

Empirical Evidence on Mergers

I. Event Study Methodology

1. Identify the “event”

What is the news?

- When did new information arrive?
- What is the content of the news?
- What were the expectations?
- Is this all the news during the “event”?

Select an event window (standard methodology)

- Relatively ad hoc trade-off
 narrow window (less noise, but may miss the news) v.
 broader window (include the news, and the noise!)

or model diffusion

- S. Ellison and W. Mullin (JLE, 2001)

Jointly estimate timing of information release and effect of information using isotonic regression techniques

Constrain expected price path to be monotonic, conditional on final event

Estimate market-adjusted price path restricting the path to be a general monotonic step form (nonincreasing for “bad” events, conversely for “good” events)

TABLE 2
TRADITIONAL EVENT STUDY

Event Number	1-Day Window	<i>t</i> -Statistic	7-Day Window	<i>t</i> -Statistic
1	.005	.549	-.009	-2.711
2	-.004	-.410	-.003	-.957
3	-.003	-.362	-.003	-.964
4	.004	.494	.003	.949
5	-.003	-.349	-.008	-2.455
6	-.006	-.660	.001	.217
7	.002	.270	-.000	-.122
8	-.011	-1.260	-.008	-2.482
9	.003	.383	-.002	-.465
10	-.018	-1.978	.001	.335
11	.007	.746	.020	3.084
12	-.028	-3.184	-.023	-3.588
13	-.003	-.369	-.006	-1.929
14	-.014	-1.605	-.003	-.831
15	-.005	-.599	.001	.291
16	-.007	-.798	-.000	-.080

NOTE.— See Figure 3 for the list of events.

HEALTH CARE REFORM

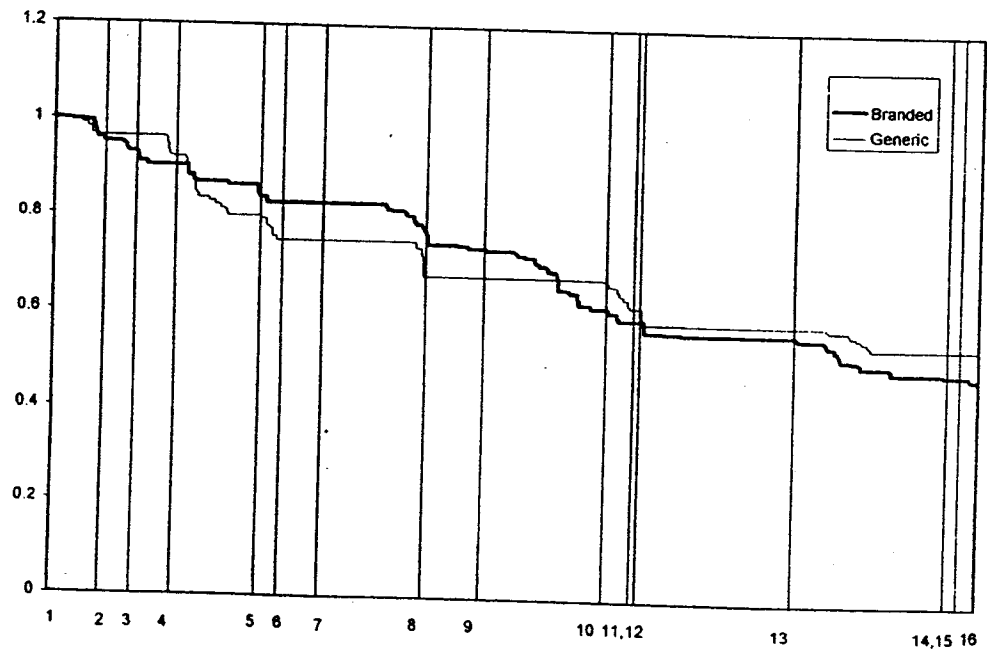


FIGURE 4.—Isotonic regression of branded and generic portfolios

Isotonic Regression

(Ellison & Mullin, 2001)

Find the regression function

$$\hat{f}(x) = \arg \min_{f(x)} \sum_{i=1}^n (y_i - f(x_i))^2$$

subject to

$$\hat{f}(x_j) \geq \hat{f}(x_k) \quad \text{for } x_j < x_k$$

$$\hat{f}'(x_j) = 0 \quad \forall x \notin \{x_1, x_2, x_3, \dots, x_n\}$$

Isotonic regression requires the function to be a nondecreasing step function;
Antitonic regression requires the function to be a nonincreasing step function.

