# Effective Programming Practices for Economists

# Scientific Computing

## What is numpy?

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# What is numpy?

- Library providing:
  - Multidimensional arrays
  - Fast elementwise calculations
  - Fast linear algebra
- The mother of all tensor libraries

# What is an array?

```
>>> import numpy as np
>>> arr = np.array([[1, 2], [3, 4.0]])
>>> arr

array([[1., 2.],
       [3., 4.]])

>>> arr.dtype
dtype('float64')
```

- Mental models:
  - 1d array: A vector
  - 2d array: A matrix
  - 3d array: A "list" of matrices
  - ...
- All array entries have the same type

# Why are calculations on arrays fast?

1. Homogeneous datatype:
   - The datatype of all array elements is known
   - Numpy can get same performance as statically type languages
2. Contiguous memory layout:
   - All array elements are physically stored next to each other in memory
   - This can create enormous performance gains!

This holds for any language!