

The Energy Revolution

HOW IT IS REDRAWING THE MAP OF THE GLOBAL ECONOMY

PREPARED FOR

Iseo Summer School

PREPARED BY

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PRESENTED

Iseo
20 June 2013

Agenda

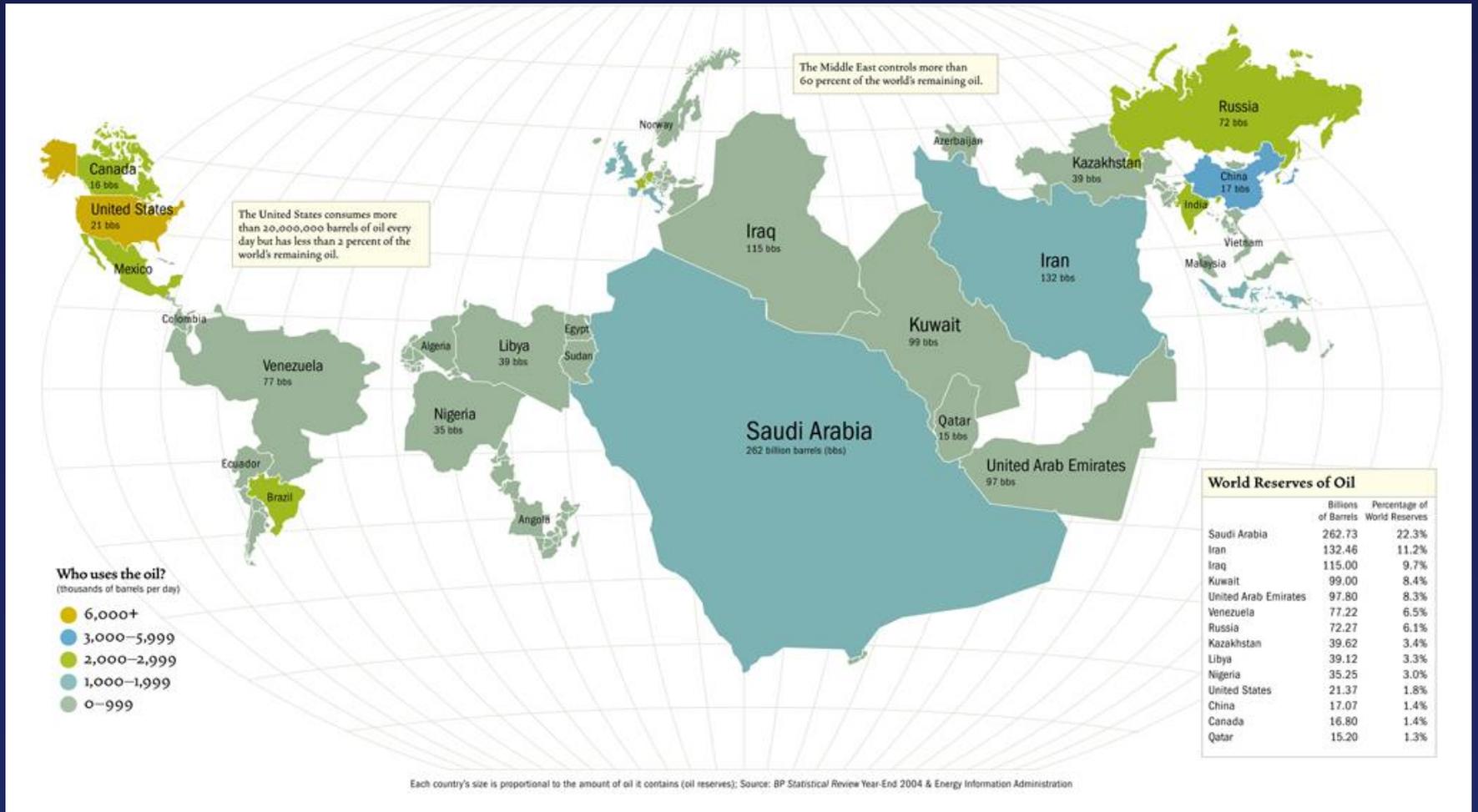
- I. Goals for Class
- II. A Fact-Based Overview of Oil
- III. The Natural Resource Curse
- IV. What (or Who?) Determines the Price of Oil?
- V. How Do Oil Prices Affect a Macroeconomy?
- VI. Policy Options to Protect an Economy from Oil Price Swings
- VII. Class Discussion

I. Goals for Class

- Look at new trends in global oil markets
- Review the “natural resource curse” debate
- Develop an understanding of the microeconomic drivers of oil prices, including optimal behavior for a “partial monopolist”
- Develop an understanding of the main channels through which oil price movements affect a modern macro economy
- Discuss policy options to protect an economy from oil price swings

II. Fact-Based Overview of Oil

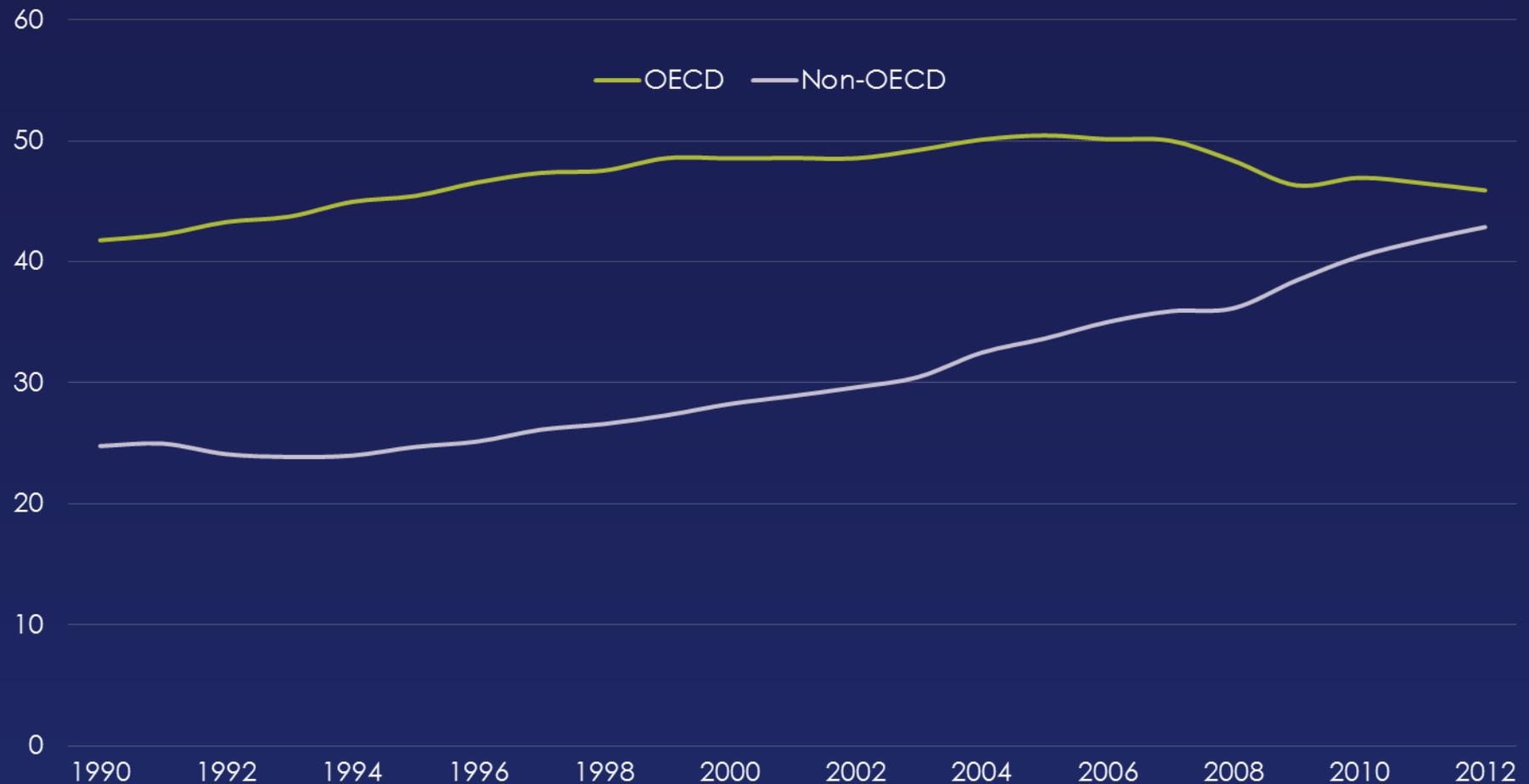
Where is oil found? The world's largest conventional oil reserves are heavily concentrated in the Middle East.



Where is demand for oil growing the fastest?

Where is demand for oil growing the fastest? Non-OECD countries are increasing their consumption, while OECD countries are reducing consumption.

Total Petroleum Consumption by Country/Group
Million Barrels per Day



In particular, oil consumption has doubled in China in the past decade and risen notably in countries like India and Brazil.

Total Petroleum Consumption, Select Countries
Million Barrels per Day

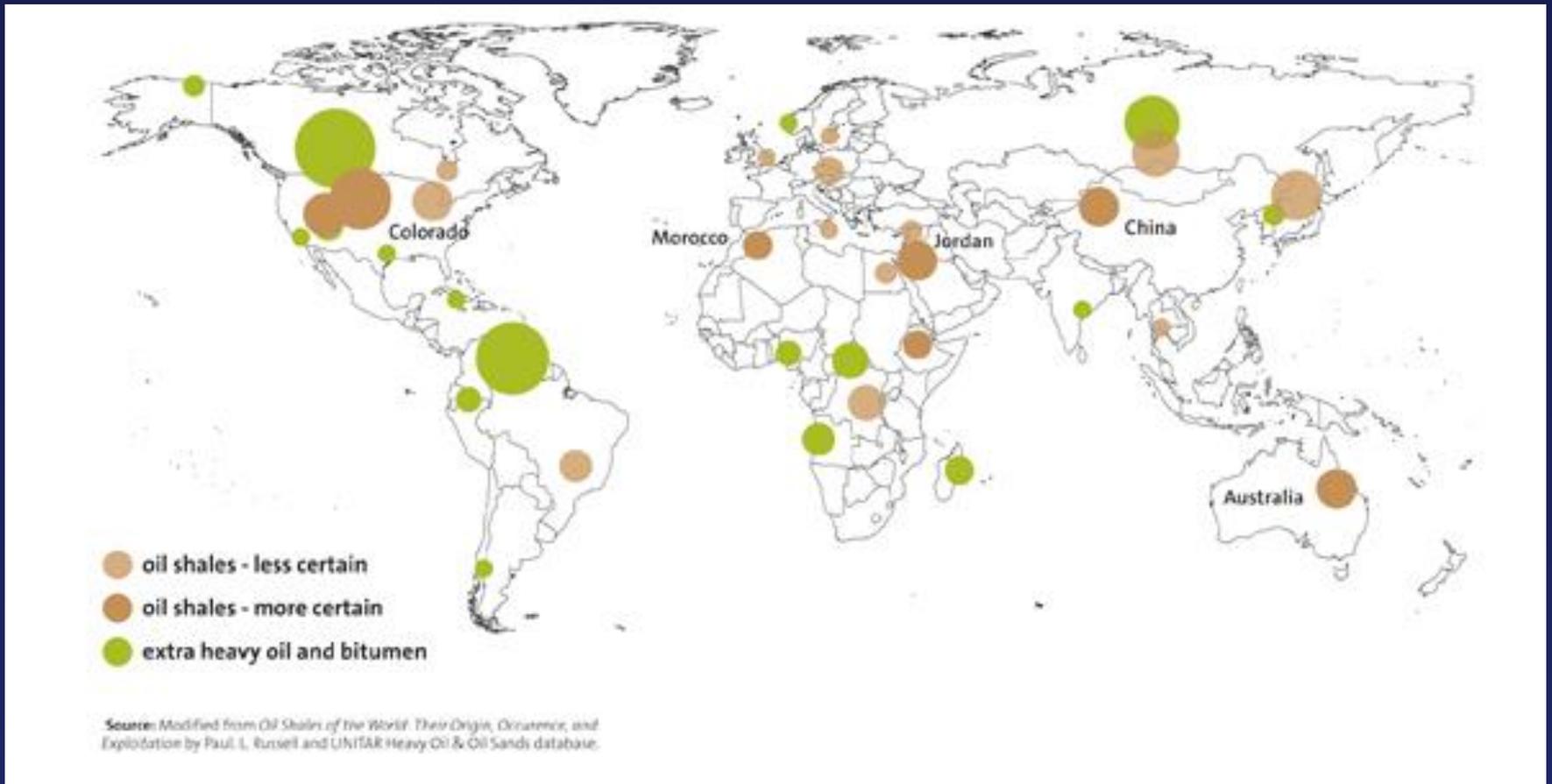


Source: EIA International Energy Statistics.

Rapidly advancing technology has led to rapid increases in production of oil from unconventional sources.

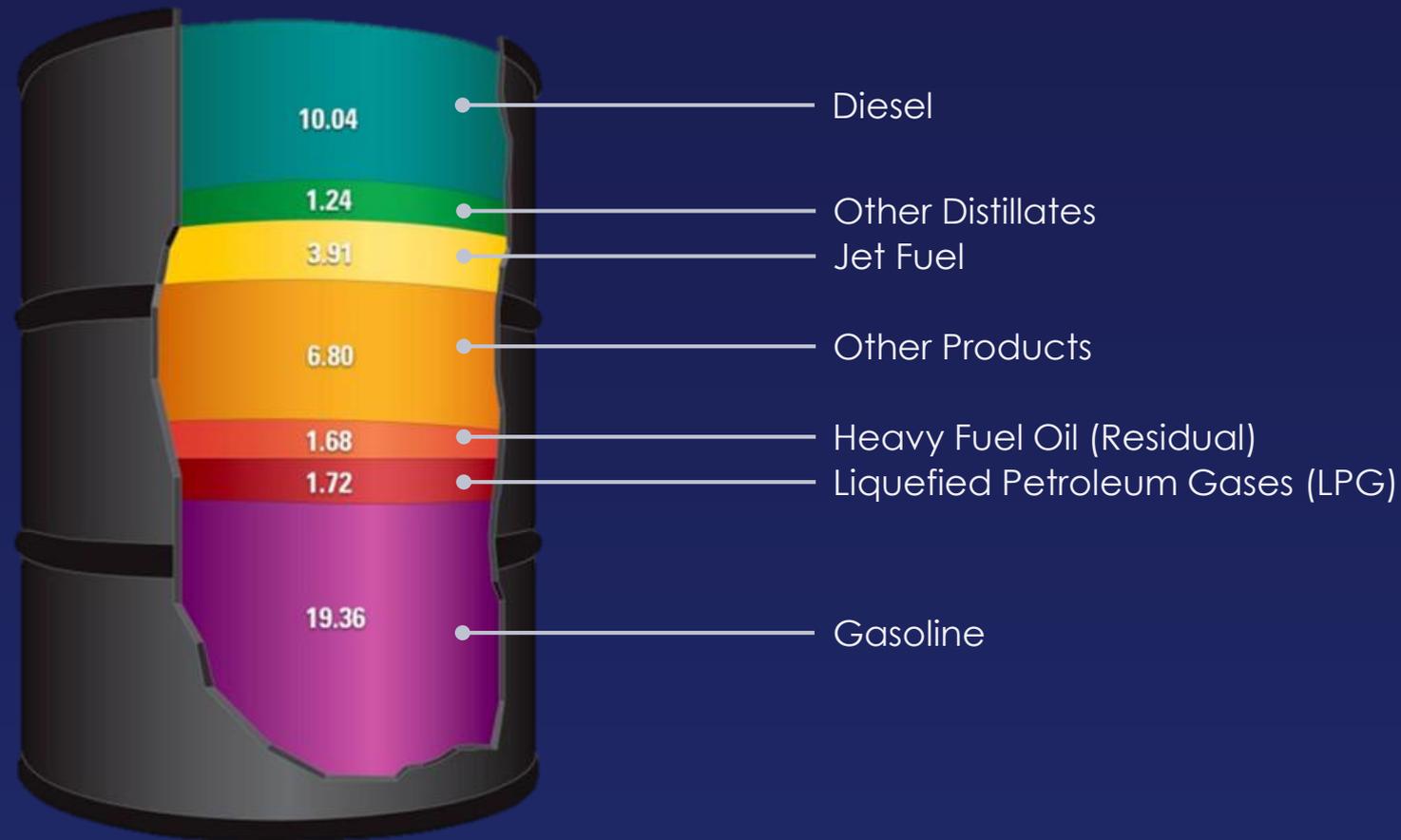
- Conventional oil
 - Petroleum found in liquid form that can be pumped without further processing or dilution
 - Onshore and offshore
- Unconventional oil
 - More difficult to extract and requires unconventional technologies. Cannot be extracted without being heated or diluted
 - Onshore and offshore
 - Types:
 - Oil sands (tar sands) – Sediments composed of sand, clay minerals, water, and bitumen (ex: Canada)
 - Oil shale – Fine-grained sedimentary rocks that contain large amounts of a solid organic matter (kerogen) (ex: Russia)
 - Shale oil (tight oil) – Oil produced from shale reservoirs (ex: North Dakota)

Where are the unconventional reserves? The Americas have significant unconventional oil reserves. Water needed for fracking.



What comes out of a barrel of oil? Cracking a barrel of oil produces...

Products Made from a Barrel of Crude Oil
Gallons, 2009

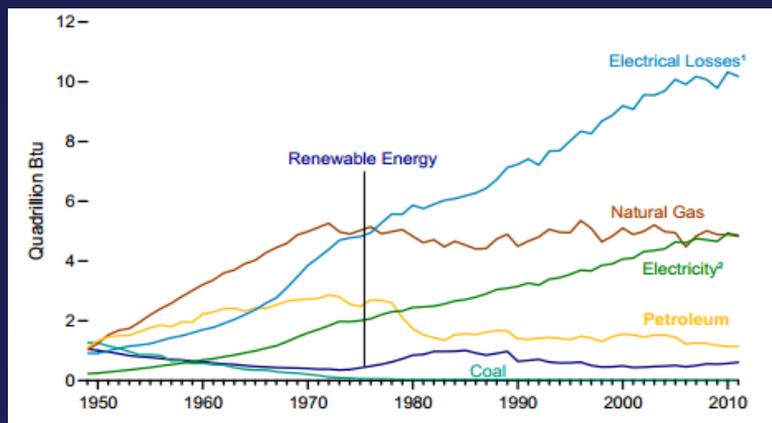


What sectors use petroleum?

