

# Charting Special Topic: Dual Axis Combo Chart

IT 7113 Data Visualization

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Fall 2023

<http://idi.Kennesaw.edu/it7113/>

# Introduction



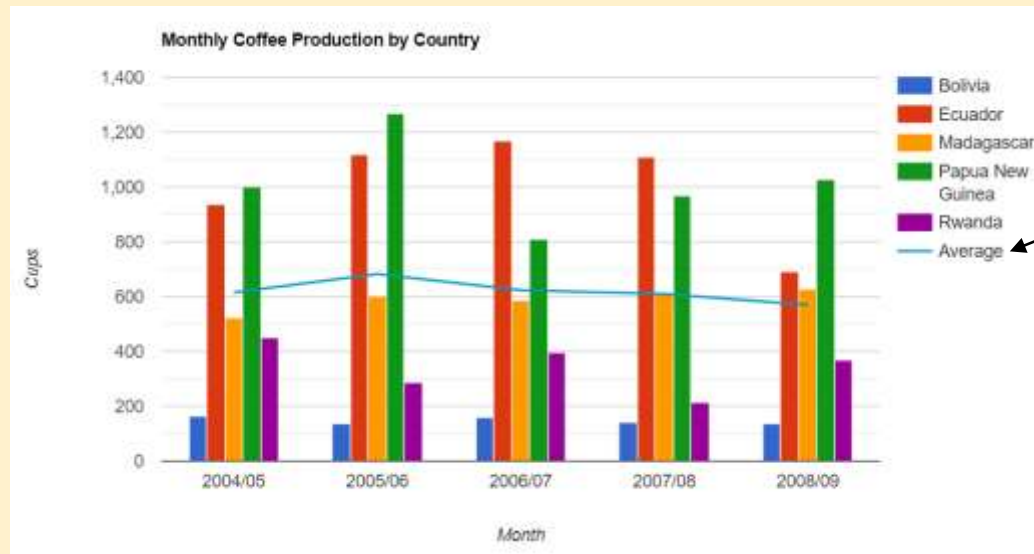
- Composite or compound charts include the elements and features from multiple basic charts
  - They are structurally more complex, consisting of multiple charts or multiple types of charts, arranged in the same (bigger) charting space
- Common types of composite charts
  - **Combo chart**
  - **Dual axis chart**
  - Small multiples
  - Nested chart
  - Stacked chart
  - Nested/stacked hierarchical chart
  - Overlaid chart
- This lecture gives an in-depth examination
  1. combo chart
  2. dual axis chart
  3. dual-axis combo chart

This lecture

# 1. Combo Chart



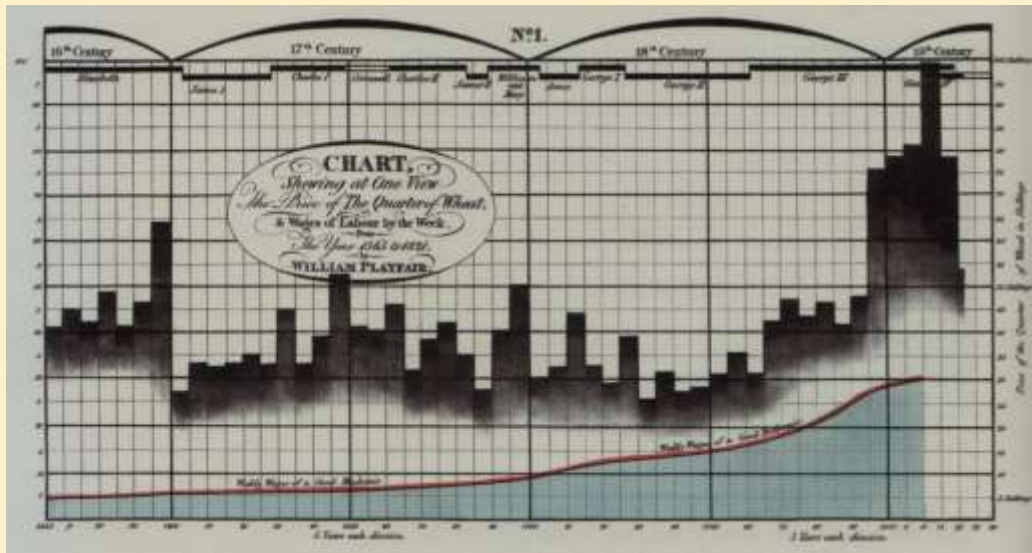
- Combo (combination) chart is **chart that lets you render each data series as a different marker type**
  - Two (or more than two) data series are visualized using different form of charts or visual attributes like color or shape: column + line is the most often
- Often used when some data serials or variables are treated as different groups and we want to show them differently.
  - Combo charts can have one Y axis or two of them (see dual axis chart)
- Use cases
  - Show trending line or a statistic (such average) line.



The average is different from individual countries, so it is shown as a line to distinguish – applying Gestalt's principle.

