



COS30045 DATA VISUALISATION

TP02-2024 Assignment 3B - Project process book
Title: Economic Surveys Australia 2023 - Employment and Demand
Indices



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1. Introduction

1.1. Background and motivation

There is no doubt that the economy is one of the most crucial factors in boosting a country's value and elevating its global ranking. A strong economy not only enhances a nation's standing on the world stage but also plays a vital role in ensuring that its inhabitants enjoy a stable and prosperous life. In this report, we aim to present comprehensive data visualizations that illustrate the economic statistics of Australia up to the year 2023, following the global pandemic. The datasets, sourced from the OECD Library website, reveal that while Australia's economic growth recovered strongly and rapidly in the aftermath of the pandemic, this growth is now showing signs of slowing down. Our analysis will delve into these trends, providing insights into the factors contributing to the initial recovery and the subsequent deceleration.

We do believe that our data visualization will be playing a significant role in supporting inhabitants and also for organizations to have an overview of Australia's economy including Investor, Financial Analysts, Academics, Researchers, Businesses, Entrepreneurs, International Organizations, Media, Journalists and General public [5].

Obviously, various groups are interested in the Australian economy for different reasons, and data visualization plays a crucial role in this. Investors and financial analysts can use our charts to analyze market conditions, manage risks, and optimize investment portfolios. Businesses and entrepreneurs rely on our visual data to engage in strategic planning, financial forecasting, and improving operational efficiency. Academics and researchers utilize our visualizations to study economic trends, publish findings, and educate students. International organizations employ visual

data to monitor economic performance, provide policy recommendations, and conduct comparative analyses. Media and journalists use visual aids to report on economic news, offer in-depth analysis, and raise public awareness. Meanwhile, the general public benefits from visual data to manage personal finances, plan careers, and keep track of the cost of living. Each group leverages data visualization to understand and influence the economic landscape of Australia effectively [12].

1.2. Visualisation purpose

Team member - 103422254 (Thang Truong)

Data visualization enables users to answer a variety of questions by making complex data more accessible and understandable. From our understanding, the purpose of data visualisation will help identify trends and patterns over time, compare performance across different products or regions, and understand the distribution of variables like age, trend, habits or income. Users can also explore relationships between the variables, detect outliers, and gain geographical insights. Additionally, visualization aids in resource allocation, performance tracking against targets, understanding users' behaviours, and identifying operational inefficiencies [6].

According to my completed visualisation (dataset1) which can enable users to find out significant advantages information like

- The Line Chart illustrates an essential economic metric, showcasing Employment, Real Domestic Demand, and Nominal Domestic Demand.
- The trends in employment levels over year (quarters from each year have been added together -from Bar chart).
- The Area Chart provides an extensive depiction of Real Domestic Demand, covering almost a decade from 2016 to 2025, highlighting the total demand for goods and services within the economy.

- The Scatter Plot Chart depicts the variations in Nominal Domestic Demand over time.

From our perspective, data visualization offers numerous benefits, including saving users significant time in reading and researching statistics. It enhances decision-making, increases productivity, fosters innovation, and improves communication. Additionally, it helps businesses and Financial Analysts quickly interpret complex data, streamline operations, and identify new growth opportunities. Effective visualization also supports economic resilience during crises by aiding critical decision-making and resource allocation. Finally, it creates job opportunities in data science and analytics, contributing to overall economic development.

Team member: - 104924340 (Linh Doan)

Our visualization will allow users to answer the following questions:

1. How did the economic growth recovery patterns differ across OECD countries?
2. What were the main drivers of GDP growth during the recovery period?
3. What is the change in employment concerning real and nominal domestic demand?
4. Did economic growth slow down, and if so, when did it start showing signs of slowing down? [4]

Benefits of the visualization include:

- Comparisons of cross countries' economies
- Components of economic growth are underlined
- The connection between employment and economic demand
- Early warning signs for possible economic slowdown can be spotted

1.3. Project schedule

Verify and working on datasets	Updating Project process book	Updating Project process book (cont....) and start coding	Updating Project process book (cont.) and coding (cont....)	Review and submit
From: 01 st -Sep-2024	From: 09 th -Sep-2024	From: 24 th -Sep-2024	From: 30 th -Sep-2024	6-7 th /10/2024
To: 06 th -Sep-2024	To: 20 th -Sep-2024	To: 27 th -Sep-2024	To: 04 th -Oct-2024	
Contribution: 20% on each team member	Contribution: 20% on each team member	Contribution: 40% on each team member	Contribution: 20% on each team member	Review, combination tasks and ready to submit

2. Data

2.1. Data source

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We collected 2 sample datasets from the OECD Library website in terms of Economic growth recovered strongly from the pandemic and the economy recovered rapidly but growth is now slowing.

Please refer to the references to verify the credibility of the sources [13].

Dataset 1- Economic-growth-recovered-strongly

The datasets we had collected are being expressed in a type of table format. It contains three attributes like Employment, Real domestic demand, and Nominal domestic demand. The values for these attributes are numerical, string and date format. They are wonderful in terms of used trend analysis and forecasting in economic contexts.

Data from our datasets has been cleaned and customised in terms of attractive to users and enhances the role of storytelling. The reasons are the original dataset associated with sample charts and having different formats as we are not expected. This is not suitable for encoding.

Dataset 2- The-economy-recovered-rapidly-but-growth-is-now-slowing

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The data presented in this visualization is derived from two main indexes and quarterly time intervals:

Employment Index: This index tracks the changes in employment levels over time, where the base period is set to March 1, 2016 (indexed to 100). This allows us to observe how employment levels have increased or decreased relative to the base period.

Real Domestic Demand Index: This index measures the demand for goods and services within the domestic economy, adjusted for inflation. Like the Employment Index, it uses March 1, 2016, as the base period (100), making it possible to compare changes in real demand over time, independent of price level changes [3].

Nominal Domestic Demand Index: Unlike the Real Domestic Demand Index, this index reflects the total demand for domestic goods and services without adjusting for inflation. It is also indexed to the same base period, March 1, 2016 (100), to provide a consistent frame of reference.

Quarterly Dates: The intervals used for this data are based on quarterly time periods (e.g., Q1 2016, Q2 2016, etc.), which represent the data collection periods for each of the indices mentioned. These dates help to map the progression of the economic indicators over time.

All indices are ratio data, as they represent measurements relative to a base value. The quarterly dates are interval data, marking regular time intervals to show trends across different periods.

This visualization is intended to illustrate the trends in employment and domestic demand (both real and nominal) over time, enabling a comparative analysis of how these economic factors have shifted from the base period of March 1, 2016. By indexing the data to a common reference

point, we can directly observe how each factor has evolved, which is useful for identifying economic patterns or evaluating policy impacts. [8]

2.2.Data processing

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According to the dataset 1 we believe that it is well-structured with consistent formatting and no obvious errors, duplicates or missing values. Next, we are ensuring that all dates and numerical values are consistent. We also normalized the data to make comparisons between different attributes easier. For the derived variables we are going to derive quantities such as growth rates to calculate the percentage change over time for employment, real domestic demand, and nominal domestic demand. Secondly, we will identify long-term trends in each attribute, analyze correlations between these variables. Finally, we will use existing data to calculate values from each quarter for a year and perform comparative analysis to understand economic shifts by comparing different time periods.

