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Dynamic Competition in Telecommunications

Implications for Regulatory Policy

Neil Quigley

In this issue...

The federal government designs the CRTC's regulatory policies to promote the entry of new firms into the market for wireline local access services using current facilities and technology. Yet the current pace of technological change means that competition cannot be measured simply by counting the number of competitors in the market. What is needed are incentives for firms to invest in new technologies and to compete for *the market, rather than in the market, to the long-term benefit of Canadian consumers.*

The Study in Brief

In recent years, the Canadian Radio-television and Telecommunications Commission (CRTC) has adopted a range of policy initiatives designed to promote the entry of new firms into the business of providing wireline local access telephone services, and increasing the number of viable competitors in that market. Despite its efforts, however, the CRTC's own assessment is that competition is limited even in the largest urban centres and virtually nonexistent outside them.

This *Commentary* looks at the policies the CRTC has adopted and their implications for competition in wireline local access services. In particular, the *Commentary* considers the importance of technological change as a driver of competition in telecommunications, and the implications of regulatory restrictions on retail prices for investment in and entry to the wireline local access business.

Where technical change provides a credible threat to a network that is already in place, high levels of competition and substantial benefits to consumers do not, in fact, require that numerous competing providers operate in the market. Investment in new technologies and services that allow a firm to compete with existing technologies may provide greater benefits than competition among providers of the same technologies and services in the market. Competition from potential providers of local access (such as cable, wireless, and satellite-based technologies) will force firms already in the market to invest in order to preserve their market position. Consumers will benefit from this investment even if incumbent firms are not replaced by potential competitors.

Canada's local residential telephone prices, which are set by the CRTC, are well below those in the U.S. Such low regulated prices, however, are a substantial barrier both to entry by new competitors using the current technology and to investment in new technologies, such as Voice over Internet Protocol telephony.

The current pace of technological change in telecommunications means that competition in wireline local access services in Canada cannot be measured by counting the number of competitors in the market. Policies designed to promote entry using the current facilities and technology will reduce incentives to invest in new technologies and to compete for the market, which will limit the long-term benefits to Canadian consumers.

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The telecommunications industry provides services that are a fundamental driver of productivity gains in the Canadian economy and central to the operation of every business and household. With the introduction of new technology that enables voice, data, and entertainment services to be carried over a single high-speed line, potentially bringing all providers of these services into direct competition, the structure of the telecommunications industry is changing rapidly. For consumers and businesses to gain the maximum benefits, the regulatory regime that determines critical elements of pricing and competitive interaction in the telecommunications sphere must now recognize and facilitate this revolutionary change.

Competition results from rivalry among companies. Recognizing the benefits of competition, all developed countries have adopted policies to preserve it and to prohibit certain actions designed to reduce it. Many governments also adopt industry-specific regulations when they suspect that the structure of particular industries is reducing competition in particular markets. Telecommunications is one example of an industry that has provoked just such regulation.

In markets where industry-specific regulations are in use, the interplay between rules and competition is complex. Regulators normally attempt to promote competition, but they also mandate prices where they consider competition is insufficient to ensure that prices are set at or near realistic levels. In assessing claims about whether mandated prices are necessary, regulators are challenged to distinguish the private interests of companies that are already in the industry and those that wish to enter from the interests of society as a whole.

Faced with that challenge, regulators find it convenient to focus on both the number of companies supplying the market and trends in prices as measures of rivalry. One problem with such an approach, however, is that competition is much more complex and dynamic than these static measures suggest. For example, if regulators ignore the role of actual and potential technological change as a cause of competitive tension in markets, then they may understate the extent of the actual competition and invoke regulatory policies that are inconsistent with the long-term interests of consumers.

The complexity of combining industry-specific regulation with competition is nowhere more evident than in Canadian telecommunications markets. Since those markets were opened in the early 1990s to allow competition with incumbent network operators, new entrants have been very successful in some markets, such as cellular service, and have taken a small, but significant, share of fixed-wire, or wireline, local access services to business customers. They have been far less successful, however, in providing services to residential customers. More than 20 so-called competitive local exchange carriers (CLECs) have attempted to enter the residential market, many hoping to use Canadian regulations that require they be allowed unbundled access to incumbents' facilities, but most have proved to be financially unviable.

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The new entrants' lack of success in the residential market led the Canadian Radio-television and Telecommunications Commission (CRTC) to take the view that there is little, if any, evidence of competition in the supply of local access services for such customers.[1] The CRTC's view has been echoed elsewhere, notably by then industry minister Allan Rock (2003), who stated:

> Local competition is virtually non-existent in all but our largest cities. We would like to see the CRTC consider what additional measures it can take to promote competition beyond those major urban centers so that all Canadians can enjoy the benefits of healthy competition.

The CRTC takes the view that there is little, if any, evidence of competition in the supply of local access services for Canadian residential customers.

These claims are striking because the Canadian telecommunications industry scores very highly on many international benchmarks. Prices for residential telephone services in Canada are regulated at levels substantially lower than those in the U.S. A large amount of new investment has gone into the infrastructure of incumbent local exchange carriers (ILECs), the networks of the cable companies, and the wireless (cellular, satellite, and fixed) networks of both incumbents and entrants, resulting in a network of high quality and an uptake of broadband data connections second only to those in South Korea. This investment, however, has focused on business customers and on developing the provision of mobile, high-speed data and entertainment services, rather than on residential wireline voice services. Canada is also slow in deploying new-generation Voice over Internet Protocol (VoIP) services by high-speed data providers that now have the technical capability to compete in the residential voice telephony business.

This *Commentary* attempts to explain the apparent paradox between the existence of substantial competitive tension (as suggested by measures of investment and industry performance) and the absence of in-market competition in local residential telephony. The explanation hinges on the distinction between static and dynamic competition, and between competition *in* the market and competition *for* the market: Where technological change provides a credible threat to the incumbent network, competition from potential providers of local access will force incumbents to invest to preserve their market position, thus providing consumers with greater benefits than competition between actual providers using the same technology.

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1 In its 2002 review of competition in telecommunications (2002b), the CRTC noted that the incumbent telecommunications companies held 96 percent of total lines and 97 percent of total local access wireline revenues. It further noted that competition in wireline local access was "primarily confined to the urban business segment." In its subsequent price-cap determination, the CRTC concluded:

> Overall, the evidence filed by the parties in this proceeding reinforced the perspective provided by[CRTC 2002b]. Facilities-based local competition is generally limited to the business market in large urban areas. There is some resale-based competition in the business market in other areas. There is little, if any, local competition of any type in the residential market….In addition, there was no evidence to suggest that competitors had made any inroads into the market for residential optional local services. On the contrary, the [incumbent local exchange carriers] were able to increase revenues from these services through rate increases without experiencing a significant reduction in demand. (CRTC 2002a, paras 47, 59.)

The CRTC's most recent competition assessment (2003) finds the situation little changed. See also Dalfen 2002.

The study proceeds as follows. In the next section, I examine the concept of competition and efficiency. Then, I consider an alternative approach to understanding competition based on the dynamic process of innovation — competition for the field based on the development of new technologies — and its implications for social welfare. I then examine the extent of competition in Canadian residential telephone service as the CRTC defines it, and consider the impact of regulated pricing on competition in the market. This is followed by a discussion of technology races in telecommunications — in particular, the potential for entry by cable companies and wireless providers using new-generation VoIP technology.

The CRTC does not place sufficient weight on competition resulting from investment in new technologies and its impact on competition for *the market, rather than* in *the market.*

I conclude that the CRTC does not place sufficient weight on competition resulting from investment in new technologies, its impact on competition *for* the market, rather than *in* the market, and the welfare gains resulting from these elements of dynamic competition. As a result, the CRTC is understating both the extent of the existing market discipline on incumbents and the vigour of the competitive process in local telecommunications. If in-market competition is less vigorous in Canada than it is in the U.S., a fundamental reason is that the CRTC has set retail residential telephone prices so low as to discourage technological investment by cable companies or CLECs leasing unbundled network elements and made it economically unattractive for them to enter the voice telephony market.

