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To What Extent Do Public Interest and Private Interest Affect Regulations? An Empirical Investigation of Firms in Japan

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[Abstract]: Through an empirical analysis of firms in Japan, this paper investigates to what extent the public interest and the private interest theories, respectively, explain the actual regulatory process. Our estimation findings are as follows. First, the explanatory power of the public interest theory is higher in non-public utility industries, while that of the private interest theory is higher in public utility industries. Second, rapidly growing industries become less regulated as they no longer need government protection. Third, highly competitive industries become more regulated so as to retain profit for individual companies. Fourth, price level has different implications among industries. The negative coefficient in non-public utility industries supports the public interest theory, while the positive coefficient in public utility industries supports the private interest theory.

[Key words]: Determinants of regulation; Corporate governance; Public interest theory; Private interest theory

[JEL classification]: L44, L51, L52

1. Introduction

According to welfare economics, regulations are constructed to improve social welfare in industries where there are market failures. However, not all regulations implemented in reality seem to be designed with social welfare in mind, nor are they always drawn up in the most desired form. For example, some regulations work to protect politically well-connected companies from severe competition. Lack of relevance to social welfare can also be seen in the opposition campaigns of involved interest groups in the deregulation process, which results in deregulation being implemented in a distorted form. Observation suggests that actual regulation is tampered with by the intervention of certain interest groups.

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Previous studies on regulatory economics, such as Stigler (1971) and Peltzman (1976), have recognized that the actual regulatory process does not necessarily reflect the implications of welfare economics. These researchers propose two perspectives: the public interest theory and the private interest theory. The public interest theory assumes that regulations are organized to maximize social welfare, as is typically discussed in traditional welfare economics. The private interest theory, on the other hand, assumes that regulations are the result of a power balance among various interest groups, including the government, companies, consumers, and community residents.

It is the purpose of this paper to investigate, by empirical methodology, which theory—the public interest or the private interest—better explains the actual regulatory process. Our paper makes several contributions to the existing field. First, we empirically compare the fitness of these two theories in real regulatory situations. While certain previous studies recognize the two theories in their analytical framework, empirical research has rarely been implemented. For example, Peltzman (1976) focuses on the theoretical generalization of the private interest model using a politician's objective function. Moreover, although some studies use the empirical method, most focus only on one theory or the other, and do not compare the two. For example, although Stigler (1971) and Primeaux Jr. et al. (1984) use an empirical model to investigate the private interest theory, they do not consider the public interest theory at all.

Second, we generalize the issue for multiple industries by using the industry-level total regulation index. The total regulation index, or "regulation weight," expresses the strength of regulations in an industry and can be compared among industries. Using this index enables us to implement an analysis of multiple industries and thus to draw a general implication which cannot be obtained in an intra-industry analysis. In fact, most existing studies focus on a specific regulation in a specific industry. For example, Benmelech and Moskowitz (2010) examine usury laws as a proxy for financial regulation, while Dnes and Seaton (1999) investigate deregulation in regional electricity companies. Berg & Jeong (1991) focus on incentive regulation for electric utilities.

Third, we include multiple factors such as corporate governance and market price in determining the fitness of the two theories. Most previous studies have viewed the regulatory process from a single perspective. For example, Kroszner and Strahan (1999) use only the sign of the competition variable to determine which theory is correct. In this paper, we define the fitness of the two theories based on various factors including corporate governance, governmental intervention, industrial growth rate, competition, and market price index. This enables us to cover broader aspects of the two theories and interpret each theory appropriately.

Fourth, we calculate the percentages of the fitness of the two theories with regard to public utilities and non-public utilities. As stated above, previous literature rarely compares the two theories in an empirical model. This means that previous work assumes implicitly that only one of these theories is correct. However, we assume that both theories explain the real situation to some

extent but that the percentage of fitness differs with each. Moreover, we note the difference between public utilities and non-public utilities. Since our regulation index includes all types of regulation programs in an industry, we consider the possibility that the dominant type of programs can differ with industrial characteristics. In fact, our result shows that the fitness of each theory differs significantly in public utilities and non-public utilities.

This paper consists of five parts after the introduction. Section 2 explains theoretical background by overviewing previous literature on the regulatory process. Section 3 shows our model structure for the empirical analysis. Section 4 explains the data and the variables used in the analysis. Section 5 shows the empirical results, and Section 6 summarizes the conclusions.

2. Theoretical background

2.1 Public interest theory and private interest theory

As Vickers and Yarrow (1988) note, previous literature has proposed mainly two theories to explain how regulations are constructed: the public interest theory and the private interest theory. The public interest theory assumes that regulation is formulated to correct various types of market failures and to improve social welfare, as seen in traditional welfare economics. Under this assumption, regulations are constructed by a government with the intention of maximizing social welfare, and no other interest groups can intervene in the regulatory process. That is, as Viscusi (2005) indicates, this theory assumes that "under what kind of situation the regulation *should be* formulated" directly explains "under what kind of situation the regulation *is* formulated."

