

Regulation, Competition, Diversification, Governance and Costs: An Empirical Analysis of Public Utility and Manufacturing Firms in Japan

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Summary of This Study

- **Purpose:** investigate how regulation, competition, governance structure, and business diversification strategy affect the cost structure of firms
- **Method:** translog cost function using 358 public utility firms and manufacturing firms from 1989 to 2002
- **Results**
 - The regulation factor does not affect the cost structure
 - The competition and governance factors affects a firm's cost reduction
 - The level of diversification is positively related to the firm's business costs (lack of economies of scope)

Contributions of This Study (1)

1. This is the only study so far to **consider together the four important factors** (regulation, competition, governance structure, and business diversification)
 - Previous studies
 - only regulation (e.g. Ter-Martirosyan and Kwoka (2010))
 - competition and governance structure (e.g. Berger and Hannan (1998))
 - only diversification (e.g. Jeng and Lai (2005))
2. This study uses the **quantity** rather than the quality variable of regulation
 - Previous studies: Dummy variable (e.g. Fabrizio et al. (2007), Ter-Martirosyan and Kwoka (2010))
3. We introduce the factor of **governance structure in the cost function**
 - Previous studies: governance structure in a firm's performance (e.g. Zelenyuk and Zheka (2006) and Berger et al. (2009))

Contributions of This Study (2)

4. We include a variable for the **strategic behavior** of a firm.
 - Many firms operate in more than two industries
 - a multi-segment strategy is investigated
 - If there exist scope economies, this factor has negative effects on costs
5. We try to obtain more **general results of regulation** in both public utility and manufacturing industries
 - Previous studies: specific types of regulation or specific industries
 - environmental regulation: Nowell and Shogren (1994)
 - incentive regulation (e.g. Berg and Jeong (1991))
 - price regulation (e.g. Vogelsang (2002))
 - energy industry (e.g. Majumdar and Marcus (2001))
 - rail industry (e.g. Mizutani et al. (2009))
 - postal service industry (e.g. Mizutani and Uranishi (2003))
 - When the focus shifts to general regulation or to other industries, the results will be the same as in the specific cases?

Previous Studies (1)

- Regulation

- Conflicting results

- Regulation reduces costs (e.g. Ter-Martirosyan and Kwoka (2010))
 - Regulation increases costs (e.g. Fabrizio et al. (2007))
 - Regulation does not affect costs (e.g. Berg and Jeong (1991))

- Competition

- Competition certainly affects firms' costs.

- Competition improves cost efficiency (e.g. Fenn et al. (2008))
 - Competition worsens cost efficiency (e.g. Nakamura (2010))
 - U-shaped relationship (e.g. Sari (2003))

Previous Studies (2)

- Governance Structure

- Foreign ownership improves cost efficiency (e.g. Berger et al. (2009))
- The existence of large shareholders has differing results
 - Large shareholders decrease cost efficiency (e.g. Berger and Hannan (1998))
 - Large shareholders increase cost efficiency (e.g. Berger et al. (2009))
- governmental ownership increases cost efficiency (e.g. Berger et al. (2009))
- 'Keiretsu' increases cost efficiency (e.g. Jeng and Lai (2005))

- Diversification Strategy

- Diversification causes cost inefficiency (e.g. Rajan et al. (2000))
- There exist economies of scope (e.g. Ottoz and Di Giacomo (2012) in Italian bus industry)

Empirical Model -Cost Function-

- $$\ln C = \alpha_0 + \alpha_Q \ln Q + \sum_i \beta_{w_i} \ln w_i + \frac{1}{2} \alpha_{QQ} (\ln Q)^2 +$$

$$\frac{1}{2} \sum_i \sum_j \beta_{w_{ij}} \ln w_i \ln w_j + \frac{1}{2} \sum_i \beta_{Qw_i} \ln Q \ln w_i + \gamma_{REG} RG_{REG} +$$

$$\sum_l \gamma_{CMP_l} CMP_l + \sum_m \gamma_{GS_m} GS_m + \gamma_{DIV} STR_{DIV} +$$

