Understanding Complex Results An Introduction to Visualization and pandas

Nick DeRobertis¹

 1 University of Florida Department of Finance, Insurance, and Real Estate

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Why Visualize?

• So far we've had one main output from our model, number of years

Salaries and wealth over time have also been outputs, but we haven't
had a good way of understanding that output. It's a bunch of
numbers.

• This is where visualization comes in. We have some complex result, and want to make it easily interpretable.

What we Have so Far

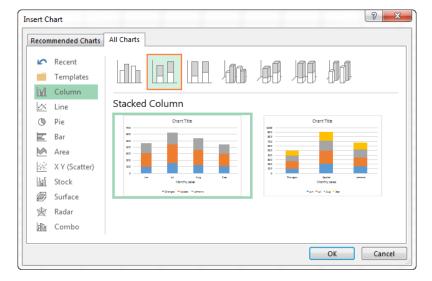
Retirement Info

Time	Salaries	Wealths
1	61,200	31,050
2	62,424	48,208
3	63,672	66,537
4	64,946	86,100
5	76,182	109,451
6	77,705	134,350
7	79,259	160,882
8	80,844	189,137
9	82,461	219,209
10	96,727	254,352
11	98,662	291,735
12	100,635	331,480

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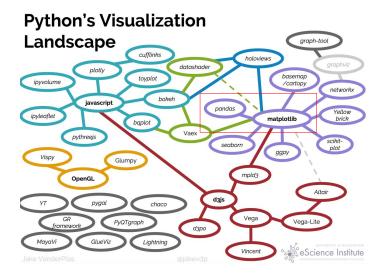
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Visualization in Excel



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An Overwhelming Number of Options in Python



• Ultimately, we will be creating graphs using matplotlib but we won't use it directly.

• Instead, we will use pandas

• pandas is actually creating its graphs using matplotlib for us, but it is simpler to use.

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Visualization in Excel

Adding Graphs to the Dynamic Salary Retirement Excel Model

- I will now go back to the "Dynamic Salary Retirement Model.xlsx"
 Excel model to add visualization
- I have also uploaded the completed workbook from this exercise as "Dynamic Salary Retirement Model Visualized.xlsx"
- Follow along as I go through the example.

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Some Setup Before we can Visualize in Python

- pandas does a **lot** more than just graphing. We will use it throughout the rest of the class.
- Previously we've worked with lists, numbers, strings, and even our custom types (our model dataclasses)
- pandas provides the DataFrame as a new type that we can use.
- Before we can get to graphing, we must learn how to use the DataFrame.

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What is a DataFrame?

A DataFrame is essentially a table. It has rows and columns, just like in Excel.

Some Features of the DataFrame

- Add or remove columns or rows
- Group by and aggregate
- Load in and output data from/to Excel and many other formats
- Merge and join data sets
- Reshape and pivot data
- Time-series functionality
- Slice and query your data
- Handle duplicates and missing data

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A Basic DataFrame Example

```
>>> import pandas as pd
>>> df = pd.DataFrame()
>>> df['Sales'] = [1052, 212, 346]
>>> df['Category'] = ['Aprons', 'Apples', 'Bowties']
df
```

Sales Category 0 1052 Aprons 1 212 Apples 2 346 Bowties

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Introduction to Pandas

Creating and Using Pandas DataFrames

- I will now go through the notebook in "Intro to Pandas and Table Visualization.ipynb"
- Follow along as I go through the example.
- We will complete everything up until DataFrame Styling

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Intro Pandas Lab

Getting Started with Pandas

- Work off of the Jupyter notebook Pandas and Visualization Labs.ipynb
- 2 Complete the lab exercises in the first section entitled "Pandas"

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Styling Pandas DataFrames

 It is possible to add styling to our displayed tabular data by styling the DataFrame

• The styling is very flexible and essentially allows you to do anything

 Out of the box, it is easy to change colors, size, and positioning of text, add a caption, do conditional formatting, and draw a bar graph over the cells.

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Introduction to Pandas

Creating and Using Pandas DataFrames

- I will now go through the next section in "Intro to Pandas and Table Visualization.ipynb"
- Follow along as I go through the example.
- This time we are covering the remainder of the notebook starting from "DataFrame Styling"

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Pandas Styling Lab

Styling Pandas DataFrames

- Keep working with the same lab Jupyter Notebook
- Complete the lab exercises in the second section entitled "Pandas Styling"

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A Minimal Plotting Example

```
Line Graphs using pandas
>>> %matplotlib inline
>>> ret_df.plot.line(x='Time', y='Salaries')

    Salaries

250000
225000
200000
175000
150000
125000
100000 -
 75000
```

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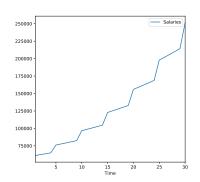
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Basic Graph Types: Line Graphs



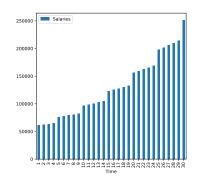


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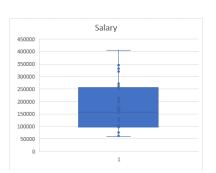
Basic Graph Types: Bar Graphs

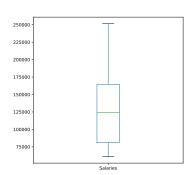




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Basic Graph Types: Box and Whisker Plots





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Introduction to Graphing

Graphing Using Pandas

- I will now go through "Intro to Graphics.ipynb"
- Follow along as I go through the entire example notebook.

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Intro Visualization Lab

Introduction to Graphing with Pandas

- Keep working with the same lab Jupyter Notebook
- 2 Complete the lab exercises in the final section entitled "Graphics"

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Lecture Resources

Lecture Resources

- Slides Understanding Complex Results
- 2 Lecture Notes Understanding Complex Results
- Opnic Salary Retirement Model Visualized
- Intro to Pandas and Table Visualization
- 10 Minutes to Pandas (Official Intro)
- Pandas Official Styling Guide
- Intro to Graphics
- Pandas Official Visualization Guide
- Opnic Salary Retirement Model Visualized
- Pandas and Visualization Labs

Intro Pandas Lab Resources

Getting Started with Pandas Resources

- Pandas and Visualization Labs
- Slides Understanding Complex Results
- 10 Minutes to Pandas (Official Intro)

Exercise: Slide 14

Pandas Styling Lab Resources

Styling Pandas DataFrames Resources

- Pandas and Visualization Labs
- Slides Understanding Complex Results
- Pandas Official Styling Guide

Exercise: Slide 17

Intro Visualization Lab Resources

Introduction to Graphing with Pandas Resources

- Pandas and Visualization Labs
- Slides Understanding Complex Results
- Pandas Official Visualization Guide

Exercise: Slide 24