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# A Discussion of the International Implications of Shale

## Presentation based on the Center for Energy Studies publications:
## "Shale Gas and US National Security"
## "US LNG Exports: Truth and Consequence"
## SENR Testimony Feb 12, 2013

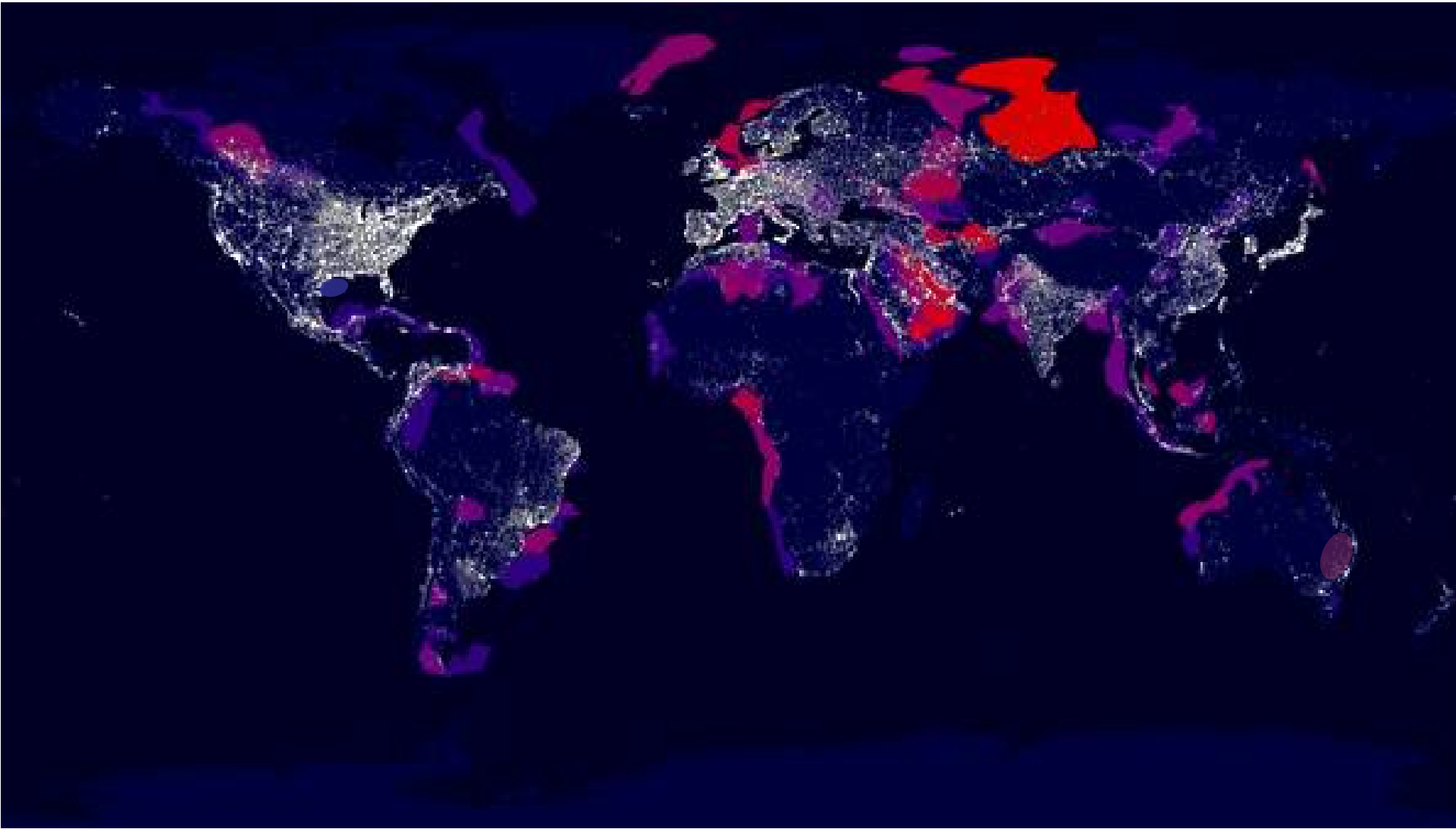
**Kenneth B Medlock III, PhD**

James A Baker III and Susan G Baker Fellow in Energy and Resource Economics, and
Senior Director, Center for Energy Studies, James A Baker III Institute for Public Policy
Adjunct Professor, Department of Economics
Rice University

