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POLICY BRIEF
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Measuring the Economic Impact of Alberta's Crude Oil Curtailment Policy[1]

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EXECUTIVE SUMMARY

- In January 2019, in response to a growing and prolonged price differential between the Western Canadian Select (WCS) price of oil and the West Texas Intermediate (WTI) benchmark, the government of Alberta imposed 'curtailment' limits on crude oil and bitumen production, leading to a 8.7% reduction in production volumes.

- Due to the subsequent increase in the WCS price of oil, the curtailment policy led to an estimated increase in producer operating income of $658 million per month, while consumers, predominantly refiners in the US Midwest, lost economic benefits equal to $763 million per month.

- If the Government of Alberta had instead sought to maximize short-run producer economic benefits through a de facto cartel curtailment policy, oil production should have been reduced by an additional 16.3% over its initial controls, limiting total production to a much larger 25% of baseline production.

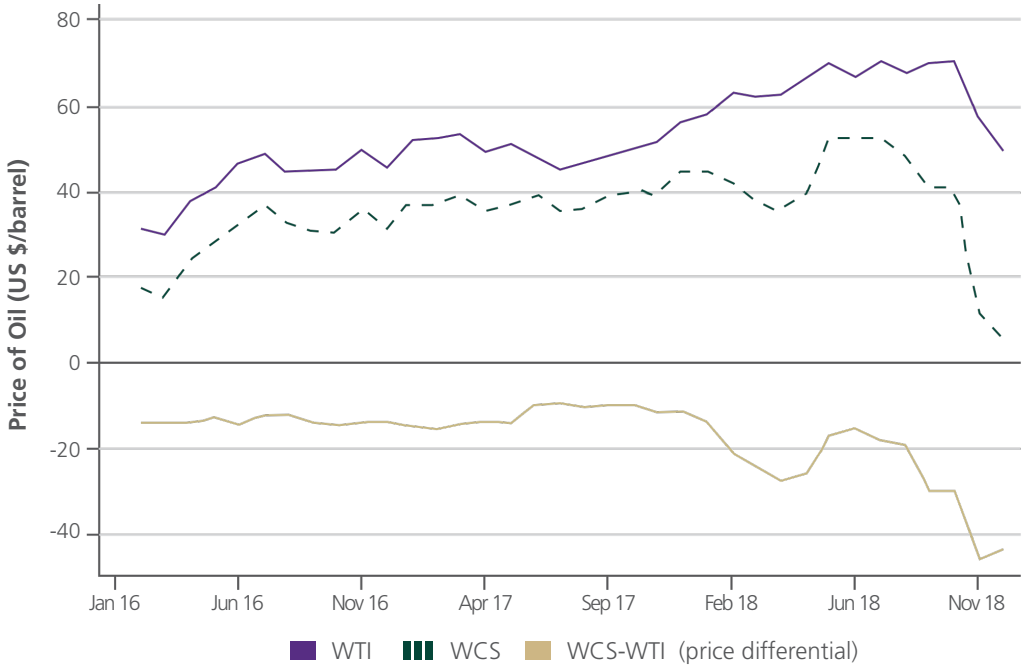
INTRODUCTION

In January 2019, Alberta required large crude oil and bitumen producers to reduce production by 8.7%. Traditionally Alberta had adopted a "hands-off" philosophy with respect to the day-to-day operation of oil markets. Thus, this curtailment policy represented a notable interventionist shift in how the province approached the production and marketing of crude oil and bitumen. Curtailment responded to a growing and prolonged price differential between the Western Canadian Select (WCS) price of oil price, the key benchmark for Alberta's heavy oil production, and the West Texas Intermediate (WTI) benchmark. The WCS blend is a heavy oil which typically sells at a discount to the lighter, sweeter WTI. Figure 1 illustrates that beginning in August 2018 the WCS diverged from the WTI, with the price differential between the benchmarks increasing from an average of US$12.77/barrel (bbl) in 2017 (Heyes et al., 2018) to more than US$45/bbl. The sudden, persistent and large difference in prices prompted industry leaders to express concerns about the financial health and economic viability of the sector, not to mention the attendant ramifications for the province's budget (Seskus, 2018). The differential also ignited calls for a policy response. As owner of the resource, the Government of Alberta earns royalties on revenues from oil production, supporting the province's operating budget. Lower domestic prices entail

[1] This Policy Brief is based on research paper "Production Controls in North American Heavy Oil and Bitumen Markets", coauthored by Brandon Schaufele and Jennifer Winter.

lower revenues from oil production and hence lower royalties. Consequently, the Government of Alberta intervened in the market, limiting the quantity of crude oil and bitumen that the province's 25 largest operators were permitted to produce and, accordingly, increased the WCS price of oil exiting the province from a low of $5.97/bbl in December 2018 to $53.25 in April 2019 (Alberta, 2020).

