CITD BRIEF:
OKLAHOMA OIL

WES WATKINS CENTER FOR
INTERNATIONAL TRADE DEVELOPMENT
School of Global Studies and Partnerships

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OKLAHOMA OIL

Introduction

Trade allows us to get what we need to function in our daily lives. Whether it be the food that ends up in our grocery stores, components of the cars we drive, the buses we ride, or the aircraft that vault us to meetings, conferences, and vacations, most products are comprised of inputs from a range of countries. On the export side of the equation, items produced here in Oklahoma, from grains and meats to components, assemblies, and finished goods, are also shipped all over the world to the tune of over $6 billion (USD) annually and growing.

It is well known that Oklahoma has and extracts crude oil (producing up to 575,000 barrels of crude oil per day[1]). What is less well known is that despite its oil reserves, crude oil is also one of Oklahoma's largest imports, representing 26 percent of imported goods in 2018 according to official statistics of the United States Census Bureau.[2] This amounted to a value of $3.095 billion (USD) in imports that year. Furthermore, this high volume of crude oil imports takes place in the context of a decade of rising domestic oil production. The U.S. oil industry is now producing record amounts of oil, doubling from 7.78 million barrels per day in 2008 to 14.61 million barrels per day only 10 years later. The surge in American oil production has prompted some to declare U.S. oil independence. This is evidenced by the fact that in 2015 the Obama administration lifted a 40-year-old ban on crude oil exports. The results following that change are evident: crude oil exports from the United States surged from $10 billion (USD) in 2016 to over $60 billion (USD) in 2019 and is exported to a variety of destinations, including Canada, South Korea, the Netherlands, India, the U.K., Taiwan, and China.[3]

Why Supply Chain Analysis?

The seemingly baffling import of oil by Oklahoma is a great example of how supply chain network analysis can explain trade relationships and reveal actionable policy insights for improving Oklahoma's terms of trade. Dauntingly, future markets and policy changes provide no guarantee that Oklahoma will continue to be a part of this network. In this brief analysis, we map out where Oklahoma's oil comes from and what is being done with the oil after it is imported. We then simplify some conventional concepts within the oil-industry that help explain this dynamic. This analysis provides insight into Oklahoma's petrochemical industry and possible directions for future supply chain analysis and potential policy adjustments.

"Supply chain network analysis can explain trade relationships and REVEAL ACTIONABLE POLICY INSIGHTS for improving Oklahoma's terms of trade."

Refining takes Crude Oil Too

The first step in understanding the counterintuitive import of crude oil is determining where the oil comes from and what is being done with the oil after it is imported. The changing geopolitical context over the last 10 years has seen the U.S. gradually shift from purchasing crude oil from Saudi Arabia, Venezuela, Iraq, Russia, Nigeria, Brazil, and Colombia to sourcing it exclusively from the tar sand oil deposits in Alberta, Canada. For Oklahoma, this is a particularly important change, because oil coming from the tar sands is shipped not just to Oklahoma, but to the Gulf Coast petrochemical complexes in Texas and Louisiana. Besides using some of the imported oil in its refining industry, Oklahoma lies en route to, and is a transport hub for the existing Gulf Coast petrochemical infrastructure, which concentrates more than 50 percent of the United States' refining capacity. This affords Oklahoman infrastructure an important role, as well as a relative advantage over other petrochemical facilities in the nation. In fact, the role is not limited to refining,

CRUDE OIL is one of Oklahoma's largest **IMPORTS**

since a large amount of the crude oil imported from Canada is shipped by rail, representing a boon for the rail and transport industry in Oklahoma, as well as the storage and pipeline infrastructure out of Cushing.

After locating the source of the oil and determining that it is then refined for later export, we can go onto answer why this is the case. The answer has to do with something called the crude slate. The crude slate can be defined as the crude diet, or the mix of different crude grades that refineries use in their production process. This takes us to concepts that are perhaps well-known within the oil industry, but not very well-understood outside of the industry. According to the American Petroleum Institute, crude oil can be classified as sweet or sour, depending on its sulfur content, as well as heavy or light, depending on its density and specific gravity. Sweet crudes are crudes that have low sulfur content (which is a very corrosive element), and heavy crudes are crudes that are rich in sulfur. Heavy crudes, as the term implies, have a higher density and gravity, whereas light crudes have a lower density and gravity.

