32146 - Data Visualisation and Visual Analytics

Assessment 3

Visual Analytics

Analysing Australian Import and Export

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Introduction

Australia plays a pivotal role in global trade, with a diverse and evolving portfolio of imports and exports. This report presents a detailed analysis of Australia's international trade over the past 36 years. The goal is to identify and highlight key trends and patterns that have shaped the country's trade position, providing insights for policymakers, researchers and various stakeholders.

The dataset sourced from ABS statistics spans from 1988 to 2024 and includes extensive records on both imports and exports. It is organised into 10 major categories and 67 sub-categories, effectively capturing the performance of various sectors in terms of value and growth. By examining this long-term trade data, the report sheds light on the structural shifts, competitive advantages and the economic significance of different industries. All the figures are presented in million Australian dollars (A$ millions)

Category Code	Category Name
0	*Food and live animals*
1	*Beverages and tobacco*
2	*Crude Materials, inedible, except fuels*
3	*Mineral fuels, lubricants, and related materials*
4	*Animal and vegetable oils, fats, and waxes*
5	*Chemicals and related products, nes*
6	*Manufactured goods classified chiefly by material*
7	*Machinery and transport equipment*
8	*Miscellaneous manufactured articles*
9	*Commodities and transactions not classified elsewhere in the SITC*

From all the above categories, Category 6- Manufactured goods classified chiefly by materials is chosen as the main category to be further analysed statistically and visually for this report.

Data Preparation

To begin with the analysis, two separate Excel sheets containing Australia's import and export data, measured in millions of Australian dollars (A$ millions), were examined, spanning from 1988 to 2024 and organised in a structured table across multiple categories and subcategories.

For analytical purposes, the data was grouped into two main types: statistical patterns (focusing on ratios and totals) and analytical patterns (focusing on changes and trends over time). Further segmentation was carried out to form targeted views such as import analytics, export analytics, import statistics, export statistics, and raw dollar value trends. These groupings ma de the dataset ready for visual exploration and comparative analysis using Tableau.

Data Transformation

The raw data was found to be clean and consistent, with no missing or duplicate entries. This allowed a smooth transformation process. After combining the import and export records, the data was classified into two key perspectives:

- Analytical: This segment was used to uncover meaningful change patterns across years, helping to answer the questions related to growth, volatility and sector-wise performance shifts. These insights were crucial for creating dynamic Tableau dashboards that support visual comparisons across timelines.

- Statistical: The group focused on summarising trade values like total exports or average imports across industries and years. These metrics formed the basis for visualising core trade trends and highlighting dominant sectors using clear statistical charts.

Statistical Patterns and Analytical Patterns

Statistical Pattern (Ratio)

The statistical pattern is used to measure the proportion of each import or export relative to the overall trade total for a given year. This helps in identifying which sectors contribute the most to Australia's trade portfolio annually. The formula applied to each category is :

$$Percentage\ Ratio_{(i-import/export)} = \frac{subtotal_{(i-import\,/\,export)}}{total_{(import\,/\,export)}} \times 100\%$$

The same is applied to all the sub-categories, allowing us to calculate their share within their respective parent categories. This ensures that all values are normalised and expressed on a consistent percentage scale, simplifying year-over-year and cross-category comparisons.

The analytical pattern focused on assessing how trade values change over time by calculating the year-on-year percentage change. For any given category or sub-category, the value from the current year is compared to the previous year using the following formula:

$$Annual\ Change\ =\ \frac{d_t}{d_{t-1}}\ x\ 100\%$$

Here, d refers to the trade value (in A$ million dollars) for a specific category in year t.. This helps in identifying growth trends, declines and volatility across sectors.

Note: The baseline year is taken as 1988, and the change ratio is assumed to be 100% to serve as a reference point.

Data Visualisation

The use of statistical and analytical patterns played a crucial role in transforming raw Excel data into meaningful import and export metrics for visualisation in Tableau. Tableau's powerful and intuitive features enabled us to uncover complex trade dynamics, offering deeper insights into the factors influencing Australia's trade landscape.

