

Unconventional Oil and Gas Activity and Crude Export Restrictions

*A discussion of U.S. policy of restricting crude oil
exports.*

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Introduction

Economics of Export Restrictions

Unconventional Oil and Gas

A World Without Export Restrictions

New Investment Opportunities

Conclusions

Introduction

Energy Policy and Conservation Act (EPCA)

- 1973 Oil Crisis – OPEC proclaimed an embargo on oil that lasted from October 1973 to March of 1974.
- December 1975 – President Ford signed the Energy Policy and Conservation Act (EPCA)
 - Section 103 prohibited the export of crude oil and natural gas.
 - EPCA created a Strategic Petroleum Reserve
- October 9, 2015 – the U.S. House of Representatives passed a bill that would repeal the sections of EPCA that prohibit the export of crude and natural gas.
 - The recent “shale boom” has been the catalyst for this proposed policy change.

Prior Research

The renewed interest in lifting the export ban has been the catalyst for a number of studies on the economic implications if the ban were to be lifted:

- Studies have claimed large economic benefits if the ban is lifted:
 - IHS, 2014
 - Increase crude production by **3 million B/D**.
 - Spur **\$750 billion** of new investments.
 - Increase GDP by **\$135 billion** and per household income by **\$391**.
 - Create almost **1 million jobs** at export ban removal's peak.

Prior Research

- Brookings, 2014
 - Increase U.S. GDP by between **\$600 billion** and **\$1.8 trillion** (NPV through 2039)
 - Create **200,000 to 400,000** jobs annually between 2015 and 2020.
- ICF International, 2014
 - **\$70.2 billion** in new investments by 2020
 - **500,000 B/D** increase in domestic production
 - **300,000** new jobs in 2020
 - **\$38.1 billion** in GDP gains in 2020.

Prior Research

All of these economic benefits are based on the following logic:

- Domestic crude priced at discount to foreign crude
- Remove export ban → Higher price for domestic producers
→ Increased in production → Economic benefits
- But just last month, a study by EIA estimated that a Brent-WTI spread of **\$6/b-\$8/b** is needed to to cover transportation costs and thus make it economical for crude export.
 - But currently, WTI is trading at **\$1.49 discount** to Brent AND
 - LLS is trading at **\$0.61 discount** to Brent

Prior Research

Many studies have agreed that the lifting of the export ban will have no effect—or negative effect—on gasoline prices for consumers.

- Refined products, such as gasoline, are traded on a global market, for which no export ban is present.
- Export ban lifted → Increased Domestic Production
 - Increase Global Supply → Depress Global Prices
 - Lower Gasoline Prices for consumers
- This logic is based on the assumptions that:
 1. Export ban does indeed spur new domestic production
 2. Specific assumptions about global price elasticity of supply

Project Goals

- The purpose of this study is **not** to create specific recommendations on whether the ban should be lifted or not.
- Present a theoretical model to describe the global market for crude.
- Corroborate this model with data.
- Assess likely implications of removal of the export ban on:
 - Up-stream oil and gas producers
 - Down-stream refining and petrochemical industry
 - Consumers
 - New investment opportunities
- Louisiana is potentially impacted differently by the export ban:
 1. Relatively large share of refining and petrochemicals
 2. Gulf coast production not impacted by shipping constraints from mid-continent.

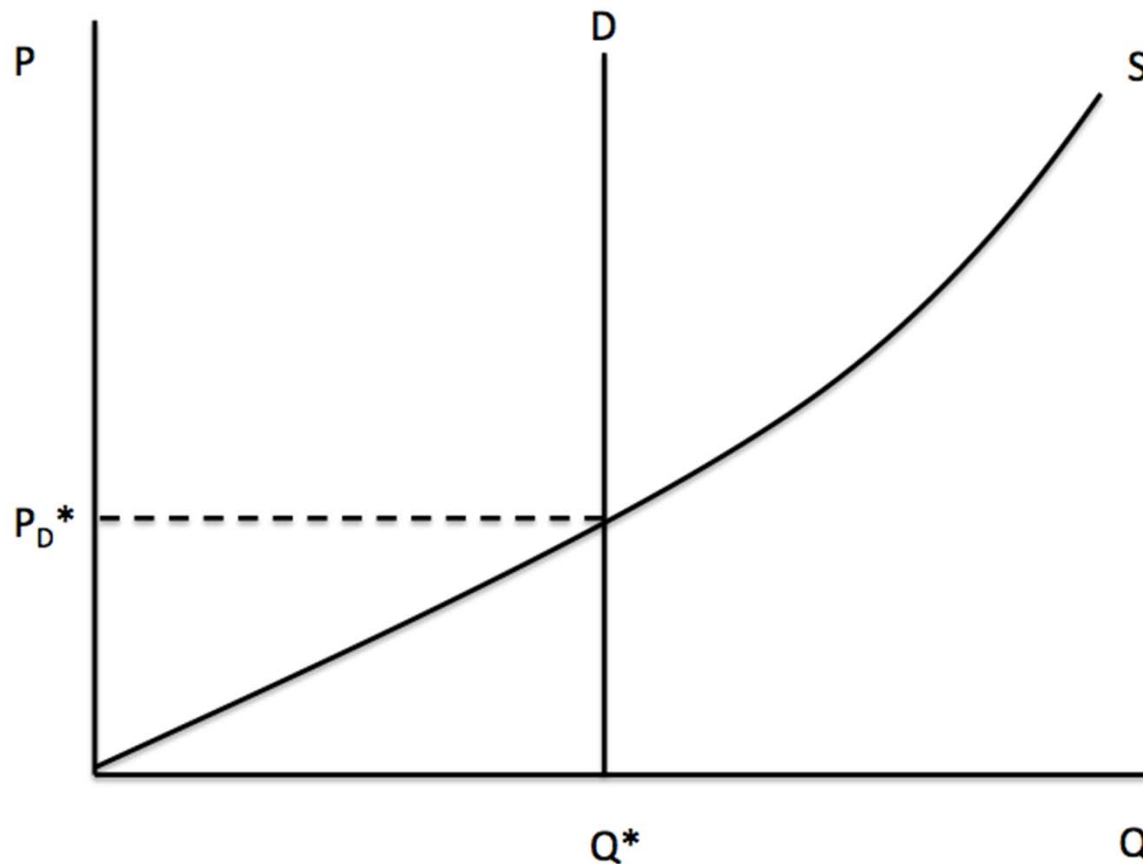
Economics of Export Restrictions

Model Assumptions

- ***Assumption 1: Export Restrictions on Crude Oil but not Refined Product***
- ***Assumption 2: Heterogeneity and Substitutability***
- ***Assumption 3: Zero Transportation Costs***

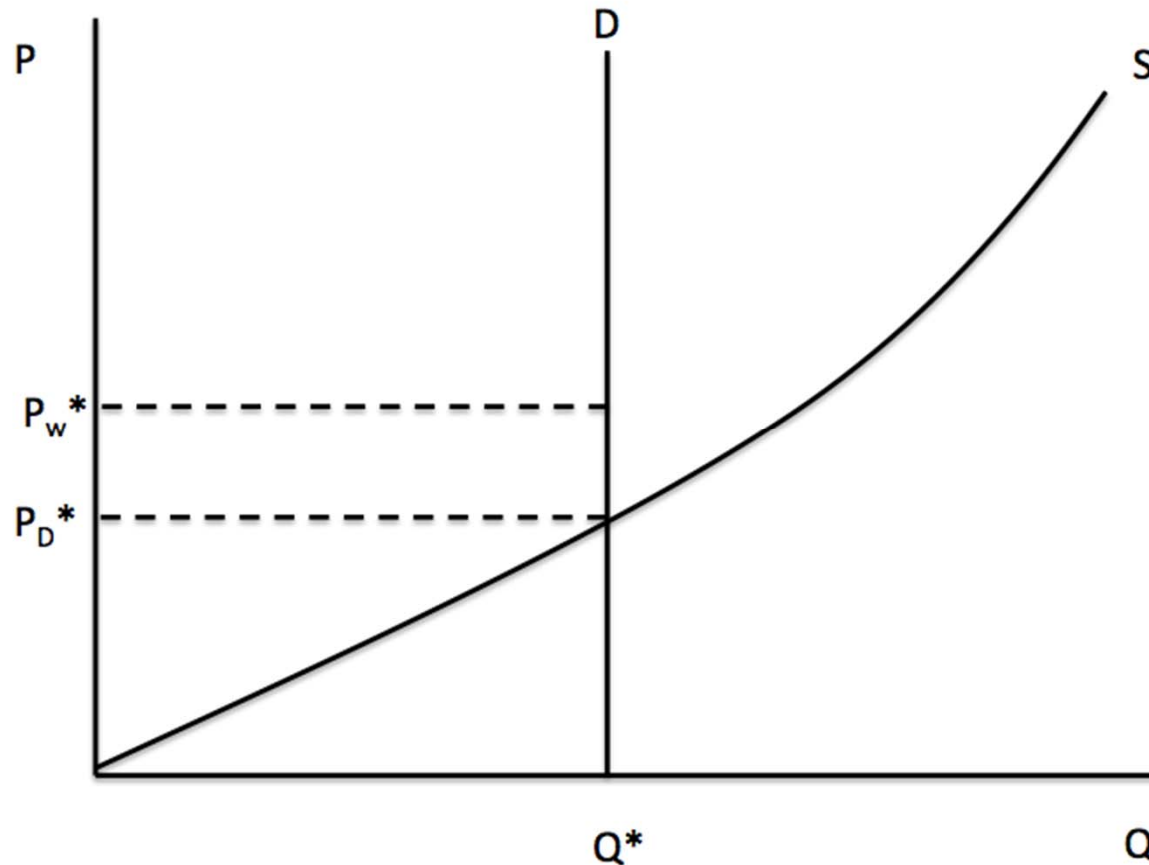
All models start with model assumptions. We will discuss a base model with these assumptions incorporated, and then discuss specific implications if these assumptions do not hold in the “real world.”

