

32146 Data Visualisation and Visual Analytics - Autumn 2024

Assessment Task 3: Visual Analytics

Report: Australian International Trade

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Table of Contents

1. Introduction.....	3
2. Data Preparation Process.....	4
3. Visualisations that Analyse All Main Categories.....	5
4. Relationship between Main Categories and Sub- Categories.....	11
5. Dashboard Analysis	12
6. Storyboard Analysis.....	16
7. Conclusion.....	22
8. Bibliography.....	24

INTRODUCTION

Australia's international trade plays a crucial role in its economy, reflecting the nation's engagement with the global market. This report delves into the comprehensive dataset extracted from the Australian Bureau of Statistics (ABS), encompassing over three decades of trade data from 1988 to 2023. The dataset provides a detailed account of Australia's import and export activities, categorized into 10 main categories and further subdivided into 67 sub-categories. Each sub-category encapsulates the performance metrics of various industries, shedding light on their productivity and resource utilization.

This extensive dataset serves as a vital resource for analyzing trends, identifying growth areas, and understanding the dynamic landscape of Australia's trade. By examining the export and import values, the dataset offers insights into the economic interdependencies and strategic priorities that shape Australia's trade policies. Moreover, the detailed breakdown by industry allows for a granular analysis of how different sectors contribute to the nation's trade balance and economic health.

The subsequent sections of this report will present a series of visualizations and analyses derived from this dataset, aimed at uncovering key trends and patterns in Australia's international trade. Through this analysis, stakeholders can gain a deeper understanding of the historical and contemporary factors influencing Australia's trade dynamics, ultimately informing policy decisions and strategic planning.

DESCRIBING THE DATASET (EXPORT & IMPORT)

The Export-Import dataset sheet records the annual export values, measured in millions of Australian dollars (AUD). The data is organized by year, starting from 1988 through 2023, with each row representing a specific year. The columns detail the export values across 10 main categories, each encompassing multiple sub-categories. This hierarchical structure allows for an in-depth analysis of how different sectors contribute to the overall export performance.

The main categories in the export data include:

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

Each main category is further divided into sub-categories, providing insights into specific industries and their export performance. For instance, the Food and live animals' category might include sub-categories such as crops, livestock, and dairy products, each with its export values recorded annually.

DATA PREPERATION

To conduct a comprehensive analysis of Australia's international trade, the data preparation process involved several meticulous steps to ensure accuracy and clarity. The dataset comprises nine sheets, each serving a specific purpose in detailing the import and export activities from 1988 to 2023.

Export and Import Datasets

The foundation of the dataset lies in the Export-dataset and Import-dataset sheets. These sheets capture the annual values of exports and imports in millions of Australian dollars (AUD), spanning from 1988 to 2023. The data is categorized into various main categories, each containing multiple sub-categories, allowing for a granular analysis of different sectors and industries.

Statistical Calculation

To gain insights into the proportionate contributions of each category and sub-category, the Export-stat and Import-stat sheets were created. These sheets calculate the percentage values from the total annual export and import figures:

The share of each main category was calculated by dividing the category value by the total value in the last column.

Similarly, the sub-category share was determined by dividing the sub-category value by the respective main category value.

This step provided a clear understanding of the relative importance of different categories and sub-categories in the overall trade activities.

Analytical Trends

To analyze the year-over-year changes, the Export-Ana and Import-Ana sheets were developed. These sheets record the annual change in export and import values, calculated by dividing the current year's value by the previous year's value, resulting in a percentage change. This analysis helps in identifying trends, growth patterns, and anomalies over the years.

Combined Statistics and Analytics

For a consolidated view, the Export-stat and Import-stat sheets were merged into a single sheet called Statistics. Similarly, the Export-Ana and Import-Ana sheets were combined into the Analytics sheet. These combined sheets facilitate a more streamlined analysis by bringing together the statistical and analytical perspectives of both exports and imports.

Raw Dollar Values

Lastly, the Raw Dollar sheet was created to maintain a record of the original values from the Export-dataset and Import-dataset sheets. This sheet ensures that the raw data is preserved for reference and validation purposes.

VISUALISATIONS THAT ANALYSE ALL MAIN CATEGORIES

BAR CHART FOR STATISTICS SHEET

To effectively illustrate the share of exports and imports for specific years, We created an insightful bar chart in Tableau, incorporating various features to enhance user interaction and data comprehension. Here's a detailed account of the steps involved in creating this visualization:

Setting Up the Data:

We began by dragging all the main categories along with the trade types (Export and Import) to the Rows section. This ensured that each category's share in the trade was distinctly represented.

We then dragged Year, changing it to the time format, and Measure Names to the Columns section. This allowed the bar chart to reflect the data distribution across different years.

Filtering and Interactivity:

To enable users to explore the data for any specific year, we added Year as a filter. This functionality allows users to select a particular year they are interested in, dynamically updating the visualization accordingly.

Color Coding and Labels:

We applied color coding to the Measure Names (Export and Import) to differentiate between the two types of trade visually. This helps users quickly identify and compare the shares of exports and imports.

To provide precise information, we added labels to all the bars in the chart, displaying the exact percentage values for each category's share.

Percentage Values:

We converted the ratio values into percentage values by changing the data to 'percent of total'. This transformation allows users to understand the relative share of each category in the total trade, providing a clearer picture of the data.

Dynamic Title:

We inserted a dynamic title that changes based on the selected year. This feature enhances the chart's clarity, as the title explicitly mentions the year chosen by the user, making the visualization contextually relevant.

