Finance and Corporate Innovation: A Survey

— FIN5016 Paper Presentation

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Introduction

Corporate innovation is an increasingly important topic that has attracted great attention from academic researchers in financial economics in recent years.

Related publications in the top three finance journals (*JF*, *JFE*, *RFS*):

- 2000 – 2008: 5
- 2009 – 2017: 56

Largely because of the availability of high-quality patent and citation data that capture a country's or a firm's innovation output.

Research Questions

1. How is corporate finance motivated and financed?
2. To what extent do financial markets and systems shape the initiation, process, features, and outcomes of technological innovation by corporations?

Important to

- investors
- business practitioners
- social scientists
- policy makers

Importance of Innovation

Technological innovation is vital for a country's economic growth and a firm's long-term competitive advantage.

- Innovation accounts for approximately 50% of a country's total GDP growth.
- Economists have estimated that 85% of a nation's economic growth is attributable to technological innovation (Rosenberg, 2006).
- A one-standard deviation increase in patent stock per capital is associated with a 0.85% increase in GDP growth (Chang et al., 2018).

Venture Capital and Entrepreneurship

Firms' Internal Characteristics

Firms' External Characteristics

Market Characteristics

Laws and Policies

- Laws:
  - IP (Intellectual Property) protection laws
  - Labor laws
  - Bankruptcy laws
- Policy uncertainty
- ...

Laws and Policies

IP Protection Laws

- Lerner (2009) examines how IP protection laws affect innovation by analyzing 177 major patent policy shifts in 60 nations over the past 150 years.
- Policy changes include:
  1. Whether the country offered comprehensive patent protection;
  2. the length of time that a patent is valid;
  3. the cost associated with obtaining and maintaining the patent;
  4. provisions for patent revocation.
- Innovation measures:
  1. Patent filings in Great Britain by residents of the country;
  2. patent applications by domestic entities in the country;
  3. applications by foreign entities in that country.

Laws and Policies

IP Protection Laws

- Puzzle: Negative impact of IP protection law changes on the number of patents generated.
- Explanations:
  1. The patent-based measure of innovation may not fully capture the true extent of innovation output.
  2. There might be confounding policy changes in some of the sample countries.
  3. The common wisdom among economists that patent protection can encourage innovative actions might be over-exaggerated.

Laws and Policies

IP Protection Laws

- Fang et al. (2017) examine how IP rights protection affects innovation in China around the privatization of state-owned enterprises (SOEs).
- IP protection quality measure: A survey-based index published by the Chinese Academy of Social Sciences (CASS). The annual survey is to ask the respondents (legal professionals, e.g., judges and IPR lawyers, and corporate executives) to rate from 5 (best) to 1 (worse) three areas:
  1. The length of time it takes for courts to resolve IP disputes;
  2. the cost of resolving the dispute as a percentage of the value of the IP under dispute;
  3. The fairness of court decisions.
- Innovation measure: weighted average patent number (new patents have large weights)

Laws and Policies

IP Protection Laws

- Finding: Innovation increases after SOE privatizations, and this increase is more pronounced in cities with strong IP rights protection.
- Implication: IP rights protection is beneficial to firms' innovative incentives but this positive effect mainly exists among non-SOE firms rather than SOEs.

Laws and Policies

Labor Laws

- Wrongful discharge laws: Protect employees against unfair firing/layoffs, limit firms' ability to hold up innovating employees after the innovation turns out to be successful.
- Intuition: By mitigating the possibility of hold-up risk faced by R&D employees, such laws increase their incentives to innovate and in turn boost the employers' innovation output.
- Acharya et al. (2014) formally test the above intuition and find that wrongful discharge laws indeed have a positive impact on innovation and new firm creation.

Laws and Policies

Bankruptcy Laws

- Bankruptcy laws: Protect the interests of creditors, on firms' incentives and efficacy in the innovation process.
- Intuition: When the bankruptcy code is friendly to creditors, innovative firms might be discouraged from pursuing innovation for fear of excessive liquidations. In contrast, a debtor-friendly bankruptcy code may lead to more innovation by promoting continuation upon failure.
- Acharya and Subramanian (2009) test and confirm the intuition above. They also find that the negative effect of a creditor-friendly bankruptcy code on innovation is more pronounced for firms in technologically innovative industries.

Laws and Policies

Universal Demand Laws

- Universal Demand Laws: Makes it harder for shareholders to file derivative lawsuits and thus reduces a company's shareholder litigation risk.
- Lin et al. (2021) studied the impact of adoption of UD laws in 23 US states between 1989 and 2005 on firms' innovation activities and outcomes.
- Finding: Firms experience an increase in their innovation activities and outcomes after the adoption of UD laws.

Laws and Policies

Policy Uncertainty

- Bhattacharya et al. (2017) explore whether the uncertainty of government policies also affects corporate innovation.
- Policy uncertainty measure: National elections.
- Innovation measure: Patenting-based variables.
- Finding: Patenting outcomes significantly decrease during times of policy uncertainty, especially for more innovation-intensive industries.
- Explanation: Patenting outcomes decrease because number of inventors decrease during national elections.

Financial Market Development

- Financial systems
- International trade rules
- Trade liberalization
- Financial accounting regulation

Financial Market Development

Financial Systems

- Tadesse (2006) compares the innovation outcomes of industries operating in countries with bank-centered financial systems with those in countries with market-based systems.
- Innovation measure: Increases in output yield due to shifts in the best-practice technology.
- Information intensiveness measure: Intangible assets fraction.
- Finding: While market-centered systems have a positive effect on innovations in almost all industrial sectors, bank-centered countries contribute more to innovation in information-intensive sectors.