Domestic Market for Light Sweet Crude



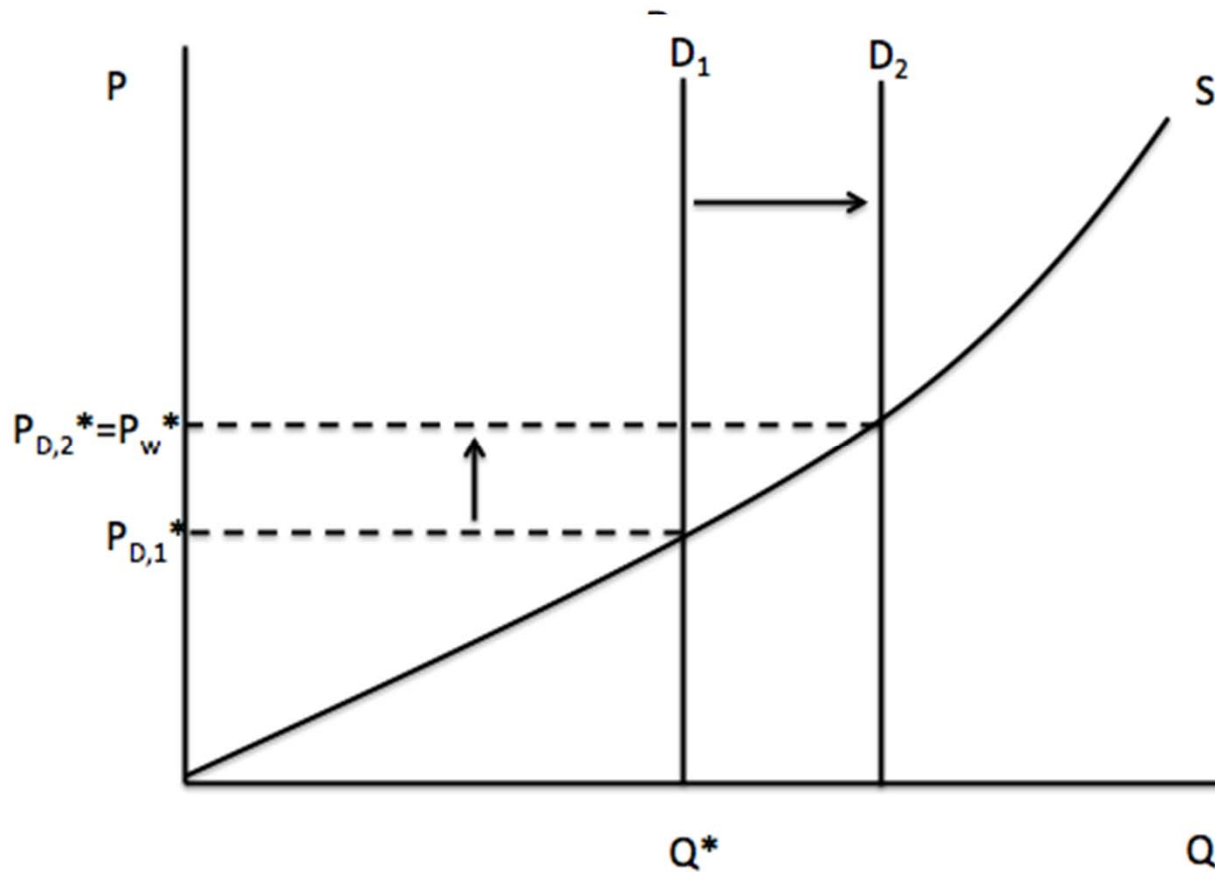
In the short-run, the supply curve for crude is upward sloping, while demand (i.e. refinery demand) is fixed.

Domestic Market for Light Sweet Crude



Because of export restrictions, the domestic price will not necessarily be equal to the world price.

Domestic Market for Light Sweet Crude



Domestic refineries receive a discount on light sweet crude relative to the world price, so they adjust refining operations to take advantage of the differential thus driving up the price.

Model Implications

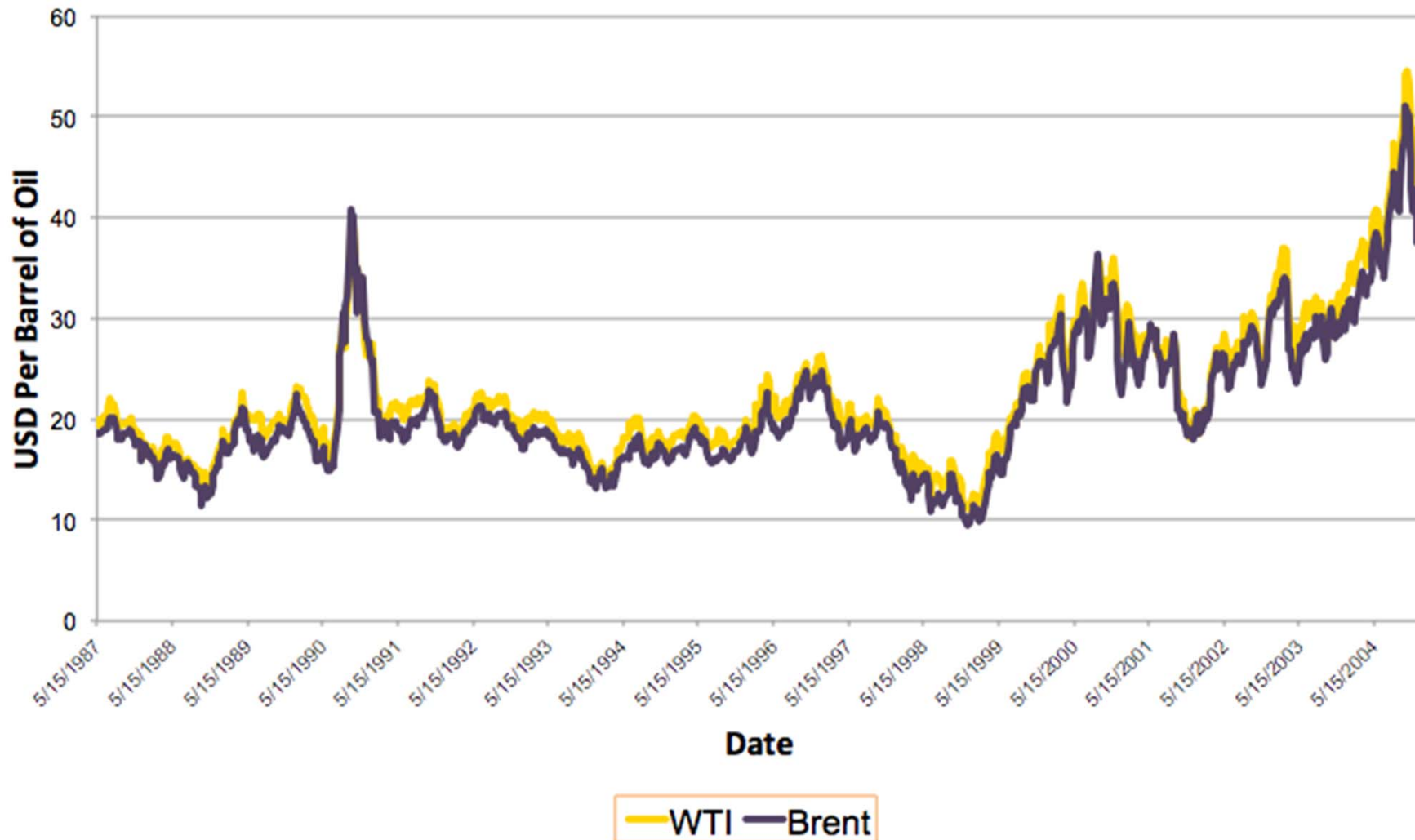
- **Prediction 1:** *The domestic price of crude is determined by the domestic supply and domestic demand, i.e. refining demand.*
- **Prediction 2:** *In the short-run, it is possible for the domestic price to deviate from the world price; specifically it is possible for the domestic price to decrease relative to the world price.*
- **Prediction 3:** *If the domestic price is less than the world price, in the short-run refiners will benefit at the expense of producers.*
- **Prediction 4:** *In the long-run, the market will move back into equilibrium where the global price is equal to the domestic price.*

Model Implications

- In the **short-run**, refiners can benefit from the crude export restriction at the expense of upstream producers.
- In the **long-run**, economic theory predicts that the domestic crude price and global price will move in tandem.
- Does the data support this theory?