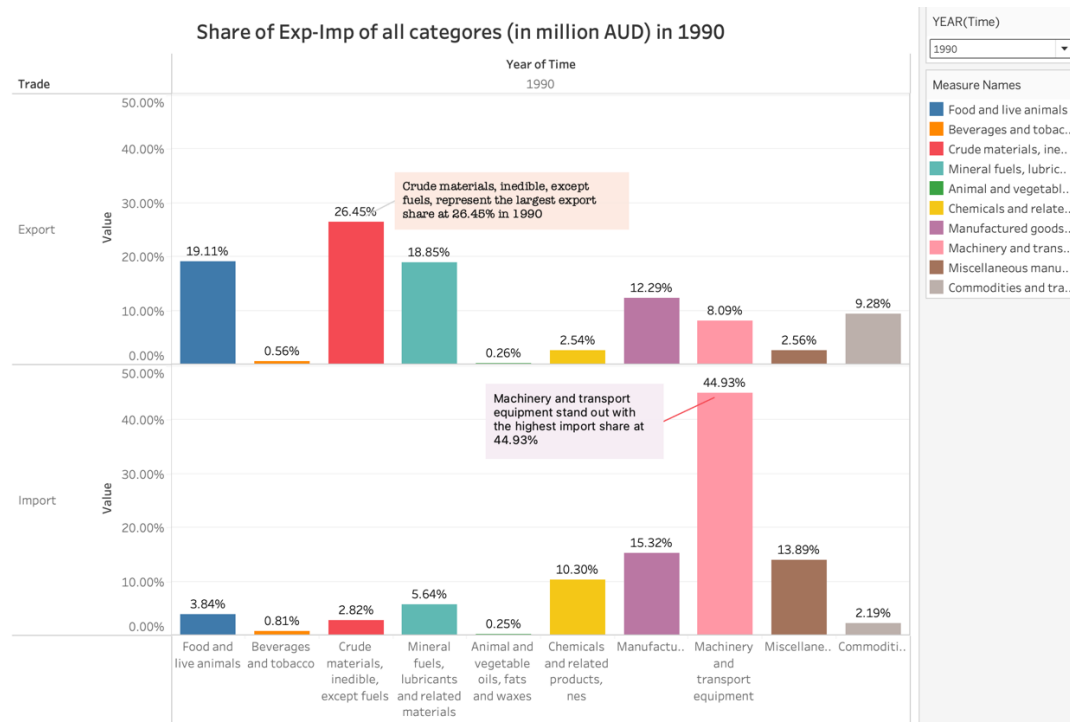


Fig 1.1

The bar chart (Fig 1.1) reveals key insights into Australia's trade patterns in 1990, highlighting significant categories like machinery, crude materials, and mineral fuels in both exports and imports. The dominance of specific categories provides a snapshot of the economic and industrial landscape of the time, indicating areas of strength and reliance on international markets.

Insight: The "Machinery and Transport Equipment" category highlights a critical area of Australia's trade dynamics in 1990. While the heavy reliance on imports underscores the importance of these goods to the economy, the existing export activities also show potential for growth. Addressing the trade imbalance in this category could yield significant economic benefits, reducing dependency on foreign goods and enhancing Australia's position in the global machinery and transport equipment market.

LINE GRAPH FOR ANALYTICS SHEET

In the next phase of our analysis, we focused on illustrating the changes in the value of exports and imports for all commodities using the Analytics sheet. This sheet is instrumental as it records the year-over-year percentage changes for various commodities, providing crucial insights into the evolving trends and dynamics of trade over time.

To create this visualization, we started by utilizing the Analytics sheet, which contains detailed records of the annual changes in value for both exports and imports across all main categories. We then selected the measure values for all main categories and dragged them into the Rows section. This setup enabled the creation of separate line graphs for each commodity, effectively showcasing their respective changes over the observed period.

Next, we added the Year field by dragging it into the Columns section. This allowed us to plot the data across the timeline from 1988 to 2023, giving a comprehensive view of the trade changes over these years. To ensure the trends were represented clearly and consistently, we used the average values for all the measure values. This approach helped smooth out any extreme fluctuations, providing a more stable and reliable visualization of the trade changes.

To enhance the user experience, we added a filter for Trade, enabling users to switch between export and import data seamlessly. This functionality allows users to generate graphs specifically for exports or imports, making it easier to analyze and compare the distinct aspects of trade.

Finally, we arranged the line graphs for each commodity within a single frame, allowing users to view and compare the trends of all categories simultaneously. This comprehensive layout facilitates the identification of overarching patterns and anomalies across different commodities, providing a holistic view of Australia's trade dynamics.

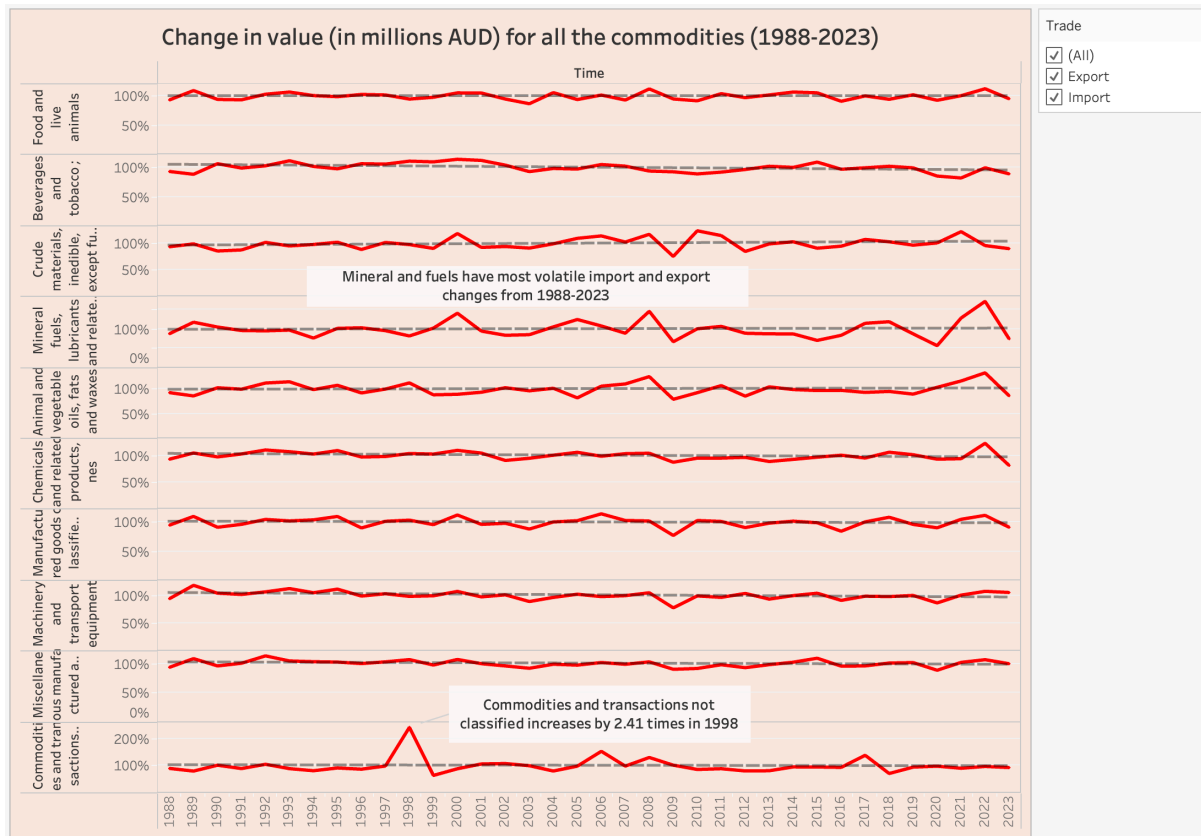


FIG 1.2

The line graph (FIG 1.2) provides a comprehensive view of the changes in trade values for various commodities from 1988 to 2023. Key insights include the volatility in mineral fuels, the stability in agricultural products, and the dynamic trends in manufactured goods and chemicals. The significant spike in commodities not classified elsewhere in 1998 underscores the impact of specific events on trade values. Overall, the graph highlights the diverse and evolving nature of Australia's international trade, influenced by global market conditions, domestic production capabilities, and strategic economic policies.

BAR CHARTS FOR RAW DOLLAR VALUE

In constructing this visualization, we began by selecting the measure values for all main categories, ensuring that each category's raw dollar values were included. We then dragged these measure values to the Rows section, allowing each main category to be represented as a distinct bar graph. This setup facilitated easy comparison of the raw dollar values across different commodities.

