

# Social-insurance Undergraduate Research Fellowship (SURF)

## Data Visualization by Jonathan A. Schwabish

05/24/2023



Center for  
Financial Security  
UNIVERSITY OF WISCONSIN-MADISON



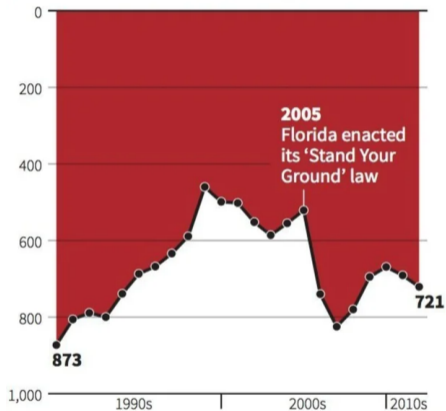
Retirement & Disability  
Research Center

# The Hunt for the Worst Data Visualization

by Jared Hutchins and his Students

# Gun deaths in Florida

Number of murders committed using firearms



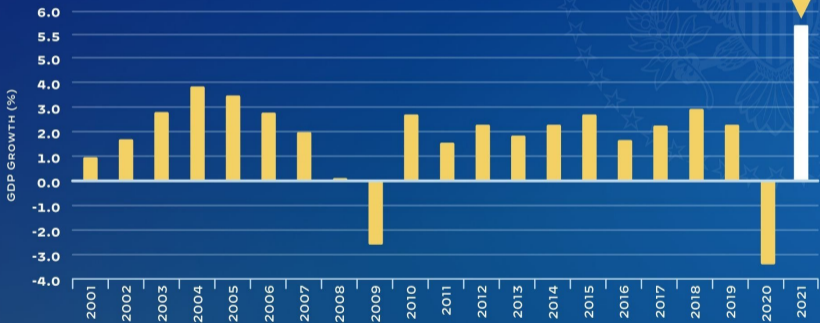
Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

