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Recent Trends in the Theory and Practice of Telecommunications Regulation In the U.S. and Public Policy Implications

by

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Table of Contents

page

1. Introduction.....1
   1.1 General Considerations.....1
   1.2 The FCC Motivations for Deregulation.....4

2. Telecommunications in the United States.....8
   2.1 Economic and Technical Characteristics of Telecommunications Industry.....8
   2.2 Institutional Setting.....18
      2.2.1 Industry Structure.....18
      2.2.2 Regulatory Setting.....20

3. Telecommunications Policies: Objectives and Instruments.....23

4. Entry Policies in the Telecommunications Industry.....33
   4.1 Federal Telecommunications Decisions on Entry.....33
      4.1.1 Hush-A-Phone and Carterfone.....33
      4.1.2 Above 890 Decision.....35
      4.1.3 Microwave Communications Inc., and Specialized Common Carriers.....37
      4.1.4 Value Added Network.....39
      4.1.5 Communication Satellites.....39
   4.2 Results of the FCC Policy.....41
      4.2.1 FCC Policy and Stated Objectives.....41
      4.2.2 Structural and Economic Barriers to Entry.....46

5. Pricing Policies in the Telecommunications Industry.....48
   5.1 General Pricing Principles.....48
      5.1.1 Monopoly Context.....48
      5.1.2 Competitive Environment.....51
   5.2 Competitive Services Pricing.....52
      5.2.1 Intercity Services Pricing.....52
      5.2.2 Terminal Equipment Pricing.....55

pages

5.2.2.1 Residential Telephone Sets: Tariffs and Installation Fees.....55
5.2.2.2 Two-Tier Tariff Philosophy.....58
5.3 Usage Sensitive Pricing.....66
5.3.1 Timing Single Message.....66
5.3.2 Peak-Load Pricing for Local Calls: New York Experiment.....69
5.3.3 Directory Assistance.....71

6. Rate of Return Regulation.....74
6.1 Regulation and Competition.....74
6.2 Regulation and Inflation.....75
6.2.1 Computation of the Rate Base.....77
6.2.2 Computation of the Allowed Rate of Return.....78

7. Summary and Conclusions.....80
7.1 Summary of the U.S. Experiment.....80
7.2 Uncertainty of Future.....82
7.3 Implications for Canadian Scene.....85

Appendix A. Brief review of some theories of regulation.....A-1

Appendix B. Economies of Scale and Sustainability of Multiproduct Monopoly.....B-1

Appendix C. Pricing.....C-1

1. Introduction

1.1 General Considerations

Society through its political representatives assigns to its members a set of objectives, sometimes called priorities. While some of these goals are very abstract in nature and most often defined in qualitative terms, some others are more easily measurable or operational (e.g. social indicators). Once these priorities are identified, it is then necessary to assign some desired values or targets to each, establish a hierarchy amongst them and decide on appropriate compromises since some objectives conflict.

In the free market system, the achievement of the societal objectives is mostly arrived at by economic agents (consumers and producers) interacting with each other. However, beginning in the 1930's, government, through taxation and expenditure power, and through the regulatory process, have gradually increased their importance in both the economy and social domains in such a way that they now contribute to the realization of some of society's objectives.

The telecommunications industry is part of a set of industries commonly referred to as public utilities. It is generally agreed that a public utility is any entreprise which is subject to government regulation including price regulation, barriers to entry, etc... The regulatory requirement to protect the public interest arises because of special features of public utility entreprises, namely, the services which they provide are necessary. For examples, the maintenance of a transportation system, or electric power or telephone system is viewed a matter of life-and-death to all members of society. In other words, these industries are viewed as instruments for reaching some of the priorities already established by the government or in our framework, regulatory agencies. In more technical terms, these industries are known to generate a large number of externalities.

For example, the telecommunications industry can be used as an instrument for promoting the east-west cultural exchanges with the objective of promoting Canadian identity. However, to try to reach these ill-defined and broadly stated objectives, one must assign more accessible and intermediary goals to the telecommunications industry such as the objective that the largest part of the population must have access to reliable, efficient and diversified telecommunications services at reasonable prices. Government helps to achieve these goals with the operational policy instruments which it has at its disposal. For example, the regulatory commission must approve tariffs as being 'just and reasonable', the quality of service provided must be of a certain standard, carriers must follow certain prescribed depreciation practices and procedures, etc.

Until recently, the American telecommunications industry, characterized by a complete monopoly structure was regulated mainly by two means: first, competition was prevented by the establishment of barriers to entry, and second, an upper bound was imposed on the rate of return that could be earned by carriers. The company was allowed to be the sole supplier but, in exchange, it accepted regulation, and the requirement to supply the services to all the customers on demand at 'just and reasonable' prices. Implicit in this procedure was the presumption that if full competition were allowed, its impact on the society would eventually become negative. In two important decisions in 1968 and 1969, the FCC struck down tariff provisions banning the use of foreign attachments on the telephone network, i.e. the Carterfone Decision, and also, permitted the entry of Microwave Communications Ins. into private line communications. As a consequence of these two decisions, the FCC relaxed some legal barriers to entry. The carriers, however, reacted to these decisions with non-price and price strategies. As an example of non-price strategy, carriers have introduced a new range of services aimed at the medium class customers.

Pricing and entry are inexorably linked. It is self-evident that the philosophy underlying pricing of the various services should evolve in accordance with the new philosophy of deregulation. This new situation of

of competition, both at the terminal equipment and intercity service levels has created at least three consequences with respect to tariffs. First, there has been the displacement of a value-of-service pricing to a cost-of-service approach; second, there has been continuing debate on whether tariffs should be based on average (full distributed) or long-run marginal (incremental) costs; and third, intervenors, the regulated companies and regulators are now examining the various objectives and role that should be ascribed to tariffs.

The American telecommunications industry has undergone some major structural changes in the past ten years. Part of the change can be attributed directly to the liberalized policy adopted by the FCC regarding entry into the telecommunications market. Two reasons are often cited for the growth of competition: empirical evidence casting serious doubt on the existence of economies of scale and market pressures resulting from technological change. The presence of both competition and monopoly, however, has also created a number of regulatory problems which were unknown ten years ago. One key problem, for example, which now confronts the regulator is how to make the determination where and when competition should be slowed down or accelerated.

The challenge which now faces government and regulatory commissions is how to utilize various instruments e.g. tariff structure, barriers to entry, service quality, etc... in a way that their respective objectives can be met. While it can safely be said that the objectives of regulation remain unchanged, it must be assumed that the new environment of monopoly competition permitted by the FCC will enable it to achieve those goals more appropriately. Therefore, a key objective of this report will be to evaluate the extent to which the new competitive monopoly environment, and carrier reactions and the resulting (new) pricing strategies have permitted the FCC to reach it stated goals than in the previously regulated monopoly context.

1.2 The FCC Motivations for Deregulation

Two immediate factors have created pressure on the FCC to deregulate-the rapid growth of technological change, and empirical evidence which has cast doubt on the existence of economies of scale in the industry. There is a third reason, but its measurement is difficult to gauge i.e. the emergence in recent times in the U.S. of a philosophy advocating the rollback of government in all of society's affairs, the so-called libertarian philosophy.

a) Economies of Scale

It has long been accepted that the telecommunications industry is a natural monopoly reflecting both indivisibilities and a high degree of capital intensity. This means that the average cost of production decreases with an increasing level of output, given a state of technology. However, it must be emphasized that even if costs decrease over time, it is not sufficient to conclude that there are economies of scale since decreasing costs can arise from exogeneous changes in technology. Moreover, this characteristic is a long-term concept, reflecting the fact that in the long run all the costs are variable including capital costs.

Defined in the above manner, the economies of scale argument has been found to have less empirical substance (see sub-section 2.1) than was believed previously. It has also been postulated that if there are economies of scale in the telecommunications industry, it is because of technological innovations, particularly at the transmission level.

