

# Data Visualization and Analysis

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## Executive Summary

Report on Australian International Trade Dataset Analysis (1988 - 2023)

This report presents findings from an in-depth analysis of trade data, specifically focusing on the import and export volumes across various product categories over several years. Key graphical techniques, including trend lines, bar charts, and outlier analysis, were employed to visualize and understand patterns within the dataset.

### Main Categories:

1. Food and Live Animals
2. Beverages and Tobacco
3. Crude Materials (Inedible, Except Fuels)
4. Mineral Fuels
5. Animal and Vegetable Oils
6. Chemicals and Related Products
7. Manufactured Goods
8. Machinery and Transport Equipment
9. Miscellaneous Manufactured Articles
10. Commodities and Transactions Not Classified Elsewhere

### Key Findings:

- **Rising Trends in Food Exports:** The "Food and Live Animals" category demonstrated a steady increase in export volumes, indicating a growing demand for these goods globally.
- **Volatility in Machinery Imports:** "Machinery and Transport Equipment" imports showed significant fluctuations, suggesting potential influences from global economic conditions and shifts in manufacturing demands.
- **Outliers in Mineral Fuels:** Notable spikes in "Mineral Fuels" imports and exports were identified, likely due to changes in energy policies, price fluctuations, or supply chain disruptions.
- **Stable Growth in Manufactured Goods:** The "Manufactured Goods" category exhibited consistent growth, highlighting its role as a stable contributor to trade volumes.

The report concludes with recommendations to support strategic decision-making in key industries. Additionally, a comparative analysis of dashboard and storyboard methodologies is provided. While dashboards are advantageous for real-time monitoring and quick insights, storyboards offer a detailed narrative, suitable for presenting complex analyses. Both approaches have unique benefits and limitations, and their application depends on the specific needs of the audience.

## Data Preparation

### The Statistical Pattern (Ratios)

To calculate each category's share of total annual imports and exports, the category's value is divided by the total import or export value and multiplied by 100. This provides a clear view of each category's contribution to the yearly trade total.

#### Category Calculation:

- **Import Percentage** =  $(\text{Category Import} / \text{Total Import}) \times 100$
- **Export Percentage** =  $(\text{Category Export} / \text{Total Export}) \times 100$

#### Sub-Category Calculation: For each sub-category within a main category:

- **Import Percentage** =  $(\text{Sub-category Import} / \text{Category Import}) \times 100$
- **Export Percentage** =  $(\text{Sub-category Export} / \text{Category Export}) \times 100$

For example, in 1988, "Beverages" had an import percentage of 0.87% and an export percentage of 0.64%. Within "Beverages," "Tobacco" contributed 28.07% of imports and 8.09% of exports. These percentages are useful in visualizations to compare category contributions.

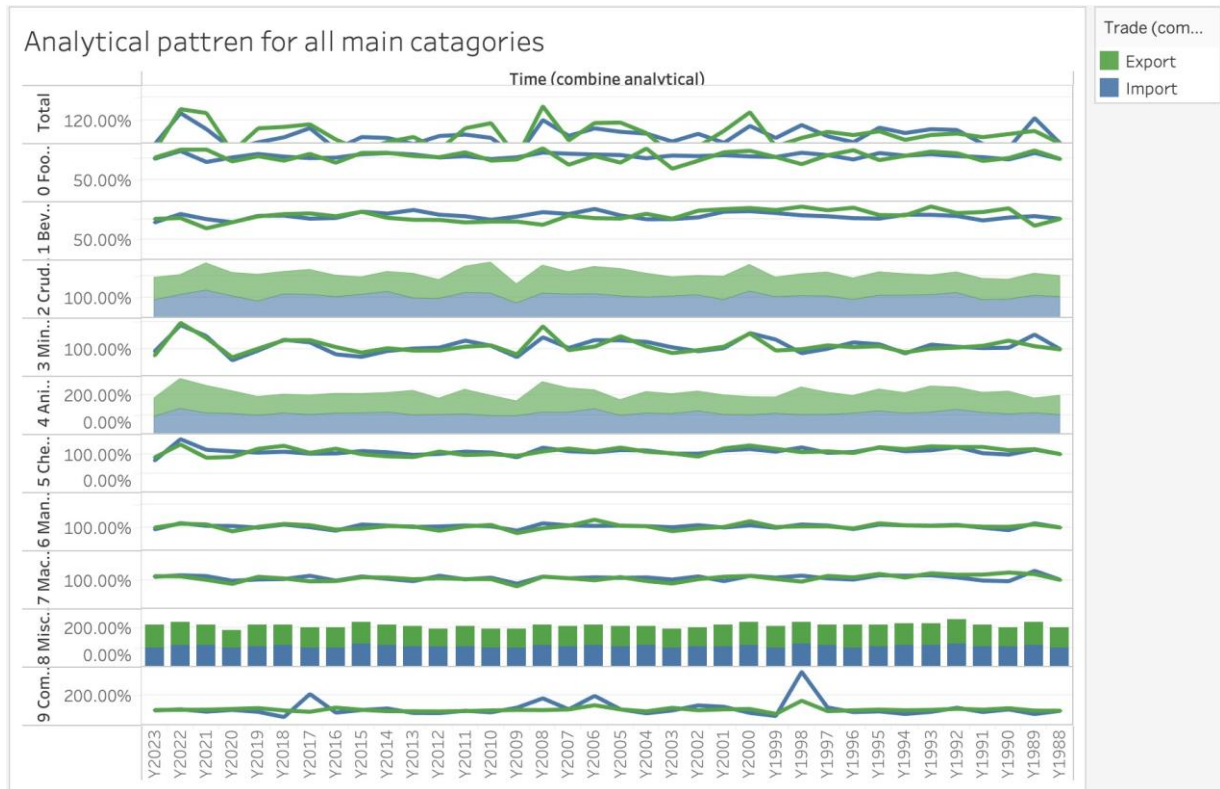
### The Analytical Pattern (Changes)

To assess year-over-year changes in each category or subcategory, I calculated the change ratio by dividing the current year's value by the previous year's value. This method highlights annual fluctuations, helping to identify growth trends and declines.

For example, the "Beverages" category's import total rose from AUD 367 million in 1988 to AUD 386 million in 1989, resulting in a change ratio of 105.18%. Conversely, exports for "Beverages" fell from AUD 272 million to AUD 228 million, with a ratio of 83.82%.

Data was organized into "Statistical-Combined," "Analytical-Combined," and "Dollar Combined" datasets and imported into Tableau. The base year, 1988, was set at 100% to provide a reference point, supporting time-series analysis for both statistical and analytical insights.