Our analysis was driven by a series of dynamic and diverse visualisations that aimed to comprehensively explore trade values. The core focus was placed on **Category 6: Manufactured Goods Classified Chiefly by Materials**, along with its key sub-categories, to provide a detailed and targeted view of this industrial segment.
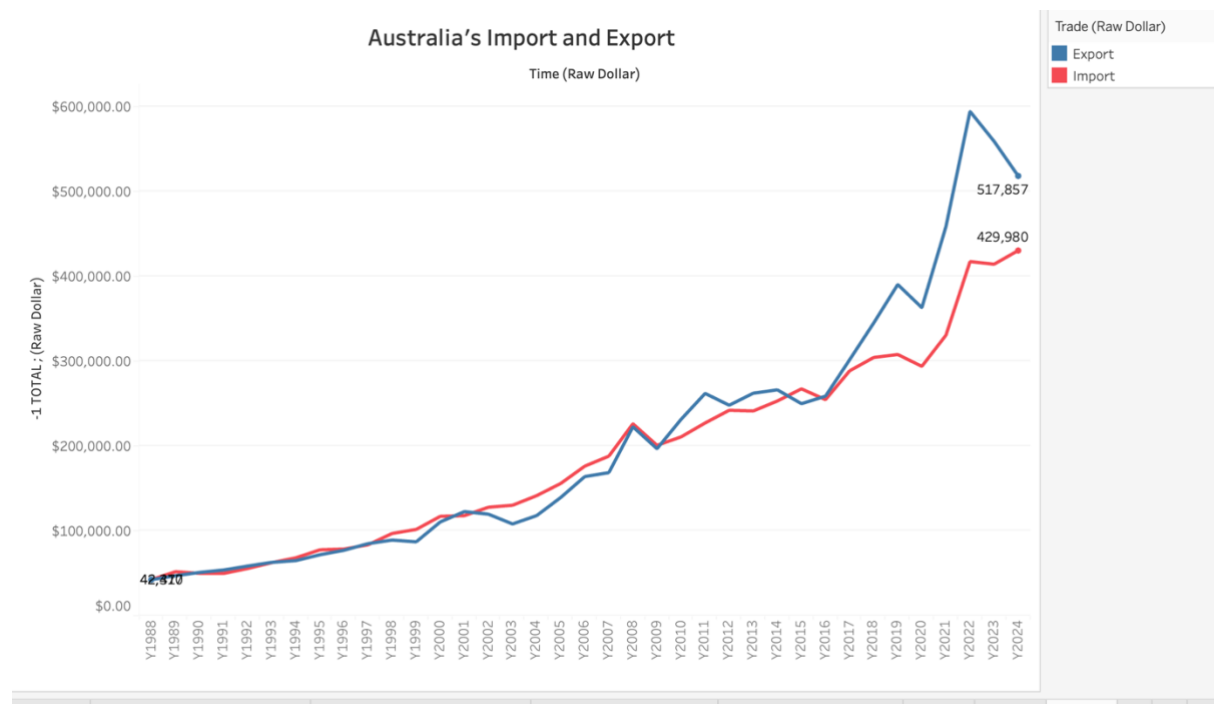
To support this analysis, a range of visual formats were employed, including polygon charts, bar graphs, and line charts, each chosen to highlight specific patterns or anomalies. Tableau's dashboards and storyboards were particularly valuable in synthesising and communicating these findings.

Dashboards allowed us to integrate multiple visualisations into a single interactive interface, making it easier to observe trends and relationships across different trade categories at once. This holistic view supported real-time exploration and comparison of trade data from various perspectives.

Storyboards, on the other hand, were used to guide the viewer through a structured data narrative. By sequencing dashboards and visuals effectively, storyboards helped showcase key insights and trade shifts over time, enabling clearer communication and encouraging informed, data-driven conclusions.

Overall, Tableau's capabilities not only enhanced the clarity and impact of our analysis but also supported the effective storytelling of Australia's evolving trade dynamics.
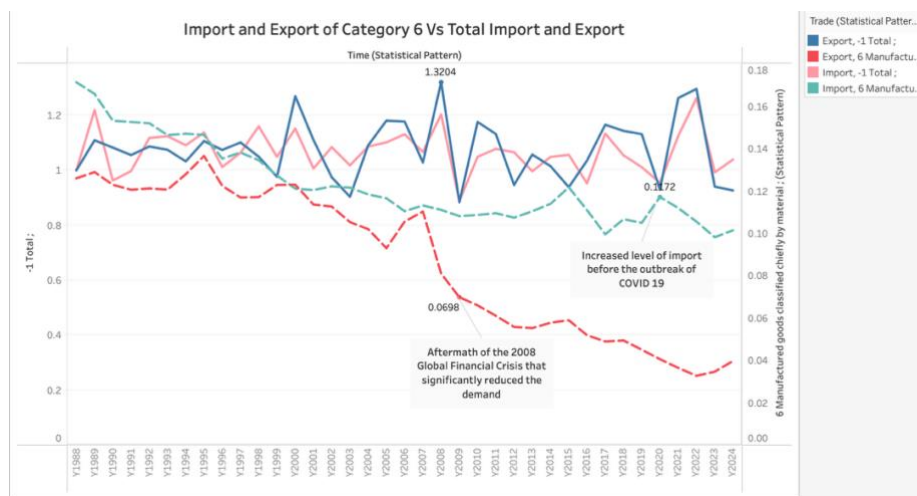
Imports and Exports: An Overview

The graph depicts the total imports and exports of Australia, spanning 36 years from 1988 – 2024 in terms of raw dollar with imports and exports both rising steadily. From 1988, trade began at around A$42 billion but by 2023 exports peaked to nearly A$594 billion and imports reached A$430 billion by 2024. From the year 2016, we can see a widening gap between the import and export trend, indicating trade surpluses in recent years

The use of dual axes helps identify trends in Australia's trade in terms of percentage change. The highest export ratio was 1.32 in 2008, which coincided with the global commodity boom. The lowest ratio of 0.88 in the following year reflects the aftermath of the Global Financial Crisis. A sharp rebound in 2022 can be linked to the COVID-19 recoveries, which increased the global demand for Australian resources like iron ore and LNG (DFAT , 2024).

Category 6: Manufactured goods classified chiefly by Materials.