Figure 1 | Time Series of Oil Prices: WTI, WCS and Differential



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This Polcy Brief measures the short-run economic impact of Alberta's curtailment policy. It also speculates on several long-run implications, even though it is still too early to provide an empirical assessment of these longer term ramifications. By restricting supply and increasing the WCS price of oil, curtailment transferred economic surplus (which for Alberta's oil producers equals revenues net of variable costs) from consumers of Alberta's crude oil and bitumen, a group comprised of Alberta's vertically integrated firms and refiners primarily in the United States' Petroleum Administration for Defense District (PADD) II, to producers, including the Government as owner of the resource. Transfers are not costless, however. By intervening in the oil market, the government created artificial scarcity and an overall reduction in economic activity (i.e., deadweight loss in the jargon of economics). This means that the benefits to Albertan producers in the short-run should be weighed against the overall affect on the market, which includes losses to consumers.

BACKGROUND ON ALBERTA'S CURTAILMENT POLICY

Three factors led to the increased gap between the WCS and the WTI during late 2018 and, eventually, to Alberta's intervention in the oil market. First, heavy oil and bitumen operators dramatically increased output over the prior decade. Production of heavy oil in Western Canada equalled 2.3 million barrels per day (bpd) on total oil production of 4.5 million bpd in October 2018 (Canada Energy Regulator, 2019). For comparison, in October 2009, 3.3 million bpd were produced. The majority of the 1.1 million bpd increase comes from due to heavy oil and bitumen.

The increase in quantity produced coincided with the second cause of the price differential. Infrastructure bottlenecks began to materialize in 2016, but became a regular feature of the market in late 2018. Given the increased production volumes, insufficient pipeline capacity existed to move product to markets. Oil was stuck in the province at a time when surplus storage capacity rapidly dwindled. With insufficient pipeline capacity and dwindling alternatives to store the physical product, shippers were increasingly forced to move barrels via rail and truck, or were compelled to accept low post-apportionment prices.

The final reason for the late 2018 price differential came from the consumer side of the market. Several refinery outages temporarily reduced demand for Alberta's heavy oil. These included both planned and unplanned maintenance at large refineries in Wisconsin, Indiana and Illinois.

Alberta's curtailment commenced in January 2019 with Regulation 214/2018 (Alberta, 2019). The new regulation granted Alberta's Minister of Energy authority to establish a maximum combined production quantities for crude oil and bitumen in the province (Alberta, 2018), as well as the right to allocate production to specific operators. Initially designed to terminate on December 31, 2019, the rules remained until the end of 2020.

Alberta's curtailment policy was equivalent to a textbook production control policy. Quantity supplied is withheld from the market in order to increase prices received by producers. During the initial month of curtailment, January 2019, aggregate provincial production was reduced by 325,000 bpd, equivalent to a 8.7% decrease from October 2018's production. The months of February through June saw curtailed volumes corresponding to 250,000, 250,000, 225,000, 200,000 and 175,000 bpd. Both conventional and oilsands operators were covered. Operator-specific allocations were determined via a formula based on an "adjusted baseline", a value representing the best six months of production over the past year. The first baseline period began in November 2017, terminating at the end of October 2018. Curtailment exemptions were provided for new entrants and to operators producing fewer than 20,000 bpd. The threshold implied that the policy only affected a small handful (25) out of 421 operators in the province. Finally, starting in October 2019, additional crude shipped by rail, rather than via pipeline, was exempted from the curtailment quotas.

The curtailment policy yielded a large and immediate market response. First, the WCS-WTI price differential, which hovered around $40/bbl for most of December 2018, plummeted to less than $15/bbl in January and dropped below $10/bbl in February. Second, crude-by-rail shipments fell alongside the differential. Roughly, 350,000 bpd were shipped by rail in December 2018. Only 125,000 bpd moved via rail cars in February.