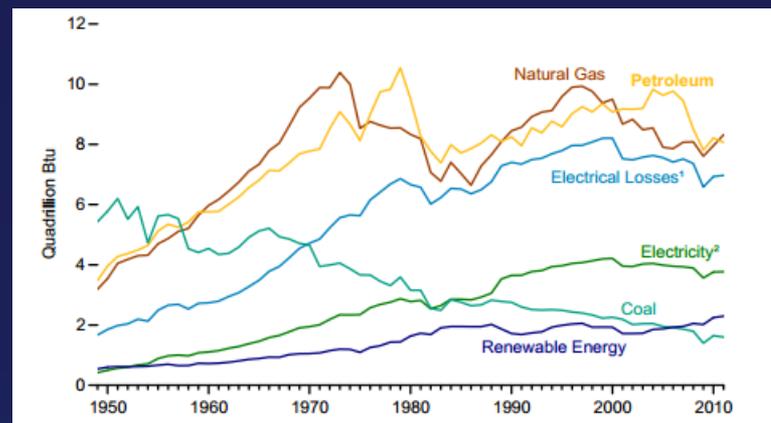
What sectors use petroleum? Increasingly oil use is directed toward transportation.

Energy Consumption Estimates by End-Use Sector, 1949-2011

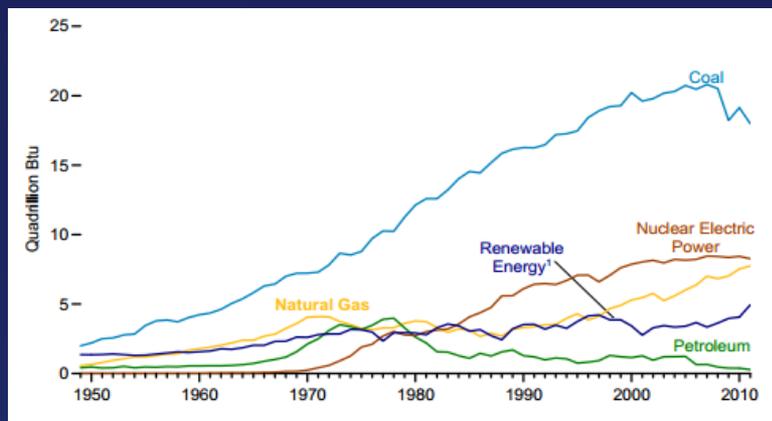
Residential



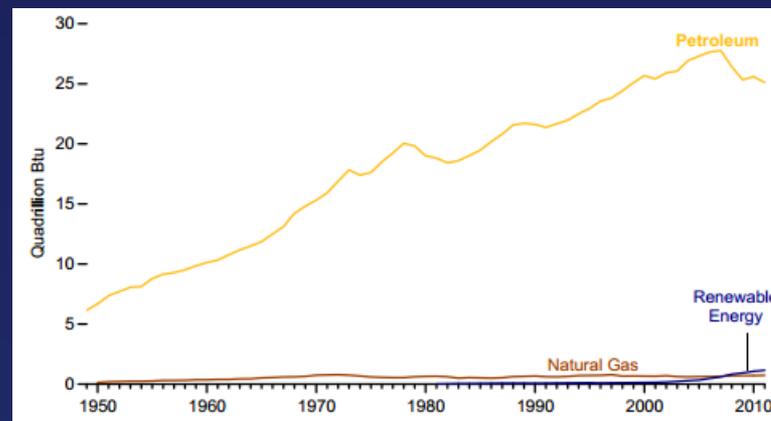
Industrial



Electric Power



Transportation



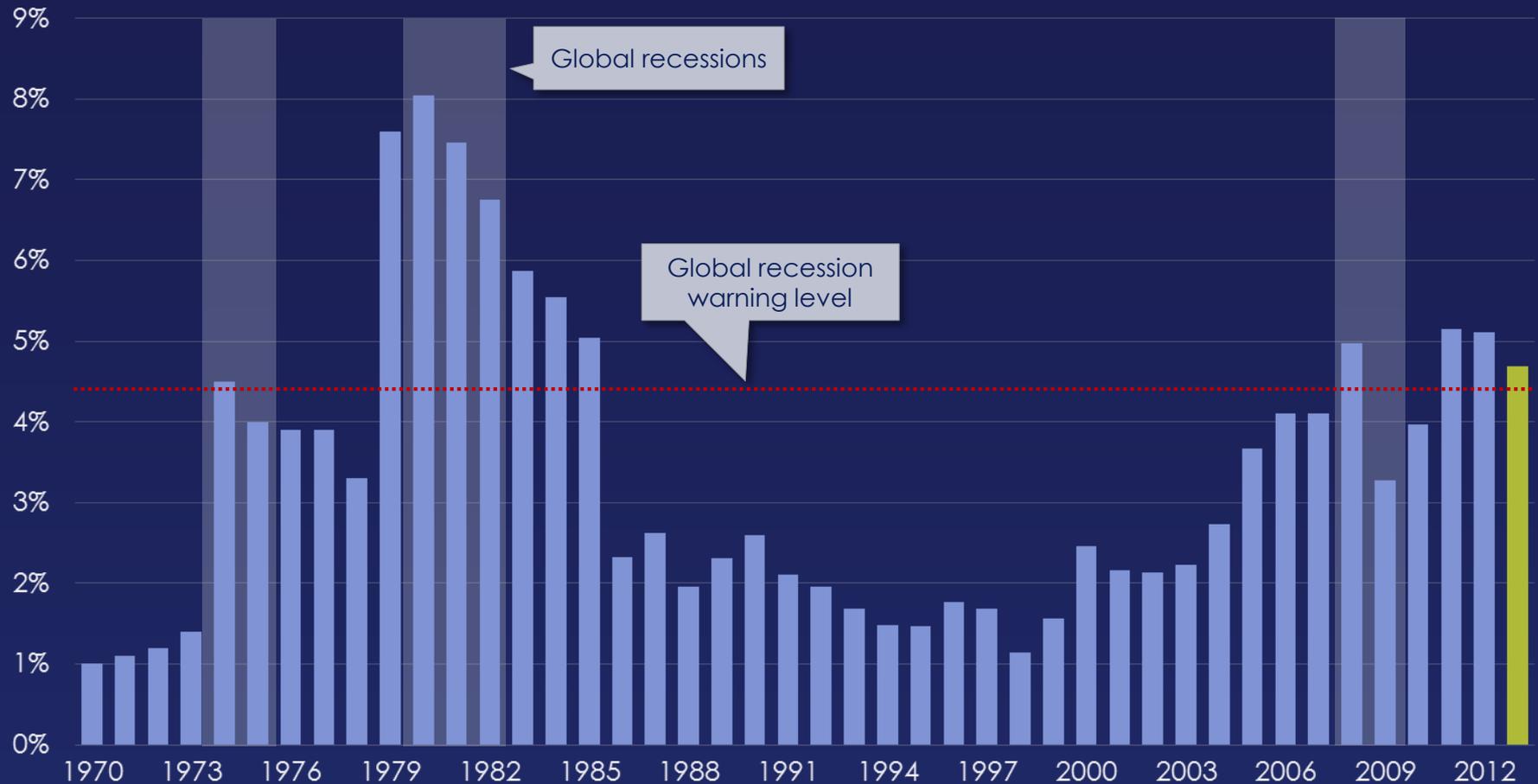
Source: U.S. Energy Information Administration, "Annual Energy Review 2011"

What is the world's oil bill?

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The World's Oil Bill

World Oil Consumption, Brent Crude Prices / World GDP (Nominal)

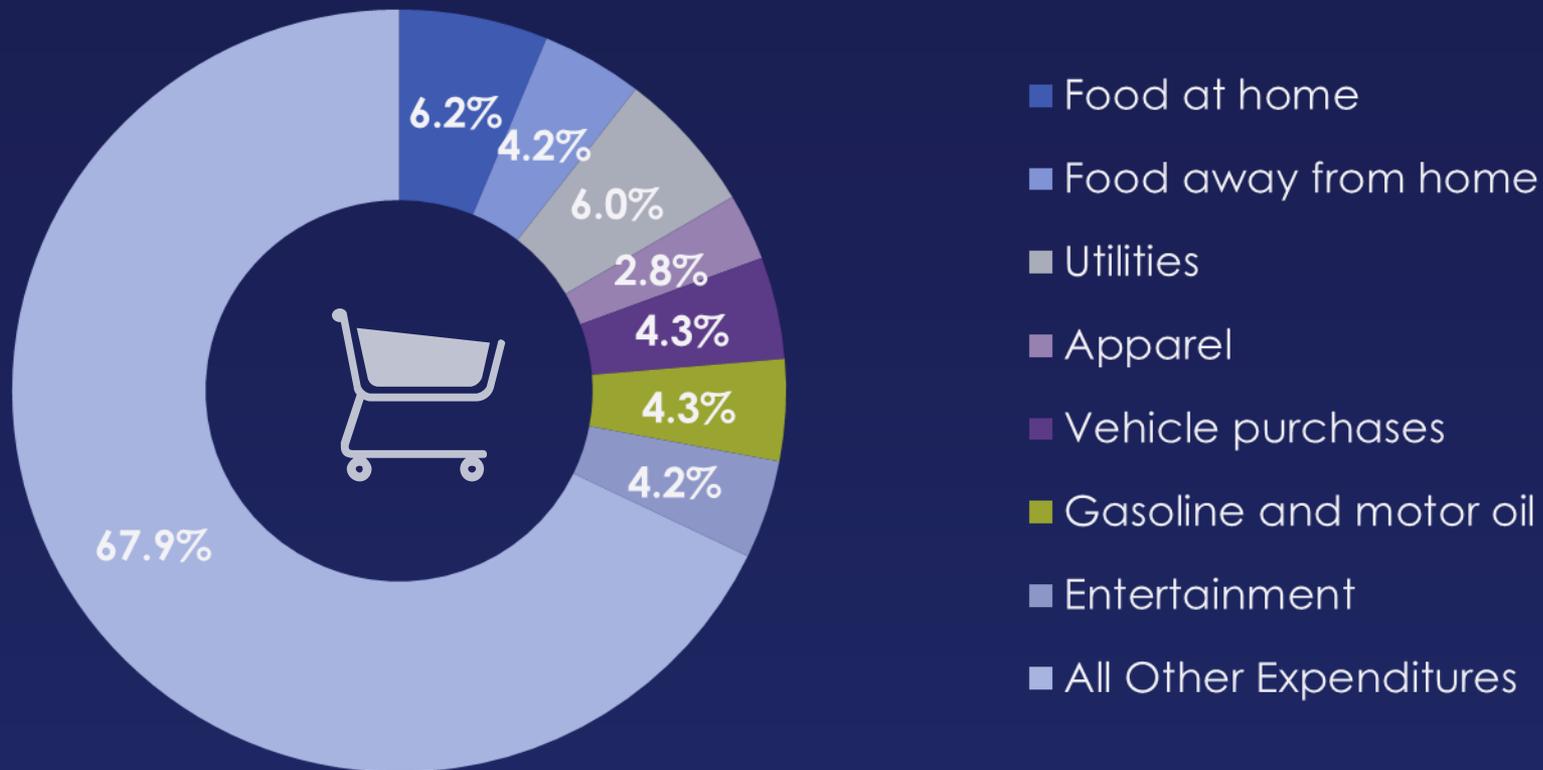


*2012 assumes 3.2% Y/Y real global growth; 2013 assumes 3.3% global growth and \$105 oil

Source: IMF, WEO (April 2013), IEA. Oil Market Report (May 2013); EIA; Haver Analytics

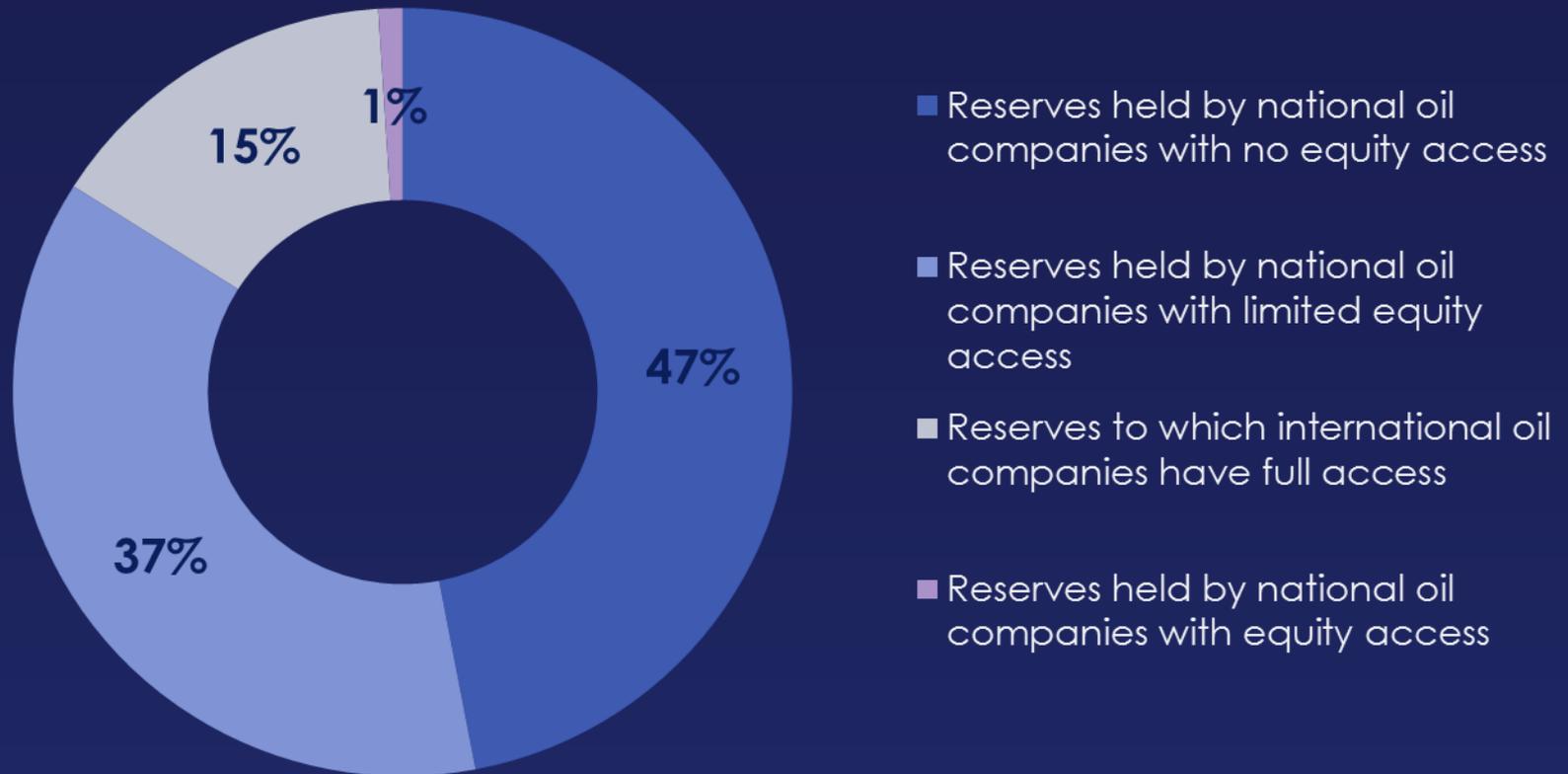
How much does oil represent in typical U.S. household budget? About 4.3% of an average budget, or about \$2,800 per year.

Average Annual Expenditure per American by Item, 2011
Average Income After Taxes



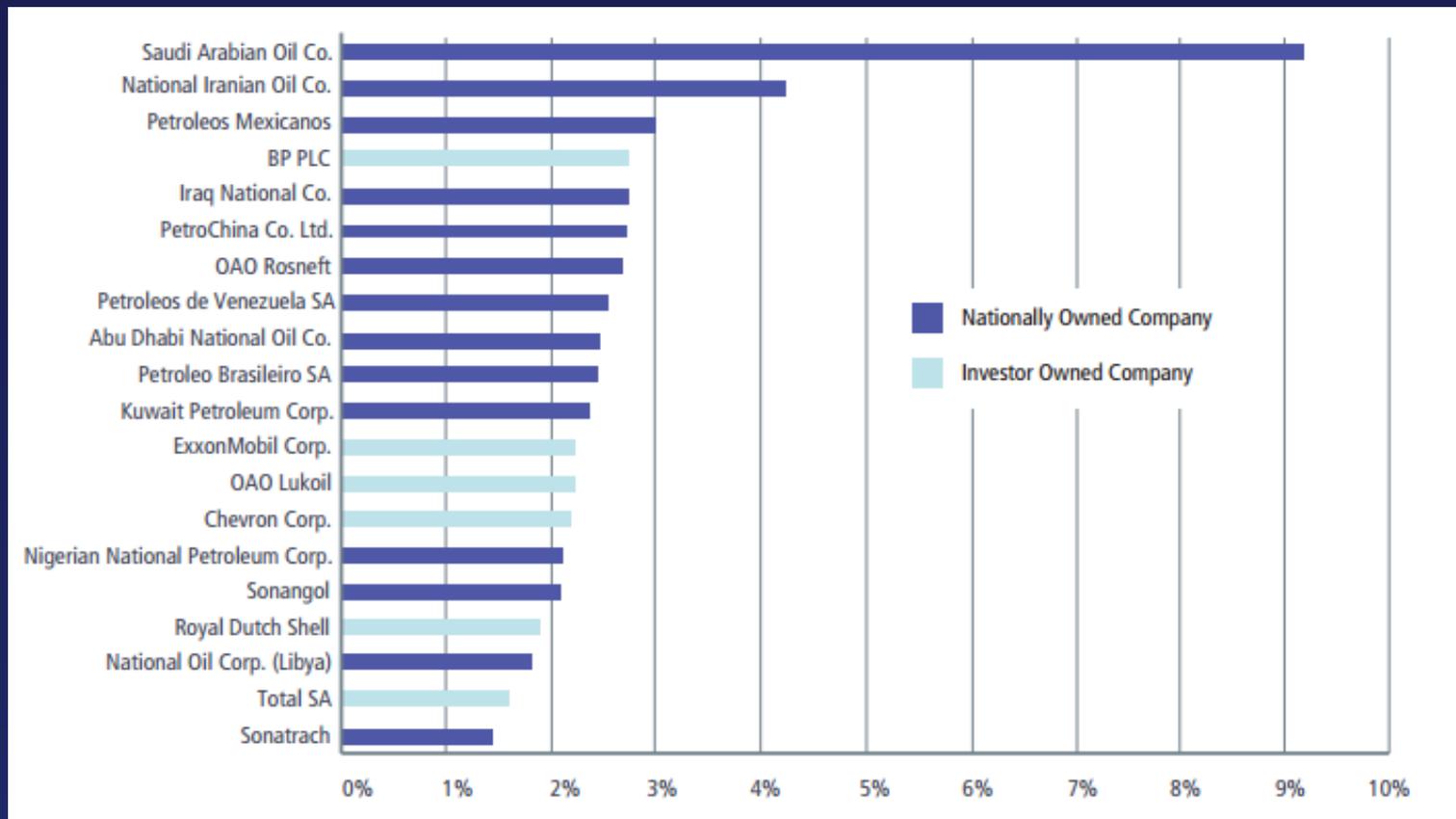
Who owns the world's oil? Oil is largely controlled by national governments and their state oil companies.

