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Diverse paths in improving broadband availability: deductive inference from the
perspective of neo-institutional economics

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Abstract

This paper aims at deducing how different owner-management relations of operators lead them and a regulator to make different decisions with regard to broadband, by adopting an approach of neo-institutional economics and a model based on game theory.

Out of five modes that Aoki (2010) proposes as types of corporate organization, H- and S-modes are studied in this research, which used to be typically observed in general in the United States and Japan respectively. First, it is deduced that operators in each mode makes different decisions on broadband businesses affected by the respective natures of owner-management relations. Then a model of unbundle regulation game is applied to both modes, and combinations of best strategies for each are found to be exactly the opposite: (no unbundle regulation, no additional broadband investments, no entrance) for the regulator, the incumbent and the competitor in H-mode case, while (unbundle regulations, additional investments, entrance) in S-mode. Short case studies of the United States and Japan support the model's validity temporarily, though closer investigations are required.

This result indicates that the owner-management relations of operators can determine the effectiveness of unbundle regulation, and suggest that they should be taken into account when practitioners examine possible measures.

1 Introduction

Recognizing the influence of broadband on the economic competitiveness of a country as social infrastructure, regulators or/and ministries in various countries are trying to specify effective measures to facilitate the diffusion. There exist many analyses on promoting factors of broadband adoption both qualitative and quantitative. They suggest intense competition and reasonable prices affect the level of diffusion paying little attention to institutional bases that enable such kind of intermediate factors.

This paper aims at clarifying that institutional factors affect the level of broadband diffusion deductively. "Institution" is defined in several ways. Among them, neo-institutional economists define it as "rules of a social game" which include official/unofficial rules, regulation, norm, and shared understandings. Institutions characterize and are observed in corporate governance, inter-company relations, and government-business relations. We focus on organizational forms of incumbent and competitive telecom operators such as corporate governance. It is defined in narrow sense as problems of relations between shareholders and management in maximizing benefit of the former. We see it in broader sense as coordination of benefits between the two actors.

Broadband adoption is a result of balance between demand and supply, and this paper focuses on the latter. There is no single definition for broadband globally, and various levels of minimum transmission speed are set by counties and organizations. We regard high-speed fixed lines such as xDSL, FTTx and cable modem here without specifying a minimum speed.

2 Related literature and the framework of this paper

2.1 Analyses on promoting factors of broadband diffusion

There can be seen a large number of quantitative analyses on promoting factors of broadband diffusion based on the econometric approach¹. Quite a few researches point out inter-/intra- technology competitions and reasonable end user prices as accelerators, paying little attentions to the institutional bases that enable those factors.

Qualitative analyses reveal that various kinds of patterns and speed in broadband diffusion can be seen across countries. Fransman (2006) tells us that we can observe intense competitions and strong regulation commonly in leading countries. Pointing out that those factors depend on the regulatory regime in a country concerned and in the foundation is the institutional basis of regulation, it just implies the necessity of institutional analysis.

2.2 Neo-institutional economics and political economy

Institutionalism in the social science argues that institutions determine policy choices and the comparative advantage of a nation. According to the logic, different institutions cause different promotional measures for broadband and different speed and scope in technology diffusion.

"Varieties of Capitalism" in the political economy school insists that institutional characteristics are observed by nation. Liberal market economy (LME) , represented by Anglo-Saxon countries such as the United States and the United Kingdom, is thought to have a comparative advantage in innovations in the telecom industry (Hall and Soskice 2001). The comparative advantage in ICT diffusion is not discussed here. Amable (2003) indicates that social democratic countries in Scandinavia are advanced in usage of PCs and Internet, but the causal relations between institutions and ICT usage are remained to be analyzed.

2.3 Typology of organizational form in the comparative institutional analysis

Comparative institutional analysis, one of the theories of institutional economy, consider a firm as an organization which are operated through interactions among investors (shareholders in many cases), management, and employees, instead of seeing it as a single entity (Aoki 2001, 2010, Milgrom and Roberts 1992 for example). It classifies institutions based on corporate governance and organizational architecture which are determined by the relations of three parties.

¹ Cambini and Jiang (2009) review literature thoroughly.

