Braguinsky, S., Ohyama, A., Okazaki, T., & Syverson, C. (2015). Acquisitions, productivity, and profitability: evidence from the Japanese cotton spinning industry. The American Economic Review, 105(7), 2086-2119

Zhu Xuanli

July 26 2018

Theoretical Question: Can changes in corporate control of assets increase productivity?

- **Idea/Intuition:** M&A reallocate control of productive assets to entities to produce more efficiently
- **Notion/Theory:** productivity across plants, firms, and even countries depends on managers or management practices
- **Literature:** Bloom and Van Reenen (2007, 2010), Bloom et al. (2013)

How has Previous Research done?

however, not been fully conclusive about multiple motives for and consequences of ownership changes:

- raise the productivity of inputs: "higher productivity buys lower productivity"
- driven by nonefficiency consideration: managerial hubris, market power, or investor irrationality

part of the literature's ambiguity due to

- data limitations: e.g. no clean distinguish between physical (quantity) productivity and revenue productivity
- M&A increase market power -> high output price -> measured productivity gain even without changes in technical efficiency

Contribution of This Paper

A dataset at **an unusual level of detail** to investigate the production and input allocation processes:

- Japanese cotton spinning industry, a growing industry at the open of 20th century
- plant-level physical units of operating inputs and outputs, output price and wages
- plant-level capacity utilization (for plant productivity conditional on operation)
- firm-level financial data
- major ownership and/or management turnover events

Investigate the effects and mechanisms of ownership and management turnover at a typically unavailable level of detail

- Use this dataset to show how such events affected plants' physical productivity levels, profitabilities, prices, and other operational and financial metrics

Findings

1. "Higher profitability buys lower profitability, and improve it"

- Acquired firms' production facilities were not less physically productive (conditional on operating) but much less profitable than acquiring firms before acquisition, why?

2. Acquired firms actually had more productive capital but

- also higher average unrealized output levels and lower capacity utilization
- after acquired, not gain market power, but drops in unrealized output and gains in capacity utilization, thus increasing in both their productivity and profitability

3. Acquired firms have a superior ability to manage industry demand changes

- better management in inventory levels, capacity utilization, and unrealized output, thus increasing reducing returns on capital

Implications

1. The considerable productivity growth in Japanese cotton spinning industry is drived by ownership and management reallocation during industry concentration

2. leading firms are not due to their market power but rather the ability to acquire and fully utilize the most productive capital

3. This single industry case study offers broader lessons given the economic environment at that time:

- unfettered capitalism close to today: less government intervention, equity financing, joint stock companies with diffused ownership
- the development of an advanced industrial in a country undergoing transition to modernity with self-sustaining growth

1. Entry and Acquisitions in the Japanese Cotton Spinning Industry: Background Facts

Japanese cotton spinning industry:

- the only significant Asian instance of successful assimilation of modern manufacturing techniques before WWII
- after unexpected opening to free trade, cotton yarn experienced largest price fall and highest net imports

- however in late 1890s, domestic cotton spinning industry began a remarkable ascendance

