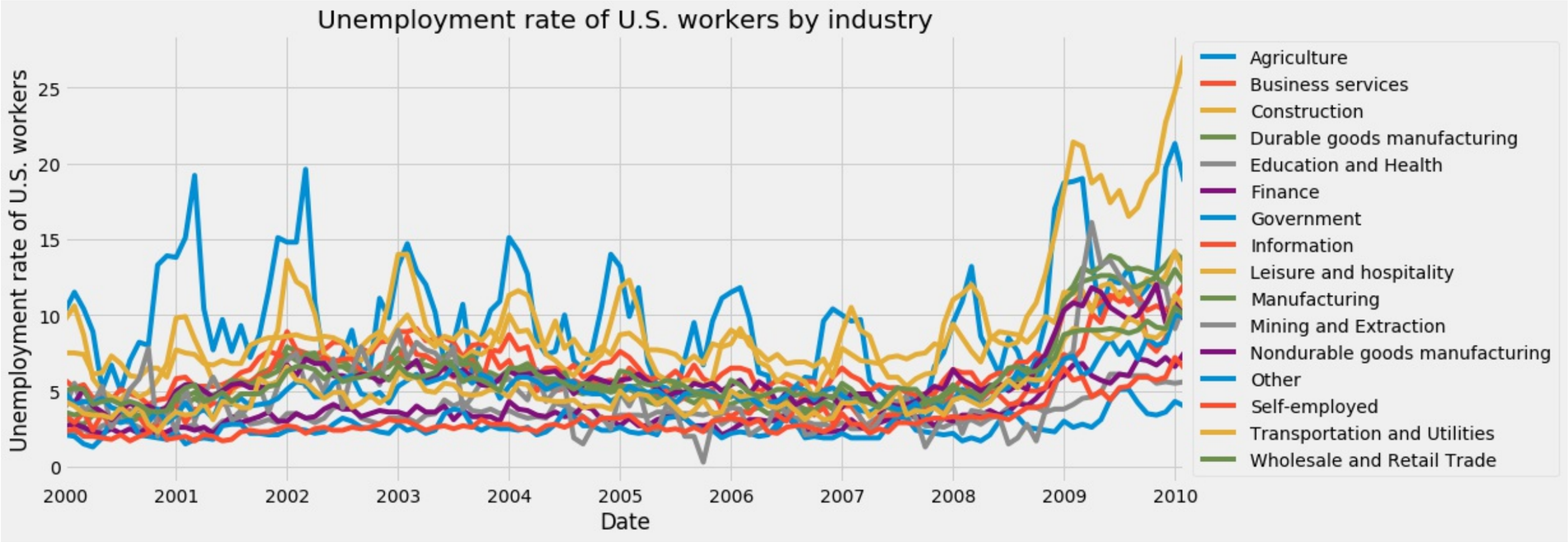
VISUALIZING TIME SERIES DATA IN PYTHON

Apply your knowledge to a new dataset

Thomas Vincent
Head of Data Science, Getty Images

The Jobs dataset



VISUALIZING TIME SERIES DATA IN PYTHON

Let's get started!

