

Introduction

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Digital markets worldwide are in rapid flux. The Internet and World Wide Web have traditionally evolved in a largely deregulated environment, but recently governments have shown great interest in this rapidly developing sector and have been imposing regulations for a variety of reasons that are changing the shape of these industries. For good or ill, the industrial organizations of broadband ISPs, Internet backbone providers and content/application providers are in turmoil; even the immediate future is highly uncertain. Broadband ISPs no longer simply provide a conduit for service delivery, they are involved in producing content and transaction services themselves, in competition with content and delivery providers. Further, the traditional lines between and among all three of these sectors is blurring, as each enters into the others' markets. We are seeing the emergence of powerful, competing platforms, linked in complex ways that challenge traditional economic analyses.

In this context, debate focuses on vertical relations between downstream Internet service providers and upstream Internet backbone providers regarding transit arrangements and pricing for interconnection. Particular issues relate to appropriate service quality discrimination and interoperability standards. In particular, mobile operators must now compete with virtual mobile network (sometimes branded) resellers. These circumstances, along with convergence driven telecommunications operator and information technology provider rivalry, leaves a complex chain of substitutions in end-users' markets to be analysed. For instance, the wireless-only household market segment has recently emerged. This phenomenon has implications for the delivery of triple-play service and the optimal ownership of rural telecommunications utilities. This volume examines the microeconomics of platform structure and firm competition within and between digital markets, modern theoretical treatments of regulatory intervention in digital markets

and the consideration of forward-looking experimental analysis of demand for yet to be provided services.

The volume is divided into four parts: governance issues; regulation and investment; next-generation service markets; and wireless communication. Final remarks are provided by Shane Greenstein. The structure of the volume is guided by the basic themes considered at the International Telecommunications Society's Africa-Asia-Australasia Regional Conference 'Mobile Technology and Broadband Application Developments', which was held in Perth, Western Australia on 16–18 August 2009. The volume contains a selection of parallel session papers presented at the conference as well as seven invited papers commissioned to augment the volume. The invited papers are authored by Rob Frieden (Chapter 3), Ingo Vogelsang (Chapter 4), Harald Gruber (Chapter 6), Nicholas Economides and Brian Viard (Chapter 7), Christiaan Hogendorn (Chapter 8), Jerry A. Hausman (Chapter 13), and Edmond Baranes and Cuong Huong Vuong (Chapter 14).

The Conference was sponsored by: Arnold & Porter LLP, the Australian Competition & Consumer Commission, Axiata, BT, Concept Economics, Curtin Business School, DotEcon, Edward Elgar Publishers, Electronic and Telecommunications Research Institute, France Telecom, Global Competition Review, IBBT, IDATE, Inderscience Publishers, InfoCom Research, Inc., National Telecommunications Commission of Thailand, NERA Economic Consulting, NTT DoCoMo, Pacific Telecommunications Council, Sheppard Mullin, Telecom Italia, Telenor and Telus. The conference was attended by 150 researchers, practitioners and regulators involved in telecommunications market analysis.

I: GOVERNANCE ISSUES

The volume begins with three chapters concerned with aspects of national and transnational governance of information network infrastructures. These analyses are important as network platforms act as a conduit for service delivery and as a means to conduct market transactions. A unifying theme of the analyses is regulators' desire to stimulate the development of next-generation broadband networks, whilst not imposing a technological winner. In particular, in Chapter 1, 'Challenges of institutional governance for network infrastructures: Reinstitution and expansion of legal innovations', Barbara Cherry examines how recent US deregulatory telecommunications policy, particularly that related to broadband and the Internet, may create conditions for future instability. Cherry argues that the elimination of common carriage for broadband as a means 'to push *laissez-faire* policy, advocated by the large incumbent telecommunications carriers and many economists, to decrease the role of government rather than a response to a

crisis.’ Instead, the divergent path may trigger its own crises, creating a demand for re-imposition of the dismantled rules associated with the common carriage framework. Adding to this complexity is the accelerated pace of technological and societal activities and change which are undermining the temporal presuppositions that underlie the division of powers among the branches of government. Scheuerman (2004) asserts that the conflation among the temporal roles of the various branches of government poses difficulties for the maintenance of the rule of law within a liberal democracy.