The curtailment's operator-specific allocations applied pro rata rationing of production. Textbook models of pro rata allocation under a supply constraint typically stress potential misallocation distortions (e.g., Viscusi, Vernon and Harrington, 2005). When production is allocated equi-proportionally, quantity from less productive firms is able to 'crowd out' quantity from more efficient firms. Indeed, regulations governing apportionment of Canada's cross-border oil pipeline infrastructure generate this exact outcome. However, Alberta's curtailment regulations avoided this misallocation distortion, because they included the Curtailment Consolidation and Transfer provision (IL 2018-43). This gave operators a mechanism to consolidate and transfer production allocations. The most profitable barrels, therefore, had a path to market, even if the operator reach the limit of its production allocation.

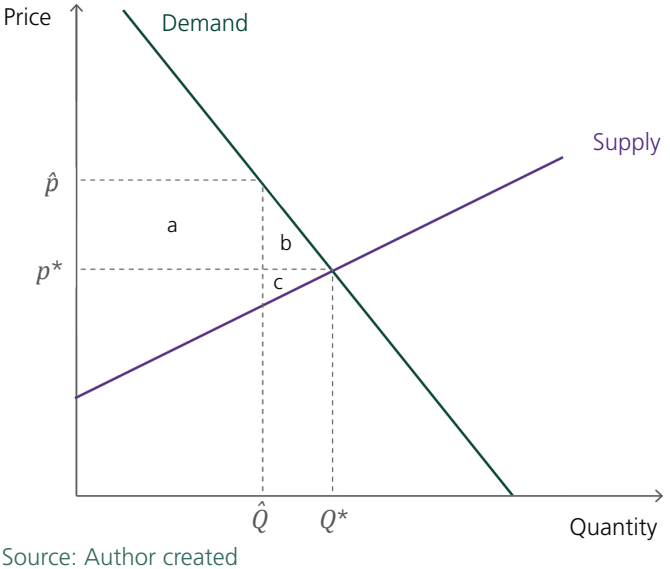
The curtailment policy received mixed support from Alberta's major oil producers, largely because the policy had differential effects for suppliers and consumers of Alberta's heavy oil. Pure play producers such as Cenovus and Canadian Natural Resources, for example, expressed strong support for the government's intervention. These firms operate primarily on the production-side of the market, extracting oil and shipping product to independently owned refineries. In contrast, several vertically integrated companies, those engaged in both oil production and refining, voiced uneasiness about the curtailment. Suncor, Husky and Imperial Oil, for instance, communicated initial trepidation regarding the market intervention.

THE ECONOMIC IMPACT OF CURTAILMENT

Alberta's curtailment policy was designed to reduce the WCS-WTI price differential and, in turn, to transfer economic benefits from consumers of crude oil to producers. It accomplished this by limiting quantity supplied, creating artificial scarcity, leading to an increase in the price of Alberta's heavy oil. A partial equilibrium framework illustrates the economics underlying this surplus transfer.

The intuition for the transfer is illustrated in **Figure 2** (Gardner, 1983). Figure 2 shows the demand and supply for Alberta oil. Prior to the curtailment, the market price and quantity in Alberta are given by p* and Q*. Price, p, can be thought of as the WCS, and Q as the quantity produced of a bitumen-heavy oil blend. The curtailment policy is a production control that limits output to $\hat{Q} <$ Q*, with higher prices paid by consumers as the consequence. p* increases to $\hat{p}$.

Figure 2 | Impact of Curtailment Policy on Oil Price



Source: Author created

Two effects are apparent from curtailment as illustrated in Figure 2. First, at $\hat{Q}$, producers receive an additional $\hat{p}$ - p* per barrel relative to the pre-curtailment equilibrium. Region **a** represents the total value of the resulting transfer from consumers to producers (i.e., the amount produced multiplied by the increase in price). In order to obtain area **a** however, producers forego region **c**, the producer surplus on the restricted supply, Q* - $\hat{Q}$. As long as the size of **a** is greater than the size of **c**, as it is in Figure 2, oil producers are better off with curtailment than without it. Refiners, in turn, as demanders of crude bitumen, must pay a higher price for their feedstock and are unambiguously worse off. Refiners lose the dollar amounts associated with areas **a** and **b** in Figure 2.[2]

The second feature to note in Figure 2 is that production restrictions distort the market, creating an economic efficiency loss. This loss, represented by areas **b+c**, arises because a smaller quantity of bitumen is supplied than would be the case under a no-curtailment scenario.[3] Area **a** is not lost, because this represents the transfer from consumers (i.e., refiners) to producers. Still, at the market-level, a tradeoff exists. Increases in producer profits, area **a**, are offset by increases in overall economic inefficiencies. The sizes of areas **a**, **b** and **c** depend on the structure of the market. Econometric analysis is used to determine the relevant parameters.

