

Study questions: Pakes (1986) and Rust (1987)

References

Pakes (1986), Rust (1987)

Technical references: Bertsekas (1987) for dynamic optimization (including optimal stopping problems), Judd (1998) for numerical dynamic programming, Stern (1997) for simulation estimation methods

Other applications of dynamic discrete choice models in economics include Wolpin (1987) and are surveyed in Eckstein and Wolpin (1987) and Rust (1994).

Plan: I plan to cover these papers largely via class discussions. Given the technical difficulties of these papers, however, I will lecture on certain points. Pakes (1986) will be discussed in some detail, followed by a discussion comparing and contrasting the Rust (1987) paper.

A. Pakes (1986)

1. The goal of Pakes' analysis is to estimate the returns from holding patents. How can these measures be important for policy-making regarding patents?
2. Pakes treats the renewal costs as exogenous in this analysis. Can the results be used to set "optimal" renewal costs? How would "optimal" be defined? What about an "optimal" limit to patent lives (L in Pakes' model)?
3. What is the objective function that firms are assumed to be maximizing? What are a firm's decision variables? Why is this model a *discrete*, rather than continuous model? How are the solution methods different for discrete and continuous model?
4. What are the data employed in this analysis? What are the stochastic elements in the model? What is uncertain from a patent-owning firm's point of view? What is uncertain from the econometrician's point of view?
5. Pakes assumes that the returns are a Markov process (assumption A1). How would the model be different if it was assumed that each project's return r was constant over time (i.e., $r_a = r_1, \forall a = 1, \dots, L$)? Derive the likelihood function of the resulting model (hint: it is identical to the likelihood function of another paper we have covered this semester).
6. Pakes does not consider the decision of a firm to acquire a patent in the first place. Levin, Klevorick, Nelson, and Winter (1988) point out that one primary reason that firms may not want to acquire a patent is to protect the secrecy of their invention. How would interpretation of the results be affected by this consideration?

B. Rust (1987)

Compare and contrast:

1. Objective function
2. Assumptions on stochastic process (the ϵ 's in Rust, the r 's in Pakes)

3. What is observed by the maximizing agent? What is observed by the econometrician?
4. Recall that dynamic optimization problems have *state* variables. What are the state variables in the two models?

Explain:

1. *nested fixed point algorithm* (p. 1001, top). Does the Pakes paper require or use a similar algorithm?
2. (i_t, x_t) is a *regenerative stochastic process* (bottom, p. 1000).
3. f is an *optimal stationary, Markovian replacement policy* (p. 1007). What does each descriptor mean? Is the decision rule in the Pakes model stationary?
4. (i_t, x_t) is a *controlled stochastic process* (bottom, p.1000). What will the upper and lower bounds on the x_t process be?

References

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