4-2006

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Yuntsai CHOU

Kung-chung LIU
Singapore Management University, kcliu@smu.edu.sg

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Telecommunications Policy 30 (2006) 171–182
TELECOMMUNICATIONS POLICY
www.elsevierbusinessandmanagement.com/locate/telpol

Paradoxical impact of asymmetric regulation in Taiwan's telecommunications industry: Restriction and rent seeking ☆

Yuntsai Chou[a,*], Kung-Chung Liu[b]

[a]*Graduate School of Social Informatics, Yuan Ze University, 135 Yuan Tong Rd., ChungLi City, Taoyuan County, Taiwan*
[b]*Institute for Social Sciences, Academia Sinica, 128 Academia Rd., Sec. 2, Taipei 115, Taiwan*

Abstract

The mobile penetration rate in Taiwan has climbed from 6.86 to 112.15. Mobile phone accounts per 100 capita in the first 6 years of market competition, during this time the state-owned incumbent Chunghua Telecom has been dethroned by a new entrant, Taiwan Cellular Corp. This paper addresses the cause of Taiwan's unprecedented mobile growth, and provides policy solutions for countries that strive to improve their telecommunications sectors in a short time scale. The authors highlight the fundamental role of asymmetric regulation, rather than pure liberalization, in the creation of the deregulated telecommunications industry in Taiwan. The asymmetric regulation in Taiwan is manifested in a twofold framework: the dominant carrier vs. competitors, and the fixed-line carrier vs. mobile companies. Econometric analysis concludes that dualistic asymmetric regulation leads to higher growth for mobile competitors and raises the total mobile penetration rate. However, the authors warn against the paradoxical consequences of dualistic asymmetric regulation. The regulatory benefits which mobile entrants received evolved into rents when they successfully lobbied to end the follow-me call service, the pricing scheme of which contradicts the asymmetric revenue-sharing constraint. The paper calls for a sunset clause for dualistic asymmetric regulation in order to take full advantage of its strengths, while at the same time preventing rent seeking by the firms, which benefit.

Keywords: Regulatory asymmetry; Revenue-sharing constraint; Contractarian approach; Regulatory costs; Rent seeking

1. Introduction: on the wave of the wireless society

Driven by the policy goal of building Taiwan into an Asia-Pacific Telecommunications Hub and obtaining WTO membership, the Taiwan government has passed three telecommunications reform acts since the early 1990s in order to restructure the market. These acts established a liberalization framework by introducing private competition, the separation of the public telecommunications operator from the regulatory regime, and the categorization of telecommunications services. In early 1997, eight mobile licenses were awarded to six

☆The research is funded by the National Science Council of Taiwan (NSC 89-2414-H-155-002) and (NSC 90-0001).
*Corresponding author. Tel.: +886 3 4638800 x 764; fax: +886 3 4638884.
E-mail addresses: ychou@saturn.yzu.edu.tw, ychou@mail.tcg.gov.tw (Y. Chou), liukc@gate.sinica.edu.tw (K.-C. Liu).

0308-5961/$ - see front matter © 2006 Published by Elsevier Ltd.
doi:10.1016/j.telpol.2005.06.016

Table 1
Mobile communications in Taiwan

	Mobile subscribers	Penetration rate (subscribers/per hundred persons)	Market share of entrants (%)	Market share of the incumbent (%)
September 2003	25,290,000	112.15	69.06	30.94
December 2002	23,905,000	106.44	71.87	28.13
December 2001	21,632,980	96.58	73.80	26.20
December 2000	17,874,000	80.26	73.90	26.10
December 1999	11,541,139	52.24	69.85	30.15
June 1999	7,477,000	34.29	63.60	36.40
December 1998	4,727,045	21.56	53.89	46.11
March 1998	2,442,980	11.21	30.00	70.00
December 1997	1,492,000	6.86	0.00	100.00

Source: DGT 〈http://www.dgt.gov.tw/Chinese/Data-statistics/11.3/graph3.shtml〉.

out of 22 enterprises via a beauty contest. In each region, four new entrants competed with the state-owned incumbent—Chunghua Telecom—for a share of its market.[1]

Within only 6 years of opening the market, mobile subscription in Taiwan has escalated from 6.86 to 112.15 phone accounts per 100 head (as of September 2003). An additional 20 million users signed up for the service, and the number of mobile subscribers has grown 16.02 times. The unmet demand for mobile telephony before 1998—a waiting list of over one million—has vanished entirely. Meanwhile, Chunghua Telecom's market share plummeted to about 30 percent. The leader status of Chunghua Telecom has been eroded by a private entrant, Taiwan Cellular Corp, which now holds a significant lead of 6 000 000 users.[2] Table 1 summarizes the development of mobile communications in Taiwan.