Rob Albon (Chapter 2 ‘Beyond traditional regulatory models: Emerging governance for new networks’) traces the evolution of ICT regulation and governance across the OECD since the 1980s liberalisation. Albon’s principal finding is that telecommunications has a relatively advanced regulatory design. These designs are relatively transparent and consultative compared to other infrastructure areas. EU directives also appear to be catalysts for the liberalisation and formation of economic regulation. Additionally, a move away from telecommunications-only regulation is identified, with governments combining telecommunications with spectrum management, broadcasting and posts as part of a communications-sector-wide regulator. Finally, many countries encounter difficulty in dealing with government desires to further develop broadband on a national scale with greater data rates, including the need to address structural and competition issues beyond the traditional regulatory ambit. The leading countries in broadband penetration and data speed have a diversity of provision by technology, and below average DSL. No country in this position is embarking on a large-scale NBN initiative.

In Chapter 3 (‘Government oversight of next generation wireless networks’), Rob Frieden examines the regulatory status of wireless carrier-delivered video content to determine the ‘necessary’ scope and nature of government oversight. Past practices of the US FCC in regulating the cable industry are reviewed to highlight the disparate treatment of wireless-delivered video content. Frieden concludes that the FCC, and other NRAs, must balance the carriers’ interests in finding new revenue centres to pay for next generation network upgrades with subscribers’ interests in maximizing their options for wireless handset use. NRAs should also aid wireless carriers to exploit technological innovations that enable the provision of telecommunications, information and video programming service combinations. However, regulators need to guard against carriers’ anti-competitive strategies that favour their services by handicapping access to alternative sources. Frieden concludes that as most NRAs seek to promote video programming competition and access for wired cable TV ventures, these NRAs should undertake similar efforts to promote wireless access,

because wireless carriers have equivalent incentives and abilities to blunt competition.

II: REGULATION AND INVESTMENT

The next three chapters analyse traditional areas of concern to firms and regulators in telecommunications markets, that is, investment and the appropriate role for regulation. Ingo Vogelsang (Chapter 4, ‘Incentive regulation, investments and technological change’) provides a review of the academic literature about the relationship between price regulation and investment. Vogelsang then develops policy proposals on pricing assuming that regulators can commit to incentive regulation. Because prices are set after investment, the wish for lower prices creates an ex-post conflict with the ex-ante desire for high investment (Brito et al., 2008). Lack of commitment leads to ex-post policy that inhibits investment. Anticipating such policy, the regulated firms refrain from investing. The introduction of the regulatory commitment issue shows the potential tension between the inability of regulators to commit over the long time horizon of infrastructure investments and the provision of cost-reducing incentives. This leads to policy proposals balancing the investment and incentive aspects. Next, the difference between ordinary and innovative investments are examined as reasons to abandon regulation altogether.

In Chapter 5, ‘Policy and regulation for next generation networks’, Martin Cave focuses on the policy and regulatory challenges posed by the introduction of NGAs. In developed countries with ubiquitous networks, for the first time in decades governments and regulators are not facing operators with fully sunk costs in the most monopolised part of the network, the local loop. Thus, their problems have increasing similarity with those faced by regulators of other infrastructures seeking to elicit efficient investment decisions, except that telecommunications have the extra complication, or benefit, of operating in an environment where no element of the value chain is conclusively a natural monopoly. However, a faster pace of technological change entails a greater risk of obsolescence than is present in the case of many infrastructures. Accordingly, the regulatory approaches to NGAs being adopted in various jurisdictions are reviewed. Then the role of central government in promoting high-speed broadband, as part either of a long-term policy or of a recovery plan is critically assessed.

Chapter 6 by Harald Gruber (‘Sector regulation and investment incentives: The European experience’) argues European telecommunications regulatory reform is inspired by open access regulation to bottleneck elements in the customer access infrastructure. Competitive access is seen as the means for eliminating the deadweight loss from monopoly and for establishing efficient

service provision in fixed-line telecommunications. Cost-based access pricing regimes are introduced to favour competitive entry. In this sense the ladder of investment concept worked to illustrate the entry mode with increasing own facilities over time. However, it failed to deliver significant investment for inter-platform competition. This issue is now compounded by the fact that FTTH becomes in many contexts the only option for high-speed broadband access. This therefore requires a stepping up of regulation towards a utility style regulation with warranted rates of return for providers of open access fibre networks. The implicit rate of return should provide for sufficient incentives to invest, but there remains the problem that competitive pressure may not be as high as desired by policy makers. This therefore requires substantial public support for the roll out of NGA networks. A further issue for regulatory policy is to create incentives for dynamic efficiency in terms of the sector pursuing innovation in technology and services.

