Quantifying the Price Effect of Deregulation as a Pro-competition Policy

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Abstract

This research constructs a data set regarding competition policy through a comprehensive review of previous studies, and performs a meta-analysis to quantitatively assess the price effects of deregulation. A structural econometric model is used to eliminate possible biases from heterogeneity of the studies,such as in publication types and measurement methods. Four types of regulations that deter competition are characterized and three groups of industries are made for drawing practical implications. We find that deregulation to promote competition reduces prices by 0.23% and that these estimated price effects are more stable when we control for the publication types and measurement ways. Easing regulations that restrict consumers' choice is shown to be most efficient in promoting competition, lowering prices by 0.7%. This is followed by eliminating the limitation in the number of firms in the industry, with 0.2% price reduction. Overall, the network and service industries are shown to be more responsive to deregulation than the R&D industry. These results could shed light on policy implementation when a pro-competition policy is called for due to restrictive regulations in the corresponding industries.

Keywords
Deregulation, meta-analysis, promoting competition, price effect

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1. INTRODUCTION

In situations when competition policy is called for, regulators must often decide whether deregulation is necessary, and if so, what kind of regulation should be targeted. There has been much discussion on the effectiveness of competition regulation or deregulation, and it is perhaps necessary to draw a general result from these existing studies. Regulators also might want to know the size of the price effects when a certain type of deregulation policy is implemented.

Previous studies have focused on a specific industryina single country when measuring the long-term effect of deregulation. The objective of this study is to review and integrate previous studies quantitatively and provide generalized and consistent results on the effects. In this research, we examine the effecton prices of various competition policies in various industries since the 1970s.

Most studies suggest that pro-competitive policy reforms may reduce market prices and at the same time raise investment and innovation by inducing competition. Our research uses a unique and comprehensive dataset constructed by surveying existing studies on regulation and price effects. In particular, we use a meta-analysis method with a structural estimation to quantify the extent of price reduction by deregulation in order to answer the following research questions: 1) does the government's competition policy with deregulation have an impact on anti-competitive behaviour?; 2) if so, how much is the impact of deregulation on consumer prices in the market?; and 3) how does the resulting effect differ by regulation type and sub-sector?

The empirical analysis of this paper is two-fold: 1) estimating the equation ofthe general effect of deregulation on prices and 2) quantifying the unbiased effects of each policy type in each sub-sector. Findings from the analysis can provide the implication on the principal argument of public interest in favour of deregulation and pro-competitive practices in the growth and development of industries.

This study has two main contributions to previous research. First, we applied a meta-analysis method covering more than 250 previous studies regarding different regulations and sub-industries. This allows us to quantitatively compare the different effects of deregulation using statistical methods, potentially providing a consistent and integrated summary regarding the outcome of policy implementation. In particular, we present a method of dealing with potential biases stemming from the different characteristics of previous studies. Second, we focus on the price effect of industry policy. Many studies have shown the effects of deregulation on the innovation and investment of the producer; however, the price effect is the other important consideration of the policymaker. This study can be used inpolicy reform or policy implementation as a reference for considering the effect of deregulation on the market.

In what follows, we first present previous studies on competition policy, deregulation, and price effects. We then specify the data, variables, and statistical models of the effects, and draw conclusions from our findings.

2. PREVIOUS STUDIES

This research builds on studies regarding the quantification of price effects in deregulation policies. There area substantial number of papers that investigate changes in consumer pricesdue to regulation or deregulation in various industries. Examples of such studies include the effect of environmental regulation in the energy industry (Joskow & Rose, 1985), deregulation on truck freight prices (Ying & Keeler, 1991), regulation of the entry of pharmacies and physicians (Schaumans & Verboven, 2008), environmental regulation in the cement industry (Ryan, 2012), regulation on the innovation of British manufacturing firms (Blundell, Griffith, & van Reenen, 1999), and effects of the price advertising ban on liquor prices (Milyo & Waldfogel, 1999).