With such rapid growth in the mobile penetration rate in 5 years, Taiwan has pushed its rank from far below average to a position of global paramountcy in mobile, outperforming all OECD member countries. It has been said that the liberalization policy implemented by the Ministry of Transportation and Communication (MOTC) and Directorate General of Telecommunications (DGT) constitutes a breathtaking development (Chou, 2000). An examination of liberalization precedents worldwide finds that Taiwan's experience is exceptional. Among the countries that have undergone telecommunications reforms, none of them has ever achieved so high a mobile penetration rate or reversed the dominant status of the incumbent in such a short time.

This paper is written to address the "real" cause behind the unprecedented mobile development in Taiwan, and to discuss feasible solutions for other countries planning to improve their telecommunications in a short time. The asymmetric features inherent in Taiwan's communications regulations are highlighted for the first time, and based upon a perspective of contractarianism and institutional economics, it is contended that this dualistic asymmetric regulation governing Taiwan's telecommunications is in fact the key institutional component which fostered its growth in mobile telephony. The telecommunications regulators place restraints, including price caps and interconnection mandates, on the dominant carrier alone, and yet give mobile communications providers the authority to set their tariffs and interconnection charges. This asymmetry in regulations allows fixed-line end users to be easily lured to switch to mobile services as mobile companies set high tariffs for fixed-line-to-mobile communications. Subsequently, mobile communications traffic has surged, with revenues surpassing those of fixed-line telephony (DGT, 2003).

[1]Among the eight, two nationwide licenses went to Taiwan Cellular Corp and FarEastTone, and six regional licenses went to KG Telecom, Tuntex, TransAsia, MobiTai, Taiwan Cellular Corp, and FarEastTone. The licenses are ratified with the standard of the Global System for Mobile communications (GSM). Nationwide operators use the 1900 GSM standard, while regional operators deploy the 900 GSM standard.

[2]Taiwan Cellular Corp. now has 8.78 million subscribers, a 29.8 percent market share.

The dualistic asymmetric regulation in Taiwan is thus a potential model for policymakers in other countries wishing to expand telecommunications. The question, which remains, is, should countries embrace this approach without reservation? In response, this paper investigates the paradoxical consequences, which the dualistic asymmetric regulation fosters, and finds that asymmetric regulation could entail rents for mobile competitors, even though it successfully grows mobile services. The rival competitors thus have an incentive to secure these rents through uneconomic activities such as political lobbies or entangling lawsuits.

2. Dualistic asymmetric regulation and its policy impact

Fig. 1 portrays the twofold framework of the asymmetric regulation: dominant/non-dominant carrier[3] and fixed-line/mobile service provider. The letters A, B, C, and D individually represent different types of telecommunications service providers (TSPs). Fig. 1 also shows six types of communications transmission and termination between A, B, C, and D. In 1997, the DGT declared Chunghua Telecom, the only fixed-line carrier thus far, to be the dominant carrier and other mobile service providers to be non-dominant carriers. Accordingly, the dualistic framework of asymmetric regulation is manifested in Line 2 as Chunghua Telecom versus non-dominant mobile firms. Compared with its counterparts, Chunghua Telecom is subject to excessive regulatory oversight from the DGT. The asymmetric constraints on the dominant carrier and on the fixed-line service provider are respectively analyzed as follows.

2.1. Asymmetric constraints on the dominant carrier

Article 26.1 of the Telecommunications Act (1999) prohibits the dominant carrier from refusing interconnection and abusing its market power. The dominant carrier is obligated to disclose certain cost information, sell bottleneck services, and provide unbundled access to its network (Liu, 2001).[4,5] Article 9 of the ''Administrative Regulation Governing Tariffs of Type I Telecommunications Enterprises'' obliges the dominant carrier to set its tariffs based on the price caps approved by the DGT.

As is well known, unbundled access may deprive the incumbent of economies of scope and scale while providing cost savings to its rivals. Total element long-run incremental cost (TELRIC) pricing, which charges unbundled elements at long-run marginal costs, does not compensate for the incumbent's opportunity costs of providing such access (Brock & Katz, 1997). Sidak and Spulber also argue that unbundled access infringes upon the incumbent's property rights as protected by the Constitution (1998, p. 34). In addition, asymmetric disclosure of cost information empowers rivals in competing against the dominant carrier, as they can behave strategically by setting prices slightly below the incumbent's (Besen & Farrell, 1994). The author' previous study demonstrates that the mandate of *symmetric* information disclosure otherwise deflates the market values of competitive rivals as they are unable to engage in strategic behaviors (Chou, 1999, pp. 304–5). As far as price

