

# PRIVATE AND PUBLIC MERGER WAVES

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# What do we do?

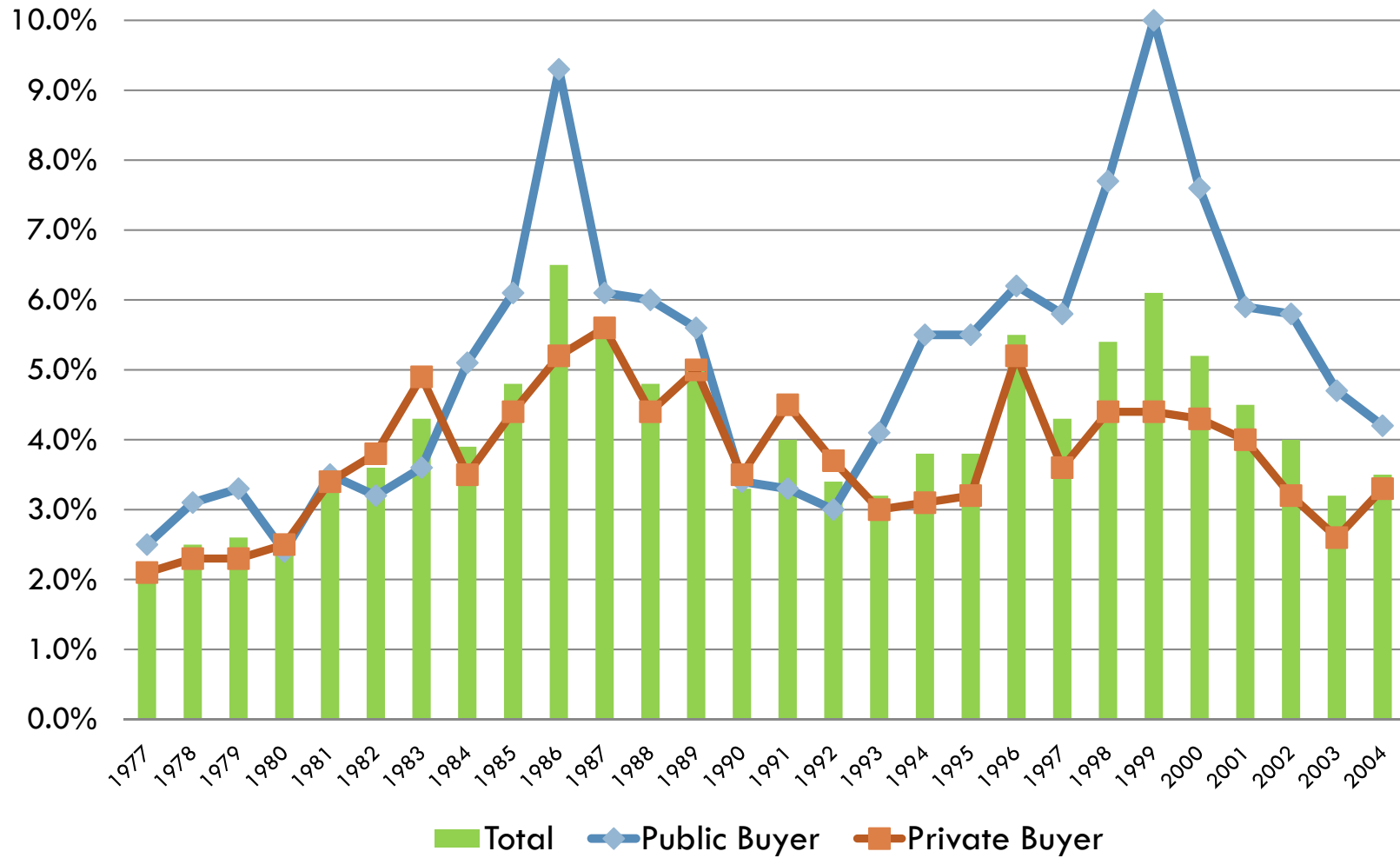


- We analyze public and private firm merger waves in US manufacturing using plant-level data.
- Why:
  - ▣ Private mergers have not be studied and compared to public mergers
  - ▣ Public and private firms differ:
    - Size and productivity
    - Access to capital
    - Corporate Governance

# What do We Know about Merger Waves?

- Acquisitions are pro-cyclical (i.e. mergers do come in waves)
- What drives merger waves?
  - ▣ Real factors: Productivity shocks, technology
  - ▣ Financial factors: liquidity, access to capital
  - ▣ Other factors: preemptive mergers, empire building
- What are the outcomes of merger waves?
  - ▣ Stock returns versus operating performance

## Transaction by Buyer Type



The aggregate merger wave, to a large extent, is driven by higher participation of public firms.

# Questions Addressed by Our Paper

Q

- Why do public and private firms behave differently over the merger waves?

1

- Do public and private firms react differently to wave-related macro factors such as liquidity, credit ratings or investment opportunities?

2

- Being public itself is a choice! Which firms choose to become public? Do differences reflect the selection or treatment effect?

3

- Do public and private firms differ in merger outcomes?

# A Preview of Our Results

1

- Public firms respond to their own fundamentals and changes in investment climate more than private firms do.
- No evidence that waves are driven by industry misvaluation

2

- Large, more productive firms in high growth and capital intensive industries choose to become public
- Later, these firms acquire more when opportunities rise

3

- Mergers lead to gain in efficiency. On-the-wave mergers between public buyers and sellers are particularly value enhancing.

4

- Favorable financing conditions such as high liquidity stimulate acquisitions. Productive firms take advantage and engage in value-enhancing transactions.

# A Preview of Our Results



5

- Acquisitions by public firms with less than investment grade debt are the most sensitive to liquidity shocks

6

- The gain in efficiency of acquired assets does not depend on the method of payment

# Background



- Overall mergers: Betton, Eckbo, Thornburn (2008) survey.
- Merger Waves:
  - ▣ Mitchell and Mulherin (1996), Maksimovic and Phillips (2001), Harford (2006) and Dittmar and Dittmar (2008), Stouraitis and Rau (2008)
- Public v private firms:
  - ▣ Celikyurt, Sevilir, and Shivdasani (2008), Hovakimian, and Hutton, (2008)
- Initial conditions matter:
  - ▣ Lemmon, Roberts, and Zender (2008)
- Valuation:
  - ▣ Rhodes-Kropf and Viswanathan (2004)

# “Neoclasical Model”

- Skill and Opportunity costs:

H1: An acquirer is more likely to retain an asset if he can improve or maintain its productivity, and sell an asset if he cannot.

H2: The acquirer is more likely to sell an asset that he cannot improve when the market price of those assets is higher.

H3: An acquirer whose marginal plants are efficient is less likely to sell plants acquired in a merger.

H4: Acquirers whose marginal plants are efficient is less likely to sell a plant if the industry in which the plant operates receives a positive value shock.

