Refining Margins in British Columbia

Examining Transportation Fuel Prices and Refinery Net-Revenues in the Context of Supply Costs and Provincial Liquid Fuel Policy

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Introduction and Summary

This report provides an analysis of the high wholesale gasoline and diesel prices in the Vancouver area of British Columbia in recent years. The Vancouver area in this analysis includes the regions within British Columbia that are within the same fuel market as Vancouver: they generally draw fuel from the same wholesale facilities and experience the same trends in fuel prices. This region includes the Lower Mainland of British Columbia east to Hope and north to Pemberton, as well as Vancouver Island, accounting for 78% of the provincial population. This analysis examines fuel prices in this area as a function of fuel supply costs, including:

- Crude oil costs;
- Transportation costs of crude oil and finished fuel; and
- Refinery margins (i.e. the net-revenues that refineries earn when transforming crude oil into fuels, which can include windfall profits).

This report also compares the cost impact of a seemingly uncompetitive fuel market relative to the cost of the British Columbia Renewable and Low Carbon Fuel Requirement (RLCFR) — a regulation that requires transportation fuel suppliers to reduce the average greenhouse gas emissions per unit of transportation energy supplied. It concludes with a discussion of potential policy solutions for high fuel costs in British Columbia and a discussion of potential improved competitiveness from a robust RLCFR.

The report builds on findings published in a 2015 Navius report, and assesses market dynamics that have emerged since that report.

The analysis shows that:

- Prior to the year 2010, there was a narrow and relatively consistent spread in refining margins across Canada. After 2010, refinery margins in the Vancouver area increased relative to the Canadian average resulting in gasoline and diesel prices that were higher than expected given the price of crude oil.
- From 2010 through 2014, the wholesale pricing of gasoline and diesel was consistent with the supply cost of fuels from Alaskan North Slope (ANS) oil. During that time, the refineries supplying the Vancouver area fuel market that could process cheaper "landlocked" crude oil (e.g. Canadian light and heavy oil) likely made greater profits which appeared as a rising average refining margin. While these profits were a windfall resulting from constraints on the export of oil from Alberta, they were a normal outcome of a functioning fuel market.

- Since 2015, supply cost has not been the basis for wholesale pricing of gasoline and diesel, resulting in an increase in the average refining margin within the Vancouver area fuel market that cannot be attributed to competitive market forces. This high refining margin resulted in correspondingly high retail fuel prices.
- The decoupling of supply cost and wholesale price is not a result of scarcity pricing, where prices rise until demand matches a fixed supply: data indicate that the fuel market in the Vancouver area has been adequately supplied in the study period, with no rationing to the market. The pipeline that serves as the main fuel supply for this fuel market has had some additional capacity to transport light products such as gasoline and diesel, and the region has generally been a net-exporter of these fuels through its primary marine trading hub, the Port of Vancouver.
- Therefore, since 2015, higher fuel prices appear to be the result of a lack of competition in the Vancouver fuel market, which is consistent with other data in this report relative to market competitiveness. The resulting high refining margins translate directly into higher retail prices for gasoline and diesel.
- This apparent lack of competition has cost consumers $2.4 billion, or $1,730 per household between 2015 and the end of 2017. This is equivalent to an average 13 cent/L premium on gasoline and diesel over this period relative to the price one would expect in a competitive market.
- A comparison of the cost to consumers of these inexplicably high refining margins versus the incremental cost of the RLCFR shows that the policy cost is small relative to the margin cost. Between 2010 and 2016 (the last year for which RLCFR data is available), the cost of the high refining margin has been more than five times larger than the RLCFR cost.
- The problem of high margins and fuel prices is caused by an apparent lack of competition. Therefore, solutions that increase fuel and crude oil supply and reduce notional supply cost without introducing more competition into the market are unlikely to lower the price of fuel.
- Regulating fuel markets or mandating transparency could increase competition and there are precedents for these actions in other provinces and some US states.
- In the long-run, greenhouse gas reduction policies such as the RLCFR could solve the problem. The RLCFR supports demand reduction (e.g. electrification of transport) and creates a market where domestic production of alternative fuels can emerge (e.g. the synthesis of lower-carbon gasoline from natural gas and/or biomass), providing an additional incentive for new retailers and wholesalers to bypass the incumbent fuel suppliers. With less fuel demand and sufficient new fuel supply, petroleum fuel suppliers may need to lower prices to compete for the remaining market share.

What are refinery margins?

A refinery margin (also called the 'crack spread') is the revenue associated with refining petroleum fuels. This value, which is widely reported for key global refining hubs, is expressed as a value per volume (e.g. $/L), net of the cost of the crude oil input. The simplest refining margin calculation is based on subtracting the relevant crude oil cost from the wholesale price of gasoline in the refiner's market. More advanced calculations account for the relative proportion of refined products from each barrel and refinery configurations; there is no universal measure. Therefore, actual refinery margins are a function of both the non-crude cost of refining as well as the wholesale price of the finished refined products. Costs include energy costs, operating and maintenance costs and returns to capital investments. Like most goods, the wholesale price of refined products is a function of their supply and demand within regional, continental and global markets.

Because calculated refinery margins must cover costs, they are a proxy, not an absolute indicator of profits. A high refining margin does not necessarily mean a refinery is highly profitable. For example, complex refineries have more flexibility to convert crude oil into the most valuable slate of products. However, that flexibility comes at a cost. A complex refinery requires a greater initial capital investment and will require a higher return on its activities to make that investment viable.

Nonetheless, a comparison of refining margins and crude oil costs over time provides a reasonably reliable indication of the *relative* profitability of refining in a given market:

- If the margin is rising and crude oil costs are not rising, it generally means profits are rising,
- Similarly, if the margin in one region rises much more rapidly than in other regions or is much higher for similarly complex refinery configurations without some other explanation of refining costs, it generally means refining is a more profitable industry in that region.