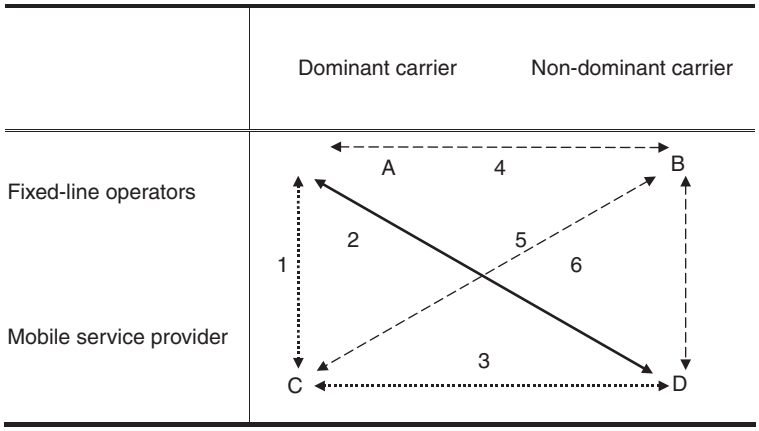
[3]The term ''dominant carrier'' is defined by Article 5 of ''Administrative Regulation Governing Tariffs of Type I Telecommunications Enterprises'' as a TSP that meets any of the following criteria:

(A) having control over essential facilities, or
(B) having dominant market power over prices, or
(C) having subscribers or turnover that account for at least 25 percent in the relevant market.

[4]Article 26.1 states that a designated dominant carrier is prohibited from:

(A) refusing, directly or indirectly, interconnection requested by other facility-based TSPs by reason of proprietary technology;
(B) refusing to disclose information to other facility-based TSPs regarding the measurements of interconnection charges and relevant costs thereof;
(C) improperly determining, maintaining, or altering the prices charged for telecommunications services;
(D) refusing, without due cause, access to network elements requested by other facility-based TSPs;
(E) rejecting, without due cause, the lease requests of transmission circuits made by TSPs or subscribers;
(F) rejecting, without due cause, testing requests made by TSPs or subscribers and,
(G) abusing market power or engaging in unfair competition.

[5]This provision corresponds to Article 10 of the Fair Trade Law that prohibits anti-competitive conduct by the dominant carrier.



A: the fixed-line operator with the dominant status;
B: the non-dominant fixed-line operator;
C: the mobile company with the dominant status; and
D: the non-dominant mobile firm.

Line 1: communication originated, transmitted, or terminated between A and C;
Line 2: communication originated, transmitted, or terminated between A and D;
Line 3: communication originated, transmitted, or terminated between C and D;
Line 4: communication originated, transmitted, or terminated between A and B;
Line 5: communication originated, transmitted, or terminated between B and C; and
Line 6: communication originated, transmitted, or terminated between B and D;

Fig. 1. Dualistic Asymmetric Regulation in Taiwan. *Notice*: Three new fixed-line licenses were awarded on March 19, 2000 and these firms started local service in/as early as ? April 2001. Therefore, only three combinations are available as of the day of analysis (i.e., Line 1, Line 2 and Line 3).

caps are concerned, they function closer to the requirement of information disclosure in a competitive market. Such regulation enables rival competitors to obtain information regarding the incumbent's tariff schemes at reduced costs and to strategically price their services. Admittedly, market entrants prefer asymmetric constraints on the dominant carrier so that they can realize a competitive advantage in capturing market share.

2.2. Asymmetric restrictions on the fixed-line service provider

The determining feature of dualistic asymmetric regulation lies in the restriction on the fixed-line operator. This regulation distinguishes Taiwan from all other regulatory governances worldwide. In the DGT's view, the fixed-line network is the basic infrastructure over which long-distance, international, and mobile services are originated, transmitted, or terminated. Like long-distance and international services, mobile communications are treated as the downstream service of local telephony. As the "access charge" model is used for revenue allocation between upstream and downstream services, the DGT applied the same rule to mobile communications generated from Chunghua Telecom's fixed-line network.

Article 19 of "The Administrative Rules for Network Interconnection Between Type I Telecommunications Carriers" stipulates that:

Except for international communications, ownership of tariffs for communications between mobile communications networks and fixed-line communications networks shall be governed by the following principles:

1. Tariffs shall be collected by the call-originating telecommunications carrier from its subscribers pursuant to the tariff schedules set by mobile communications network carriers, and the revenue from tariffs shall go to the mobile communications network carriers; and

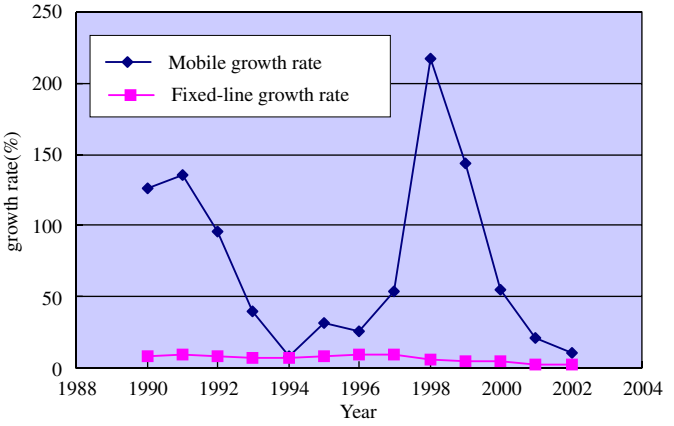


Fig. 2. Mobile and fixed-line communications in Taiwan. *Data source*: DGT statistics (http://www.dgt.gov.tw).

