Today

- A brief history of IO research.
- Discussion of reduced form empirical IO research

Reduced form work on IO topics

- Not everything has to be structural.
- The only necessary condition for a paper to be good, is that we learn something useful about how markets work.

Reduced form work on IO topics

- What does “a reduced for approach to empirical work” mean?
- When is a reduced form approach appropriate?
- What is the role of reduced form work?

Reduced form work on IO topics

Three Examples:

- Ginger Jin and Phillip Leslie, The Effect of Information on Product Quality: Evidence from Restaurant Hygiene Grade Cards, QJE 2003
- Pinelopi Goldberg, Dealer Price Discrimination in New Car Purchases: Evidence fro the Consumer Expenditure Survey, JPE 1996
- Austan Goolsbee and Chad Syverson, How do Incumbents Respond to the Threat of Entry? Evidence from the Major Airlines, QJE 2008

Goolsbee & Syverson, How do Incumbents Respond to the Threat of Entry?

- Austan Goolsbee and Chad Syverson, How do Incumbents Respond to the Threat of Entry? Evidence from the Major Airlines, QJE 2008

I. INTRODUCTION

In this paper we examine how incumbents respond to the threat of entry by a competitor. Though this topic has been the object of considerable theoretical and policy debate, it has received little empirical attention, mainly due to the problems of identifying the *threat* of entry separately from actual entry.

We will examine this issue in the passenger airline industry. We are able to identify discrete shifts in the threat of entry in this circumstance by using the expansion patterns of the industry's most famous potential competitor—Southwest Airlines.[1] In particular, we look at situations where Southwest begins or even announces it will begin operating in the second endpoint airport of a route (having already been operating out of the first endpoint), *but before it starts flying the route itself*. We investigate how incumbents respond to such threats.

Goolsbee & Syverson, How do Incumbents Respond to the Threat of Entry?

- Identification

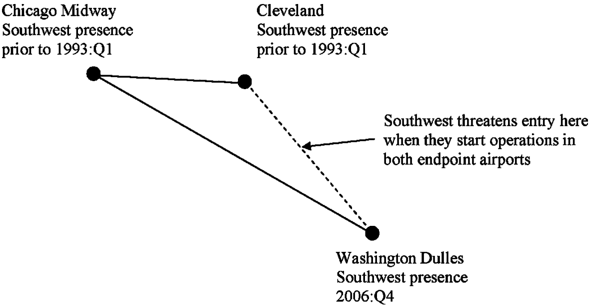


FIGURE I
Identifying a Threatened Incumbent Route

Goolsbee & Syverson, How do Incumbents Respond to the Threat of Entry?

- What happens if $P(\text{entry}) = 1$?
- What happens if $P(\text{entry}) = 0$?
- What happens if $P(\text{entry}) \in (0, 1)$?

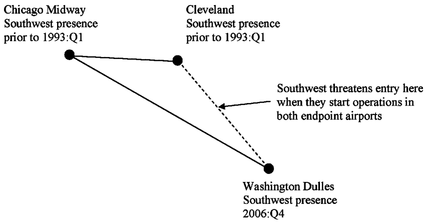


FIGURE I
Identifying a Threatened Incumbent Route

Goolsbee & Syverson, How do Incumbents Respond to the Threat of Entry?

Logic of paper:

- To Establish: Two terminal nodes increases chance of entry, but does not make it certain
- To Investigate: Resultant increase in P(entry) $-->$ impact on prices of incumbent(s)
- Can say anything about channels/specific models?

- What is this a reduced form of?
- What do you think of identification strategy?

Goolsbee & Syverson, How do Incumbents Respond to the Threat of Entry?

II. DATA

We build the core of our sample from the U.S. Department of Transportation's DB1A files from the first quarter of 1993 through the final quarter of 2004. These data provide a 10% sample of all domestic tickets in each quarter. From these, average logged ticket prices and the logged total number of passengers within each route-carrier-quarter combination are constructed (unfortunately the data do not report specific travel dates within the quarter).[4]

4. We use Severin Borenstein's cleaned files, which are already aggregated up to the route-carrier-quarter level, because this is the level of our analysis, rather

Goolsbee & Syverson, How do Incumbents Respond to the Threat of Entry?