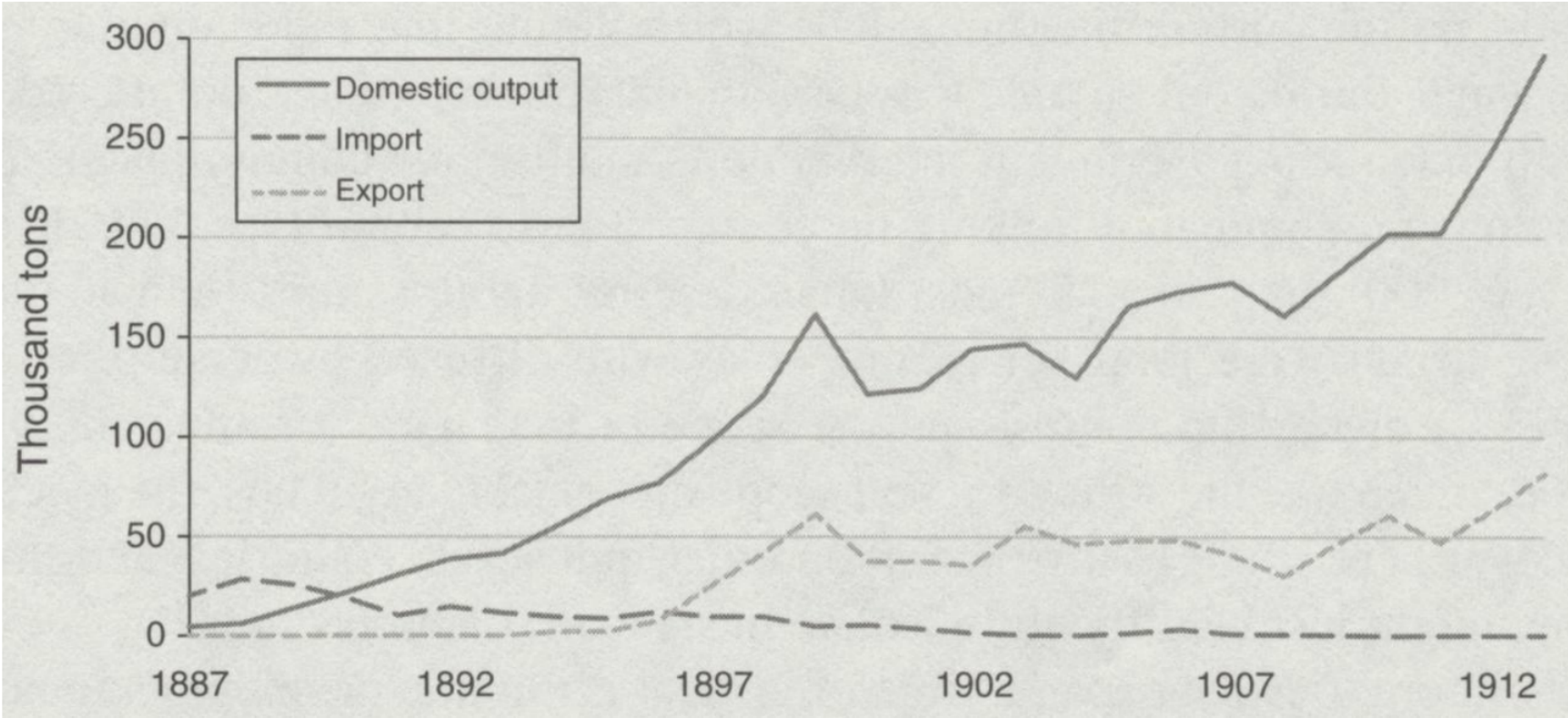


FIGURE 1. DOMESTIC OUTPUT, IMPORT, AND EXPORT OF COTTON YARN, 1887–1914

Source: Nihon Choki Tokei Soran, authors' estimates.

1. Background: development went through 3 stages

1st (~1890): technology was rudimentary, spinning mills were small and unproductive

2nd (1890s): explosive growth due to

- 2 major innovations: switch to raw cotton imported from India & adoption of a newer type of cotton spinning machinery
- tripled firm no. and average plant capacity & five-fold average plant employment

2nd (1890s): market condition:

- very competitive market: market power par or below even for large firms = price taker
- early entries: disadvantage: stuck with older vintage machines
- early entries: advantage: a superior ability to "manage sales"
  - trading houses' sales limited to reputable producers when slow demand
  - selling outside entailed risks

