Do State R&D Tax Credits Matter for Innovative and Economic Outputs?

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Overview

- An empirical study on the effect of state research and development (R&D) tax credits on some innovative and economic outputs in the states.
- Data from all 50 states and Washington, D.C. in period of 1979 to 2002.
- Potential contributions:
  - To S&T policy literature: one of the first assessments on state R&D tax policy
  - To state policy-making: Useful evidence for state R&D policy design

Why R&D is So Important?

- For individual companies, R&D can improve the bottom line through:
  - Cost reductions (process innovations)
  - Market expansion (product innovations)
  - Absorptive capacity for external knowledge
- For whole economy, private R&D is a major determinant of economic growth
- For states: more professional employment opportunities, higher innovative capacity, productivity improvement, or enhanced competitiveness

State Policies on R&D

- Role of government in R&D:
  - Public good → correcting market failures
  - Federal vs. State government

- State policies on R&D
  - R&D tax incentives

    R&D tax credit, exemption of sales and use taxes for R&D properties, etc.
  - State services on technology
  - Higher education

State R&D Tax Credits

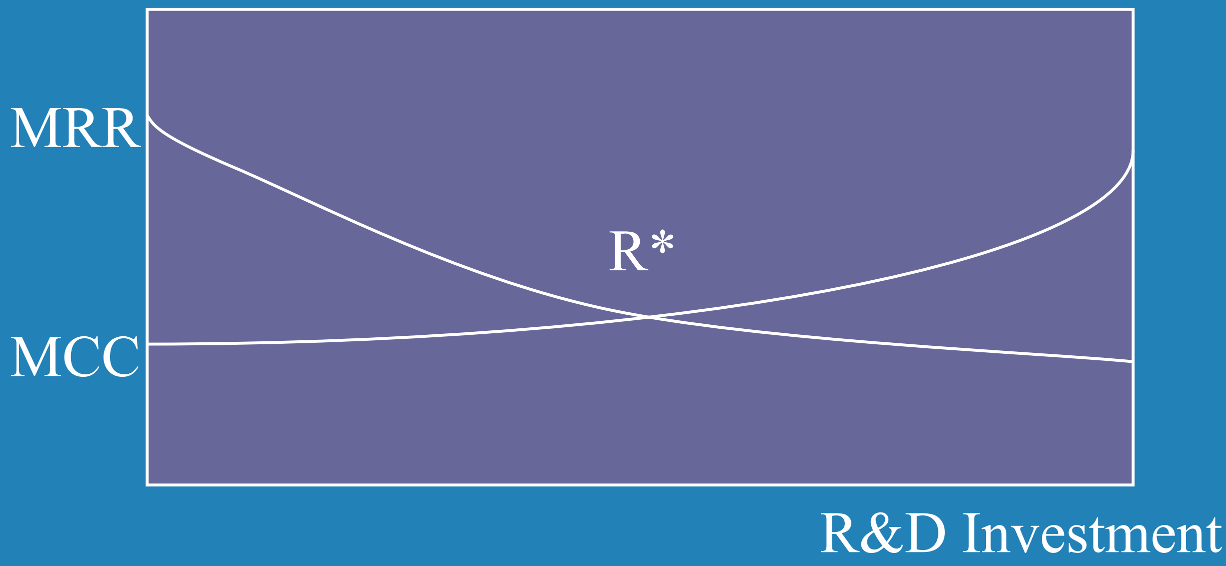
- First R&D tax credit: federal R&E credit authorized in the Economic Recovery Tax Act of 1981
- First state R&D tax credit: Minnesota R&D tax credit (1982)
- The amount of R&D credit equals to the excess of qualified R&D expenses multiplied by R&D credit rate

Year	No. of States providing R&D credit
1982	1
1987	6
1992	13
1997	22
2002	34
2004	37

Multi-objectives of State R&D Credits

- Job creation
- Number of jobs created for state residents
- Company growth
- Diversification of the state's economy
- Growth in R&D investment
- Introduction of new products
- Movement of firms or the consolidation of firms into the state