According to the dataset 2

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In this section, we detail the data processing operations, including data cleanup, derivation of variables, and data manipulation techniques. Data processing is a crucial step to ensure that the data is ready for analysis and visualization. Below are the operations carried out for processing the data:

1. Standardization of Date Format

Objective: Both datasets have interval data, but the date formats might not be consistent across sources. We standardize the date format to ensure proper alignment of data points when merging or comparing datasets.

Process: The dates are converted into a common format (YYYY-MM-DD) in Excel. This allows for easy sorting and filtering of data by quarters (e.g., Q1 2016, Q2 2016).

2. Year-over-Year Growth Rate Calculation

Objective: To understand how key economic indices like GDP, employment, and demand change over time, we calculate their year-over-year (YoY) growth rates.

Process: The YoY growth rate is calculated using the formula:

- **$[(\text{Current period value} - \text{Last period value}) / \text{Last period value}] \times 100$**

Application: This is applied to GDP, Employment Index, and both the Real and Nominal Domestic Demand Index to track their percentage change on an annual basis.

3. Moving Averages Calculation

Objective: Economic data often experiences short-term fluctuations, so we apply moving averages to smooth out these fluctuations and highlight longer-term trends.

Process: In Excel, we use the AVERAGE () function over a defined window (e.g., a 4-quarter moving average) to compute the average index value over time. This helps in reducing volatility and focusing on the overall trend [14].

4. Derivation of Recovery Strength Index

Objective: The Recovery Strength Index measures how the economy has recovered post-recession compared to pre-recession trends.

Calculation:

- **Recovery strength index = (Post-recession growth rate / Pre-recession average growth rate) * 100**

Explanation: This index provides a comparative measure, where values greater than 100 indicate stronger recovery compared to pre-recession trends, and values less than 100 indicate a weaker recovery.

5. Derivation of Contribution to GDP Growth

Objective: For each component contributing to GDP growth (e.g., employment, demand), we calculate its relative contribution to total GDP growth.

Calculation:

- **Contribution of Component to GDP Growth = Component Growth * Component Weight / Total GDP Growth**

Explanation: This calculation allows us to determine how much each component (such as Employment Index or Demand Index) contributes to the overall growth of GDP, factoring in its weight within the economy.

3. Requirements

3.1. Must-have features

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Dataset 1:

From our perspective, the following features can make our project failed such as:

- Could not calculate the growth rate for employment, real domestic demand and nominal domestic demand by using Line Chart.
- Could not calculate the value of quarter per year and add them together and display them on the Bar Chart.
- Charts are required to have xAxis and yAxis but could not showcase.
- Could not identify and analyze seasonal patterns or cycles in order to accurately forecast.
- Could not compare different time periods to aware economic shifts for deriving meaningful insights.
- Could not use colour pallets effectively to highlight data points and engage with users.

To ensure the project is productive and effective, we are committed to delivering all the above features which are considered as must have features in our project. This has necessitated the use of mathematical calculations to derive data from our dataset [11] and proficient in using D3 library version 6.

Dataset 2:

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In the project, the must-have features of the line chart, stacked bar chart, and pie chart were essential for effectively communicating the economic data and achieving the core objectives of the visualization platform. These features provided the foundation for interactive and comparative analysis, without which the project would be considered incomplete or unsuccessful.

The line chart needed to be interactive, allowing users to explore trends in GDP growth across different OECD countries over time. It was critical that users could hover over data points to see precise values for each time, enabling detailed comparisons between countries. This feature was essential for tracking and analysing changes in GDP over time. Without it, users would be unable to visualize economic trajectories and make meaningful comparisons between different nations.

The stacked bar chart was required to display the contributions of multiple components (e.g., employment, real and nominal domestic demand) to overall GDP growth. The ability to see how each component stacked up relative to the others over time was crucial for understanding the composition of GDP growth. This chart provided insight into the relative impact of different economic factors on GDP growth. Without the stacked bar chart, users would miss a clear visual representation of how each component contributed to the total economic performance.

The pie chart was needed to show the proportional distribution of GDP components or other key categories at a specific point in time. It was essential that the pie chart provided a clear visual breakdown of how different elements contributed to the whole. The pie chart allowed users to quickly grasp the relative size of each component in the dataset, providing an easy way to

understand the distribution of factors like employment and demand within the total GDP. Without it, users would lose a crucial perspective on the proportional relationships in the data.

3.2. Optional features

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We do know that there are some optional features that could make our data visualisation go to another level such as integration with external data sources. Incorporating additional data sources for a more comprehensive analysis. Automated reporting in terms of regularly updating stakeholders on key metrics and improving the user interface to support users in terms of accessibility and user experience. Lastly, the website should be responsive and display effectively across various devices. However, we may not be able to deliver these optional features due to our commitment to other assignments.

Team member - 104924340 (Linh Doan)

In addition to the must-have features, the project identified several optional features that would be beneficial to include but were not considered critical for the project's success. These features were aimed at enhancing the user experience and providing additional analytical insights. Below is a list of these optional features and an evaluation of whether any of them were delivered:

The ability to generate predictive trend lines based on current economic patterns. This would allow users to see potential future GDP growth trends by extrapolating data from past and current indicators. Due to time constraints and the complexity of implementing predictive algorithms, this feature was not included in the final version of the project. However, it remains a valuable feature for future development [4].

A heatmap to visualize the strength of economic recovery across various countries and indicators. This feature would provide a color-coded map indicating which countries or economic factors have shown stronger recovery

post-recession. While the concept was promising, we did not have enough time to fully develop and implement a heatmap feature. It was deprioritized in favour of core functionalities.

The ability for users to download data tables of their selected views. This would allow users to extract data for further analysis outside the visualization tool, providing more flexibility in working with the data. We successfully implemented the option to download data tables for selected countries and time periods, enabling users to take the data offline for additional analysis. This feature enhances the usability of the platform by offering more functionality beyond the visualizations. [10]