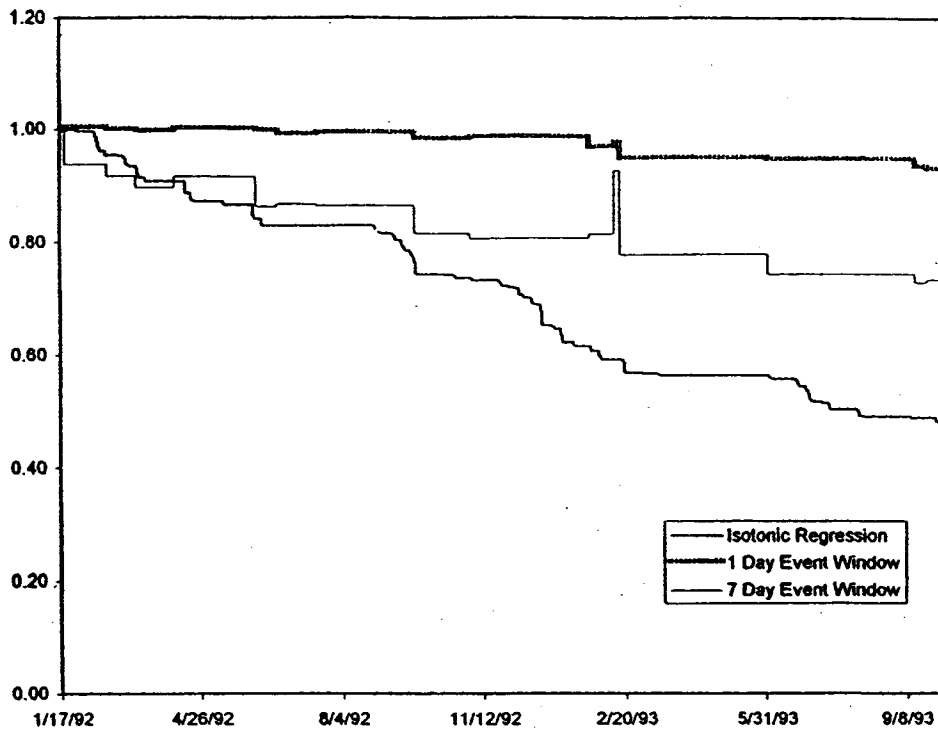


FIGURE 5.—Isotonic regression and traditional event study

HEALTH CARE REFORM

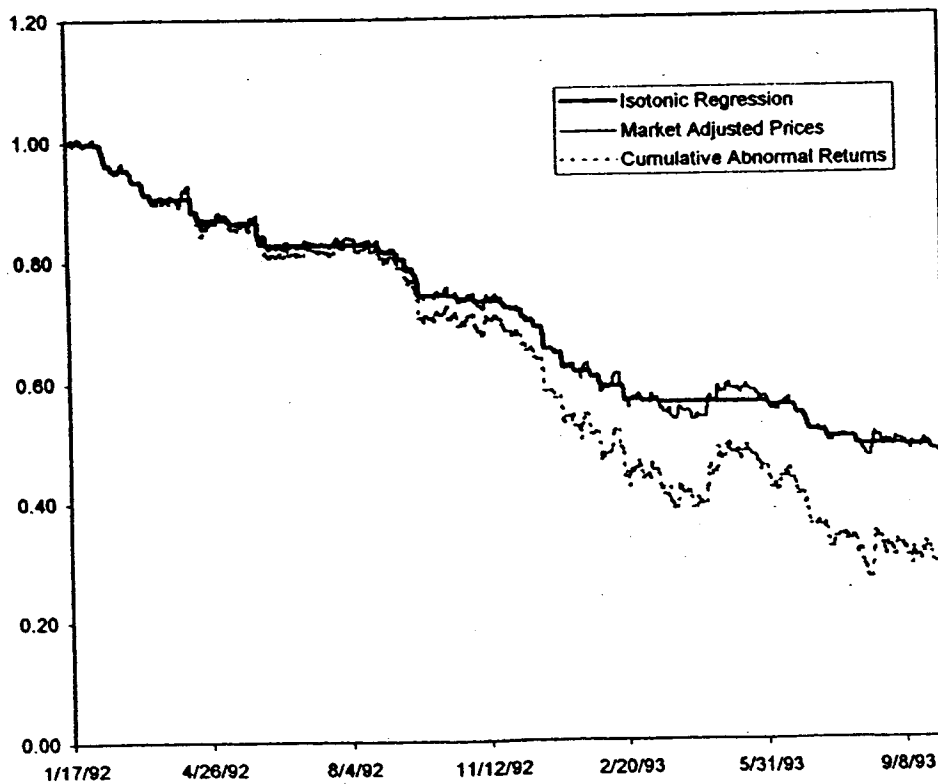


FIGURE 6.—Isotonic regression and CAR plot

2. Select the empirical model

Finance Method:

