# Analyzing the Development of Cost-of-Living in London Over Time


## ABSTRACT

This project aims to investigate the development of the cost-of-living in London over a specified period by examining various factors that contribute to the overall living expenses. By analyzing historical data on housing, transportation, food, education, and healthcare, we seek to identify trends and patterns that may provide insights into the evolving economic landscape of London. To achieve this, we have collected relevant data on cost components and utilized data visualization techniques, specifically line charts, to represent the information in a comprehensible manner. The line charts allow for easy comparison of the different cost factors, while also enabling the identification of significant fluctuations and correlations in the cost-of-living over time. Through this analysis, we aim to provide a comprehensive understanding of the changes in London's cost-of-living, facilitating informed decision-making for individuals, businesses, and policymakers. The findings of this study may contribute to discussions on affordability, urban planning, and the overall economic well-being of London's residents.


## 1 INTRODUCTION

The cost-of-living in a city has a significant impact on the quality of life and financial well-being of its residents. In recent years, London has experienced substantial changes in its economic landscape, resulting in fluctuations in the cost-of-living. Understanding these trends can be crucial for policymakers, businesses, and individuals to make informed decisions and address the challenges associated with living in the city.

In this project, we aim to analyze the development of the cost-of-living in London over time using advanced data visualization techniques. By presenting the data in a visually compelling and interactive manner, we seek to uncover insights and detect trends related to the cost-of-living in the city. This analysis will provide valuable information for various stakeholders, including policymakers, urban planners, businesses, and residents, to better understand the dynamics of London's cost-of-living and develop effective strategies to tackle the associated challenges.

## 2 PART 1: ANALYTICS

### 2.1 Research Questions

Based on the provided data and other potential datasets, we propose the following research questions:

- Q1: "Analyze the development of cost-of-living over time in London. Are there any detectable trends?". Historical data on cost of living in London, including housing, transportation, food, and other expenses. The provided dataset on the cost of living increase in London is appropriate to answer this question.
- Q2: "How does the cost of living in London compare to other major cities around the world?". Cost of living data for other major cities globally, including similar categories as for London (housing, transportation, food, etc.). The Global Cost of Living Index dataset (example: Numbeo or The Economist Intelligence Unit) would be appropriate for this question. This dataset should include a comprehensive list of cities and their cost of living indices.
- Q3: "What are the main factors contributing to the increase in the cost of living in London?". Data on factors contributing to the cost of living, such as inflation rates, wage growth, population growth, and housing supply in London. Data from the UK Office for National Statistics (ONS) and other relevant sources like the Bank of England could be used to gather information on inflation rates, wage growth, population growth, and housing supply.

### 2.2 Data Collection and Processing

To analyze the development of the cost-of-living in London, we collected data from various sources, including government reports, statistical agencies, and private organizations. The data covers a range of factors that contribute to the cost-of-living, such as housing, transportation, food, healthcare, and education, among others. The time frame of the data spans multiple years, allowing us to examine trends and patterns over time.

#### 2.2.1 Data Collection

The primary sources of data for this project are:

- Office for National Statistics (ONS) [3]: The ONS provides extensive datasets on various aspects of the UK economy, including consumer price indices, average weekly earnings, and housing prices.
- Greater London Authority (GLA) [1]: The GLA offers datasets on London-specific indicators, such as average rents, household incomes, and transport costs.
- Numbeo [2]: Numbeo is a crowd-sourced database that provides information on the cost-of-living in cities worldwide, including London. The data covers various categories like food, transportation, utilities, and leisure activities.

We gathered data from these sources, focusing on factors that contribute significantly to the cost-of-living in London.

#### 2.2.2 Data Processing

Once the data was collected, we performed the following steps to process and prepare it for visualization:

- Data Cleaning: We addressed any inconsistencies, missing values, and outliers in the data. In some cases, we used interpolation or aggregation techniques to fill gaps in the data.
- Data Transformation: We converted the data into a consistent format suitable for visualization, such as CSV or JSON files. This involved standardizing units of measurement, converting categorical variables into numerical values, and normalizing data where necessary.
- Data Integration: We combined the data from different sources, ensuring that the information was accurately aligned in terms of time periods and geographical boundaries.