# The setup

Productivity

Productivity

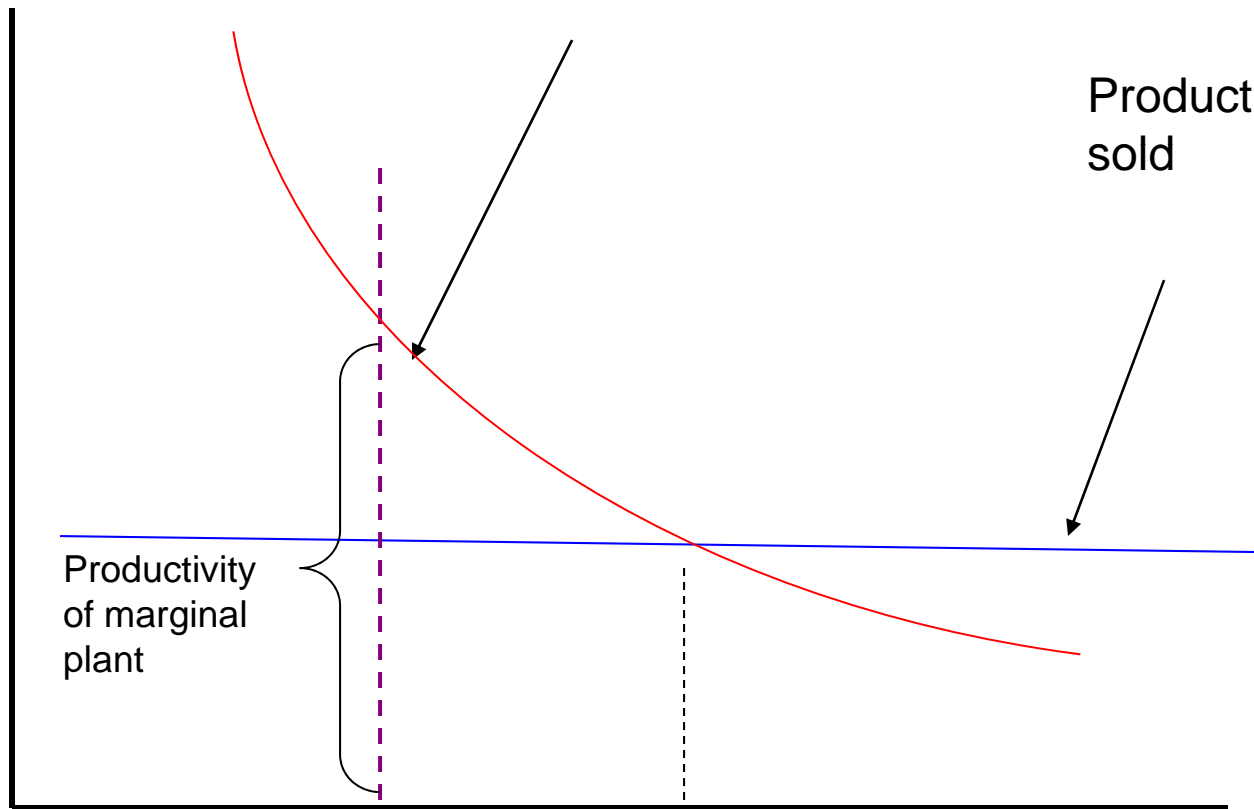
Productivity if sold

Productivity of marginal plant

actual size

optimal size

# of plants



# The setup

Productivity

Productivity

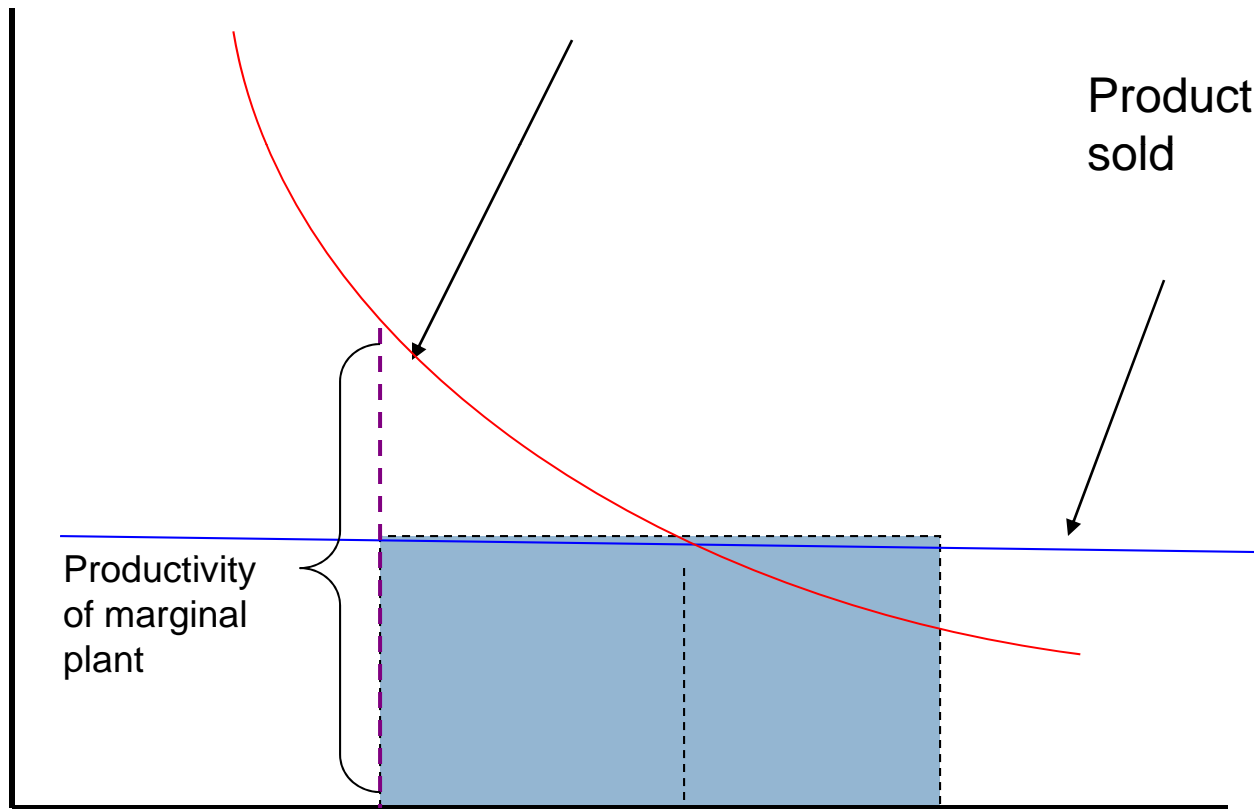
Productivity if sold

Productivity of marginal plant

# of plants

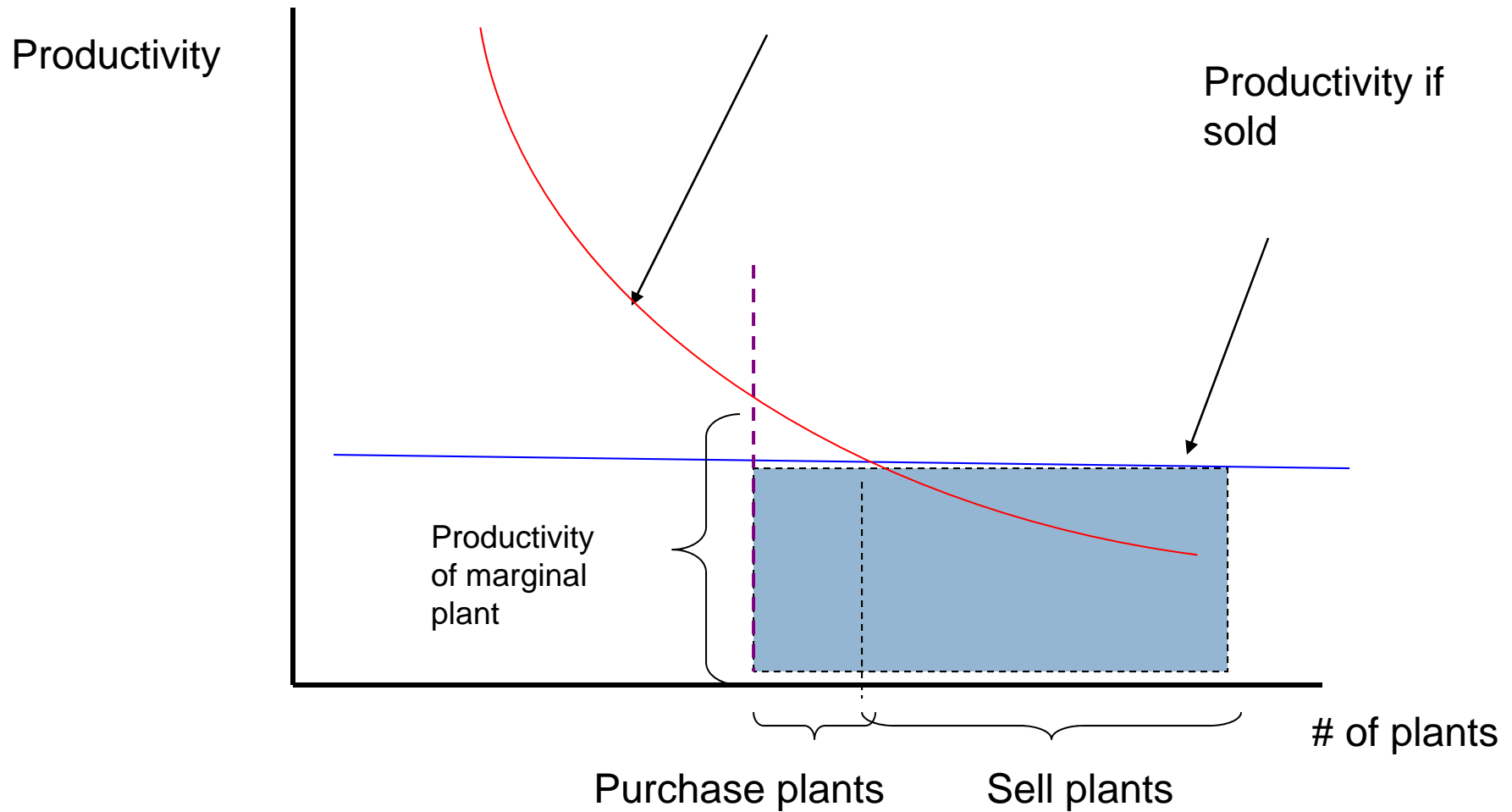
Purchase plants

Sell plants



# The setup

Productivity



# Industry shock

Productivity

Productivity

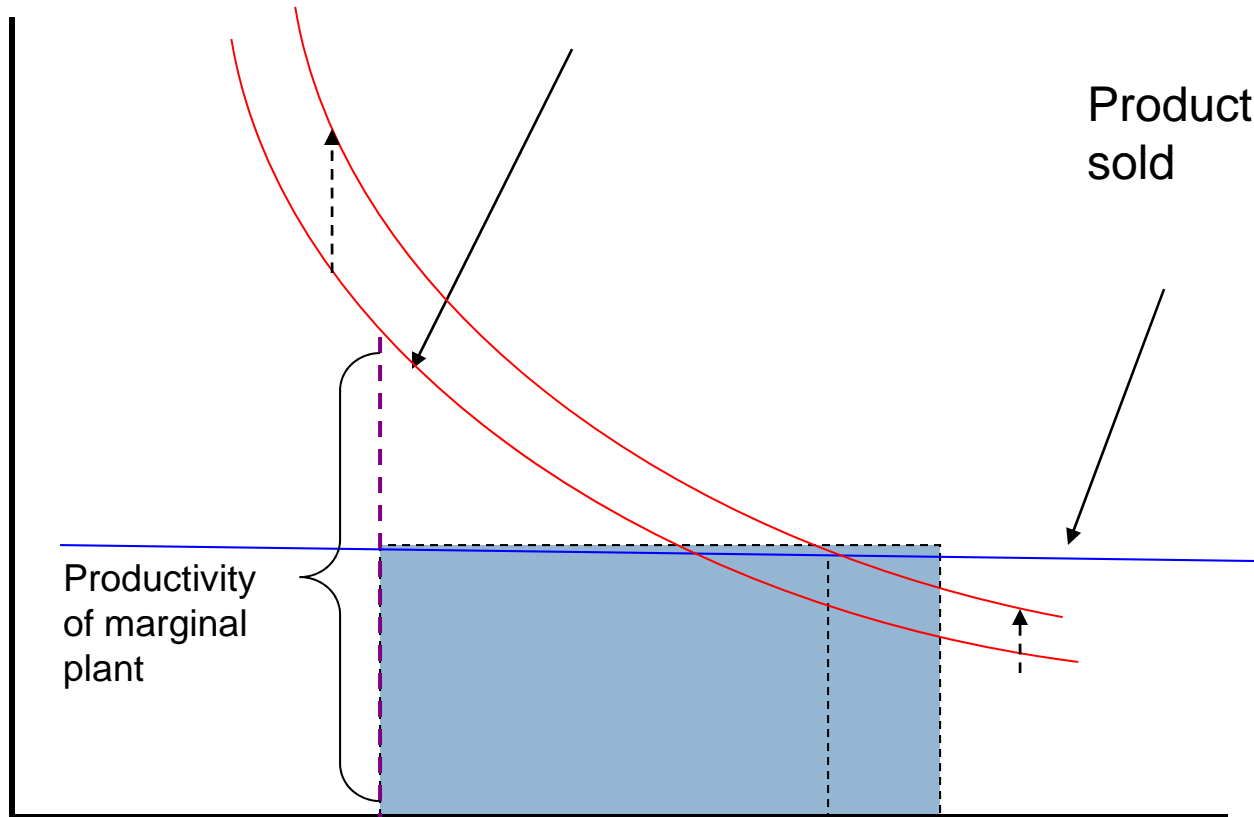
Productivity if sold

Productivity of marginal plant

# of plants

Purchase plants

Sell plants



# Our Data



- The Longitudinal Research Database (LRD) and the Longitudinal Business Database (LBD) maintained by the Census Bureau
  - Manufacturing industries only (SIC 2000 – 3999)
  - All large firms (with >250 employees) and a sample of small firms on a rotating 5-year panel
  - Plant-level input and output information: value of shipments; labor, material and capital costs
  - Sample period: 1974 – 2004