Understanding Competition and Efficiency

Competition is the process generated by rivalry among companies in or for markets. It includes rivalry in terms of price, altered or improved products or techniques of production, brand awareness and reputation, and the provision of information to consumers (Hughes 1987; Stigler 1987; Blaug 1996). Competition produces benefits for both consumers and society as a whole because it induces companies to be internally efficient, to make the optimal use of resources, and to make investment decisions that will provide competitive advantages in the future.

To understand what approach to competition in telecommunications will provide the greatest benefits to society as a whole, one must first consider the nature of efficiency and its links with competition.[2]

The standard approach of economists is to distinguish among three types of efficiency: allocative, productive, and dynamic. *Allocative efficiency* refers to the allocation of scarce resources among competing uses. *Productive efficiency* is determined by the production processes within companies — in particular, whether they minimize production costs. Both allocative and productive efficiency are static concepts because they relate to the allocation and use of resources at any point. Measures of allocative and productive efficiency reflect the efficiency today of the resource allocation and production decisions made in the past.

Dynamic efficiency refers to the efficiency of the framework for decisionmaking over time.[3] In particular, a dynamically efficient economy is one in which the

2 The following discussion of efficiency owes much to my earlier joint work with Professor Lewis Evans.

3 Dynamically efficient states of the world are those in which the incentives for decisionmaking work to maximize the present value of social welfare over time, subject to the overall resource constraints the economy faces.

incentives for investment (in new assets and new knowledge) are such as to maximize long-run social welfare by providing for the optimal introduction of new services and new technologies and aggregate economic growth in the economy.

Dynamically efficient economies are normally characterized by static inefficiency at any point. Static inefficiency may result from:

- dynamic inefficiency in the past, which may result from a statutory monopoly or regulation that required or motivated inefficient investment decisions;
- dynamic efficiency in the past, resulting, for example, from the emergence of a situation in which previously efficient investment decisions turn out to be inefficient in current settings; or
- the creation of short-term market power as a result of a dynamically competitive process to develop new technologies or products that capture the entire market until superseded by subsequent innovation.

If the economy is dynamically efficient, one would expect static inefficiency from the first source to erode gradually. Static inefficiency of the second and third types is ubiquitous because it stems from uncertainty and the inability of human beings to predict the future perfectly.[4]

The reduction in economic growth that results from slower development and adoption of innovations imposes high costs on society.

The losses in social welfare resulting from long periods of dynamic inefficiency can be quantitatively large, for several reasons. First, inappropriate investment decisions — for example, poorly located electricity plants, overinvestment in railway lines, or adoption of a dead-end technology — may go on influencing the efficiency of the market for long periods after initial construction. Second, when the introduction of new services is delayed, the consumer and producer surpluses associated with the sale of the service or product are lost to society, and these losses are necessarily larger than those associated with monopoly pricing or output decisions.[5] Finally, when dynamic inefficiency results in inadequate incentives to invest in new technologies, the reduction in economic growth that results from slower development and adoption of innovations imposes high costs on society.[6]

Dynamic inefficiency is normally associated with either monopoly or regulation because, under both market structures, companies face reduced incentives to invest. Where a pure monopoly operates without fear of competition from entrants, or where regulatory control of pricing and market structure is so directive that it resembles central planning, dynamic efficiency is reduced by the absence of both competitive tension in investment decisionmaking and investment in competing technologies. Competitive decisionmaking is particularly important in industries

4 Fershtman and Pakes (2000) provide an excellent formal analysis of the conjunction of rivalry, product quality, and investment that generates dynamic efficiency (even though static inefficiencies will be present at any particular point).

5 In contrast, under conditions of pure monopoly, society suffers deadweight losses and consumers are made worse off by the transfer of consumer surplus to producer surplus, but only under very special conditions could the monopolist obtain all of the consumer surplus.

6 The calculation of the magnitude of the losses resulting from dynamic inefficiency is always arguable both from the point of view of the counterfactual (the introduction and rate of uptake of the service in a dynamically efficient environment) and the methods of empirical estimation. However, examples of these calculations (such as Hausman 1997 and Goolsbee 2000) are sufficiently robust to support the theoretical conclusion that the losses are large.

where the pace of technological change is rapid because it is not possible to be sure which path of technical change will yield the greatest benefits to consumers.

When prices are set at marginal cost, telecommunications firms that need to make substantial fixed and sunk investments will not be able to cover the total costs of a project, with the result that departures from marginal-cost pricing will be optimal.[7] However, telecommunications regulators often require incumbents to share their facilities or networks with entrants who pay only the marginal cost of their use of the facility. If companies expect the regulator to provide competitors with access to their facilities at marginal cost, they will also not expect to recover the costs of their fixed investments.[8] The shortcomings of regulatory determinations that set prices at marginal cost can be illustrated by a review of the assumptions of the theory of perfect competition — (Box 1).

Marginal-cost-pricing models provide no direct means of recognizing the fact that regulatory access determinations give potential entrants a free option to use the network operator's technology. When the network investment is fixed and irreversible, but technological change results in considerable uncertainty about the economic life of that network, the value of that option is high. As Hausman (1999, 200) puts it:

> Regulators' failure to recognize the sunk character of much network investment leads to the grant of a free option to the competitors of the incumbent. Causing the shareholders of the incumbent firm to fund the free option for the competition will lead to underinvestment. Given the amount of uncertainty in a dynamic industry with rapidly changing technology and economics this can have an especially large effect on investment incentives because the value of the option is high.

Competition in the Field versus Competition for the Field

To understand competition in telecommunications, one must work with an approach that captures both competition in markets and competition for markets.

The large economies of scale associated with investment in telecommunications networks mean that static competition in markets is often limited to situations where companies compete using different technologies, or where competition is based on wholesale or network leasing arrangements (often driven by regulation). However, telecommunications is also characterized by competition based on investment in new technology that will not just provide consumers with new services but may also supplant the existing technology for the delivery of existing services. Thus, to understand competition in telecommunications, one must work with an approach that captures both competition in markets and competition for markets.

In a now famous essay on utility regulation, Professor Harold Demsetz (1968) argued that there is no necessary reason for competitive markets to be characterized only by rivals sharing the field as opposed to rivals competing for the right to be the incumbent provider. Demsetz pointed out that, even under conditions of

7 See Baumol and Bradford 1970; Kahn 1988; Sidak and Spulber 1998, 408; Laffont and Tirole 2000, 7.

8 Having the regulator add a share of the common costs to the marginal or incremental cost does not solve the problem since this approach is unlikely to produce the dynamically efficient price (Sidak and Spulber 1998).

Box 1: ***Perfect Competition and Marginal Cost***

Most undergraduate textbooks in microeconomics and industrial organization provide a diagrammatic representation of the equilibrium in a "perfectly competitive" market, where firms face a price that is at the intersection of short-run marginal cost and average total cost.* At this price, companies earn a competitive rate of return on capital, which compensates for the risk associated with investment in that business.

Perfect competition holds only under very special assumptions, including that all companies produce homogeneous products with technologies that provide for identical cost structures. In effect, perfect competition assumes away nearly all of those aspects of real-world markets that determine market structure and provide a basis for competitive conduct (such as rivalry in terms of price setting, innovation in products and processes, and advertising).

Under perfect competition, a company has no incentive to engage in anticompetitive or collusive conduct because it cannot increase market share. It has no incentive to invest in research and development or to make the fixed (and substantially sunk) investments required to make the services associated with those technologies available to consumers. This is because the company will be unable to recover the costs of investment in the development of a new technology if (under the assumptions of perfect competition) its competitors can acquire the same technology at the same time and push prices in the market down to marginal cost.

The limitations of the model of perfect competition mean that the modern economics literature uses much richer models of competitive processes in real-world markets. Large numbers of firms are not required for efficient outcomes if firms produce similar products and can quickly expand production capacity. Moreover, with smaller numbers of firms, unequal firm size may make collusion between firms more difficult (Carlton and Perloff 2000). And in competitive industries, the driver of lower prices will be the introduction, adoption, and adaptation of innovations, with resulting entry of firms with new technology and exit of firms with inferior technology (Jovanovic and MacDonald 1994). From the perspective of regulators, however, these approaches to competition are less useful because they suggest complex pricing rules with onerous requirements for the collection of data relevant to any price determination.