III: NEXT-GENERATION SERVICE MARKETS

The next four chapters focus on modelling issues related to virtual goods markets, spillovers and network neutrality. In particular, Nicholas Economides and Brian Viard (Chapter 7, 'Pricing of complements and network effects') examine a monopolist of a base good that benefits from a complementary good provided either by it or another firm. Use of the complementary good requires the base good, but not the reverse. The model assesses and calibrates the extent of the positive influence on the base good profits that are created by the existence of the two sources (internal or external) of the complementary good. An equivalence between a model of a base and complementary good, and a reduced-form model of the base good where network effects are assumed in the utility function as a surrogate for the presence of direct network effects (i.e., a consumer's utility directly increases in the number of users) or indirect network effects (i.e., arising from increased variety of complementary goods produced by other firms) is established. This allows examination of the pricing of the complementary good under different market structures and in the context of the effect of other complementary goods via the network effects. Additionally, the study assesses and calibrates the influence of the intensity of network effects and quality improvements in the complementary good on profits from the base good. Also evaluated is the incentive that a monopolist has to improve the quality of the base good rather than that of a complementary good that it produces.

Christiaan Hogendorn (Chapter 8, 'Spillovers and network neutrality') considers that the practices addressed by network neutrality include an ISP:

offering content providers an ability to prioritize their traffic; preferring one service or one set of applications over others; or choosing to block or slow a service or set of services. Clearly any of these would be a large change from current practice, but the question is why that should be a public policy concern? The reason is that the ISP would choose preferred services or differential prices based on private valuations of those services. That is, the ISP will base its preferred services and fees on what it can privately appropriate from content provider's revenue. Hogendorn suggests three main reasons for divergence. First, the Internet is a GPT, which means that the applications of content providers often have public values in excess of their private value. Second, the Internet is a network of networks, and so network effects are rampant throughout all Internet-associated products. These take time to grow and they accrue to users beyond the content provider, so the dynamic, public value is likely to be higher than the static, private value. Finally, the Internet is an innovation-spawning technology, so that most of its content is rapidly changing and developing, adding new value. This means that the static value of content may be much less than the dynamic value, since successful development causes future increases in value.

Kurt DeMaagd and Johannes Bauer (Chapter 9, 'Network neutrality and sector performance: Exploring policy options with simulation methods') argue that the main concern of the network neutrality debate is a clarification of the principles that ought to govern the relations between network operators and providers of applications and content. A broad range of economic and non-economic goals is advanced by stakeholders. For example, not only is the need for mandated network neutrality rules contested in the political realm, where broader political objectives also are deliberated; it is far from being settled theoretically and empirically within the community of economic researchers. Considerable progress has been made in a short period of time, but theoretical explorations have yielded a broad range of possible outcomes, contingent on specific model assumptions and theoretical frames. This chapter explores whether progress in addressing these questions by means of simulation methods, capable of coevolving populations of heterogeneous agents, can be used to study policy interventions in communications systems.

IV: WIRELESS COMMUNICATIONS

The final five complementary chapters deal with wireless communications markets. In Chapter 10 ('Mobile communications: Economic and social impact'), Gerald R. Faulhaber examines US voice subscriptions and usage growth in comparison to wireline telephony. The extensions of voice mobile into forms of data services are also discussed. World trends are reviewed, particularly in the developing world. Specifically compared are the

deployment and growth of mobile to PCs, broadband, wireline and Internet users. In the penultimate section, both empirical results and anecdotal evidence regarding the substantial impact of mobile telephony on the economies of developing countries, and the pivotal role of mobile telephony as an engine of economic development are reviewed. Faulhaber concludes that to ensure that mobile fulfils its promise there must be a release of large amounts of spectrum for use by mobile service operators; more technological innovation be encouraged by reducing the cost of low-end devices and systems; maintenance of light touch regulation; and for poor rural areas, encourage the deployment of power delivery systems so customers can charge their mobiles.

