Public R&D Spillovers and Productivity Growth

1. Data

- **Patent data + Compustat**: 1950-2020
  - Most comprehensive panel of its kind
    - Freely available on my website

2. How is public R&D different?

1. More fundamental \( y_i = \alpha + \beta \cdot \text{[patent i is publicly funded]} + \chi \cdot \gamma + \varepsilon_i \)
2. More 'ahead of time' \( y_i = \text{years ahead of class creation} \)
3. More likely to generate spillovers \( y_i = \# \text{of classes citing} \) especially to small firms

3. From theory to data

- Productivity-enhancing function with spillovers
  \[
  \frac{\Delta Y_t}{Y_{t-1}} = \frac{\alpha Y_{t-1}}{\alpha Y_{t-1} + \sum_{j=1}^{n} \frac{P_{aj} + s_{aj}}{P_{aj} + s_{aj}} - \frac{P_{aj} + s_{aj}}{P_{aj} + s_{aj}} \epsilon_j}
  \]

- \( P_{aj} \) and \( P_{aj} \) = patents \( s_{aj} \) and \( s_{aj} \) = shares of exposure (Jaffe '86)

- Take logs, estimate flow equation as

4. Shift-Share IV for public R&D spillovers: funding shocks

- Due to wars, space race, geopolitics, pandemics, etc.

- **Positive impact** on firm-level productivity

5. Patent examiner IV for public and private spillovers

- Examiner leniency provides variation in the visibility of innovation

6. Aggregation: Heterogeneous agent model of growth

- Heterogeneous firms + 2 types of spillovers
  - Private and public

- Decline in public R&D explains a third of the deceleration in TFP

Conclusion

- **Large, positive impact of public R&D** on firm productivity through technology spillovers
- Public R&D spillovers at least **twice** as impactful as private R&D spillovers
- **Smaller firms** are more negatively impacted by the decline in public R&D
- Decline in public R&D in the US can account for a third of the deceleration in TFP

Arnaud Dyèvre – London School of Economics

✉️ a.dyevre@lse.ac.uk, 🐦 @ArnaudDyevre, 🌐 arnauddyevre.com