**Consequences of Government Intervention in North American Heavy Oil Markets: Evidence from Alberta's Curtailment**

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## Overview

## In January 2019, the Canadian province of Alberta implemented output controls on crude oil and bitumen production. The primary outcome of this production control policy, regulations known as curtailment, involves transferring market surplus from refiners, mainly those in the US Midwest, to producers in Alberta. The curtailment program responded to a growing and prolonged differential between the Western Canadian Select (WCS) price of oil, a key benchmark for Alberta production, and the West Texas Intermediate (WTI) benchmark. The WCS blend is a heavy oil, a product that typically sells at a discount to the lighter, lower sulphur WTI blend. Beginning in August 2018, the WCS diverged from the WTI, increasing from a long-run average of roughly $13/barrel (bbl) to more than $45/bbl. The sudden, persistent and large price differential prompted domestic industry leaders to express concern about the financial health and economic viability of the sector, not to mention the attendant ramifications for the province’s budget (Seskus, 2018). As owner of the resource, the Government of Alberta earns royalties on the revenues from oil production, funds that support the province’s operating budget. The royalty rate depends on WTI rather than WCS (Government of Alberta, n.d.), and so as the differential increases, firms’ gross revenue decreases but the royalty rate increases. Lower domestic prices entail lower revenues and generally lower royalty payments received by the government. As a consequence, the Government of Alberta intervened in the market, establishing production controls on the province’s 25 largest oil producers. This intervention marks a meaningful shift in the North American heavy oil market as governments had typically avoided direct market intervention.

## This paper fits within a growing literature studying industrial organization of North American oil markets. For example, Borenstein and Kellogg (2014) evaluate joint refinery and transportation capacity constraints in the US Midwest. New supply of light sweet crude from North Dakota, combined with pipeline capacity constraints in Cushing, Oklahoma, lowered refinery feedstock costs in the Midwest. Borenstein and Kellogg find that virtually none of these lower costs were passed through to gasoline or diesel prices, suggesting refiners obtained rents from the cost shock. McRae (2015) studies ConocoPhillips’ ownership of the Seaway pipeline connecting Cushing to Texas. Despite the build-up in supply in Oklahoma and an increasing differential between the WTI and Louisiana Light Sweet benchmarks, ConocoPhillips appears to have strategically delayed the pipe’s reversal, enabling its refineries to obtain lower cost feedstock. McRae calculated that ConocoPhillips’ refineries in the Midwest earned an additional $2 million per day. Muehlegger and Sweeney (2017) study how refinery market power influences cost pass-through in the US, finding that pass-through rates increase from effectively zero at the firm-level to approximately 45% at the national scale. This paper complements this research, illustrating how the fortunes of the US refiners’ market is affected by a major government policy in Canada.

## Methods

## The main consequence of the curtailment involves transferring surplus from the consumers of Alberta’s crude oil and bitumen, predominantly refineries in the US Midwest (PADD II), to producers in Alberta, including the Government as owner of the resource. Production controls are not costless, however. By intervening the oil market, the government created artificial scarcity, generating a deadweight loss. Of course, both the size of the transfer and the magnitude of the deadweight loss depend on the elasticities of supply and demand. The first contribution of this paper is to formulate a partial equilibrium model to measure the magnitude of these quantities, both in aggregate and for the marginal barrel curtailed. In the process, we estimate econometric models of supply and demand for the regional heavy oil market and compare elasticities to others found in the literature. We then proceed to build an optimization model that determines whether the amount of oil and bitumen curtailed is actually too small or too large from the perspective of a profit maximizing production industry. That is, if the Government of Alberta wanted to maximize the joint profits for oil producers (i.e., effectively operate as a cartel in oil production), what is level of curtailment it should impose?

## Results

Table 1 shows a sample of results arising from Alberta’s curtailment. Table 1 shows how much value was transferred from consumers to producers in Alberta’s heavy oil and bitumen market. Results represent monthly values calculated using October 2018 and January 2019 as baselines. A baseline curtailment rate of 8.7% is applied for these calculations. In Model 1, the curtailment led to a $658M per month transfer from consumers to Alberta’s heavy oil and bitumen to producers (including the Government of Alberta through royalties on revenues). This means that due to the increased WCS price of oil, producers earn more revenue – and consumers pay a higher price – per barrel sold. The consequence of this higher price, across all barrels sold, totals approximately $650M per month. The loss in consumer surplus in Model 1 equals $763.1M per month. The value is greater than amount received by producers because the curtailment created artificial scarcity by limiting quantity supplied. This, in turn, generates deadweight loss. Another way of saying this is, the Alberta heavy oil and bitumen market would have been larger but-for the curtailment and the difference in total market value between the actual outcome and the but-for scenario is given by the deadweight loss. Deadweight loss can also be calculated as the difference between the gain to producers and the loss to consumers. Deadweight loss is shown in column 4 of Table 1 at $104.3M. Finally, column 5 of Table 1 shows the “price” of the curtailment transfers in terms of deadweight loss per dollar increase in producer surplus – i.e., this is the marginal deadweight loss of the last dollar transferred. At the margin, each additional $1 dollar transferred from consumers generates a marginal deadweight loss of $0.29 in Model 1 and $0.42 in Model 2.

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|  | Change in Producer Surplus | Change in Consumer Surplus | Deadweight Loss | Marginal Deadweight Loss |
| Model 1 | $658.7M | -$763.1M | $104.3M | 0.286 |
| Model 2 | $730.1M | -$875.9M | $145.8M | 0.420 |

Table 1: Market-level Transfers as a Result of the Existing Curtailment Program

Table 2 shows the results from an analysis where the Government of Alberta seeks to maximize the joint profits at the production level of the supply chain (i.e., operate as a cartel in oil production). Applying the parameters from Model 1, should Alberta want to maximize producer revenues it would need to curtail production by 25.0%, an additional 16.3% more than the initial curtailment rate of 8.7%. A curtailment rate of 25.0% generates additional producer surplus equal to $1,144M alongside a deadweight loss of $857.8M. This gain to producers is $486M more than the existing policy. Model 2 suggests a slightly higher optimal curtailment rate of 26.1%. In Model 2, the increase in producer surplus is $1,315M, while the cost to consumers is $2,630M.

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|  | Implied Curtailment Rate | Change in Producer Surplus | Change in Consumer Surplus | Deadweight Loss |
| Model 1 | 25.0% | $1,144M | -$2,003M | $857.8M |
| Model 2 | 26.1% | $1,315M | -$2,630M | $1,315M |

Table 2: Implications of a Producer Surplus Maximizing Curtailment Rates

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