It should further be noted that theoretical work on the concept of economies of scale is now directed towards three domains, namely, the redefinition of this concept in a context of a multi-product firms, definition and characterization of the concept of economies of specialization (or economies of scope) in order to capture complementary in the production of many products, and the definition and characterization of the

concept of the sustainability of natural monopoly which permits the monopolist to introduce a price strategy which prevents any entry in the industry. (These subjects are more fully described in Appendix B at the end of the report). It should also be emphasized that these models have limited applicability because of the strong hypotheses employed. Once, however, they are generalized, it is certain that they will have an important impact on the regulatory setting.

b) Technological Innovation

Telecommunications is a very dynamic area and technological change is accerelating. It is certain that technological innovation was an important reason for pressuring the FCC to foster competition in the telecommunications industry particularly since the FCC's Above 890 decision (1959) where the development of microwave transmission opened new areas of the spectrum for possible use in transmission. Today, the equipment market is characterized by new technology as integrated circuits, fiber optics, microprocessors, word processors, etc... Also, events accompanying the computer revolution of the past decade indicate that the telephone network can be adapted, tailored and modified by computer assisted instruments to meet differing-consumer requirements. In particular, the new terminal equipment capacities include devices which can transmit high-speed data to distant computers, send facsimile transmissions, store, sort, and display information in the individual's communications instrument, and permit the evolution of such new services as electronic mail, electronic funds transfer, interactive data base service which could provide home libraries of diverse informational services to the public and, two-way television.

Taking in account this multiplicity of possible new services, the FCC has concluded that market place competition rather than the government enforced monopoly would best assure that a wide range of communications options and alternatives are available.

These motivations have been reflected in the MTS and WATS Market Structure Inquiry. "... in view of the rapid evolution of communications and related technologies and the expanding and increasingly complex needs of communications consumers, we (i.e. the FCC) believe that this is an appropriate time to examine those interstate services which we have not affirmatively evaluated in recent years to ascertain what industry structure would best serve the public interest in current circumstances...". (CC Docket no. 78-72).

The rapid evolution of technology and the liberalized barriers to entry thus have made the boundary of the industry rather vague, and consequently have brought to the forefront the question of the extent to which new services should be regulated. For example, electronic mail and funds transfers are interesting examples of the mixture of two previously distinct industries. As far electronic mail is concerned, the rapid strides in electronics and computers suggest that low cost terminal equipment may emerge as consumer items capable of teleprinter or facsimile offerings which could serve as an attractive alternative to existing postal service. This is a new service that combines characteristics of current offerings which are in two distinct regulatory juridictions. With respect to electronic funds transfer, this new service combines two different elements: communications and finance. It is interesting to ask whether the proposed electronic transfer funds operations constitute a common carrier operation requiring FCC approval or is it a private system which should be left unregulated?

The remainder of the report is organized as follows: Section 2 briefly describes the industry structure in the U.S., its regulatory setting and also reviews the main economic characteristics of the industry. Section 3 formalizes the relationship between the instrument and objectives pertaining to the telecommunications industry. Sections 4 and 5 review recent FCC decisions relating to entry and evaluates pricing strategies that the FCC, state commissions and/or the carriers have introduced. (Barriers to entry and pricing are examined jointly since both fall under the jurisdiction of the regulator). Also examined are structural and economic bar-

riers to entry, price strategies before and after the introduction of competition. In the context of rate structure pricing schemes such as two-part tariffs and peak load pricing are examined. Reference is made to a report on the application of peak, off-peak pricing in New York State. Section 6 reviews some recent problems associated with the determination of the revenue requirement and these are evaluated in relation to stated objectives enumerated in Section 3. Traditional methods of regulation are also reevaluated with respect to the new environment of monopoly competition. Section 7 provides a summary and conclusion.

The paper concludes with 3 appendices which deal with various theories of regulation advanced for explaining government intervention in markets, recent theoretical developments for defining and testing the presence of economies of scale in a multi-product monopoly context, and the impact of pricing schemes on the distribution of income. These appendices have been included to give the reader an insight into some of the formal mathematical models which have been developed on regulation. While these models are currently too simplified to have practical policy implications, they are the beginning of a process which may lead to the formulation of more realistic models which may, in the future enable, lead to more sophisticated empirical measurement, and subsequently be the basis for policy. It is the conviction of the present writer that this approach combined with simulation models are the only ones which will give some fruitful results in the long run. However, it is also clear that before applying these models data must be available, data which for the time being are mostly lacking.

2. Telecommunications in the United States

As noted earlier one of the objectives of the report is to evaluate the consequences of allowing more competition in the telecommunications industry relative to FCC objectives. However, as entry into the industry and the tariff strategies are linked, it is not possible to evaluate the consequences of liberalizing barriers to entry, without at the same time evaluating pricing policies.

Study of the relationship between barriers to entry and pricing, however, are compounded by the following problems:

- the economics and technical characteristics of the telecommunications industry;
- the structure of telecommunications in the U.S.;
- the two tier of regulation.

In this section, each of these problems will be briefly examined.

2.1 Economic and Technical Characteristics of Telecommunications Industry

Among the main economic and technical characteristics of the telecommunications industry, the following reflect the complexity of this industry:

1. Multiproduct Industry: the telecommunications industry supplies a variety of services - switched and nonswitched, voice and nonvoice grade, monopoly and competitive - to customers who have different incomes, cultural backgrounds, interests, tastes, etc... From a demand perspective, this means that depending on customer class, price and income elasticities are likely to vary quite substantially. This makes it possible, for example, for a company to finance a market which has an inelastic demand from a market with elastic demand. It also means that services furnished to lower income groups can be subsidized

via the pricing mechanism and thereby permit the regulatory body to implement some of its income redistributive goals. For example, the monopoly voice services supplied by AT and T have been shown to earn a higher rate of return on allocated investment relative to the overall rates of return for all interstate services than do Telpak and the record-telegraph services.

The difference among price and income elasticities is only one facet of demand. Another facet is non-zero cross-elasticities between the services. In other words, because of the existence of many services in this industry, there exists the possibility that some services may be substitutes for others. For example, the private network can be seen as a substitute to the toll service, both for industry and government. Rostow noted (Memorandum of Evidence, submitted by Bell Canada, March 1978, p. 50) by examining the revenues of the specialized telephone companies that the public message service and private lines offering interconnection seem to have a high cross-elasticity of substitution. The Cost Analysis Task Force of the FCC also has recognized the importance of the cross-elasticities by requesting that Bell provide for the application of Method 7 methods of estimating elasticities and cross-elasticities for all the services supplied (see Fully Distributed Cost: Implementation Manual, Supplement to Docket 18128) but especially for the MTS and WATS services. The issue of non-zero cross-elasticities raises the question of subsidizing services which have close substitutes from services without any close substitutes. It is anticipated that the problem will become more important as new services are introduced to meet the exigencies of competition.

There are also two other points which should be considered for determining an "optimal" tariff structure: these are "time" and "product" substitutes.

It is a well-known fact that the demand for the telecommunications services varies substantially during a standard period of time, e.g. day, week, etc... Consequently, there are peak and off-peak periods, the peak period responsible for capital investment in the network.

This raises at least four questions:

- are peak users financed by the off-peak ones?

- what is impact on the rate base if peak demand were reduced by a certain percentage?

- is the displacement of the demand from peak periods to the off-peak periods easier for private customers than for entreprises?

- does the present method of regulation create an incentive for over-investing in capital (Averch-Johnson effect)?

These four questions are examined in Section 6 in relation to the New York Public Utility Commission experience about the application of peak-load pricing.

As far as service substitution is concerned, telecommunications industry can be thought as one among many industries which attempt to satisfy the "need" for communication. The other two industries which meet this need are transportation and post. The trade-off between transportation and communication will become more and more important in the future as the energy costs continue to rise. It is evident that in the development of a policy for the telecommunications industry, and subsequently for the tariffs strategy, this facet of the problem must be taken into account. Also, the electronic mail is now a subject of great controversies, in particular for determining who should regulate this new service .

Underlying the above discussion is the question of the definition of telecommunications services and the policy strategies that these definitions imply. For example, there is a consensus that the basic budget service, the possession of an instrument capable of receiving and initiating calls, is an essential service which must be provided to all customers at reasonable cost even if this service has to be fi-

nanced by some others. The question, of course, is to determine the extent to which this "merit good" definition must be extended to other services. (In the Appendix C , the argument is advanced that the nature of the services supplied strongly determines the manner the services are priced or should be priced).