World Oil Reserves Access by Company Type, 2010
Percent of World Total



These national owned oil companies account for the vast majority of world crude production.

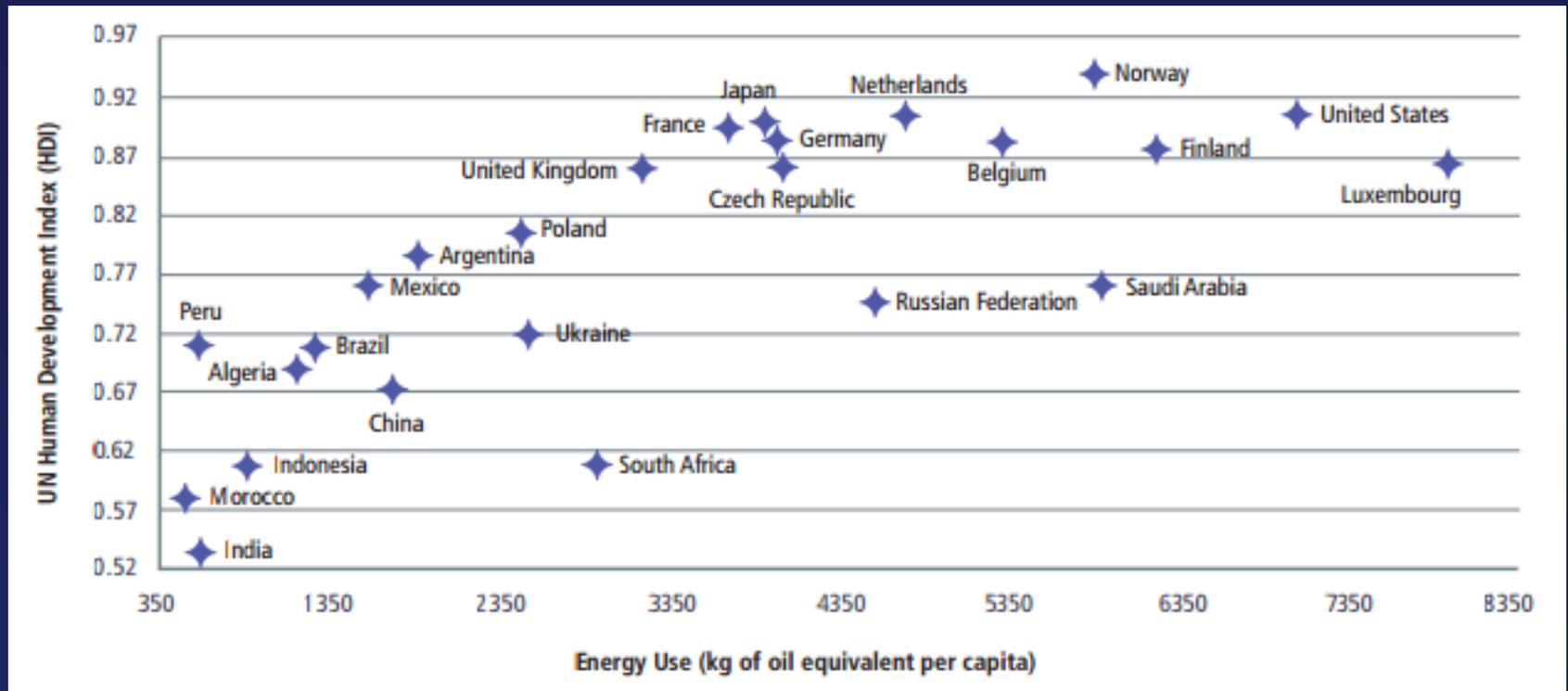
World Crude Production by Company, 2010
Percent of World Oil Production



How is energy related to economic development?

How is energy related to economic development? There is a clear positive link between economic development and energy use.

U.N. Human Development Index vs. Energy Use, 2009

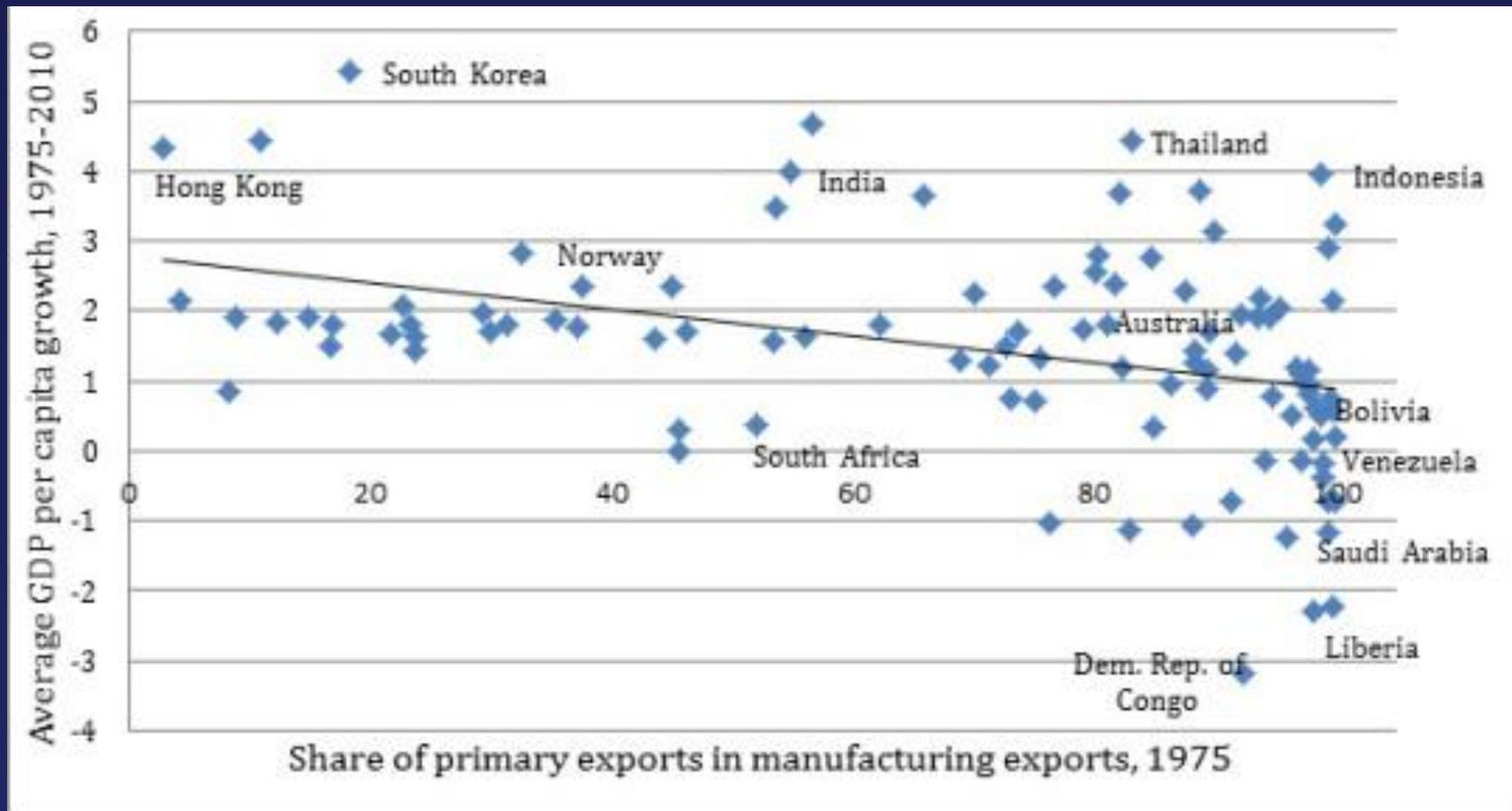


III. The Natural Resource Curse Debate

Is it good to have large deposits of natural resources?

Is it good to have large deposits of natural resources? Not always. Many countries find that it could actually be a “curse”.

Correlation between GDP Growth and Resource Dependence



What exactly is the natural resource curse?

- Phenomenon discovered in 1990s by Robert Barro (1991) and Richard Auty (1993). Two drivers: econometric studies of economic growth and institutionalists.
- Based upon the observation that countries like Angola, Nigeria, Sudan, and Congo are all rich in oil, diamonds, and minerals, yet experience low per capita income.
- The counterpoint is that countries like Japan, Korea, Taiwan, and Singapore have virtually no exportable natural resources, but have achieved high per capita income.
- Widely written about for the past 20 years by many, including Jeffrey Sachs, Joseph Stiglitz, Carmen Reinhart, Dani Rodrik, and others

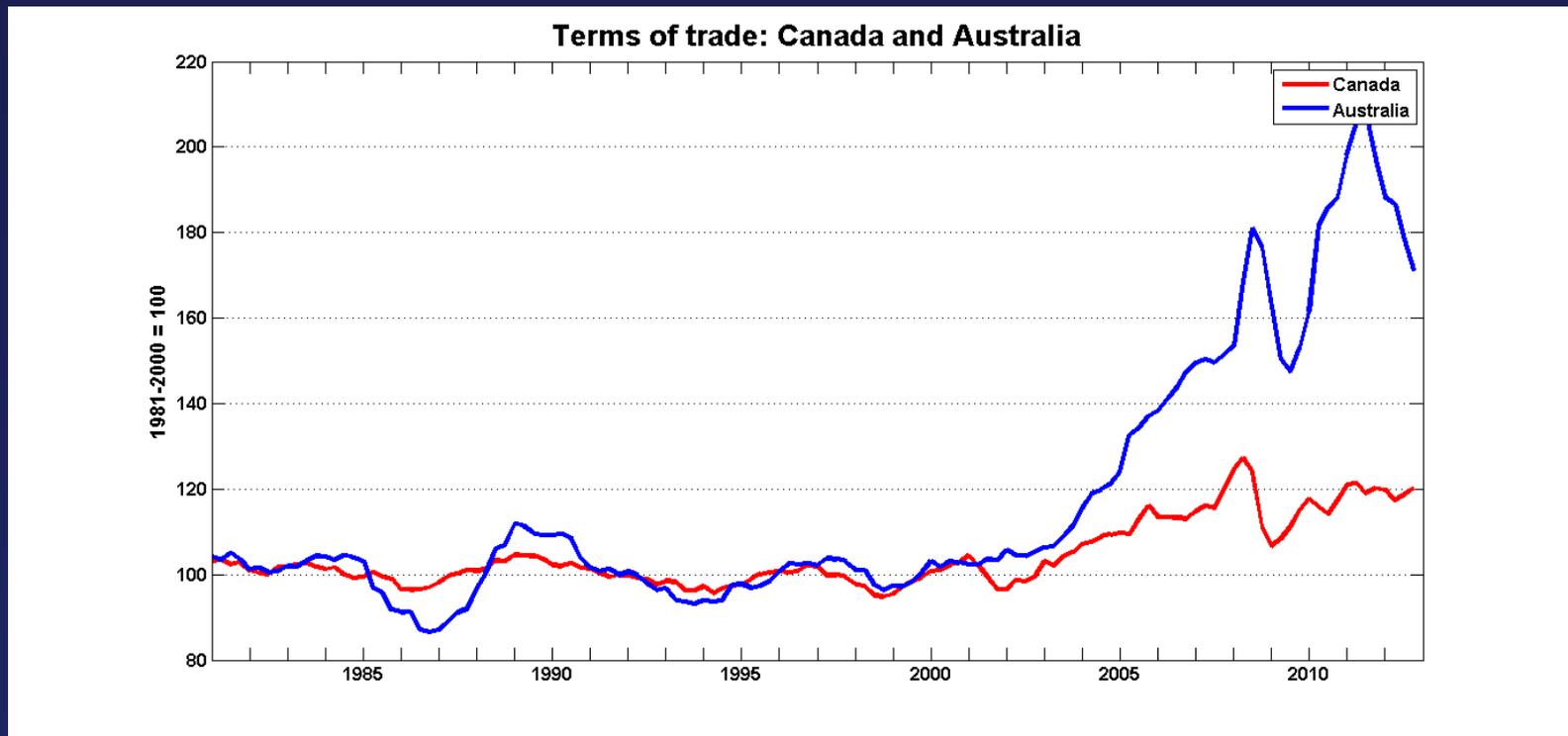
“Natural resource curse” seems like a paradox. Why might countries with abundant natural resources often have lower economic growth?

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Reasons Why Abundance of Natural Resource Could Slow Growth

- Dependence on single source of revenue
- Income inequality
- Volatility of natural resource prices
- Government mismanagement
- Corruption or mismanagement of resources
- Appreciation of the real exchange rate leads to decline in the international competitiveness of other sectors of the economy
- Easy flow of money from a natural resource may lead to unsustainable public expectations for social benefits/welfare programs

“Dutch disease” is an aspect of the resource curse. This occurs when strong resource exports appreciate a country’s currency and make its manufactured exports less competitive internationally.



*Terms of trade is the ratio of the price of exported goods to the price of imported goods

Source: Maclean's, "The Dutch Disease Down Under"

What does new economic research suggest about the natural resource curse?

- Frankel (2010) provides a good recent overview. He concludes that it is not necessarily good or bad to have lots of natural resources.
- Cotet and Tsui (2013) find oil abundance uncorrelated with violence, coup attempts, and political violence. But they do find that oil does boost military spending.
- Caselli and Michaels (2013) look at oil windfalls in municipal governments in Brazil. They find that oil does boost spending on public goods and services, infrastructure, etc., but by less than expected. Household income is virtually unchanged. They find that much oil revenue “disappears”—that is, goes to corruption.
- This is not just an issue for emerging market countries. There are concerns in Canada, Australia, Israel, and other countries with heavy natural resource endowments—although worries in these advanced countries focus more on Dutch Disease issues.

IV. What (or Who) Determines the Price of Oil?

Oil prices have been extremely volatile for the past 40 years.



Is oil a competitively priced commodity?

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Factors that Make the Oil Market Uncompetitive

- Inelastic demand
 - Lack of substitutes
 - Long-lived assets
 - Infrastructure advantage
- Exhaustible Supply
 - Restricts New Entrants
 - Production Costs Grow
- Public ownership of resources
 - National patrimony
 - Barriers to entry
 - Rent seeking behavior
 - Existence of cartel



Nationally owned oil companies provide governments and officials with the power and means to exert control over the oil market.

Methods of Government Manipulation in the Oil Market

- Taxation
 - Impose severance taxes
 - Impose social tax on oil
- Quotas/Limits
 - May not accept bids for production
 - Limit production (maybe due to environmental concerns or patrimony considerations)
 - Block access to outside/foreign developers
- Rent-Seeking
 - Might require bribes to obtain access to drill
 - Subsidize oil prices for preferential trade partners
 - Support ineffective or corrupt management

Perhaps the most prominent difference between the oil market and more competitive markets is the existence of a cartel.

What is a Cartel?

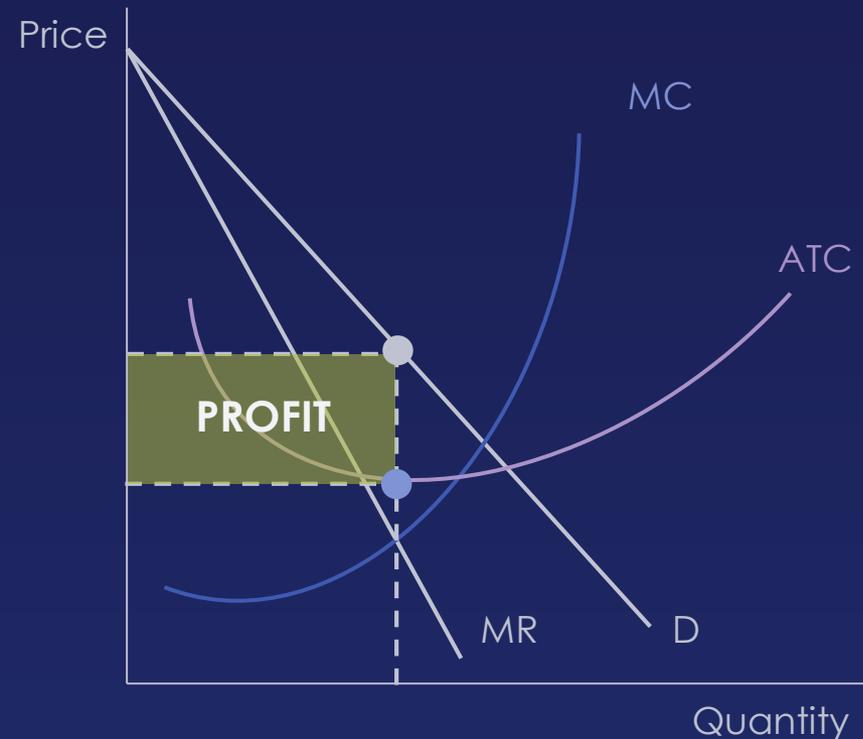
A cartel is a formal agreement between firms to fix prices and production. Members may agree to fix prices, restrict output, or allocate market shares. The goal of a cartel is to increase members' profits by reducing competition.