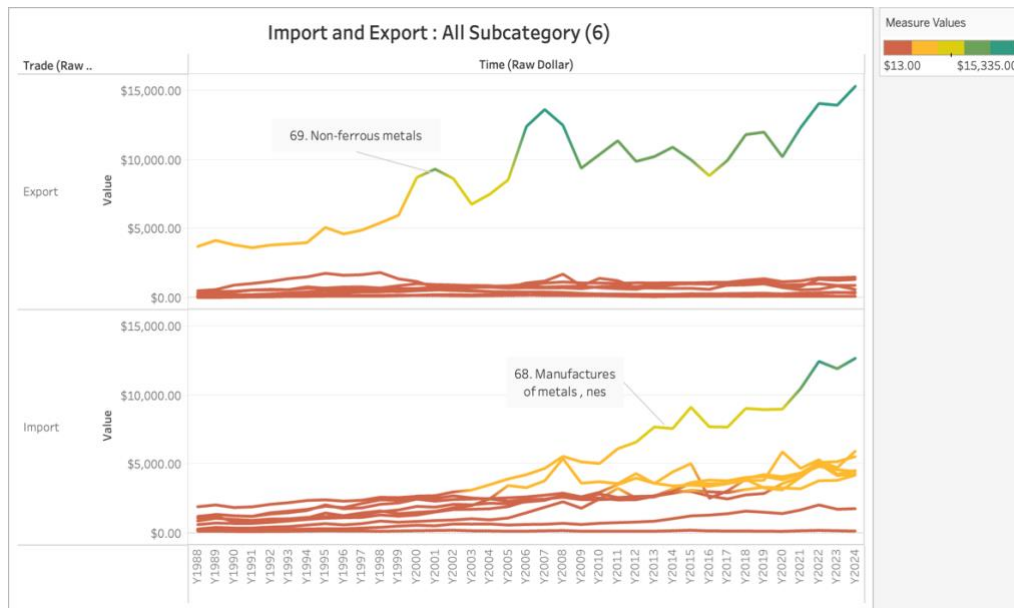Import and Export of Category 6 Vs Total Import and Export

The graph compares Australia's total trade with the relative share of Category 6 imports and exports over 1988–2024. While Category 6 initially held a notable share in both flows, its importance has steadily declined, especially on the export side. In the early years, Category 6 exports made up around 10–12% of total exports. However, following the 2008 Global Financial Crisis, its contribution dropped sharply to under 7% and remained low, reflecting Australia's continued focus on raw material exports rather than processed goods with imports telling a similar story, though from a higher starting point. Category 6 accounted for 15% of imports in 1988 but declined to just above 10% by 2023. A spike in 2019 suggests increased demand before the COVID-19 pandemic impacted supply chains. The trend indicates the country's reliance on imported semi-manufactured goods and a persistent gap in its domestic value-added production with recent government policies aiming to address this issue by promoting onshore mineral processing and industrial resilience (Department of Industry, Science and Resources, 2023).

Subcategories for the chosen Category 6 includes: 61. Leather and Leather manufactures, nes, and dressed furskins, 62. Rubber Manufactures ,nes, 63. Cork and wood manufacturers(excl. furniture), 64. Paper, paperboard and articles of paper pulp, of paper or of paperboard, 65. Textile yarn, fabrics, made-up articles nes, and related products, 66. Non-metallic minerals manufacturers, nes, 67. Iron and steel, 68. Non-ferrous metals, 69. Manufacturers of metals, nes.

Analysis of Sub-category

The following visualisation clearly presents the 36-year export and import trends across all subcategories within **Category 6. Manufactured Goods Classified Chiefly by Material**. The dual line chart enables straightforward comparison between import and export values, making it easier to identify key patterns and each subcategory's contribution to overall trade dynamics. Strategic annotations further enhance the visual by highlighting significant shifts and notable trends among the major subcategories.
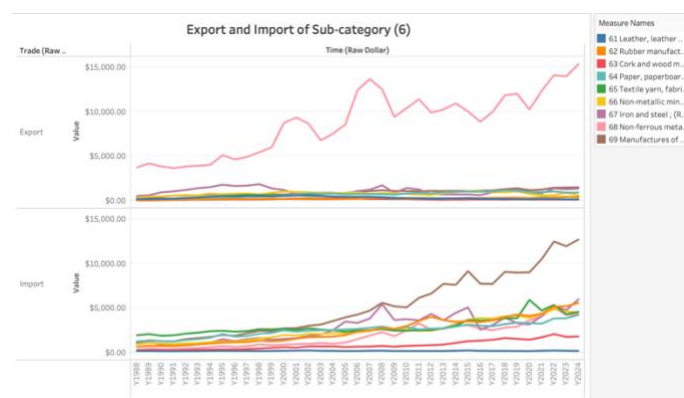
Figure: Import and Export : All Subcategory (6)

Colour legends were used for the chosen sub-categories to help distinguish the trade values and identify the top import and export goods for Category 6.

Export Trends

"68. Non-ferrous metals" stands out as the leading export subcategory, showing a strong and persistent rise post 2000's, with peaks around 2008 and 2018 thereby reflecting Australia's strength in exporting value-added mineral products such as alumina and refined aluminium. "67. Iron and steel" also contributed to the total export, though on a minor scale, showing mild growth between 1990 and 2008 followed by a slight fluctuation in limited overseas demand

Import Trends

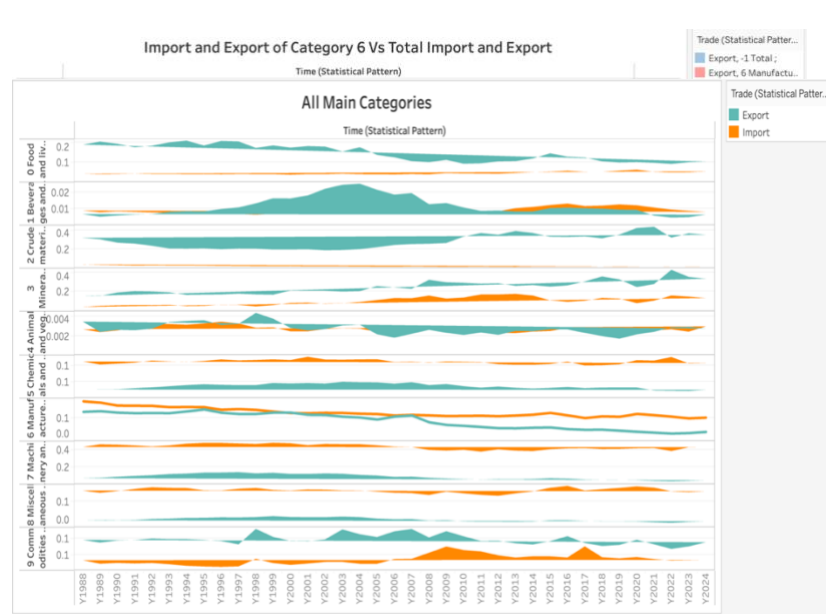"69. Manufacturers of metals" clearly dominate the import space with a sharp and consistent rise since the early 2000s, highlighting the country's dependency on foreign-manufactured metal products. "67. Iron and steel" and "66. Non-metallic mineral manufacturers" also contribute significantly to imports, exhibiting moderate fluctuations throughout the years.