2. Capital Intensiveness: because of the capital intensiveness nature of the telecommunications industry, many services are supplied from common or joint plant. This necessitates that a portion of the common costs be attributable to the provision of specific services or particular units of a service. Some separation rule therefore is required in order to make this allocation. The existence of optimal sharing and the knowledge of the implications of its application are important for relating the cost of each service to its tariff and, consequently for evaluating the presence or absence of cross-subsidy. For example, it is important to know how common costs are apportioned between monopolistic local service and competitive toll exchange. In FCC Method 7, the allocation of these common costs is based on "historical cost causation". More specifically, datum dollar amounts (the common measure for all services) on a service-by-service basis are derived as follows:

a) determining non-fungible directly attributable plant per service;

b) determining additional dollar assigments of fungible plant by:
   i) separating out facilities available for future growth (FAFFG) from facilities not available for future growth (non-FAFFG) and estimating these components based on current (non-FAFFG) and forecast use (FAFFG);
   ii) use of a more appropriate causation based procedures (not explained in the reference).

As noted in Sub-Section 2.2, the problem is still complicated by the presence of two levels of regulation. Further, one of the main interests of the game theoretic approach developed recently, and parti-

cularly the Shapley value, is to suggest that once one accepts some minor axioms, a precise cost separation formula can be derived (see Appendix C for more details).

3. Indivisibilities: the capital input of the telecommunications industry is subject to some important indivisibilities. As far as marginal cost pricing is concerned indivisibilities raise at least two additional issues. First, the marginal cost cannot be uniquely defined, and second, it is probable that there will always be excess capacity in the network, even during the peak periods. This raises the important ancillary question of which subscriber pays for cost of the excess capacity.

4. Natural Monopoly: by definition, a firm supplying solely one service is referred to as a natural monopoly if it has decreasing average cost in the long run, given the technological state of the art. But companies in the telecommunications industry furnish a variety of services and this factor complicates the definition. For example, an ordinary telephone calls have a number of characteristics associated with it - direction of call, time made, distance over which it travels, place of origin and destination - so that depending on the particular characteristics chosen, it is possible to define a local call in several different ways. It is now apparent in the literature that the definition of a natural monopoly in this context is not so easy, the reason being if outputs do not expand proportionately, we do not know how to define an index of aggregate output by which to divide total cost, nor do we have any way of aportioning the joint and common costs so as to calculate an average cost, item by item.

This characteristic of natural monopoly associated with the telecommunications industry has long been accepted. However, recently, debate has centered on whether the empirical evidence indicates the existence of economies of scale. For example, L. Waverman ("The Regulation on Intercity Telecommunications" in A. Philips, ed., Promoting Competition in Regulated Markets (1975)) shows that while the four types of scale economies

identified (scale economy at the plant level, firm economies of scale, multiproduct economy, contracting economies, p. 207-208) likely were present in the early 1940's, it is now probable that some of these economies are no longer binding. Moreover, he also demonstrates that ecomies of scale at the plant or firm level, measured in terms of average cost which decreases as output increases, have not been present in this industry for at least fifteen years. Only in contracting economies, i.e. the ability to reduce cost and risks by organizing activities within the firm does Waverman demonstrate some justification for the perpetuation of a near monopoly in much of the intercity communications industry.

However, other cost studies come to different conclusions. For example, A. Froggatt ("Incremental Costing in Practice" in Trebing ed. "Essays on Public Utility Pricing and Regulation", Michigan State University, 1971) has stated: "Oddly enough (and those who are intimately familiar with the telephone business find this surprising), it has been suggested by a few individuals in their testimony in FCC docket no. 16258 that Bell may have exhausted its economies of scale... Suffice it to say that my testimony in the Interstate Rate Case (same docket), additional evidence on the record in that case, and current studies support the conclusion that Bell's economies of scale have not by any means been exhausted" (page 195). Moreover, Dean Gillette from Bell Telephone Laboratory Inc. has recently reported (Public Utilities Fortnightly, May 11, 1978) that: "The products that will have the greatest near term impact on exchange area costs are based on digit processing embodied in large-scale integrated circuits. Applications are showing up in every part of the plant, in terminals, distribution plan, central offices, trunks and operations support systems. In exchange plant applications, most benefit comes as it has in the toll plant: by aggregating the needs of many subscribers and many wire centers, and by developing systems for common use. I think that we can get scale economies in the exchange plant with new technology; so I see the prospects for cost reductions as being very good indeed" (p. 40).

It should be noted that, mainly because of the absence of a theoretical foundation, all tests for detecting the presence or absence of economy of scale implicitly assume that the industry only supplies one ser-

vice. Thus it is an important question to determine if the conclusions (like those of Waverman) still hold when the multiproduct aspect if taken into account. In a very recent study M. Fuss and L. Waverman, (Multiproduct MultiInput Cost Function for a Regulated Utility: The case of Telecommunications in Canada, W.P. no. 7810, June 1978, Institute for Policy Analysis, University of Toronto), concluded that: "the estimates of the overall scale economy are not sufficiently precise to enable one to reject the hypothesis of increasing, constant, or decreasing return in scale" (p. 50). The following comment made by Trebing and Melody in (Regulation and Entry, Klass and Sheperd, ed., MSU Public Utility Papers, 1976) is also noteworthy: "A definitive analysis of economies and deseconomies of scale in communications remains to be developped" (page 104).

Although the emphasis has been focused on the measurement of economies of scale, the most important question in the context of natural monopoly is to determine if it is always less costly for a society to have a single firm producing combination of output rather than to have a multifirm production. Thus, as Bonbright has noted Principles of Public Utility Rates, pages 14-15, "a widespread assumption that a public utility must be producing on the declining segment of its unit-cost curve in order to justify its claim to acceptance as a natural monopoly, this assumption ignores the point that, even if the unit cost of supplying a given area with a given type of public utility service must increase with an enhanced rate of output, any specified required rate of output can be supplied most economically by a single plant or single system". More technically, the important concept behind this quotation is strict subadditivity of the cost function which means that the cost of the sum of any output vectors is less than the sum of the costs of producing them separately. It is intuitively evident that for a single product firm, evidence of scale economies is sufficient to prove subadditivity of the cost function, but it is not necessary. Moreover in the case of the multiproduct firm, scale economies (as defined in the Appendix B) is neither necessary or sufficient for monopoly to be the least costly from a productive organization. Consequently the purposes of the Appendix are then to redefine the concept of natural monopoly in the multipro-

duct case and to determine some conditions which will guarantee that the cost function if subadditive.

This shift of emphasis from the decreasing average costs concept to the one of subadditivity of the cost function introduces some difficulties for testing (and estimating) the presence or the absence of economies of scale. In effect, as Baumol has said: "because a claim of natural monopoly asserts that production by a single firm is cheaper than it would be in the hands of any and every possible combination of smaller firms, one must know the behaviour of the cost curve throughout its length in the interval between the origin and the particular output level considered". In this context of testing for subadditivity of the cost function, Fuss and Waverman have concluded that "there is no real evidence to support the contention that Bell Canada's production process is subadditive" (op. cit. p. 35).

We close this section with the following comments.

a) it is well-known that a tariff structure for a natural monopoly based solely on marginal costs of supplying a service will not recover the fixed costs of providing the service. But since this industry is regulated by the constraint that it must be self-financed, it follows that some services have to be priced above their marginal costs. Consequently, there is a departure from the marginal cost principles, and depending of the level of the allowed rate of return some distributional rearrangement as well. This raises the difficulty of determining the optimal departure from the marginal cost pricing and the form of cross-subsidy. For example, Kahn and many other economists assert that economic logic would argue for setting rates for more elastic services at their marginal costs using the revenue surplus (i) to subsidize basic service, the demand for which is almost certainly less elastic, and (ii) to enable rates the long lines portion of the business to be priced downward toward marginal costs. Note that this pricing rule, called the inverse elasticity rule, has been avocated by AT & T since the entry of competitors into the industry. In Appendix C, some other pricing schemes will be discussed for a decreasing cost industry, schemes which permit the satisfaction of the revenue requirement.

b) the existence of a sole supplier may be economically justified even if some carrier produces at increasing average cost. In effect, the real question is whether a given quantity of service can be provided more cheaply by a set of producers rather than by a single one. In other words, and assuming that the government eliminates temporarily every barrier to entry, will there still be an incentive i.e. positive economic profit for some producers to enter the industry? Technically, the question refers to the existence of tariffs which permit the sustainability of the monopolist. Under some reasonable assumption, it can be shown that no viable competition can exist in this kind of industry (i.e. assuming decreasing average cost). Of course, the problem is strongly related, but not identical to cross-subsidization. Some of these various questions will be considered in Section 5 and in Appendix B.

c) due to the technical characteristics of indivisibilities and the capital intensiveness of the industry, the investment projects of the carriers are usually made some periods in advance, i.e. investing now for satisfying the forecasted demand with an horizon of three to four years ahead. Because of this characteristic the FCC Cost Task Force has introduced a category called: facilities available for future growth for a three years horizon. Further, any new project necessitates many years of gestation, and the rate of introduction of the new technologies is also planned for many years, especially in a complete monopoly environment. The introduction of the dimension of the evolution of the demand as well as the replacement of the existing facilities means that the telecommunications industry is always in a disequilibrium situation and consequently that the decision based on a short term marginal cost pricing are not the same as those based on long term marginal cost. It follows that the proper time perspective is crucial for a policy based in part on the tariffs.

d) the previous comments stressed the costing aspect as an element of definition for the products in the telecommunications industry. It is also possible to question the quantity supplied of the various services. In other words, the increase in output, even under the conditions of economies of scale, can lead to some socially non-optimal

results. Restricting demand in some way is among various goals which are under tariffs (see Section 3).

