ENERGY DIPLOMACY
THE ECONOMIC AND ENVIRONMENTAL IMPACTS OF AN OIL SHORTAGE

what does REMI *say?* sm

Presented by Shane Vyskocil, Economic Associate and Harry Walsh, Economic Associate

Agenda

- Background on the Strait of Hormuz and recent tensions
- Previous REMI applications to energy diplomacy
- Discussion of alternatives to bypass the Strait
- Model Demonstration

What is the Strait of Hormuz?

□ The Strait of Hormuz is a 21 mile wide strait that connects the Persian Gulf to the Gulf of Oman

□ According to the EIA, the Strait of Hormuz is the world's most important strategic oil chokepoint

□ Chokepoints are "narrow channels along widely used global sea routes that are critical to global energy security" (EIA, 2019).


Source: Goran tek-en via Wikimedia Commons, edited for emphasis

Oil exports through the Strait of Hormuz

Crude oil, condensate, and petroleum products transported through the Strait of Hormuz

- In 2018, the Strait's daily oil flow averaged 21 million barrels per day (b/d)
  - One-third of total global seaborne traded oil
  - More than 25% of global liquefied natural gas trade
  - About 21% of global petroleum liquids consumption
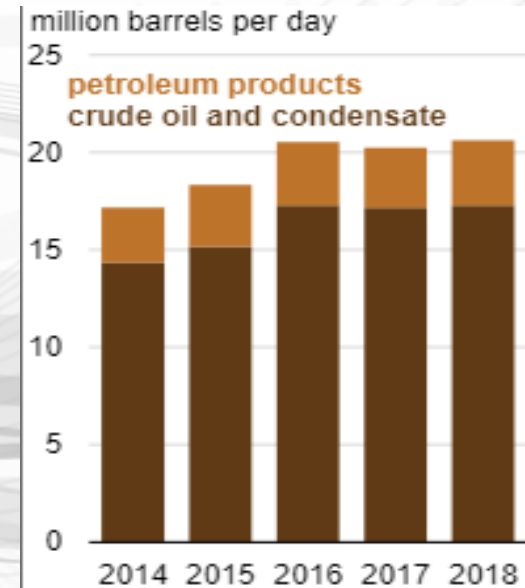
Source: U.S. Energy Information Administration and ClipperData, Inc.

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Tensions with Iran

□ Iran has threatened to close the Strait of Hormuz, a response to American sanctions imposed after withdrawing from the Iran deal

□ In June, two tankers were targeted in an attack attributed to the Iranian military

□ In July, a British tanker was seized by the Iranian Navy

Source: US Navy

Tensions with Iran

□ Military tensions have increased in the region

◻ In June, the Iranian Revolutionary Guard shot down a U.S. Navy surveillance drone operating above the Strait of Hormuz

◻ The U.S. approved retaliatory strikes on Iran, but aborted the effort minutes before the strikes were scheduled

◻ The U.S. has requested allies take part in a naval mission to protect shipping in the Strait of Hormuz

REMI Application to Energy Exports

□ What would the impacts be if the United States increased natural gas exports to fill international demand from a disruption at the Strait?

□ United States natural gas production history:
  ▪ 2005: 18,051bcf produced
  ▪ 2009: 21,577bcf produced
  ▪ 2018: 30,438bcf produced

U.S. Dry Natural Gas Production

Million Cubic Feet

Source: U.S. Energy Information Administration
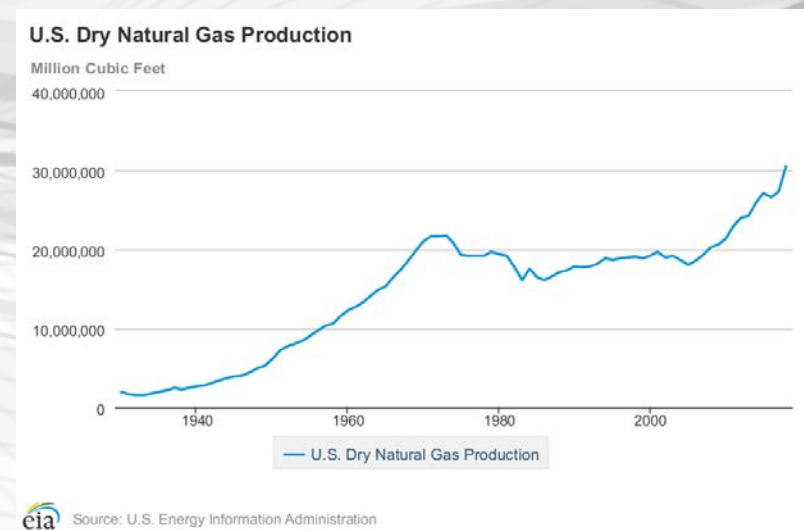
REMI Application to Energy Exports