The current research is closely related to research on network industries such as cable television (Rubinovitz, 1993; Tasneem, 2001), telecommunications (Mathios & Rogers, 1989; Singh, 1998; Viard, 2007), and e-commerce with digital content products (OECD, 2013). This research attempts to provide a comparison of the impact of industrial regulation according to different sub-sectors.

Another strand of research this paper contributesto is the application of meta-analyses, a quantitative way of surveying literature. Early applications of meta-analyses can be found in the domain of medical, pharmaceutical, and psychological researches, utilized to efficiently make the best use of results from numerous experiments (Durlak & Lipsey, 1991; Stanley, 2001).

The meta-analysis method has recently extended intoindustrial economics. A representative example of meta-analysis in this field might be the estimation of cartel overcharges (Connor & Bolotova, 2006). That research follows the standard meta-analysis method and applies it to the estimation of the price effects of cartel investigation. However, there is no previous meta-analysis studiesestimating the effect on the market of deregulation and pro-competitive policy reforms. Therefore, our study can be a reference in terms of providing wider and deeper results with more comprehensive observations using new methodology in the area of industrial economics.

3. DATA AND ESTIMATION MODEL

3.1. Data

We collected competition policy case studies published since the 1970s and constructed a dataset containing related information such as research description, results, and methodology. Our dataset is a general collection of previous studies from all available public sources including journal articles, books, book chapters, working papers, and the publications of universities, research institutes, and governments. Initially, there were 378 studies in the database, but those in which we could not identify the price effects were excluded. The final dataset contains 251 observations (studies) on the ex-post evaluation of pro-competitive regulatory reforms.

Our data is generally composed of two groups of variables. The first group is a case-specific characteristic in each study (denoted by Y and X) including variables such as the estimates of the price effect (in percentage), regulation type (A, B, C, D), industrial classification (NAICS[1]), country (AUS, BEL, CAN, DEU, DNK, EU, FRA, GBR, HKG, IRL, ISR, ITA, JPN, MEX, NLD, NOR, NZL, SGP, SWE, TWN, USA, ZAF), and year (1950s, 1960s, …, 2000s). The second group is a study-specific characteristic (denoted by Z) including the type of publication (journal article, book, working paper, etc.) and measurement type of the price effect (empirical, yardstick, case study and so on). Table 1 presents a simple descriptive statistics of our dataset.

TABLE 1. Descriptive Statistics

	Obs	Mean	Std.Dev.	Min	Max
Price Effect	251	-1.240	6.147	-60	-0.002
Regulation A	251	0.486	0.501	0	1
Regulation B	251	0.255	0.437	0	1
Regulation C	251	0.147	0.355	0	1
Regulation D	251	0.112	0.315	0	1
Network	251	0.534	0.500	0	1
R&D	251	0.167	0.374	0	1
Service	251	0.167	0.374	0	1
Journal Article	251	0.462	0.500	0	1
Book	249	0.048	0.215	0	1
Working Paper	251	0.167	0.374	0	1
Measurement 1	251	0.486	0.501	0	1
Measurement 2	251	0.434	0.497	0	1
Year Gap	251	7.817	20.695	0	224

3.2. Variables

3.2.1. Regulation Types

We made four groups of competition regulations depending on their characteristics such as whether the regulation targets suppliers or customers, and what methodology it utilizes. The first group of regulations (Regulation A) restricts the number of suppliers of goods or services. Limiting the number of licenses or increasing entry costs correspond to this category. The second group (Regulation B) includes regulations that restrict the ability of suppliers to compete. These regulations restrict the freedom of sellers by limiting sellers' price-setting abilities or setting product standards that are unfair in the markets.

The third group (Regulation C) reduces the incentive of suppliers to compete by creating a self-regulatory regime, enforcing the public disclosure of suppliers' information, or giving exemption to a certain group from general competition law. The fourth group (Regulation D) corresponds to the restriction of choices and information available to customers. These regulations can be implemented

[1] North American Industry Classification System, 2012

by changing important information for customers or by reducing the mobility of customers.Various regulations that limit competition can be categorized into these four groups, with Table 1 showing the distribution of each type of regulation in our data set.