Figure: Export and Import of Sub-category (6)

The area was particularly useful in demonstrating the percentage of trade contribution by Category 6 in comparison to trade volume. The red area represents the total share of exports by category 6 in terms of total trade, which is relatively small, with its peak at 10% of the overall export trade and declining in later years past 2008. The imports remain constant with a relatively stable level of imports as compared to exports.

The polygon chart visualization highlights the trade dynamics of various categories and sub-category 6 over time, indicating that even though Australia has generally maintained high export volumes as compared to imports in several key categories, category 6 seems to deviate from the overall trend. The chart help provide a clear comparison of trade patterns across different sectors.
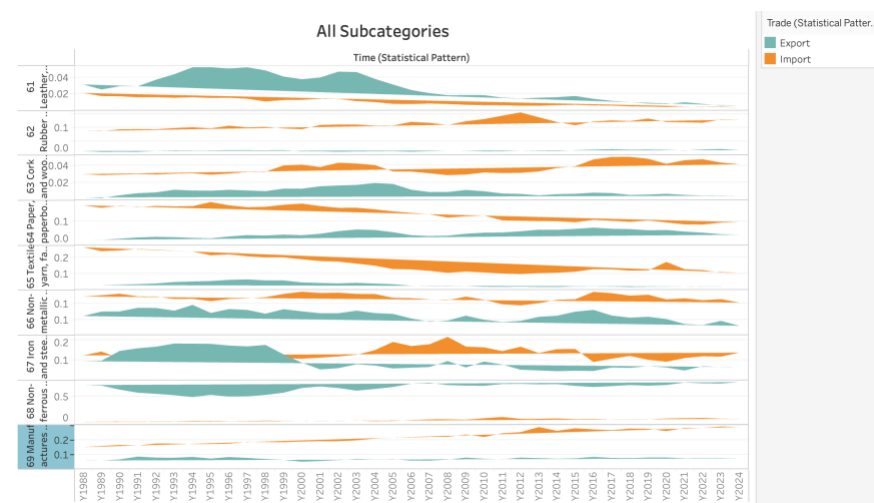
Main Categories:

Categories such as "3. Mineral fuels, lubricants and related materials" and "7. Machinery and transport equipment" have substantial and fluctuating trading volume. "6. Manufactured goods classified chiefly by materials" shows a relatively decreasing trade volume with exports decreasing (in light blue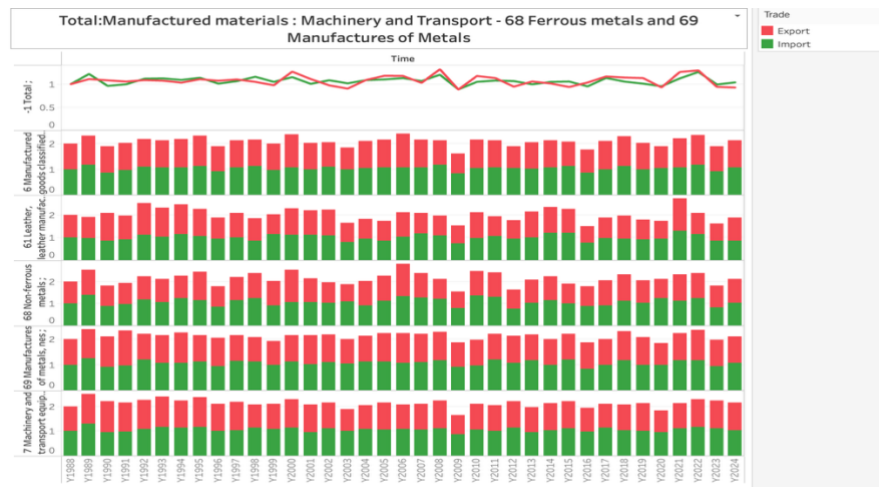) and a slight increase in imports (in orange) due to a lack in value-added manufacturing facilities. (Department of Industry, Science and Resources, 2023).

