Innovation-Performance-Empirics
Holy or Unholy trinity?

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A big picture view

Innovation

 Processes

 Products

 Performance

 Growth
Three questions to ask

1. How do we measure innovation?
2. How do we measure performance?
3. How do we link innovative ability to performance?
Some context

- We often estimate something that looks like this:

\[ \text{Performance} = f(\text{Innovativeness}|X) + \epsilon \]  (1)

- Measures of performance, innovativeness and \( X \) depends on:
  - Question(s) being investigated?
  - Unit of observation
    - Global, regional, national, territorial, or firm
  - Data availability

- Plagued with econometric pitfalls
  - Causation
  - Measurement error
  - Dynamic effects
Technological innovations comprise new products and processes and significant technological changes in products and processes. An innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). Innovations therefore involve a series of scientific, technological, organisational, financial and commercial activities. (OECD, 1992)
Measuring innovation is surprisingly hard

Degree of difficulty depends on context and questions being asked

- Fundamentally about measuring capacity
  - To create
  - To absorb (diffusion)
  - To act entrepreneurial

- Idiosyncratic = realization of a stochastic process

- Type of innovation (radical-incremental; component-system)

- What is measurable/observable
  - Inputs
  - "Innovation production function"
  - Output
  - What are the inputs and outputs?
What’s used to measure innovation?

- **R&D Activity** (Hamberg 1964; Mansfield 1980; Scherer 1982)
  - R&D expenditures
  - R&D personnel
- **Patents statistics** (Scherer 1965; Griliches 1990; Carew 2005)
  - Counts, citations, spillovers, networks
  - Patent counts (WWZD?)
  - IP protection modalities
- **Innovator or not?** (Baldwin and Sabourin 1999)
- **Counts of products or processes underdevelopment or on the market** (Traore and Rose 2003; Traore 2004; van Moorsel et al. 2006; Herath et al; 2008; Laughland et al. 2009)
Some issues with how we measure innovation

- Availability of data
- Appropriateness as a proxy
  - What is really being measured
  - Correlation with latent variable - innovative capacity
  - Measurement error and estimator
- Intermediate inputs versus new or improved product or process
- No real notion value (e.g. new anti-cancer drug versus new cost-of-production reducing process)

- What’s in $X$ is important
- How $X$ is incorporated and interacts with Innovation is also important
Measures of ”market performance”
(see Perloff, Karp & Golan)

- Rate of return
  - Accounting or economic profits (Fisher and McGowan AER 1983)?
- Margins
  - MC not observable
  - Old SCP school: AVC, P-P margins
- Tobin’s $q$
  - Market value to replacement value
  - Replacement value not easily observed, and imprecisely measured (e.g. dynamics, goodwill, etc)
How about using price (of either inputs or outputs)?

- Hedonic price methods?
  - Measurable attributes/characteristics
  - Monopoly power specifically, price distortions generally

BUT

- Need to define extent of the market and have a clear notion of differentiation
- Thin markets? Publicly available? Observable (e.g. transfer pricing)?
Measures of organizational performance
(see Carton & Hofer)

- Accounting
- Profit
- Growth
- Leverage, liquidity & cash flow
- Efficiency
- Operational
- Market based (e.g. Tobin’s q & Jensen’s α)
- Survival
- Economic value (e.g. EVA)
Measures of organizational performance, cont

Impact of innovative activities on performance can be difficult to assess - what is the counter-factual?

- Causal models from the broader social-science literature
  - Propensity score matching
- Quasi or natural experiment methods
  - D-i-D

Issues:

- Observability & measurability
- Data accessibility
- Spillovers, IP ”sharing”, appropriability, and attribution of innovation on performance
- Devil is in the institutional & governance details
THANK YOU!