Trends in refinery margins in the Vancouver Area and Canada

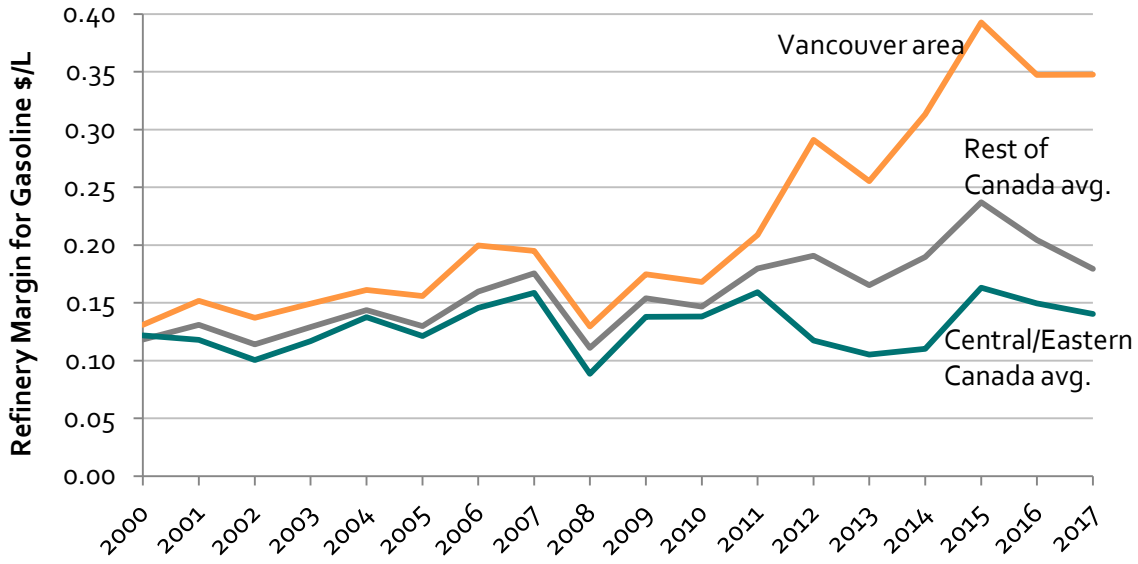
Our assessment of refining margins in the Vancouver area and Canada runs from the start of 2010 to the end of 2017. The Vancouver area in this analysis includes the regions in British Columbia that are within the same fuel market as Vancouver, i.e. they generally draw fuel from the same wholesale facilities and experience the same trends in fuel prices. This region includes the Lower Mainland of British Columbia east to Hope and

north to Pemberton, as well as Vancouver Island, accounting for 78% of the provincial population.

The analysis shows that margins in the Vancouver area have increased relative to margins in the rest of Canada since 2010. The difference between the fuel market in the Vancouver area and the rest of Canada has grown and taken a different structure since Navius first reported on this topic in 2015. Analyzing the fuel supply costs in the Vancouver market indicates that from 2010 through 2014, higher refining margins were the result of refineries processing cheaper "landlocked" crude and selling fuels into a market where the price was set by the cost of refining more expensive crude oils with tidewater access (i.e. access to marine trade). However, from 2015 through 2017, the price of fuel has decoupled from the supply cost even though the market was adequately supplied with fuels. Barring some unknown driver not identified this study, the evidence indicates that the decoupling of fuel prices from supply cost in the Vancouver fuel market is a result of a lack of competition amongst the relatively few fuel suppliers in a concentrated market.

Prior to the year 2010, there was a narrow and relatively consistent spread in refining margins across Canada. After 2010, refinery margins in the Vancouver area increased relative to the Canadian average (Figure 1). Before 2010, refinery margins were somewhat higher in western Canada because this region was an area of net crude oil supply. The cost of crude oil in this region was less than in areas of net demand (e.g. Eastern Canada), with the discount reflecting the cost of transporting the oil to major trading hubs. Lower crude oil costs likely resulted in higher refining margins because refiners were able to sell into markets where the price of fuel was set by higher crude oil prices. Since 2010, refining margins in the Vancouver area have increased substantially: margins have grown to be 50-90% larger than the Canadian average shown in Figure 1, versus 10-20% larger in the decade prior.

Figure 1: Annual average refinery margins for gasoline in Vancouver relative to rest of Canada



Margin data is from the Kent Group Ltd. The costs are real 2017 CAD. The representative markets included in the data are: Vancouver, Calgary, Regina, Winnipeg, Toronto, Montreal, Saint John, and St. John's. The "rest of Canada average" is a non-weighted average that excludes Vancouver. The Central/Eastern Canada average is a non-weighted average that includes Toronto, Montreal, Saint John, and St. John's. Refinery margins are based on the average slate of crude oils available to refiners in each market and do not represent the margins for a specific refinery using a specific source of crude oil.