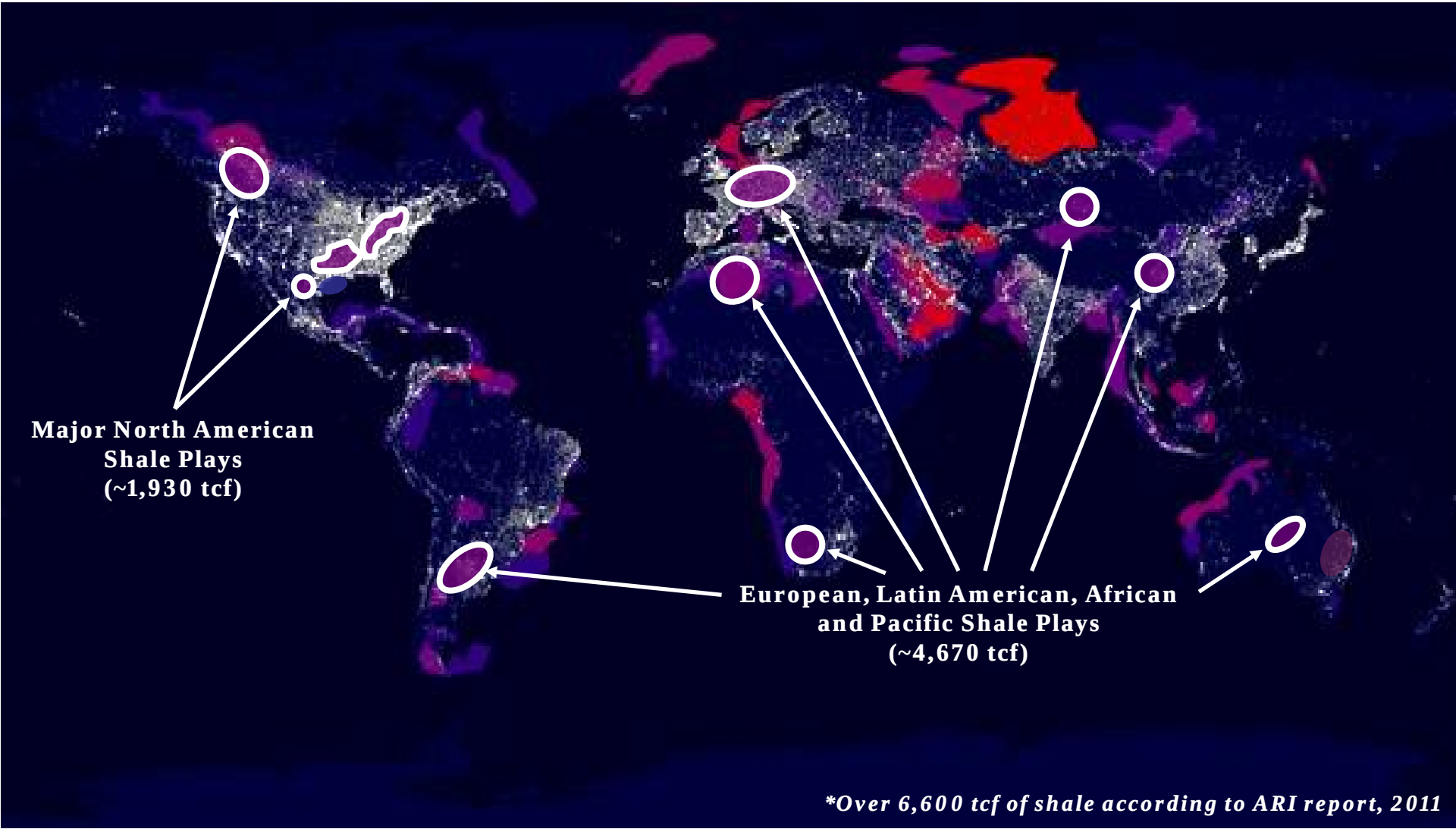
**May 2, 2013**

**James A Baker III Institute for Public Policy**
**Rice University**

# The "50,000 Foot" view in 2000: LNG is coming to North America



# The difference a decade makes: Over 6,600 tcf of technically recoverable shale*




*Over 6,600 tcf of shale according to ARI report, 2011

# Far-reaching implications of shale gas

- Current and future shale gas production in the US, Europe and Asia makes the long run *global* gas supply curve more elastic.
  - This has geopolitical implications
  - Mitigates the potential for sustained long term increases in price.
  - Greater supply elasticity also pressures traditional pricing paradigms.
- Growth in production from US shale plays has impacted the relative price of oil and gas in the US, and
- ... it has raised the possibility of US LNG exports.
  - Domestic price impacts are a central concern, but will not likely be large given domestic elasticity of supply.
  - Recent work by Hartley and Medlock (2013) indicate this apparent opportunity may be highly contingent on the value of the US dollar.
- But, can the US experience be replicated elsewhere?

# International Impacts

# Geopolitical Repercussions of Expanded U.S. Shale Gas Production

- According to a recent BIPP CES study, growth in shale gas production…
  - Virtually eliminates U.S. LNG imports for at least two decades
  - Combats the long-term potential monopoly power of a "gas-OPEC" or a single producer such as Russia to exercise dominance over large natural gas consumers in Europe or elsewhere
  - Substantially reduces Russia's market share in Europe from 27 percent in 2009 to 13 percent by 2040, reducing the chances that Moscow can use energy as a tool for political gain
  - Reduces the future share of world gas supply from Russia, Iran, and Venezuela; without shale discoveries, these nations would have accounted for about 33 percent of global gas supply in 2040, but with shale, this is reduced to 24 percent.

# Geopolitical Repercussions of Expanded U.S. Shale Gas Production (cont.)

- … growth in shale gas production…
  - Reduces the opportunity for Venezuela to become a major LNG exporter and thereby lowers longer-term dependence in the Western Hemisphere and in Europe on Venezuelan LNG
  - Reduces competition for LNG supplies from the Middle East, thereby moderating prices and spurring greater use of natural gas, an outcome with significant implications for environmental objectives as well
  - Reduces U.S. and Chinese dependence on Middle East natural gas supplies, lowering the incentives for geopolitical and commercial competition between the two largest consuming countries and providing both countries with new opportunities to diversify their energy supply
  - Limits Iran's ability to tap energy diplomacy as a means to strengthen its regional power or to buttress its nuclear aspirations