2. Bad debts shall be assumed by the call-originating telecommunications carrier and such carrier shall not be relieved of its responsibility to pay relevant charges to the call-terminating telecommunications carriers.

While the calling party pays all the communications charges, Article 19 delegates to mobile firms the pricing authority over all outgoing and incoming mobile services, and allocates such revenues to them. Under this pricing scheme, Chunghua Telecom cannot retain the revenues of the outgoing mobile communications originated from its fixed-line network but is mandated to collect the charges on behalf of the mobile firms. Chunghua Telecom is then paid access charges by the mobile firms for transmitting calls to their mobile networks.

Since the establishment of the asymmetric revenue-sharing scheme between mobile and fixed-line communications, the mobile market has grown very quickly, while local telephony has experienced stagnant growth (see Fig. 2). Indeed, the growth of both types of communications is interdependent, as they entail substantial effects of substitution for each other (Kelly, 1996, p. 11).[6] Table 2 delineates four calling patterns between fixed-line and mobile communications. Chunghua Telecom can only set the tariff of the calling pattern A (fixed-line-to-fixed-line communications), while the pricing authority of the other three goes to mobile firms. Chunghua Telecom under this asymmetric revenue-sharing scheme retains only the revenues of Pattern A. Unlike in most countries, where Pattern B's (mobile-to-fixed-line communications) tariff is set higher than C's (fixed-line-to-mobile communications) due to a concern with universal service, those tariffs in Taiwan are indifferent. Because mobile firms collect the revenues of both Patterns B and C, they have no incentive to differentiate the tariffs.

Supposing a consumer's choice of mobile telephony is a function of the price and the quantity of outgoing and incoming calls (Shih, 2000),[7] a higher tariff of Pattern C assuredly reduces the calling volume from the fixed-line network to mobile systems while multiplying the calls made from mobile networks. By setting a lower tariff for Pattern D (mobile-to-mobile communications) than C, mobile carriers further encourage the

[6]Mobile substitution takes place at the level of (1) marginal choice over a second fixed-line telephone and (2) replacement of fixed-line telephony (i.e., the first telephone) (Kelly, 1996, p. 11).

[7]Jun-ji Shih considers the utility of a consumer using the mobile service to be

$$U = U(q, x, y) \tag{1}$$

where q is the number of outgoing calls, x is the number of incoming calls, and y is the quantity of all other goods consumed.

The consumer's income constraint is

$$Y = sq + rx + y + H \tag{2}$$

Y is the total income, s is the tariff per outgoing call, r is the tariff per incoming call, and H is the installation fee for the telephone (Shih, 2000, pp. 8–10).

Table 2
Calling patterns from fixed-line to mobile communications

Calling to	From	
	Fixed-line network	Mobile network
Fixed-line network	A (NT $0.34/min)	B (NT $5.00/min)
Mobile network	C (NT $5.60/min)	D (NT $4.8/min)

Source: ⟨http://www.dgt.gov.tw⟩.

1. When making a call terminated by the local exchange carrier, the caller will adopt either the calling pattern A or B, depending on availability of access to the local exchange network.
2. When making a call terminated by mobile service providers, the caller will definitely choose Pattern D as long as he/she has mobile access.
3. It is imperative to notice that Pattern A will not be replaced by B, because the former's tariff is much cheaper than the latter's.
4. However, the calling pattern D is more likely to replace C if the latter's tariff is more expensive than the former's.

fixed-line users to migrate to mobile-to-mobile communications. Currently, the number of mobile subscribers has exceeded that of fixed-line telephony by ten million (DGT, 2003). When telephone users migrate from the calling pattern C to D, Chunghua Telecom hardly obtains any access charges from mobile service providers and its expected revenues are seriously truncated. Accordingly, this asymmetric tariff scheme enables mobile firms to sign up customers more quickly and allows mobile-to-mobile service to prevail. While mobile service providers have enjoyed extraordinarily high profits over the last 5 years, Chunghua Telecom is experiencing a decline in calls and traffic volume of local voice telephony.

