Investment Tax Credits and Innovation
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Research Question
- How does firm innovation respond to an investment tax credit reform?
- Which types of firms are more responsive?
  - Financially constrained firms
  - SOE vs. non-SOE firms
  - Foreign owned vs. solely domestically owned firms

Motivation
- Investment tax credit (ITC) is a widely-used tool for the government to encourage firm investment and stimulate the economy.
- How does ITC affect firm investment behavior?
  - Hall and Jorgenson, 1967; Abel, 1982; Sen and Turnovsky, 1990; Goosbloed, 1998
- Investment tax credit ⇒ cost of capital ⇒ investment behavior
- Technology is the engine of productivity growth of firms.
  - externally purchasing existing technology embodied in physical machines and equipment
  - internal innovation
- However, existing papers ignore the effect of investment tax credit on firms’ internal innovation and their technology adoption strategies.
- Two Competing Effects
  - Substitution effect
    - Investment in technology advancing machines and equipment and R&D activities can both improve firms’ technologies and productivities.
  - Scale effect
    - The decrease in the price of physical capital induces the firm to upsize, associated with an increase in the demand for all input factors.
- Physical capital can expand firms’ risk tolerant capacity, thus may have positive effects on firm innovation, which is normally considered as risky activities.

China’s Value-added Tax (VAT) Reform
- September 12, 2004
- Eligible firms are in six industries in three northeastern provinces of China.
- Production-type VAT ⇒ Consumption-type VAT
  - After the reform, the expenditure on fixed assets (excluding structures) can be deducted from the value-added tax base for affected firms.
  - The cost of fixed assets (especially machines and equipment) decreases and the cost of R&D activities is unchanged.

Theoretical Framework
- Suppose that a firm’s production combines ordinary inputs (N) and R&D investment (R).
- The ordinary production is a function of physical capital (K) and labor (L): \( N = (\alpha K^\nu + (1 - \alpha) L^\nu)^\frac{1}{\nu} \)
- How do R&D activities combine with ordinary inputs?
  - Case 1: \( AN = ADF(A | R) \cdot N = K^\rho + L^\rho + (1 - \alpha - \beta) R^\rho \)
  - Case 2: \( \alpha K^\nu + (1 - \alpha - \beta) R^\rho \)
- \( \max_{K, L, R} \left[ \beta (\alpha K^\nu + (1 - \alpha - \beta) R^\rho)^\frac{1}{\nu} + (1 - \beta) R^\rho \right] + c_K K + c_L L + c_R R \)
- \( \sigma = 1 \)
- Prediction: The ITC reform decreases investment in innovative activities when the elasticity of substitution (\( \sigma = 1 \)) between ordinary investment and innovative investment is greater than 1.

Empirical Results
- Number of patents, DDD: \( (Y_{NE-end} - Y_{NE-nonEnd}) - (Y_{nonNE-end} - Y_{nonNE-nonEnd}) \)

Robustness Checks
- Placebo tests
- PSM analysis
- Alternative sample
- Long-term effects of the 2004 VAT reform
- R&D Expenditure
- Fixed investment response to the 2004 VAT reform

Conclusion and Discussion
- We study the effects of the 2004 value-added tax reform in China, which reduces the relative cost of fixed investment of the eligible firms, using a simple theoretical model and the triple-difference empirical method.
- The reform leads eligible firms to decrease R&D investment, resulting in lower innovation, which is consistent with substitution effect.
- The impacts of the reform on innovation are stronger for
  - financially more constrained firms
  - non-SOE firms
  - domestic firms

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