<https://developers.google.com/chart/interactive/docs/gallery/combochart>

# A Classic Combo Chart

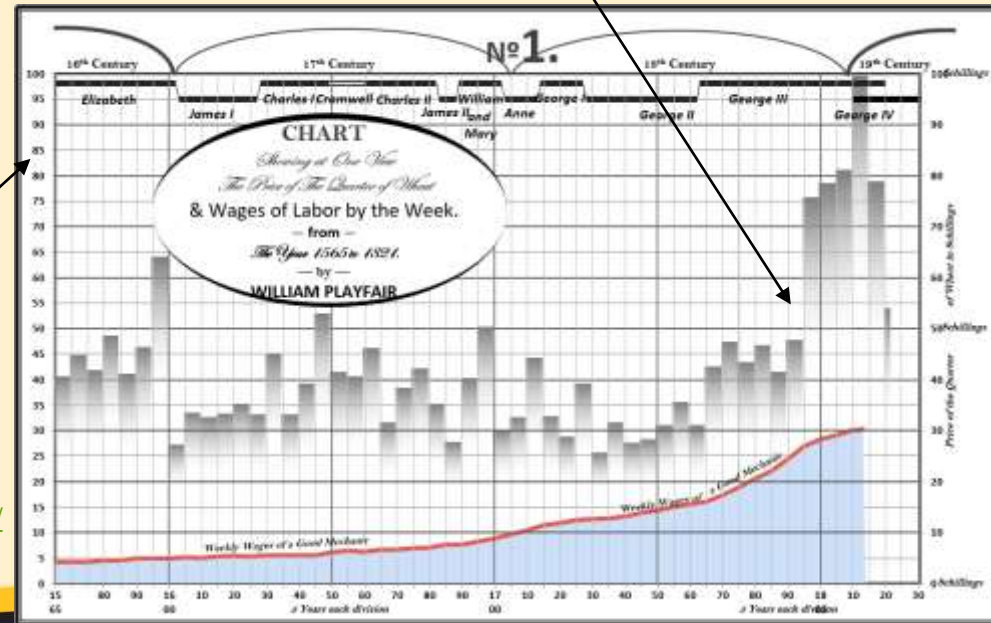


Two data series:  
1. price of the quarter of wheat (bar)  
2. Weekly wages of a good mechanic (line)

[https://commons.wikimedia.org/wiki/File:Chart\\_Showing\\_at\\_One\\_View\\_the\\_Price\\_of\\_the\\_Quarter\\_of\\_Wheat,\\_and\\_Wages\\_of\\_Labour\\_by\\_the\\_Week,\\_from\\_1565\\_to\\_1821.png](https://commons.wikimedia.org/wiki/File:Chart_Showing_at_One_View_the_Price_of_the_Quarter_of_Wheat,_and_Wages_of_Labour_by_the_Week,_from_1565_to_1821.png)

X axis represents year (time); y axis represents money amount (Schilling)

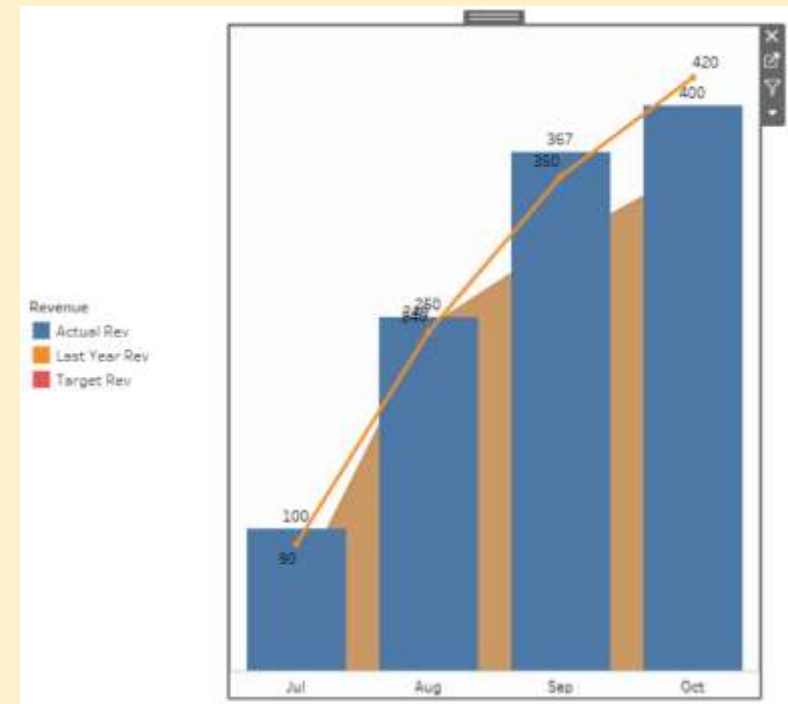
<https://www.wisevis.com/william-playfair-excel-redesign/>



# Three Marker Types in One Combo Chart



- It possible to have three data serials (three chart types) in one chart
  - Line + area + column



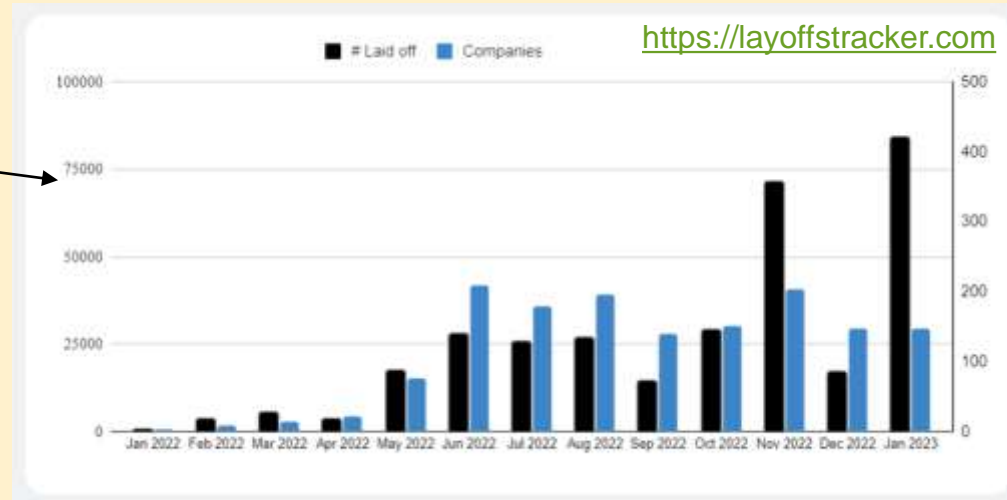
<https://community.tableau.com/s/question/0D54T00000C6d5gSAB/3-different-types-of-chart-in-a-single-axis>

# 2. Dual Axis Chart



- Dual axis chart is a chart with two vertical axes.
  - There are two vertical axes (left and right) representing two (or more) variables/measures
  - Two axes represent measures that have **significantly difference in**
    - value ranges (scales)
    - different measuring units
    - different data types

The left axis (black column, representing # laid off) is very different from the right one (blue column, representing # of companies) in scale and range.



