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Executive Summary

This report highlights key findings, strategic recommendations and design decisions to present a comprehensive overview of Australia's trade, particularly in the food and live animals' industry. Over the past 35 years, Australia's imports and exports have grown consistently, with a notable divergence beginning in roughly 2017 due to increased exports. The main exports consist of mineral fuels and crude materials, reflecting Australia's resource rich land, while machinery and transport equipment make up the largest share of imports. Notably, the growth of global commodity prices increased the proportion that iron ore, coal and natural gas make up of Australia's trade. Certain export categories such as cereals and mineral fuels display high volatility. Volatility in trade is influenced by global demand and environmental factors impacting supply and demand. Imports have stability relative to exports, indicating Australia's established and sufficient production base. There has been a notable decline in food and live animals as a proportion of total exports. In contrast, Australia's stable food imports highlight its self-sufficiency. However, cereal and meat imports diverge from typical growth trends.

Regarding the food and live animal sector, several strategic recommendations are proposed. Firstly, Australia should reprioritise this sector due to the strong demand form Asian markets. To support this, investment in mitigating the impact of negative weather conditions on cereal production is suggested to reduce the volatility of this sector. Additionally, Australia should diversify its food exports to stabilise this category from fluctuations in dominant subcategories, like meat and cereal products. Further, by establishing surplus reserves and improving their shelf life a buffer can be created to protect against production and market downturns.

This report details design choices that maximise data comprehension. Most notably, a consistent colour scheme and valid graph types are used to enhance readability. To simplify interpretation of the data, axis rescaling and

clear data formats were applied to reduce cognitive load on the reader. A dashboard enables interactive exploration of the data with clickable elements and tooltips. Likewise, storyboards apply human centred design to present insights in a logical flow.

1. Introduction

This report outlines the key information and trends found in Australian Trade over the 1988-2023 period. We analyse the relevant data in the 2024-Spring-Ass3-V15.xlsx dataset and develop statistical and analytical patterns to reveal important insights. By effectively graphing the data, we outline key findings, trends and recommendations for main categories, subcategories and their relationships between each other. This includes the strong growth of Australia's economy while remaining relatively rudimentary.

2. Data Collection and Preparation

To enable data analysis, we first collect and prepare the data. We download the 2024-Spring-Ass3-V15 dataset from an online repository and save it as an xlsx file. This file is stored on a cloud drive with version control. There are two sheets, “Export-dataset” and “Import-dataset” which contain Australian export and import data respectively. Within these two sheets, each row represents a year, and each column represents an attribute. Hence, the data possesses a column/row format as we are using excel. Subsequently, the data must be formatted so that it is in the correct category (Column). This is ensured during data entry. Several steps must be taken to address abnormalities and prepare the dataset for graphing and analysis in Tableau. Tableau is selected as it is well suited to handling high dimensional data, like the data found in trade datasets. We make all changes in a separate sheet which references the original dataset, following best practices to ensure that the raw data is not lost and updates to the original data are reflected in subsequent calculations. This ensures data consistency.

Firstly, the Year column uses the format “YNNNN” where N is an integer. The “Y” character prevents tableau from recognising the years as numbers which prevents time series plotting. Hence, the “Y” character must be removed from all years. Likewise, the year column is originally formatted as text, we change this to a number format to enable graphing.

Calculated values are used to extract additional insights and information. We use Statistical and Analytical patterns to create meaningful new data for both sheets. Specifically, for the statistical pattern, we calculate each main category and subcategories' proportion of trade using the following formulae (See Appendix A for a list of main categories). The statistical pattern gives a more valuable data point for plotting, as the proportion of trade is more relevant than raw dollar values which fluctuate with country-wide growth. This is done for the Import and Export sheets individually:

$$\text{Main Category}_i \text{ Proportion} = \text{Main Category}_i \text{ Dollars} / \text{Total Trade Dollars}$$

$$\text{Sub-Category}_j \text{ Proportion} = \text{Sub-Category}_j \text{ Dollars} / \text{Main Category}_i \text{ Dollars}$$

Next, we calculate the analytical pattern, which represents the percentage change in trade from the previous year to capture year-over-year growth. However, when a previous year shows zero trade, this creates a divide by zero error. In this specific case, the error is caught, and the value is replaced by a null entry so that meaningful graphing may be done with the remaining data points. The growth for the initial year (1988) is set at 100% to facilitate subsequent calculations as there are no preceding years. The 1988 data point is not included in analytical plots. The analytical pattern uses the following formulae:

$$\text{Main Category}_i \text{ Change} = \text{Main Category}_i \text{ Dollars} / \text{Main Category}_{i-1} \text{ Dollars}$$

$$\text{Sub-Category}_j \text{ Change} = \text{Sub-Category}_j \text{ Dollars} / \text{Sub-Category}_{j-1} \text{ Dollars}$$

Subsequently, we combine the calculated values for the Import and Export sheets into one sheet which enables plotting of both Import and Export values in one chart for easy comparison. Additionally, these sheets are pivoted to enable the use of tree maps.

3. Dataset Characteristics and Data Types

3.1 Data Quality

First, we evaluate the relevant dimensions of data quality. The dataset is complete as it has no missing values and is sufficient to support analysis. The dataset does not contain an entry for the current year (2024). However, the timeliness is sufficient as the imports and exports for the most recently completed year (2023) are populated. The dataset is accurate as it complies with government provided records and real-world results. The dataset's validity is high as it is sourced from the Australian Bureau of Statistics which is a trusted government source. The dataset captures detailed categories and sub-categories of trade in millions of Australian dollars, making it sufficiently precise for this context where values commonly reach billions of dollars. Additionally, the dataset has high accessibility due to its widely accessible excel format and standardised data point formatting. The volume, or quantity, of the data is relatively small, hence it does not fall into the category of big data. This enables the analysis of the data to be more manageable and handled by simple analysis tools. The dataset contains numerical and text values which encode all trade amounts and metadata, making the dataset sufficiently diverse. Additionally, the use of only numerical and text values simplifies the tools necessary to analyse the data, enabling the use of conventional techniques. Specifically, we collect the following structured internet data attributes for the years 1988-2023 (See Appendix B). We define data types with the following key: Quantitative interval-scale (I), Categorical Ordinal (O), Categorical Nominal (N), Quantitative ratio-scale (R).

3.2 Abnormal Values and Outliers

Some stand-out categories in the dataset contain zero trade. Specifically, “23 Crude Rubber” and “96 Coin (excl. gold coin) not being legal tender” in the export dataset, and “21 Hides, skins and fur skins, raw”, “41 Animal oils and fats” and “96 Coin (excl. gold coin) not being legal tender” in the import dataset contain zero values as outlined in the following table.

Trade / Category	No. Zeros
Export / 96	22
Import / 96	17
Export / 23	2
Import / 21	13
Import / 41	5

External research reveals several possible explanations for these notable values. Specifically, zero trade can be caused by low supply or demand resulting in a dollar value which does not show on a scale of millions of dollars. Alternatively, measurement gaps or restricted data could explain the lack of trade. Additionally, restrictions on specific goods can stop trade, this includes trade bans or regulatory changes. For example, health concerns over diseases like avian influenza (U.S. Department of Agriculture, Animal and Plant Health

Inspection Service, 2024) could have led to temporary restrictions on animal oil and fat products. The consistently low trade values for both the import and export of non-legal tender coins suggest limited demand or regulatory constraints. Another abnormality is that the statistical pattern sheets reveal categories that total to over or under 100% of trade for a particular year. However, this discrepancy is within a sufficiently small margin and is to be expected for large, rounded time series data.

4. Data Visualisation

4.1 Total Trade Line Graph

Here we plot the total trade in dollars over the 1988-2023 period. We selected a line graph as it clearly conveys progression over time in an intuitive and standardised manner. Tableau does not recognise any outlier points. We plot import and export trade on the same chart to enable easy comparison. The import and export data are separated by distinct colours which are clarified by a key. This colour scheme is kept consistent across all subsequent charts so that the reader develops an intuitive understanding of the graphs. A line of best fit is provided for both the import and export plots. The line of best fit is dashed to separate it from the data points. Further, the equations for the lines of best fit are provided in a colour coded annotation to enable extrapolation of the data.

Due to the density of the datapoints, it was particularly challenging to include data labels without sacrificing readability. To clarify the value of data points without decreasing readability we displayed more salient gridlines. Throughout all graphs data labels are only added where necessary to provide additional context and highlight key points for consideration and analysis. Additionally, the data points were highlighted with circular dots to clarify their position. The dataset originally contains values in millions of dollars which creates the need for mental arithmetic when reading off large values on the y-axis. Hence, we rescale the axis to plot data in billions of dollars to increase readability.