  - Our final sample: 500,000 firm-years and 1.2 million plant-years
  
- Matched with Compustat to identify public firms.

# Advantages of the Census Datasets

1. It covers both public and private firms!
2. Unique plant and firm identifier
  - ▣ We can identify and track the exact plants that change ownership
3. Input and output information
  - ▣ We can estimate productivity on the plant level
4. Used in merger/firm structure research
  - ▣ Maksimovic and Phillips (2001, 2002, 2008), Schoar (2002), Yang (2008) and Maksimovic, Phillips, and Prabhala (2008)
  - ▣ Haltinwanger, Jarmin and Miranda (2009)

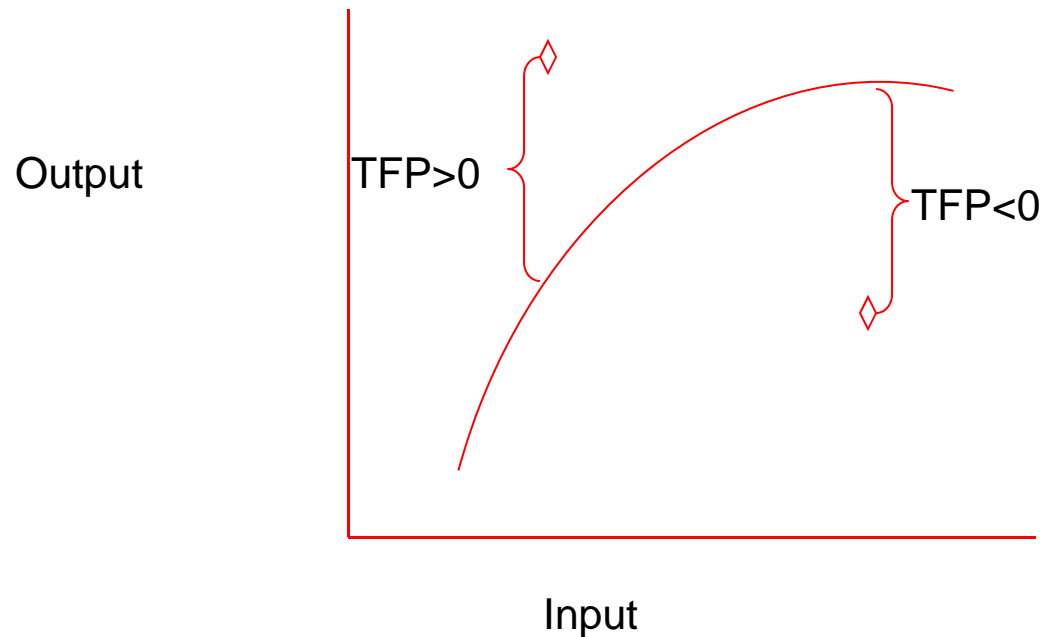
# ECONOMETRIC CHALLENGE



- Public and private firms have different characteristics
  - ▣ Size productivity
  - ▣ Selection into public status
- Several approaches
  - ▣ Descriptive
  - ▣ Matching and samples with overlapping supports
  - ▣ Estimate the propensity to go public and use this propensity to predict mergers over 10 years later after firm birth.