Crude Slate: Sweet and Sour

To make things more interesting, different parts of the world produce different types of crude oil within this sweet-sour and heavy-light scale. Saudi Arabia, for example, has both sweet light and heavy sour crudes, whereas Russia produces mid-sour and heavy sours in the Ural region, and extra light and sweet oil in its Far Eastern island of Sakhalin. Venezuela and Canada produce heavy sour crudes. In the U.S., around three-fourths of the crude currently being pumped is sweet and light. This includes shale oil obtained through fracking, which has seen the production levels in states like North Dakota, Oklahoma, Texas and New Mexico surge in the last ten years.

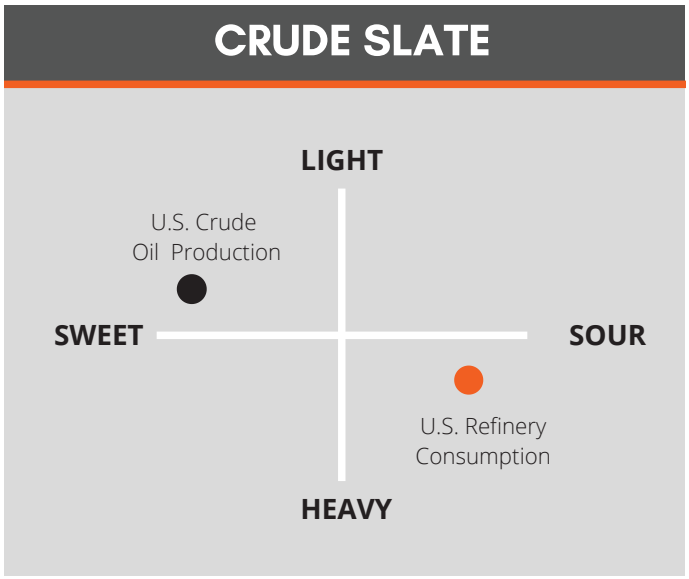

Figure 3: Crude grades and their uses within the U.S. market.
Source: CITD Analysis.

But the trade in oil is not just determined by the types of oil being produced; oil deposit type is only half of the story. The other half has to do with refineries. Oil refineries require billions of dollars in investment, and they are planned for with the mid- and long-term in mind. One of the key aspects of refineries is the crude slate they are designed to process. Refineries must invest billions of dollars in specific equipment (like crackers, cokers, and hydrotreaters) to process their defined crude slate. In the U.S., which for decades imported the majority of its oil, refineries are geared to process a crude slate that corresponds to those sources that supplied them with crude oil. In other words, most American refineries are geared for the heavy sour crudes that they have been importing for decades from Saudi Arabia, Venezuela, Kuwait, Iraq, and Russia, to name a few. More importantly, the mismatch between the oil produced domestically in the U.S., which is sweet and light, and the oil consumed by refineries, which is heavy and sour, means that the U.S. must import crude oil to feed its refineries while finding a market for the oil it is currently producing.

Refineries configured to process feedstock that is light sweet oil have what is in the industry called a “sweet tooth”. The presence of sweet tooth refineries in East Asia (China, Taiwan, Japan, South Korea), Western Europe (the U.K., the Netherlands) and in the Canadian cities of Montréal and Toronto mean that American sweet light has a market

outside the US–at least for the time being. Refineries often do change their crude slate, but this is a costly transition that is guided by market conditions and oil availability, and does not happen overnight. As a result, future markets and policy changes provide no guarantee that Oklahoma will continue to be a part of this network.

Oklahoma Refineries

In Oklahoma, the existing refining capacity has been operating at full capacity. According to the United States Energy Information Agency (USEIA), Oklahoma refineries have a combined capacity to process 525,300 million barrels per day.[4] Some of these refineries, like the Ardmore and Tulsa East and Tulsa West refineries, were built as early as 1913. The other two larger refineries, Ponca City and Wynnewood, were built in the 1920s. Only the smallest refinery, the Thomas Refinery, was built in the last 40 years. The existing infrastructure has been updated and refitted through the years, but as mentioned previously, the feedstock or crude slate they are designed for cannot be adapted overnight. This means that Oklahoman refineries have a need for imported heavy sour crude, explaining the $3 billion (USD) in imports of crude oil from Canada.