3.2.2. Industry Classification

We made three industry groups that are of our interest based on the NAICS code: (1) the network industry (22, 48, 49, and 51), (2) the high R&D industry (21, 22, 31, 32, 33, and 51), and (3) the service industry (54, 55, 56, 61, 62, 71, 72, 81, and 92). The network industry category includes utilities, transportation, and information-related (broadcasting and telecommunications) industries. High R&D industry mostly consists of manufacturing and information-related industries. The service industry includes all types of services such as public administration, art, education, and medical services. Notable policy implications can be derived from the analysis of the relationship between competition regulation and their price effects in these industries.

3.2.3. Measurement Methods

Measurement methods are categorized into three groups. The first one is the yardstick method, namely when the corresponding study actually measures changes in price. The second method is the empirical or econometrics method. With this method, a study estimates the price effect using statistical tools or econometrics. The third group includes all the remaining methods that do not fall into any of these categories (Boyer & Kotchoni, 2011; Connor & Bolotova, 2006).

3.2.4. Publication Types

We consider four publication types: journal articles, books, working papers, and miscellaneous. In our data set, journal articles comprise the largest portion. The type of publication can affect the precision of the measurement so this variable is treated as a source of potential bias (Boyer & Kotchoni, 2011; Connor & Bolotova, 2006).

3.3. Model

We employ a meta-analysis method which is typically a statistical tool for estimating the mean and variance of underlying population effects ina collection of empirical studies addressing the same research question. There are two models of estimation: reduced-form and the structural model. The reduced-form model simply shows how changes in prices are explained by case-specific and study-specific variables (Connor & Bolotova, 2006). The structural model considers potential measurement error in price-effect estimation (Boyer & Kotchoni, 2011). We assume that the true competition effect depends only on the vector of variables Y that impacts the size of effects:

$$\theta_i = a + Y_i\beta + \varepsilon_i, \quad E(\varepsilon_i) = E(\varepsilon_i Y_i) = 0 - (1)$$

The competition effect can be positively or negatively biased by factor $Z_i\gamma$ (a linear combination of the Z variables).

$$X_i = (1 + Z_i\gamma)\,\theta_i$$

where X_i is the competition estimate for study i, and Z_i is the set of variables that explain the size of the bias.

$$X_i = (1 + Z_i\gamma)\,(a + Y_i\beta + \varepsilon_i)$$
$$X_i = a + Y_i\beta + Z_i\delta + Y_i \otimes Z_i\tau + u_i\,,-(2)$$

where $\delta = a\gamma$, τ is a Kronecker product operation between parameter vectors β and γ, and u_i=(1 + $Z_i\gamma$)ε_i. Therefore, the competition effect depends on Y_i and Z_i variables as well as the interaction between them. Here we assume that there is no variation in Y_i given Z_i, meaning the regulation-related variables are independent of the measurement variables. This assumption allows us to drop the interaction term (Kronecker product). Along with this assumption, we employ alog-liner model for the econometrics form:

$$\log|X_i| = a + Y_i\beta + Z_i\delta + u_i\,,-(3)$$

where we put absolute brackets on X_i because the competition effect is negative by definition. Once we have the parameter estimates, we can predict unbiased price effects from the estimation using Eq. (1):

$$|\hat{\theta}_i| = \exp(\hat{a} + Y_i\hat{\beta}) - (4)$$

We will report the estimation result in the results section.

4. RESULTS

4.1. Average Price Effect of Regulation

We first check the average competition effects according to the regulation types and the industry characteristics. The result is shown in Table 2. Overall, the large standard deviations imply that these effect measures have large dispersions depending on the studies. The pro-competitive effect from regulation type A shows the highest price reduction of more than 2%. Regulation type B follows with 0.6 percent and other types are shown to have 0.3% reduction. For all three industry groups, regulation type A was the most effective and the R&D industry shows the largest price reduction.