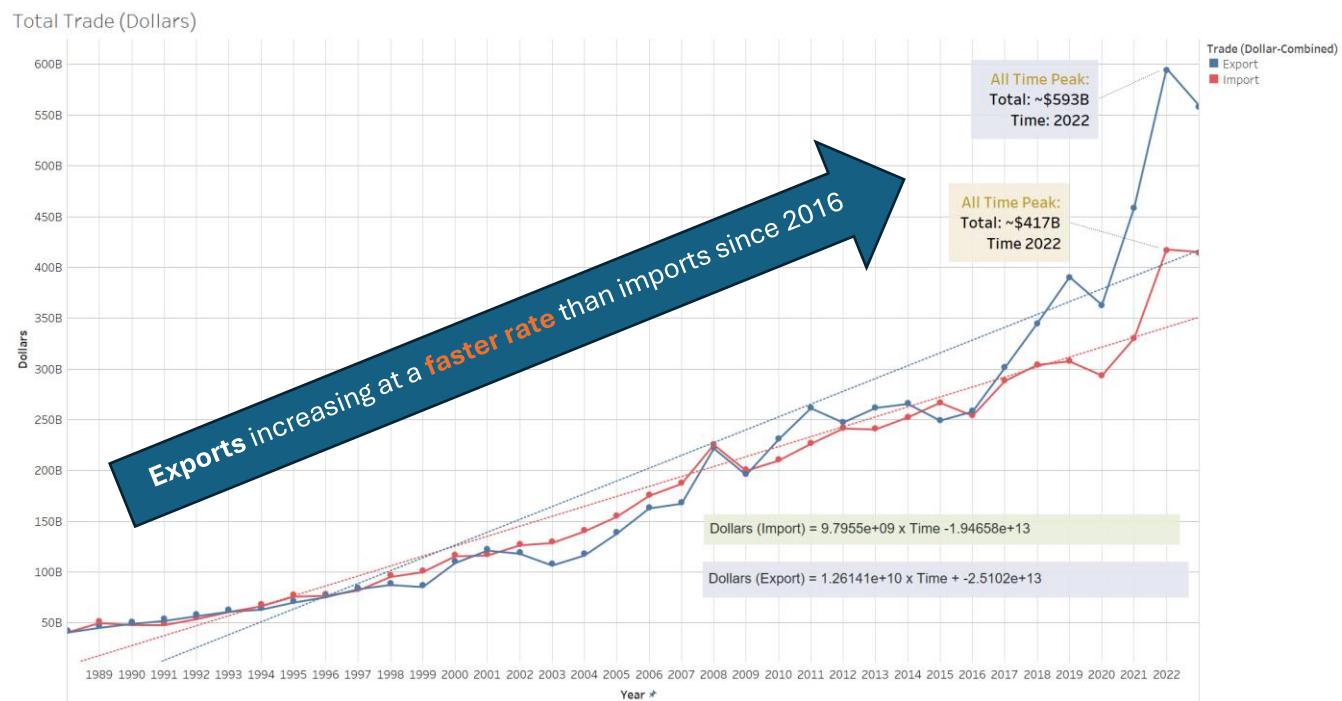


Figure 1

From figure 1 we see consistent growth in both imports and exports. The growth seems to be linear up until 2016 where imports and exports diverge to follow a more exponential growth pattern. Before this point there was a strong 1-1 correlation between imports and exports, however exports have since outpaced the growth of imports, indicating Australia is producing an abundance of resources. We highlight this divergence with a storytelling arrow element, colour coded to exports. This storytelling approach is carried through all subsequent charts to highlight key findings. Hence, Australia's growing prosperity and presence on the global stage is revealed. Around 2016 there was a recovery in global commodity prices, especially for key Australian exports like iron ore, coal and natural gas. Additionally, China and other Asian countries are major consumers of Australian resources (World Bank, 2016). In 2016, China's economic reforms and urbanisation efforts boosted demand for Australian energy. This explains the growth in export values around this time. The graph also reveals an all-time peak for both imports and exports in 2022, at \$417 Billion and \$593 Billion respectively. This can be explained by high global demand for energy, metal and agricultural commodities leading and post-pandemic recovery.

4.2 Main Category Stacked Area Charts

Here we plot each main category's proportion of total trade. We plot both the imports and exports on separate area charts. A stacked area chart was selected as it intuitively conveys proportions of a whole over time. To clearly visually separate each subcategory, distinct colours were chosen with a key to clarify their meaning. To improve readability of specific data points the grid lines were accentuated to aid in referencing the axis values. Further, the y-axis was formatted as a percentage to reduce the mental arithmetic required by the decimal format of the proportions. Intuitive axis labels were included on the axis. Further, the y-axis was scaled to be between 0 and 1 such that the height of the graph intuitively conveys the whole available proportions. Additionally, the x-axis was set between 1988-2023 such that there was no blank space on either side of the plot. This made the plotted areas fill up the entire axis to intuitively convey that they represent proportions.

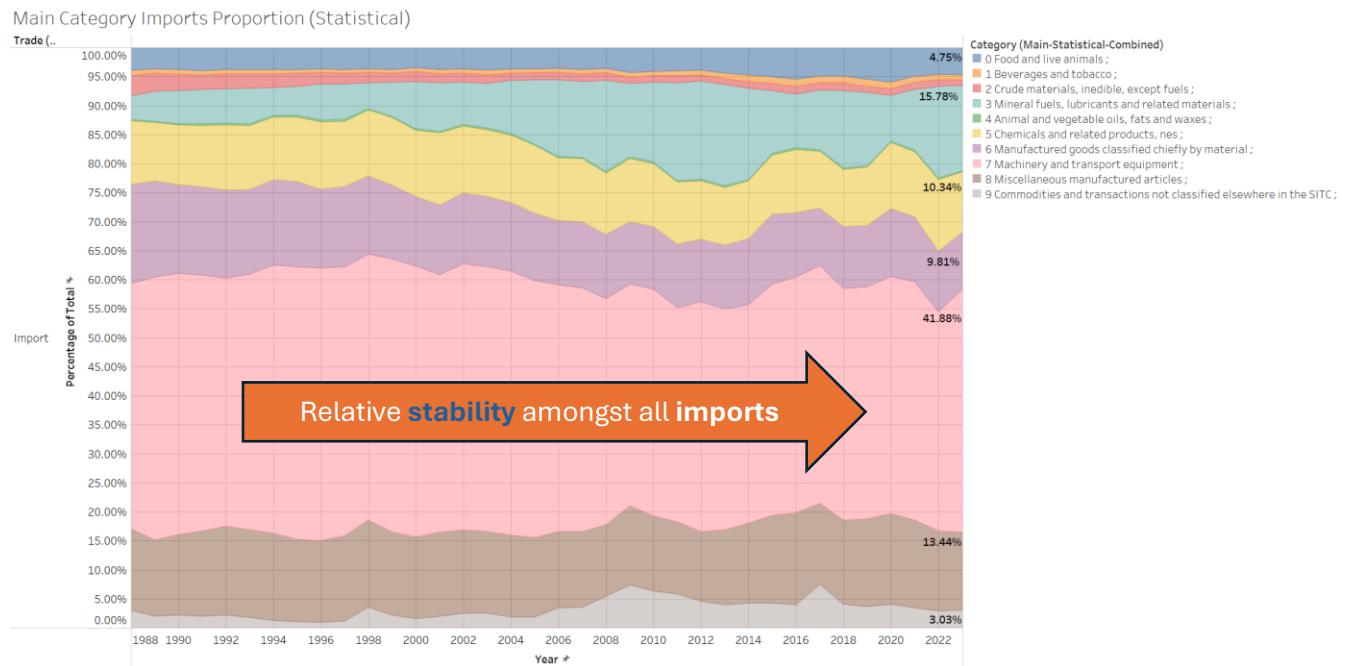


Figure 2

The figure 2 chart above reveals several interesting import findings. Firstly, all categories of imports remain relatively stable. This reflects Australia's established economic structure and reliance on specific imports that are

supported by long-term trade relationships that provide stability. These relationships are particularly between Asian countries like China, Japan and South Korea, as well as North America. Machinery and Transport Equipment shows dominance, being consistently above 40%. This reflects Australia's high demand for external machinery despite its resource-rich land. Australia's demand for refined goods is further revealed by other dominant categories. Specifically, manufactured goods, chemicals, and miscellaneous manufactured articles are all amongst the largest imports. Contrastingly, Australia's smallest imports include crude materials, food and live animals, indicating Australia's self-sufficient produce industry. This distribution is unique for a developed country like Australia, as typically developed countries can produce higher order commodities rather than crude materials and livestock.

