J. Finan. Intermediation 24 (2015) 1–24

Contents lists available at ScienceDirect

J. Finan. Intermediation

journal homepage: www.elsevier.com/locate/jfi

Financial innovation and endogenous growth

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ARTICLE INFO

Article history:
Received 6 July 2013
Available online 21 April 2014

Keywords:
Screening
Financial intermediation
Invention
Economic growth
Corporate finance
Technological change

ABSTRACT

Is financial innovation necessary for sustaining economic growth? To address this question, we build a Schumpeterian model in which entrepreneurs earn profits by inventing better goods and profit-maximizing financiers arise to screen entrepreneurs. The model has two novel features. First, financiers engage in the costly but potentially profitable process of innovation: they can invent better methods for screening entrepreneurs. Second, every screening process becomes less effective as technology advances. The model predicts that technological innovation and economic growth eventually stop unless financiers innovate. Empirical evidence is consistent with this dynamic, synergistic model of financial and technological innovation.

1. Introduction

Two observations motivate this paper. First, a considerable body of research documents that technology and finance have evolved together, often in a synergistic manner, over several centuries (Allen and Gale, 1994; Frame and White, 2004; Goetzmann, 2009; Tufano, 2003). For example, to finance the construction of vast railroads in the 19th and 20th centuries, financial entrepreneurs developed specialized investment banks and accounting systems to facilitate screening and

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http://dx.doi.org/10.1016/j.jfi.2014.04.001
1042-9573/

monitoring by distant investors (Chandler, 1965, 1977; Baskin and Miranti, 1997; Neal, 1990). More recently, financial entrepreneurs developed modern venture capital firms to screen information technology start-ups. And, still more recently, financiers designed new financial institutions for identifying biotechnology endeavors with the highest probability of commercial success (Gompers and Lerner, 2001; Schweitzer, 2006). Econometric evidence from the United States (Amore et al., 2013; Chava et al., 2013) and around the world (Beck et al., 2012) suggests a strong connection between finance and technological innovation.

Second, economists have not yet developed models of the coevolution of technology and finance in which both technological and financial improvements reflect the actions of profit-maximizing agents. Existing Schumpeterian models of technological innovation examine "technological entrepreneurs", who choose how much to invest in the risky, but potentially lucrative, process of improving technology (Aghion and Howitt, 2009). These models either ignore the financial system, or presume that economies are endowed with fixed, unchanging financial systems, or assume that finance changes in a mechanical manner with economic activity. Thus, these models do not include "financial entrepreneurs", who choose how much to invest in, for example, the risky, but potentially lucrative, process of improving their abilities to identify the most promising technological entrepreneurs. As such, existing models cannot provide insights into how the policies, laws, and regulations that shape the incentives of technological and financial entrepreneurs interact to determine the rate of economic growth.

In this paper, we add two novel features to the canonical model of Schumpeterian growth, so that we can explore the interaction of finance and technology. First, we model *both* technological and financial innovation as reflecting the explicit, profit-maximizing choices of individuals. In textbook Schumpeterian models, technology evolves based on the choices of entrepreneurs. Our model also includes financial entrepreneurs, who choose how much to invest in the risky activity of improving the screening of technological entrepreneurs. Investors will pay for improved screening information because it increases the probability of investing in profitable technologies. Just as successful technological innovation generates temporary rents for the technological entrepreneur in textbook Schumpeterian models, successful financial "innovation" generates temporary rents for financiers who are better at screening technological entrepreneurs than their competitors in our model. Thus, financial entrepreneurs choose how much to invest in improving the screening of technological entrepreneurs based on the expected profits from this activity.

A second novel feature is that every screening modality becomes less effective at identifying promising entrepreneurs as technology advances. Moving up the Schumpeterian technological quality ladder, any particular screening procedure becomes less effective at identifying the entrepreneur with the best chance of successfully making the next technological innovation. That is, informational asymmetries widen endogenously as technologies advance. For example, the processes for screening the potential builders of new, cross-Atlantic ships in the 16th century were less effective at screening innovations in railroad technologies in the 19th century. Technological innovation makes existing screening technologies obsolete.

The core implications of the theory are that (1) technological and financial innovation will be positively correlated and (2) economic growth will eventually stagnate unless financiers innovate. In terms of positive synergies between technological and financial innovation, first note that technological change increases the returns to financial innovation. As technology advances, any given screening technology becomes less and less effective at identifying capable technological innovators as informational asymmetries grow. Thus, the benefits – and hence profits – from improving the screening of entrepreneurs grow with technological advances. The synergies work in the other direction too. Better screening boosts the expected profits from technological innovation, because the expected returns from investing in technological innovation grow when financiers are better at identifying the most promising projects (innovators). In terms of stagnation, the model stresses that existing screening methods become increasingly inadequate at identifying promising technological innovations as the world's technological frontier advances. Consequently, unless financiers innovate and improve screening technologies in tandem, the probability of finding successful entrepreneurs declines, slowing growth. With appropriate policies, laws, and regulations, however, the drive for profits by financial and technological entrepreneurs alike can produce a continuing stream of financial and technological innovations that sustain growth.