Next, we dragged the Year field to the Columns section, plotting the data across the timeline from 1988 to 2023. This chronological arrangement enabled us to observe how the trade values for each commodity evolved over the years.

To ensure clarity and consistency, we used the average values for all the measure values. This approach smoothed out extreme variations, providing a stable and reliable view of the trade data. The resulting bar graphs for each commodity were arranged within a single frame, offering a comprehensive and visually accessible representation of the data.

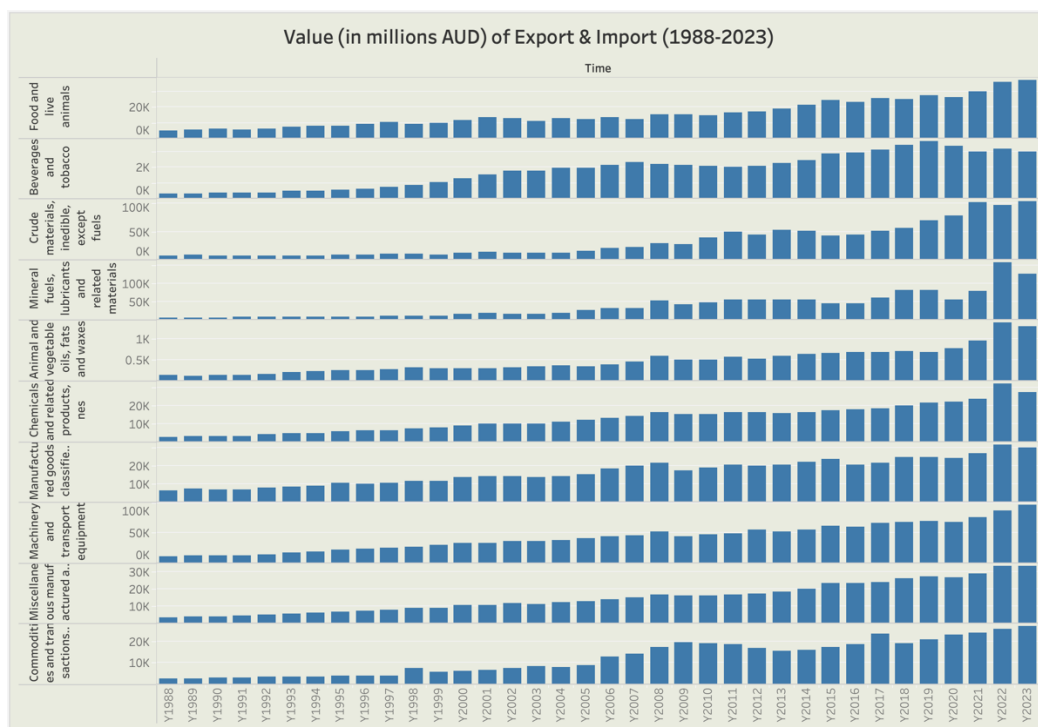


FIG 1.3

The bar chart (FIG 1.3) reveals steady growth in trade values for most commodities from 1988 to 2023, with significant contributions from categories like mineral fuels, machinery, and crude materials. While most categories show a consistent upward trend, some exhibit notable fluctuations reflecting changes in industrial demand and economic conditions. Overall, the chart underscores the robust expansion and dynamic nature of Australia's international trade.

RELATIONSHIP BETWEEN MAIN CATEGORIES AND SUBCATEGORIES IN AUSTRALIAN INTERNATIONAL TRADE

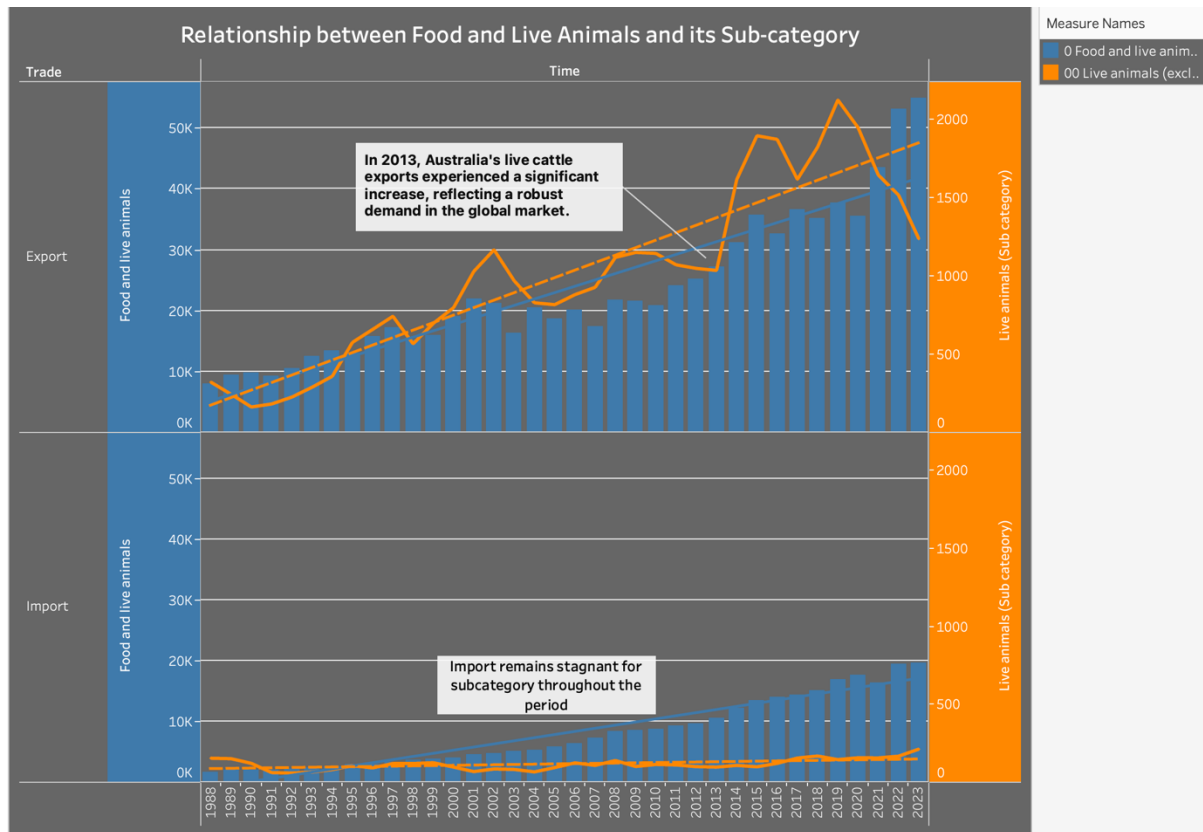


FIG 2.1

Export Trends

Overall Growth: The export values for the main category "Food and Live Animals" have shown a steady increase over the period from 1988 to 2023. This indicates a growing global demand for Australian agricultural products.