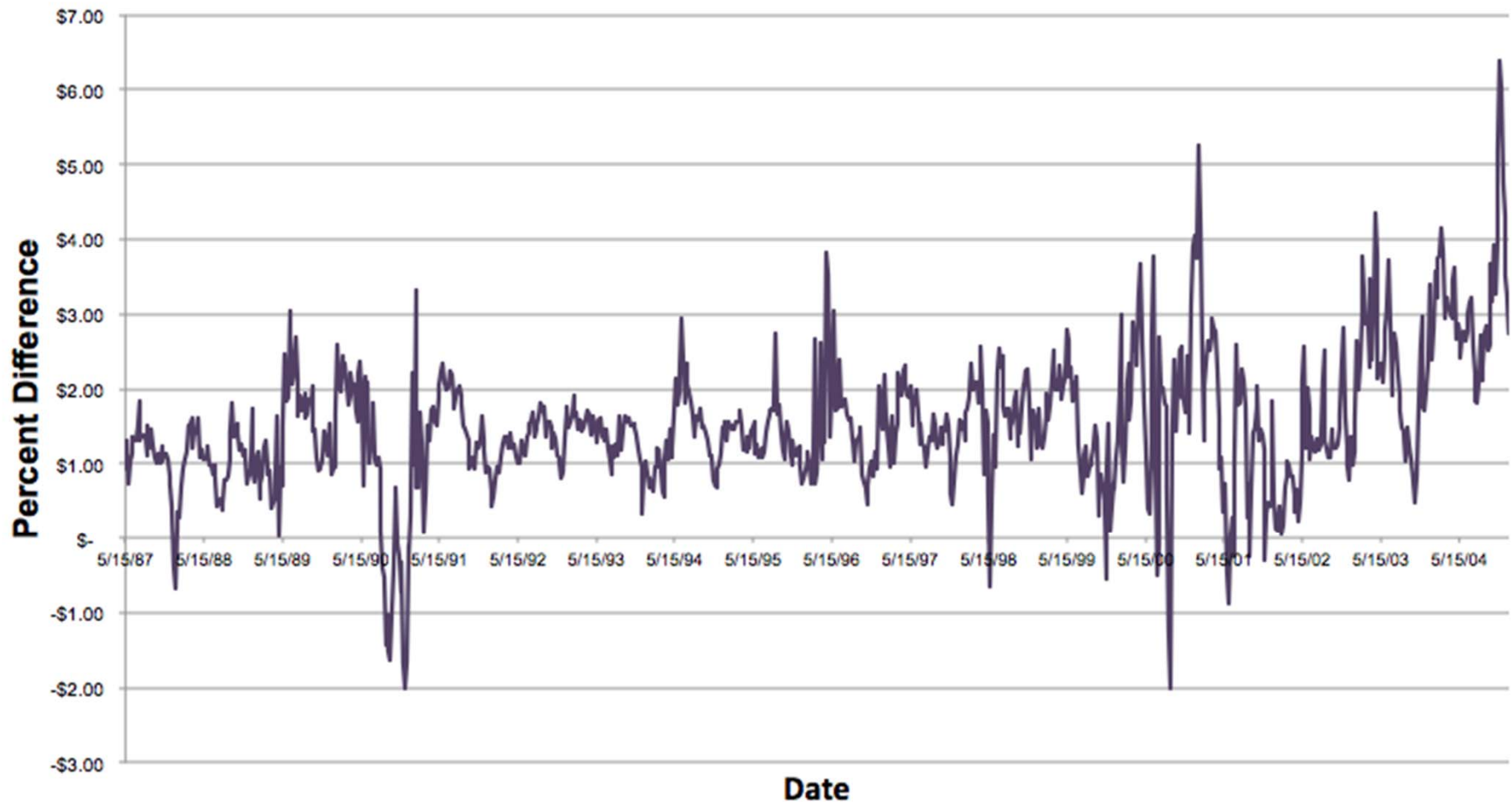
Corroborating the Model with Data

WTI and Brent Crude Spot Prices



Corroborating the Model with Data

Percent Difference Between WTI and Brent Spot Prices

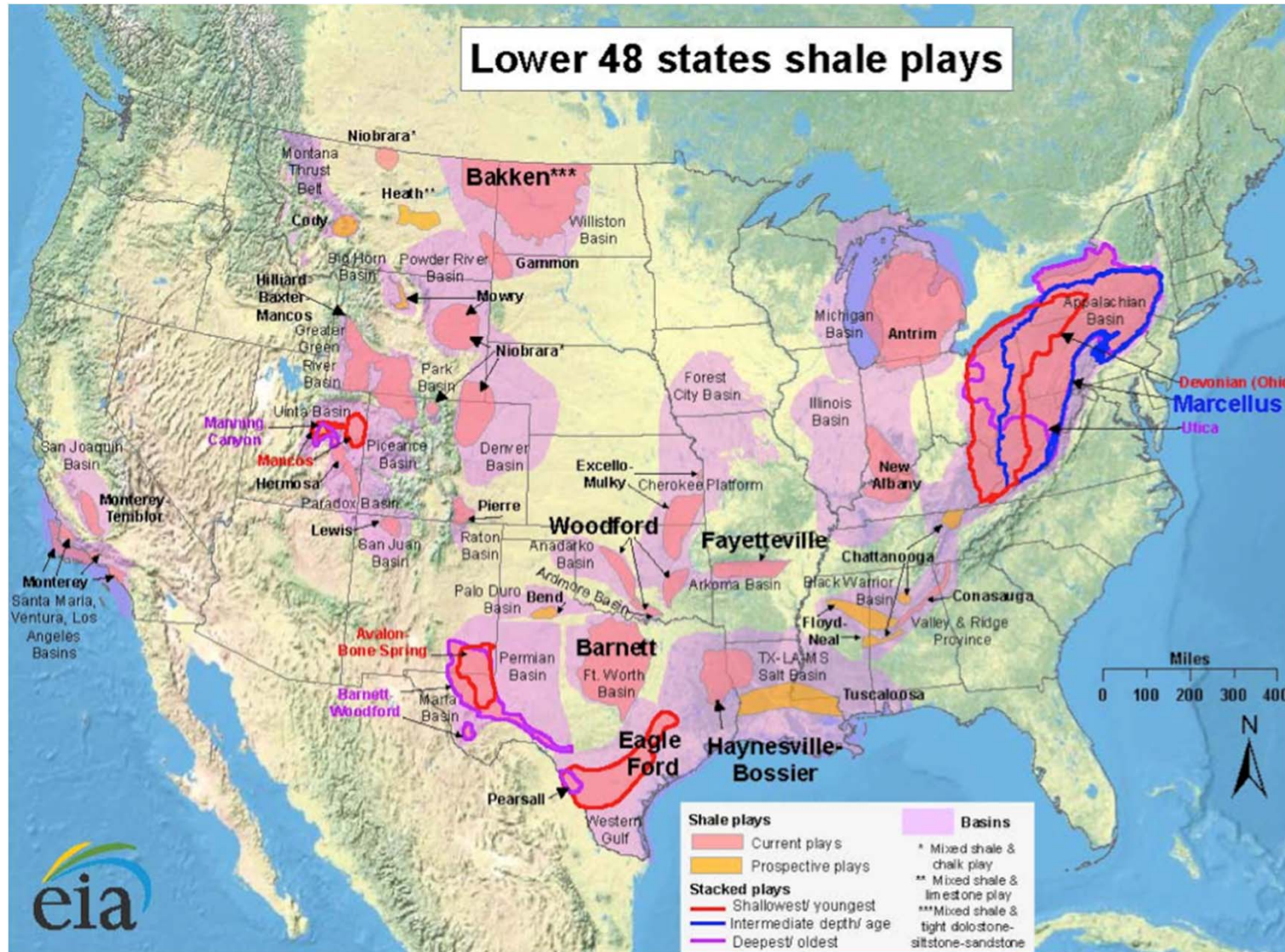


**Unconventional Oil and Gas Plays and the
Global Market for Crude**

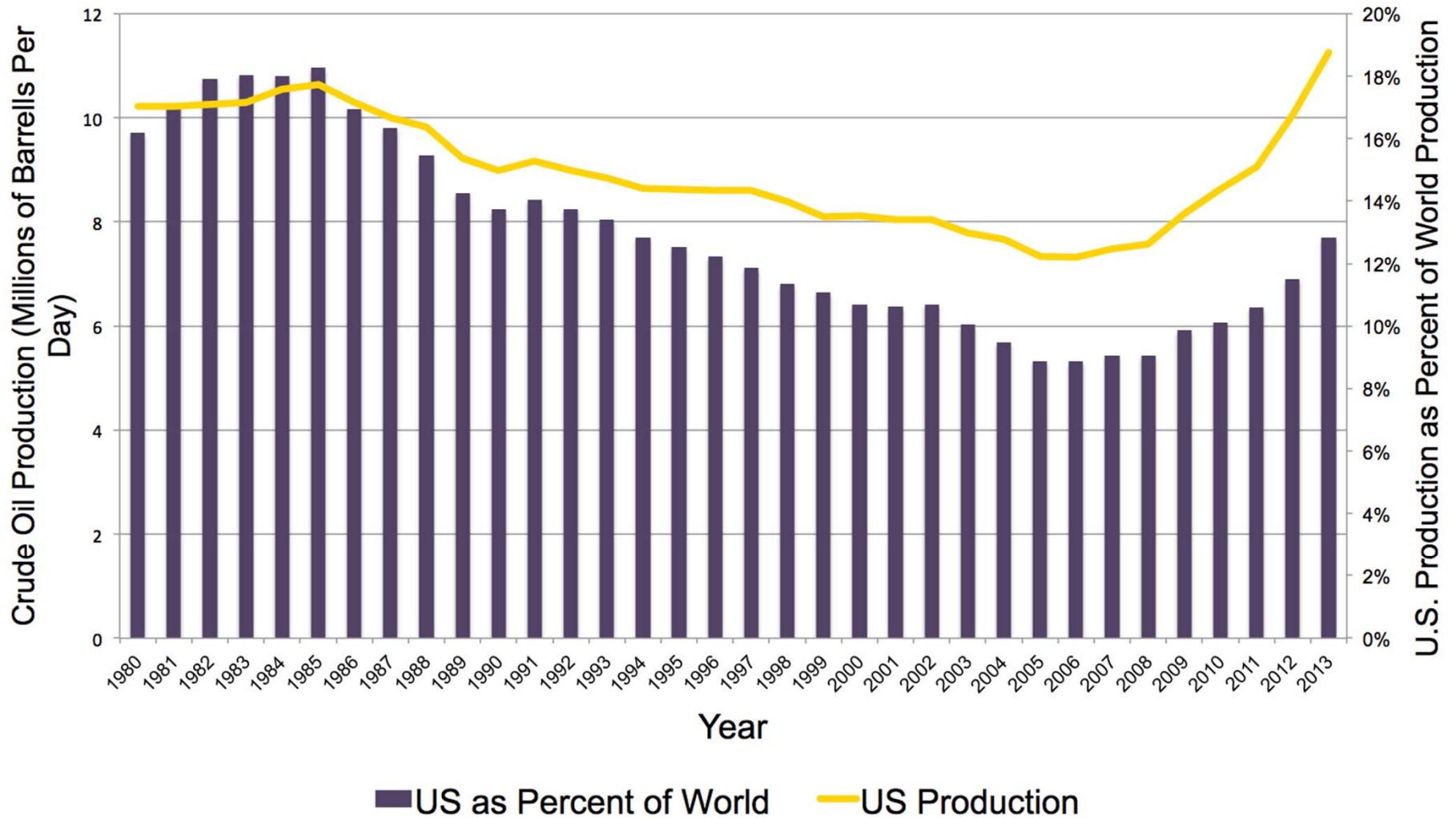
U.S. Shale Plays

- Consider two facts about the shale boom:
 1. Shale has significantly increased U.S. production to levels not seen since “peak oil” of the 1970s.
 1. Shale has been concentrated almost exclusively in the U.S.

