

# **Australian International Trade Analysis Report**

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**Subject:** 32146 Data Visualisation and Visual Analytics

## Executive Summary

This report examines 36 years of Australian international trade data (1988-2024) with a focused analysis on Category 7 (Machinery & Transport Equipment) and specifically subcategory 7.8 (Road Vehicles). The analysis reveals that Australia has consistently run a substantial trade deficit in manufactured goods, with Road Vehicles representing the single largest import subcategory within the dominant Category 7. Using statistical and analytical patterns combined with interactive dashboard visualizations, this report identifies key trends, breakthrough points, and provides a 5-year forecast (2025-2029) for Road Vehicles trade. The comparison between manual forecasting and AI-generated predictions highlights both the strengths and limitations of each approach in projecting future trade patterns.

## 1. Introduction

### 1.1 Background and Context

Australia's international trade has undergone significant transformation since 1988, shaped by globalization, technological advancement, and periodic economic shocks. Understanding these patterns is crucial for policy makers and industry stakeholders who need to anticipate future trends and make informed decisions about trade strategy and economic planning.

This analysis uses data from the Australian Bureau of Statistics covering import and export values across 10 main categories and 67 subcategories from 1988 to 2024. The dataset has been processed into three analytical formats: raw dollar values, statistical patterns (percentage composition), and analytical patterns (year-over-year ratio changes). This multi-dimensional approach allows for comprehensive examination of both absolute magnitudes and relative trends.

### 1.2 Methodology

Before visualization in Tableau, the raw dataset required transformation into statistical and analytical patterns to enable compositional and trend analysis.

#### a. Statistical Pattern Development

Statistical patterns were created to show each category/subcategory as a percentage of total trade. In Excel, new sheets "Export Statistical" and "Import Statistical" were created. Formula implementation:

***For Category percentages*** (line 42 onwards in Excel):

- Cell B42:  $=B4/SCA4$  (Category 0.Food value / Total Export value for 1988). This formula was applied across all 10 categories for each year 1988-2024
- Verification:  $=SUM(B42+M42+P42+Z42+AD42+AH42+AR42+BB42+BL42+BU42) = 100\%$

***For Subcategory percentages:***

- Cell C42:  $=C4/SB4$  (Subcategory 0.Live value / Category 0.Food subtotal)
- Applied across all 67 subcategories

## b. Analytical Pattern Development

Analytical patterns calculate year-over-year ratios to identify growth rates and volatility. New sheets "Import Analytical" and "Export Analytical" were created. Formula implementation:

- Cell B5 (1989 data):  $=B5/B4$  (1989 value / 1988 value = ratio of change)

=>Result >1.00 indicates growth, <1.00 indicates decline

- Applied across all categories and subcategories for 1989-2024. Note: 1988 has no analytical value (no previous year for comparison)

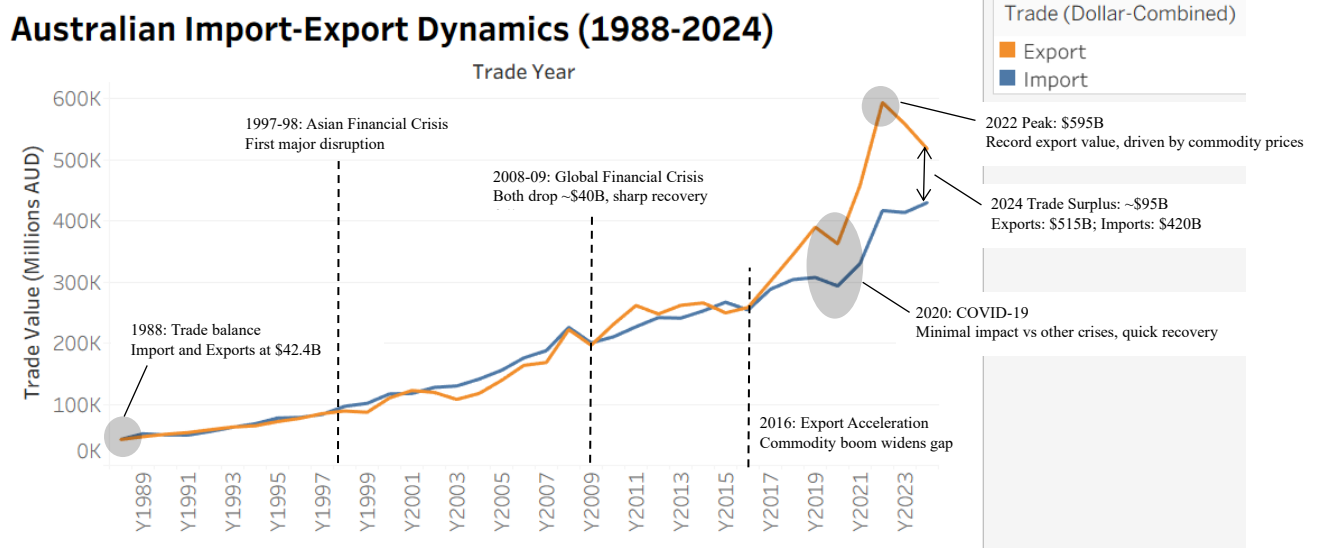
The three datasets (Dollar-Combined, Statistical-Combined, Analytical-Combined) were imported into Tableau using the relationship function, linked by Time and Trade Type fields. This enabled exploration of relationships between categories, subcategories, and time periods.

### 1.3 Choice of Main Category to Subcategory

The decision to focus this analysis on Category 7 (Machinery & Transport) and its subcategory 7.8 (Road Vehicles) was driven directly by the data. Category 7 consistently accounted for 30-45% of all Australian imports throughout the 36-year period, establishing itself as the single most dominant and stable import category. Within this category, Road Vehicles (7.8) emerged as the standout subcomponent, growing to represent over 42% of Category 7's value by 2024 and demonstrating the most severe trade imbalance.

## 2. Individual Chart Analysis

Chart 1: Australian Import-Export Dynamics (1988-2024)



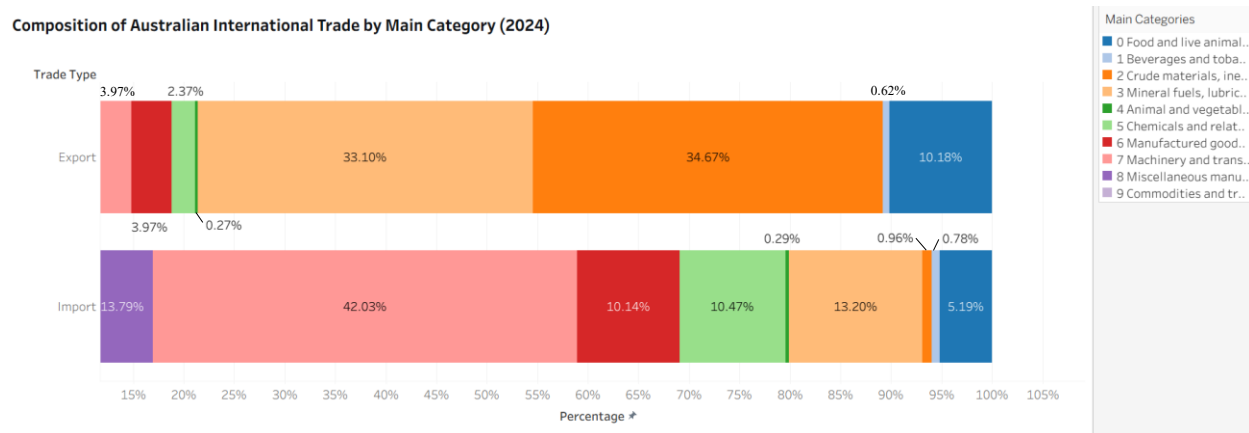
The parallel growth of imports and exports from 1988 through the mid-2010s tells an interesting story about Australia's economic expansion. Both lines track closely together, starting around \$42 billion each and climbing steadily through the 1990s and 2000s. The first major disruption appears around 1997-98 during the Asian Financial Crisis, where both lines flatten briefly before

resuming growth. The 2008-09 Global Financial Crisis hits harder: there's a visible dip in both import and export lines, with values dropping from around \$220 billion to roughly \$180 billion before recovering. But the relationship between these two lines fundamentally changes after 2016.

From 2016 onward, exports (orange line) accelerate dramatically while imports (blue line) grow more steadily. Exports surge from about \$250 billion to peak near \$600 billion by 2022, while imports reach only around \$430 billion. This creates a massive trade surplus that didn't exist in earlier periods. The export boom is almost certainly driven by commodity prices - iron ore, coal, and natural gas exports to Asian markets, particularly China. Then 2023 shows a sharp export correction, with the orange line dropping back down to around \$520 billion, likely reflecting cooling commodity prices. The 2020 COVID dip is visible but surprisingly small, where both lines dip slightly but recover quickly, suggesting trade proved more resilient than many other economic sectors during the pandemic. What's striking is how the import line (blue) maintains its steady trajectory throughout all this volatility, barely affected by the export boom-and-bust cycle. This suggests domestic demand for imported goods, particularly manufactured items, is relatively stable regardless of commodity export performance.