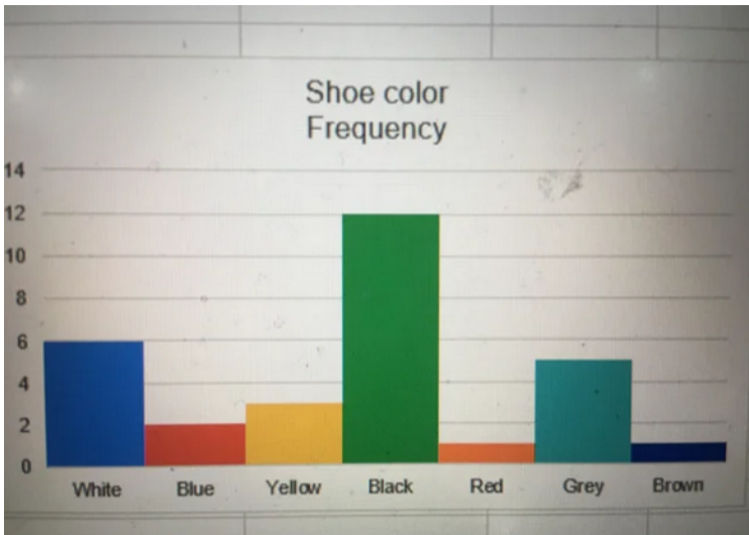
REUTERS

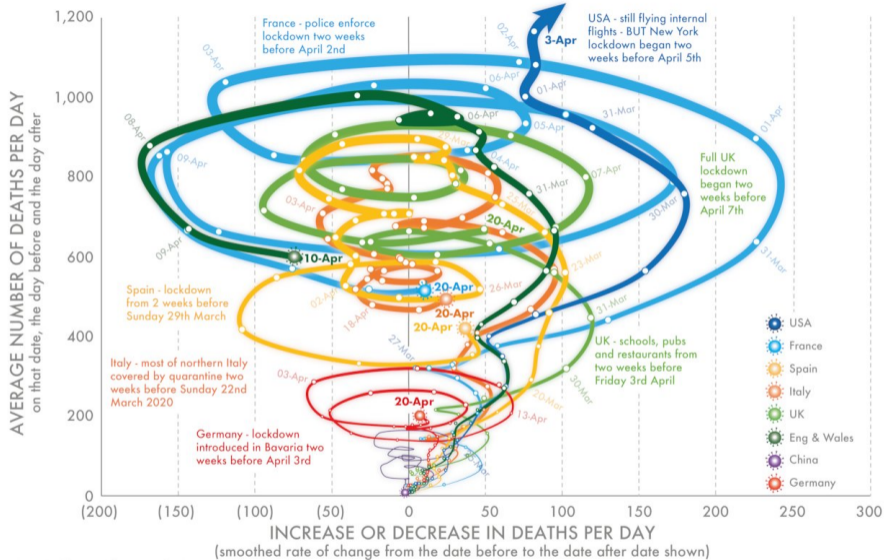


# AMERICA'S ECONOMIC GROWTH IN THE 21ST CENTURY



Source: Bureau of Economic Analysis





DannyDorling.org. Illustration by Kirsten McClure @orpheuscat

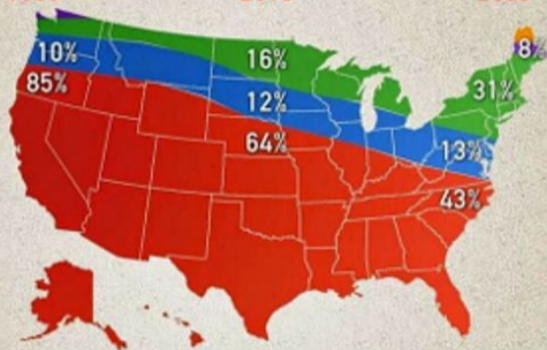
# CHANGING FACE OF AMERICA

Percent of total U.S. population by race and ethnicity, 1960-2060

1960

2010

2060



OTHER

ASIAN

HISPANIC

BLACK

WHITE

SOURCE: PEW RESEARCH CENTER

NIGHTLY NEWS  
from BRENNAN THOMPSON

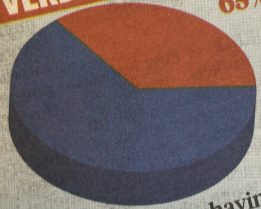
n in tax  
ur years,  
with cer-  
o deliver a

Ony  
argued among  
mining tax, carbon tax, hous  
ing tax, death duties and a  
retirees' tax.

**YOUR VERDICT**

**YES**  
35%

**NO**  
65%



Will Anthony Albanese having  
Covid-19 affect the Labor party's  
chances at the election?



# Basic Principles

# Why Data Visualization?



# Picture Superiority Effect

- A good picture is worth so much: Retain more information seen through pictures than through words
- Disseminate research → Construct compelling and effective graphics

# Construct Effective Graphs

Tap into the brain's “pre-attentive visual processing” in contrast to “attentive processing”

# Construct Effective Graphs

Tap into the brain's "pre-attentive visual processing" in contrast to "attentive processing"

Example:

1269548523612356987458245

0124036985702069568312781

2439862012478136982173256

# Construct Effective Graphs

Tap into the brain's "pre-attentive visual processing" in contrast to "attentive processing"

Example:

1269548523612356987458245  
0124036985702069568312781  
2439862012478136982173256

vs

126954852**3**612**3**56987458245  
01240**3**6985702069568**3**12781  
24**3**98620124781**3**698217**3**256

# Construct Effective Graphs

- Many approaches: Choose fonts, colors, styles, layouts, and chart types
- Three basic principles:
  1. Show the data
  2. Reduce the clutter
  3. Integrate the text and the graph

# 1. Show the Data

- Present data via graphs
- Simple graphs to understand the story
- Do not show all the data



## 2. Reduce the Clutter

- Unnecessary or distracting visual elements reduce effectiveness
- Dark or heavy gridlines; unnecessary tick marks, labels, or text; unnecessary icons or pictures; ornamental shading and gradients; unnecessary dimensions. . .