Sub-category

Sub-category 68. Non-ferrous metals and 69. Manufactures of metals, nes show significant trade fluctuations in exports and imports respectively, with other categories remaining relatively stable and low throughout the years

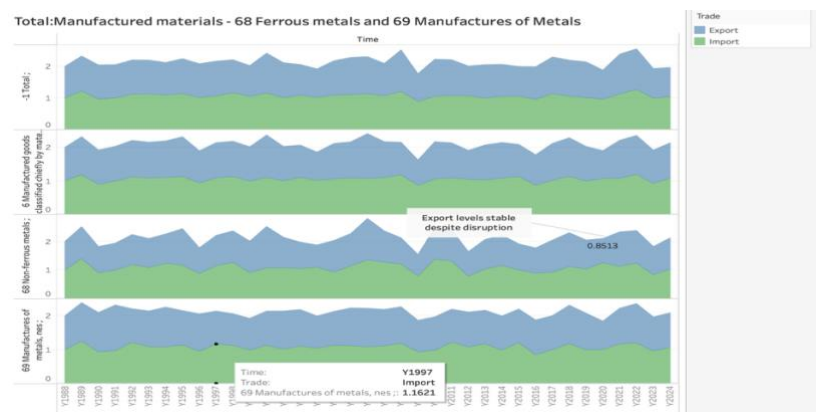# Analysis of Sub-categories and the Impact of COVID-19

The trade analytics indicate a sharp dip in global trade due to COVID-19 and its impact on the Australian markets. Despite the supply chain disruption, Category 6. Manufactured goods classified chiefly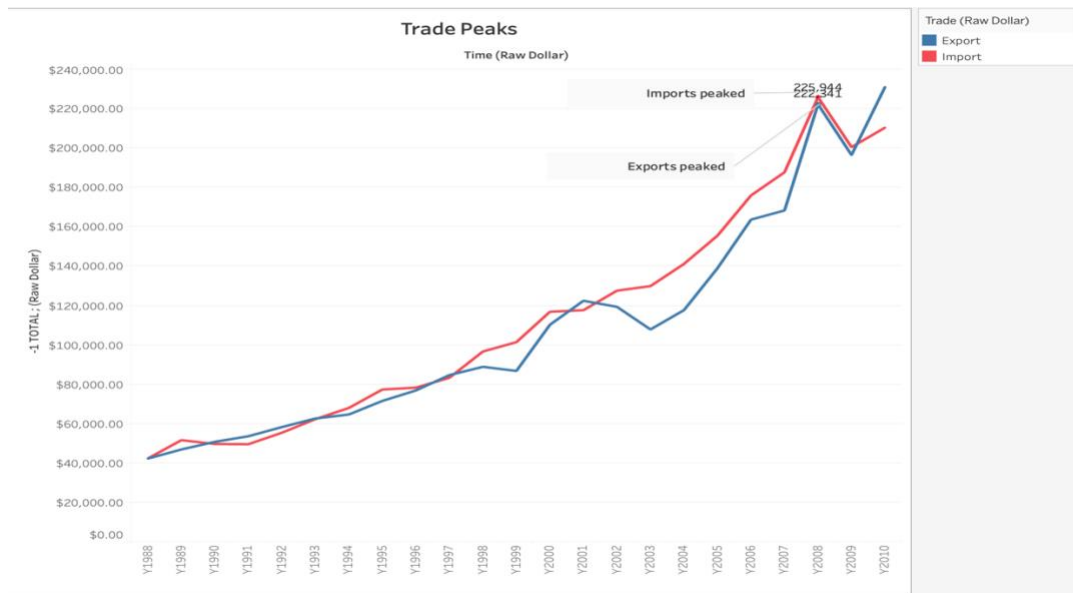 by materials showed a slight change in trade patterns than other categories, despite being prone to severe volatility. With subcategories in particular, 68. Non-ferrous metals and 69. Manufacturers of metals, nes, remained relatively stable, indicating the role of these minerals in supporting the infrastructure, energy, and manufacturing sectors.

According to the Australian Bureau of Statistics (ABS, 2021), metal and fabricated product exports remained stable with some segments rebounding quickly due to increased demand from East-Asian markets particularly China resulting in non-ferrous metals including aluminium, copper and nickel retaining stable export volumes as being critical inputs in electronics, transport and green energy sectors and also due to domestic industrial consumption and government -backed projects.

Furthermore, post-2020, the Australian Government announced the Infrastructure Investment pipeline in its federal Budget 2021-22 with an investment of $110 billion (Australian Department of Treasury, 2021) to ensure the demand for core construction and fabricated materials remains intact during the pandemic recovery phase.

Why did Australia's Trade peak in 2008?

Trade Peaks

In 2008, Australia's trade economy reached a historic peak, driven by soaring global demand for its mineral and energy resources. According to the Department of Foreign Affairs and Trade's publication Composition of Trade Australia 2008, the total value of goods and services traded surged by 23.1% to $561 billion, making 2008 one of the most significant years in the country's trade history. Overall commerce rose by 7.7% in volume, highlighting both increased demand and high commodity prices globally

This chart helps capture the surge in both export and import values, with trade climbing from $42,417 million in 1988 to a peak of $231,143 million in 2008. This sharp rise reflects Australia's strengthened position in global markets, particularly in minerals, fuels, and education services.

Major drivers of Trade:

☐ Japan as Leading Trading Partner:
Japan regained the top position with two-way trade reaching $76 billion (up 39%), fuelled by strong demand for coal and iron ore, as well as refined petroleum and transportation services. (DFAT, 2009)

☐ China's Surging Role:
Though China had overtaken Japan as Australia's largest trading partner in 2007, it ranked second in 2008 with $74 billion in trade (up 27%).
China's demand for energy, iron ore, and copper significantly boosted export revenues. (DFAT, 2009)

☐ Export Expansion:
Australia's exports reached $278 billion in value (up 27.6%). Major contributors included:

- Education services – $15.5 billion (up 23%)
- Iron ore – $30 billion (up 85.4%)
- Coal – $47 billion (up 124.6%)
  (DFAT, 2009)