- 1) Estimate a Capital Asset Pricing Model (CAPM) using data before the event window opens.

$$R_{it} - R_{ft} = \alpha_i + \beta_i (R_{mt} - R_{ft}) + \varepsilon_{it}$$

where:

R_{it} = return on shares of firm i at time t

R_{ft} = risk-free rate of return at time t

R_{mt} = market rate of return at time t

β_i = "systematic risk of asset i" relative to market

- 2) Calculate predicted returns during event window:

$$\hat{R}_{it} = \hat{\alpha}_i + \hat{\beta}_i \tilde{R}_{mt}$$

where \sim denotes deviation from risk-free rate

$\hat{}$ denotes predicted/estimated values

- 3) Compute residuals
-typically, cumulated these over event window; CAR (cumulative average residuals)

$$\hat{e}_{it} = \tilde{R}_{it} - \hat{R}_{it}$$

$$CAR_{it} = \sum_{s \in W} \hat{e}_{is}$$

W = event window

“I.O. Method”:

1. Estimate modified CAPM

$$R_{it} = \alpha_i + \beta_i R_{mt} + \delta_i D_{it} + \varepsilon_{it}$$

where D_{it} = indicator variable for event window

δ_i = estimated average effect per time interval in event window

2. Could modify if desired to estimate different CAPM parameters before and after event.

Event Study Methods with Multiple firms

1. If expected responses are identical across firms:

Finance: Form portfolio of stocks for all firms; run one CAPM on portfolio; calculate residuals.

Value-weighted portfolio?

Equal-weighted portfolio?

I.O.: Run SUR; constrain $\delta_i = \delta$ for all firms.

2. If firms may have differential event responses:

a. Estimate separate δ_i ;

test mean significance or joint test of all δ_i significant

or

b. Model heterogeneity (e.g., Rose, 1985 RAND , Mullin³, RAND)

1) Leverage effects:

The proportional change in equity value will depend on the leverage (debt) of the firm. => adjust for D/V ratios.

2) Industry mix:

Control for firm's share of business in affected market:
e.g., Steel sales/Total sales

3) Model the expected change in V:

Function of observable characteristics?

$$\delta_i = \delta_0 + \delta_1 \frac{\text{Steel shipmts}_i}{\text{Total shipmts}_i} + \delta_2 \frac{\text{Track Investmt}_i}{K_i} + \delta_{3k} \text{Region}_{ik}$$

3. Data Sources

Share prices and returns:

CRSP files (at Sloan):
NYSE, ASE, NASDAQ
daily 1962 - present
monthly 1926 - present

Also: newspapers (pre-CRSP), Daily Stock Price Record (Dewey reference)

Market return:

- S&P 500
- CRSP value-weighted (equal -weighted) portfolio
- Other broad portfolio (some sensitivity for historical studies)

Risk-Free rate:

T-bills
probably not very critical for high frequency (daily, weekly) returns.

Events:

Wall Street Journal
New York Times
Trade Press for relevant industry

on-line accounts are fine, but you should read the stories, not just the headlines/entries!

TABLE 1 The Number of Rival Firms per Merger (*NR*), Values (*V*) and Market Shares (*S*) of the Bidder and Target Firms, Four-Firm Concentration (*CR₄*) and Merger-induced Change in the Herfindahl Index (*dH*) across Subsamples of the Data Base, 1963-81