Conditions for Cartel

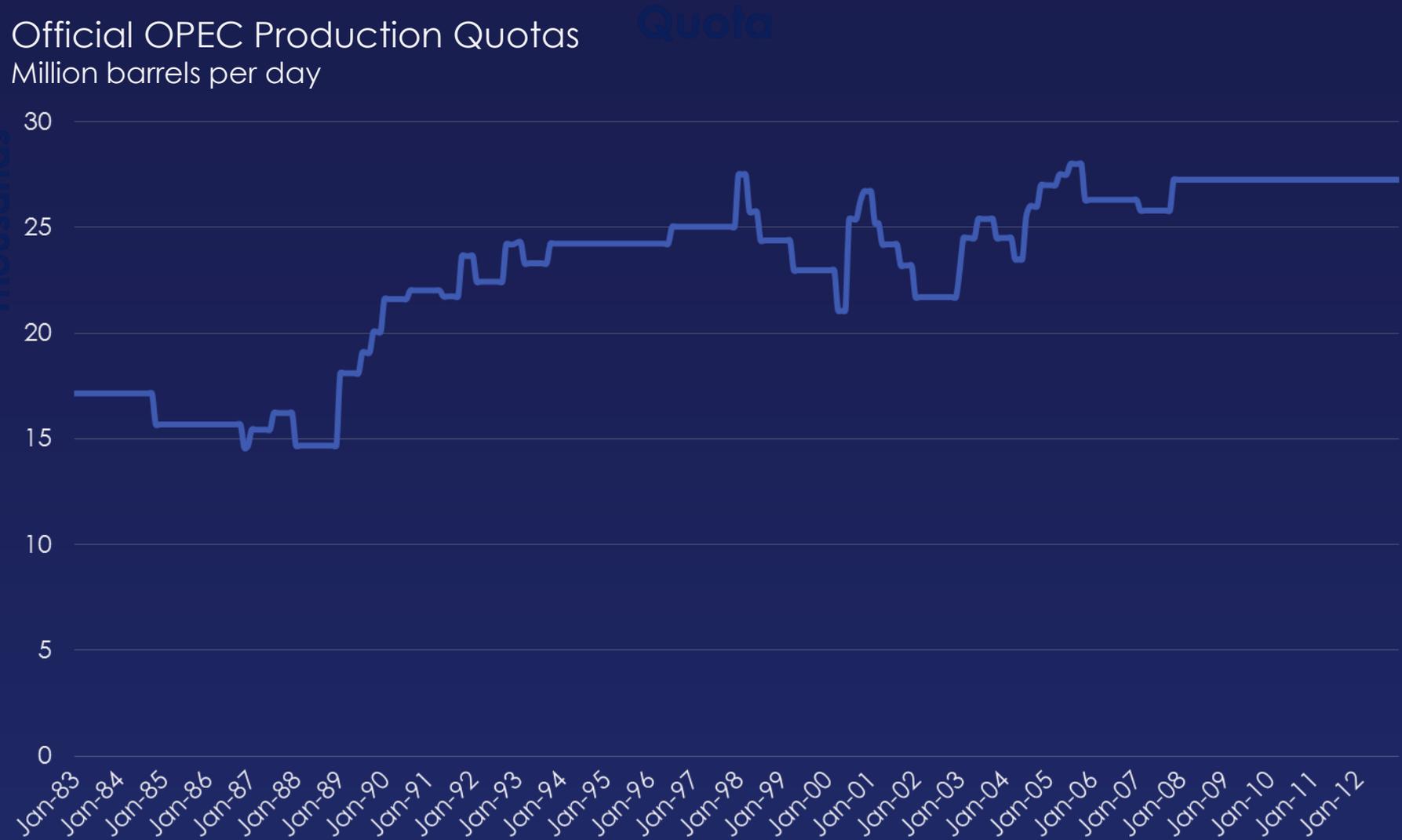
- Homogenous products
- Inelastic demand
- High barriers to entry in an industry:
 - Control of scarce resources
 - Increasing returns to scale
 - Technological superiority
 - Government-created barriers

Outcome of Cartel Price Fixing

Prices are fixed above the point where marginal revenue = marginal cost

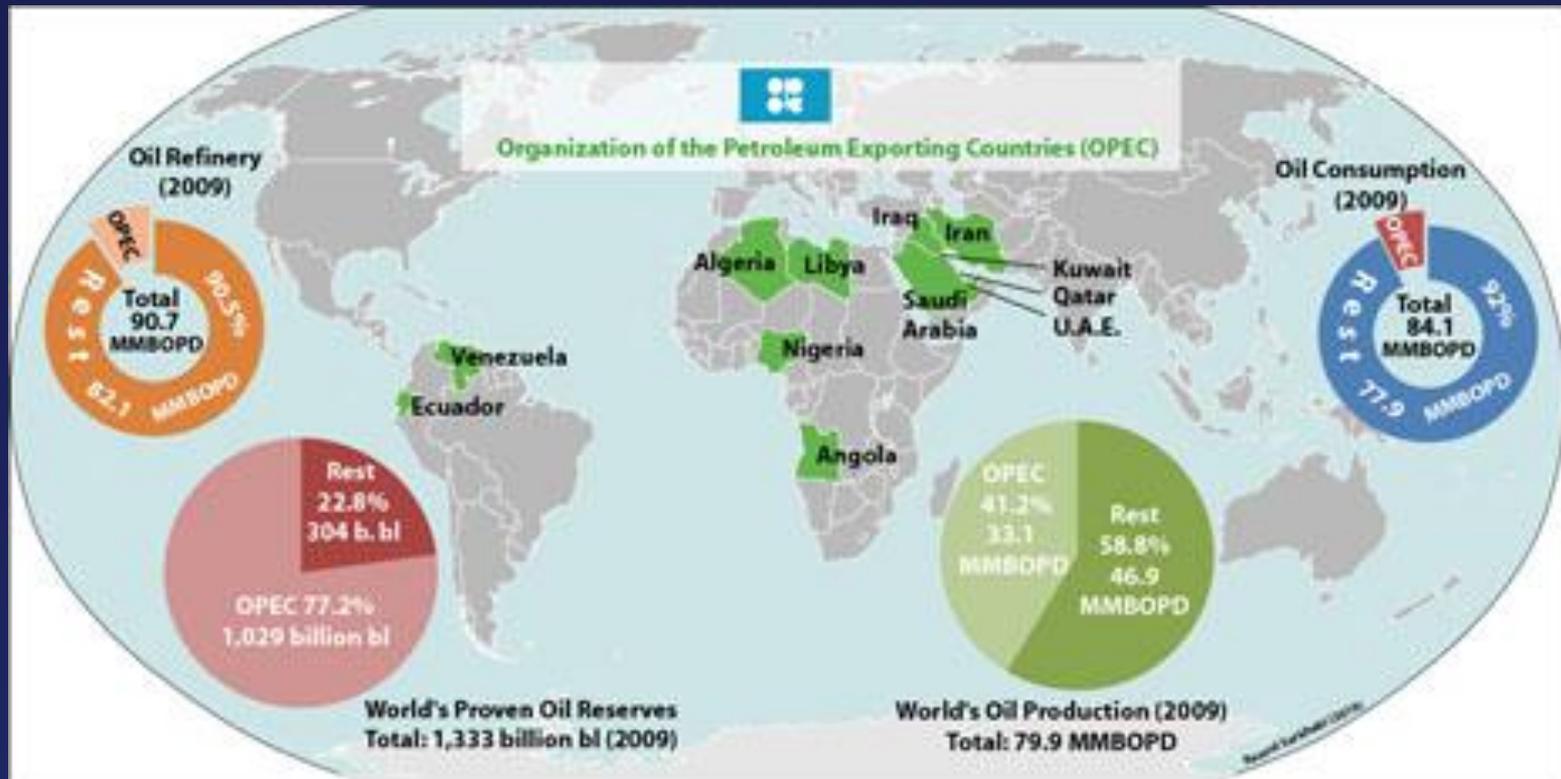


Since the 1980s, OPEC has set target prices and constrained production.



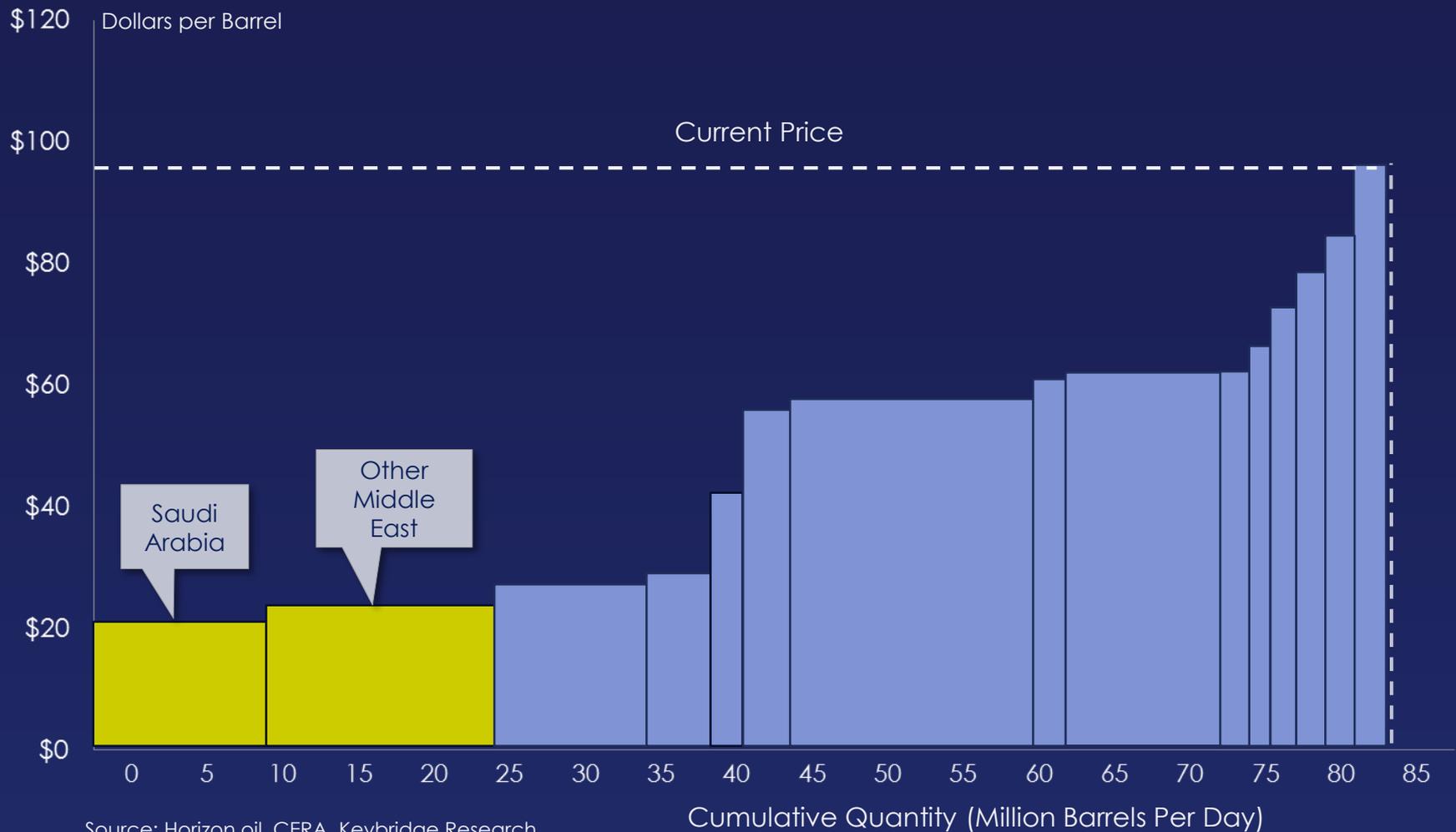
The source of OPEC's power? That fact that 77% of proven oil reserves are in OPEC countries.

Share of Global Recoverable Oil Reserves



OPEC countries control most oil reserves with the lowest marginal costs, providing them enormous pricing power.

Global Marginal Cost of Oil Production (as of 2009)



Source: Horizon oil, CERA, Keybridge Research

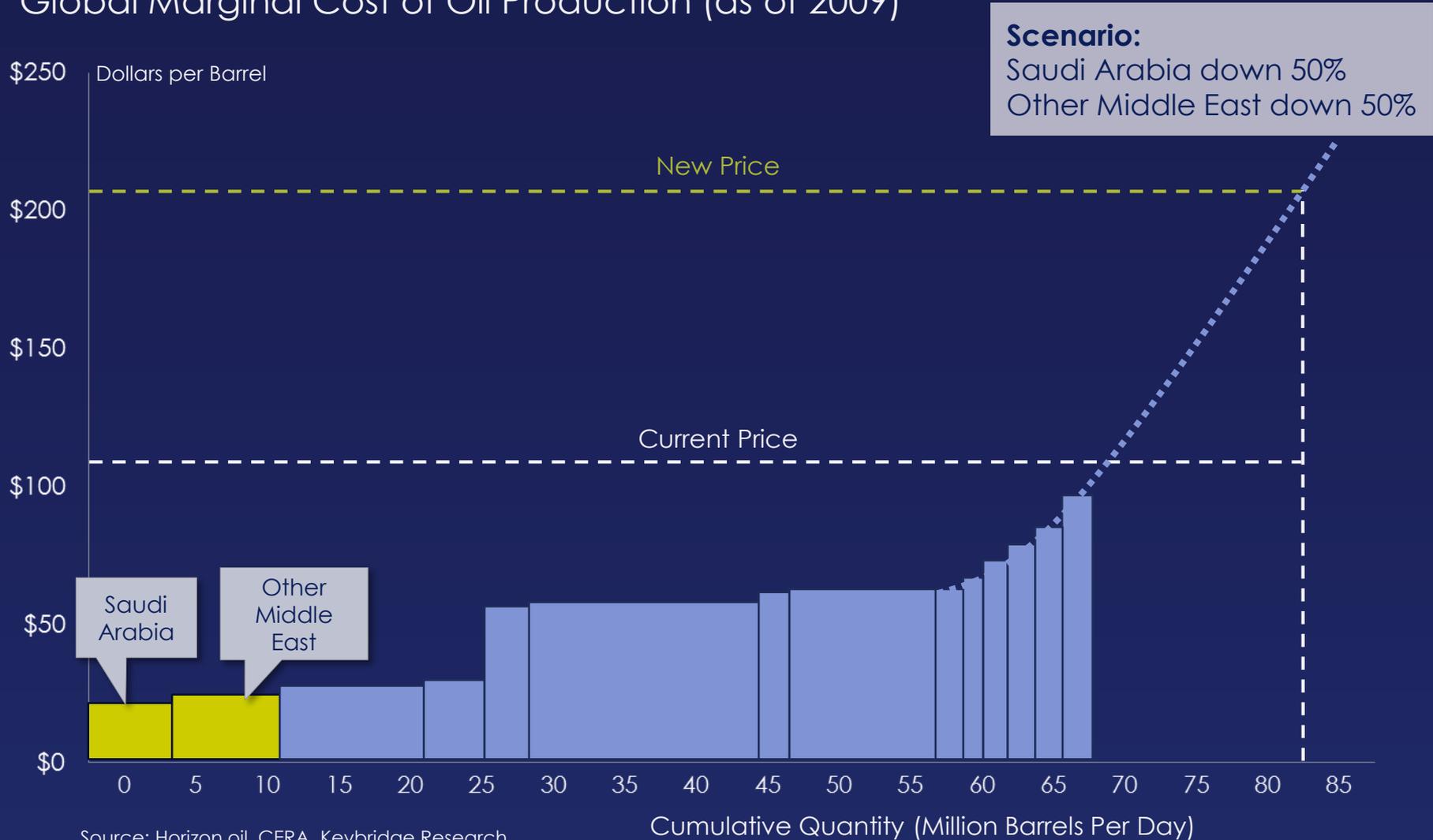
If several of the major OPEC countries were to increase production of their low cost oil, it could dramatically lower prices.

Global Marginal Cost of Oil Production (as of 2009)



Similarly, if OPEC producers cut production, other producers would be forced to pump oil with higher marginal production costs.

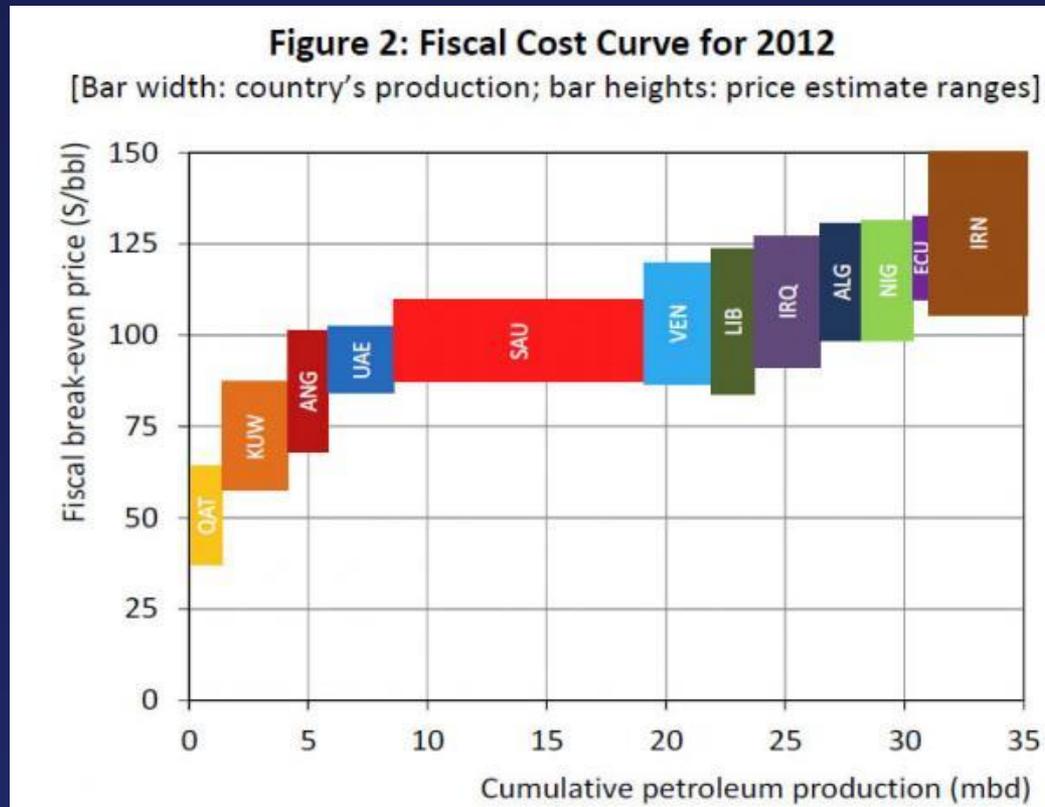
Global Marginal Cost of Oil Production (as of 2009)



There are multiple factors that OPEC countries consider when setting target oil prices.

#1: Paying for Government Programs (i.e., the social safety net)

OPEC “Breakeven” Oil Price and Oil Production by Country
Dollars per Barrel, Million Barrels per Day



But even OPEC can overplay its hand. There are economic rules that it should not violate when setting target oil prices.

#2: Profit Maximization (from von Stackelberg (1952))

$$P_{max} = \frac{C}{1 + \left[\frac{1}{\beta} \sigma (\mu + 1) \right]}$$

C = competitive market price

β = price elasticity of demand

σ = market share

μ = price responsiveness of competitors

Middle of the road oil price demand and supply elasticity parameters allow one to sketch out theoretical supply conditions.

