BIBLIOGRAPHY

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Internal Group 1 4PM Tuesday

A. Data Dictionary

1. Month

- Definition: The period time during which the aggregated value of petrol import/export is recorded, starting from the 1st of the month to the last day of that month
- Scope: Jun 2021 < Month < Jul 2022 (after June 2021 and before July 2022)
- Format: MMM-YYYY
- Source: Australian Petroleum Statistics, Commonwealth of Australia 2022
- Relationships and contexts: A dimension to benchmark among the value of fuel variables for the same time frame. Data is accumulative within the month, thus may cover different number of days (28,30 or 31 days)

2. Product type

- Definition: The type of oil imported/exported which may differ from each other in the origins and purposes of use.
- Scope: 3 types including Automotive gasoline, Crude oil & other refinery feedstocks or LPG
- Format: Indicated by a string, with LPG is an abbreviation of Liquefied petroleum gas
- Source: Australian Bureau of Statistics and Kpler
- Relationships and contexts: Each type has different methods of exploitation to produce corresponding fuel for commercial use. High volume import of one type can have some relations with low volume of others.

3. Import Volume

- Definition: The total accumulative amount of fuel imported into Australia from different countries for a period of time.
- Scope: Greater than 0
- Format: One digit decimal, measured in megalitres (ML)
- Source: Australian Bureau of Statistics and Kpler
- Relationships and contexts: A component to measure the net imports of fuel as an indirect factor of fuel price change. Import volume and import value have positive correlation

4. Import Value

- Definition: The import turnover of different types of oil into Australia from different countries for a period of time.
- Scope: Greater than 0
- Format: One digit decimal, measured in millions of Australian dollars (A$m)
- Source: Australian Bureau of Statistics and Kpler
- Relationships and contexts: A component to measure the national trade of balance, corresponding with the net imports to provide insights.

5. Export Volume

- Definition: The total accumulative amount of fuel exported from Australia to different countries for a period of time.
- Scope: Greater than 0
- Format: One digit decimal, measured in megalitres (ML)
- Source: Australian Bureau of Statistics and Kpler
- Relationships and contexts: A component to measure the net exports of fuel as an indirect factor of fuel price change. Export volume and export value have positive correlation

6. Export Value

- Definition: The export turnover of different types of oil into Australia from different countries for a period of time.
- Scope: Greater than 0
- Format: One digit decimal, measured in millions of Australian dollars (A$m)
- Source: Australian Bureau of Statistics and Kpler
- Relationships and contexts: A component to measure the national trade of balance, corresponding with the net exports to provide insights.

7. Net Import-Export Value

- Definition: The trade of balance of fuel measured by the total import value minus the total export value, an indirect factor influencing retail fuel price change
- Scope: Range between import and export value of the same period
- Format: One digit decimal, possibly negative and measured in millons of Australia dollards (A$m)
- Source: Australian Bureau of Statistics and Kpler

- Relationships and contexts: Depending on product type, the value could be negative or positive, reflecting the position of net imports or net exports of the country

8. Price

- Definition: The price at which the fuel is sold to retail customers, reflecting the value at the point of record.
- Scope: Greater than 0
- Format: One digit decimal, measured in Australian dollars
- Source: Australian Bureau of Statistics and Kpler
- Relationships and contexts: Key data to identify any change in the price of each type of fuel at different time periods.

B. Data quality assessment

- Data source: The data set is reported in the Australian Petroleum Statistics (APS) by the Department of Climate Change, Energy, the Environment and Water and licensed by the Common Wealth of Australia. Original data is collected by the Australian Bureau of Statistics and Kpler, all of which are well-known and reliable institutes for data reports and analysis

- Data selection: The data have been extracted via 2 main layers

+ 1st data layer is extracted from a variety of sources and clearly indicated in the report, including companies, institutes for the purpose of providing the audience some overview of sales of petroleum products, exports and imports of petroleum products and crude oil, production of crude oil and condensate, refinery input and output, and stocks of petroleum products. The dataset also reconciles a small proportion of estimation due to confidentiality without indicating the exact amount.

