

Preface

PURPOSE AND MOTIVATION

The *International Handbook of Telecommunications Economics* aims to serve as a source of reference and a technical supplement for the field of telecommunications economics. The intention is to provide both comprehensive and up-to-date surveys of recent developments and the state of various aspects of telecommunications markets. The Handbook is meant for professional use by economists, advanced undergraduate and graduate students, and also to prove useful to policy analysts, engineers and managers within the industry. With the last two decades of the twentieth century witnessing revolutionary technology and institutional change in telecommunications markets, publication of the Handbook is timely. In terms of organization it has proved convenient to categorize material into volumes on the basis of the economics pertaining to traditional 'narrowband technology' markets, markets associated with emerging 'broadband technologies' and the political economy and institutions that structure markets within which telecommunications companies operate and evolve.

The industrial organization of traditional or circuit-switched markets was primarily that of mandated monopolies offering a small array of narrowband services such as local, long-distance and international calling. This structure was supported by natural monopoly arguments. Not surprisingly, research in this era often concerned the analysis and review of production, costs and the productivity of operators. Further, the increasing privatization of incumbent operators required them to produce closer to minimum cost. Accordingly, studies examining the economies of scale and scope were prominent. Market deregulation and liberalization led to the rebalancing of rates so as to reduce cross-subsidization. In this changing environment, the analysis of competition, demand, pricing and aspects of industrial organization were important ongoing research themes. With the growth of global telecommunications, the organization of international markets and their pricing and other arrangements came under increasing scrutiny. The role of telecommunications in economic development was also considered an important discourse. During this regime welfare aspects of telecommunications markets were concerned with identifying and fulfilling universal service obligations.

In the face of developments in digital technology (mobile, satellite and

terrestrial), telecommunications, cable TV, broadcasting and computers are fast converging into a single industry. The advent of these high-capacity and intelligent networks has resulted in the development of new services, such as SMS, home banking and Internet services. The proliferation of networks and their need for, more or less, seamless interconnection has led to industrial restructuring through mergers and alliances. Such reorganization is also intended to allow operators to offer a full range of services. Growth in Internet network infrastructure and subscription has provided a base for the development of e-commerce markets. Accordingly much recent research on broadband networks is forward-looking and concerned with innovation and the future of these networks, for example, the forecasting of Internet telephony adoption, the impact of e-commerce on industrial organization and the structure of future retail markets. Fixed, mobile and satellite market segments, their interaction, regulation and pricing are also matters of importance to network planners and other market participants. When faced with competing technology platforms, practically for the first time, investment decisions are more complex. Appropriate investment decisions, inherently difficult, are made more so because of the price volatility of extant technology due to ongoing innovation to enhance its productivity. In this environment new treatments of uncertainty in telecommunications are being developed. This broadband regime brings with it concerns of identifying appropriate standards and delivery for universal service.

Finally, the structure within which modern communications companies operate and evolve is complex, Accordingly, corporate strategy has to evolve beyond that relevant to a national monopoly, which may provide international service, to deal optimally with new technology and its associated service innovations, and changing composition and patterns of demand. Corporations must also account for multiple objectives associated with both national economic and social policy. Further, the subtle transition from communication to information markets places additional demands on corporate trajectories. In this light the recent corporate experience of major international telecommunications companies can provide useful lessons. Exploring the interaction of diversity in national approaches with the continuing need for international cooperation and coordination continues to be an important area of debate.

ORGANIZATION

The organization of the *International Handbook of Telecommunications Economics* has sought to reflect principal topics in the field that have either received intensive research attention or are in need of an integrative survey.

The chapters of the Handbook can be read independently, though many are complementary. Volume I begins the Handbook with three chapters on production, cost and productivity. Russel Cooper, Erwin Diewert and Terry Wales (Chapter 1) focus on the subadditivity of cost functions. To determine whether a multi-product regulated industry is a natural monopoly, it is helpful to estimate a multiple output cost function for the incumbent firm and then determine whether this estimated cost function is subadditive. This chapter considers issues in the development of functional forms capable of addressing the subadditivity question in a theoretically valid context. Yale Braunstein and Grant Coble-Neal (Chapter 2) consider issues related to cost function estimation in the telecommunications industry. Their coverage encompasses concerns associated with specification of functional forms, problems with data and approaches to addressing them, and the treatment of technical change. Estimation and testing of economic theory are also discussed. Laurits Christensen, Philip Schoech and Mark Meitzen (Chapter 3) present a survey of TFP methods and studies for the telecommunications industry. TFP is widely recognized as a comprehensive measure of productive efficiency. Further, methodological issues in measuring TFP are considered. The relationship between TFP and output growth is also examined. Finally, a discussion of TFP and its application to price cap regulation concludes the chapter.