Subcategory Trends: The subcategory "Live Animals" exhibits significant fluctuations, with a notable spike in 2013. This suggests that while the overall trend is upward, certain years' experience higher volatility.

2013 Spike in Exports: In 2013, there was a significant increase in the export values of live animals. This spike can be attributed to a robust demand in the global market, particularly from Southeast Asian countries which are major importers of Australian cattle. This period also saw favorable trade conditions and possibly improved logistics and export processes, contributing to the surge in exports. [1]

Import Trends

Stagnation in Imports: The import values for "Food and Live Animals" remain relatively stagnant throughout the period. This indicates that Australia relies less on imports for this category, likely due to its strong domestic production capabilities.

Minimal Change in Subcategory Imports: The subcategory "Live Animals" shows minimal import activity, reflecting Australia's self-sufficiency in producing these goods and its focus on exporting rather than importing live animals.

DASHBOARD ANALYSIS

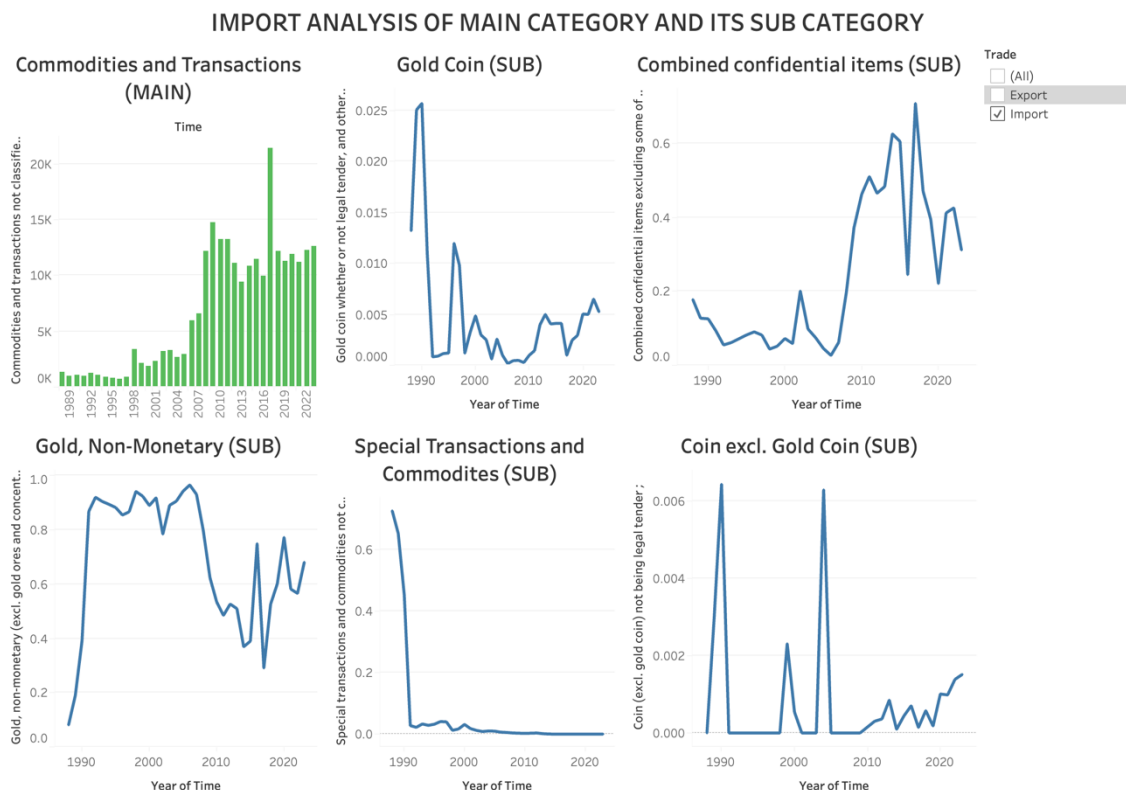


FIG 3.1

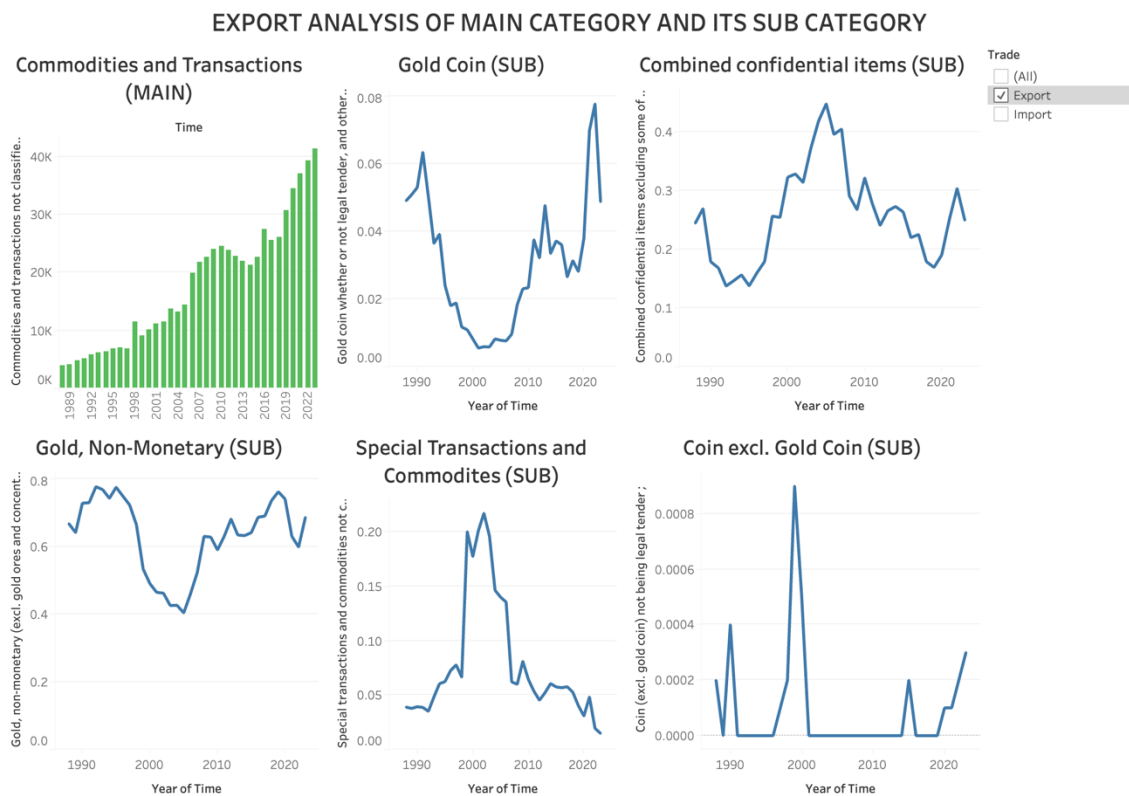


FIG 3.2

This dashboard offers a detailed analysis of Australia's import and export activities by leveraging data from the statistics and raw dollar value sheets. The bar chart showcases the total trade values for the main category "Commodities and Transactions" over time, highlighting significant growth periods. Line charts for subcategories, such as "Gold Coin" and "Gold, Non-Monetary," illustrate the trends and fluctuations in their import and export ratios. An interactive trade filter enhances usability, allowing users to switch between import and export views. The dashboard reveals critical insights, such as the steady demand for non-monetary gold and the fluctuating values of gold coins, providing a comprehensive view of trade dynamics and supporting informed decision-making.