5. Vertical integration: many carriers in the industry are vertically integrated and own, totally or partially, some subsidiaries. This means that carriers own all the equipment from station to station. If competition is allowed, ownership can be mixed. The vertical integration situation raises many policy questions. For example,

a) should the manufacturing subsidiaries be financially separated from the carriers? Can competitive services be financed by monopoly services?

b) what is the proper rate of return to allow for the manufacturing subsidiary?

c) is the introduction of cost-reducing innovation made as fast as it is economically justified?

d) what are the probable impacts of allowing competition in the interconnect market?

e) what kinds of technical specification for the equipment are required to attain a certain degree of quality of service?

f) which objectives would government like to reach by allowing competition in this industry?

Some of these questions will be taken again in the following sections of this report.

2.2 Institutional Setting

2.2.1 Industry Structure

Telecommunications services in the United States are provided by privately owned companies subject to regulation at both the federal and states levels. The Bell Telephone System, the independent (or non-Bell) telephone companies, and the Western Union Telegraph Company together operate virtually all of the nation's common carriers telephone and telegraph companies. The industry structure in domestic communications is dominated by the holding company form of organization. The holding companies do not provide communications services directly but rather provide centralized control function for a comprehensive network of operating companies as well as for vertically integrated manufacturing and research affiliates. The holding company thus typically embraces both communications services and communications equipment. To this extent, the holding company is both horizontally and vertically integrated.

The American Telephone and Telegraph Company is the major telephone holding company in the U.S. AT and T, through stock ownership, controls 23 operating (or associated) telephone companies that render intrastate local exchange and toll services; it also owns 100 percent of the stock of the Western Electric Company, and shares ownership of the Bell Laboratories with Western Electric. These constituent parts of the holding company make up what is commonly known as the Bell System. AT and T is organized by departments. First, the General Department provides advice and assistance to the various Bell operating companies on matters relating to traffic, accounting plant, financing and the legal-regulatory setting. Second, the Long Lines Department provides interstate message toll within the U.S. and between the U.S. and foreign nations, and supplies private line service. The Long Lines Department then serves to interconnect the associated companies which provide intrastate toll and local exchange services. In this context, the Department performs the functions of melding the various operating companies into a unified whole. It can

be noted that under the pressure of the competition, AT and T is designing its activities into a more "product-line" manner (Business Week, nov. 6, 1978, pp. 114-135). Among the issues this holding company form of organization raise, there is the computation of capital costs for the operating or associated companies, the so-called double-leverage problem. Also the potential entrants in communications must deal with this format or organization: for example, the specialized carrier offering the private line service must secure local loops in order to reach the customer's premises and offer point-to-point service. These issues will be discussed further in Section 6 which review some problems associated with the various components for determining the total revenue requirement and in Section 4 which evaluates the implications of liberalized barriers to entry.

In order to give an idea of the importance of the Bell System companies in the telecommunications industry in the U.S., it is noted that they account for approximately 80% of the local exchange service and for some 90% of long distance service. Western Electric accounts for approximately 85% of the domestic communications equipment market. It should be pointed out however, that private line revenues account for a minor share of the total Bell System revenues. The non-Bell companies account for the balance.

There are some 1,600 non-Bell Telephone companies in the U.S. The most important non-Bell companies are (listed by decreasing order of importance): General Telephone and Electronics Company, the Continental Telephone Corporation, United Utilities Inc., and the Mid-Continent Telephone Company. These companies are also organized in holding company format. For example, GT and E has acquired Leich Electric Company, Sylvania Electric, Lenkurt Electric Company and the Automatic Electric. Of course, even if the remaining non-Bell companies are affiliated with several telephone holding companies, their degree of integration is nowhere as complete as the General or Bell System.

2.2.2 Regulatory Setting

a) State regulation

The formal structure of regulation in the telecommunications service in the United States is composed of mixture of state and federal agencies. The courts also have an important role to play in the regulatory process by approving or rejecting regulatory bodies decisions concerning the determination of rate base, the allowance or disallowance certain operating expenses, etc... For example, the Court of Appeals for the District of Columbia reversed a FCC's decision concerning the Execunet service. In addition to these regulatory bodies, the domestic communications industry has been subject to antitrust action on a selective basis for almost 60 years; for example, the 1956 Consent Decree which preserves the vertical integration of AT and T and Western Electric.

State commissions regulatory authority is derived from their own constitutions, except for matters which are preempted by the federal government. State regulation began in 1907 when Wisconsin and New-York established independent administrative agencies with responsability to ensure that rates for telephone service were fair and reasonable. Some other state commissions were organized shortly after. At the state level, attention has focused on the control of the level of earnings for exchange and intrastate toll service within the context of state wide rate making, i.e. total revenue requirements are considered for the entire state, and revenue assessments against particular exchanges are determined on a value-of-service basis with the largest exchanges paying a higher price per station than the smaller exchanges. Also, the vertical services (PBXs, key telephone sets, etc...) are expected to yield a higher return than basic telephone services. It should be noted that in the new competitive environment, matters as financing, accounting, depreciation rates and administrative procedures are also reviewed. It has been suggested (see Alden, R., "Notes on Telecommunications Policy", United Telecommunications, Inc., mimeo, Jan. 18, 1979) that state regulation should be confined to the availability of the local exchange service for all re-

sidents of the state, to quality of the service and to its pricing. Further, in the new context of competition, the state commissions should not prevent or restrain the entry and the effective participation of the state regulated telephone companies in competitive telecommunications services. All of these subjects will be taken up again at some length in the next section of the report.

b) Federal regulation

Interstate regulation in the field of telecommunications began with the passage of the Mann-Elkins Act of 1910. This Act amended the Interstate Commerce Commission bringing interstate telephone and telegraph communications under the jurisdiction of the ICC. The next major step in Federal regulation came with the passage of the Communications Act of 1934. That Act provides the basic framework for contemporary interstate common carrier regulation. A major amendment to the Communications Act came with the passage of the Communications Satellite Act of 1962 which establishes the Comsat as a carrier's carrier.

In view of the objectives pursued in this report, it is of interest to note some of the salient features of the FCC's regulation since its creation (see Irwin, M. and Trebing, H., "A Survey of Problems Confronting the Communications Industry in the United States", in Telecommunications for Canada, E. English ed, Methuen 1973). First, the Commission has avoided, for almost all cases, adversary proceedings with the carriers in determining revenue requirements. The agency has chosen to rely primarily on continuous surveillance. For example, until 1975 the FCC had never disallowed AT and T's investment rate base on prices posted by Western Electric. Second, the Commission has devoted very little attention to problems of pricing or rate structure prior to early 1960s. With the exception of Private Line Case and two adjustments in TWX rates, the Commission had paid minor attention to the question of whether individual services were fully compensatory nor did the Commission establish guidelines that would prevent cross-subsidization between classes of users of different services. Third, the Commission has engaged itself

in matters pertaining to market structure and the impact of new technology. For example, the FCC has ordered two computer/communications inquiries and a MTS/WATS inquiry to determine the portion of telecommunications which should be regulated and the portion which should be left to market forces. Fourth, the FCC has often modified its philosophy about pricing guidelines. Up to recently, for example, FCC advocated value-of-service pricing but now it appears to favor a cost-of-service approach (see Docket 18128). Also the FCC would like to employ a fully allocated cost but many state commissions preach marginal cost pricing.