The next four chapters of Volume I analyse the traditional areas of concern in telecommunications markets, that is, competition and market structure, demand, pricing of network services and access, and vertical integration. T. Randolph Beard and George Ford (Chapter 4) focus on competition and structure in local and toll markets. They provide a review of conceptual and empirical analyses of competition relevant to the telecommunications industry. A peculiar result they provide is that competition may increase market cross-subsidy. Competition in parts of a geographic market, or fragmented duopoly, is also formally considered. Finally, merger effects are analysed using an empirical simulation model to evaluate competition in the long-distance industry. Lester Taylor (Chapter 5) notes that demand analysts must contend with shifting industry boundaries, new services, mobile telephony growth, disappearing data sources and emergence of the Internet. He describes in detail several studies that illustrate fundamental features of telecommunications demand, with regard to both theory and technique, and transcend their particular applications. Benjamin Hermalin and Michael Katz (Chapter 6) summarize and integrate the literature on retail pricing of telecommunications network services. Their central concerns are how to price network access and the exchange of information based on use. They focus on four characteristics and their implications for socially and privately optimal pricing to

end-users: consumption decisions have external effects, parties exchanging messages often have an ongoing relationship, service providers can identify customers, and incremental costs are often below average costs. Dennis Weisman (Chapter 7) considers that the dominant trends in the telecommunications industry with respect to market structure are consolidation and vertical integration. Such developments contain complex public policy and regulatory issues that both renew old debates and generate new ones. This chapter focuses on the strategic motivation for vertical integration in telecommunications markets and the corresponding regulatory and public policy issues.

The following three complementary chapters are concerned with international telecommunications markets. Douglas Galbi (Chapter 8) outlines key aspects of industry economics, firm organization and public policy relevant to understanding the globalization of telecommunications competition. Michael Einhorn (Chapter 9) reviews contemporary US policy concerning international settlements of voice and data telephone traffic. Accordingly, the FCC's previous settlements policies and the problems they posed to US carriers and callers are examined and FCC's strategy for reform is then detailed. The market under more competitive regimes is also considered. M. Ishaq Nadiri and Banani Nandi (Chapter 10) examine the contribution of telecommunications infrastructure to economic growth. Studies based on an I-O framework, and econometric cost models that describe telecommunications capital effects on industry cost structures and national productivity growth are considered. The social rate of return to telecommunications investment is discussed therein.

James Alleman and Paul Rappoport (Chapter 11) conclude Volume I with a review of the universal service concept. They argue that policy is inefficient as it is not directed to marginal subscribers, and it is costly to support because it is not targeted. Further, they consider that cross-subsidy reduces the demand for subscriber access from the group that it is intended to aid. Finally, subsidy inhibits effective competition by preventing the market from testing the efficiency of providers.

Volume II is devoted to the economics of high capacity and intelligent networks, and commences with three related but diverse chapters that cover information market innovation, Internet network history and evolution, and forecast its future. Cristiano Antonelli (Chapter 1) provides a framework to consider the accumulation of localized knowledge and competence dynamics. Such dynamics are from innovative agent activity. Agents are bounded by their competence and exposed to changing price and non-price competition. Michael Pelcovits and Vinton Cerf (Chapter 2) describe the Internet and outline its history to enable discussion of the economic forces that shape the network, and how the Internet's economics are different from

those of traditional telecommunications networks. The chapter concludes with a gaze into the future of the Internet. Paul Rappoport, Donald Kridel, Lester Taylor, James Alleman and Kevin Duffy-Deno (Chapter 3) use data from an omnibus survey to empirically estimate models of consumer Internet access. They consider dial-up access only, dial-up or broadband access and broadband but cable modem or ADSL choice situations. Results confirm that availability matters. When all forms of access are available, ADSL and cable are strong substitutes to dial-up access. ADSL and cable modems are substitutes. Other factors affecting broadband adoption are the type, duration and reach of use.