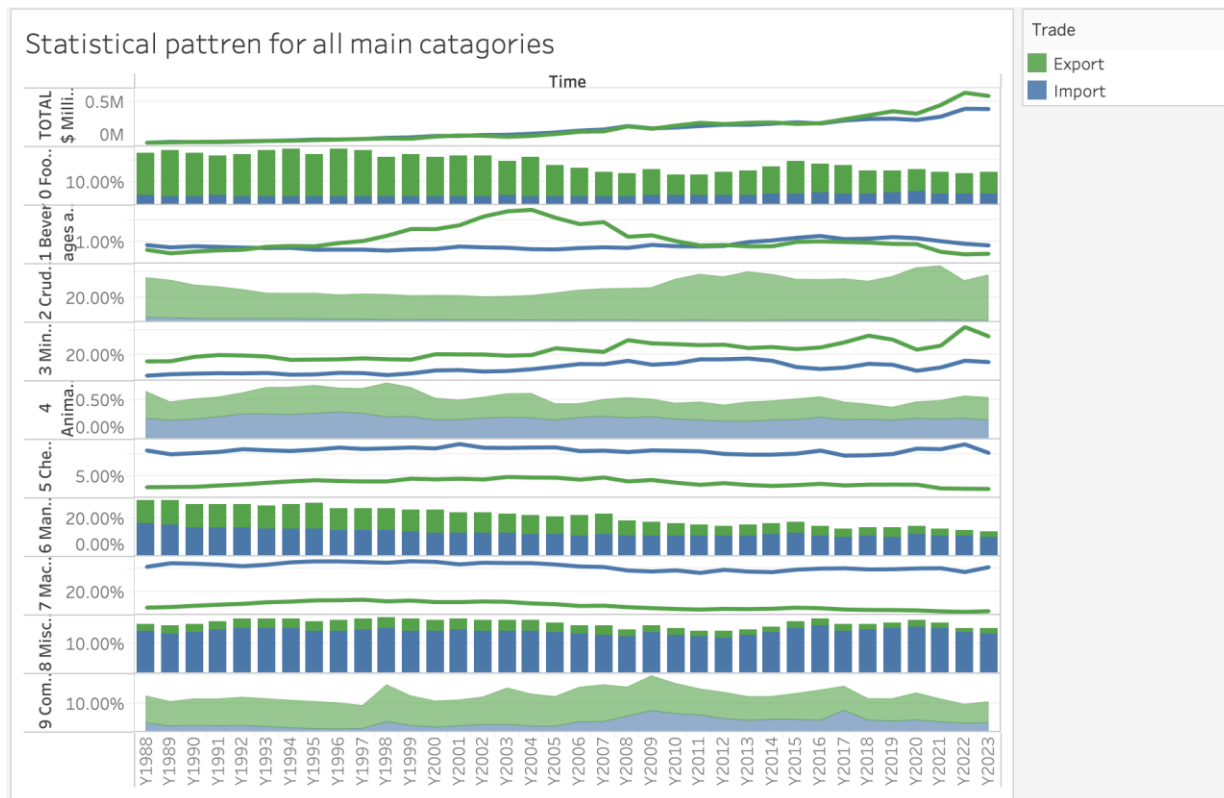
## All Main Categories



The visualization of year-over-year changes across main categories reveals fluctuations in sectors such as Food and Live Animals, Beverages, Crude Materials, Mineral Fuels, Animal and Vegetable Oils, Chemicals, Manufactured Goods, Machinery, Miscellaneous Articles, and Commodities. By examining annual import and export trends, one can identify economic factors that influence growth rates, either positively or negatively.

A notable trend is the 367% surge in commodity imports in 1998 compared to the previous year. This spike resulted from a favorable exchange rate between the US dollar and the Australian dollar, with the US dollar facilitating 83% of the trade and the Australian dollar 17% (ABS, 1998). This exchange rate made imports cheaper, boosting foreign goods' inflow.

Another significant observation is the sharp decline in import and export trade in 2009, linked to the Global Financial Crisis (GFC). In 2009, Australia's total merchandise trade dropped by 11.6%, marking the first trade decrease since 1964-65. Exports fell by AUD 27.4 billion, or 12.2%, from a 2008 peak of AUD 224.3 billion to AUD 196.9 billion (APH, 2009). This decline contributed to a recession in the Australian economy and limited global trade volumes.

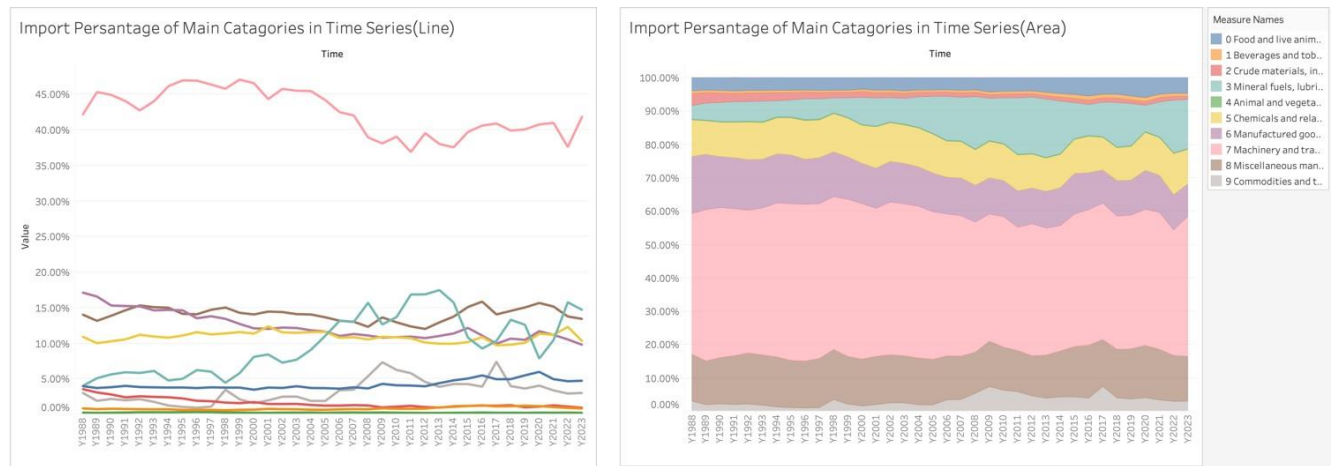


The graph provides an overview of trade patterns across main categories, illustrating total trade volumes in millions of dollars. Various chart types, including line, area, and bar charts, are used to visualize import and export ratios for each category.