☐ Record Imports:
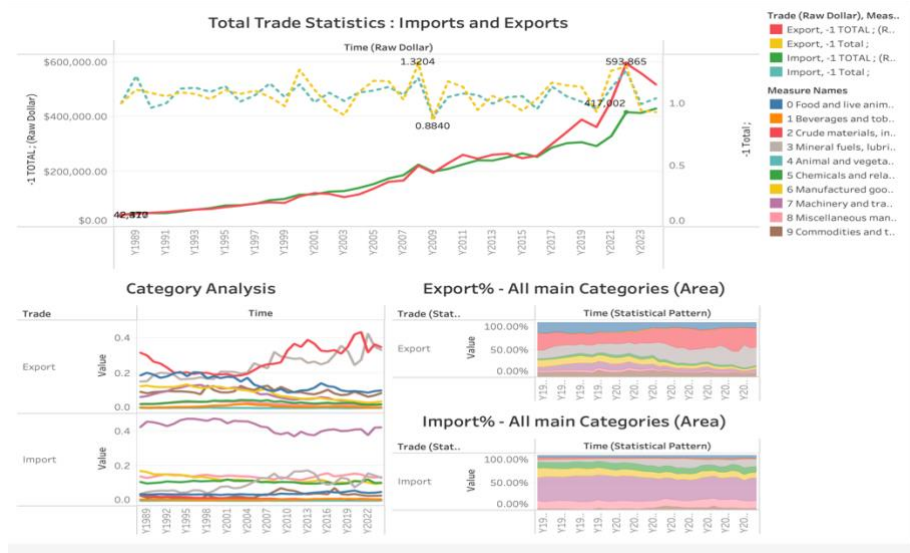Imports reached $283 billion, rising 10.2% in volume and 18.9% in value.
China surpassed the U.S. as Australia's largest import source, mainly in machinery, electronics, and textiles.
(DFAT, 2009)

Dashboards

Dashboards were used to visually explore and compare trade patterns within Category 6. Manufactured Goods Classified Chiefly by Material, with a focus on both export and import values. Key visualisations included raw dollar trends, trade ratios, and subcategory-level breakdowns for 68. Non-Ferrous Metals and 69. Manufacturers of Metals which emerged as the most prominent contributors. The dashboards highlighted trade shifts during significant periods such as 2008 (GFC impact) and 2020 (COVID-19 disruption). This approach enabled a clearer understanding of Australia's evolving industrial trade structure and import dependencies.

Total Trade Trends for Australia

The dashboard visually represents the total trade trends as well as the percentage of import and export categories, offering an immediate understanding of the categories that dominate the trade. For exports, the main categories are Category 3-Mineral Fuels and Related Materials (gray area) and Category 2 - Crude Materials (red area), highlighting Australia's wealth in natural resources such as oil, fuels, and minerals. The line charts help understand the volatility

of different categories indicating the change in values. In contrast, the primary import category is Category 7 – Machinery and Transport Equipment, depicted by the purple area in the chart.

Focusing on our chosen Category 6. Manufacturing goods classified chiefly by Materials, we observe that exports are dropping as a percentage of total trade post 2008 while imports seems to remain stable even after major disruptions such as the GFC and COVID-19

Analysis of Sub-Category 68

The next dashboards aim to present the findings and summary of the subcategory 68, which defines Non-ferrous Metals

Before moving on to analysing the subcategory 68, it is important to understand the category of which it is a part. This dashboard helps us gain insights into the trade trends of Category 6. The line chart depicts the gradual decrease of both imports and exports, while the overall exports and imports indicate an uptrend. The bubble chart helps to identify the key subcategories in both imports and exports. For instance, subcategory 68. Non-ferrous Metals lead in the export category, while subcategory 69. Manufacturers of Metals have the highest import levels.

Subcategory 68. Non-ferrous metals highlight a volatile trend with export ratios peaking at 1.45 while imports reaching as low as 0.13, reflecting Australia's export strength in aluminium, copper and precious metals , driven by the

global demand for raw industrial materials.