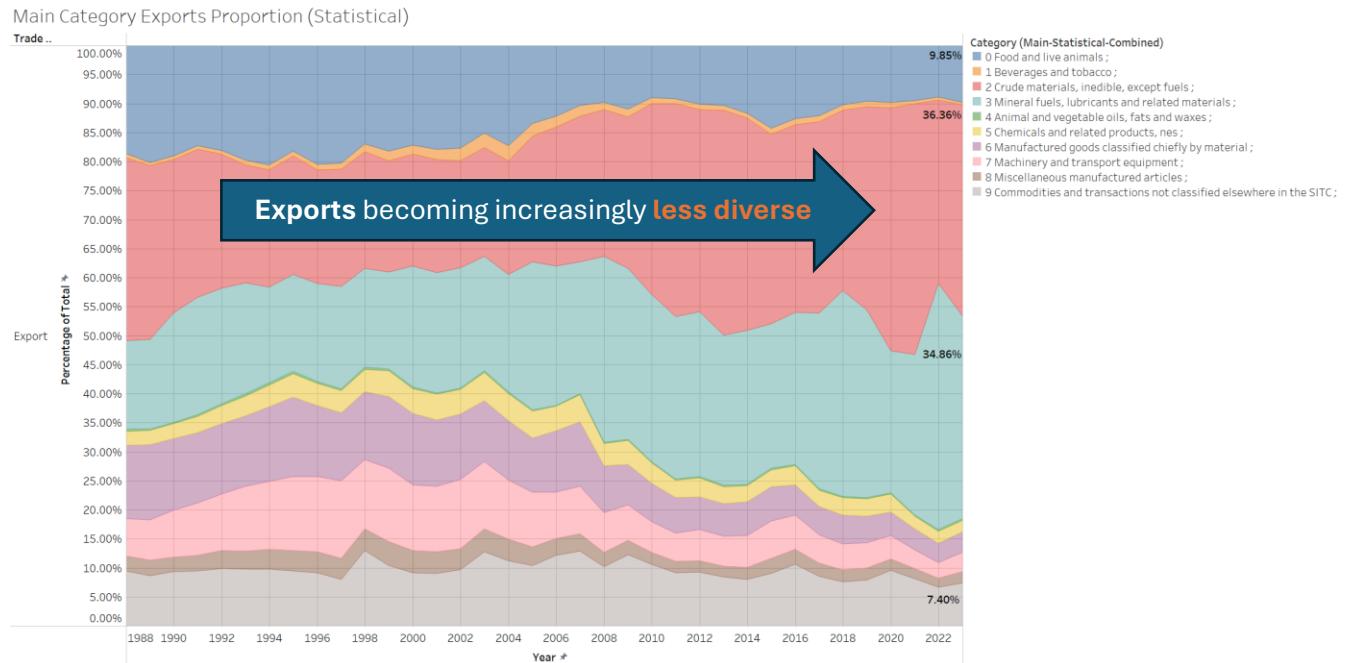


Figure 3

The figure 3 chart reveals export findings and supports the findings of the imports chart. Specifically, crude materials and mineral fuels are the two biggest exports for Australia, with crude materials typically being slightly in the lead. Likewise, Food and live animals are the next biggest export, however they have decreased in dominance, like that of all other categories. In general Australia's exports are far less stable than its imports. Australia's rich natural resources and vast arable land explains these exports. However, the shift in favour of raw goods exports is unexpected for an increasingly developed country and economy. Typically, third world countries rely on raw resources while developed countries export higher order goods as they have the means to produce them.

4.3 Main Category Box Plots

Here we show a box plot for the statistical and analytical patterns of the main categories. We plot both the imports and exports adjacent to each other on the same chart to facilitate easy comparison. A particular challenge was differentiating the many boxplots on the same axis. Row banding was used to separate each subcategory visually. Additionally, the density of the chart reduced readability of axis labels. By rotating the axis labels by 90 degrees they were now fully viewable to increase chart readability. This was necessary as the box plot shading could not be differentiated by subcategory or trade type due to Tableau's limitations.

Chart readability was also improved by only plotting outlier points to reduce clutter. The outlier points were keyed by distinct colours for each category to improve readability. The colour of the box plots was selected to contrast with the row banding for improved readability. Additionally, the y-axis was formatted as a percentage to reduce the mental arithmetic needed to interpret the original decimal values. The axis was rescaled to be between 0-0.5 as all values lie in this range. This maximised the chart area used to improve readability.

Main Categories Proportions Box Plot (Statistical)

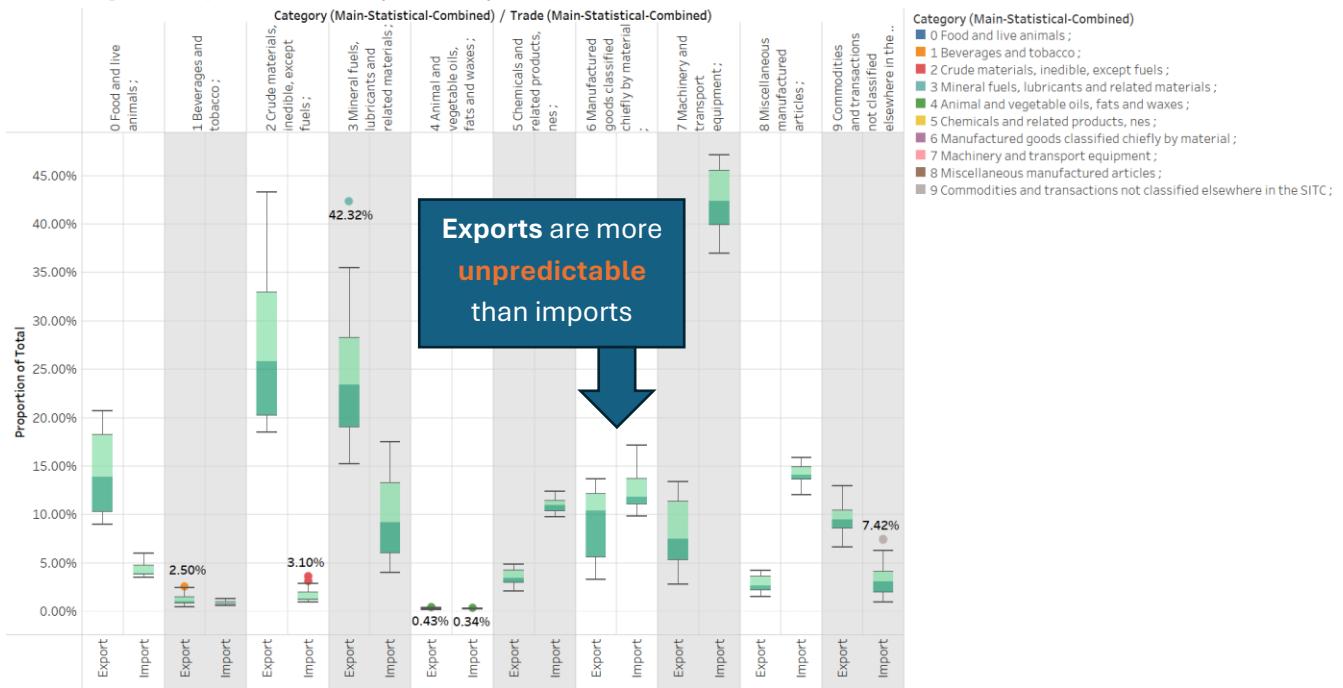


Figure 4

In the statistical pattern box plot (figure 4) we find that exports fluctuate significantly more than imports in general. This supports the findings in section 4.2. Additionally, most exports represent a higher proportion than their corresponding imports, suggesting extreme dominance of only a select few import categories, specifically category 7 (Machinery and transport equipment). This furthers the findings of section 4.2 to reveal Australia's less diversified economy. Crude materials show the strongest dominance of exports compared to imports revealing Australia's overabundance of raw materials for their population size. Tableau recognises the annotated outliers. The most extreme outlier was in an export category which further reveals the more stable imports of Australia's economy.

Main Categories Growth Box Plot (Analytical)

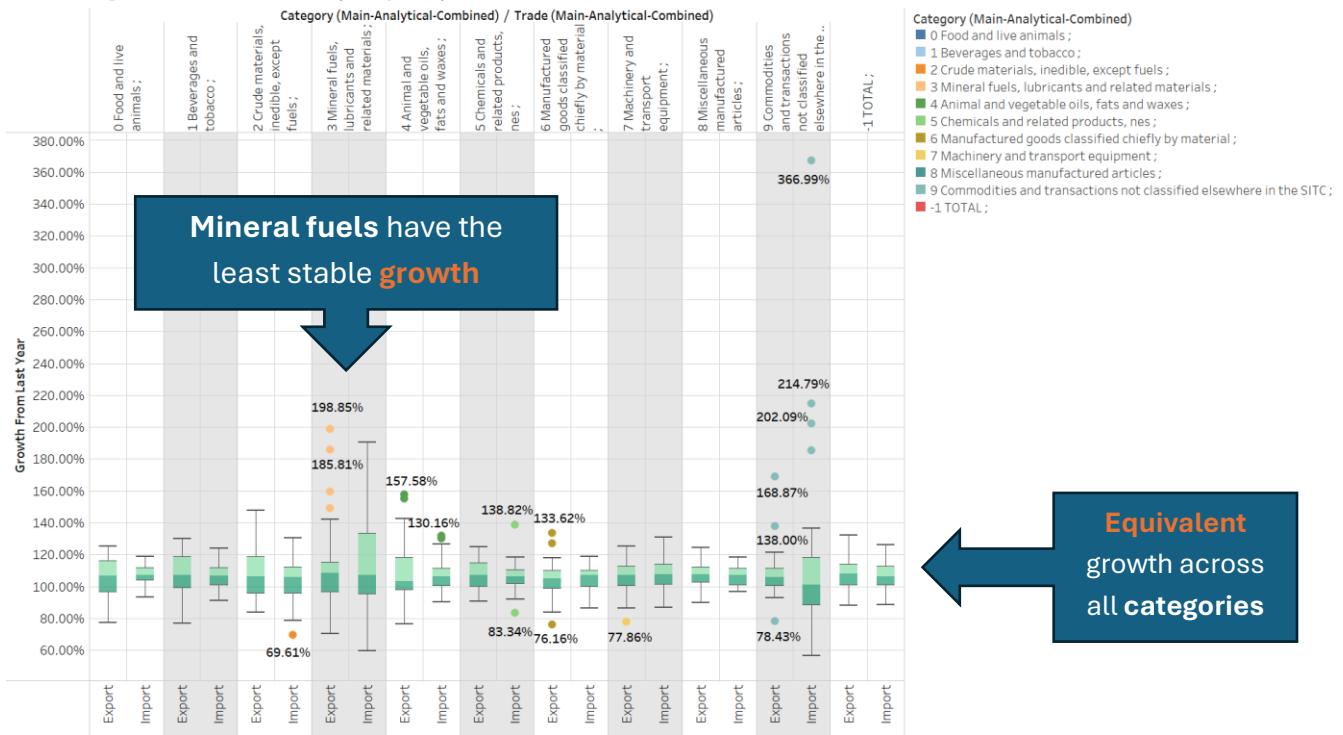


Figure 5

The analytical box plot chart (figure 5) reveals notably different stability and similarity between values compared to the statistical pattern plot. Specifically, all categories are roughly centred on 110% which reveals stable and equivalent growth amongst all categories. Additionally, there is a relatively equal distribution amongst all quartiles for each category. This provides a symmetrical range which acts as a margin of error from which we can predict future year-over-year growth. The import growth category tends to be more stable than the export growth category. The categories with narrow bands like chemical and related products are the most stable sectors with predictable growth. The least stable categories are Mineral fuels and lubricant imports and exports, as well as unclassified import commodities. This suggests trade in these categories is more sensitive to market changes. However, the overall total growth of imports and exports is relatively stable despite these various fluctuations. The most unstable categories tend to show the most extreme outliers as expected. However, unclassified export commodities have four relatively notable outliers despite having a small IQR. The extreme outlier present can be explained by the smaller volume of trade which leads to smaller monetary fluctuations being reflected as large proportional changes.