* Perfect competition can also be represented in terms of long-run marginal cost, but these models ignore imperfect information, irreversible investment decisions, uncertainty, and adjustment costs that characterize real-world decisionmaking.

natural monopoly, where there is competition for the right to be the single provider, the end result may be a market that, in the long run, is more efficient than a market in which numerous rivals compete to supply consumers at each point in time.[9]

Demsetz's theory stresses the importance of determining how a market's structure comes into being and how incumbency is lost or retained, rather than focusing on the number of competitors in the market at any point. The efficiency of competition for incumbency requires only that it is feasible for the incumbent to be replaced by a more efficient rival when such a rival exists, and that it is

9 Subsequent work has developed a body of theory relating to cooperative action that shows that, all other things being equal, cooperative action is more likely the fewer players there are in the market; nevertheless, Demsetz's general conclusion still holds. Indeed, under the conditions I describe below, collusion is unlikely because the threat of competitive bypass by a new technology makes any potential cooperative agreement unstable.

prohibitively costly for rivals to collude in the process of bidding for incumbency. In industries characterized by rapid technical change, these conditions are easily met. In telecommunications services, pure incumbency is rare, and most infrastructure owners face competition from different technologies and services platforms that may ultimately supplant the technology on which their services are based.

Competition for the market does not rely on free entry and exit to obtain efficiency in a market with one supplier.[10] In fact, it is precisely the existence of barriers to entry once incumbency has been achieved — thus enabling the company to cover the fixed costs of entry — that provides the investment incentives which allow consumers to benefit from the incumbent's products and services.

Prices may be higher when there is competition for the field than when there is substantial competition in the field, but higher prices benefit consumers by providing incentives to introduce new technology.

Demsetz's theory is consistent with the fact that prices may be higher when there is competition for the field than when there is substantial competition in the field. Higher prices are needed to compensate the service provider for the fixed (and often sunk) costs of investment to develop and implement the technology and infrastructure associated with the service. Prices that are high enough to provide returns that will cover these costs actually benefit consumers, since potential entrants will then have the incentive to develop the new technologies that will enable them to supplant the incumbent and offer consumers better products or services.

An alternative, but complementary, approach to that of Demsetz has developed in the literature on patent races. Patents provide incentives to companies to invest in research and development up to the amount they expect to recover from successful innovations. Without patents, there would be too little innovation — information about each innovation would pass to competitors, who could then prevent investors from capturing all the benefits from their development of the innovation. Competition to develop patents induces companies (even monopolists) to innovate more rapidly than otherwise because market share, profitability, and long-term viability hinge on the company's ability to bring new products to the market (Reinganum 1982, 1989).

Dynamic Competition and Innovation

One of the outstanding contributions of Joseph Schumpeter (1942) to the literature in economics was the emphasis he placed on the economic incentives that determine the pace and direction of innovation. Schumpeter argued that, in the long term, social welfare is influenced much more by competition through the introduction of new products and methods of production than by price competition. Schumpeter also recognized that innovation had a profound effect on market structure, allowing firms with new technologies to enter the market and requiring firms with inferior technology to exit.[11]

Schumpeter also developed the idea of the tradeoff between static and dynamic efficiency, which has subsequently become widely recognized in the economics

10 In this sense, Demsetz's theory of competition for the market is quite different from the theory of contestable markets, since in the latter the absence of barriers to entry is a necessary condition for efficiency.

11 Both these aspects of Schumpeter's work have been captured in modern extensions of his work, such as Barro and Sala-i-Martin (1995) and Aghion and Howitt (1992).

literature (see, for example, Viscusi, Vernon, and Harrington 1995, 93). The tradeoff is based on the notion that, under the conditions associated with perfect competition — that is, where there is free entry and exit, and all firms have the same technology and information — price is driven down to the short-run marginal cost. At this price, and with instantaneous adjustment to any lower short-run marginal cost resulting from technological innovation, no rational entrepreneur has an incentive to innovate. This is because the perfectly competitive market prevents a potential innovator from recovering any of the fixed costs of investment in the new technology.

In an ideal regulatory setting, the regulator would commit to rates that would fully cover the initial fixed costs of investment.

Regulators face this tradeoff whenever they attempt to drive short-term prices toward short-term marginal costs, rather than providing incentives for future investment. In the case of a very large investment in a telecommunications network, the regulator has a strong incentive to capture static efficiency gains by encouraging marginal-cost pricing. If the telecommunications company expects the regulator to change the rules so that its profits would be reduced once its investment in the new technology has been sunk — and is thus irreversible — the company may conclude that it is not sufficiently profitable to make the investment in the first instance. In an ideal regulatory setting, the regulator would commit to rates that would fully cover the initial fixed, both common and joint, costs of investment.

The regulator may, however, have difficulty committing to providing the incumbent a sufficient return on investment and to doing that efficiently. Regulatory contracts on pricing may be difficult to write prior to the investment and equally difficult to enforce by a third party after the investment, simply because it is hard for the courts and the regulator to measure the incumbent's costs. Indeed, if it were easy for outsiders to measure costs, a main reason for allowing competition would be negated.[12]

One solution to this hold-up problem discussed in the economics literature is contracts on pricing. Such contracts may be too difficult to write, however, because of the many unforeseeable contingencies that might arise, such as incomplete contracts. As well, contracts on pricing may be too difficult to verify and enforce by a third party such as the courts or an arbitrator. Generally, the design of long-term contracts in the regulatory setting is complex (for evidence on long-term contracting in the regulatory sphere, see Crocker and Masten 1996). However, if the expected hold-up problems were insurmountable, privately owned utilities would not exist in the first place. Thus, regulators are able to offer some expectation of a commitment to provide full opportunity-cost recovery, even if, as in the U.S., it comes through after-the-fact compensation for stranded assets (see Sidak and Spulber 1998).

Alternatively, regulators are often concerned about the potential for excess profits generated in the absence of competition in the market and the uncertainty associated with the success or impact on competition for the market. The most obvious concern raised by incumbency is the potential for excess profits if technological change is slower than expected. Although lack of regulatory activism on prices may, in fact,

12 A well-known problem with regulation is that the regulated firm has far more information about its costs than has the regulator. Furthermore, the firm has some control over its costs and can lower them through additional but unobserved effort. Because the regulator does not observe this effort and thus cannot fully compensate the company for it, cost-reduction effort is underprovided. For a theoretical discussion of optimal regulation under asymmetric information, see Laffont and Tirole (1993).

leave the incumbent with higher profits than it needs, given the ultimate realized state in respect of new technology development, such profits are windfall gains after the fact that can create, at worst, only static inefficiency and thus short-term welfare losses. Dynamic efficiency may actually be enhanced by the fact that higher prices for the existing technology provide entrants stronger incentives to invest in new technologies. Where the regulator considers short-term profits for the incumbent to be above the dynamically efficient level, alternative regulatory mechanisms can address this issue.

Regulators may also be concerned that, if there is only a limited number of incumbents, the potential for cooperative behaviour will increase, with an attendant reduction in efficiency. It is, however, well established in the economics literature that collusive behaviour — either tacit or explicit — occurs only when firms can agree on a viable form of cooperation, capable of being monitored, from which deviations can be punished. In the telecommunications industry, the uncertainty associated with technological change makes cooperative agreements hard to negotiate and enforce. Competitors rarely have identical technology platforms, and the most important competitive strategies may be those associated with investment in the development, adaptation, and implementation of new technologies. For example, the destabilizing effect and potential competitive gains associated with new technology may be reasons Bell and Telus have been so aggressive in recent years in investing in the infrastructure necessary to attract business customers outside their traditional geographical service areas.

In the telecommunications industry, the uncertainty associated with technological change makes cooperative agreements hard to negotiate and enforce.

Collusion is unlikely in dynamically efficient markets, where network providers compete with different infrastructure technologies — as occurs when networks are constructed at different times. Competitors will see limited payoff to cooperation when they do not know which technology will provide the optimal starting point for the next wave of technical change and when they cannot readily monitor their competitors' research on new technologies. If one network has newer technologies and lower costs, or the prospect of being able to offer a superior range of new services in the future, it is unlikely that the owner of this network would enter into collusive agreements that protected the owner of an older network's market share.