U.S. Shale Plays



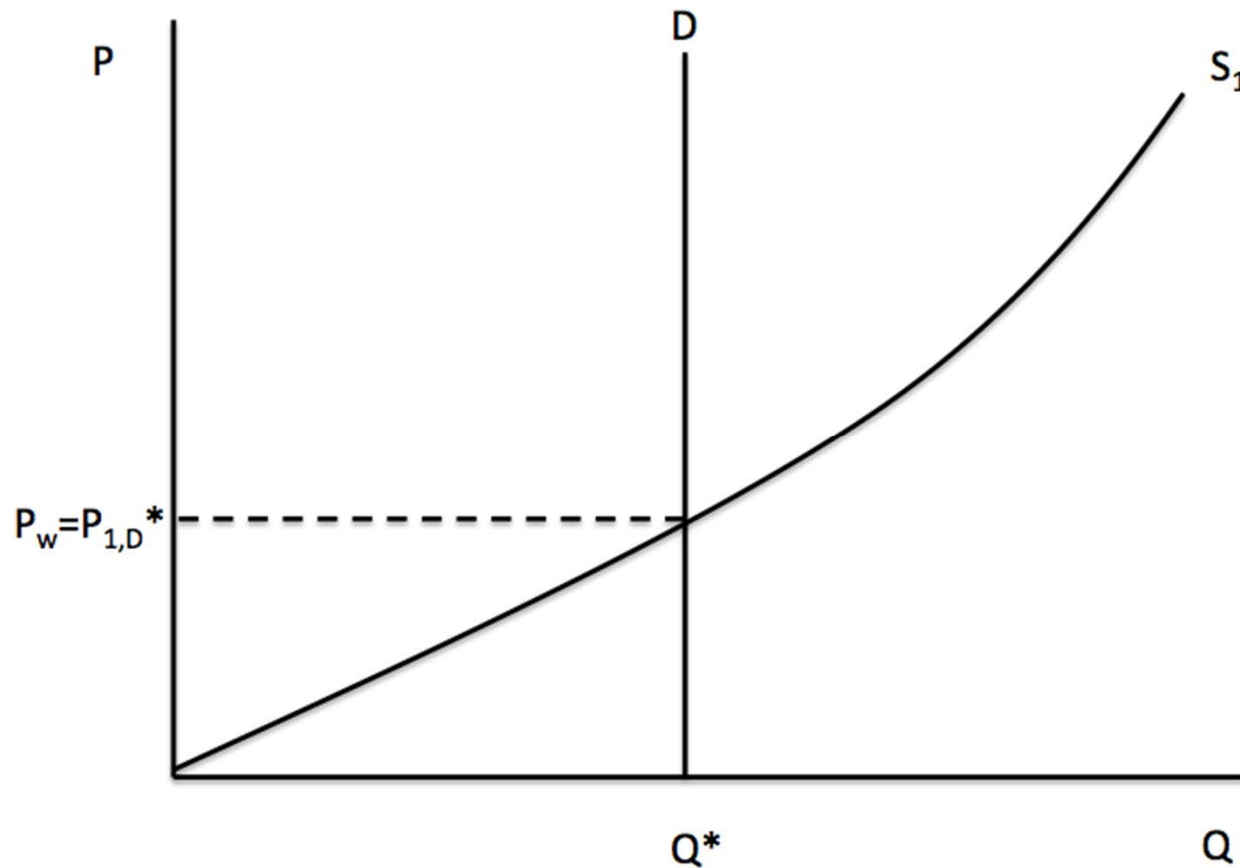
U.S. and World Crude Production



Historical Perspective

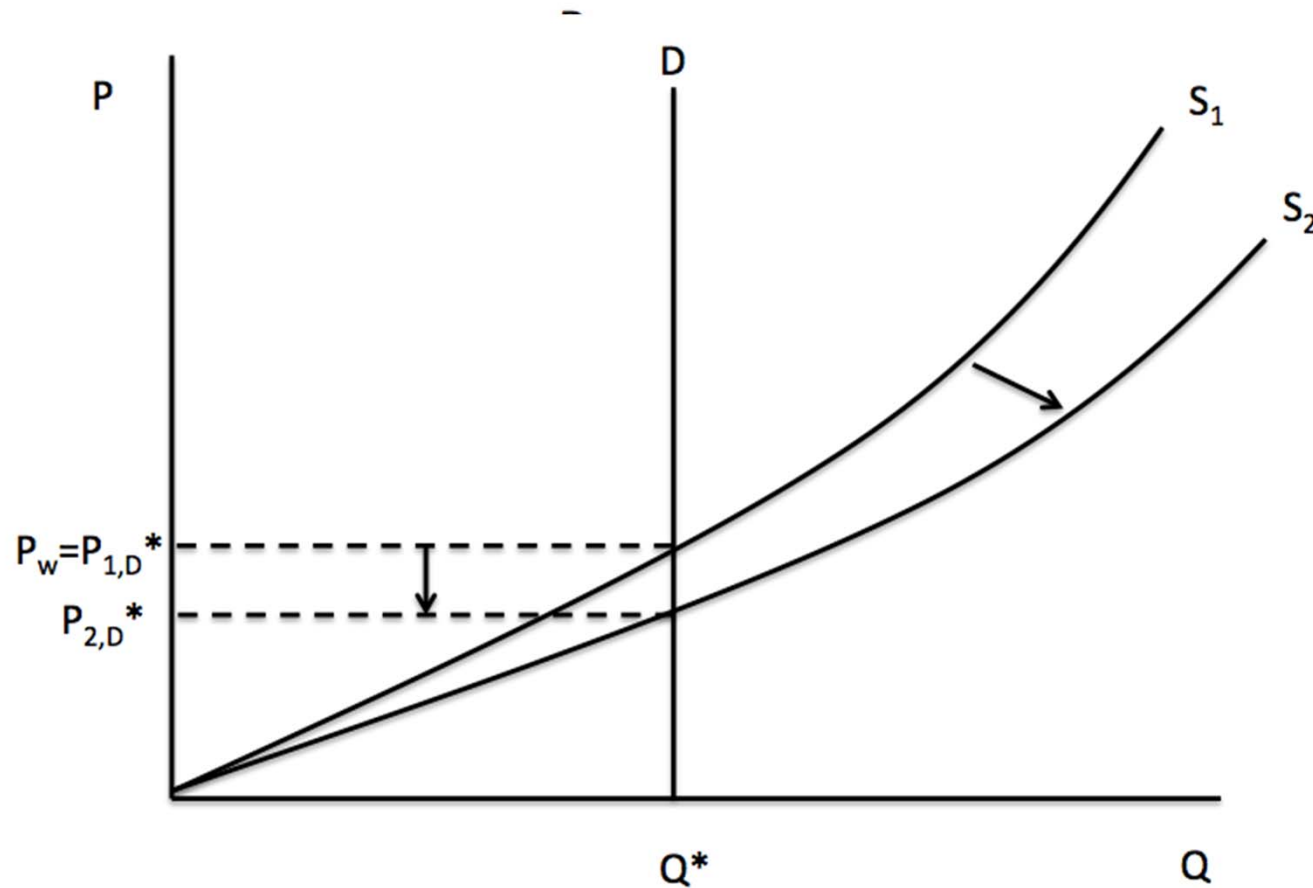
- Historically, WTI has traded at a slight premium to Brent (due to quality differences).
- Shale oil has been almost exclusively concentrated in the U.S.
- So what does the economic theory predict will occur due to the advent of this new production?

Domestic Market for Light Sweet Crude



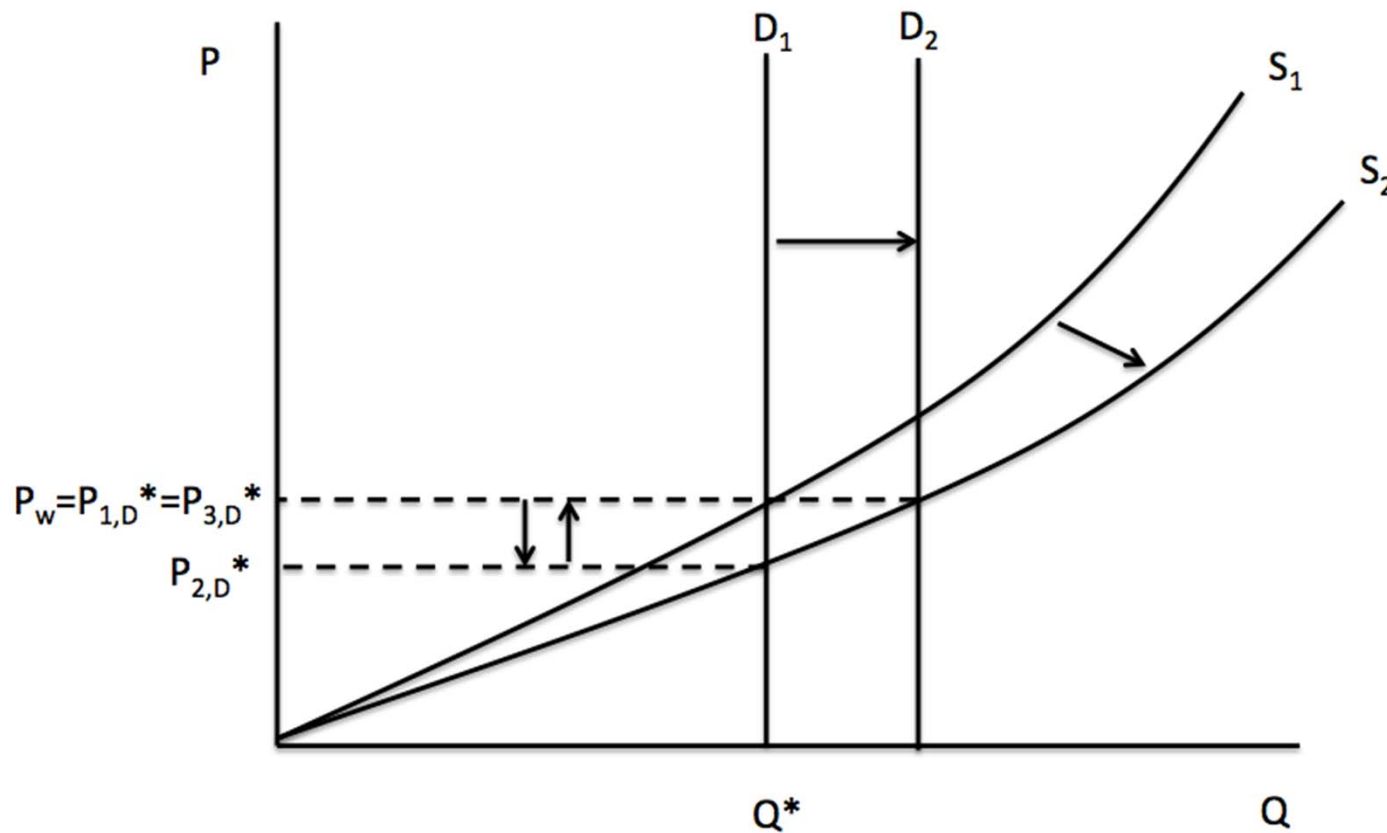
Before the shock, the market is in its long-run equilibrium with domestic and world prices approximately equal.

Domestic Market for Light Sweet Crude



The new shale production shifts supply outward and creates a price differential between domestic and world prices.

Domestic Market for Light Sweet Crude

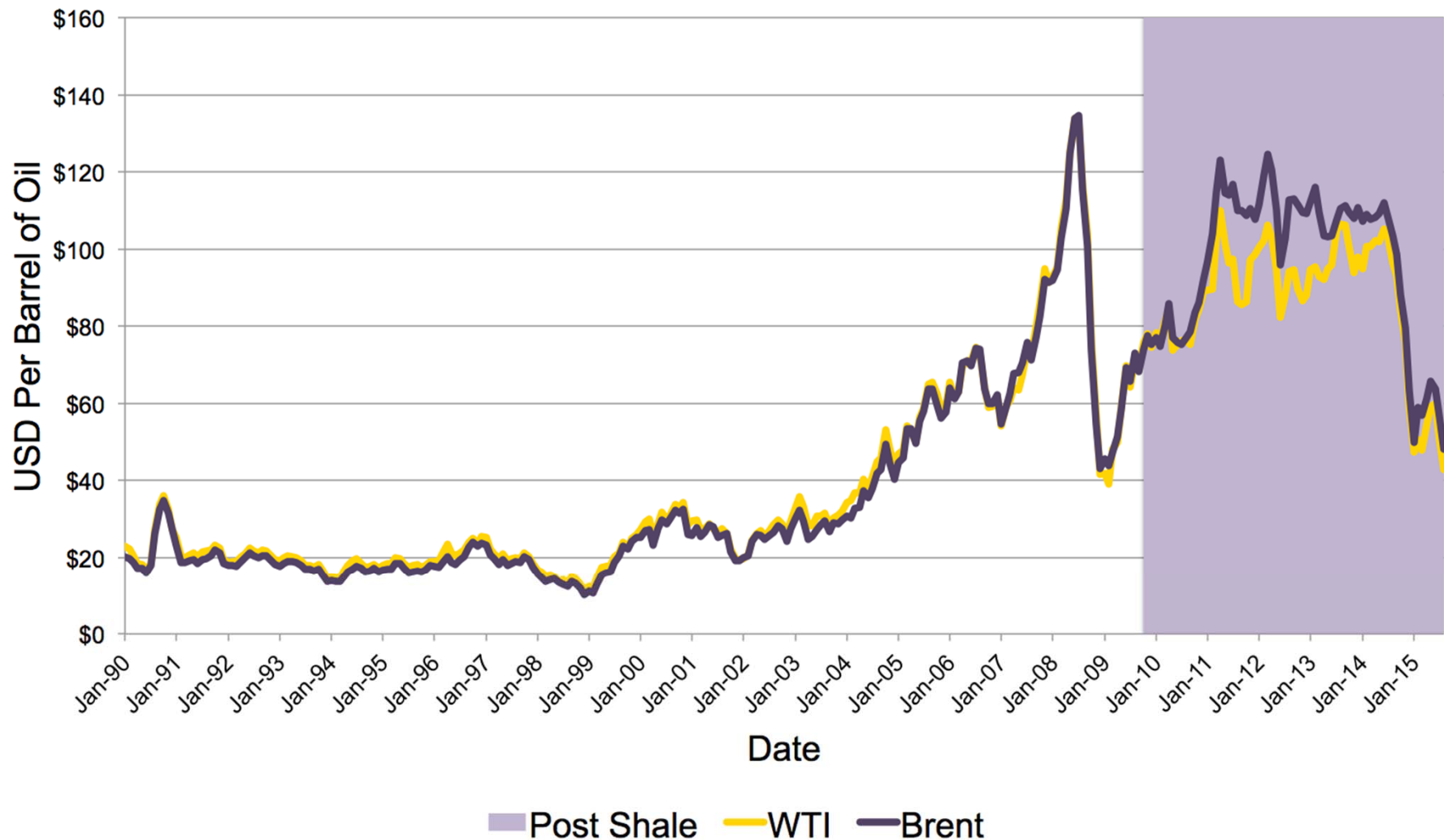


Refineries adjust operations to better utilize the new glut of light sweet crude, thus increasing demand until the world price and domestic price converge.