# Total Factor Productivity

- Total Factor Productivity --- industry adjusted



# Productivity Calculation

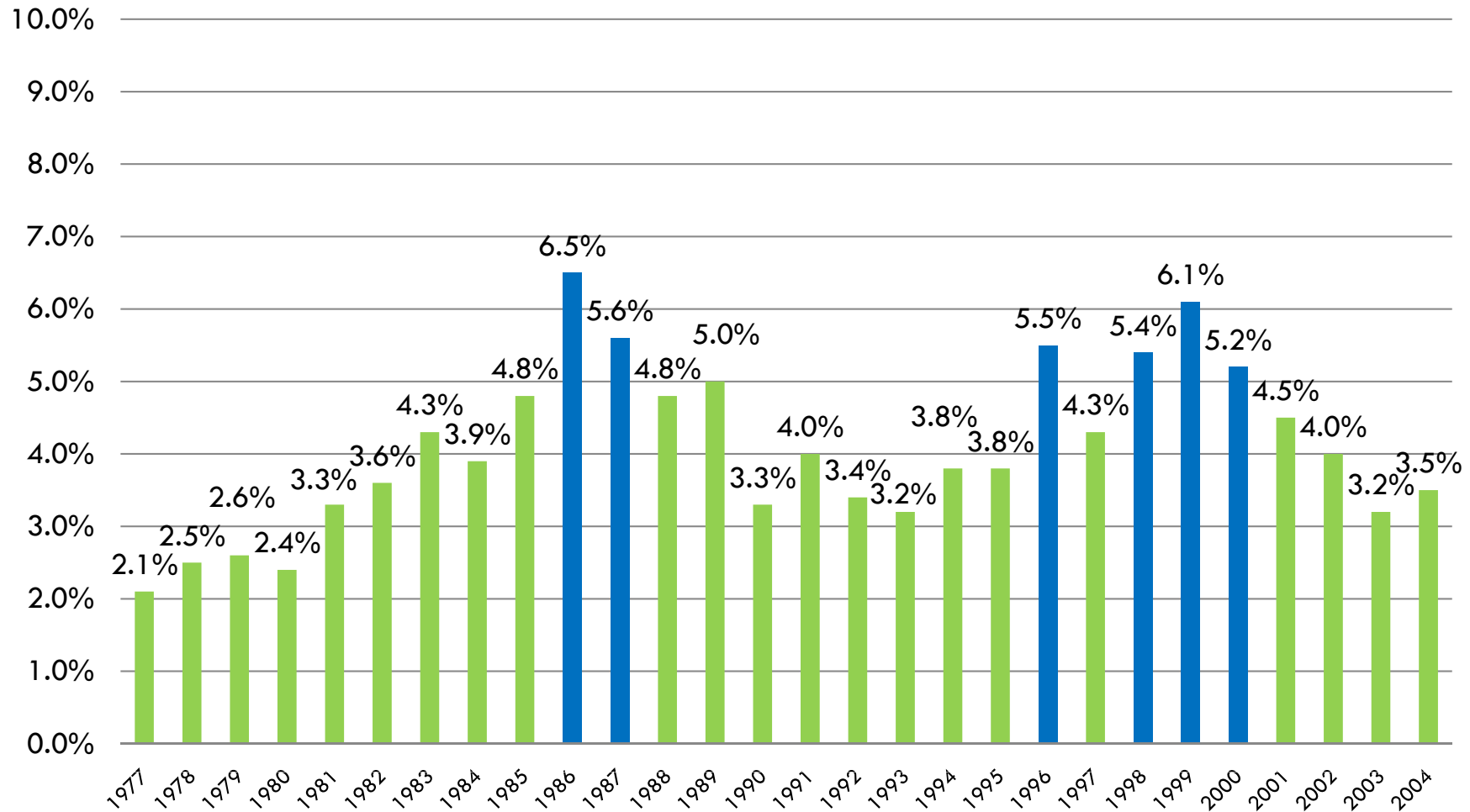
- We calculate a plant-level total factor productivity (TFP) as a measure of efficiency.
- It compares the actual output with the predicted output which is estimated using the amount of input.
- A positive TFP suggests above-average productivity. By construction, the average TFP in the industry is zero.
- We estimate a five-year rolling regression with firm fixed effects and standardize TFP by industry standard deviation to account for estimation precision
- We also adjusted for mean-reversion in change of TFP by subtracting the predicted change off the actual change.



## A Few Quick Facts about Merger Waves

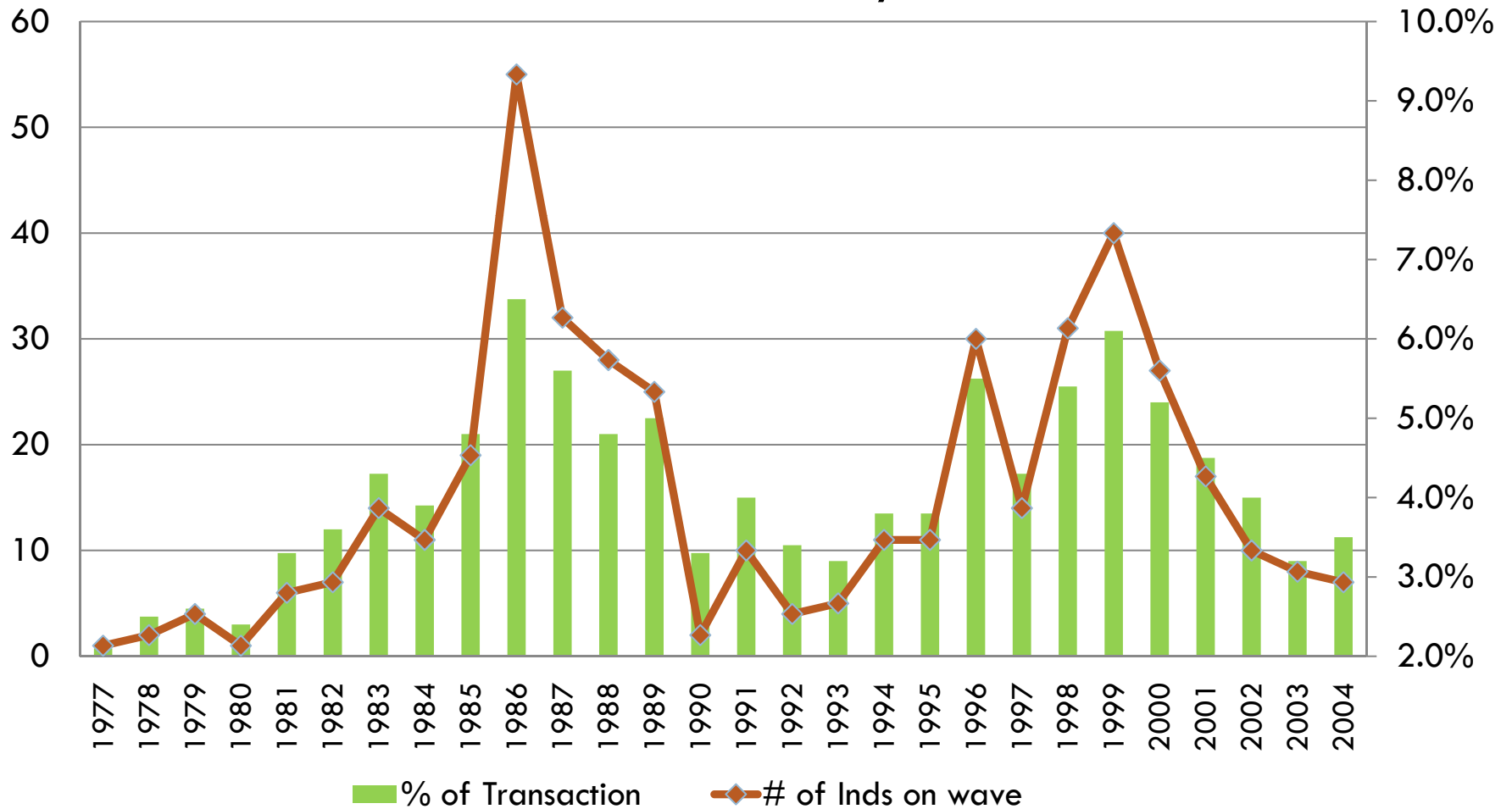
We define six aggregate wave years with rate of transaction greater than the mean rate + stdev(mean rate).