TABLE 2. Average Price Effects of Regulation

	Mean Effect	StdDev	Min	Max
Total	-1.240	6.147	-60.000	-0.002
Regulation A	-2.007	8.588	-60.000	-0.002
Regulation B	-0.656	2.331	-15.966	-0.006
Regulation C	-0.379	0.759	-3.960	-0.023
Regulation D	-0.372	0.815	-4.400	-0.011
Regulation A				
Network	-2.245	9.459	-60.000	-0.006
R&D	-4.348	13.637	-60.000	-0.009
Service	-2.463	8.931	-40.582	-0.038
Regulation B				
Network	-0.246	0.180	-0.700	-0.022
R&D	-1.702	3.773	-10.177	-0.021
Service	-1.923	5.267	-15.966	-0.010
Regulation C				
Network	-0.670	1.240	-3.960	-0.028
R&D	-0.149	.	-0.149	-0.149
Service	-0.231	0.204	-0.643	-0.086
Regulation D				
Network	-0.479	1.144	-4.400	-0.011
R&D	-0.497	1.189	-4.400	-0.011
Service	-0.514	0.151	-0.750	-0.405

This result is from themeta-data of a large number of studies, but these analyses are heterogeneous in their methodologies and publication types. Our further estimation, therefore, takes this heterogeneity into consideration and predicts for more stable price effect.

4.2. Estimation Results

We estimate Eq. (3) using a generalized method of moments (GMM). The regulation variables are endogenous because changes in price could call for changes in regulations. We applied country dummies as excluded instruments. The rationale is that the country variables are in principle exogenous and is related to the types of regulation. In the next subsection, we show the pseudo first-stage estimation results and then present the GMM results.

4.2.1. First Stage Estimation

Although there is no explicit first-stage estimation in GMM, we can separately perform a regression of endogenous variables on instruments. The results are shown in Table 3. We are interested in the relationship between regulation type and industry characteristics. The network industry is significant in the equation of regulation A (limiting the number of firms), the service industry is significant in the equation of regulation B (limiting the ability of firms to compete), and R&D is significant in the equation of regulation C (limiting the incentive to compete). Note that these equations have nothing to do with the price effect. Even though the dependent variables are dummies, it could be said that a certain industry calls for a certain type of regulation. The number of firms is important in

TABLE 3. Pseudo First-stage Estimation Result

	Regulation A		Regulation B		Regulation C	
	Coeff	StdErr	Coeff	StdErr	Coeff	StdErr
Network	0.188	0.093	-0.181	0.080	-0.020	0.065
R&D	-0.055	0.080	0.038	0.075	-0.156	0.040
Service	0.169	0.114	-0.190	0.094	-0.031	0.069
Journal Article	-0.254	0.098	0.160	0.088	0.142	0.061
Book	-0.190	0.151	0.287	0.148	0.040	0.104
Working Paper	-0.214	0.104	0.132	0.093	0.046	0.055
Measurement 1	0.214	0.146	-0.339	0.164	0.091	0.072
Measurement 2	0.199	0.147	-0.496	0.164	0.168	0.081
Year Gap	0.004	0.004	0.000	0.005	-0.004	0.004
Constant	0.224	0.184	0.638	0.192	0.051	0.089
Country Dummies	Y					
Time Dummies	Y					
R2	0.319		0.299		0.306	
Obs.	249					

the network industry because it is easy for the largest company to become the dominant one utilizing network effect. Regulation B refers to restriction on competition using policy such as imposing industry standards. This could be significantly effective for the service industries. In the same way, regulation C could let down R&D industries attempting to compete.