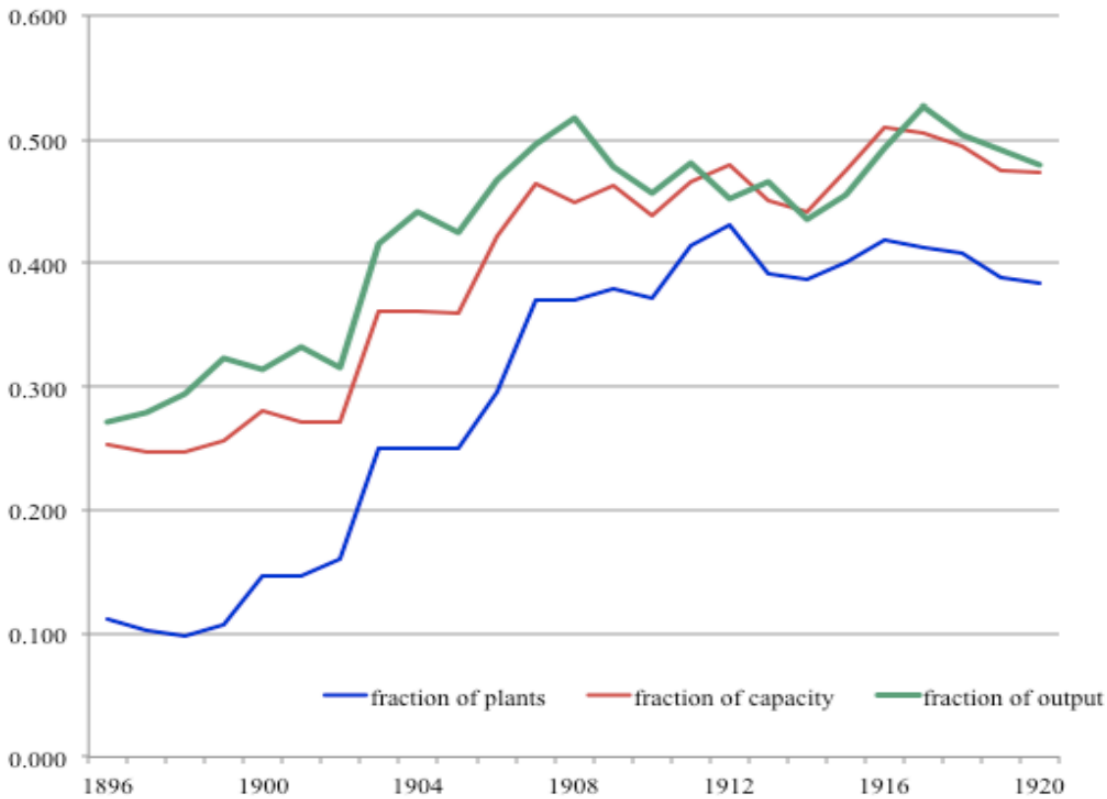
1. Background: development went through 3 stages

3rd (1900~): facing the limits of market size

- shut down in Chinese market -> first major "overproduction crisis"
- industry consolidation by acquisitions of existing production facilities:
  - purchases new machinery took times
  - 49/78 acquired at least once since 1897
- 5 large firms emerged through serial acquisitions and mergered to 3 after 1918
- 4.3% plants per year were merged & 40% by top5

- **So Why concentration of ownership? for productivity improvement or sales management?**

Figure A2. Ownership concentration in three largest firms



Source: Our estimates. The figure depicts the evolution of the fraction of plants owned by the three largest firms in 1920 (Kanegafuchi Boseki, Toyo Boseki, Dainippon Boseki) and these plants' capacity and output as a fraction of the industry total. Toyo Boseki data include that of its predecessor firms (Osaka Boseki and Mie Boseki) prior to their 1914 merger, and Dainippon Boseki includes the data of its predecessor firms (Amagasaki Boseki and Settsu Boseki) prior to their 1918 merger.

2. Data

A dataset at **an unusual level of detail** to investigate the production and input allocation processes:

- plant-level data source:
  - historical statistical yearbooks by Japanese prefecture governments (1899-1920)
  - Geppo bulletin of the All-Japan Cotton Spinners' Association (1896-1898)
- plant-level physical units of operating inputs and outputs, output price and wages
  - average daily no. of spindles & employees, intermediate input, output quality
- plant-level capacity utilization: no. of days of operation,
- firm-level financial data: BS, PL, shareholders, managers
- major ownership and/or management turnover events

3.1 Descriptive Analysis: Differences between Acquirers and Targets before Acquisition

TABLE 1—FUTURE ACQUIRING, ACQUIRED, AND EXITING PLANTS IN 1896–1897

		Acquired plants		
	Acquiring plants	First cohort	Second cohort	Exiting plants
TFPQ	0.066	0.034	0.156	−0.211
	(0.156)	(0.225)	(0.229)	(0.552)
Profit per paid-in share	0.274	0.185	0.159	0.159
	(0.205)	(0.074)	(0.149)	(0.101)
Price (yen/400 lb.)	94.7	92.4	92.8	91.7
	(6.5)	(3.8)	(7.4)	(7.0)
Logged price residual	−0.041	0.014	0.012	0.021
	(0.151)	(0.040)	(0.041)	(0.062)
Main count of yarn produced	21.5	17.5	17.2	13.9
	(11.5)	(2.6)	(4.7)	(5.6)
Days in operation	323.7	315.9	300.6	278.6
	(29.8)	(29.5)	(55.6)	(56.8)
Equipment age	5.28	5.88	2.79	11.77
	(3.49)	(2.76)	(1.00)	(6.69)
Firm age	9.13	11.06	3.31	12.54
	(5.08)	(3.81)	(2.05)	(7.86)
Observations	32	33	32	24