Sample Characteristic	168 Unchallenged Mergers						98 Challenged Mergers					
	116 Horizontal			52 Nonhorizontal			80 Horizontal			18 Nonhorizontal		
	Range	Mean	Median	Range	Mean	Median	Range	Mean	Median	Range	Mean	Median
<i>NR</i>	1-55	15	6	1-51	10	5	1-29	5	3	1-18	5	3
<i>V_B</i>	9-8,557	847	325	7-9,896	1,017	450	10-23,555	1,544	452	101-4,520	1,577	845
<i>V_T</i>	10-6,480	151	27	10-1,130	80	22	1-9,470	471	101	10-1,412	313	100
<i>CR₄</i>	6-94	33	31	5-90	34	31	5-99	58	60	7-83	47	50
<i>S_B*</i>	.8-7.1	2.2	1.3		NA		.1-60.0	14.8	12.0		NA	
<i>S_T†</i>	.4-5.1	2.8	1.3	.6-20.0	10.0	5.1	.2-47.0	12.8	9.0	8.0-40.0	18.3	15.0
<i>dH‡</i>	.02-0.33	0.15	.05		NA		.02-24.18	3.33	1.00		NA	

NOTE.—NA = not available; subscript *B* and *T* denote bidder and target; *CR₄*, *S*, and *dH* are in percentages and refer to the major industry of the target firm; *V* is measured in millions of dollars and represents the *maximum* of the book value of the firm's assets and (if listed) the market value of its equity. The median, as reported, is such that 50% of the sample has a numerical value less than or equal to the numerical value listed.

* *N* = 37 observations (of the 116 unchallenged mergers) and 72 (of the 80 challenged mergers).

† *N* = nine observations (of the 116), six (of the 52), 64 (of the 80), and 13 (of the 18).

‡ *N* = five observations (of the 116) and 64 (of the 80).

Mergers and Market Concentration Doctrine

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TABLE 2 Percentage Average Abnormal Returns (*AAR*) to Bidder, Target, and Rival Firms over 2 Event Periods relative to the Day of the *Wall Street Journal* Announcement of the Merger Proposal, 1963-81 (*Z*-Values in Parentheses)^a

Sample	<i>N</i> Observations	<i>AAR</i> (-20, 10)	<i>AAR</i> (-3, 3)
I. 70 nonhorizontal mergers:			
Target firms	31	19.80*** (7.32)	14.88*** (13.15)
Bidder firms	59	-.41 (-.10)	.37 (.96)
Equal-weighted pairs of bidder and target firms	24	8.26*** (4.59)	6.96*** (9.32)
Equal-weighted portfolios of rival firms	70 ^b	-.87 (-.20)	-.07 (1.02)
II. 196 horizontal mergers:			
Target firms	104	18.69*** (12.05)	11.19*** (15.87)
Bidder firms	160	1.64* (1.87)	.64* (1.77)
Equal-weighted pairs of bidder and target firms	81	10.18*** (9.84)	5.49*** (12.11)
Equal-weighted portfolios of rival firms	196 ^c	1.26*** (2.50)	.58*** (2.86)
III. 80 horizontal challenged mergers:			
Target firms	43	21.70*** (10.14)	11.46*** (12.55)
Bidder firms	67	3.20** (2.02)	1.01* (1.85)
Equal-weighted pairs of bidder and target firms	37	13.43*** (9.31)	6.41*** (10.71)
Equal-weighted portfolios of rival firms	80 ^d	2.80*** (2.77)	.48** (2.01)

^a *AAR* and *Z* are defined in n. 23.

^b 70 portfolios containing 553 individual rival firms.

^c 196 portfolios containing 2,062 individual rival firms.

^d 80 portfolios containing 384 individual rival firms.

* Significantly different from zero at a 10% level of significance.

** Significantly different from zero at a 5% level of significance.

*** Significantly different from zero at a 1% level of significance.

Table 2

Average daily abnormal return to the portfolio of rival firms that produced either diazo or vesicular microfilm (estimated coefficients and *t*-statistics).

Event date	Days relative to newspaper announcement (day 0)				
	-20 to 10	-10 to 5	-3 to 3	-1 to 1	0
Merger proposal announcement	-0.0015 (-0.95)	-0.0016 (-0.77)	-0.0009 (-0.28)	-0.0024 (-0.50)	-0.0054 (-0.65)
Antitrust complaint announcement	-0.0005 (-0.24)	-0.0004 (-0.14)	0.0031 (0.74)	0.0147 (2.34)	0.0157 (1.45)

Table 3

Average daily abnormal return to the rival firm (3M) that produced vesicular microfilm (estimated coefficients and *t*-statistics).