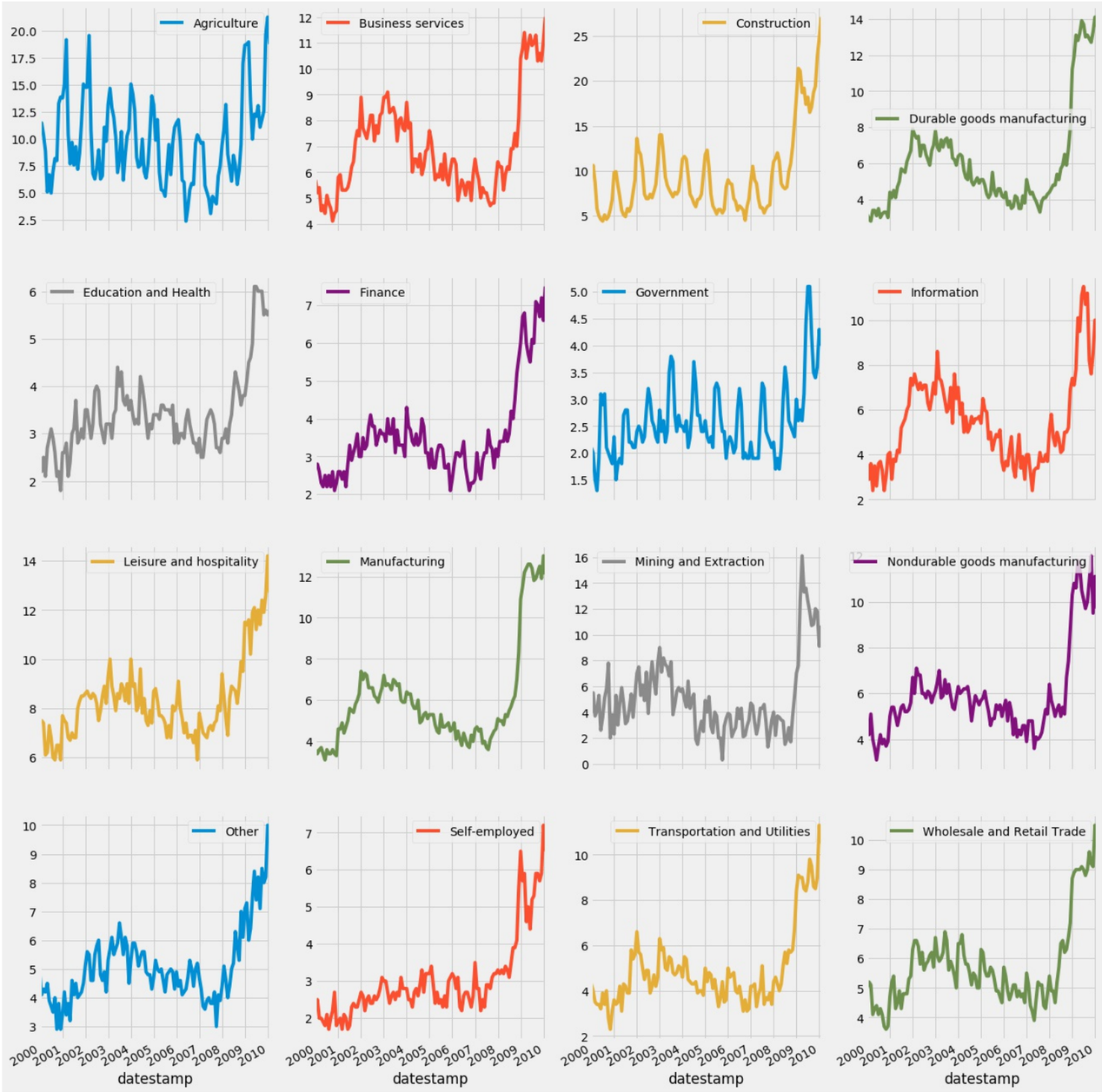
VISUALIZING TIME SERIES DATA IN PYTHON

Beyond summary statistics

Thomas Vincent
Head of Data Science, Getty Images

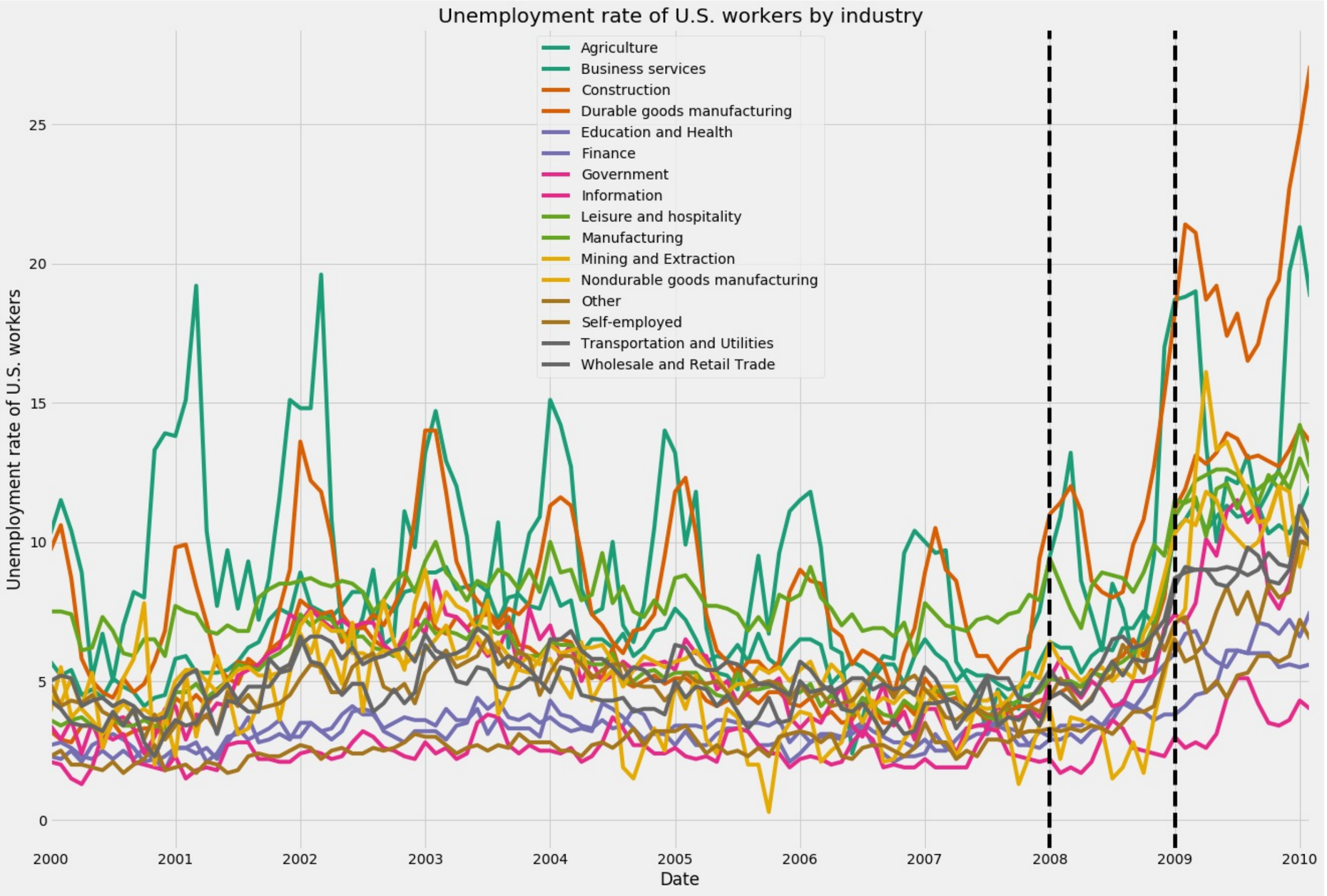
Facet plots of the jobs dataset

```
In [1]: jobs.plot(subplots=True,
                  layout=(4, 4),
                  figsize=(20, 16),
                  sharex=True,
                  sharey=False)

In [2]: plt.show()
```


Agriculture
Business services
Construction
Durable goods manufacturing
Education and Health
Finance
Government
Information
Leisure and hospitality
Manufacturing
Mining and Extraction
Nondurable goods manufacturing
Other
Self-employed
Transportation and Utilities
Wholesale and Retail Trade
datestamp
datestamp
datestamp
datestamp