World Oil Demand		
	High Value	Low Value
Long-run price elasticity	-0.6	-0.45
Short-run price elasticity	-0.09	-0.068

Non-OPEC Oil Supply		
	High Value	Low Value
Long-run price elasticity	0.5	0.4
Short-run price elasticity	0.125	0.08

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Long-run price elasticity	0.5	0.4
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Why is the price elasticity of demand for oil so low???????
Hint: the average car is on the road for 16 years!

OPEC's pricing in the 1990s was sustainable long term. Oil pricing today pushes against the limits of short-run pricing levels.

OPEC Cartel Market Share and World Oil Prices

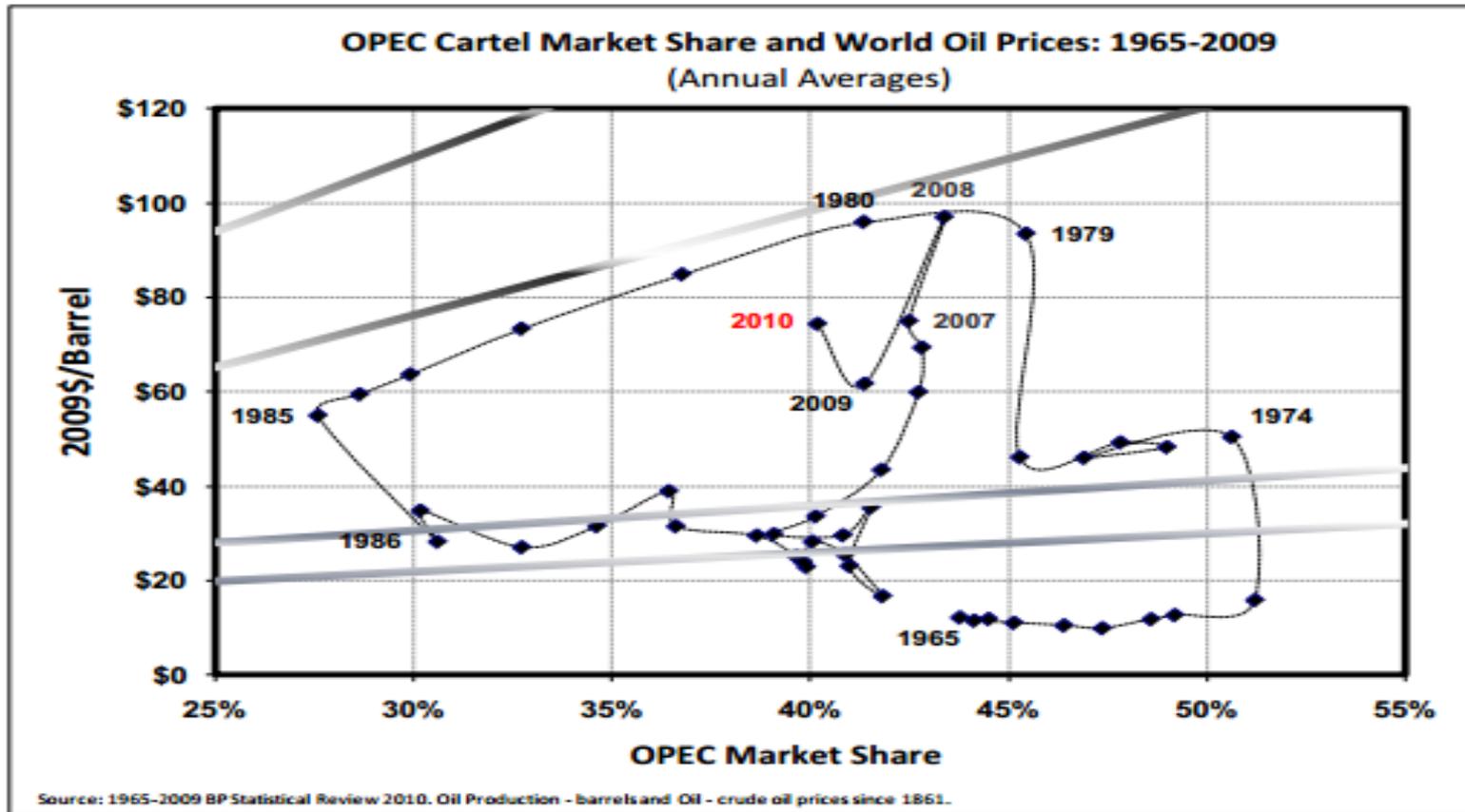


Figure 2. OPEC Cartel Market Share and World Oil Prices: 1965-2010.

Key lessons from von Stackelberg for OPEC and oil producers in general:

If you overcharge consistently for your oil, what will happen?

Key lessons from von Stackelberg for OPEC and oil producers in general:

If you overcharge consistently for your oil:

- You may cause a global recession and hurt demand for your oil
- You may lose market share
- You may encourage technical innovation to replace your oil
- You may encourage consumer governments to shift policies, impose an import fee on your oil, etc.

Key lessons from von Stackelberg for OPEC and oil producers in general:

If you want to maximize your revenue over a number of years, it could be a good idea to:

Key lessons from von Stackelberg for OPEC and oil producers in general:

If you want to maximize your revenue over a number of years, you should:

- Exploit the low short-run price elasticity for oil
- Have variable prices—high most years, but low some other years to de-validate investments by IOCs, alternative energy suppliers, EV makers, technology companies, etc.
- Pay attention when your consumers make investments in more efficient or non-oil capital goods (cars, power plants, etc.)

Will oil prices rise or fall in the next 10 years? The 1980 wager between Paul Ehrlich and Julian Simon.

The Bet:

- \$1,000
- Choose 5 minerals (Ehrlich chose copper, tin, nickel, chromium, and tungsten.)
- Choose any 10-year window.

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Cornucopians:

- Scarcity drives up prices,
- Demand falls, supply increases
- Technology advances to solve the problem,
- After a lag, prices fall

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The Outcome:

- Simon won easily. The prices of all 5 minerals dropped.

On the supply side, oil – and other natural resources – differs from normal goods in that it is an exhaustible resource.

Hubbert's Peak (1956)

Billions of Barrels per Day

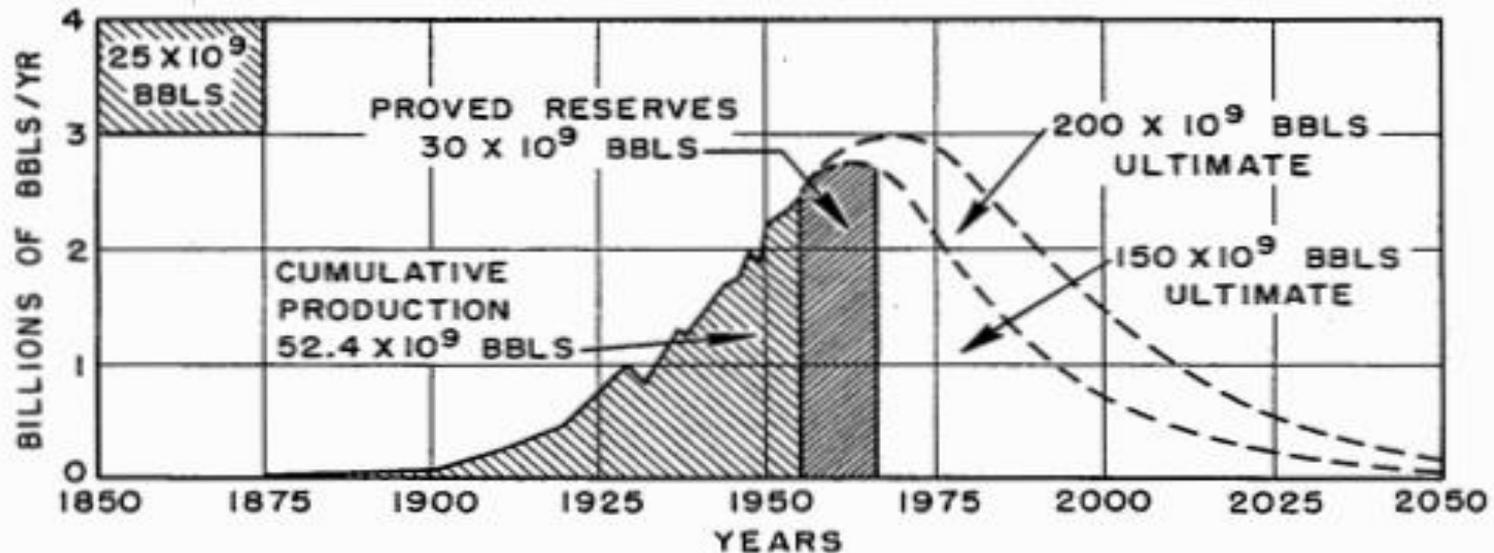
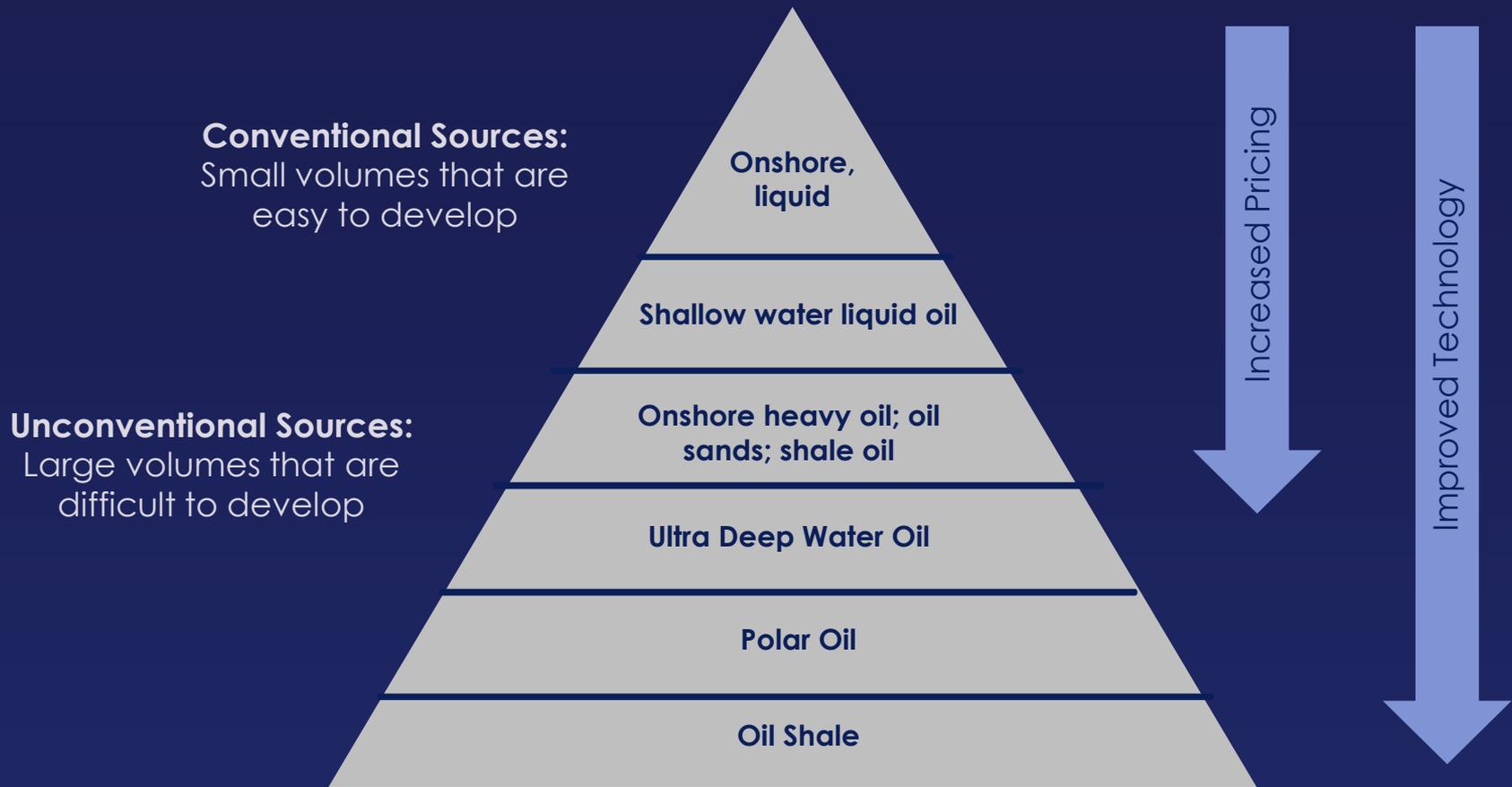


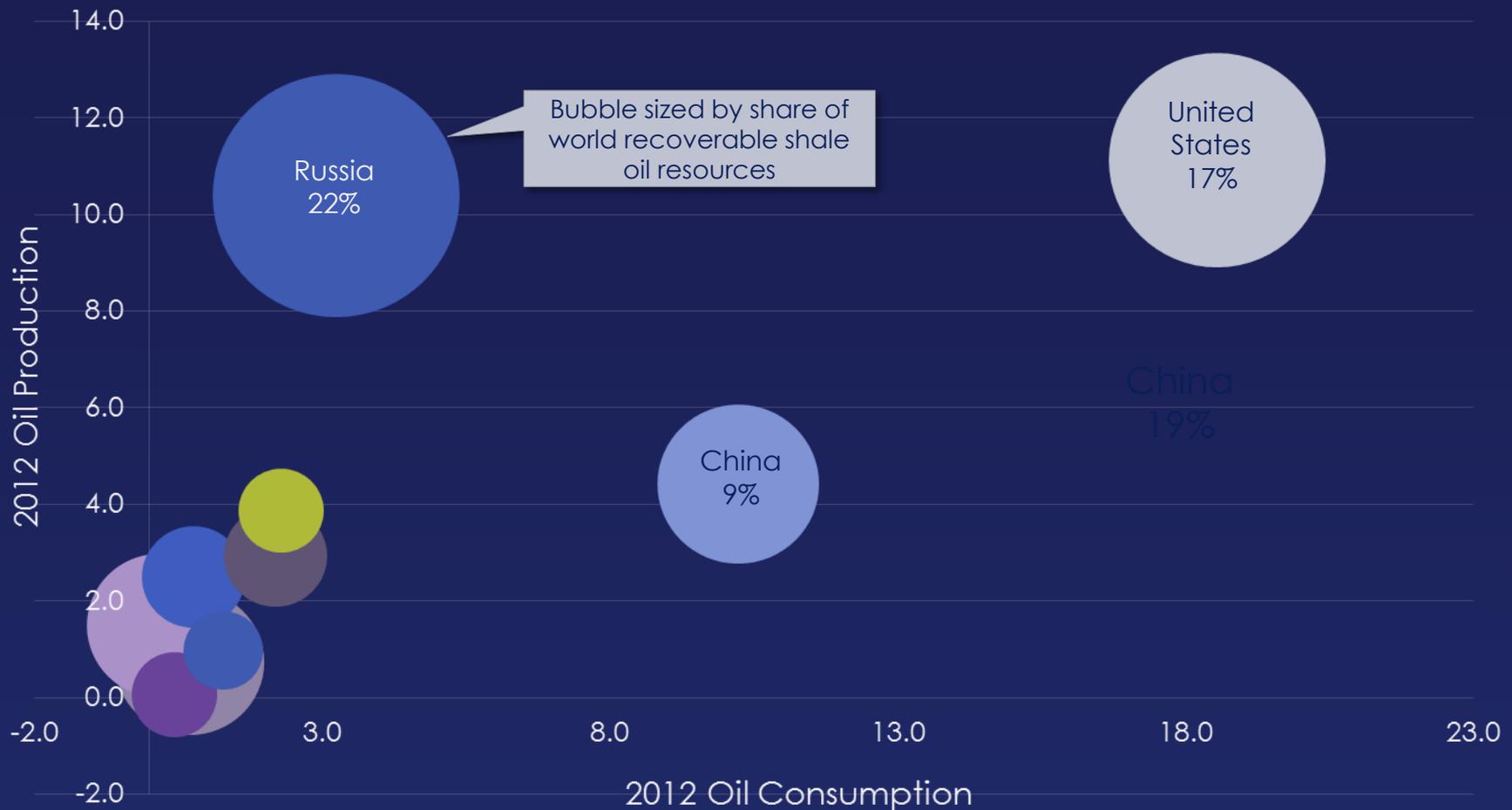
Figure 21 – Ultimate United States crude-oil production based on assumed initial reserves of 150 and 200 billion barrels.

As conventional resources get depleted, new technologies are helping producers reach previously inaccessible resources.



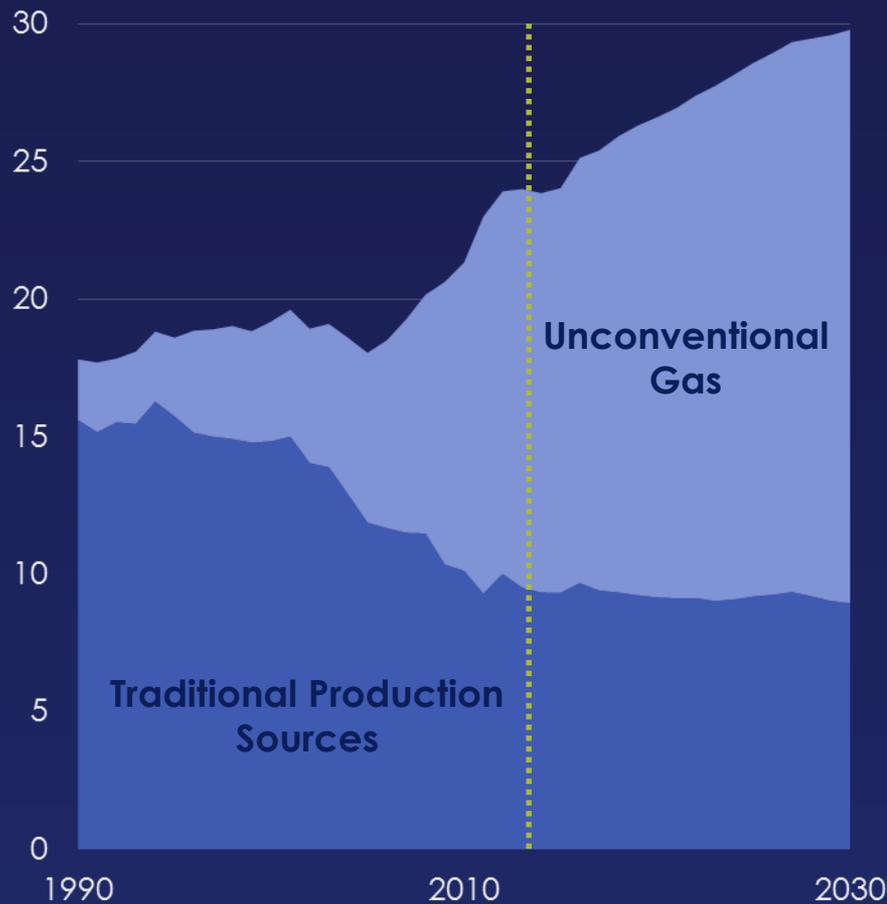
Shale oil in particular, could become a valuable source of production for some of the largest oil consumers.