However, in reality, sometimes regulations are not created to address market failures (Posner 1974). Stigler (1971) argues that regulatory processes are interposed by various interest groups such as companies, trade groups, consumers' unions, and community residents. What is called the private interest, or capture, theory is the idea that rather than correcting market failures, regulation is designed to further the interests of lobbying groups which control the regulatory process. Since Peltzman (1976) generalized Stigler's (1971) model of the private interest theory, some studies, such as Primeaux Jr. et al. (1984), Ros (1999), and Feijen and Perotti (2006), have applied it in their empirical analysis. For example, Primeaux Jr. et al. (1984) test Peltzman's model by the logit model using data from the electricity industry. While there is still room for improvement in the private interest theory in that it cannot sufficiently explain some regulations for social, environmental, health and safety issues, this theory is supported by evidence from empirical studies on various regulation programs and various industries: Dnes et al. (1998) for price cap regulation in the UK electricity industry, Dnes and Seaton (1999) for deregulation policy in the UK regional electricity industry, Kroszner and Strahan (1999) for US banks, Feijen and Perotti (2006) for financial regulation in manufacturing industries in 15 countries, Benmelech and Moskowitz (2010) for US financial regulation, and Smyth and Soderberg (2010) for regulator decisions in the

Swedish electricity market.

2.2 Fitness of each theory with reality

Researchers have tried to determine which of the two theories—public interest or private interest—reflects reality, and to identify the factors affecting regulatory formation. As stated above, the private interest theory is supported in various areas, but most researchers do not compare it with the public interest theory in their analysis. Similarly, most welfare economics studies based on the public interest theory overlook the private interest theory. On the other hand, some studies on regulatory economics include both theories in the same framework and determine which is supported by empirical analysis. Kroszner and Strahan (1999) and Benmelech and Moskowitz (2010) support the private interest theory, while Smyth and Soderberg (2010) support the public interest theory.

However, is it true, as most previous studies assume, that only one of the two theories reflects reality? Rather, we consider that both theories can explain reality to some extent, though the fitness of each theory differs. For example, the government might try to maximize social welfare during a regulatory process in which interest groups have already intervened. To examine this possibility, we employ a "public interest and private interest" approach instead of a "public interest versus private interest" approach.

When determining which theory is supported or identifying the factors affecting regulatory formation, previous studies use various factors, which we have grouped into five categories, according what each is related to: governance structure, governmental intervention, industrial characteristics, competition, and market price. First, governance structure is commonly included in the various forms. Stigler (1971) uses the presence of a cohesive opposition, Primeaux Jr. et al. (1984) use the influence of stakeholders such as residential consumers, industrial consumers, and natural gas producers, Ros (1999) uses private ownership, Feijen and Perotti (2006) use external dependency of finance, and Smyth and Soderberg (2010) use variables related to decision making (e.g. private ownership, governmental ownership, decisions in favor of customers, decisions in large utilities) in their analysis. In fact, since governance structure disciplines and guides decision-makers toward a certain direction favorable to the governing actor, it can influence the regulatory process.

Second, governmental intervention is also frequently mentioned, as it reflects the government's intention to improve social welfare. We separate it from governance structure, though one might consider governmental intervention as a type of governance structure. Governmental intervention is different, however, in that it intends to maximize social welfare while governance structure intends to maximize the interest of specific groups such as companies or business groups. This means that governmental intervention is related to the public interest theory.

Third, industrial characteristics include the industrial growth rate and profit rate. Berg &

Jeong (1991) use a firm's margin, Dnes and Seaton (1999) use abnormal market returns earned by special interest groups such as regional electricity companies, generators, and foreign companies, and Ros (1999) uses yearly growth.

Fourth, competition is also commonly used to test the two theories. Kroszner and Strahan (1999) include small firms' share of the number of firms in the state, Ros (1999) includes the competition level, Feijen and Perotti (2006) use industry-level number of establishments before a crisis as an explanatory variable, and Benmelech and Moskowitz (2010) use the bank Herfindahl concentration index.

Fifth, since Peltzman (1976) states that the price of goods influences decision-makers' objective function, empirical studies such as Ros (1999) include the price variable. Price is the main variable by which the government measures the monopoly level and also the factor that affects interest groups' incentives to capture the regulatory process.

In summary, factors related to governance structure are considered to belong to the private interest theory in its original nature, while those related to governmental intervention belong to the public interest theory. The other factors—industrial characteristics, competition, and price—can be determined on a case by case basis, since these factors can influence both the government's incentive to protect an industry and the interest group's incentive to capture the regulatory process to retain profit. Which incentive dominates the other is a question to be determined by empirical observation.

