Using Structural Models To Simulate IP Damages

Luke M. Froeb
Director, Bureau of Economics
Federal Trade Commission

ABA Intellectual Property Section
Antitrust Section
December 11, 2003

Disclaimer: Views are my own, not necessarily those of FTC or any of its Commissioners.

Co-author Acknowledgements

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- Online patent damage Simulator: http://www.antitrust.org/simulation.html

Outline

- Economic Methodologies for predicting unobserved "but-for" worlds

- Accounting Methodologies used for predicting unobserved "but-for" worlds

- Comparison & Illustration

- How do you challenge economic model-based simulation?

Litigation Poses Difficult Questions

- Will this merger raise price?

- How much did this conspiracy raise price?

- What would profits have been absent some illegal behavior?
  - Patent infringement
  - Antitrust violation

- These questions compare two states of the world, but only one is observed

How Do We Predict the Unobserved State of the World?

- **Natural experiments**
  - Using historical data and empirical model to compute "but-for" world.
  - Best--if nature has performed good experiment

- **Classroom experiments**
  - FCC used experiment to predict effects of ATT-Comcast

- **Structural models**
  - Estimate parameters
  - "Simulate" unobserved state of the world
  - Good if model captures reality; and good estimates.

Natural Experiments are Best but Good Data are Rare
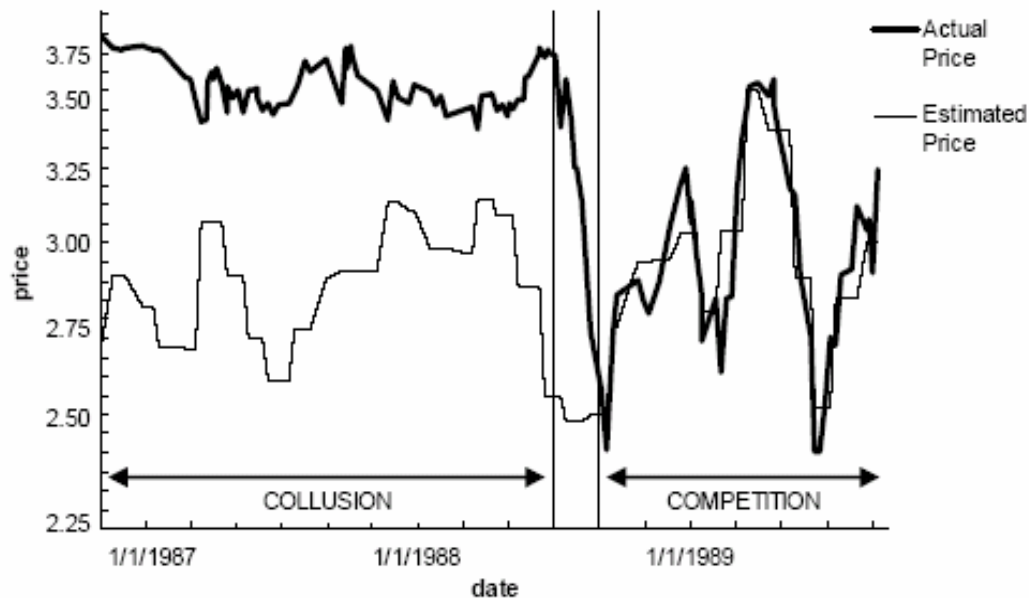
- ■ Compare control vs. treatment group

Figure 1. Actual and estimated prices for frozen perch at auction.

- ■ Try to hold everything else constant
  - ❑ Backcast is the "control" group

Structural Models

- Specify and estimate model
- Make sure model can explain observed state of the world
- "Simulate" unobserved state of the world
- Models tell you
  - What matters, why, and how much
- Models force economists to "put cards on table"
  - Assumptions are explicit;
  - Clear link from evidence to conclusions
  - Attack "linkage" (model) or attack evidence

"but-for" World in IP Litigation

- **Synonyms: "unobserved state," "counterfactual"**

- **Reasonable Royalties: if infringer had legally licensed patent**
  - Infringer would have made fewer sales (higher costs)
  - Patentee would have competed less vigorously
  - Rivals would react with higher prices