The next four chapters in Volume II concern e-commerce markets and, more generally, online activity and its regulation. Steven Globerman (Chapter 4) provides a description of e-commerce, its current state and prospects. Identification and assessment of hypotheses linking e-commerce growth to changes in organizational characteristics are made, and evidence evaluated. Michael Ward (Chapter 5) distinguishes online from traditional retail markets, and asserts that lower consumer search costs lead to greater substitutability among homogeneous goods, but stronger brand preference for heterogeneous goods. Reduced delivery costs are argued to lead to rapid adoption of online retailing for travel and financial products, while higher delivery costs suggest more modest online retailing for groceries and sporting goods adoption. Robert Frieden (Chapter 6) addresses problems and opportunities presented by services provided via the Internet. After reviewing the pre-existing regulatory models that apply, the chapter considers whether a single legal and regulatory foundation exists to address the public policy issues raised by Internet-delivered communications and e-commerce. The argument concludes with suggestions on how governments should promote telecommunication and information processing infrastructure use as a conduit for services that promote education, rural development and commerce. Timothy Tardiff (Chapter 7) sees that trends in product innovation are producing complex service offerings and pricing structures. As a result, the prescription that price equals marginal cost in competitive markets is inadequate. To understand this outcome and related pricing patterns, cost structures of firms offering these services are considered and their pricing implications discussed. Examples of pricing trends for retail telecommunications services include the growth of pricing options in place of single undifferentiated prices, and the offering of 'one-stop shopping'. Finally, whether pricing responses are likely to be pro- or anti-competitive is discussed.

The following three chapters concern alternative technology platforms, their convergence and regulation, and the difficulties facing operators in making network investment decisions. Harald Gruber and Tommaso

Valletti (Chapter 8) show mobile telephony development is restricted by the available radio spectrum. Switching from analogue to digital transmission has somewhat relaxed the constraint. Further, extending cellular mobile telephony to higher frequency bands has allowed more subscribers to be accommodated. By relaxing the spectrum constraint more firms are able to supply service, and so improve service quality and price. Empirical studies find that digital technology and firm entry accelerate diffusion, but that national differences in diffusion persist. Joseph Pelton (Chapter 9) argues that satellite services growth is driven by price and technical competition, regulatory and trade reform, and advance in frequency allocation. However, satellite communications remain a complementary service and supplement to ground-based systems. Developing countries are a major growth opportunity for satellite operators by filling niches in their broadband fibre networks. He argues that geosynchronous satellite systems will dominate LEO satellite systems, and that stratospheric platforms will reduce LEO system opportunity further. Jerry Hausman (Chapter 10) regards advice on setting regulated prices is flawed when it does not recognize substantial industry fixed costs. Further, it is often claimed that economies of scale are such that regulated firms' costs are below those of entrants. Another problem arises when a regulated firm wants to decrease prices of services subject to competition. Most economists conclude that cost-based regulation leads to consumer harm and so regulatory attempts to set prices independent of demand does not make sense. Within this approach, why the failure to take account of sunk costs leads to a downward bias in regulated prices is discussed. Assumptions that network investment is fixed, not sunk, lead to error. Finally, which incumbent network elements should be subject to mandatory unbundling is considered.

Jorge Schement and Scott Forbes (Chapter 11) conclude Volume II with a discussion of universal service policy for the twenty-first century. They argue that basing policy solely on the short-term constraints faced by corporations and government misses an opportunity to build an equitable foundation for a global information age. Universal service should be sensitive to diverse population needs. The old concept of universal service simply represents an intention to wire the nation. It is proposed here that welfare is optimized when populations choose their access configuration.

Volume III contains a collection of chapters concerning the structure within which modern communications companies operate and evolve. This emerging structure is reflected in the transition from telecommunications to information social policy induced by service transformation. In this context, selected corporate experiences, international cooperation and coordination operations, and regional studies help describe the complex environment in which corporate strategies must develop and be applied. Eli

Noam (Chapter 1) describes the evolution of the telecommunications sector from incumbent monopoly status. He argues that incumbent carriers are in the midst of vertical diversification and horizontal expansion. Entrants with more efficient technology that has a greater modality impose these processes on incumbents. To maximize the gains from Schumpeterian creative destruction requires regulatory policy that ensures major companies become rivals and not partners.