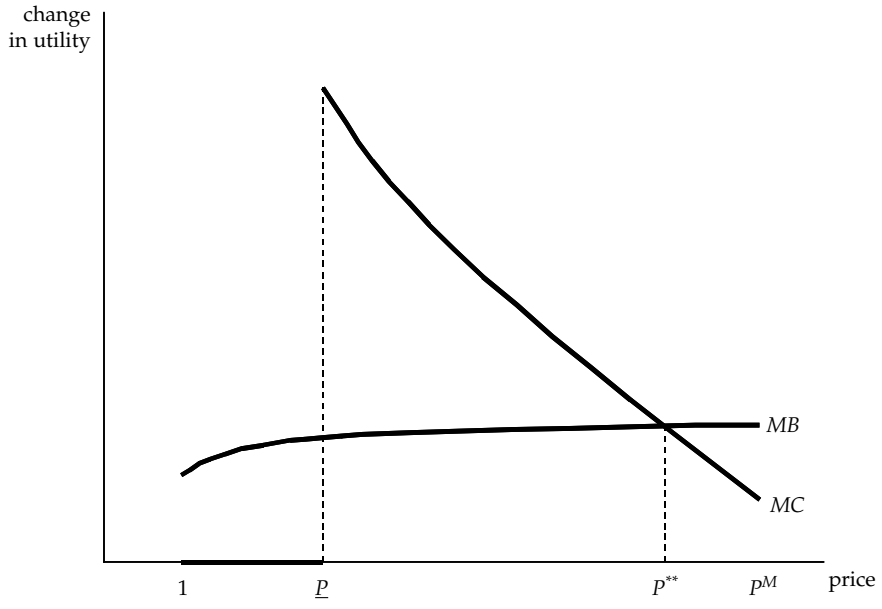
Evans, Quigley, and Zhang (2003) provide a formal framework for the analysis of the tradeoff between static and dynamic efficiency in the context of competition for the field. In their model, competition for the field takes the form of rivalry to develop an intermediate good, such as a new network to deliver telecommunications services. Once developed, each innovation is introduced through a large fixed investment for which a patent, or technological superiority over existing technologies, enables the network owner to capture the field and provides the potential to set price above marginal cost. The tradeoff between static and dynamic efficiency is captured by the fact that higher prices for the owner of the technology platform on which services are delivered to consumers results in more rivalry for incumbents, more innovations, and more economic growth, which increases social welfare but at the cost of reducing static efficiency.

Evans, Quigley, and Zhang assume that a regulator is able to set the price for using the network at anywhere between the marginal cost and the unconstrained monopoly price. They show that the optimal regulated price is above marginal cost, where the rate of growth is zero, but below the price that an unconstrained

Box 2: ***The Tradeoff between Static and Dynamic Efficiency***

The tradeoff between dynamic and static efficiency can be seen in the figure below, which uses the framework of the endogenous growth model of Barro and Sala-i-Martin (1995). In this model, the rate of return to investment in intermediate goods, such as a new telecommunications technology, rises with the price of intermediate goods and — up to the monopoly price — the rate of growth.

The figure plots the marginal benefit arising from innovative behaviour (*MB*) and the marginal cost due to static inefficiency (*MC*) from increasing the regulated price *P* by a small amount. At a price of 1 (the assumed marginal production cost of the intermediate input), there is no dynamic benefit resulting from innovation, as there is insufficient incentive to innovate. This is true for all prices below $\underline{P}$. However, just above *P*, the return on the investment in innovation becomes large enough to justify the cost, and the ensuing economic growth implies large dynamic efficiency gains. For every price up to the optimal regulated price, P^{**}, the marginal benefit from increasing the regulated price outweighs the marginal cost of doing so. The model also predicts that it is not optimal to allow intermediate input producers to price at the price level P^M that would be set by an unconstrained monopolist. At P^M, static welfare losses are so high that society is better off with lower prices even though this reduces the incentive to compete for incumbency. (See Evans, Quigley, and Zhang 2003.)



monopolist would set. In a numerical simulation of the model, the authors show that the optimal price produces a 27 percent increase in consumer welfare compared with the price set at marginal cost.

To demonstrate the relevance of this result for regulatory policy, consider the price that the incumbent network owner would set in the absence of regulation. The dynamically efficient price is that which just allows the recovery of the costs incurred in obtaining incumbency, including the research and development associated with the technology embodied in the network. Setting the unconstrained monopoly price may maximize profits in the short term, but it will have the unwelcome side effects of inducing greater investment by those companies that are competing for

incumbency and making it economically feasible to introduce these new technologies at an earlier time. Despite the benefits of higher short-term returns, setting prices at the unconstrained monopoly level may result in the incumbent's network being bypassed by a new entrant before the incumbent has recovered its full costs. Thus, incumbents realize that, in a dynamically competitive environment, setting prices above the dynamically efficient level may not maximize their returns. (Box 2).

Thus, where markets are dynamically competitive, competition for the field will constrain the incumbent's pricing. Prices will be set below the unconstrained monopoly level, but above marginal cost to the extent necessary to allow the incumbent to expect to recover the fixed costs of its network. In these circumstances, the potential gains from price regulation are minimal, but if regulators are tempted to set prices at or near marginal cost, the potential losses to society as a whole may be substantial.

Competition and Industry Structure in Canadian Telecommunications

The CRTC's Approach

The CRTC's policies are geared to both sustaining and increasing the number of competitors that provide services to consumers using the existing telecommunications infrastructure.

In its decisions and in its recent assessment of the state of competition in telecommunications (CRTC 2002b), the CRTC has focused on the number of competitors in each business segment as a measure of competition. Accordingly, its policies are geared to both sustaining and increasing the number of competitors that provide services to consumers using the existing telecommunications infrastructure. The CRTC's key indicators in monitoring competition include:

- various measures of "market" size and "market" share according to criteria such as revenues, subscriber lines, and minutes;
- the number and description of suppliers in the market;
- lists of available services, pricing levels, and trends, and
- corporate financial conditions.

The CRTC mentions new technologies only insofar as they might affect the definition or nature of the services provided in the markets the commission defines, but it does not consider them, as such, part of the competitive process.

In a recent competition review, the CRTC (2002b) observes that, in 2001, incumbent local exchange carriers provided more than 96 percent of local lines and attracted more than 97 percent of local wireline revenues, while competitive local exchange carriers provided just 8 percent of business local access lines (4.7 percent of business access revenues) and only 0.6 percent of residential local access lines (0.4 percent of revenues). Thus, even though four ILECs (each of which is now able to expand its local access services into the others' territory) and 8 CLECs provide competition in the residential local access market, competition nevertheless appears to be limited, on the basis of the CRTC's market-share-based approach.

CRTC initiatives to enhance competition have focused on promoting entry by lowering the costs entrants face to use the ILECs' networks or to purchase wholesale services from them. In wireline telephony, for example, the CRTC has substantially reduced rates for services competitors purchase from the incumbents, and removed

restrictions on the ILECs' ability to adopt pure bundling strategies and to respond to competition from CLECs. In particular, important CRTC decisions in the past three years include:

- a reduction of nearly 60 percent in direct connection per minute rates for most ILECs (2000);
- a reduction of roughly 50 percent in ILEC toll-free/800 database query charges (2000);
- a 39 percent reduction in unbundled local loop rates (2001);
- a reduction in the markup over cost on many services CLECs purchase to connect to ILEC switches and provide leased-line connections to business customers, and a reduction in long-distance access rates from 25 percent to 15 percent, (effective in 2002);
- restrictions on the ablity of ILECs' ability to use "winback" promotions targeted at customers who have switched to CLECs (until January 15, 2003, these promotions were subject to CRTC approval; since then, a moratorium has been in place on approvals of all such promotions);
- a requirement that ILECS provide customers with high-speed Internet access separately from local telephone service to facilitate entry by firms providing only voice services.

Defining the Process and Outcomes of Competition

The CRTC's approach to the analysis of competition is an unreasonably narrow view of the competitive process.

The CRTC's approach to the analysis of competition does not do justice to the extent of competitive pressure that currently exists for the supply of residential local access services. Rather, it represents an unreasonably narrow view of the competitive process, and one that is poorly suited to the development of regulatory policy that provides benefits to consumers.

