A Monopolistic Competition Economic Model of the Horticultural Industry with a Risk of Harmful Plant Invasion

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Analysis applying monopolistic competition model

- Consumers’ utility increasing in nursery good variety
- Monopolistic competition in nursery good production (#nurseries n = # varieties)
- Prob. of biological invasion increasing in n
- Contrast #nurseries:
  1. Market eq’m n_p;
  2. Optimum w/o invasion damages n_s;
  3. Optimum given damages n^*.
- Simulation using US and Canadian data
Why market eq’m diverges from the social optimum

In the long run,
• Deadweight loss due to monopolistic competition \((n^p < n^s?)\)
• Negative externality due to possible biological invasion \((n^* < n^s)\)

Q. Does \(n^p\) exceed \(n^*\) in the steady state?

Along transition,
• \(n^p\) and \(n^s\) change due to entries/exits (data suggests entries due to positive profits)
• \(n^*\) changes because of changes in \(A\) (area invaded) upon invasion

Q. Can # nurseries be compared along transitions?
Technical questions

• For simulation, the aggregate industry profit function is specified as eqn (41):

\[ \Pi(n) = B \left( n^p - n \right) n, \quad B = r \frac{1-\gamma}{\gamma} \]

• The scaling parameter \( r \)—how is it pinned down?
• Can \( \Pi \) be derived from assumptions on technology?
On function $\Pi$

- Can get it from assumptions on primitives? (either by max $U$ or by a partial eq’m analysis)
Parameter values for US and Canada simulations

- Estimated gamma are quite different in US and Canada—intuitions?
- How would landscape / concentration of nurseries factor in?
- Dynamics of invaded areas upon invasion

\[ \dot{A} = rA \left(1 - \frac{A}{K}\right) \]

- Are \( r \) and \( K \) the same for US and Canada?
Sensitivity analysis

• Key parameters: gamma, fixed cost of nursery operations, …
  – Any fixed-cost component other than full-time labor?

• How do the optimal #nurseries depend on them? Is the sign unambiguous? If so, stating them might be useful
Placing bounds on optimal nurseries

• Would be useful to know what the reasonable upper or lower bounds are

• Factors implying under-estimate?
  – Control of invasives / containment after establishment? (reducing dA/dt)

• Factors implying over-estimate?
Among others, the strengths are:

• Theoretical model: an innovative and sensible way to describe how nurseries production causes biological invasion, and how to compare eq’m and the first best

• Simulations: combined use of nurseries market data and hazard model estimates based on species observations