The Role of the Firm in Nurturing Human Capital: The Case of Minority Inventors in the Golden Age of Invention

Xiaoding Liu (corresponding author)
Texas A&M University
xliu@mays.tamu.edu

Tristan Fitzgerald
Texas A&M University
tfitzgerald@mays.tamu.edu

September 2024

ABSTRACT

In this paper, we investigate one of the most fundamental questions in economics, namely how does society discover and nurture talented individuals in STEM-related fields? We propose that this question cannot be answered without understanding the critical role of firms in the human capital accumulation process, given that the evolution of the technological innovation landscape has been defined by two key trends: (1) the marked shift in patenting activity from 'independent inventors' to firms, and (2) the rapid growth in the size and diversity of inventor teams. We hypothesize that the notable rise in the importance of firms in the modern innovation ecosystem can be explained by: (1) firms implementing more equitable and institutionalized processes for selecting skilled workers, and (2) the corporate structure acting as a more efficient mechanism to facilitate knowledge sharing and teamwork among a more diverse set of inventors.

To test this theory, we adopt a long-run perspective, examining the entire evolution of the U.S. innovation landscape from the first patent in 1790. This approach allows us to document the full transition of underrepresented population groups (namely female and ethnic minority researchers) as they gradually entered and established themselves in the skilled labor force, and to assess their long-term impact on innovation and economic development. Using over 200 years of historical U.S. patent, confidential full-count census, and corporate records in conjunction with state-of-the-art optical character recognition technology and machine learning algorithms, we are the first researchers to construct a comprehensive dataset that identifies and links all inventors and assignees of patents since 1790. This database allows us to observe the personal characteristics and professional experiences of all individual inventors who have patented in the U.S., as well as track their migration, collaboration, and productivity over a long horizon.

Using our novel research setting and unique dataset, we present several findings that are new to the economics literature. First, we show that (large) firms appear to be the primary providers of initial employment for underrepresented R&D-focused workers. Second, using multiple

exogenous shocks to the allocation of inventors to alternative R&D organizational structures (i.e., working within a firm vs. working as an independent inventor), we find that corporations appear to promote greater collaboration and knowledge sharing within the boundaries of the firm by incorporating underrepresented inventor cohorts into a broader array of technological problem-solving activities. We further demonstrate that this leads to significant differences in both the productivity and the types of innovation pursued by skilled individuals operating inside versus outside the boundaries of the firm.

An important implication of our results is that firms appear to be a critical mechanism for allowing skilled individuals from underrepresented minority groups to overcome potential barriers to realizing their potential. As a result, we offer a new explanation for the central role of the firm in the modern innovation ecosystem, namely the superior ability of corporations to access underutilized sources of skilled labor talent and to combine their (diverse) individual skills with the firm's existing resources.

Keywords: Innovation, Theory of the Firm, Diversity, Inventor Teams, Labor Productivity
JEL Classification: J24; L2; M14; M54; O31; O34