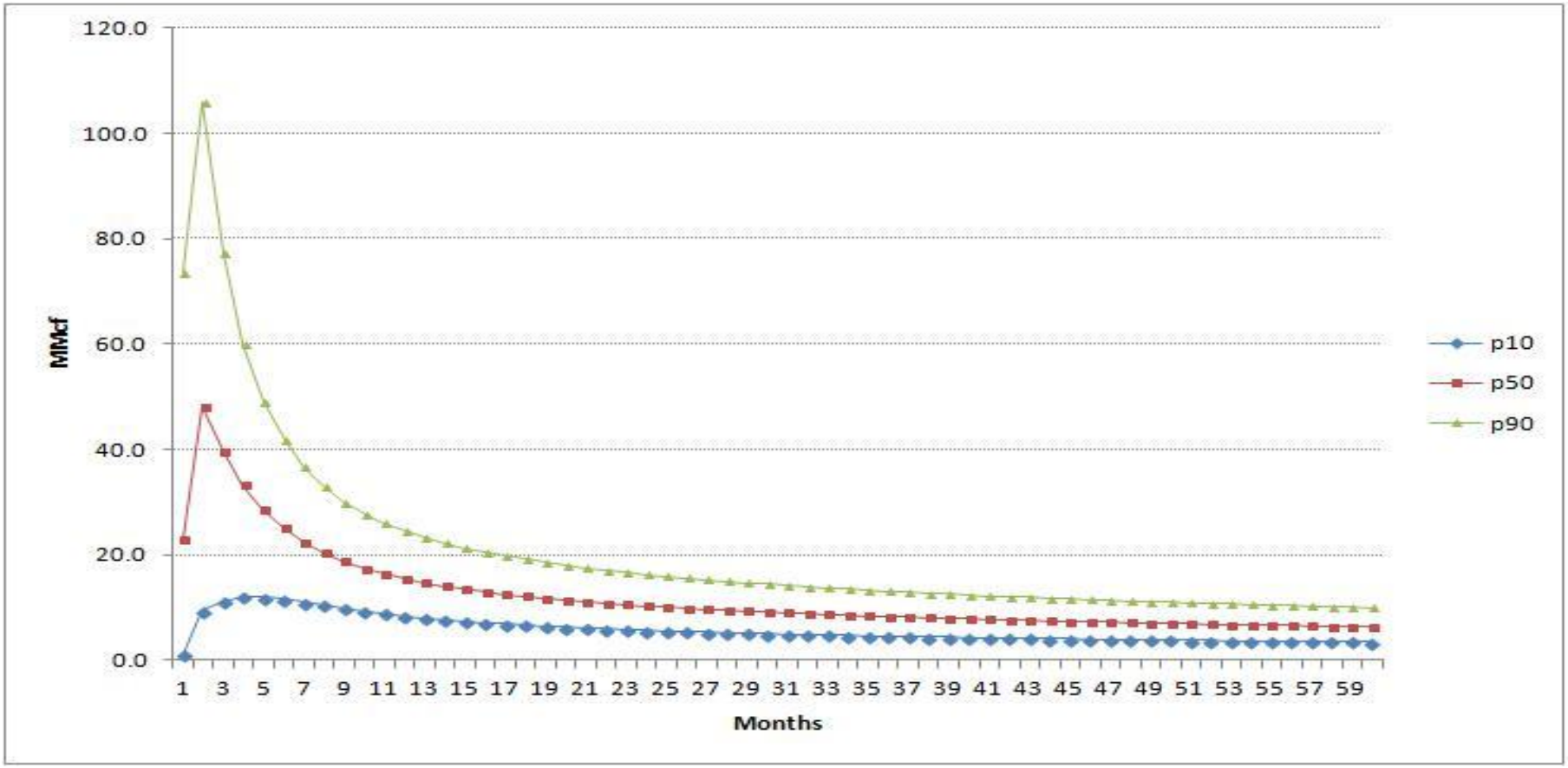
**But…**

# … nothing is certain…

- A stable regulatory environment that fosters responsible development of domestic resources is critical to achieving the benefits presented by shale.
- Many issues face shale development: some are global, some are not.
  - **Resource Access** – mineral rights ownership; acreage acquisition; resource assessments; environmental opposition; etc.
  - **Market Structure** – transportation regulatory structure (unbundled access vs. incumbent monopolies); bilateral take-or-pay obligations or marketable rights; existence of gathering and takeaway capacity and hurdles to development; competing resources (RPS, coal, nuclear, etc.); pricing paradigms; etc.
  - **Water** – volume and availability for production; water rights and resource management regulation; flowback options (recycle and/or treatment and disposal) and native infrastructure; concerns about watershed protection during drilling operations (casing failures and fracture migration); etc.
  - **Other issues** – earthquakes related to injection of produced and treated water; long term environmental effects of methane (and other gases) escape; concerns about potential chemical and/or radiation contamination from produced water; ecological concerns related to land use and reclamation; etc.

# Questions about well performance

- EURs can vary within a shale play substantially
  - Barnett type-wells illustrated (based on analysis of over 12,000 horizontal wells)
  - Ultimately, profitability matters, and there is little debate about resource scale

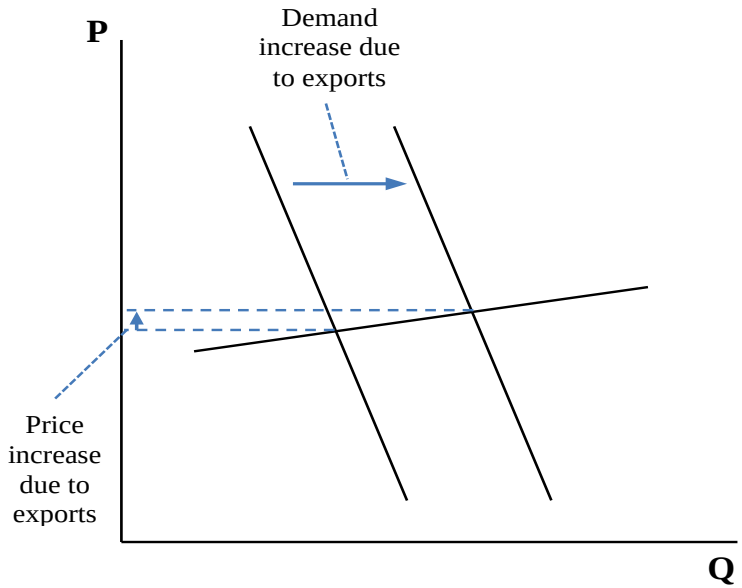


# The Prospect of US LNG Exports

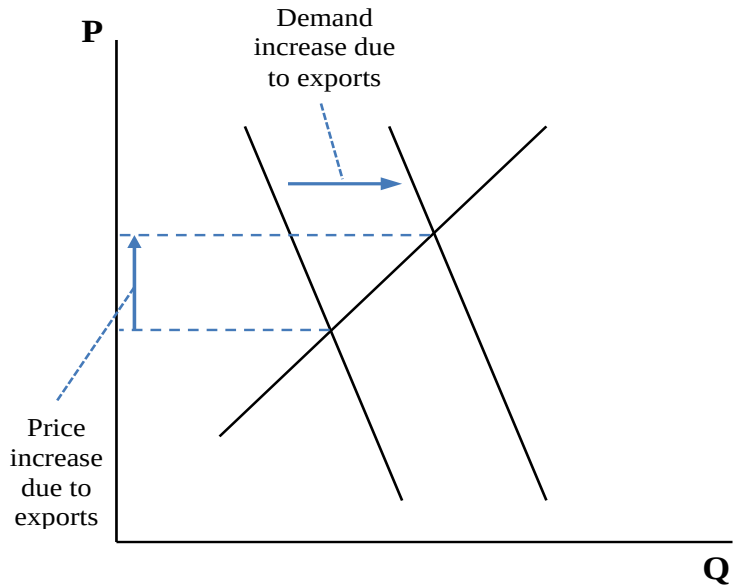
# Domestic Price Impacts of US LNG Exports

- Common claim: US price will increase substantially
  - Only true if US domestic supply is highly inelastic (pictured below) and foreign supply is highly elastic (not pictured). This claim is unlikely.