3. Empirical study of dualistic asymmetric regulation

Regression tests are used to measure the impacts of the dualistic asymmetric regulation on mobile communications development, indicated by the mobile penetration rate and its growth. The fixed effects model runs an ordinary least-squares (OLS) estimation on the two dummy policy variables—the asymmetric constraints on the dominant carrier (*caps*) and on the fixed-line carrier (*payTai*)—and their interaction term, *asyTai*, a product of multiplying *caps* and *payTai*. The data, the model, the variables, and the discussion of the control variables are included in the appendix.

Table 3 presents the regression results on the mobile penetration rate, and Table 4 reports the results on the growth rate.[8] Column A in Table 3 validates the effectiveness of dualistic asymmetric regulation on a country's mobile penetration level. Neither the restraint on the incumbent nor that on the fixed-line operator can by itself generate significant impact; whereas their interaction term raises the penetration rate per capita by 22 percent. Likewise, Column C of Table 3 shows that the interaction term produces a 21 percent increase in the competitors' subscription level per capita. However, neither dual regulatory asymmetries nor their interaction term significantly causes the incumbent's subscription level per head to plummet (see Column B in Table 3). That is, simultaneous introduction of both asymmetric restraints is confirmed to develop a country's mobile communications, and seemingly, it does not accomplish this at the expense of its incumbent's advances.

The results in Table 4 then reveal the other part of the story. Although the dominant-carrier restraint and the implementation of the twofold asymmetric regulation do not affect the incumbent's mobile penetration level, they do have significant and negative impacts on its growth pattern (see Column A of Table 4). Once initiated, the dominant-carrier restraint decreases the incumbent's mobile growth rate by 80 percent. Adding the revenue-sharing constraint results in an additional 76 percent decrease in the incumbent's mobile growth

[8]The two proxy variables for the asymmetric regulation on the incumbent, *caps* and *xcaps*, produced similar and consistent findings, although the dummy one gave a slightly larger impact. This paper thus presented the regression results generated by the dummy variable *caps*.

Table 3
Regulatory impact on the mobile penetration rate

Variables	Mobile subscription per capita (*mobrate*) [A]	Penetration rate of the incumbent (*incumbs*) [B]	Penetration rate of the competitors (*compets*) [C]
Intercept	−0.72***	−0.32***	−0.15
	(0.10)	(0.06)	(0.08)
Market Openness	0.04***	0.01*	0.05***
(*firms*)	(0.01)	(0.00)	(0.01)
Dominant-carrier restraint	0.02	0.02	0.04
(caps)	(0.05)	(0.03)	(0.04)
Revenue-sharing constraint	Dropped	Dropped	Dropped
(*payTai*)			
Interaction effect 1	0.22**	0.01	0.21***
(*asyTai*)	(0.08)	(0.04)	(0.05)
Mobile-party pays principal	Dropped	Dropped	Dropped
(*payMob*)			
Interaction effect 2	0.06	−0.01	0.04
(*asyMob*)	(0.06)	(0.03)	(0.04)
GDP per capita	1.13e−05***	4.52e−06**	5.73e−06**
(*gdppc*)	(3.12e−06)	(1.683−06)	(2.20e−06)
Fixed-line per capita	2.06***	1.01***	0.48
(*fixrate*)	(0.33)	(0.19)	(0.25)
Observations	136	116	116
F statistic	67.04	31.85	53.65
R^2 within	0.7688	0.6498	0.7576

Data source: ITU Telecommunication Indicators (2003); DGT statistics 〈http://www.dgt.gov.tw〉.
*Significant at the 5% level.
**Significant at the 1% level.
***Significant at the 0.1% level or less.

rate.[9] In contrast, Column B in Table 4 demonstrates a much stronger impact on the development of the competitors' mobile voice services. Simultaneous introduction of both asymmetric regulations increases the competitors' growth rate by 13.29 times.

The regression results combined lead the authors to conclude that the implementation of the dualistic asymmetric regulation will foster rapid development in mobile communications in a short period of time. The econometric analysis allows recommendation of a policy solution for countries with underdeveloped telecommunications. They are advised to simultaneously implement twofold asymmetric regulation in hopes of rapidly expanding mobile voice services in a short time. The question, which remains, is whether or not implementation of such dualistic asymmetric regulation is justified based on the outcome of rapid penetration in mobile communications. The econometric findings in Table 4 affirm that, while competitors gain from twofold asymmetric regulation and boost their subscription level, the incumbent's ability to grow its customer base is devastated by the same regulatory framework. That is, the swift expansion of mobile communications is made possible at the expense of the incumbent's growth. The next section explores the drawbacks which asymmetric regulation entails.

4. Seeking regulatory rents

In the last decade, the contractarian approach has made itself a presence in policy analysis in response to the call for regulatory devolution and renovation. It views industrial regulation as a contract between the

[9]It is imperative to notice that, as shown by Column A in Table 4, a country concurrently promulgating the dominant carrier restraint and the mobile-party-pays tariff scheme will have the growth rate of its mobile incumbent decreased by 83 percent, compared with the country adopting the caller-pays principle. In this sense, the caller-pays principle is a more favorable revenue-sharing regime for the incumbent than the mobile-party-pays one.

