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Imperfect competition, integer constraints and industry dynamics

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Abstract

Amir and Lambson (Amir, R. and V. E. Lambson (2003), Entry, Exit, and Imperfect Competition in the Long Run, Journal of Economic Theory, 110, 191–203) developed a general infinite-horizon, stochastic model of endogenous entry and exit by integer numbers of firms facing sunk costs and uncertain market conditions. Here a more tractable special case is presented to show how the model can provide a unifying framework for issues that arise in dynamic oligopolies. Examples of these issues include: (1) the relationship between sunk costs and industry concentration, (2) entry when current profits are negative, and (3) the relationship between entry and the length of the product cycle.

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1. Introduction

The traditional industrial organization paradigm explores the interaction between industrial structure, conduct, and performance, with emphasis on the determinants and effects of market power.[1] The realization that entry and exit are empirically important motivated the development of dynamic theoretical models of industrial organization. Almost all of these models are either (1) finite-horizon (often two-period) models with an integer number of firms, or (2) infinite-horizon models with a continuum of firms. Both classes of models have been instructive, but neither is

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[1] See Scherer and Ross (1990).

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without shortcomings. Finite-horizon integer models suffer from the drawback that the final period behaves like a static (one-period) model, raising questions about their applicability to ongoing industries. Infinite-horizon continuum models, with their infinitesimal price-taking firms, are ill-suited for exploring traditional industrial organization questions regarding market power.

To address these shortcomings, Amir and Lambson (2003) developed a general stochastic infinite-horizon model where the number of active firms is required to be an integer. Exogenous shocks that are external to the firms – such as demand or factor price changes – generate endogenous entry and exit. The infinite-horizon avoids the final period problem and the integer number of firms makes the model suitable for addressing traditional industrial organization questions concerning imperfect competition. The integer constraint and the associated inability to satisfy equilibrium zero-profit conditions generate implications for the behavior of firms over time.

The most closely related precedent to Amir and Lambson (2003) is the stochastic dynamic game with entry, exit and endogenously driven dynamics proposed by Ericson and Pakes (1995). Their model has inspired several related studies, including Doraszelski and Satterthwaite (2003) and Doraszelski and Besanko (2004). The former introduces private information on entry costs and scrap values as a way of addressing some difficulties with the existence proof offered by Ericson and Pakes while the latter explores the role of capacity choices in industry dynamics.

The remainder of this paper illustrates how the framework of Amir and Lambson (2003) might be applied. Section 2 contains a tractable special case of the general model. Whereas the general model imposes very little structure on the stochastic process governing the exogenous shocks, here the shocks are i.i.d. and the set of possible shocks is finite. Subsequent sections apply this simplified model to some traditional IO questions. Of course, these issues have been the focus of much research using a variety of models. The examples below illustrate how our model can provide a unifying framework for the analysis of dynamic oligopolies with integer constraints.

Section 3 revisits the assertion underlying much of the traditional industrial organization literature that higher sunk costs result in higher concentration, that is, that higher sunk costs reduce the number of firms that are active in an industry. This plausible assertion induced a vigorous debate in the traditional literature concerning the empirical importance of entry barriers.[2] However, Bernheim (1984) called this assertion into question. Using a simple model of sequential entry, he showed that anticipation of higher costs of future entry tends to stimulate current entry. Others noted that higher entry barriers tend to reduce exit as well as entry; examples include Londregan (1990) and Agarwal and Gort (1996). Lambson (1992) established in an infinite-horizon continuum model that higher sunk costs reduce both entry in good times and exit in bad times and that either effects may dominate on average.[3] Section 3 shows that these results carry over to the infinite-horizon integer model of Section 2: since higher entry barriers reduce both entry and exit, the effects on the average number of firms over time – and hence on the average concentration over time – is ambiguous.

Section 4 uses the model to frame a discussion of rent dissipation as an explanation for why firms tend to lose money before eventually becoming profitable. There is a large literature on preemptive entry driven by rent dissipation. Examples include, among many others, Eaton and Lipsey (1979), Fudenberg and Tirole (1985, 1987), Maleug and Schwartz (1991) and Anderson and Engers (2001). Due to the lumpiness of the technology implicit in the integer constraint, the zero-profit entry condition is almost never exactly satisfied. Thus the expected present value of an

[2] Much of this debate centered around a perceived positive correlation between concentration and profit rates across industries. See, for example, Weiss (1974), Demsetz (1974), Dewey (1976), La Manna (1986) and Lambson (1987).

[3] Bentolila and Bertola (1990) made a similar argument in the context of labor markets with training and search costs.