Annotating events in the jobs dataset

```
In [1]: ax = jobs.plot(figsize=(20, 14), colormap='Dark2')

In [2]: ax.axvline('2008-01-01', color='black', linestyle='--')

In [3]: ax.axvline('2009-01-01', color='black', linestyle='--')
```


Unemployment rate of U.S. workers by industry
Agriculture
Business services
Construction
Durable goods manufacturing
Education and Health
Finance
Government
Information
Leisure and hospitality
Manufacturing
Mining and Extraction
Nondurable goods manufacturing
Other
Self-employed
Transportation and Utilities
Wholesale and Retail Trade
Unemployment rate of U.S. workers
0
5
10
15
20
25
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Date

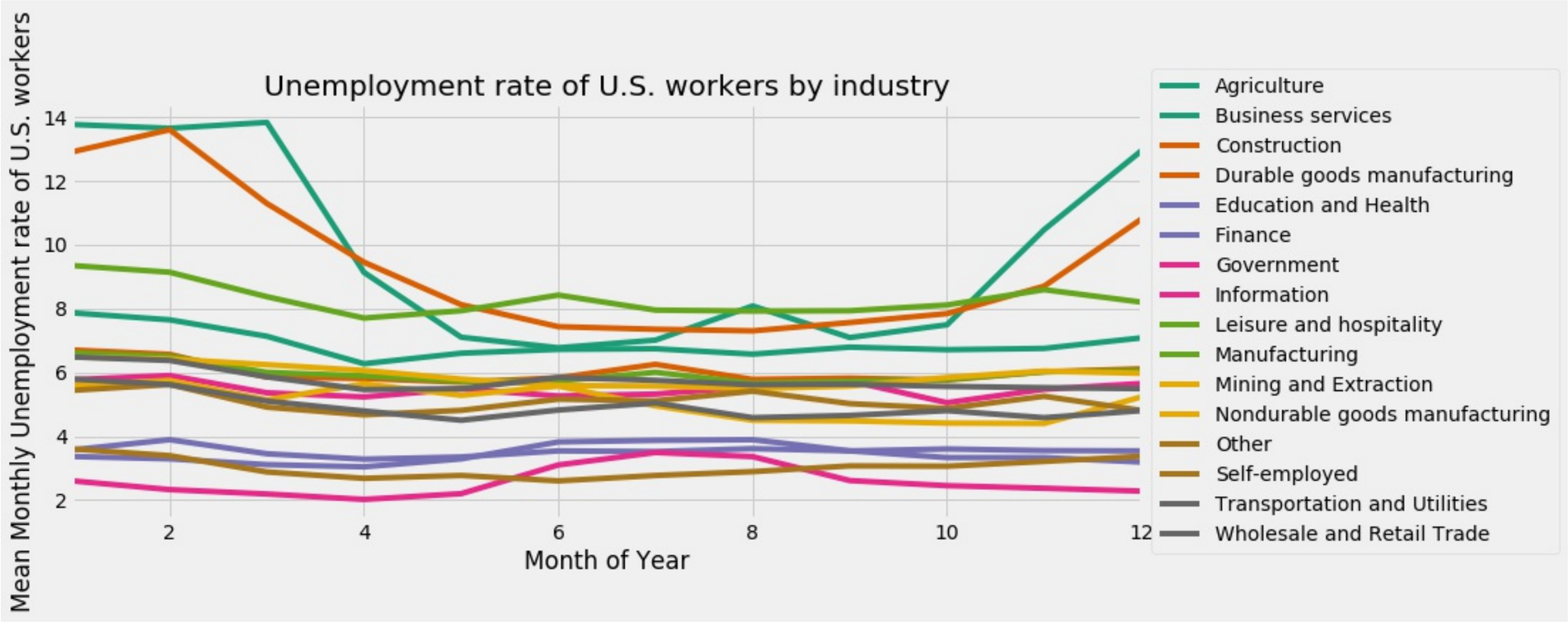
Taking seasonal average in the jobs dataset

```
In [1]: print(jobs.index)
        DatetimeIndex(['2000-01-01', '2000-02-01', '2000-03-01',
                       '2000-04-01', '2009-09-01', '2009-10-01',
                       '2009-11-01', '2009-12-01', '2010-01-01',
                       '2010-02-01'],
                      dtype='datetime64[ns]', name='datestamp',
                      length=122, freq=None)

In [2]: index_month = jobs.index.month

In [3]: jobs_by_month = jobs.groupby(index_month).mean()

In [4]: print(jobs_by_month)
            Agriculture  Business services  Construction  \
datestamp
1             13.763636           7.863636     12.909091
2             13.645455           7.645455     13.600000
3             13.830000           7.130000     11.290000
4              9.130000           6.270000      9.450000
5              7.100000           6.600000      8.120000
...
```