3. Telecommunication Policies: Objectives and Instruments

Section 1 of the Communications Act of 1934 states: "The Communications Act of 1934 is created for the purpose of regulating interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible, to all the people of the United States a rapid, efficient, nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges, for the purpose of the national defense..." Nowhere does the Act refer to the need for competition as a means for reaching these objectives. The draft of the Communications Act of 1978 (Section 101, page 6) however, states: "The Congress hereby finds that the regulation of interstate and foreign telecommunications is necessary, to the extent marketplace forces are deficient, in order to:

(1) make available to the people of the United States nation-wide and world-wide telecommunications services which are diverse, reliable, and efficient and which are available at afforded rates; and

(2) advance United States foreign policy, the national defense, and the safety of life and property"

Although the objectives are almost the same in the two acts, the Communications Act of 1978 assumes that regulation will supplement the market forces in order to reach stated objectives. Clearly, the emphasis has been reversed.

In view of reaching the objectives stated in the Communications Act of 1934, the Communications Commission was given broad powers under the Act: "... with respect to common carriers, all companies are required to furnish adequate service upon reasonable request. The Commission may order physical connections between carriers, and may establish through routes and charges and determine the division of such charges. All rates, practices, classifications and regulations must be 'just and reasonable'... Rates must be filed with the commission and adhered to... Common carriers

must obtain certificates of public convenience and necessity for the construction, acquisition, or operation of a new line or for the extension of an existing line. The commission may prescribe uniform accounting systems and depreciation charges... The Commission also is instructed to inquire into the management of common carriers and to keep itself informed of technical developments and improvements to the end that the benefits of new inventions and developments may be made available to the people of the United States" (see Phillips, C., The Economics of Regulation, Richard D. Irwin ed., 1969, pp. 640-641). It is interesting to note that these objectives are still present in the recent FCC decisions. For example, in the inquiry about the usefulness of introducing a complete competition in the MTS/WATS market, the FCC Stated that "we will exploring such factors as the best means of achieving low costs and charges to the public, technical and operational efficiency, network planning and management, innovations, and how best to satisfy the desires and service of the public". (CC docket no. 78-72, p. 5).

What are the powers of the FCC under the Communications Act of 1934 compared to those under the new Act? Reviewing the draft of the new Act, it appears that the (new) Commission will possess some of the same powers as held by the FCC under the old Communications Act. For example, the Commission "will have to determine whether any person is a common carrier, will also have to classify carriers and interstate telecommunications services subject to this title and may prescribe different requirements under this title for different classes... Also, in classifying services under this title the Commission will have to determine which telecommunications are non competitive services" (page 40). The Commission will determine and prescribe the equitable and lawful rate, and the burden of proof will be upon the carrier (pages 43-44). "The Commission may for purposes of the Universal Service Compensation Fund, classify the property of any carrier in order to determine to which service costs should be assigned" (page 45). "The Commission may... authorize or require by order any common carrier providing a non competitive service to extend such service to a community..." (page 50). But, and this is a very different viewpoint from the old Act, "in the exercice and performance of its powers and duties under this Act, the Commission shall:

(1) place maximum feasible reliance on marketplace forces to achieve the purposes of this part;

(2) promote the maintenance of basic voice telephone service at affordable rates achieved by regulation (when marketplace forces are deficient) with provision for equitable treatment of all common carriers and by direct assistance where appropriate;

(3) rely on competition to provide efficiency, innovation, and low rates, and to determine the variety, quality, and cost of telecommunications services;

(4) establish full, fair and competitive conditions;

(5) prevent practices which would allow any carrier to limit or exclude competition in the provision of telecommunications services (p. 47-48)".

It is clear from the above paragraphs that the telecommunications industry is visualized as a means for reaching some general, and broadly defined, objectives, e.g. national defense, the safety of life and property, and the satisfaction of desires and service needs of the public. An additional example is illustrated in the letter sent by Senator Talmadge to the Director of Office of Technology Assesment, requesting that OTA contribute to a project to study the contribution that broadband communications can make to "rural community development". It is also clear that having an economically efficient and adequate communications system represents an objective in its own right. And such objectives as the introduction of innovation, standardization of the equipments, etc... can be seen as some means for reaching the objectives of possessing an efficient and economical telecommunications system. In order words, there exist hierarchy of objectives some of which can be seen as means for reaching other objectives.

Before discussing the operational means the FCC possesses to meet some of its stated objectives e.g. tariffs, barriers to entry, the

following comments on objectives are warranted, given that one of the purposes of this report is to determine to what entent some of these objectives have been reached in the regulated monopoly environment and are being attained in the new monopoly competitive environment.

First, it should be noted that the highest level of objectives are stated in very general terms with some being more immediately associated with the interests of subscribers and some effecting all citizens in society. Consequently, many "things" can be included in these objectives. Their non-operationality is evident if one cannot conclude whether their objectives have or have not been achieved. Second, taking the aggregate character of most of the objectives, they all incorporate a mixture of both equity and efficiency, and, it is a well-known fact that they can often be in conflict. That one would like to have an economically efficient system of telecommunications may be incompatible with the objectives that rates be reasonable for all parties and that there must exist some control on the impact of technological innovations e.g. network planning (which can postpone some cost reducing). In some cases, the government can impose, on equity grounds that all citizens have access to the telecommunications services, but this objective may conflict with the objective that the tariffs be just and reasonable for all parties. (It will be shown below that even at the most operational levels of objectives, some trade-offs must be made between equity and efficiency). Third, some objectives pertain more immediately to the content of the communications services e.g. "advance United States foreign policy", while some others refer to the technical aspects of the telecommunication network, e.g. "system integrity". These two categories of objectives also interact to some extent: for example, to satisfy the needs of customers and government for data transmission, new technology has been developed, which , in turn, this has introduced vaguenesses in defining the boundaries of the industry.

We now turn to the operational means (or objectives) which are available to the FCC and state commissions to reach the stated and more general objectives. Tariffs, various barriers to entry and depreciation

methods are examples of some of the means available to Commissions. It is evident that these instruments must now be taken in consideration in the new competitive environment. (These considerations will be more fully described in the next three sections of the report). For now, however, our primary objective is to show how these instruments relate to the various objectives identified above. In attempting this, the multiple objectives which underly tariffs will be emphasized. It will then be possible to see both the complementarities and conflicts between these goals.

The FCC possesses the power to impose on the carriers the obligation to provide basic service on demand at reasonable cost. In the process of regulation, this obligation can be viewed as an exchange with the carriers i.e. the carriers are the sole supplier of the services in a particular region, and are allowed to earn a certain rate of return on its investment. This means of regulation carries with it an idea of "merit" good (see Appendix C) and consequently implies some form of cross-subsidization. In other words, by imposing that all demands be satisfied means that government views telecommunications services to be so important in a collective sense that nobody should be prevented from obtaining these services because of cost factors. Finally, the pricing principle more closely associated with this is the "value-of-service" (or what the traffic can bear) rather than the "cost-of-service" approach.

The second means of regulation is the imposition of some minimal standard of quality in the provision of the services. These requirements have a direct impact on the technical specification of equipment and on the objective of "quality and reliability of communications". For example, among the specifications is the probability that the loss in a final route cannot exceed 3% of the calls. It is obvious that this means of regulation must be related in some way or another to the objective of "standardization of technical equipment" and to the "introduction of technological innovation" and "integrity of the network". In the context of the interconnect market, Bell has insisted that a protective interface de-

vice be inserted between subscriber equipment and the exchange network, contending that such a device is required to protect the technical integrity of the network. It is clear that these objectives and means introduce some pressure on the financing problem of the carriers, so they must be studied in relation to the capital attraction function of the tariffs (see below). For example, in the Communications Act of 1978, it is clearly specified that (page 41):

"Every common carrier shall establish connection, when a reasonable request is made for such connection, with any other carrier unless the Commission determines that:

(1) the establishment of such connection will result in substantial or economic harm to the common carrier from whom the connection is sought; and

(2) the harm to the carrier exceeds the benefits to the public which would be created by the connection being requested".