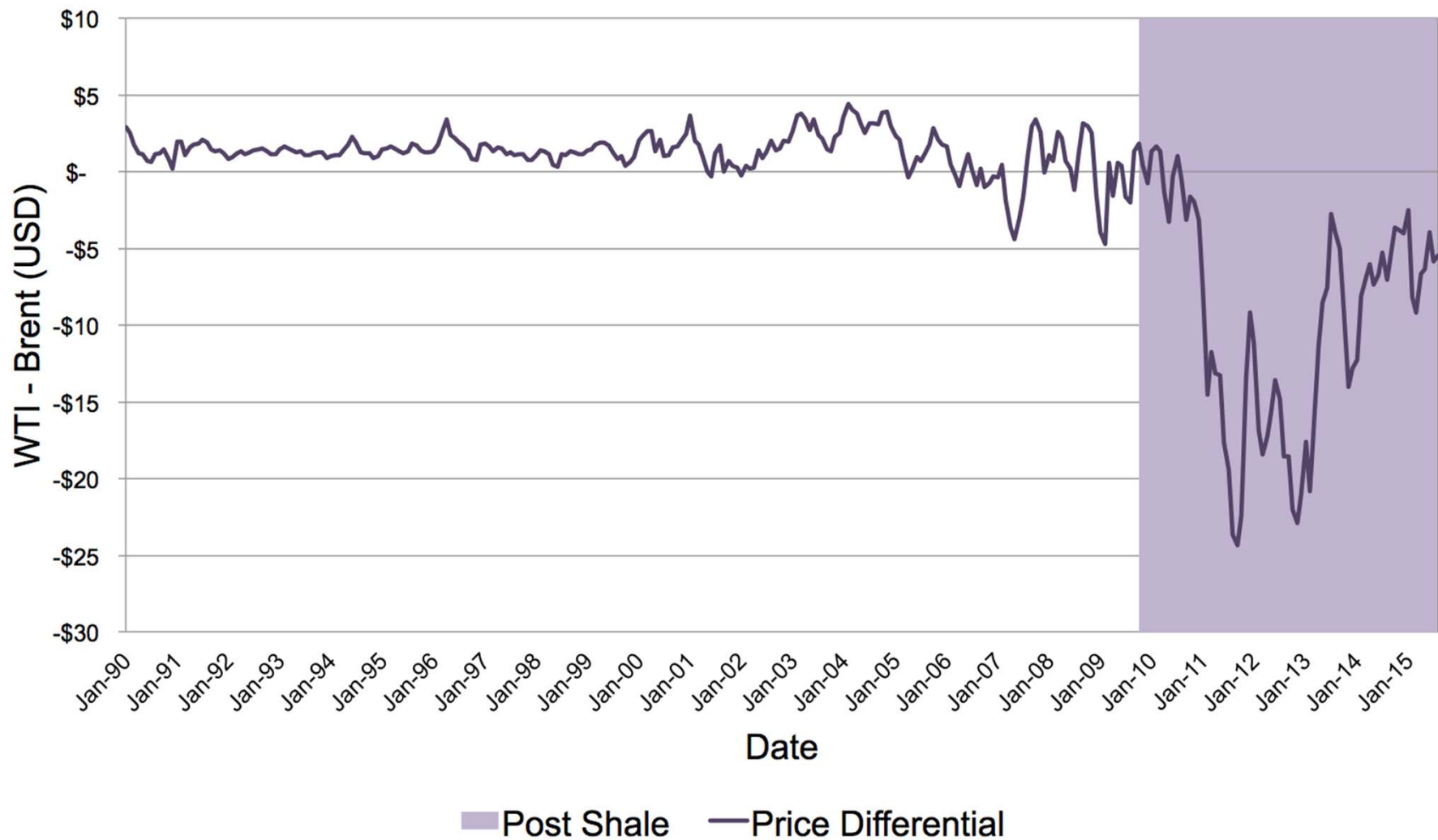
Model Implications

- **Prediction 1:** *The advent of shale oil production creates an increase in domestic supply which drives down the price of domestic price relative to the world price.*
- **Prediction 2:** *In the short-run, this will create increased crack spreads for refiners that process light sweet crudes, and therefore refineries will substitute away from other medium grade or heavy grade crudes towards light crude.*
- **Prediction 3:** *In the long-run, the market will move back into equilibrium where the global price is equal to the domestic price.*