- To Establish: Two terminal nodes increases chance of entry, but does not make it certain

TABLE I
PROBABILITY OF SOUTHWEST'S ENTRY INTO A ROUTE

Southwest operates in one endpoint airport in the previous quarter	0.0025
(single presence)	(0.0002)
Southwest operates in both endpoint airports in the previous quarter	0.1851
(dual presence)	(0.0203)
N	163,952

Notes. The table shows marginal effects estimates from a probit estimation for Southwest's entry into a route in a particular quarter, conditional on the number of the route's endpoint airports served by Southwest in the previous quarter. The excluded category includes observations where Southwest does not serve either endpoint airport in the previous quarter. Quarter fixed effects are included. Standard errors are in parentheses.

Goolsbee & Syverson, Implementation

For each route in our sample, we look at the 25-quarter window surrounding the quarter in which Southwest establishes a presence in both endpoints (three years before to three years after) and define Southwest's actual entry as occurring when it establishes direct service—i.e., flights without a change of plane—between the two airports.[8] This follows the findings from U.S. antitrust authorities that nonstop service and connecting service can be considered separate markets, or at least substantially differentiated products. However, we did find similar results defining entry as also including change-of-plane service.

In all, we observe Southwest threatening entry into 704 routes over the sample period, 533 of which Southwest had actually entered with direct flights by the final quarter of 2004, the end of our observation period. This yields over 19,000 route-carrier-quarter observations of average logged fares and passenger counts for major airlines' direct flights on threatened routes. The standard deviation of average logged fares across observations is 0.45, and for logged passengers it is 2.02.

Goolsbee & Syverson, Implementation

$$y_{ri,t} = \gamma_{ri} + \mu_{it} + \sum_{\tau=-8}^{3+} \beta_\tau \left(\text{SW\_in\_both\_airports}\right)_{r,t_0+\tau}$$

$$(1) \qquad + \sum_{\tau=0}^{3+} \beta_\tau \left(\text{SW\_flying\_route}\right)_{r,t_e+\tau} + X_{ri,t}\alpha + \varepsilon_{ri,t},$$

where $y_{ri,t}$ is the outcome of interest (e.g., mean logged fares) for incumbent carrier i flying route r in quarter t. SW_in_both_airports$_{r,t_0+\tau}$ are time dummies surrounding the period when Southwest establishes a presence in both endpoints of a route but without flying the route. SW_flying_route$_{r,t_e+\tau}$ are time dummies that commence in the period when Southwest actually starts flying the route. The dummies are mutually exclusive, so the implied effects on the dependent variable given by their coefficients are not additive. γ_{ri} and μ_{it} are carrier-route and carrier-quarter fixed effects, respectively. Some specifications also include a set of controls $X_{ri,t}$.

In all regressions, we weight observations by the average number of passengers flying the route-carrier over the sample.

Goolsbee & Syverson, Implementation

TABLE II
INCUMBENT RESPONSES TO THE THREAT OF ENTRY

	(1) ln(P)	(2) ln(Q)	(3) Cost controls
Southwest in both airports (no flights)	−0.030	−0.177**	−0.025
$t_0 - 8$	(0.024)	(0.088)	(0.024)
Southwest in both airports (no flights)	−0.071**	−0.155	−0.053*
$t_0 - 7$	(0.030)	(0.110)	(0.029)
Southwest in both airports (no flights)	−0.065*	0.013	−0.059
$t_0 - 6$	(0.035)	(0.103)	(0.037)
Southwest in both airports (no flights)	−0.079*	0.083	−0.072
$t_0 - 5$	(0.044)	(0.119)	(0.046)
Southwest in both airports (no flights)	−0.100*	0.068	−0.093*
$t_0 - 4$	(0.049)	(0.134)	(0.051)
Southwest in both airports (no flights)	−0.142**	0.097	−0.137**
$t_0 - 3$	(0.056)	(0.146)	(0.059)
Southwest in both airports (no flights)	−0.132**	0.072	−0.123**
$t_0 - 2$	(0.056)	(0.159)	(0.061)
Southwest in both airports (no flights)	−0.135**	0.165	−0.125*
$t_0 - 1$	(0.065)	(0.193)	(0.071)
Southwest in both airports (no flights)	−0.186**	0.196	−0.162**
t_0	(0.073)	(0.201)	(0.079)
Southwest in both airports (no flights)	−0.215**	0.240	−0.185**
$t_0 + 1$	(0.073)	(0.217)	(0.080)
Southwest in both airports (no flights)	−0.228**	0.123	−0.201**
$t_0 + 2$	(0.075)	(0.223)	(0.082)
Southwest in both airports (no flights)	−0.277**	0.167	−0.243**
$t_0 + 3$ to $t_0 + 12$	(0.079)	(0.224)	(0.085)
Southwest flying route	−0.237**	0.267	−0.211**
t_e	(0.082)	(0.239)	(0.091)
Southwest flying route	−0.288**	0.224	−0.260**
$t_e + 1$ to $t_e + 2$	(0.087)	(0.232)	(0.095)
Southwest flying route	−0.344**	0.329	−0.316**
$t_e + 3$ to $t_e + 12$	(0.113)	(0.271)	(0.117)
Operating cost control,			0.106
endpoint airport 1			(0.065)
Operating cost control,			0.158**
endpoint airport 2			(0.048)
N	19,414	19,414	18,176