Event date	Days relative to newspaper announcement (day 0)				
	-20 to 10	-10 to 5	-3 to 3	-1 to 1	0
Merger proposal announcement	-0.0038 (-2.34)	-0.0046 (-2.05)	-0.0043 (-1.31)	-0.0053 (-1.06)	-0.0037 (-0.42)
Antitrust complaint announcement	-0.0016 (-0.72)	-0.0003 (-0.09)	0.0014 (0.33)	0.0085 (1.28)	0.0124 (1.08)

TABLE 4 Estimated Event Responses, U.S. Steel

Event	U.S. STEEL
STANCOMM	-.01563 (-.9302)
STANOIL	.01233 (.7280)
REPPULL	-.01360 (-.8078)
PROSRPT	-.01879 (-1.1181)
BOCRPT	-.00273 (-.1623)
USSRUMOR	-.13739 (-8.1402)
USSDEN	.07748 (4.6075)
LEASECAN	-.01356 (-.8068)
DISSUIT	-.09736 (-5.7882)
DISTDEC	.02620 (.8797)
GOVAPPL	-.02850 (-.9618)
SCTREARG	.06362 (2.1531)
SCTDEC	.03826 (1.7596)

t-statistics are in parentheses.

TABLE 5 Average Estimated Event Responses

Event	STEEL RIVALS	RAILROADS	GN RAILWAY	STREET RAILS
USSRUMOR	.00374 (.1782)	.02033 (3.0246)	.00063 (.0698)	
USSDEN	.00903 (.4316)	-.01320 (-1.9742)	.00104 (.1160)	
DISSUIT	-.03532 (-1.6874)	.01260 (1.8828)	.01203 (1.3362)	
SCTREARG	.06233 (1.7707)	-.01860 (-.7394)	.00458 (.4072)	
SCTDEC	.04260 (1.3366)	-.02858 (-1.7453)	-.00115 (-.0876)	-.02551 (-.3533)

t-statistics are in parentheses.

TABLE A2 Trust Competitor Subsample (in chronological order)

Trust	Event Date	Competitor*
Amer. Glucose Sugar Ref.	1-22-98	American Sugar Refining
Cleveland Brew. & Malting	3-5-98	American Spirits Mfg.
American Hard Rubber	3-12-98	U.S. Rubber
Federal Steel	6-4-98	Colorado Fuel & Iron, Columbus & Hocking, Tennessee Coal & Iron
Kentucky Distilleries	2-4-99	American Spirits Mfg.
American Beet Sugar	2-11-99	American Sugar Refining, Hawaiian Com. and Sugar
National Salt	3-4-99	Pennsylvania Salt
Amer. Smelting and Ref.	3-11-99	National Lead
American Shipbuilding	3-11-99	Cramps Ship and Engine
American Hide and Leather	3-18-99	U.S. Leather
National Screw	3-25-99	Simmons Hardware
Continental Cotton Oil	4-8-99	American Cotton Oil
Amalgamated Copper	4-29-99	Allouez Mining, Arnold Mining, Atlantic Mining, Baltic Mining, Calumet and Hecla, Franklin Mining, Old Dominion Copper, Tamarack Mining
Pacific Coast Biscuit	5-6-99	National Biscuit
Monongahela River Consol.	6-3-99	Dominion Coal, New Central Coal
American Writing Paper	6-10-99	International Paper
American Grass Twine	6-24-99	Standard Rope and Twine
American Ice	7-8-99	Knickerbocker Ice of Chicago
Pittsburgh Coal	8-26-99	Dominion Coal, New Central Coal
National Starch	11-4-99	American Sugar Refining, American Beet Sugar
Atlantic Transport	3-10-00	Pacific Mail
Standard Screw	4-7-00	Russell and Erwin, Simmons Hardware
Massachusetts Breweries	8-11-00	Distilling Corp. of America
U.S. Steel	2-9-01	Colorado Fuel and Iron, Republic Iron and Steel, Tennessee Coal and Iron
Chadwick-Boston Lead	4-6-01	National Lead