4.4 Individual Main Category Line Charts

Here we provide line charts for each individual main category for the analytical pattern. This reveals the time series data not captured in the box plot. Each category has its own individual axis. This reduces clutter and enables the use of custom axis scales for each category to sufficiently capture the relevant fluctuations in each category. We choose to plot the categories next to each other to enable quick comparison and reference such that unique attributes of categories can be established. Row banding is used to differentiate the ranges of each category. A difficulty with this approach was ensuring the readability of the category labels. This chart does not allow for rotated labels; hence a tooltip and scrollbar was added to expand on the labels when hovered over. We apply this same technique for dashboards as outlined later. This maximises readability, however the visible parts of the labels are still sufficient to glean which category they belong to.

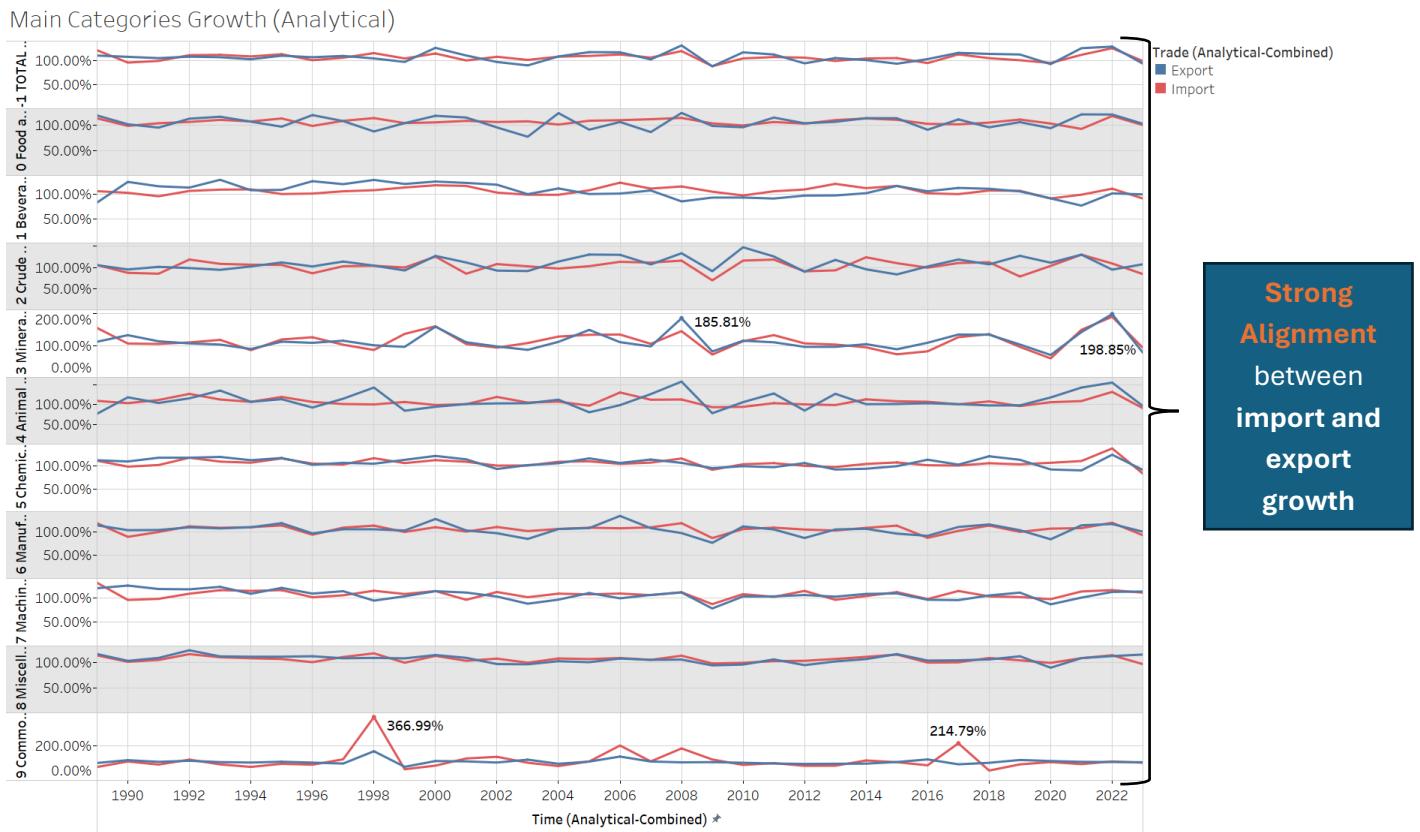


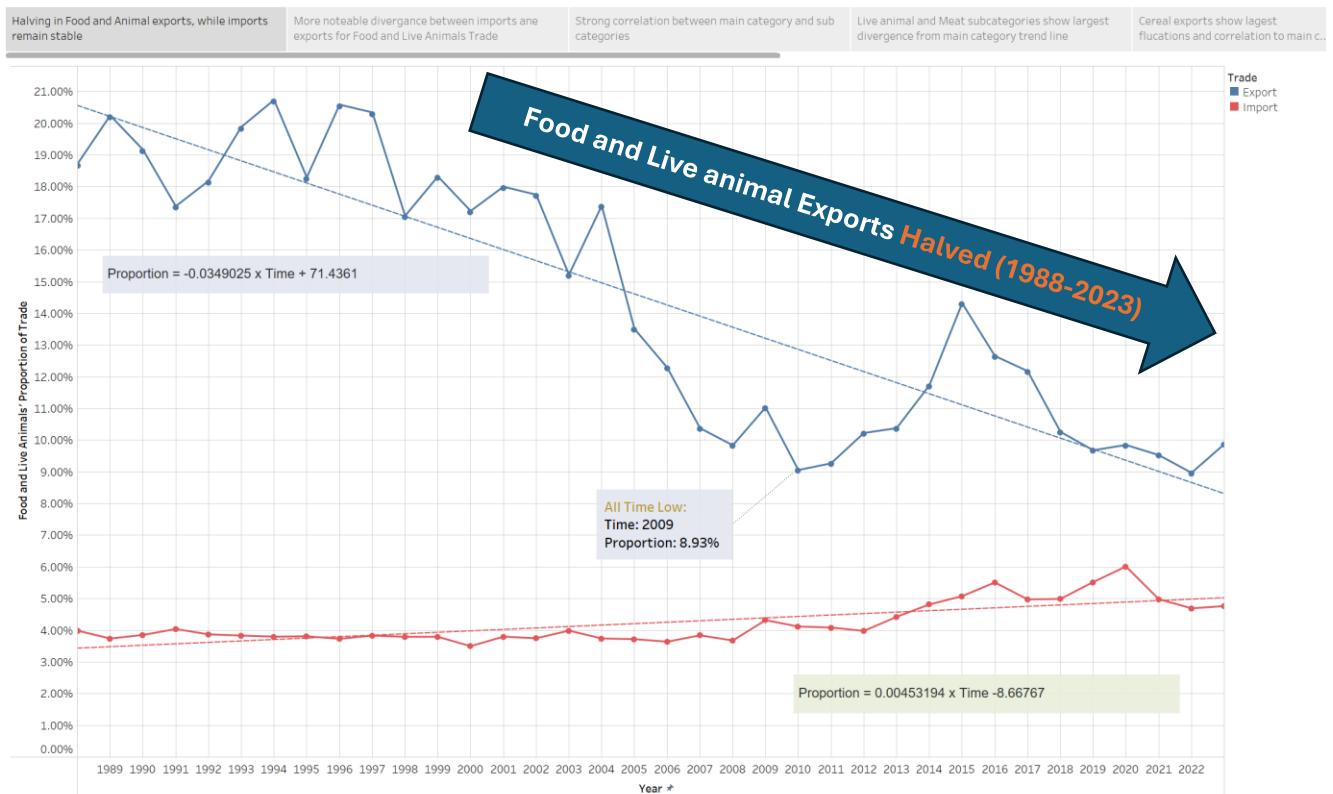
Figure 6

Figure 6 reveals several notable findings. Firstly, it shows a strong correspondence between import and export growth amongst all categories. This is supported by the total category having an almost one-to-one relationship between the two variables, showing on average, all trade follows this correspondence. However, as predicted in section 4.3, unclassified commodities have some notable deviances from this norm. Animal and vegetable oils, fats and waxes also show a lesser correspondence between export and import growth compared to other categories. Additionally, there is relatively stability amongst all categories, however Mineral Fuels show consistent fluctuations amongst imports and exports. The fluctuations in mineral fuels directly affect the growth Australia's total trade, indicating a high exposure to these volatile markets with demand driven cycles.