Table 1: Five Modes of Corporate Organization

	H-mode	G-mode	S-mode	SV-mode	RE-mode
Owner-management relation	Private-contract-based	Co-governance	Relational contingent governance	Tournament-like governance	Various: owners' power is weaker than H-mode
Management-employee relation	Hierarchy	Expertise of both companies are bilateral and reciprocal at mid-level	Expertise of both companies are bilateral and reciprocal at mid-level	Adverse hierarchy	Expertise of both companies are bilateral and reciprocal at high-level

Summarized by the author based on the analysis by Aoki (2010)

Aoki (2010) classifies corporate organizations into five categories based on the types of corporate governance and organizational architecture (Table 1). H-, G-, and S-mode used to be typically seen in the United States, Germany and Japan respectively, however the organizational forms are characterized not by nation but by clusters of firms recently according to his analysis. Furthermore, hybridization between different modes is supposed to be ongoing (Aoki 2010, Jackson and Miyajima 2007). France and Germany also see the hybridization in corporate governance, but those trends do not indicate the possibility of global convergence to a single model, as varieties of hybridization are observed in those countries (Aoki 2010). Filatotchev and Wright (2005) argues the diversity in corporate governance from different perspective: they suggest that different type of governance are preferred by firms in different stage in the corporate life cycle.

2.4 Framework of this paper

This paper presents a theoretical model that explains the causal-effect relations between institutional factors and operators' strategies on broadband infrastructure investments and market entrance, based on the typology of corporate organization determined in Aoki (2010).

Privatization of incumbent operators and market liberalization were the trends globally observed since mid-1980s through 2000. This movement could be seen as a sign for the convergence towards the liberal market economy model on one hand. On the other, there remains diversity in institutions: government's shareholding in the incumbent, legal constraint on the incumbent,, organizational characteristic of competitive operators, development of stock and bond markets, and limits of shareholding by banks or foreigners, for example. Thus it will be quite reasonable to adopt the approach of comparative institutional analysis.

Out of the five modes mentioned above, we focus on H- and S-mode in this paper, and explain how operators with the corporate governance of each type and regulators/ministries concerned take different strategies by applying game theoretic approach. Unbundle regulation is taken as an example of promotional policy though there are many options for promotion in practice (Belloc et al. 2012). This is because the effectiveness of unbundle regulation as a promotional measure is quite controversial both in practice and in academics. We clarify that whether the unbundle regulation works well depends on which mode the operators concerned are characterized to.

In the next chapter, the distinction of H- and S-mode is described in terms of investment strategies in general and specifically in broadband business. An unbundle regulation game model is presented in chapter 4, and see that H- and S-mode games have different equilibria. Simple case studies are also done here to check the applicability of the game model.

3 Type of corporate governance and investment decisions

3.1 H-mode

3.1.1 Corporate governance

The corporate governance of this type is determined by private contracts between shareholders and management. Compensation for both actors are decided in the market in principle with possibility of either of them acquires the entire surplus: Shareholder-oriented in the case the owners take all, while managerial capitalism in another (Aoki 2010). We take the former case in this paper as it has been working as a norm in practice especially in the United States

3.1.2 Investment decisions

Decisions are made aiming at maximizing shareholders' benefit in the shareholder-oriented governance. Shareholders' benefit is maximized by stock price maximization which equals to corporate value maximization. In achieving this goal, maximization of current profit from the static viewpoint and that of net present value of cumulative net cash flow from the dynamic viewpoint are the norms for shareholders and management to make investment decision.

Shareholders tend to sell their shares once a discount rate or profit level change, and move their money to business with a better condition easily. Thus they pursue short-term profit naturally. This kind of behavioral pattern does not suit broadband business in principle which can expect short-term profit scarcely. Management therefore decides not to invest in broadband business.

The deduction above gives us the following inference: Both incumbent and competitive operators in H-mode are reluctant to invest in broadband infrastructure or business.

3.2 S-mode

3.2.1 Corporate governance

Owner-management relations change according to the financial situation in this mode. Normally, managerial decisions are left to management, while relational monitors get into the company and try to save it when the financial situation is at danger. Traditional main bank system in Japan is a close example (Aoki 2010).

3.2.2 Investment decision

The intention of management is taken into the corporate decision directly in normal situation. This means that the policy of management determines the decision of a firm. In the case that management prioritizes innovativeness and to take leadership in commercializing the latest technologies, they decide to invest in the broadband business though they cannot expect short-term profit. The same decision can be made if management is required to ensure public utility by law or other kind of institution.