### Key Insights:

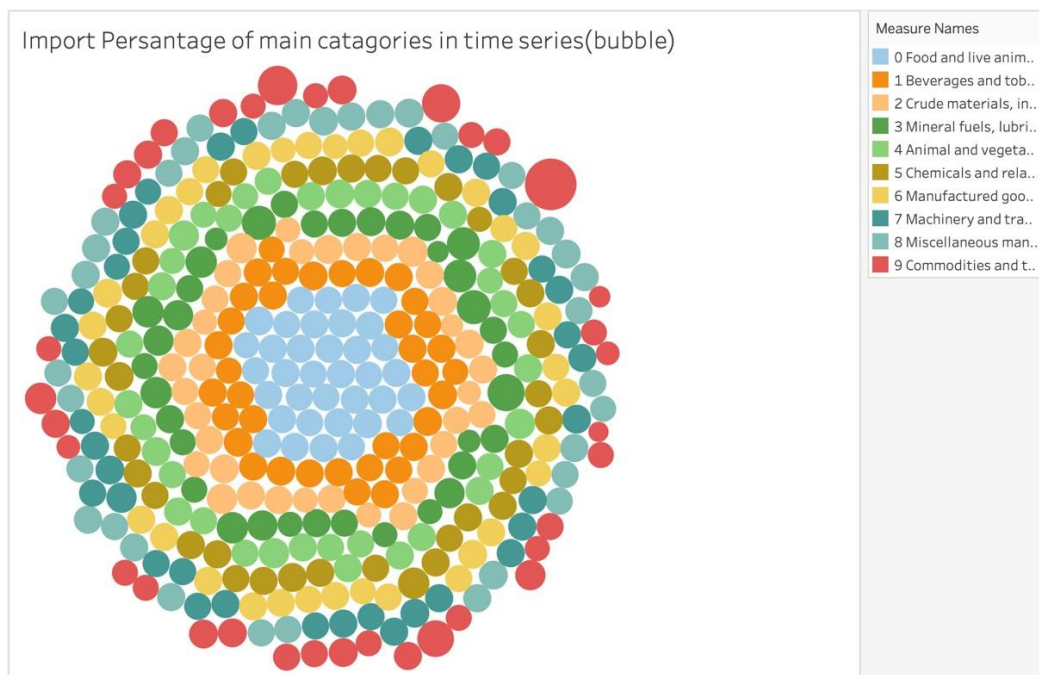
- **Food and Live Animals:** A notable 15% decrease in exports was observed in 2004, largely due to strict biosecurity regulations under the Australian Standards for the Export of Livestock. These measures aimed to improve animal welfare but impacted export levels.
- **Beverages:** Exports surged by 150% over a decade, peaking at 2.5% of total exports before declining sharply due to recent tariffs imposed by China on Australian bottled wine. These tariffs, along with higher shipping costs, led to a 27% reduction in exports from 2020 to 2023, resulting in a \$2.1 billion impact on the industry.
- **Steady Export Strength:** Categories such as Food and Live Animals, Crude Materials, and Commodities have maintained stable export levels, indicating robust international demand.
- **High Import Reliance:** Imports are substantial in sectors like Chemicals, Machinery, and Miscellaneous Articles, reflecting Australia's dependency on foreign goods to meet local demands in these industries.

Overall, this data visualization highlights Australia's evolving trade dynamics, emphasizing the impact of regulatory changes, international relations, and global market conditions on trade volumes.



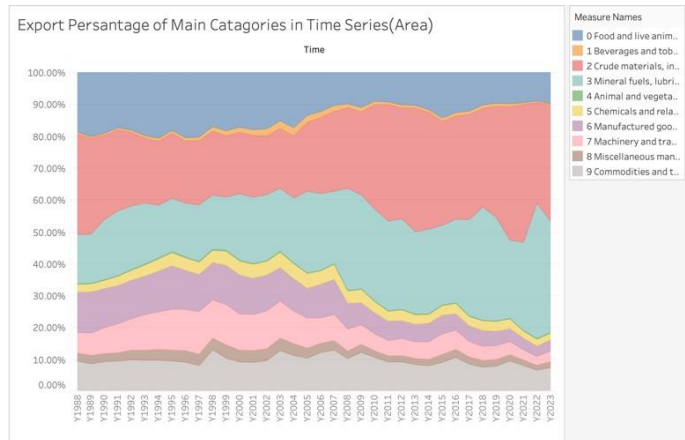
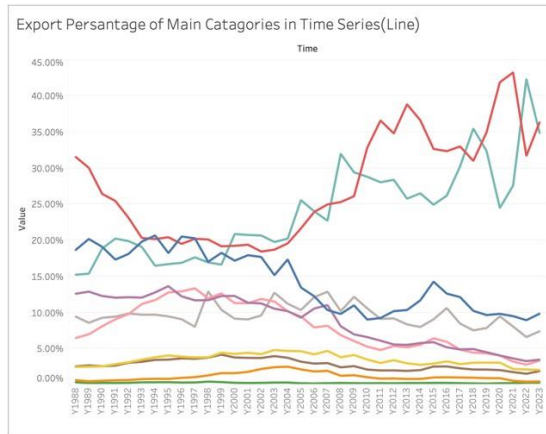
The analysis of import percentages across main categories from 1988 to 2023 reveals key drivers of Australian imports. The most significant contributor is the "Machinery and Transport Equipment" category, which consistently accounts for approximately 40% of total imports annually. Over this period, imports of machinery and transport equipment averaged AUD 6,054.82 million, emphasizing Australia's reliance on these goods.

Another critical category is "Mineral Fuels," which reached its peak contribution at 18% of total imports in 2013, a notable increase of 13% since 1988. The rise in demand for mineral fuels aligns with free trade agreements with countries such as China and reduced tariffs in the Asia-Pacific region. These agreements, particularly with New Zealand and PNG, which together account for 58% of crude refinery feedstock imports, have strengthened Australia's trade position in the energy sector.



The visualizations, including line, area, and bubble charts, provide an in-depth look at import distribution by category and year. In Tableau, further filtering allows for specific year-by-year comparisons, giving a more granular view of import trends across these main categories and highlighting their impact on the Australian economy.