Table 4
Regulatory impact on the growth rate of mobile communications

Variables	Growth rate of the incumbent's mobile subscription (*inshare*) [A]	Growth rate of the competitors' mobile subscription (*comshare*) [B]
Intercept	−18.56**	61.31**
	(5.07)	(11.51)
Market Openness	0.02	0.38**
(*firms*)	(0.06)	(0.11)
Dominant-carrier restraint	−1.61**	−0.95
(*caps*)	(0.33)	(0.85)
Revenue-sharing constraint	Dropped	Dropped
(*payTai*)		
Interaction effect 1	−1.42*	2.66*
(*asyTai*)	(0.57)	(1.26)
Mobile-party-pays principal	Dropped	Dropped
(*payMob*)		
Interaction effect 2	−1.80**	1.76
(*asyMob*)	(0.43)	(1.09)
% changes in GDP per capita	1.95**	6.25**
(*gdpln*)	(0.44)	(1.53)
% changes in Fixed-line per capita	6.58**	3.52
(*fixln*)	(1.19)	(2.39)
Observations	112	47
F statistic	106.92	11.08
R^2 within	0.8663	0.6616

Data source: ITU Telecommunication Indicators (2003); DGT statistics 〈http://www.dgt.gov.tw〉.*Significant at the 5% level.
**Significant at the 0.1% level or less.

regulator and the regulated firm. Both parties ex ante specify the substantive terms and conditions of regulation and ex post implement and enforce the regulation (Moe, 1984). Indeed, each telecommunications operator has a unique incentive intensity concerning service provision. If the incentive scheme with which a policy alternative is associated corresponds to its incentive intensity, its opportunity costs are greatly reduced and its expected payoffs increase (Chou, 1999). Otherwise, the policy alternative will distort the firm's incentive to undertake telecommunications. As evidenced by the present econometric analysis, the twofold asymmetric regulation in Taiwan increases the expected payoffs of mobile entrants by granting them the right to charge and collect tariffs of fixed-line-to-mobile communications, and as a result, they are more likely to make a telecommunications investment. Since the promulgation of the regulation, mobile competitors have signed up 2.32 times more subscribers than Chunghua Telecom (DGT, 2003). Chunghua Telecom so far has lost nearly 70 percent of the mobile market to the entrants.

From the contractarian point of view, regulatory asymmetry enables mobile entrants in Taiwan to reduce business risks and take advantage of the unequal terms of competition to behave opportunistically, since the incumbent is obligated to disclose all cost information and to provide full network access. The asymmetric revenue-sharing constraint even acts like wealth transfer from Chunghua Telecom to the competitors. The mobile competitors are thus greatly better off under asymmetric regulatory governance and they have strong incentives to preserve this governance.

Policy scholars have long observed that interest group politics play an influential role in policy formation and implementation. Since policies inevitably allocate costs and benefits among regulated firms, firms as interest groups will make efforts to direct the policy agenda toward their own benefits. The winners in the current regulatory regime desire to sustain influence over policymaking and deter policy changes that do not reward them. On the contrary, losers tend to expand the scope of conflict. By mobilizing countervailing forces, these firms struggle to redefine policy images and change policy agendas (Baumgartner & Jones, 1993).

Accordingly, the telecommunications firm has an incentive to invest in non-economic activities, such as lobbying or public affairs, in exchange for regulation in their favor.

However, such non-economic activities do not necessarily lead to socially desirable outcomes even if they benefit individual firms (Mbaku, 1998). Particularly when the benefited firms successfully lobby against the deployment of new services or technologies, the regulatory benefits they receive evolve into rents, that is, abnormal profits. Economic output will decrease when the firms allocate resources towards rent seeking rather than production and innovation (Shleifer & Vishny, 1998. Sidak and Spulber argue against regulations that encourage entry by subsidizing entrants or applying rules asymmetrically on incumbents because they may create the potential for uneconomic bypass. The entry would be uneconomic without subsidies or asymmetric regulation (Sidak & Spulber, 1998). This dualistic asymmetric regulation places Taiwanese mobile entrants in an advantageous position to compete with Chunghua Telecom and, as is evidenced by the present econometric analysis, entails regulatory benefits for them. They undoubtedly will engage in lobbies to preserve the benefits. The case of the follow-me call service (the 099 service) is then examined to illustrate how mobile entrants lobbied against a new service whose pricing scheme contradicts the dualistic asymmetric regulation.