Although the above-mentioned factors are all shown to be important in the literature, analysis considering these factors together in the same model has rarely been implemented. Most studies focus on some of the above factors, depending on the industry being investigated. For example, Kroszner and Strahan (1999), who use data on the bank industry, examine the competition variable to test the two theories. Moreover, the research interest of the existing literature is to determine which theory−the public interest or the private interest−reflects reality. Thus, it has not been examined to what extent each theory can explain the real regulatory process. In this paper, we try to answer this question by considering the two theories in the same model including all the important factors mentioned above.

3. Model

3.1 Model structure and methodology

Our research method is based on Kroszner and Strahan (1999). They determine whether public interest or private interest theory reflects reality by the sign of the main variable, competition. Similarly, we measure the explanatory powers of the public and the private interest theories by the signs of multiple variables: industrial characteristics, competition, and price index. We use multiple variables to determine the supported theory, which enables us to view the regulatory

process from multiple perspectives. In our analysis, a negative variable sign supports the public interest theory, while a positive sign supports the private interest theory. In addition to the above variables, we assume that there are certain factors that should be considered in advance as public/private interest-related. These are the structure of corporate governance and governmental intervention. We will explain the characteristics of each variable later.

We consider that both the public interest and the private interest theories have some explanatory powers applicable to real situations. Thus, we calculate the explanatory power of each theory after the estimation. Summing up the magnitudes of the variables supporting the same theory enables us to measure the whole explanatory power as a theory. That is, the coefficients of significant variables showing the positive sign are adjusted and summed up to measure the fitness of the private interest theory, and the absolute values of the coefficients of variables significantly showing the negative sign are also adjusted and summed up to measure the fitness of the public interest theory. Since all variables are standardized before the estimation, the magnitude of the variables can be compared with each other in themselves, even if the unit of measurement is different.

In this paper, we consider the public interest and the private interest theories, as shown in Figure 1.

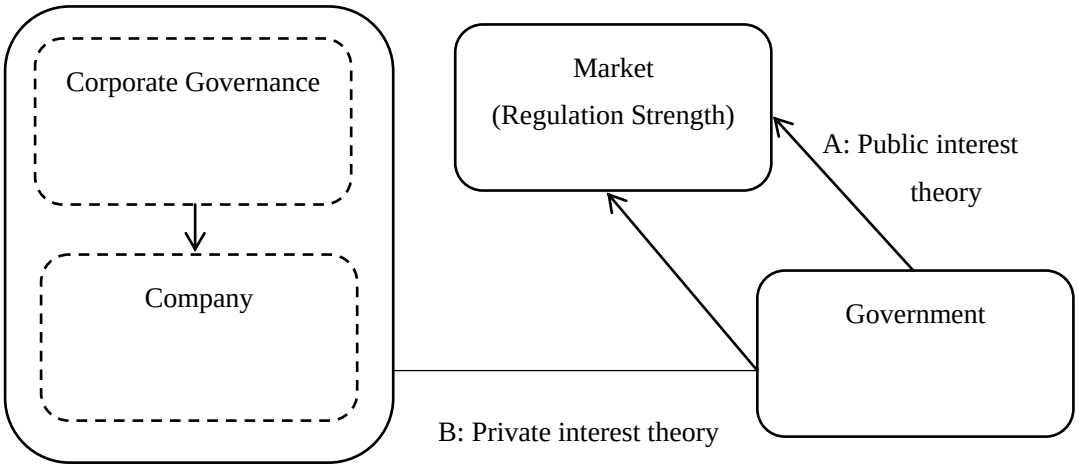

Figure 1 Public interest theory and private interest theory

Arrow A shows the public interest theory and arrow B shows the private interest theory. In the public interest theory, regulations are constructed by the stand-alone government directly interfering in the market to maximize social welfare. In the private interest theory, the government is influenced by certain interest groups, say companies, and constructs regulations for the sake of these groups. In other words, the interest groups indirectly interfere in the market through the

government. The left side of Figure 1 shows that companies are also influenced by the structure of corporate governance, such as ownership by influential shareholders. The border between corporate governance and the company itself can be ambiguous; for example, some monitoring systems exist inside a company; these two actors are enclosed respectively in dotted boxes.

Based on the above method, we consider the characteristics of the explanatory variables used in the analysis below. The explained variable is the regulation strength in the market. As more regulations are implemented in the industry, the value of the regulation strength becomes high. By regulation strength, we mean here all types of regulations related to price, entry, environmental protection, health and safety, etc. This regulation strength is explained by the structure of corporate governance, governmental intervention, industrial characteristics, competition, and price index.