## 2. Reduce the Clutter



Source: Laurent Bergé

### 3. Integrate the Text and the Graph

- Do not narrate the text elements that appear in the graph
- Construct visualizations to complement the text and to contain enough information to stand alone

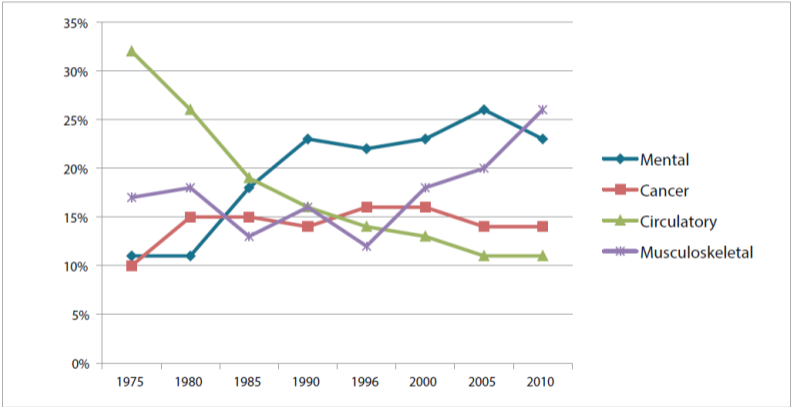
# Main Idea

**Graphs are not meant for the author, but for the reader or the seminar audience.**

# Eight Graphs Transformed

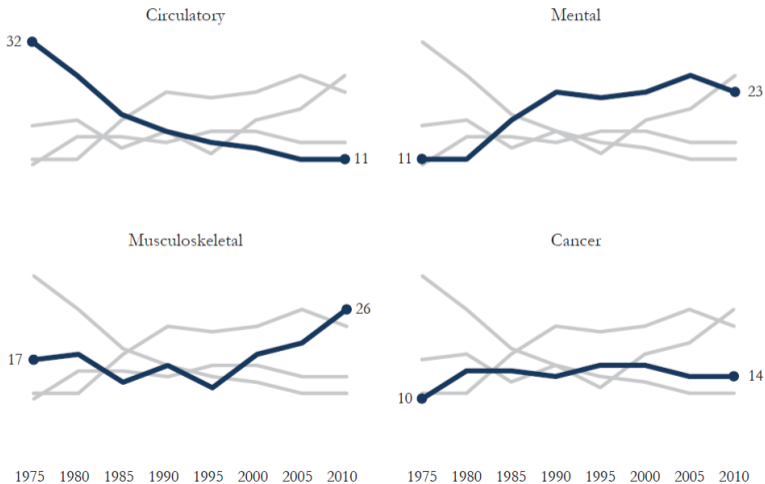
# Line Plot

Initial DI Worker Awards by Major Cause of Disability—Calendar Years 1975-2010



# Line Plot

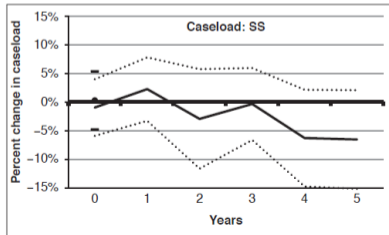
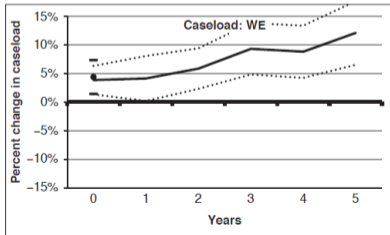
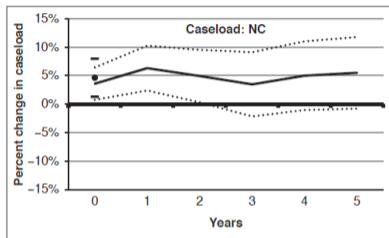
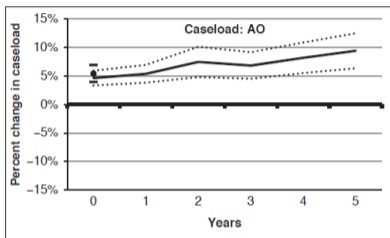
Initial DI Worker Awards by Major Cause of Disability—  
Calendar Years 1975–2010  
(Percent)