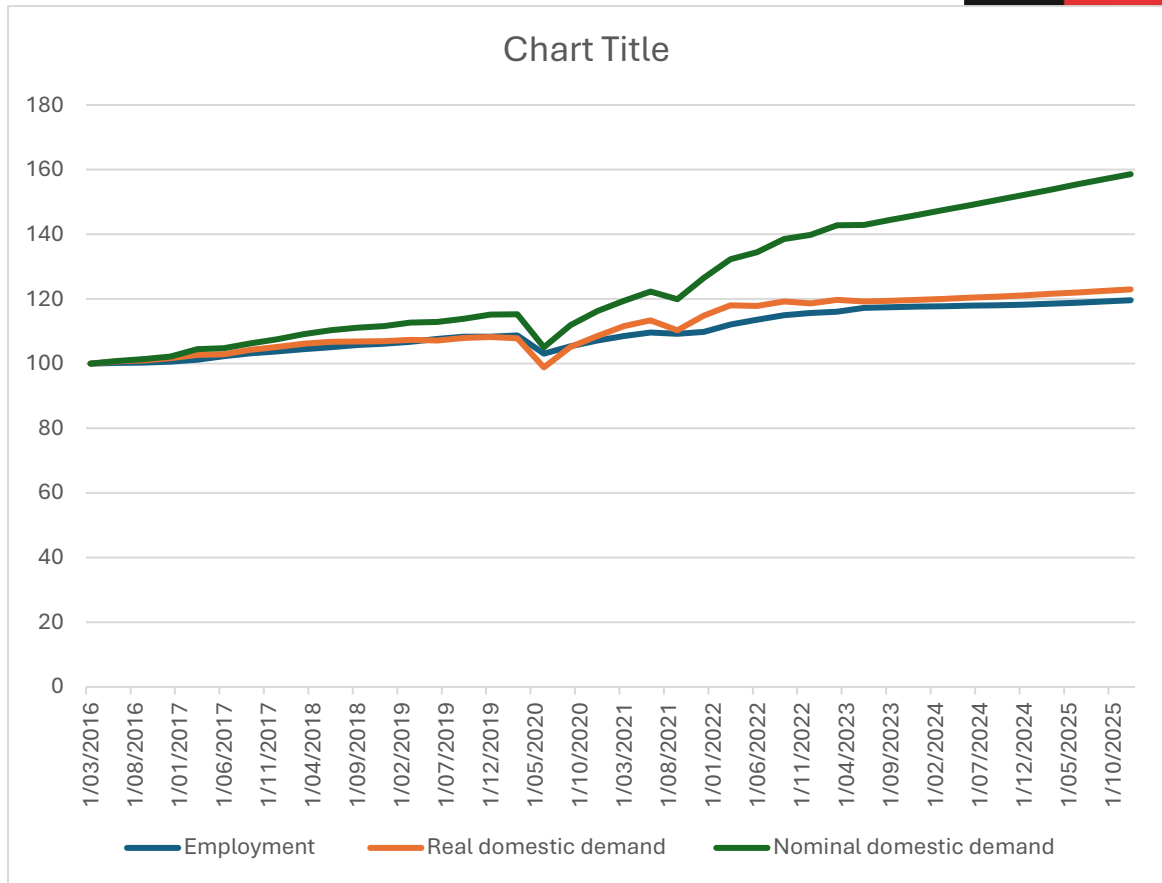
4. Describe Visualisation design

Team member - 103422254 (Thang Truong)

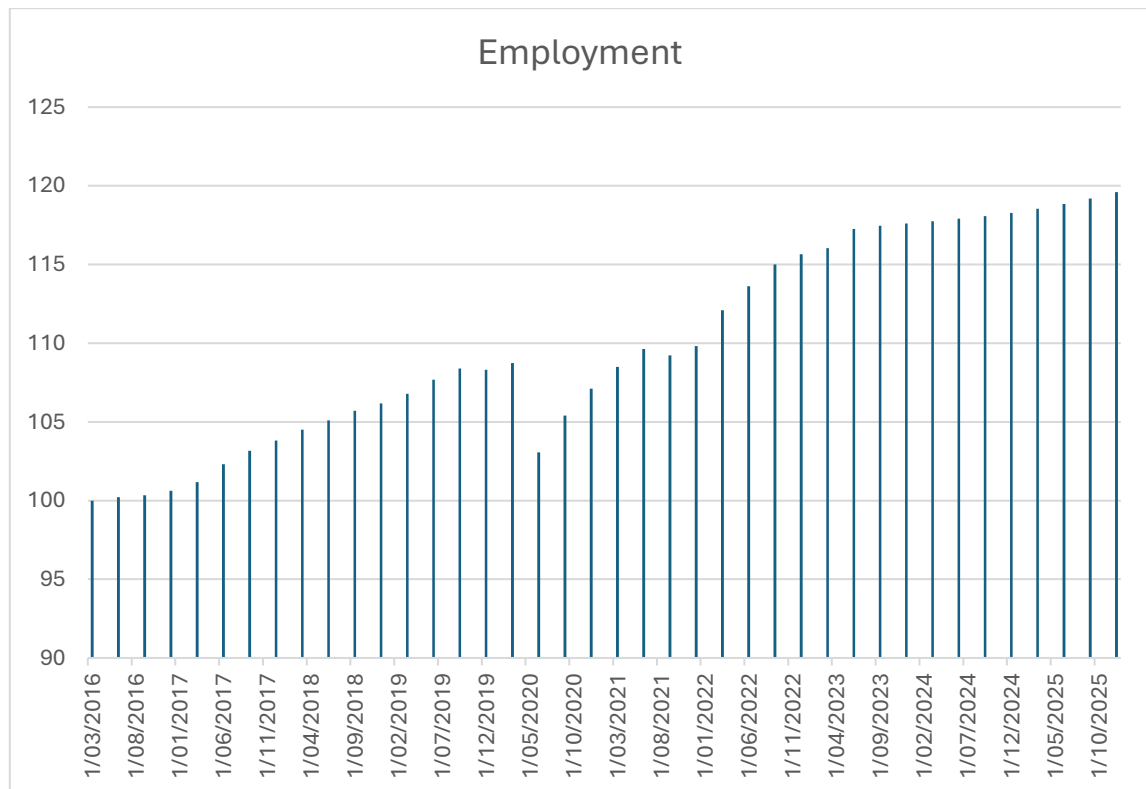
According to our team discussion and perspective, we will use a bar chart to representation of sum of employment data spanning multiple years, a line chart to show crucial economic indicator in terms of Employment, Real Domestic Demand, and Nominal Domestic Demand over time, an area chart offers a comprehensive visualization of Real Domestic Demand over nearly a decade, spanning from 2016 to 2025 and a Scatter Plot chart to represent the changes in Nominal Domestic Demand over time in terms of measures the total demand for goods and services within the economy at current prices, without adjusting for inflation.

Sketch designs

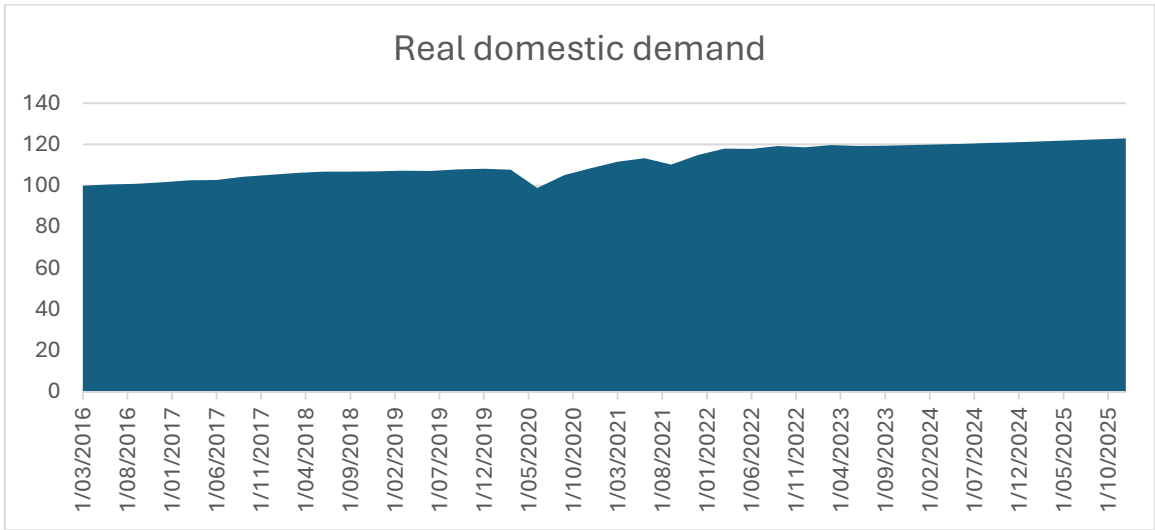
Line Chart:



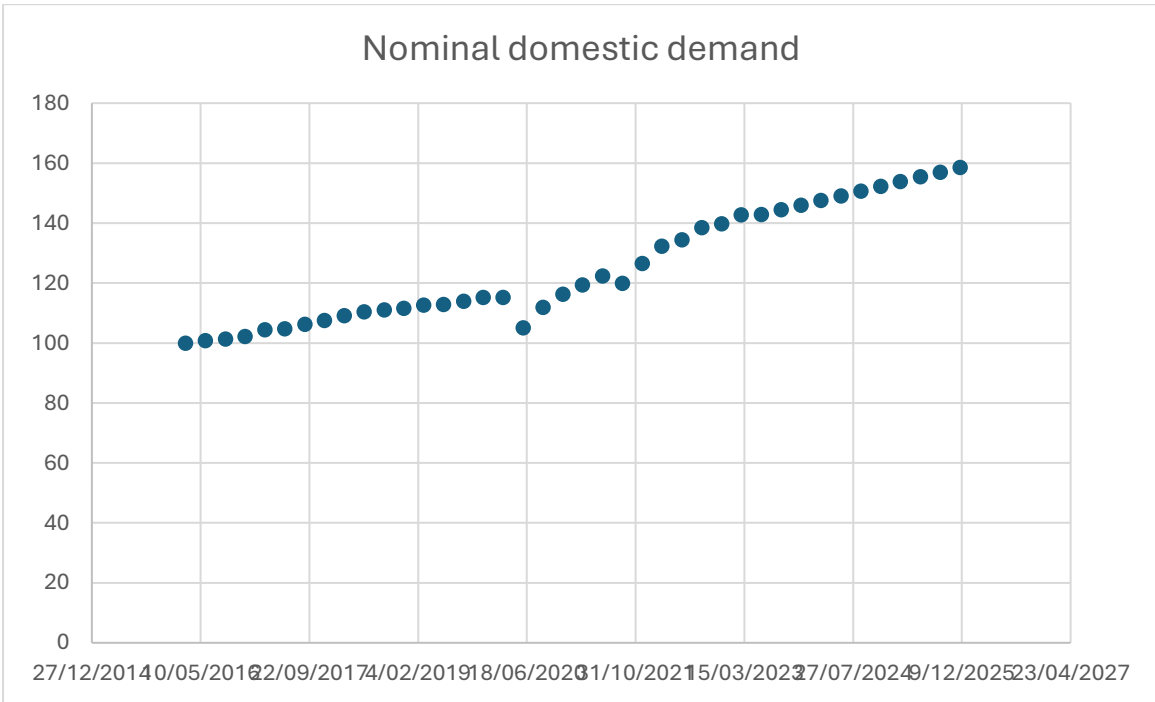
Bar Chart:



Area Chart:



Scatter Plot Chart:



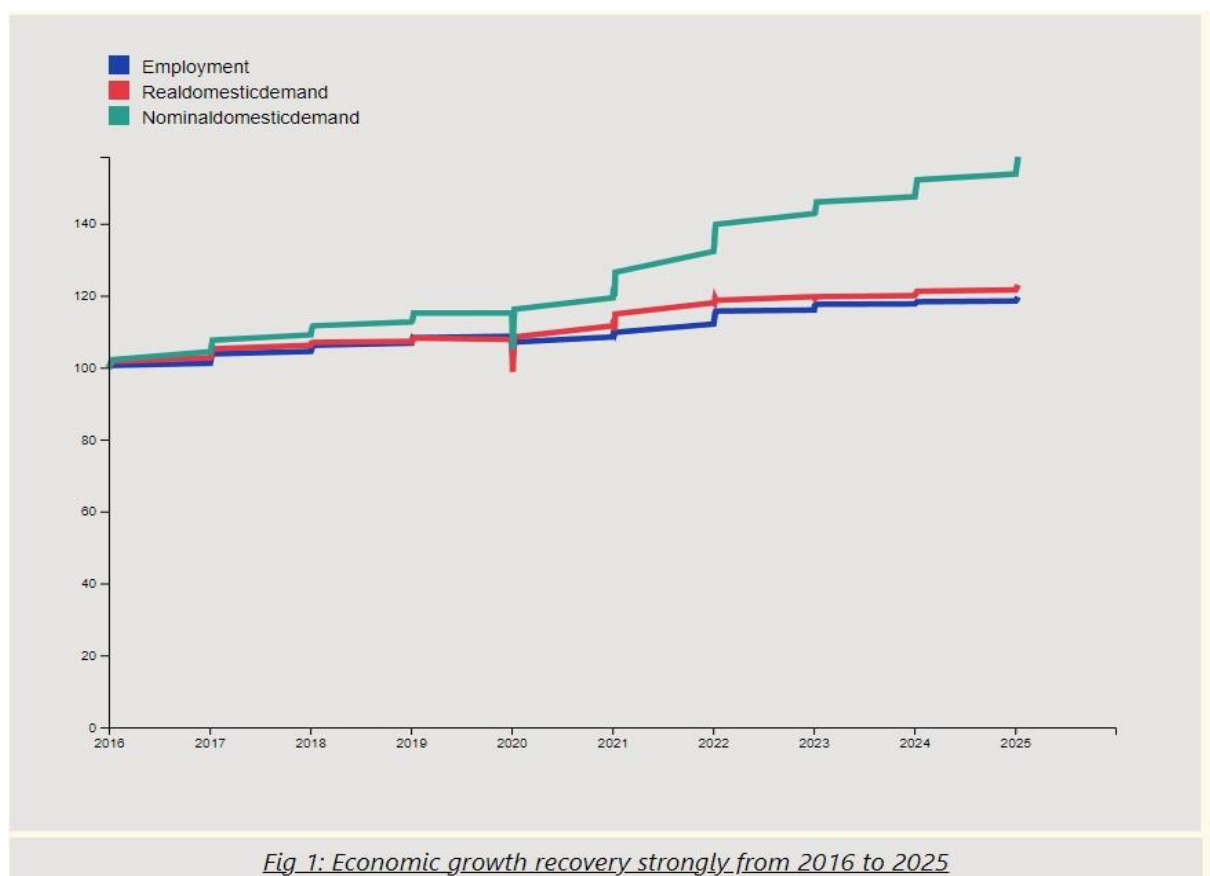
We acknowledge that there are alternative tools like Tableau and Power BI [7], which allow users to explore data through filters and clickable elements. Additionally, Canva and Illustrator can combine charts, icons, and text to narrate a cohesive story. However, we have decided to use version 6 of the D3 library for our visualization. The main reason is that we have extensive experience working with practical labs associated with version 6

of the D3 library, and we are confident in our ability to create effective data visualizations using this tool.

The evolution of our design started with reviewing datasets and selecting appropriate idioms based on the data's nature and the insights we aimed to convey. Initially, we considered bar charts for comparing categories and line charts for illustrating time trends. As the design progressed, I incorporated pie charts to highlight proportions and identify long-term trends across different time periods. Finally, we refined the design to ensure each visual element effectively communicated its intended message, utilizing our preferred library to create interactive and engaging visualizations. This iterative process resulted in a comprehensive and user-friendly data visualization.

