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Endogenous growth and adverse selection in entrepreneurship

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ABSTRACT

This paper proposes a model of Schumpeterian endogenous growth incorporating the role of market imperfections that exist due to adverse selection between investors that finance R&D and entrepreneurs that perform R&D. There is a distribution of agents indexed by a skill factor that determines one's average productivity at performing research. An entrepreneur starts-up a research venture by borrowing from an investor that funds R&D so as to invent new goods. Skill is private information, creating an adverse selection problem for the investor who designs a truth-telling mechanism. We show that an increase in the mean skill enhances growth as it leads to greater R&D productivity and investment; while an increase in the dispersion of the skill distribution dampens growth as it makes the adverse selection problem between investors and entrepreneurs more severe. The growth rate would double in the absence of adverse selection. The R&D investment of the average size firm must be subsidized threefold for the negative adverse selection effect to be nullified. We provide U.S. industry-level and European sector-level evidence in favor of the positive scale effect and negative adverse selection effect using the firm size distribution (FSD) to proxy for the entrepreneurial skill distribution.

1. Introduction

The literature generally, but not always, points to a negative relation between adverse selection and growth. Adverse selection in credit markets raises the cost of doing business (via screening) and limits the number of individuals that become entrepreneurs (via credit rationing), both of which have been shown to inhibit neoclassical growth; nevertheless, adverse selection can induce agents to undertake high-risk projects that generate greater neoclassical growth.[1] This paper combines R&D-based endogenous growth theory with adverse selection between investors that finance R&D and entrepreneurs that perform R&D. In doing so, we establish an important link between endogenous growth and the firm size distribution (FSD) through adverse selection. The contribution of this paper is twofold. We show that an increase in the mean of the entrepreneurial skill distribution enhances growth as it leads to greater R&D productivity and investment; while an increase in the dispersion of the entrepreneurial skill distribution dampens growth as it makes the adverse selection problem between investors and entrepreneurs more severe. We provide U.S. industry-level and European sector-level evidence in favor of both predictions using the FSD to proxy for the entrepreneurial skill distribution.

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[1] See Bencivenga and Smith (1993), Aziaradis and Smith (1993, 1998, 1999), Boyd and Smith (1992), Bose and Cothren (1996, 1997), and Ho and Wang (2005) for the former; and see Shi (1996) for the latter. The effect of asymmetric information on growth has also been investigated in a human capital framework (Eicher, 1999; van Long and Shimomura, 1999), and with regards to moral hazard in financial markets (Tsiddon, 1992; Fu, 1996) and the contracting environment in production (Francois and Roberts, 2003).

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The model merges two existing theories widely studied in separate fields of economics: innovation-driven endogenous growth used in macroeconomics and mechanism design used in contract theory. A competitive firm combines intermediate goods and production workers to manufacture the final good. There is a distribution of entrepreneurs indexed by a skill factor that determines one's average productivity at performing research. An entrepreneur starts-up a research venture by borrowing from an investor that funds R&D so as to invent new intermediate goods. When a research firm invents a schematic for a new intermediate good, it receives an infinitely lived patent granting it monopoly rights over the new intermediate good, which is then sold to a monopolist that manufactures and sells it to the final goods firm. An entrepreneur that is more skilled invents a greater number of new intermediate goods. Skill is private information, creating an adverse selection problem for the investor who designs a truth-telling, incentive-compatible mechanism. The engine of growth is the expansion in the variety of new intermediate goods.

An increase in the mean skill of an entrepreneur enhances Schumpeterian endogenous growth, referred to as the *positive scale effect*. An increase in mean skill raises the number of new intermediate goods invented per dollar of R&D, which in turn augments the incentive of the investor to fund R&D, both of which raise the total number of innovations. This result is a manifestation of the scale effect common in first-generation endogenous growth theories and it still holds in the absence of the adverse selection problem, so it is not a discriminating feature of the model.

