Data Visualisation Assignment A3

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Contribution

Team Members	Tasks
Ga-Eun	
James Smith	4, 5, 6
Tegh Bir Singh	1, 2, 3
Yiqian Yang	7, 8

Tasks

To complete the assessment task you will need to:

1. Merge import and export data into one sheet in Excel.
2. In Excel, create two patterns, one for statistical analysis and the other for analytical analysis, for all categories and sub-categories.
3. Import the two patterns into Tableau, and create time series charts for comparing import and export for all main categories of the dataset.
4. In Tableau, create interactive charts exploring details of trade for all main categories. Find any trend and change point in interactive charts, and in the report explain what you have found and how that has happened.
5. In Tableau, create a visual dashboard that combines the time series chart and interactive chart together for ONE main category and its sub-categories.
6. Create a visual storyboard for ONE main category (which can be the same as the category used in Task 5) to illustrate the relationship between the trends and change points.
7. In the report, write a summary of the advantages of dashboard and story board that have been found through this trade data visualisation process.
8. In the report, describe the results of visual analytics for the selected categories.
9. At the end of the report, include a section that lists every group member's contribution to this assignment.

Contents

Background Information

This report will go over the analysis of the "Australian Internation Trade data set" from the ABS (Australian Bureau of Statistics). The analysis will look at the various categories and subcategories to find relationships.

Executive Summary

In examining the data, we have come to see the make-up of Australia imports and exports. In particular we will examine category 1 ("Beverages and Tobacco") and category 3 ("Mineral fuels, lubricants and related materials") and category 2 (Crude materials, inedible, except fuels).

We will explain how government policy has affected imports and exports. Such as why as there has been a significant increase in importation of tobacco in recent years. We will also go over how the mining and textile industry have changed over time.

We will then discuss the positives and negatives of data visualisation techniques used such as dashboard or story board.

Data Preparation

The data set was manipulated to make five sheets in the file "Data v4.xlsx".

The five sheets are:

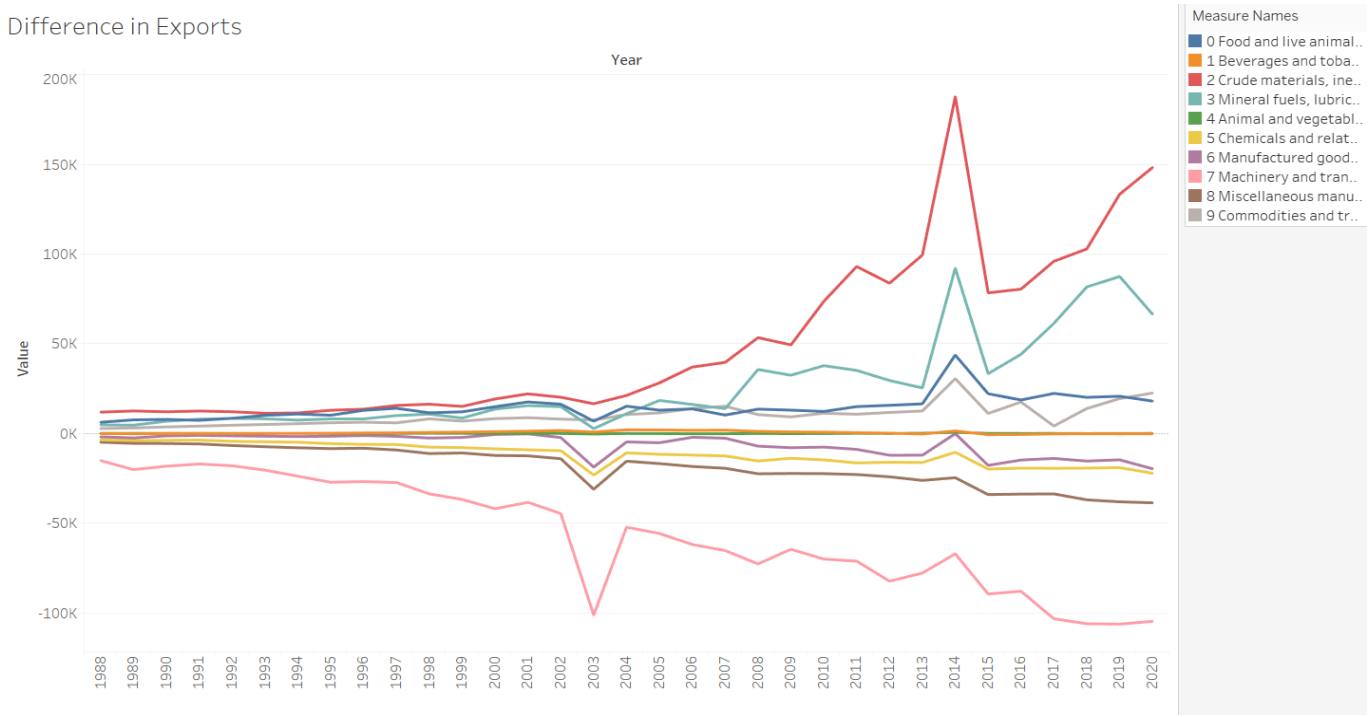
1. Original Data
2. Difference [Analytical Pattern]
3. Ratio [Analytical Pattern] (has Null entries)
4. sub pct (percentage of sub-categories) [Statistical Pattern]
5. gross pct (percentage among main groups) [Statistical Pattern]

The data preparation steps are shown in file "A3 R1.ipynb".

Data Analytics

Import vs Export by category

The following graph shows the difference between the exports and imports. A positive value means there are more exports than imports.