Management may be relatively less aggressive in network investment if it is not motivated by innovativeness nor required to ensure public welfare. Even though there is no institutional impediment to investment. In the case management which intends maximize the market capitalization, it acts just the same as H-mode counterpart,

Except this case, s-mode operators can be far more aggressive in broadband investment in comparison with H-mode ones in general,

4 Unbundle regulation game

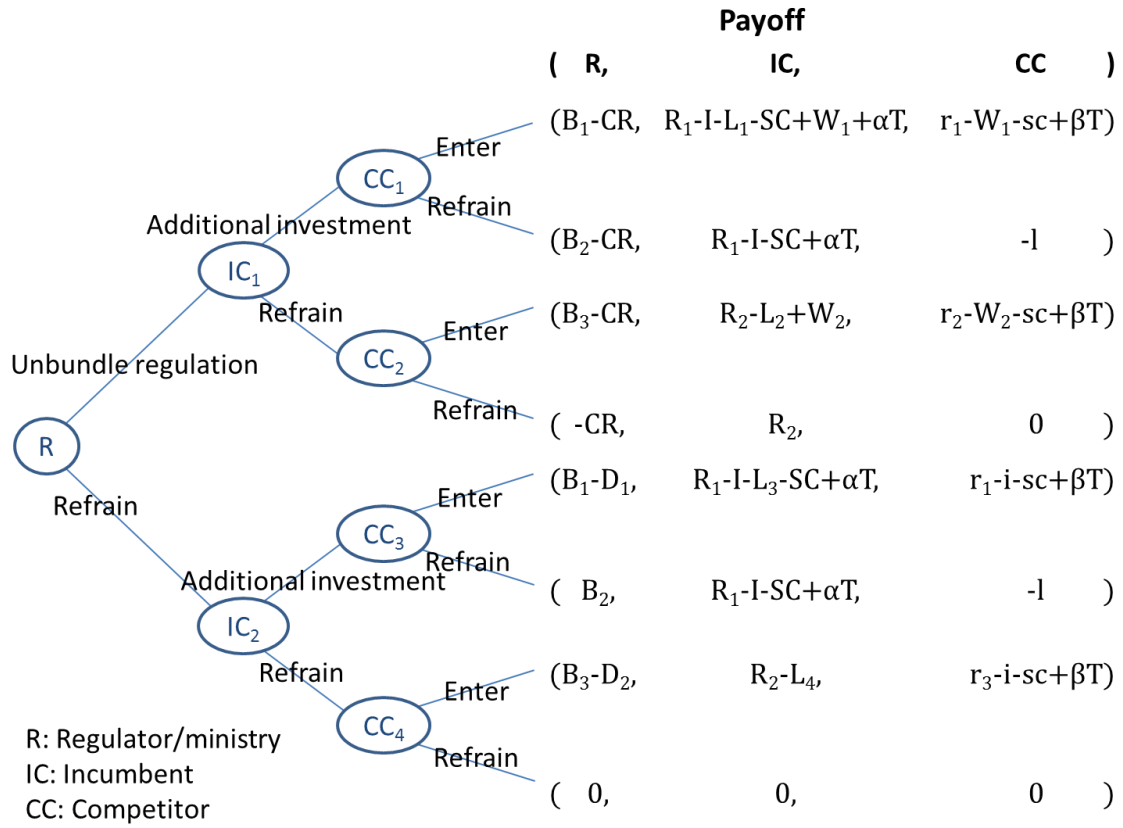
4.1 Structure of game

We examine a game with complete information played by regulator/ministry, incumbent and competitive operators concerning unbundle regulation. Shareholders and management are supposed to take part in an operator's decision with regard to investment and market entrance, but they are not considered as a separate player in the game tree with the assumption that they make decision according to the logic we discussed in the previous chapter.

The unbundle regulation game is described as a game tree in Figure 1. Regulator/ministry is assumed to investigate the possibility of unbundle regulation when an incumbent has made investment to a certain extent. The incumbent decides whether they continue to invest following the regulator's/ministry's decision. Competitive operator then determines whether it enters into the broadband market.

Each player makes decisions by calculating net present value of its own payoff.

Figure 1: The Unbundle Regulation Game



B : Social welfare ($B_1 > B_2 > B_3$)

CR : Regulation cost

D : Social cost regarding duplex investment ($D_1 > D_2$)

I : Broadband investment by an incumbent ($I > 0$)

i : Broadband investment by a competitor ($i > w_1 > w_2 > 0$)

L : Loss of incumbent caused by competitor's entrance ($L_1 > L_2, L_4 > L_2, L_4 > L_3$)

l : Loss of competitor caused by its refrainment

R : Retail sales of incumbent ($R_1 > R_2$)

r : Retail sales of competitor ($r_3 > r_1 > r_2$)

SC : Customer acquisition cost of incumbent

sc : Customer acquisition cost of competitor

T : Brand image related to innovativeness/public liability

α, β : Coefficient ($0 \leq \alpha, \beta \leq 1$: 0 in the case of H-mode, 1 in the case of S-mode with motivation in innovativeness or requirement to ensure public welfare at maximum)

W : Wholesale revenue of incumbent paid by a competitor ($W_1 > W_2$)

Players make decision by calculating net present value (NPV) of cumulative total of elements above. The formulas for NPV calculation are not presented in the payoff matrix for the sake of simplicity.

