Financial Innovation in the UK

S.A. Heffernan, M. Fu, X. Fu

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- **Financial innovation:** the arrival of a new or better product and/or a process that lowers the cost of producing existing financial services
- **Motivation**:
(1) Very little empirical work on financial innovation
(2) UK/London – leading role in the wholesale financial markets

- **Objectives**: To answer three questions:
(1) What are the determinants of the likelihood of financial innovation?
(2) What factors contribute to successful innovation?
(3) Are some UK regions or financial sectors more innovative than others?

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(1) Determinants of the likelihood of financial innovation?

Logit model – equation (1)

$$FI_i = \alpha_1 + \sum_{i=1}^{n} \kappa_i WC_i + \nu_i$$

FI_i : a binary variable which equals 1 if a financial firm i reports that it has been innovative and 0 otherwise

WC_i : a vector of sector and firm-specific variables affecting a firm's probability of being innovative

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(2) Determinants of Successful Innovation by Financial Firms

Generalized Tobit model – two stages

Stage 1: the probability of successful innovation – equation (3)

$$SI +_j = \alpha_2 + \sum_{j=1}^{m} \gamma_j W_j + u_j$$

Stage 2: successful innovation – equation (4)

$$SI_j = \alpha_3 + \sum_{j=1}^{m} \beta_j X_j + \varepsilon_j$$

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(3) Are some UK regions/sectors more innovative than others?

Innovation index – equation (2), derived from equation (1): The higher a sector or region scores, the more innovative it is relative to others.

$$ISCORE_i = \frac{e^{\alpha_1 + \sum_{i=1}^{n} \kappa_i WC_i}}{1 + e^{\alpha_1 + \sum_{i=1}^{n} \kappa_i WC_i}}$$

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Choice of Independent Variables Based on Theoretical & Empirical Studies

- Firm size: (SIZE) Number of employees and log(SIZE)

- Firm age dummy (D_A) = 1 if firms were established after 01/01/2000: "learning by doing" effect (Arrow, 1962) OR are younger firms more likely to innovate? (Aron &Lazear, 1990)

- HC: Labour force skills/the quality of human capital: log of the proportion of employees educated to degree level or above.

- R&D intensity (IRD): the ratio of expenditure on both in house and extramural R&D to total turnover: does greater R&D expenditure positively impact on innovation?

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Choice of Independent Variables Based on Theoretical & Empirical Studies

- Public financial aid dummy (DPS) = 1 if firms received financial support to develop innovative techniques from government or the EU

- Cooperation dummy (D_{COOP}), = 1 if firms cooperated on innovation with other enterprises/institutes – e.g.: suppliers, clients, competitors, consultants, commercial labs, higher ed

- Sector (3) /Regional dummies (12)

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Choice of Independent Variables Based on Theoretical & Empirical Studies

- In addition, the estimation of eq (1) includes three constraint variables:

  - Risk dummy (D_{RISK}) = 1 if excessive perceived economic risk was medium to high

  - Cost dummy (D_C) = 1 if direct innovation costs and/or the cost of finance are medium to high.

  - Finance dummy (D_F) = 1 if the cost of raising finance was medium to high

- Estimation of eq (4) <u>excludes</u> the above but includes:

  - Appropriability Dummy (D_{APP}) = 1 if firms use any formal (e.g. copyright, patents, etc) or strategic (e.g. secrecy, complexity of design) methods to protect innovations

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Data:

- 2005: *Fourth Community Innovation Survey* (ONS, 2006): 28,000 UK firms asked for information on innovations from 2002-2004.

- 1185 **financial** firms surveyed: 57% response rate. Data were cleansed, leaving 539 firms (45.5%).

3 groups:

- SIC65: financial intermediaries: all firms except insurance & pensions (30%)

- SIC66: insurance and pensions (20%)

- SIC67: other activities – e.g. stock broking and fund management (50%)

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Data: of the 539 financial firms (45.5% of the sample):

- most based in London & the South (39%), followed by Northern England (17%), the Midlands (12%), and Scotland (10%) (**Chart 1**).

- 43% engage in financial innovation.

- More product (34%) than process (27%) innovators; 18% report both types

- 14% are new/start-up firms

- < 3% relied on public financial support

- Average R&D expenditure: just 1.2% of total turnover

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Data (continued): of the 539 financial firms:

- 55% engaged in formal/strategic methods to protect innovations

- 20% cooperated/collaborated with other firms/institutions

- 31% earned revenue from the sale of innovations

- Average sale of innovations as a percentage of total sales: 10.5%
  .
- New to the market: the true *"innovators"*

- New to the firm: *"imitators"*: sell an <u>existing</u> good/service for the first time

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Key findings – Q1: Determinants of the likelihood of financial innovation?
Results - Table 3:
Diagnostics:
- The pseudo R squared: 0.61 - 0.68.
- Correct classification: 70-77%

Financial firms more likely to innovate:
- The larger they are (s.t. diminishing returns)
- The higher the quality of their workforce
- The more they invest in R&D
- The more they cooperate with others, e.g. suppliers, consultants, competitors, higher ed
- The <u>higher</u> the perceived risk and direct cost of innovation

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Key findings-Q2:Determinants of Successful Financial Innovation? (Table 4)

Generalised Tobit**:** 2- stage approach justified- Rho is significant

Successful innovation (SI) and for imitators (SI_{NF}) is more likely:

- The more educated the work force
- The more they invest in R&D
- The more they cooperate with others

Successful innovation for innovators (SI_{NM}) is more likely:

• The larger and/or younger they are

• The more they cooperate

• The greater the R&D

Also:

• Age of Firm (D_A): different signs and largely insignificant, so little evidence to support "learning by doing" or Lerner (2006).

• May support Aron and Lazaer (1990): (a) younger firms more successful if innovators (b) imitators enter the market to stay competitive but could lose revenue because of near substitutes.

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ISCORE (a relative measure of the average degree of innovation by sector and region - see eq.2) & Mean Difference t-tests (**Table 5**) show:

- **Stock broking, fund management:** significantly more innovative than financial intermediaries or pensions & insurance.

- **London & South:** significantly more innovative than other regions, except Scotland. The large numbers of firms concentrated in this area may be indicative of and/or encourage the benefits of **clustering**:

  - attract a well educated workforce

  - encourage cooperation and R&D

  - facilitate knowledge spillovers.

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Key Conclusions:

(1) The likelihood of financial innovation rises with: the size of the firm, the quality of human capital, expenditure on R&D, firm cooperation/collaboration, the availability of finance.

(2) The success of financial innovation rises with: human capital, R&D expenditure but is not influenced by the firm's age and attempt to protect the innovation.

(3) Firms are significantly more innovative if they are:stock brokers or fund managers and/or they are located in London and the South.

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Issues/Limitations:

• The data are cross-section.

• More firm-specific detail needed – e.g. accounting info such as leverage to provide a more objective measure of financial constraints.

• No major financial reforms during the period.

• Survey Questions: (1) No regulation questions (2) New to the market (Innovator); New to the Firm (Imitator)

• Each EU country conducts a similar survey but not possible to obtain cross EU data.