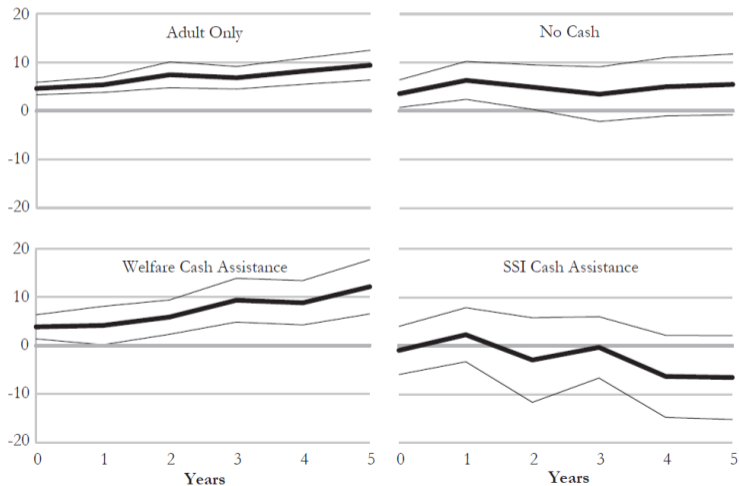
# Regression Results Plot

Regression results of the correlation between the long-run unemployment rate and SNAP caseloads for four groups



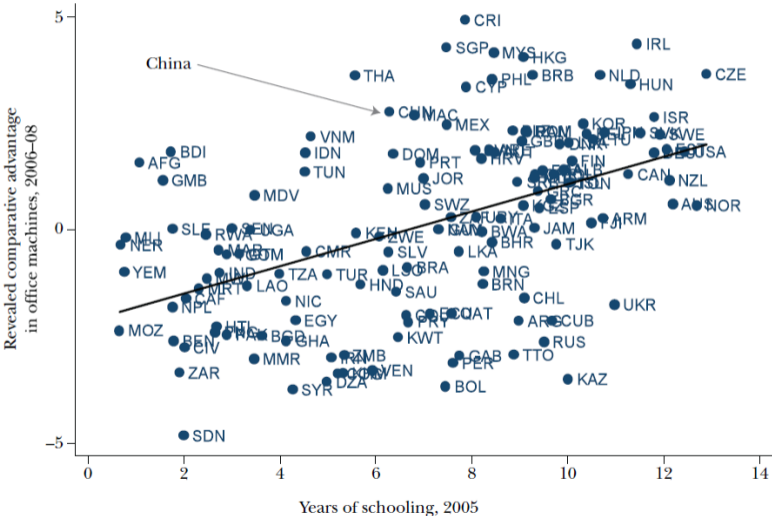
# Regression Results Plot

Implied Impulse Response Functions for Different Caseloads  
(Percent change)



# Scatterplot

Education and Exports of Office Machines

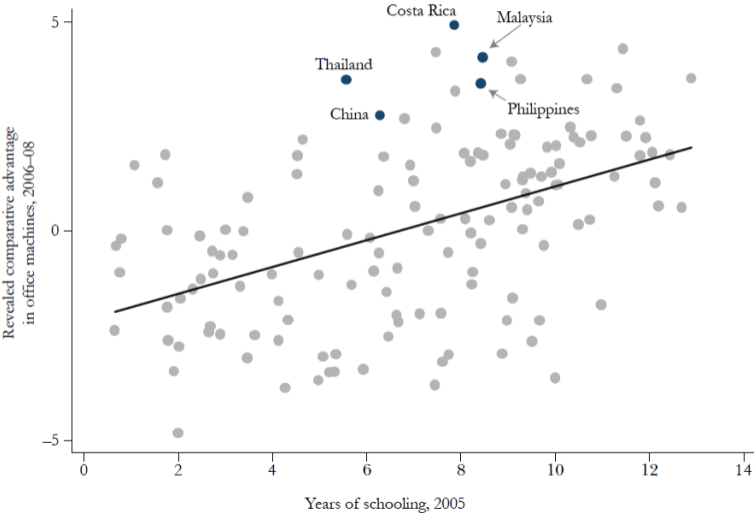


## Scatterplot

*[The figure] plots countries' revealed comparative advantage in office machines . . . averaged over 2006 to 2008, against the average years of schooling of the adult population in 2005 . . . China is above the regression line, indicating that its specialization in the sector is greater than one would expect given its level of education, but it is hardly an extreme outlier. Other middle-income countries—including Costa Rica, the Philippines, Malaysia, and Thailand—have larger positive residuals.*