# Dual Axis Chart Usage



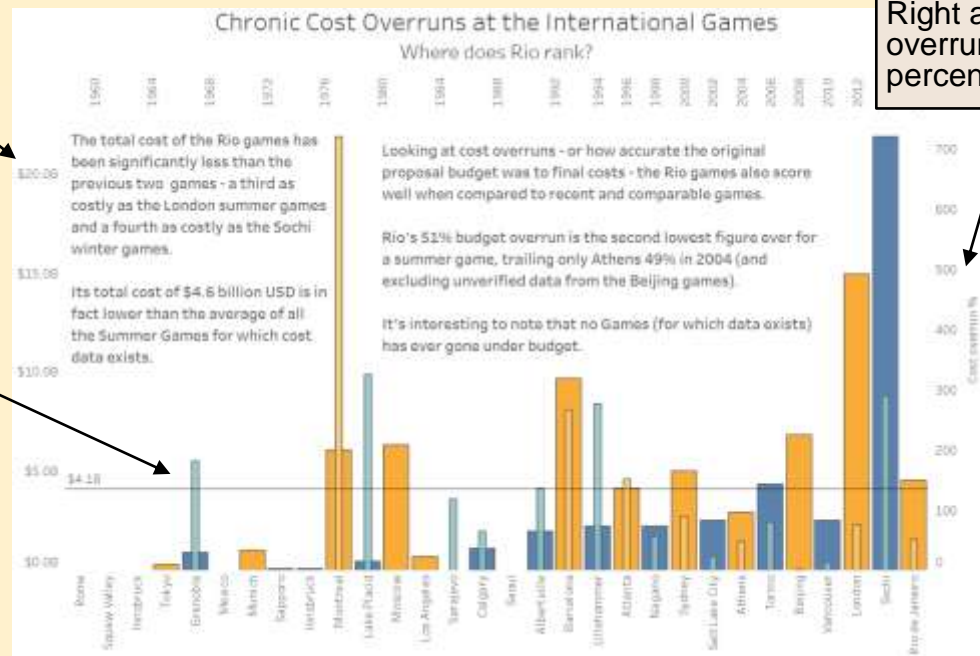
- Why use a second axis?
  - We want to put the two (or more) variables together to show some kind of relationship (correlation).
  - To save screen space (one chart instead of two)

Left axis is for budget, money data type, absolute dollar value.

Column + (narrower) column dual axis chart: two columns use different styles.

Right axis is for overrun percentage in %

<https://public.tableau.com/profile/dash7070#!/vizhome/OlympicCostOverruns/WEBDash>

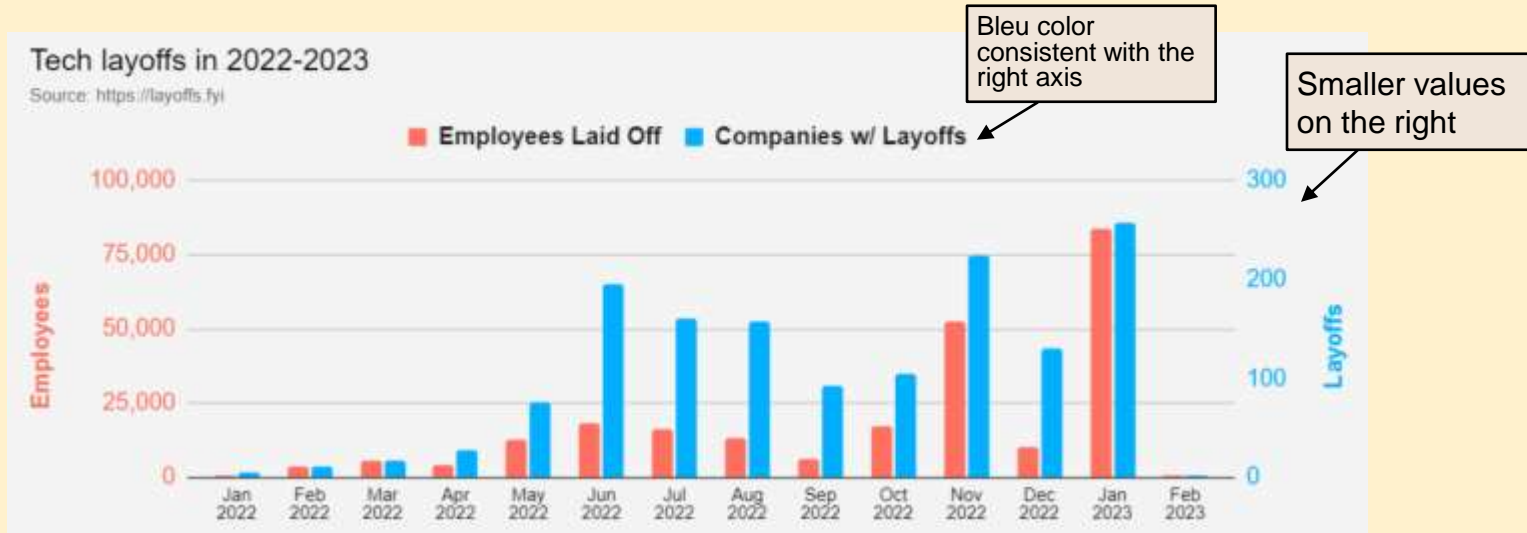




# Which axis does it refer to?



- Design conventions (it is a good practice to follow conventions)
  - Put the variable with larger value ranges to the left, and the one with smaller ranges on the right.
  - Use color help to associate with an axis