4.5 Food and Live Animals Analysis

Here we elect to analyse the main category of Food and Live Animals. This main category was chosen for analysis as it is curiously rudimentary resource for a developed country like Australia to be exporting. This analysis requires drawing connections between subcategories and the main category. The relevant subcategories are outlined in Appendix C. To support this analysis, dashboards are created. All charts on the dashboard follow previously defined design decisions for their respective chart type. Additionally, the keyed colours used to differentiate each category type are specified to reduce confusion. The axis of the charts was chosen to use a range that does not exaggerate the fluctuations which ultimately improves readability and the clarity of trends. A storyboard is used to convey the findings of the comparative analysis in an intuitive and progressive manner.

Food and Live Animals Story

**Figure 7**

Unlike other raw resources food and live animal trade has been decreasing over time for Australia (Figure 7). Specifically, there has been a halving in food and animal exports while imports have remained stable. This reveals the reduction in dominance of this sector to caution future investment. This can be explained by Australia's shift toward mineral resources like coal, iron ore and natural gas (Section 4.2). As the mining and energy sectors grew, food and agricultural products became relatively less significant in proportion, despite stable growth in absolute terms. Likewise, the increasing monetary value of mineral resources means food and live animal trade occupy a less significant share of trade (Geoscience Australia, 2020). The small stable proportion of food and live animal imports is explained by Australia producing the majority of its own food. Hence, imports are mainly specialised items that cannot be grown domestically, this limited need keeps them stable.

Despite this, food and live animal dollar exports have significantly outpaced imports to reach an all-time high in 2023 (Figure 8). Additionally, exports show a stronger divergence from imports, which is unlike most other trade as seen in section 4.1. This can be explained by the growing economies, population and hence demand from Australia's Asian trade partners which rely on Australian food exports for high quality produce. Australia produces its own supply of food and live animal goods. Hence imports have shown slower growth than exports due to Australia's limited need for food imports, which explains the divergence of imports and exports.

Food and Live Animals Story

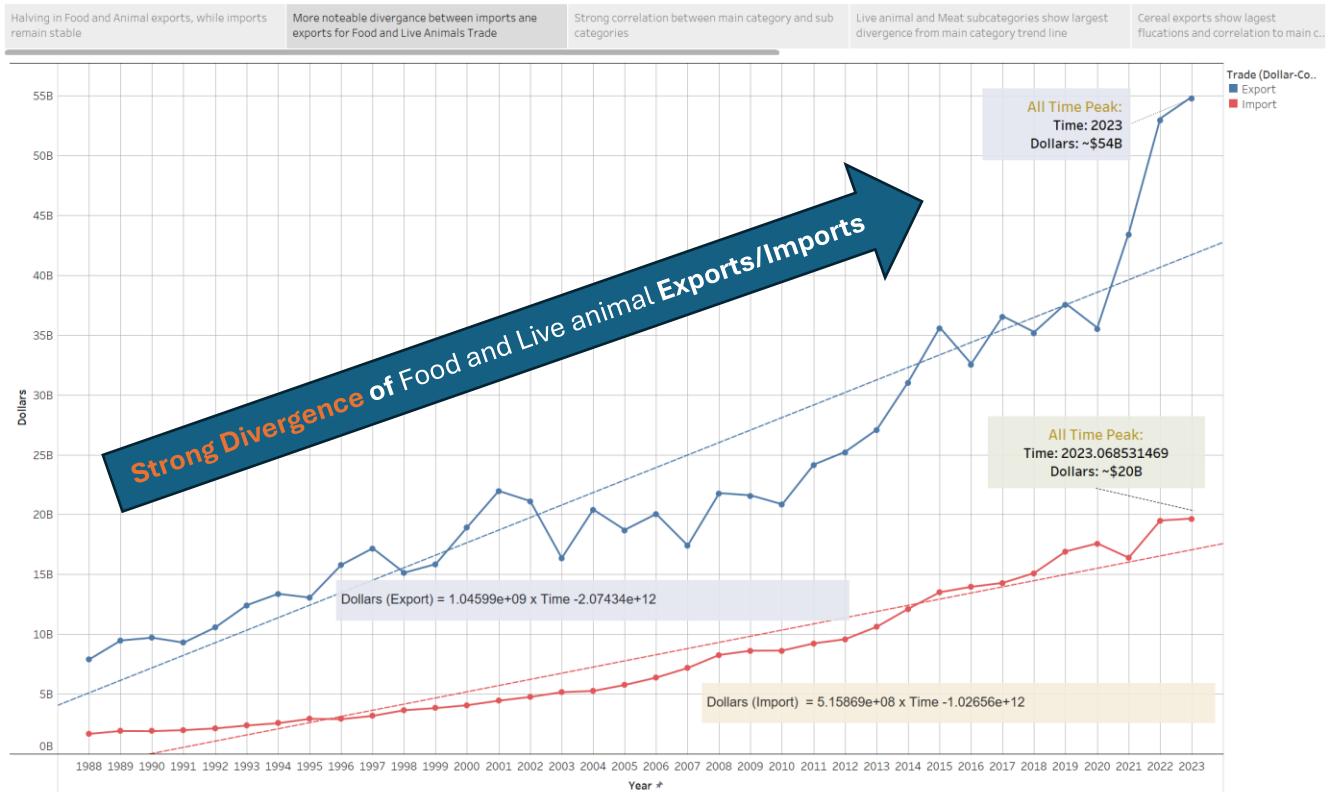
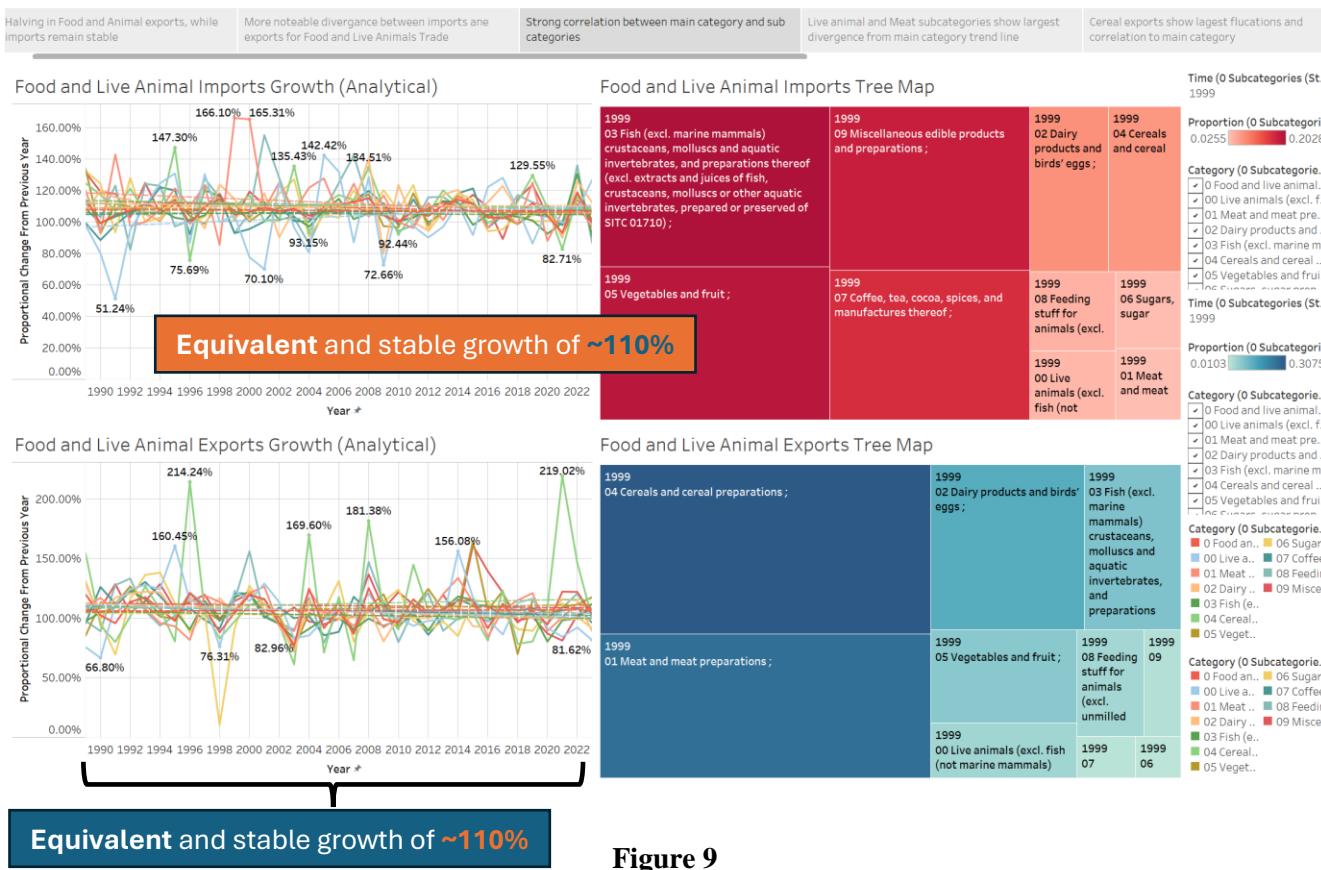


Figure 8

The dashboard in figure 9 compares the growth of the subcategories with the growth of the main category for both imports and exports. While attempting to convey this information on a single chart for quick comparison, the cluttered lines reduced readability. Hence, we separated imports and exports into separate charts. However, we still required an easy comparison of the two charts which is why they were added to a dashboard to be displayed at the same time. Despite this, the charts still had clutter due to the many subcategories. By adding a filter, the user can easily select and deselect subcategories to perform analysis in a readable and dynamic manner. These clickable elements facilitate interaction and exploration of the data to aid in finding trends. Additionally, the composition of the main category is conveyed in a tree map for both imports and exports. The tree maps are colour coded to match previous themes for import and export keying. The legends for this keying are displayed to clarify how shading reflects the magnitude of a subcategory's proportion of the main category. Distinct and intuitive colours were chosen such that each extreme of the shading gradient is clearly differentiable. For example, a lighter colour suggests a smaller magnitude. Additionally, the size of the boxes is used to reflect this, making tree maps an especially intuitive means to convey composition as two visual aspects are used to quantify magnitude. The tree map can be filtered to display the subcategory composition of a particular year, this provides vital context to aid in analysing the analytical charts on the dashboard.