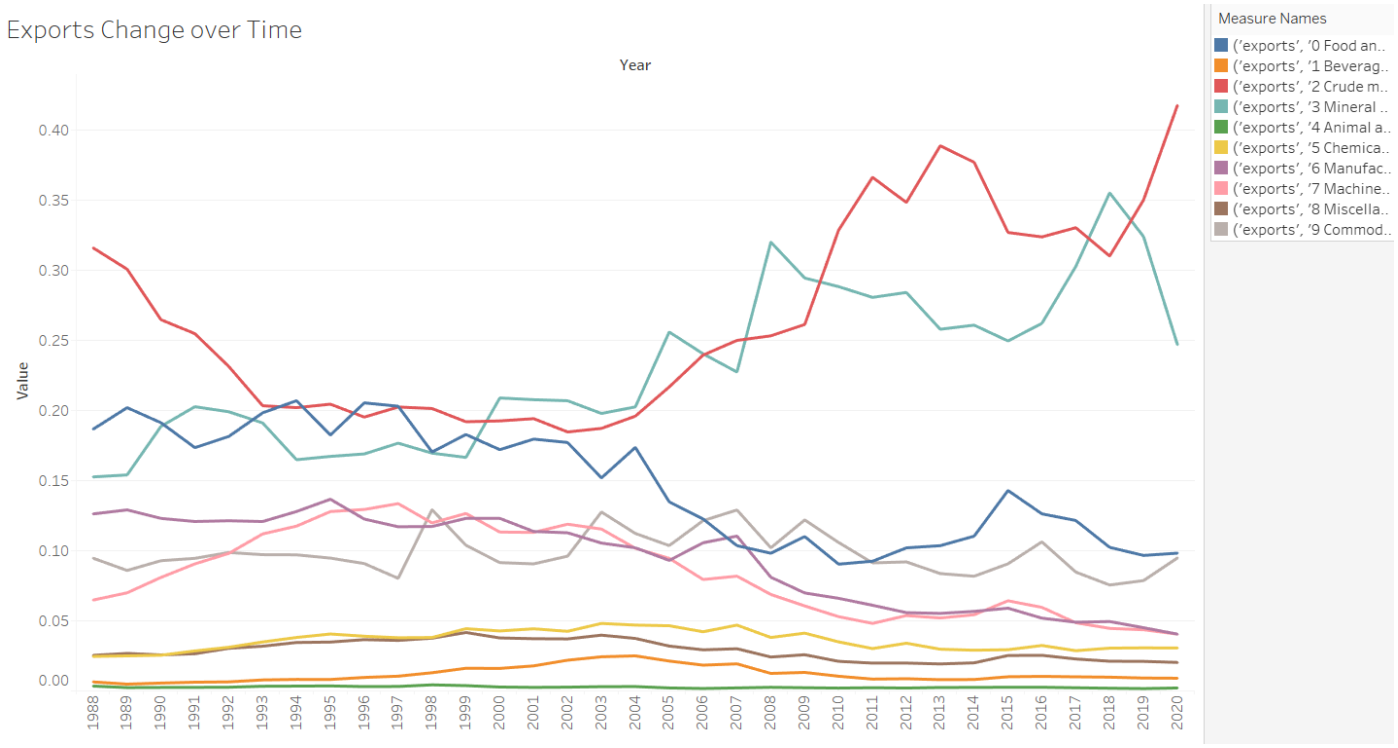
The graphs suggest Australia's top 3 imports are

- 7 Machinery and Transport Equipment
- 8 Miscellaneous Manufactured articles
- 5 Chemical and related products

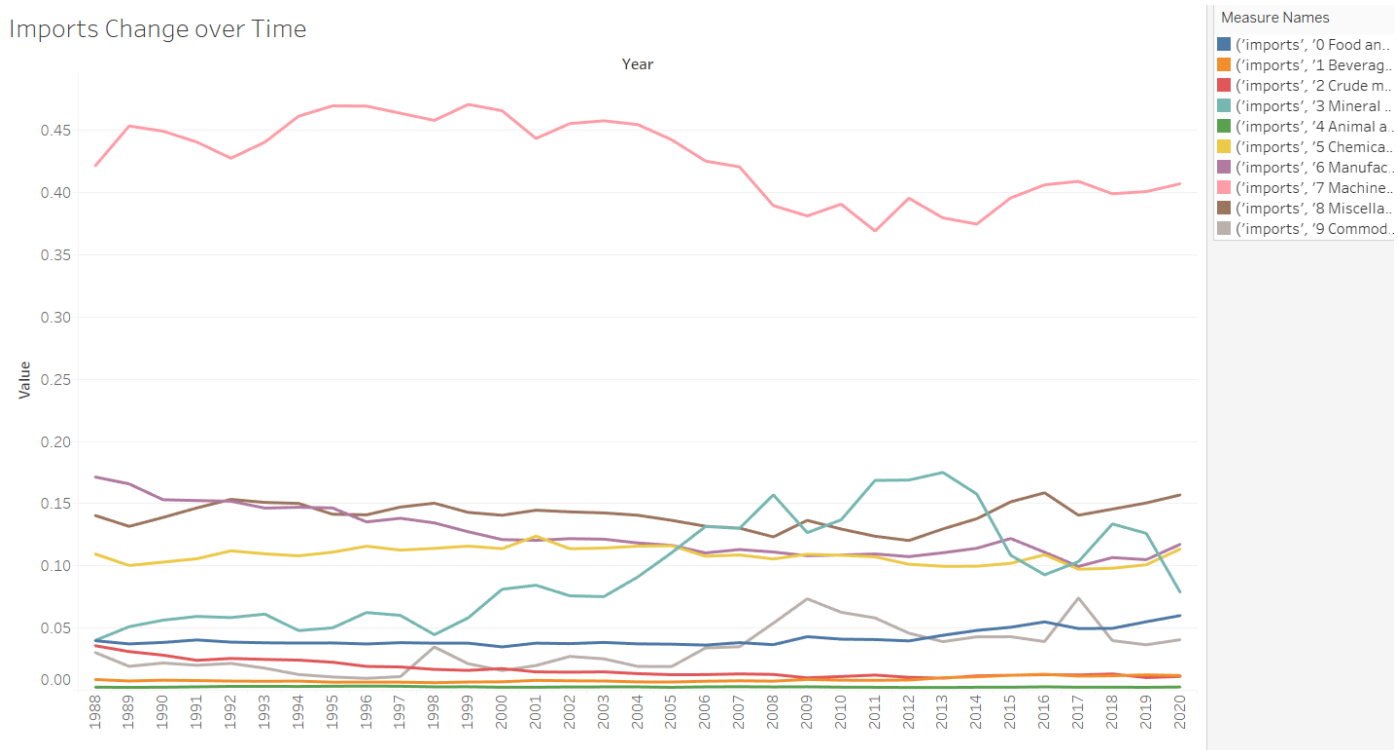
And Australia's top 3 exports are:

- 2 Crude material, inedible except fuel
- 3 Minerals fuels, lubricants, and related material
- 9 Commodities and transactions not classified (In general Food and Live animals had higher levels of export but in 2020 it was not as high as category 9)

This is confirmed by the "Exports Change over Time" graph except with "Food and Live Animals" having marginally higher exports in 2020. We can see both categories account for 10% of exports each.



Looking at the "Imports Change over Time" graph we can see our prediction is mainly correct except Manufactured Goods has a marginally higher level of exports than Chemicals and Related Materials.



It is extremely interesting to observe the dip and spikes in the Difference graph.

Why is there a sudden dip in 2003 and a sudden spike in 2014?

The sudden dip in 2003 is caused by a huge increase in imports.

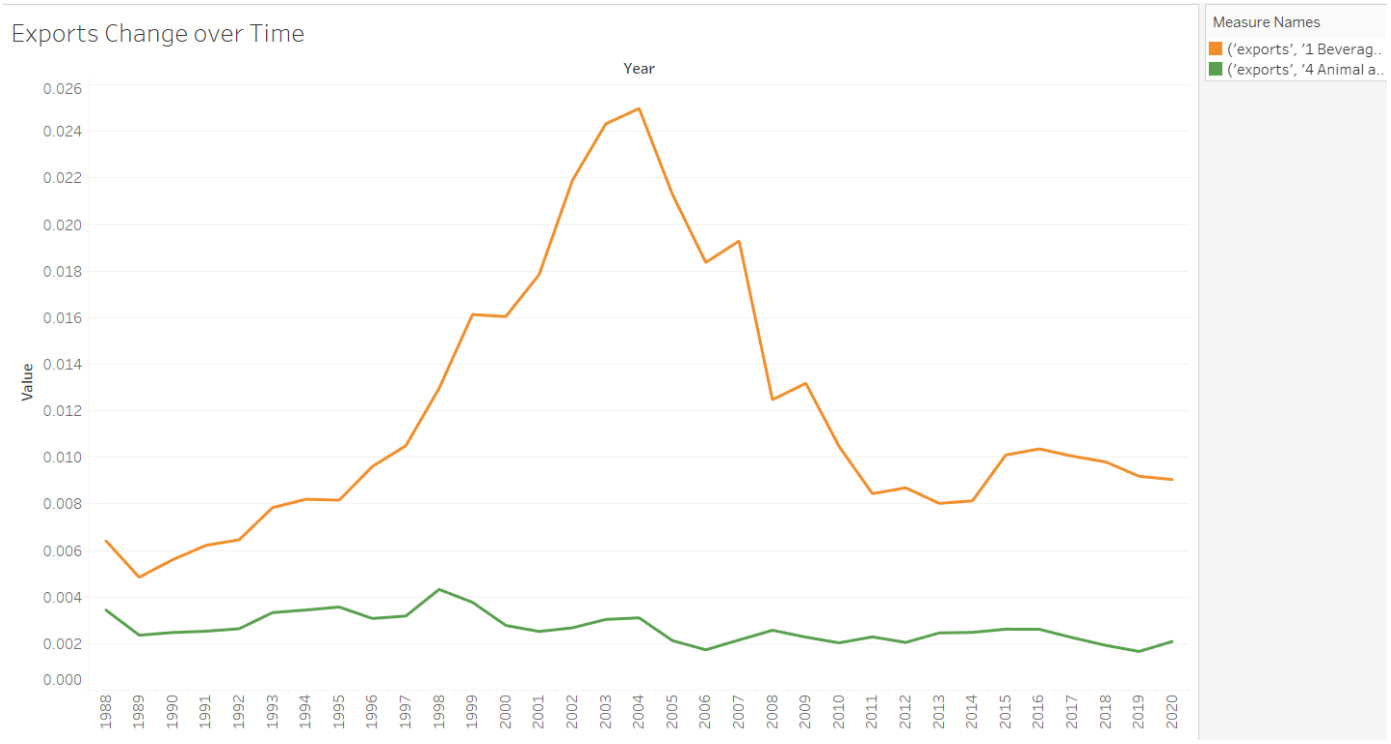
This is caused by (D. Dark):

- Cheaper imports compared to domestic goods
- Increase of income
- Tariff reduction
- Buy unavailable goods or niche products

