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Better and Stronger? Theory and Evidence on the Effect of R&D Tax Credits on the Trajectory of Firms

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MOTIVATION

- Investments in R&D have seen sustained growth around the world in the past decade (OECD, 2021).

- **Many governments aim to incentivize R&D** (Jones & Williams, 2000).

- Vast literature on the effect of R&D incentives on R&D investments (see Mitchell et al., 2020; Gaillard-Ladinska et al., 2015).

- Yet, do they impact?
  - **Performance trajectory of firms** (scale, productivity)
  - **Structure of the firms** (skill, technology)

- Important implications for firms and public policies:
  - What are the returns to innovation at the firm-level?
  - What are the benefits of such inventives on productivity and scale? For policy-makers, funds are scarce and should be allocated smartly.

THIS PAPER...

1. Develops a **theoretical framework** to understand the channels through which R&D tax credits impact firm outcomes, although heterogeneously based on firm size.

2. **Empirically** assesses the causal effects of R&D tax credits using a staggered adoption differences-in-differences matching estimator (Bastos et al., 2018), leveraging data on the SIFIDE R&D tax credits program.

3. Answers the following **key questions:**
   - Do R&D tax credits lead to increased investments in R&D in supported firms?
   - How does the program concretely impact scale and productivity of supported firms? Are the effects heterogeneous based on firm size?
   - Do supported firms exhibit structural changes in terms of skill composition and technological adoption?

CONCEPTUAL FRAMEWORK

1. The model draws from standard IO assumptions.

2. Investment in R&D is characterized as a trade-off between the **use of resources** (that could have otherwise been used in production) and the **probability of innovating**.

3. **Main results of the theoretical model:**

   - R&D tax credits incentivize investments in R&D by **reducing the marginal cost** to invest in innovation.

   - Use of R&D tax credits yields differentiated results on firm performance based on the type of innovation undertaken (**product vs. process innovation**)

   - **Large firms** are more likely to engage in process innovation while **small firms** are more likely to engage in production innovation.

DATA

1. **SIFIDE Dataset:**
   - Panel dataset that includes information on firms that received the R&D tax credits from 2006 to 2019.
   - We exclude firms that were denied any support by the program.

2. **Sistema de Contas Integradas das Empresas (SCIE):**
   - Firm-level panel dataset that includes information on firms' finances and accounting from 2004 to 2019.
   - We drop observations with negative sales/production.
   - We use investments in immaterial assets to proxy R&D activity (Bessone Basto et al., 2021)

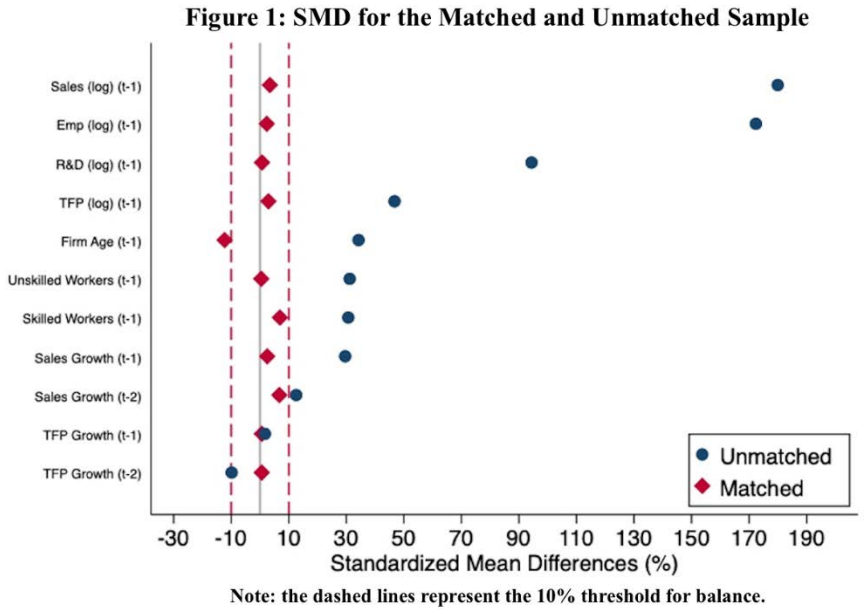
3. **Quadros de Pessoal (QP):**
   - Employer-employee matched dataset. Includes information on the workers of firms in a given year, such as experience, tenure, education, wages, etc. from 2004 to 2019.