Notes. The dependent variable in columns (1) and (3) is the passenger-weighted average logged fares. In column (2) it is logged total passengers. Standard errors are in parentheses and are clustered by route-carrier. The sample includes all routes where Southwest threatens entry, as defined in the text. The "Southwest in both airports" dummies denote Southwest having flights involving airports on both ends of a route previous to actually flying the route. The "Southwest flying route" dummies denote Southwest actually operating flights on the route. *Denotes significance at a 10% level. **Denotes significance at a 5% level.

Goolsbee & Syverson, Implementation

Titles of other tables:

TABLE III
BASELINE ESTIMATES WITH A LONGER EVENT WINDOW

Dependent variable:	$\ln(p)$

TABLE IV
RESULTS FOR "NEARBY" ROUTES

	(1)	(2)
	$\ln(p)$ nearby airport	$\ln(q)$ nearby airport

TABLE V
INCUMBENT RESPONSES IN CAPACITY: PASSENGERS VERSUS SEATS, FLIGHTS, AND LOAD FACTORS

	Dependent variable			
	(1)	(2)	(3)	(4)
	$\ln(q)$ T100	ln(seats) T100	ln(flights) T100	ln(load factor) T100

Goolsbee & Syverson, Implementation

TABLE VI
DETERRENCE VERSUS ACCOMMODATION: PRICE RESPONSE ON ROUTES WHERE SOUTHWEST'S ENTRY DATE IS PREANNOUNCED

	Dependent variable: ln(p)	
	(1) Not certain	(2) Preannounced
Southwest in both airports (no flights) $t_0 - 8$	−0.030 (0.024)	−0.003 (0.033)
Southwest in both airports (no flights) $t_0 - 7$	−0.071** (0.030)	0.006 (0.036)
Southwest in both airports (no flights) $t_0 - 6$	−0.065* (0.035)	0.019 (0.042)
Southwest in both airports (no flights) $t_0 - 5$	−0.079* (0.044)	−0.013 (0.036)
Southwest in both airports (no flights) $t_0 - 4$	−0.100* (0.049)	−0.036 (0.038)
Southwest in both airports (no flights) $t_0 - 3$	−0.142** (0.056)	−0.060 (0.041)
Southwest in both airports (no flights) $t_0 - 2$	−0.132** (0.056)	−0.024 (0.045)
Southwest in both airports (no flights) $t_0 - 1$	−0.135** (0.065)	−0.057 (0.055)
Southwest in both airports (no flights) t_0	−0.186** (0.073)	
Southwest in both airports (no flights) $t_0 + 1$	−0.215** (0.073)	
Southwest in both airports (no flights) $t_0 + 2$	−0.228** (0.075)	
Southwest in both airports (no flights) $t_0 + 3$ to $t_0 + 12$	−0.277** (0.079)	
Southwest flying route t_e	−0.237** (0.082)	−0.200** (0.071)
Southwest flying route $t_e + 1$ to $t_e + 2$	−0.288** (0.087)	−0.337** (0.082)
Southwest flying route $t_e + 3$ to $t_e + 12$	−0.344** (0.113)	−0.389** (0.082)
N	19,414	6,423

Notes. The dependent variable in each column is the passenger-weighted average logged fares. Standard errors are in parentheses and are clustered by route-carrier. The sample in column (1) is the same as the baseline sample from Table II. The sample in column (2) includes all routes where Southwest begins flying the route simultaneously with entering the second airport. In such circumstances, of course, t_0 and t_e are the same and there are no periods after t_0 where Southwest is not yet flying the route, so those coefficients are left out of the specification. *Denotes significance at a 10% level. **Denotes significance at a 5% level.