## % of Plants in Trans. In US Manufacturing Industries

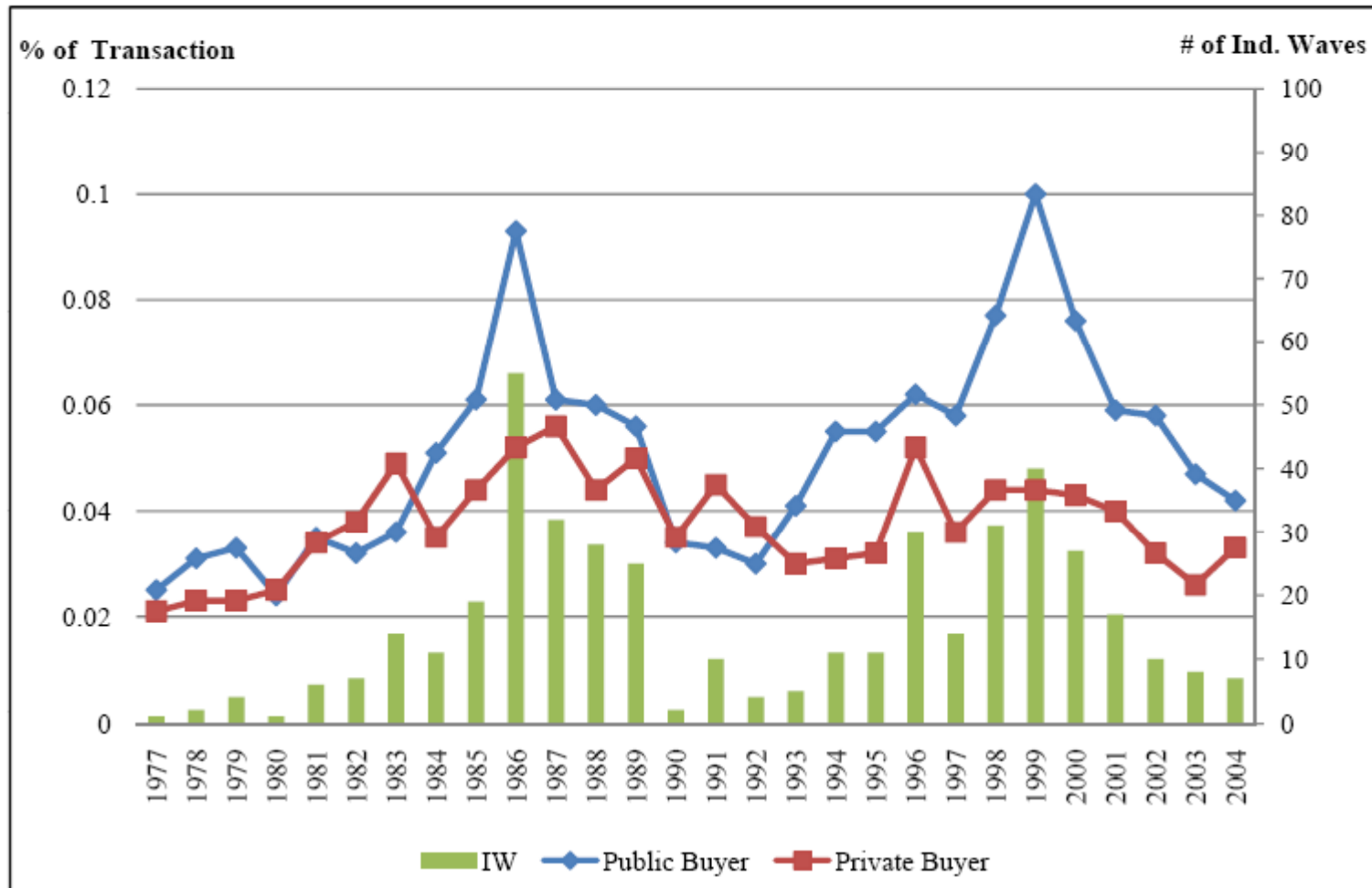


The aggregate wave is driven by many industries having frequent transactions simultaneously.

## Global and Industry Waves



# Private and Public Merger Waves



Waves are not associated with sig. reallocation between public and private firms. More public-to-public deals are done on the wave. (Table 1A)

	% of plants in trans.	% of Full Sales	% of Partial Sales
Off-the-wave Years	3.70%	1.78%	1.96%
On-the-wave Years	5.70%	2.80%	2.91%

Buyer	Off-the-Wave	On-the-Wave
Private	65%	57%
Public	35%	42%

Seller	Off-the-Wave	On-the-Wave
Private	70%	60%
Public	30%	40%

Transaction		
Public Buyer Public Seller	12%	19%
Public Buyer Private Seller	23%	24%
Private Buyer Public Seller	18%	21%
Private Buyer Private Seller	48%	37%

## Table 2

Public waves – very cyclical, more transactions on the waves.

Table 2: Merger Waves by Industry

This table lists the most public and the most private industries in our sample based on percentage of output produced by public and private firms. It also presents the percentage of transaction in each industry on- and off-the-wave.

### Most "Public" Industries

Industry	Number of Firms	Number of Establishments	% of Public Firms	% of Output by Public Firms	% of Trans. off-the-wave	% of Trans. on-the-wave
Guided Missiles & Space Vehicle	34	66	61%	70%	5.7%	7.4%
Search & Guide Instruments	108	179	44%	54%	6.9%	11.6%
Paperboard Mills	58	152	42%	59%	6.4%	9.2%
Engines and Turbines	72	125	40%	56%	5.1%	8.7%
Communication Equip	342	501	39%	49%	5.6%	7.4%
Primary Smelting	53	88	39%	54%	6.8%	7.0%
Petroleum Refining	85	189	39%	55%	7.5%	12.8%
Industrial Organic Chemicals	188	417	39%	55%	6.5%	10.1%
Rubber Products	36	68	39%	56%	7.7%	21.6%
Computer & Office Equip	344	460	38%	46%	5.0%	5.6%
Average					6.3%	10.1%

Table 2 – Panel B

More “private” industries— less cyclical, relatively less transactions on the waves vs. more “public” industries.

**Least "Public" Industries**

Industry	Number of Firms	Number of Establishments	% of Public Firms	% of Output by Public Firms	% of Trans. off-the-wave	% of Trans. on-the-wave
Wood Containers	180	205	3%	4%	1.7%	3.5%
Women's Outwear	528	654	5%	12%	1.8%	2.3%
Concrete	721	1496	5%	14%	3.7%	5.0%
Jewelry	166	181	6%	9%	2.0%	2.5%
Commerical Printing	1067	1385	8%	17%	2.6%	3.3%
Meat Products	476	843	8%	30%	3.8%	5.1%
Newspapers	280	715	8%	32%	4.9%	8.7%
Misc Industrial Machinery	658	747	8%	13%	2.3%	3.1%
Millwork, Veneer, and Plywood	490	731	8%	22%	3.1%	3.9%
Sawmills and Planning Mills	477	778	9%	27%	3.2%	4.1%
Average					2.9%	4.2%