- In 2012, REMI and RBAC, Inc., collaborated on a report that analyzed different export scenarios of Liquefied Natural Gas (LNG), finding:
  - Effects on domestic natural gas prices
  - US macroeconomic impacts
- Baseline of 3 BCF/day exported compared to:
  - High LNG export scenario (6 BCF/day)
 - Low LNG export scenario (0 BCF/day)

REMI Application to Energy Exports

□ RBAC's GPCM Natural Gas Market Forecasting System analyzed how an increase in LNG Exports would effect U.S. natural gas prices

  ▫ Exports would increase international demand for U.S. LNG and raise prices for domestic consumers

**Henry Hub Price**
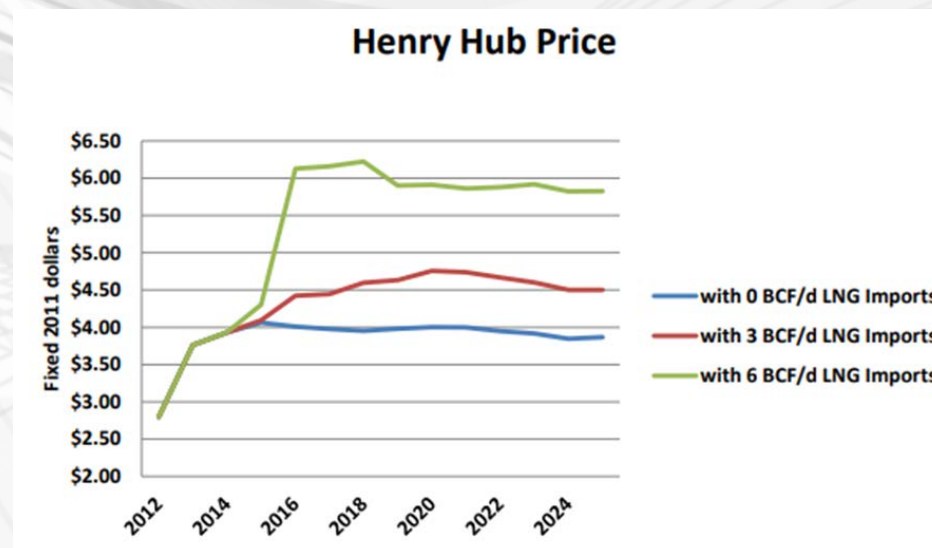
REMI Application to Energy Exports

□ The REMI's PI+ model found LNG exports:

◻ To have a short-term positive economic impact due to initial infrastructure investments

◻ To have a negative economic impact in the long run, due to higher domestic natural gas prices