4.2.2. GMM Estimation Results

TABLE 4. GMM Estimation Result

	[1]		[2]		[3]	
	Coeff	StdErr	Coeff	StdErr	Coeff	StdErr
Regulation A	-1.368	0.245	-1.664	0.370	-1.744	0.363
Regulation B	-2.136	0.372	-2.112	0.454	-2.530	0.465
Regulation C	-1.216	0.145	-0.854	0.328	-1.904	0.333
Network			0.233	0.230	0.085	0.218
R&D			-0.393	0.229	-0.337	0.226
Service			0.195	0.300	0.213	0.262
Journal Article					0.553	0.215
Book					0.600	0.238
Working Paper					-0.064	0.243
Measurement 1					0.031	0.271
Measurement 2					-0.705	0.325
Year Gap	0.052	0.012	0.050	0.012	0.039	0.012
Constant	-0.678	0.144	-0.642	0.356	-0.246	0.461
Time Dummies	Y					
Obs.	251		251		249	

Table 4 presents the GMM estimation results. We compare three different specifications depending on the inclusion of industry dummies and publication/measurement variables. The coefficients for regulation variables are shown to be negative and the specification [3] shows the largest coefficients in absolute terms. The negative coefficients of the three regulations imply that dealing with regulation type D (limiting consumers' choice) would be the most effective in promoting competition. Since the dependent variable is a logarithm of the absolute price effect, a negative coefficient would mean lower effectiveness in reducing prices. In specification [3], regulation A has the lowest coefficient among three types of regulation, meaning it is the most effective. This is followed by regulation C, with regulation B being the least effective.

Industry dummies are not significant in specifications [2] and [3]. The coefficient for network industries and service industries are positive, but the one for R&D industries is negative. This implies that the competition effects for R&D industries are rather lower than others, although the coefficients are not significantly estimated. The coefficients for publication types and measurements are also insignificant. These variables are for controlling for heterogeneity in related studies. Year gap variables are significant in all three specifications and are positive. This means that the longer the period of regulation, the more effective it makes the policy in promoting competition.

TABLE 5. Estimates of Price Effects Controlled for Heterogeneity

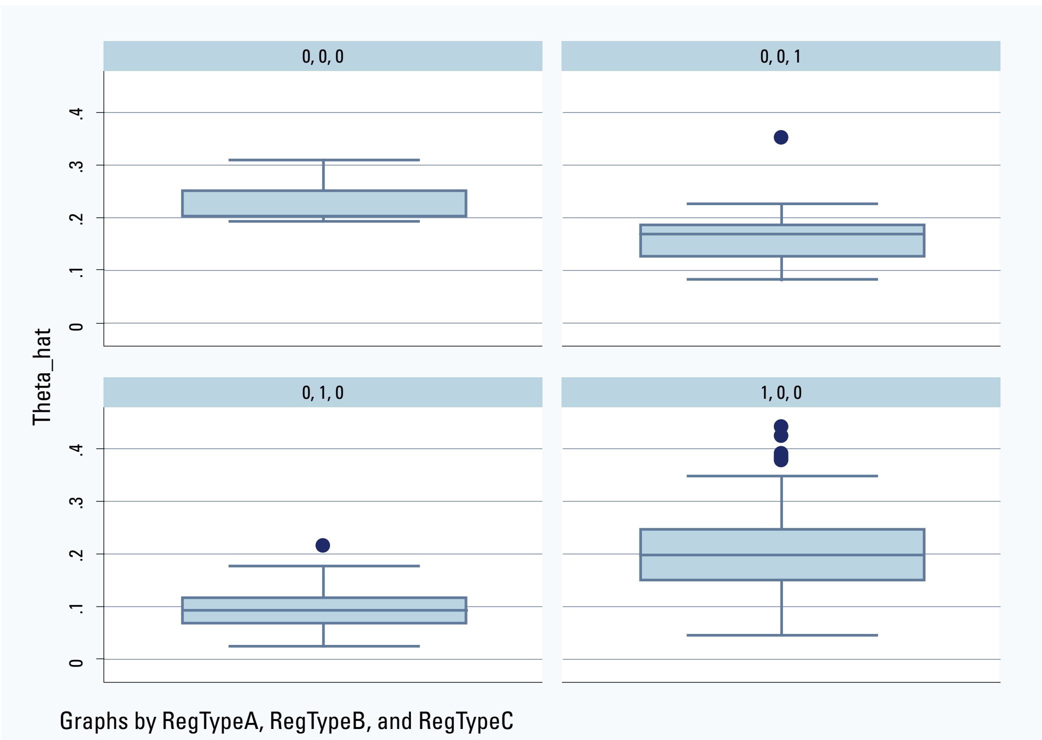
	Mean Effect	StdDev	Max	Min
Total	-0.225	0.274	-2.799	-0.023
Regulation A	-0.202	0.081	-0.441	-0.048
Regulation B	-0.097	0.036	-0.212	-0.023
Regulation C	-0.173	0.066	-0.351	-0.083
Regulation D	-0.685	0.626	-2.799	-0.195
Regulation A				
Network	-0.203	0.072	-0.422	-0.054
R&D	-0.146	0.034	-0.233	-0.110
Service	-0.210	0.110	-0.441	-0.059
Regulation B				
Network	-0.108	0.035	-0.212	-0.068
R&D	-0.078	0.023	-0.119	-0.043
Service	-0.079	0.016	-0.105	-0.062
Regulation C				
Network	-0.181	0.038	-0.228	-0.124
R&D	-0.083	.	-0.083	-0.083
Service	-0.174	0.029	-0.205	-0.125
Regulation D				
Network	-0.540	0.276	-0.885	-0.195
R&D	-0.514	0.268	-0.852	-0.195
Service	-1.529	0.988	-2.799	-0.311