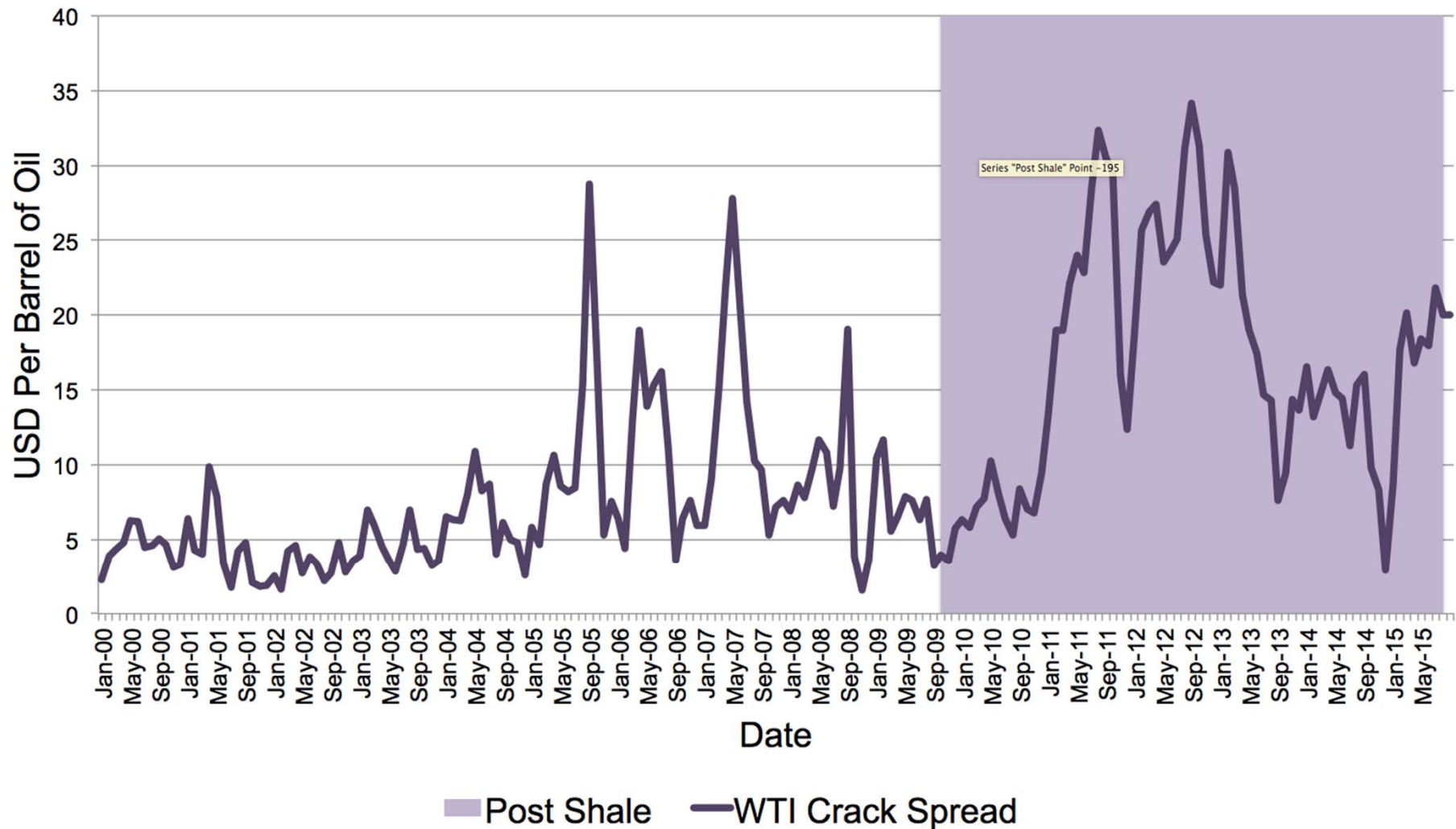
Corroborating the Model with Data



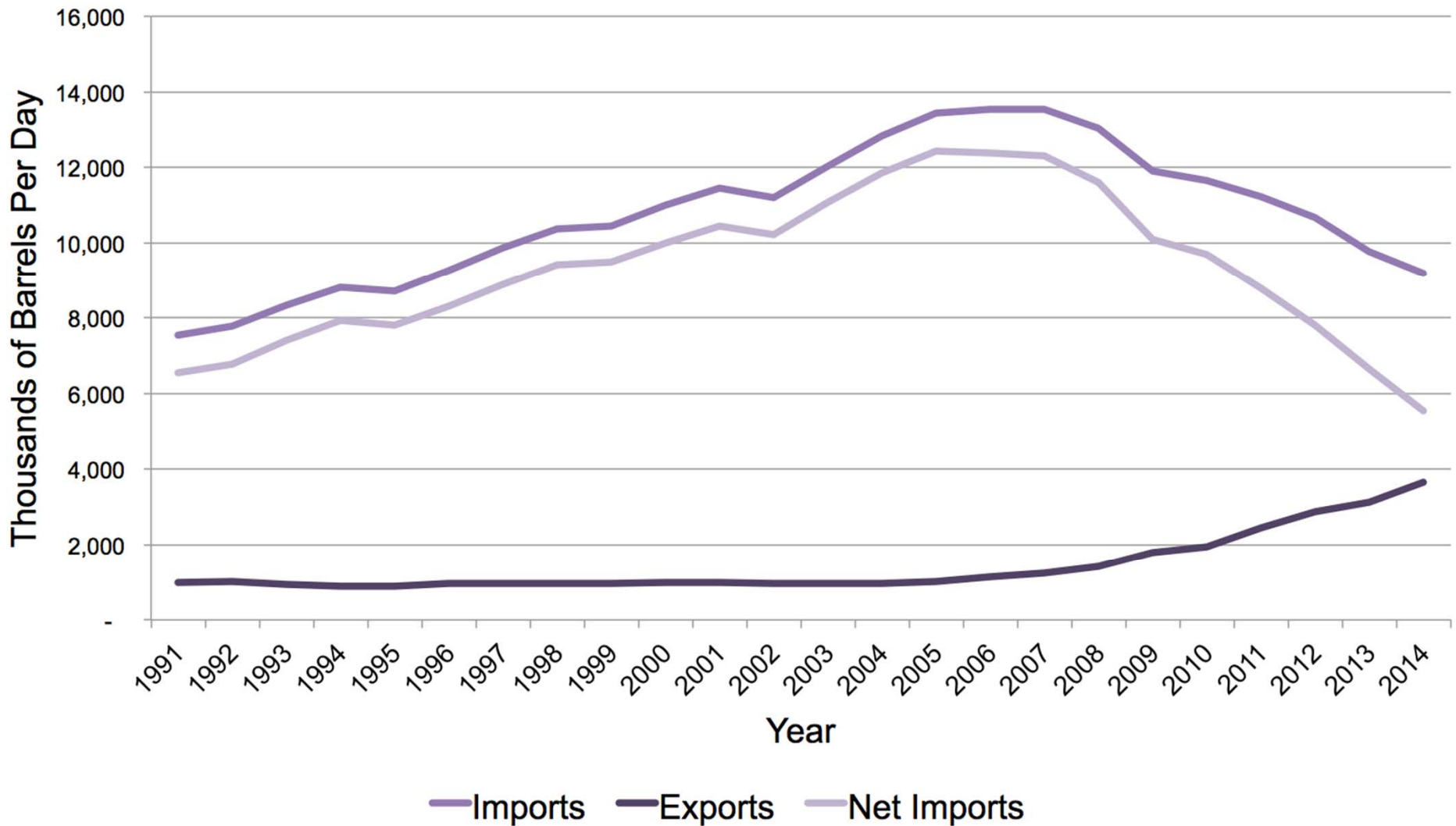
Corroborating the Model with Data



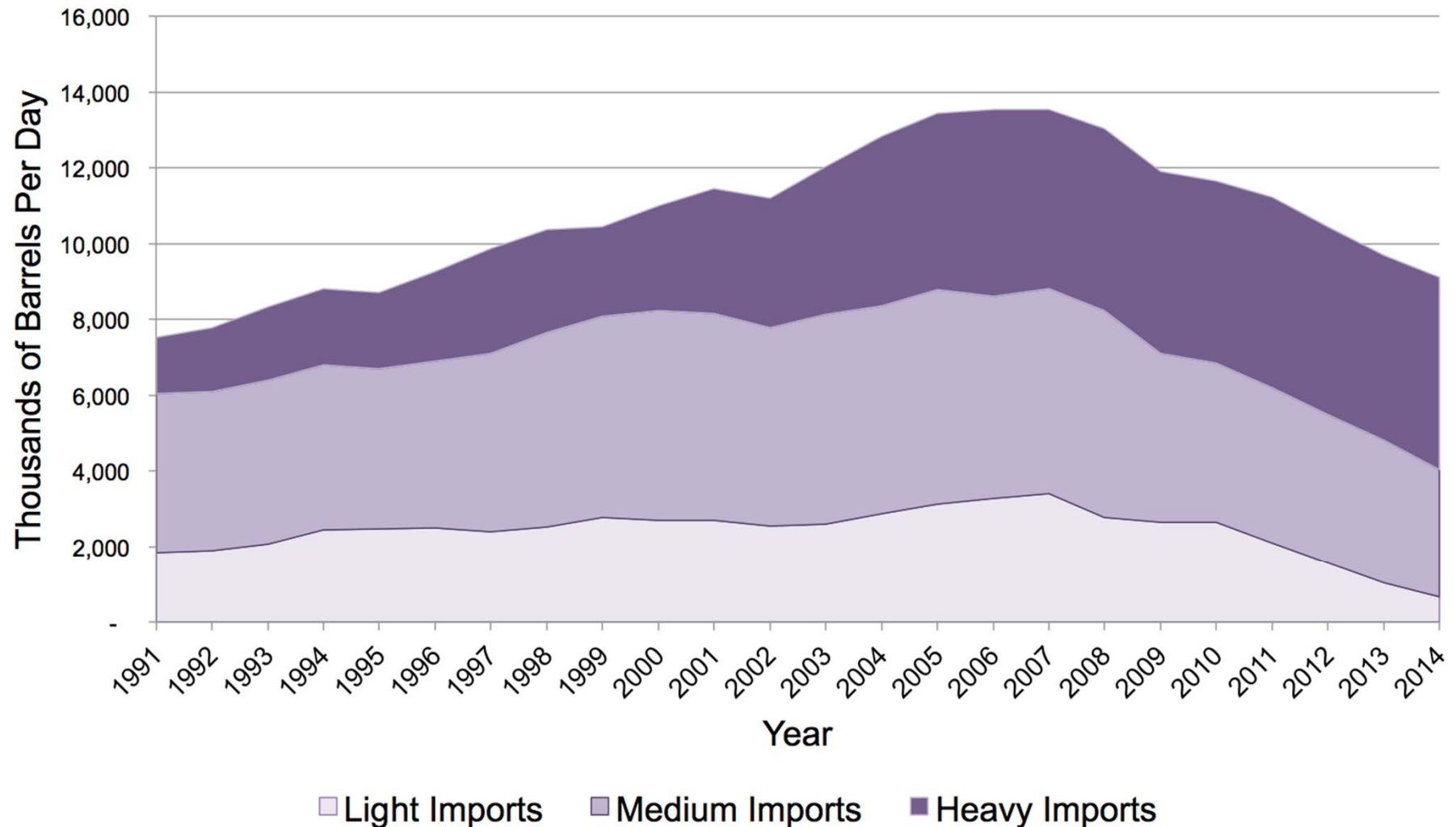
Corroborating the Model with Data



Corroborating the Model with Data



Corroborating the Model with Data



Note: Light, medium, and heavy crudes defined as more than 35 API, Between 25 and 35 API, and less than 25 API respectively.

Winners and Losers

- Refineries – Winners
 - Because the refined product is traded globally, increases in global crude prices will lead to increases in refined product prices.
 - Refineries will be able to sell the refined product at the higher world price, but will have the advantage of purchasing unrefined product at the lower domestic price.
- Producers – Losers
 - If crude exports were allowed, then domestic producers would always sell at the world price, as the world price would always be the same as the domestic price (with adjustments for quality differentials and transportation costs).
 - But with export restrictions, if the global price is higher than the domestic price, then producers will either have to:
 - a) Store crude until price increases (estimates during the boom suggested that more than 15 percent was going into storage!)
 - b) Sell product at a relatively low price.

Winners and Losers

“Major oil companies are exporting refined products with no limitations. Why shouldn’t independent producers be allowed to do the same? . . . This would be equivalent to telling American farmers they can’t export their wheat, yet allowing Pillsbury to export all the processed flour they want.”

- Harold Hamm, CEO Continental Resources

Winners and Losers

- Consumers – Neither!
 - Recall, consumers do not actually consume crude directly—they consume the final products created from the crude, such as gasoline. Refined products are traded on the global market and therefore subject to the global price.
 - A recent IHS study estimates that the lifting of the ban will actually *decrease* prices for consumers:
 - Export Restrictions Lifted → Increased Domestic Production
 - Decrease Global Crude Prices
 - Decrease Global Gasoline Prices

A World Without Export Restrictions

What Would the World Look Like with No Export Ban?

- This next section discusses the likely implications that the export ban has had on oil producers, refineries, consumers, and new investment opportunities.
- The baseline model needs to be considered, but in addition likely limitations of the model assumptions are also considered as well as likely implications if these assumptions are removed.
 - In particular, the baseline model assumed zero transportation constraints and no shipping costs.
 - How does incorporating these into the discussion change the likely implications?

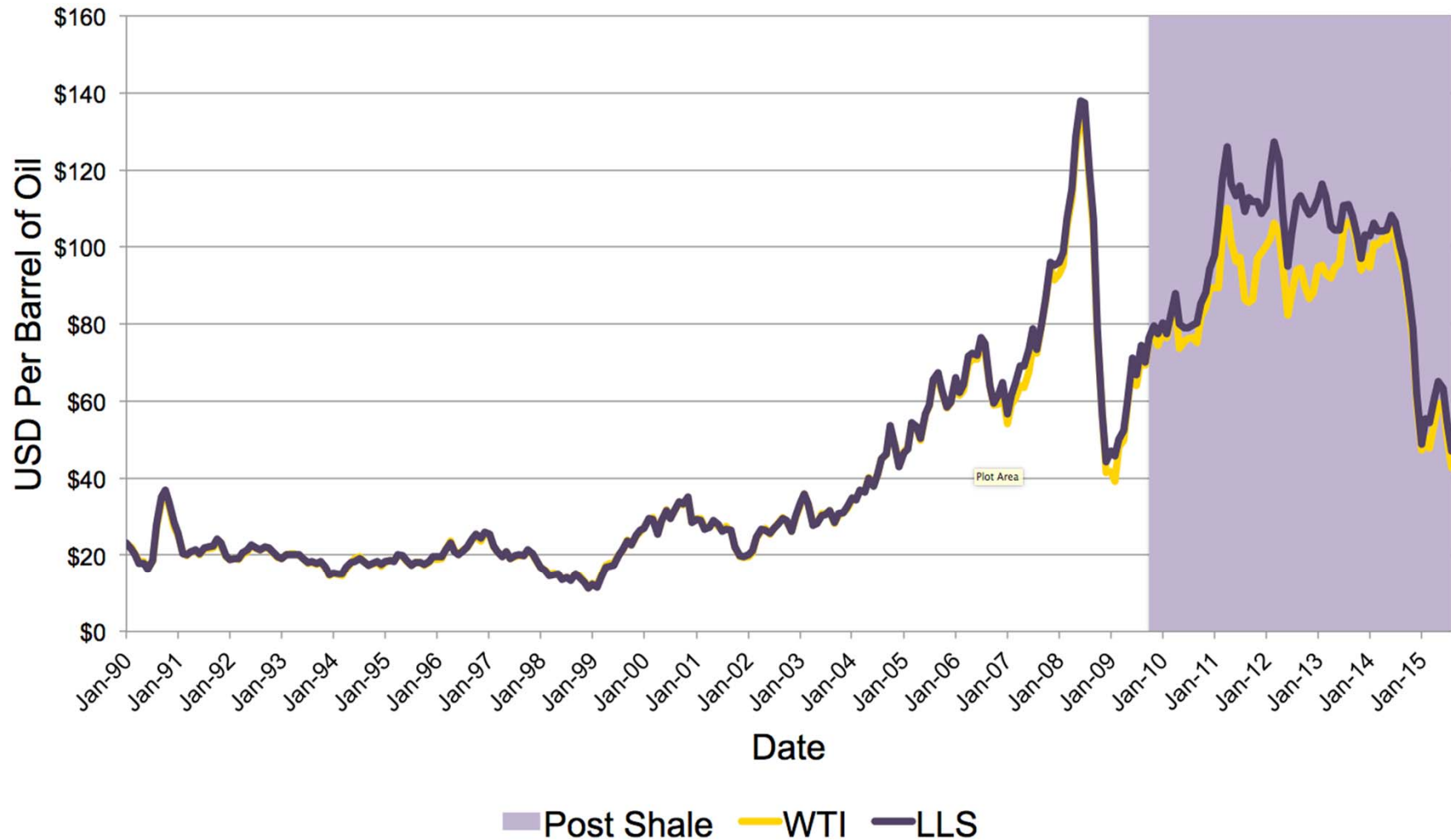
What Would the World Look Like with No Export Ban?

- While the model presented assumes that there are **zero transportation constraints**, Borenstein and Kellogg (2014) and Kaminski (2014) suggest that part of this price differential between Brent and WTI observed has been due **to pipeline capacity constraints** between the Midwest and the Gulf Coast.
- Thus the price differential can be broken up into two components:
 1. Shipping constraints and costs to get from Cushing to gulf coast.
 2. Export ban that prevents oil from being shipped overseas.
 - Note (2) will only be binding *if* the differential between Brent and gulf coast crudes are less than the shipping costs.