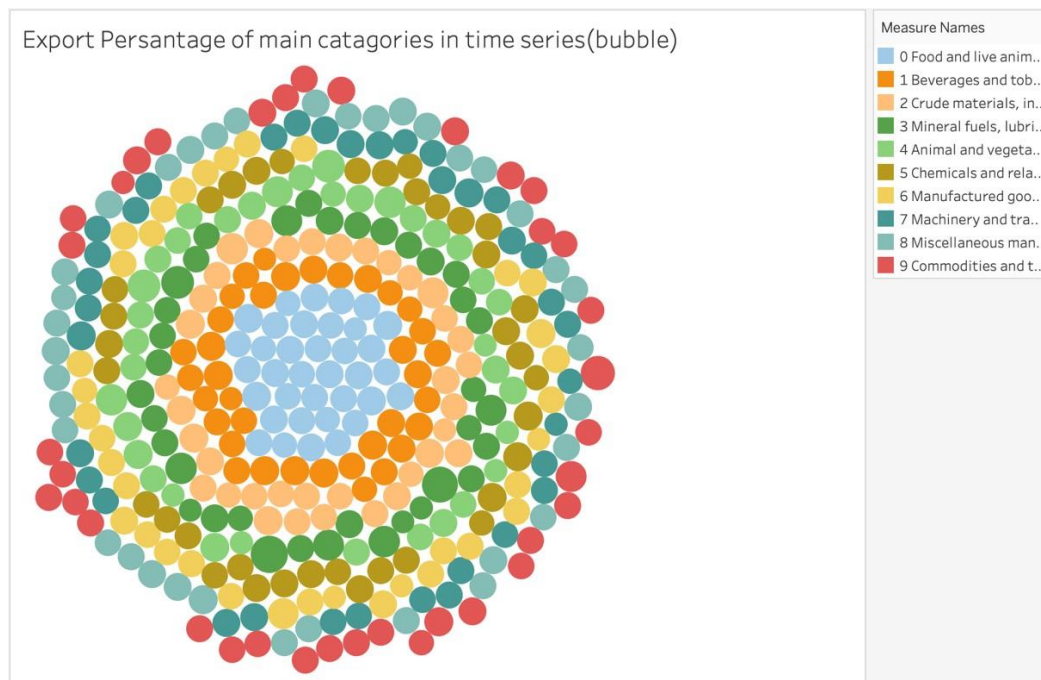




The export percentages of Australia's main categories from 1988 to 2023 highlight the key sectors driving the country's exports. "Machinery and Transport Equipment" is the largest contributor, averaging 40% of total exports annually, with a yearly export value of AUD 6,054.82 million.

"Mineral Fuels" also stands out, peaking at 18% of exports in 2013, a 13% increase since 1988. This growth is linked to trade agreements with China and tariff reductions in the Asia-Pacific region, with key partners like New Zealand and PNG, which together supply 58% of Australia's crude refinery exports.

The visualizations, including line, area, and bubble charts, depict annual export percentages across categories, with Tableau filters enabling specific, year-by-year insights. This detailed view enhances understanding of Australia's export dynamics and highlights significant shifts over time.





## Dashboards

Agriculture plays a crucial role in Australia’s economy, impacting social, economic, and environmental sustainability. With over 85,000 farm businesses across the nation (National Farmers Federation, 2018), Australian agriculture produces a variety of commodities such as beef, cotton, dairy, grains, and sugar. Over the past 30 years, global demand for Australian agricultural products has increased, with exports becoming a vital part of the industry.

To analyze trends within the "Food and Live Animals" category, two dashboards were created to provide insights into export and import dynamics. These dashboards focus on key sub-categories, including Live animals, Meat and meat preparations, Dairy products and birds’ eggs, Fish and seafood, Cereals, Vegetables and fruits, Sugars, Coffee, Animal feed, and other edible preparations.

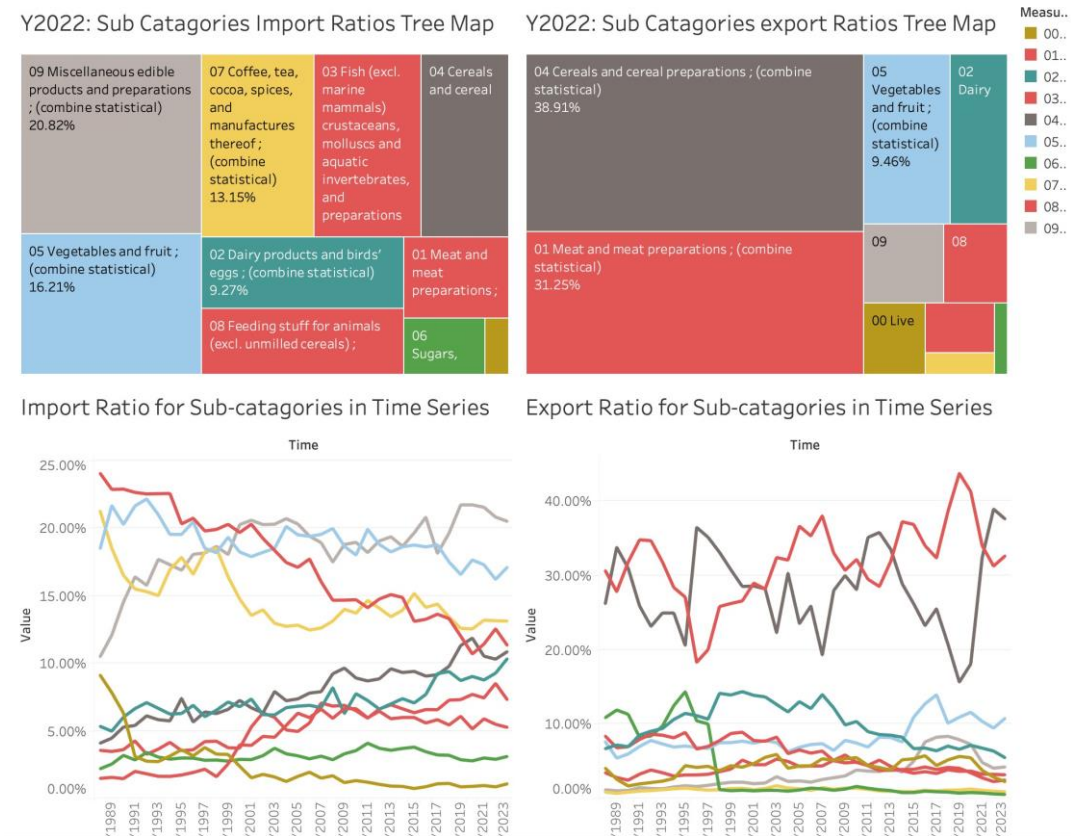
### Key Insights from the Dashboards:

**Import Ratios (2022):** A tree map visualization shows that the largest imports within this category are cereals and meat preparations. The time-series graph highlights fluctuations in import ratios over the years, with notable peaks and declines driven by changes in domestic demand and international supply conditions.

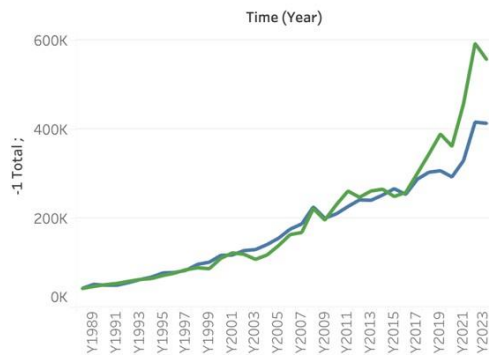
**Export Ratios (2022):** Exports are dominated by meat and meat preparations, dairy, and cereals, which reflect Australia’s strong market position in these areas. The export time-series chart illustrates steady growth in demand for these products, with spikes during periods of high global demand or favorable trade agreements.