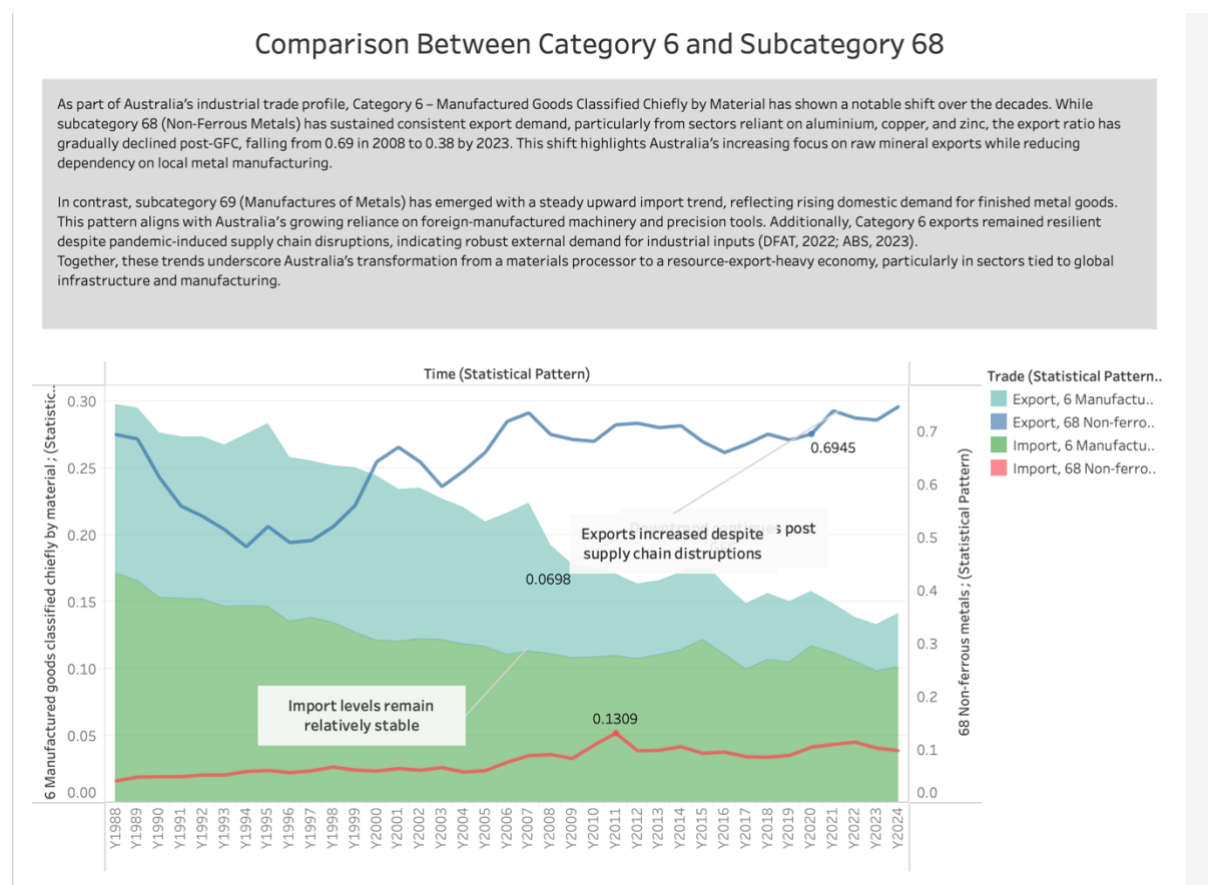Category 69. Manufactures of metals, nes lead in the import category with a stable import ratio of 0.29, with exports fluctuating below parity, indicating domestic reliance. The imports have steadily increased post-2010, coinciding with Australia's growing infrastructure and machinery needs. Other sub-categories like 64. Paper, 65. Textiles and 62. Rubber remains relatively flat in both exports and imports, suggesting that it plays a less significant role in Australia's material trade.
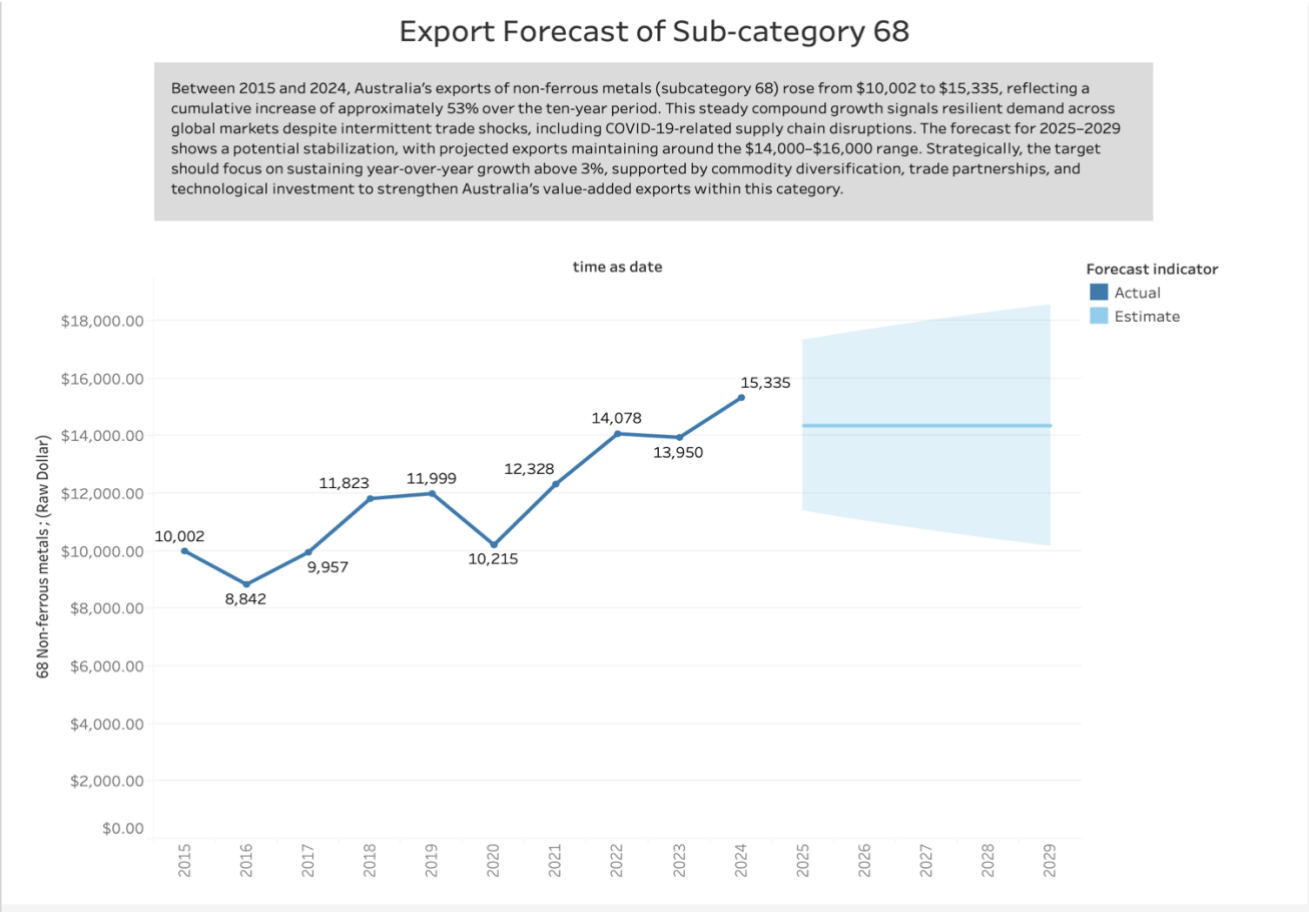
Storyboards