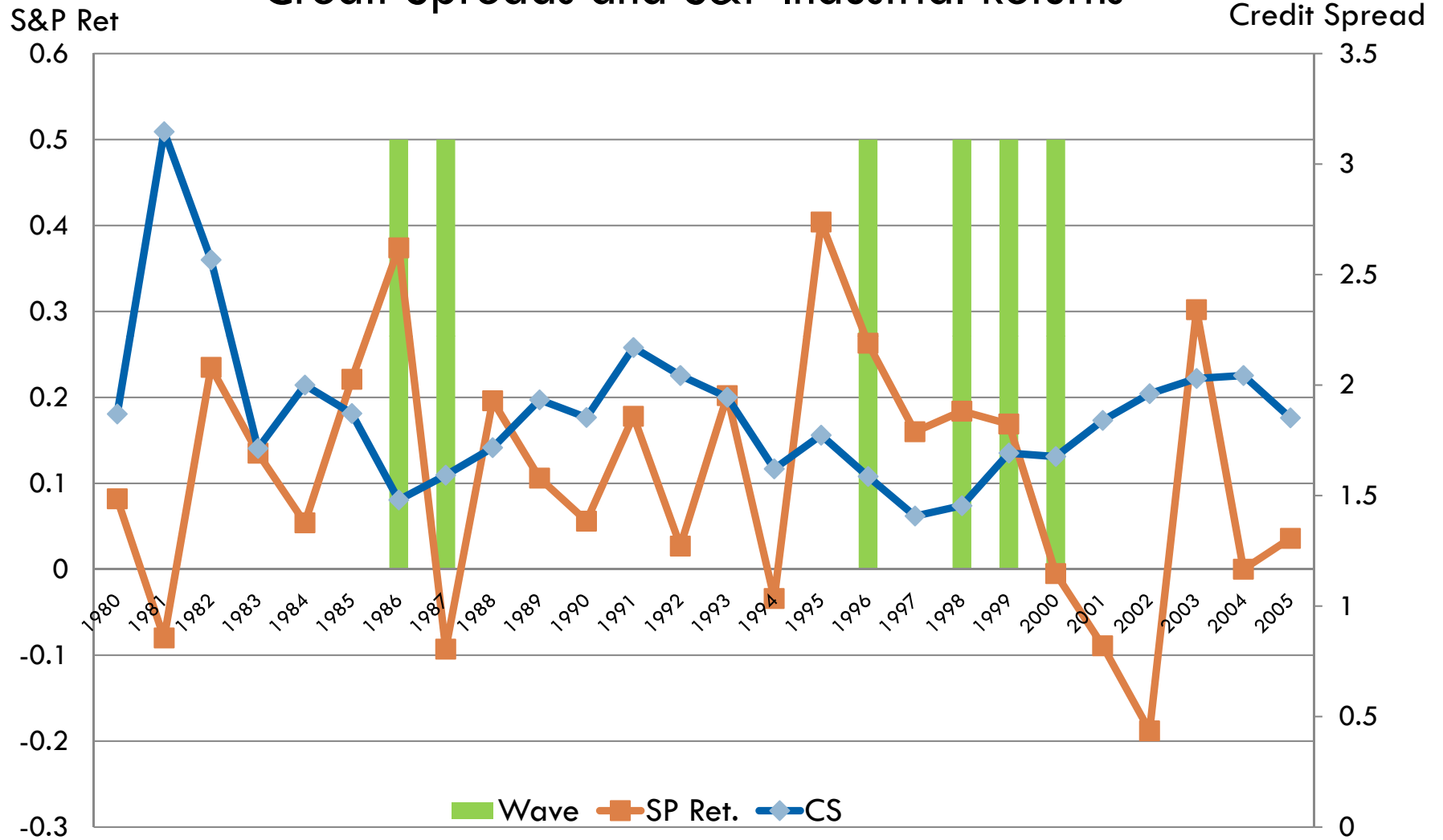
Do public and private firms react differently to changes in their fundamentals and macro factors?

# Factors that Are Driving Merger Waves



- Macro factors
  - Credit spread: C&I loan rate – Fed Fund rate
  - S&P Industrial Index return
  - Global wave indicator
- Industry and firm level factors
  - Industry Tobin's q, Industry concentration
  - Size and productivity

# Credit Spreads and S&P Industrial Returns



$\text{Corr}(\text{SP Ret}, \text{CS}) = -23\%$



## Endogenizing the public status:

Being public itself is a choice which may convey some information about the firm

# The Choice of Being Public

- Being public provides better access to financial markets → Firms which expect to have high needs (because they are better) for external capital may choose to become public.
- If public capital for early-stage firms is costly, only the best firms (who can afford the cost and expect to have later needs) will go public.
- We use the initial conditions (first year productivity and size) of a firm  $X_{i0}$  as a proxy for its quality ( $\mu_i$ )

$$y_{it} = \pi_1 X_{i,t0i} + \pi_2 Z_{i,t-1} + v_{it}$$

$$P_{it} = 1 \text{ if } y_{it} > P_{i^*}$$

$$P_{it} = 0 \text{ if } y_{it} \leq P_{i^*}$$

# Initial Conditions are Very Persistent

Initial Size Quintile	Size Qunitile (10 years later)				
	1	2	3	4	5
1	43%	29%	16%	9%	3%
2	16%	40%	28%	12%	5%
3	4%	16%	42%	31%	7%
4	1%	3%	14%	52%	29%
5	0%	0%	1%	6%	93%

Initial Size Quintile	TFP Quintile (10 years later)				
	1	2	3	4	5
1	36%	23%	16%	13%	12%
2	17%	32%	28%	15%	8%
3	9%	20%	37%	25%	10%
4	6%	12%	26%	39%	17%
5	8%	10%	15%	27%	40%

# Predicting the Public Status (Table 3)

Dependent Variable: D_Pub	Five Years after Initial Appearance			Ten Years after Initial Appearance		
	(1)	(2)	(3)	(4)	(5)	(6)
TFP0	0.0029 (0.002)	0.0198 *** (0.003)	-0.0089 (0.009)	0.0052 (0.004)	0.0290 *** (0.005)	0.0100 (0.015)
TFP02	0.1148 *** (0.006)	0.1004 *** (0.006)		0.1716 *** (0.010)	0.1558 *** (0.010)	
SIZE0	0.0180 *** (0.005)	0.0125 *** (0.005)		0.0190 ** (0.008)	0.0146 * (0.008)	
SIZE02	0.0018 *** (0.000)	0.0019 *** (0.000)		0.0022 *** (0.000)	0.0022 *** (0.000)	
CDTVS25	0.0031 *** (0.000)	0.0021 *** (0.000)	0.0022 *** (0.000)	0.0042 *** (0.000)	0.0028 *** (0.000)	0.0028 *** (0.000)
I_CapEx		0.1208 *** (0.007)	0.1172 *** (0.007)		0.1991 *** (0.013)	0.1995 *** (0.013)
I_Tobinq		0.0956 *** (0.014)	0.1092 *** (0.014)		0.1423 *** (0.023)	0.1494 *** (0.023)
HERF		0.0720 *** (0.007)	0.0778 *** (0.007)		0.0413 *** (0.011)	0.0437 *** (0.012)

# Size spline ....

Dependent Variable: D_Pub	Five Years after Initial Appearance			Ten Years after Initial Appearance		
	(1)	(2)	(3)	(4)	(5)	(6)
Q2(Size0)			0.0143 *** (0.003)			0.0142 *** (0.005)
Q3(Size0)			0.0570 *** (0.004)			0.0672 *** (0.006)
Q4(Size0)			0.1086 *** (0.004)			0.1195 *** (0.006)
Q5(Size0)			0.3005 *** (0.006)			0.3051 *** (0.008)
Q2(Size0)*TFP			-0.0299 ** (0.012)			-0.0612 *** (0.020)
Q3(Size0)*TFP			-0.0075 (0.011)			-0.0324 * (0.018)
Q4(Size0)*TFP			0.0145 (0.010)			0.0021 (0.017)
Q5(Size0)*TFP			0.0562 *** (0.010)			0.0483 *** (0.016)
R-square	0.1797	0.1912	0.169	0.1645	0.1777	0.167
Number of Obs	187,581	187,581	187,581	88,934	88,934	88,934

# Cox Proportional Hazard Model

Failure: Becoming Public

Analysis Time: Years after initial appearance

	Haz. Ratio	z
TFP0	<i>1.047</i> *	1.79
TFP0_2	<i>2.435</i> ***	7.6
Size0	<i>11.402</i> ***	35.22
Size0_2	<i>0.921</i> ***	-29.73
CDTVS25	1.024 ***	22.33
CDTVS1	1.263 **	2.08
I_CapEx	2.330 **	2.22
I_Opmarg	0.896 *	-1.84
Herfindahl Index	2.135 ***	4.02
S50	2.026 ***	8.87
Tobin's q	1.114 ***	3.29

# Decisions to Buy Assets (Table 4)

## Panel A

Dependent Variable: D\_Buy

Variable	Public	Private	P-value for Difference	Public	Private	P-value for Difference
Firm Size	0.0070 *** (0.000)	0.0062 *** (0.000)	<0.001	0.0069 *** (0.000)	0.0062 *** (0.000)	<0.001
TFP	0.0035 *** (0.001)	0.0003 * (0.000)	0.070	0.0035 *** (0.001)	0.0003 * (0.000)	0.072
I_Tobinq	-0.0008 (0.001)	-0.0009 *** (0.000)	0.136	-0.0018 (0.001)	-0.0011 *** (0.000)	0.100
HERF	-0.0039 (0.019)	0.0061 * (0.003)	0.046	-0.0121 (0.019)	0.0052 (0.003)	0.030
Credit Spread	-0.0275 *** (0.003)	-0.0009 ** (0.000)	<0.001			
S&P IndRet.	0.0266 *** (0.006)	0.0051 *** (0.001)	0.892			
D_GW				0.0329 *** (0.002)	0.0032 *** (0.000)	<0.001
Pr(D_Buy)	7.36%	1.75%		7.36%	1.75%	
R-square	0.009	0.129	0.1293	0.011	0.130	0.1305
Number of Obs	99,121	420,944	520,065	99,121	420,944	520,065