+ 2nd data layer is extracted from the report, which isolates the information on export and fuel price to explore the pattern of the fuel price and trade of balance thus evaluating the relationship between them.

- Reputation of collectors: The collectors also the authors come from a variety or reliable institutes, including the National Offshore Petroleum Titles Administrator (NOPTA) and WA Department of Mines, Industry Regulation and Safety (DMIRS), Kpler, International Energy Agency, Australian Institute of Petroleum, ORIMA Research, MotorMouth and Informed Sources and other companies in the industry.

- **Data quality on variable level:**

+ Completeness: The dataset includes basic variables within a moderate time frame to observe the pattern. However, the variable “price” is recorded on a quarterly basis, which may not be sufficient to evaluate the fluctuation in a shorter period, such as monthly.

+ Uniqueness: The dataset does not fulfill this criterion as data is not unique at the point of recording. For example, according to the Australian Petroleum Statistics Report of June 2022, the export value of LPG in June is different from the same result in the Report of July 2022.

+ Timeliness: The dataset meets the criteria by reflecting the collection results within a month since the event

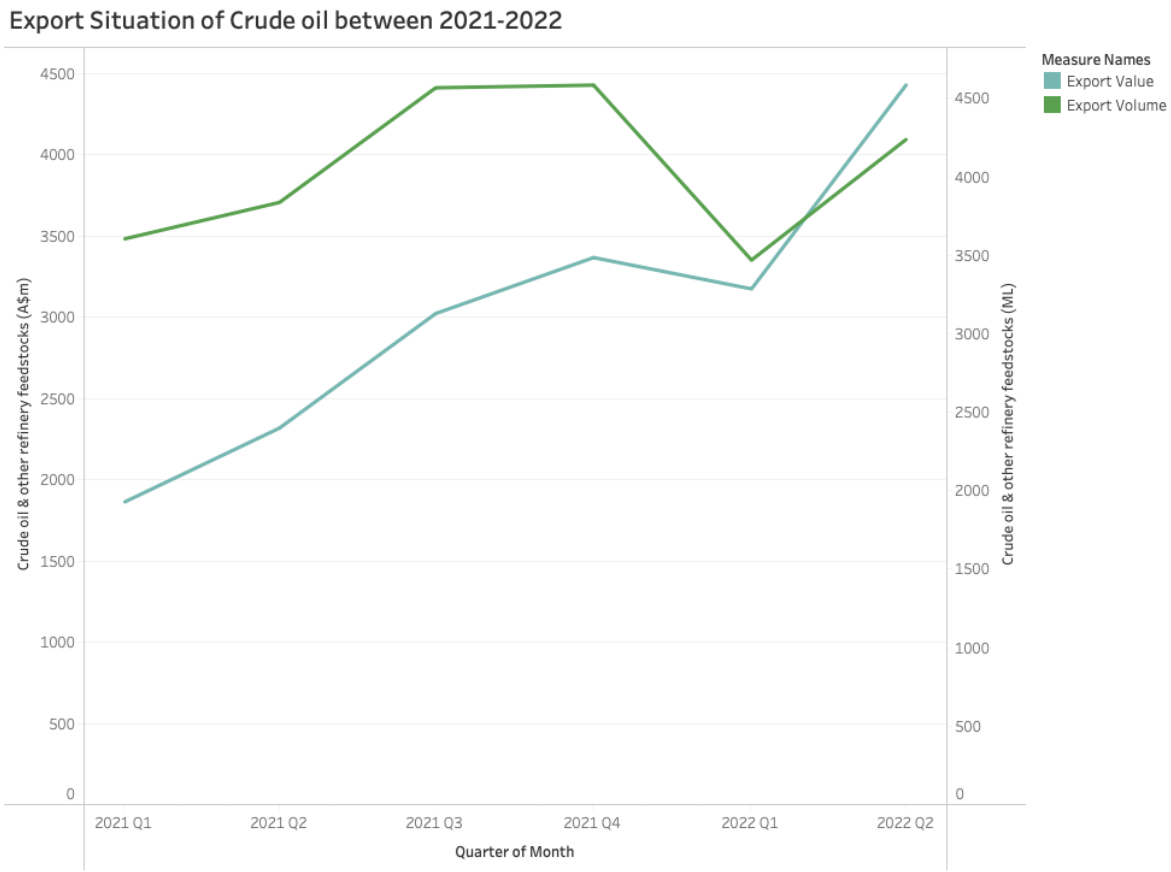
+ Validity: The dataset conforms to the syntax of its definition. However, there are some disparities in the format of date between the recording time of “price” and “export value” and other variables, which needs some moderation to obtain 100% data validity.