**The Elasticity of Domestic Supply and the Impact of Exports on Price**



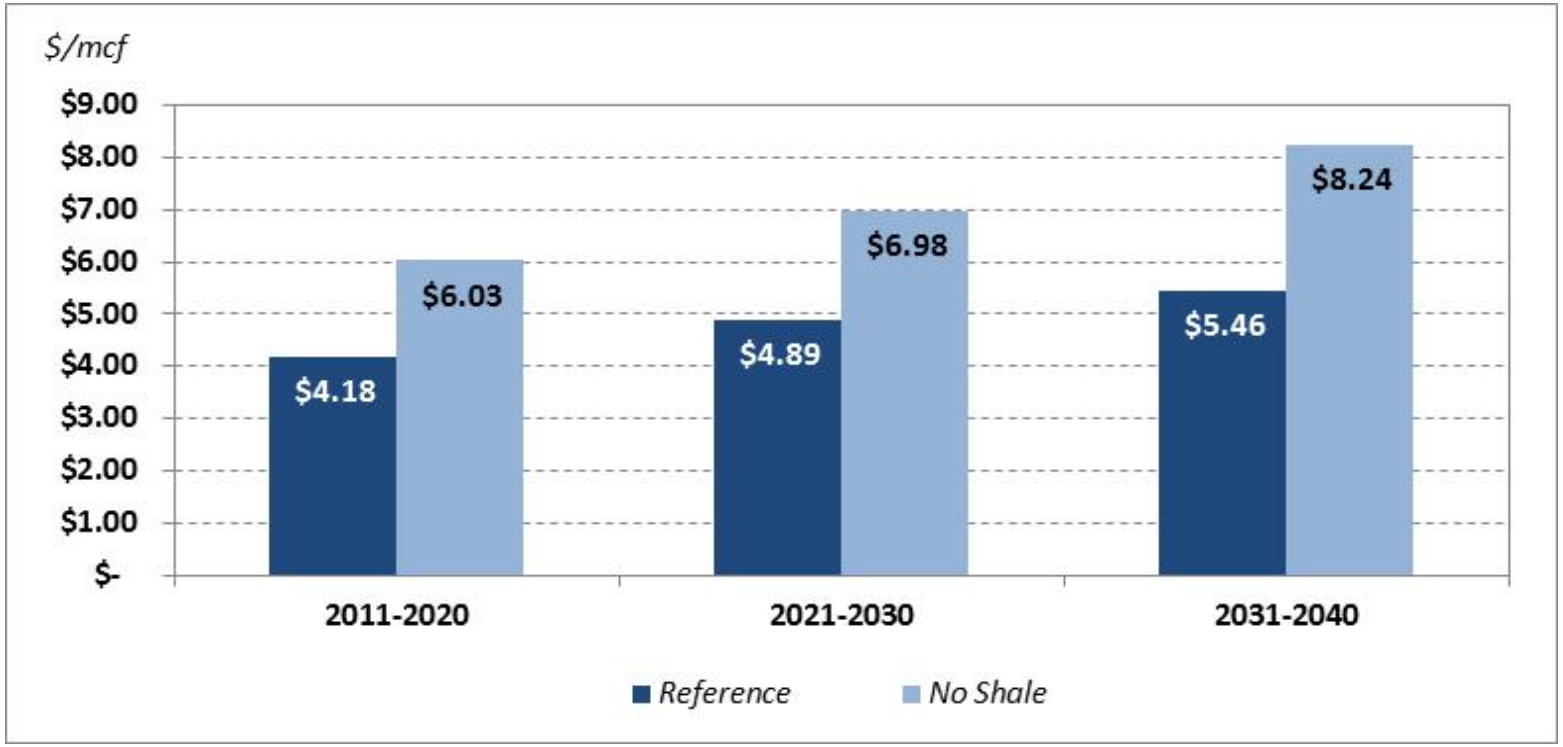

**Case 1: Supply elastic**




**Case 2: Supply inelastic**

# Impact of Shale on Henry Hub, 2011-2040

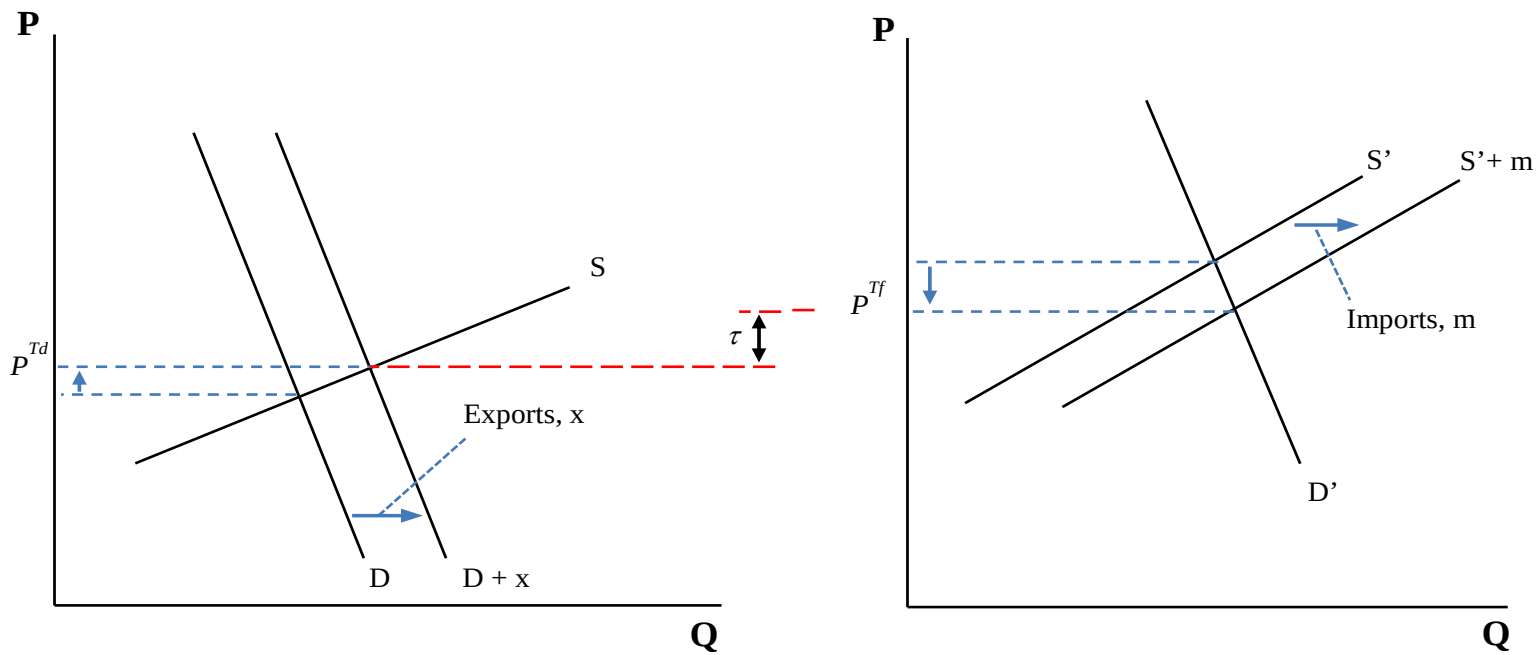
- The domestic supply curve is much more elastic as a result of shale gas developments. Domestic ***long run*** elasticity*
  - with shale = 1.52; without = 0.29.




* - Results derived from the Rice World Gas Trade Model (RWGTM). The RWGTM was developed by Ken Medlock and Peter Hartley at Rice University using the MarketBuilder software provided by Deloitte MarketPoint .