Conceptual Framework



- Tax incentives:
  - Reduce cost → Shift MCC down
- Government funding of industrial R&D:
  - Reduce cost → Shift MCC down
  - Increase profitability → Shift MRR up
- Higher education:
  - Reduce cost → Shift MCC down

The Model

$$Y_{i,t} = F(SRDC, PRDG, GRD, URD, HE, X)$$

- Y: Innovative or economic output
- SRDC: State R&D tax credit
- PRDG: Government funding of industry R&D
- GRD: R&D conducted in government
- URD: R&D conducted in higher education
- HE: Higher education outputs
- X: Other control variables

The analysis is at the state instead of firm level

Measurement and Data (1)

- Number of US private patents by origin and application year
  - Data is constructed based on the NBER patent data.
  - The state origin refers to the state where the inventor resides.
  - Application year is better than grant year because of the significant delay from application to the final approval.
- Number or dollars of federal SBIR Award
  - Data is obtained from US Small Business Administration (SBA).
  - Only Phase I SBIR data is used.
  - Only non-defense sources are considered.

Measurement and Data (2)

- R&D employment data
  - The ideal data is the number of employees working in industrial R&D activities by state.
  - Total employment by Industry (Bureau of Economic Analysis – BEA)
    - Data for industries but not for R&D personnel
  - Occupational Employment Statistics (Bureau of Labor Statistics)
    - Data for R&D occupations but not for industries
    - Only available from 1998

Measurement and Data (3)

- State R&D tax credits
  - Data is constructed based on information in state statues, tax forms and other government publications.
- Government funding of industry R&D
  - R&D obligations from non-defense federal sources to US industrial firms (NSF)
- R&D conducted in government
  - R&D from non-defense agencies to federal intramural (NSF)
- R&D conducted in higher education sector
  - Total academic R&D expenditures (NSF)
- State higher education
  - Number of post-doctorates, and doctoral, master, and bachelor graduates in science and engineering (NSF)

Statistical Evidence (1) - Patents

Variable	All US Patents	US Utility Patents	US Private Patents
Academic R&D expenditure (1-year lag)	1.510***	1.209***	0.279
Academic R&D expenditure (2-year lag)	0.071	0.293	1.049***
Non-defense federal sources to industries (1-year lag)	-0.113	-0.135	0.092
Non-defense federal sources to industries (2-year lag)	0.175	0.256	0.241**
Non-defense federal sources to federal intramural (1-year lag)	-0.169**	-0.151	-0.222***
Non-defense federal sources to federal intramural (2-year lag)	-0.372***	-0.374***	-0.221***
Dummy for state R&D tax credit	63.161***	51.584***	34.893***

Note: ** significant at 5% level; *** significant at 1% level

Statistical Evidence (2) - SBIR

Variable	Phase 1 award from non-defense	Phase 1 dollars from non-defense
Post doctorates in Science and Engineering	0.025***	0.0013***
Doctoral degrees in Science and Engineering	-0.016	-0.0017***
Academic R&D expenditure (1-year lag)	0.036***	0.0017
Academic R&D expenditure (2-year lag)	0.038***	0.0055***
Non-defense federal sources to industries (1-year lag)	0.0025	0.0005
Non-defense federal sources to industries (2-year lag)	-0.0023	-0.0006
Non-defense federal sources to federal intramural (1-year lag)	0.0012	0.0006**
Non-defense federal sources to federal intramural (2-year lag)	-0.0076**	0.0000
State R&D credit	1.16***	0.075***
State R&D credit (1-year lag)	1.26***	0.14***

Preliminary Findings

- The offer of state R&D credit has significant and positive effects on the SBIR and number of patents. It suggests that the state innovative and economic performance could be improved by providing tax incentives to encourage industrial R&D activities.
- Academic R&D plays a positive role in industry-generated patents and SBIR. This may be achieved through R&D spillovers from universities to industries.
- Federal intramural R&D resources may have negative impact on industrial innovative and economic output. This may be due to the competing nature of different R&D performers.