+ Accuracy: The dataset reconciles a small proportion of estimation, especially the import value of natural gas due to confidentiality since December 2013, corresponding to ≈ 6% values

+ Consistency: The dataset shows considerable consistency with similar datasets of fuel price in terms of measurement, format, and record methodology. However, the value frequency between “price” and other values bears some differences, which requires some minor adjustments before analysis.

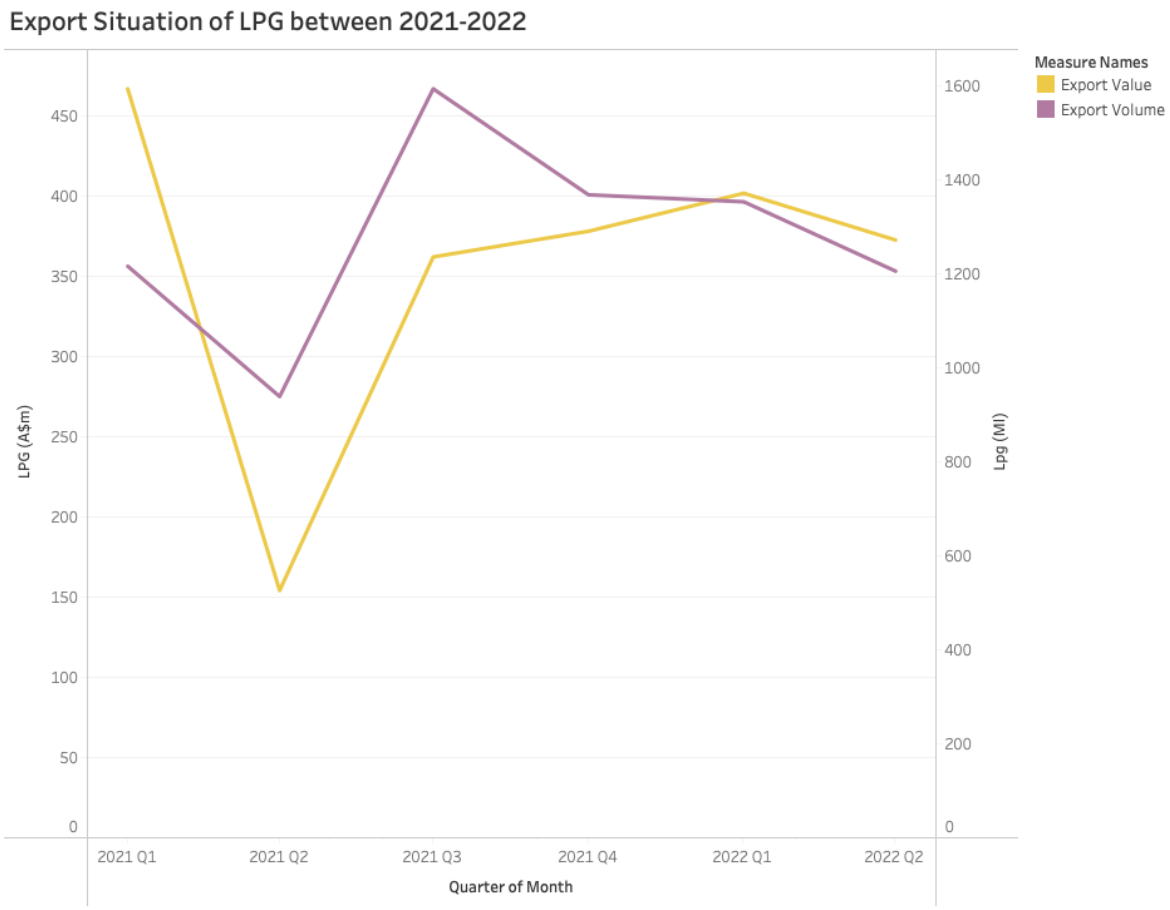
=> Overall, this dataset meets the standard criteria of quality to support further analysis for business needs of predicting the factors influencing fuel price change. However, it should be aware of some limitations in the data quality, especially in terms of accuracy, completeness and uniqueness.