TABLE A2 Continued

Trust	Event Date	Competitor*
Amalgamated Copper	4-20-01	Allouez Mining, Arnold Mining, Atlantic Mining, Baltic Mining, British Columbia Copper, Calumet and Hecla, Centennial Mining, Franklin Mining, Old Colony Mining, Quincy Mining, Rhode Island Copper, Union Copper L&M, Winona Copper, Wolverine Copper
Eastern Milling and Export	4-20-01	Marsden Company
U.S. Shipbuilding	5-4-01	American Shipbuilding, Cramps Ship and Engine
Consolidated Tobacco	6-8-01	Havana Commercial
Corn Products	6-15-01	American Sugar Refining
U.S. Reduction & Refining	7-6-01	American Smelting & Refining
Fairmont Coal	7-13-01	Dominion Coal, Monongahela River, New Central Coal, Pittsburgh Coal, Texas & Pacific Coal
Clarksburg Fuel	10-12-01	Dominion Coal, Monongahela River, New Central Coal, Pittsburgh Coal, Texas & Pacific Coal
Lehigh Valley Brewing	10-19-01	Distilling Corp. of America
Red Jacket Coal & Coke	12-14-01	Dominion Coal, New Central Coal, Texas and Pacific Coal
Keystone Coal & Coke	3-8-02	Monongahela River, New Central Coal, Pittsburgh Coal, Texas and Pacific Coal
Inter. Mercantile Marine	4-26-02	Pacific Mail
Havana Company	5-31-02	Universal Tobacco
Amalgamated Sugar	7-26-02	American Sugar Refining
U.S. Realty and Construction	8-2-02	Manhattan Beach, Brunswick Land and City Improvement Company
Federal Mining and Smelting	8-22-03	National Lead, American Smelting & Refining

* When more than one competitor is listed against a trust, our analysis is conducted on an equally weighted portfolio of all the listed competitors to the trust.

TABLE 4 Average Weekly Abnormal Returns and Cumulative Abnormal Returns for 41 Trust Participants and Participant Portfolios

Week	Market Model			Mean Adjusted Model		
	AR(%)	t-statistic	Positive/ Negative	AR(%)	t-statistic	Positive/ Negative
-8	-1.11	-0.01	24/17	.14	-.03	25/16
-7	-.83	.08	22/19	-.10	.86	22/19
-6	.00	2.14**	18/23	-.10	1.79*	21/20
-5	.51	1.12	22/19	.45	.94	21/20
-4	.54	1.42	22/19	.58	1.59	18/23
-3	-.58	1.10	20/21	-.57	.89	20/21
-2	3.54	5.07***	30/11***	3.44	4.80***	31/10***
-1	6.42	7.48***	25/16	6.60	7.34***	28/13**
0	5.07	3.30***	26/15*	5.31	3.12***	27/14**
+1	-1.72	.13	15/26*	-1.85	.25	17/24
+2	3.31	.83	21/20	2.89	.67	20/21
+3	-1.06	-.74	15/26*	-1.05	-.44	14/27**
+4	2.58	1.37	13/28**	3.20	1.50	14/27**

Weekly Interval	Average Cumulative Abnormal Returns (CARs)			Average Cumulative Abnormal Returns (CARs)		
	CAR(%)	z-statistic	Positive/ Negative	CAR(%)	z-statistic	Positive/ Negative
(-2, 0)	15.04	9.15***	31/10***	15.35	8.81***	29/12***
(-3, +1)	12.74	7.64***	31/10***	12.93	7.30***	29/12***
(-4, +4)	18.10	6.65***	31/10***	18.55	6.57***	28/13**
(-8, +4)	17.68	6.46***	26/15*	18.98	6.45***	26/15*

*** $\alpha = .01$, two-tailed test, ** $\alpha = .05$, two-tailed test, * $\alpha = .10$, two-tailed test.

TABLE 5 Average Weekly Abnormal Returns and Cumulative Abnormal Returns for 41 Trust Competitors and Competitor Portfolios

Week	Market Model			Mean Adjusted Model		
	AR(%)	t-statistic	Positive/ Negative	AR(%)	t-statistic	Positive/ Negative
-8	-.98	-1.56	15/26*	-.98	-1.38	15/26*
-7	-.55	-.57	14/27**	-.42	-.28	16/25
-6	-.81	-1.03	18/23	-.95	-1.17	16/25
-5	.60	.30	16/25	.28	-.12	17/24
-4	.62	1.12	22/19	.30	.57	21/20
-3	-2.25	-2.57**	11/30***	-1.87	-1.73*	14/27**
-2	-2.38	-2.22**	14/27**	-2.45	-1.97*	14/27**
-1	-.59	-.87	16/25	-.22	-.24	18/23
0	-.60	-.65	14/27**	-.45	-.55	14/27**
+1	-1.05	-2.20**	13/28**	-1.21	-1.79*	12/29***
+2	-.59	-.88	15/26*	-.64	-.81	15/26*
+3	-.09	-.01	19/22	-.82	-.80	17/24
+4	-.88	-.88	14/27**	-.91	-1.57	16/25

