

# **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

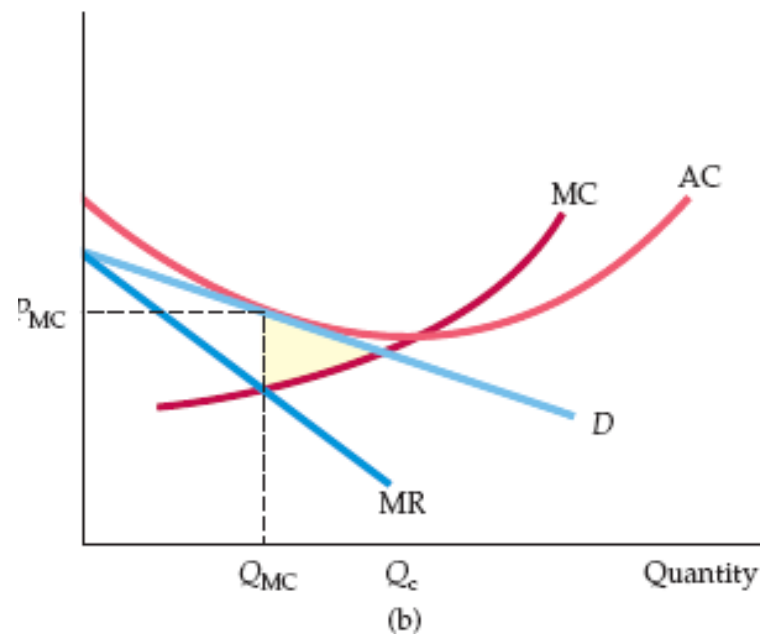
- For simulation, the aggregate industry profit function is specified as eqn (41):

$$\Pi(n) = B(n^p - n)n, \quad B = r \frac{1-\gamma}{\gamma}$$

- 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