C. Visualisation



As one of the two product types exported by Australia, both export volume and value of crude oil experienced an upward trend over the observation period with a comparable growth rate.

In the period of Quarter 1 2022, the export volume dropped significantly compared to the export value, signifying an increase in the oil price which offsets the drop in volume.

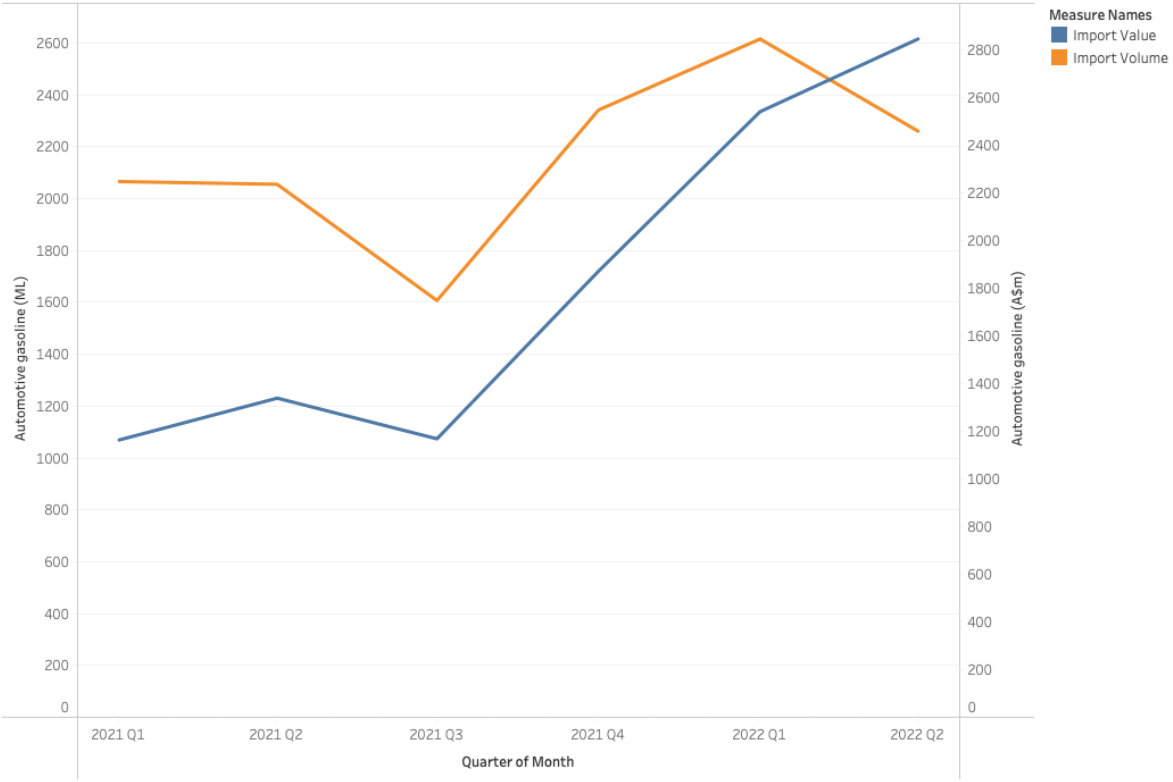


The trends of Export Value and Export Volume for Month Quarter. Color shows details about Export Value and Export Volume . The data is filtered on Month Year, which keeps 2021 and 2022.