Weekly Interval	Average Cumulative Abnormal Returns (CARs)			Average Cumulative Abnormal Returns (CARs)		
	CAR(%)	z-statistic	Positive/ Negative	CAR(%)	z-statistic	Positive/ Negative
(-2, 0)	-3.57	-2.16**	15/26*	-3.12	-1.59	12/29***
(-3, +1)	-6.87	-3.81***	10/31***	-6.19	-2.81***	11/30***
(-4, +4)	-7.81	-3.05***	12/29***	-8.26	-2.97***	10/31***
(-8, +4)	-9.55	-3.33***	11/30***	-10.34	-3.29***	10/31

*** $\alpha = .01$, two-tailed test, ** $\alpha = .05$, two-tailed test, * $\alpha = .10$, two-tailed test.

Horizontal Mergers in Paper (Pesendorfer, 1998)

Investment
FOC:

$$x_i \left\{ [MR_i(K, X_i) - c_i(\delta K_i + X_i)] \frac{\beta}{1-\beta} - \frac{\partial Y}{\partial X} \Big|_{X=X_i} \cdot (X_i > 0) \right\} = 0$$

X_i = investment by firm i

K_i = capital stock

δ = depreciation factor

β = discount rate

$Y(X)$ = cost of new capacity X

assume:

full capacity utilization

no-cost scrapping of excess capacity

initial Cournot equil, $E(\text{future mergers}) = \emptyset$

one shot game

If $X_i \neq 0$:
re-write for c_i

$$c_i = MR_i - \frac{\partial Y}{\partial X} \cdot (X_i > 0) \cdot \frac{1-\beta}{\beta}$$

where $MR_i = MR_i(K, X, K_i, X_i)$

This should look familiar!

Remarks follow in much the same spirit as Farrell/Shapiro:

ex: R4: if $x_m = \emptyset$, then $C_m < C$

intuition: since MR_m declines post-merger, if firms maintain capacity (output), it must be due to much lower costs

R5: If $C_m = C$, merger reduces welfare

intuition: if costs are unchanged, only effect is output reduction, which generates welfare loss

R6: If $x_m = \emptyset$, welfare increases with merger

intuition: see R4.

Empirical Approach:

- Collect data on plant capacity by type of paper
 - industry capacity ↑ 20% 1978-1992
 - substantial firm heterogeneity
 - most capacity growth by ↑ speed of existing machines
 - 24% of firms change capacity in any year $\left\{ \begin{array}{l} 6\% \downarrow \\ 18\% \uparrow \end{array} \right.$
- Collect price data by product (census data)
- Discrete choice models estimate decision to add or scrap capacity as a function of recent merger activity. (Table 4)
- Compute implied cost changes

i) estimate $\ln(P_{kt}) = \alpha \cdot \text{GDP}_t + \gamma \ln(Q_{kt})$

• k = paper product class

• instrument for Q with paper ind. w

ii) construct $\hat{MR}_i = \hat{P} + \frac{\partial \hat{P}}{\partial Q} \cdot K_i$

iii) construct $\hat{C}_i = \hat{MR}_i - \frac{\partial Y}{\partial X} \cdot (x_i > 0) \cdot \frac{1-\beta}{\beta}$

fix $\beta = .95$, $\delta < 1$, $\frac{1-\beta}{\beta} \cdot Y(x)$ quadratic in x

See tables 5A-5E

Results

1. Merging firms are drawn from lower part of cost distribution

2. Costs decline subsequent to merger

- Raw data :
 - 1/3 firms increase market share post-merger
 - 2/3 firms decrease market share post-merger
- Probit/multinomial logit:
 - Mergers increase likelihood of scrapping capacity ($x_i < 0$)
 - Hard to pin down effect on adding capacity (positive, noisy)
- Apparently, enough capacity is kept to imply expansion relative to optimal capacity implied by $c_m = c_0$ (i.e., no merger cost saving capacity)

3. Mergers increase aggregate welfare

- Merged firms gain most: $\Delta\pi_m \sim + \$470m$
- Unmerged firms lose: $\Delta\pi_{nm} \sim - \$100m$
- Consumers gain $\Delta CS \sim + \$200m$
- Net welfare gain in preferred spec: $+ \$570m$