After completing the data collection and processing steps, we had a clean, consistent, and integrated dataset ready for visualization and analysis.

### 2.3 Correlations between Datasets

The datasets for Q1 and Q2 can be correlated by comparing the cost of living indices across cities, revealing trends and patterns in the cost of living worldwide. The dataset for Q3 can be correlated with the dataset for Q1 to investigate how specific factors contribute to the cost of living increases in London over time. This can help identify key drivers of cost of living changes and potential areas for intervention.

## 3 Part 2: Design and Discussion

### 3.1 Visualization Techniques

To effectively analyze the development of the cost-of-living in London, we employed various visualization techniques to present the data in a clear, concise, and informative manner. The chosen visualization techniques not only help us understand the patterns and trends in the data but also facilitate the exploration and comparison of different aspects of the cost-of-living.

#### 3.1.1 Line Chart

The line chart was chosen to represent the development of the cost-of-living over time. By plotting the data points as a continuous line, we can easily observe trends and changes in the cost-of-living across multiple years. The line chart enables us to identify periods of growth, stability, or decline in the cost-of-living, as well as compare the rates of change among different factors contributing to the cost-of-living.

#### 3.1.2 Scatterplot

We used a scatterplot to examine the relationship between two variables, such as income levels and housing costs. By plotting individual data points on a two-dimensional plane, the scatterplot allows us to observe correlations, outliers, and potential causality between the variables. This visualization technique aids in identifying whether specific factors are driving the cost-of-living in London, and how they may be interrelated.

#### 3.1.3 Stacked Bar Chart

A stacked bar chart was employed to present the composition of the cost-of-living in London. Each bar represents a specific year or period, and the segments within the bar depict the proportion of different components, such as housing, transportation, or food, that contribute to the overall cost-of-living. This visualization technique enables us to examine the relative importance of each factor, as well as observe how their contributions have evolved over time.

### 3.2 Analysis and Findings

Through the utilization of the implemented visualization techniques, we were able to analyze the development of the cost-of-living in London over time and identify several key trends and patterns. These findings not only provide insights into the factors contributing to the cost-of-living but also highlight potential areas of concern and opportunities for improvement.

#### 3.2.1 Increasing Cost-of-Living

The line chart revealed a clear upward trend in the cost-of-living in London over the years. This increase can be attributed to a combination of factors, such as rising housing prices, increased transportation costs, and inflation in the prices of goods and services. The continuous growth in the cost-of-living indicates that London residents may face increasing financial pressure, particularly those with lower or stagnant incomes.

#### 3.2.2 Housing as a Significant Contributor

The stacked bar chart demonstrated that housing costs are a major component of the overall cost-of-living in London. Over time, housing costs have increased at a faster rate compared to other factors, further exacerbating the burden on residents. This finding suggests that addressing housing affordability should be a priority for policymakers to alleviate the financial strain on Londoners.

#### 3.2.3 Income and Cost-of-Living Disparities

The scatterplot showed a positive correlation between income levels and housing costs, indicating that higher-income individuals are more likely to reside in areas with higher living costs. However, it also revealed that certain lower-income groups face disproportionately high living costs relative to their income, suggesting that these groups may be particularly vulnerable to financial stress.

#### 3.2.4 Regional Variation in Cost-of-Living

Our analysis also uncovered regional differences in the cost-of-living across London. Some areas exhibited higher living costs due to factors such as property prices, access to amenities, and transportation infrastructure. Understanding these regional variations can help inform targeted policy interventions and resource allocation to address disparities in the cost-of-living.

In summary, our findings indicate that the cost-of-living in London has been on the rise, with housing costs playing a major role in driving this increase. Additionally, income and regional disparities in living costs highlight the need for targeted interventions to support vulnerable groups and address the affordability challenges faced by London residents.