Crude Oil Production and Consumption, Share of Recoverable Shale Oil
Thousand Barrels Per Day

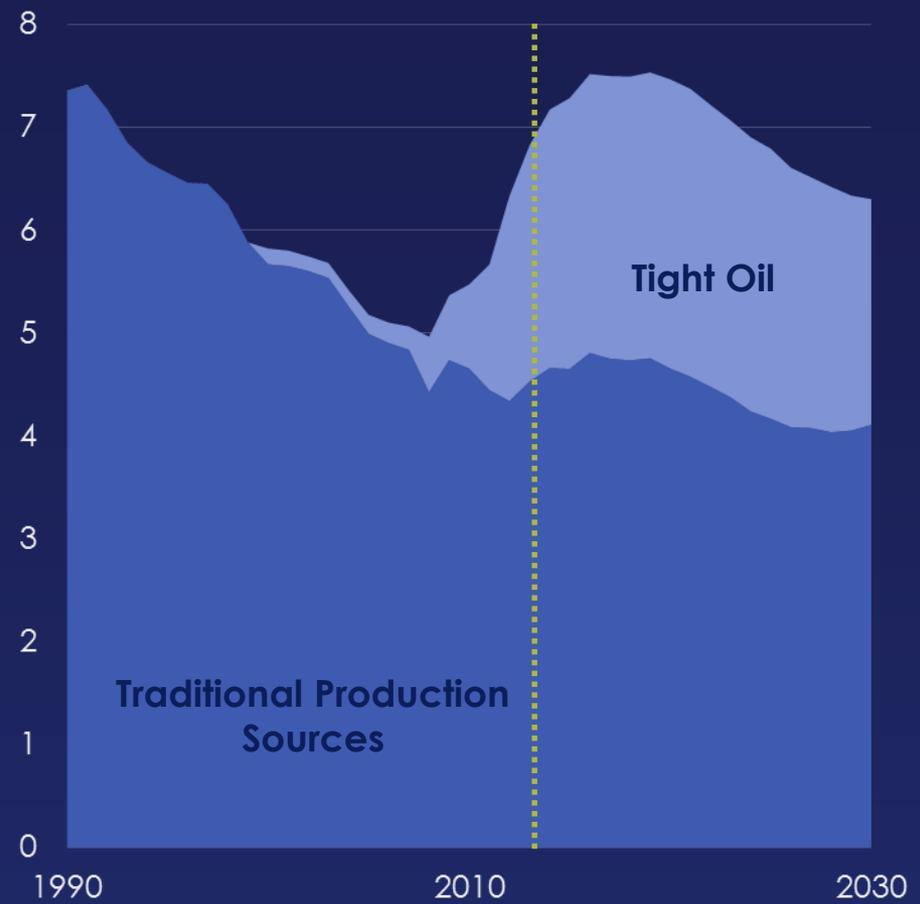


For example, U.S. shale gas and oil are greatly changing the U.S. production story.

U.S. Dry Natural Gas Production
Trillion Cubic Feet



U.S. Domestic Crude Oil Production
Million Barrels Per Day



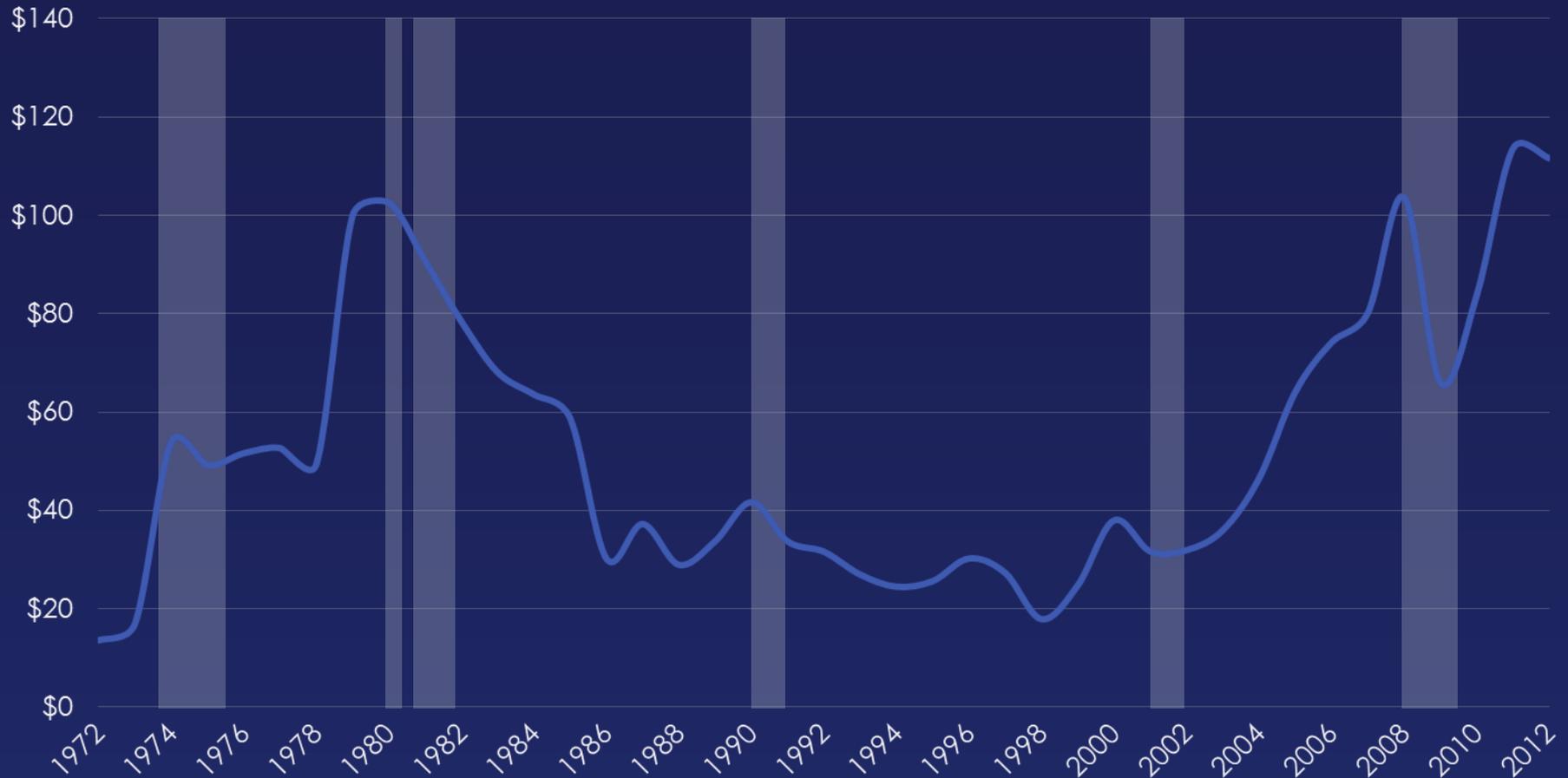
Note: Unconventional gas includes both tight and shale gas

Source: Energy Information Association, "Annual Energy Outlook 2013 Early Release," Figure 3, Figure 1

V. How Do Oil Price Swings Affect a Macroeconomy?

There is a powerful link between spiking oil prices and global recessions, although the relationship is imperfect.

Average Crude Oil Price and NBER Recessions
Dollars per Barrel (2011 Dollars)



There are four main channels through which high oil prices affect a macroeconomy:

Demand Effects

- *High oil prices reduce real income growth*
- *More spending for fuel means less income for other forms of consumption*

Supply Effects

- *Rising energy costs eat into business profits if they cannot be passed on*
- *Energy-intensive sectors, like airlines, may cancel flights, layoff workers, or cancel orders for new planes*

Policy Effects

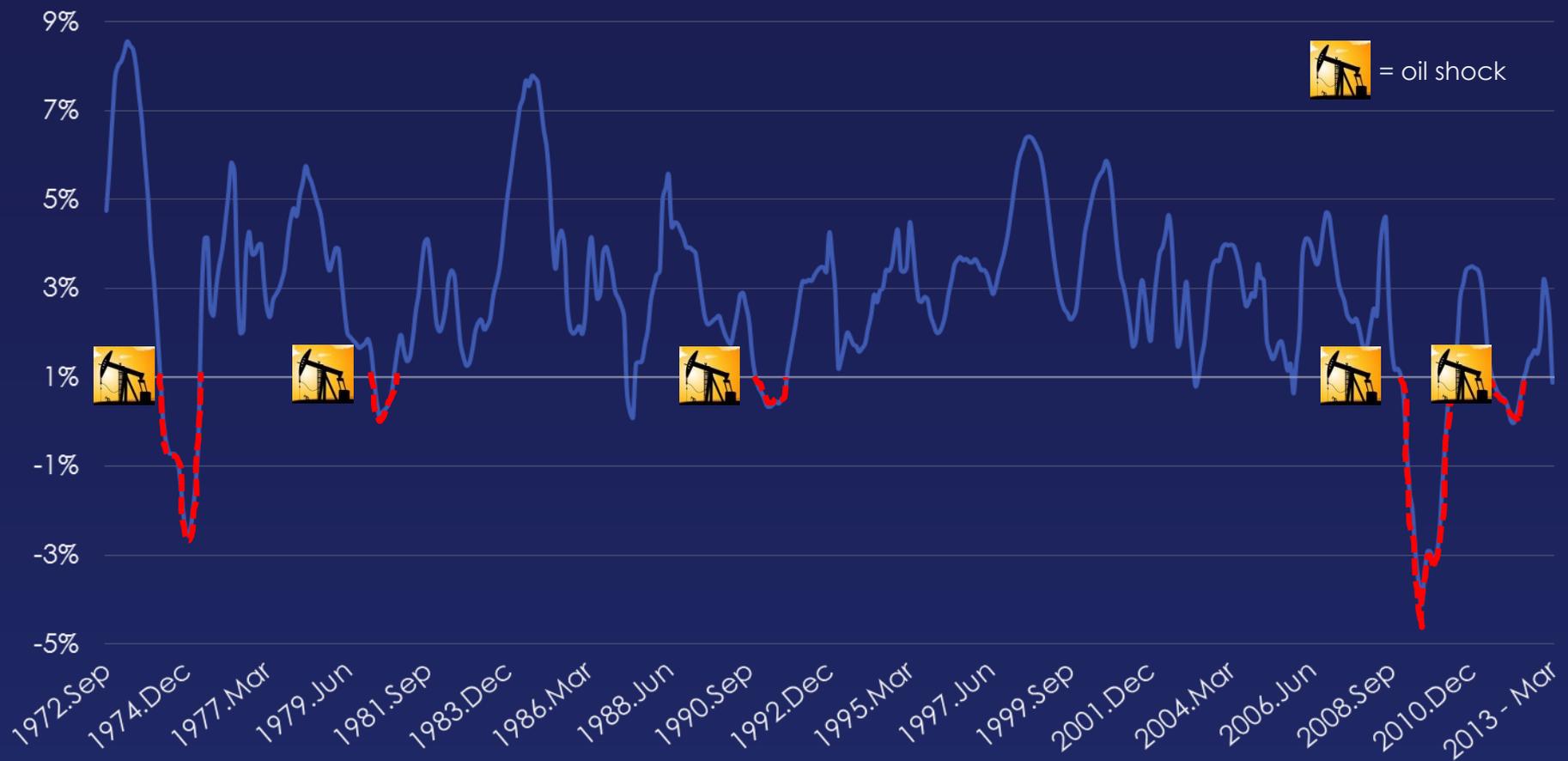
- *Although central bankers may emphasize core inflation more than headline inflation, higher inflation may spark fears of a price-wage spiral and cause monetary tightening*
- *This could weaken housing, investment spending, and car sales*

Effects on Confidence & Markets

- *Higher oil prices hurt both consumer and investor confidence*
- *As equity prices decline, household wealth effects turn negative*

High oil prices depress real income in oil importing countries. U.S. real disposable income has virtually never fallen below 1% growth for 3 consecutive months, except after oil shocks.

Year-on-Year Change in U.S. Real Disposable Income 3 Month Moving Average



Note: an oil price shock is defined as any period in which oil prices increased: 1) by 70% or more, or 2) by \$40 a barrel or more, each within a 10-month window

Source: Bureau of Economic Analysis

This is a global effect: after “Arab Spring,” high oil prices depressed wages in oil importing countries around the world.

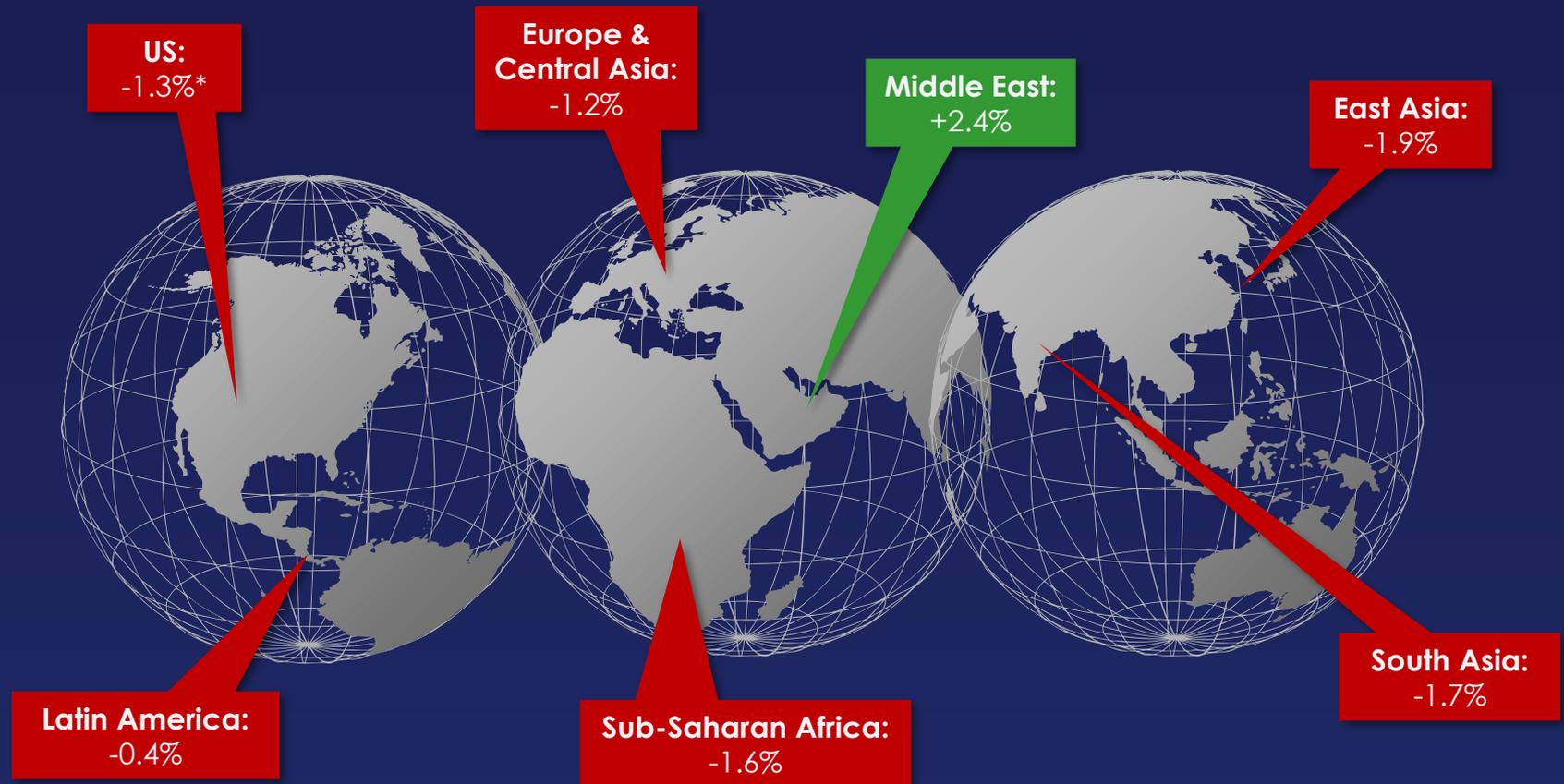
Year-on-Year Change in Real Wages & Salaries



Sources: US Bureau of Labor Statistics; Statistical Office of the European Communities (France); OECD (Brazil & Japan); China National Bureau of Statistics. *Brazil data uses real earnings. **Japan data uses real private sector earnings.

In fact, the effect of higher oil prices is fairly uniform around the world—except of course for oil producers.