# Price Impacts of US LNG Exports: Introducing the Foreign Market Response

- When trade between two markets is introduced, price in each adjusts. The adjustments will depend on the relative elasticities of supply and demand.




Domestic Market

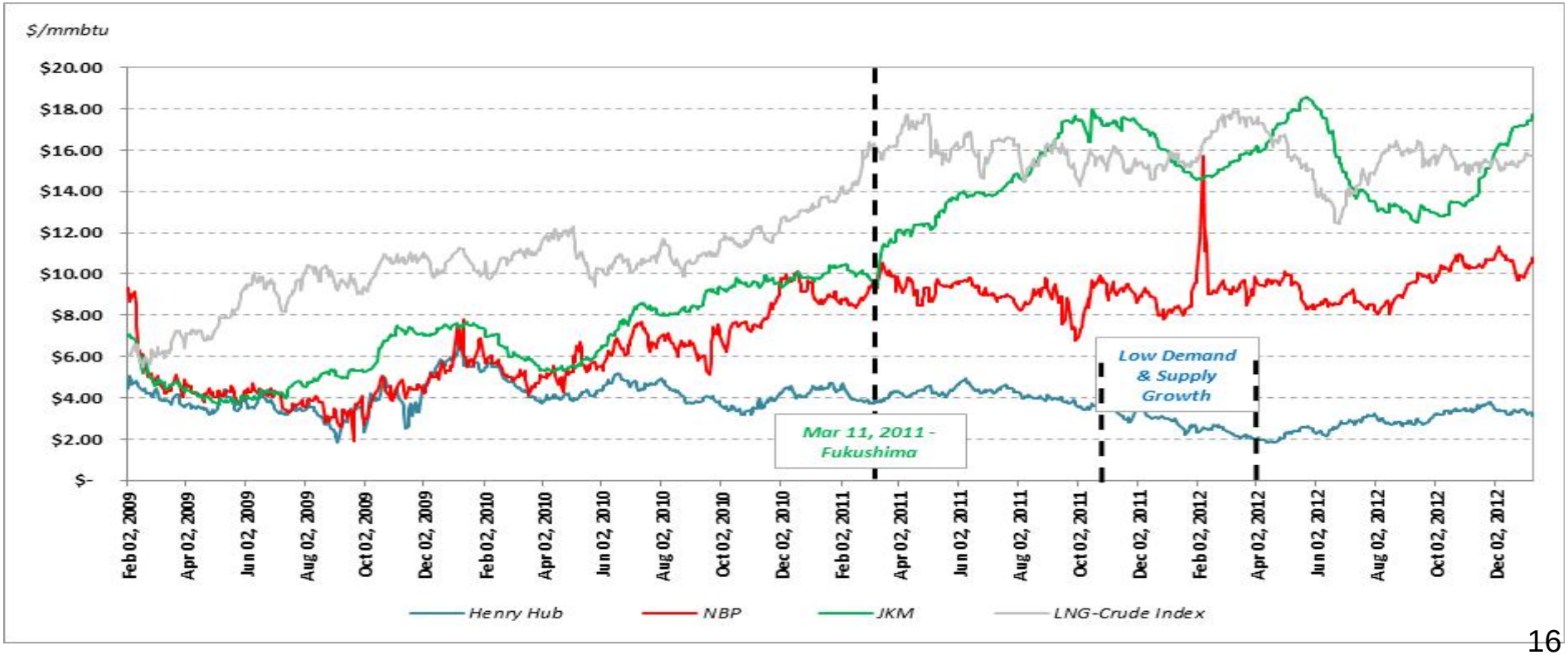
Foreign Market

# The Impact of US LNG Exports

- Lots of attention given to current international spot price, but several factors are often ignored, such as
  - short term capacity constraints, which are important when considering where we are today,
  - domestic market interactions with markets abroad, and
  - a weak US dollar.
- "Spot" price of natural gas in Asia changed after Fukushima.
- US LNG exports could put significant downward pressure on international price.
  - In 2011, LNG trade totaled about 32 bcfd. Current US filings total over 30 bcfd.
- Effects of international trade are contingent on both domestic and foreign elasticities of supply and demand.

# International Prices

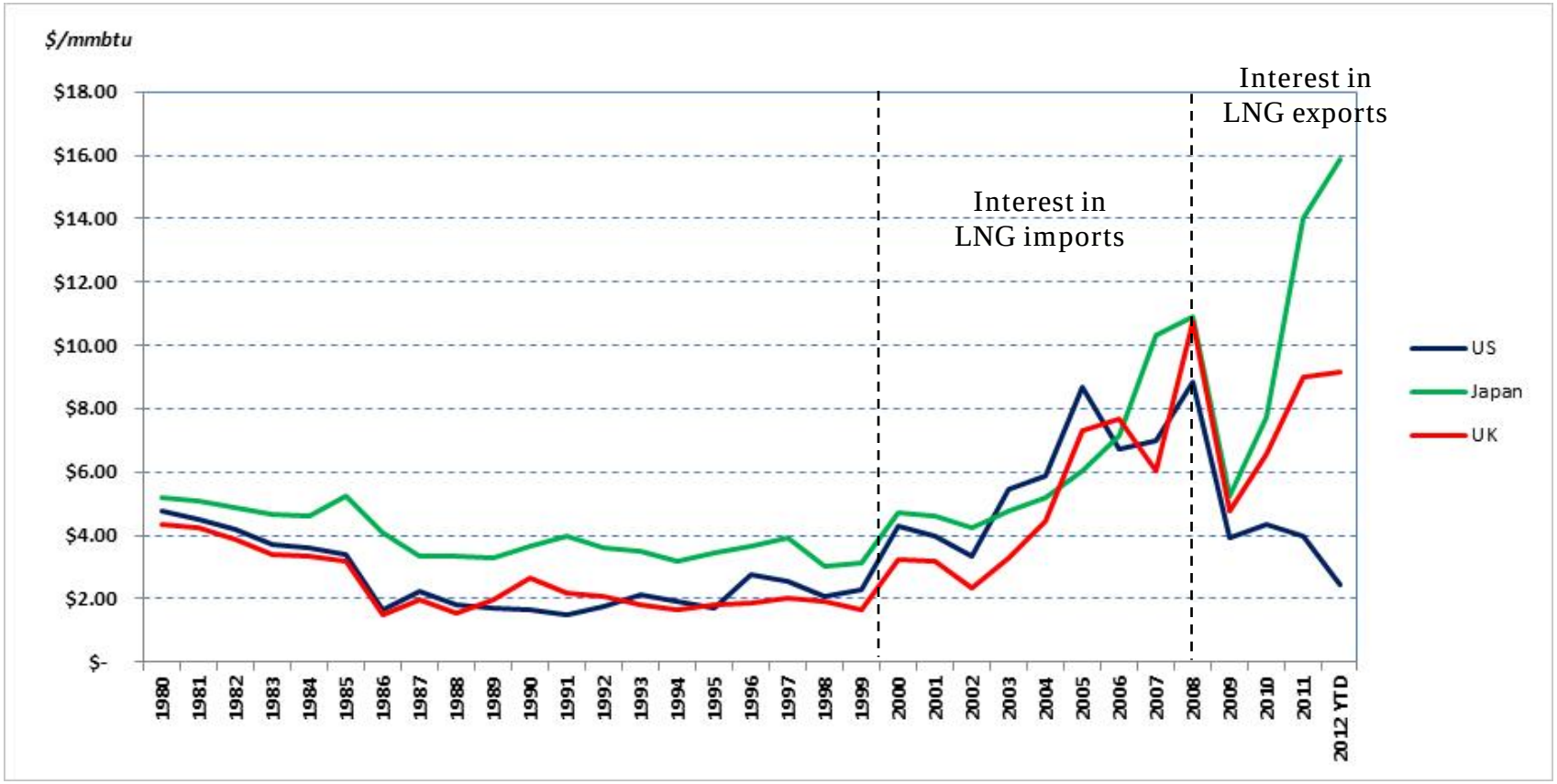
- Will the change in regional natural gas price relationships since March 2011 persist?
  - Unexpected demand shocks have had an influence.
  - It is reasonable to expect that US price will rise to reflect marginal cost and JKM premium will subside with relief of deliverability constraint