3.1 Descriptive Analysis: Differences between Acquirers and Targets before Acquisition

1. new plants acquired later have highest productivity (TFPQ), not acquirers plants

- physical productivity conditional on the plant operating
- inputs measured by input service flows rather than stocks

2. aquirers are most profitable (ROE), following other aged plants

- reported net earnings divided by the amount of paid-in shareholders' capital

3. all firms earn similar prices per unit weight though future acquirers produce higher quality

- acquirers' count-adjusted prices (residual from regression of logged unit-weight prices on main count) are even somewhat lower than those of other firms
- profitability gaps thus are not because supernormal prices

3.1 Descriptive Analysis: Differences between Acquirers and Targets before Acquisition

4. acquired new plants have significantly newer capital, but less average operation days

- They were efficient while operating, but they were operating considerably less (~1m?)

5. Plants that were to exit had oldest capital, worst productivity and profitability

3.2 Empirical Models: How Acquired plants' Performance changed after Acquisition

Estimate plant-level productivity:

- naive OLS suffer endogenous productivity processes: simultaneous shifts in input use and productivity around acquisitions
- productivity estimation method of De Loecker (2013)

$$y_{it} = \beta_k k_{it} + \beta_l l_{it} + \beta_i i_{it} + \beta_a a_{it} + \omega_{it} + \varepsilon_{it}$$

- k/l: logged capital and labor flows, i.e., spindle-days and worker-days
- i: changes logged plant capacity to control for any adjustment cost
- a: logged age of plant capital
- ω: captures productivity and subsumes the constant
- ε: iid error

3.2 Empirical Models: How Acquired plants' Performance changed after Acquisition

Estimate plant-level productivity:

- Productivity evolution:

$$\omega_{it+1} = g\left(\omega_{it}, \mathbf{acq}_{it}\right) + \xi_{it+1}$$

- ξ: an exogenous productivity shock or innovation

$$g\left(\omega_{it}, \mathbf{acq}_{it}\right) = \sum_{j=1}^{3} \gamma_j \omega_{it}^{j} + \theta_1 lb\_acq_{it} + \theta_2 ea\_acq_{it} + \theta_3 la\_acq_{it}$$

- *acq*: a vector of time dummies defined around each acquisition event
  1. lb_acqit: a "late pre-acquisition" dummy (2 years)
  2. ea_acqit: an "early post-acquisition" dummy (3 years)
  3. la_acqit: a "late post-acquisition" dummy (3+ years)

3.2 Empirical Models: How Acquired plants' Performance changed after Acquisition

Estimate plant-level productivity:

- 1st stage: a polynomial approximation using all inputs to get predicted productivity
- proxy variables: cotton consumed, and including 3 acquisition timing dummies
  - capital and labor are at least semi-dynamic
  - The quantity of cotton consumed in production reflects all subsequent unobserved productivity shocks (e.g. stoppages due to breaking yarn, adjustments made to spindles rotation speeds, . . .)
- 2nd stage: use moment conditions to search for coefficients: $E[\xi_{it}|_{l_{it}}^{k_{it}}] = 0$
- Results: β_k/β_l: 0.323/0.738, and derived productivity TFPQ: $\hat{\omega}$

3.2 Empirical Models: How Acquired plants' Performance changed after Acquisition

$=>$ **Use performance measures (TFPQ, ROE,...) to see how acquisitions changes plant operations and performance:**

Regression specification 1: changes within acquired plants

$$y_{it} = \alpha + \theta_1 lb\_acq_{it} + \theta_2 ea\_acq_{it} + \theta_3 la\_acq_{it} + m_A + \mu_t + \varepsilon_{it}$$

- interest: coefficients on period dummies
- include acquisition fixed effects, and year fixed effects
- baseline: pre-acquisition period $>$2 years before arquisition

