP Elasticities:”
(GDP change/yr for a price doubling)

Magnitude of GDP Losses From Shocks, Possible Declining Effect

- Current *empirical* estimates of the magnitude of the U.S. oil price-GDP elasticity around -5.5%
 - Cumulative, multi-year loss as % of 1-years GDP
 - Large Macro-model-based estimates smaller by ~1/2: 0.0% to -3.6%, mean -1.1%
- Is effect declining w/ oil/GDP share?
 - Expect yes, but Uncertain. Large macro-Models say yes.
 - Guerrieri/FRB: “oil price/GDP multiplier is basically a linear function of oil share”
 - Huntington (2005) find influence of oil share ambiguous
 - Brown et al (2005): find influence of energy/GDP share lost given 3-yr NOPI