Bike Sales Data - Exploratory Data Analysis

Project Description

This project is an in-depth exploratory analysis of bike sales data to extract business insights, trends, and patterns. The analysis includes revenue and profit margins, customer demographics, and product performances measured against each different geographical region.

Dataset Information

The dataset contains 112,036 records of bike sales with the following key features:

- **Date:** Transaction dates (2011-2017)
- **Customer demographics:** Age, gender, location (country/state)
- **Product details:** Category, sub-category, product name
- **Financial metrics:** Unit cost, unit price, profit, revenue, cost
- **Sales metrics:** Order quantity, profit margin
- **Source:** https://www.kaggle.com/code/sadiqshah/bike-store-sales-in-europe/data

Project Goals & Insights

Key Metrics Summary

Metric	Value
Total Records	112,036
Average Order Quantity	11.9 units
Average Revenue	$757.14
Average Profit	$286.04
Average Profit Margin	47.21%

Top Performing Countries by Revenue

Country	Total Revenue	Average Profit Margin
United States	$27,777,098	48.154604%
Australia	$21,196,395	41.839322%
United Kingdom	$10,575,628	49.995962%
Germany	$8,956,724	45.951477%
France	$8,414,745	43.62949%
Canada	$7,906,182	54.801102%

Product Category Performance

Category	Total Revenue	Units Sold	Profit Margin
Bikes	$61,434,484	36,201	32.592335%
Accessories	$15,022,766	1,042,791	56.492086%
Clothing	$8,369,522	254,713	31.496657%

Customer Demographics Analysis

Age Group	Percentage of Sales (100%)	Profit (100%)	Average Order Value
Adults (35-64)	49.945530	50.660984%	$63.509681
Young Adults (25-34)	35.916765	35.307369%	$68.777909
Youth (<25)	13.775709	13.602239%	$54.624743
Seniors (64+)	0.361997	0.429408%	$31.633872

Top 5 Most Profitable Products

Product	Revenue	Profit	Order Quantity
Mountain-200 Black, 38	$3,345,501	$1,302,237	1632
Road-150 Red, 62	$3,810,023	$1,237,388	1185
Mountain-200 Silver, 42	$3,070,174	$1,226,878	1456
Road-150 Red, 52	$3,152,610	$1,044,569	971
Road-150 Red, 56	$3,142,811	$1,004,376	985

Visualizations

Revenue Distribution by Country Across Years
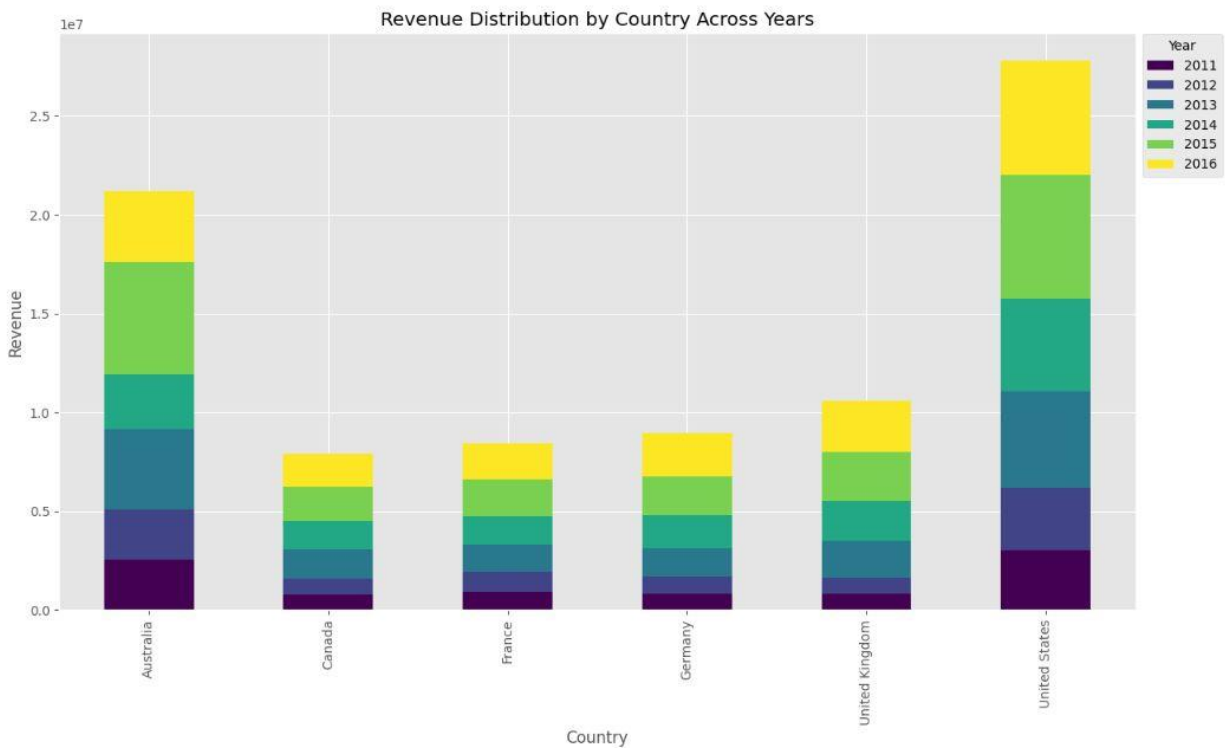
- Across all years, the US continues to register the highest total revenue above all other countries.
- Australia was the second most significant contributor, presenting revenue that was consistently high but still lower than that of the US.
- Heart-breaking as it may be, Canada, France, Germany, and the United Kingdom really contribute so much less revenue compared to the US and Australia.
- All countries experience consecutive year-on-year growth, implying that revenue is spread out over the years and not just concentrated in one year.
- Most countries show 2016 as the highest segment; hence, strong growth in the last year of the dataset.
- Revenue is very heavily concentrated, with two countries (the US and Australia) doing most of the heavy lifting and the others contributing relatively small portions.