In contrast to the pattern of Crude oil Export, the export situation of LPG experienced a lower level both in volume and absolute value.

A downward trend can be seen in both metrics, with irregular spots in the half end of the year 2021, where the export volume decreases substantially while the export value slightly increases. This outlier may infer a change in product type exported rather than a sharp increase in the price. Besides, an error may occur in this dataset.

Import Situation of Automotive gasoline between 2021-2022

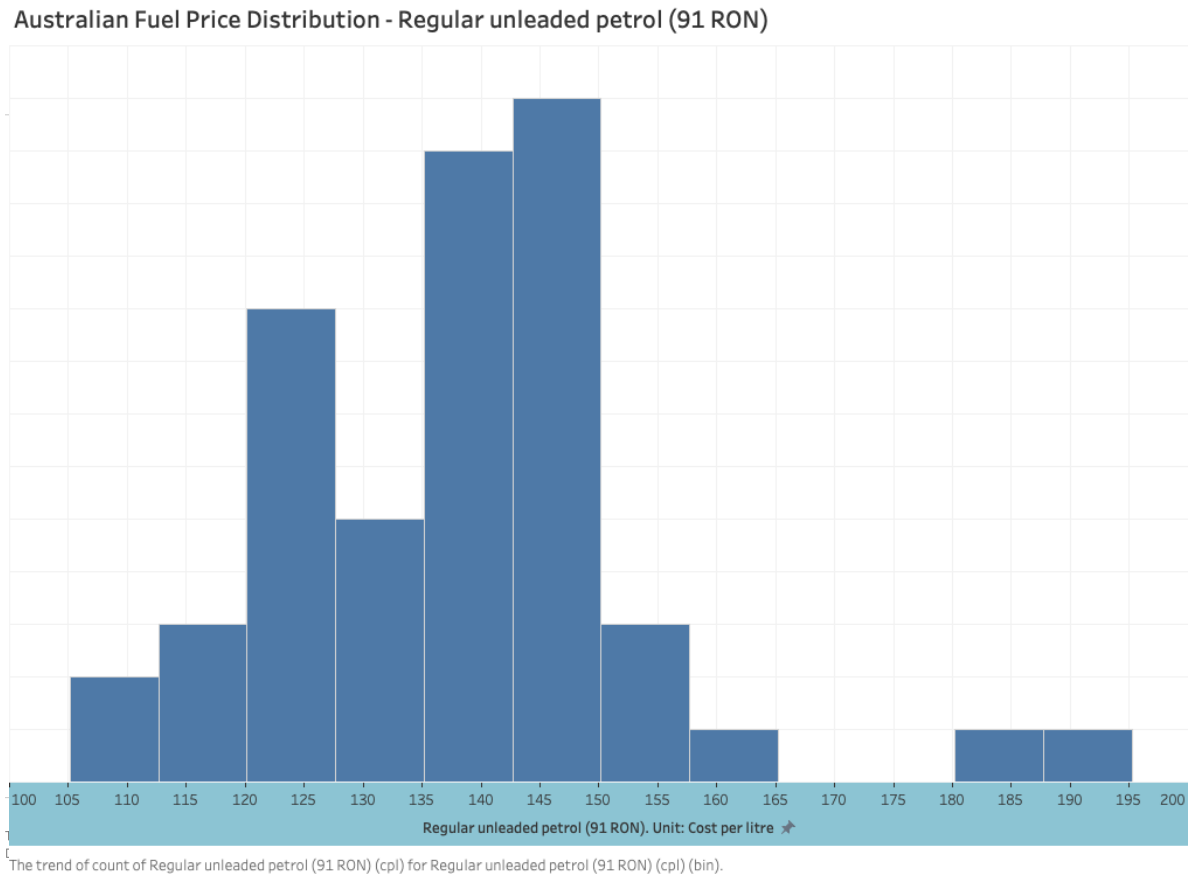


The trends of Import Volume and Import Value for Month Quarter. Color shows details about Import Volume and Import Value. The data is filtered on Month Year, which keeps 2021 and 2022.

