The Economics of Eco-labeling: Theory and Policy Implications

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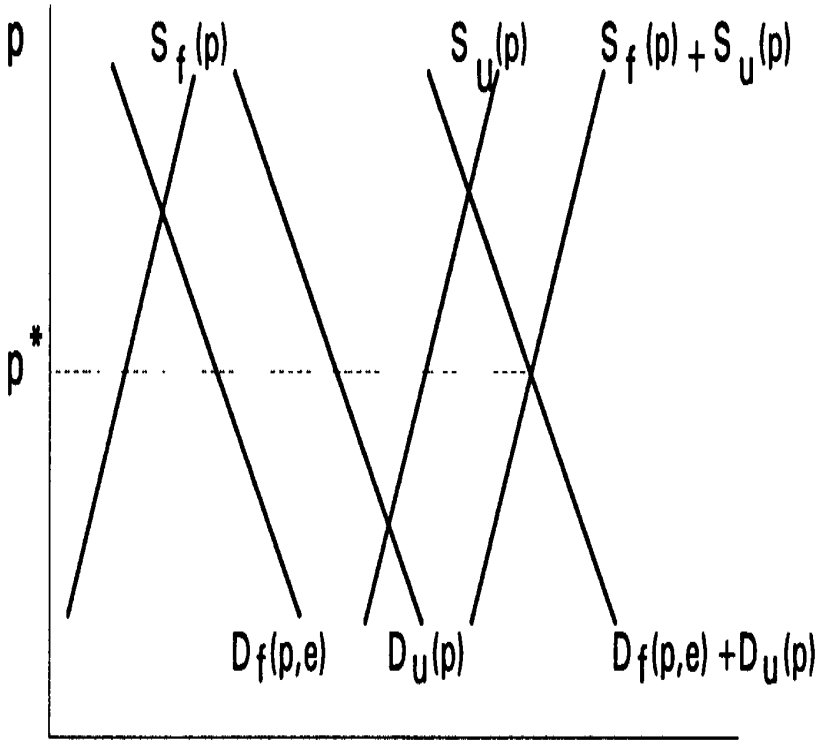
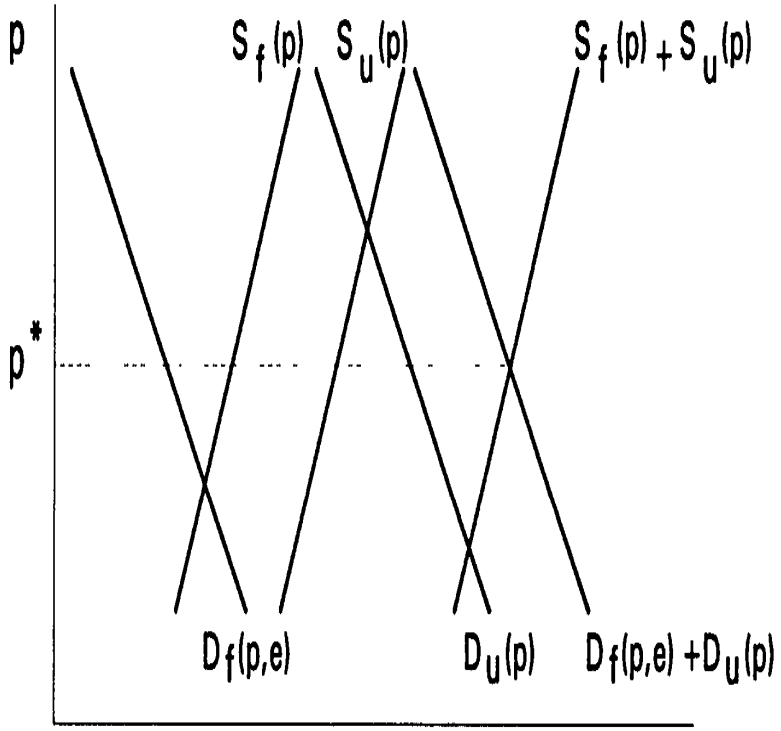
Stylized Facts

- Consumers consistently express willingness to pay a premium for ‘environmentally friendly goods’
- Firms may wish to capitalize on consumers’ WTP but suffer an asymmetric information problem
  - Environmental friendliness attribute is not identifiable by consumers (credence good)
- Role for third party to provide information (eco-labeling)
  - Many examples (Europe, US, Canada, Asia)
  - focus on ‘cradle-to-grave’?
  - Latent concern for ‘mistakes’

Early literature





Some oversights

- rational response by buyers
  - Why don't brown buyers purchase certified goods if they are cheaper?
- rational response by sellers
  - Why don't some green sellers migrate to uncertified market?
  - Sedjo & Swallow Land Econ paper fixes this
- but ...