While the CLECs identified in Table 1 have only a small share of the total residential local access business in Canada, aggregate market share does not provide a firm basis on which to assess these companies' competitive impact. The CLECs offer local access service primarily in major urban centres, which means that their market share would be substantially larger than the CRTC cites if the total network access service (NAS) in the geographical markets in which they actually compete were used as the denominator for the calculation. For example, Eastlink has 30 percent of the local access business in Halifax and a number of other towns in Nova Scotia and Prince Edward Island. The existence of these fringe firms is also important because of their potential to expand if incumbents' pricing makes it profitable for them to do so. If local access pricing makes it unattractive for fringe firms to increase their market share substantially, one must assume that prices are near or below their competitive level, making it extremely difficult to argue that this market has a competition problem.

In the CRTC's focus on the number of competitors in the market and its failure explicitly to consider investment in new technologies to be part of the competitive process, there is the danger that Canadian regulators may not recognize the greatest competitive pressure that incumbents face. The need to make substantial

Table 1: ***Competitors in Canadian Residential Local Access Markets***

Company	Location	Services
Telus	ILEC in BC and Alberta; CLEC in Ontario and Quebec	
Sasktel	ILEC in Saskatchewan	
Manitoba Telecom Services	ILEC in Manitoba	
Bell Canada	ILEC in Ontario and Quebec	
Aliant Telecom	ILEC in the Maritimes	
AT&T Canada	CLEC in major centres in Ontario and Quebec	Bundle of long distance and local access
Eastlink	CLEC in major centres in the Maritimes	Bundle of voice, data and cable TV
FCI Broadband	CLEC in the Greater Toronto area	Bundles of local access, long distance and data
360 Networks/Group Telecom	CLEC in 17 major centres across Canada	Local access and long distance
Microcell	CLEC in Calgary and several cities in BC	Wireless networks providing local access
Primus	CLEC in major cities in Ontario and Quebec	Bundle of local access and long distance
Sprint/Call-Net	CLEC in a number of cities in Ontario	Bundles of local access and long distance
Vidéotron Telecom	CLEC in Quebec	Local access

long-term investments in infrastructure in order to provide new services affects competition today, not just when those services are introduced in the future. In a dynamically competitive industry such as telecommunications, rivalry is built around the development of new services based on technologies that are not yet "in the market" as the CRTC defines it.

For example, as I discuss in more detail later, the threat of the cable companies' introducing Voice over Internet Protocol telephony is now exerting much more competitive pressure on the ILECs' conduct and investment decisions than competition from CLECs' using unbundled local loops is ever likely to provide. In response to the CRTC's competitive model, CLECs invested approximately $15 billion to enter the Canadian wireline business, but many went bankrupt, and even the strongest have needed massive financial restructuring to survive. In contrast, the cable companies have a very large share of residential broadband services, which gives them a substantial customer base for the introduction of VoIP services — yet cable networks do not figure in the CRTC-defined local access market.[13] In telecommunications markets that are undergoing rapid technological change, the market definitions the CRTC uses today must be sufficiently broad to capture the

13 Evans and Schmalensee (2001) express similar views in the context of the antitrust analysis of market power and predatory pricing.

impact of the rivalry generated by the anticipation of the introduction of new services in the future.

Also open to criticism is the CRTC's focus on market structure and entry using conventional technology rather than on the competitive processes that created the market structure. An example is its concerns about the trends in business local access rates resulting from the CLECs' entering the market. The commission acknowledges that business local access rates have fallen over the past five years as a result of competition from both entrants and potential entrants, producing benefits for businesses in the form of lower prices (CRTC 2002a, para 68). Yet the CRTC is concerned that

> the downward trend in ILEC local business rates squeezed the margins available to competitors and therefore acted as an impediment to competitive entry. The Commission considers that, if this situation were to continue, it would have a significant adverse effect on the development of local competition — to the detriment of both customers and competitors. The effect would initially be manifested in the business market where the price reductions occur. However, over the longer term there would likely be an impact on competitive entry into the residential market as well, since CLECs would have difficulty achieving economies of scope and scale on the same basis as the ILECs. (Ibid., para 70.)

The absence of new entrants is not a competition problem, but an indication that the market already exhibits competitive pricing.

In other words, there has been and continues to be a competitive process in business local access, from which consumers have benefited through lower prices. The CRTC is concerned that lower prices have limited the ability of new firms to enter the market and undermined the competitive positions of those already in the market, but the reason for the concern is far from clear. Lower prices inevitably reduce the extent of entry because there are fewer rents for entrants to compete for. However, if prices are low enough to deter efficient entrants, then it is reasonable to assume that prices are close to their competitive level. In such circumstances, the absence of new entrants is not a competition problem but an indication that the market already exhibits competitive pricing.

Regulation of Tariffs for Residential Local Access

Because the CRTC considers that competition in the supply of residential local access services is insufficient, it regulates the ILECs' tariffs. Both the absolute level of the tariffs the CRTC sets and the cross-subsidies embedded in them have implications for competition.

It is widely recognized that the costs of residential telephone service in Canada are substantially below those in the U.S. In a recent study, Seaboard Group (2003) concludes that, although price differences may vary in some comparable locations in the two countries, overall residential telephone service pricing is about 70 percent more expensive in the U.S. than in Canada (Table 2), whether considering a minimal or a "full-service" bundle; moreover, the results hold in comparisons of the lowest and highest prices.[14] Service quality standards in the two countries are

14 The comparison of highest and lowest prices suggest that the effects of longer average local loop lengths and greater economies of scale in the U.S. are not driving the results.

Table 2: ***Price Comparisons of Canadian and U.S. Wireline Service Bundles***

	Bundle A[a]	Bundle B[b]	Bundle C[c]
		(US$, including taxes)[d]	
Canadian average	19.33	32.85	70.76
U.S. average	35.72	56.89	123.37
Lowest Canadian	17.11 Regina	26.83 Regina	66.73 Cornerbrook
Lowest U.S.	23.17 Seattle	43.92 Seattle	103.37 Seattle
Highest U.S.	46.76 Tuscaloosa	70.54 Pasadena	143.05 Pasadena
Highest Canadian	22.05 Lethbridge	36.42 Lethbridge	78.03 Toronto

a Bundle A includes local connection with unlimited local calling, 100 free local toll minutes (where applicable) and 10 free nationwide long-distance toll minutes.

b Bundle B includes local connection with unlimited local calling, 100 free local toll minutes (where applicable), 50 free nationwide long-distance toll minutes, caller ID and basic voice mail.

c Bundle C includes local connection with unlimited local calling, 300 free local toll minutes (where applicable), 200 free nationwide long-distance toll minutes, caller ID and basic voice mail, inside wire maintenance and DSL data service.

d Currency conversion is based on a three-year average exchange rate. The conclusion that Canadian rates are significantly below those in the U.S. is robust to the use of a purchasing power parity exchange rate.

Source: Seaboard Group (2003, 10).

sufficiently similar to ensure that variations in service cannot explain the higher prices in the U.S. Rather, the explanation lies in the regulatory regime.

The Impact of Low Regulated Prices and Cross-Subsidies on Competition

The structure of residential service rates the CRTC sets and the cross-subsidies embedded in them represent a substantial barrier to both the development of competition in the market and to the introduction of new technologies (Table 3).[15] Only in rate bands A, B, and C (and possibly in D) would entry be attractive for CLECs if they could replicate the cost structures of the ILECs in providing service. In the other rate bands, the relationship between cost and the allowed rate suggests that CLECs would not enter to provide residential access services using the same technology as do the ILECs.[16]

This observation has considerable significance in interpreting the share of each line of business the CLECs have captured. It is not appropriate to assess CLECs' market shares according to the total number of access subscribers when the structure of regulated prices makes it uneconomical for them to compete for customers in some rate bands. Rather, the CLECs' share of any line of business should be judged

15 In recent years, the CRTC has rebalanced tariffs to reduce the magnitude of these cross-subsidies, but those embedded in current tariffs still cost $250 million a year.