Monthly averages in the jobs dataset

```
In [1]: ax = jobs_by_month.plot(figsize=(12, 5), colormap='Dark2')

In [2]: ax.legend(bbox_to_anchor=(1.0, 0.5), loc='center left')
```

Monthly averages in the jobs dataset



VISUALIZING TIME SERIES DATA IN PYTHON

Time to practice!

VISUALIZING TIME SERIES DATA IN PYTHON

Decompose time series data

Thomas Vincent
Head of Data Science, Getty Images

Python dictionaries

```
# Initialize a Python dictionnary
In [1]: my_dict = {}

# Add a key and value to your dictionnary
In [2]: my_dict['your_key'] = 'your_value'

# Add a second key and value to your dictionnary
In [3]: my_dict['your_second_key'] = 'your_second_value'

# Print out your dictionnary
In [4]: print(my_dict)
        {'your_key': 'your_value',
         'your_second_key': 'your_second_value'}
```

Decomposing multiple time series with Python dictionaries

```
# Import the statsmodel library
In [1]: import statsmodels.api as sm

# Initialize a dictionary
In [2]: my_dict = {}

# Extract the names of the time series
In [3]: ts_names = df.columns

In [4]: print(ts_names)
['ts1', 'ts2', 'ts3']

# Run time series decomposition
In [5]: for ts in ts_names:
            ts_decomposition = sm.tsa.seasonal_decompose(jobs[ts])
            my_dict[ts] = ts_decomposition
```

Extract decomposition components of multiple time series

```
# Initialize a new dictionnary
In [1]: my_dict_trend = {}

# Extract the trend component
In [2]: for ts in ts_names:
            my_dict_trend[ts] = my_dict[ts].trend

# Convert to a DataFrame
In [3]: trend_df = pd.DataFrame.from_dict(my_dict_trend)

In [4]: print(trend_df)
            ts1  ts2 ts3
datestamp
2000-01-01  2.2  1.3 3.6
2000-02-01  3.4  2.1 4.7
...
```

VISUALIZING TIME SERIES DATA IN PYTHON

Python dictionaries for the win!