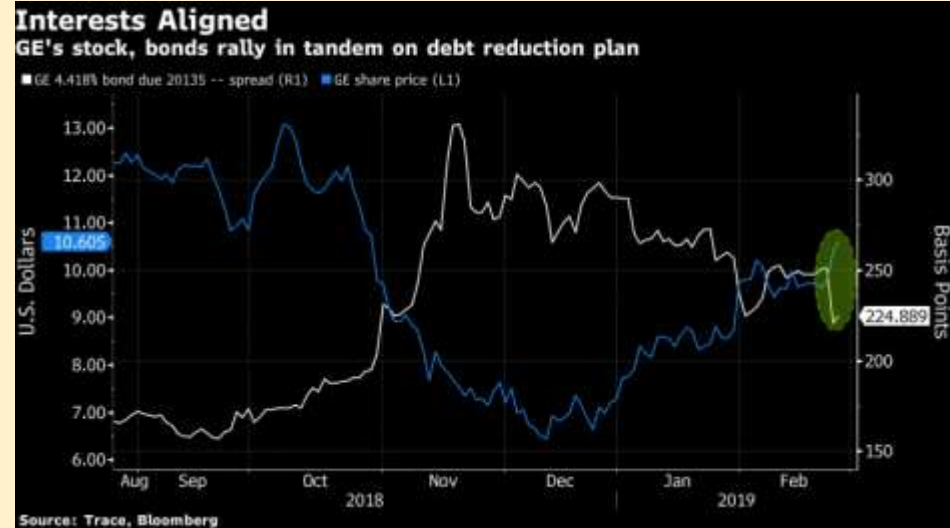
<https://layoffs.fyi>



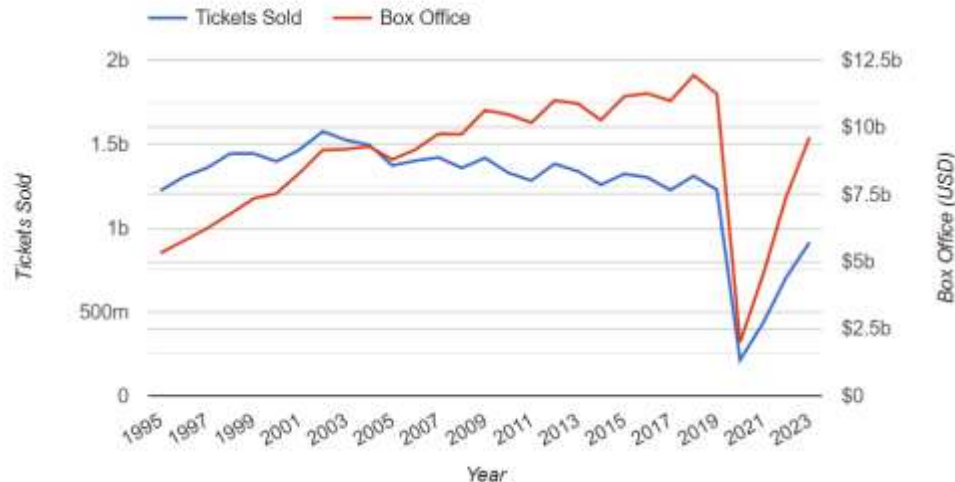
# Dual Axis Chart with Two Lines



<https://finance.yahoo.com/news/corporate-america-goes-debt-diet-110001131.html>



Annual Ticket Sales



<https://www.the-numbers.com/market/>

# Dual Axis Chart with Three Lines



<https://marketrealist.com/2019/02/analyzing-the-trends-in-teslas-valuation-multiples-in-q1>

Tesla's Forward EV-to-EBITDA



Three lines in one dual axis chart: two of them (yellow and green lines) are grouped to use the same right axis. However, the design is questionable as the two ratios are still of very different range.

<https://cathiesark.com/arkk-holdings-of-tsla>

Three lines in one dual axis chart: two of them (purple and yellow) are grouped to use the same right axis, as they are of same units and data type, and with similar ranges.

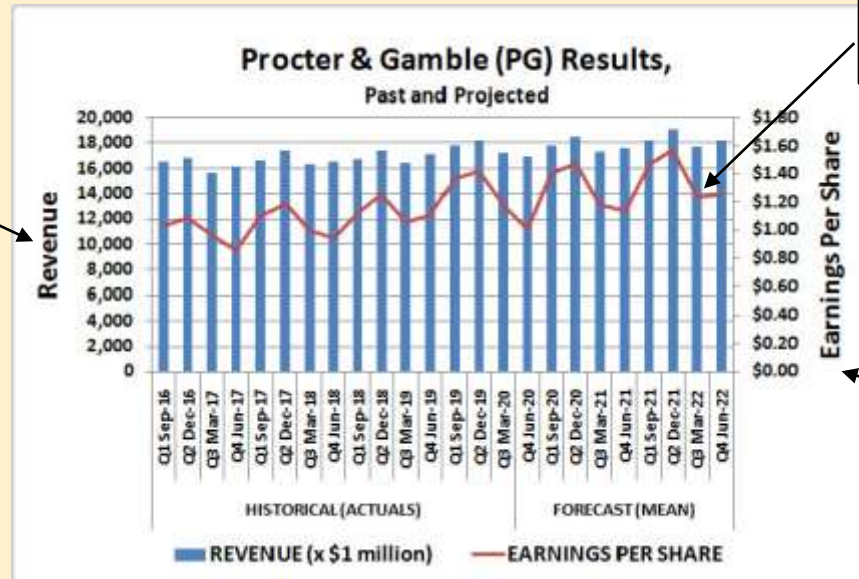


# 3. Dual Axis Combo Chart



- Dual axis combo chart = dual axis chart + combo chart.
  - Two (or more than two) data series are visualized using different form of charts or visual attributes like color or shape
  - A combo chart may not need two axes; a dual axis chart may not need two chart types. But a dual axis combo chart has two different exes and two different chart types.
- Typical example: column + line is the most often used type
- Column + Line design conventions (it is a good practice to follow conventions)
  - Columns refer to the left axis, lines (or other marker types) refers to the right axis
  - Put the variable with larger value ranges to the left, and the one with smaller ranges on the right.

Blue columns refer to the left axis (revenue). Revenue has larger value range.



The red line refers to the right axis (EPS).