Final designs

Line Chart:



Bar Chart:

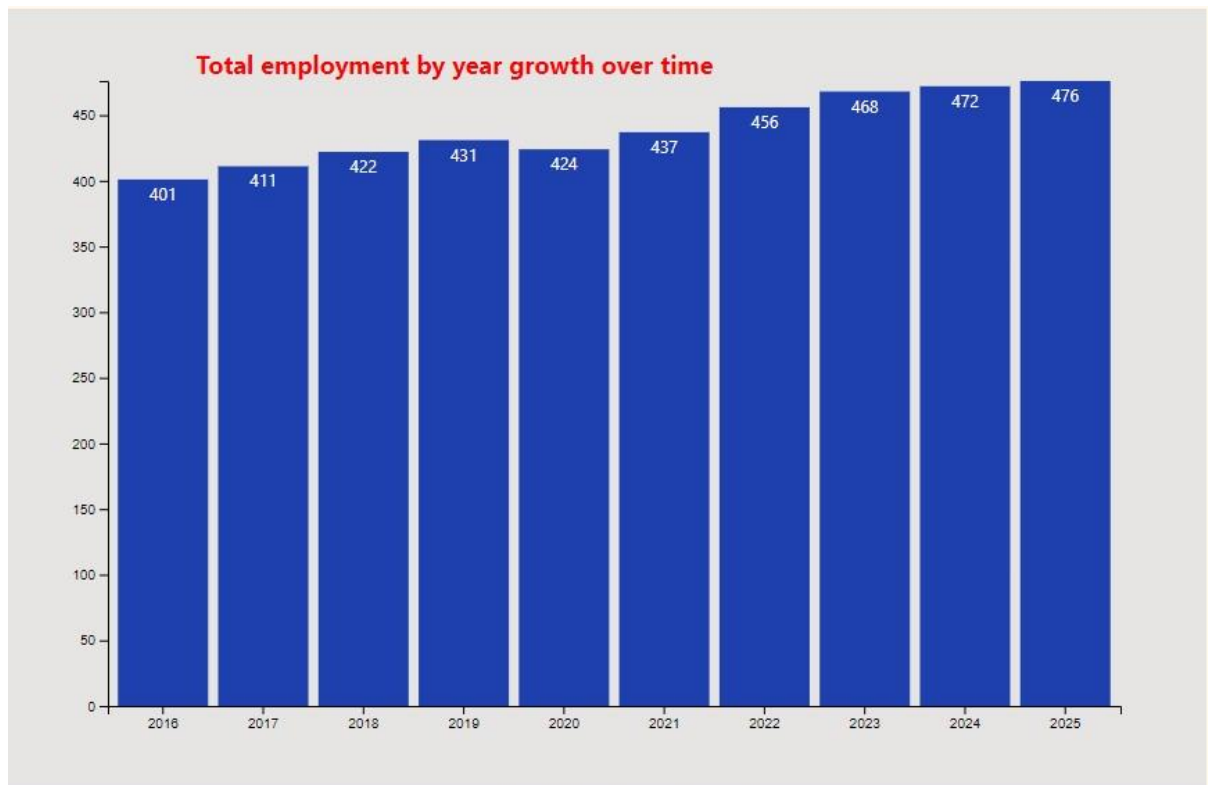


Fig 2: Sum of Employment by year

Area Chart:

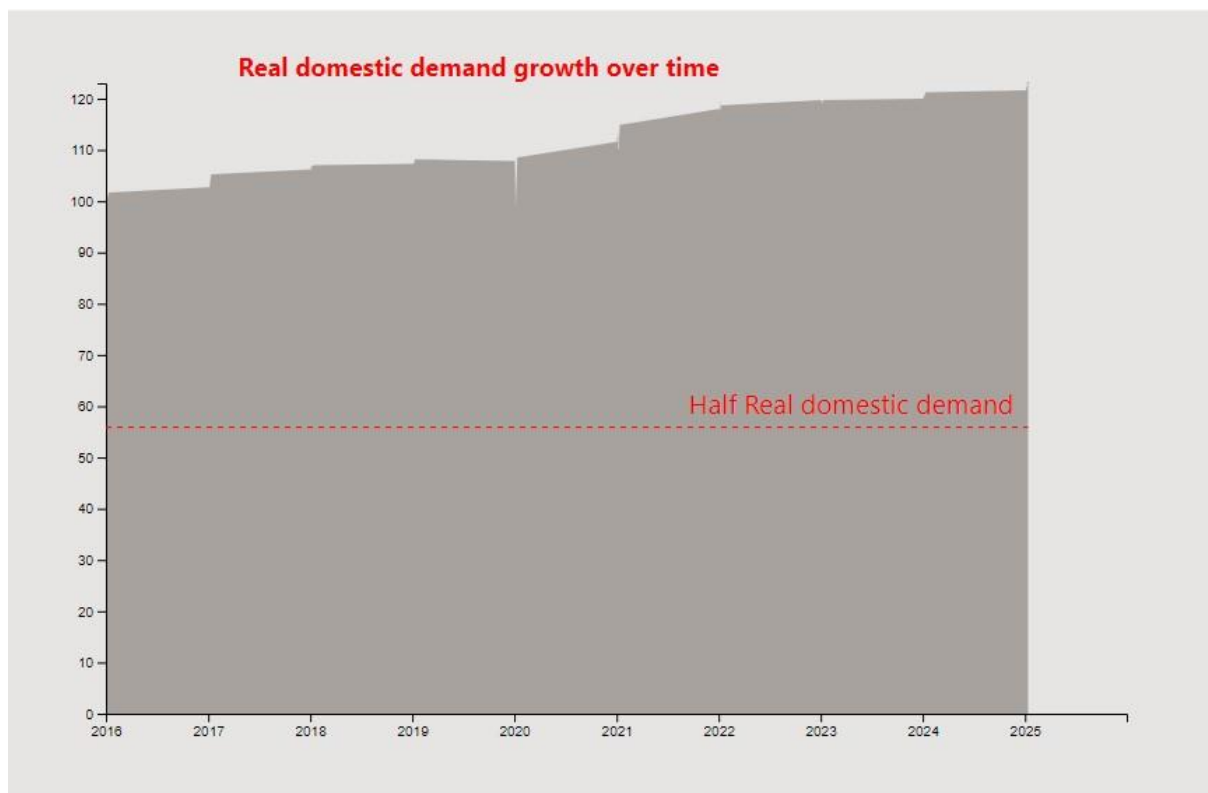
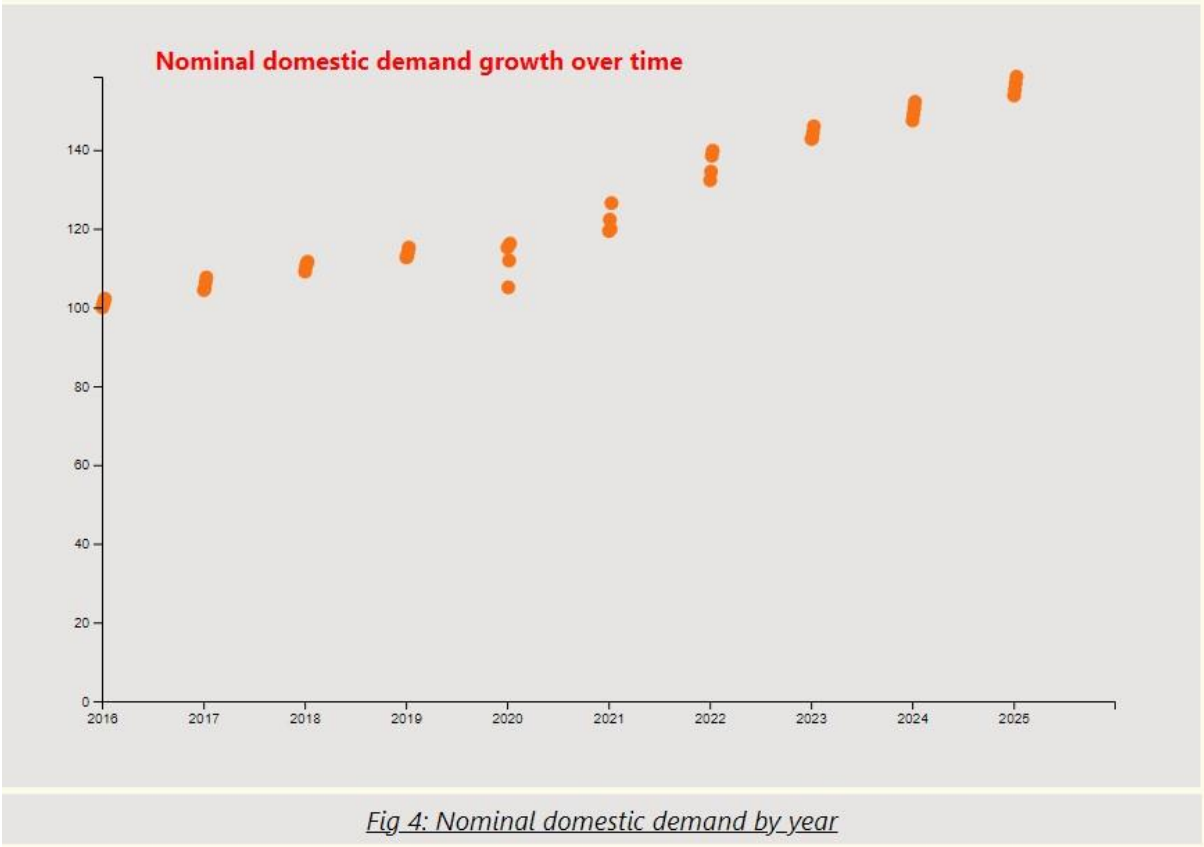