As Figure 1 shows, the structure of corporate governance belongs to the private interest theory. Arrow B expresses the fact that the structure of corporate governance influences the company's decision-making and then the government's action with regard to the market. Thus, the variables related to corporate governance are considered in advance as variables of the private interest theory. In our empirical analysis, whether the signs of the governance variables are negative or positive, they are interpreted as the impacts of private interest groups. The sign depends on the interest of the capturing group. If fewer regulations are favorable for the capturing group, the sign will be negative, while if they desire more regulations the sign will be positive. As the variables of corporate governance, we include the following seven: managerial ownership, ownership by large shareholders, ownership by financial institutions, foreign ownership, control by the parental company, M&A threat, and the power of trade groups.

Figure 1 also shows that direct governmental intervention belongs to the public interest theory. The government directly interferes in the market as shown by arrow A. Thus, regardless of the sign of the coefficient, governmental intervention is deemed to be the public-interest impact in the empirical analysis. The sign merely shows the direction of the government's intention. When more regulations are favorable for the market, the industry becomes highly regulated, which generates the positive sign. When the government considers fewer regulations as desirable, the sign will be negative. Sometimes the latter case can be observed with deregulation in the real world, which is also direct intervention from the government into the market. As a measure of governmental intervention, we include governmental ownership in the model.[1]

[1] One might consider that governmental intervention can reflect the interest of private groups and thus belongs to the private interest theory. Surely, in Figure 1, there is another arrow from "Government" to "Market," which belongs to arrow B. However, governmental ownership, the proxy we used here for governmental intervention, is relatively independent of the other groups, and as a result, we can distinguish arrow A from arrow B. This is because, when it comes to shareholding, the government is expected to behave as an independent owner and monitor of the company, as are the other shareholders. It is natural to assume that shareholders observe, monitor, and make a decision independently from the companies they own, as most discussions on corporate governance implicitly assume. Thus, in this paper, the governmental direct intervention in the form of ownership corresponds to the public interest

In addition to these variables, we include industrial characteristics, competition, and price index as explanatory variables in the model. These are the variables whose signs are used to determine whether the public or the private interest theory is supported. We include the growth rate of the industry as the variable of industrial characteristics, the number of companies in the industry and the inverse of the Herfindahl-Hirschman Index (HHI) as variables of competition, and the inverse of Consumer Price Index (CPI) as price variables. We explain the interpretation of each variable below.

First, we can interpret the positive sign of the growth rate of the industry to indicate that when companies are able to obtain abundant resources from the market to be used for capturing, more regulations are made for the sake of these companies. Thus, the positive sign supports the private interest theory. Conversely, the negative sign supports the public interest theory. When the industry grows, since the existing companies can sustain enough profit to survive, the government does not need to protect the industry. Similarly, as high-growth industry attracts many competitors in pursuit of excess profit, the problems of monopoly are reduced, which results in less necessity for the government to regulate.

Second, the positive sign of the competition variables means that regulations are increased by the capture of existing companies to sustain enough profit to survive. Conversely, the negative sign means that the government regulates more to avoid problems with monopoly when there are very few companies in the industry.

Third, the price variable can be interpreted as follows. In the private interest theory, when the price goes down, existing companies participate more in political activities to keep their profit. Thus, the industry becomes highly regulated. On the other hand, in the public interest theory, when the price becomes lower, regulations are relaxed since monopoly problems are reduced, which leads to less necessity for the government to interfere.

In summary, we can express our model as equation (1).

$$REG = f(CG_i, GOV_j, IND_k, COMP_l, PRICE_m). \quad (1)$$

Where *REG* : strength of regulations in the industry,

CG_i: corporate governance (*i* =*MANAGE* (the managerial ownership), *LARGE* (the ownership by large shareholders), *FINANCIAL* (the ownership by financial institutions), *FOREIGN* (the foreign ownership), *PARENT* (the control by the parental company), *M&A* (the M&A threat), *TGROUP* (the power of trade groups),

GOV_j : government (*j* = *OWN* (the governmental ownership)),

IND_k : industry structure (*k* = *GROWTH* (the growth rate of the industry)),

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theory.

$COMP_l$: competition *(l = NUM* (the number of companies in the industry), *INVHHI* (the inverse of HHI)),

PRICE: price (m =INVCPI (the inverse of CPI)).

We take the inverses of HHI and CPI so that we can interpret the negative sign as the public-interest impact and the positive sign as the private-interest impact.

3.2 Empirical model

Based on equation (1), we specify the empirical model here. As stated above, we consider that the fitness of each theory differs between public utility industry and non-public utility industry. In order to reflect the difference between them, we add the cross terms of the variables shown above and public utility dummy (*P*), which generates the empirical model expressed as equation (2).