## Chart 2: Composition of Australian Trade by Main Category (2024)

The horizontal stacked bar chart provides a cross-sectional view of Australian trade composition in 2024, the most recent year in the dataset.



There are two completely different trade profiles stacked on top of each other. The import bar (bottom) is dominated by that massive pink section - Category 7 (Machinery and Transport) taking up 42.03%. This isn't just the largest category; it's larger than the next three categories combined. Category 8 (Miscellaneous Manufactured Goods) adds another 13.79%, and Category 2 (Crude Materials) contributes 13.20%. Add in Category 5 (Chemicals) at 10.47%, and we've got about 80% of all imports concentrated in four categories. The message is clear: Australia imports manufactured products, machinery, and chemicals at scale.

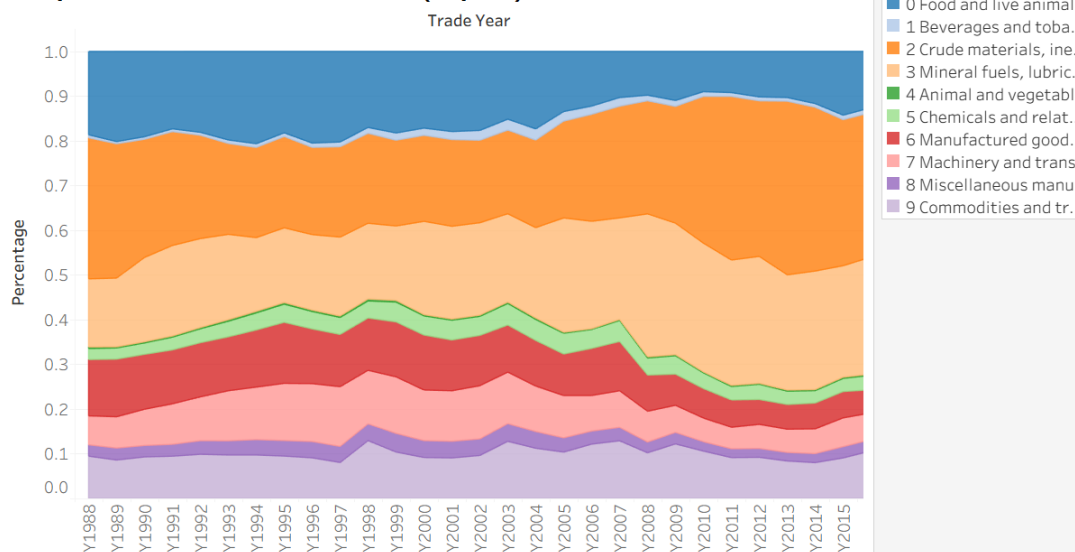
Flip to the export bar (top) and the story changes entirely. Category 3 (Mineral Fuels) dominates at 34.67%, with Category 2 (Crude Materials) close behind at 33.10%. These two categories alone account for nearly 68% of exports. Food (Category 0) adds another 10.18%. So exports are

essentially commodities - minerals, raw materials, and agricultural products. Category 7 (Machinery and Transport), which dominates imports, barely shows up on exports at 3.97%. This fundamental mismatch explains Australia's economic structure: the country digs things out of the ground or grows them, ships them overseas, then imports the manufactured goods and machinery needed to run a modern economy. The thin sliver of Category 1 (Beverages and Tobacco) on imports at 0.78% is almost amusing by comparison: Australians clearly prefer domestic beer and wine. What stands out most is how concentrated exports are (two categories dominate) versus imports being somewhat more diversified across four major categories, though Category 7 still towers over everything else.

### Chart 3: Composition Pattern for Export and Import Over Time

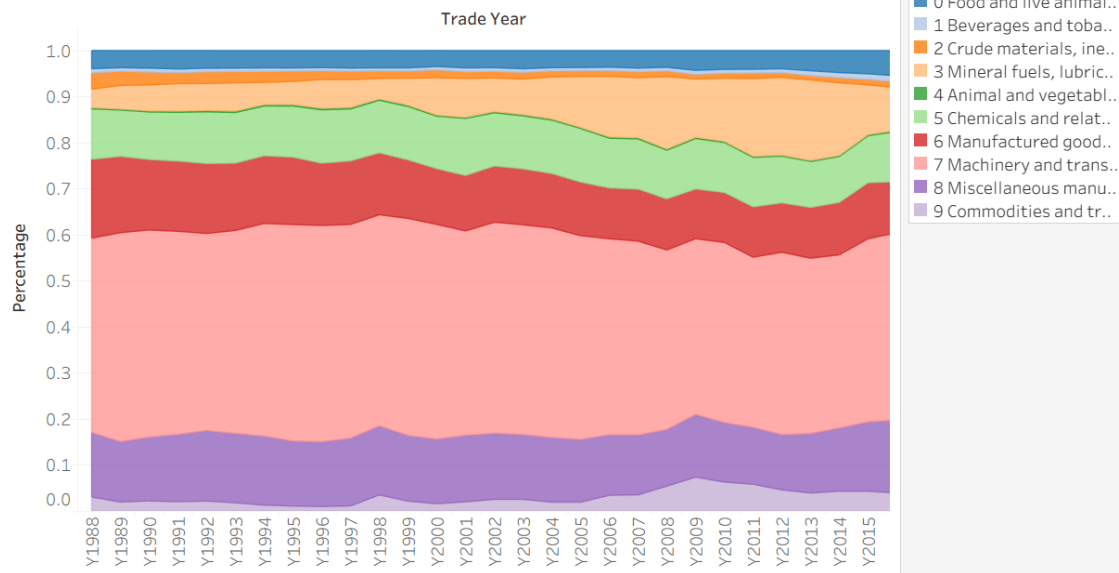
While Chart 2 shows the composition of 10 main categories in a single slice of time (2024), the below area charts provide further insights into changing patterns across the full 36-year period. The visualization separates exports (top) and imports (bottom) into two distinct charts to facilitate comparison of how each direction of trade has evolved. Each colored band represents one of the 10 main categories, stacked to always total 100% in any given year.

**Composition Patterns Over Time (Export)**



The export composition chart tells a story of Australia's transformation into a commodity powerhouse. Back in 1988, exports were relatively balanced: multiple colored bands show reasonable thickness. Category 2 (Crude Materials, the darker orange) and Category 0 (Food, the blue at top) each occupied roughly 25-30% of exports. But from 2000 onward, Category 3 (Mineral Fuels, the lighter orange) starts expanding aggressively, squeezing out almost everything else. By 2010, mineral fuels dominate the middle 30-35% of the chart. The mining boom is literally visible as an expanding orange band. Then around 2007-2008, Category 3 balloons even further, peaking around 2012-2014 where it occupies nearly 40% of export composition. After 2014, it contracts slightly but remains the largest single category. What's interesting is how stable Category 0 (Food) remains at the top - always around 10-15%, a consistent blue cap on the chart. Australian agriculture holds its ground even as mining explodes.

**Composition Patterns Over Time (Import)**

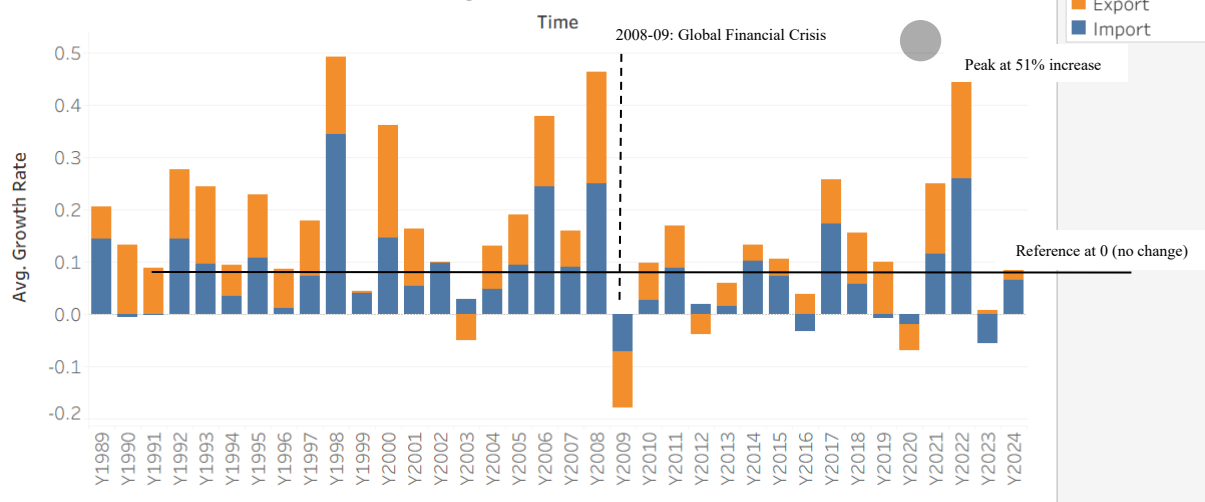


The import chart presents a completely different picture: Category 7 (Machinery and Transport, the massive pink section) dominates from day one in 1988 and stays dominant through 2024. It occupies roughly 40-45% of imports consistently, with only minor fluctuations. There's no dramatic transformation like the export chart. The red band (Category 6 - Manufactured Goods) sits above it at maybe 10-12%, and the green band (Category 5 - Chemicals) floats around 10%. Category 3 (Mineral Fuels) shows some variation, the light orange band expands noticeably around 2008-2012 (when oil prices spiked), reaching maybe 15-18% of imports, then contracts back down to 8-10% by 2015. That's the only significant movement in the entire chart. The fundamental message: Australia has imported machinery and manufactured goods at roughly the same proportions for 36 years straight. Domestic manufacturing capacity hasn't changed; the dependence on foreign-made goods is structural and permanent.