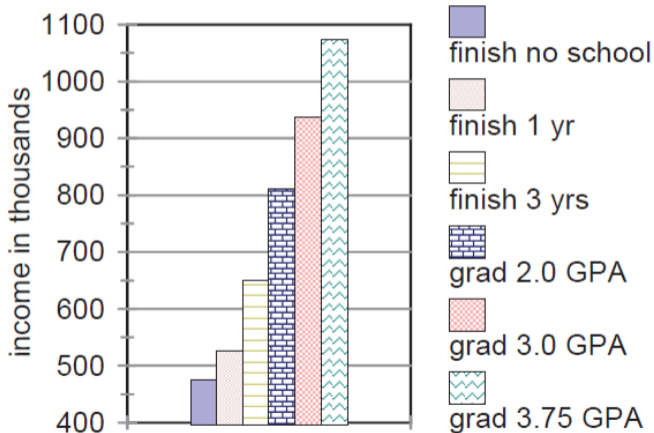
# Scatterplot

Education and Exports of Office Machines



# Bar Plot

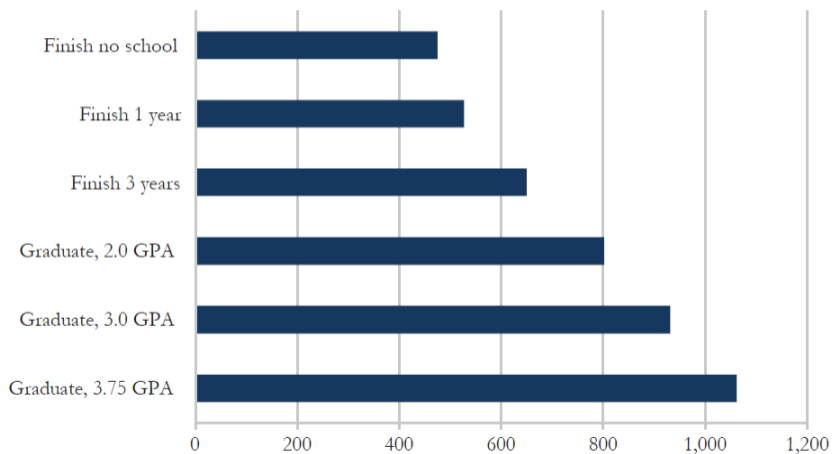
Figure 2 Discounted Expected Lifetime Earnings,  $VN(t')$



# Bar Plot

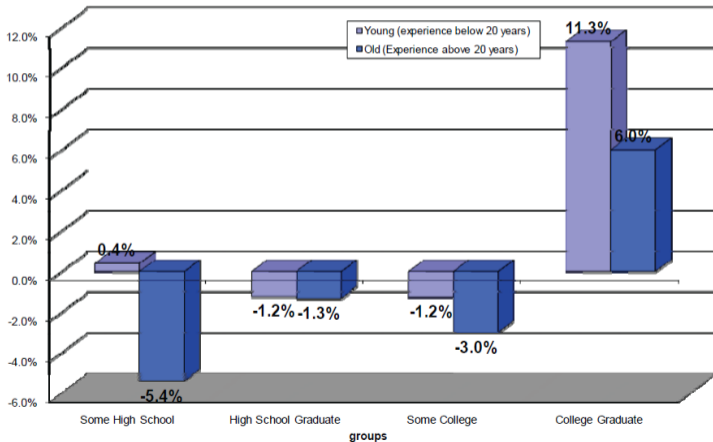
## Discounted Expected Lifetime Earnings, $VN(t')$

(Income in thousands)