Using the estimation result in specification [3], we predict the average price effects for promoting competition. Table 5 provides the estimated competition effects. These estimates are the competition effects controlled for the heterogeneity of existing studies, or in other words, possible biases.

We can compare these results with thosein Table 2. First of all, the small standard deviations reveal that the estimations have a good quality of prediction. The estimated competition effects are mostly smaller than the uncontrolled ones. This implies that price effects could be overestimated when results are aggregated from previous studies. Therefore, our approach has the potential to make a more reliable summary of existing results.

Overall, regulation D is shown to be the most effective; that is, eliminating restrictions on customers' choices is efficient in promoting competition. Restriction on the number of firms (regulation A) is the next most efficient measure. Deregulating the limits on the ability to compete (regulation B) is shown to be the least efficient. Among three types of industries, the network and service industries are more responsive than the R&D industries in promoting competition by deregulation. Figure 1 shows the distributions of price effects by different regulation types.

FIGURE 1. Box-plots for the Distribution of Price Effects by Different Regulation Types



Note: Corresponding regulation types are D, C, A, and B in clockwise order.

The mean effect is highest with regulation D, with regulation A coming in second. The distribution of price effects with regulation D is shown to be right-skewed, while that of regulation C is left-skewed. We can also see that regulation D, a group of A and C, and B have significantly different effects on prices. This result provides a significant implication for competition policy through deregulation.

5. CONCLUSION

This research investigates the price effect of deregulation using meta-analysis of a comprehensive data set of related researches. Meta-analyses have recently been used in regulation and industry analyses since there is a significant number of reviews and empirical studies oncommon regulation, and such analyses can provide integrated and consolidated policy implications by generalizing the results from those studies. Therefore, one of the main contributions of this study is the comprehensive data set made out of results in related studies.

Overall, deregulation has an impact on pro-competitive behaviour so that consumer prices are lowered. Our structural estimation that controls potential biases shows how simple aggregation of price effects can be overestimated. Even though we collected a large number of data points from existing studies, there exist some sources of biases depending on the characteristics that belong to the study itself, not to the corresponding policy. These characteristics are the measurement methods and publications types of existing studies. The resulting structural parameter estimates can be used to predict the price effects that control for these sources of biases.

Dealing with the restrictions on the consumer's side can be most effective in reducing prices, and eliminating the regulation on the number of suppliers is also effective on the producer's side. Deregulation is shown to be more efficient with network and service industries than with the R&D-oriented industries. These results could shed light on policy implementations when a pro-competitive policy reform is called for and there are certain restrictive regulations on the corresponding industries.

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