Figure 1 only shows an average refining margin for each market. For example, the trend for Vancouver is based on a crude oil price that is a weighted average of the crude oils refined in western Canada (e.g. Canadian light and heavy oil). It is not specific to a refinery but instead reflects the average margin in the Vancouver market. To explain the trend in this market's refining margin, one must consider the specific supply costs of suppliers to this market. This report makes this estimate for three archetypal suppliers to the Vancouver fuel market:

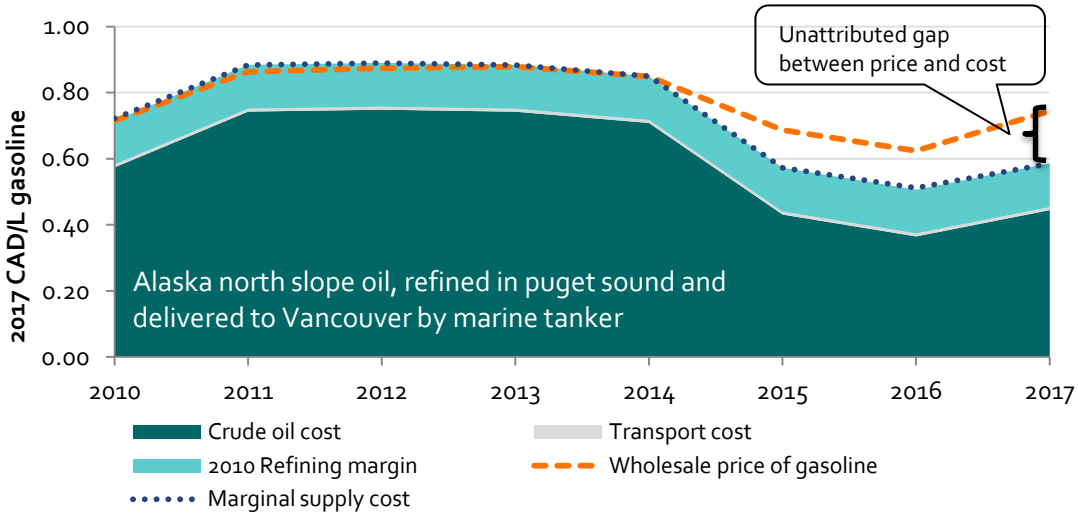
- Alaskan North Slope (ANS) oil with marine supply to Washington state where it is refined and barged to the Vancouver area (Figure 2). The refineries in Washington refine other crude oils, such as light oil from North Dakota,[1] but the supply cost of fuels produced from this crude stream is similar to the Canadian light oil archetype described next. Including this production does not add new information to the analysis.
- Canadian light oil delivered from Alberta by pipeline and refined in the Vancouver area (Figure 3).
- Canadian heavy oil refined in Alberta with the finished fuels delivered by pipeline to the Vancouver area (Figure 4).

[1] Morningstar Commodities Research, 2017, *Pacific Northwest Refineries: Cheap Crude and a Captive Market*

The supply costs for each of these three archetypal suppliers are composed of the crude oil input cost (adjusted for CAD/USD exchange rate), transportation cost for crude oil and finished products, and the refining margin. The refining margin is the average margin in the year 2010, which is used as an example of a "normal" margin for the refineries, given that margins had been relatively stable between 2000 and 2010. The supply cost for the Vancouver based refinery archetype also includes the British Columbia carbon tax but without an adjustment for any related changes in corporate income tax.

From 2010 through 2014, the price of gasoline was likely defined by the supply cost of fuels produced from ANS oil. In a competitive market, the price of gasoline will rise until supply and demand are equal. Over the long-run, the price will be defined by the "marginal" supply cost, which is the highest cost supply required in that market. In this case, the marginal supply is the Washington state refinery using ANS oil (Figure 2). From 2010 through 2014, the supply cost (the area Figure 2) is generally the same as the wholesale price of gasoline (the orange dashed line in Figure 2). A similar trend exists for diesel fuel.

Figure 2: Estimated refining costs vs. wholesale gasoline price in Vancouver, ANS oil refined in Washington state (annual averages)

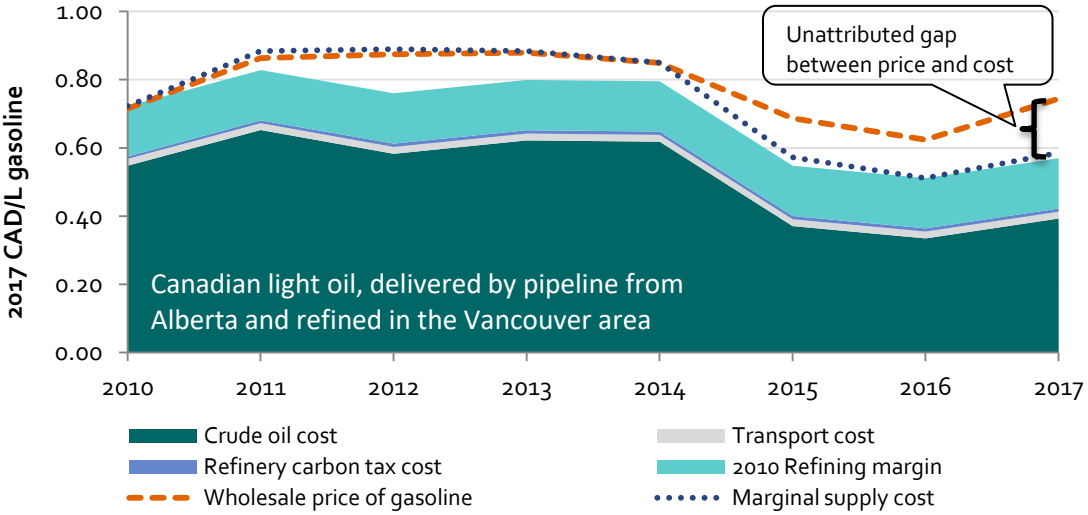


The wholesale price of gasoline for Vancouver is from the Kent Group Ltd. The price of ANS oil in Valdez, Alaska is from state government data.[2] Transportation costs are based on 1.4 2017 CAD/bbl to transport crude oil 1200 Nautical miles from Valdez, Alaska to Anacortes, Washington, (a conservative high cost given that oil must travel on higher cost US flag ships), and $0.06/bbl to transport product from Anacortes to Vancouver on a "handy size" tanker.[3]

[2] Alaska Department of Revenue – Tax Division. Crude Oil and Natural Gas Prices.