3.2 Empirical Models: How Acquired plants' Performance changed after Acquisition

Regression specification 2: compare acquired plants to incumbent plants of acquiring firms (control group for DID)

$$\overline{y}_{it} = \alpha_0 + \beta_1 AA_{it} + \beta_2 Acquired_{it} + \beta_3 Acquired_i \times AA_{it} + m_{it} + \mu_t + \varepsilon_{it}$$

- baseline: collapse incumbent plants to weighted average of plants within a given acquisition outcomes: $\overline{y}_{it} = \frac{1}{\#m_A} \sum_{j \in m_A} \omega_j y_{jt}$
- $AA/Acquired$: after acquisition dummy / acquired dummy
- m/μ: acquisition-year fixed effect / calendar year fixed effect
- *interest*: β_3 reflects DID change in acquired plants' performance

3.3 Empirical Results: Changes in Productivity and Profitability

productivity and profitability changes within acquired plants:

TABLE 2—WITHIN-ACQUIRED-PLANTS COMPARISONS OF PRODUCTIVITY, PROFITABILITY, AND PRICES

	All acquisitions			By serial acquirer		
	TFPQ	Plant ROCE	log price residuals	TFPQ	Plant ROCE	log price residuals
Late pre-acquisition dummy	−0.003	0.020	0.011	−0.016	0.025	0.018
	(0.019)	(0.013)	(0.013)	(0.030)	(0.016)	(0.030)
Early post-acquisition dummy	0.045*	0.060***	0.036	0.053	0.106***	0.065
	(0.026)	(0.022)	(0.027)	(0.046)	(0.023)	(0.063)
Late post-acquisition dummy	0.126***	0.089***	0.044	0.159**	0.140***	0.089
	(0.033)	(0.025)	(0.034)	(0.062)	(0.032)	(0.068)
Constant	0.603***	0.102***	0.029***	0.356***	0.079**	0.041***
	(0.032)	(0.013)	(0.010)	(0.025)	−0.031	(0.008)
Acquisition fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,078	891	1,118	512	472	521
Adjusted R^2	0.734	0.639	0.097	0.695	0.625	0.082

Notes: The omitted category is period three years or more prior to acquisition. Serial acquirers are Kanegafuchi, Mie, Osaka, Settsu, and Amagasaki Boseki. The omitted category includes the period three years or more prior to acquisition. Robust standard errors clustered at the acquisition level in parentheses.

3.3 Empirical Results: Changes in Productivity and Profitability

productivity and profitability changes within acquired plants:

- acquired plants' TFPQ levels improve considerably following acquisition, and it takes time for this to manifest itself fully
- profitability growth occurs faster than the relatively back-loaded growth in productivity
  - As no separate post-acquisition firm profit accounts, profitability for acquired plants is defined as divided firm ROCE according to plant's installed spindle capacity (?)
- profitability changes are not due to changes in plant-specific prices
- patterns for subsamples of serial acquriers are qualitatively similar with slightly more pronounced in magnitude

3.3 Empirical Results: Changes in Productivity and Profitability

DID framework using incumbent plants as control group:

TABLE 3—WITHIN-ACQUISITION COMPARISONS OF PRODUCTIVITY AND PROFITABILITY: ACQUIRED AND INCUMBENT PLANTS

	All acquisitions			By serial acquirer		
	TFPQ	Plant ROCE	log price residuals	TFPQ	Plant ROCE	log price residuals
After acquisition	−0.055***	−0.004	−0.031**	−0.048***	−0.012	−0.026*
	(0.013)	(0.012)	(0.013)	(0.008)	(0.016)	(0.015)
Acquired plant	−0.025	−0.030***	−0.019	−0.032*	−0.032**	−0.015
	(0.021)	(0.011)	(0.014)	(0.017)	(0.013)	(0.015)
After acquisition × acquired plant	0.091***	0.040***	0.024	0.113***	0.058***	0.033
	(0.023)	(0.014)	(0.017)	(0.028)	(0.017)	(0.025)
Constant	0.480***	0.145***	0.038***	0.410***	0.069***	−0.007
	(0.034)	(0.018)	(0.008)	(0.008)	(0.013)	(0.008)
Acquisition fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,487	1,392	1,528	1,067	994	1,091
Adjusted R^2	0.347	0.433	0.108	0.489	0.455	0.164

3.3 Empirical Results: Changes in Productivity and Profitability

DID framework:

- TFPQ change after acquisition is positive significant while there is little systematic difference prior
- profitability change after acquisition is positive significant while there is acquired firms' profitability deficits prior
- no differences in prices
- reinforce the fact that: acquisition was accompanied by growth in the acquired plants' productivity and profitability levels, not only to themselves, but also relative to changes within incumbent plants owned by their acquiring firms

3.4 Empirical Research: Decomposing Profitability Differentials 1

Findings above present a sort of puzzle

- Why are incumbent plants more profitable before if not price or productivity?
- How does acquisition improve acquired firms' TFPQ?