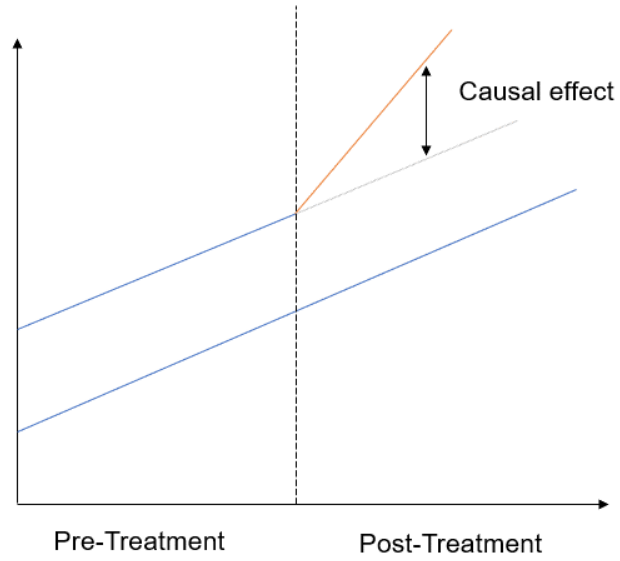
4. **Comércio Internactional (CI):**
   - Firm-level panel dataset that includes information on exporting firms' transactions, exporting varieties and destinations, amongst other, from 2004 to 2018.
   - Use exporting product variety as a proxy for impact of the program on firm product lines.

5. **Inquérito a Utilização de Tecnologias de Informação e Comunicação (IUTICE):**
   - Survey dataset that includes information on firm-level technological adoption, from 2004 to 2019.
   - Use information on various technologies to examine the effect of the program on technological adoption.

EMPIRICAL STRATEGY

- Impact assessing a policy requires a counterfactual i.e. what would happen in the absence of the R&D tax credits.
- This is challenging, especially in the absence of randomized controlled experiments, as firms who apply to the R&D tax credits program may already be very different than the firms who did not apply.
- Our approach: Matching Differences-in-Differences Estimator (Bessone Basto er al., 2021; Bastos et al., 2018)





MAIN RESULTS

1. **R&D Tax Credits Boost R&D Investments**
   - R&D tax credits stimulate R&D investments, especially at the extensive margin.
   - Creation of “new innovators”: firms that previously did not invest in R&D decided to do so because of the program.

2. **R&D Tax Credits Lead to Heterogeneous Performance Effects**
   - Increased number of product variety and scale (sales and employment) gains amongst treated firms.
   - Productivity and margins also improve amongst treated firms.
   - Results are **heterogeneous based on firm size**: smaller firms see larger scale gains, while larger firms do not see increases in employment and see larger productivity and margin improvements.
   - This suggests different patterns of use of the R&D tax credits based on firm size.

3. **R&D Tax Credits Lead to Structural Changes in Terms of Technological Margin**
   - We see evidence of a skill bias in terms of the increased share of skilled to unskilled workers.
   - Firms that participate to the program also tend to exhibit higher technological adoption.

KEY TAKE-AWAYS

- **Conclusion:**
  - Positive effects on R&D, especially at the extensive margin (”new innovators”).
  - Positive scale and productivity gains, although differently between large and small.
  - Changes in skill composition and technological adoption confirm structural changes.

- **Implications:**
  - Program seems to reach its objectives in terms of incentivizing R&D.
  - Program particularly important to create ”new innovators”.
  - Effects on performance, however, depend heavily on the characteristics of firms.

- **Extensions:**
  - Undertaking a cost-benefit analysis to understand the welfare effects of the program.
  - Assessing the industry effects of the policy.
  - Assessing the effects of the policy on incentivizing exporting.
  - Understanding the effects of the policy at the worker-level.

Obrigado