The dashboards allow for a focused analysis of each sub-category’s contribution to Australia’s agricultural trade, revealing patterns and shifts in export and import trends. By examining these visualizations, stakeholders can identify areas of opportunity and potential risks, helping guide strategic decisions in the agricultural sector.

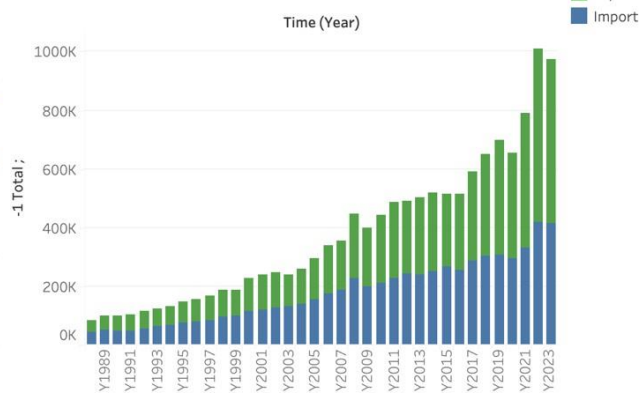
### Changes and Trends in Sub-Categories of Food and Live Animals



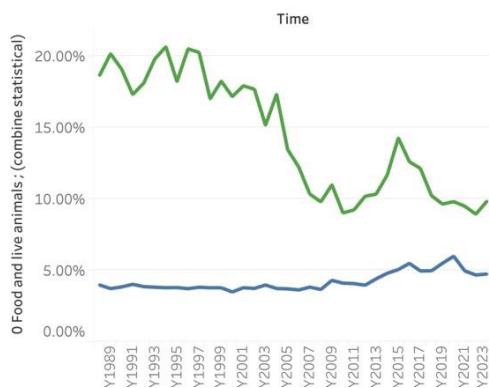
Total Exports (\$Million) in Time Series (Line)



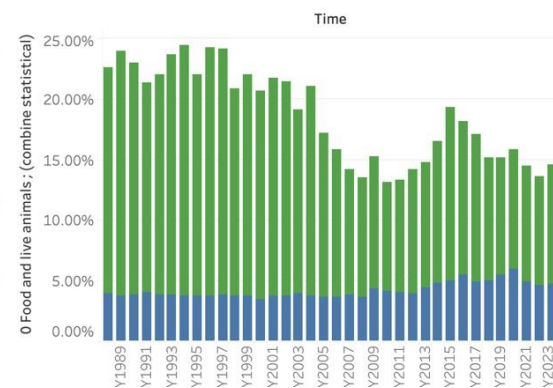
Total Exports (\$Million) in Time Series (Bar)



Exports Percentage of Food and Live Animal in Time Series (Line)



Exports Percentage of Food and Live Animal in Time Series (Bar)



The integrated dashboard provides a clear view of trends in Australia's "Food and Live Animals" exports and imports from 1995 to 2023. Key insights include:

**Export Growth:** Steady growth in high-demand products like meat, dairy, and cereals has solidified Australia's role as a key supplier in the Asia-Pacific, benefiting from trade agreements and reduced tariffs.

**Impact of Global Events:** Events such as COVID-19 and the Global Financial Crisis affected demand and supply, with notable fluctuations in imports and exports.

**Import Dependence:** Australia relies on imports of certain food items, exposing it to global supply disruptions, as seen during the COVID-19 pandemic.

**Trade Balance:** The comparison of imports and exports shows resilience, with exports recovering quickly post-crisis, indicating a strong agricultural sector.

This dashboard aids in strategic decision-making by offering a comprehensive, visual overview of trade dynamics and potential risks.

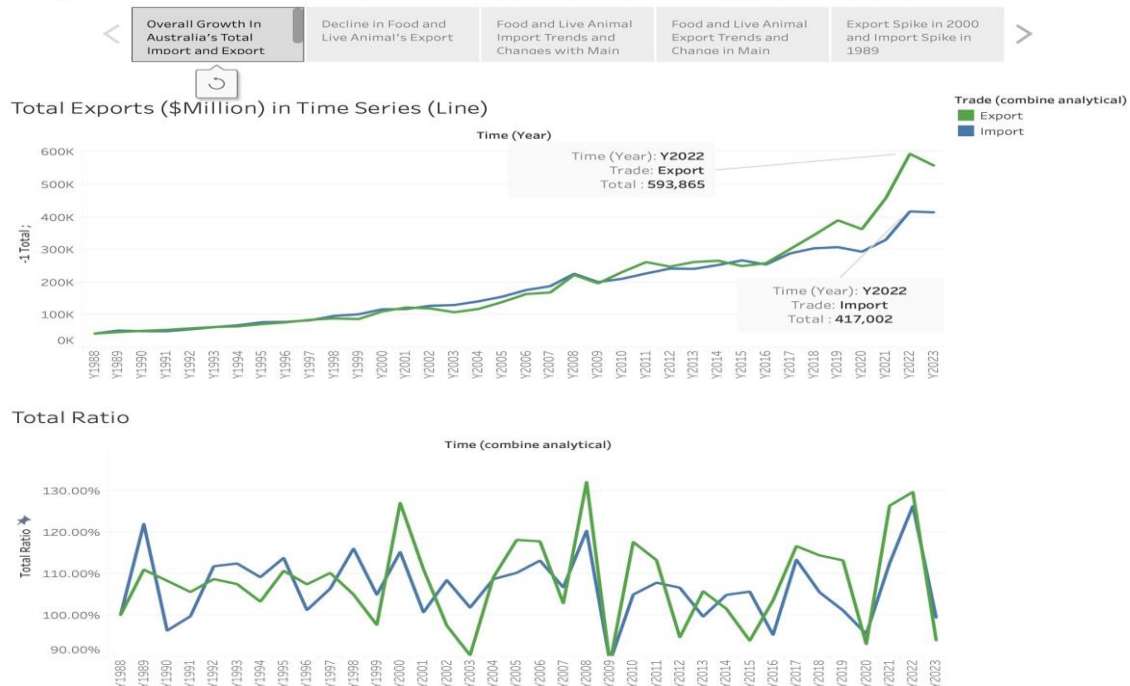
## Storyboards

The storyboard in Tableau uses a sequence of visualizations to create a cohesive narrative about Australia's trade in "Food and Live Animals." Each dashboard forms a story point, with five key points highlighted for analysis.

