Summary
The idea

Productivity growth = Investment in R&D × Research productivity
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- Can be a "feature of the world"
- Result of (mis)allocation of innovative resources across and within firms
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Productivity growth \( = \) Investment in R&D \( \times \) Research productivity

- Can be a "feature of the world"

- Result of (mis)allocation of innovative resources across and within firms

This paper: firms with high research productivity \( \neq \) highest R&D incentives

- Quantify misallocation using French manufacturing data
The assumptions

Two sources of competitive advantage: innovation steps or process efficiency

- Innovation steps: quality improvement of innovator over incumbent
- Process efficiency: lower marginal costs of producing any product
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Two sources of competitive advantage: innovation steps or process efficiency

- Innovation steps: quality improvement of innovator over incumbent
- Process efficiency: lower marginal costs of producing any product

Both have the same effect on markups and private innovation incentives

- But source of long-term growth is quality improvements (externality)
- Social planner would reallocate innovative resources to high-step size firms
Discussion
Very insightful paper on a key question: misallocation of innovative resources

Three comments:

1. Conceptual point: is price variation evidence of misallocation?

2. Quantification: how should firm-level prices be measured?

3. Extension: model the alternative sources of R&D misallocation?
Price variation = step sizes?

Quality steps and process efficiency distinguished with *price data* (prodcom)

\[ p_{ij} = \left( \frac{\text{input costs}}{\text{process efficiency}_j} \right) \times \frac{\text{process efficiency}_{ij}}{\text{process efficiency}_{ij}} \times \text{quality step}_j \]

- **Price dispersion is driven by quality steps**
- **Markup dispersion is driven by quality steps} \times \text{process efficiency}**
- **Productivity dispersion is driven by process efficiency**
Price variation = step sizes?

Quality steps and process efficiency distinguished with price data (prodcom)

\[ p_{ij} = \left( \frac{\text{input costs}}{\text{process efficiency}_j} \right) \times \frac{\text{process efficiency}_j}{\tilde{z}_{ij}} \times \text{quality step}_j \]

- Price dispersion is driven by quality steps
- Markup dispersion is driven by quality steps \( \times \) process efficiency
- Productivity dispersion is driven by process efficiency

\[ \Rightarrow \text{Based on French manufacturing data:} \]

- Large dispersion in innovation step-sizes (prices)
- Planner would increase high-step R&D share by 38%
Price variation = step sizes?

In most growth models: process efficiency and quality steps are isomorphic

\[ \ln Y = \int_0^1 \ln \left( \sum_{j \in J} \tilde{y}_{ij} \right) \, di \quad \text{where} \quad \tilde{y}_{ij} = \varphi_j \times \gamma_j \times q_{ij} \times l_{ij} \]
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Recent models: introduce welfare-relevant difference productivity and quality

- Some technologies enable standing-on-shoulders (= growth) while others do not
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- Some technologies enable standing-on-shoulders (= growth) while others do not
- Does standing-on-shoulders/long-run growth come from quality or productivity?
  - e.g. Aghion et al. '19, De Ridder '19
  - e.g. Cavenaile et al. '22, Ignaszak and Sedlacek '21

Price variation could reflect “bad rents”: opposite policy implications
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- **Differs per paper.** In practice: mix of quality and productivity drives growth?

- Price variation could reflect “bad rents”: opposite policy implications
Price variation = step sizes?

Note: also if quality drives growth, price variation can reflect process efficiency

\[ Y \frac{e-1}{e} = \int_0^1 \left( \sum_{j \in J} \tilde{y}_{ij} \right) \frac{e-1}{e} \, di \quad \text{where} \quad e > 1, \quad \tilde{y}_{ij} = \varphi_j \times \gamma \times q_{ij} \times l_{ij} \]
Price variation = step sizes?

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\[ Y \frac{\epsilon - 1}{\epsilon} = \int_0^1 \left( \sum_{j \in J} \tilde{y}_{ij} \right) \frac{\epsilon - 1}{\epsilon} \, di \quad \text{where} \quad \epsilon > 1, \quad \tilde{y}_{ij} = \varphi_j \times \gamma \times q_{ij} \times l_{ij} \]
Price variation = step sizes?

Production function estimates from *The Hitchhiker’s Guide to Markup Estimation* (De Ridder, Grassi, Morzenti ’22)

Hence: hard to identify high step-size firms in practice (subsidize high price?)
Surprising finding: **process efficiency is very homogeneous across firms**

- Structural estimation: ratio high/low process efficiency of **1.02**
  - Benchmark for the US: **within-sector** 90/10 ratio of **1.92** (Syverson '04)
  - ⇒ most misallocation doesn’t come from **bad rents**
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Could be caused by price definition? Price index:

\[ p_j = \prod_{i \in I_j} \left( \frac{p_{y_{ij}}}{y_{ij}} / \frac{p_{y_j}}{y_j} \right)^{\omega_{ij}} \]

8 or 10 digit: (Eslava & Haltiwanger '20; De Ridder, Grassi & Morzenti '22; Lenzu, Rivers & Tielens '22).
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\[ p_j \quad + \quad \text{labor-price relationship regression} \quad \Rightarrow \quad 99\% \text{ meas. error} \]

⇒ could this cause understatement TFPQ variance + high step size variance?
Extension: additional sources of misallocation

Could process/internal innovation be source of process efficiency $\Delta$?
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- Markup-enhancing innovation (Peters ’20):

  $$ y_{ij} = l_{ij} \lambda_j^{s_{ij}} \quad \rightarrow \quad \mu_{ij} = \gamma_j \lambda_j^{s_{ij}} $$

  $\Rightarrow$ endogenous process efficiency: greater misallocation?
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**French innovation survey:**

- Revenue % comes from products where **process innovation** has happened?
  - Among innovating firms: average of 54%
  - Other questions: did you innovate on a good you already produced? etc.
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Most models of creative destruction: R&D costs increase \textit{convexly} in $x$

$$rd_j = \phi_z \cdot x_j^\theta \cdot n_j^\sigma \quad \text{where} \quad \theta > 1$$

- $\theta$ maps to \textit{cost elasticity} of R&D $\Rightarrow$ well-estimated from tax discontinuities
- Any heterogeneity in private R&D incentives cause efficiency loss
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Matters for policy: lower returns to reallocation of R&D to high-step firms
Great paper, first-order question, significant policy implications

- Open question: is variation in prices evidence of misallocation?
- Practical issue: identify high step-size firms. Subsidize high-price firms?
- May be able to improve measurement of prices (and hence TFPQ)

And there are other sources of R&D misallocation ⇒ great for future research