4.2 Mode of corporate governance and its equilibrium

Various combinations are possible regarding the modes of governance of incumbent and competitor. We take up two cases in this paper: both operators have H-mode characteristics for the first case (H-H), and both have S-mode ones with motivation of innovativeness/requirement to ensure public welfare for the second (S-S). Sub-game perfect equilibria are examined by backward induction in each case.

4.2.1 H-H case

H-mode operators make decisions based on short-term benefits. In the case of market entrance, competitor's payoffs are negative regardless of unbundle regulation, as it calculates NPV of its profit in short term. Furthermore, β equals zero because it does not place importance on brand image created by innovativeness or public welfare. If it refrains from entering, the expected loss cannot be so large in short term. The competitor therefore decides not to enter the broadband market.

An incumbent decides not to continue investments with the same logic.

Consequently, no additional investments and entrance can be expected under the unbundle regulation, and just negative effect of regulation cost remains. Regulator/ministry decides to refrain from introducing the unbundle regulation based on the inference above mentioned.

4.2.2 S-S case with motivation in innovativeness/requirement to ensure public welfare

A competitor and an incumbent can make decision from long-term perspective in this case, and this makes NPV of their profit positive. In addition to this, α and β are positive as they place importance on innovativeness/public welfare. As a result, their payoffs in the case of entrance and additional investment can surpass the expected loss in the case of refrain.

This means that the incumbent continues to invest and the competitor enters the market under the unbundle regulation. They take the same actions if the regulation is withheld. Regulator/ministry then makes a regulatory decision by considering relative value of regulatory cost and investment duplex cost.

4.3 Explanatory capability of the model

4.3.1 H-H case

The United States can be taken as an example of this case. 'Non-financial business corporations were placed under tremendous pressure for short-term share price gain' in the country (Aoki 2010: 181). As the effectiveness of telecom regulation are discussed based on the stock price changes generally (Bittlingmayer and Hazlett 2002 for example), H-mode short-termism has been assumed to be dominant in telecom sector as well.

ILECs (incumbent local exchange carriers) were said to be reluctant to invest in technology upgrading of their access networks since their establishment in 1984, and even after the Internet revolution took place in 1994, even though the modest spending might be sufficient (Ferguson 2004 : 97-98). The unbundle regulation was introduced on the telephone access networks by 1996 Telecom Act DSL had been put under the regulation, but was exempted by FCC in 2005 after repeated law suits and rulings (Bauer 2006, FCC 2005). The argument of DSL unbundle regulation started and ended in the same period that dot com bubble emerged and collapsed. The possibility of dot com companies' rapid profit growth was overestimated and investors rushed into purchasing stocks of those companies during the bubble economy

(Goldfarb et al. 2006, Howcroft 2001). The unbundle regulation was assumed to enable CLECs to reduce procurement cost, and this prospect resulted in the excessive evaluation of profitability of their broadband business (Bittlingmayer and Hazlett 2002 : 266 citing JP Morgan Equity Research2001). This is the way how investors made 'irrational' decision during the bubble economy. Investors withdrew their money from dot com companies after the bubble bursted, and most of CLECs gave up their business unavoidably.

Despite the introduction of the DSL unbundling and competitors' entrance are unexpected actions by the players, we can explain what occurred by applying our model. It is rational for ILECs as H-mode companies to be reluctant to invest in technology upgrading. As the unbundle regulation and competitors' entrance were the strategies unsuitable to the sub-game perfect equilibrium, the situation was quite instable. Eventually, players changed their strategies in line with the equilibrium, lifting of the regulation by FDD and CLECs' withdrawal from the broadband market namely.

From the analysis above, our game theoretic model is thought to be reasonably applicable to H-H case.

4.3.2 S-S case with motivation in innovativeness/requirement to ensure public welfare

The closest example for this case is Japan where the unbundle regulation was introduced to ADSL and FTTH in 2000 and in 2001 respectively. NTT, an incumbent, continued to invest network upgrading before and after the regulation introduced, and the entrance of Softbank, a competitor, brought the stiff price competition and resulted in the rapid diffusion of ADSL.