CONSUMER AND PRODUCER IMPACTS OF ALBERTA'S CURTAILMENT

The key conclusions from the empirical analysis are presented in Tables 1 and 2. Table 1 shows results for two models studying the implications of Alberta's curtailment as the policy was implemented in January 2019. Measuring the magnitude of the economic wealth transfer and the loss of economic efficiency involves estimating key structural parameters of Alberta's heavy oil market. Typically, regional oil markets, such as the one for Albertan heavy oil and bitumen, are believed to have very inelastic demands and supplies in the short-run (Kilian, 2020). Small changes in market conditions yield large changes in prices. Our models confirm this for Alberta. While Table 1 shows the actual consequences of Alberta's curtailment, Table 2 asks a different question. It uses the same parameters as those in Table 1 but investigates what the curtailment rate should have been if the Government of Alberta's exclusive objective was to maximize the economic return to producers. That is, what would the market-level consequences be if the Government of Alberta operated as a cartel in heavy oil and bitumen oil production?

Models 1 and 2 were estimated using data on Alberta's heavy oil market from 2016 through 2019.[4] Using the parameters from these models, Table 1 shows how much economic 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 yardsticks. A baseline curtailment rate of 8.7% is applied for these calculations. In Model 1, the curtailment led to a $658M per month economic transfer from consumers to Alberta's heavy oil and bitumen to producers (including the Government

[2] An argument could be made that refiners in US PADD II were able to exploit infrastructure bottlenecks to earn rents and the curtailment works to redistribute the market surplus (Borenstein and Kellogg, 2014).

[3] This deadweight loss only arises if the equilibrium is given by *(p*, Q*). An argument may be that pipeline bottlenecks distort this equilibrium and an alternative, inefficient equilibrium would have obtained. This is not the correct way to view this problem, however. Pipes are not the only means of transportation. Rail and truck are also used to ship crude oil and bitumen. Moreover, oil is storable, so placing barrels in storage is another option. A vital role of markets is to send signals to producers and consumers with respect to various demand and supply options. Prior to the curtailment, government intervention did not distort the market signals. Therefore, p* and Q* is the appropriate ``no policy'' counterfactual.

[4] Model 1 assumes that both heavy oil and bitumen demand and supply can be represented by linear approximations. Model 2 assumes that demand takes a negative exponential form, while the supply function remains linear.

of Alberta through royalties on revenues). This means that due to the increased WCS price of oil, producers earned more revenue – and consumers paid 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 benefit in Model 1 equals $763M per month. The value is greater than the economic benefit received by producers because the curtailment created artificial scarcity by limiting quantity supplied. This, in turn, caused economic efficiency losses. In other words, the Alberta heavy oil and bitumen market would have been larger but for curtailment, and the difference in total market value between the actual outcome and the but-for scenario is given by the economic efficiency loss. The efficiency loss can also be quantified as the $104M difference between the gain to producers and the loss to consumers.

The results for Model 1 are slightly more conservative than those for Model 2. In Model 2, the gain to Albertan producers is $730M, while the loss to consumers equals $876M. The economic efficiency loss in this case is $145.8M, roughly $41M larger than the $104M estimate in Model 1.

Finally, column 5 of Table 1 shows the "price" of the curtailment transfers in terms of efficiency loss per dollar increase in producer economic benefit. At the margin, each additional $1 dollar transferred from consumers caused a reduction in economic efficiency of $0.29 in Model 1 and $0.42 in Model 2.