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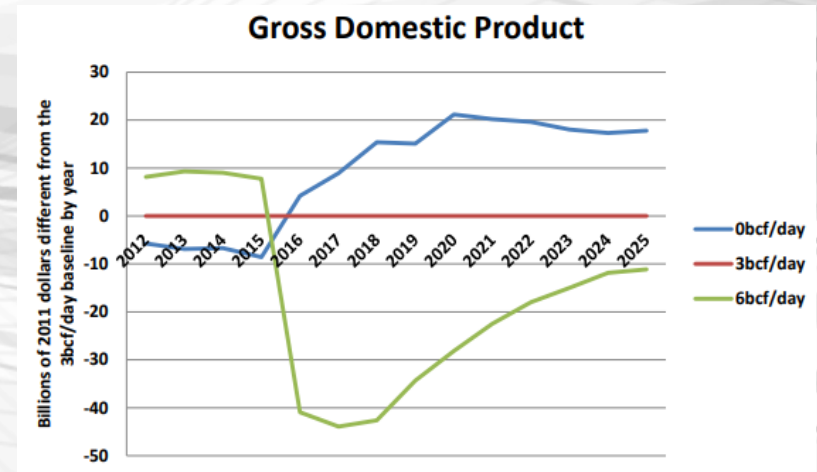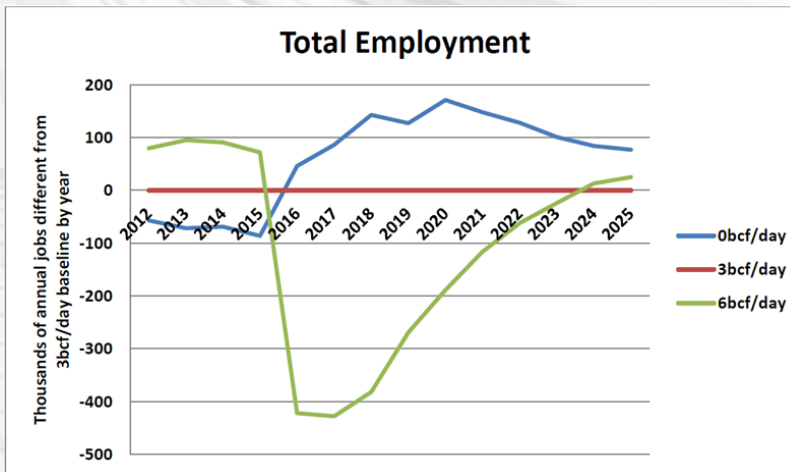
U.S. imports from the Strait of Hormuz

Volume of crude oil and condensate transported through the Strait of Hormuz by destination

- In 2018 the U.S. imported 1.4 million barrels per day through the Strait
  - 18% of total U.S. crude oil and condensate imports
  - 7% of total U.S. petroleum liquids consumption
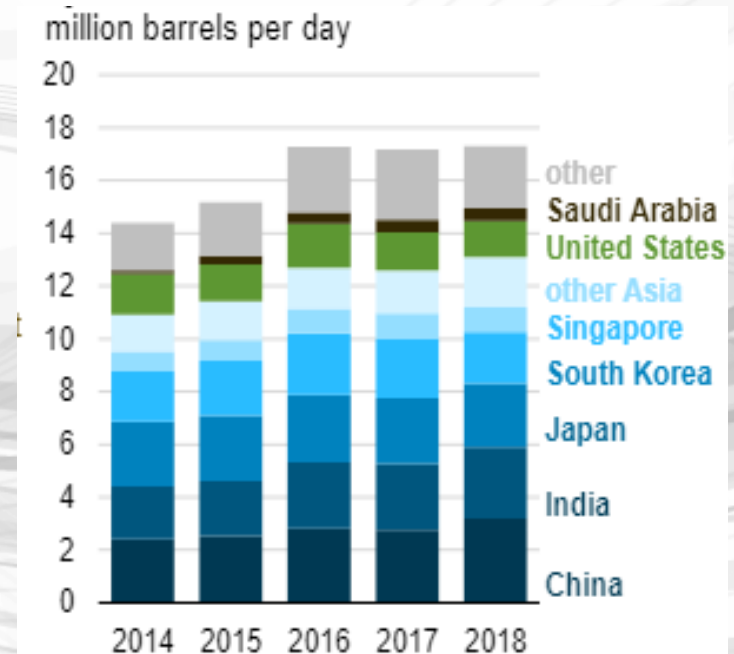
Source: U.S. Energy Information Administration, based on tanker tracking data published by ClipperData, Inc.

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Oil Price Elasticity

□ The Federal Reserve published a report which summarized the price elasticities of oil in existing literature

□ A review of 30 papers that reported price elasticities (excluding 3 outliers) gave the following data:

Mean	-0.14
Median	-0.12

Caldara, Dario, Michele Cavallo, and Matteo Iacoviello (2016). Oil Price Elasticities and Oil Price Fluctuations. International Finance Discussion Papers 1173.