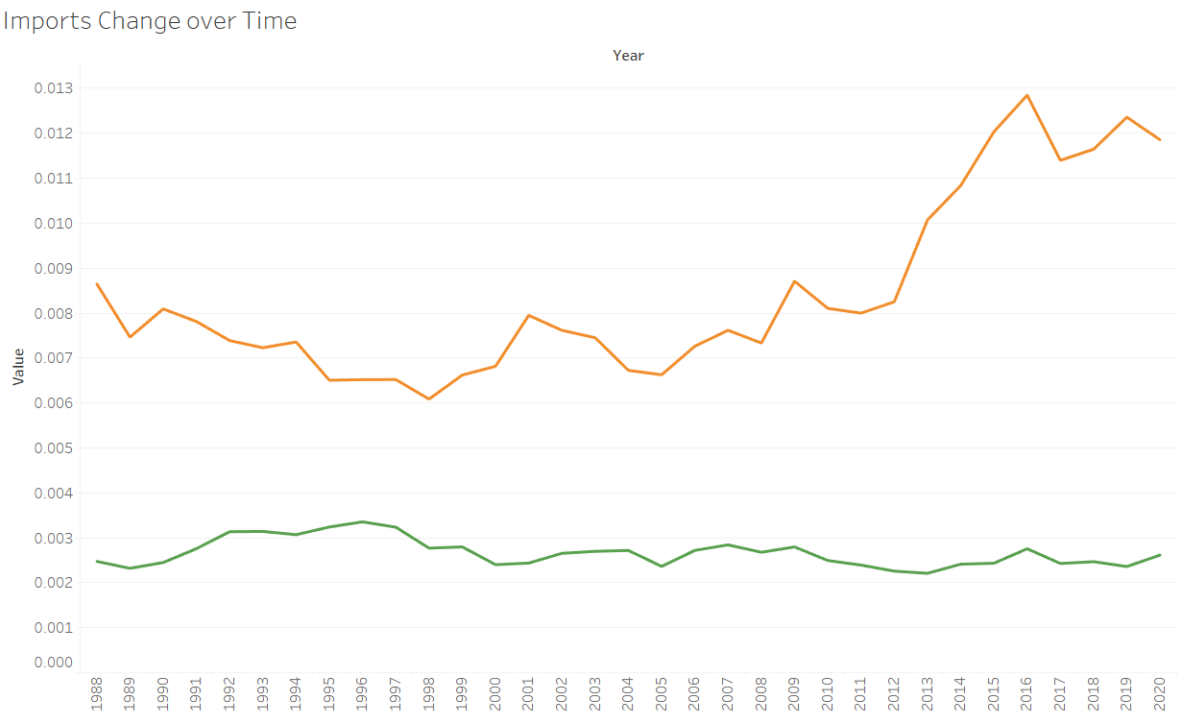
The 2014 spike according to the data from the ABS occurred because of an increase in the exports of goods and decreases in imports.

It is a bit hard to see changes in some categories because they are overwhelmed by the other categories. As result the graph of category 1 and category 4 are shown separately below.

We can see there is a massive peak for category 1 in 2004 followed by a steep decline.

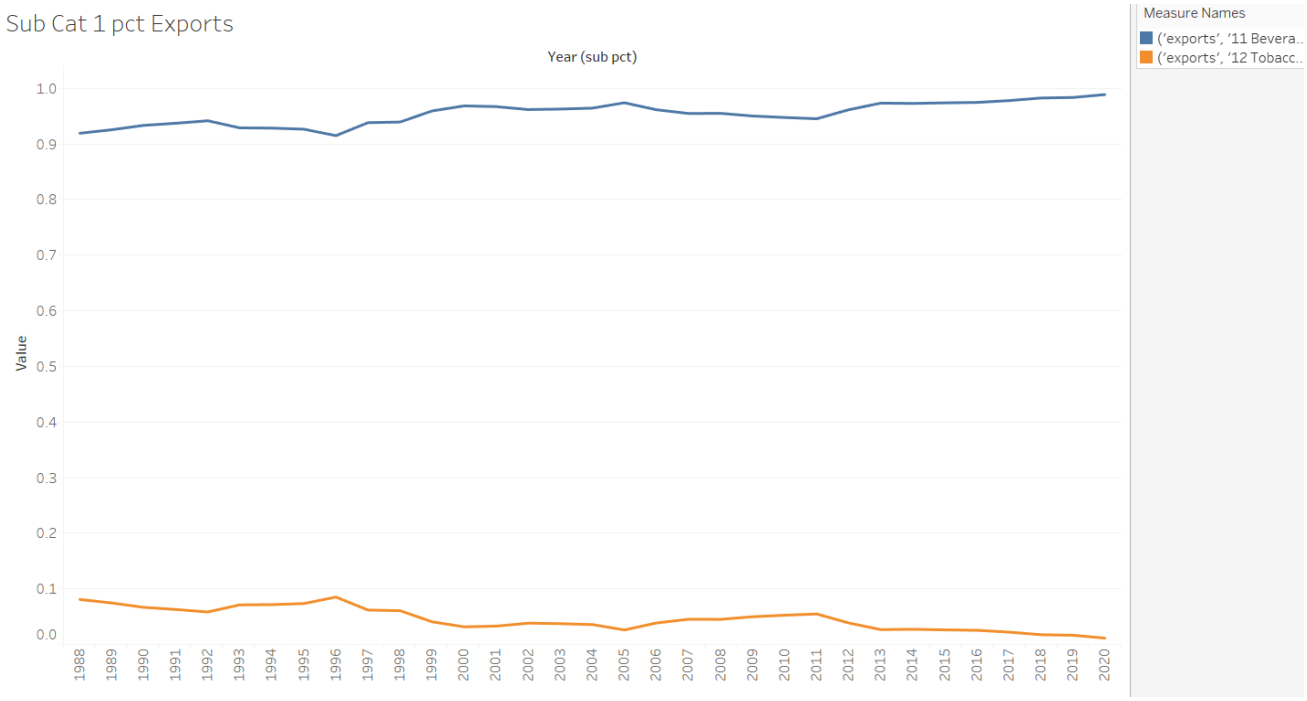


Looking at the imports category 4 is stable, but for category 1 imports seem to have gone up in recent years.