Price data from Platts; LNG Oil-Index author's calculation

# A Longer Term View of Prices

- The recent divergence is new… but can it persist? Or, is it a result of short term constraints?

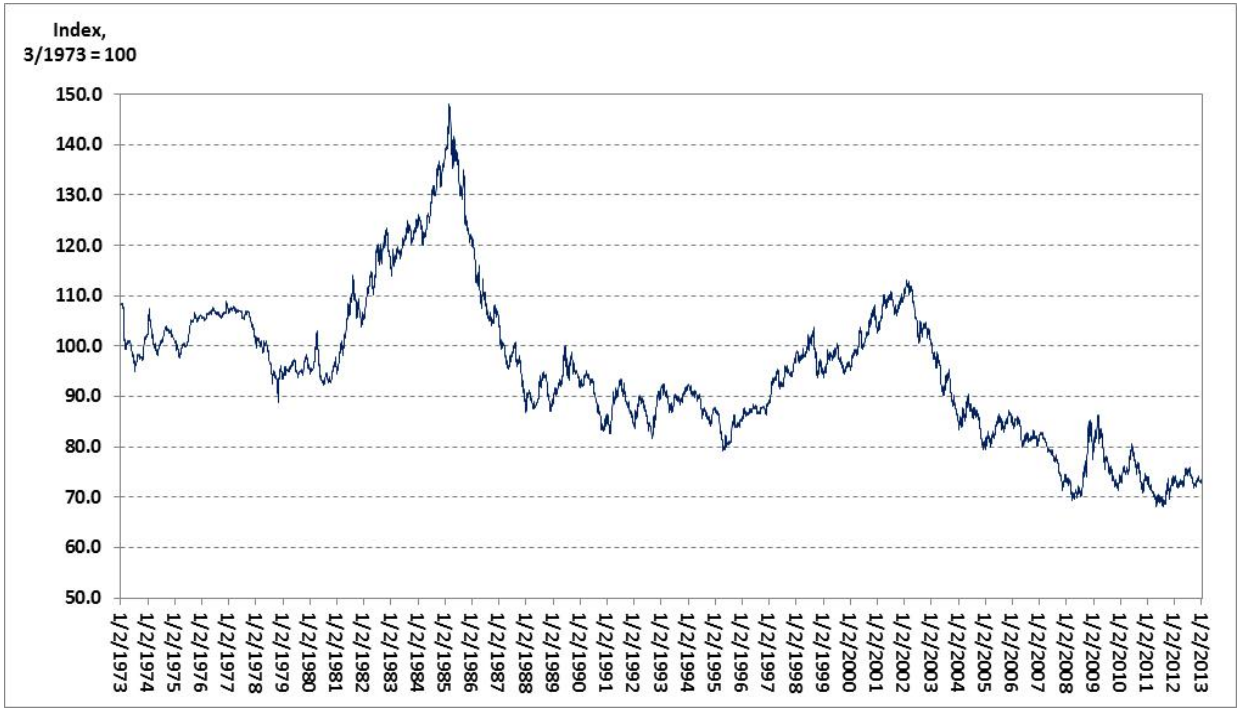



Sources: Compiled from Platts, IEA, EIA

# Exchange Rate Effects

- Other factors that are important to the issue are the exchange rate, the role of liquidity in pricing paradigms, and foreign supply developments.
  - Exchange rate impacts: $P_{US} - P_{UK} \cdot XR \cdot HR = arb\ value$

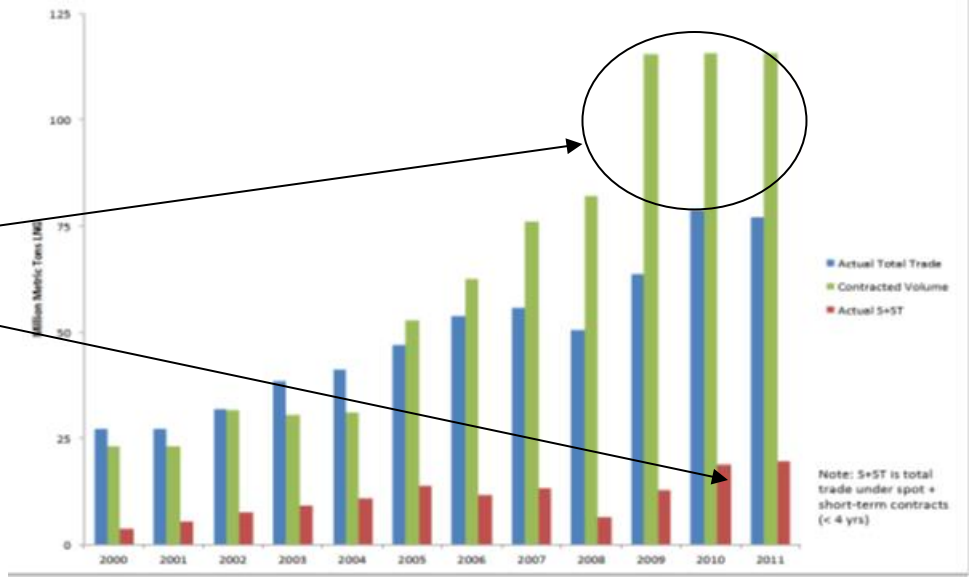
**Trade-Weighted Value of US $, Major Currencies (Daily, Jan 1973 – Jan 2013)**



