Industrial Reorganization: Learning about Patient Substitution Patterns from Natural Experiments

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\Industrial Disorganization"

Many new empirical industrial organization studies forecast counterfactual outcomes [...], without a clear foundation in experience. [...] We`d expect such a judgment to be based on evidence showing that the simulation-based approach delivers reasonably accurate predictions. {Angrist and Pinske (JEP 2010)

Discrete Choice Demand - A Shaky Foundation?

Cornerstone of empirical IO

Models based on untestable assumptions

- IIA
- Limited di erentiation among products

Little exogenous variation in choice sets

Natural Disasters Randomly Change Choice Set

Hospitals destroyed/closed by natural disasters

Internal Validity: Areas immediately surrounding relatively una ected

External Validity: Disasters in range of environments

Hospitals Good Industry to Examine Demand Models

Hospitals are important

- Hospital care more than 5 percent of GDP
- Hospital demand models used to address a variety of questions

Rich patient-level data helpful for identi cation

Several critiques

- Brennan and Guerin-Calvert, 2013; Doane, Froeb, and Van Horn, 2012; May, 2013

Experimental Validation in Other Settings

Vending Machines: Conlon and Mortimer (2013)

School Choice: Pathak and Shi (2014)

Schooling and Fertility: Todd and Wolpin (2006)

What you should take away from this talk

Heterogeneity in unobserved hospital quality is important

We provide guidance on which models to use

- Use combination of semiparametric and parametric models

Widely used models lead to di erent policy conclusions

- Model choice matters

Overview

1. Disasters
2. Discrete Choice Models
3. Model Performance
4. Welfare
5. Conclusions

Natural Disasters

Location	Month/Year	Severe Weather	Hospital(s) Closed
Northridge, CA	Jan-94	Earthquake	St. John's Hospital
Americus, GA	Mar-07	Tornado	Sumter Regional Hospital
New York, NY	Oct-12	Superstorm Sandy	NYU Langone
			Bellevue Hospital Center
			Coney Island Hospital
Moore, OK	May-13	Tornado	Moore Medical Center

Tornado: Americus, GA

Tornado: Moore, OK

Superstorm Sandy: Manhattan, NY

Superstorm Sandy: Brooklyn, NY

Earthquake: Los Angeles, CA

Primitives

Hospitals $j = 0; 1; :::; J$, where 0 indexes the outside option.

Patients $i = 1; :::; N$

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Patient's choice of hospital is denoted h_i

Patients choose hospital one time

Focus is Prediction and Welfare

Probability of choosing

Experimental Design

Estimate models on period before disaster

Some Models Match Market Shares Well

Sumter

Examine Relative Model Performance

Examine Percent Improvement in RMSE over Indicator Model

- $1 \quad (\frac{RMSE_{Model}}{RMSE_{Indic}} \quad 1)$

Three Sets of Predictions:

- Aggregate Shares
- Aggregate Diversion Ratios: $\frac{y_{j;1} \; y_{\;j;0}}{y_{dest;0}}$
- Individual Predictions

Comparing Models: Aggregate Shares

Comparing Models: Aggregate Diversion Ratio

Comparing Models: Individual Predictions

Optimal Model Combination

$$y_{ij} = {}^{\text{Semipar}}\hat{y}_{ij}^{\text{Semipar}} + \cdots + {}^{\text{CDS}}\hat{y}_{ij}^{\text{CDS}} +$$

Weights non-negative, sum to one (Timmerman (2006))

Averaged across experiments

Comparing Models: Individual Predictions

Model Combination

How Well Do Discrete Choice Models Perform?

Correlation Coe cient

Robustness

Changing Choice Set Patients

Capacity Constraints

Case Mix

Medicare Insurance Only

Removing Destroyed Areas

Doctors

Counterfactual Hospital Mergers

Hospitals with higher WTP have higher market power

- Suppose hospital k and l are merging
- Change in WTP

$$WTP_{(k;l)}(S) \quad WTP_k(S) \quad WTP_l(S)$$

approximates change in market power from merger

Counterfactual Hospital Mergers

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We examine all possible counterfactual mergers (95 in total)

Meaningful Predicted Welfare Di erences Across Models

SD / Mean

Meaningful Predicted Welfare Di erences Across Models

Correlation, RMSE and Percent Change in WTP

Conclusion

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{Nevo and Whinston (JEP 2010)

Future Work: Examining Machine Learning Models