- **Lost Profits: if infringer had never existed**
  - Patentee would have charged more and sold more
  - Rivals would have charged more and sold more too

Courts Compute IP Damage with Crude Rules of Thumb

- **Drawing bright lines where there are none**
  - "acceptable" vs. "unacceptable" substitutes
  - similar problem to market delineation in merger analysis
- **Accountants project pre-infringement growth to post infringement period or project sales based on company documents.**
  - Ignore market shocks that occur post-infringement
- **Accountants infer lost sales from market shares**
  - With non-infringing competitors

Accounting For Market Forces

- **Price Erosion**
  - Infringement leads to lower prices
- **Quantity Accretion**
  - Infringement leads to higher quantity
- **Inferring Substitution Patterns from Market Shares**
  - Property of logit demand
- **Structural Economic Models take account of all these factors simultaneously**
  - 1995 David Evans applied logit merger model to patent infringement case

Types of Structural Models

- Homogenous product, "Cournot"
  - Firms set quantity
- Differentiated products, "Bertrand"
  - Firms set price
- Unique products or services, "Auctions"
  - Firms bid for right to buy or sell
- Unique products or services, "Bargaining"
  - Alternatives to agreement determine terms of bargain

Simulation vs. Market Share Rule

■ Damages (% of patentee profit) in a Hypothetical Case Based on Mor-Flo

Methodology	Elasticity of Demand		
	-0.5	-1	-2
Simulation (Bertrand model)	19.7%	7.4%	3.8%
Market-share rule (no erosion)	17.7%	17.7%	17.7%

BIC Leisure v. Windsurfing Int'l.

- ## Patent Damages in a $1,000's

	Licensee Sales	Patentee Sales	Total
Original Award	750	2,102	2,852
Simulated Damages	376	1,115	1,491
Simulated Damages (nest)	403	890	1,293
Royalty Only Award			1,079

Online Games (if time)

- http://www.antitrust.org/simulation.html

When to Use Simulation: Mergers vs. IP

- Using simulation to inform policy is easier than applying model to a specific case
  - Much we don't know
  - Like whether models can predict real outcomes
- Merger Guidelines are good alternative in merger cases
  - Jan. 29, 2004, Brownbag on Merger Simulation
- Simulation may be best alternative in damage cases

How to Challenge Simulation

- "An expert is someone who knows some of the worst mistakes in his subject and who manages to avoid them" --Werner Heisenberg (1969)
- The worst mistakes occur when practitioners use the methodology to predict the future without first making sure that it can accurately describe the present.
- Courts give a break to plaintiffs
  - Lower burden of proof
  - But assumptions can be potentially tested
- Some number beats no number
  - Show that your model is better than rival's.

Concord v. Brunswick

"Neither the Daubert analysis nor the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the ipse dixit of the expert. **A court may conclude that there is simply too great an analytic gap between the data and the opinion proffered.** A court must focus on the reasonableness of using a particular approach, along with the expert's particular method of analyzing the data thereby obtained, to draw a conclusion regarding the particular matter to which the expert testimony was directly relevant."

How do You Tell if the Model Cannot Describe the Present?

- **Structural models have three components**
  - Consumer model ("demand")
  - Firm model ("supply")
  - Equilibrium: how consumers & firms interact
- **Each makes assumptions or predictions that can be refuted by evidence**

Does Demand Model Accurately Characterize Consumer Behavior?

- **Who is choosing?**
  - e.g., drugs (MD, PBM, consumer)
- **Do they make a single choice from a well defined set of alternatives?**
- **Do they make choices based on relative prices?**
- **Do they stockpile inventory?**
- **How is heterogeneity handled?**

Does Firm Model Accurately Characterize Firm Behavior?

- ## Do firms behave as modeled?
  - Four "P's" of Marketing: Price, Product, Placement, and Promotion

- ## Do firms differ as modeled?
  - Margins, elasticities, Costs

- ## Are costs as modeled?

- ## Is the retail sector "transparent?"

- ## Is competition static?

# Does Model Accurately Characterize Equilibrium?

- Do real margins look like actual margins?
- Do prices vary with marginal cost?
  - e.g., seasonality in pricing
- What happens following past entry or disappearance of a competitor?
  - Can model explain the past?

