

**Experimental statistics: Fuel from pump**

This data is partially the result of modelling.

**Assumptions and foundations of the model**

- 1) The assumption is that collection of road and carbon tax from the sales of fuel for road transport (known fee per liter of fuel) gives the correct value of total fuel consumed by vehicles traveling on Icelandic roads. The volume of gasoline calculated from the tax data differs by 1% from the volume delivery reported by the National Energy Authority. The difference in the volume of diesel fuel was close to 15%. These differences are considered to be due to:
  - a. Inaccuracies in the density of the fuel. Here, it is assumed that:
    - i. The density of gasoline is 0.7489 tons /m<sup>3</sup>. Accepted values range from 0.698 to 0.780 tons/m<sup>3</sup>.
    - ii. The density of diesel oil is 0.8508 tons/m<sup>3</sup>. Accepted values range from 0.830 to 0.875 tons /m<sup>3</sup>.
  - Due to the definition for the term “from pump” in the National Energy Authority data, the fuel could include tax exempt (coloured) fuel oil or fuels that are yet sold.
- 2) Gas stations sell fuel at one price per type of fuel, one for gasoline and one for diesel oil.
  - a. If the fuel price for the fuel station was missing, the median value for all gas stations in the same region owned by that distributor during a given month is used.
  - b. If the fuel station is known but the price for the day is missing, the median price for the month is used.
  - c. For older data, the fuel price was calculated using the average fuel price for a given month from the Statistics Iceland price index database. The average price was shifted up or down using the average difference in fuel prices and average prices at the gas station when both are known.
- 3) Payment card transaction volume at fuel stations is primarily due to the sales of fuel. Analysis of transactions at five location over four months where it was known that snacks, candy, books, oil and other maintenance items were sold in addition to fuel showed that the fraction of fuel sales amounted to 88-98% of the total sales. Analysis of a single gas station

where it was known that groceries were also sold showed that fuel sales were approximately 85% of the total annual sales. This led to the following assumptions:

- a. If the fuel station has mixed operations (not exclusively gasoline) and no restaurant is registered at the same address, the total payment card transactions were assumed to be 95% due to sales of fuel.
  - b. If the fuel station has mixed operations (not exclusively gasoline) and a restaurant is registered at the same address, the total payment card transactions were assumed to be 98% due to sales of fuel. In this case, food sales are automatically reported to a different business.
  - c. If the fuel station only features fuel pumps, the total payment card transactions were assumed to be 100% due to sales of fuel. Approximately 70% of all fuel stations in the country are in this category.
- 4) There is a higher fraction of diesel fuel sold in the category “utan kortaveltu”.
- a. If a company invests in on site pumps, it is more likely due to operation of vehicles that use diesel fuel.
  - b. Here, the assumption was that the sale of gasoline in the “utan kortaveltu” is a maximum of 10% of the total volume over a two year period. This is done by changing the fraction of gasoline that is bought by payment cards. As an example, gasoline sales in 2019 were 39.6% of the total volume of fuel distribution, but the fraction of gasoline is close to 43% of the total volume of fuel sold through payment card transactions for the same year.

#### **Known or expected errors in the model**

Some gas stations offer club discounts. By assuming a fixed and higher fuel price, we are underestimating the total volume of fuel delivered in the “kortavelta” sector and overestimating the volume in the “utan kortaveltu” sector. This error is estimated to be within 3% of the total sales; the discount is up to 5% of fuel price when applied, and less than half of the buyers are likely to use this discount.

It is known that the importance of services other than fuels varies greatly among fuel stations that offer other services than exclusively fuels. The variation can be

## Metadata

at least 20%. Care should, however, be taken when analysing this, since transaction volume is often misclassified with profit of sales. High purchasing price and considerable taxation of fuels means that the profit margin of fuels is relatively low compared to other products and services. This means that figures showing profit of sales can inflate the importance of other sales, while total cash-flow is still primarily due to fuel sales.

It is assumed that sales outside of payment card transactions (“utan kortaveltu”) follow the same yearly pattern as is seen in payment card transactions. This assumption may not be correct and an alternative method is under development. In this method a part of the portion of fuel is distributed based on VAT reporting among business sectors where vehicle operations are a key component. These sectors include road cargo transportation, bus and tour operators, municipal busses and companies in the mining and construction sectors. The impact of these sectors is in turn scaled by the number of vehicles registered within each sector. Here, the assumption is that VAT reporting and number of vehicles are an indirect measure of how much the vehicles in the sector are used. This method, however, shows a quite similar “more during the summer” trend than the payment card transactions.

Less is known about the daily fuel price when considering older data from 2015-2018. For these years, the average fuel price from the price index database for a given month was used to create a price estimate. Then, the difference between the actual fuel price at the gas station (or stations in the same region) and the average was calculated for years and months where both were known. The fuel price and the shift from the average show a slight seasonal variation. The median value for the shift for a given month calculated from a shifting window of three months for 2019 onwards was chosen as the shift from average price for the given year.

The maximum shift from the average was 30 ISK per liter, but the general shift was +/- 5 ISK/l. This method means that any short-term price changes that took place between 2015 and 2018 were not detected. Therefore, the total volume calculated during short-term changes such as price wars returns lower fuel sales than actually occurred.

In some instances, the majority of payment card transactions were reported as coming from the fuel company’s headquarters. This means that nothing is known about whether the transactions are due to roadside assistance, repairs, food sales

or fuel sales. In these cases, an attempt was made to use known locations of fuel stations and sales patterns of other fuel stations in the vicinity to distribute the sales figures from headquarters to the actual fuel stations to estimate the fraction of fuel sales and assign a fuel price to the fuel sales. Analysis of the sales for 2016 to 2019 showed that this distribution led to 8% less volume of fuel sold as compared to using the median value of the fuel price with no distribution.