Projected Price Change from Closure

□ Since 7% of U.S. petroleum liquids consumption comes from the Strait of Hormuz:

　　▫ A 7% forced supply decrease from a closure would cause a projected price increase of 50% of petroleum liquids
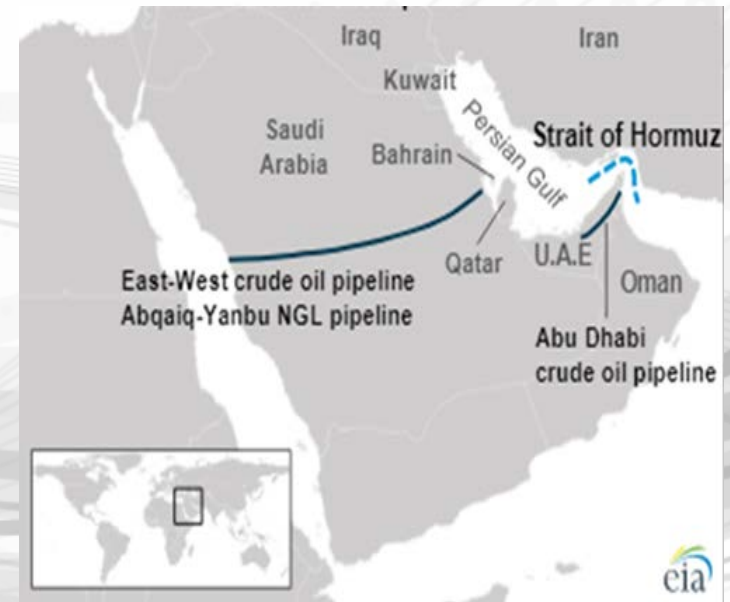
$$E_d = \frac{\Delta Q/Q}{\Delta P/P}$$

$$\frac{\Delta P}{P} = \frac{1}{E_d}\frac{\Delta Q}{Q}$$

$$\frac{\Delta P}{P} = (-7.14)(-0.07) = +0.50$$

Proposed Alternatives: Bypass the Strait of Hormuz

□ Long term closure could lead to pipeline expansions to bypass the Strait

  ▫ The Abu Dhabi Crude Oil Pipeline in the UAE was opened in 2012 for this purpose

□ Saudi Arabia plans to expand the East-West pipeline that connects the Mideast gulf to the Red Sea:

  ▫ This would increase the pipeline's capacity by 2 million b/d

□ The expansion is expected to be operational by 2023

Source: U.S. Energy Information Administration

Proposed Alternatives: Bypass the Strait of Hormuz

□ Only Saudi Arabia and the UAE have the available pipelines and additional capacity to bypass the Strait of Hormuz

  ▣ EIA reports that pipelines in the region have 3.8 million b/d of unused capacity for export

□ Assuming the U.S. proportion of these exports remains constant:

  ▣ 6.76% of this capacity could be used to ship oil to the U.S. (256,880 b/d)

Proposed Alternatives: Bypass the Strait of Hormuz

□ If the United States utilized this capacity of 256,880 b/d:

  ▫ Assuming 20 million b/d of U.S. petroleum liquids consumption, there would now be a forced supply decrease of about 5.7% (1,143,120 b/d)

  ▫ This would lead to a price increase of about 40.8%

$$E_d = \frac{\Delta Q / Q}{\Delta P / P}$$

$$\frac{\Delta P}{P} = \frac{1}{E_d} \frac{\Delta Q}{Q}$$

$$\frac{\Delta P}{P} = (-7.14)(-0.057) = +0.408$$

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Model Demonstration

Scenario 1

- Concept: Initial impact from closure of the Strait of Hormuz

- Methodology
  - 50% Increase in Fuel Cost (liquidized petroleum)
    - From 7% Supply Decrease

Scenario 2

- Concept: Impact of Strait of Hormuz closure with utilization of existing pipeline capacity

- Methodology
  - 50% upward revision of baseline fuel costs (petro)
    - Starting 2020 with Hormuz closure
  - 9.2% downward revision in simulation fuel costs
    - Starting 2021 in reaction to closure

Scenario 3

- Concept: Partial consumption substitution from oil to natural gas as fuel due to supply constraint

- Methodology
  - Decrease in imports of extracted oil
    - Representative of 18% of US crude oil imports (Hormuz)
  - Increase in demand for natural gas extraction
    - 4:1 ratio of reallocation, split between residential and industry demand