The next three chapters concern the evolution of telecommunication policy to information social policy. Martin Fransman (Chapter 2) analyses the transformation from old to new telecommunications industry, and on to info-communications industry. He argues that the demise of the old telecommunications industry began with the opening of monopoly markets to competition, and the EU and WTO agreeing to liberalization. Further transformation to an info-communications industry was due to packet switching, IP and WWW technology. William Melody (Chapter 3) provides a review of telecommunications reform and information infrastructure development by focusing on traditional and network economy indicators. Traditional indicators include measures of network access and service, and competition in fixed network and mobile telephony markets. Information infrastructure development is measured by network investment, availability and use of new access technology, and Internet market development. Countries selected are leaders in global markets. Erik Bohlin (Chapter 4) considers that political and convergence dynamics will require telecommunications policy research to address a wider and more comprehensive set of questions. His chapter elaborates the nature of telecommunications policy research, addressing political inertia and its implications for policy, explaining the increased scope of telecommunications policy, and suggesting future research needs, including that of a sustainable information society.

The four chapters that follow describe the experience and visions of communications corporations. Peter Curwen (Chapter 5) argues that initial attempts to form global alliances floundered, even though 'New' Concert may have arisen from the ashes of its predecessor. Alliance formation is a slow process, partly because of the time required to obtain regulatory clearance, and because partners need time to ensure network architecture and standards are compatible. Time is a scarce resource in a rapidly changing industry. Furthermore, alliances consistently underestimate the difficulty of keeping relatively loose arrangements in place. Niall Levine, Douglas Pitt and David Lal (Chapter 6) analyse changes BT faced in the 1990s. They argue that the causes and effects of change are relevant to the disciplines of strategic planning, organizational behaviour, telecommunications management, economics and regulatory policy. They contend that BT faces permanent revolution in redefining its strategy and organizational practices

to meet emerging market opportunities and environmental challenges posed by increasing competition and regulation. Martin Taschdjian (Chapter 7) considers that US WEST's evolution into international markets and broadband technology is typical of the telecommunications revolution. Its history of strategic initiatives, and the learning and adjustments made, offer insight into the issues of convergence, diversification, technology, competition, shareholder value and public policy. These lessons suggest AT&T's strategy of evolving from a long-distance carrier into a local broadband services company faced significant challenges. James Alleman and Lawrence Cole (Chapter 8) conclude that GTE purchased the long-distance telephone company SPC because it was already involved in telecommunications and other high-technology business, had an acceptable investment return, and an effective management in handling regulatory process. However, they claim the move was imprudent. Important mistakes include an inadequate understanding of interconnection charges and valuation analysis, and of a government imposed Consent Decree.

The seven chapters that appear next provide a complementary overview and analysis of national and international agencies that affect regulatory policy and international telecommunications aid activity. Richard Cawley (Chapter 9) provides insight into the substance and process of telecommunications regulation and policy in the EU in the latter part of the twentieth century. He considers an important message in the EU context is that regulatory policy can often not be designed from a first-best standpoint. It is constrained by the legal and institutional structures that are enshrined in successive EU treaties, and these in turn reflect evolving political, social and economic prerogatives and compromise between member states. Timothy Brennan (Chapter 10) argues that across the US, cable TV systems have begun to expand offerings beyond multi-channel point-to-multipoint video to include high-speed broadband Internet service. Recently, the US Federal Trade Commission, with the FCC, imposed open access requirements on Time Warner's cable systems as a condition for approving its acquisition by America On-Line. The merits of imposing such broadband access requirements are debatable. To ensure locality access rules are efficiency based, open access requirements should be imposed independently of merger occurrence. Tim Kelly (Chapter 11) asserts that ITRs, among the longest surviving international treaties, are regarded, especially in developing countries, as an expression of national sovereignty. The current ITRs, adopted in an era when old certainties were tumbling, remain essentially unchanged. For example, at the time of drafting there were only half a million Internet users globally. The current situation is one of atrophy in which the ITRs are slowly falling into neglect. Dimitri Ypsilanti (Chapter

12) considers that regulators are trying to interpret principles that are largely empty of detail. An associated difficulty is gaining consensus on the degree to which the details of policy should be the same, as opposed to the general frameworks. A means to ensure the continued convergence of regulation is through sharing experiences, and more open evaluation of regulator performance, including benchmarking. Such an approach will ensure best practice regulation is more widely adopted and provide an impetus for convergence in policy and the implementation of regulation. Bruno Lanvin (Chapter 13) addresses the question as to whether it is too late to bridge the digital divide by stressing the main aspects of the present approach. That is, how do the attitudes of stakeholder groups differ from what they were two or three years ago? Why has the issue recently moved from an important problem to a matter of emergency? Finally, how are the nations of the G-8 gearing up to react to this challenge? Charles Kenny (Chapter 14) provides an early history of WBG involvement in the sector and describes change in the 1990s. In particular, the IFC undertook the role of investing in private telecommunications and the WBG moved toward supporting reform in policy and the development of regulatory institutions. After discussing developments in the late 1990s, including early reaction to evolution of the Internet, the increasing importance of universal access and the need for broadened strategy focus, the chapter examines ongoing efforts to reform the WBG strategy for information infrastructure. Claude Barfield and Steven Anderson (Chapter 15) indicate that 50 per cent of WTO members made no basic telecommunications commitment to the GATS. Further, they argue that ongoing negotiation should insist countries meet their 1997 commitments. Negotiations should also harvest more commitments from informal unilateral liberalization. An obvious omission involves basic telecommunications and technology convergence. Future negotiation must gain commitments concerning technology and anticompetitive practice by non-telecommunications entrants. Finally, the WTO basic telecommunications agreement needs to confront international pricing.