Fig 3: Real domestic demand by year

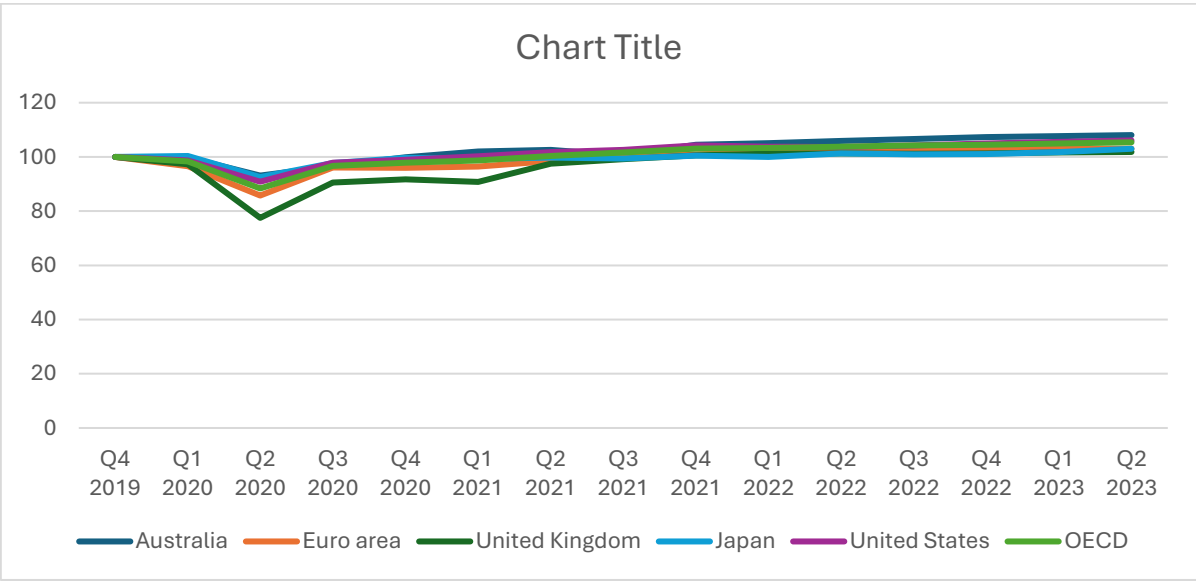
Scatter Plot Chart:



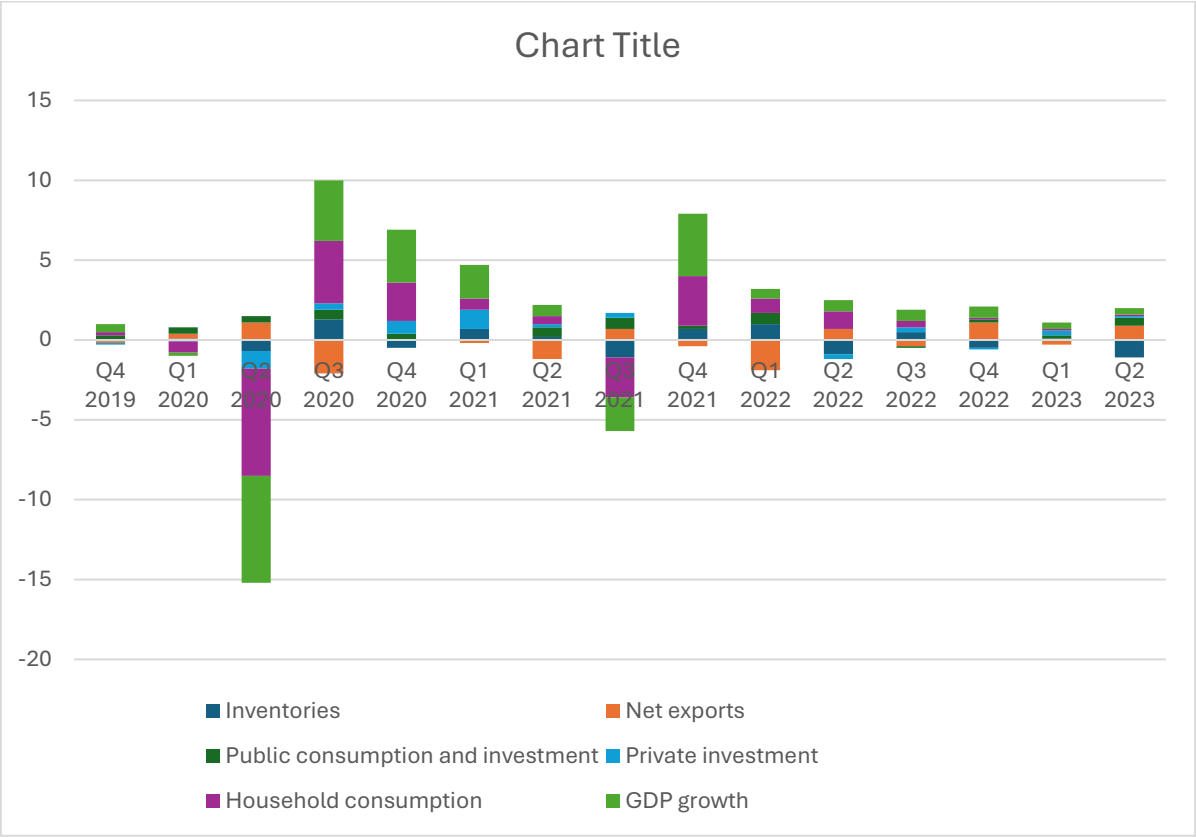
Team member: - 104924340 (Linh Doan)