The 099 call service offered by Chunghua Telecom since 1999 allows consumers to be fully connected with only one number.[10] Consumers' utilities are indeed increased through its full access. When the 099 number is set on the consumer's mobile phone, the traffic is terminated at the mobile system and the mobile service provider must grant Chunghua Telecom interconnection with its system. Chunghua Telecom's original rate for the 099 call service was $NT3.60 per minute and the company contributed an NT$2.00 access charge to the mobile firm for traffic termination.

From the viewpoint of the rival mobile competitors, the allocation of the revenues of the 099 call service and access charges nonetheless infringes on their right to retain the revenues from all mobile communications. The mobile firm earns a net profit of about NT$5.00 per minute for the mobile service terminated over its network, while obtaining only an NT$2.00 access charge for the 099 call service. In addition, the 099 call service shares certain characteristics of a mobile service and yet costs less than mobile telephony, so that mobile subscribers are easily lured to the service. Mobile competitors were set to lose profits if the 099 call service became more popular. Therefore, mobile rivals lobbied the DGT to raise the tariff and the access charge on the 099 call service. The mandated high tariffs of the 099 call service then led to a huge decline in subscription immediately after its debut. This case demonstrates that regulated firms will invest in non-economic activities to deter service renovation that conflicts with their interests and to withhold their privileges induced by the *status quo* policy regime.

5. Conclusion: paradoxical impact on telecommunications development

This paper has examined the paradoxical impact which dualistic asymmetric regulation in Taiwan has had on telecommunications development. Econometric analysis permits recommendation of a policy solution for countries with underdeveloped telecommunications. Simultaneously implementing twofold asymmetric regulation will bring about rapid penetration in mobile communications. It is notable, however, that this prompt development of mobile communications is achieved at the expense of the incumbent's growth. Designated as a competition safeguard, asymmetric regulation entails policy benefits for mobile entrants, enabling them to gain a higher penetration rate and abnormal profits. These beneficiaries, through lobbying, then forestalled the 099 call service since its pricing scheme infringed on the asymmetric revenue-sharing constraint. The regulatory gains then evolved into rents when the benefited firms lobbied against a renovated value-added service.

Dualistic asymmetric regulation even creates disincentives for telecommunications firms to deploy fixed-line technologies and services, since the local exchange carrier is prohibited from setting and collecting tariffs for its outgoing traffic. As the fixed-line network involves specific assets, the firm is more likely to forego providing service if it is deprived of the opportunity to earn a fair return on this irreversible investment. The regulation therefore impedes competition in local telephony. In the long run, it may hinder

[10]The 099 call service operates via setting up the 099 number either on the consumer's home phone, office phone, or mobile phone. In such a case, the consumer can be reached anywhere.

telecommunications development since it distorts companies' incentives to invest in local exchange service and directs their efforts to rent-seeking activities.

Policymakers must be alert about rent-seeking behaviors by rival competitors when promulgating twofold asymmetric regulation in hopes of rapid growth in communications services. The present empirical analysis implies that there should be a sunset point for the regulation, such that it no longer applies once a certain point in market development (defined, for example, in terms of penetration rate) has been reached. It is suggested that policymakers insert such sunset clauses in dualistic asymmetric regulation in order to fully utilize its merits while avoiding rent-seeking activities by beneficiaries. However, the asymmetric revenue-sharing constraint should not be repealed until after the mobile market has consolidated. Telecommunications officials must also refrain from arbitrary discretion when promulgating regulations on the dominant carrier in the competitive market. By so doing, regulators could create policy credibility and mitigate business risks for the companies, thus creating an even playing field upon which companies are equally affected by regulations and can thus focus on providing service and developing telecommunications in a way which maximizes public benefit.

Acknowledgments

The authors are indebted to Jun-Ji Shih, Zsehong Tsai, Jonna Chen, Shaio-Tung Chang, T. F. Leng, HuiJen Wei, Albert Lin, and Gerald W. Brock for their valuable discussions to improve this paper. We also thank Pingchung Chen, Jiahui Chang, and Junbin Chen for their research assistance and Paul Festa and Kent Suarez for their editorial help. Any remaining errors are solely the responsibility of the authors.

Appendix A. Econometric analysis

Regression analyses were performed on the panel data designated by country and by year (1981–2002). Eight OECD countries with different mobile pricing schemes—Japan, Hong Kong, Singapore, France, Germany, Portugal, Britain and the US—are selected as the benchmark of regulatory governance. Among those countries, Portugal has a tariff regime similar to Taiwan's, in which the fixed-line operators retain only interconnection charges for their outbound traffic terminated at the mobile network. In contrast, France, Germany, and the UK set up the "caller pays" tariff scheme, in which outgoing traffic is charged by its originator and mobile firms retain only the revenues of their own outgoing calls. Japan, Hong Kong, Singapore, and the US on the other hand have adopted the "both-ends-pay" (or "mobile party pays") principle, in which mobile phone users pay for both outgoing and incoming calls but mobile firms are not authorized to set the tariff for fixed-line-to-mobile communications and do not own such revenues. A dummy variable *payTai* records whether or not a country implements the asymmetric regulation on the fixed-line operators. Another dummy variable *payMob* was created to further differentiate the impacts generated by the mobile-party-pays principal from those of the calling-party-pays one. Ideally, it could more accurately measure the impacts of each tariff regime by weighting the two dummy variables with a continuous one that records the interconnection charge or the percentage of the communications revenues attributed to either operator. However regrettably, such data are not made available publicly.