Import Analysis of Main Category and Its Subcategories (FIG 3.1)

Trends and Insights

- **Commodities and Transactions (Main Category):** The total import value shows a general upward trend, particularly after 2000, with notable peaks around 2013 and 2019. This suggests an increasing demand for diverse commodities and transactions over time.
- **Gold Coin (Subcategory):** The import ratio for gold coins peaked significantly in the early 1990s, then experienced a steep decline and remained relatively low and stable. This indicates a historical high demand that tapered off, possibly due to market saturation or changes in trade policies.
- **Gold, Non-Monetary (Subcategory):** This subcategory shows consistent fluctuations but maintains a higher ratio compared to other subcategories. The steady demand suggests its critical role in various industrial applications or investment purposes.
- **Combined Confidential Items (Subcategory):** The import ratio for combined confidential items shows variability, with noticeable peaks around 2010 and 2018. These peaks could be linked to specific market demands or confidential trade agreements.
- **Special Transactions and Commodities (Subcategory):** This subcategory saw a high ratio in the late 1980s but dropped significantly afterward, stabilizing at a lower level. The initial high ratio may indicate one-time large transactions or the introduction of specific trade categories that were later regulated.
- **Coin Excluding Gold Coin (Subcategory):** The import ratio shows sporadic peaks, indicating occasional high demand, possibly driven by collector interest or specific financial instruments.

Export Analysis of Main Category and Its Subcategories (FIG 3.2)

Trends and Insights

- **Commodities and Transactions (Main Category):** The total export value has shown a strong and steady increase since the late 1990s, with significant growth post-2005. This reflects Australia's expanding role in global trade and its diversified export portfolio.
- **Gold Coin (Subcategory):** The export ratio for gold coins peaked in the late 1980s and early 1990s, followed by a decline and stabilization. This trend mirrors the import pattern, suggesting shifts in global gold coin demand and trade policies.

- Gold, Non-Monetary (Subcategory): The export ratio for non-monetary gold is relatively high and consistent, indicating a strong and stable global demand for Australian gold, likely for industrial use and investment.
- Combined Confidential Items (Subcategory): This subcategory shows notable peaks around 2005 and 2015, indicating periods of high demand or large confidential transactions. These could be driven by specific trade deals or market conditions.
- Special Transactions and Commodities (Subcategory): The export ratio peaked in the late 1980s and early 1990s, then declined and stabilized at a lower level. This suggests that special transactions were more prominent in earlier years but have since become more regulated or less frequent.
- Coin Excluding Gold Coin (Subcategory): The export ratio shows occasional peaks, like imports, indicating intermittent high demand periods. These peaks could be related to specific market interests or economic conditions.

Relationships and Insights

Gold Subcategories: Both "Gold Coin" and "Gold, Non-Monetary" show significant activity in both imports and exports, indicating Australia's strong position in the global gold market. The trends suggest that while demand for gold coins fluctuated, non-monetary gold maintained consistent demand, reflecting its diverse uses.

Special Transactions: The high ratios in the late 1980s for special transactions in both imports and exports indicate a period of significant trade activity, which later stabilized. This could be due to initial large deals or regulatory changes that standardized these transactions.

Confidential Items: The variability in the combined confidential items' ratios highlights periods of significant confidential trade activities. These could be driven by strategic trade agreements or sensitive market demands that fluctuate over time.

STORYBOARD ANALYSIS

STORYBOARD FOR COMMODITIES AND TRANSACTIONS & ITS SUB CATEGORIES

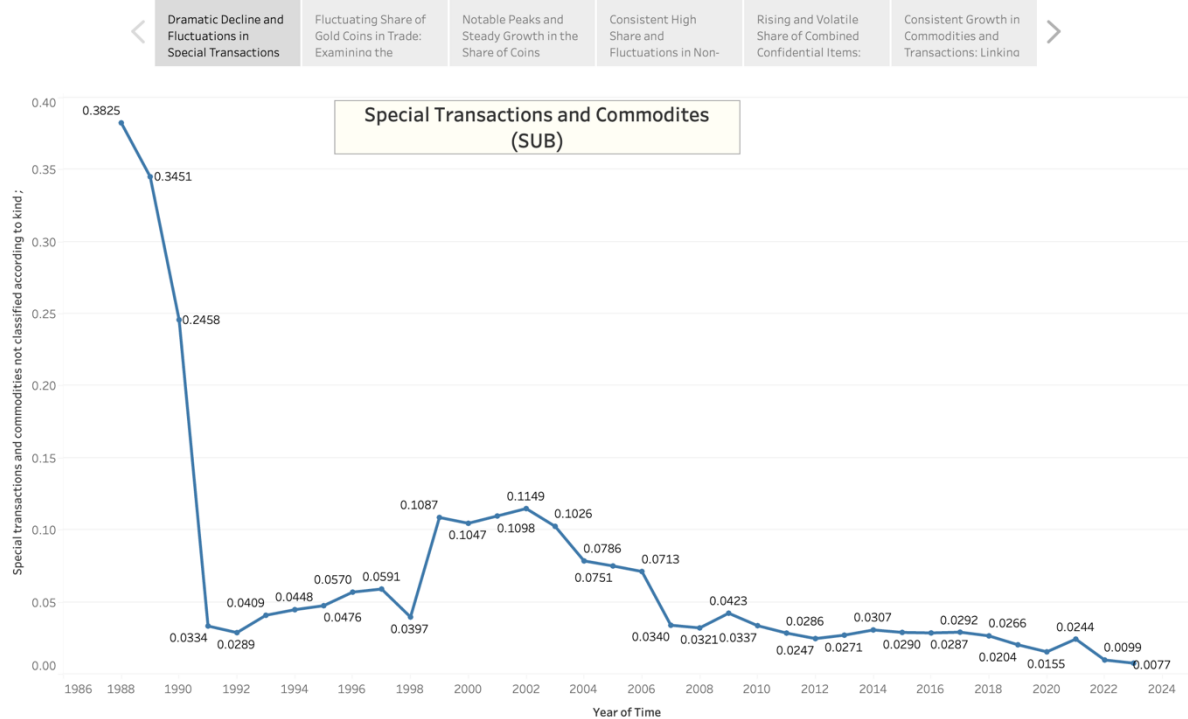


FIG 4.1 : STORY 1

CAPTION: “Dramatic Decline and Fluctuations in Special Transactions and Commodities: Analyzing the Shifts in Share of Imports and Exports from the Main Category (1988-2023)”