Food and Live Animals Story



From figure 9 several key findings, trends and change points arise. Firstly, there is a strong correlation in the overall growth between the main category and subcategories. This is revealed by the similar trend lines for both imports and exports. Consequently, both the subcategory and main categories have stable and roughly equivalent growth (hovering around 110%) in both imports and exports.

However, figure 10 reveals that the “Live animal” and “Meat and meat preparations” import subcategories show notable divergence from this trend. This can be explained by the high fluctuations of the subcategories which seem to stabilise over time. Interestingly, the imports of these two categories seem to have a rough negative correlation, where an increase in one subcategory corresponds to a decrease in the other. This makes sense as if there are more meat products imported there will be less need for live animal imports to be used for meat products, and vice versa.

Food and Live Animals Story

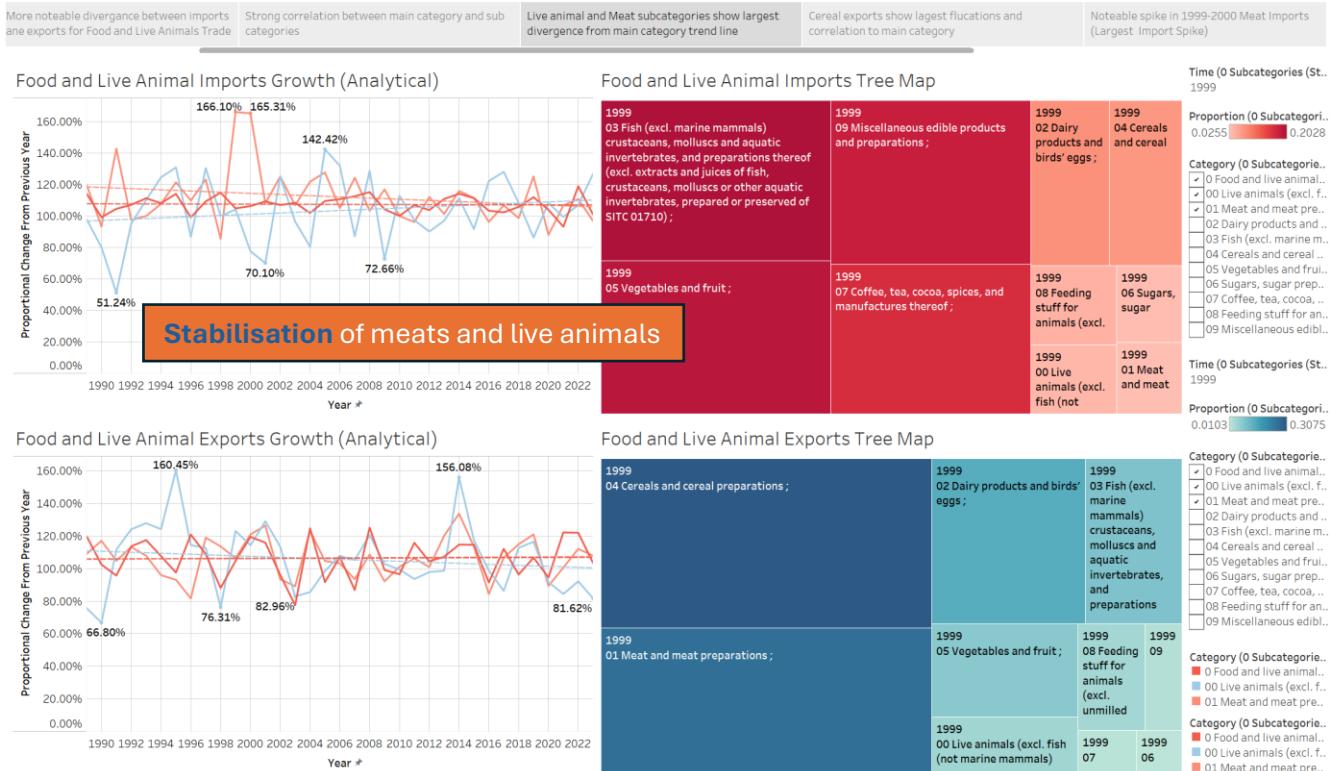


Figure 10

Figure 11 reveals that cereal exports show the most radical fluctuations compared to all other exports. As the subcategory makes up a significant proportion of the main category, a causal relationship is justified and visible in the case of exports but not imports. Specifically, changes in the export subcategory are typically reflected, although less drastically, in the main category. This relationship can be used for predictive modelling. These fluctuations are explainable by several factors. Firstly, peaks in cereal exports often coincide with years of bumper harvests due to favourable weather conditions (Grain Central, 2022). These periods lead to a significant increase in cereal products, allowing for higher export volumes. Additionally, global supply shortages due to less favourable weather conditions during an opposite season in other countries can lead to an increase in demand and hence an increase in exports. Further, the chart reveals that each major change point (during 1996, 2004, 2008 and 2021) is preceded by a downturn in production the previous year as indicated by the negative growth. Hence, a major contributing factor to these large spikes in export growth is the recovery, released inventory and or overcorrection following years of low production or demand. Consequently, meat trade is a more stable business environment.

Food and Live Animals Story

Strong correlation between main category and sub categories

Live animal and Meat subcategories show largest divergence from main category trend line

Cereal exports show largest fluctuations and correlation to main category

Noteable spike in 1999-2000 Meat Imports (Largest Import Spike)

Consistent inverse relationship between Meat and Cereal exports

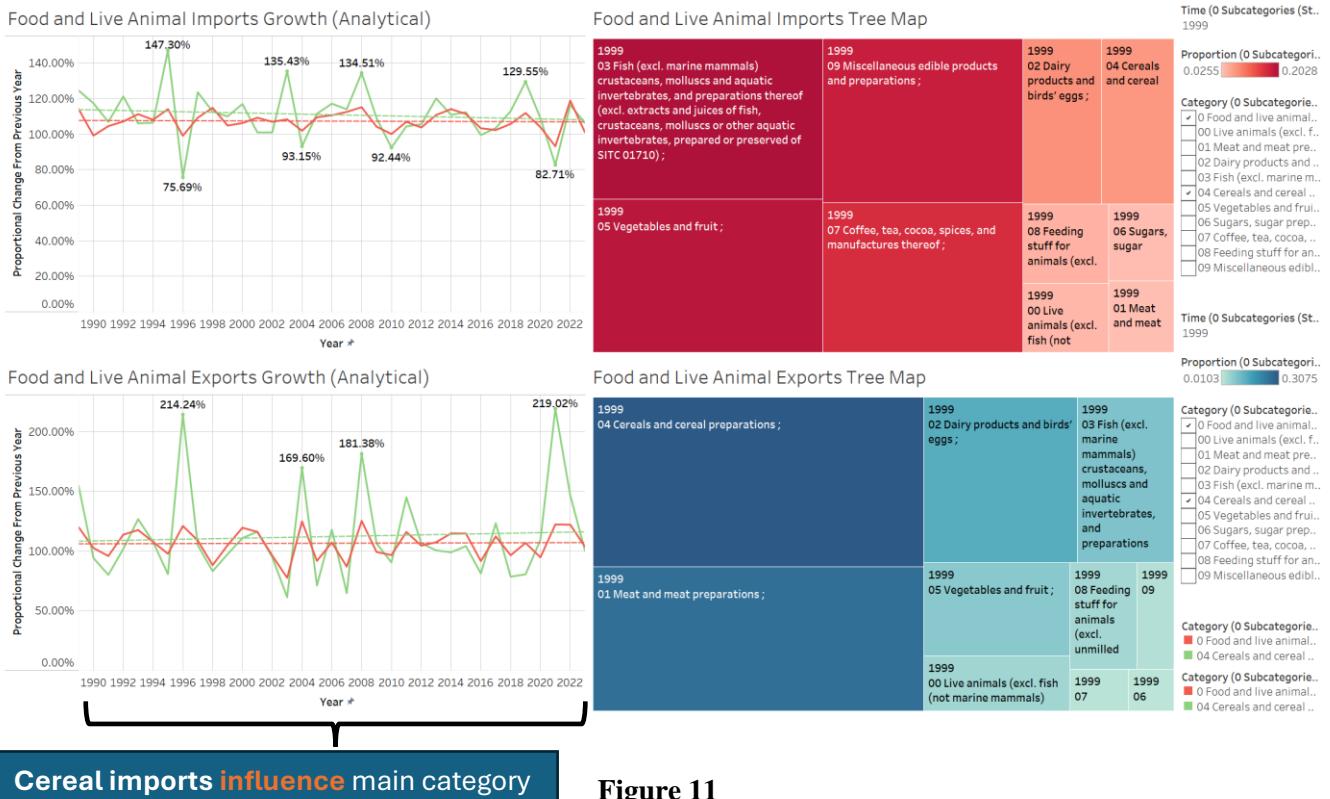


Figure 11

In figure 12, a notable change is seen in the 1999 and 2000 imports of meat and meat preparations. Where there is a spike in imports during this period that extends beyond that of natural fluctuations present in the rest of the data. This spike can be explained by the drought conditions experienced by Australia during parts of the late 1990s (Australian Institute for Disaster Resilience, n.d.). Drought leads to reduced grazing conditions which increases the costs for animal feed. This ultimately decreases the local meat supply which necessitates increased imports. Additionally, the Asian Financial Crisis in 1997-1998 had a significant impact on economies across Asia, including some of Australia's major meat export markets ("Asian Financial Crisis," n.d.). This would lead to reduced demand from Asia, causing Australian producers to cut back on meat production. An overcorrection from Australian producers could lead to a shortage during the following years of 1999-2000 while the market readjusted.