16 The Commissioner of Competition has noted this point in submissions to the CRTC (CRTC 2002a, para 317).

Table 3: ***Rates and CRTC-Mandated Costs for Bell Canada's Local Residential Access Service***

Rate Band[a]	Rate	CRTC Cost Estimate[b]
	(C$ per NAS per month)	
A	21.50	10.28
B	21.50	12.49
C	21.50	14.18
D	21.50	17.34
E	21.50	26.28
F	21.50	27.00
G	21.50	43.50

a Rate bands are based on NAS densities, but rate band F incorporates consideration of the average length of the local loop to each NAS, and band G includes consideration of road accessibility to provide service. In those bands where cost exceeds the allowed rate, access providers receive funding from a levy on all Canadian telecommunications providers that was originally set at 4.5 percent of revenues, and is currently around 1 percent of revenues.

b The CRTC calculates its cost estimate using its costs model, not the costs Bell Canada considers it incurs in providing service. The rates are the author's estimates or rates charged for 2002 based on CRTC-approved rates and available public information.

Sources: CRTC Decision 2001-238-2 and Order 2001-848, and information supplied by Bell Canada.

against that part of the market where, given costs and the prices set by the regulator, competition is feasible — which is considerably smaller than the total market.

Low prices may make it uneconomical for potential entrants to compete with incumbents unless they have a technology that allows them to provide services at substantially lower cost. For example, in a recent application, Call-Net (2003) asked the CRTC to recognize that, at current regulated retail prices, entry is not attractive unless the cost of leasing the ILECs' lines is reduced substantially below the actual cost of those lines; accordingly, Call-Net requested the CRTC to halve the charges the CLECs pay the ILECs for unbundled local loops. Call-Net's proposal aims to increase dramatically the operating margins of CLECs, providing greater scope for entry and creating the cash flows necessary for CLECs to undertake substantial new investments. However, providing CLECs access to facilities at well below cost would serve only to distort incentives and substantially impair market efficiency. Instead, increasing retail prices to the level at which it would become viable for CLECs to enter the market would provide greater long-run benefits for consumers because of the potential for substantially increased dynamic efficiency.

Another example follows from the fact that Canada's regional ILECs are no longer restricted from competing outside their traditional geographic service areas. The unattractiveness of expanding residential local access business at the regulated prices is also illustrated by the fact that, until now, regional ILECs have made only minimal incursions into the residential business of other ILECs. In the supply of services to business, in contrast, the story is quite different: Western Bell has invested $1 billion in western Canada,[17] largely to compete for the business customers of Telus; in turn, it is likely that Telus has invested similar amounts in competing for business customers in Ontario and Quebec. This pattern is consistent with the suggestion that regulated prices for residential access service are so low as to serve as a disincentive to competition, but that prices for business services are sufficient to attract facilities-based competition.

Low regulated prices also serve as an impediment to investment in new technology. Entry into the residential telephone service market with an alternative technology is feasible only if the technology provides a cost structure that offers the expected competitive return on investment at retail prices low enough to entice customers away from their current service provider. Even where a new technology (such as VoIP telephony delivered over a cable network) is more cost efficient than

17 Bell Canada owns 60 percent and Manitoba Telecom Services 40 percent of Western Bell (Bell Canada, press release, April 10, 2003).

an existing ILEC service, it would not be profitable for a CLEC to enter the market using this technology unless its costs were below the regulated rates. Low regulated retail prices make the business case for new technologies more difficult, and slow down new investment and the delivery of new services to consumers (Fudenberg and Tirole 2000; Evans and Schmalensee 2001).

Of course, the current level of regulated prices may not prevail over the full life of any new investment, if for no other reason than that the CRTC might remove price regulation following a significant new entry into residential local access services. At a minimum, however, if the CRTC were to remove the regulated prices, the new entrant would need a business case for its new technology that allowed it to set a price at a level that would attract a large number of customers from the incumbent. Moreover, to the extent that the price the regulator sets accurately reflects the incumbent's incremental cost, it also signals potential entrants about the prices the incumbent might set in the face of greater competition if regulated prices were removed.

Regulatory policy based on inappropriate definitions of competition has the potential to reduce consumer welfare.

Summary

Regulatory policy based on inappropriate definitions of competition has the potential to reduce, rather than increase, consumer welfare. The CRTC's policies follow from the presumption that the greater the number of competitors there are in a market, the more competition exists. However, in industries such as telecommunications, where technological change is rapid, competition for the market may provide more benefits to consumers than competition in the market. Where competition for the market is important, the number of competitors in the market at any point does not usefully measure the extent to which competitive processes underlie market behaviour. In addition, where prices are low, whether as a result of competition or regulation, only the most efficient providers will be viable, and the entry of new firms using technology identical to that of incumbents is unlikely to provide benefits to consumers.

The CRTC sets low prices for residential services while retaining substantial cross-subsidies between urban and rural areas. Such policies provide short-term benefits to consumers, but at the cost of inhibiting the introduction of new technologies and services that would otherwise occur under dynamic competition.

Technology Races in Telecommunications

Competition in the modern telecommunications industry is characterized by repeated sunk investments in technologies and facilities to provide upgraded and new services to consumers.[18] These investments may be incremental (such as changes to the existing copper wire network) or revolutionary (such as the cellular phone and the projected transition to VoIP). As each new product partly or

18 In practice, the development of new technologies (by firms such as Alcatel, Cisco, Lucent, and Nortel) is distinct from the investment in these technologies by CLECs and ILECs, but the nature of the technological changes and the speed and extent of their adoption still provide a way for consumers to differentiate among competing companies.

completely supersedes its predecessor, it makes redundant the investment that went before it: the path from telex to facsimile to Internet document transmission provides a clear example.

VoIP Technology

The latest revolutionary product of the telecommunications industry is Voice over Internet Protocol technology. It involves voice communication over a data network where the signal is digitized, divided into data packets that are carried over a shared network, and then converted back to an analog voice signal on arrival. Because the voice signals can be carried on the same network as data traffic, VoIP makes possible a variety of competitive alternatives, cost savings, and potential service enhancements. In particular, with VoIP, voice traffic no longer requires a dedicated circuit between the parties for the full period of the conversation, physical switches are replaced by software that allows the routing instructions on the packet to be read and implemented, and telephone numbers are no longer tied to any particular physical location.

The public Internet was once thought to be too prone to traffic delays and security problems to be a feasible network carrier for VoIP traffic, leading some potential providers to suggest that a dedicated network was required for high-quality service. Technological improvements are assuaging many of these concerns about the Internet, however, and consumers now seem more willing to switch to a VoIP provider.

VoIP's most notable short-term competitive enhancement is that network access service over a telephone line will no longer be necessary to obtain telephone service.

VoIP's most notable short-term competitive enhancement is that network access service over a telephone line will no longer be necessary to obtain telephone service. Any provider of high-speed data services will be able to offer telephone services as well through a high-speed connection — whether cable, DSL, or wireless — enabled for VoIP and interconnected with the public switched telephone network. Firms that offer VoIP services over the Internet are likely to be strong and viable competitors in the emerging IP voice business.

From the perspective of medium-term competition, VoIP's most important feature is that it will drive competition toward offering telephone, data, television, and video-on-demand services through a single service provider and a single high-speed data connection. This "convergence of content and platforms" means that telephone companies, cable companies, and other data service and entertainment providers will find themselves competing directly with each other. Moreover, this competition is likely to be particularly vigorous because each of the potential competitors has an existing customer base linked to some subset of the services that will shortly be offered over high-speed data networks.

The potential for VoIP technology to facilitate the entry of new firms and to alter fundamentally the nature of the telecommunications industry has been discussed for some time, but only now is it becoming a reality. This might suggest that the theory of dynamic competition is flawed and can be reasonably ignored by competition regulators. However, the theory does not require that a new firm replace an existing one, only that competitive tension exist as a result of the potential for a replacement to occur. A change is more likely if the incumbent firm does not respond to potential entrants' investment in new technology with equivalent investment of its own. To maintain their competitive position, existing firms will have to provide new services at prices that are low enough to deter new firms from

Table 4: ***Local Access Technologies and Their Capacity to Deliver VoIP Communication and Entertainment Services***

Technology	Key Elements of Uncertainty
Copper Wire — DSL	Ability to deliver bandwidth sufficient to provide video-on-demand.
Copper Wire — VDSL	Payoff on infrastructure investment required to reduce loop lengths to the point where bandwidth is sufficient for video-on-demand, and the potential for regulators to require that this infrastructure be made available to competitors at cost.
Cable — switched circuit	The choice between retaining switched circuit technology for telephony and using IP for the delivery of other services, and adopting IP for all network services.
Cable — VoIP	The willingness of consumers to pay for a powered network, and consumer acceptance of non-powered telephone networks. Payoff to large investments in the back-office systems required to offer a telephone service.
Satellite	Capability to deliver voice, data and video-on-demand, and service quality compared to wireline services.
Cellular	Ability to solve service quality issues and deliver bandwidth sufficient to provide video-on-demand.

entering the market and consumers from switching to alternative providers. For example, the very large investment that incumbent wireline operators have made in DSL technology has reduced the payoff to entrants using alternative technologies (such as cable, fixed wireless, and cellular), while giving them the network infrastructure necessary to implement VoIP technology and offer new services such as video-on-demand.