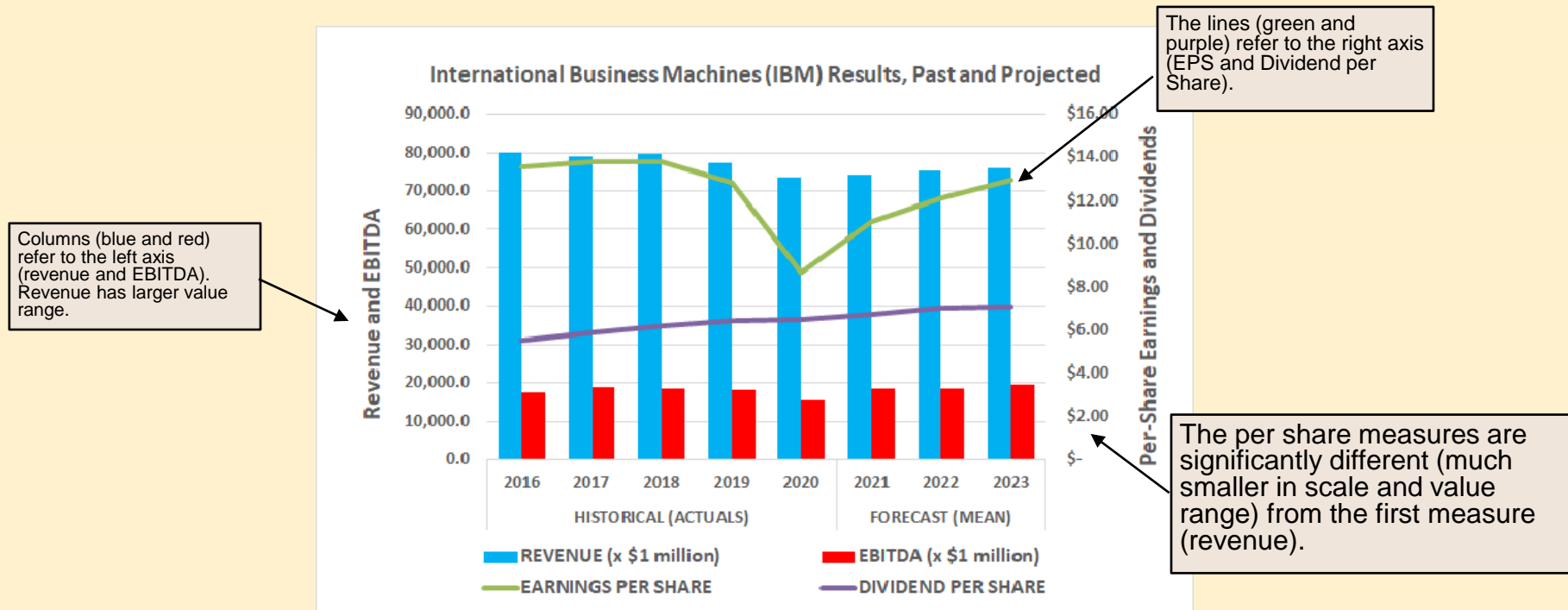
The second measure (EPS) is significantly different (much smaller in scale and value range) from the first measure (revenue).

<https://fool.whotrades.com/blog/43151739255>

# Variation – more variables



- We can have two or more data serials on each axis
  - **Note**: the current version of Tableau has a limitation on dual axis combo chart: it can only have one axis (either left or right), not both axes, with two or more variables grouped.

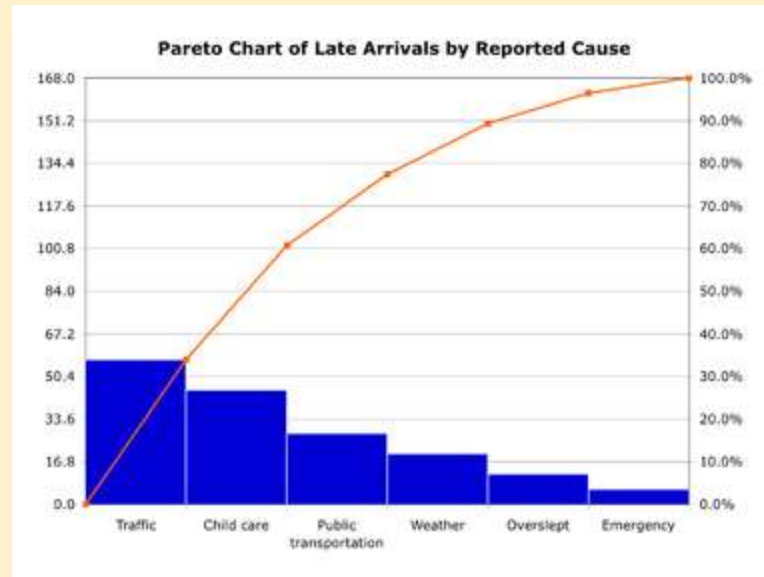


<https://www.fool.com/investing/2021/01/29/ibm-stock-had-terrible-q4-heres-why-still-a-buy/>

# Pareto Chart



- Pareto chart is a kind of dual axis combo chart with some additional settings
  - Individual values are represented in descending order by bars/columns, and the cumulative total (in %) is represented by the line.
  - [http://en.wikipedia.org/wiki/Pareto\\_chart](http://en.wikipedia.org/wiki/Pareto_chart)
- Used intensively in quality control data visualizations
  - [https://en.wikipedia.org/wiki/Seven\\_basic\\_tools\\_of\\_quality](https://en.wikipedia.org/wiki/Seven_basic_tools_of_quality)