$$\begin{aligned} REG = {} & \alpha_0 + \Sigma\, \beta_1\, CG_{MANAGE} + \beta_2\, CG_{LARGE} + \beta_3\, CG_{FINANCIAL} + \beta_4\, CG_{FOREIGN} \\ & + \beta_5\, CG_{PARENT} + \beta_6\, CG_{M\&A} + \beta_7\, CG_{TGROUP} + \beta_8\, GOV_{OWN} + \beta_9\, IND_{GROWTH} \\ & + \beta_{10}\, COMP_{NUM} + \beta_{11}\, COMP_{INVHHI} + \beta_{12}\, PRICE_{INVCPI} + \gamma_1\, PCG_{MANAGE} \\ & + \gamma_2\, PCG_{LARGE} + \gamma_3\, PCG_{FINANCIAL} + \gamma_4\, PCG_{FOREIGN} + \gamma_5\, PCG_{PARENT} \\ & + \gamma_6\, PCG_{M\&A} + \gamma_7\, PCG_{TGROUP} + \gamma_8\, PGOV_{OWN} + \gamma_9\, PIND_{GROWTH} \\ & + \gamma_{10}\, PCOMP_{NUM} + \gamma_{11}\, PCOMP_{INVHHI} + \gamma_{12}\, PPRICE_{INVCPI} + \varepsilon \quad . \end{aligned} \tag{2}$$

The coefficients of the variables which are not multiplied by the public utility dummy show the impact in non-public utility industry, while the sum of the coefficients of cross terms and non-cross terms shows the impact in public utility industry. For example, β_{10} shows the effect of competition in non-public utility industry, while the sum of β_{10} and γ_{10} shows the effect in public utility industry. All variables except *P* are standardized.

As stated above, in order to calculate the explanatory powers of the public and the private interest theories, the adjusted magnitude is calculated for each variable showing statistical significance after the estimation. It is defined as the ratio of the impact of the variable to the sum of the impacts of all significant variables. In our model, the negative sign of the coefficient supports the public interest theory while the positive sign supports the private interest theory. The exceptions are the variables of corporate governance, which belong to the private interest theory regardless of the sign, and the governmental intervention, which belongs to the public interest theory regardless of the sign.

Since we assume in advance that corporate governance variables all belong to the private interest theory, the signs must be positive. Therefore, the adjusted magnitude of each variable of corporate governance is calculated as:

For non-public utilities,

$$\text{Adjusted magnitude of each } CG = \frac{|\beta_i|}{\sum_1^{12}|\beta_j|} \quad (3)$$

$where\ i = 1, \dots, 7\ and\ j = 1, \dots, 12.$

For public utilities,

$$\text{Adjusted magnitude of each } CG = \frac{|\beta_i| + |\gamma_i|}{\sum_1^{8}(|\beta_j| + |\gamma_j|) + \sum_9^{12}|\beta_j + \gamma_j|} \quad (4)$$

$where\ i = 1, \dots, 7\ and\ j = 1, \dots, 12$

Similarly, since we assume in advance that governmental intervention belongs to the public interest theory, the sign ought to be negative. Therefore, the adjusted magnitude of governmental intervention is calculated as:

For non-public utilities,

$$\text{Adjusted magnitude of } GOV = \frac{-|\beta_8|}{\sum_1^{12}|\beta_j|} \quad (5)$$

$where\ j = 1, \dots, 12.$

For public utilities,

$$\text{Adjusted magnitude of } GOV = \frac{-(|\beta_8| + |\gamma_8|)}{\sum_1^{8}(|\beta_j| + |\gamma_j|) + \sum_9^{12}|\beta_j + \gamma_j|} \quad (6)$$

$where\ j = 1, \dots, 12$

On the other hand, variables *IND*, *COMP*, and *PRICE* have the meaning of the estimated sign. Thus, the numerator is not taken as absolute value.

For non-public utilities,

$$\text{Adjusted magnitude of each } IND, COMP, and\ PRICE = \frac{\beta_i}{\sum_1^{12}|\beta_j|} \quad (7)$$

$where\ i = 9, \dots, 12\ and\ j = 1, \dots, 12.$

For public utilities,

$$\text{Adjusted magnitude of each } IND, COMP, and\ PRICE = \frac{\beta_i + \gamma_i}{\sum_1^{8}(|\beta_j| + |\gamma_j|) + \sum_9^{12}|\beta_j + \gamma_j|} \quad (8)$$

$where\ i = 9, \dots, 12\ and\ j = 1, \dots, 12$

Finally, we calculate the fitness of each theory into public utility and non-public utility industries respectively. The fitness of public interest theory can be defined as the absolute value of the sum of the adjusted magnitude of all significant variables whose signs are negative and that of private interest theory as the sum of the adjusted magnitude of all significant variables whose signs are positive. The total of these two values of fitness is equal to 1 in each public and non-public utility industry. Thus, the fitness of each theory is expressed in the value it takes between 0 and 1.

4. Data and variable

We use Japanese 643 industry-level observations in 2002. Industrial categorization is based on the middle class of the *Japan Standard Industrial Classification*. We collected the data from *JIP Database 2006* by the Research Institute of Economy, Trade & Industry for the regulation data and *Needs Financial Quest* by Nikkei Digital Media for all other data. Year 2002 is the latest annual year in which we can obtain all the data for the variables. The definition and summary statistics of the variables are shown in Table 1. All variables except *P* are standardized to compare the magnitudes.