Decomposing plants' profitability differences by detailed financial data

$$\frac{\pi_i}{C_i} = \frac{(1-v)Y_i}{C_i} - \frac{w_i L_i}{C_i} - \frac{R_i}{C_i}$$

- π: plant's operating income
- $(1-v)Y$: value added = output - intermediate input - non-labor operational costs
- wL/R: labor costs/capital costs
- C: share of owning firm's capital employed = (shareholders' capital + interest-bearing debt) * ratio of installed capacity (i.e. number of spindles)

3.4 Empirical Research: Decomposing Profitability Differentials 1

compare acquired plans and incumbent plants for ~4 years prior to acquisition

TABLE 4—DECOMPOSITION OF PLANTS' RETURNS ON CAPITAL: INCUMBENT AND ACQUIRED PLANTS, AND ACQUIRED PLANTS PRE- AND POST-ACQUISITION

Pre-acquisition means	Acquired plants (A)	Incumbent plants (B)	Difference (B) − (A)	Percentage difference
ROCE	0.053	0.104	0.051	95.3***
Of which:				
net output value/capital employed	0.193	0.257	0.065	33.5***
Minus:				
wage cost/capital employed	0.077	0.094	0.018	22.9***
capital cost/capital employed	0.062	0.059	−0.004	−6.2***
Observations	133	269		

=> incumbent plants' 5.1% ROCE advantage over acquired plants is mostly explained by net output value

3.4 Empirical Research: Decomposing Profitability Differentials 1

compare acquired plants before&after acquisitions (0-3y/3-10y)

Pre- and early post-acquisition means	Pre-acquisition (A)	Early post-acquisition (B)	Difference (B) − (A)	Percentage difference
ROCE	0.062	0.126	0.063	101.7***
Of which:				
net output value/capital employed	0.202	0.286	0.084	41.6***
Minus:				
wage cost/capital employed	0.078	0.103	0.025	32.2***
capital cost/capital employed	0.062	0.058	-0.004	−7.0**
Observations	163	159		

Pre- and late post-acquisition means	Pre-acquisition (A)	Late post-acquisition (B)	Difference (B) − (A)	Percentage difference
ROCE	0.062	0.163	0.100	161.1***
Of which:				
net output value/capital employed	0.202	0.317	0.114	56.6***
Minus:				
wage cost/capital employed	0.078	0.103	0.025	31.7***
capital cost/capital employed	0.062	0.051	−0.011	−17.3***
Observations	163	280		

=> improvement of ROCE again most comes from net output value

3.4 Empirical Research: Decomposing Profitability Differentials 2

$=>$ **So what's the secret of net output value?**

Decomposition net output value (gross margin)

$$\log\left(\frac{\psi Y_i}{C_i}\right) = \log\left(\psi p_i\right) + \log\left[\frac{\exp\left(\hat{Y}_i\right)}{C_i}\right] + \text{TPFQ}_i$$

- $\psi = 1 - v$: unit price margin (common to all producers)
- p: plant's output price
- $\hat{Y}$: predicted output from the production function (i.e. combined total input)

3.4 Empirical Research: Decomposing Profitability Differentials 2

Decomposition net output value in pre-acquisition years

TABLE 5—DECOMPOSITION OF PLANTS' NET OUTPUT VALUES: INCUMBENT AND ACQUIRED PLANTS AND ACQUIRED PLANTS PRE- AND POST-ACQUISITION

Pre-acquisition means of logs	Acquired plants (A)	Incumbent plants (B)	Difference (B) − (A)	Percentage difference
ln(net output value/capital employed)	−1.791	−1.436	0.355	42.6***
Of which:				
ln(price margin)	−1.407	−1.377	0.030	3.1
TFPQ	0.500	0.568	0.069	7.1***
ln(total input/capital employed)	−0.883	−0.627	0.256	29.2***
Observations	129	262		