Peak GDP Effects of a \$50 Increase in the Price of Oil

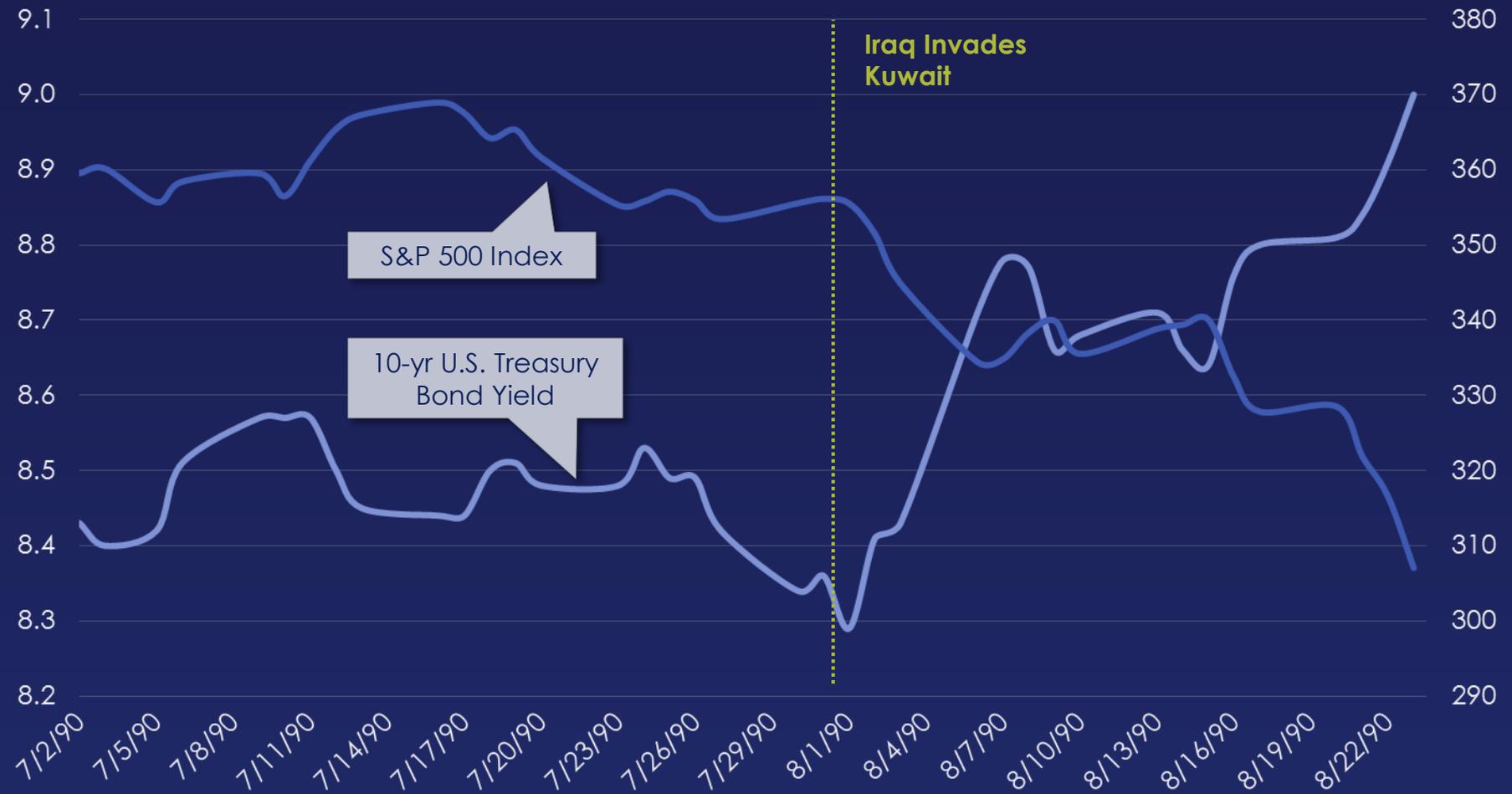


*Author's estimates

Source: World Bank simulations (June 2011). "GDP impact of oil price shock." All regional figures assume oil-importing countries, except the Middle East figure, which represents oil-exporting countries.

There are also negative market psychology effects.

Interest Rate and Stock Market Response to Iraq's 1990 Invasion of Kuwait U.S. 10-yr Treasury Bond Yield, S&P 500 Index



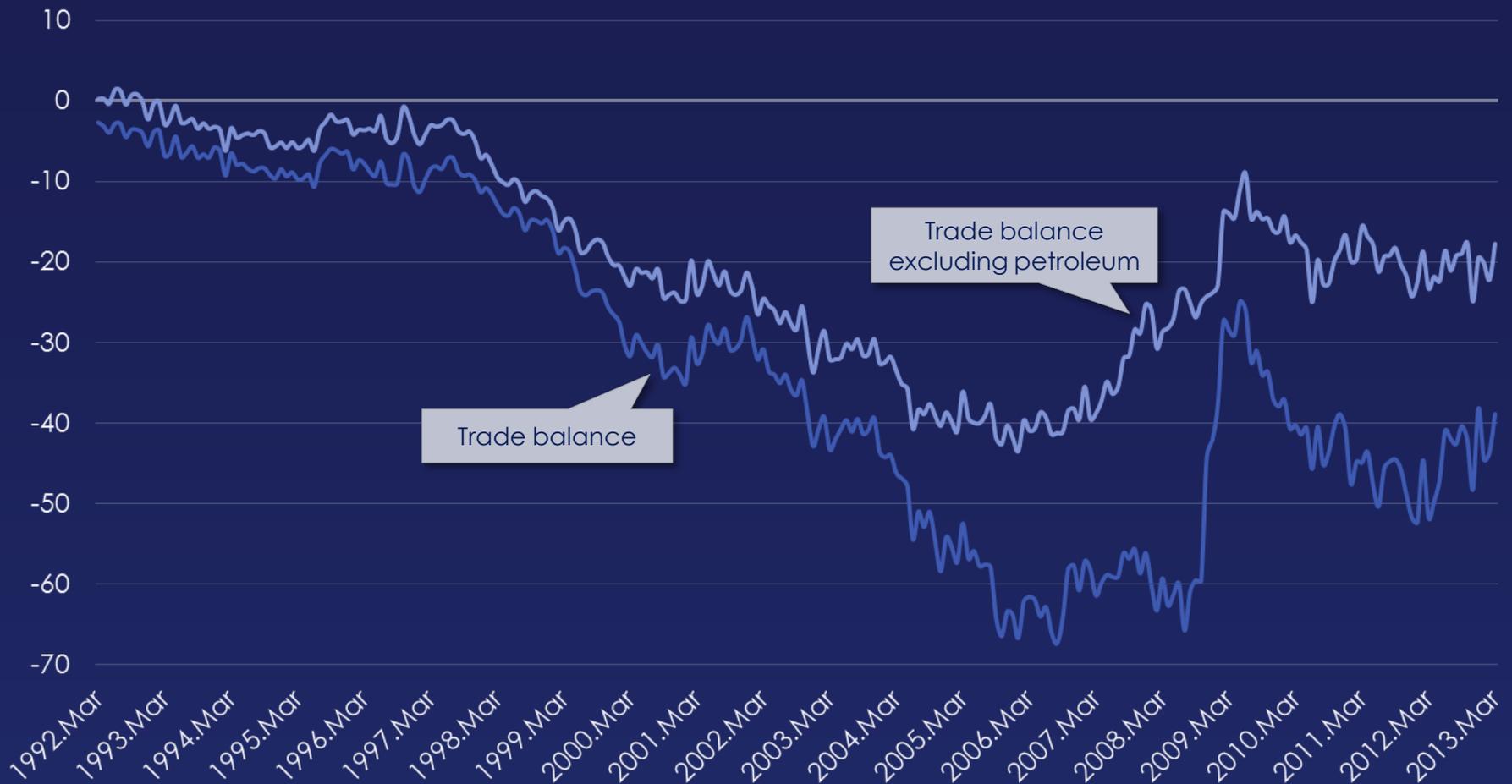
The powerful inter-linkages among world events, oil prices, and market psychology continues even to today.



Oil also negatively impacts importing countries' trade balances.
More than half of the U.S. trade deficit is due to oil imports.

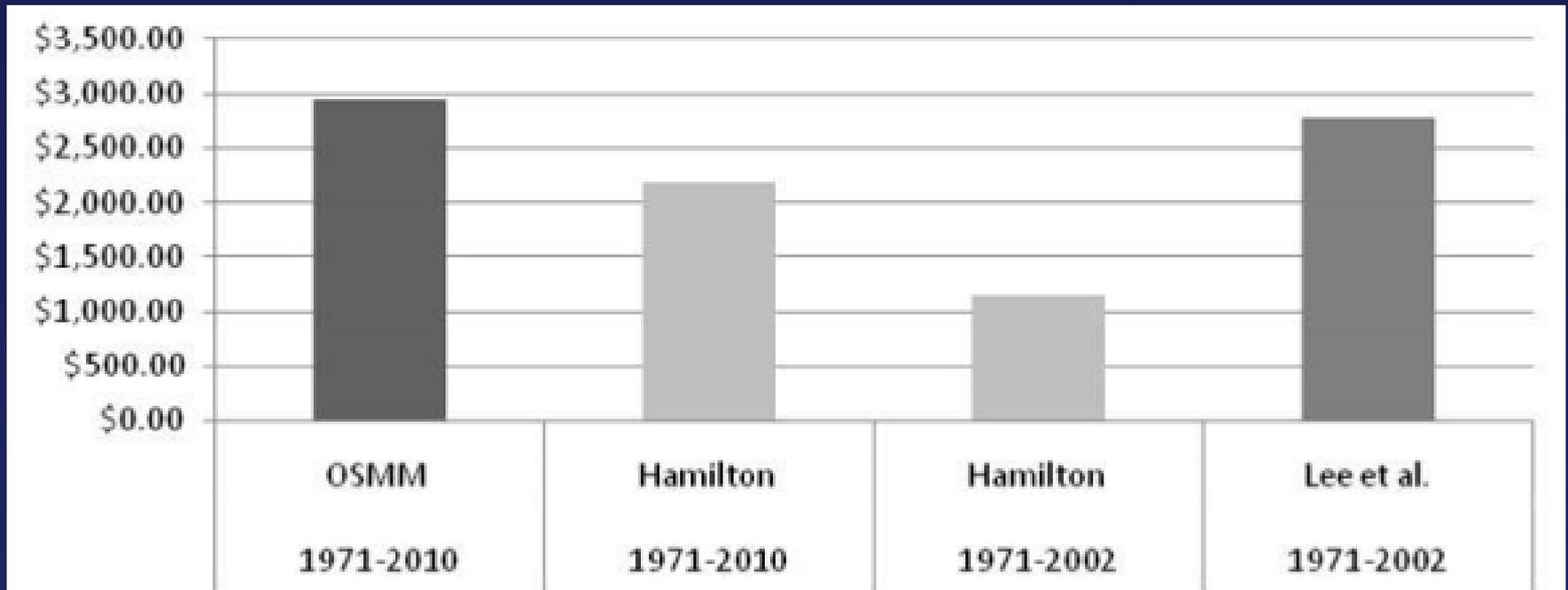
U.S. Trade Balance

Billions of Dollars, SA



Modeling studies estimate that changes in oil prices since OPEC's creation have cost the global economy trillions of dollars.

Comparison of Total Historical Cost Impact of OPEC on the U.S. Economy
Billion Dollars



However, there can be positive macro effects with new oil and gas discoveries. U.S., manufacturers have recently announced \$96 billion in investments to take advantage of the cheap natural gas.

Recent Investment Announcements from the U.S. Manufacturing Sector

Sector	Total Number of Announcements
Chemicals & Fertilizer	67
Steel & Aluminum	18
Tires	4
Plastics	6
Natural Gas to Liquids	3
Glass	1
Transportation	3
Packaging	1



Increased domestic energy production and low gas prices are projected to bring many benefits to the U.S. economy.

Higher Growth

By 2020 new production and reduced consumption could lead to a 2.0 to 3.3% increase in real GDP, or \$370-\$624 billion (in 2005\$) respectively.

Increased Employment

A total of 2.7 to 3.6 million net new jobs could be created by 2020, with 600,000 of those in the oil and gas extraction sector and 1.9 million in ancillary sectors.

Improved Trade Balance

The current account deficit—currently 3% of GDP—could be reduced to 1.2 to 2.4% of GDP by 2020.

Higher Industrial Production

Lower natural gas and electric power prices and increased productivity could allow industrial production to be 2.9% higher by 2017; by 2035, 4.7% higher.

VI. Policy Options to Protect an Economy from Energy Price Swings

Heavy dependence on foreign oil can negatively affect importing countries. How?

Problems of Heavy Dependence on Foreign Oil

Heavy dependence on foreign oil can negatively affect importing countries. How?

Problems of Heavy Dependence on Foreign Oil

- Cause a recession or higher unemployment
- Dependence on volatile or unfriendly trade partners
- May undermine your foreign policy goals
- Require large expenditures for military/energy security
- Exposure to oil price swings
- Exposure to temporary supply shortages
- Hurts your trade balance
- Greenhouse gas emissions

There are at least four key externalities that stem from heavy dependence on oil.

Greenhouse Gases

In the U.S., transportation activities accounted for 33% of all carbon dioxide emissions from fossil fuel combustion in 2011, with virtually all of this coming from petroleum products.

Defense Budgets

The U.S. Department of Defense spends an estimated \$86 - \$104 billion per year protecting its shipping lanes for oil in the Persian Gulf.

Foreign Policy Priorities

Dependence on oil can lead to changes in a country's foreign policy priorities, including in China.

Oil Spills

The 2010 Gulf of Mexico oil spill resulted in more than 127 million gallons of crude oil spilling into the Gulf for nearly 90 days, damaging thousands of miles along the coastline.

With steadily rising transportation needs, how can the world slow oil demand in future decades? Key pathways include:

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Alternative Sources of Liquid Fuels

- ▶ Corn/Sugar-based biofuels
- ▶ Cellulosic-based biofuels
- ▶ Biodiesel
- ▶ Coal/gas to liquids

Improve Vehicle Efficiency

- ▶ Fuel-economy standards
- ▶ Hybrids/engine improvements
- ▶ Adjust vehicle attributes/preferences.
- ▶ Traffic management

Alternative Drivetrains

- ▶ Electric vehicles
- ▶ Plug-in hybrid vehicles
- ▶ Natural gas vehicles
- ▶ Hydrogen vehicles

Reduce Vehicle Miles Travelled

- ▶ Public transportation
- ▶ Carpooling
- ▶ Telecommuting
- ▶ Bicycles, walking

What policies can governments adopt to encourage adoption of these technologies and strategies?

Taxes

Technology Mandates & Subsidies

R&D Support

Public Infrastructure

What policies can governments adopt to encourage adoption of these technologies and strategies?

Taxes

- ▶ Gasoline and Carbon Taxes
- ▶ Cap & Trade
- ▶ Gas Guzzler Tax
- ▶ User Fees (Toll, Congestion Pricing)
- ▶ High vehicle registration fees for big cars

R&D Support

- ▶ Public Research Initiatives (e.g., ARPA-E)
- ▶ R&D Tax Credits
- ▶ Support for Pilot/Demonstration Projects

Technology Mandates & Subsidies

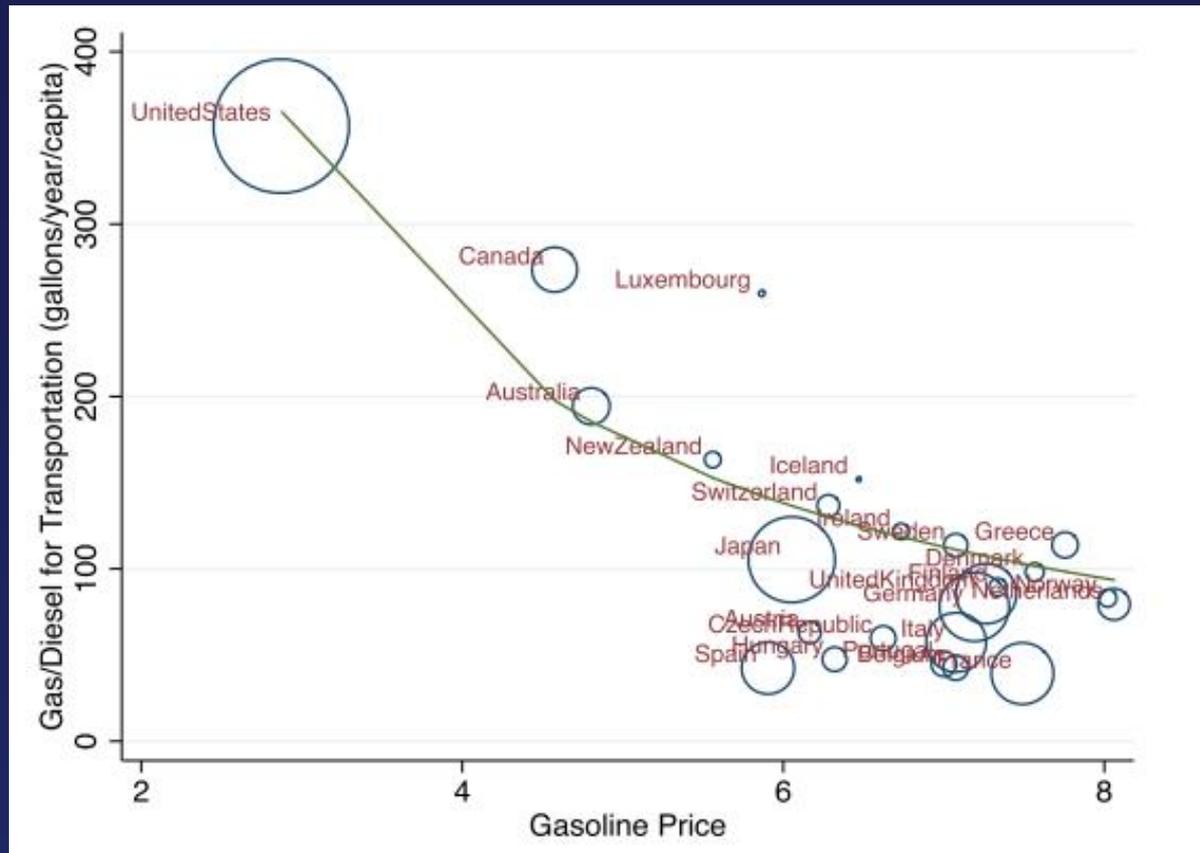
- ▶ CAFE (fuel economy) Standards
- ▶ Fuel Mandates
- ▶ Tax Credits
- ▶ Financing Assistance (Loans and Guarantees)

Public Infrastructure

- ▶ Public Transit Expansion/Modernization
- ▶ Anti-Sprawl Zoning Laws
- ▶ Carpool and Bike Lanes
- ▶ Smart/Hybrid Infrastructure
- ▶ Alternative Fuel Infrastructure

Gasoline consumption per capita does tend to decline as price increases

Transportation Fuel Consumer per Capita Versus Fuel Price
Gallons per Year per Capita, Dollars