Interestingly, it can also be noted that the four largest refineries, making up 97 percent of the state's refining capacity, are owned by corporations headquartered in Texas (for example Valero Energy Corporation, from San Antonio, Phillips 66 Co. from Houston, and HollyFrontier Corporation from Dallas). Only the smaller Thomas Oil Refinery, with a 14,000 barrels per day refining capacity, is owned by a firm headquartered in Oklahoma. This firm is Ventura Refining & Transmission LLC, from Oklahoma City. For the State of Oklahoma, this begs for some questions to be asked. Is there a clear mid- to long-term strategy in place for the state's economy and local actors in regard to the petrochemical industry? Concentration of refining capacity and ownership of refineries among firms headquartered in Texas reveals a clustering around existing and growing installed capacity, capital markets, and a business ecosystem that becomes more favorable and competitive for this sector as it grows further. Will Oklahoma continue to participate in this market? Furthermore, is capturing value a priority for Oklahoma firms and the state's policy for the oil sector? Although the state produces a considerable amount of oil (570,000 barrels per day), much of which is not currently being processed in Oklahoma refineries, almost no crude oil exports are being registered from the state. This means that even when it may be exported eventually, this crude oil is first being shipped out of state and credited to firms in other parts of the country, most likely Texas or Louisiana.

US Role in International Market

Although many of the factors that define the crude oil market are not within the state's control (types of crude produced, location of production, crude oil prices, refining, pipeline and storage infrastructure, etc.), monitoring of certain indicators can be crucial for the state's oil producers and existing refiners. For example, monitoring the "sweet tooth" of refineries in East Asia, Québec, and Western Europe is crucial as they are the markets for sweet light crude produced in the United States. If refineries in these areas begin a transition towards heavy sour crude, American oil would be out of a market, since American refineries themselves are currently not geared to process sweet light crude, meaning the domestic market would not be an option. Alternatively, transitioning local refining capacity would require billions of dollars in investment but would guarantee a local market for locally produced oil.

Over the last 10 years, the U.S. oil production capacity has seen substantial growth. There's no doubt that Oklahoma has contributed to this growth. Additionally, imports are currently necessary for the U.S. petrochemical industry, and refineries are critical determinants of crude oil flows; but the international trade in crude oil has other implications for the state of Oklahoma. For example, although the state purchased substantial amounts of Canadian crude,

Canada's purchases from Oklahoma are much lower. At the state level, Oklahoma had a $3.4 billion (USD) trade deficit with Canada in 2019. Canada purchased only $1.57 billion (USD) worth of goods from Oklahoma but exported $4.96 billion (USD) (including crude oil) to the state. Surely, this allows room for negotiation for Canada to step up purchases and correspond to Oklahoma's investment in Canadian goods.

No Certain Future for OK Oil

Since the 40-year-old ban on crude oil exports was lifted in 2015, U.S. oil exports surged from $10 billion (USD) to $60 billion (USD) in the span of 3 years. Due to this surge in oil exports, the U.S. is exporting to a variety of destinations including, the Netherlands, India, U.K., and Taiwan. Although an oil producing state, Oklahoma continues to import more oil than it exports, primarily from Canada. This need to maintain imports is due to the mismatch between locally produced crude slates and installed refining infrastructure. As it stands, businesses have determined it to be prohibitively costly to convert these refineries to process light sweet crude, even though it would guarantee a refining market for oil produced in Oklahoma. With a robust storage and pipeline infrastructure at Cushing, the state maintains a strong position in oil transportation and storage playing a crucial role in the transit route for Canadian crude towards the Gulf Coast petrochemical complex. Since transportation is Oklahoma's second major export industry, jobs dependent on the crude oil transported through and stored in Cushing would be affected if these transportation flows are disrupted or changed. Oklahoma produced sweet light crude does find its way into international markets that have a "sweet tooth", but policy changes and future market shifts provide no guarantee that Oklahoma will continue to be a part of this network. Furthermore, the dominance of oil clusters in Texas raises questions as to whether Oklahoma will continue to participate as significantly in this market in the future. These reasons combine to make a compelling case for the state to closely monitor and understand the dynamics of how international trade impacts the crude oil market in Oklahoma.

Endnotes

1 As of December 2019, according to the United States Energy Information Agency.
2 US Census Bureau. (1994, March 1). Census Bureau Home Page. Retrieved from https://usatrade.census.gov/
3 U.S. Energy Information Administration (EIA). (2020). Retrieved from https://www.eia.gov/
4 U.S. Energy Information Administration (EIA). (2020). Retrieved from https://www.eia.gov/

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