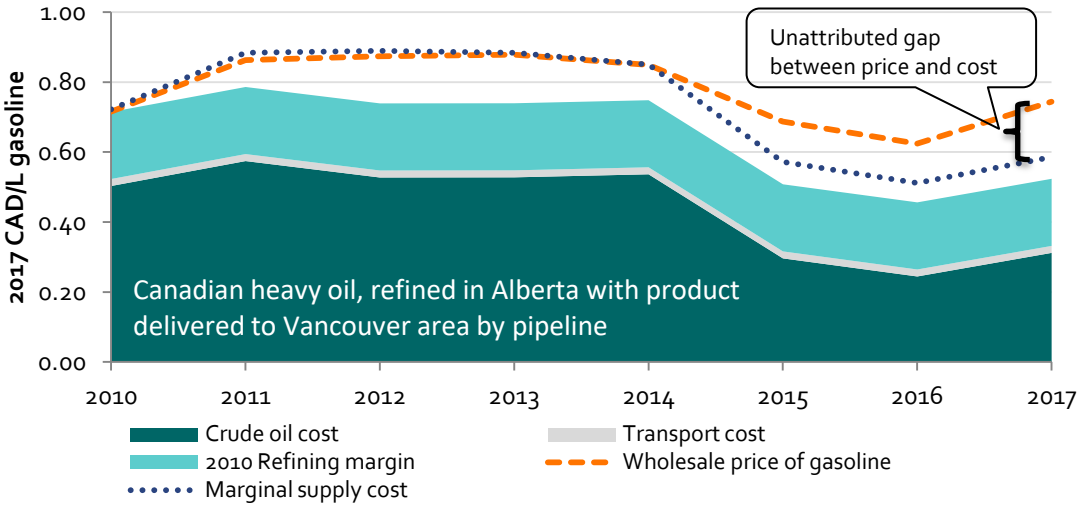
[3] US Congressional Research Service, 2014, Shipping U.S. Crude Oil by Water: Vessel Flag Requirements and Safety Issues.

Figure 3: Estimated refining costs vs. wholesale gasoline price in Vancouver, Canadian light oil refined in the Vancouver area (annual averages)



The wholesale price of gasoline for Vancouver is from the Kent Group Ltd, as is the price of light crude oil in Edmonton, Alberta.[4] The transportation cost is based on a pipeline toll of $3/bbl.[5] The refinery carbon cost is based on a refining greenhouse gas intensity of 8.8 gCO2e per MJ of gasoline produced[6] and the British Columbia carbon tax value in each year.[7]

Figure 4: Estimated refining costs vs. wholesale gasoline price in Vancouver, Canadian heavy oil refined in Alberta (annual averages)



The wholesale gasoline price, crude oil price (Western Canadian Select heavy crude oil in Edmonton) and pipeline transportation cost are based on the same information as in Figure 3.

[4] Kent Group Ltd.

[5] National Energy Board, Pipeline Profiles: Trans Mountain Pipeline.

[6] Approx default value from the GHGenius 4.03a lifecycle greenhouse gas model

[7] The value in nominal Canadian dollars was $20/tonne CO_{2e} in 2010, $25/tonne in 2011, and $30/tonne thereafter

During the 2010 through 2014 period, the refineries supplying the Vancouver fuel market that could process cheaper "landlocked" crude oil (e.g. Canadian light and heavy oil) likely made greater profits, which appeared as a rising average refining margin. Because of oil transportation constraints, crude oil produced within Alberta and the continental US was selling at a discount relative to crude oil with access to marine trade routes (e.g. ANS). Refineries that could access the cheaper crude oil and sell it into a market where the price of fuels was set by a more costly crude oil earned a profit, which is likely the cause of rising refining margins in the Vancouver market. This profit is approximately the same as the gap between a refinery's supply cost and the marginal supply cost in the market (i.e. the difference between the stacked areas and the blue dashed line in Figure 3 and Figure 4). Therefore, from 2010 through 2014 the refineries based in British Columbia and Alberta likely earned a windfall profit from the discount between landlocked and ocean-going crude oil, but this windfall was a normal outcome in a functioning market. This windfall would have also applied to the Washington state refineries when processing landlocked crude oil and also applies to the diesel fuel market.

Since 2015, the marginal supply cost has not defined the wholesale price of gasoline, resulting in an increase in the average refining margin within the Vancouver area fuel market and a corresponding increase in fuel prices. This increase cannot be attributed to 'traditional' market forces; the supply costs in this analysis cannot explain the price of gasoline in the Vancouver area since 2015, nor is rationing evident. This "unattributable gap" between the wholesale price and the marginal supply cost shown in Figure 3 through Figure 2 is the cause of the high average refining margin in the market since 2015. The market for diesel fuel shows a similar change in the refining margin.

The unattributable gap between supply cost and price is not a result of scarcity pricing where prices rise until demand matches a fixed supply: The Vancouver fuel market appears to have been adequately supplied by the sources considered in this analysis. The main supply of crude oil and finished fuel to the Vancouver fuel market is the Trans Mountain pipeline, whose average nominal capacity is 300,000 barrels (bbl)/day when transporting 20% heavy oil.[8] However, when transporting less viscous liquids (e.g. light oil, gasoline and diesel), the capacity is higher, reaching 400,000 bbl/day with 0% heavy oil.[9] Based on the relationship between heavy oil throughput and capacity, one can calculate an adjusted capacity that reflects the quantity of heavy oil being shipped. This "adjusted capacity" shows that the pipeline could have transported more light oil and finished products (i.e. the throughput is less than the adjusted capacity in Figure 5). The unutilized capacity to ship fuels averaged 35,000 bbl/day in 2017, or 20% of provincial gasoline and diesel consumption (roughly 25% of the Vancouver market fuel consumption). While

[8] National Energy Board, Canada's Pipeline System 2016, Trans Mountain Pipeline