	(18,991)	(18,702)	(19,682)	(40,571)	(4,273)
Gain to Un-merged Firms	-14,198	-11,910	-13,180	4,333	-16,903
	(7,234)	(6,269)	(20,030)	(29,608)	(1,809)

5. OTHER PAPERS:

Total Welfare	31,166	30,507	30,396	25,590	36,311
	(4,094)	(4,100)	(6,209)	(9,016)	(894)
Consumer Surplus	4,888	4,347	7,953	8,405	6,319
	(1,713)	(1,610)	(4,486)	(6,213)	(632)
Producer Surplus	26,278	26,160	22,444	17,185	29,992
	(2,479)	(2,683)	(2,945)	(3,533)	(328)
Gain to Merged Firms	28,832	28,651	26,765	21,470	34,280
	(3,439)	(3,581)	(4,633)	(6,404)	(752)
Gain to Un-merged Firms	-2,554	-2,490	-4,322	-4,285	-4,288
	(1,036)	(1,050)	(2,715)	(3,499)	(485)

6. TISSUE:

Total Welfare	298,692	301,234	294,882	293,335	295,869
	(14,676)	(14,595)	(21,106)	(25,415)	(3,338)
Consumer Surplus	96,089	96,097	96,269	91,971	93,258
	(7,950)	(8,209)	(10,542)	(12,404)	(1,714)
Producer Surplus	202,604	205,137	198,613	201,365	202,611
	(6,815)	(6,423)	(10,614)	(13,196)	(1,624)
Gain to Merged Firms	242,905	245,941	234,938	230,820	250,956
	(11,952)	(11,619)	(16,422)	(19,950)	(3,056)
Gain to Un-merged Firms	-40,301	-40,804	-36,326	-29,456	-48,345
	(5,240)	(5,238)	(5,894)	(6,907)	(1,432)

7. BOXBOARD:

Total Welfare	412	72,568	-17,910	-38,689	60,377
	(16,381)	(13,263)	(18,191)	(18,204)	(10,913)
Consumer Surplus	-22,098	12,865	-18,346	-17,315	-27,686
	(8,594)	(7,484)	(8,466)	(6,736)	(6,669)
Producer Surplus	22,510	59,702	436	-21,374	88,063
	(8,412)	(6,931)	(10,240)	(11,908)	(5,908)
Gain to Merged Firms	11,832	65,724	-8,566	-31,594	74,950
	(12,233)	(9,652)	(14,051)	(15,507)	(7,889)
Gain to Un-merged Firms	10,679	-6,022	9,002	10,220	13,113
	(4,235)	(3,466)	(4,134)	(3,900)	(3,056)

8. LINERBOARD:

Total Welfare	163,587	108,186	84,374	178,452	-121,580
	(82,962)	(91,518)	(117,588)	(91,258)	(37,630)
Consumer Surplus	90,203	-31,157	69,329	168,745	-178,631
	(64,079)	(72,043)	(72,225)	(72,517)	(31,272)
Producer Surplus	73,384	139,344	15,045	9,707	57,050
	(52,942)	(66,982)	(65,256)	(55,270)	(30,739)
Gain to Merged Firms	112,771	128,791	45,789	98,758	-26,638
	(60,261)	(68,989)	(84,430)	(67,712)	(30,158)
Gain to Un-merged Firms	-39,386	10,553	-30,744	-89,051	83,688
	(28,788)	(27,798)	(31,328)	(39,047)	(13,768)

Some caveats

1. Investment:

- Do we observe equilibrium investment levels?
 - Only 24% of firms change capacity each year
 - Not all capacity changes \Leftrightarrow “investment”
- Estimates assume $\delta < 1$ to identify costs for firms w/o rated capacity changes. How much does this matter?
- Estimates assume $Q_i = \delta K_i + x_i$. True in data?

2. Demand:

- Is homogeneous product sold in single national market a reasonable approximation for these products?
 - \$300m of total gain from tissue products alone
- Very stripped down model (just GDP, constant elas.)

3. Welfare calculations assume all implied cost reductions are efficiency gains. How should we account for changes in monopsony power?

4. Do these results match auxiliary evidence?

- Aggregate up to get profit effects of each merger: do ex ante share price movements, ex post returns, ex post profit data provide corroboration?