

# **Proposal to NBER Economics of Hydrocarbon Infrastructure and Transportation Project**

by

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The discovery of shale oil in parts of the United States (US) that do not produce significant amounts of conventional oil has led to a substantial volume of this oil moving by rail. These rail shipments have impacted US energy markets, as well as the markets for other products that move by rail. The proposed research is motivated by several overarching questions related to this trend. The first is whether moving substantial volumes of oil by rail is likely to continue or is it a transitory phenomenon that is the result of the rapid spread of the shale oil and gas boom? The second is whether regulatory oversight of railroad rates and terms of service should be modified to account for an increasing share oil movements by rail. The third question is whether current and expected future oil movements by rail for certain origin and destination pairs are sufficient to justify investments in additional oil pipeline capacity.

## **Where is the Oil Coming From and Where is It Going?**

This theme of the proposed research will first document the set of origin and destination pairs with oil movements by rail and the annual volume of oil moving between these origin and destination pairs for each of the past ten years. The Surface Transportation Board's (STB) Carload Waybill Sample (CWS) will be the primary dataset used for this analysis.

STB requires all railroads that terminate 4,500 or more carloads to compile a stratified random sample of their waybills and report this sample on a monthly or quarterly basis depending on traffic activity. Sampling rates vary between 2.5 and 50 percent depending on the number of carloads in the shipment. Shipments consisting of 1 or 2 carloads are sampled at the lower rate, shipments of 101 more carloads at the higher rate, and other sampling rates apply to shipments with 3-15 (8.3%), 16-60 (25%), and 61-100 (33.3%) carloads.

During processing, additional information is paired with the sampled record such as details on the railcar (e.g., capacity, dimensions, and mechanical characteristics) and location identifiers (e.g., census region, station zip code, standard production location code). The processed records, typically numbering more than 500,000 for a year, thus contain a range of information on the shipment, including routing, billed tons, miles traversed, revenue, origin, destination, interchange points, railroads traversed, car type, car ownership (e.g., railroad and private), and commodity. Commodity type is recorded using the U.S. Department of Commerce's Standard Transportation Commodity Codes (STCC). STCCs are 2 to 7 digit codes, with the first two digits corresponding to major commodity groups and each additional digit a refinement. For hazardous materials only, the "Hazmat" code supplements the regular STCC.

The CWS data will be linked with data on state-level conventional and shale oil production to quantify the role that railroads play in moving oil to market. A matching sample of annual state-level oil production and annual rail movements of oil in and out of the state will allow a number of questions to be addressed. First, to what extent do increases in shale oil production in a state lead to more movements of oil by rail originating in that state? Second, how do in-state factors such as the availability of oil pipeline capacity or domestic refining capacity impact the use of railroads to move oil? Finally, what characteristics of origins and destinations allow railroads to capture a greater share of the rents associated with oil extraction? One would expect that a railroad must charge lower prices for movements that could potentially go by pipeline. Alternatively, for states with unexpected large increases in oil production relative to last year, the railroad may be able to charge higher prices to move this oil to market. These hypotheses and other related hypotheses can be investigated using this linked dataset,

### **The Need for Modifications to Regulatory Oversight Process**

The increased use of railroads to move oil has adversely impacted producers of a number of bulk goods, most notably grains and other agricultural products. The popular press has documented numerous instances of shipments of agricultural products sitting idle while tracks are used to move oil by rail. This portion of the proposed research will use the linked dataset to assess how shipments of other products have been impacted by oil movements. One would expect shippers of agricultural products to face higher prices for movements originating or terminating at locations where oil movements are originating and terminating. For this reason, there may be a need for additional regulatory safeguards against excessive rates charged to captive shippers of agricultural commodities.

Another dimension of potential regulatory reform is the need for uniform standards for the rail cars used to ship oil. There have been a number of high-profile rail accidents involving oil shipments. It is unclear the extent to which the specific rail cars used to transport the oil contributed to the accident. The CWS provides detailed information on number and types of rail cars used for a given oil shipment that can be used to investigate whether there is any evidence that the type of rail cars used to move the oil contributed to rail accidents occurring. Information on the rail car characteristics of oil shipments for an origin-destination pair can be correlated with the incidence of rail accidents and other service failures along this route.

A final regulatory challenge is how to allow railroads to charge for the increased cost associated with managing the riskiness of a given shipment. The current STB process for determining whether a rate is excessive and worthy of regulatory intervention does not account for the increased cost that railroads must bear as a result of moving a potentially dangerous shipment such as oil. If the STB would like railroads to make the investments necessary to reduce the risk of rail accidents involving oil and other potentially hazardous materials, then the railroads must have the opportunity to recover these costs in the rates they are allowed to charge by the STB. This portion of the research will explore alternative approaches to determining shipment rates worthy of regulatory review.

## **The Potential Financial Viability of Oil Pipelines**

The nature of shale oil production—rapid well depletion and the need for almost continuously drilling activity to sustain production—seems to imply that constructing oil pipelines from producing regions to consuming regions may no longer make economic sense. The goal of this portion of the research is to assess the extent to which investments in oil pipelines between origin and destination pairs are financially viable. This research will use the matched dataset on annual state-level conventional and shale oil production and the CWS data to forecast future oil production in the state in order to compute the potential revenue stream available to a potential pipeline between a given origin and destination pair.

The difference between this estimated revenue stream and the expected cost of the pipeline, to the extent that it is negative, measures of how large the relative environmental costs moving the oil by rail versus pipeline must be before it would be economic to construct the pipeline. Estimates of this magnitude will be computed for all origin and destination pairs moving significant volumes of oil moving by rail. This magnitude should provide valuable input into any discussion of the increased environmental costs of moving oil by rail versus by pipeline.