STORYBOARD FOR COMMODITIES AND TRANSACTIONS & ITS SUB CATEGORIES

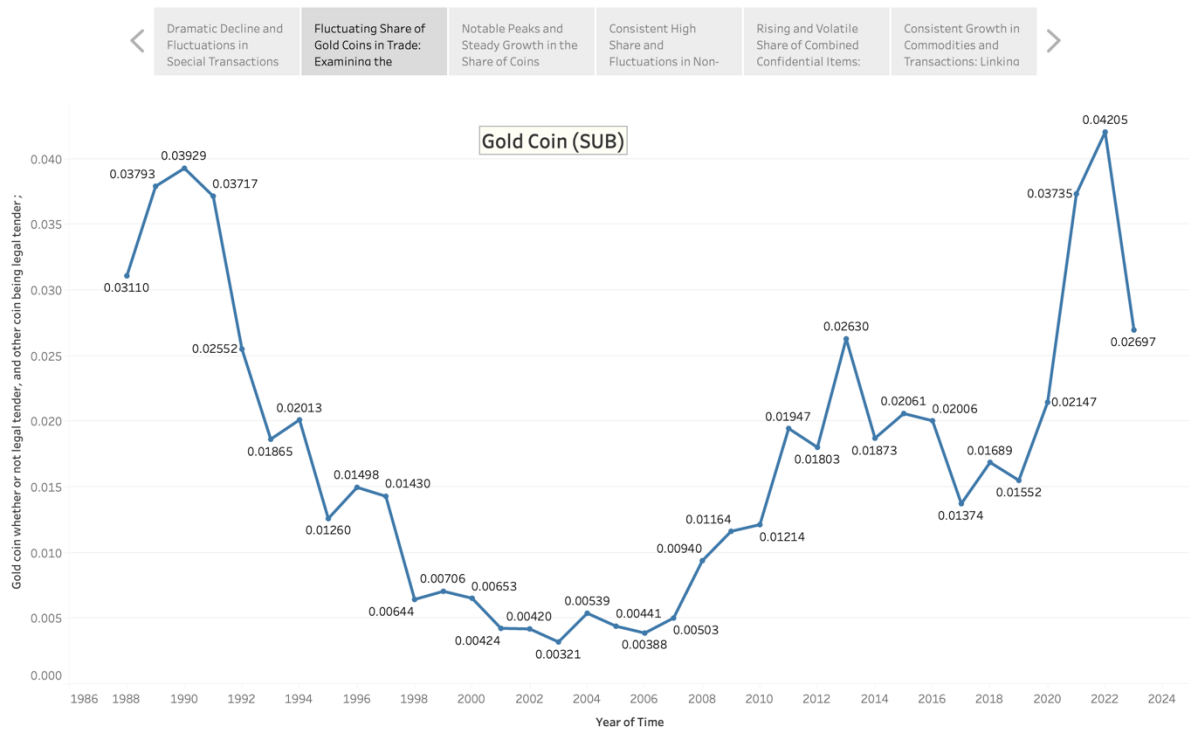


FIG 4.2: STORY 2

CAPTION: “Fluctuating Share of Gold Coins in Trade: Examining the Variability in Import and Export Shares within the Main Category (1988-2023)”

STORYBOARD FOR COMMODITIES AND TRANSACTIONS & ITS SUB CATEGORIES

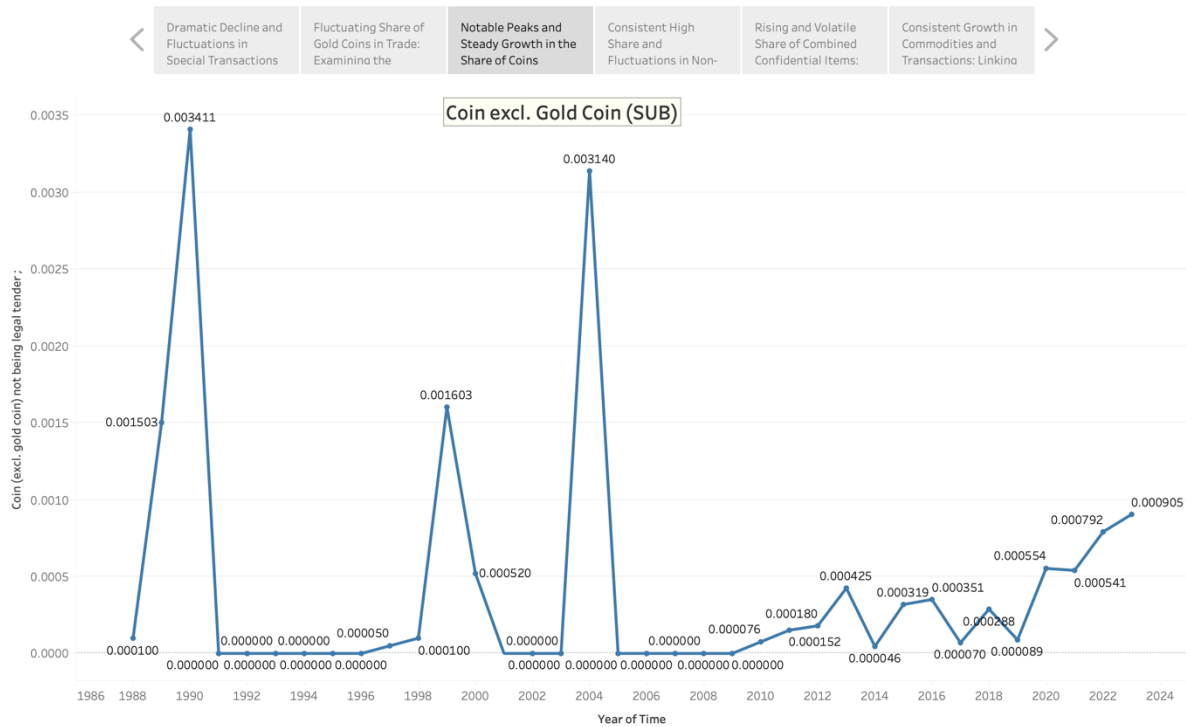


FIG 4.3: STORY 3

CAPTION: “Notable Peaks and Steady Growth in the Share of Coins Excluding Gold Coin: Tracking Import and Export Trends within the Main Category (1988-2023)”