VISUALIZING TIME SERIES DATA IN PYTHON

Compute correlations between time series

Thomas Vincent
Head of Data Science, Getty Images

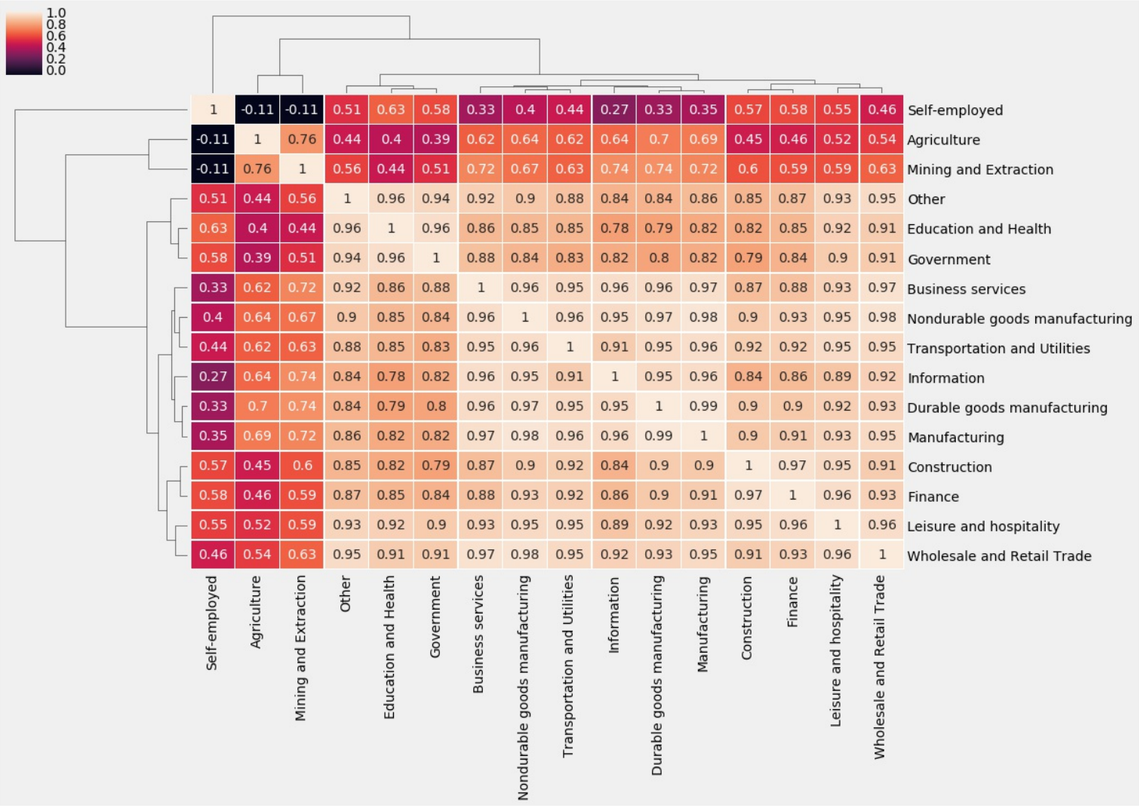
Trends in Jobs data

```
In [1]: print(trend_df)
            Agriculture  Business services  Construction  \
datestamp
2000-01-01          NaN                NaN           NaN
2000-02-01          NaN                NaN           NaN
2000-03-01          NaN                NaN           NaN
2000-04-01          NaN                NaN           NaN
2000-05-01          NaN                NaN           NaN
2000-06-01          NaN                NaN           NaN
2000-07-01     9.170833           4.787500      6.329167
2000-08-01     9.466667           4.820833      6.304167
...
```

Plotting a clustermap of the jobs correlation matrix

```
# Get correlation matrix of the seasonality_df DataFrame
In [1]: trend_corr = trend_df.corr(method='spearman')

# Customize the clustermap of the seasonality_corr correlation matrix
In [2]: fig = sns.clustermap(trend_corr, annot=True, linewidth=0.4)

In [3]: plt.setp(fig.ax_heatmap.yaxis.get_majorticklabels(), rotation=0)

In [4]: plt.setp(fig.ax_heatmap.xaxis.get_majorticklabels(), rotation=90)
```

The jobs correlation matrix



VISUALIZING TIME SERIES DATA IN PYTHON

Congratulations!

Thomas Vincent
Head of Data Science, Getty Images

Going further with time series

- Data from Zillow Research
- Kaggle competitions
- Reddit Data

Going further with time series

- The importance of time series in business:
  - to identify seasonal patterns and trends
  - to study past behaviours
  - to produce robust forecasts
  - to evaluate and compare company achievements

Getting to the next level

- Manipulating Time Series Data in Python
- Importing & Managing Financial Data in Python
- Statistical Thinking in Python (Part 1)
- Supervised Learning with scikit-learn

VISUALIZING TIME SERIES DATA IN PYTHON

Thank you!