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- if test perfectly identifies quality at zero cost, how is information imperfect?
  - false positives, false negatives
  - arbitrary weighting in multi-facet evaluation?
- realistically, need costly test that delivers noisy signal

Assumptions

- Two types of technologies, G and B
- Consumer valuations are $P_G > P_B$
- Assume production costs are increasing and convex in q
  - so MC and TC are both increasing in q
  - assume green costs larger than brown costs
  - $c_B(q) = q^\delta,\ \delta > 1; c_G(q) = \alpha c_B(q), \alpha > 1$
  - firm's elasticity of supply, η, related to δ
    - $\eta = \frac{1}{\delta - 1}$
    - $\delta < 2 \Rightarrow \eta > 1$
    - $\delta > 2 \Rightarrow \eta < 1$
- probability type k passes certification test is ϕ_k
- test costs A for all firms
- fraction of type k sellers seeking certification is λ_k

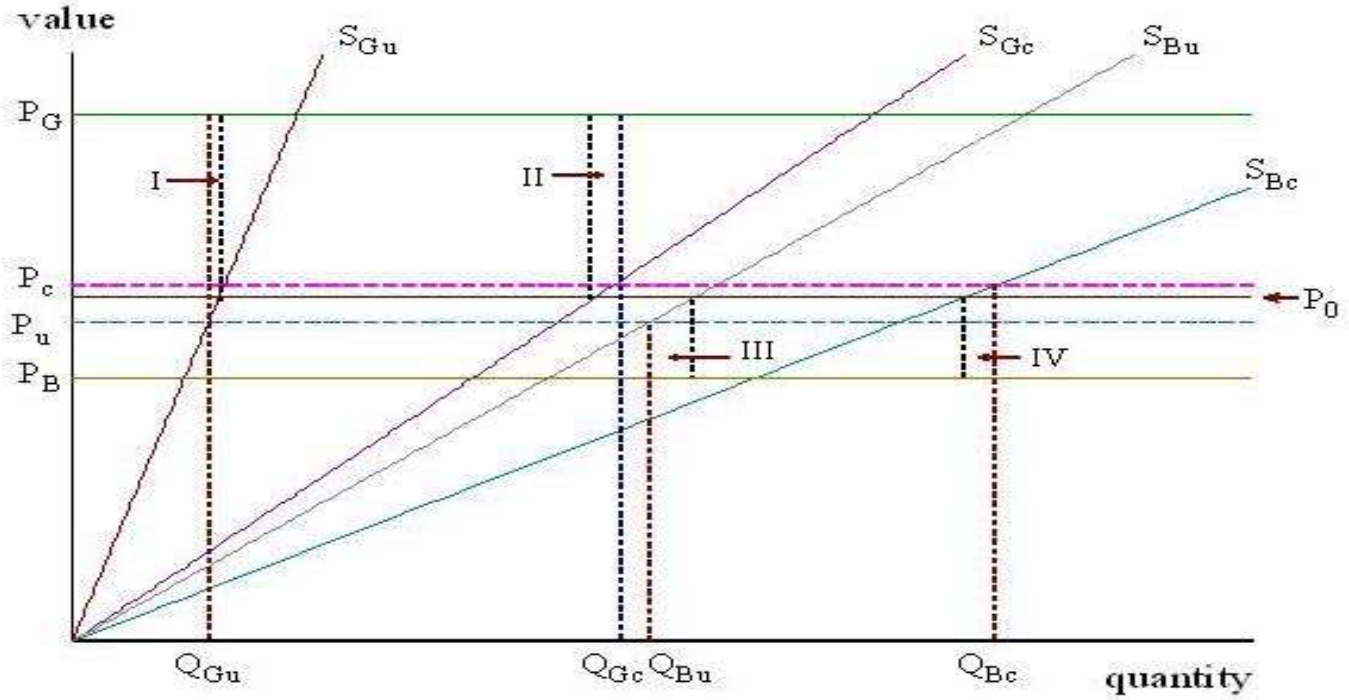
Rational expectations prices

- no-information: $P_0 = \theta_0 P_G + (1 - \theta_0) P_B$
  - $\theta_0 = pr(G)$
- pass test: $P_c = \mu P_G + (1 - \mu) P_B$
  - $\mu = pr(G \mid \text{c})$
- fail test or unlabeled: $P_{un} = \nu P_G + (1 - \nu) P_B$
  - $\nu = pr(G \mid \text{not c})$