Storyboards are powerful tools in Tableau that transform data visualisations into meaningful narratives. They allow users to present insights step-by-step, guiding viewers through a logical flow of analysis. By structuring visual content into a coherent sequence, storyboards make it easier to interpret complex datasets and highlight significant patterns. In this report, storyboards were effectively used to construct and present two focused stories with each offering a clear view of Australia's trade trends and uncovering deeper insights into category-level trade performance over time.

Story 1 : Analysis of Category 6 : Sub-Category 68

Comparison Between Category 6 and Subcategory 68

As part of Australia's industrial trade profile, Category 6 – Manufactured Goods Classified Chiefly by Material has shown a notable shift over the decades. While subcategory 68 (Non-Ferrous Metals) has sustained consistent export demand, particularly from sectors reliant on aluminium, copper, and zinc, the export ratio has gradually declined post-GFC, falling from 0.69 in 2008 to 0.38 by 2023. This shift highlights Australia's increasing focus on raw mineral exports while reducing dependency on local metal manufacturing.

In contrast, subcategory 69 (Manufactures of Metals) has emerged with a steady upward import trend, reflecting rising domestic demand for finished metal goods. This pattern aligns with Australia's growing reliance on foreign-manufactured machinery and precision tools. Additionally, Category 6 exports remained resilient despite pandemic-induced supply chain disruptions, indicating robust external demand for industrial inputs (DFAT, 2022; ABS, 2023).
Together, these trends underscore Australia's transformation from a materials processor to a resource-export-heavy economy, particularly in sectors tied to global infrastructure and manufacturing.

Category 6 has experienced a long-term decline in export share since the early 2000s, influenced by the aftermath of the Global Financial Crisis and shifting global trade priorities. Despite global supply chain disruptions during COVID-19, exports remained relatively stable, highlighting resilience in Australia's manufacturing sector. Imports, on the other hand, steadily increased, with subcategories like Non-ferrous metals and Manufactures of metals contributing significantly to the volume. The trend reflects Australia's growing dependency on imported intermediate goods while navigating structural changes in global industrial supply networks (DFAT, 2023; ABS, 2024)

Story 2: Export forecast of Sub-Category 68

This story helps project the export trends for sub-category 68. Non-ferrous metals from 2015 to 2029. The category saw consistent growth, with exports increasing by over 50% from 2015 to 2024. Despite global disruptions, the trend remained upward, indicating strong international demand. The forecast suggests a moderate but stable outlook through 2029, highlighting opportunities to strengthen Australia's trade position through innovation and market expansion.

Advantages and Disadvantages of Tableau Boards

Tableau dashboards and storyboards serve different purposes in data visualisation. Dashboards are excellent for real-time monitoring, offering interactive and customizable views that help users quickly interpret key metrics and make informed decisions. However, they can sometimes be cluttered and require time to build and maintain effectively.

In contrast, storyboards are ideal for structured storytelling. They guide viewers through data insights in a logical sequence, making them useful for presentations or highlighting key trends. Their limitation lies in reduced interactivity and flexibility for real-time exploration. Using both tools together can provide a well-rounded strategy for both analysis and communication

Conclusion

The analysis of Australia's trade trends, particularly within Category 6 - Manufactured Goods Classified Chiefly by Materials, reveals a long-term decline in export contribution since the early 2000s. This downward shift reflects Australia's reliance on raw material exports over value-added manufacturing. Despite global events such as the GFC and the COVID-19 pandemic, exports in key subcategories like Non-Ferrous Metals (68) remained relatively resilient due to their critical role in energy, infrastructure, and industrial applications.

Imports, especially in subcategory 69—Manufactures of Metals, have consistently increased post-2010, suggesting a growing dependency on foreign-finished goods. The dashboards illustrated how major disruptions impacted trade patterns but also underscored Australia's stability in certain industrial exports. Storyboards provided a clear narrative of these shifts, reinforcing how trade strategies and government interventions have shaped outcomes.

This comprehensive exploration through Tableau allowed for both macro- and micro-level insights, offering policymakers a clearer lens into sector performance, vulnerability, and long-term trade positioning.

Recommendation

To strengthen Australia's trade strategy in Category 6 and ensure long-term sustainability:

- **Promote Onshore Manufacturing**: Invest in domestic value-adding industries for raw materials—particularly in metal refining and fabrication—to reduce import reliance and boost export value.
- **Support Non-Ferrous Metals Sector**: Continue supporting the export of non-ferrous metals (e.g., aluminium, copper) through innovation and green processing technologies, capitalising on global demand for critical minerals.
- **Restructure Import Policies**: Reassess import dependencies in subcategory 69 by encouraging local production of finished metal goods to enhance economic resilience.
- **Trade Diversification**: Expand bilateral trade relationships and diversify export markets to reduce vulnerability from over-dependence on a few trading partners.
- **Infrastructure Investment Alignment**: Align industrial policy with national infrastructure projects to ensure steady domestic demand for manufactured goods and enable sectoral growth.

By addressing these priorities, Australia can better harness its material resources, improve its manufacturing capacity, and secure a more balanced and resilient trade economy amid global shifts.

Reference

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