Numerous potential and actual entrants into the Canadian telecommunications sector are now investing in technologies that will compete with the fixed wire local loop network (see Table 4). Each of these technologies carries with it some uncertainty, so that it is not yet clear which technology will provide the basis for incumbency when the provision of VoIP telephone services bundled with data, television, and video-on-demand services becomes ubiquitous. Moreover, since the path of technological change is uncertain, incumbents have had to invest in many different technologies, as they can never be certain how quickly potential entrants' technologies might become viable. As a result, consumers benefit greatly from rivalry for the market in the presence of uncertain technical change even in areas in which incumbent firms have not been supplanted.

The Competitive Position of ILECs

The convergence of voice, data, and entertainment services poses a threat to incumbent local exchange carriers because of their currently limited ability to offer entertainment services over their existing networks. Evidence strongly suggests that consumers prefer the convenience of purchasing bundles of products from a single provider, and that the availability of one particularly desirable service can determine which bundle the consumer chooses to purchase. Many observers of current trends in communications and entertainment suggest that, over the next decade, video-on-demand will drive consumer choice. Accordingly, unless ILECs are able to offer video-on-demand as part of the standard bundle of services they provide to residences, they may find themselves under intense competitive pressure from cable companies.

Some ILECs are beginning to offer entertainment services on a limited basis,[19] but if they want to deliver products such as video-on-demand, they will have to increase their networks' bandwidth. They can do this in three ways. First, they can upgrade their copper wire networks by investing in Asymmetric Digital Subscriber Line and Very High Data Rate Digital Subscriber Line technologies. Although both technologies provide the necessary bandwidth over short loop lengths, their performance falls quickly with increasing loop length, requiring greater investment not only in DSL technology but also in reducing loop lengths by extending the deployment of fibre-optic cable closer to homes. A second way to increase bandwidth is to replace existing copper loops with fibre-optic cable installed directly into homes. A third way is to use wireless local area networks to provide the connection between cabinets and homes. Most ILECs favour the use of DSL technology because it allows them to leverage their substantial investment in copper loops.

The Competitive Position of Cable Companies

For cable companies, the biggest stumbling block to offering VoIP telephony services is the cost of equipping cable networks to provide a level of service quality that consumers will accept.

For cable companies, the biggest stumbling block to offering VoIP telephony services is the cost of equipping cable networks to provide a level of service quality that consumers will accept. In the U.S., cable entrants to the telephony business have largely focused on competing for residential second-line business with a product that, in several key respects, is inferior to the standard wireline local access service that ILECs provide. Current VoIP technology can offer telephony service at a substantial discount, but it may not function during a power failure, and has slightly lower voice quality and a less reliable connection to emergency services and similar facilities. According to industry analysts, a VoIP service that matches the quality and reliability of current wireline local access service offered by ILECS could be provided at a price that is competitive but not substantially below current regulated rates for this service (see, for example, Merrill Lynch 2003).

Over the past ten years, Canadian cable companies have invested heavily in network upgrades to be able to offer video-on-demand and high-speed data services, placing them in a strong position also to provide telephone services with VoIP technology. However, these companies will have to make further substantial investments before they can offer local telephone services. For example, UBS Warburg recently predicted that it would cost Rogers Communications $500 million to offer telephone service to 30 percent of its subscriber base (cited in *The National Post*, August 25, 2003, p. FP5). Obviously, cable companies will not make investments of this magnitude unless they expect to cover their costs.

Some cable companies (such as Cox Communications and Comcast in the U.S. and Eastlink in Canada) have, however, successfully entered the local telephone business in recent years using circuit switch technology, and a number of others have done so using VoIP technology.[20]

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19 For example, Sasktel and Manitoba Telecom launched television services in late 2002 and now have about 12,000 customers; Telus expects to offer television service to 15 communities in British Columbia and Alberta in 2004. Bell Canada also offers television service, but through its satellite provider, ExpressVu, not over its fixed wire network.

20 For example, Cablevision in Long Island, Time Warner Cable in Portland, Maine, and Vonage, which has more than 50,000 subscribers to its VoIP telephone service in 20 U.S. centres.

Over the past seven years, Cox Communications has grown from a single-service cable television company into a multi-service broadband communications provider offering customers high-speed Internet access, and residential telephone and video-on-demand services in addition to traditional and digital cable television services. Cox introduced local telephone service in 1997 using circuit switch technology; it now has 750,000 customers in 10 local markets in the U.S., representing a 17 percent market share (and as high as 40 percent in the first areas in which it introduced telephone service). The company attributes its success to investment in the infrastructure and operational support necessary for the successful provision of telephone service, including reliability, advanced services, and effective back-office functions such as billing (Cox Communications 2003).

Comcast, another U.S. company, acquired AT&T's broadband telephony business in 2002 to add to its existing cable telephony business in Michigan and Maine. The company now has over 1.4 million cable telephony subscribers, representing approximately 16 percent of all its telephone service customers.

In Canada, Eastlink, which provides cable television services to 250,000 homes in Nova Scotia and Prince Edward Island, launched circuit switch telephone service in September 1999. It is now estimated to have about 50,000 telephone subscribers, most of whom purchase a "watch, surf, and talk" bundle that includes cable television, high-speed data service, and a local phone line with up to 15 features (Merrill Lynch 2003, 55).

Eastlink and other cable companies that have entered the telephony market using circuit switch technology face the risk of having to incur substantial added costs if they find it necessary to adopt VoIP technology. Such companies have, however, developed the back-office systems required to offer local voice telephony, which would be a substantial advantage over cable companies that have not offered voice services in the past.

In Canada the introduction of VoIP telephone service by major cable television companies is still in its infancy.

In contrast to the situation in the U.S., in Canada the introduction of VoIP telephone service by major cable television companies is still in its infancy. Whistler Cable has announced a trial second-line service, while both Rogers Communications and Cogeco have said they will eventually offer telephone service, but they have not indicated when. Shaw Communications has stated it has no plans to offer a telephone service in the foreseeable future. In any case, the business case for VoIP services is much less attractive in Canada than it is in the U.S. A recent Merrill Lynch report (2003, 53) says that "The Canadian market has unique attributes that, on balance, are likely to impede cable operator VoIP deployments relative to the U.S. — likely by 1–2 years." Among the factors that are contributing to the relatively slow rollout of VoIP services, the most important, according to the study, appears to be that retail prices for residential telephone service are lower in Canada than in the U.S. Moreover, only 7 percent of Canadian homes have a second telephone line, compared with 18 percent in the U.S., so that there is only a very limited market in this country for VoIP services over a non-powered network; accordingly, the effective introduction of VoIP services in Canada will have to depend on the use of a substantially more capital-intensive powered network.[21]

21 Although relatively more U.S. homes have second lines, a higher proportion of Canadian homes are linked with broadband service, which allows both voice and data traffic to be carried on a single line.

It is unclear which of the various competing technologies will ultimately prove superior in providing the future services residential and business subscribers will demand. However, as in any technology race among potential suppliers of services, any supplier, whether new or incumbent, will spend an amount on developing and implementing new technology just sufficient to ensure that expected earnings equal the competitive rate of return.

Conclusion

In Canada, the regulation of local telephone services has been much influenced by traditional theories of natural monopoly applied to the copper wire local access network. There is, however, no role for technological change in these models. An alternative approach suggests that, where technological change is occurring, competition for the field may be as important as competition in the field in generating long-run economic efficiency.