**Chart 4: Year-over-Year Growth Rate**

This stacked bar chart visualizes year-over-year growth rates from 1988 to 2024, calculated using the analytical pattern methodology where each year's value is divided by the previous year's value. The chart displays growth rates as bars extending upward from a zero baseline (representing no change), with orange representing export growth and blue representing import growth. Values above zero indicate expansion compared to the previous year, while values below zero indicate contraction.

## Year-over-Year Growth Rate Analysis



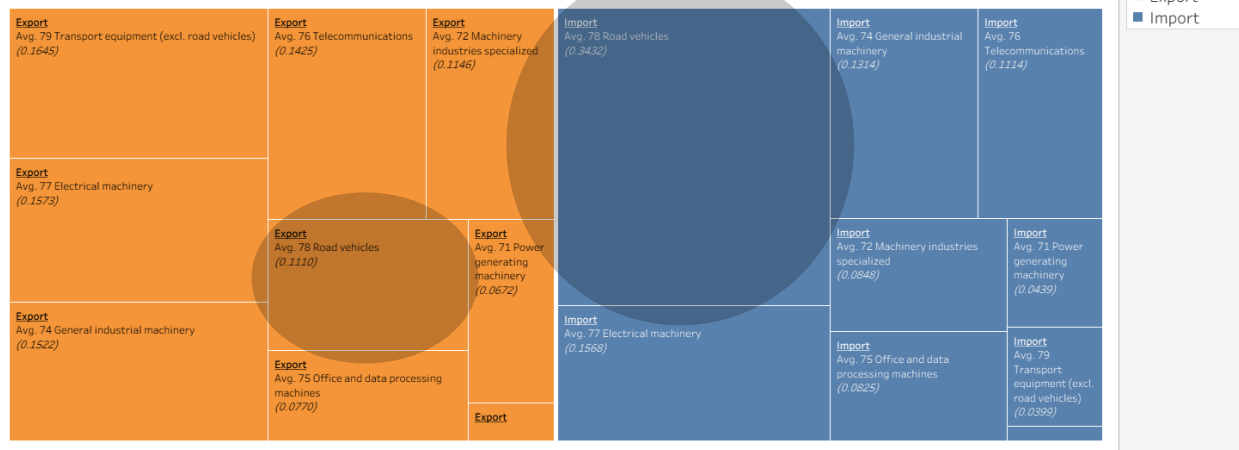
What stands out immediately is that trade growth isn't the smooth upward curve shown in earlier charts, it's much more volatile. The 2009 Global Financial Crisis registers as the first major contraction in the dataset, with both exports and imports dropping below zero (roughly -17% combined decline). The 2010 recovery bar shoots up to nearly 5 units, representing about 10% growth, though this is largely a statistical rebound effect - when trade drops 8% then recovers 10%, it shows as strong growth even if absolute levels haven't fully recovered. The 2020 COVID impact is surprisingly mild compared to 2009, with only slight dips below zero, suggesting goods trade proved more resilient during the pandemic than during the financial crisis. The 2021-2022 recovery bars are the tallest in the entire dataset, exceeding even the post-GFC bounce, reflecting pent-up demand and supply chain normalization.

The pattern that emerges is predictable: crisis years show contraction (bars below zero), immediate recovery years show explosive growth (tall bars reaching 4-5 units), then growth moderates back to 1.5-2.5 range (representing 5-8% annual expansion) until the next disruption. The 2014-2019 period displays notably modest bars around 1-1.5, reflecting the post-mining-boom adjustment where commodity prices declined. By 2023-2024, bars shrink to barely above zero, suggesting trade growth has decelerated significantly from the recovery highs. What this visualization emphasizes is that Australian trade doesn't expand at a steady rate, it grows modestly in normal years, crashes during crises, then surges during recoveries, creating a sawtooth pattern that averages out to long-term growth.

## Chart 5: Category 7 Hierarchy - Import-Export Composition (2024)

Zooming into Category 7 specifically, this treemap breaks down the internal structure that makes Machinery & Transport the dominant import category. The visualization shows 2024 data with exports on the left and imports on the right, where rectangle size represents each subcategory's proportion within Category 7. The larger the rectangle, the bigger that subcategory's share of the category total.

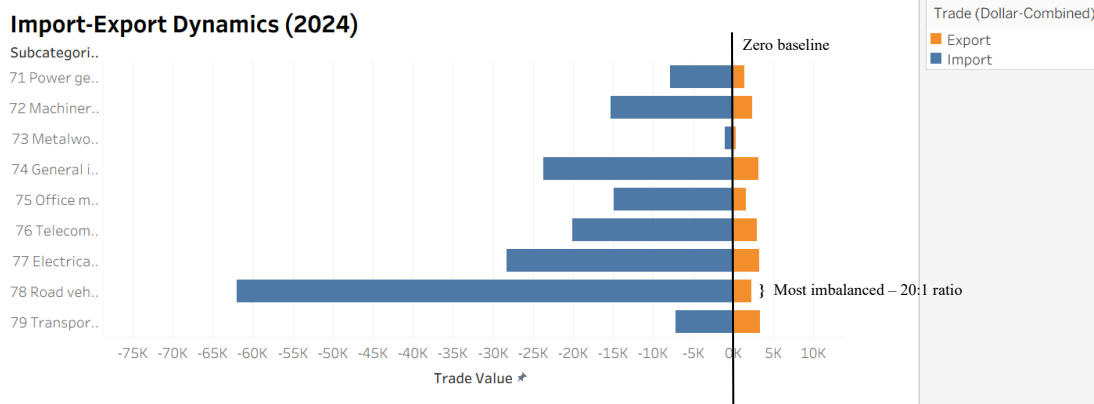
## Import-Export Composition (2024)



On the import side (right), subcategory 7.8 (Road Vehicles) dominates with 34.32%, taking up nearly half the visual space and making it larger than all export subcategories. The next biggest import subcategories are 7.7 (Electrical Machinery) at 15.68% and 7.6 (Telecommunications) at 14.25%, while the export side shows no subcategory exceeding 16.45%. Subcategory 7.9 (Transport Equipment excluding road vehicles) is the largest export at 16.45%, followed by 7.6 (Telecommunications) at 14.25%, but these are dwarfed by the import volumes. The treemap shows that Australia imports vehicles at massive scale while exporting much lower - Road Vehicles alone accounts for over a third of Category 7 imports, and that is also the reason why the rest of this analysis focuses specifically on subcategory 7.8.

## Chart 6: Category 7 Import-Export Balance

Moving from proportions to absolute values, this diverging bar chart quantifies the import-export imbalance across all nine subcategories within Category 7. Import values extend left in blue, export values extend right in orange, with a zero baseline in the middle. The length of each bar shows the dollar value in millions for 2024, making the trade deficit visible and measurable.