### Story Point 1

This point presents Australia's growth in "Food and Live Animals" exports and imports, illustrated through line graphs. The top graph shows total export and import values over time, highlighting Australia's expanding global trade footprint in agriculture. The bottom graph compares import and export ratios, providing insight into the balance between them and capturing fluctuations driven by factors such as global demand and economic shifts. By visualizing these metrics, the storyboard offers a clear, structured view of trade trends, helping stakeholders track performance and identify shifts in trade dynamics over time.

Changes and Trends in Australia's Trade & Imports and Exports of Food and Live Animals



**The storyboard highlights key phases in Australia's trade evolution:**

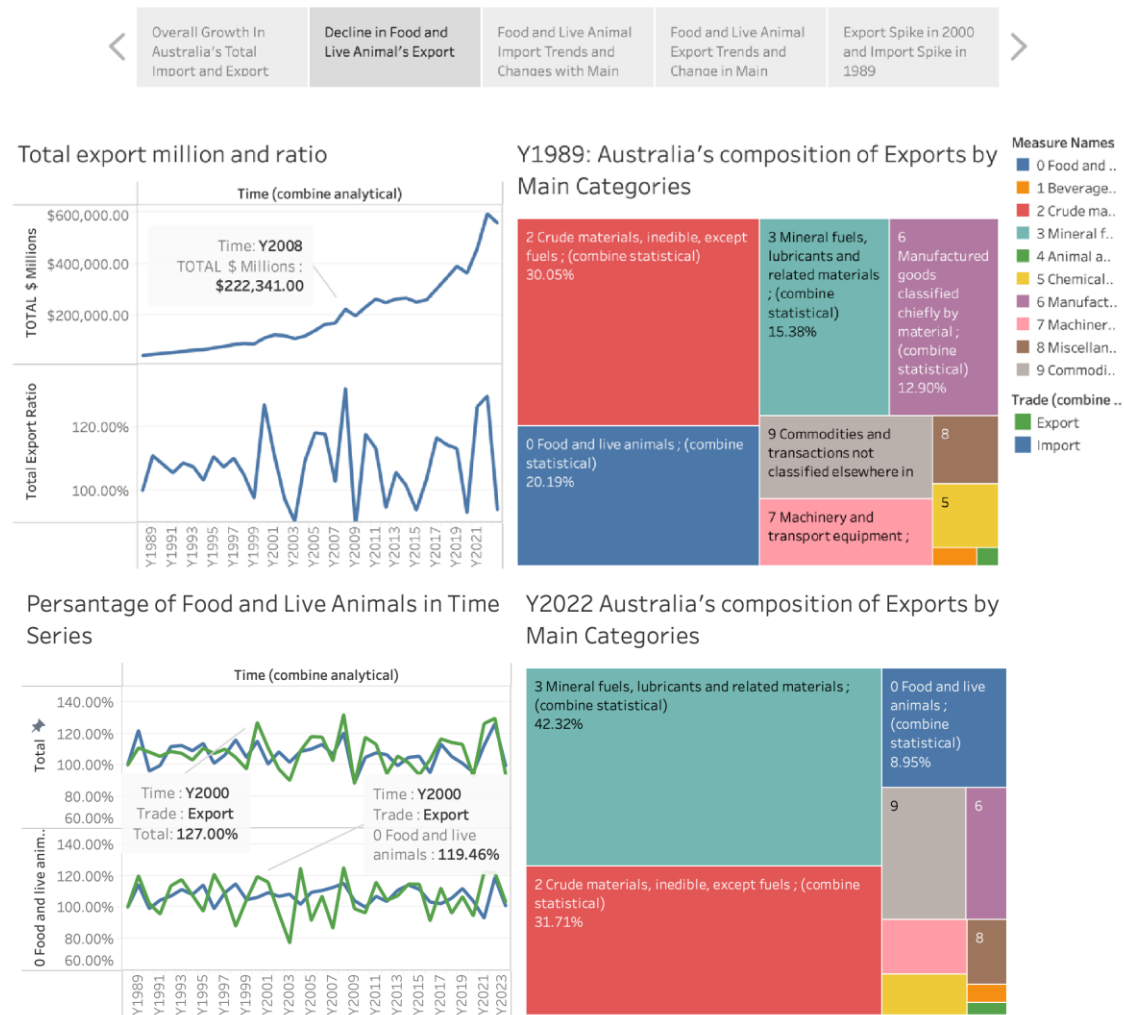
**1980s-1990s Economic Deregulation:** Australia opened its economy to international markets, paving the way for trade expansion. Exports surged in the early 2000s, spurred by a weaker Australian dollar and the global exposure from events like the 2000 Sydney Olympics (DFAT).

**2000s Export Growth:** From the early 2000s, exports grew at an average annual rate of 8.1%, largely due to rising commodity prices. Even with the impact of the Global Financial Crisis (GFC) in 2007-2008, which saw trade rates drop from 142% to 86%, Australia maintained profitable growth.

**2016-2019 Boom and COVID-19 Impact:** Exports increased significantly starting in 2016, with global demand peaking due to inflation during the COVID-19 pandemic in 2019. Figure 10 illustrates this trend, showing a 34% rise in import-export turnover within a single year.

Story Point 2

Changes and Trends in Australia's Trade & Imports and Exports of Food and Live Animals