Equilibrium classes

- Depending on parameters there are three possible classes of equilibrium
  - high A: separating equilibrium ($\lambda_B = 0, \lambda_G = 1$)
  - low A: pooling equilibrium ($\lambda_B = \lambda_G = 1$)
  - medium A: *partial pooling* equilibrium ($0 < \lambda_B < \lambda_G = 1$)

Introduction of label can raise or lower welfare

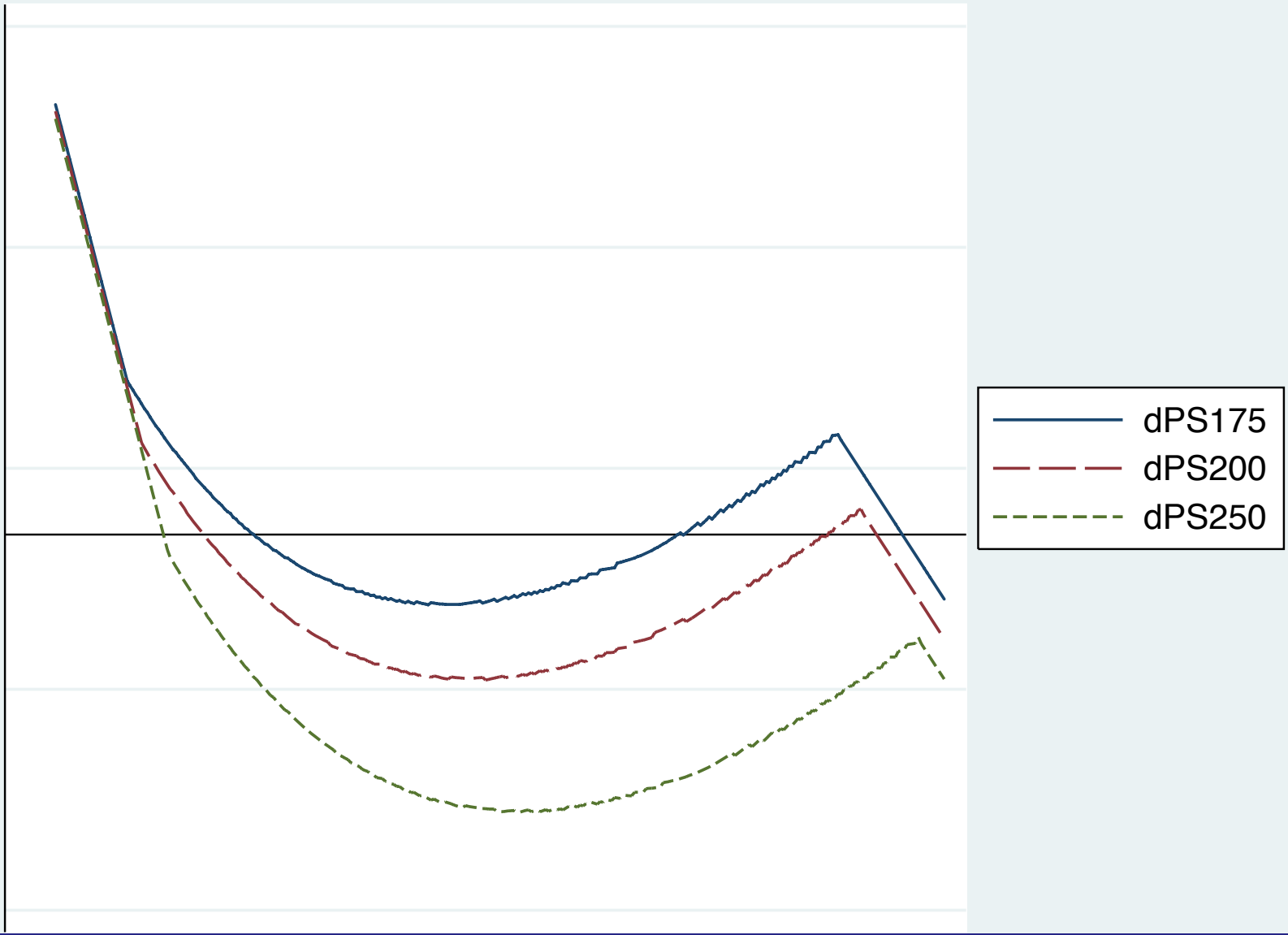


- areas I, IV represent welfare reductions
- areas II, III represent welfare gains
- net effect?