The third and we believe the most important means of regulation are the various forms of barriers to entry. These means of regulation have been subject to more and more discussion during the last ten years and, in fact, the FCC has liberalized these barriers to entry (see the next section for examples). Here, we consider four possibilities of eliminating or maintaining barriers to entry and their possible impact in relation to stated objectives.

a) the provision of services by only one carrier. In this context a fundamental problem is whether a tariff structure exists which, even if competition is allowed, will act as a disincentive for firms planning to enter into the market. More technically, this question relates to the sustainability of natural monopoly, that is, even if the government allows competition, is it possible to formulate a tariff structure which will serve to block competition (see Appendix B)? Parenthetically, it shall be noted that the existence of barriers to entry in the existing market can also be in contradiction with the efficiency-incentive function of the

tariff because the introduction of cost-reduction innovations can be prevented.

b) the prohibition of providing new services (cable, pay television, etc...). The regulatory problem is then to determine how this might stand in conflict with the objectives of "accessibility and variety of services " and of "interconnections and mode interactions assistance". Further, this method of regulation is intimately related to the four functions of the tariffs (discussed below). Consequently, it is also important that attention be paid to the various consequences that the elimination of these barriers could introduce. For example, the provision of new services, e.g. electronic mail, data transmission, raises the question of regulatory responsability and the companies to be regulated.

c) the vertical integration between the supplier of the hardware and the carriers. Among the policy questions two are important (see Kahn, The Economics of Regulation, John Wiley and Sons, New York, 1970, vol. 2, p. 291): i) should the manufacturer be financially separated from the carrier? ii) what is the proper rate of return to allow for the manufacturer? This barrier to entry must also be related to the efficiency-incentive objective of tariffs and also to the rate of introducing cost-reducing innovations.

d) the non-competition at the terminal level. This point is closely related with (c). Of course, this point also must be related to the "technical specifications of the equipment" and consequently, to the "quality and reliability of communications".

It should be noted that new Act states: "no person shall provide a non-competitive telecommunications service and also be engaged in the manufacture of equipment used in furnishing any common carrier service." In other words, since new Commission must set the appropriate condition for broadening competition in this industry, the legislator has thought that one way of accomplishing this objective was to liberalize entry at the interconnect market by splitting of the common carriers and affiliated equipment manufacturers.

The second most important means of regulation is the determination of the tariffs. The process of tariff regulation for the telecommunications industry can be divided into two steps: the first one consists of the determination of a total revenue requirement for the carrier, the second one being the determination of a particular tariff structure. The current accounting rules are embodied in a unified system of accounts which classify revenues, expenses, assets and liabilities. Also, all companies which provide local exchange service are regulated by state commissions which recognize this system of accounts. Recently the FCC has undertaken an inquiry in view of establishing a new uniform system of accounts.

It is possible to identify four functions or objectives served by tariffs:

a) Capital Attraction Function, i.e. the tariffs must be high enough for generating sufficient revenues for the carriers so a "fair" rate of return on their rate bases be obtained on one hand, and to allow innovations on the other hand. It should be noted that this industry must compete with many others for capital. Moreover, in all the rate hearings permissible rate of return is determined by the embedded cost of capital, and this contradics the rational utilization of the network which should be based on prospective incremental cost (see Kahn, A.E., Between Theory and Practice; Reflections of a Neophyte Public Utility Regulator, Public Utilities Fortnightly, Jan. 2, 1975). This function is also dependent of the financial structure, different methods of depreciation and the income distribution function (subscriber versus shareholder). For example, the regulating agency might impose a relatively high debt-capital ratio to benefit the subscriber. On the other hand, it might require a certain depreciation method which increases the burden of financing on the subscriber. This objective can also be in conflict with the policy of the government to properly develop telecommunication. For example, allowing a certain rate of return can induce carriers to eliminate existing facilities and introduce new ones and/or to expand the existing facilities. On the other hand, this objective can serve to increase the qua-

lity and the variety of services. Thus, even at this level of disaggregation, tariffs levels reflect some government objectives.

b) Demand-Control Function, i.e. the tariffs must be set such that the customer can MAKE use of the telecommunications services rationaly. This function is an essential means for preventing subcribers from overtaxing the system and also for shifting peak demand to off-peak ones. Of course the success of the controlling demand is strongly dependent on demand elasticity. In Section 5, we will comment about the New York state experience which employed a peak-load pricing approach. This objective may also be in contradiction with the capital attraction principle as the monopolist attempts to induce the subscriber to use various services. This objective can also be discussed in relation with the various pricing schemes, e.g. the two-part tariff, which includes both fixed cost for accessing the network, and current costs for utilization.

c) Efficiency-Incentive Function, the cost of supplying the services should be as low as possible e.g. that the regulation process should not create any distortion in the allocation of resources, such capital over-investment. This objective can be in conflict both with the various barriers to entry which exist and the objective of controlling the technological impacts. Of course, this function can be consistent with the capital-attraction function as it has a direct impact on the rate base. But from the carrier perspective, it can be a "non-interesting" objective as it is remunerated by a certain rate of return on this base, so the regulated carrier has an interest that the rate base be as large as possible.

d) Income-Redistribution Function is essentially the relationship amont subscribers and between the subscribers and share-holders. It is obvious that this function is related to the determination of the tarrif levels and its associated problem, the structure of corporate financing, the capital attraction function and the depreciation methods. It also relates to cross-subsidy problems. Appendix B discussed this function with reference to a study made in U.S. using the "inverse elasticity rule" as a means for determining tariffs.

Finally, depreciation is also a very important means of regulation, given the relative importance of the capital structure. In fact, depreciation expense is the most important annual expense. This means of regulation is related to the capital-attraction and income redistribution of the tariffs. Moreover, it is also crucial to every facet relating to technological innovation, and consequently, it carries with it an idea of intertemporal cross-subsidization.

In the following three sections of the report, these telecommunications objectives will be evaluated in relation with the recent U.S. experience relating to liberalized barriers to entry, introduction of new tariff schemes and various components which constitute rate of return regulation. These means must be reassessed given the new competitive environment. The role of the depreciation in the new context serves as the best example because it is important not only for equipment dedicated for the provision of local service but also for all the equipment required in this industry.

4. Entry Policies in the Telecommunications Industry

The previous two sections have set the economic and institutional background for the telecommunications industry in the U.S. and have also given a global view of the various objectives that the FCC and the state commissions would like to achieve, given the regulatory instruments that are available. The present and following two sections provide facts and examples relating to liberalized entry into the market, proposals of new pricing schemes and some recent decisions relating to the determination and computation of the various components of the rate of return regulation. Further, in each of these sections, the reaction of the common carriers to the various subjects are described and an evaluation of the new policies in relation with the stated objectives is undertaken. Also, the regulatory instruments will be reassessed in the context of monopoly/competition.

4.1 Federal Telecommunications Decisions on Entry

The Federal Communications Commission has made a number of decisions that have allowed selected entry into markets (interconnect, private line and satellite markets) that had previously been supplied exclusively by a regulated monopolist. Although this new policy on entry has moved toward greater liberalization, it is still formulated on a case-by-case basis i.e. explicit policy has still to emerge. However, two often stated objectives have been put forward by the FCC for encouraging competition: first, the requirement to stimulate technological advance and second, a public interest argument that a greater freedom of choice for subscriber should be available. Liberalized entry has created a large number of issues, issues which have not yet been completely resolved and for which the long term impact has been only partially perceived.

4.1.1 Hush-A-Phone and Carterfone

Historically, telephone companies have provided what they term end-to-end communications service. This policy resulted in situation where the subscribers were required to use telephone equipment (including

terminal apparatus, local loops, switching office and long haul facilities) owned and furnished almost entirely by the telephone companies. Such policy was sanctioned and approved by filed tariffs before regulatory agencies; in cases where the subscriber did not wish to abide by the policy, loss of telephone service was threatened.

Among the arguments put forward by telephone companies on their policy refusing to interconnect, the following three are most often cited:

a) other systems do not meet the technical standards for a reliable public telephone network;

b) other systems would lead to wasteful duplication and higher costs, i.e. loss of the presumed economies of scale;

c) the interconnection would allow users to build competitive systems on high profit routes but depend on the carriers for low profit routes, i.e. the cream-skimming argument.