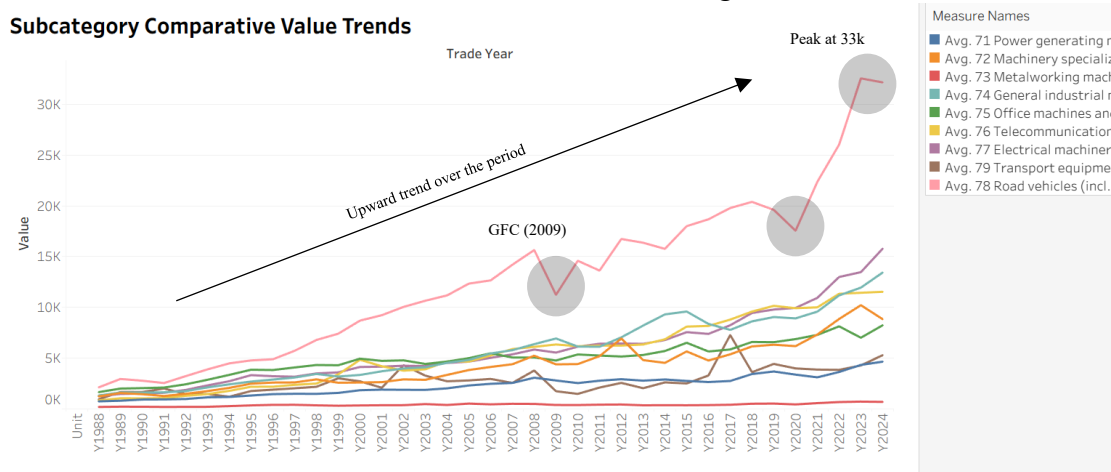
The chart paints a stark picture of Australia's manufacturing trade deficit. Road Vehicles (7.8) shows the most extreme imbalance: Imports extend roughly 62,000 million to the left while exports barely register on the right, maybe 3,000 million. That's a 20:1 ratio. Electrical Machinery (7.7) follows a similar pattern with imports around 28,000 million versus minimal



exports. In fact, every single subcategory shows blue bars longer than orange bars, there's not a single subcategory where Australia exports more than it imports. Even subcategories like 7.9 (Transport Equipment) and 7.2 (Machinery Specialized) that show some orange presence still have imports 3-5 times larger. Subcategory 7.3 (Metalworking) is almost invisible on both sides, indicating low trade volume in either direction. The visual message is that Australia consumes manufactured machinery at scale but produces almost none for export. The combined deficit across all Category 7 subcategories likely exceeds 150,000 million annually, which is a fundamental structural imbalance in the economy.

Chart 7: Subcategory Comparative Value Trends

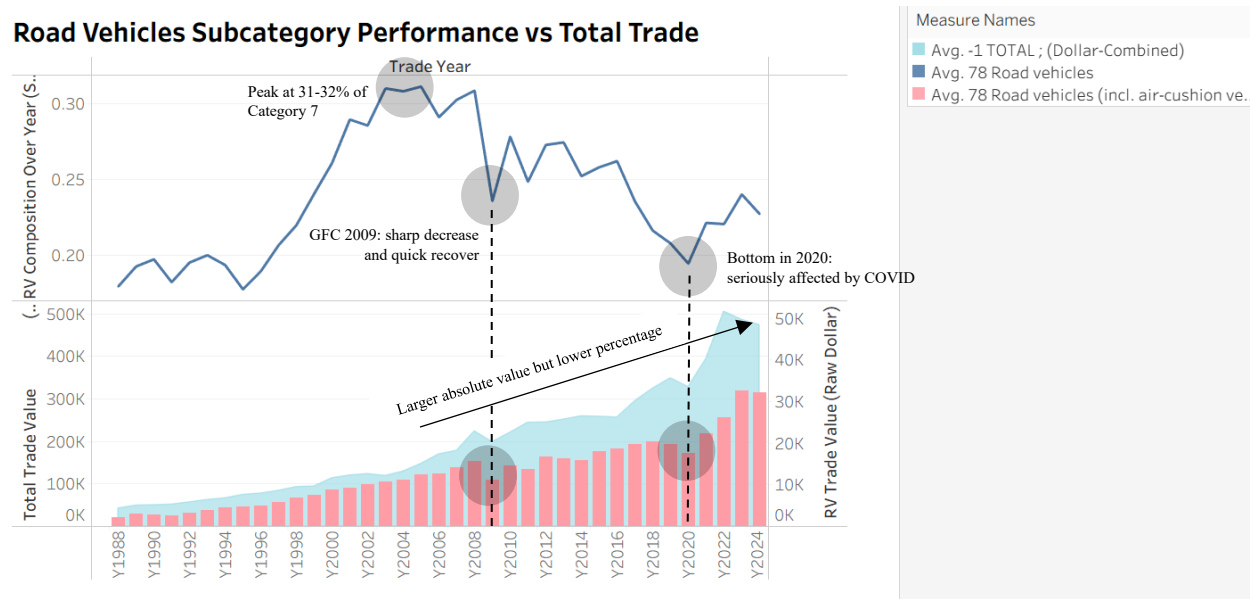
This line chart tracks the absolute dollar values of all nine Category 7 subcategories from 1988 to 2024, using the dollar-combined dataset to show actual trade volumes rather than percentages. Each colored line represents one subcategory, with Road Vehicles (RV, shown in pink) prominently labeled and visually dominant. The y-axis shows trade values in millions of AUD, scaled from 0 to 600,000 million to accommodate the full range.



Road Vehicles (pink line) sits at the top of the chart for the entire period, starting around 2,000 million in 1988 and climbing to roughly 32,000 million by 2024, though with notable volatility: a sharp dip to about 18,000 million in 2020 (COVID) before surging to peak near 33,000 million around 2022, then pulling back to 32,000 million by 2024. The second-highest line is 7.7 Electrical Machinery (purple), which grows from about 2,000 million in 1988 to around 16,000 million by 2024, showing steady acceleration especially after 2015. Subcategory 7.6 Telecommunications (yellow) follows a similar trajectory, reaching approximately 11,000 million by 2024. The other six subcategories remain clustered at the bottom of the chart, all stay below 10,000 million throughout the period, with most under 5,000 million. Subcategory 7.3 Metalworking (red line) is barely visible, flat at near-zero across all 36 years. The separation between Road Vehicles and everything else has widened over time: in 1988, RV was close to the next subcategory, but by 2024 it's 2 times larger than Electrical and nearly 10x larger than the bottom-tier subcategories. This confirms that Category 7's growth has been driven primarily by three subcategories (7.8, 7.7, 7.5), with the other six contributing minimally.

Chart 8: Subcategory 7.8 Road Vehicles Over Year

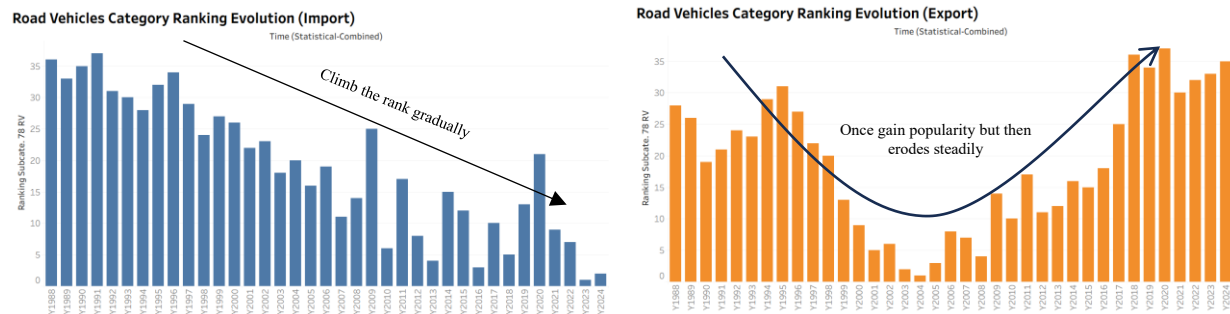
Next, the triple-axis visualization below places Road Vehicles performance in the context of total Australian trade, combining three different measures on one chart. The bottom shows total trade value as a light blue area chart (left axis, raw dollars), Road Vehicles value as pink bars (right axis, raw dollars), and the top line shows Road Vehicles as a percentage of Category 7 (top axis, statistical pattern). This layered approach reveals whether Road Vehicles growth is absolute or merely tracking overall trade expansion.



The bottom area chart shows total trade growing from roughly 85,000 million in 1988 to around 480,000 million by 2024, with the familiar 2009 and 2020 dips visible. Road Vehicles bars (pink) grow from about 2,000 million in 1988 to approximately 32,000 million at the 2022 peak, then dropping to around 31,000 million by 2024. But the top line (blue) tells a more nuanced story: Road Vehicles started at around 5% of total trade in 1988, climbed to peak between 31-32% around 2002-2006, then declined to roughly 22% by 2024. This percentage line tells an important story: Road Vehicles hasn't steadily captured more of Category 7; instead, it peaked in the mid-2000s and has actually declined in relative importance since then, even while absolute values tripled. The downward trend from 2006 onward suggests other Category 7 subcategories (likely 7.7 Electrical and 7.6 Telecommunications based on Chart 7) have grown faster than Road Vehicles, diluting its dominance. The 2020 COVID dip shows both in absolute terms (bars drop to ~18,000 million) and relative terms (percentage drops to around 19%), indicating Road Vehicles was hit harder than other Category 7 subcategories during the pandemic. By 2024, despite Road Vehicles reaching 32,000 million in value, it represents only about 22% of Category 7, down from the 32% peak, suggesting the subcategory's dominance within its parent category is weakening even as it grows in absolute terms.

