The Black Box of Intangible Capital: Wanted! Data from Deep within Firms

Workshop on Confidential Data Collection for Innovation Analysis in Organizations
Redmond, Washington
September 9-10, 2009
Outline of presentation

- Illustration of the issue
- Measuring investments in innovation
- Microeconomic perspectives
Grab your iPod, flip it over, and read the script at the bottom. It says: "Designed by Apple in California. Assembled in China." Where the gizmo is made is immaterial to its popularity. It is great design, technical innovation, and savvy marketing that have helped Apple Computer sell more than 40 million iPods. Yet the folks at the BEA don’t count what Apple spends on R&D and brand development, which totaled at least $800 million in 2005. Rather, they count each iPod twice: when it arrives from China, and when it sells. That, in effect, reduces Apple -- one of the world’s greatest innovators -- to a reseller of imported goods.
Mandel’s Observations

- Macroeconomic estimates of business investment are understated b/c they miss many of the *inputs* to innovation
  - Corrado, Hulten, and Sichel (2005) suggested inputs to innovation such as Apple’s design and branding are business investment from an economic point of view.
  - “any use of resources today designed to increase the productive capacity of the firm in the future is investment.”

- “Transactions” of business functions associated with innovation (i.e., *outcomes* of innovation such as design) are not tracked appropriately in our statistical system
  - …. Apple, Cisco, and fabless semiconductor makers such as Nvidia are “resellers” of imported goods!
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What are inputs innovation?

- “Innovation encompasses but is more than research and development” (NAS 2005).
  - Schumpeterian view: Involves more than invention, object is to make profits (1912).
  - Common thread in all approaches is “the extraction of economic value from novel activities” (IVS project 2007)

- Innovations may be technological or non-technological.
When firms commit to innovation…

- The evidence of commitment is an **allocation of resources** to developing and implementing:

<table>
<thead>
<tr>
<th>1. New products</th>
<th>3. New marketing methods</th>
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<tr>
<td>2. New production or distribution processes</td>
<td>4. New methods for organizing and executing business practices</td>
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Source: Oslo Manual

- … which is akin to the “economic” view in CHS.

- CHS offered a **scheme to measure intangible investment** and capital.
Intangible vs. tangible investment rate rises over time in the United States

Intangible capital

- Computerized information
  - Software
  - Databases
- Innovative property
  - Tech R&D
  - Nontech. R&D
- Economic competencies
  - Marketing and branding
  - Strategic firm practices

Source: Unpublished update to CHS, Corrado (forthcoming), NAS workshop volume. Last point plotted is 2007.
...and their ratio is positively correlated with the *level* of labor productivity

The relationship

- holds for GDP/capita, even is a bit stronger
- holds with alternative PPP (2008 EKS $), but is a bit weaker

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Logic Map of the Business Innovation Process

The Black Box of Intangibles… some keys are:

- measures of innovation outcomes in (anything close to) a common metric both within and across firms.

- A generally accepted classification scheme for the different types of innovation, including characteristics or key features of each type
  - Product/process long a distinction of R&D by type: apply to nontechnological innovation and business functions too (Mandel)
  - Innovation typology literature is extensive and cuts across numerous disciplines
  - A recent typology of typologies (Chandy and Prabhu 2009) helps reduce the complexity and provides a rigorous approach.
Put another way

- **Productivity** of resources devoted to innovation (esp., productivity by *type* of innovation) remains a black box.

- **Prevalence** of innovation by type is a black box.

- Existing “policy” literature on the microeconomic environment of innovation is richly nuanced and textured, but in need of richer data!
  - Nelson – national innovation systems
  - Porter – industry clusters and national competitive advantage
Some logical steps

- Identify and classify instances of the innovation process within firms
- Collect data that capture the net outcome of individual instances within firms
- Explore correlates of net outcomes across firms using a rich set of controls.
Unit of Analysis

- Instances of innovation processes within organizations are “projects.”

- At a previous NSF workshop, there was broad agreement that the project level would appear to be the “unit of innovation” within organizations (or proto-orgs).
  - A project may include the entire process from invention and discovery to implementation and commercialization
  - Or, a project may include just design (or redesign) and marketing.
  - Similarly, a project may involve restructuring the firm to implement a new business model or customer services delivery system,
  - Or, it could involve the creation of new capability subsequent to an acquisition of a start-up.
Identification/Classification matters

- Experiment: Can we identify/classify “items” in the innovation process, their inputs, and their outcomes?
- …. and what is feasibility of quantification in $$?
# Illustrative examples....

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<td>%-pt increase in customer satisfaction or %-pt increase in market share</td>
<td>requires perceptual data (and/or models) to quantify in $$</td>
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<sup>1</sup> Requires additional components such as lifetime of appropriable revenues.
Thoughts for this conference

- May be easier to protect identity of very large firms, especially those with several SBUs
- Need mix of industrial and services firms to get the right statistics, which also helps protect identity
  - How would one discern an innovation in business practices at Microsoft vs. Walmart vs. IBM?
  - Rates of return protect identification by scale.
  - Industrial firms have a record of providing data on R&D projects to researchers for study (Mansfield got data on 70 projects from one firm in the 1960s, a recent team got actual and perceptual data on 129 projects from one division of one firm in the early 2000s).
- Linking standard, public correlates (eg., industry and location, financial valuation) without disclosing identity greatly raises the degree of difficulty.
Intangible Investment (CHS method) in the Market Sector (% GDP, 2004)

Values for the US are annual averages of 2000-2003 figures.
Contributions to NFB Labor Productivity Growth, percent change, annual rate

Without Intangibles          With Intangibles


Intangible capital
Labor composition
Tangible capital
MFP

Source: Unpublished update to CHS, Corrado (forthcoming) NAS workshop volume