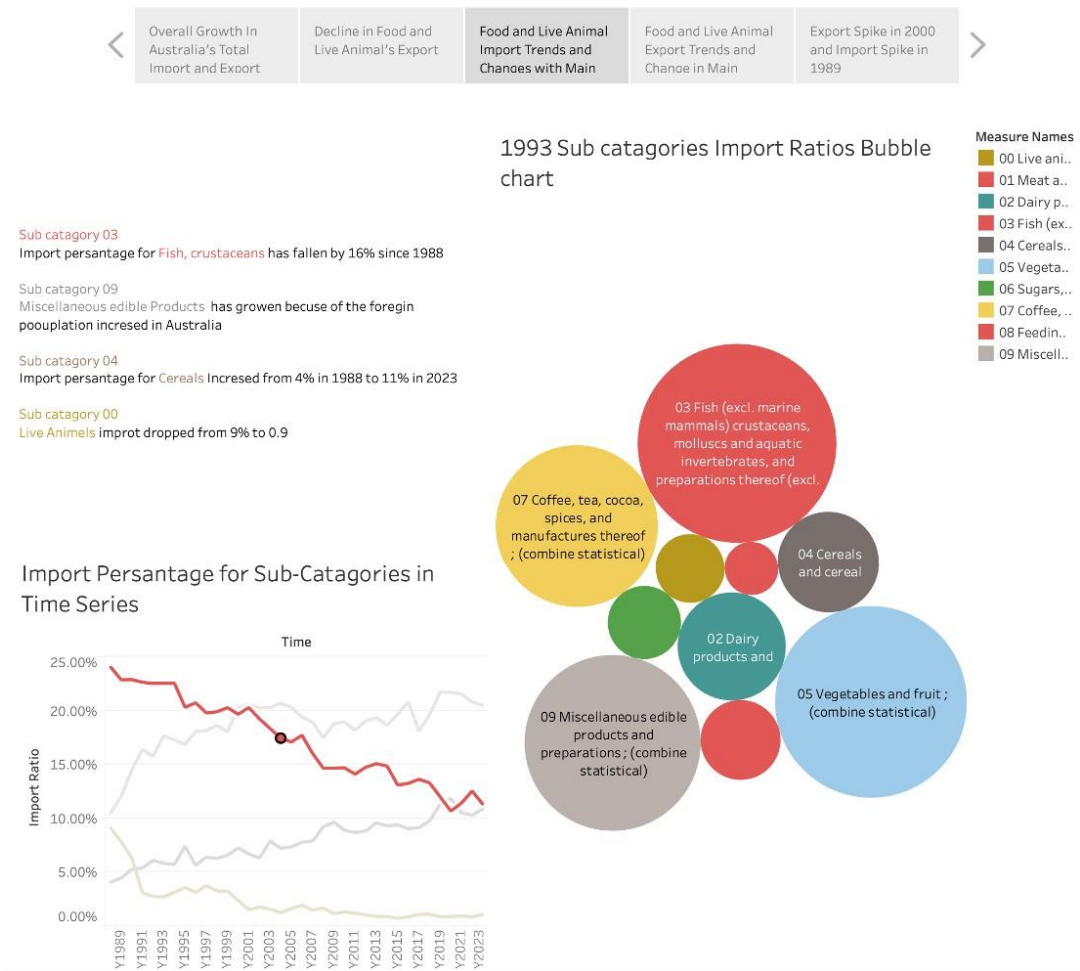
Between 1989 and 2022, Australia's export landscape saw a shift. While "Food and Live Animals" exports declined by 11%, driven by policies phasing out live sheep exports and the severe 2019-2020 drought, the "Minerals and Fuels" category expanded rapidly, growing at an average of 13.1% per year.

A notable export surge occurred in 2000, with total exports increasing by 30% and "Food and Live Animals" rising by 31%, largely due to strong global demand. Another peak in export ratios appeared in 2013-2014 and 2018-2019, climbing by 89% as demand for high-quality protein surged.

In recent years, Australia has shifted focus toward domestic processing of livestock before export, reducing reliance on live animal exports. This strategy, which saw processed exports grow at 26% annually, adds value to agricultural exports and mitigates the risks associated with live animal transportation.

Story Point 3

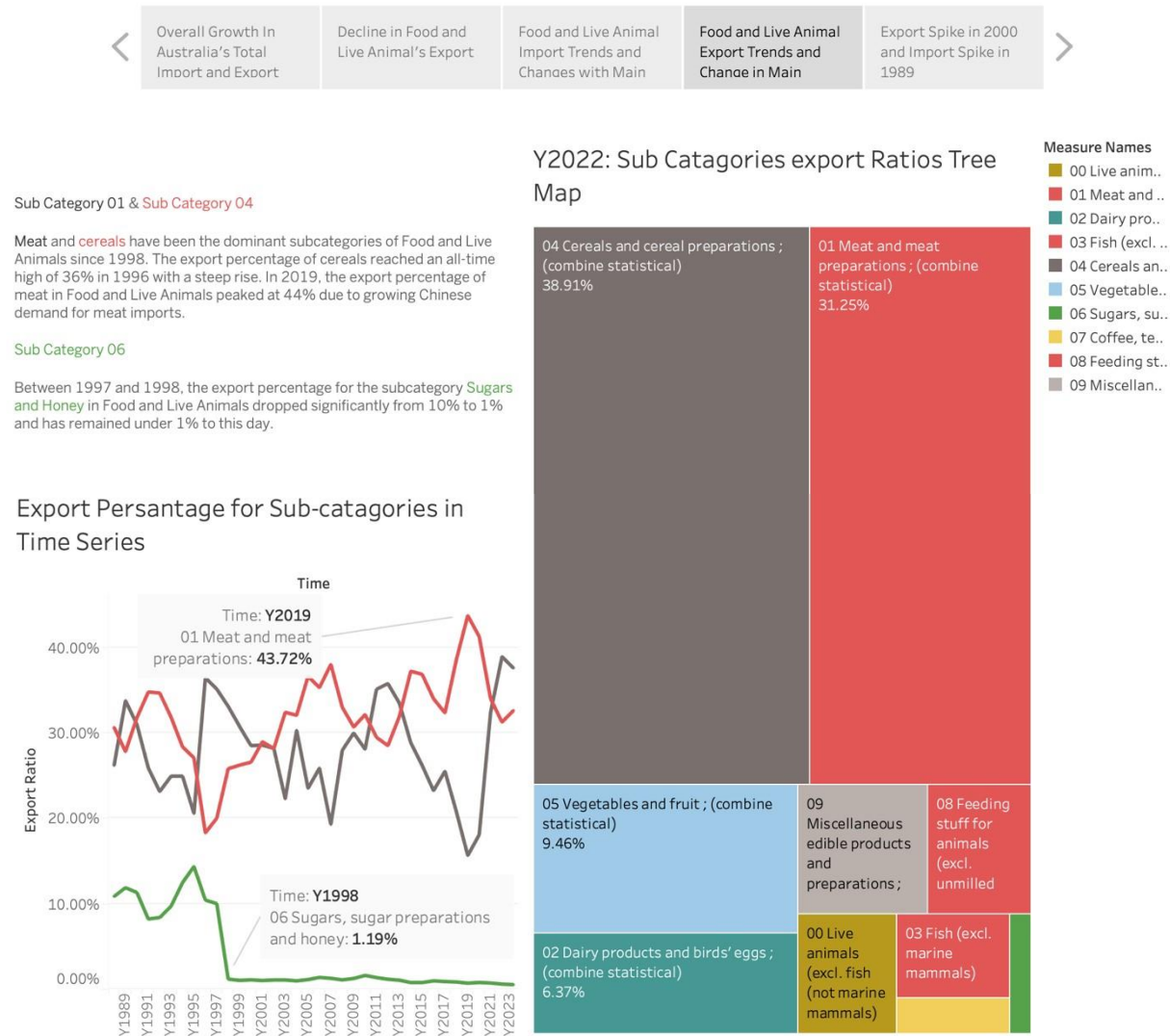
Changes and Trends in Australia's Trade & Imports and Exports of Food and Live Animals





Story Point 4

Changes and Trends in Australia's Trade & Imports and Exports of Food and Live Animals



**Dominant Subcategories:** Since 1998, "Meat and Meat Preparations" and "Cereals and Cereal Preparations" have led exports in the "Food and Live Animals" category.