Act on Nippon Telegraph and Telephone Corporation, etc. (NTT Act) stipulates that Japanese government needs to retain no less than 30% of NTT's shares, and Minister of Finance holds more than 32.59% shares as of end of March 2012. This means that the operator does not need to coordinate benefits between its owners and management according to the benchmark set by Berle and Means (1932)², but the Finance Minister does not comment on NTT's corporate strategy in practice. The second largest shareholder is a bank, but it is prohibited to have more than 5% shares in an operating company by Banking Act. Therefore no single shareholder retains more than 20% shares if the portion of the Finance Minister is deducted and the coordination between the owners and management is supposed to be required.

With regard to Softbank, Masayoshi Son, the founder and CEO, holds more than 20% of total shares. Thus the company is not in the situation of owner/management separation in strict sense, but it can be quasi-S-mode as the intention of management is taken into strategies without interruption by shareholders.

In addition to above issues, some researches indicate that hybridization of H- and S-mode is emerging in Japan as mentioned above. Jackson and Miyajima (2007) classify NTT DoCoMo into one kind of hybrid mode with S-mode employment form and H-mode outsider monitoring. They also point out that NTT DoCoMo is in the group which utilizes bonds actively but is reluctant in managerial reform. Softbank is categorized as another kind of hybrid mode with H-mode employment and S-mode insider monitoring (Miyajima 2011). Those analyses suggest that S-mode governance still works in the telecom industry though operators adopt hybrid-mode.

² According to Berle and Means (1932), a company with a single shareholder retain less than 20% of total shares needs to coordinate benefits of its owner and management as the owners cannot influence the management automatically.

Several institutional factors enabled NTT to continue investment in broadband. First, the operator set the goal of FTTH deployment nationwide in its VI&P strategy (Visual, Intelligent and Personal) as early as 1990, and this works as a commitment on continuous investment. Second, NTT Holding Company retains the whole shares of NTT East and West, regional companies which are in charge of broadband access facilities. The structure of holding company prevents the regional companies and their huge investments from being exposed to the direct monitoring by outsiders³. Third, NTT Holding Company and two regional companies are required to make effort to improve public welfare by NTT Act (Article 3). They are obliged to make business plan in each fiscal year and to receive permission from the Minister of Internal Affairs and Communications (Article 12). Those legal institutions are thought to impose the requirement for efforts to ensure public welfare on NTT.

Softbank started its ADSL business in 2001 by utilizing the unbundle regulation with the corporate vision 'to accelerate "digital revolution" in the 21st century with broadband' (according to the company's financial statement FY2003). Though the company succeeded to attract customers quickly with extremely low pricing, it faced huge deficit exceeding 100B yen in fiscal 2002. Despite its stock price continued to decline gradually, Softbank survived and managed to make the broadband business profitable in fiscal 2005.

Decisions of operators and regulator/ministry and the result of the regulation can be explained by our S-mode game model. Various institutional factors make and enable NTT to continue investment even after the unbundle regulation was enforced. Though its organizational form can be under hybridization, the holding company architecture prevented H-mode monitoring from outsiders. Softbank entered to the broadband market supported by its strong willingness to be innovative, and survived through difficult years. As a consequence of the unbundle regulation, broadband prices were reduced while the availability and quality were improved, and rapid diffusion become possible.

From the analyses above, we can evaluate the applicability of our game theoretic model to S-S case positively.

5 Conclusion

This paper clarified by deduction that corporate governance mode (H/S) determines operators' strategies on investment and market entrance and regulatory decision. This means that broadband availability is continued to be improved in a country with S-S operators, subject to the operators' motivation in innovativeness/public welfare regardless the unbundle regulation. Contrary to S-S case, broadband availability cannot be improved irrespective of the unbundle regulation in a country with H-H operators, and other promotional measures are to be considered. Furthermore, the analysis suggests that the correlation coefficient of the unbundle regulation to broadband diffusion cannot be evaluated appropriately unless institutional factors, corporate governance in this regard, are taken into account properly.

The way we evaluated the explanatory capability of the model was quite simple. The model should be tested and refined in stricter manner with more cases, discussion on open access of cable modem in the United States and facility-based competition in FTTH in Japan for instance.

³ Ida (2006) indicates that both VI&P strategy and the holding company architecture are the byproducts of lengthy discussion on NTT's break up.

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