Comparative statics

- changes in A
  - in separating equilibrium, testing itself adds little
  - result is independent of test cost
  - higher costs lower welfare
  - similar features in pooling equilibrium
  - in partial pooling equilibrium, composition changes with A
    - higher cost yields direct reduction in green profits
    - but lowers brown profits faster
    - so exodus of brown sellers, certified price increases
    - net effect is increase in green profits
- changes in test accuracy have mixed results
  - increase in ϕ_G *lowers* certified price
  - decrease in ϕ_B increases certified price
    - intuition: brown sellers are indifferent before and after
    - if uncertified price falls then so must certified price
- potential for more accurate and costly test to raise welfare

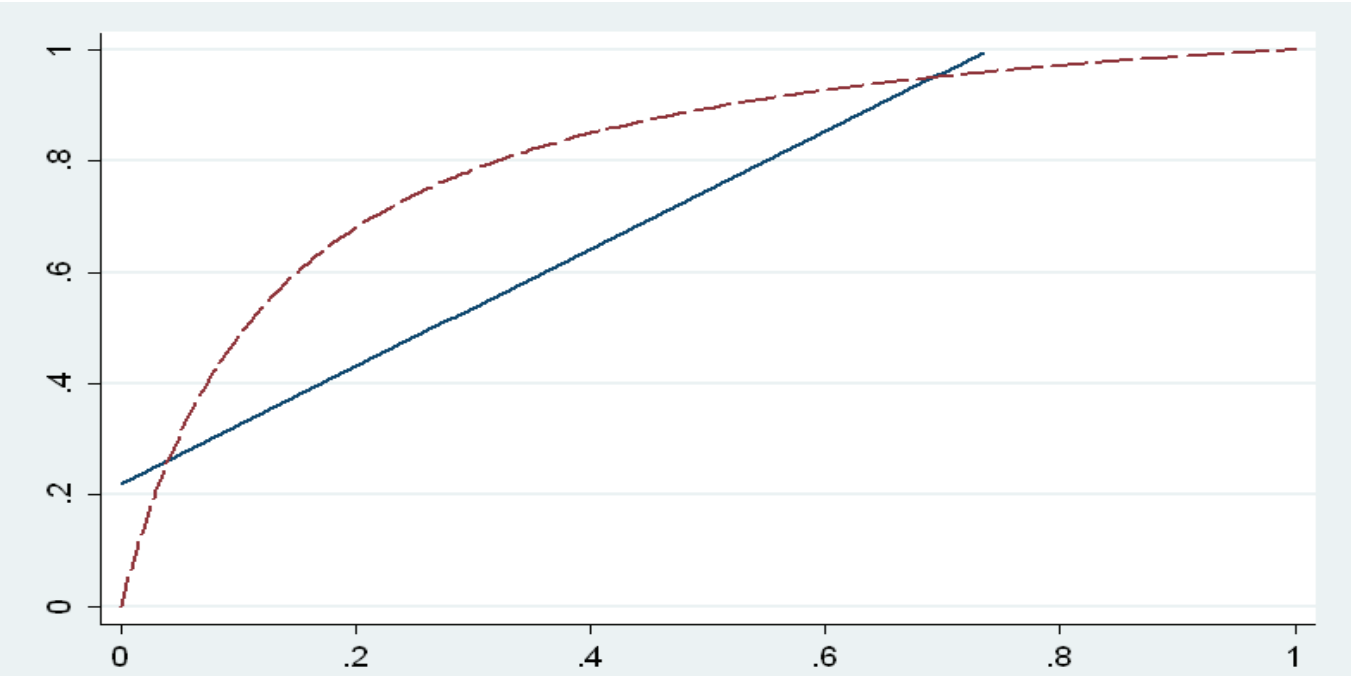
Eco-labeling equilibrium



Endogenous firm type

- relax assumption that firm types are fixed
- allow choice between *G, B* before testing choice
- four possible combinations, though one (*G*, don't test) not viable
- compare payoffs from remaining three combos
- turns out must have both *G* and *B*
- all *G* and at least some *B* test
  - firms indifferent between *G* and *B*, with testing
  - induces relation between μ and ν
  - also have relations that yield μ, ν based on N_G

