Effective Programming Practices for Economists

Scientific Computing

What is numpy?

Janoś Gabler and Hans-Martin von Gaudecker

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!