The distinctive feature of the model is that an increase in the dispersion of the entrepreneurial skill distribution dampens Schumpeterian endogenous growth, referred to as the *negative adverse selection effect*. In the absence of asymmetric information between the investor and entrepreneurs, dispersion has no effect on growth. An increase in dispersion is associated with lower growth due to the incentive compatibility of the optimal mechanism: dispersion affects growth via the inverse of the hazard rate of the skill distribution, which in turn quantifies the severity of the adverse selection problem. The inverse of the hazard rate measures the extent to which it is more costly for the investor to fund R&D in the presence of asymmetric information (relative to an economy without asymmetric information). The intuition is that if the R&D investment in an entrepreneur is increased, then so is his informational rent; and to maintain incentive compatibility, the investor must also increase the rents of all entrepreneurs with greater skill levels. The implication is that the greater is the dispersion of the skill distribution, the larger is the informational advantage of skilled entrepreneurs; thus, the more pronounced is the role of adverse selection in inhibiting growth.

We obtain a quantitative estimate of the extent of the growth distortion caused by asymmetric information between investors and entrepreneurs. The second-best is defined as the outcome that arises in the absence of the adverse selection problem. We find that adverse selection is responsible for decreasing the second-best growth rate by about 50%.

We derive the R&D subsidy that aligns the decentralized equilibrium with the second-best. We find that the R&D investment of the average size firm must be subsidized threefold for the negative adverse selection effect to be nullified. The less skilled is an entrepreneur, the more severe is the negative impact of adverse selection on his R&D investment and rate of innovation. Because skill determines firm size, small firms must be subsidized to a greater extent than large firms. This reflects the well-known problem that small firms suffer the effects of capital market imperfections to a greater extent than large firms.

We perform two empirical studies at different levels of aggregation to test the predictions that the growth rate is increasing in the mean and decreasing in the dispersion of the entrepreneurial skill distribution, which we proxy with the FSD, wherein firm size is measured by employment. The first study considers 314 U.S. 4-digit manufacturing industries. We obtain the growth rate of total factor productivity (TFP) from the NBER-CES database and the FSD from the Statistics of U.S. Business (SUSB). We estimate the impact of the mean and standard deviation of the 1992 FSD on the 1992–1993 TFP growth rate to examine contemporaneous effects and the average 1992–1996 TFP growth rate to examine long-run effects. The second study considers European 2-digit manufacturing sectors. The panel includes 22 sectors spanning 21 countries, for a total of 316 observations. We obtain the FSD and growth rate of labor productivity from Eurostat. We estimate the impact of the mean and standard deviation of the 2002 FSD on the 2002–2003 and average 2002–2005 growth rate of labor productivity. In both studies, we find evidence in favor of the positive scale effect and the negative adverse selection effect: average firm size has a significant positive effect on contemporaneous and long-run productivity growth, and the standard deviation of firm size has a significant negative effect on contemporaneous and long-run productivity growth. The positive scale effect is in agreement with the evidence in Pagano and Schivardi (2003) and Acs et al. (1999), who also find a positive relation between average firm size and growth.

Most of the literature examines the impact of adverse selection on growth using theories with the following two features.[2] First, growth involves capital accumulation in the neoclassical sense, whereas we examine the impact of adverse selection on innovation-driven growth. Second, there are two types of agents that seek to borrow funds to produce capital, whereby an agent's unobservable type determines the riskiness and productivity of his production technology. Financial intermediaries offer a menu of contracts to induce self-selection and/or pay an exogenous fee to screen the agents (to obtain a separating equilibrium). By contrast, the entrepreneurs in our framework require funds to invent new goods, and they are heterogeneous in terms of their productivity at R&D.

[2] See Bencivenga and Smith (1993), Bose and Cothren (1996, 1997), and Ho and Wang (2005). Growth models of credit rationing arising from adverse selection make similar assumptions (Aziaradis and Smith, 1993, 1998, 1999).