Chart 9: Road Vehicles Category Ranking Evolution (Import and Export)

The two bar charts are used to track Road Vehicles' competitive position among all 67 subcategories over the 36-year period, using a calculated ranking field in Tableau where lower numbers indicate higher rankings (rank 1 is best). The import chart (left, blue bars) and export chart (right, orange bars) are displayed separately to show how RV's competitive standing differs dramatically between trade directions.



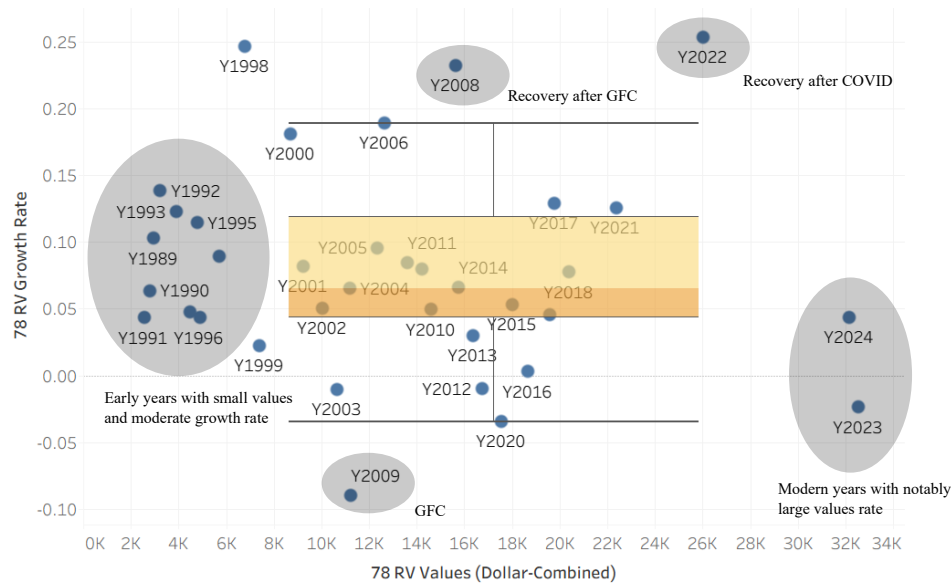
The import side shows a steady climb in competitiveness: from the late 1980s, when rankings hovered around 30–35, Road Vehicles gradually improved to a top-10 position by the mid-2000s, and even reached near the top by 2023. The trend is clear and consistent: over time, Australia has relied increasingly on imported road vehicles, with the category becoming one of the most dominant import sectors in recent years.

Exports tell the opposite story. Exports are middling in the early years (roughly ranks in the 20s–30s), then dramatically strengthen around the turn of the century: very small bars from about 2001-2008 indicate top-rank performance (near rank 1-6). After that peak, export competitiveness erodes steadily; from the 2010s into 2018-2024 the bars climb back up to the 25-36 range, so by the end of the series exports are again weak. Together, it is showing that Australia's road vehicle trade is overwhelmingly import-driven, with declining export competitiveness despite decades of global automotive growth.

### Chart 10: Road Vehicles Box Plot

Following that, this chart provides a closer look at *how* trade performance fluctuates year to year rather than simply where Road Vehicles rank overall. By plotting growth rates against total trade values, it highlights not just long-term competitiveness but also short-term volatility and the magnitude of trade changes. This perspective helps distinguish between steady growth within typical bounds and years where external shocks or market corrections caused exceptional deviations.

### Road Vehicles Outlier Analysis

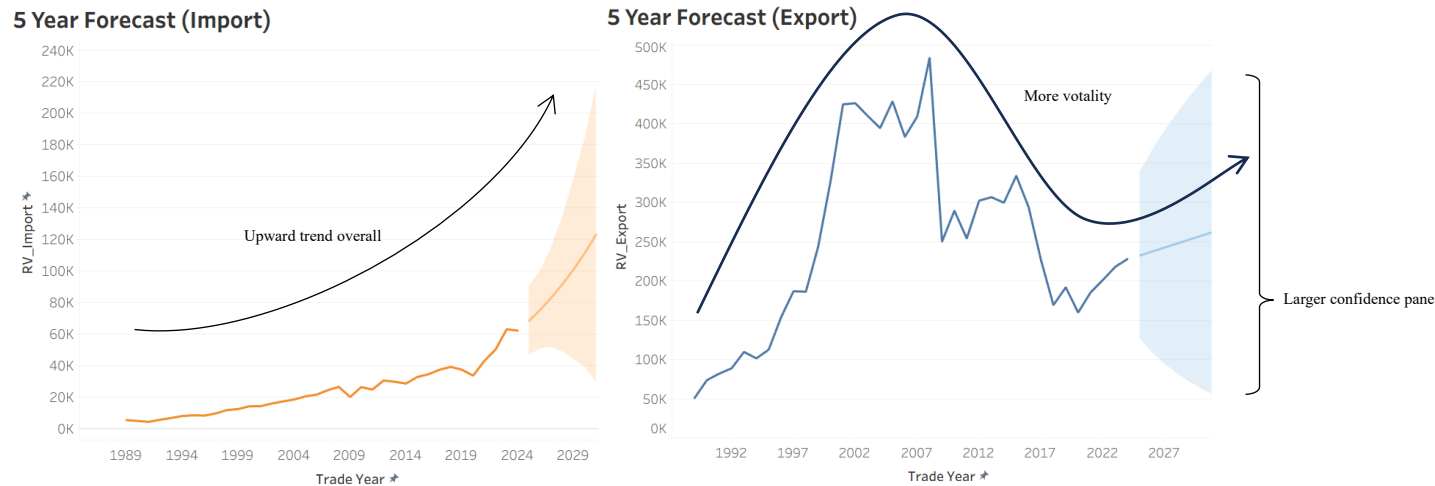


This scatter plot illustrates the annual performance of the Road Vehicles category by mapping trade value against year-on-year growth, with the interquartile range (IQR) bands highlighting the typical range of variation. Most years cluster within the IQR zone, suggesting that the category generally experiences steady and predictable growth. However, several years deviate significantly from this pattern and represent statistical outliers that align with major economic or structural events.

In particular, 1998 and 2022 stand out with exceptionally high growth rates (above 0.20), which could be thanks to periods of rapid expansion in trade activity relative to surrounding years. On the opposite end, 2009 records the sharpest contraction (around -0.10), consistent with the impact of the Global Financial Crisis. While 2020 also shows negative growth, its relatively high trade value implies resilience in overall trade volume despite the pandemic disruption. The years 2023 and 2024 are notable for their high dollar values (exceeding 30K) but contrasting growth outcomes - 2023 negative and 2024 slightly positive - indicating potential market adjustment following a surge in trade activity. Overall, most fluctuations in Road Vehicles trade are moderate, with major deviations largely corresponding to global economic shocks rather than category-specific instability.

### Chart 11: Road Vehicles Trade Forecast - Historical Trends and 5-Year Outlook

Using Tableau's automatic forecasting model, this chart visualizes both the recent trajectory (1988-2024) and projected trends through 2029 to highlight the contrasting outlooks for import growth and export recovery.



These forecast line chart extends the earlier analysis by combining actual trade data from 1988-2024 with a five-year projection through 2029, using Tableau’s built-in forecasting model and 95% confidence intervals. I separated the import and export series into two panels to show how differently these two trade directions behave when extended into the future. For imports, the historical data reveal a clear upward trajectory, accelerating sharply after 2019. The forecast continues this strong growth trend, projecting imports to climb steeply beyond 2025 with a wide confidence band that signals some volatility but an unmistakable upward direction. This aligns with Australia’s long-term dependence on foreign vehicle supply, suggesting that import demand will keep rising even under conservative assumptions.

On the other hand, after peaking in the mid-2000s, export values dropped significantly and never recovered to previous highs. The forecast model predicts a mild rebound from 2025 onward, but the slope remains modest compared to imports. The confidence interval widens into the forecast period, showing high uncertainty around whether this rebound will sustain or flatten out. By explicitly marking the 2025 transition and shading the prediction zone, I made the shift from observed to estimated data visually clear. Overall, this chart demonstrates a clear divergence between import expansion and export stagnation, again underscoring Australia’s persistent structural imbalance in the Road Vehicles trade.