Goolsbee & Syverson, Implementation

- Notice how simple the paper is.
- Notice how it relates to theory
- Notice how important the clarity of thinking embodied in the writing is.
- Notice how clear (and clean) the identification is. Do you agree?

Goldberg, Dealer Price Discrimination in New Car Purchases

- Pinelopi Goldberg, Dealer Price Discrimination in New Car Purchases: Evidence fro the Consumer Expenditure Survey, JPE 1996
- What is price discrimination?

Goldberg, Dealer Price Discrimination in New Car Purchases

Here's some context for this paper (Ayres and Siegelman is in AER in 1995):

new cars. In brief, Ayres and Siegelman find that dealers' initial offers to white females during price negotiations for a new car are, on average, $200 higher than corresponding offers to white males; black females receive offers that are approximately $450 above the offers made to white males; and black males fare the worst, by being asked to pay $1,100 more than whites. Similar figures apply to the final offers these groups receive.[1]

These conclusions are based on a controlled experiment during which pairs of testers visit various dealerships in the Chicago area and bargain about the price of the same new car. The nature of the experiment offers the results enormous credibility: the testers have approximately the same age, education, and appearance and use the exact same bargaining strategy. As a result, differences in quoted prices are attributed to the dealers' attitude toward minorities rather than the buyers' behavior.

Goldberg, Dealer Price Discrimination in New Car Purchases

Here's Penny's thoughts on that...

These conclusions are based on a controlled experiment during which pairs of testers visit various dealerships in the Chicago area and bargain about the price of the same new car. The nature of the experiment offers the results enormous credibility: the testers have approximately the same age, education, and appearance and use the exact same bargaining strategy. As a result, differences in quoted prices are attributed to the dealers' attitude toward minorities rather than the buyers' behavior. In reality, however, different classes of buyers may not act alike; hence price distributions are determined not only by supply behavior but by the interaction of demand and supply. By adopting the same bargaining strategy, the testers in the controlled experiment act as though they were coming from one point of the buyers' distribution, whereas equilibrium outcomes are determined by the whole distribution. The reported markups may thus be different from the ones realized in actual purchases of new cars.

What kind of price discrimination does she have in mind?

Goldberg, Dealer Price Discrimination in New Car Purchases

How would you empirically work out if Penny is right?

Goldberg, Dealer Price Discrimination in New Car Purchases

Logic of the paper

- Be very careful and self critical about data and measurement issues
- Establish that the difference in discounts does not appear in OLS - so some interaction of demand and supply
- Think through all the reasons why might get this - i.e. sources of endogeniety - and try to isolate

Goldberg, Data

The primary data source for this paper is the Consumer Expenditure Survey, which is conducted by the Bureau of Labor Statistics to compute the Consumer Price Index. To my knowledge, this survey is the only recent, publicly available data set that includes detailed information on automobile stocks and purchases.[5] Each quarter around 4,500 households are interviewed and asked questions on family characteristics, income, employment, expenditures, and ownership and disposal of cars; 75 percent of these households are reinterviewed the next quarter, and the remaining 25 percent are replaced by a new group. Previous work with the CES indicates that the household sample is representative of the U.S. population and can be used to address questions concerning automobile purchases.[6] To maximize the

[5] Another survey that contains information on car ownership is the Survey of Consumer Finances; however, its vehicle model descriptions are less detailed, lacking specific vehicle characteristics and options purchased.
[6] In Goldberg (1995), I estimate a discrete choice model of automobile demand and use the parameter estimates in conjunction with population weights provided in the

Goldberg, Data

number of available observations, I pool data from 1983 to 1987. During that period approximately 32,000 distinct households were interviewed, 9 percent of which bought a new car. To reduce possible measurement problems, I drop households with inconsistent responses or missing values; furthermore, I eliminate households that bought a car from a source other than a dealer, received a car as a gift, or use their vehicle for business purposes, so that I end up with around 1,300 reliable observations.[7] The CES data set was supplemented by the *Automotive News Market Data Book* (ANMDB), which provides information on suggested retail prices and options.

