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Interdependent Search and Industry Dynamics: on Ericson and Pakes (1995)

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Abstract

This note argues about a central analytical inconsistency of Ericson and Pakes (1995). Notwithstanding the explicit claims of the article, the formal hypotheses employed there imply that a firm's investments do not affect both the evolution of this firm and the dynamics of the whole industry.
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This note is to show that one of the central purported aims of Ericson and Pakes (1995) – namely the analytical characterization of the dynamics of a generic industry composed of a number of interacting and heterogeneous firms – is contradicted by some of the subsequent hypotheses put forward in the article.

The authors consider an industry evolving in discrete time. "The opportunity (technology) provided by this industry is open to all, so that the only distinction among firms is their achieved state of "success" (index of efficiency), $\omega \in \mathbb{Z}$, in exploiting it." (p. 55.) Here $\mathbb{Z}$ is the set of all integers. Firms with larger ω are "doing better". The industry structure is a vector s whose ω-th coordinate is the number of firms at state ω. Thus the time-path s_t gives the evolution of the industry, namely, how many firms of each efficiency index enter, continue to stay and leave. As from p. 57, "$p(\omega'|\omega, x)$ is a firm's transition function: it gives the probability of shifting into state ω' conditional on being in the state ω and investing the amount $x \in R_+$." And indeed the paper suggests that each firm chooses its optimal search investment program which in principle should depend also on other firms' programs. However, hypothesis A.6 (p. 58) requires that there is "a regular Markov transition kernel, $Q : \mathbb{Z}_+^\infty \times \mathbb{Z}_+^\infty \to [0, 1]$, i.e.:

$$\forall B \subset S, \forall s \in S, \sum_{s' \in B} Q(s'|s) = \text{Prob}\{s_{t+1} \in B | s_t = s\} \ldots ."$$

Since this transition probability is *the same* for any and every decision to invest, enter or exit, the evolution of the whole industry, in fact, *does not* depend on those decisions. (Here $\mathbb{Z}_+^\infty$ seems to be a set of vectors with nonnegative integer coordinates numbered by all integer numbers.)

Consider a particular case. Let there be a single firm in the industry. Then the individual transition function must be the same as the transition kernel for the whole industry. Hence, one obtains

$$p(\omega' \mid \omega, x) = Q(e_{\omega'} \mid e_\omega)$$

regardless of what x is. Here "e_ω is a vector with one in the ω-th place and zero elsewhere" (p. 57). This de-linking between individual competitive outcomes and investment decisions in fact is supposed to hold also with multiple firms.

Consequently, *if $Q(\cdot \mid \cdot)$ is hypothesized to be independent of firms' investments, then every firm's transition function $p(\cdot \mid \cdot, x)$ does not depend on a firm's investments x.* Hence, the model utterly trivializes the problem – a firm's investment does not affect its index of efficiency – violating the original claim of the paper of understanding the dynamics of interdependent firms, whose relative efficiency depends in a probabilistic way on investment decisions.

References

Ericson, R.E. and Pakes, A. (1995), "Markov-Perfect Industry Dynamics: A Framework for Empirical Work", *Review of Economic Studies,* **62**, 53–82.