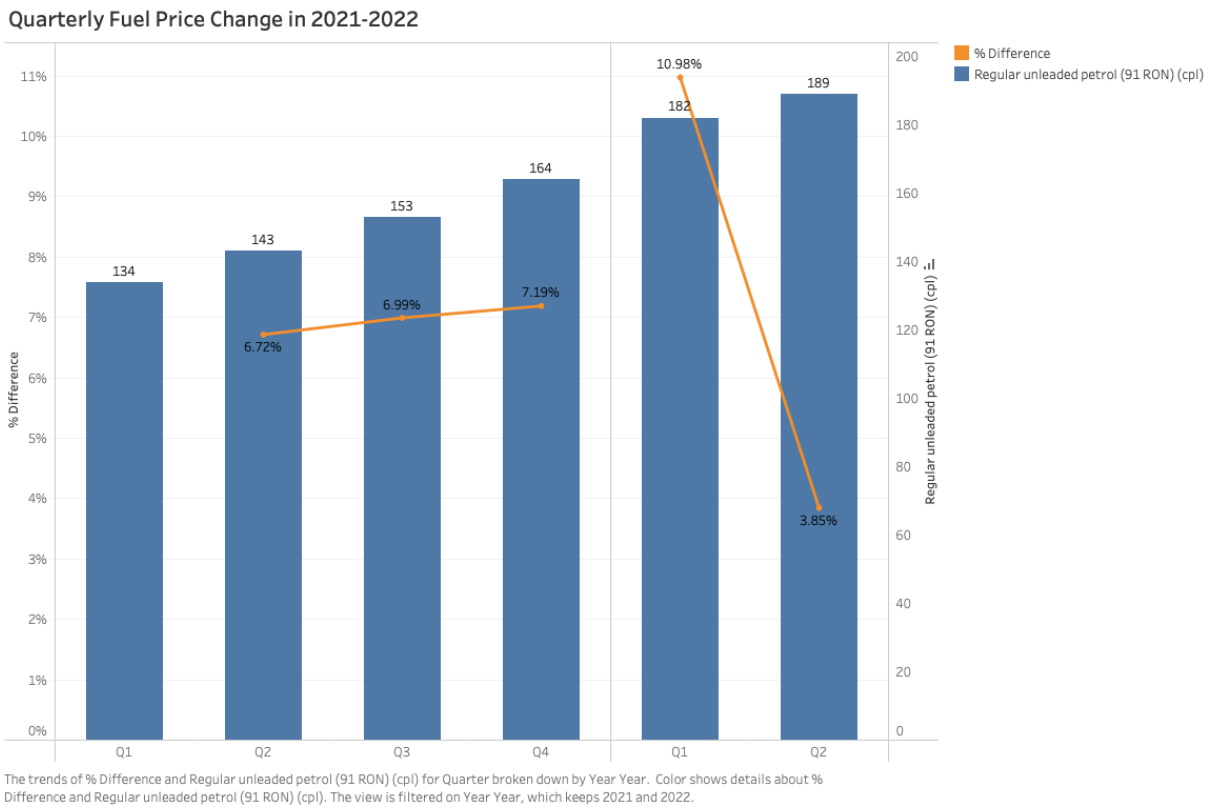
Automotive gasoline is among the main product type imported into Australia which i supposed to have an indirect impact on retail fuel price.

Overall, both export value and volume have seen an upward trend since the end of 2021, despite a considerable drop in mid-2021 possibly due to the Covid-19.

A peculiar pattern in 2nd Quarter 2022 with a growth in import value but decrease in volume, which may need further deep dive and compare with fuel price change in the same period to identify the trend.



