

Competition and irreversible investments

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Abstract

Incumbent monopolists frequently claim that the introduction of competition will reduce future profits and therefore delay future investments. In this paper we show, that not only is this not generally true, but in the oligopolistic industry model of Dixit and Pindyck [Investment under Uncertainty, 1994] this is never the case. We extend this result to situations in which investments have positive externalities and situations in which the monopolist has multiple investment opportunities. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

In *Investment under Uncertainty*, Dixit and Pindyck (1994) document the significance of irreversibility and uncertainty for the investment decisions of the firm. It is shown that irreversibility and uncertainty induce a firm to invest (optimally) only when the value of a completed investment exceeds the value of the option to invest. In an extension of the standard irreversible investment model, Dixit and Pindyck solve this type of investment problem when there are two firms engaged in a strategic investment game.

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The purpose of this paper is to find the effect of competition on the optimal investment strategy of the firm. We examine this issue by comparing the optimal investment strategy of a monopolist with the optimal investment strategy of two firms. In the process of this comparison, we extend the two-firm model of Dixit and Pindyck to allow for investments with both positive and negative externalities. The effect of competition turns out to be the same for either type of externality, but for very different reasons.

In the first case, the introduction of competition has two opposing effects. Firstly, competition lowers the expected profit flow from an investment and this tends to delay investment. Secondly, competition introduces a strategic benefit to investment, namely that it deters the investments of other firms. Our main result is that the strategic effect always dominates and competition thus precipitates investment. In the second case, where investments are mutually beneficial, the optimal investment policy is essentially a question of coordination. In equilibrium, both firms invest early in anticipation that the other firm will invest early as well.

The paper is organized as follows. Section 2 briefly recapitulates the model, as it is presented in Dixit and Pindyck. In Section 3, we state and prove the main proposition of this paper namely that competition precipitates investment when entry reduces an incumbent's profits. In Section 4, we consider the case of investments with positive externalities and show that while the type of equilibrium changes, the result continues to hold. In Section 5, we extend the analysis, by allowing the monopolist to invest twice rather than just once. Finally, Section 6 comments on the literature and Section 7 concludes.

2. The oligopolistic industry model of Dixit and Pindyck

The oligopolistic industry model is a simple extension of the standard irreversible investment model. To study the effect of competition we allow a second similar firm to invest as well. Either firm may choose to invest first, second, or not at all. When only one firm has invested, it earns the profit flow of a monopolist; when two firms have invested, they both earn the profit flow of a duopolist. Specifically, assume the profit flow to be given by

$$\Pi = YD(N) \quad N = 1, 2$$

where Y is an industry-wide shock process and $D(N)$ gives the profitability of the market as a function of N , the number of firms that have invested. We have in mind an industry in which each firm has one investment opportunity. For such an industry, the natural comparison is between one firm with one investment opportunity and two firms with one investment opportunity each. Later, in Section 5 we will consider the case in which there are always two investment opportunities

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