# 3D Chart

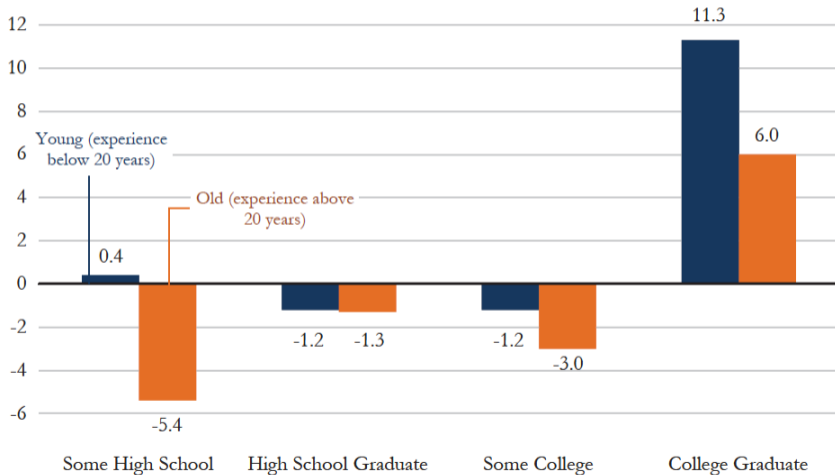
Change in real weekly wages of US-born workers by group, 1990-2006





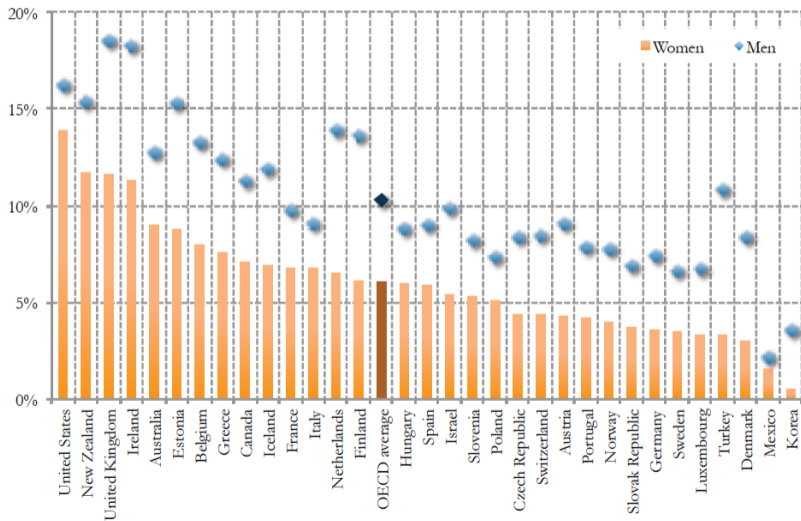
# 3D Chart

Change in real weekly wages of US-born workers by group, 1990–2006  
(Percent)



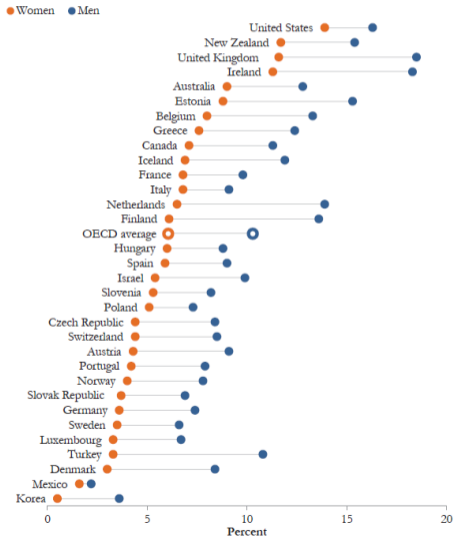
# Unbalanced Chart

Percentage of Employed Who Are Senior Managers,  
by Sex, 2008



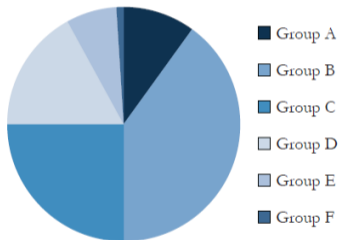
# Unbalanced Chart

Percentage of Employed Who Are Senior Managers, by Gender, 2008  
(percent)