Revenue by Age Group
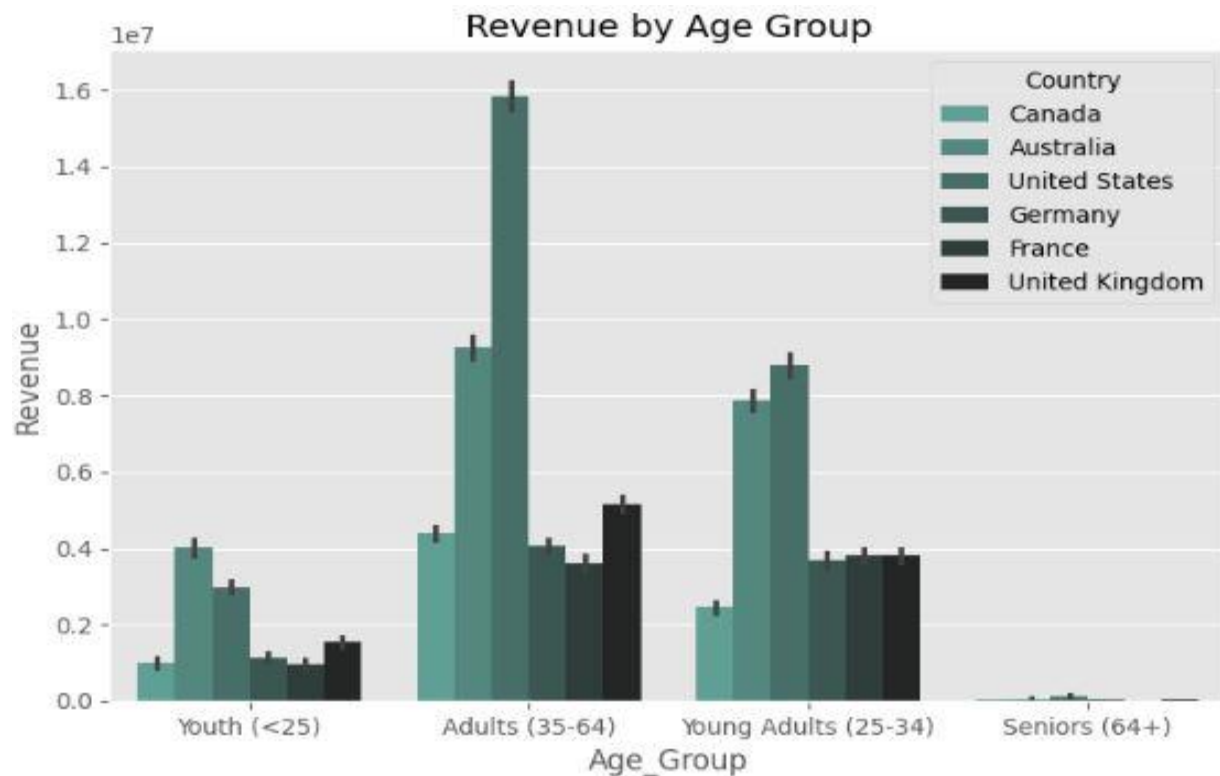
- Adults aged 35–64 are the primary source of income in every nation, with the US and Australia at the top.
- Young adults between the ages of 25–34 contribute a solid revenue, particularly in Australia and the US, but lag behind the adult category.
- The young group, less than 25, has some income, but their contribution is significantly smaller than that of the adults and young adults.
- Seniors 64+ earn very little revenue in all nations, nearly zero compared to the rest of the groups.
- In total, the majority of revenue is generated from adults and young adults, indicating that middle-aged and working-age customers make the most sales.

Data Cleaning Process

- Removed 1,993 duplicate records.
- Handled datetime conversion for proper time series analysis.
- Added calculated Profit Margin column.
- Addressed outliers in Order Quantity, Unit Cost, and Revenue.
- Standardized categorical variables.

Key Pointers:

- The business is running well, with a healthy overall margin of 47.21.
- Accessories command the highest profitability at 56.49%, whereas, since there is low profitability of around 32%, the biggest revenue generator is bikes, which is around $61.4M.
- Sales are highly concentrated in just two regions: the United States accounts for 38 percent, and Australia accounts for 29 percent. Together they amount to more than two-thirds of the total revenue.
- The customer profile primarily consists of adults aged 35 to 64 and 25 to 34, with the two segments together accounting for over 85 percent of the sales and profits, while seniors barely contribute, at less than 1 percent.
- The order average, which stands at 12 units, indicates bulk-buying behavior. This, perhaps, is driven by accessory and clothing purchases.
- The year-on-year growth in revenues has been steady, peaking in 2016, indicating strong, steady sales momentum.