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[Table 1]

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REG is the regulation weight calculated in *JIP Database 2006*. The calculation method of this weight is as follows. First, each business sector in an industry is categorized into "regulated" or "non-regulated" based on the regulatory documents by the Management and Coordination Agency in Japan. Next, the added value of each business sector is calculated. Then, the total added value of all regulated sectors and of all regulated and non-regulated sectors is generated. As a result, regulation weight expresses the ratio of the added value in regulated business sectors to that in all sectors in an industry.

As the measurement of CG_{MANAGE}, CG_{LARGE}, $CG_{FINANCIAL}$, and $CG_{FOREIGN}$, we calculated the ratios of shares held respectively by company managers, top ten shareholders, financial institutions, and foreign owners, to the total number of shares with respect to company, and take the industrial average based on the middle class of the *Japan Standard Industrial Classification*. CG_{PARENT} is the ratio in an industry of the companies with a parent company. $CG_{M\&A}$ is the ratio in an industry of companies having experienced M&A as a buyer or a seller. CG_{TGROUP} is the ratio in an industry of the companies belonging to some sort of trade group. GOV_{OWN} is the ratio of shares held by the government to the total number of shares.

IND_{GROWTH} is the industrial average of the growth rate of revenues from the previous year. $COMP_{NUM}$ is the number of companies in the industry. $COMP_{INVHHI}$ is the inverse of the Herfindahl-Hirschman Index (HHI) based on revenues. We take the inverse of HHI so that a higher value of $COMP_{INVHHI}$ means a higher level of competition. Similarly, $PRICE_{INVCPI}$ is the inverse of Consumer Price Index (CPI). As we take the inverse of CPI, $PRICE_{INVCPI}$ means the lowness of the price.

Last, we generate the cross terms of the above variables and the public utility dummy, *P*.

P takes a value of one if the industry belongs to the public utility industry category, a value of zero otherwise. These cross terms express the difference between the public and the non-public utility industries. The coefficient of non-cross term shows the impact in non-public utility industry, while the sum of the coefficients of non-cross term and cross term of the same variable shows the impact in public utility industry.

5. Estimation results

The estimation result by OLS is shown in Table 2.

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[Table 2]

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Model 1 is the full model shown as equation (2), Model 2 excludes GOV_{OWN} from Model 1, and Model 3 excludes all cross terms from Model 1. The adjusted magnitude of each variable is calculated based on equations (3) through (8). The fitness of each theory is defined as the absolute value of the sum of the adjusted magnitudes of all significant variables whose signs are negative for public interest theory and positive for private interest theory. The value in the dark black box shows the result in non-public utility industry and that in the light black box shows the result in public utility industry. Note that the latter is calculated as the sum of the coefficients of cross term and non-cross term of the same variable.

The most important result is that the explanatory power of public interest theory is higher in non-public utility industry while that of private interest theory is higher in public utility industry. In Model 1 of Table 2, the fitness of public interest theory is 80.4% and that of private interest theory is 19.6% in non-public utilities, while in public utilities, the fitness of public interest theory is only 24.3% and that of private interest theory is 75.7%. This result does not support the traditional assumption that the government is keen to interfere in public utility industry while it tends to leave control to the market in non-public utility industry.

We can interpret our result as follows. Since non-public utility industry is not highly regulated in its original nature, the government might have high incentive to interfere in this industry. Generally, companies in non-public utility industry tend to pursue their own economic gain rather than to maximize the social welfare. Thus, the government might try to lead them to consider more closely the public interest. As a result of the intense interference of the government, other interest groups are excluded from the determination process of regulations. This is consistent with the

result that most of the other actors such as shareholders and trade groups are not significant in non-public utility industry.

On the other hand, since public utility industry is highly regulated in its original nature, the government has less incentive to interfere in this industry. Rather, considering the recent criticism that public utilities are inefficient because of government protection, the government has incentive to withdraw and leave control to the market. Thus, the regulatory process is subject to interference by other interest groups. This is consistent with the result that various factors such as corporate governance and industrial characteristics are significant in public utility industries.

Next, we will discuss each variable used to determine the supported theory by its estimated sign. First, the industrial growth rate has a negative effect in public utility industry, which suggests that highly growing industry becomes less regulated probably because the government no longer needs to protect the industry. Conversely, the industrial growth rate is not significant in non-public utility industry. The number of companies in the industry has a positive effect in public utility industry, which suggests that a highly competitive industry becomes more regulated to sustain profit for each company. However, the other measure of competition, the inverse of HHI, is not significant in either industry. The inverse of CPI has a positive impact in public utility but a negative impact in non-public utility industry. This suggests that when the price is high, the industry is strongly regulated in non-public utility industry. On the other hand, in public utility industry, when the price is low, the regulation is strengthened.