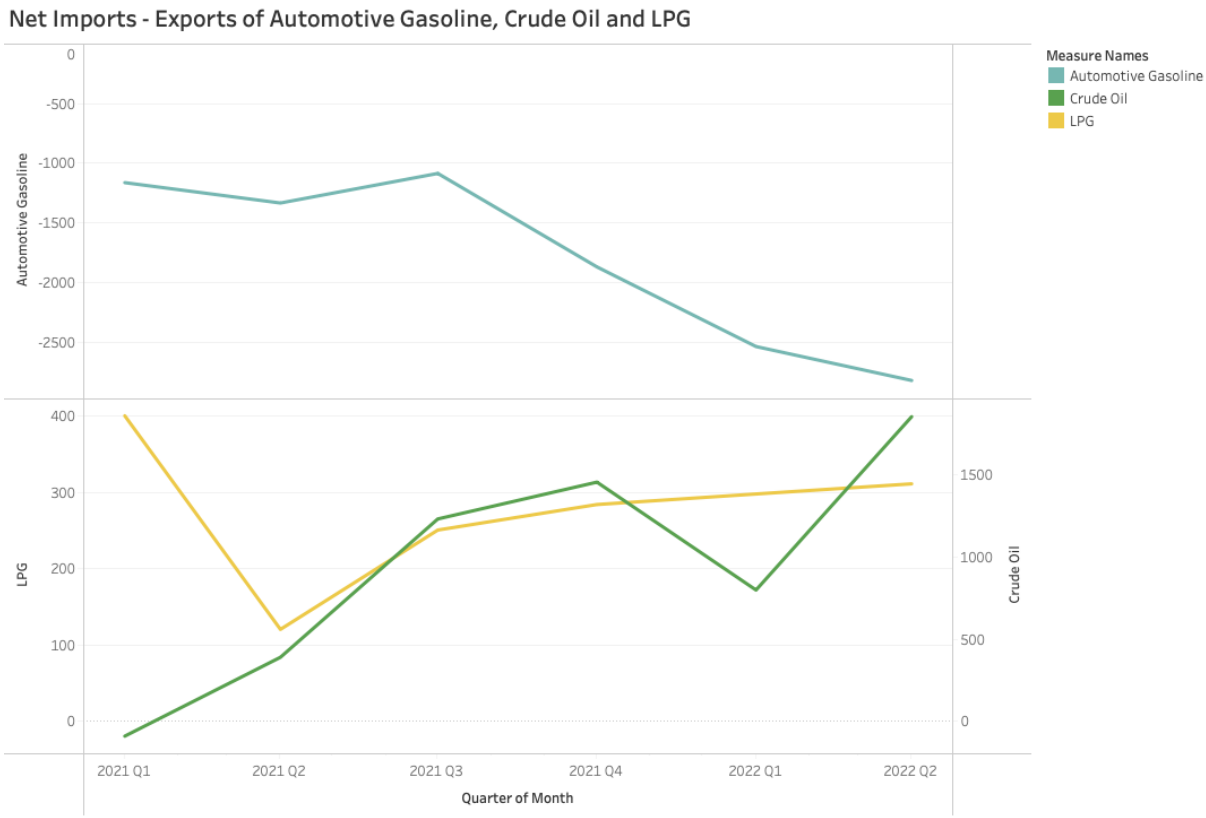
Generally, the distribution of fuel price mainly fall in the range 135-150 cents per litre. In comparison with the graph of **Quarterly Fuel Price Change** aforementioned, this is the main distribution before a significant increase by the end of 2021. Further exploration on other factors such as margins and demand-supply is fundamental to find out the pattern for forecasting.



The increasing trend of fuel prices from the graph matches with the realistic situation in the context of many social, political and environmental events since 2021.

However, there is a noticeable feature in the pattern is the significant increase in fuel price from Quarter 4 2021 to Quarter 1 2022 with nearly 11% compared to previous time periods at 6-7%. This needs to be placed in relative to the trade of balance in the same period to identify any correlation between the two.