Despite restrictive tariffs, minor inroads were made into the telephone companies' monopoly. For example, from 1921 to 1949 solely 129,000 Hush-A-Phone had been sold to customers (Kahn, A., The Economics of Regulation, John Wiley and Sons, Inc., 1971). In 1956 the FCC decided that the device be removed because it caused distorted sound when utilized for maximum privacy! Although the Circuit Court of Appleals reversed the FCC's decision, Bell continued to refuse interconnection until the landmark Carterfone decision of 1968.

In June 1968, the FCC obliged the common carriers to allow subscribers to connect their mobile radio systems to the telephone system by using a converter made by a Texas firm, Carter Electronics Corporation. Technically speaking, the Carterfone is a cradle-like instrument that interconnects private radio communication systems with the telephone companies' public network, by placing a telephone handset in the instrument; the device transmits the telephone signals by radio to the private mobile units and amplifies incoming signals from the field unit so that the telephone can hear them.

This FCC decision meant that business customers (but not residential ones) could hook up a variety of terminal devices e.g. computer terminals, PBX's etc, to the telephone network. And, even if the Commission recognized that interconnection could have harmful technical or economic effects on the system, and that such effects, if shown, might well be a public interest question under the Communications Act, it simply decided that in Carterfone no such effects had been proven. Therefore, the Commission held that the interstate tariffs prohibiting foreign attachments were unreasonable, unlawful, and unreasonably discriminatory.

The FCC objectives in the case of the Carterfone decision seem to have been:

- to allow competition where it would have no adverse effect on the telephone system; for example, the FCC declared that the telephone companies could set up reasonable standards for interconnection devices in view of protecting the technical integrity of the network;

- to make policy more reasonable and less discriminatory;

- to expand the options open to the communications consumers;

- to increase opportunities for communications equipment suppliers;

- to stimulate innovation.

4.1.2 Above 890 Decision

In the Above 890 Decision (1959 and 1960), the FCC proposed to authorize private users to construct, own and operate their own microwave systems rather than continuing to buy the service from the existing common carriers. In making this decision, a number of points were made and emphasized by the Commission:

- private systems could provide a service on a cost and quality better tailored to individual requirements;

- certain private users constructed their own microwave system only when the common carriers refused to provide the necessary service;

- expanded eligibility would be a competitive spur to the manufacturing of equipment and in the development of technology;

- availability of common carrier facilities is not a condition of eligibility for private users;

- FCC refused to allow the private users to share frequencies on a cooperative basis; in 1966, the FCC reversed its position and now permits extensive sharing of private systems;

- FCC rejected the common carriers objection based on the cream-skimming argument because no adverse effect was proved.

On the basis of the above, it appears that the objectives of the FCC in the "above 890 decisions" were

- to make possible an alternative communications system to commercial, industrial and government entities that would be better tailored to their individual requirements in terms of costs, quality, flexibility and availability;

- it anticipated more competition in the manufacturing sector and in the communications industry and thus have "a positive influence on the state of the art in communications";

- it felt that needs were unfulfilled and the impact on common carriers would not be detrimental.

It can be noted that the growth of private microwave was constrained, up to the Carterfone decision, by the refusal of carriers to interconnect their toll and exchange telephone facilities to those of customer-operated systems.

4.1.3 Microwave Communications Inc., and Specialized Common Carriers

On August 1969, the FCC authorized construction of a public specialized common carrier microwave system paralleling lucrative routes of AT and T and Western Union between Chicago and St-Louis with connections at intermediate points. The MCI system can connect specific sites, but cannot connect one phone to other as is available with the telephone company's switched network. The MCI system depends on interconnection with the Bell system for its survival: consequently, the Carterfone decision was critically important to MCI.

In the MCI case, the FCC following MCI's representations, ruled that business would not be diverted from the Bell system because it was opening up new sub-markets of customers, primarily small businessmen who could not afford Bell System private line services. This objective, MCI said would be reached through innovative services. Consequently, on this basis and taking the testimony of witnesses into account FCC concluded that the MCI's offerings would permit subscribers to obtain a type of service not actually available and would tend to increase the efficiency of operation of the subscribers' business.

The MCI decision, of course, precipitated a lot of applications for similar point-to-point services throughout the U.S. In order to deal quickly with these applications, the FCC in 1971 established policy procedures (Docket 18920) to process such applications. In fact, the FCC adopted a policy of increased competition in data transmission and other private line communications services. It created a new class of carrier, the specialized common carrier. The main reasons put forward by the FCC for justifying its decisions are the followings:

- a public need for such services existed; i.e. more flexibility and a wide range of choices for the user;

- entry should not degrade services rendered by the telephone carriers;

- that competition in the data communications market was both desirable and feasible as a policy goal because it stimulates innovation and develops a competitive-market benchmark for regulation.

In other words, the FCC expected the new microwave competition to be oriented toward new communication services and markets as well as innovation in meeting changing and differentiated needs. Then, by developing new services, new markets and new technology, the specialized common carriers would be able to increase the total size of the communications market, and especially data communications.

Finally, the FCC encouraged the common carriers to compete in this specialized carrier field. But the "suggestion" made by the FCC had a corollary: how much protection and how long should the new specialized carriers be protected? In its Docket 18920, the Commission gave some general principles for answering this question: "Moreover, we subscribe fully to the view of our staff, endorsed by the Department of Justice, that there should not be any "protective umbrella" for the new entrants of any artificial bolstering of operations that cannot succeed on their own merits".

In the sub-section concerned with an evaluation of this competitive policy, the way which the telephone companies have reacted to competition will be evaluated. An important issue considered is the extent to which the existing common carriers should be allowed to abandon rate averaging in specific markets to compete with the new specialized common carriers.

4.1.4 Value Added Network

In a more recent decision, the FCC has authorized the first commercial application of the packet switching concept. Small packets of digitized data are transmitted over lines to a designated recipient, usually a computer. The first application (January 1973) approved was Packet Communications Inc. The company planned to lease lines from the established carriers to implement and operate a packet switching communications network.

In its decision, the FCC made clear that it felt that the existing common carriers were unable to meet demands, and that the new entry would provide new and improved facilities.

4.1.5 Communication Satellites

The Communications Satellite Act of 1962, which created Comsat as a private corporation for international communications, established an international commercial communications satellite system in conjunction with other countries. One policy question was whether Comsat could, in addition to its role as a carriers' carrier, provide service directly to certain qualified classes of users. With the exception of the Apollo program, the Commission ruled that Comsat was to operate essentially as a carrier's carrier, because otherwise direct competition would threaten the economic viability of the overseas carriers; also, the Commission has secured rate reductions from the overseas cable carriers. On the related issue of ground station ownership, the Commission has elected to split terminal ownership between the international carrier and Comsat. The Commission has been under pressure to maintain a balance between new sub-marine cables and new satellite systems.

A decade later, the FCC made a decision (June 1972) which set rules for the ownership and operation of domestic communication satellites. Favouring multiple entry, the decision authorized all technically and financially qualified parties acting independently or in coalitions to operate communication satellites. The total capacity of the proposals by AT and T

and by the specialized carriers was several times as large as the market could justify. But for the Office of Telecommunications Policy, this appeared not to be a problem because such policy would in part "encourage potential innovators and offerers of new services to think more concretely about their market possibilities. It would encourage them to search out the needs, desires and willingness to pay for potential users-to the benefit of both". (Policy speach of C. Whitehead, former head of OTP, March 70, reported in Welch, J., Telecommunications: Competition and Technological Change, Xerox University Microfilms, 1975).

In short, the OTP stressed that technological change not only necessitated a change in policy, but that policy would lead to more innovation.

The introduction of domestic satellites raises many questions and issues:

- are the cost savings incident to satellite relay real or illusory?

- can the satellite contribute to services unique from those rendered by the land carriers, such as digital modulation techniques that make channels available for remote computer access services?

- if the answer to the above question is positive, this in turn raises question about toll revenue separations between Bell System and independent telephone companies; and

- as satellite broaden the market potential for suppliers of communications equipment, will these equipments be purchased on a competitive basis or will they be subjected to the customary buying practices of the carriers?

