Learning in Firms: Evidence and Implications

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Conference on FDI, SMEs, Firm Growth, and Trade in Kenya

March 29, 2017
Introduction

- To be sustainable over the long run, growth has to be based on increasing productivity.
- Learning by firms is a key source of productivity improvement.
- A primary task of industrial policy, done well, is to promote learning.
- The $64,000 question: How?
Introduction (cont.)

- Traditional view:
  - Some sectors inherently generate more learning than others.
  - The learning is partly external. Firms under-invest on their own.
  - The government should subsidize/promote activities generating learning externalities.

The Product Space (Hidalgo et al., 2007)

Goods=trees, entrepreneurs=monkeys. “What trees you have monkeys on today determines where your monkeys will be tomorrow.”
Both the traditional view and, arguably, the Hausmann et al view see learning as a function of output in particular sectors.

Policy implication: get a steel, or auto, or electronics, or [fill in the blank] sector.

Learning will happen pretty much automatically.

This talk: I will review some recent research on the learning process in firms and argue that the above view is too simple.

Learning is not automatic, and we need to think carefully about the circumstances under which it occurs and fails to occur.
Learning Gains (Potentially) Large

Figure 1 shows the monthly average of the daily production of billets in tons over the sample period.1

Figure 1 displays several remarkable facts. First, the daily production of billets doubled in a span of almost 12 years. This is especially striking given that there were no major changes in production conditions. Second, while the steelmaker improved the furnace (though did not change its size) and introduced an incentive scheme for its employees, we do not spot jumps in output commensurate with discrete production enhancements. Third, output growth is continuous, suggesting that a flow of small improvements to the production process took place. It appears as if small improvements, or “tweaks,” might be necessary to exploit the potential gains created by new equipment or practices, otherwise jumps would be observed.2

We propose a production function, at the heat level, which suggests a natural output decomposition. This decomposition shows that output increases, despite not

1 We show the monthly average of the daily production level (rather than the monthly production levels) to eliminate fluctuations in total production levels from one month to another due to month length.

2 Indeed, the steelmaker’s management, as well as other experts we talked to, stressed that production involves many trade-offs, which require a lengthy trial and error process and tweaking in order to discover the optimal way to produce. See Section VII for some specific examples. The notion that “tweaking” existing technologies can be an important source of economic growth and technological progress is advanced in Meisenzahl and Mokyr (2012) who stress the importance of “tweakers” to explain the technological leadership of Britain during the Industrial Revolution.

Hendel and Spiegel (2014): steel mini-mill doubled output over 11 years with same capital and a familiar technology.

Mostly not explained by observables.

Their story: tweaking/experimentation by workforce.
But They Are Not Always Realized

III. THE MANAGEMENT INTERVENTION

III.A. Why Use Management Consulting as an Intervention?
The field experiment aimed to improve management practices in the treatment plants (while keeping capital and labor inputs constant) and measure the impact of doing so on firm performance. To achieve this, we hired a management consultancy firm to work with the plants as the easiest way to change plant-level management rapidly. We selected the consulting firm using an open tender. The winner was a large international management consultancy that is headquartered in the United States and has about 40,000 employees in India. The full-time team of (up to) six consultants working on the project at any time all came from the Mumbai office. These consultants were educated at leading Indian business and engineering schools, and most of them had prior experience working with U.S. and European multinationals.

Selecting a high-quality international consulting firm substantially increased the cost of the project. 10 However, it meant...

Bloom, Eifert, Mahajan, McKenzie and Roberts (2013): Large, mature textile firms in India had not implemented basic management practices (e.g. labelling inventory).
Intensive Consulting Can Help

But question remains: why hadn’t firms adopted basic practices on their own?
Barrier to Learning: Organizational Frictions

▶ Atkin, Chaudhry, Chaudry, Khandelwal and Verhoogen (forth.)
Standard “buckyball” design: 20 hexagons, 12 pentagons.

For standard ball, almost all firms use 2-hexagon and 2-pentagon “flush” dies.
Barrier to Learning: Organizational Frictions (cont.)

Hexagons tessellate. $\sim 8\%$ of rexine wasted.
Barrier to Learning: Organizational Frictions (cont.)

Pentagons don’t. \(\sim 20-24\%\) of rexine wasted.
Barrier to Learning: Organizational Frictions (cont.)

In a YouTube video of a Chinese factory producing the Adidas Jabulani ball, I noticed a different layout of pentagons.

Fig. 7. Maximum density double-lattice packing with regular pentagons.
Barrier to Learning: Organizational Frictions (cont.)

Or the Wikipedia Pentagons page:
Barrier to Learning: Organizational Frictions (cont.)

Annalisa Guzzini (an architect, my wife) and I developed a blueprint based on optimal packing.

- 44mm-edge pentagons: \( \sim 250 \) with old die vs. 272 with ours.
- 43.5mm-edge pentagons: \( \sim 258 \) vs. 280.
Barrier to Learning: Organizational Frictions (cont.)
Quick summary:

- We gave out the new dies to a random subset of firms.
- A few adopted, most did not.
- Cutters didn’t like the die.
  - They are paid piece rates, with no incentive to reduce waste, and the new die was slowing them down.
  - They told owners it didn’t work.
- We did a second experiment.
  - Offered bonus of one month’s pay to show owners that dies work.
  - Workers accepted and about 50% of affected firms adopted.

Moral of the story: conflict of interest within the firm can prevent adoption of a “no-brainer” technology.
Competition Can Raise Productivity Within Firms

![Graph showing output per shift, blooms over time with productivity training identified.]

- Private firm threatened to enter in Nov. 1999 and April 2001.
Exports Stimulate Quality Upgrading and Learning

- Atkin, Khandelwal and Osman (forth.) randomized initial export contacts among Egyptian rug producers.
The initial contacts led firms to improve quality on various dimensions (consistent with previous quasi-experimental research).
The treated firms had better performance than control firms even for identical-specification rugs. Productivity improved.
Summary

- Learning is not automatic!
  - Just hosting a sector/activity should not be the goal of industrial policy.

- Factors that appear to support learning in firms:
  - Labor “contracts” that encourage information-sharing.
    - Not clear how policy can bring these about, unfortunately.
  - Competition.
    - Could be in domestic market, from imports, or on export market.
  - Exporting.
    - Exposure to demanding rich-country consumers seems to stimulate productivity improvements as well as quality upgrading.
References