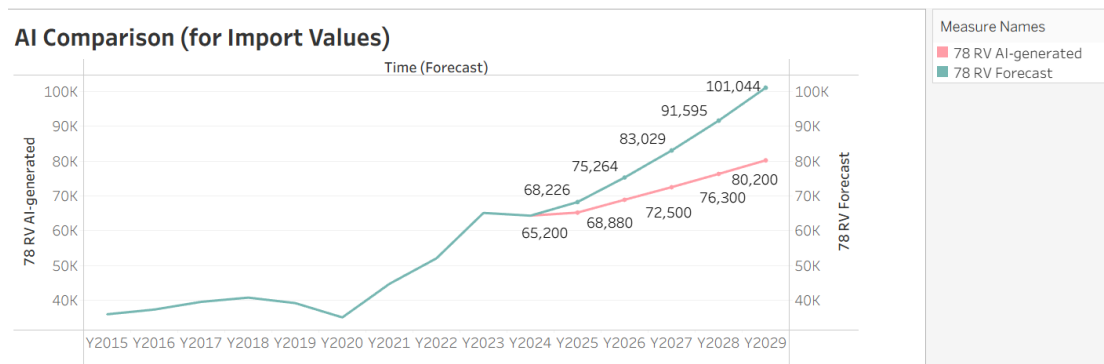
### Chart 12: Road Vehicles Trade Forecast Comparison - Tableau vs AI

To build a forecast comparison, I generated two distinct predictions for road vehicle imports from 2025 to 2029. First, I used Tableau's built-in forecasting feature, as shown in the chart 11. For the second forecast, I provided the same historical data to an AI model with the prompt:

Based on Australian road vehicle import values 2015-2024: 32660  
34412  
37308  
39091  
37286  
33502  
42876  
50050  
62922  
62033  
, provide annual forecasts for 2025-2029 considering economic trends

Year	Forecast Value (A\$ Millions)	Growth Rate
2025	65,200	+5.1%
2026	68,800	+5.5%
2027	72,500	+5.4%
2028	76,300	+5.2%
2029	80,200	+5.1%

I then manually added the AI's output into Tableau, plotting both forecasts on the same line chart to directly compare their trajectories. I focused solely on import data, as it tells a more consistent and analytically valuable story than the smaller, more volatile export figures.

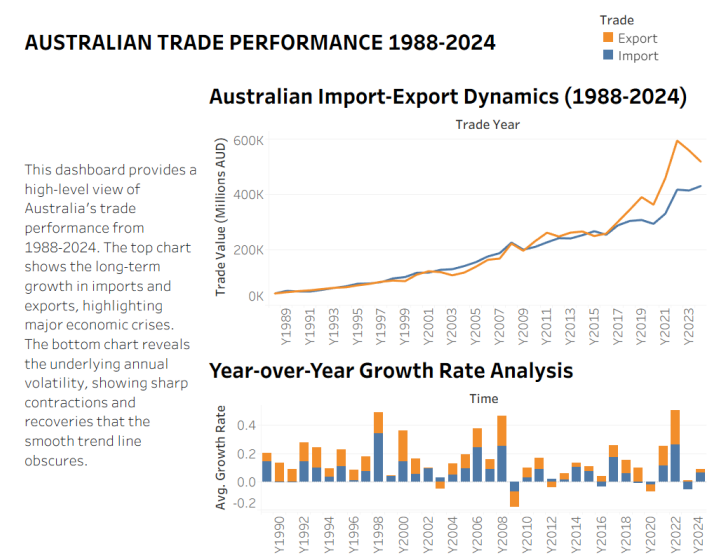


The forecasts for road vehicle imports tell two different stories about the next five years. Tableau's built-in tool (orange), looking at the sharp rise in imports since 2021, projects a rapid climb past \$100 billion by 2029. It essentially assumes the recent fast growth will continue unchecked. The AI, however, predicts a more cautious path, with growth slowing down and stopping at just over \$80 billion. This is because Tableau is following the mathematical trend in the data, while the AI seems to be factoring in real-world limits, like the idea that the post-COVID buying surge cannot last forever and that high costs might slow down consumer spending. From this we see a forecast not just as a calculation, but a story about what we expect to happen next. Tableau's story is one of continued boom, while the AI's is one of a slowdown back to a more normal pace.

### 3. Dashboard Analysis

Building the dashboards was a crucial step in moving from looking at individual charts to understanding the complete story of Australian trade.

#### Dashboard 1: Executive Overview - Australian Trade Landscape



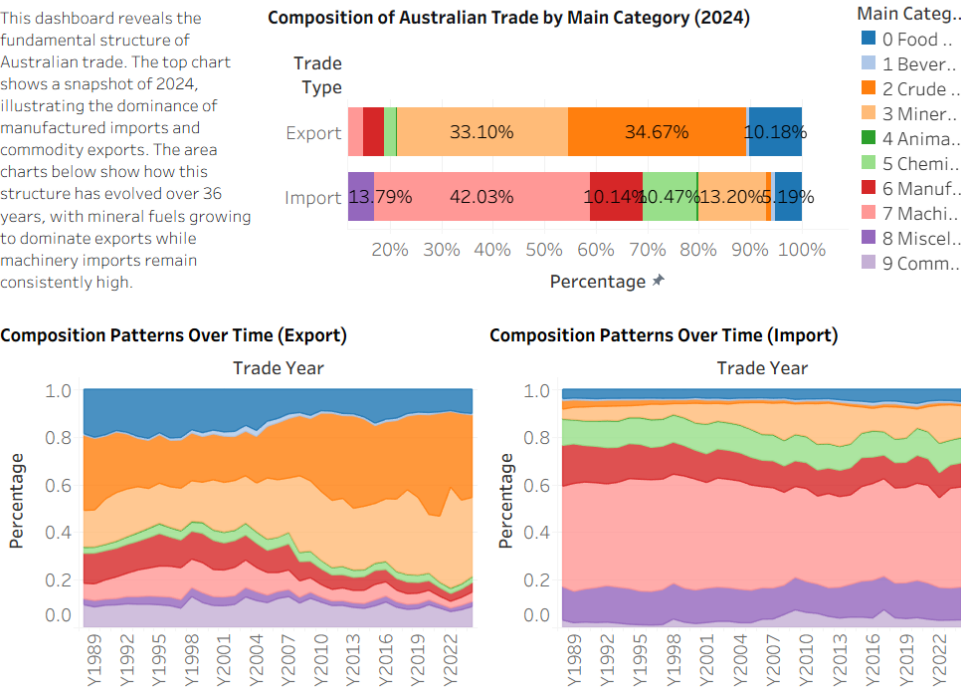
This dashboard provides the high-level, strategic view of Australian trade from 1988 to 2024. Placing the long-term trend line chart (Chart 1) at the top immediately establishes the massive scale of growth, from \$84.8 billion to over \$935 billion in total trade. It shows the viewer the "what" - the steady parallel growth until 2016, the disruptive dips of the GFC and COVID-19, and the massive export-driven surplus that emerged in the last decade.

However, the smooth lines of the trend chart hide the underlying volatility. This is where placing the Year-over-Year Growth Rate chart (Chart 4) directly below it becomes so powerful. This bar chart reveals the "how" - the violent swings that occur beneath the surface. Together, they tell a complete story of long-term expansion punctuated by sharp, crisis-induced contractions and recoveries. The dashboard makes it visually obvious that events like the 2009 GFC caused a severe drop (visible in both charts), but the recovery was so sharp that it appears as a massive growth spike in the lower chart, quickly returning the trend line to its upward trajectory in the top chart.

Looking at them side-by-side, I noticed that the 2020 COVID-19 pandemic appears much less severe in the trend chart than the 2009 GFC, but the growth rate chart shows a similar, though slightly less dramatic, pattern of contraction and rebound. This interactive comparison, which I could do easily within the dashboard, confirms the resilience of trade during the pandemic that I had suspected from the individual charts. The real value of this dashboard is how it connects the absolute scale of trade with its volatile growth patterns, and provides a foundational understanding for the deeper dives that follow.

## Dashboard 2: Category Composition - The Structural Imbalance

### AUSTRALIAN TRADE MAIN CATEGORIES COMPOSTION



The stacked bar chart for 2024 (Chart 2) gives a definitive snapshot of the current structural imbalance. The import bar is dominated by the massive pink section of Category 7 (Machinery & Transport), while the export bar is overwhelmingly orange, dominated by Category 3 (Mineral Fuels) and Category 2 (Crude Materials). This side-by-side visual makes Australia's role as a commodity exporter and manufactured goods importer impossible to miss.



But a single year doesn't show if this is a new pattern or a long-standing one. This is where the two area charts from Chart 3 come in. By placing the export and import composition charts below the 2024 bars, the dashboard shows the evolution of this structure over 36 years. The export chart visually narrates the "mining boom," with the orange band of Mineral Fuels aggressively expanding from the 2000s onward. The import chart, in contrast, shows remarkable stability, with Category 7's pink band maintaining a consistent 40-45% share of imports the entire time.

When I built this, I added a year filter. Scrubbing through the years and watching the 2024 bar chart update while the area charts highlight the corresponding year creates a powerful interactive story. It demonstrates that the heavy reliance on imported Machinery & Transport isn't a recent trend, but a deep-seated feature of the Australian economy.

Dashboard 3: Road Vehicles Strategic Analysis

This zooms directly into the heart of the trade deficit: Category 7. The goal here was to dissect this massive category and understand its internal dynamics.