The threat of their being bypassed by an alternative and superior technology imposes competitive discipline on incumbents. It drives them to maintain prices at competitive levels, invest in new technology, and provide new services to customers since failure to do so will simply increase the speed with which alternative technologies become economically feasible. Thus, the state of competition in local access telecommunications in Canada hinges much more on the presence of alternative access technologies that may supplant fixed wire local access than it does on the fact that those companies do not yet have a large market share in local access telephony.

Dynamic efficiency is a more important driver of economic growth than is static efficiency, because dynamic efficiency maximizes the social benefits from investment in infrastructure and new technologies. More important, there is a tradeoff between static and dynamic efficiency. Regulatory policies that force incumbents to reduce prices for existing technologies or, worse, that require cross-subsidies for certain categories of consumers (such as those in rural areas) may have a substantial negative impact on consumer welfare by making the business case less attractive for potential entrants. Regulatory policies that require pricing at incremental cost or subsidized prices delay the point at which new technologies and services become economically viable and make competition for incumbency less attractive.

Competition cannot be increased by subsidizing providers of local access.

The CRTC's recent analyses focus entirely, but incorrectly, on static definitions of competition such as market share and the number of entrants in local residential telephony. Convergence among the application technologies and infrastructures required for voice and data communication and on-demand entertainment means that, at least in the sense of dynamic competition, the notion of entry to provide local access is an anachronism. Competition is more likely to come from cable, satellite, and wireless providers than from wireline telecommunications companies. Moreover, competition is more likely to be part of a strategy to provide a full range of voice, data, and entertainment services than to provide just residential local access. More important, convergence implies that competition cannot be increased by subsidizing providers of local access; rather, competition is enhanced by the race between wireless and wireline providers to offer customers integrated telephone, data, and entertainment services.

The CRTC's view that competition is lacking in residential local access is a result of its failure to recognize the high level of dynamic competition for the market and the way this process drives competitive outcomes and benefits for consumers, even when there is limited competition in the market. In failing to use a dynamic model that captures competition for the market, the CRTC understates both the extent of the existing market discipline on incumbents and the vigour of the competitive process in local telecommunications. The danger of this view is that it may lead to regulatory policies that waste resources artificially stimulating competition in ways that are inconsistent with the development of technology and services, and that are not in the long-term interests of consumers.

Finally, but most important, both the small number of competitors in the residential local access business in Canada and the cable companies' limited interest in moving into VoIP residential telephony provide dramatic illustrations of the dynamic efficiency losses that result when regulators set prices too close to marginal cost. Prices that are low compared with relevant international benchmarks provide short-term gains to consumers, while subsidized prices for subscribers in rural and remote areas may be consistent with certain social and political objectives. However, such policies inhibit investment in competing technologies and delay the introduction of new services for consumers. Thus, in seeking to understand the reasons for the limited extent of competition in residential local access, the CRTC should look first and foremost at its own pricing policies.

References

Aghion, Philippe, and Peter Howitt. 1992. "A Model of Growth through Creative Destruction." *Econometrica* 60 (2): 323–51.

Barro, Robert, and Xavier Sala-i-Martin. 1995. *Economic Growth*. New York: McGraw-Hill.

Baumol, William, and David Bradford. 1970. "Optimal Departures from Marginal Cost Pricing." *American Economic Review* 60 (2): 265–83.

Blaug, Mark. 1996. "Competition as an End-State and Competition as a Process." In Curtis Eaton and Richard Harris, eds., *Trade, Technology and Economics: Essays in Honour of Richard G. Lipsey*. Cheltenham, UK: Edward Elgar.

CRTC (Canadian Radio-television and Telecommunications Commission). 2002a. *Regulatory Framework for Second Price Cap Period*. Telecommunications Decision 2002-34. Ottawa. May.

———. 2002b. *Status of Competition in Canadian Telecommunications Markets*. Report to the Governor in Council. Ottawa. December.

———. 2003. *Status of Competition in Canadian Telecommunications Markets*. Report to the Governor in Council. Ottawa. November.

Call-Net Enterprises. 2003. *Application to Promote Local Residential Competition*. Presented to the Canadian Radio-television and Telecommunications Commission. Ottawa. May 29.

Carlton, Dennis, and Jeffrey Perloff. 2000. *Modern Industrial Organization*. 3rd ed. New York: HarperCollins.

Cox Communications. 2003. *Whitepaper: Preparing for the Promise of Voice-over Internet Protocol (VoIP)*. Atlanta. February.

Crocker, Kevin J., and Scott E. Masten. 1996. "Regulation and Administered Contracts Revisited: Lessons from Transaction-Cost Economics for Public Utility Regulation." *Journal of Regulatory Economics* 9: 5–39.

Dalfen, Charles. 2002. Notes for an address by the Chairman of the Canadian Radio-television and Telecommunications Commission to the International Institute of Communications, Canadian Chapter, Ottawa. November.

Demsetz, Harold. 1968. "Why Regulate Utilities." *Journal of Law and Economics* 11: 55–65.

Evans, David S., and Richard Schmalensee. 2001. "Some Economic Aspects of Anti-Trust Analysis in Dynamically Competitive Industries." NBER Working Paper 8268. Cambridge, MA: National Bureau of Economic Research. May.

Evans, Lewis, Neil Quigley, and Jie Zhang. 2003. "Optimal Price Regulation in a Growth Model with Monopolistic Suppliers of Intermediate Goods." *Canadian Journal of Economics* 36 (2): 463–74.

Fershtman, Chaim, and Ariel Pakes. 2000. "A Dynamic Oligopoly with Collusion and Price Wars." *RAND Journal of Economics* 31 (2): 207–36.

Fudenberg, Drew, and Jean Tirole. 2000. "Pricing a Network Good to Deter Entry." *Journal of Industrial Economics* 48 (4): 373–90.

Goolsbee, A. 2000. "The Value of Broadband and the Deadweight Loss of Taxing New Technology." University of Chicago and National Bureau of Economic Research. Mimeographed.

Hausman, Jerry. 1997. "Valuing the Effect of Regulation on New Services in Telecommunications." *Brookings Papers on Economic Activity: Microeconomics*: 1–38.

———. 1999. "The Effect of Sunk Costs in Telecommunications Regulation." In James Alleman and Eli Noam, eds., *The New Investment Theory of Real Options and Its Implications for Telecommunications Economics*. Boston: Kluwer Academic.

Hughes, Alan. 1987. "Competition Policy." In J. Eatwell, M. Milgate, and P. Newman, eds., *The New Palgrave Dictionary of Economics*, vol. 2. London: Macmillan.

Jovanovic, Boyan, and Glenn MacDonald. 1994. "The Life Cycle of a Competitive Industry." *Journal of Political Economy* 102 (2): 322–47.

Kahn, Alfred. 1988. *The Economics of Regulation*. Cambridge, MA: MIT Press.

Laffont, Jean-Jacques, and Jean Tirole. 1993. *A Theory of Incentives in Procurement and Regulation*. Cambridge, MA: MIT Press.

———. 2000. *Competition in Telecommunications*. Cambridge, MA: MIT Press.

Merrill Lynch. 2003. *Voice Over Broadband: The Challenge from VoIP in the Residential Phone Market*. Toronto. June 24.

Reinganum, Jennifer. 1982. "A Dynamic Game of R and D: Patent Protection and Competitive Behaviour." *Econometrica* 50: 671–88.

———. 1989. "The Timing of Innovation: Research, Development and Diffusion." In Richard Schmalensee and Robert Willig, eds., *The Handbook of Industrial Organization*. New York: Elsevier Science.

Rock, Allan. 2003. Address to the Canadian Wireless Telecommunications Association. March 26.

Seaboard Group. 2003. *Communications Pricing for Consumers: A Cross-National Survey*. Montreal. May.

Schumpeter, Joseph. 1942. *Capitalism, Socialism and Democracy*. New York: Harper.

Sidak, J. Gregory, and Daniel F. Spulber. 1998. *Deregulatory Takings and the Regulatory Contract: The Competitive Transformation of Network Industries in the United States*. Cambridge: Cambridge University Press.

Stigler, George. 1987. "Competition." In J. Eatwell, M. Milgate, and P. Newman, eds., *The New Palgrave Dictionary of Economics*, vol. 2. London: Macmillan.

Viscusi, Kip, James Vernon, and James Harrington. 1995. *The Economics of Regulation and Antitrust*, 2nd ed. Cambridge, MA: MIT Press.

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