## 4 Part 3: Implementation

### 4.1 Data Processing and Sources

We used the D3.js library [4, 5] to create the visualizations for this project. D3.js is a powerful JavaScript library that enables the creation of dynamic, interactive, and data-driven visualizations in web browsers. By leveraging D3.js, we were able to implement the line chart, scatterplot, and stacked bar chart visualizations, and effectively present the cost-of-living data in a manner that facilitates analysis, exploration, and comparison. Additionally, the interactivity of D3.js allows users to engage with the visualizations, such as hovering over data points for detailed information, and zooming or panning to focus on specific areas of interest.

To implement our D3 webapp visualization, we used the dataset provided by the assignment for the cost-of-living indices in London. We gathered additional data from the ONS and GLA to provide a comprehensive view of the cost of living in London. Furthermore, we complemented these datasets with data from Numbeo for detailed expense category breakdowns.

The data were preprocessed using a Python script, which aggregated and cleaned the data from multiple sources. We ensured the consistency of the data by standardizing the format and units across all sources. After preprocessing, the data were converted into the required CSV format for use with D3.

### 4.2 Visualization Layout

Our D3 webapp visualization consists of three main components:

- **Line Chart**: Displays the development of the cost-of-living index in London over time. This layout enables us to analyze the overall trends and patterns in the cost-of-living, as well as identify any notable fluctuations or changes.
- **Scatterplot**: Showcases the relationship between different factors influencing the cost of living, such as income levels and housing prices. This visualization helps users identify correlations and explore potential causal relationships.

- **Stacked Bar Chart**: Provides a detailed breakdown of the various expense categories contributing to the cost of living, allowing users to understand the composition of living expenses over time and compare the impact of each category.

These visualizations are designed to complement each other, offering a comprehensive understanding of the cost-of-living trends in London.

### 4.3 User Interaction

The implemented visualization provides several user interaction features to enhance the user experience and facilitate data exploration:

- **Tooltips**: Display detailed information about each data point on the line chart, scatterplot, and stacked bar chart. Users can hover over a data point to see its exact value and additional context, such as the expense category or year.
- **Zoom and Pan**: Allows users to zoom in and out on specific sections of the visualizations to examine the data more closely, and pan to navigate through the data.
- **Filtering**: Enables users to filter the data by specific expense categories or time periods, focusing on the aspects that are most relevant to their analysis.

These interactive features allow users to explore the data in more depth, providing a better understanding of the cost-of-living trends in London and facilitating the discovery of new insights.

## 5 Conclusion

In this project, we have employed various visualization techniques to analyze the development of cost-of-living in London over time. Our findings have revealed a consistent upward trend in living costs, with housing being a significant contributor to this increase. We have also identified income disparities and regional variations in living costs, emphasizing the need for targeted policy interventions to address these issues.

The visualizations provided an effective means of exploring complex data and uncovering important patterns and trends. By combining different visualization techniques, we have gained a comprehensive understanding of the factors influencing the cost-of-living in London and identified areas that warrant further attention from policymakers and stakeholders.

Moving forward, it would be valuable to extend this analysis by incorporating additional data sources, such as crime rates, education, and healthcare access, to gain a more holistic view of the factors contributing to the cost-of-living in London. This would enable more informed decision-making and facilitate the development of targeted strategies to improve living conditions and affordability for all London residents.

## References


[1] Greater london authority, 2023. Accessed: 2023-03-30.

[2] Numbeo: Cost of living index, 2023. Accessed: 2023-03-30.

[3] Office for national statistics, 2023. Accessed: 2023-03-30.

[4] M. Bostock. D3.js - data-driven documents, 2011. Accessed: 2023-03-30.

[5] M. Bostock, V. Ogievetsky, and J. Heer. $D^3$ data-driven documents. *IEEE transactions on visualization and computer graphics*, 17(12):2301–2309, 2011.