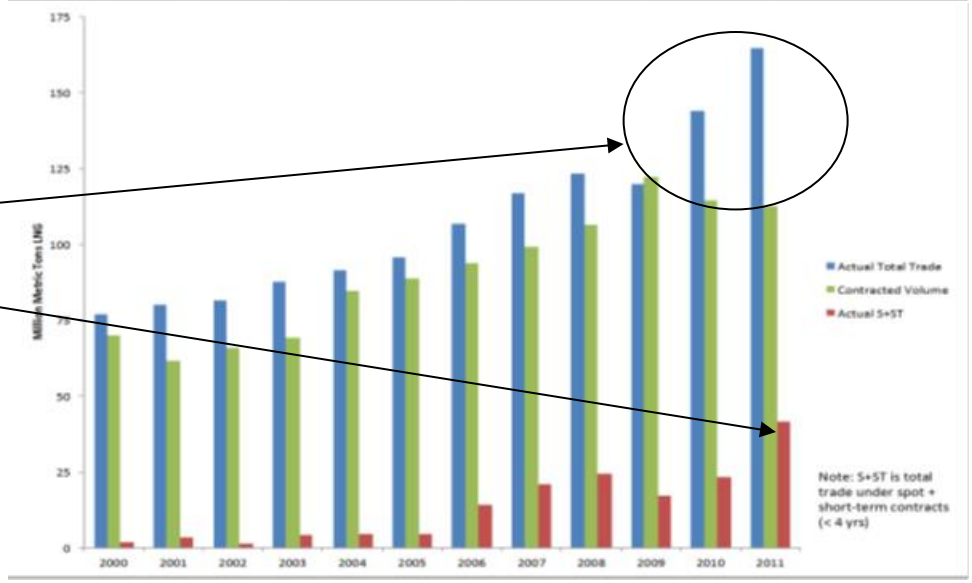

*Source: US Federal Reserve Bank*

# Contracts and flows

- Atlantic Basin LNG diverted…
  - short term volumes expand




- … Pacific Basin LNG expands.
  - short term volumes expand

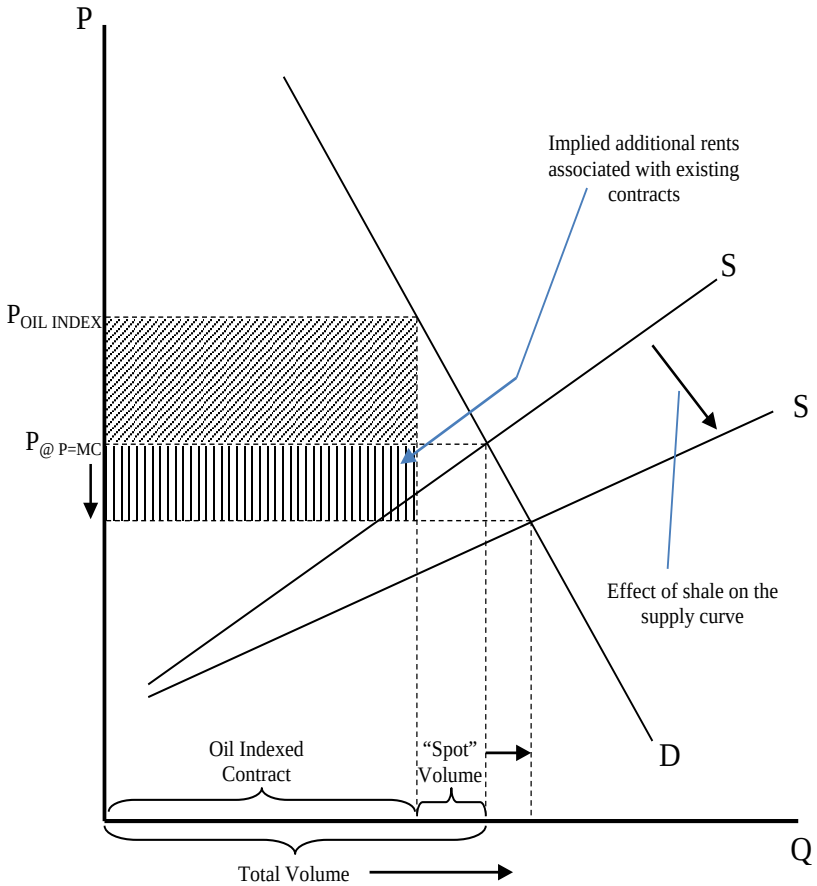



Data Sourced from the International Group of Liquefied Natural Gas Importers (GIIGNL)