Table 1 | Economic Transfers from the Curtailment Policy

	Increase in Producer Benefits	Reduction in Consumer Benefits	Efficiency Loss	Marginal Efficiency Loss
Model 1	$658M	-$763M	$104M	-$0.29
Model 2	$730M	-$876M	$146M	-$0.42

Table 2 shows the estimated results from a hypothetical alternative scenario where the Government of Alberta seeks to instead maximize industry profits from oil production (i.e., it operates as a monopoly cartel in oil production). Applying the parameters from Model 1, the government should have curtailed production by 25.0%, an additional 16.3% beyond than the initial curtailment policy of 8.7%. A curtailment rate of 25.0% generates additional producer economic benefits equal to $1,144M alongside a reduction in consumer-related losses of $858M. 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.

Table 2 | Economic Transfers under a Monopoly Curtailment Policy

	Optimal Curtailment Rate	Increase in Producer Benefits	Reduction in Consumer Benefits	Efficiency Loss
Model 1	25.0%	$1,144M	-$2,003M	$858M
Model 2	26.1%	$1,315M	-$2,630M	$1,315M

These cartel, or optimal, curtailment rates present points of reference for how far the Government of Alberta might have pushed the curtailment limits. They also suggest restraint in the policy's implementation. Comparing the optimal to actual curtailment production limits suggests that Alberta's policy was relatively modest.

There are several probable explanations for this divergence. First, government officials may simply not have known the optimal curtailment rate. The province has limited practice with this class of policy, so inexperience is plausible. A more likely account is that Alberta was concerned with prospective long-run implications of larger production constraints or, given the province's historical commitment to open markets, it may have been ideologically reticent to impose such heavy-handed controls on the industry. Alternatively, it may have weighed the costs to vertically-integrated firms in its calculus. Regardless, based on these results, the Alberta Government could have enacted more stringent controls, facilitating even larger transfers to the province's upstream producers.

CONCLUSION

Intended as a short-run intervention, Alberta's curtailment policy marked a shift in the province's willingness to interfere in oil markets, ultimately achieving its primary objective of shrinking the WCS-WTI price differential. The policy sought to safeguard a fragile energy sector and this brief measures the scale and market implications of Alberta's actions. Results suggest that the province's producers received roughly $700 million per month in additional net revenues as a consequence of the production controls on crude oil and bitumen. These revenues largely come at the expense of consumers in the US Midwest, so represent an economic transfer. Yet, while refineries in the the US's PADD II comprise the largest buyers of Alberta oil, domestic purchasers of Alberta crude were also affected. This includes companies that own refineries within the province.

Historically, Alberta was reluctant to alter the market-determined distribution of surplus, allowing producers and consumers to negotiate freely. By breaking with this norm, the curtailment policy represents more than a market transfer. It signifies a shift in how Alberta treats its fossil fuel markets. While the short-run benefits are large and can be quantified, the long-run implications of this change may be more significant, largely due to the new uncertainty regarding future government policy and the province's willingness to intervene in markets. Uncertainties may appear along several dimensions. For instance, the curtailment policy supported pure upstream players rather than vertically integrated firms. Companies with refineries, firms such as Suncor, Imperial and Husky Energy, made strategic investments that helped insure against downside risks associated with the WCS-WTI differential. Indeed, they may have profited off their investments. The curtailment policy extended this insurance to all players in the industry, even those who opted not to own mid- or downstream assets. Yet, by offering cover to upstream producers, the policy undermined some of the upside from owning a refinery. As such, the curtailment policy may chill similar future mid- and down-stream capital investments: if the government is offering a bailout to upstream producers, why would corporate boards allocate capital to diversified asset portfolios? This is a single example of how uncertainty influences investment decisions when governments choose winners. The obvious counter-argument is that, without the curtailment policy, a persistent differential would have pushed several producers to the edge of collapse and that the equilibrium reprecussions would feedback to all producers and levels of the market. While there may be some merit to this claim, currently little evidence supports it.

Finally, the curtailment policy responded to a series of unique conditions that arose within a regional, Canadian oil market. January 2019's situation differed markedly from subsequent events, such as those associated with the COVID pandemic. May 2020, as an example, delivered a collapse in the global price of oil. Low WCS oil prices were paired with low WTI prices, both attributable to global economic

uncertainty and a pandemic-induced recession. Alberta's oil producers may have been in a similarly weak financial position in this circumstance, but this was not a consequence of an extraordinary differential between the WCS and WTI. Province-specific production controls would likely do little to alleviate low prices. The Alberta curtailment policy was designed to achieve a specific objective at a particular point in time. Evaluated against the goal of shrinking the 2019 WCS-WTI price differential, the policy succeeded.

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