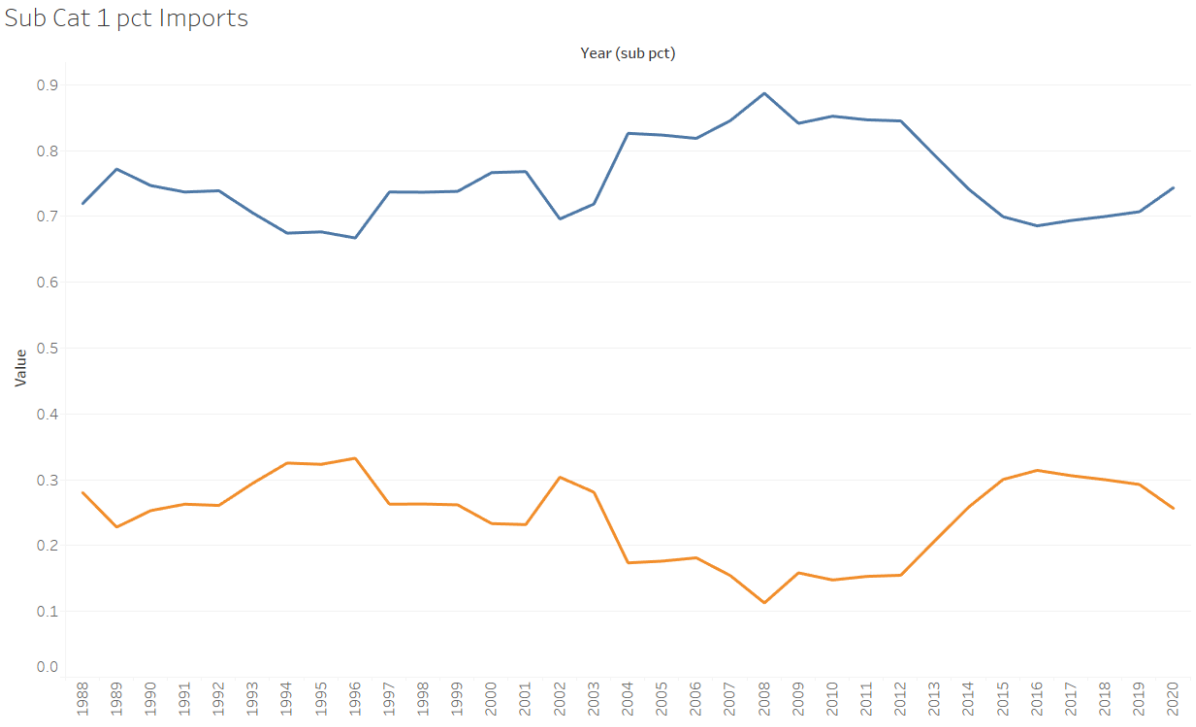


To further investigate category 1, we will investigate its sub-categories. Unsurprising when examining exports, the sub-percentages for tobacco were quite low while the beverages sub-category was significantly higher.

Carefully looking at the graph we can see the sub-percentage of tobacco has gone from about 8% to 1%. This could mean smoking is becoming less common worldwide.

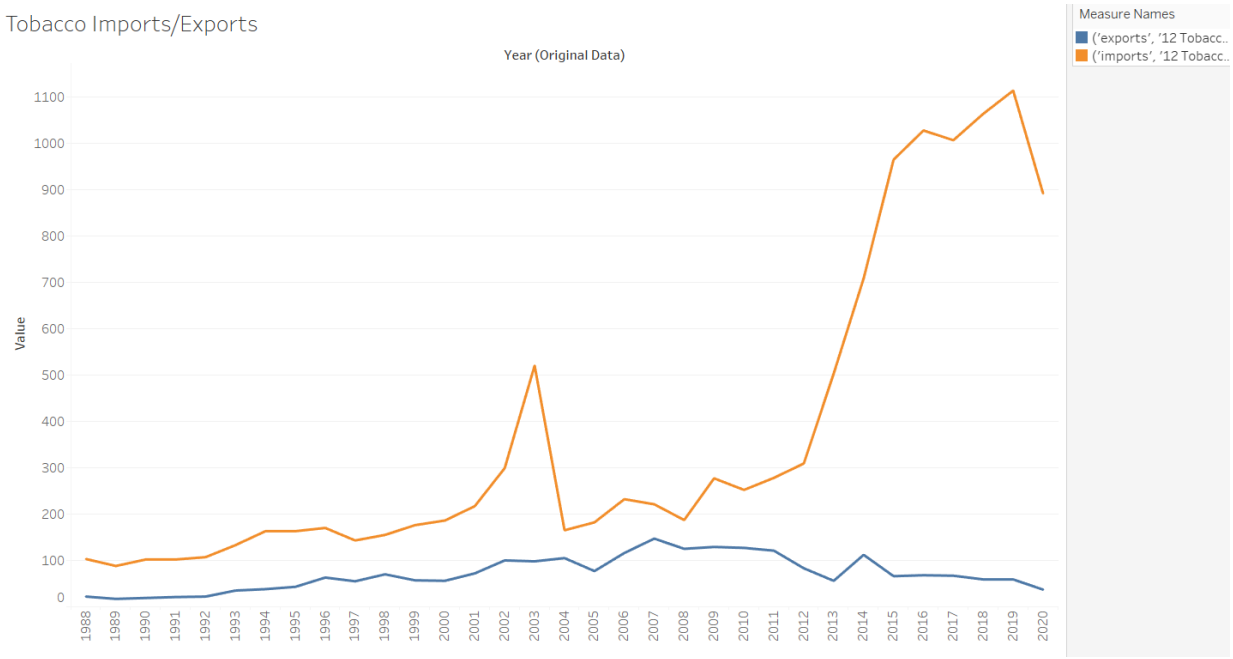


There was strong contrast with the graph on exports. Approximately 30% of import were made up of tobacco while 70% were beverages. This strong difference suggests Australia has limited production of tobacco onshore.