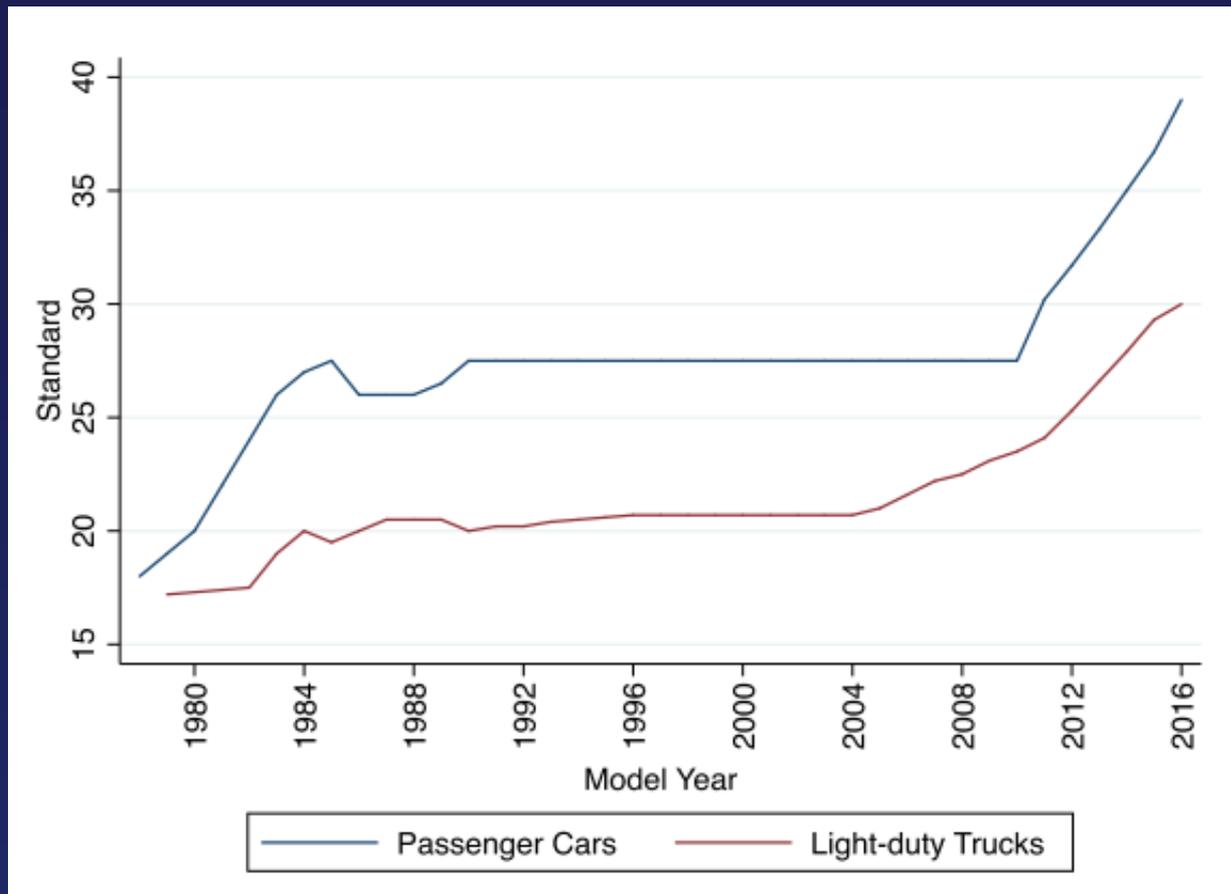
Policy Option: Motor Fuel Tax

2010 Motor Fuel Taxes for OECD Category 1 Countries Dollars per Gallon

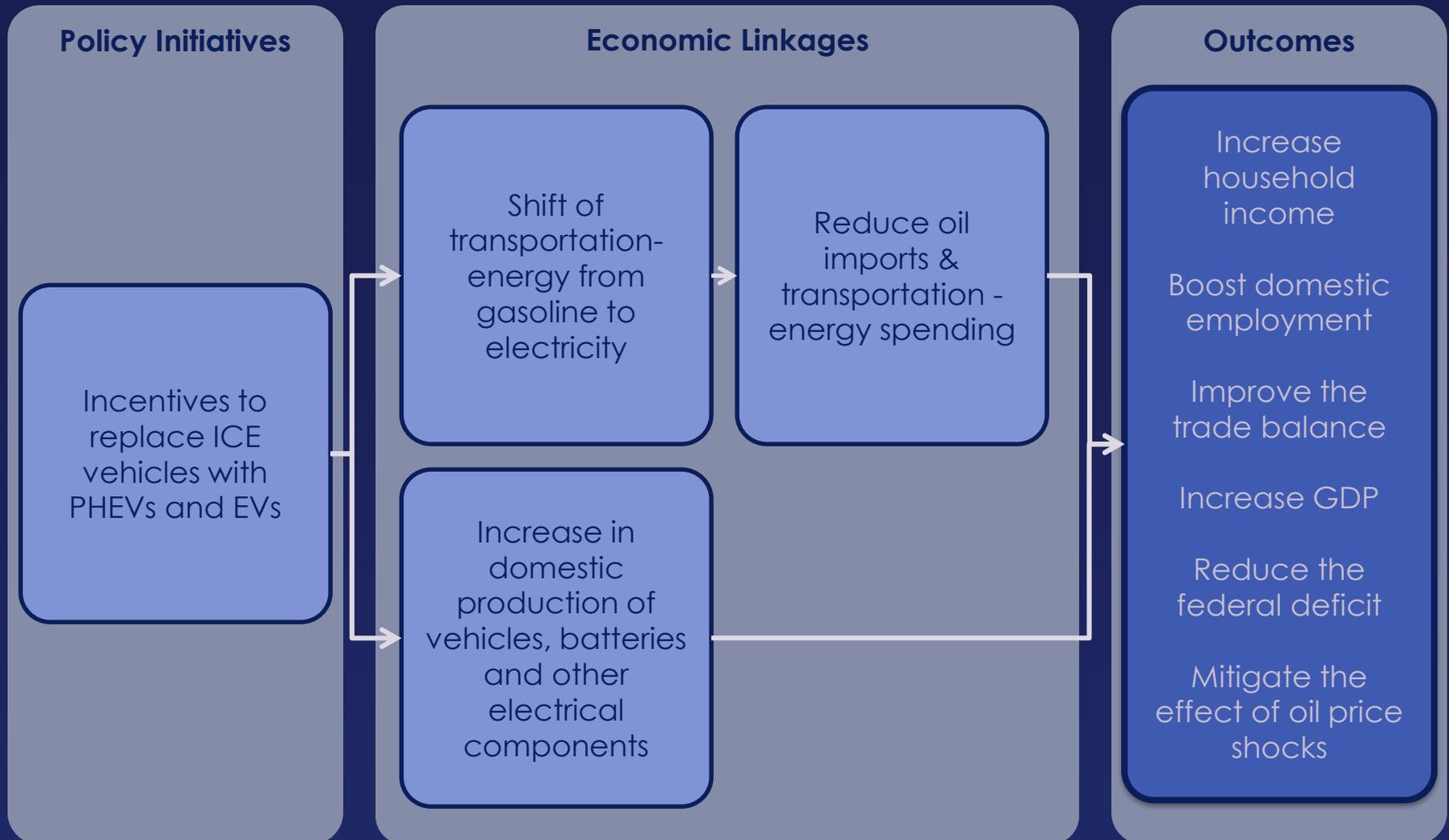
Country	Gasoline	Diesel
US	\$0.49	\$0.59
Canada	\$0.96	\$0.77
New Zealand	\$1.20	\$0.00
Australia	\$1.34	\$1.34
Iceland	\$2.28	\$2.03
Japan	\$2.59	\$1.55
Korea	\$2.64	\$1.87
Spain	\$2.66	\$2.08
Hungary	\$2.68	\$2.17
Austria	\$2.77	\$2.18
Luxemburg	\$2.90	\$1.94
Czech Republic	\$3.04	\$2.59
Switzerland	\$3.09	\$3.15
Slovak Republic	\$3.23	\$2.31
Sweden	\$3.24	\$2.56
Ireland	\$3.41	\$2.82
Italy	\$3.54	\$2.65
Belgium	\$3.58	\$2.10
Denmark	\$3.58	\$2.68
Portugal	\$3.65	\$2.28
France	\$3.80	\$2.69
Greece	\$3.82	\$2.39
Norway	\$3.87	\$2.97
Finland	\$3.93	\$2.28
UK	\$3.95	\$3.95
Germany	\$4.10	\$2.95
Netherlands	\$4.19	\$2.29

Policy Option: Fuel Economy Standards

CAFE Standards from 1978 to 2016
Miles per Gallon



In a 2010 study, Werling and Wescott studied how vehicle-electrification policies could affect the U.S. economy.



The policy proposal included incentives to transform the U.S. transportation sector through the purchase of GEVs.

Grid-Enabled Electric Vehicle Sales and Stock
Percent of Sales or Stock

Scenario	Base Case		EC Policy Scenario	
Year	GEV Sales (share)	GEV Stock (share)	GEV Sales (share)	GEV Stock (share)
2010	0.0%	0.0%	0.0%	0.0%
2015	1.5%	0.1%	4.5%	0.7%
2020	1.6%	0.1%	25.7%	5.3%
2025	2.1%	0.1%	69.9%	20.6%
2030	2.6%	0.2%	91.2%	42.4%

*Grid Enabled Vehicles (“GEV”) include plug-in hybrids and electric vehicles.

A key driver of economic change was that lower gasoline consumption would reduce U.S. reliance on oil imports.

Oil Imports

Million Barrels per Day

Year	Base Case	EC Policy	Difference
2010	11.9	11.7	-0.2
2015	12.5	11.7	-0.9
2020	12.4	11.0	-1.5
2025	11.8	9.5	-2.2
2030	12.1	8.9	-3.2
Cumulative BBL Oil Reduction, 2010-2030	---	---	-11,908

The study found that the average U.S. household would be better off due to rising income and lower energy consumption.

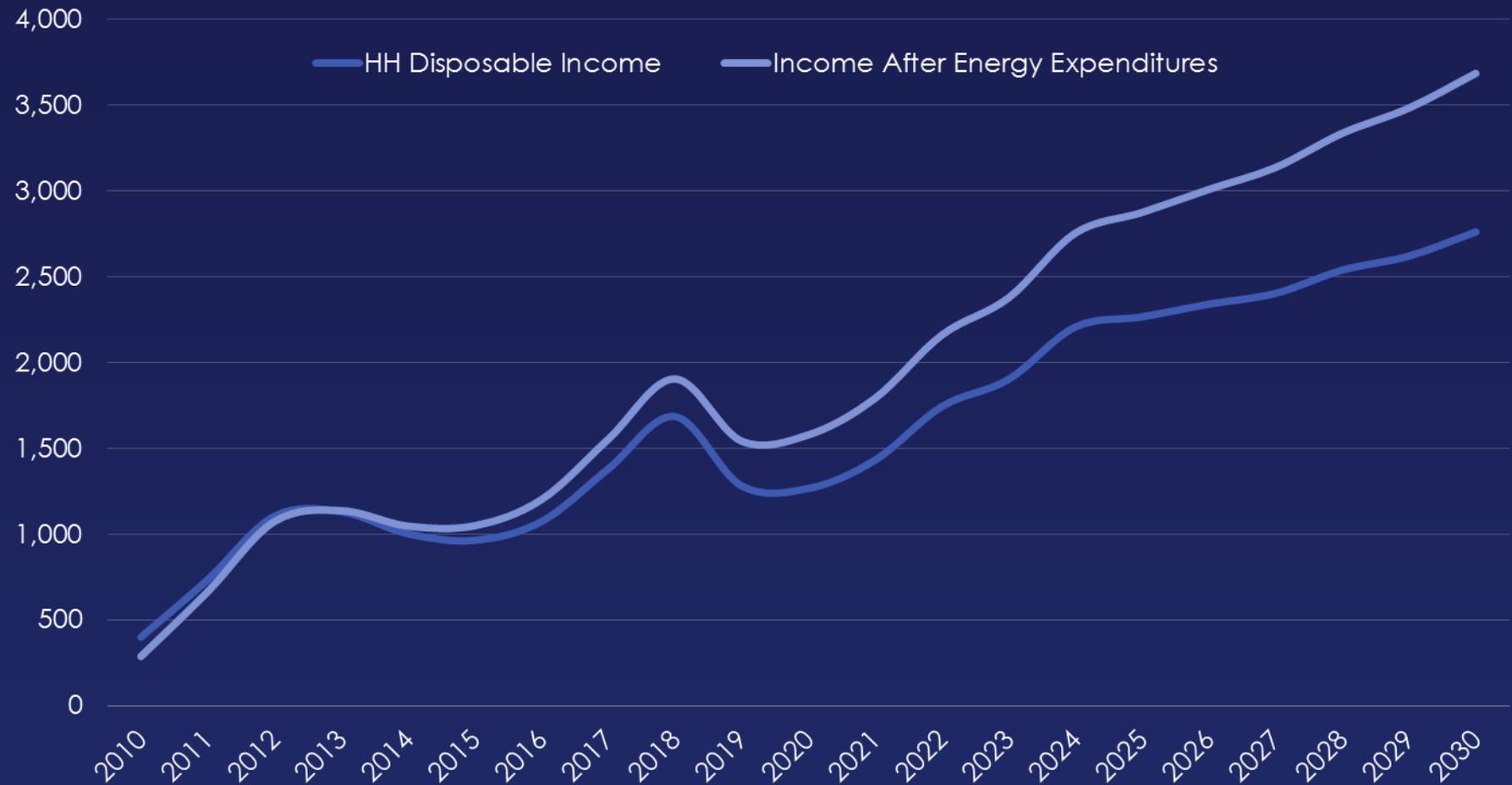
Difference in Disposable Income
Billions

Scenario / Year	Income After Energy Expenditures			
	Base (\$ bn)	EC (\$ bn)	Total Change (\$ bn)	Per Household (\$)
2010	\$10,253	\$10,287	\$35	\$289
2015	\$12,012	\$12,144	\$131	\$1,051
2020	\$13,865	\$14,071	\$206	\$1,580
2025	\$15,622	\$16,014	\$393	\$2,876
2030	\$17,856	\$18,383	\$527	\$3,687



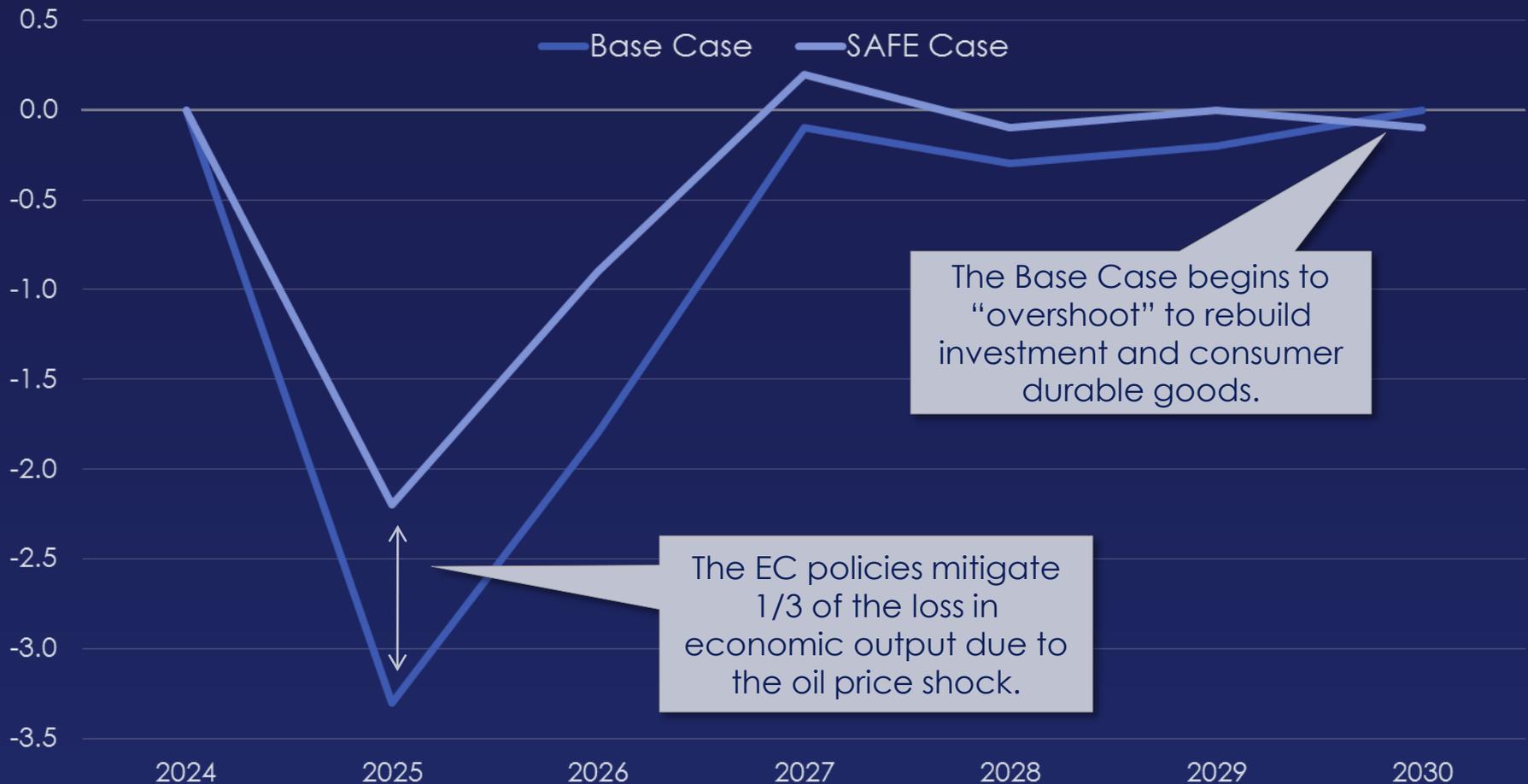
The study found that average household in the U.S. would be better off due to rising income and lower energy consumption.

Impact to Disposable Income Dollars per Household



Furthermore, the study found that EC policies could mitigate roughly one-third of the damage of an oil price shock.

Annual Impact to GDP
Percent from Baseline



Do we really need to use petroleum to fuel our cars?

Do we really need to use petroleum to fuel our cars?



Do we really need to use petroleum to fuel our cars?



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Do we really need to use petroleum to fuel our cars?



How will it all turn out? Wescott's views on energy shifts between now and 2030:

Oil

- Sharp price decline in next few years to undermine alternatives, unconventional. Then sharp rebound in prices.
- Gradually rising unconventional production.
- Demand rises until 2020-25, then declines due to electrification of transportation

Gas

- Becomes key bridge fuel to renewables
- Growing use in transportation sector – both gas-to-liquids and CNG
- Low capital costs of gas-fueled electric power assists conversion to renewables

Renewables

- Achieve true “grid parity” by 2016-20
- Suffer temporary setbacks when prices of fossil fuels tumble.

Transportation

- Steady increases in hybridization, with more electric; but gradual, not a single breakthrough; Tesla is a \$12 billion company today.
- Widespread electrification by 2020-30

VII. Class Discussion

Questions to ponder...

- What should be the priorities for building energy policy for a modern macroeconomy?
- How much freedom should governments give their citizens in terms of energy use?
- What is the best basis for modifying energy use: carrots or sticks?
- How might behavioral economics be applied to reduce energy usage?
- Do you believe energy will always be a scarce commodity in your lifetime?
- Are there other potential paradigm shifts that are likely to occur in the next 30 years that are as profound as the energy paradigm shift?
- If you were the boss of OPEC, how would you price oil for the next 10 years?
- It is now 2025. Oil is at \$50 a barrel. What happened? What didn't happen?
- It is now 2025. Oil is at \$250 a barrel. What happened? What didn't happen?