$$\sum_n \gamma_{EX_n} EX_n + t_T T + \delta D_{NPU}$$
- C : total costs, Q : revenues, w_i • w_j : $i, j = L$ (labor price), M (material and service price), K (capital price), T : time trend
- RG_{REG} : degree of regulation,
- CMP_l : $l =$ HHI (Herfindahl-Hirschman index), CR4 (concentration ratio of 4 firms),
- GS_m : $m =$ FRN (stock ratio held by foreign shareholders), TOP (stock ratio held by top 10 shareholders), BANK (main bank index),
- STR_{DIV} : number of segments,
- EX_n : $n =$ BKT (industry's bankruptcy ratio), PRF (industry's profitability),
- D_{NPU} : non-public utility dummy (non-public utility =1, otherwise =0)

Empirical Model -Share Function-

- We apply Shepard's lemma for the cost function

$$S_i = \beta_i + \sum_j \beta_{w_{ij}} \ln w_j + \beta_{Qw_i} \ln Q$$

where S_i : share of input i ($i, j = K, L, M$).

- **Estimation method:** Seemingly Unrelated Regression (SUR)
- **Restrictions:** $\sum_i \beta_{w_i} = 1$, $\sum_j \beta_{w_{Lj}} = 0$, $\sum_j \beta_{w_{Kj}} = 0$, $\sum_j \beta_{w_{Mj}} = 0$, $\sum_i \beta_{Qw_i} = 0$, $\beta_{QK} + \beta_{QL} + \beta_{QM} = 0$, $\beta_{w_i w_j} = \beta_{w_j w_i}$

Data and Variables (1)

- **Sample**: 358 manufacturing firms and public utility firms in Japan for the 14 years from 1989 to 2002
- **C**: the sum of labor, material (including energy) and capital costs
- **Q**: total sales
- w_l : labor costs/the total number of employees
- w_m : domestic Corporate Goods Price Index (CGPI) weighted by divisional sales ratio
- w_k : the sum of depreciation rate and interest rate
- RG_{REG} : "regulation weight" weighted by divisional sales ratio

Data and Variables (2)

- CMP_{HHI} : Herfindahl-Hirschman index based on sales
- CMP_{CR4} : the concentration ratio of top 4 firms
- GS_{FRN} : the stock ratio held by foreign shareholders
- GS_{TOP} : the stock ratio held by the top 10 shareholders
- GS_{BANK} : the standard deviation of the ratios of debt loan by each financial institution
- STR_{DIV} : the number of segments
- EX_{BKT} : the number of bankrupt firms/existing firms
- EX_{PRF} : the weighted average profitability of the industries

Summary Statistics

Variable	Unit	Mean	Standard Deviation	Minimum	Maximum
TC (total cost)	Million yen	408,031	543,665	1,843	3,042,338
Q (output)	Million yen	415,140	554,060	1,926	3,000,000
w_L (labor price)	Thousand yen	6,260	2,375	1,068	15,907
w_M (material price)	-	95.7899	26.4882	7.3416	249.9917
w_K (capital price)	-	0.1131	0.0357	0.0258	0.2802
T (time trend)	-	8.4916	3.7817	1.0000	15.0000
RG_{REG} (degree of regulation)	-	0.4585	0.3920	0.0000	1.0000
CMP_{HHI} (Herfindahl-Hirschman index)	-	0.4677	0.2505	0.0161	1.0000
CMP_{CR4} (concentration ratio of 4 firms)	-	0.7154	0.2936	0.0119	1.0000
STR_{DIV} (numbers of industries which a firm involves)	-	3.4330	1.3698	2.0000	12.0000
GS_{FRN} (stock ratio held by foreign shareholders)	-	0.0584	0.0591	0.0000	0.4024
GS_{TOP} (stock ratio held by top 10 shareholders)	-	0.3813	0.1230	0.0837	0.7876
GS_{BANK} (main bank dummy)	-	0.0908	0.0645	0.0198	0.6566
EX_{BKT} (industry's bankruptcy ratio)	-	0.2032	0.3622	0.0008	0.9828
EX_{PRF} (industry's profitability)	-	0.8731	0.3884	0.2510	5.9841
D_{NPU} (non-public utility dummy)	-	0.5000	0.5007	0.0000	1.0000
S_L (share of labor)	-	0.1657	0.0763	0.0393	0.5384
S_M (share of material and service)	-	0.7293	0.0868	0.4158	0.9067
S_K (share of capital)	-	0.1050	0.0662	0.0177	0.3374