# Decisions to Sell Assets (Table 4)

## Panel B

Dependent Variable: D\_Sell

Variable	Public			Private			P-value for Difference
	Public	Private	P-value for Difference	Public	Private	P-value for Difference	
Size	0.0106 *** (0.000)	0.0138 *** (0.000)	<0.001	0.0107 *** (0.000)	0.0138 *** (0.000)	<0.001	
TFP	-0.0089 *** (0.001)	-0.0018 *** (0.000)	<0.001	-0.0089 *** (0.001)	-0.0018 *** (0.000)	<0.001	
I_Tobinq	-0.0042 *** (0.001)	-0.0016 *** (0.000)	0.379	-0.0050 *** (0.001)	-0.0015 *** (0.000)	0.1236	
HERF	-0.0848 *** (0.020)	0.0289 *** (0.006)	<0.001	-0.0886 *** (0.020)	0.0292 *** (0.006)	<0.001	
Credit Spread	-0.0366 *** (0.003)	-0.0015 * (0.001)	<0.001				
S&P IndRet.	0.0173 *** (0.006)	0.0183 *** (0.002)	0.021				
D_GW				0.0370 *** (0.002)	0.0034 *** (0.001)	<0.001	
Pr(D_SALE)	7.91%	4.08%					
R-square	0.013	0.037	0.0408	0.0141	0.036	0.0408	
Number of Obs	107,645	557,470	665,115	107,645	557,470	665,115	

# T5: Economic Significance: Prob. Of Buying varying Credit Spread

Panel A: Probability of Purchases

	Credit Spread					D_GW	
	p10	p25	p50	p75	p90	0	1
(1) Public firms	8.45%	7.84%	7.32%	7.04%	6.50%	6.50%	9.81%
(2) Private firms	0.80%	0.79%	0.77%	0.77%	0.75%	0.70%	0.90%
(3) Private firms using medians of data from public firms	6.53%	6.45%	6.38%	6.34%	6.25%	5.94%	7.36%
Ratio (unadjusted): (2)/(1)	0.09	0.10	0.11	0.11	0.12	0.11	0.09
Ratio (adjusted for size): (3)/(1)	0.77	0.82	0.87	0.90	0.96	0.91	0.75

# T5b: Economic Significance: Prob. Of Selling varying Credit Spread

Panel B: Probability of Sales

	Credit Spread					D_GW	
	p10	p25	p50	p75	p90	0	1
(1) Public firms	9.33%	8.51%	7.81%	7.44%	6.72%	6.89%	10.61%
(2) Private firms	3.55%	3.52%	3.50%	3.48%	3.45%	3.35%	3.67%
(3) Private firms using medians of data from public firms	6.66%	6.62%	6.57%	6.55%	6.50%	6.32%	6.85%
Ratio (unadjusted): (2)/(1)	0.38	0.41	0.45	0.47	0.51	0.49	0.35
Ratio (adjusted for size): (3)/(1)	0.71	0.78	0.84	0.88	0.97	0.92	0.65

# T7: Decisions to Buy (PREDICTED Public)

Panel A: Decision to Buy Assets

Dependent Variable: D\_BUY\_NEW

Variable	Public-like	Private-like	P-value for Difference	Public-like	Private-like	P-value for Difference
Firm Size	0.0116 *** (0.001)	0.0021 *** (0.000)	<0.001	0.0115 *** (0.001)	0.0021 *** (0.000)	<0.001
TFP	-0.0006 (0.001)	-0.0001 (0.000)	0.674	-0.0006 (0.001)	-0.0001 (0.000)	0.671
I_Tobinq	-0.0014 (0.001)	-0.0003 (0.000)	0.634	-0.0015 (0.001)	-0.0003 (0.000)	0.686
HERF	-0.0568 *** (0.021)	-0.0071 (0.005)	0.560	-0.0595 *** (0.021)	-0.0070 (0.005)	0.615
Credit Spread	-0.0109 *** (0.00)	0.0002 (0.00)	0.103			
S&P IndRet.	0.0113 ** (0.005)	0.0015 (0.001)	0.576			
D_GW				0.0082 *** (0.00)	0.0001 (0.00)	0.155
Pr(D_Buy)	3.22%	0.40%		3.22%	0.40%	
R-square	0.046	0.178	0.129	0.047	0.177	0.129
Number of Obs	39,336	36,190	75,226	39,336	36,190	75,226

# T7: Decisions to Sell (with high PREDICTED Public (Q4))

Actual Pub/Priv Sample(w/ Pr Pub)			
Actual Public	Actual Private	Actual Public	Actual Private
0.0052 *** (0.002)	0.0078 *** (0.001)	0.0051 *** (0.002)	0.0077 *** (0.001)
-0.0056 ** (0.002)	-0.0025 (0.002)	-0.0055 ** (0.002)	-0.0025 (0.002)
-0.0044 (0.003)	-0.0003 (0.002)	-0.0063 ** (0.003)	-0.0001 (0.002)
-0.1603 ** (0.065)	-0.0663 * (0.037)	-0.1596 ** (0.064)	-0.0654 * (0.037)
-0.0448 *** (0.011)	-0.0321 *** (0.007)		
0.0054 (0.015)	0.0031 (0.009)		
		0.0333 *** (0.006)	0.0147 *** (0.003)
6.85%	6.43%	6.85%	6.43%
0.0063	0.0056	0.0104	0.005
10786	29280	10786	29280

# T8: Propensity Score matching Model

**Panel B: Propensity Score Matching**

Probability of Purchases	All	Off-the-Wave	On-the-Wave
		0	1
Public firms	5.37%	4.83%	6.47%
Private firms	1.11%	1.03%	1.28%
DIF	4.27%	3.80%	5.19%
DIF(Matching)	3.10%	2.56%	4.00%
# Treatment	16,656	11,138	5,518
# Control	143,576	99,735	43,841
T-stat (from bootstrap)	(16.36)	(13.31)	(9.64)
% Explained by matching	0.27	0.33	0.23

Probability of Sales	All	Off-the-Wave	On-the-Wave
		0	1
Public firms	6.63%	5.88%	8.16%
Private firms	3.42%	3.21%	3.90%
Dif	3.22%	2.68%	4.26%
Dif(after matching)	0.30%	0.03%	0.85%
# Treatment	16,656	11,138	5,518
# Control	143,576	99,735	43,841
T-stat (from bootstrap)	(1.07)	(0.13)	(1.91)
% Explained by matching	0.91	0.99	0.80

# T9: Credit Ratings and Acquisitions

Panel A: Decisions to Buy Assets

Dependent Variable: D\_BUY\_NEW

Variable Name	No Rating		Low Rating		High Rating	
Firm Size	0.0074 *** (0.001)	0.0075 *** (0.001)	-0.0045 *** (0.001)	-0.0047 *** (0.001)	-0.0015 (0.001)	-0.0016 (0.001)
TFP	0.0028 *** (0.001)	0.0028 *** (0.001)	0.0021 (0.002)	0.0023 (0.002)	0.0040 ** (0.002)	0.0036 ** (0.002)
I_Tobinq	-0.0332 (0.020)	-0.0370 * (0.020)	0.0986 ** (0.044)	0.0853 * (0.044)	0.0506 (0.037)	0.0343 (0.037)
HERF	-0.0063 *** (0.002)	-0.0064 *** (0.002)	-0.0047 (0.004)	-0.0055 (0.003)	0.0125 *** (0.003)	0.0100 *** (0.002)
Credit Spread	-0.0216 *** (0.003)		-0.0603 *** (0.009)		-0.0217 *** (0.006)	
S&P IndRet.	0.0388 *** (0.008)		0.0286 * (0.017)		0.0092 (0.014)	
D_GW		0.0239 *** (0.003)		0.0582 *** (0.006)		0.0360 *** (0.005)
Pr (D_Buy)	6.10%		8.89%		9.37%	
R-square	0.012	0.012	0.010	0.014	0.003	0.007
Number of Obs	58,655	58,655	14,773	14,773	25,693	25,693