Since various cross terms in Model 1 are significant, Model 1 seems to be better than Model 3. A model excluding important variables is severely biased, as is known in econometrics. Although the public utility dummy in Model 3 is significant, there are differences which cannot be controlled by an intercept dummy. The slopes of some variables are different depending on the government's incentive to interfere in the industry. This suggests the necessity of analysis considering the fundamental differences between public and non-public utility industries.

Similarly, governmental ownership is important and should not be excluded from the model, as the comparison of Models 1 and 2 shows. In Model 2, which excludes GOV_{OWN} and $PGOV_{OWN}$, the explanatory power of private interest theory in non-public utility industry is 0%, while 26.2% in Model 1, which includes these two variables. Based on Model 2, we might wrongly conclude that the private interest theory has no explanatory power in the non-public utility industry. The importance of governmental ownership is shown by the result in Model 1 that both of GOV_{OWN} and $PGOV_{OWN}$ are significant.

In addition, the absolute value of the adjusted magnitude of price index is high in both public and non-public utility industries. This means that regulation strength is determined largely by the price level. This is consistent with previous studies such as Peltzman (1976) and Ros (1999) that conclude the price is the important basis for the regulation. However, as the sign of the price

index is not the same, the interpretation differs between the public and non-public utility industries. The negative coefficient in non-public utility industry supports the public interest theory, while the positive coefficient in public utility industry supports the private interest theory.

6. Conclusion

The purpose of this paper is to investigate by empirical analysis to what extent the public interest and the private interest theories respectively explain the actual regulatory process. Our paper makes several contributions to the existing field. First, we empirically compare the fitness of these two theories with regard to the real situation. Second, we generalize the issue for multiple industries by using an industry-level total regulation index. Third, we include multiple factors such as corporate governance and market price in determining the fitness of the two theories. Fourth, we calculate the percentages of the fitness of the two theories in public utilities and non-public utilities.

Our estimation result shows the following point. First, the explanatory power of public interest theory is higher in non-public utility industry while that of private interest theory is higher in public utility industry. The fitness of public interest theory is 80.4% and that of private interest theory is 19.6% in non-public utilities, while in public utilities, the fitness of public interest theory is only 24.3% and that of private interest theory is 75.7%.

Second, high-growth industry becomes less regulated since the government no longer needs to protect it. Third, highly competitive industry becomes more regulated to sustain profit for each company. Fourth, the price level has different implications among industries. The negative coefficient in non-public utility industry supports the public interest theory, while the positive coefficient in public utility industry supports the private interest theory.

Moreover, governmental ownership is important and thus should not be excluded from the model. Finally, our result supports previous studies concluding that price is the most important basis for regulation.

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Table 1 Summary Statistics

Variable	Definition	Mean	Std. Dev.	Min	Max
REG	Regulation weight	-0.009	0.992	-0.535	2.284
CG_{MANAGE}	Industrial average of managerial ownership	0.015	1.003	-0.800	6.001
CG_{LARGE}	Industrial average of ownership by top ten shareholders	0.042	0.960	-2.266	2.408
$CG_{FINANCIAL}$	Industrial average of ownership by financial institutions	0.027	0.989	-1.461	3.528
$CG_{FOREIGN}$	Industrial average of foreign ownership	0.014	1.004	-0.775	6.376
CG_{PARENT}	The rate of companies under parent companies in the industry	-0.041	0.654	-0.157	6.753
$CG_{M\&A}$	The rate of companies having experienced M&A in the industry	-0.028	0.688	-0.136	9.218
CG_{TGROUP}	The rate of companies belonging to trade groups	0.019	0.972	-2.967	0.633
GOV_{OWN}	Industrial average of governmental ownership	0.002	1.009	-0.087	21.782
IND_{GROWTH}	Industrial average of the growth rate of revenues from the previous year	0.000	1.000	-1.069	17.465
$COMP_{NUM}$	The number of companies in the industry	0.008	1.007	-0.482	13.995
$COMP_{INVHHI}$	Inverse of Herfindahl-Hirschman Index (HHI) based on revenues	0.006	1.003	-0.642	10.106
$PRICE_{INVCPI}$	Inverse of Consumer Price Index (CPI)	-0.005	1.008	-3.593	7.613
PCG_{MANAGE}	Cross term of *P* and CG_{MANAGE}	0.002	1.010	-0.085	23.504
PCG_{LARGE}	Cross term of *P* and CG_{LARGE}	0.004	1.010	-0.197	7.399
$PCG_{FINANCIAL}$	Cross term of *P* and $CG_{FINANCIAL}$	0.004	1.010	-0.179	9.020
$PCG_{FOREIGN}$	Cross term of *P* and $CG_{FOREIGN}$	0.003	1.010	-0.153	11.856
PCG_{PARENT}	Cross term of *P* and CG_{PARENT}	0.001	1.006	-0.069	20.270
$PCG_{M\&A}$	Cross term of *P* and $CG_{M\&A}$	0.000	1.006	-0.039	25.476
PCG_{TGROUP}	Cross term of *P* and CG_{TGROUP}	-0.005	0.987	-0.207	5.222
$PGOV_{OWN}$	Cross term of *P* and GOV_{OWN}	0.001	1.010	-0.065	21.487
$PIND_{GROWTH}$	Cross term of *P* and IND_{GROWTH}	0.000	1.000	-0.523	25.299