Looking at the data, the peak of exports for category 1 is mostly like due to the beverages being exported to other countries. No further reason could be found.

Further examining tobacco, we can see there has been an extremely sharp increase in imports from 2012 to 2016. This is mostly likely due to the increasing price of cigarettes. As the Australian government aims to reduce smoking rates, they have increased the price of cigarettes. It is quite interesting to see the packaging law in 2006 and 2011 did not reduce the value of imports because of the price increase.

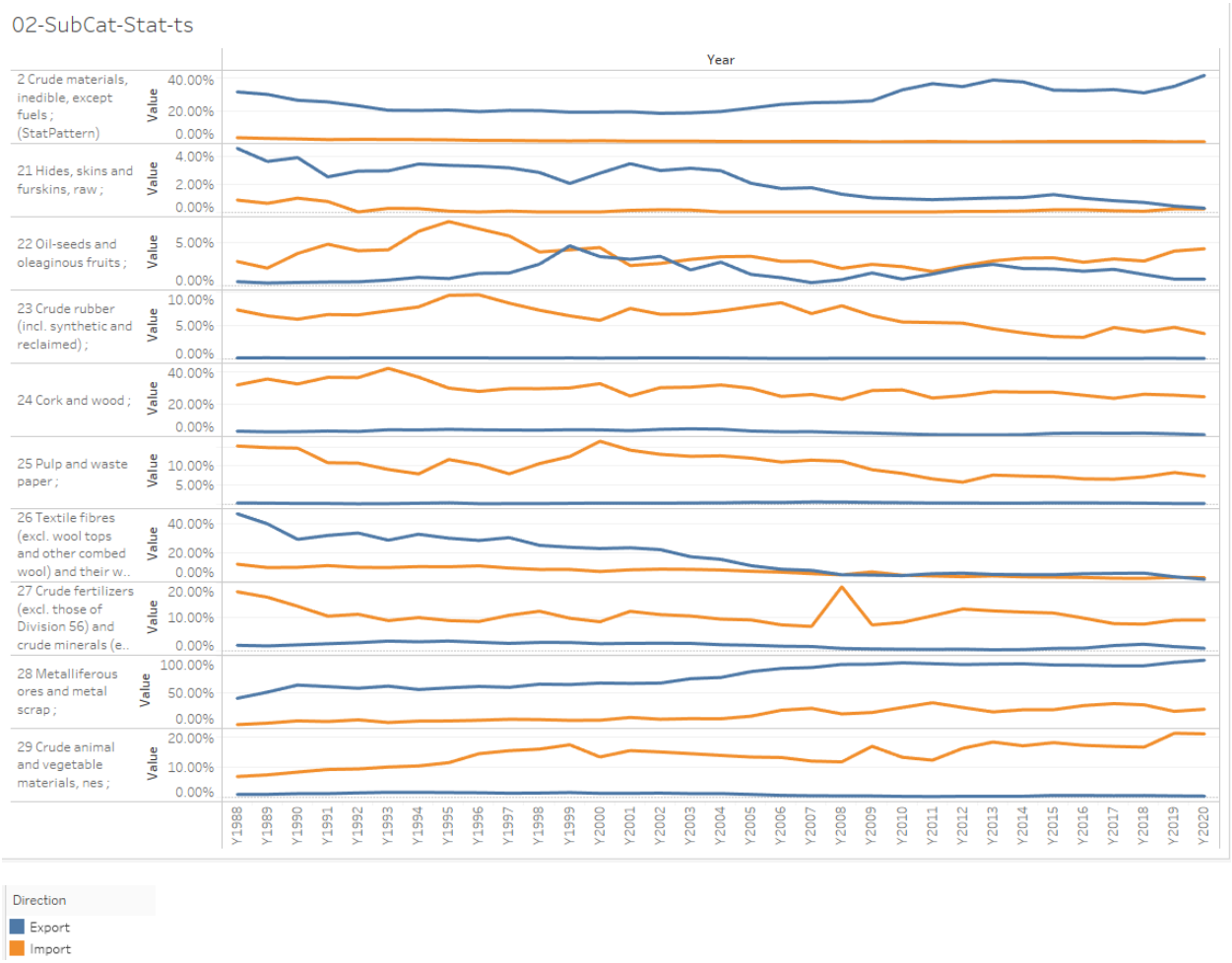


Trend and Change point analysis

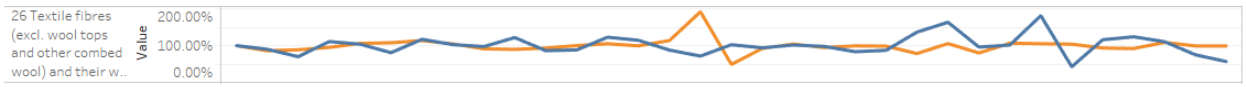
Category 2

Categories 2 and 3 make up most of Australian export market. Category 2 is dominated by exports of metal ores while category 3 has become dominated by gas exports.

I the case of category 2 there has been a consistent increase in the proportion of metal ore exports in category 2, coinciding with a gentle rise in the importance of category 2 as a whole. Together these imply that there has been a steady increase in international demand for raw metal ores and scrap since the 1990s. Before the mining industry took over, textiles dominated the category. It's unclear if declining importance of the textile industry is a result of weakness in the industry or the sheer strength of the mining industry in Australia.