[9] National Energy Board, 2014, *Canadian Pipeline Transportation System: Energy Market Assessment*, p17

these data show that the pipeline could not carry any additional heavy oil, they do not support the hypothesis that the Trans Mountain pipeline has served as a constraint for supply of refined products to the Vancouver area. Similarly, fuel import and export data do not indicate a scarcity of supply. British Columbia has generally been a net-exporter of gasoline and diesel through the Port of Vancouver since 2015 (includes all marine trade in the Vancouver area). As well, net-trade volumes are very small relative to the pipeline capacity, ranging from 0.1 to 0.3% of the pipeline's capacity (Figure 6).[10]

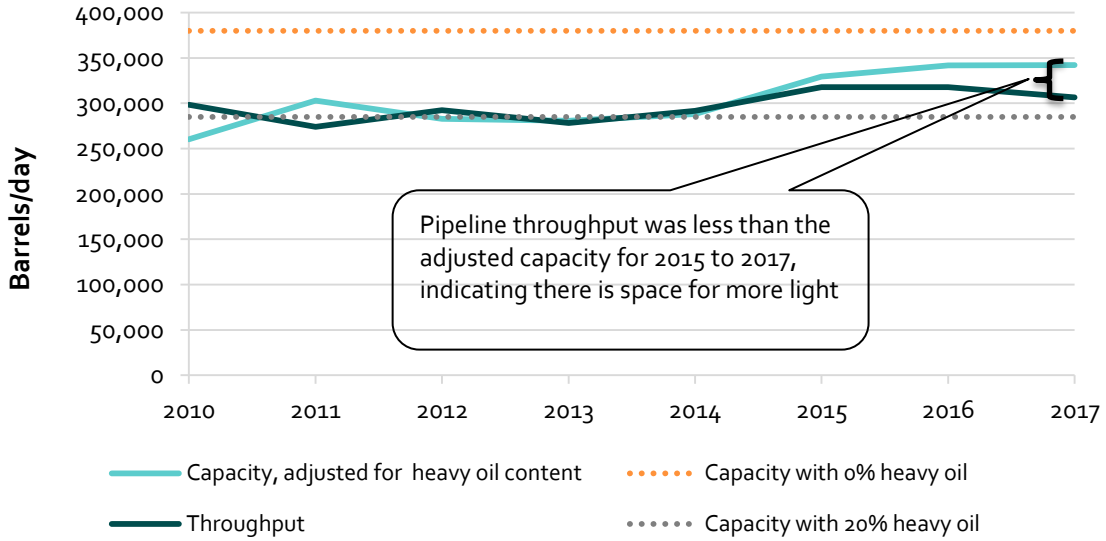
Since 2015, the high fuel prices that are decoupled from supply cost may be the result of a lack of competition in the Vancouver fuel market. Based on operating capacity, about 80% to 90% of fuel supply to this market is controlled by four firms, indicating a relatively strong oligopoly.[11] Within an oligopoly, the incumbent firms may tacitly cooperate ('unconscious parallelism'[12]) to generate profits. This cooperation does not necessarily imply collusion. Instead, in a market with only a few entities and a repeated process of price setting, a firm may observe that if it does not lower its price, other firms will likely not lower their prices. In this case, the market is not functioning competitively and the wholesale price of gasoline and diesel could be higher than the marginal supply cost for a prolonged period. Because of the cost and lead time required to build a new refinery, there are rarely new suppliers entering the refining market to disrupt this equilibrium.

[10] Vancouver Fraser Port Authority, 2018, *Port of Vancouver Statistics Overview 2017*

[11] Canadian Fuels Association, A graphic view: today's refining capacity across Canada

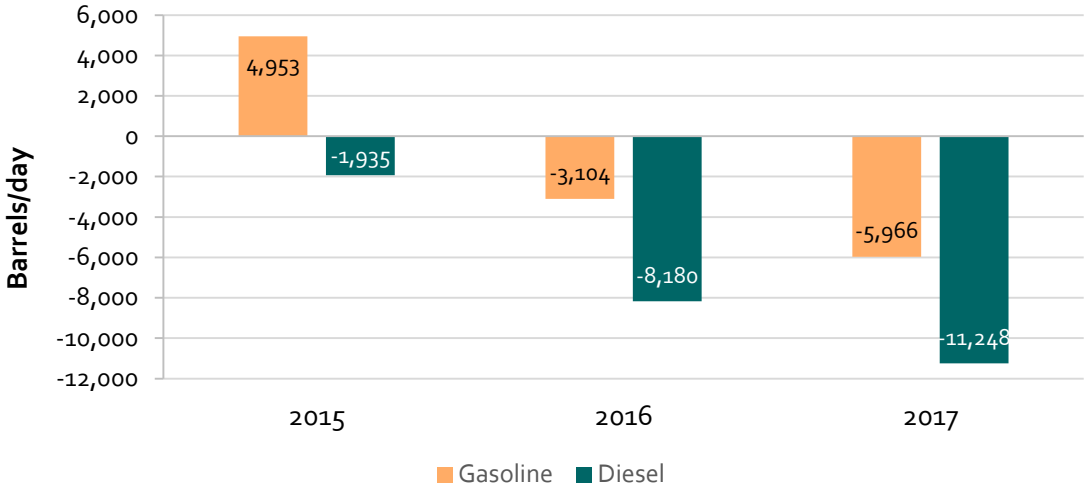
[12] OECD, Glossary of Statistical Terms

Figure 5: Trans Mountain pipeline capacity and throughput



The total pipeline throughput and the heavy crude oil throughput used to calculate the adjusted capacity are based on monthly data from the National Energy Board.[13] The pipeline capacity as a function of heavy crude oil shipments is also from the national energy board[14] and affidavits filed with National Energy Board.[15]