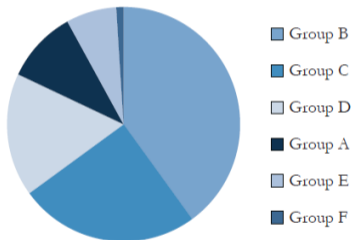


# Pie Chart

**A Pie Chart**

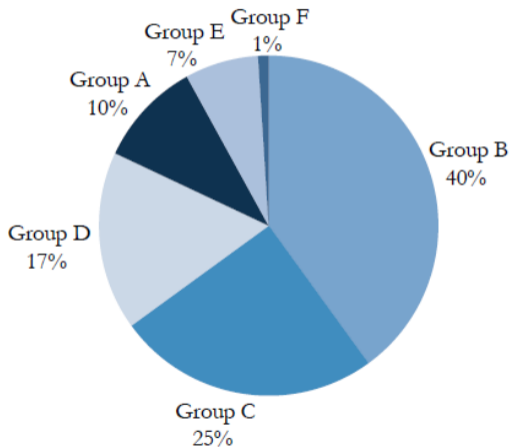


**B: A Pie Chart, Rotated**



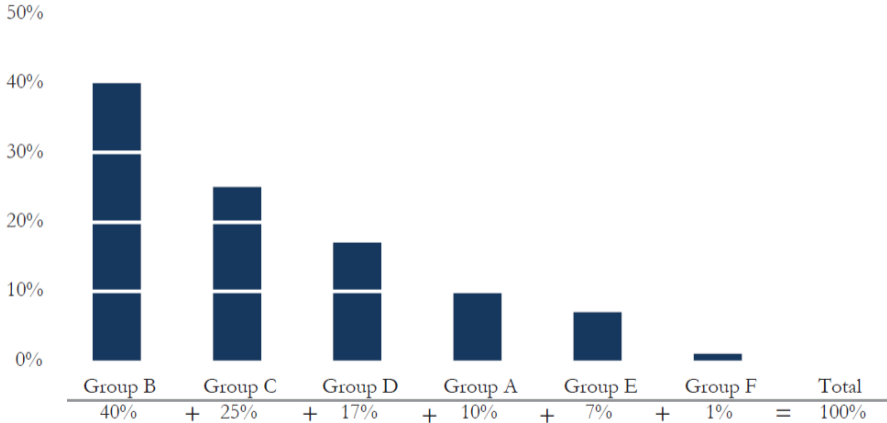
# Pie Chart

## A Pie Chart, Labeled



# Bar Plot: Alternative to Pie Chart

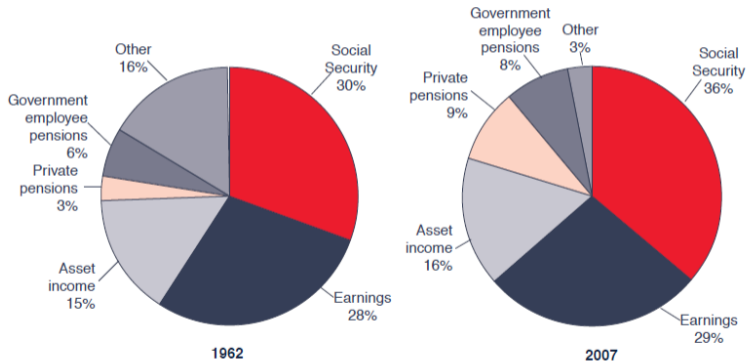
Percentage of Total Sales



# Two Pie Charts for Comparison

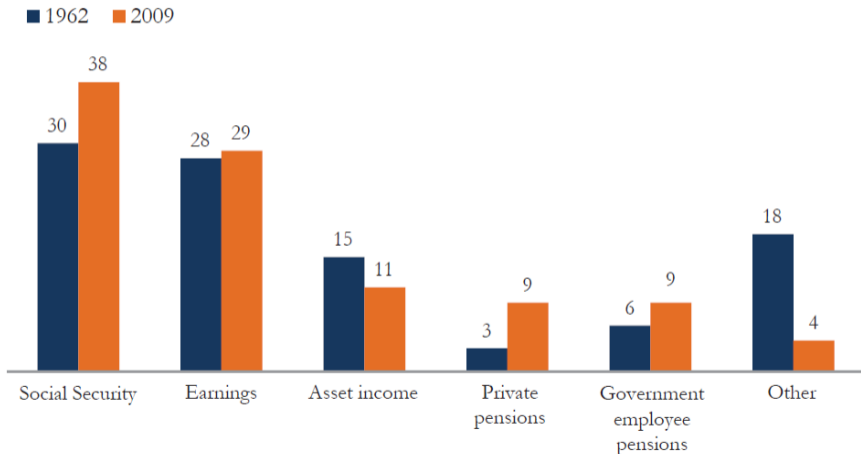
## Shares of Aggregate Income, 1962 and 2007

Aggregate income, by source



# Paired Bar Plot: Alternative to Two Pie Charts

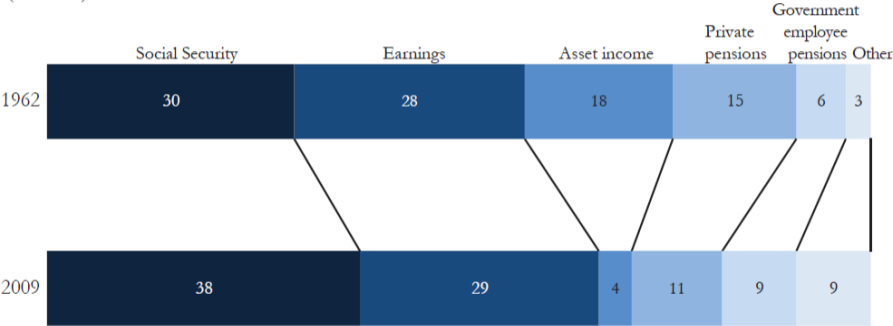
Shares of Aggregate Income, 1962 and 2009  
(Percent)





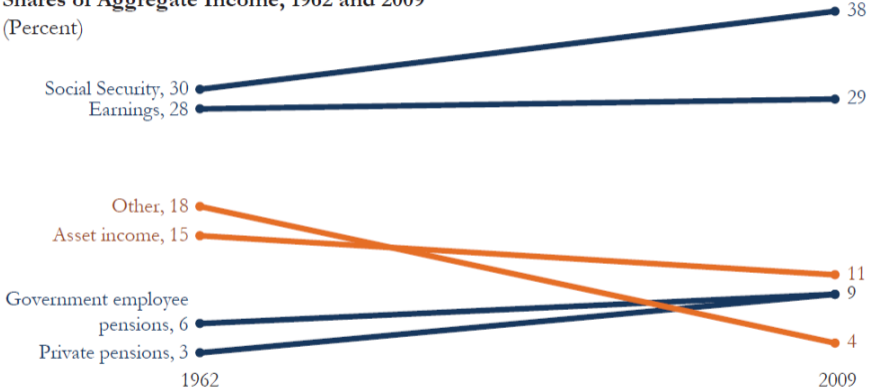
# Stacked Bar Plot: Alternative to Two Pie Charts

Shares of Aggregate Income, 1962 and 2009  
(Percent)



# Slope Chart: Alternative to Two Pie Charts

Shares of Aggregate Income, 1962 and 2009  
(Percent)



# Tools and Resources

# Colors

- Avoid using default palettes
- Create, modify, and export color palettes: [Adobe Kuler](#); [ColorBrewer2.0](#); [ColorSchemeDesigner](#); [Colrd](#)
- Choose colors from any image: [Instant Eyedropper tool](#)
- Simulate varieties of color blindness: [Oracle](#); [Vischeck](#)
- Test grayscale-consistent color palettes: [ColorBrewer2.0](#)

# Fonts

- Do not use the boring and overused Arial, Calibri, and Times New Roman typefaces
- Font Squirrel; Google Fonts

# Conclusion

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- Presentation matters
- Consider the needs of your audience
- Invest some time learning and thinking about the details of graphical presentation