=> for the same amount of capital employed, incumbent plants mobilize almost 30 percent more of their combined inputs toward production than acquired plants

3.4 Empirical Research: Decomposing Profitability Differentials 2

Decomposition net output value before/after acquisition

Pre- and early post-acquisition means of logs	Pre-acquisition (A)	Early post-acquisition (B)	Difference (B) − (A)	Percentage difference
ln(net output value/capital employed)	−1.735	−1.392	0.343	40.9***
Of which:				
ln(price margin)	−1.438	−1.367	0.071	7.4**
TFPQ	0.499	0.568	0.069	7.2***
ln(total input/capital employed)	−0.795	−0.593	0.202	22.4**
Observations	157	157		

Pre- and late post-acquisition means of logs	Pre-acquisition (A)	Late post-acquisition (B)	Difference (B) − (A)	Percentage difference
ln(net output value/capital employed)	−1.735	−1.275	0.460	58.4***
Of which:				
ln(price margin)	−1.438	−1.316	0.122	13.0***
TFPQ	0.499	0.685	0.187	20.5***
ln(total input/capital employed)	−0.795	−0.644	0.151	16.3***
Observations	157	278		

=> input use intensity dominates early post-acquisition profitability growth, with TFPQ growth mattering relatively more in the long run

3.4 Empirical Research: Decomposing Profitability Differentials 2 (Alternative)

2 alternative measures of TFP:

- Recall that our TFPQ estimation has two distinguishing characteristics: physical units & inputs as service flows
- this rule out any plant-level heterogeneity in prices and input utilization

1. TFPQU: measures TFPQ without conditioning on the plant actually operating by using input stock (spindles & workers)
   - thus higher (lower) input utilization shows up as higher (lower) TFPQU for a plant
2. TFPR: revenue-based output measure typically used in the literature
   - any difference between this productivity measure and TFPQU comes from price differences across producers

3.4 Empirical Research: Decomposing Profitability Differentials 3

TABLE 6—TOTAL FACTOR PRODUCTIVITY CHANGES AROUND ACQUISITION EVENTS

	Within-acquired plants estimations				Difference-in-differences estimations		
Dependent variable	TFPR	TFPQU	TFPQ	Dependent variable	TFPR	TFPQU	TFPQ
Late pre-acquisition dummy	0.020 (0.051)	−0.027 (0.044)	−0.003 (0.019)	After acquisition	−0.083** (0.035)	−0.042* (0.024)	−0.055*** (0.013)
Early post-acquisition dummy	0.168*** (0.058)	0.104*** (0.038)	0.045* (0.026)	Acquired plant	−0.075** (0.035)	−0.093*** (0.029)	−0.025 (0.021)
Late post-acquisition dummy	0.290*** (0.080)	0.211*** (0.050)	0.126*** (0.033)	(After acquisition) × (acquired plant)	0.148*** (0.042)	0.139*** (0.033)	0.091*** (0.023)
Constant	0.750*** (0.065)	0.304*** (0.053)	0.603*** (0.032)	Constant	1.197*** (0.083)	0.393*** (0.042)	0.480*** (0.034)
Acquisition fixed effects	Yes	Yes	Yes	Acquisition fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Year fixed effects	Yes	Yes	Yes
Observations Adjusted R^2	1,047 0.824	1,077 0.478	1,078 0.734	Observations R^2	1,430 0.636	1,486 0.318	1,487 0.347

=> input utilization heterogeneity explains most of the difference

3.5 Empirical Research: Input utilization: The Role of Demand Management

$=>$ **So what's the secret of net input utilization? Why were stronger firms able to utilize their inputs so much more than weaker firms?**

TABLE 7—INVENTORY AND ACCRUED PAYMENTS TO OUTPUT VALUE RATIOS: INCUMBENT AND ACQUIRED PLANTS AND ACQUIRED PLANTS PRE- AND POST-ACQUISITION

Means	Acquired plants (A)	Incumbent plants (B)	Difference (B − A)	Percentage difference
Inventory/produced output (C)	0.046	0.018	−0.028	−61.0***
Accrued revenues/produced output (D)	0.031	0.015	−0.016	−50.6***
Unrealized/produced output (C) + (D)	0.078	0.033	−0.045	−57.4***
Observations	113	195		