Gary Madden, Aaron Morey and Erik Bohlin (Chapter 11, 'Regulator incentives and third generation national mobile telecommunications market entry') argue the potential for increased competition arising from entry into national mobile markets is recognised by the EC. Recently, research on the assignment of spectrum licences is concerned with the design and success of auction assignments. However, the determinants of market entry have received little attention. The analysis herein suggests that ex-post payment modes encourage entry, and that incumbents win licences with less onerous deployment obligations. Further, entrants that win licences with direct assistance from NRAs appear to receive more favourable licence conditions. These findings suggest that incumbents have advantages in 3G spectrum assignments, that result in them winning licences in more attractive markets. However, the analysis also suggests NRAs can, and do, design spectrum packages that increase the likelihood of entry. Thus, it would seem that EC directives on mobile entry are consistent with NRA decision-making across the world, and that mobile markets are evolving accordingly.

Benoît P. Freyens (Chapter 12, 'Licensing options for digital dividend spectrum: An Australian perspective') reports that by end-2013, the switchover of analogue television for DTV services will release a sizeable portion of 700 MHz UHF spectrum for use by non-broadcasting services. The main digital dividend allocation policy issues concern: consistency with the objectives of the Act; and resolving legal conflicts over the high-value of the spectrum and incumbents' rights. A bespoke approach can contribute to clarifying both issues. First, the more tailored are licences to meet the needs of certain users in particular bands, the better the fit with market aspirations and legislated objectives. Second, resolving legal conflict concerning UHF band reallocation may require compromise. Given the deeply rooted nature of incumbent spectrum rights under the Broadcasting Act 1997, it is doubtful other approaches will be effective. Whereas wholesale replacement of the apparatus-licenced digital dividend by spectrum licences will polarise positions, a bespoke licensing approach may conciliate incumbent and future user views. Finally, a bespoke approach would better address the needs of

providers of wireless access services that face different market structures, while addressing long-term objectives of the Act.

In Chapter 13, 'Two-sided markets with substitution: Mobile termination revisited', Jerry A. Hausman argues that regulators consider that fixed-to-mobile prices are set too high. This inference follows typically as mobile termination is seen as a monopoly problem, where mobile carriers do not face competition to terminate calls to their customers. This view misses two important economic factors. First, some or all of the excess of price over cost for mobile termination is used to lower prices for mobile subscription, as would be expected in a two-sided market. The second economic factor is that consumers who want to reach someone on-the-go can substitute mobile-to-mobile calls for fixed-to-mobile calls, and do so given relative prices. When allowed for substitution to mobile-to-mobile calls, which are assumed to be prices at cost, the monopoly termination implication no longer holds true. In terms of a policy recommendation it is concluded that regulating termination charges on the basis of costs is unjustified. When prices in the mobile markets are set competitively, such market intervention seems misguided. While the calibrated results suggest welfare may be enhanced by lowering termination charges below the market-determined rate, they also suggest it is well beyond usual regulatory calculations to determine the optimal prices.

Edmond Baranes and Cuong Huong Vuong (Chapter 14, 'Policy implications of asymmetric termination rate regulation in Europe') argue that the setting of asymmetric termination rate regulation between fixed and mobile operators, and different sized MNOs, should be replaced by symmetric regulation. In principle, asymmetric regulation is only appropriate when there is a demonstrated need. Furthermore, the regulator should reduce asymmetry via a glide path with MNOs well established in the market. This approach avoids the 'cash cow' problem and allows the incumbent to invest, especially in further deploying the FTTH network. Another consideration is distortion in the MTR. In this case implementing asymmetric MTR regulation is necessary when MTRs are above cost or there are tariff-mediated effects. It may be that both types of asymmetric regulation can be replaced by symmetric regulation simultaneously. This situation is relevant in an environment in which fixed and mobile services offered by an MNO and the incumbent become closer substitutes; and in the context when important investments are required to deploy further network infrastructure by all players.

V: FINAL REMARKS

The final chapter in this volume (Chapter 15, 'The absence of data for measuring the economic impact of IT in the US') by Shane Greenstein

illustrates the state of US data collection for the Internet economy. Greenstein indicates that the available data is inadequate, and that this is pervasive throughout many of the key questions in Internet economic policy. Moreover, US policy formulation across a range of issues is poorer as a result. Importantly, this knowledge gap is not restricted to the US.