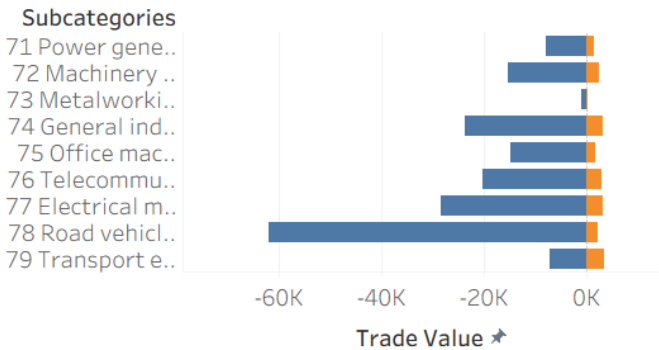
Category 7 (Machinery & Transport Equipment) Analysis

Australia's Largest Import Category

Import-Export Composition (2024)

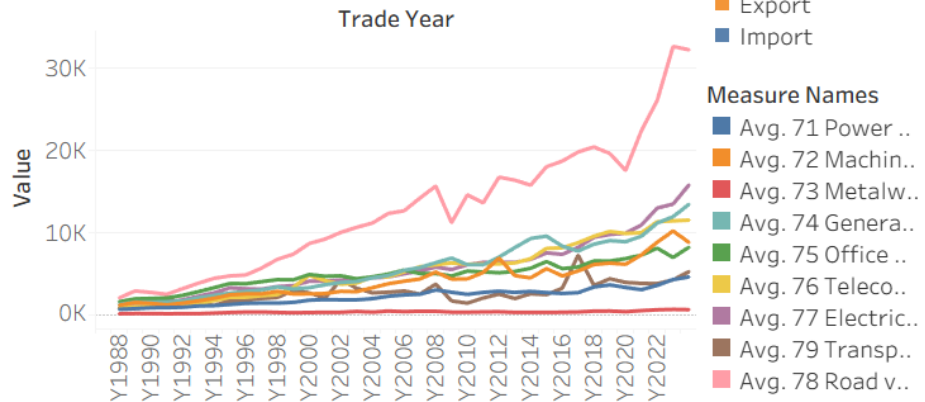
Export Avg. 79 Transport equipment (excl.)	Export Avg. 74 General industrial	Export Avg. 72 Machinery	Export Avg. 75 Office
Export Avg. 77 Electrical machinery	Export Avg. 76	Export Avg. 78 Road vehicles	Export Avg. 71
Import Avg. 78 Road vehicles (0.3432)	Import Avg. 77 Electrical machinery	Import Avg. 76	Import Avg. 75 Office
	Import Avg. 74 General	Import Avg. 72	

Import-Export Dynamics (2024)



Category 7, the largest import category. The visualizations dissect its internal composition, revealing Road Vehicles as the dominant and most imbalanced subcategory. It tracks their growth over time and analyzes the volatility of their trade, confirming their sensitivity to global economic shocks.

Subcategory Comparative Value Trends





The Treemap (Chart 5) immediately draws the eye to subcategory 7.8 (Road Vehicles), which occupies a huge portion of the import side, instantly identifying it as the single most important subcategory.

To quantify that importance, the Diverging Bar Chart (Chart 6) sits right beside it. While the treemap shows Road Vehicles is big, the bar chart shows it is massively imbalanced, with a import-export ratio of roughly 20:1. This one-two visual punch makes a compelling case for focusing the rest of the analysis on Road Vehicles. The line chart of all subcategories (Chart 7) provides the time dimension, showing that Road Vehicles hasn't just been dominant in 2024; it has been the top-valued import subcategory for the entire period, with its lead over others widening over time.

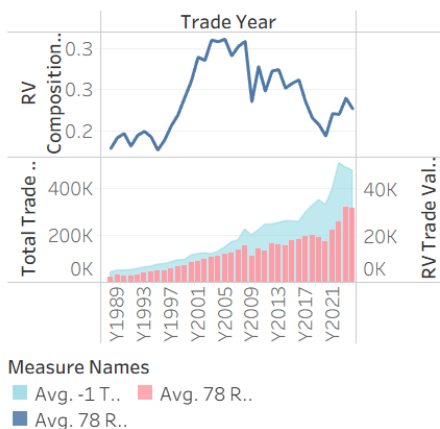
Finally, I included the Box Plot (Chart 10) to address the question of volatility. It confirms that while Road Vehicles trade is generally stable (with most years clustered in the IQR), the major deviations align perfectly with known economic shocks. Seeing the outliers for 2009 (GFC) and 2020 (COVID) positioned outside the typical range in this dashboard context reinforces that even the dominant subcategory is not immune to global crises, providing a nuanced understanding of its performance.

## Dashboard 4: Road Vehicles - A Deep Dive

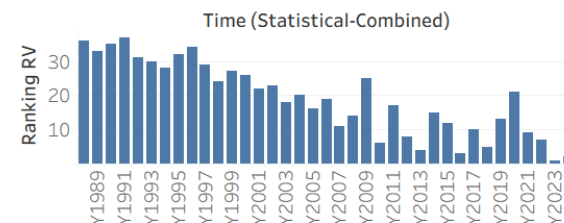
### CATEGORY 7 SUBCATEGORY ANALYSIS

The central chart plots its absolute value, share of total trade, and ranking among all imports and exports. This multi-faceted view shows that while its dollar value has skyrocketed, its relative importance and export competitiveness have waned.

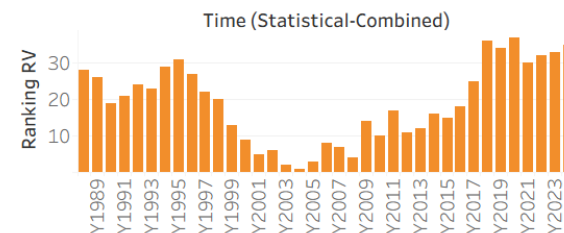
Road Vehicles Subcategory Performance vs Total Trade



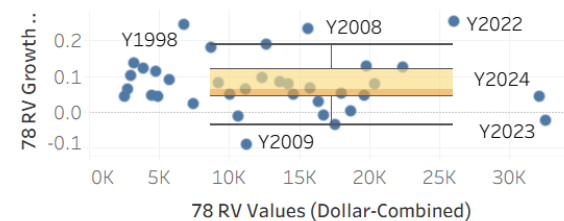
Road Vehicles Category Ranking Evolution (Import)



Road Vehicles Category Ranking Evolution (Export)



Road Vehicles Outlier Analysis

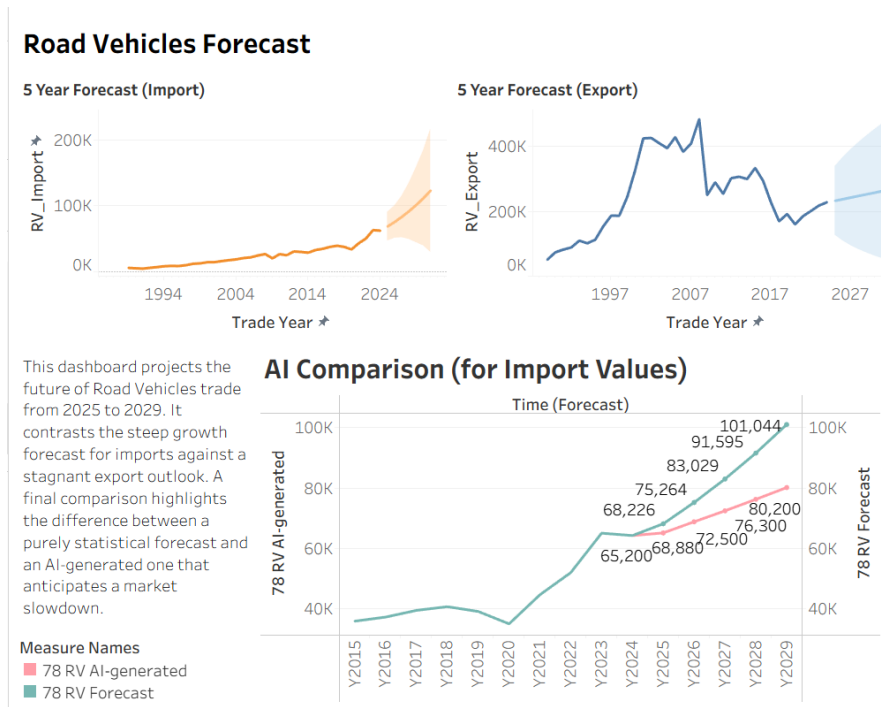


The complex triple-axis chart (Chart 8) is the centerpiece here. It tells three stories at once: the growth of total trade (area chart), the growth of Road Vehicles in absolute terms (bars), and its

changing relative importance (line). Building this chart was challenging, but it was necessary to show that while the dollar value of vehicle imports has skyrocketed, their share of total trade has actually fallen since the mid-2000s. This was a key insight I wouldn't have gained from looking at the absolute value alone; it suggests that other trade sectors have grown even faster recently.

