

Product Innovation Investment under Bankruptcy Threat

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Abstract

We analyze the effect of external financing and associated bankruptcy threat on the speed of product innovation in a market characterized by technological and demand uncertainty. In a dynamic market setting we characterize the optimal R&D investment strategy of a monopolistic incumbent firm that can invest to develop a new product with uncertain demand. The size of the R&D investment flow determines the distribution of the stochastic innovation time and at the same time influences the dynamic evolution of firm's liquidity. If liquidity is negative the firm faces bankruptcy risk. We show that the optimal investment is a U-shaped function of liquidity and characterize under which circumstances it is optimal for the firm to go into debt in order to speed up innovation. Furthermore, we show that, due to the existence of financial frictions, the relationship between the incumbent's profit on the existing market and the expected innovation time for the new product is non-monotone and follows a tilted-z shape. We empirically verify the theoretically derived prediction of a U-shaped relationship between liquidity and investment using a dataset consisting of a sample of more than 80,000 Italian manufacturing companies.

Keywords: Product Innovation, Bankruptcy Threat, Optimal Investment, Uncertainty, Dynamic Optimization