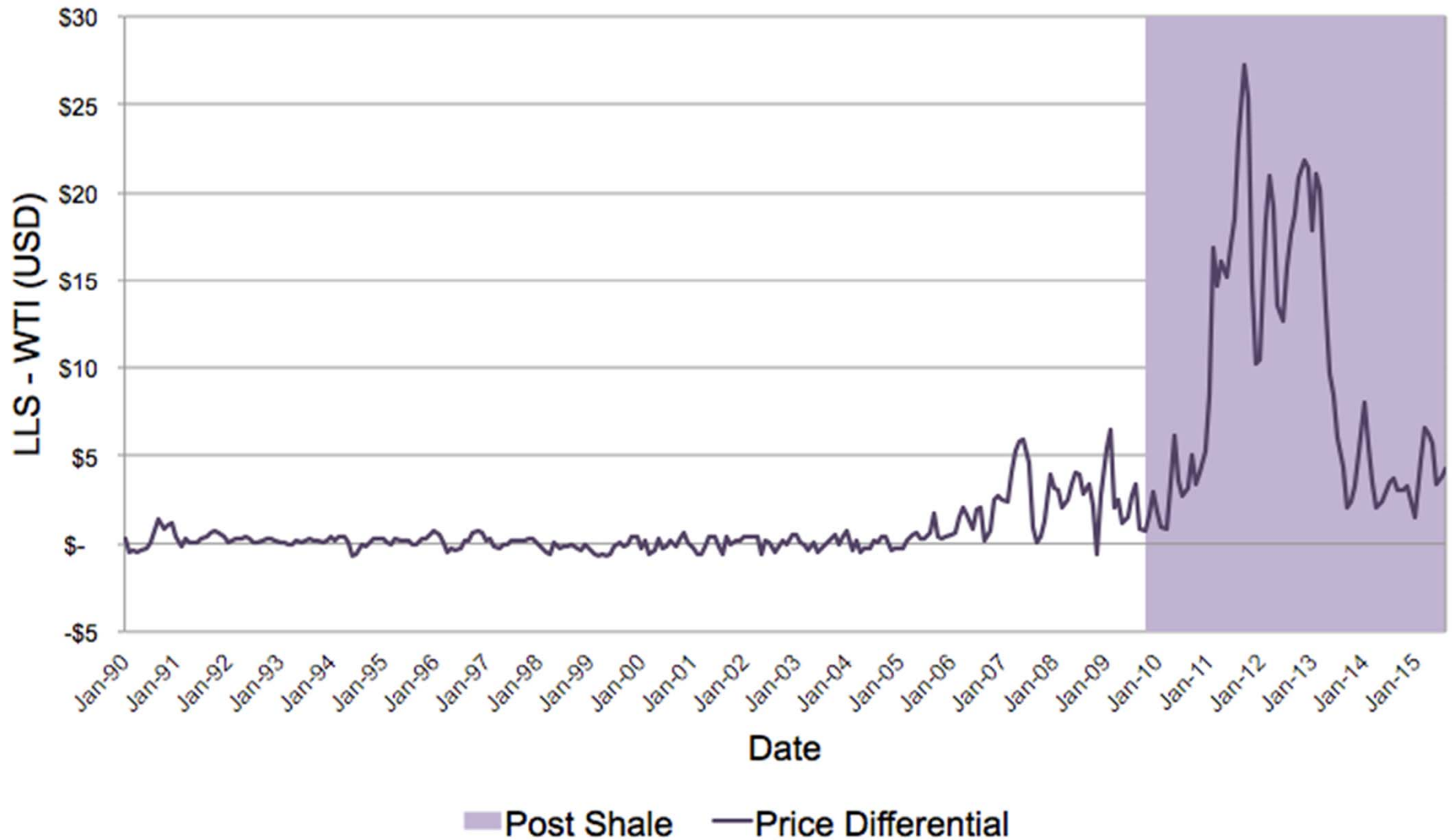
What Would the World Look Like with No Export Ban?

- Thus, potentially, none of the remaining price differential between Brent and WTI is due to the export ban, but instead due to actual transportation constraints within the U.S.
 - If this is the case, then the lifting of the export ban today might have *no impact* on the price differential going forward.
- Remember, economic benefits highlighted by a number of studies are contingent upon the removal of the ban removing this price differential between Brent and WTI.
 - If these constraints within the U.S. are causing the price differential, the lifting the ban will have no impact on domestic prices!

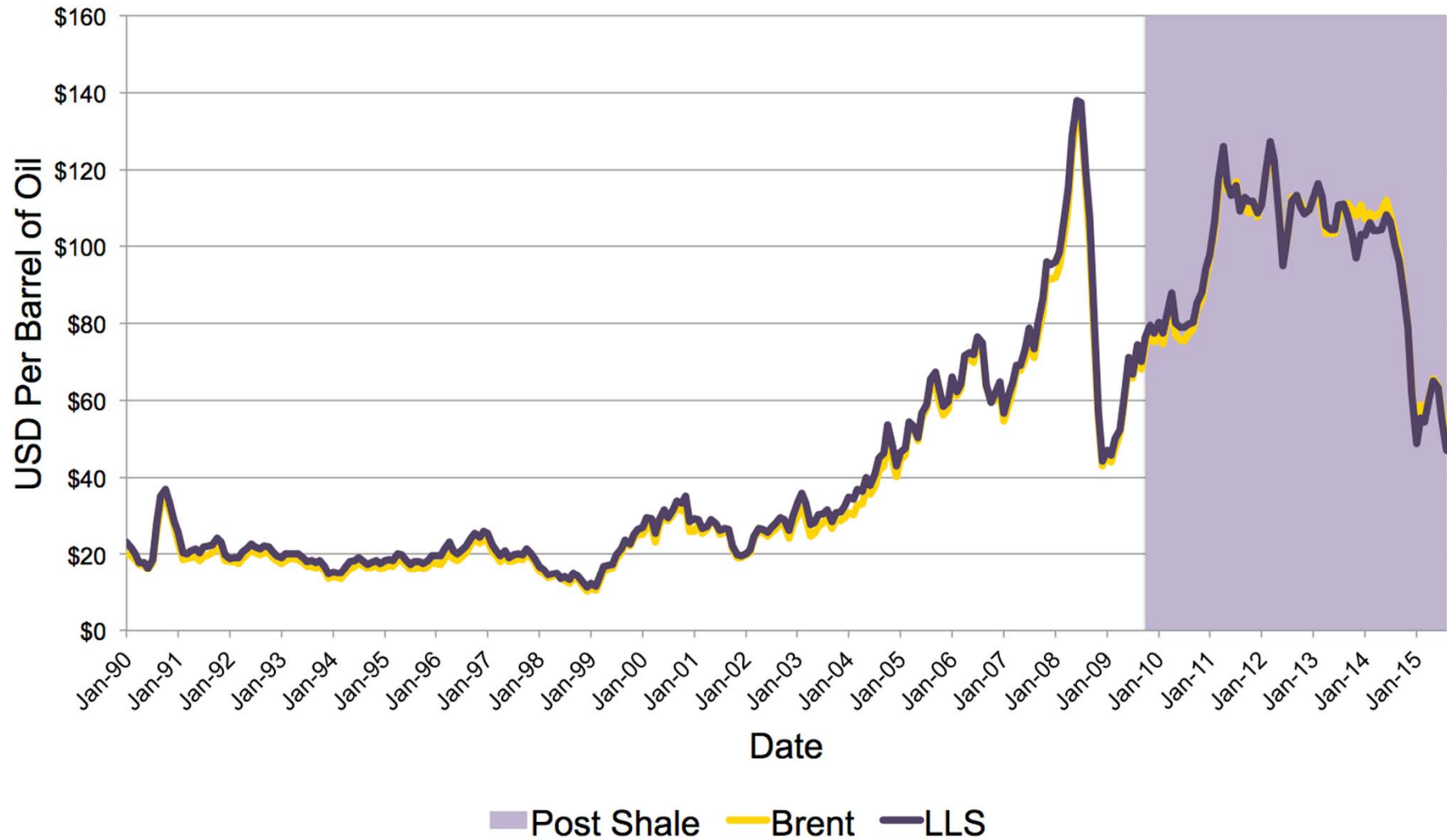
Comparing WTI and LLS



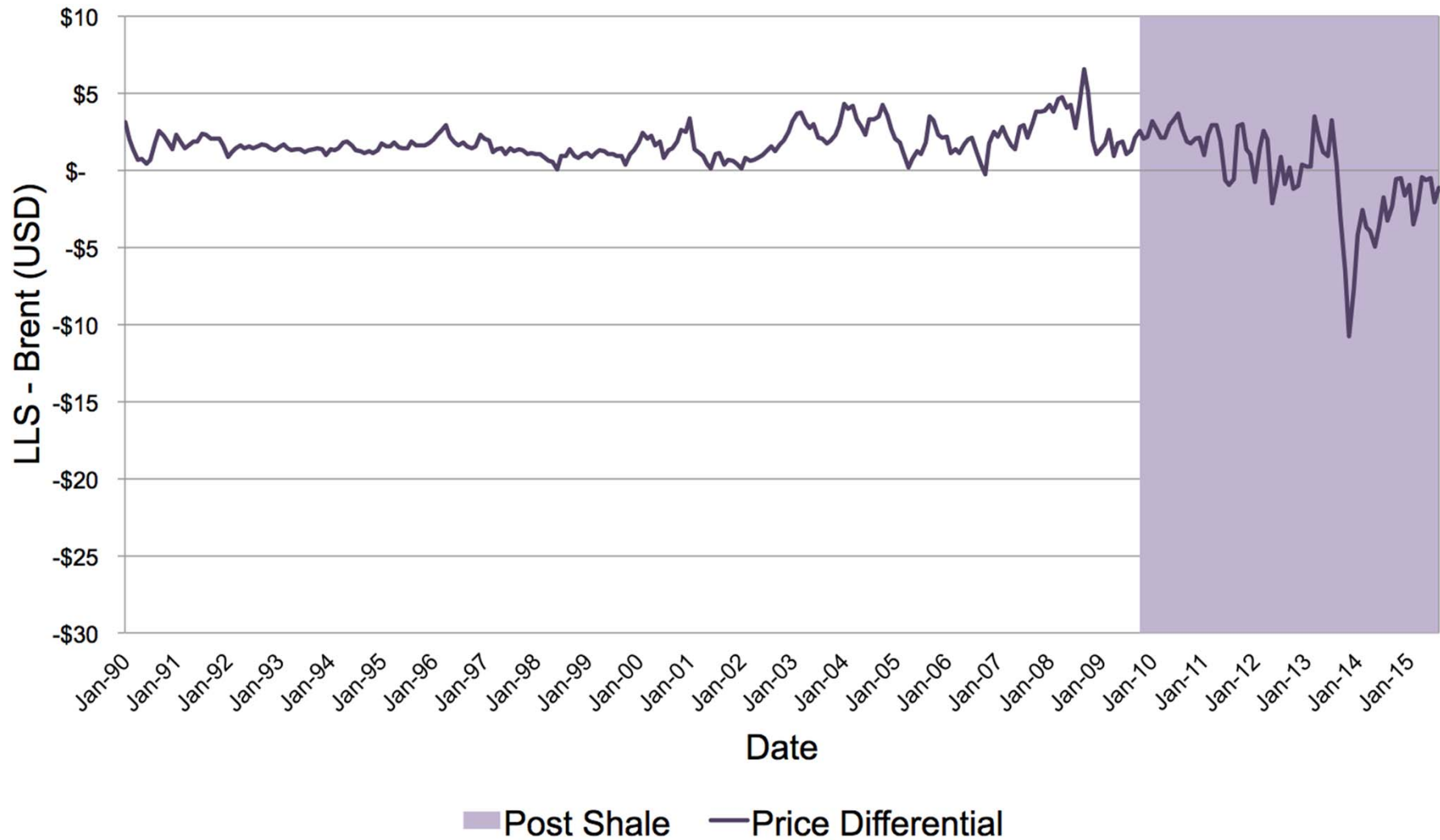
Comparing WTI and LLS



Comparing LLS and Brent



Comparing LLS and Brent



What Would the World Look Like with No Export Ban?