Figure 6: Net-trade of gasoline and diesel through the Port of Vancouver



Negative values indicate net-exports of the commodity. The Port of Vancouver includes all marine trade in the Vancouver area. Net-trade is the difference between inbound and outbound gasoline and diesel shipments, less any domestic cargo movements recorded in port statistics.[16]

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[13] National Energy Board, Government of Canada Open Data, Pipeline Throughput and Capacity Data

[14] National Energy Board, Canada's Pipeline System 2016, Trans Mountain Pipeline

And

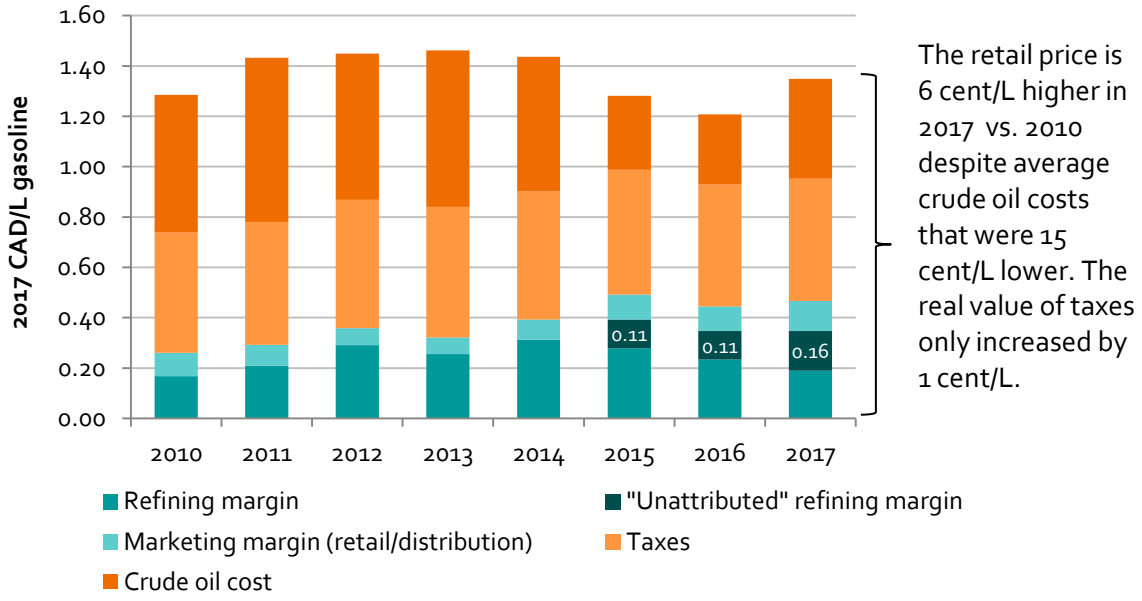
National Energy Board, 2014, *Canadian Pipeline Transportation System: Energy Market Assessment*, p17

[15] National Energy Board, REGDOCS

[16] Vancouver Fraser Port Authority, 2018, *Port of Vancouver Statistics Overview 2017*

High refining margins are responsible for higher than expected retail gasoline prices relative to 2010. Since 2010, fuel taxes and marketing margins (net revenues for retailers) have not varied substantially in absolute terms. Real fuel taxes were only 1 cent/L higher and real marketing margins were only 3 cent/L higher in 2017 compared to 2010. In contrast, crude oil costs fell by 15 cent/L, but this was offset by the average refining margin which grew by 19 cent/L between 2010 and 2017 (Figure 7). In 2015 and 2016, the portion of this margin that is not attributed to normal fuel market forces was 11 cent/L, rising to 16 cent/L in 2017. Consequently, the average retail gasoline price in 2017 was 6 cent/L higher despite a crude oil cost that was 27% (15 cent/L) lower than in 2010. Prices and refining margins can also include any cost impact of renewable fuels at the rack. However, these renewable fuels do not necessarily increase costs (Figure 8) and British Columbia has required renewable fuel blending since mid-2010.

Figure 7: Average annual retail gasoline prices in Vancouver by component



Data is from the Kent Group Ltd.

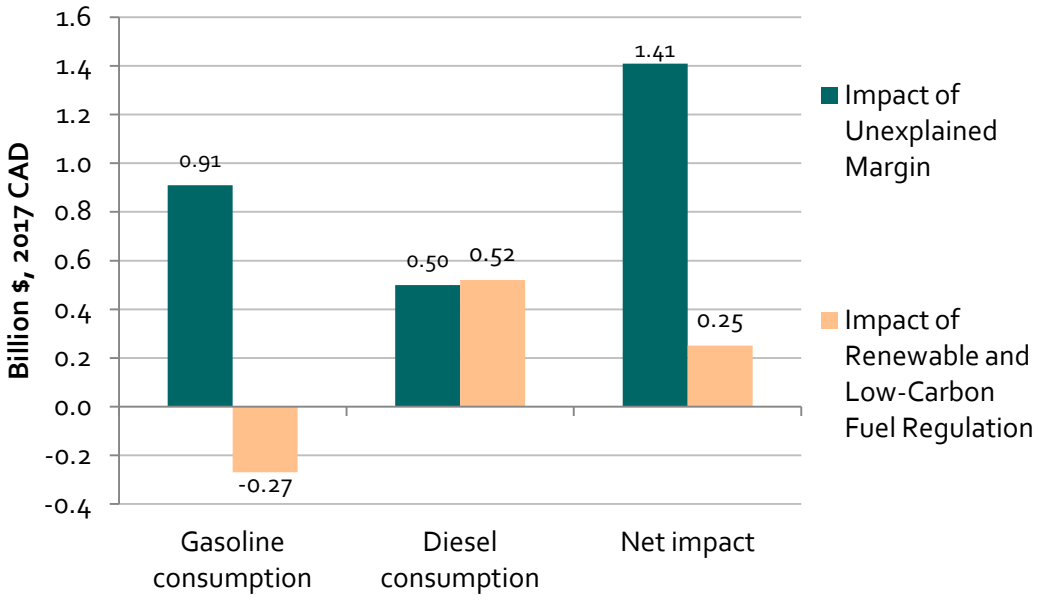
The cost of renewable and low-carbon fuel policy versus refining margins in the Vancouver area