Sketch designs

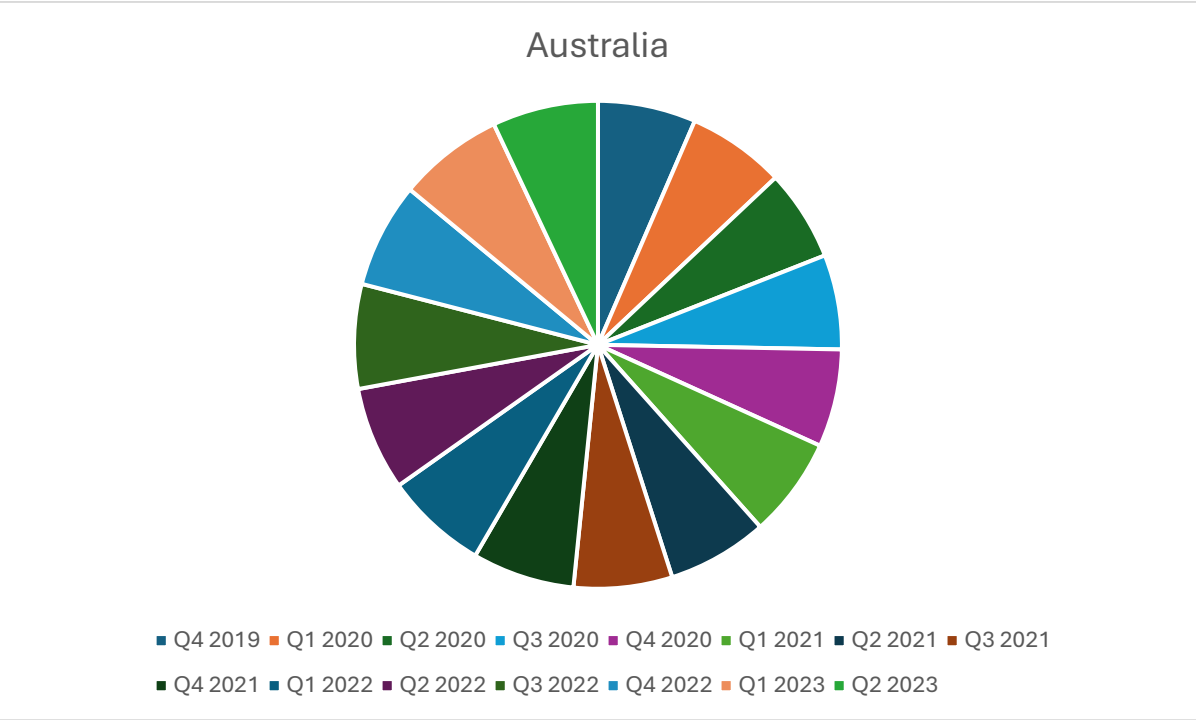
Line Chart:



Stacked Bar Chart



Pie Chart



These features were identified as critical to the success of our project, and without them, the project would not meet the intended goals.

The interactive line chart was essential for displaying GDP growth trends over time across various OECD countries. This feature allowed users to compare and track the economic performance of different nations, offering a clear visualization of how GDP evolved over time. The interactivity of the line chart, which enabled users to hover over data points to see detailed information, was crucial for providing a detailed view of the data. Without this feature, users would not have been able to analyse and compare the economic trajectories effectively. We successfully delivered this feature, ensuring it met all functional requirements [1].

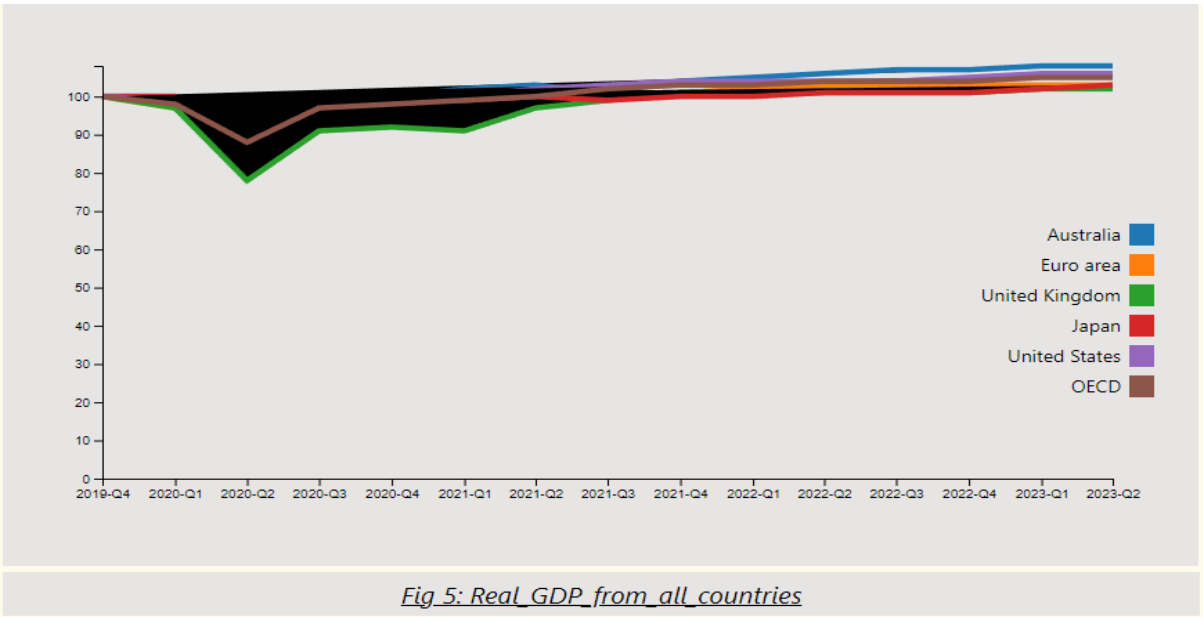
The stacked bar chart played a key role in visualizing the contributions of different components to GDP growth, such as employment, real domestic demand, and nominal domestic demand. This chart type was crucial for providing a clear comparison of how each component contributed to overall GDP, allowing users to see the relative impact of these factors in a single visualization. The stacked bar chart enabled users to understand how different components built up the total GDP growth over time. This feature was implemented successfully, offering users the ability to compare and analyse the components in an intuitive way [9].

Finally, the pie chart was a must-have feature for showing the proportional distribution of economic components within a specific category, such as the breakdown of GDP components in a particular period. The pie chart provided users with a quick and easy way to understand the relative sizes of each component, helping them visualize how different factors contributed to the whole. This feature was also delivered as promised, enabling users to gain insights into the proportionate relationships within the data [2].