- Brent is currently trading at a \$1.66 premium to WTI.
- Brent is currently trading at a \$0.86 premium to LLS.
- Bakken (Guernsey WY) is trading at a \$.07 premium to Brent.
- Bakken (Clearbrook, MN) is trading at \$4.54 less than Brent.
- IHS' study stated the following in May of 2014.
 - IHS: "Without the ability to export oil, price discounts between **2015 and 2018 are projected to be as much as \$12-\$15 per barrel** (compared to \$3-\$5 per barrel today) . . . However, many of the tight oil plays are located inland, and the price at the wellhead for these plays is lower—**typically ranging from \$4-12 per barrel** . . . As a result, the wellhead price of Bakken crude oil in North Dakota is approximately **\$25 per barrel** below its international equivalent during the 2015-2018 period.

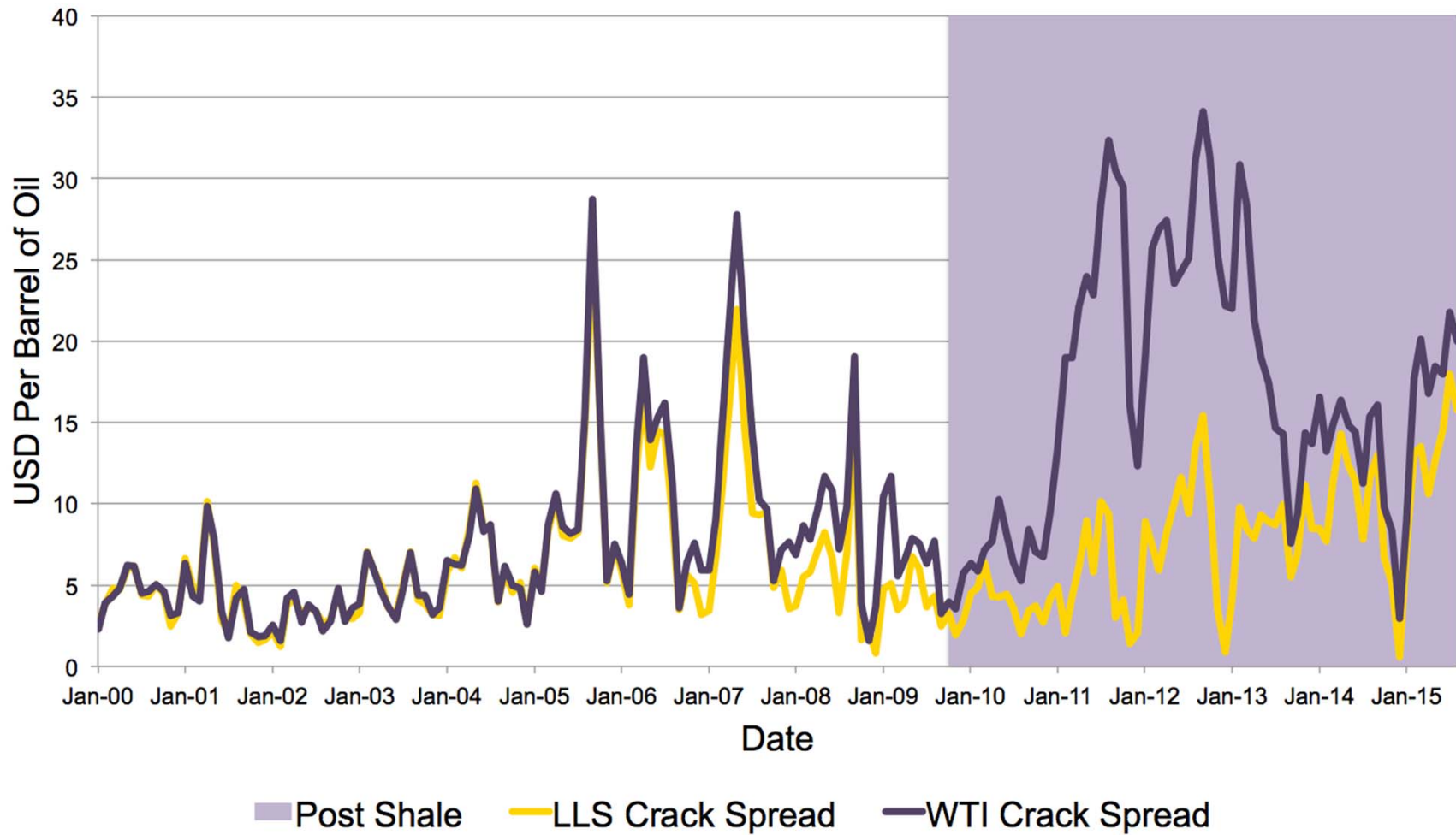
Impact of Export Ban Removal on Louisiana Producers

- Louisiana—and other gulf coast producers—are unlikely to be impacted by crude export ban as the price differential between Brent and gulf coast crudes is simply not large enough to justify shipping overseas.
- Mid-continent crudes will always need to get crude to the gulf coast before shipping overseas, and price differential between gulf coast crudes and mid-continent crudes indicates that transportation costs and constraints are still a factor in price differentials—but becoming less so every day.

Impact of Export Ban Removal on Louisiana Refineries

- Currently, gulf coast crude is not trading at a significant discount to Brent.
 - Therefore, there is currently little advantage that Louisiana refineries get from lifting the ban.
- Refineries, though, have been a beneficiary of the shale boom.
 - They likely would have benefited, though, regardless of whether the export ban was in place or not. The magnitude of *how much* they benefit from the “boom vs. ban” can be debated.

Comparing Crack Spreads



New Investment Opportunities

Opportunities

- While not specifically included in the economic model, a discussion of the economic implications of the removal of the export ban cannot be complete without a discussion of potential new business opportunities created by lifting the ban.
- While this decades old discussion rightly focuses on the upstream oil and gas industries compared to the downstream refineries, the recent shale boom has created opportunities for exporting both crude and natural gas to international markets.

Liquefied Natural Gas

- One solution to shipping natural gas in an economical way overseas is to liquefy the natural gas into “Liquefied Natural Gas” (LNG).
 - This process includes cooling the gas to extremely cold temperatures (-260°F) such that the gas becomes a liquid at normal atmospheric temperatures.
 - The gas is loaded onto ships that are constructed specifically to safely store the LNG at these extremely low temperatures.
 - At the destination, the LNG is then converted back into gas which is then connected to a natural gas pipeline and sold to consumers.

Liquefied Natural Gas

- The lifting of the export ban has the potential to impact these projects in a number of ways.
 1. Because of the current export restrictions, in addition to the permitting needed for the construction of the facilities themselves from the Federal Energy Regulation Commission (FERC), each facility also needs to get approval from the Department of Energy for the export of the gas itself.
 - While LNG export approval to countries for which the U.S. has a free trade agreement is almost given, approval to non-FTA countries is not as transparent.
 - This process can be riddled with uncertainty and take years to complete, as it is based on whether the project is in the “public interest”

Liquefied Natural Gas

2. Both gas and crude oil are both **simply hydrocarbons**.
- Changes in temperature and/or pressure will change whether in the form of a gas or a liquid.
 - Natural gas liquids (NGLs), which include propane and butane are largely free from export restrictions because these can be produced as part of the crude oil refining process, while methane (a typical natural gas molecule) cannot be exported without special approvals from the federal government.
 - On the other side of the coin, crude oil that needs to be refined cannot be exported without being refined, but the NGLs that comes out of these same wells can be exported with no restrictions.
 - This has been described as “**a very convoluted set of molecule laws.**”

Removal of the export ban can put all of these molecules on an even playing field, and let the market determine their appropriate relative values and highest value end use.

LOOP Export Terminal

- The Louisiana Offshore Oil Port (LOOP) began operations in 1981, during a time of declining U.S. oil production.
 - LOOP receives and temporarily stores crude oil from a number of sources including tankers carrying crude from all over the world, domestic production in the Gulf of Mexico and from the Houston to Houma (Ho-Ho) Pipeline.
 - LOOP served as a means of efficiently importing crude, on large vessels that cannot enter relatively shallow waters, for the feedstock needed for American refineries.
 - LOOP is the only port in the U.S. capable of offloading crude from “Ultra Large Crude Carriers” (ULCCs) and “Very Large Crude Carriers (VLCCs)” due to its distance offshore and water depth.

LOOP Export Terminal

- The recent shale boom and glut of light sweet crude has created both a challenge and opportunity for LOOP.
 - Because crude imports have been declining, this has the potential to impact both LOOP's utilization and relevance.
 - But the new supply of domestic crude also has the potential to create an opportunity for LOOP to expand its operations to become an export terminal as well.
- The ban on crude exports is a major hindrance to this happening.
- If the U.S. repeals its ban on crude exports, thus allowing for LOOP to become a two-way import and export terminal, Louisiana will have the potential to become the epicenter for global crude trading.

LOOP Export Terminal

- Currently, the Brent spot price is the global standard for the global price of crude.
 - Even gasoline prices here in the U.S. track the Brent spot price—not the WTI spot price GoM could be the new Brent.
- But the removal of the export ban has the potential to change the global dynamic of crude markets—and Louisiana is in a unique situation to become the epicenter of this global market.

LNG and LOOP – Implications for Louisiana

- Opening up the United States for free trade of crude oil and natural gas can have significant implications for the U.S. oil markets and the gulf coast economy.
 - Allow for the gulf coast to become the world trading hub for LNG and crude oil.
 - Will spur investment in LNG facilities in the gulf coast region.
 - This will necessarily be accompanied by increases in storage capacity and potentially even pipeline capacity to move the crude along the gulf coast—either towards LOOP for export or away from LOOP for import.

Potentially, the refining industry could trade its decades old protectionist policies for a chance at truly becoming the world epicenter for hydrocarbon commerce.

Conclusions

Conclusions

- Two main conclusions
 1. The export ban does create winners and losers in the short-run; namely domestic refineries are able to purchase crude from domestic producers at a discount and sell refined products at the world price. But the intermediated-run implications on both domestic refiners and domestic upstream producers are likely insignificant.
 2. Corroborates past research that has concluded the export ban has little (or no) impact on the domestic price of gasoline for consumers.

Conclusions

- Thus, when viewed holistically, basic economic principles alongside the data paint a very humdrum picture for both proponents and opponents of the export ban.
 - Proponents have argued that the removal of the export ban will create large increases in domestic production and hundreds of thousands of domestic jobs.
 - Opponents have argued that the repeal of the law will significantly increase oil and gas production thus exacerbating global CO₂ emissions and climate change.

Results of this research indicate that both this potential benefit and concern are likely grossly exacerbated.

Conclusions

- I argue that the debate over the export ban should **not** be decided based:
 - Net economic costs or benefits,
 - Protecting one industry at the expense of another, or
 - Environmentalists' concern that the removal of the ban will increase global CO₂ emissions.

All of these supposed costs and benefits are **highly speculative** and are **based on a number of large assumptions** about the future.

When a basic economic model is corroborated by the data, all of these benefits/concerns appear to be over-blown.

Conclusions

- Instead the debate **should** focus on:
 - Whether the federal government should be in the business of implementing protectionist policies at the expense of creating frictions that are numerous and whose impacts are impossible to fully quantify.
 - Whether or not the export ban has been successful in achieving national security objectives.

Conclusions

- For Louisiana, the removal of the export ban will remove a long-run federal protectionist policy on an industry that has served as an important component of our economy.
- But in return will have the opportunity for the state to be at the center of an emerging global trading hub.
- Certainly, one might find solace in clinging to a decades old policy that was created for national security reasons as justification for protecting a specific Louisiana industry.

But having confidence in our state and our nation's energy economy, we can decide to take risks that have the potential to grow Louisiana's economy into a dynamic future by becoming the potential world trading hub for oil and gas.



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