The last eight chapters in Volume III are concerned with regional issues. It is hoped that while the issues may be peculiar their lessons will be widely applicable. Andrea Kavanaugh (Chapter 16) considers that any assertion that the Internet favours a new pan-Arabism is ill founded and a more likely outcome is increased pan-elitism. Wealthy, well-educated and young Arab new media users are improving their lifestyles through consumerism, entertainment and realistic news coverage. Nor does the Internet suggest there will be new pan-Arabism, as elite Arabs are drifting farther from their less advantaged brethren. The gap between the haves and have-nots in the Arab Middle East is widening at a great pace. Mark Shadur, Kellie Caught and

René Kienzle (Chapter 17) argue that Australia and New Zealand have major differences in their telecommunications sectors as a result of deregulation. These differences have resulted in distinct market structures, competitor strategy and user outcomes. The chapter outlines change programmes for organizational design, work organization, employee involvement and SHRM. The question as to whether organizational changes have improved operational outcomes remains. Marcelo Resende (Chapter 18) traces the recent evolution of the Brazilian telecommunications sector, in particular the public provision of telecommunications and the system that replaced it. His principal focus is the emerging regulatory framework and challenges facing the sector. The period prior to privatization is examined through aggregate and firm-specific productivity indicators, and a description of the main events defining the institutional design is given. An examination of the post-privatization environment follows. Meheroo Jussawalla (Chapter 19) posits that as Chinese leadership encouraged the deployment of the latest IT and pursued development of global information infrastructure through the mid-1990s, the existing telephone network became obsolete and led to a planned broadband cable network. China now has to devise a future to better diffuse the information superhighway. Further, China needs to combine the goals of information infrastructure advancement with investment in primary education or face social unrest. Nicolas Curien and Dominique Bureau (Chapter 20) describe the change in regulatory oversight of the French telecommunications and electricity sectors. Among network industries, telecommunications and electricity are not uniquely affected by liberalization and market-oriented EU directives. Given the criteria of opening markets to competition and maintaining the public operators' dominant position in certain market segments, telecommunications and electricity are interesting sectors to study. Moreover sector comparisons are relevant as the public sector companies involved, France Télécom and EdF, are efficient and able to withstand international competition. Günter Knieps (Chapter 21) considers the German entry process and its relationship to EU network liberalization policy. New German telecommunications law tends toward over-regulation and a large regulatory base. Further, the potential for phasing out sector-specific regulation is sketched. A critical appraisal of the Review of the German Monopoly Commission is also provided. The analysis shows that after entry deregulation, regulation of market power is only justified in local telecommunications networks when they constitute monopolistic bottlenecks. Elsewhere actual and potential competition is sufficient to discipline the market. T.H. Chowdary (Chapter 22) observes that until recently the Indian telecommunications sector was characterized by millions of applicants waiting for network connection, unsatisfactory service delivery,

inflated telephone tariffs – too high to generate funds for network improvement – inability to develop technology locally and poor communications for export-orientated business. Automation and computerization of telephone directory assistance, billing, complaint and fault registration, and control to improve quality of service were resisted. He describes how the move from centralized planning, liberalization, accession to the WTO and signing of the ITA have profoundly affected the provision of telecommunications and information services. Willem Hulsink and Andrew Davies (Chapter 23) argue that national governance regimes shape the internationalization approach of European PTOs. The strategic choice of PTOs, rivals and regulatory agencies determine the scope of market restructuring. The economics of innovation helps to explain innovation strategy. Occasionally industry is altered by strategic behaviour, disruptive technology and exogenous shocks, and so challenges the political and economic system. These situations create dissonance and technology may be replaced, and winning corporate strategy and industry dynamics transformed.