Each model is defined as a make/year pair; for example, the 1986 Honda Accord is considered a different model from the 1987 Honda Accord. The level of disaggregation depends on the specificity of information in the CES; sometimes the information provided by the households is not detailed enough to allow one to distinguish between finer make distinctions such as the Honda LX and Honda LXi.[8] For

Goldberg, Data

TABLE 1

LIST OF VARIABLES USED IN THE ESTIMATION

AGE	Age of household head
MINOR	Dummy, 1 if the household head belongs to a minority
FEMALE	Dummy, 1 if the household head is female
MINFEM	Dummy, 1 if the household head is female and belongs to a minority
ASSET	Value of financial assets
FINCATAX	Income after taxes
EDUCA	Dummy, 1 if the household head has attended college
WHITEC	Dummy, 1 if the household head has a white-collar job
RURAL	Dummy, 1 if town has fewer than 300,000 residents
NE	Dummy, 1 if residence is in Northeast
MW	Dummy, 1 if residence is in Midwest
WE	Dummy, 1 if residence is in West
FINAN	Dummy, 1 if household has financed the new car
DEALERF	Dummy, 1 if loan was made by dealer
FIRSTB	Dummy, 1 if the household is a first-time buyer
BRANDF	Dummy, 1 if household has bought the same brand before
TRADIN	Dummy, 1 if household traded in an old car
Q1P	Dummy, 1 if car was purchased in the first quarter and is previous year's model
Q2S	Car was bought in the second quarter, same year's model
Q2P	Car was bought in the second quarter, previous year's model
Q3S	Car was bought in the third quarter, same year's model
Q3P	Car was bought in the third quarter, last year's model
Q4S	Car was bought in the fourth quarter, same year's model
Q4P	Car was bought in the fourth quarter, last year's model
Q4N	Car was bought in the fourth quarter, next year's model
FOR	Dummy, 1 if car is of foreign origin
CLA2	Dummy, 1 if car is compact
CLA3	Dummy, 1 if car is intermediate

Goldberg, Measurement of discount

$$AD_{ij} = L_j - T_{ij},$$

$$RD_{ij} = \frac{L_j - T_{ij}}{L_j},$$

$$T_{ij} = \frac{EXP_{ij} - EX_{ij}}{S_i} + TRD_i,$$

$$L_j = LB_j + \sum_k O_k \times PO_{kj} + DF_j + DPF_j + C_d,$$

where AD_j and RD_j denote the absolute and relative discounts respectively; L_j is the list price of model j; and T_{ij} is the transactions price paid by consumer i for model j. The variable EXP_{ij} denotes the net expenditure incurred by consumer i for the purchase of model j. This figure includes extra charges (EX_{ij}), sales taxes (S_i), and the amount the consumer received for trading in an old car (TRD_i). The list price of model j is given by L_j; as can be seen from the last formula, this price can be computed by adding to the suggested retail price of the base model (LB_j) destination fees (DF_j), dealer preparation fees (DPF_j), other dealer-specific costs (C_d), and the prices of the various options the consumer has purchased. The latter are given by $\Sigma_k O_k PO_{kj}$, where O_k is a dummy equal to one if the consumer bought option k and PO_{kj} is the price charged for option k; if the model comes with the option standard, the price is obviously equal to zero.

Goldberg, OLS

III. Estimation Results

The estimation results using absolute discounts as the dependent variable are reported in table 2.[17] The four columns correspond to four alternative regression specifications.

The striking feature across all specifications is that the socio-economic characteristics are statistically insignificant. To alleviate the

Goldberg, Bargaining and Price Discrimination?