Food and Live Animals Story

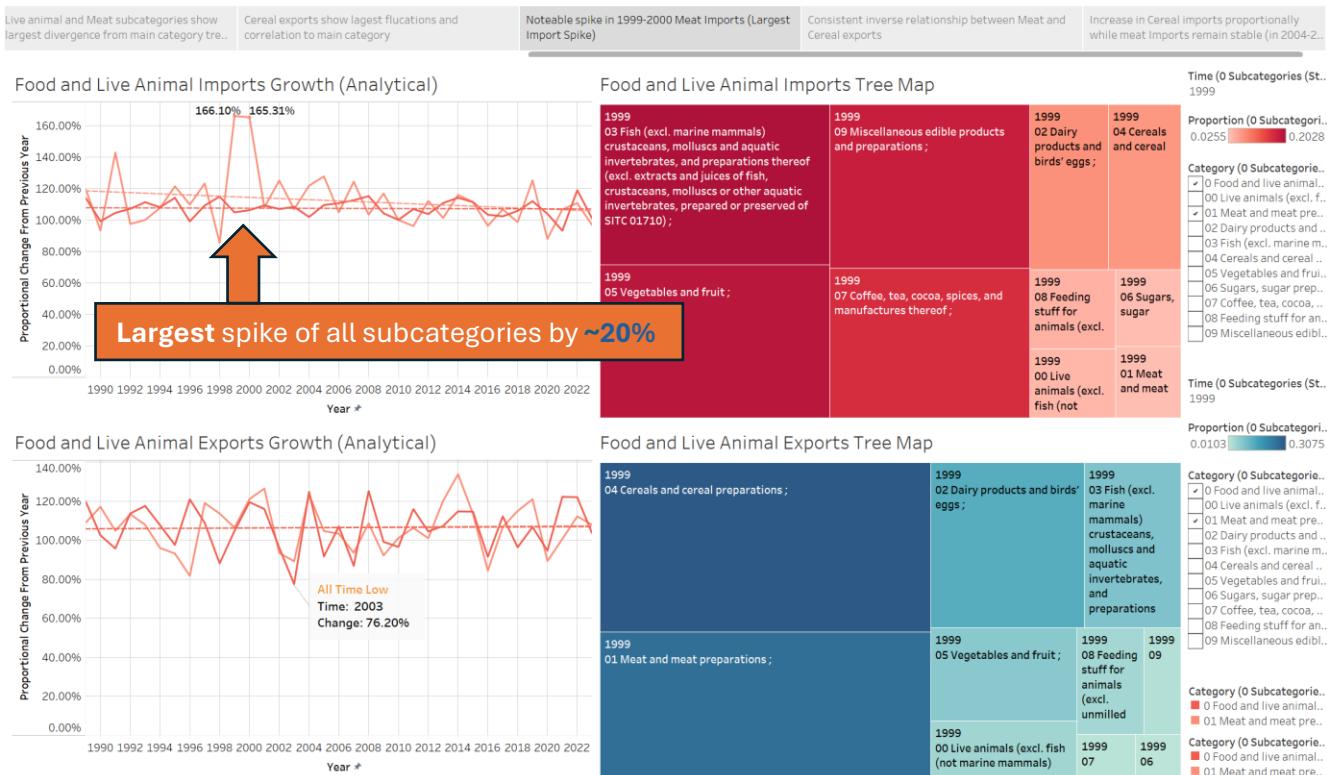
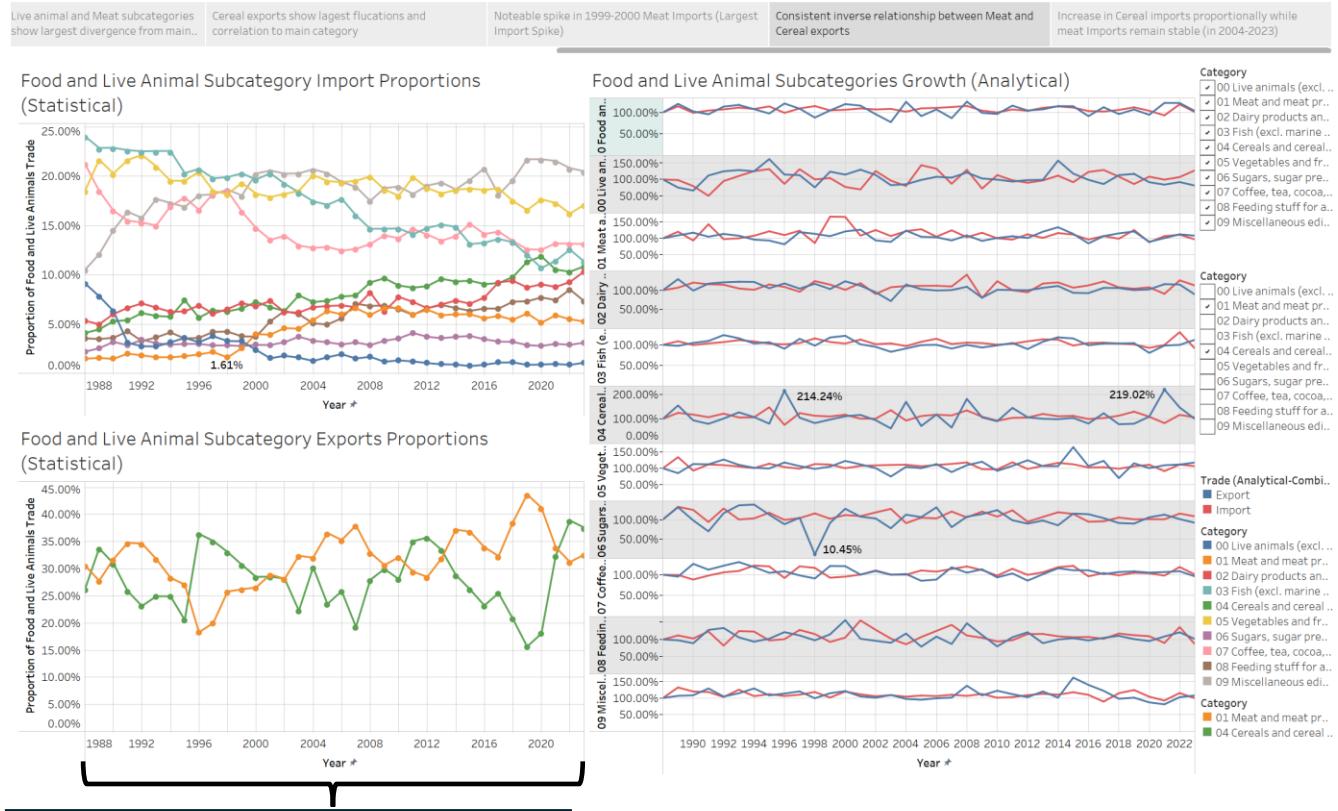


Figure 12

We elect to analyse the meat and meat preparations subcategory as it has several interesting and unique characteristics as outlined previously. Additionally, it makes up a large proportion of exports which makes it an important subcategory to assess. We compare this subcategory to another highly volatile and dominant subcategory found previously, which is that of Cereals and Cereal Preparations.

Food and Live Animals Story



Inverse relationship between 01 and 04

Figure 13

In figure 13 we highlight the export correlations between the two subcategories by only displaying them on the export chart to reduce clutter. All charts and dashboards in this story follow previously outlined design decisions to maximise readability. For example, like in section 4.5.1, filter options are provided in a sidebar with legends for colour keys to enable dynamic analysis without sacrificing the clarity of what each chart is conveying. The analytical charts are provided for additional context to help reveal interesting subcategories. Consequently, it is revealed that there is a strong negative correlation between Meat and Cereal exports. That is, when one subcategory changes, the other subcategory makes an opposite and roughly equal change. This can be used by suppliers to predict the movement of one subcategory when knowledge of the other subcategory is available, to maximise their alignment with demand. To avoid waste. This correlation is explainable by the close relationship between livestock production and cereal use as animal feed. When meat exports increase, the demand for cereal as animal feed also rises, reducing the availability of cereals for direct export.