$PCOMP_{NUM}$	Cross term of *P* and $COMP_{NUM}$	0.001	1.010	-0.150	15.913
$PCOMP_{INVHHI}$	Cross term of *P* and $COMP_{INVHHI}$	0.002	1.005	-0.177	9.396
$PPRICE_{INVCPI}$	Cross term of *P* and $PRICE_{INVCPI}$	-0.011	0.977	-0.219	4.606
P	Public utility dummy (public utility industry=1, otherwise=0)	0.044	0.204	0.000	1.000

(1) The number of observations is 643 for all variables.

(2) All variables are standardized.

Table 2 Estimation result

	Model 1					Model 2					Model 3				
	Coef.		Std. Err.	Adjusted magnitude	fitness of the theory	Coef.		Std. Err.	Adjusted magnitude	fitness of the theory	Coef.		Std. Err.	Adjusted magnitude	
CG_{MANAGE}	0.038		(0.052)			0.041		(0.051)		Non-public	0.022		(0.049)		
CG_{LARGE}	0.075	*	(0.045)	0.196	Non-public	0.070		(0.044)		utilities	0.077	*	(0.045)	0.150	
$CG_{FINANCIAL}$	-0.029		(0.051)		utilities	-0.027		(0.051)			-0.048		(0.050)		
$CG_{FOREIGN}$	0.021		(0.042)			0.020		(0.042)		public	0.017		(0.041)		
CG_{PARENT}	-0.018		(0.057)		public interest	-0.018		(0.057)		interest	0.060		(0.057)		
$CG_{M\&A}$	-0.015		(0.037)		theory	-0.015		(0.037)		theory	0.008		(0.039)		
CG_{TGROUP}	-0.042		(0.047)		80.4%	-0.042		(0.047)		100%	-0.056		(0.046)		
GOV_{OWN}	-0.025	***	(0.009)	-0.065							-0.010		(0.021)		
IND_{GROWTH}	0.066		(0.064)		private	0.066		(0.064)		private	-0.041		(0.050)		
$COMP_{NUM}$	0.008		(0.046)		interest theory	0.008		(0.046)		interest	0.038		(0.055)		
$COMP_{INVHHI}$	-0.001		(0.060)		19.6%	0.000		(0.060)		theory	-0.029		(0.062)		
$PRICE_{INVCPI}$	-0.282	***	(0.063)	-0.738		-0.282	***	(0.063)	-1.000	0%	-0.277	***	(0.059)	-0.540	
PCG_{MANAGE}	-0.066		(0.054)		Public utilities	-0.077		(0.053)		Public					
PCG_{LARGE}	-0.012		(0.125)	0.107		0.000		(0.124)		utilities					
$PCG_{FINANCIAL}$	-0.167		(0.126)		public interest	-0.157		(0.125)							
$PCG_{FOREIGN}$	-0.053		(0.063)		theory	-0.065		(0.060)		public					
PCG_{PARENT}	0.076	**	(0.031)	0.109	24.3%	0.070	**	(0.029)	0.104	interest					

$PCG_{M\&A}$	0.033		(0.027)			0.049	**	(0.023)	0.073	theory					
PCG_{TGROUP}	-0.034		(0.197)		private	-0.049		(0.196)		23.0%					
$PGOV_{OWN}$	0.041	*	(0.023)	-0.024	interest theory										
$PIND_{GROWTH}$	-0.153	***	(0.051)	-0.219	75.7%	-0.154	***	(0.051)	-0.230	private					
$PCOMP_{NUM}$	0.113	**	(0.054)	0.162		0.107	**	(0.053)	0.161	interest					
$PCOMP_{INVHHI}$	-0.021		(0.127)			-0.025		(0.129)		theory					
$PPRICE_{INVCPI}$	0.547	**	(0.231)	0.380		0.572	**	(0.236)	0.433	77.0%					
P											0.159	***	(0.018)	0.310	
N	643					643					643				
Log-Likelihood	-827.586					-828.065					-838.55079				
R-squared	0.218					0.217					0.191				

(1) Significant at 1%(***), 5%(**), and 10%(*).

(2) The value in the dark black box shows the result in non-public utility industry and that in the light black box shows the result in public utility industry. The latter is calculated as the sum of the coefficients of cross term and non-cross term of the same variable. [2015.6.29 1206]