# T9B: Credit Ratings and Asset Sales

Panel B: Decisions to Sell Assets

Dependent Variable: D\_Sell

Variable Name	No Rating		Low Rating		High Rating	
Firm Size	0.0123 *** (0.001)	0.0122 *** (0.001)	0.0084 *** (0.001)	0.0085 *** (0.001)	0.0081 *** (0.001)	0.0081 *** (0.001)
TFP	-0.0075 *** (0.001)	-0.0075 *** (0.001)	-0.0100 *** (0.002)	-0.0098 *** (0.002)	-0.0127 *** (0.002)	-0.0127 *** (0.002)
I_Tobinq	-0.0055 *** (0.002)	-0.0071 *** (0.002)	-0.0065 * (0.003)	-0.0058 * (0.003)	0.0010 (0.003)	0.0015 (0.002)
HERF	-0.0885 *** (0.024)	-0.0926 *** (0.024)	-0.0754 (0.051)	-0.0773 (0.050)	-0.0568 (0.045)	-0.0607 (0.045)
Credit Spread	-0.0337 *** (0.003)		-0.0556 *** (0.008)		-0.0334 *** (0.006)	
S&P IndRet.	0.0131 * (0.008)		-0.0016 (0.015)		0.0402 *** (0.012)	
D_GW		0.0424 *** (0.003)		0.0348 *** (0.005)		0.0252 *** (0.004)
Pr (D_Sale)	7.47%		8.05%		8.87%	
R-square	0.014	0.018	0.013	0.011	0.010	0.008
Number of Obs	64,985	64,985	15,620	15,620	27,040	27,040

# Economic Significance by Bond Ratings

## Probability of Purchases

	Credit Spread					Ratio (p10/p90)	D_GW		Ratio (1/0)
	p10	p25	p50	p75	p90		1	0	
High-Rating Firms	9.92%	9.48%	9.08%	8.87%	8.44%	1.18	11.76%	8.22%	1.43
Low-Rating Firms	11.06%	9.69%	8.54%	7.95%	6.85%	1.61	12.94%	7.17%	1.80
No-Rating Firms	6.95%	6.48%	6.06%	5.84%	5.41%	1.28	7.83%	5.43%	1.44
Private Firms	0.77%	0.75%	0.74%	0.73%	0.71%	1.08	0.91%	0.66%	1.38

## Probability of Sales

	Credit Spread					Ratio (p10/p90)	D_GW		Ratio (1/0)
	p10	p25	p50	p75	p90		1	0	
High-Rating Firms	10.22%	9.48%	8.85%	8.50%	7.80%	1.31	10.63%	8.11%	1.31
Low-Rating Firms	10.30%	8.90%	7.80%	7.31%	6.27%	1.64	10.67%	7.14%	1.49
No-Rating Firms	8.82%	8.06%	7.41%	7.07%	6.41%	1.38	10.68%	6.39%	1.67
Private Firms	3.40%	3.39%	3.37%	3.36%	3.34%	1.02	3.51%	3.23%	1.09



Do public and private firms differ in their merger outcomes on and off the wave?

# Changes of TFP (Table 11)

## Panel A

Dependent Variable	TFP (-1,1)				TFP(-1,2)				TFP(-1,3)			
Variable Name	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
D_Sale	0.030	***	0.025	***	0.042	***	0.038	***	0.031	***	0.030	***
Ln(Output)			0.055	***			0.066	***			0.067	***
TFP			-0.021	***			-0.032	***			-0.035	***
Constant	-0.017	***	-0.609	***	-0.024	***	-0.737	***	-0.032	***	-0.763	***
	0.005		0.008		0.006		0.01		0.007		0.012	
Number of Obs	809,070		809,070		663,753		663,753		549,279		549,279	
R-Square	0.001		0.01		0.001		0.012		0.002		0.012	

## Panel B

Dependent Variable	TFP (-1,1)				TFP(-1,2)				TFP(-1,3)			
Variable Name	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
D_Sale	0.018	***	0.015	***	0.033	***	0.031	***	0.020	***	0.021	***
D_GW	0.000		-0.005	***	0.005	**	-0.009	***	0.010	***	-0.002	
D_Sale * GW	0.038	***	0.032	***	0.03	***	0.027	***	0.036	***	0.032	***
TFP			-0.021	***			-0.034	***			-0.037	***
Ln(Output)			0.057	***			0.067	***			0.068	***
Constant	-0.012	**	-0.62	***	-0.021	***	-0.748	***	-0.03	***	-0.774	***
Number of Obs	769,431		769,431		643,675		643,675		529,646		529,646	
R-Square	0.001		0.011		0.001		0.013		0.002		0.012	

# Changes of TFP (Table 11)

## Panel C

Dependent Variable	TFP (-1,1)				TFP(-1,2)				TFP(-1,3)			
Variable Name	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PrvtoPrv	-0.002	-0.005	0.004	-0.003	-0.009	-0.013						
PrvtoPub	0.036 ***	0.020 **	0.032 ***	0.029 ***	0.034 ***	0.032 ***						
PubtoPrv	0.064 ***	0.057 ***	0.089 ***	0.094 ***	0.055 ***	0.045 ***						
PubtoPub	0.069 ***	0.043 ***	0.099 ***	0.082 ***	0.098 ***	0.066 ***						
D_GW		0.000		0.005 **		0.010 ***						
PrvtoPrv_GW		0.013		0.032 **		0.017						
PrvtoPub_GW		0.045 ***		0.013		0.011						
PubtoPrv_GW		0.019		-0.018		0.016						
PubtoPub_GW		0.059 ***		0.041 *		0.073 ***						
Constant	-0.017 ****	-0.012 **	-0.024 ***	-0.021 ***	-0.033 ***	-0.031 ***						
Number of Obs	809070	769431	663753	643675	549279	529646						
R-Square	0.001	0.001	0.001	0.001	0.002	0.002						

# T12: TFP Selection / IV Models

**Panel A: Heckman Selection Model**

Variable Name	TFP(-1,1)	TFP(-1,2)	TFP(-1,3)
D_Sale	0.016 *** (0.00)	0.029 *** (0.00)	0.025 *** (0.01)
Constant	0.100 *** (0.00) ***	0.130 *** (0.00) ***	0.140 *** (0.00) ***
<i>Selection</i>			
Size	0.337 *** (0.00)	0.383 *** (0.00)	0.412 *** (0.00)
Constant	-2.557 *** (0.01)	-3.361 *** (0.01)	-3.933 *** (0.01)
<i>Mills Ratio</i>			
Lamda	-0.229 *** (0.00)	-0.216 *** (0.00)	-0.188 *** (0.00)
Number of Obs	1,146,914	1,146,914	1,146,914
Number Censored	337,844	483,161	549,279

**Panel B: Instrument Variable Approach (using predicted probability of being sold)**

Variable Name	TFP(-1,1)	TFP(-1,2)	TFP(-1,3)
Pr_Sale	1.225 *** (0.02)	1.420 *** (0.03)	1.388 *** (0.03)
Constant	-0.088 *** (0.01)	-0.107 *** (0.01)	-0.108 *** (0.01)
Number of Obs	751,521	629,151	517,433
R-Square	0.002	0.003	0.001

# T12 Panel C: Treatment Models

Panel C: Average Treatment Effect: Change of TFP (Matching on Pr\_Sale)

Variable Name	TFP(-1,1)			TFP(-1,2)			TFP(-1,3)		
	0	1	BOTH	0	1	BOTH	0	1	BOTH
D_GW									
ATT	0.0%	2.0%	0.6%	1.6%	2.9%	2.0%	0.9%	2.5%	1.5%
Std. Error	(0.5%)	(0.8%)	(0.4%)	(0.6%)	(0.9%)	(0.5%)	(0.7%)	(1.0%)	(0.5%)
T- stat	-0.01	2.55	1.46	2.68	3.20	4.03	1.39	2.58	2.82
# Treatment	25,063	11,212	36,275	21,420	9,364	30,784	17,477	8,296	25,773
# Control	533,274	181,874	715,233	452,950	145,314	598,363	364,501	127,066	491,656

# Conclusion



- Public firms participate more in mergers and acquisitions than private firms and are more wave-driven.
- Transactions are more likely when credit spread is low. Public firms are also more affected by credit spreads.
- Acquired plants gain efficiency after transactions, and the improvement is greater for on-the-wave mergers .
- Initially large and more productive firms choose to become public and later these firms are more sensitive to changes in investment opportunities and participate more in acquisitions.
- The observed difference in acquisition between public and private firms is not simply driven by access to financial markets, but is to a large extent (but not totally) driven by initial quality and self selection.