TABLE 3

RESULTS FROM QUANTILE REGRESSIONS (N = 1,279)

Dependent Variable: Absolute Discount

	OLS (1)	MEDIAN (2)	10% Quantile (3)	90% Quantile (4)
Intercept	−1,168.33	−1,598.95	−2,117.75	−66.82
	(−3.21)	(−6.02)	(−4.75)	(−.19)
AGE	4.02	6.95	4.04	7.72
	(1.06)	(2.63)	(.90)	(1.74)
MINOR	−274.62	−48.73	−784.35	453.14
	(−1.04)	(−.27)	(−2.87)	(1.81)
FEMALE	−129.63	−115.02	190.00	1.11
	(−1.10)	(−1.39)	(1.52)	(.08)
MINFEM	−21.96	−98.02	445.97	−379.54
	(−.05)	(−.34)	(1.06)	(−.86)
ASSET	−.15E−02	−.22E−02	.13E−02	−.11E−02
	(−.91)	(−2.01)	(.80)	(−.66)
FINCATAX	−.82E−03	.12E−02	−.44E−02	−.17E−02
	(−.33)	(.79)	(−1.87)	(−.71)
EDUCA	−25.23	−150.03	62.04	−120.69
	(−.25)	(−2.12)	(.56)	(−1.01)
WHITEC	−117.11	−81.42	−232.37	48.75
	(−1.12)	(−1.10)	(−2.07)	(.39)
RURAL	−216.89	−199.87	−222.44	−166.03

- t-stats are in parentheses

Goldberg, Wrap up

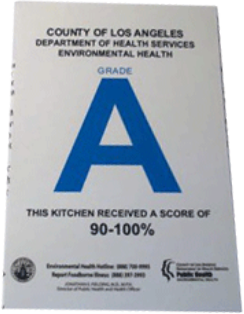
- Notice the tight link to simple theory
- Could you do this with just OLS?
- If you read it, note how carefully it works through all the possible issues.

Jin & Leslie, The Effect of Information on Product Quality

- Ginger Jin and Phillip Leslie, The Effect of Information on Product Quality: Evidence from Restaurant Hygiene Grade Cards, QJE 2003

Jin & Leslie, The Effect of Information on Product Quality

- Ginger Jin and Phillip Leslie, The Effect of Information on Product Quality: Evidence from Restaurant Hygiene Grade Cards, QJE 2003



Shut down restaurant if: score $<$ 60 for two inspections or severe problem (e.g. infestation)

Jin & Leslie, The Effect of Information on Product Quality

- Ginger Jin and Phillip Leslie, The Effect of Information on Product Quality: Evidence from Restaurant Hygiene Grade Cards, QJE 2003
- Research Question:

> The central question of our study is: does an increase in the provision of information to consumers about the quality of firms' products cause firms to improve the quality of their products? We first show that hygiene grade cards cause DHS inspection scores to increase by about 5 percent. We then verify the role of economic incentives to obtain higher scores when grade cards are issued.[3]

Jin & Leslie, The Effect of Information on Product Quality

History and Institutions

- About 20,000 resturants in LA County Avg Rev = $250k
- 13,500 survive matching between health records and tax records
- Nov 16-18 1997 TV reports on unsanitary kitchens in LA resturants
- Dec 16 1997 LA County vote for grade cards
- Jan 16 1998 ordinace put in effect at county level
- Restaurants in some incorporated cities did not have to display, all others did
- Need to be issued a grade card to be able to display: 80% of restraunts given grade card by year end
- Inspections are subjective and objective untill July 1 1997, only objective thereafter
- March 1998, addition (minor) criteria added to checklist for inspectors

Jin & Leslie, The Effect of Information on Product Quality

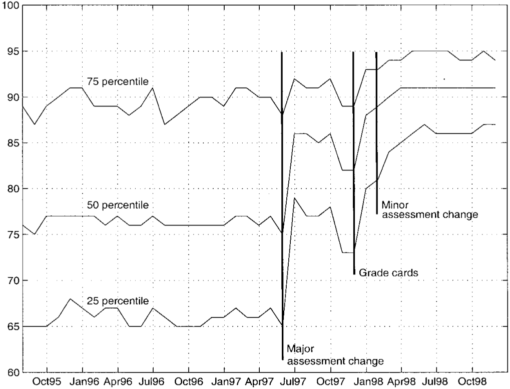


FIGURE I

Quartiles of Hygiene Quality Distribution over Time

Quartiles are computed based on all inspections in a given month. The assessment changes took place on July 1, 1997 and March 18, 1998. The grade cards began introduction on January 16, 1998. Vertical lines for regime changes are located immediately prior to a change in order to emphasize subsequent impacts on the hygiene distribution.