STORYBOARD FOR COMMODITIES AND TRANSACTIONS & ITS SUB CATEGORIES

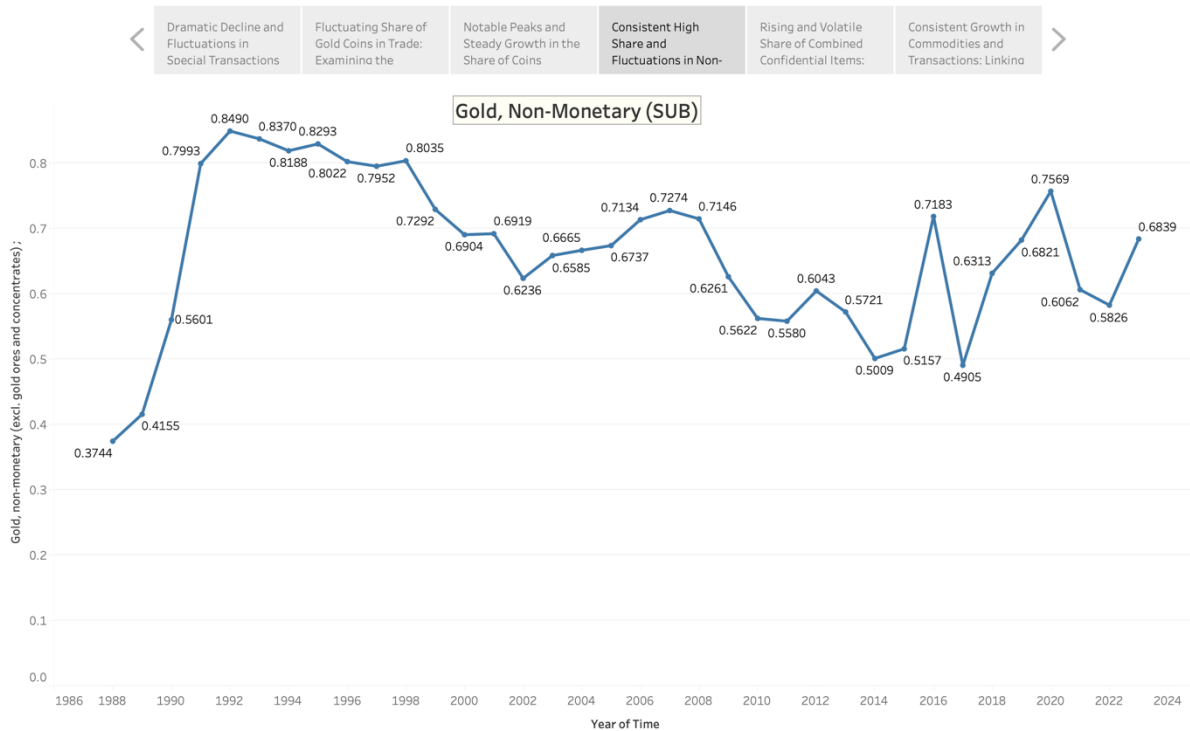


FIG 4.4: STORY 4

CAPTION: “Consistent High Share and Fluctuations in Non-Monetary Gold: Tracking the Import and Export Trends within the Main Category (1988-2023)”

STORYBOARD FOR COMMODITIES AND TRANSACTIONS & ITS SUB CATEGORIES

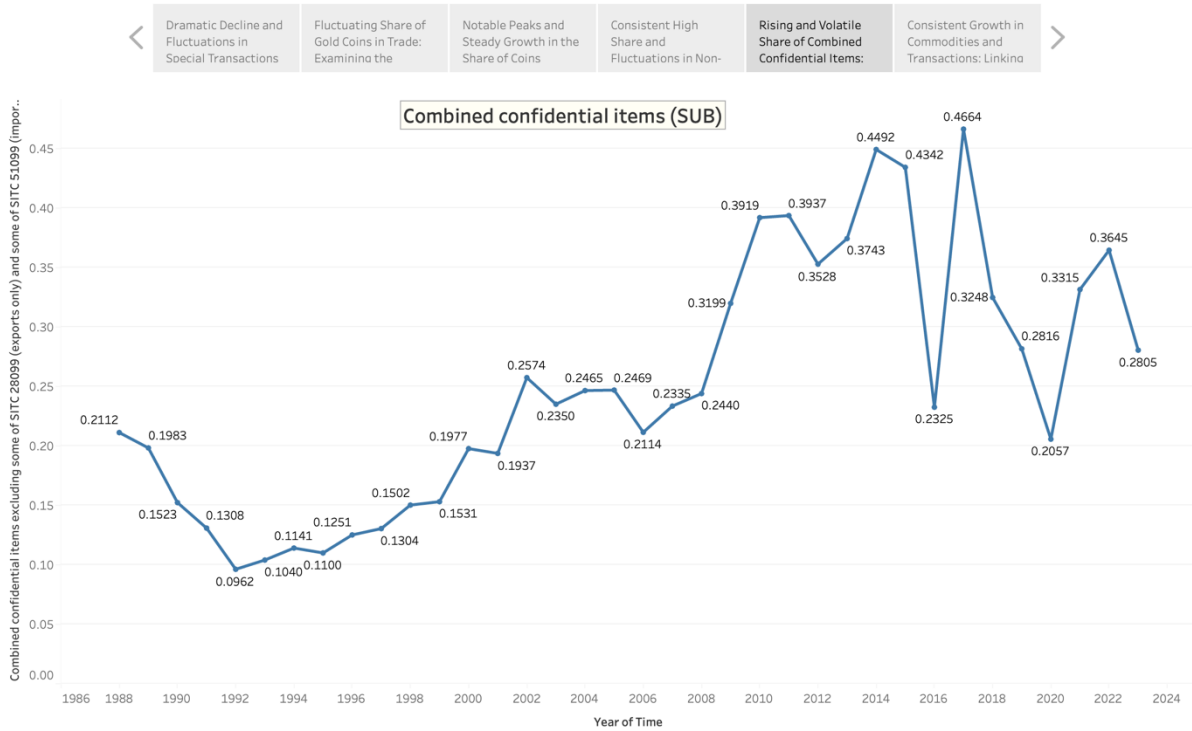


FIG 4.5: STORY 5

CAPTION: “Rising and Volatile Share of Combined Confidential Items: Analyzing Import and Export Shares within the Main Category (1988-2023)”