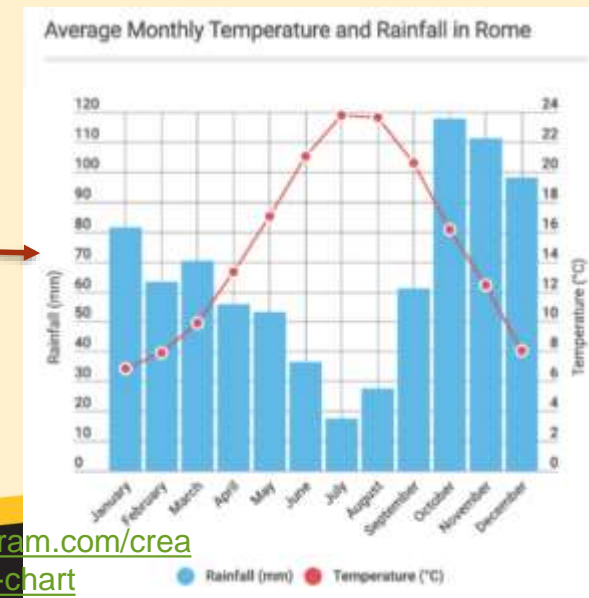
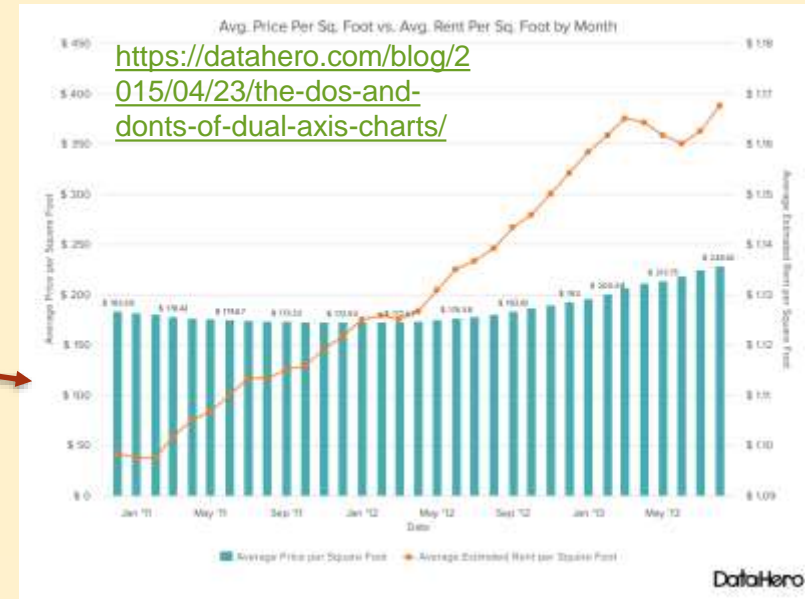




# Dual Axis (Combo) Chart Use Cases



- Absolute numbers with significant value ranges
  - Revenue vs. EPS
  - Revenue vs. Dividend
  - Student enrollment vs. faculty number
  - Price per sq foot vs. Rent per sq foot
- Absolute numbers and relative ratio data type
  - Sales vs. growth percentage
  - Profit vs. discount rate
  - Sales vs. operating margin
  - Revenue vs. market share
- Measure with different measuring units
  - Temperature vs. rainfall
  - Student enrollment vs. operational budget
  - Sales amount vs. number of stores



<https://infogram.com/create/dual-axis-chart>

# Case 1



- Battery % (left) + elevation (right)



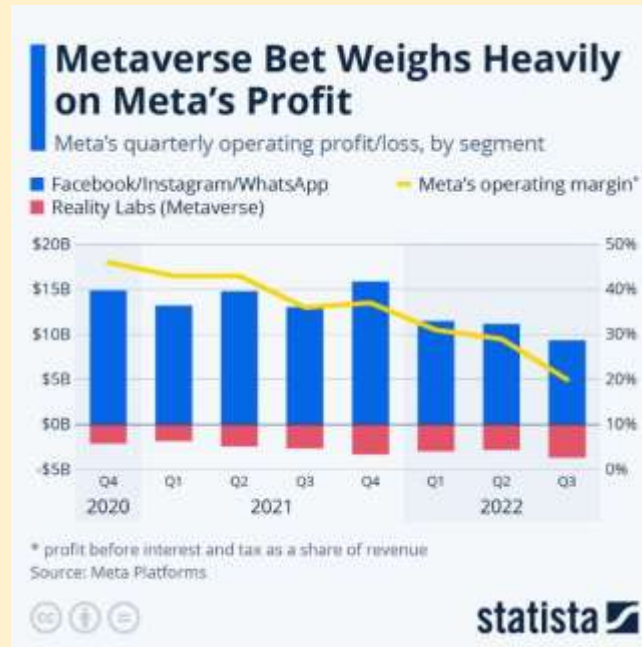
<https://twitter.com/Tesla/status/1598490134357610496>



# Case 2



- A second variable referring to the left axis – use a second series of red bars (negative values)