Relation between μ and ν

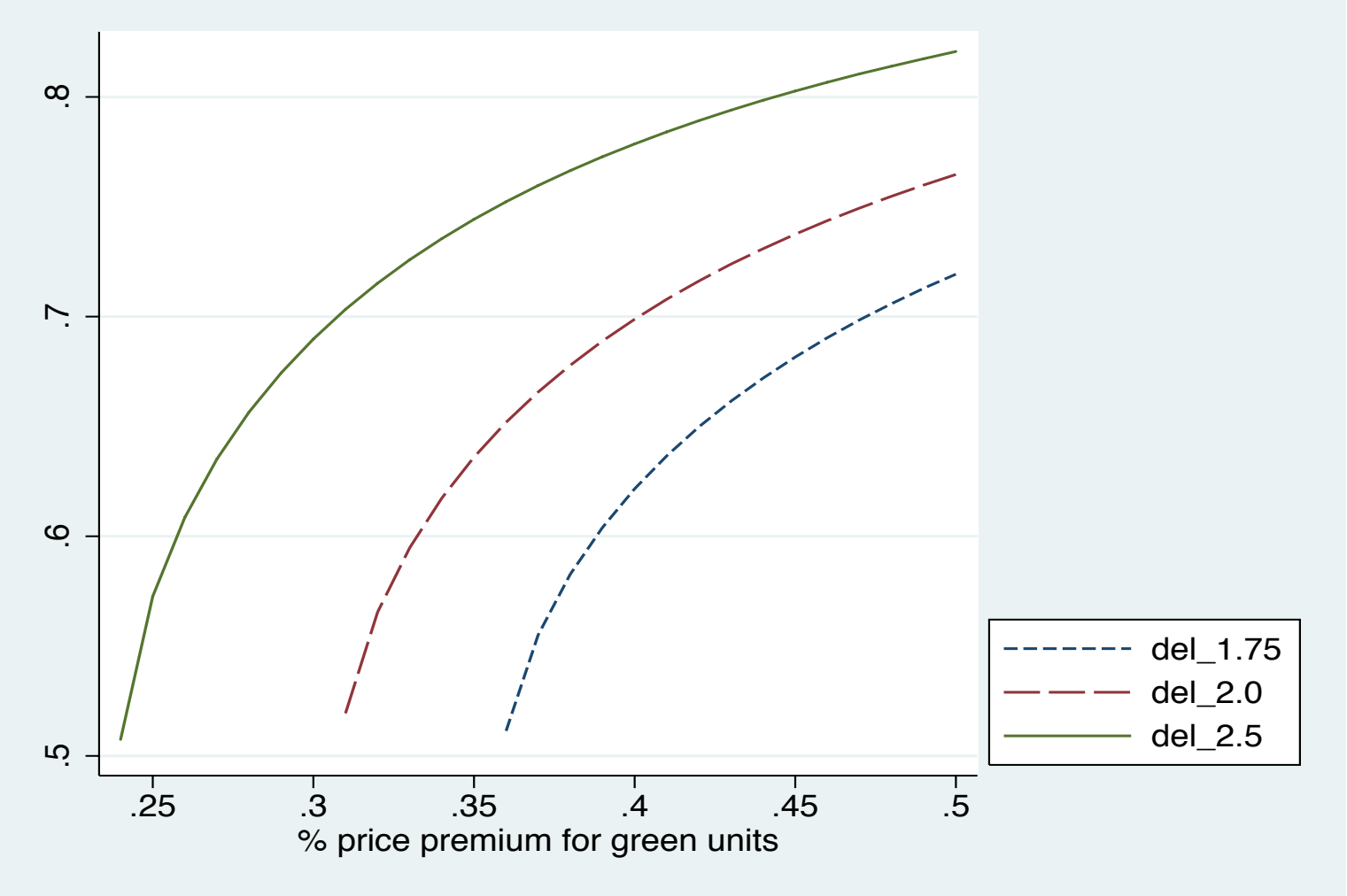


- three potential equilibria
  - pure lemons equilibrium
  - two 'interior' equilibria, with $\mu, \nu > 0$
    - one with smaller μ is unstable
    - one with larger μ is stable

Solving for N_G

- graph shows an implicit relation between μ &ν for given value of N_G
- indifference relation gives second condition relating P_c &P_{un}
- this condition induces a second relation between μ &ν for given value of N_G
- LR equilibrium value of N_G solves relation induced by combining these relations
  - analogs of three equilibrium classes from SR analysis
  - welfare can increase or decrease in LR
  - *ceteris paribus* $\Delta W_{LR} > \Delta W_{SR}$
  - suggest possibility of tradeoff over time

Price premium and elasticity of MC



Extensions and applications

- extensions
  - multiple (competing) labels
  - multiple quality grades
- applications
  - GMO
  - fair trade pricing
  - mandatory vs. voluntary labeling
  - interaction between certification and trade
  - wine judging