As far as the asymmetric restraints on the incumbent are concerned, in 1993, the OFTEL of Hong Kong issued a price cap regulation on the dominant carrier, Hong Kong Telecom, until 2002. Japan did not impose restrictions on the incumbent, NTT, until 1998, although mobile services were provided early in 1981. Singapore has not yet considered asymmetric regulation since it opened its telecommunications market in 1996. France initiated asymmetric restrictions on the dominant carrier in 1995 but ended them in 1998, and Germany began asymmetric regulation in 1993. Portugal followed the WTO basic telecommunications service agreement to adopt the dominant carrier restriction in 1998. The United Kingdom adopted the asymmetric regulation approach on BT since its privatization in 1984. The US promulgated price cap regulation against the Baby Bells and AT&T in 1989 and repealed it by the enactment of the Telecommunications Act in 1996. The dummy variable *caps* was created to reflect the presence (1) or absence (0) of such asymmetric regulation in a given country. As the key component of this regulatory asymmetry mostly lies in price cap regulation, a

variable *xcaps* was also created by multiplying the variable *caps* with the value of the price ceiling (known as the *x*-indicator) to precisely capture the effects of price caps.

The mobile penetration growth rates are assumed to be, respectively, a linear function of the regulatory variables and of the economic and demographic control variables. Three control variables are included in the regressions to account for non-policy variation in the penetration rate: the degree of market competition (*firms*), the level of gross domestic product (GDP) per capita (*gdppc*) and the number of fixed lines per capita (*fixrate*). As for the regressions against the mobile growth rate, the latter two control variables are also replaced by their growth rates: percentage changes in GDP per capita (*growth*) and percentage changes in the fixed-line subscription per capita (*fixln*). The value of *firms* records the number of the firms offering mobile voice services in a given market. By controlling *firms*, the effects caused by dualistic asymmetric regulation are separated from those caused by competition policy.

The fixed-effects model runs an OLS estimation while controlling for country-specific information. Country-specific information is accounted for by assuming that there is a time-invariant country-specific component to the error term. Because that component does not vary over time, an algebraic manipulation can be performed in order to create an estimating equation without the country-specific term that allows ordinary least-squares estimation (Chou & Brock, 1998, pp. 4)

The regressions generate positive and significant coefficient estimates for the control variable *firms*. When mobile communications is allowed for competition, the total penetration rate will increase by 4 percent as one more entrant starts to offer the service (see Table 3). The competitors benefit by a 5 percent increase in their current penetration level (or equivalently a 46 percent increase in their growth rate (as shown by Table 4)) with one more company joining the battle. Competition policy unexpectedly raises the incumbent's subscription rate, too. Rather than being devastated by market competition, the incumbent earns a 1-percent increase in its subscription base concurrently with the presence of one more rival. Market competition in this sense is a win–win strategy under which both entrants and the incumbent will be better off.

The regression results also corroborate conventional wisdom that the growth of GDP per capita is, despite its smaller-scale influence, significantly correlated with mobile development. In Table 3, a one US dollar increase in GDP per capita causes an increase in the total mobile penetration rate of about 0.01 percent, and in both the incumbent's and the competitors' of less than 0.01 percent. Table 4 shows that a one-percent increase in GDP per capita generates a 1.95 percent increase in the incumbent's subscription number but a greater 6.25 percent decrease in the competitors'. This result clearly implies that a country with a lower growth rate of GDP per capita (i.e., a more developed economy) represents a more benevolent environment for the competitors to expand.

As far as the substitution effects between fixed-line and mobile communications are concerned, the regression findings fail to support the presumed negative correlation. As shown by Table 3, a unit increase in the number of fixed lines per capita will raise the total mobile penetration level by 2.06 units and the incumbent's mobile subscription per head by 1.01 units. Table 4 reveals that a 1-percent increase in the fixed lines per capita results in a 6.58-percent increase in the incumbent's mobile subscription per head. Nevertheless, it does not generate significant impact on mobile entrants' subscription per capita. Because of the speed of entrants' subscription growth, it may constitute a non-linear relationship with the penetration rate of fixed lines, and the coefficient estimate is insignificant by the OLS estimation.

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