Fundamentals of Antitrust Economics Series: Econometrics

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Fundamentals of Antitrust Economics

I. Econometric Principles

II. Econometric Applications
Introduction

• What is Econometrics?
  – Econometrics is the application of statistical methods to economic data

• Why Use It?
  – Estimating relationships between variables of interest
  – Hypothesis testing based on economic theories and predictions
  – Forecasting economic indicators
Examples from the World of Antitrust

• Antitrust Litigation
  – Did the alleged conduct result in customers paying higher prices holding all else equal?

• Merger Analysis
  – Does the presence of certain competitors in the marketplace constrain prices?
  – Estimation of own price and cross price elasticity of demand to determine the relevant product market
What is Regression Analysis?

A regression is a statistical tool to describe the relationship between a dependent variable (e.g., price) and one or more explanatory variables (e.g., cost).

\[ \text{Price} = a + b \times \text{Cost} + e \]

- **constant**
- **error term**
- **dependent variable**
- **explanatory variable**
- **coefficient on the explanatory variable**
Scatterplot Showing the Relationship Between Price and Cost
Regression Line Showing the Relationship Between Price and Cost

- **Ordinary Least Squares (“OLS”):** A commonly used method for estimating a regression equation; yields a regression line that best fits the data such that it minimizes the sum of squared distances between the data points and the line itself.
### Interpreting Regression Results

Dependent variable: Price per unit

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Estimated Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>4.14* (1.57)</td>
</tr>
<tr>
<td>Cost</td>
<td>0.52* (0.14)</td>
</tr>
</tbody>
</table>

N = 50

$R^2 = 0.22$

Both variables are statistically significant at 5% level. Often denoted by *.
Statistical Significance I

• Is the estimated effect statistically significant, i.e., is it statistically different from zero?

• Accepted standards for precision
  – In the economics profession, it is typical to use a 5% significance level
  – Researchers often also report statistical significance at the 1% and 10% levels
Statistical Significance II

• Look at the t-statistic
  – Testing the specific null hypothesis that the coefficient is zero

\[
t = \frac{\text{Coefficient}}{\text{Standard Error}} = \frac{0.52}{0.14} = 3.64
\]

• Or look at the p-value
  – Given the observed value of the t-statistic, what is the smallest level of significance at which the null hypothesis would be rejected?
Goodness of Fit

• The R-squared ($R^2$) is a measure that tells us how well the regression line fits the underlying data
  – How much of the variation in the dependent variable is explained by the explanatory variables included in the regression equation?

• Don’t place too much emphasis on the $R^2$ to judge the usefulness of the regression equation
  – $R^2$ always goes up when more variables are added
  – Time series data tend to yield high $R^2$; cross-sectional data tend to yield low $R^2$
II. Econometric Applications

- Hypothetical Example of a Proposed Merger
- Hypothetical Example of a Price Fixing Case
Hypothetical Example: Proposed Merger of Snob and Pretentious
Hypothetical Example: Proposed Merger of Snob and Pretentious

**Snob**

Premium luxury brand

**Pretentious**

Appeals to a more youthful set of consumers

- [Image of perfume bottles]
- [Image of perfume bottles]
Using Regression Analysis to Analyze Competitive Effects

• Do the proposed merging parties compete closely with each other or with other competitors (e.g., Social Climber)?

• Suppose that Pretentious recently expanded from being a regional brand to being a national brand
  – Provides the opportunity to analyze a “natural” experiment
  – Test the hypothesis that Pretentious does not compete closely with Snob but does compete closely with Social Climber
Using Regression Analysis to Analyze Competitive Effects

\[
\ln (\text{Price of Snob}) = a + b \cdot \text{Pretentious} + \\
c_1 \cdot \text{City 1 Dummy} + c_2 \cdot \text{City 2 Dummy} + \ldots \\
d_1 \cdot \text{Month 1 Dummy} + d_2 \cdot \text{Month 2 Dummy} + \ldots + e
\]

where:

City Dummies = city fixed effects that account for time invariant city-specific effects

Month Dummies = time fixed effects that account for city-invariant time-specific effects
Results and Implications

- Also estimate a corresponding regression using price of Social Climber as the dependent variable

<table>
<thead>
<tr>
<th>When the Dependent Variable is...</th>
<th>Estimated Coefficient on Pretentious Dummy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price of Snob</td>
<td>Not statistically significant</td>
</tr>
<tr>
<td>Price of Social Climber</td>
<td>Negative and statistically significant</td>
</tr>
</tbody>
</table>

- These results suggest that *Pretentious* does not compete closely with *Snob* but does compete closely with *Social Climber*

- It does not appear that *Pretentious* and *Snob* are in the same relevant product market
Using Regression Analysis to Define the Relevant Product Market

- The set of products over which a hypothetical monopolist would be able to impose a “small but significant and non-transitory increase in price” (Horizontal Merger Guidelines)

- Econometric analysis can be used to estimate the own price elasticity of demand for that group of products.

\[
\ln Q_{it}^S = a + b \ln P_{it}^S + c \ln P_{it}^P + dX + \varepsilon_{it}
\]

where:
- \( b \) = own price elasticity of demand
- \( c \) = cross price elasticity of demand
II. Econometric Applications

• Hypothetical Example of a Proposed Merger

• Hypothetical Example of a Price Fixing Case
Hypothetical Example of a Price Fixing Case

• Plaintiffs allege a price fixing conspiracy
• Transaction sales data available for all customers that purchased the product at issue
• Data span the alleged conspiracy period and a non-conspiracy period
## Role of Economists in Class Certification Cases Analysis of Rule 23(b)3

<table>
<thead>
<tr>
<th>COMMON IMPACT</th>
<th>FORMULAIC APPROACH TO DAMAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can all (or substantially all) members of the class be shown to have been</td>
<td>Can damages be calculated for all class members on a formulaic</td>
</tr>
<tr>
<td>injured by the alleged conspiracy using common evidence?</td>
<td>basis?</td>
</tr>
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<td></td>
<td></td>
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</table>
Defining Antitrust Injury and Damages

A customer has suffered antitrust injury when:

\[
\text{ACTUAL PRICE PAID} - \text{BUT FOR PRICE PAID} > 0
\]

Damages = magnitude or “amount” of this difference
Common Proof

Same proof can be used to show the nature of harm to all class members.

Individual circumstances vary across proposed class members.
Hypothetical Example of a Price Fixing Case

Customer Uniq-orn only made purchases during the class period
Consider Plaintiffs’ Proposed Regression Model

\[ \text{Price} = a + b \cdot \text{Raw Material Cost} + c \cdot \text{Conspiracy Dummy} + e \]

- **Indicator or “dummy” variable for the alleged class period**
- **Coefficient c gives an estimate of the “overcharge” during the class period (a common coefficient)**
- **Common coefficients on the other explanatory variables**

Suppose that the estimate for c is 10 percent.
What about Customer Uniq-orn?
The Regression Yields a Positive Average Overcharge

Price Offered During the Conspiracy Period
vs. Before the Conspiracy Period
Even Here, The Regression Yields a Positive Average Overcharge

Price Offered During the Conspiracy Period vs. Before the Conspiracy Period
• There are econometric tests that tell us whether it is appropriate to assume that:
  – Each of the supply and demand factors had the same or uniform effect across all customers
  – The overcharge variable had the same or uniform effect across all customers

• Scientific testing can tell us whether it is appropriate to pool together sales transaction data across all customers

• The answer will vary depending on the facts of the case