Finally, using figure 14 we analyse the proportion of imports which Meat and Cereal trade make up. We highlight this by selecting only those two subcategories for the import chart. Consequently, it is revealed that cereal imports have increased in dominance while meat exports remain a stable proportion of food and live animal trade. Meat imports remain steady due Australia's strong self-sufficiency in this department. Simultaneously, cereal imports increased due to the demand for animal feed to support meat exports, which has historically been a major component of Australia's economy. This reflects the dynamic balancing act of Australia's food economy, where stable export markets must be supported with variable import requirements for cereals.

Food and Live Animals Story

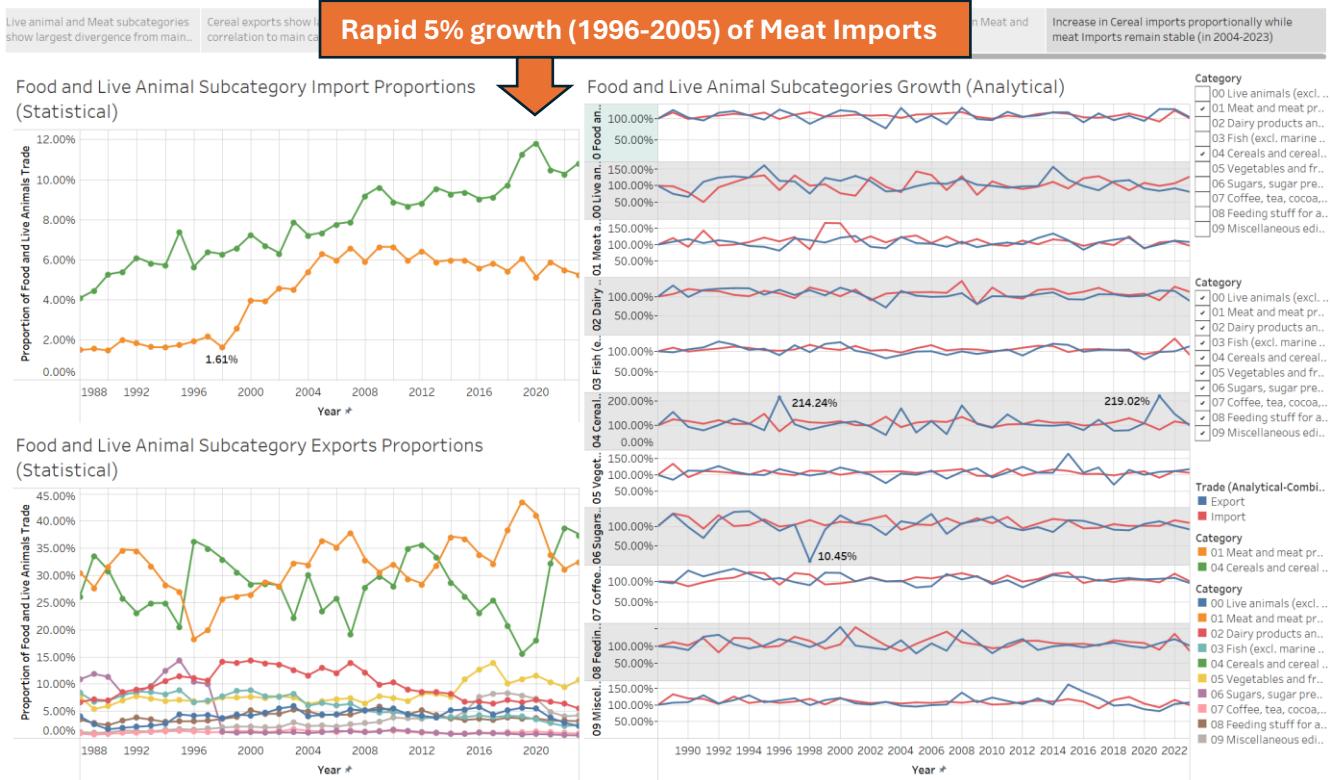


Figure 14

5. Conclusion

Based on the previous analysis we will summarise the major findings, design decisions, key trends and breakthrough points, industry recommendations and the advantages of dashboards and storyboards. Firstly, Australia's total imports and exports have shown consistent and correlated growth over the last 35 years, with significant divergence starting around 2016. This divergence was largely caused by an increase in exports. Mineral fuels and crude materials make up the largest exports, while machinery and transport equipment make up the largest imports. This reflects Australia's more rudimentary economy. During 2016, a recovery in global commodity prices boosted the value of exports for key resources like iron ore, coal and natural gas. Additionally, export categories like cereals and mineral fuels show high volatility, often influenced by factors such as global demand, substantial harvests or poor weather condition. As these are large subcategories they have a direct impact on total trade in the

main category. Further, import categories remain stable, showing Australia's well established and consistent production economy. However, export categories showed significantly more fluctuations. Specifically, food and live animals experienced a decline in proportion of total exports. Contrastingly food and live animal imports remained stable, revealing Australia's self-sufficiency in food production. There was a divergence in cereal and meat imports from the typical trend of 110% growth for food and live animal trade. Similarly, cereal imports have outpaced the stable proportion of meat imports. Additionally, there was a strong negative correlation between these two subcategories regarding exports. When meat exports increase, cereal exports decrease due to their use in animal feed, highlighting the delicate balancing act of Australia's food sector. This relationship can be used to predict the markets by suppliers. Notably, during 1999-2000 there was an extreme spike in imports caused by previous droughts.

These findings promote several recommendations for the food and live animals' industry. Firstly, given strong demand from Asia, Australia should continue to capitalise on its high-quality produce, particularly in major markets like meat and cereal. To reduce the extreme volatility found in these markets, investment in strategies to mitigate the impact of adverse weather on cereal productions should be implemented. Additionally, Australia's food and live animal products centre around meat and cereal. Australia should diversify its export products to improve stability and reduce exposure to the natural fluctuation of these produce categories. Further, by implementing mandates on minimum surplus stores and improving the longevity of these stores, periods of downturned production can be mitigated.

Various design decisions were used during graphing. This includes the use of appropriate graphing for certain data points, for example line charts for time series graphing. A consistent colour scheme was used to differentiate export and import data, as well as categories and subcategories. This consistency allows readers to develop an intuitive understanding of the graphs to increase readability. Readability was a major focus and challenge when creating all graphs. To address this, axis rescaling and appropriate data formats were used to reduce mental arithmetic.

Similarly, a dashboard was implemented, which enabled users to explore and compare related data patterns, categories and subcategories simultaneously. This created readability limitations due to the density of information being shown. To improve readability tooltips and scrollbars were added where data could not be completely displayed. Further clickable elements and dynamic visuals enabled users to interact and customise views. This simplified data interpretation by making complex multidimensional datasets more accessible and user-friendly. Furthermore, the use of storyboards improved trend visualisation. Storyboards display information sequentially to guide users through key trends, outliers and relationships in the data. These decisions follow human-centric design principles. Hence, we have successfully analysed Australian trade data with meaningful visualisations to convey practical insights.

6. References

1. Asian financial crisis. (n.d.). In *Britannica Money*. Retrieved November 8, 2024, from <https://www.britannica.com/money/Asian-financial-crisis>
2. Australian Institute for Disaster Resilience. (n.d.). *The big dry nationally 1996–2012*. <https://knowledge.aidr.org.au/resources/environment-the-big-dry/>
3. Geoscience Australia. (2020). *Value of Australian mineral exports*. <https://www.ga.gov.au/digital-publication/aimr2020/value-of-australian-mineral-exports>
4. Grain Central. (2022, March 15). *From west to east: Australia's harvest in five stories*. <https://www.graincentral.com/cropping/from-west-to-east-australias-harvest-in-five-stories/>
5. U.S. Department of Agriculture, Animal and Plant Health Inspection Service. (2024, November 4). *Import alert: Import restrictions on Canada due to highly pathogenic avian influenza*. <https://content.govdelivery.com/accounts/USDAAPHIS/bulletins/3c0025f>
6. World Bank. (2016, October). *Commodity markets outlook*. <https://pubdocs.worldbank.org/en/143081476804664222/CMO-October-2016-Full-Report.pdf>

7. Appendices

Appendix A

Main Categories:

- 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
- 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

Appendix B

Attribute	Type	Description
Years	I	These represent time intervals
Export/Import Amounts	R	These values represent the quantity of trade in millions of Australian dollars
Item Categories	N	These are labels for the different types of exports/imports. Main categories are represented by a single integer ranging 0-9. Subcategories contain the main category index as a prefix. For example, 01 is the first subcategory for main category 1. Index (-1) is the total trade for all categories in the sheet.
Series ID	N	The series ID contains unique alphanumeric codes to additionally identify each category and subcategory.
Unit	O	This is a label indicating the type of measurement (e.g., \$Millions)

Appendix C

Food and Live Animals Subcategories:

- 00 Live animals (excl. fish (not marine mammals) crustaceans, molluscs and aquatic invertebrates of SITC Division 03)
- 01 Meat and meat preparations
- 02 Dairy products and birds' eggs
- 03 Fish (excl. marine mammals) crustaceans, molluscs and aquatic invertebrates, and preparations thereof (excl. extracts and juices of fish, crustaceans, molluscs or other aquatic invertebrates, prepared or preserved of SITC 01710)
- 04 Cereals and cereal preparations
- 05 Vegetables and fruit
- 06 Sugars, sugar preparations and honey
- 07 Coffee, tea, cocoa, spices, and manufactures thereof
- 08 Feeding stuff for animals (excl. unmilled cereals)
- 09 Miscellaneous edible products and preparations