STORYBOARD FOR COMMODITIES AND TRANSACTIONS & ITS SUB CATEGORIES

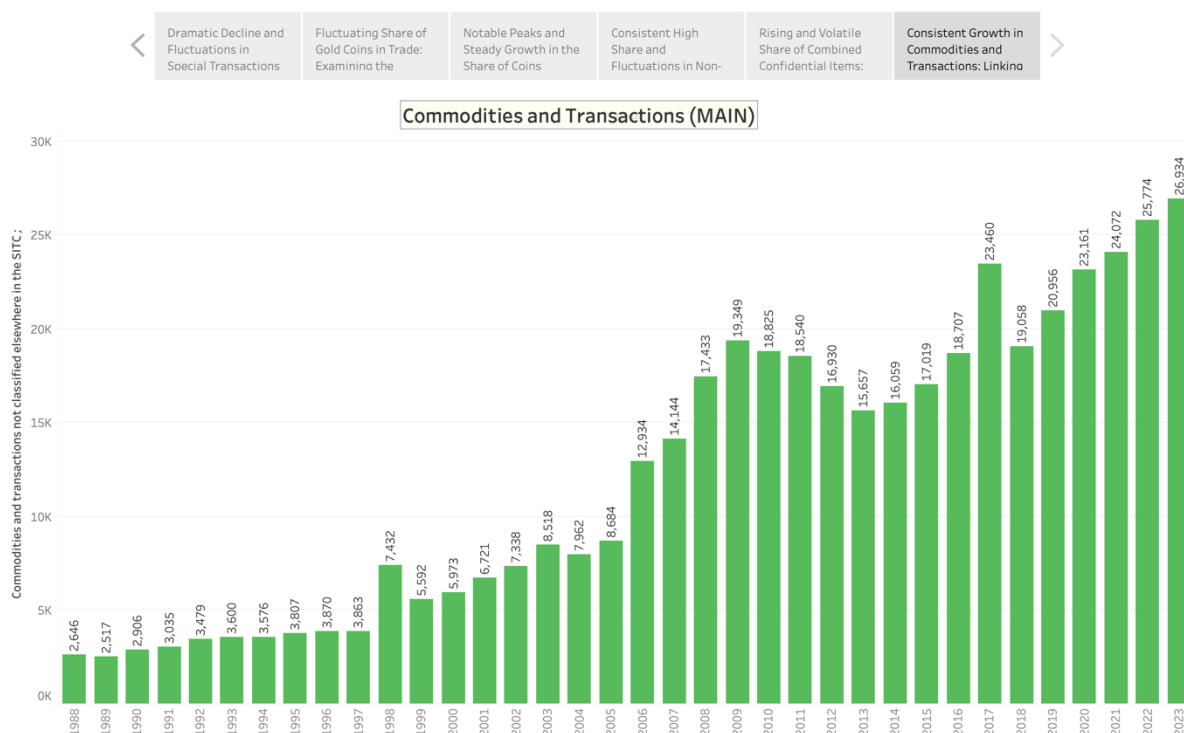


FIG 4.6: FINAL STORY

CAPTION: “Consistent Growth in Commodities and Transactions: Linking Overall Import and Export Values to Subcategory Trends (1988-2023)”

Our storyboard begins with an overarching view of the main category, "Commodities and Transactions," showcasing a steady increase in import and export values from 1988 to 2023. This growth, highlighted in the bar chart, sets the stage for a deeper exploration into the subcategories that drive these trends. We first delve into "Special Transactions and Commodities," where we observe a dramatic decline in its share from the late 1980s, followed by fluctuating recovery attempts, indicating shifts in market dynamics and regulatory changes. Moving to "Gold Coin," the line chart reveals significant peaks and troughs, reflecting varying global demand and economic conditions affecting the trade of gold coins. The "Coin excluding Gold Coin" subcategory presents notable peaks in certain years, followed by a steady growth trend, suggesting periodic high demand, likely driven by collector interest or specific financial strategies. In the case of "Gold, Non-Monetary," the chart shows a consistently high share with periodic fluctuations, underscoring its critical role in industrial applications and investments. Finally, "Combined Confidential Items" exhibit rising and volatile shares, pointing to the impact of confidential transactions and specific trade deals. Together, these charts weave a comprehensive narrative of how subcategory trends contribute to the overall growth in the main category, providing a holistic view of Australia's evolving trade landscape.

CONCLUSION

This comprehensive analysis of Australia's international trade, based on data from the Australian Bureau of Statistics spanning from 1988 to 2023, reveals critical insights into the country's economic engagement with the global market. The dataset, encompassing import and export activities across 10 main categories and 67 sub-categories, provides a detailed view of the performance metrics of various industries.

The meticulous data preparation involved organizing the dataset into nine sheets, each detailing specific aspects of trade. The Export-dataset and Import-dataset sheets capture annual values in millions of Australian dollars (AUD). The Export-stat and Import-stat sheets provide percentage values, highlighting the proportionate contributions of each category. The Export-Ana and Import-Ana sheets record year-over-year changes, identifying trends and anomalies. The combined Statistics and Analytics sheets offer a streamlined analysis, while the Raw Dollar sheet maintains the original values for reference.

Key Findings from Visualizations

Bar Chart for Statistics Sheet

The bar chart illustrates the share of exports and imports for specific years, highlighting significant categories such as machinery, crude materials, and mineral fuels. This visualization underscores the critical role of these categories in Australia's trade dynamics and reveals potential areas for growth and trade balance improvement.

Insight: The "Machinery and Transport Equipment" category in 1990 highlights Australia's reliance on imports, suggesting opportunities to enhance domestic production and reduce dependency on foreign goods.

Line Graph for Analytics Sheet

The line graphs from the Analytics sheet track annual changes in value for both exports and imports across all main categories, providing a comprehensive view of trade trends from 1988 to 2023. The graphs reveal volatility in mineral fuels, stability in agricultural products, and dynamic trends in manufactured goods and chemicals.

Insight: The diverse and evolving nature of Australia's international trade is influenced by global market conditions, domestic production capabilities, and strategic economic policies.

Bar Charts for Raw Dollar Value

These bar charts depict the raw dollar values for all main categories, showing steady growth in most commodities from 1988 to 2023. Significant contributions from categories like mineral fuels, machinery, and crude materials highlight the robust expansion of Australia's international trade.

Insight: The consistent upward trend in trade values underscores the dynamic nature of Australia's trade landscape and its expanding role in global commerce.

Analysis of Relationships Between Main Categories and Subcategories

The analysis of the "Food and Live Animals" category reveals a steady increase in export values, with notable fluctuations in the "Live Animals" subcategory. The 2013 spike in live animal exports reflects robust global demand and improved trade conditions. Import values for this category remain stagnant, indicating Australia's self-sufficiency.

Insight: Minimal import activity in the "Live Animals" subcategory highlights Australia's focus on exporting these goods, leveraging strong domestic production capabilities.

Dashboard and Storyboard Analysis

The dashboard, integrating data from the statistics and raw dollar value sheets, provides a detailed analysis of import and export activities. The bar chart showcases total trade values over time, while line charts for subcategories like "Gold Coin" and "Gold, Non-Monetary" highlight trends and fluctuations. An interactive trade filter enhances usability, allowing users to switch between import and export views.

Key Insight: Steady demand for non-monetary gold and fluctuating values of gold coins provides a comprehensive view of trade dynamics, supporting informed decision-making.

Recommendations

Enhance Export Activities: Focus on high-demand subcategories like non-monetary gold to capitalize on global market opportunities.

Address Trade Imbalances: Improve domestic production capabilities in categories like machinery and transport equipment to reduce dependency on imports.

Inform Trade Policies: Use data insights to guide strategic planning and policy decisions, focusing on sectors with significant growth potential.

Advantages of the Dashboard and Storyboard

Interactive Exploration: Users can switch between different views and focus on specific aspects of trade.

Comprehensive Analysis: Integration of statistical and raw dollar values provides a holistic view of trade dynamics.

Data-Driven Decisions: Detailed insights support informed policy decisions and strategic planning.

In conclusion, this analysis combines meticulous data preparation with insightful visualizations to offer a detailed and actionable understanding of Australia's international trade. The findings support strategic growth and economic resilience, emphasizing the importance of leveraging data-driven insights for informed decision-making and policy development.

BIBLIOGRAPHY

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