

Explaining the games gasoline retailers play

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(Phys.org) —When it's time to top up the tank, how much thought do you give to where you will buy gas? Maybe you drive around town, looking for the best deal. Chances are, you usually visit the same station in your neighbourhood, giving little thought to the price of gas.

A Western graduate student, however, has given [gas](#) pricing a lot of thought. And what he's found is an interesting, however little studied, economic conundrum.

Using a large data set of gas retailers in North America, Daero Kim, a PhD candidate in Applied Math, is working with Matt Davison, chair of Statistical & Actuarial Sciences and Kim's advisor, and Ivey Business School professor Fredrik Odegaard to help retailers determine a more lucrative strategy when it comes to gas prices.

Together, the three have come up with a mathematical model to determine what gas stations should charge to maintain demand, make a profit – all the while making it a seamless process for the customer.

Using big data and game theory, Kim, Davison and Odegaard have published a paper of their findings, Do Retailers Set Optimal Prices in the Case of Retail Gasoline Market?, in the journal Intelligent Data Analysis.

Here's how it works.

Customers are rarely aware of the price of crude oil, which ultimately

determines the price of gas at the pumps. (FYI. Crude oil closed at \$106.91 a barrel last week. The average gas price across Ontario was \$1.38 per litre.)

So, when the cost of crude is high, the cost of gas is high, with a small [profit margin](#) for retailers, Kim explained. If the price of crude falls drastically from one day to the next, customers aren't immediately aware and retailers can keep the price of gas high, even though the price of crude is low, making for a larger profit margin.

It's here retailers can play a game.

With some easily obtained data, retailers can play with the price they charge, competing with other retailers, making it seem like they are offering a deal, when in fact they are optimizing their revenue, Kim continued.

"When the (gas) price falls, because of crude oil price change, consumers compare the price to yesterday's price, and the day before. Their expected price is higher but crude is lower, so they don't need to price search harder. So retailers don't have to compete as hard as before for sales," he said.

"If [crude oil](#) price goes up sharply, the margin gets tight," added Davison, Canada Research Chair in Quantitative Finance. "But if it falls, people take a while to realize that it fell, and they don't see their price rising, so they are happy. But the retailers are making way more money, even though people aren't paying more. Eventually, people will catch on but it takes a while."

When the price of crude falls, the profit margin is large for retailers who do not immediately drop the price of gas, Kim explained. The key, for the retailer, is to shrink the cushion – that margin gap – just enough to

make yourself look like the more economic choice for the consumer, but not so much that you lose out on profit, he continued.

"It's a dynamic competition between competitors. We offer ultimate pricing using game theory models – showing how retailers can optimally price so they can increase profit," Kim said.

Davison added, "There are two ways you can make a lot of money as a retailer. You can sell not many items, but at huge markup, or you can sell an awful lot of items, at a small markup. When people and retailers compete with one another, if it's always the same product – and gas is gas – there's a lot of pressure to undercut prices and sell more gas at less of a margin. That said, there are people who basically always shop nearby because it's convenient. You might stop doing that if it's 25 cents more. If it's 2 cents more, you may not even notice."

Charging 2 cents more or less on gas, when considering thousands of litres per day, eventually adds up to a large sum for the retailers, Davison noted.

With this work, Kim and his colleagues are building a strategy for [retailers](#) to set [gas prices](#) that will optimize their competition and boost profit margins, encouraging them to keep in mind the fluctuating price of crude, in addition to wholesale [prices](#) and competitor pricing.

"Prices rise like a rocket and fall like a feather," Davison said, noting this game is one where the three players – the price of crude, the retailer and the consumer – all continuously play off one another.

Provided by University of Western Ontario

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