A comparison of the cost of the high refining margins to the estimated cost of the Renewable and Low-Carbon Fuel Requirement (RLCFR) shows that **the cost resulting from the RLCFR is small when compared with the premium that consumers in the Vancouver area paid due to high refining margins.**

Because of the decoupling of wholesale fuel prices from supply cost, and the resulting high refining margin (the unattributable gap), consumers in the Vancouver area likely paid an average of 11 cents per liter more for fuel during 2015 and 2016 than they would have in a competitive market. This premium corresponds to additional costs of $1.4 billion for gasoline and diesel in the Vancouver area (78% of provincial population), or $1,070 per household. Between 2010 and 2016, within a competitive market the RLCFR could have saved gasoline consumers in the Vancouver area $270 million while costing diesel consumers $500 million (Figure 8) (assuming population is roughly proportional to fuel consumption). On net, the RLCFR had a cost of $250 million, more than five times lower than the cost of high refining margins.

Fuel consumption data for the RLCFR only runs to the end of 2016, so it is not possible to compare the policy and margin costs to the end of 2017. However, when including 2017, the cost of the unattributable refining margin grows to $2.4 billion, equivalent to an average 13 cent/L premium on fuel prices, or $1,730 per household from 2015 through 2017.

Figure 8: Refinery margin cost relative to the RLCFR cost, 2010 to 2016



Negative values imply a benefit. The impact of the refining margins is derived from the difference between the wholesale gasoline price and the estimated marginal supply cost shown in Figure 3, Figure 4, and Figure 2, multiplied by provincial gasoline and diesel fuel consumption from Statistics Canada CANSIM table 134-0004 and the proportion of the population living in the study area (approx 78%). A similar calculation is done for diesel. The RLCFR cost impacts are estimated using the method described in Wolinetz and Hein (2017), Biofuels in Canada 2017: Tracking biofuel consumption, feedstocks and avoided greenhouse gas emissions.

Potential policy solutions to the problem of high refining margins and fuel prices in the Vancouver Area

Policy solutions need to increase competition rather than increasing fossil fuel supply or reducing fuel supply costs. Most discussion on how to mitigate high refining margins and high fuel prices in British Columbia focuses on the issue of supply and supply cost. However, any solution that addresses crude oil supply, fuel supply or supply cost is unlikely to work because all data indicate that the market has been adequately supplied and that supply cost has not defined fuel prices for several years.

The Trans Mountain Pipeline Expansion (TMX) is unlikely to address high fuel costs. Some commentary in favour of TMX argues that more pipeline capacity will reduce fuel prices in British Columbia by allowing more crude oil to be shipped into BC and by freeing up room in the existing Trans Mountain pipeline for more finished fuels, although the expanded pipeline system is not expected to carry more fuel.[17] Others have argued that the pipeline would increase oil exports and increase the price of Canadian oil. This in turn would notionally reduce Canada's trade deficit, thereby increasing the value of the Canadian dollar and reducing the relative cost of crude oil, which is priced in US dollars to refiners. However, the accuracy of these arguments is not relevant since the pipeline will not increase competition. Instead, the pipeline addresses supply and supply cost in an adequately supplied market where prices have decoupled from supply costs. It is already possible to get more fuel into the Vancouver market and this analysis indicates that a reduction in supply cost would increase refining margins rather than reduce retail prices.

Expanding the pipeline and supporting a new refinery in the Vancouver area is also unlikely to work. Another argument put forward regarding TMX is that the additional oil could be refined in a new facility in the Vancouver area. Notwithstanding that this solution requires two projects to occur, it has merit but only if the new refinery increased competition in the market. This new refinery that would be supplied by TMX would need to be owned by an entity that is not already in the Vancouver area fuel market. However, it seems the pipeline expansion will not bring a new player into the market: several of the firms that have signed long-term contracts to ship oil on the pipeline expansion are already present and other confirmed shippers are primarily involved in bitumen extraction.

A further complication is that the finished product from this hypothetical refinery needs to reach the retail market in existing or new retail locations, but the incumbent refiners have

[17] Muse Stancil, 2016, Market Prospects and Benefits Analysis of the Trans Mountain Expansion Project for Trans Mountain ULC: "refined product shipments will not increase as a result of TMEP (Trans Mountain Expansion Project." Page 2 paragraph 2

substantial control over the retail market. The trend toward divestment of retail infrastructure by refiners in the past decade has removed direct refiner ownership of retail outlets but not refiner price control. Most of divested retail assets operate under long-term brand-affiliated supply agreements from the affiliated wholesale terminal (i.e. "rack"). For example, Parkland and Imperial Oil supply fuel to independent and branded retailers under exclusive multi-year (e.g. 10 year) contracts.[18] Minimum purchase volumes and pricing structure are established by the refiner under the terms of the agreement and there are only five firms that own refinery-operated wholesale gasoline racks in the Vancouver market where retailers can purchase products.[19] Consequently, all retail sites, including unbranded retailers, have limited capacity to sustain pricing strategies or differentiate themselves by selling alternative biofuel blends since all retailers purchase from only a handful of racks. Therefore, a new refinery would only increase competition if it also invested in new wholesaling and retailing infrastructure.