# Contracts and Liquidity

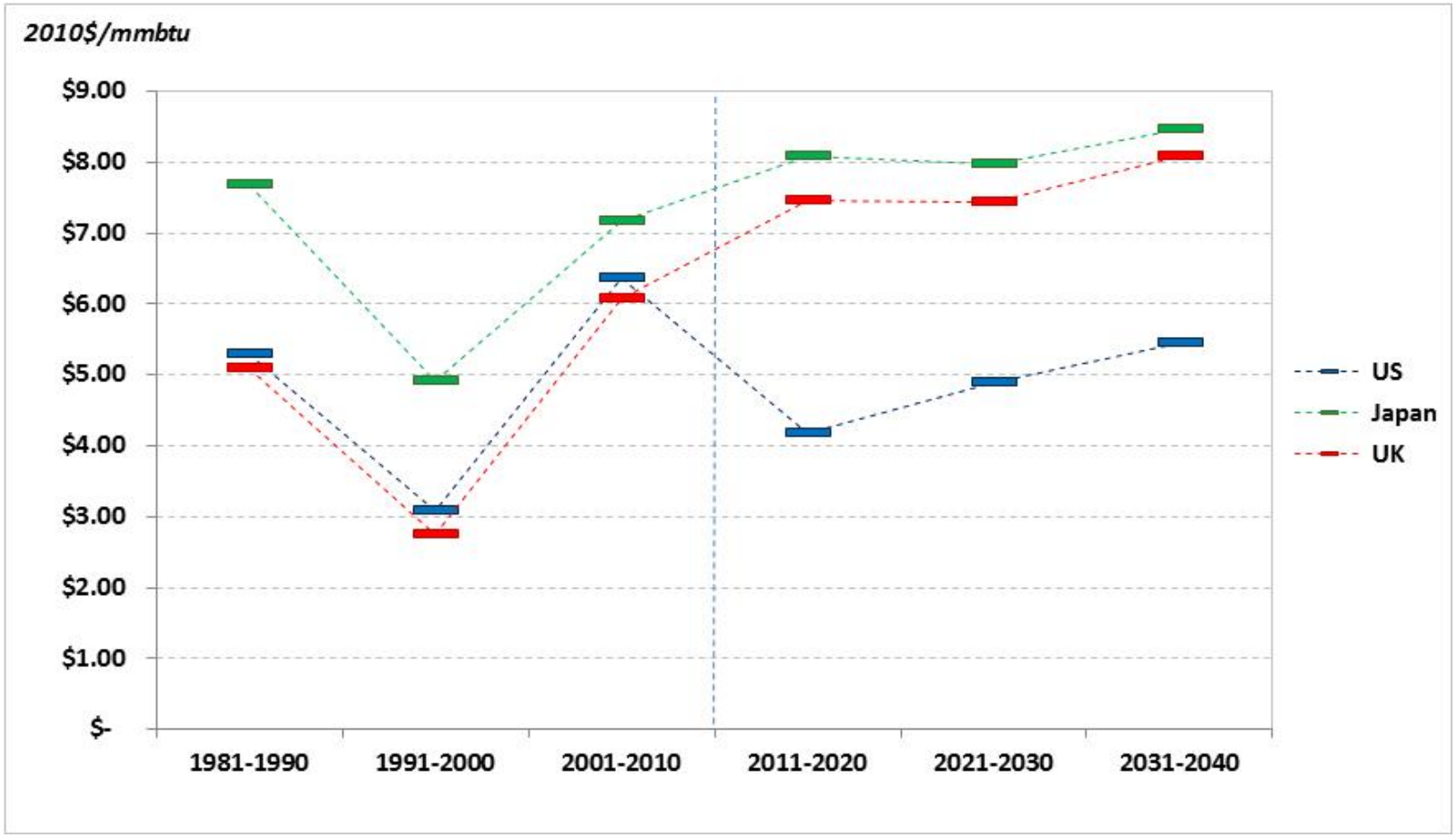
- Absent storage and physical liquidity, oil indexation provides an element of price certainty.
- Oil indexation is a form of price discrimination
  - (1) Firm must be able to distinguish consumers and prevent resale.
  - (2) Different consumers have different elasticity of demand.
- Increased ability to trade between suppliers and consumers (physical liquidity) violates condition (1).
  - This will happen in a liberalized market, or as LNG trade grows, or as hubs emerge in end-use markets.

**The Supply Curve Effect of Shale and Implications for Price**



# How do the RWGTM results compare to history?

- Henry Hub remains below the relationship that persisted historically, although the Asia price and NBP grow slightly closer.



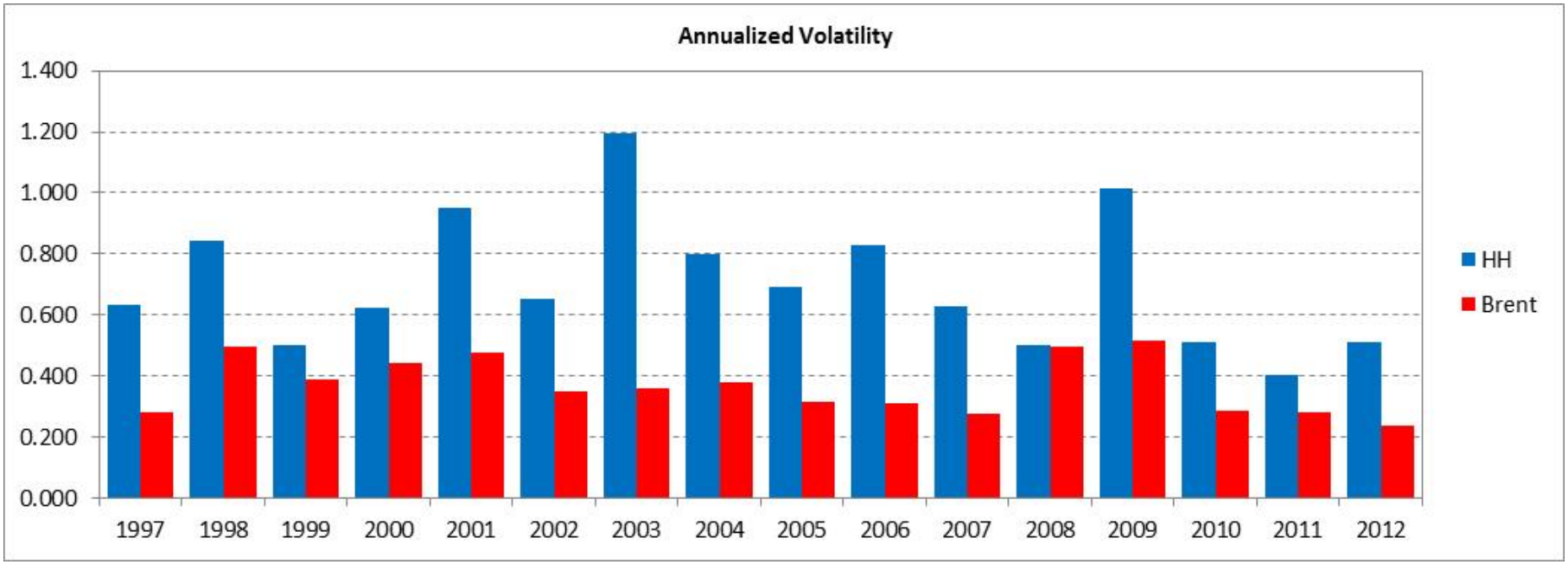

Sources: Compiled from Platts, IEA, EIA and RWGTM

# US LNG Exports

- Export capacity will be built on the expectation that current rents from arbitrage will "pay" for the upfront fixed cost.
  - But, once the fixed cost is sunk, operation no longer hinges on the payment to capital. It is possible that some terminals will not earn the *ex-ante* required rate of return, contingent on the off-take agreement.
- US LNG export capacity could be used for seasonal arbitrage. While the annual load factor would be lower in this circumstance, if seasonal price differences among the regional markets are sufficient, US exports would be profitable.
- LNG exports from the US will link global markets to storage in the US. By providing this link, liquidity benefits could spill over and contribute to very different market paradigm.
- LNG project success could hinge on who bears risk in contractual relationships.

# What about Price Volatility?

- Common claim: If we allow LNG exports we will import oil price volatility.
- The premise here is that crude oil is more volatile than natural gas. Is it?




- Economic theory predicts this. The more fungible (or tradable) a commodity is, the lower its price volatility, all else equal.
- Is the term being misused? (Volatility vs. forecast accuracy?)

# Questions/Comments