	Pre-acquisition (A)	Early post-acquisition (B)	Difference (B − A)	Percentage difference
Inventory/produced output (C)	0.048	0.013	−0.034	−72.0***
Accrued revenues/produced output (D)	0.029	0.020	−0.010	−32.4**
Unrealized/produced output (C) + (D)	0.078	0.032	−0.046	−59.4***
Observations	139	100		

	Pre-acquisition (A)	Late post-acquisition (B)	Difference (B − A)	Percentage difference
Inventory/produced output (C)	0.048	0.009	−0.039	−81.5***
Accrued revenues/produced output (D)	0.029	0.015	−0.014	−48.1***
Unrealized/produced output (C) + (D)	0.078	0.023	−0.055	−70.6***

3.5 Empirical Research: Input utilization: The Role of Demand Management

$=>$ **incumbent plants had substantially lower ratios of unrealized output, and they transferred this ability to their acquired mills after purchase. How?**

A potenitally important sources of cotton spinning firms' abilities to manage demand

- in low-demand times, major trading houses limit their purchases by "sticking" with certain producers rather than cutting prices

because

- big trading houses are stronger financially than most spinning firms and extend credit to the latter
- high risk thus make them favor reputable and well-run industry producers with established long-term relationships
- these producers thus sustain more consistent operations and have lower inventories and higher utilization levels

3.5 Empirical Research: Input utilization: The Role of Demand Management

To explore this possibility quantitatively:

- find 154 individuals likely to play the most prominent role in cotton spinners' output markets from Nihon Zenkoku Shoukou Jinmeiroku 1898
- match to 67 firms' board members or top shareholders (128/154, 33/67)
- accordingly, divid firms into in-/out-network firms
- then test whether a producer's relationship to trading houses is reflected in the performance (1898-1902)

3.5 Empirical Research: Input utilization: The Role of Demand Management

TABLE 8—PLANT AND FIRM PERFORMANCE METRICS, 1898–1902: IN-NETWORK AND OUT-OF NETWORK FIRMS

Outcome	Out-of-network (A)	In-network (B)	Difference (B − A)
TFPQ	0.433	0.488	0.055***
TFPQU	0.117	0.241	0.123***
ROCE	0.023	0.059	0.037***
Unrealized output ratios	0.127	0.084	−0.043***
Spindle utilization rates	0.739	0.781	0.043**
Logged price residuals	−0.025	0.018	0.044***
Observations	127	170	

***Significant at the 1 percent level.
**Significant at the 5 percent level.

Source: Authors' calculations.

- TFPQ, TFPQU, and ROCE of in-network firms' plants are significantly higher than out-network - in-network firms have substantially lower plants' unrealized output ratios, and relatively higher capacity utilization and prices

3.5 Empirical Research: Input utilization: The Role of Demand Management

Why initial profitability gaps and why it closed by acquisition?

- close relationships between industry producers and prominent traders allowed connected producers to manage demand fluctuations more effectively (lower average inventories and greater capacity utilization levels)
- in-network firms were also more likely to acquire other firms in the future (0.79 v.s. 0.21)
- If demand management is correlated with broader managerial abilities, TFPQ gains in longrun can be due to transferred broader managerial abilities that raised operational efficiency

Another possibility for high performance

- having chief engineers with formal technical education
- the effect is similar and more even more strong in TFPQ, but firms are largely duplicated

4. A Mechanism

empirical results indicate:

- demand management ability in capital utilization levels and unrealized output rates

a simple theory show one channel:

- how fundamental heterogeneity across owners/managers leads to variations in such ability and productivity/profitability changes surrounding acquisition

...

Conclusion

1. Management can affect business performance
   - in a way that demand management can affect both productivity and profitability
2. This ownership reallocation even provides a clear mechanism to spur an industry's growth
   - "high profitability buy low profitability" can be a good story
3. Credits, demand management or other untraditional economic things matter in real market

- Recall that in theory, a plant should be able to sell all goods and the price will go down to a lower equilibrium.
- This is a story that will never happen in economic theory! Perfect competitive market is a fairy tale!

Alternative Conclusion

"By digging deep into the micro-evidence, we aim to complement past empirical work and provide fresh insights for further development of economic theory about resource reallocation."

1. History can sometimes be a better data source than today.
2. History can always be the best place to test economic theory and find new ones.