Estimation Results

Variable	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
$\ln RG_{REG}$	-0.0007 (0.0014)	-0.0006 (0.0014)	-0.0001 (0.0014)	-0.0014 (0.0014)	-0.0007 (0.0014)	-0.0007 (0.0014)	-0.0001 (0.0014)	-0.0001 (0.0014)
$\ln CMP_{HHI}$	-	0.0292* (0.0153)	-	0.0472*** (0.0156)	-	0.0426*** (0.0153)	-	-0.0014 (0.0257)
$\ln CMP_{CR4}$	-	-	0.0428*** (0.0144)	-	0.0559*** (0.0148)	-	0.0510*** (0.0146)	0.0521** (0.0247)
$\ln GS_{FRN}$	-	-	-	-0.0214*** (0.0085)	-0.0210** (0.0084)	-0.0238*** (0.0083)	-0.0234*** (0.0082)	-0.0234*** (0.0082)
$\ln GS_{TOP}$	-	-	-	-0.0079 (0.0359)	0.0047 (0.0360)	-0.0092 (0.0356)	0.0022 (0.0357)	0.0024 (0.0359)
$\ln GS_{BANK}$	-	-	-	-0.0815*** (0.0232)	-0.0748*** (0.0230)	-0.0780*** (0.0229)	-0.0719*** (0.0227)	-0.0717*** (0.0229)
$\ln STR_{DIV}$	-	-	-	0.1455*** (0.0302)	0.1503*** (0.0300)	0.1781*** (0.0306)	0.1817*** (0.0304)	0.1817*** (0.0305)
$\ln EX_{BKT}$	-	-	-	-	-	0.0154** (0.0062)	0.0152** (0.0061)	0.0152** (0.0061)
$\ln EX_{PRF}$	-	-	-	-	-	-0.1512*** (0.0348)	-0.1472*** (0.0346)	-0.1473*** (0.0346)
D_{NPU}	-0.0467* (0.0252)	-0.0373 (0.0256)	-0.0259 (0.0259)	-0.0483* (0.0271)	-0.0347 (0.0274)	0.0255 (0.0337)	0.0365 (0.0337)	0.0366 (0.0338)
Log-likelihood	894.485	897.344	900.112	901.368	902.790	915.185	916.358	916.544
R ²	0.9676	0.9678	0.9681	0.9709	0.9713	0.9719	0.9722	0.9722
Concavity Condition	12.6%	13.1%	12.8%	20.7%	19.6%	17.9%	15.4%	15.9%

(Note):

- (1) Numbers in parentheses are standard errors.
- (2) Sample size is 358.
- (3) Statistically significant at 1% (***), 5% (**) and 10% (*).

Discussion (1)

- We discuss our findings based mainly on Cases 4 and 6 (because R^2 are large, the concavity condition is relatively high, and key variables show the correct sign)
- Regulation does not affect the cost structure
 - Our empirical results do not support either the public or private interest theory
 - Consistent with previous studies such as Berg and Jeong (1991) and Bos and Peters (1995) showing that regulation does not affect cost structure
- Competition has the effect of reducing the costs of a firm

Discussion (2)

- As the foreign shareholders' ratio becomes larger and more concentrated in a single main bank, the costs of a firm become smaller
 - Foreign shareholders: consistent with Zelenyuk and Zheka (2006) and Berger et al. (2009)
 - Main bank: consistent with Jeng and Lai (2005) arguing that the close relationship with main bank results in better monitoring and reduced information costs
- As a company diversifies more from its core industry to other industries, the costs of all the firm's business increase → no economies of scope
- As industry's bankruptcy ratio increases and industry's profitability decrease, the cost of a firm becomes large

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Thank you for your attention!