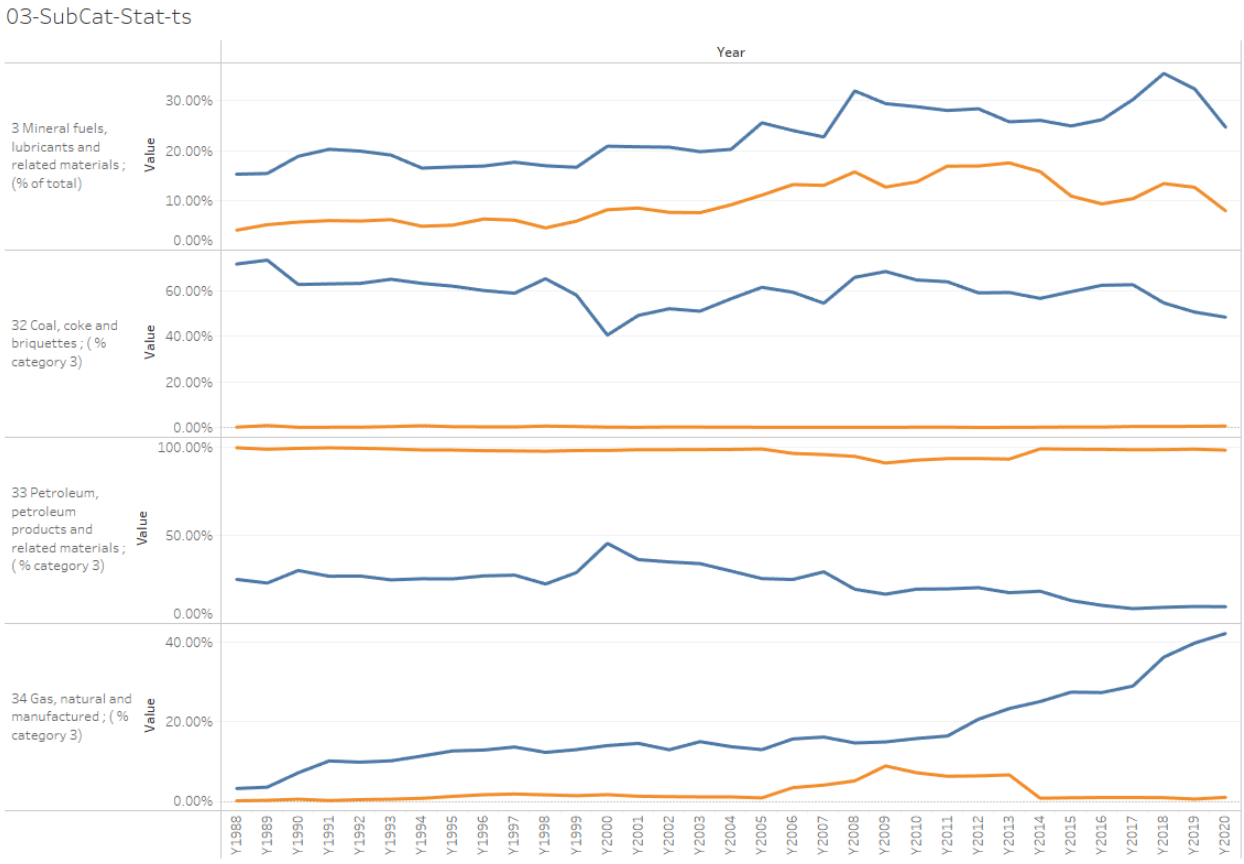


From the analytical pattern for Textiles, we can see that the export volumes are mostly stationary, except for times of significant change in the strength of the AUD (2003, 2011-12)



Category 3

Since picking up pace in 1998 and later in 2011, the Gas industry has consistently increased in importance to the Australian export volumes, while Petroleum remains the only significant contributor to Australia's category 3 imports.



03 Trade Breakdown

Analyzing the Analytical pattern for petroleum reveals that it, more so than other subcategories, is heavily impacted by foreign exchange rates. While the increase in gas volumes indicates a steady increase in demand, the fluctuations in petroleum volumes are indicative of exchange rate changes. This is evidenced particularly by the 2003 and 2011 change points, and their subsequent corrections.