**Record High for Cereals:** The export percentage for cereals peaked at 36% in 1996, showing a strong international demand for Australian grains.

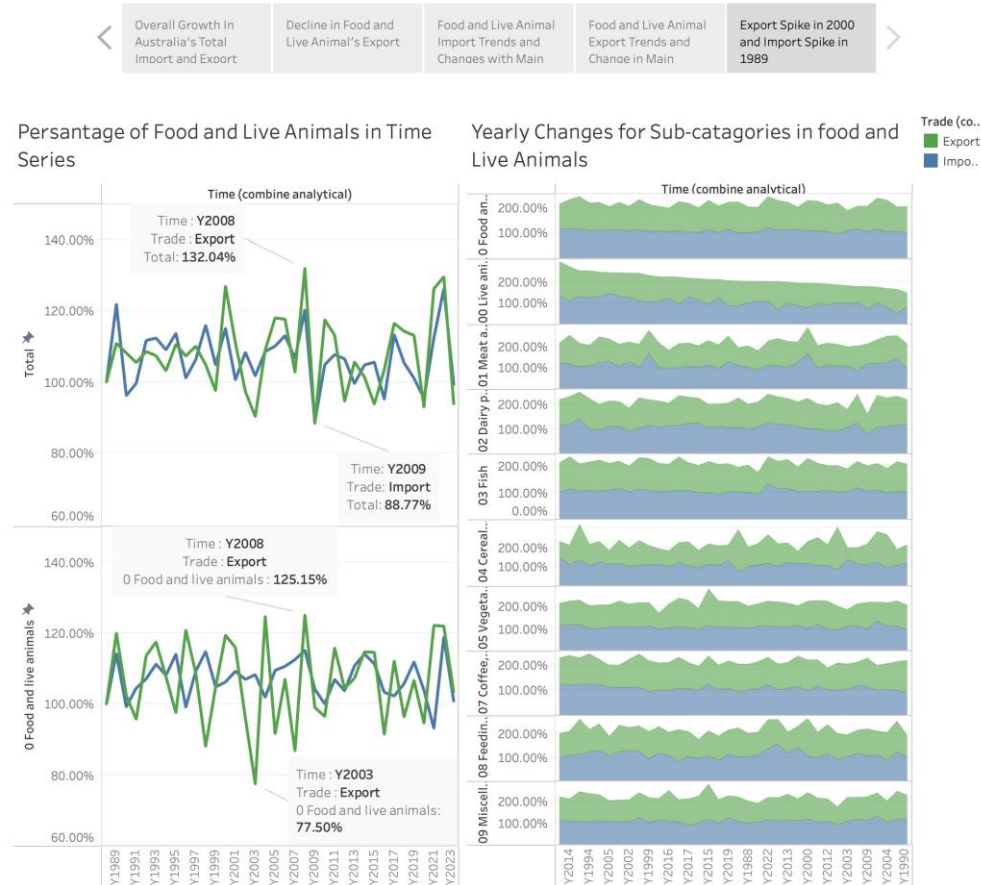
**Meat Export Surge:** In 2019, exports of meat reached 43.7%, driven by increased demand from China, making it a key growth area within agricultural exports.

**Decline in Sugars and Honey:** The export percentage for "Sugars and Honey" fell from 10% in 1997-1998 to around 1% and has remained low, reflecting reduced export focus on these products.

**2022 Export Breakdown:** The tree map shows that "Cereals and Cereal Preparations" made up 38.9% of exports, followed closely by "Meat and Meat Preparations" at 31.3%. Other significant exports included "Vegetables and Fruit" (9.5%) and "Dairy Products" (6.4%).

## Story Point 5

### Changes and Trends in Australia's Trade & Imports and Exports of Food and Live Animals



**Export vs. Import Trends:** Line graphs in contrasting colors (green for exports and blue for imports) illustrate similarities and differences between total trade and the "Food and Live Animals" sector. Key spikes are visible, highlighting growth periods.

**Growth Examples:** In 1998, total imports grew by 21%, with "Food and Live Animals" imports rising by 15%. Similarly, in 2000, total exports increased by 30%, with "Food and Live Animals" exports up by 31%.

**Demand Drivers:** Australia's reputation for clean, safe food, particularly in markets like China where 80% of consumers prefer safe imports, has fueled export demand. Population growth and rising global consumption have further boosted demand for Australian agricultural products.

**Import Composition:** Lower tariffs and increased global integration have expanded imports of consumption goods, which now account for 25% of total imports in the "Food and Live Animals" category.

**Subcategory Comparison:** The polygon graph on the right allows for a detailed view of yearly import and export changes across subcategories, helping to identify which items are more prominent in imports or exports.



## Summary

This report analyzes the trade data for Australia's "Food and Live Animals" sector from 1988 to 2023, using detailed graphical visualizations to identify key trends and insights. Through the design of dashboards and storyboards, we were able to clearly highlight the growth and shifts in exports and imports, particularly within subcategories like meat, cereals, and dairy.

Notable trends include a steady rise in export volumes, with a particular emphasis on "Meat and Meat Preparations" and "Cereals," which saw significant demand growth in Asia. Despite global challenges such as the Global Financial Crisis (GFC) and the COVID-19 pandemic, Australia's agricultural sector maintained strong export performance. Conversely, "Live Animal" exports showed a decline, likely due to policy changes and increasing ethical concerns. This shift indicates a growing trend towards processing livestock domestically before export.

## Conclusion

The analysis concludes that Australia's agricultural exports, particularly in meat and cereals, will continue to be a central driver of the economy, with rising global demand for safe, high-quality products. However, the decline in live animal exports suggests the need for a shift towards value-added products, such as processed goods, which would mitigate the risks associated with live animal transportation.

### Recommendations for the Industry:

1. **Focus on Processed Exports:** To reduce reliance on live animal exports, Australia should invest in processing livestock domestically and focus on exporting high-quality processed food products.
2. **Expand into Emerging Markets:** Strengthening trade relationships with regions that prioritize safe, premium food products, especially Asia and the Pacific, could provide growth opportunities.
3. **Diversify Export Products:** Diversifying into underrepresented subcategories, such as edible preparations, could help tap into new global demands.

### Advantages of Dashboards and Storyboards:

- **Dashboards** provide real-time, comprehensive insights into trade data, allowing quick identification of trends and outliers across various sectors.
- **Storyboards** offer a detailed narrative, helping users understand the evolution of trade over time, comparing subcategories to their main categories, and contextualizing the data to support decision-making. Together, these tools help visualize complex trade dynamics in an accessible and actionable format.

## References

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