How Well Must Structural Model Fit?

- Models are abstractions that can never be perfect descriptions of the real world

- What matters is not whether the model is unrealistic in any way, but rather whether it is unrealistic in ways likely to make it misleading

- It must fit better than the alternative
  - "Some number beats no number"

WARNING: Extrapolation Depends on Demand Curvature

- Almost impossible to know what this looks like.
- Bigger problem in Damage estimation
- Solution: use conservative assumption.
- Or do sensitivity analysis.
- e.g., Four demand curves
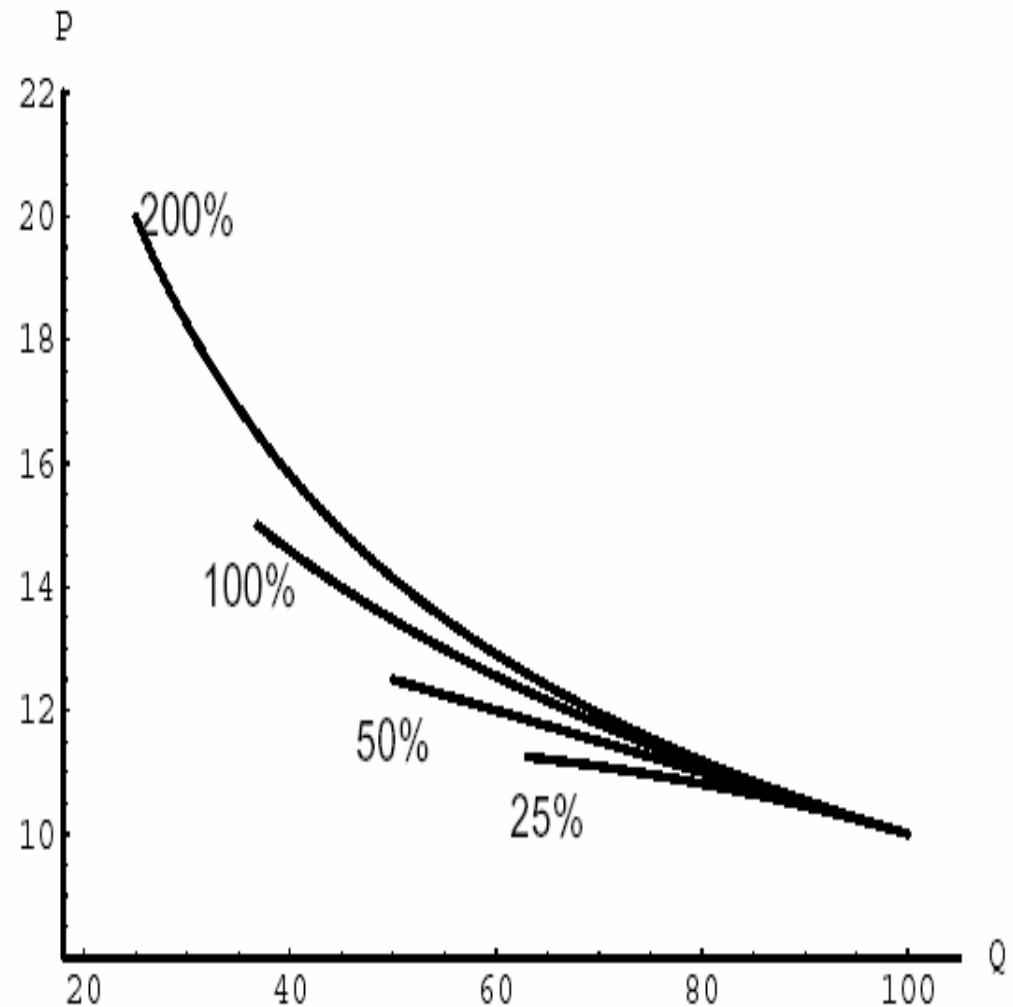
Current Agenda

- **Reassessment**
  - Over a decade since merger simulation was first used

- **Simulation puts IO Economists in the prediction business.**
  - What can we learn from macroeconomists?

- **Ultimate Test: OUT-OF-SAMPLE PREDICTIONS!**
  - How well can model predict real events?