D. Preliminary data analysis

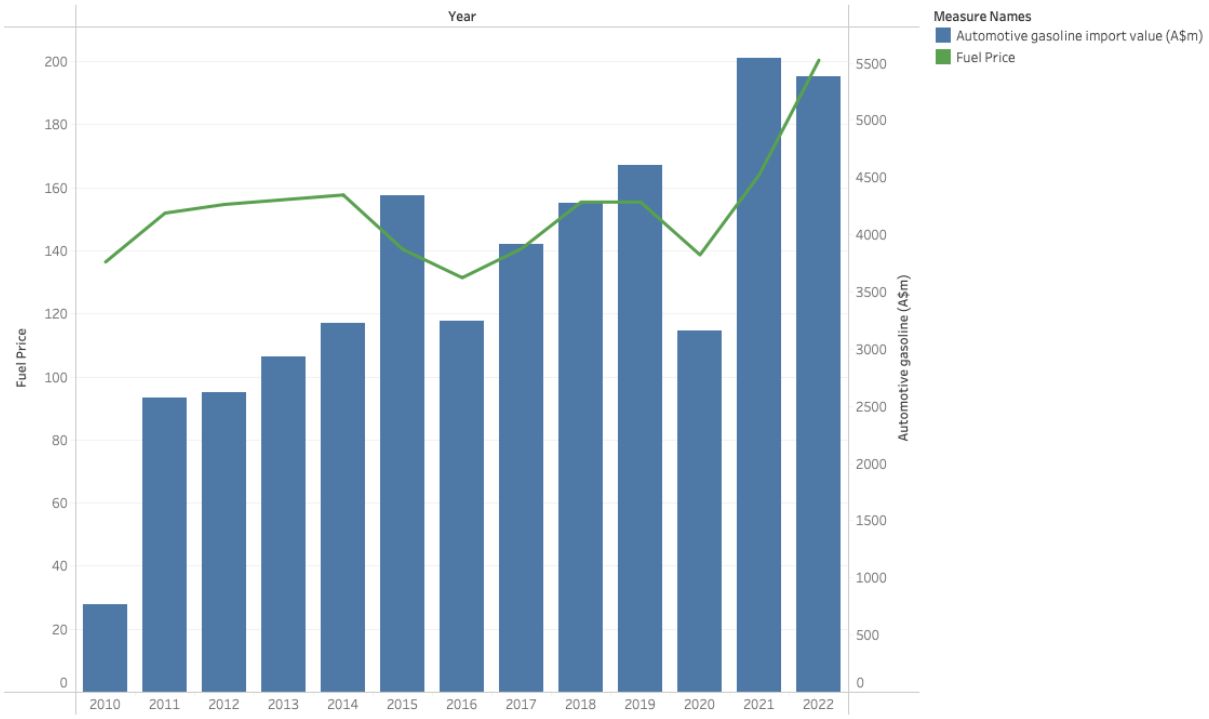


A reverse pattern can be seen in the net import-export situation between Automotive Gasoline and other two product types (LPG and Crude Oil).

As a net-import country of Automotive Gasoline, the import turnover of Australia has increased gradually over the period, also reflected in the graph of **Import Situation of Automotive Gasoline** aforementioned. This reinforces the statement of international fuel price as the most critical factor influencing retail fuel price, which is expected to include the data model in the later stages.

However, an outlier in the net-export pattern of LPG and Crude oil in the 1st Quarter of 2021 which needs further exploration and cleaning data.

Comparison between Fuel Price and Automotive Gasoline Import Value between 2010-2022



The trends of Fuel Price and Automotive gasoline import value (A$m) for Year. Color shows details about Fuel Price and Automotive gasoline import value (A$m).

Overall, the graph shows a corresponding upward trend between the Fuel Price and the import value of Automotive gasoline with an exception in 2014-1015. At this time, the value of imports increased sharply while the pattern for the price was downward.

Therefore, there should more insights into this time period to identify any errors. Later, it may be possible to build a correlation model between these two variables based on the pattern in the remaining period.