Financial Market Development

International Trade Rules

- Bloom et al. (2016) study the impact of Chinese import competition on innovation and productivity in 12 European countries.
- Import measure: Weighted average of imports across all sectors in which a firm operates.
- Innovation measures:
  1. Patenting-based variables;
  2. total-factor productivity (TFP);
  3. information technology (IT) intensity, e.g., computers per worker.
- Finding: The trade pressure induced by more Chinese imports stimulates firms to upgrade their technology and reallocate employment towards more innovative firms. In contrast, import competition from developed economies seems to have no significant effect on innovation.

Financial Market Development

Trade Liberization

- Coelli et al. (2022) studied the impact of trade policy during the Great Liberalization of the 1990s on innovation using firm-level patent data from over 65 countries.
- Liberalization measure:
  - Tariff reductions $\Longrightarrow$ Endogeneity
  - Variation in applied most favored nation tariff cuts across a firm's export markets $\Longrightarrow$ Maybe exogenous to innovation
- Innovation measure: Patenting.
- Finding: Trade liberalization has a positive, causal effect on corporate innovation in terms of new knowledge generation.

Financial Market Development

Financial Accounting Regulation

- Li et al. (2016) explore how International Financial Reporting Standards (IFRS) affect corporate innovation.
- Innovation measures:
  1. Number of granted patents $\Longrightarrow$ Innovation quantity
  2. Number of citations received by patents $\Longrightarrow$ Innovation quality
- Finding: Mandatory IFRS adopters experience a substantial increase in innovation output during the post-IFRS adoption period.
- Explanations:
  1. Relaxed financial constraints
  2. Improved managerial learning from stock prices induced by IFRS

Demographic and Social Traits of a Country or a Region

- Religiosity
- Sexual orientation
- Gambling preferences
- Bribery

Demographic and Social Traits of a Country or a Region

Religiosity

- Bénabou et al. (2022) uncover a robust negative relationship between religiosity and patents per capita in international and U.S. data.
- Religiosity measures (survey-based, all from World Values Survey):
  1. Religious person fraction;
  2. Belief in god fraction;
  3. Church attendance fraction.
- Innovation measure: Patents per capita

Demographic and Social Traits of a Country or a Region

Sexual Orientation

- Gao and Zhang (2017) studied the impact of US state-level Employment Non-Discrimination Acts (ENDAs) on corporate innovation.
- Innovation measures:
  1. Number of granted patents $\Longrightarrow$ Innovation quantity
  2. Number of citations received by patents $\Longrightarrow$ Innovation quality
- Finding: ENDAs encourage corporate innovation.
- Explanation: ENDAs match innovative firms with pro-gay employees who are typically more creative than anti-gay employees.

Demographic and Social Traits of a Country or a Region

Gambling Preferences

- Chen et al. (2014) find that firms headquartered in countries in which gambling propensity is higher tend to undertake riskier projects, spend more on innovation, and generate greater innovative output.
- Gambling preferences measure: Catholics-to-Protestants ratio (Catholic population relative to the Protestant population)
  - Protestants are typically fervently opposed to all forms of gambling, while Catholics tend to be more tolerant of gambling practices.
- Innovation measure:
  1. Research input: R&D spending scaled by book assets
  2. Research output: Patents and citations
- Explanation: Investment in innovation makes a company's stock price more lottery-like, which is a feature desired by individuals who love gambling.

Demographic and Social Traits of a Country or a Region

Bribery

- Ayyagari et al. (2014) studied the relationship between innovation and bribery in firms.
- Bribery measure: firm responses to the question "What percent of annual sales value does a typical firm like yours spend on gifts or informal payments to public officials to 'get things done' with regard to customs, taxes, licenses, regulations, services, etc.?"
- Innovation measure: A dummy variable which takes the value of 1 if the firm developed a new product line, and 0 otherwise.
- Finding: Innovating firms pay more bribes than non-innovating firms, especially in those countries with more bureaucratic regulation and weaker governance.

Future Directions or Studies on Finance and Corporate Innovation

New Innovation Measure

- Future direction: New empirical proxies that better capture the extent of corporate innovation activities than self-reported R&D expenditures and patenting-based measures.
- Limitations of R&D expenditures:
  1. R&D expenditures **only capture one particular observable quantitative input** and cannot capture the different dimensions of a firm's innovation strategies.
  2. R&D is **sensitive to accounting norms** such as whether they should be capitalized or expensed.
  3. Information on self-reported R&D expenditures contained in financial statements (e.g. those from the Compustat database) is **unreliable**, which may introduce a significant measurement error problem.

Future Directions or Studies on Finance and Corporate Innovation

New Innovation Measure

- Limitations of patenting-based measures:
  1. Patent-based measures of innovation **may not fully capture the true extent of innovation output** after observing a few puzzling empirical findings with regard to patent-based measures.
  2. **Patenting is just one way to protect a firm's intellectual property**, which largely depends on its own discretion and strategic plans. For example, many corporate innovation outputs take the form of trade secrets because their developers do not want to file for patents.
  3. **Patent data itself have a few problematic features**, such as truncation issues, the difficulty of adjusting for technology classes, the vast disparity in innovative activities across regions, and misleading assignment practices, etc., which may lead to erroneous conclusions if these issues are not properly addressed.

Future Directions or Studies on Finance and Corporate Innovation

Recent Attempts

- Kogan et al. (2017) propose a new way of measuring the value of innovation outcomes, that is, the market-perceived value of patents at the time of granting.
- Cooper et al. (2018) propose a firm's R&D quotient, defined as the firmspecific output elasticity of R&D expenditures, as an alternative corporate innovation proxy.
- Bellstam et al. (2021) develop a new proxy for corporate innovation by conducting a textual analysis of financial analysts' reports.

Conclusion

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Thanks!