Regulating fuel markets or mandating transparency could increase competition. Jurisdictions where there are issues with a lack of competition in the fuels market use several mechanisms to address the problem. California[20] and the State of Washington[21] have standing commissions or offices that provide timely market data. Quebec and all Eastern Canadian provinces have some form of price control.[22] There is no precedent for gasoline and diesel price regulation in British Columbia, although a private member's bill (MLA Horgan) for retail petroleum consumer price protection was tabled in 2007[23] and recent political commentary addresses the possibility.[24]

Policies that reduce greenhouse gas emissions and support fuel switching, such as the Renewable and Low-Carbon Fuel Requirement (RLCFR), could increase competition in the fuels market by reducing demand for petroleum fuels while increasing the supply of alternative fuels. By reducing demand and increasing the supply of alternative fuels, consumers can become more responsive to gasoline and diesel prices and petroleum fuel suppliers may need to compete for the remaining market share. The RLCFR supports demand reduction (e.g. electrification of transport) and creates a market where domestic suppliers of alternative fuels may emerge. However, this solution is not a short-term fix

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[18] Competition Bureau of Canada, 2016, *Statement regarding Parkland's acquisition of Pioneer*.

and

Alimentation Couche-Tard Inc., 2016, *Agreement to Acquire Imperial Oil Retail Assets in Ontario and Quebec*.

[19] MJ Ervin & Associates, 2017, *Canada's Downstream Logistical Infrastructure: Refineries, Pipeline, Terminals, Bulk Plants and Cardlocks.*

[20] E.g. the Petroleum Market Advisory Committee in California

[21] E.g. the Washington State Quarterly Gasoline Report

[22] Consumers Council of Canada, *Price Regulation*

[23] Official Report of Debates of the Legislative Assembly, Monday, May 7, 2007.

[24] http://www.cbc.ca/news/canada/calgary/alberta-bc-gas-prices-1.4591044

because new fuel projects have multi-year lead times. As well, the RLCFR comes with a cost as it may require consumers to use fuels that can be higher cost. However, to-date that cost has been much smaller than the cost created by an uncompetitive market for conventional transportation fuels in British Columbia.

The RLCFR could also incentivize new and independent retail sales, further increasing competition in the market, though this too is challenged by the control of existing biofuel blending facilities with current wholesalers. Because the RLCFR provides a market for new alternative fuel supplies, it also creates a rationale for new retail infrastructure or a change in retail pricing strategies. For example, an independent retailer can supply low-carbon fuels to generate and sell RCLFR compliance credits to refiners. As such, the credits provide an additional source of revenue and an additional source of flexibility in retail pricing: The credit value could provide more return on investment in retail infrastructure and the retailer could take a greater or smaller cut of the credit value depending on how aggressively it needs to price its product.

The US market provides an example of how high-throughput retailers and cardlock operators can use compliance credit value from the US Renewable Fuel Standard to sell high biofuel blends (e.g. E85, 85% ethanol, and B20, 20% biodiesel) for less than fossil fuels. For example, as of May 2018, the average E85 price by volume in the US was 22.4% less than regular gasoline (containing 10% ethanol).[25] British Columbia currently has no retailers selling higher blend biofuels, but compliance credit prices are notionally high enough to incentivize this action. The average credit price in 2017 was $164/tonne GHG avoided.[26] At that price, selling E85 with a typical carbon intensity of 40 gCO_2e/L[27] generates a credit value of 16 cent/L of blended fuel. Selling B20 with a typical carbon intensity of 15 gCO_2e/L[28] generates a credit value of 10 cent/L.

Notwithstanding this potential, refiners currently operate the biofuel blending infrastructure in the Vancouver fuel market and control the biofuel blends available to retailers from the racks. Therefore, if RLCFR credit value is to incentivize new retailers to enter the market with higher biofuel blends, that value must be sufficient to also incentivize investment in new blending infrastructure.

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[25] https://e85prices.com/, accessed May 23, 2018s

[26] Ministry of Energy, Mines, and Petroleum Resources, 2018, *Low Carbon Fuel Credit Market Report*, Government of British Columbia. link

[27] Ministry of Energy, Mines, and Petroleum Resources, 2017, *Renewable and Low Carbon Fuel Requirements Regulation Summary for 2010 to 2016*, Government of British Columbia. link

[28] Ibid.

Adjustments to the BC carbon tax and transportation fuel excise taxes could provide even more revenue for new retailers of low-carbon fuels and more flexibility in their retail pricing. In British Columbia, all liquid transportation fuels are subject to carbon pricing. However, the carbon tax is applied equally across all fuels regardless of their carbon intensity. Ethanol, biodiesel and renewable diesel are subject to the same carbon tax as gasoline and diesel even though their combustion emits considerably lower GHG emissions. The carbon tax could be adjusted to mirror Alberta's carbon levy where biofuels are exempt from the levy at blend levels above 10% and 5% in the gasoline and diesel pools respectively. At the projected carbon price of $50/tonne in 2022, the retail price of higher blend biofuels could be reduced by 9 cent/L for E85 and 2 cent/L for B20.

Changes to excise taxes would have a similar impact on ethanol blends. Excise taxes (e.g. the BC motor fuel tax) are charged by volume. Ethanol has roughly 30% less energy by volume than gasoline, resulting in higher taxation per distance travelled when using a gasoline and ethanol blend. If the current federal and provincial gasoline excise taxes of 35. 5 cent/L (in the Vancouver area) were assessed on an energetic basis, it would reduce the retail price of a E85 by almost 11 cent/L. Renewable diesel fuels have 6-8% less energy than diesel volume, so a change to energy-based taxation would have a limited impact on the retail price of diesel blends.

In total, RLCFR credits and changes in taxation could provide new retailers of E85 with an additional 36 cent/L that could be used to provide a competitive discount on their fuels or provide a greater return on investments in retail and biofuel blending infrastructure. Similarly, retailers of B20 would have an additional 12 cent/L to work with.

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