Jin & Leslie, The Effect of Information on Product Quality

Logic of Paper

- Do hygiene grade cards affect scores?
- Is this due to economic factors? Is there a revenue impact?
- Is this driven by increased actual hygiene or something else (switching of consumers, inspector behavior etc)

Jin & Leslie, The Effect of Information on Product Quality

Data: 1996-1998 panel of:

- Outcome of every restaurant health inspection in LA County
- Quarterly revenue data on restaurant in LA County, from county sales tax records (Confidential)
- Admissions into hospital for food-related and non-food related digestive disorders, by month and 3-digit zip

Jin & Leslie, The Effect of Information on Product Quality

TABLE III
THE EFFECTS OF GRADE CARDS AND DISCLOSURE REGULATION ON HYGIENE SCORES

	Without fixed effects		With fixed effects	
	Coefficient	Std. error	Coefficient	Std. error
Mandatory disclosure	4.9432	1.1384***	4.3958	1.4046***
Voluntary disclosure	4.0585	0.3199***	3.2528	0.3550***
Inspection Criteria II	7.7192	0.9181***	8.0886	0.9907***
Inspection Criteria III	9.9838	1.2233***	10.4158	1.3542***
Observations	69,991			
No. restaurants	13,544			
R^2	0.3574		0.5874	

Regressions include city random effects (i.e., we cluster the standard errors by city with Huber-White standard errors).

In the regression without fixed effects, while not reported, we also include the following restaurant characteristics: food type, food style, seating capacity, liquor license dummy, DHS risk assessment, and city dummies. Stars denote significance levels: 99 percent confidence level (***), 95 percent confidence level (**), and 90 percent confidence level (*).

The voluntary disclosure dummy is for voluntary verifiable disclosure (i.e., grade cards are issued but posting is discretionary). The excluded dummy is for voluntary nonverifiable disclosure (i.e., prior to the introduction of grade cards).

Inspection Criteria II Dummy is for inspections carried out between July 1, 1997, and March 18, 1998. See text for further details.

Inspection Criteria III Dummy is for inspections carried after March 1998. See text for further details.

FEs are at restaurant level

Jin & Leslie, The Effect of Information on Product Quality

TABLE IV
EFFECTS OF GRADE CARDS AND DISCLOSURE REGULATION ON ln(QUARTERLY RESTAURANT REVENUE)

	Coefficient	Std. error
Mandatory disclosure	0.0569	0.0153***
Voluntary disclosure	0.0326	0.0149**
B-grade	−0.0074	0.0084
C-grade	0.0039	0.0074
D-grade	−0.0023	0.0057
Mandatory × B-grade	−0.0497	0.0151***
Mandatory × C-grade	−0.0670	0.0304**
Mandatory × D-grade	−0.0565	0.0437
Voluntary × B-grade	−0.0029	0.0128
Voluntary × C-grade	−0.0238	0.0216
Voluntary × D-grade	−0.0758	0.0469
Missing grade	−0.0001	0.0096
Observations	74,321	
R^2	0.9506	

The regression also includes a restaurant fixed effects, a full set of quarterly dummies and city-level random effects (i.e., we cluster the standard errors by city with Huber-White standard errors).

D-Grade is equivalent to any score below 70 (i.e., less than a C-grade). Missing Grade is for restaurants that have opened but have not yet been inspected.

Excluded dummy is for voluntary disclosure without a standard format. Interactions with A-grade are also excluded.

The sample size is slightly reduced because we discard (i) observations for the first and last quarter when a restaurant is a new entrant or exitor, since we do not know the date of entry or exit; (ii) observations with negative tax, and hence negative revenue (due to overpayment of tax in a prior quarter); and (iii) restaurants with merged tax accounts (see text for a detailed explanation).

Stars denote significance levels: 99 percent confidence level (***), 95 percent confidence level (**), and 90 percent confidence level (*).