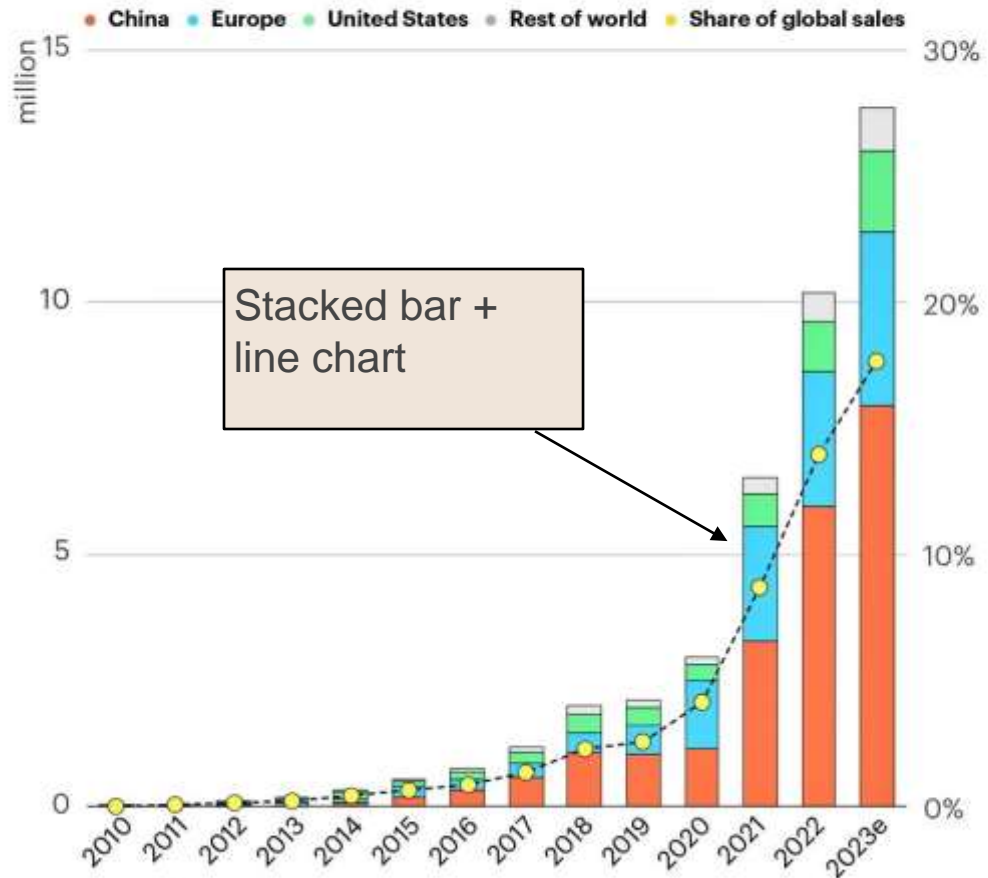
<https://www.statista.com/chart/28567/meta-operating-profit/>

# Nested combo chart



## Electric cars are booming – global sales are on course to jump 35% this year to 14 million

Global electric car sales and share of global car sales, 2010-2023e



Stacked bar +  
line chart

<https://twitter.com/OpenskiesX/status/1695955072327536956>

Note: e = estimated

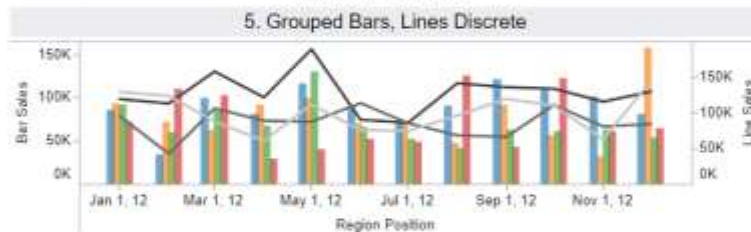
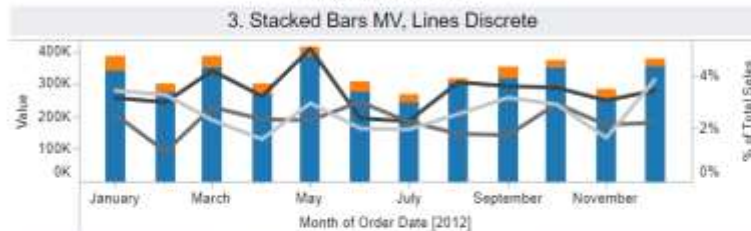
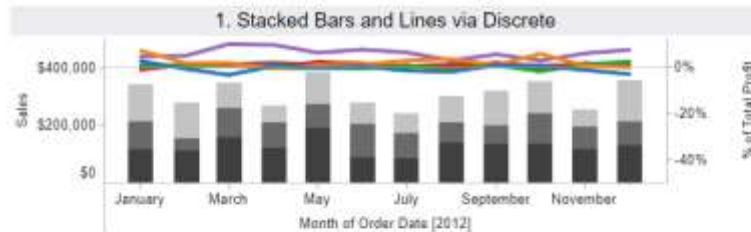
International  
Energy Agency

# More Variations



## Combining Bars and Lines in Tableau

[Open the "So You Want Bars and Lines on the Same Chart" Flowchart](#)  
[See the Drawing with Numbers blog post](#)