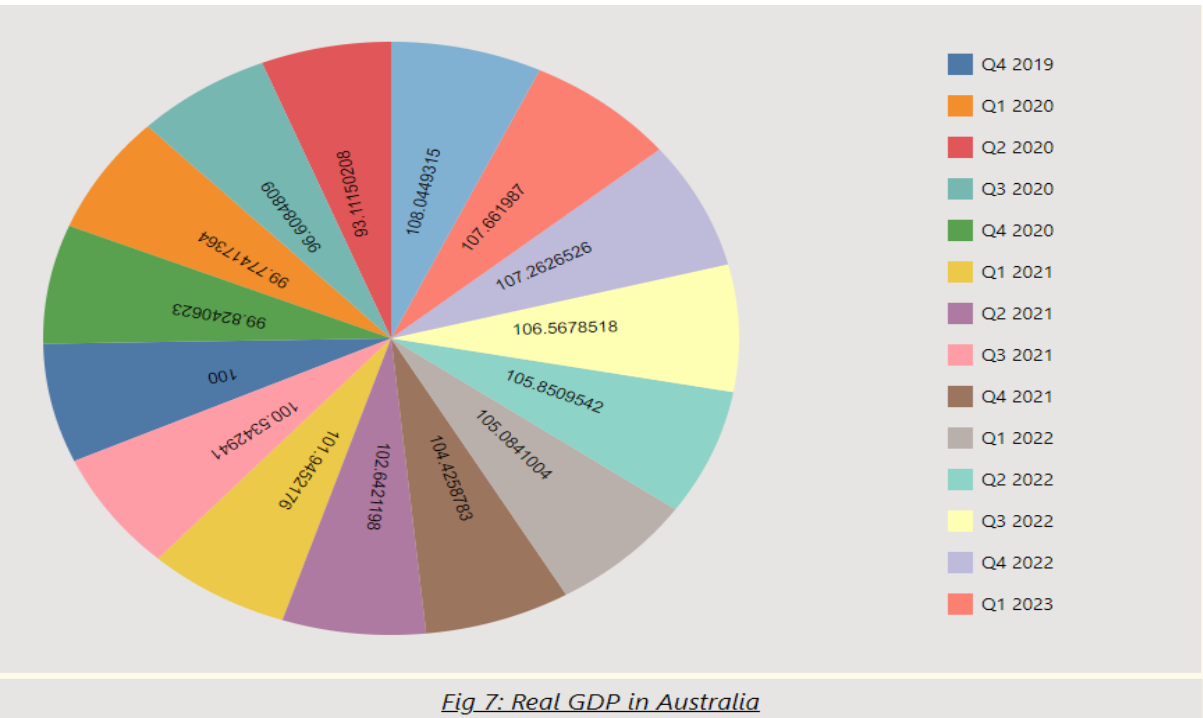
In conclusion, we were able to deliver all the promised features, including the line chart, stacked bar chart, and pie chart, ensuring the project’s success. These visualizations were vital for allowing users to interactively explore and analyse the data from multiple perspectives, fulfilling the project’s core goals.

Final designs

Line Chart:



Pie Chart



Stacked Bar Chart

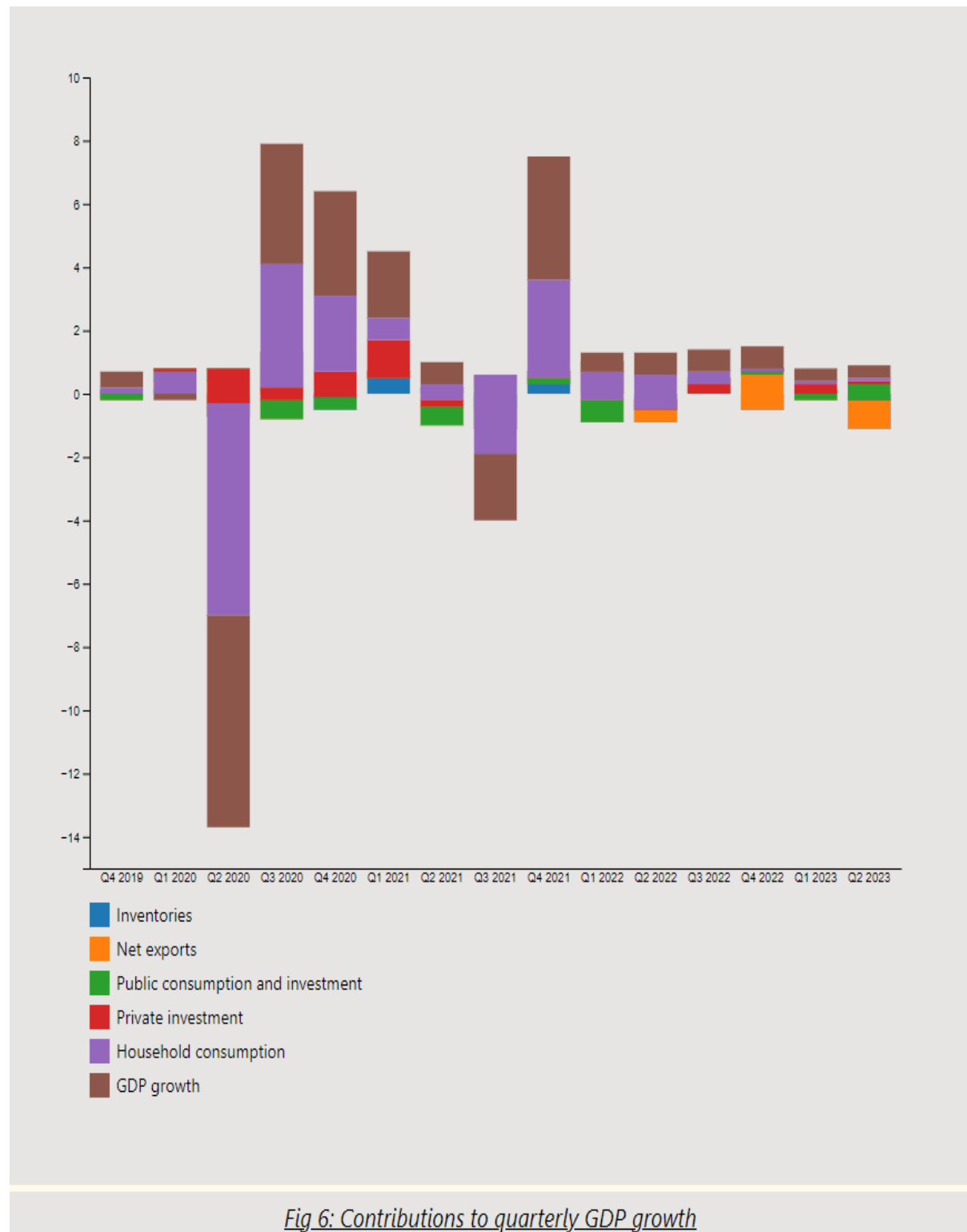


Fig 6: Contributions to quarterly GDP growth

5. Conclusion

This project focused on visualizing key economic indicators using datasets from the OECD Library website. These indicators highlighted the strong recovery of economic growth post-pandemic, and the economy recovered rapidly but growth is now slowing. We covered various categories, including Employment, Real and Nominal Domestic Demand, Inventories, Net Exports, Public and Private Consumption and Investment, Household Consumption, GDP Growth, and Real GDP from multiple countries, including Australia. Cleaning the datasets was essential for effective encoding. We acknowledged the importance of sketch designs before coding to avoid confusion about chart types and data fields. Utilizing various charts such as Line, Bar, Area, Scatter Plot, Stacked Bar, and Pie Charts, we effectively communicate complex data trends over time. Key learnings included the significance of data accuracy, clear and intuitive visualizations, improved skills in using D3 library version 6, and team collaboration to meet deadlines. Additionally, GitHub proved invaluable for storing and sharing files among team members.

6. References

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