Jin & Leslie, The Effect of Information on Product Quality

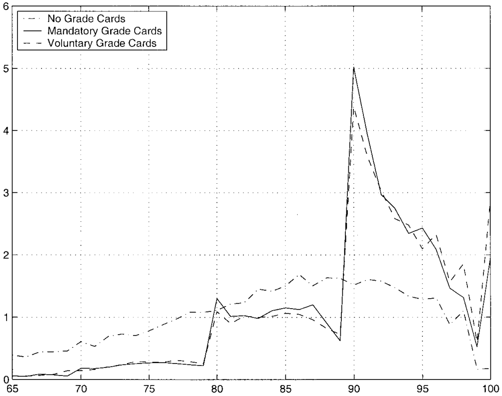


FIGURE II

Distributions of Hygiene Scores under Different Disclosure Regimes

The figure is no different from a histogram (or an unsmoothed nonparametric density). Units on the vertical axis are meaningless.

Jin & Leslie, The Effect of Information on Product Quality

TABLE V
NUMBER OF HOSPITAL ADMISSIONS IN CALIFORNIA FOR DIGESTIVE DISORDERS

	Los Angeles County				California, except Los Angeles County			
	Food-related		Nonfood-related		Food-related		Nonfood-related	
Year	Number	% Change	Number	% Change	Number	% Change	Number	% Change
1995	401		54,412		607		128,949	
1996	431	7.5%	56,692	4.2%	675	11.2%	131,623	2.1%
1997	405	−6.0%	59,585	5.1%	634	−6.1%	139,645	6.1%
1998	351	−13.3%	61,305	2.9%	654	3.2%	145,261	4.0%
1999	309	−12.0%	60,915	−0.6%	601	−8.1%	148,338	2.1%

Data come from the *Office of Statewide Health Planning and Development* in California. We use version A of the data (i.e., for each patient we observe the month of admission and three-digit zip code).

Digestive disorders are defined as any admission for which the major diagnostic category is 6 (MDC 6). We include only admissions where the patient is admitted from home as part of an unscheduled visit.

An admission for a digestive disorder is counted as food-related if the principal diagnosis (using ICD-9-CM codes) is an illness that is transmitted via food in over 90 percent of occurrences. See text for further details.

Jin & Leslie, The Effect of Information on Product Quality

TABLE VI
THE EFFECTS OF GRADE CARDS ON ln (NO. HOSPITALIZATIONS FOR DIGESTIVE DISORDERS)

	Coefficient	Std. error
Mandatory disclosure	0.0271	0.0246
Voluntary disclosure	0.0716	0.0238***
Food-related × mandatory disclosure	−0.2243	0.0426***
Food-related × voluntary disclosure	−0.2055	0.0350***
Observations	6,840	
R^2	0.9809	

Covariates not shown include fixed effects for food-related illnesses in each three-digit zip code, fixed effects for nonfood-related illnesses in each three-digit zip code, and year and month dummies. We also include three-digit zip code illness-type random-effects (i.e., we cluster the standard errors by three-digit zip code and illness-type with Huber-White standard errors).

Stars denote significance levels: 99 percent confidence level (***), 95 percent confidence level (**), and 90 percent confidence level (*).

Jin & Leslie, The Effect of Information on Product Quality

TABLE VII
THE EFFECTS OF GRADE CARDS ON THE NUMBER OF FOOD-RELATED ILLNESS HOSPITALIZATIONS

	Coefficient	Std. error
A-tile revenue	−0.0146	0.0264
B-tile revenue	0.2892	0.0615***
C-tile revenue	1.1288	0.4367**
Total revenue × grade cards	0.0156	0.0140
Population × grade cards	−3.8327	1.0045***
Q1 × population	5.9537	1.0871***
Q2 × population	9.1979	0.7719***
Q3 × population	11.2465	1.3932***
Q4 × population	8.4846	1.1998***
Observations	191	
R^2	0.9156	

The regression also includes three-digit zip code random effects (i.e., we cluster the standard errors by three-digit zip code with Huber-White standard errors).

Revenue variables are in units of 10^6. Also, revenue is deflated using the BLS consumer price index for all urban consumers.

See text for a complete description of all variables.

Stars denote significance levels: 99 percent confidence level (***), 95 percent confidence level (**), and 90 percent confidence level (*).

Jin & Leslie, Wrap Up

- How do you think they came up with this idea?