Link to worksheets, dashboards and stories

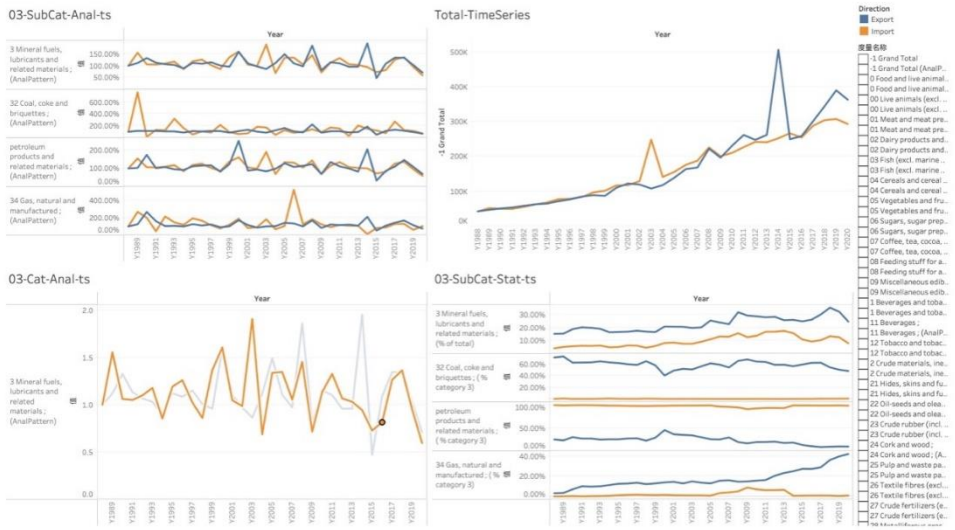
Evaluation

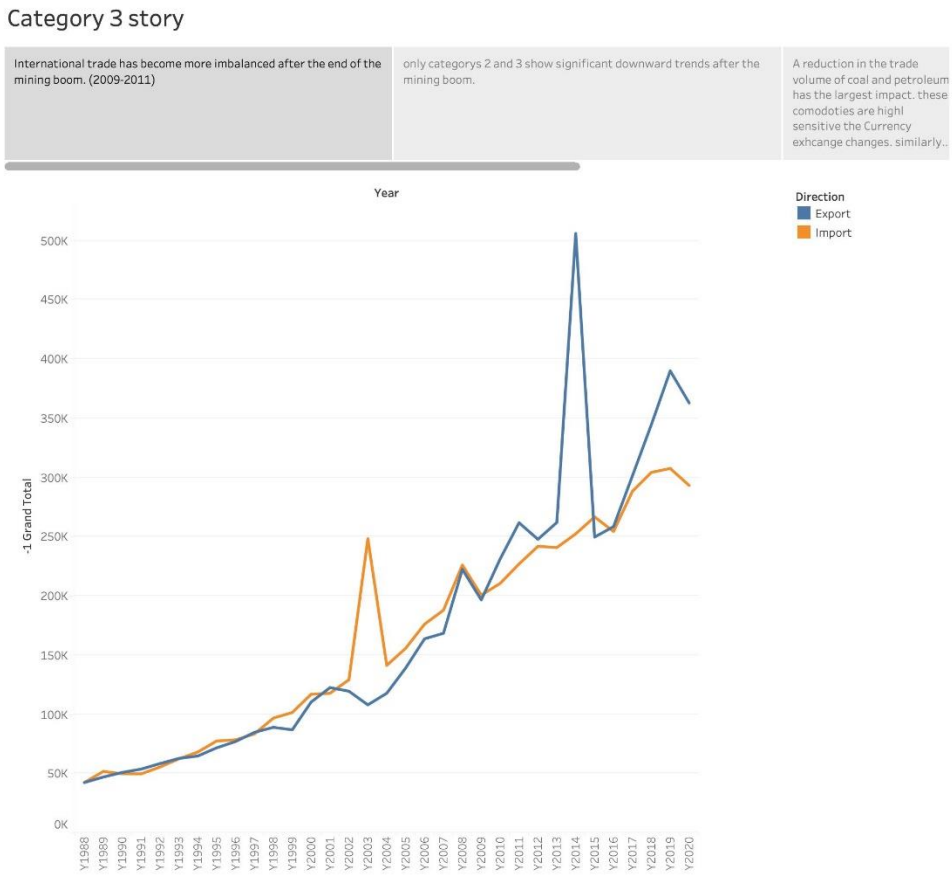
We made a visual dashboard including total time series chart, trend chart of subcategories statistic pattern, subcategories analytic pattern and categories analytic pattern and we have found some advantages of dashboards and storytelling board through this trade data visualization process.

Firstly, the visual dashboard can be more convincing compared to single chart, and the dashboard can present the results intuitively and clearly, also, it presents the dataset with greater visual impact. We can find the relationship between trend of categories and subcategories easily using dashboard since these two trend charts are put into one interface. Moreover, it is convenient for us to show charts for different subcategories since we can combine different charts in the visual dashboard flexibly.

For the advantages of storytelling board, it shows our finding in a clear order and helps users understand the hierarchy of different charts easily. In our case, we present our charts in an order of 'overall time-series graph---chart of categories---chart of subcategories'. Also, remarks at the top for each chart show the demonstration and tell the story effectively to our users.

To describe the result of visual analytics for the selected categories, we made the following two dashboards using Tableau and explored the relationship between variables. The main result we found in our dashboard is that there is a sharp increase of import price of mineral fuels, lubricants, and related materials in year 1989, at the same time, it shows in chart of subcategories that analytic pattern that there is a peak of coal, coke, and briquettes in year 1989. And the price of coal, coke and briquettes fluctuated most fiercely under subcategories. Therefore, we can infer that price increasing of coal, coke, and briquettes lead to the price fluctuation of mineral fuels, lubricants, and related materials. Finding in storytelling board is shown in category3 story.





Conclusions

We found that there were some interesting changes in the import and export volumes of categories 1 and 4, which are the result of changes in the market. These market changes are unique and affect the trend of international trade volumes for years or even decades. We found that free trade agreements, such as those introduced in the early 2000s, have reduced the cost of imports compared to domestic goods. Similarly niche products that cannot be produced here have made up an increasing portion of Australia's international trade volume.

Aside from free trade agreements, we also found that commodities make up a large portion of Australia's trade volume; both commodities that we produce at a competitive price (metal ore, coal & natural gas) & commodities we cannot produce enough of, such as petroleum. These commodities are highly sensitive to demand changes and currency changes in the international market. As such we see change points and trends that line up with a reduction in the international demand for coal and coal coke, and a simultaneous increase in the demand for natural gas. The most significant change points line up with well-known changes in the strength of the Australian dollar, hitting is lowest in 2003 and rising to its zenith during the 2009-12 mining boom.

References

ABS (Australian Bureau of Statistics), 2015, “International Trade in Goods and Services, Australia, Dec 2014” <https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/5368.0Main+Features1Dec%202014?OpenDocument=> viewed 8/11/2021

(D. Dark, J. Hawkins), 2004, “Why have Australia’s imports of goods increased so much” https://treasury.gov.au/sites/default/files/2019-03/04_Imports_of_goods.pdf viewed 7/11/2021