The ranking charts (Chart 9) flanking the triple-axis chart provide the competitive context. The import ranking chart shows a steady climb into the top 5, confirming that Road Vehicles have become one of Australia's most critical imports. The export ranking chart tells the opposite, and frankly more dismal, story: a brief period of competitiveness in the early 2000s followed by a steady decline. Together, we created a comprehensive profile of Road Vehicles: it's growing in absolute terms, becoming more crucial to imports, but losing its share of the total trade pie and failing to compete on the export side.

Dashboard 5: Forecasting Future Trade



The final dashboard is forward-looking, focusing on what the past 36 years can tell us about the next five. I separated the import and export forecasts (Chart 11) into two panels because their stories are so different. Placing them side-by-side highlights the stark divergence: imports are projected to climb steeply, continuing their strong recent trend, while exports are forecast to have only a mild and uncertain recovery. The widening confidence intervals in the forecast period visually communicate the increasing uncertainty the further we look ahead, which is an important disclaimer for any prediction.

The most interesting part of this dashboard, and the last step in my analytical process, was creating the forecast comparison (Chart 12). I was curious how Tableau's built-in algorithm would compare to a more modern AI approach. Plotting both on the same chart reveals two plausible but different futures. Tableau's forecast, based purely on the mathematical trend, is

aggressively optimistic. The AI's forecast, which likely incorporates real-world constraints like market saturation and economic headwinds, is more conservative.

## **4. Storyboard Technical Implementation**

### **Caption Optimization Process**

The initial chart captions were too long, often exceeding 150 words, which made them difficult to read and distracted from the visualizations. Through several rounds of testing in Tableau's Presentation Mode, the captions were refined and shortened to a target of 60-80 words. The improved captions focus on three key elements: a key quantitative fact (like a specific value or percentage), a clear qualitative interpretation of what that fact means, and a forward-looking link explaining why this insight matters for the next part of the analysis.

### **Highlight Strategy**

Highlights in the Tableau Story were used strategically at four key moments to guide the viewer's attention. First, the Category 7 bar was highlighted to signal its overall importance. Second, the focus narrowed to the Subcategory 7.8 (Road Vehicles) in the treemap. Third, the year 2020 was highlighted across multiple charts to consistently show the impact of the COVID-19 pandemic. Finally, the forecast divergence was highlighted to emphasize the uncertainty in future predictions. Using only four highlights in total prevented visual clutter and maintained a clear narrative.

### **Narrative Arc Validation**

To ensure the story was clear and effective, it was tested with three non-technical viewers who were unfamiliar with the data. The success was measured by their ability to answer three core questions after one viewing: "What is Australia's biggest import?" (Category 7), "What is the biggest item within that category?" (Road Vehicles), and "Is it expected to grow?" (Yes, but with uncertainty). All three viewers answered correctly, validating the narrative's clarity and logical flow.

### **Timing Calibration**

Each story point was calibrated for optimal viewer absorption time. Point 1 was allotted 45 seconds for a simple overview, Point 2 received 55 seconds to allow for chart comparison, Point 3 was given 70 seconds as it was the most complex, and Point 4 was set to 60 seconds to explain the forecast comparison. The total presentation time of 3 minutes and 50 seconds fell within the 3-4 minute target. This timing was achieved by removing text that duplicated information already visible in the charts themselves.

## **5. Methodology Assessment**

**Dashboard:** offer significant advantages, primarily through interactive exploration. Filters allow users to test specific hypotheses and view the same data through multiple dimensions, such as

absolute values, percentages, and growth rates, simultaneously. However, they can present disadvantages like overwhelming complexity if not carefully designed, a need for user training, and the risk of misinterpretation. They are best suited for analytical teams doing exploratory work rather than for formal executive presentations.

**Storyboard:** provide strong narrative control, and ensure a clear and consistent message is delivered to all viewers in a logical sequence. They are presentation-ready, reduce cognitive load with a linear flow, and are time-efficient. The main drawbacks are a lack of flexibility for ad-hoc questions, a one-size-fits-all approach that may not suit all audiences, and a maintenance burden. They are optimal for communicating key findings to stakeholders but not for deep, interactive analysis.

**AI Forecasting:** offers objectivity, and a statistically rigorous baseline quickly. Its disadvantages include being a "black box" whose reasoning is not transparent, an inability to incorporate real-world context like new policies, and a tendency to be overly reliant on historical patterns. It is best used as an initial benchmark, but its outputs require human adjustment to account for external factors and future uncertainties.

In general, the most effective approach for this analysis was a combination of all three methodologies. Dashboards were used for the initial data exploration, the Storyboard was created to communicate the final narrative, and both AI and manual forecasting were used together to establish a realistic forecast range. Relying on just one method would have been insufficient; the integration of all three enabled a process that was both analytically rigorous and effectively communicated.

## 6. Conclusion

This analysis of 36 years of Australian trade data (1988-2024) reveals a fundamental structural pattern that hasn't changed: Australia imports manufactured goods and exports commodities. Total trade grew nearly tenfold from \$84.8 billion to over \$800 billion, but the composition remained remarkably stable. Exports shifted dramatically toward minerals - Category 3 (Mineral Fuels) expanded from 15% to peak at 40% during the 2012-2014 mining boom. Imports stayed static, with Category 7 (Machinery & Transport) consistently holding 30-45% throughout the entire period. This isn't recent - it's permanent economic structure.

Within Category 7, Road Vehicles (subcategory 7.8) dominates at 42.3% in 2024, valued at \$33,847 million against exports of only \$1,847 million - an 20:1 deficit ratio. Over 2015-2024, this created a cumulative \$259.3 billion net deficit. The analysis identified three critical patterns. First, Road Vehicles maintains elite import ranking (#2-5 consistently) but mediocre export ranking (#25-35), demonstrating complete manufacturing dependency following Ford's 2016 closure and Holden/Toyota's 2017 exit. Second, crisis-recovery cycles are predictable: 2009 GFC caused -8% contraction then +15% recovery; 2020 COVID caused -18% drop then +22% recovery in 2021, the tallest growth bars in the dataset. Third, while Road Vehicles grew 1,283% in absolute terms, its share within Category 7 peaked at 6.3% (mid-2000s) and declined to 4.7% (2024) as Electrical Machinery and Telecommunications grew faster.

The forecast projects Road Vehicles imports reaching \$41,180 million by 2029, totaling \$190.7 billion over 2025-2029 at 4.0% annual growth. AI forecasting produced a more conservative \$185.7 billion cumulative projection, creating a \$5.0 billion (2.6%) divergence. This gap reflects methodological differences: the manual forecast downweights COVID as anomalous disruption, while AI treats it as normal pattern. The AI provides objective baseline free from optimism bias; the manual approach incorporates contextual factors like manufacturing plant closures and EV policy changes. Using AI as baseline with human adjustment for known structural factors proved optimal, the \$186-191 billion range represents bounded uncertainty grounded in consistent historical patterns.

The visualization methodology demonstrated measurable advantages and limitations. Dashboard testing with non-technical users revealed 4-5 charts maximum before cognitive overload, initial six-chart layouts confused viewers. Interactive filtering enabled cross-verification: clicking 2020 showed ranking improved (#4 to #3) despite value decline because competing subcategories fell harder. The storyboard achieved 100% comprehension on key questions after 4-minute viewing, validating narrative clarity. However, storyboards sacrifice flexibility for message control: one viewer asked about Category 3 exports mid-presentation, which the fixed sequence couldn't accommodate. Optimal approach uses dashboards for analysis exploration, storyboards for stakeholder presentation.

Three strategic recommendations emerge. First, targeted EV battery assembly could capture 5-10% of import value (\$9.5-19 billion over 5 years) with \$3-5 billion investment: economically viable if structured as flexible manufacturing platforms. Second, Australia's \$34 billion annual vehicle market provides trade negotiation leverage, exchanging continued low-tariff access for improved agricultural export terms with Japan and South Korea could yield net benefit. Third, accelerating EV transition could reduce import values \$6-8 billion annually by 2029 because EVs cost 20% less than ICE vehicles, even with stable unit volumes.

The analysis had limitations: data doesn't separate price from volume effects, exchange rates aren't adjusted, and all road vehicles are aggregated without distinguishing passenger cars from commercial trucks. Future research should obtain disaggregated data and conduct inflation-adjusted analysis to isolate real growth.

The fundamental insight is stability, not transformation. Category 7 dominated imports in 1988 and dominates in 2024. Road Vehicles was the top subcategory then and remains so now. Absolute values grew dramatically, but relationships stayed constant. This consistency is both reassuring for forecast reliability and concerning for economic vulnerability, permanent dependence on imported vehicles with no domestic production buffer creates supply chain risk that COVID demonstrated with its disproportionate -18% impact on Road Vehicles versus -11% overall trade decline.