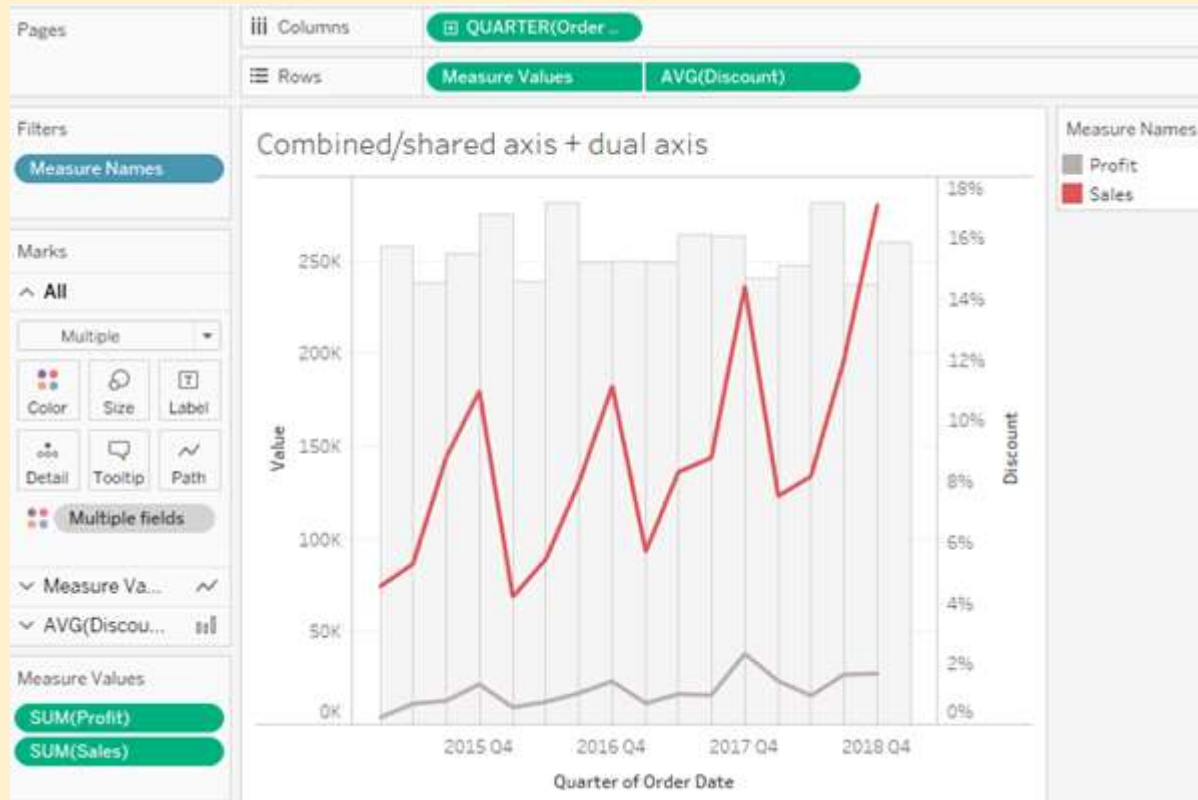


<https://public.tableau.com/app/profile/jonathan.drummy/viz/barsandlines/Introduction>

# Exercise 1



- Issues with this dual axis combo chart? How to improve?

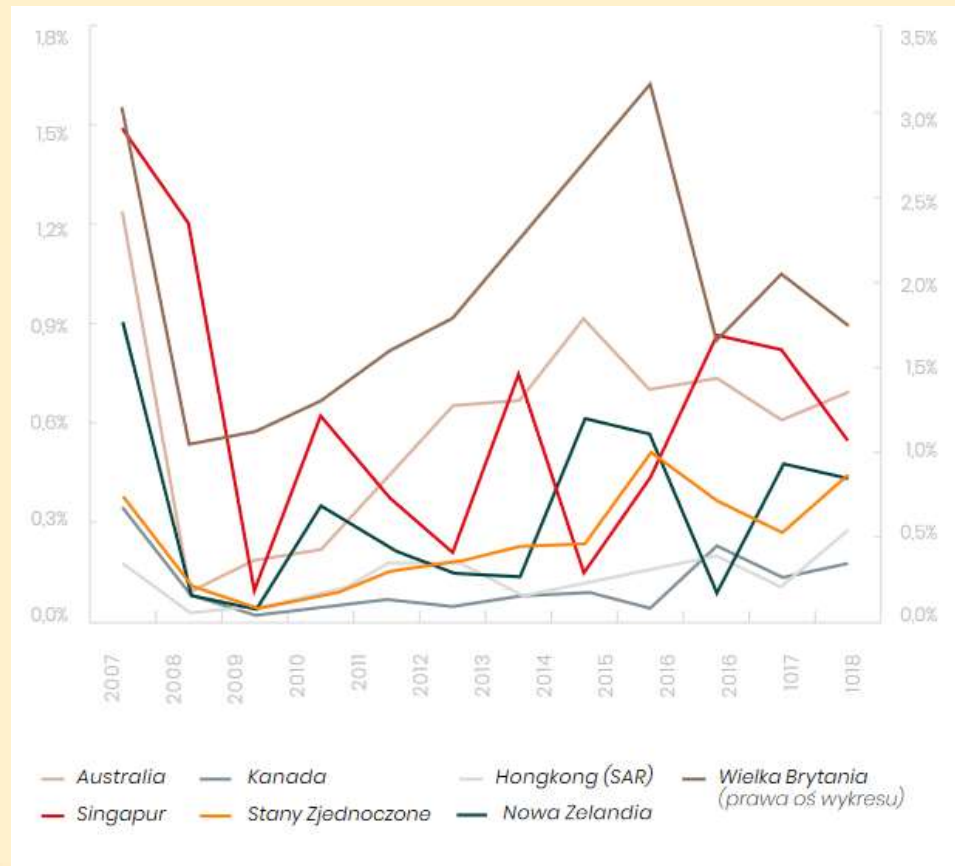


<https://www.thedataschool.co.uk/robert-headington/combined-axis-vs-dual-axis>

# Exercise 2



- Issues with this dual axis chart? How to improve?



Great Britain (Wielka brytania) has its very own right Y axis. Is this the right way to use dual axis?

<https://twitter.com/WTFViz/status/1458509947348602885>

<https://viz.wtf/post/667492909034225664/great-britain-wielka-brytania-got-to-have-its>



# Design Questions



- Should I use a second axis?
  - Are two axes using different measuring units, or showing different value ranges?
- What marker (chart) types to use for each data serial (variable)? What marker type is best? Do I need to use different marker type?
  - Generally, lines for time related data

# The case against dual axis charts



- Dual axis is not the universal solution to all cases.
- The following article provides some cases against dual axis charts and some alternatives
  - <https://blog.datawrapper.de/dualaxis/>





# Making Dual Axis Combo Chart in Tableau



- Official Tableau Help
  - Build a Combination Chart [https://help.tableau.com/current/pro/desktop/en-us/qs\\_combo\\_charts.htm](https://help.tableau.com/current/pro/desktop/en-us/qs_combo_charts.htm)
  - Add Axes for Multiple Measures in Views [https://help.tableau.com/current/pro/desktop/en-us/multiple\\_measures.htm](https://help.tableau.com/current/pro/desktop/en-us/multiple_measures.htm)
  - Creating an Overlapped Bar Chart (with video) <https://kb.tableau.com/articles/howto/dual-axis-bar-chart-multiple-measures> or direct video on YouTube <https://www.youtube.com/watch?v=ImmeBu0mu34>
- Various ways to combine bars and lines - need some hacks
  - <http://drawingwithnumbers.artisart.org/bars-and-lines/>
- Others
  - <https://evolytics.com/blog/tableau-201-how-to-make-a-dual-axis-combo-chart/>
  - <https://playfairdata.com/3-ways-to-use-dual-axis-combination-charts-in-tableau/>