4.2 Results of the FCC Policy

4.2.1 FCC Policy and Stated Objectives

In the previous sub-section, several illustrations were given to lowering legal barriers to entry in the U.S. telecommunications industry. The crucial question is what has been the net effect of such a policy in the interconnect and private line markets? However, before answering this question, the following comments are noteworthly.

a) as the period of observation has been brief, conclusions arrived at by various observers have not been uniform;

b) the relative importance, in terms of revenues of the services which are now subject to competition is still small: for example, in 1971, private lines revenues accounted for only 2 to 4% of the Bell system U.S.A. total revenues. Thus, communications remains a highly interdependent and integrated industry in terms of both the physical provision (the network) of service and the development and marketing of new service offerings. This is mainly because message toll service and exchange (local) telephone services represent the largest share of the total revenues of common carriers, and these services will be protected from competition, at least for the foreseeable future (the FCC's inquiry concerning the MTS/WATS market however should not be forgotten). However, what is really important is the composition of future markets and especially the voice market versus the new markets associated with data, record and video communications. It is then easy to understand why the established telephone carriers have made some efforts to resist for the entry of competititors in the markets;

c) the Bell System, frustated by reversal before the FCC and the Courts, has sponsored legislation (the Consumer Communication Reform Act of 1976) that shifts the juridictional control of telephone apparatus from the FCC to that of the states, which are more regulated-minded. For the time being, the FCC Rules and Regulations (Part 68) state that the federal government has absolute primary juridiction over the interconnec-

tion of customer provided equipment to the interstate telephone network, and that such interconnection may not be prevented by state regulatory action. That ruling, the FCC noted, was based both in precedent and the Communications Act. However, AT and T has recently argued that competition can exist in the business subscriber market and in the extension equipment market. But, Bell has also proposed a primary instrument concept, a concept that would sanction a single telephone instrument provided by regulated telephone companies in every home and single line business. This concept is not without opposition; for example, IBM has stated that the primary instrument concept would eliminate competition from the voice and terminal market. (see D. Williams, IBM Hits Phone Industry 'Primary Instrument' Plan, Electronic News, Sept. 26, 1977, p. 19);

d) the recent opposition of the FCC to MCI's Execunet and Southern Pacific's Sprint serve to illustrate that limits still do exist to the removal of these barriers. In effect, the Commission ordered MCI to illustrate that limits still do exist for the removal of these barriers. In effect, the Commission ordered MCI to discontinue its Execunet service, on the ground that it was not a service MCI had been authorized to provide. But the Court of Appeals for the District of Columbia took the position that the FCC cannot effectively confine the specialized common carrier, once it has been approved, to the lines of activity stressed in its original application. The following quote from the Court of Appeals is of some interest: "the Commission's Specialized Common Carrier decision cannot reasonably be read to have made an affirmative determination that the public convenience and necessity required "private line" restrictions on the facilities authorizations of specialized common carriers. Instead, it appears that the Commission saw benefits accruing to the public from the services which were before it. In granting the facilities authorization on the basis of that public interest finding, the Commission perhaps did not intend to open the field of common carrier communications generally, but its constant stress on the fact that specialized carriers would provide new, innovative, and hitherto unheard of communications services clearly indicates that it had no very clear idea of precisely how far or to what services the field should be opened." (emphasis added)

e) For many people, the question of regulation versus deregulation is not necessarily a zero-one issue. For example, in this case of the Citizens Band Radio, or the so-called "everyman's radio", an intelligent mix of regulation, deregulation and self-regulation is needed for permitting an optimal utilization of this service. Note that the CB is an important means by which person-to-person communication can be markedly enhanced, a fact in the public interest. But accompagnying the CB boom are the following problems:

a) spectrum congestion;
b) license processing backlog;
c) unlicensed operation;
d) out-of-band and overpowered which can cause interference to other electronic home entertainment equipment, and even critical public safety services.

It is clear in this context that government regulation does not offer a total solution to the problems associated with million of new Citizen Band operators, neither would complete deregulation.

Having made these comments, we now evaluate the net effect of permitting competition in the interconnect and the private line markets in relation with the stated and implicit objectives of the FCC. These objectives can be summarized as follows: introduction of new technology and new services through an increased growth of innovation, enlarged diversity of services for the customers, satisfaction of the needs of some subscribers, creation of an interconnect market. A caveat is in order: it is clear that in a completely monopoly environment the common carriers have contributed a much to meet these objectives. Society is not starting from scratch; but perhaps a more appropriate question is the following: would the record have been if there had been more competition? And, of course, an appropriate answer is not easy to find.

We first consider those writers which believe that the introduction of competition in the telecommunications industry has had a positive

benefit in terms of the aforementioned objectives. For example, Dr Irwin in "Subscribers Interconnection and Vertical Integration", mimeo, Nov. 1977, found that "the FCC decision in 1968 spawned a new industry: the interconnect market. And, even if the original entrants to the industry were largely offshore suppliers, a second generation of suppliers developed within the U.S., largely manufacturers a computer-related hardware". For Dr Welch, Workable Alternatives to Regulation, Public Utilities Fortnightly, Oct 23, 1975, "prior to competition, small and medium sized customers had charged that they were being ignored by the telephone company. They allegedly were required to use equipment with unneeded services designed for larger, more sophisticated customers and had to pay for capacity that was not needed. With the onset of competition there has been a proliferation of products by Bell in the interconnect market designed for the small and medium sized customers. The evidence is legion, but one case is especially noteworthy: the no. 1 electronic switching system" (page 37). In summary, it appears that Bell has become more sensitive and responsive to the needs of its customers. Moreover, in relationship with the rate of innovation, it appears that AT and T has increased its rate in the face of new competition. "It has been claimed that development time for some PBS's has declined to one year, whereas before competition it took six years" (idem). In Selective Competition in the Telephone Industry by R. Stone, M. Schankerman, C. Fenton, T. Plus E Inc. Cambridge, Mass, 1976, these authors have said: "in the period prior to terminal equipment competition, Telco innovation performance was lethargic" (page 22). And they continued by enumerating a partial list of new products or services introduced by outside interconnectors including modems, teleprinters, cathode-ray tube display terminal, telephone answer-record devices and toll restrictors. Dr Welch (op. cit., page 2) concluded in the same fashion: "some of the new entrants also appear to be innovative, especially in the data transmission market where the technological base may be greater than it is in the interconnect market". Finally is said (idem, page 3): "it can be concluded that the new competition has had a beneficial influence on technological progress in the telecommunications industry". Professors Trebing and Melody in Regulation and Entry abound in the same sense: "the beneficial effects of liberalized entry (whether actual or potential) have been substantial.

New services have been introduced, customer options expanded, constraints relaxed, and many traditional practices have been either overturned or reexamined." (page 111). Finally, the FCC in its Docket 19129 summarizes as follows the intensified competition in the equipment market:

a) common carriers have dropped prices on various subscriber terminal equipment; (see the next sub-section)

b) carriers have emphasized a reduction of the cost of manufacturing equipment exposed and vulnerable to competition;

c) carriers have broadened, extended and expanded the number of features in terms of the various pieces of equipment, particularly in key systems and in PBX's;

d) market competition now dictates product retirement;

e) competition in research and development has intensified;

f) product life cycle has been reduced from seven years to approximately one year;

g) carriers and their manufacturing affiliates have found it essential to emphasize marketing functions.

Even if these quotations give us the impression that all the observers conclude positively about the introduction of competition in the telecommunications industry, this is not the case. In fact, many questions were raised about the innovation rate in the industry. For example Chairman Wiley of the FCC said at least twice (quoted in Rostow, opt. cit. pages 27-28) that he was "disappointed by the failure of some specialized carriers to fulfill their promise to provide new and innovative services". Also (page 55), Rostow said that even if the FCC has made findings to the effects that competition increases the rate of innovation in certain decisions, it has found surprisingly few technological innovations to support its claim.

For Welch (opt. cit. page 8), "... new entrants especially in the interconnect market have not been technically innovative". Some others questioned about the relative benefits compared to the relative gains of liberalizing barriers to entry. For Rostow (opt. cit. page 3): "in my opinion, the policy allowing competing carriers interconnection with the network has been largely instrumental in bringing about the present crisis in our telephone industry...". Finally, some authors questioned about the rythm of entry in the industry. For example, Welch noticed (page 9) that a number of interconnect firms have already failed. And, he advocated the idea that "this lack of stability may be a factor that, in part, accounts for the lack of technical innovativeness by many firms in this market". Finally, Trebing and Melody in "Regulation and Entry" opt. cit. page 102, wrote "if one assesses the pattern of entry in the post-Carterfone-MCI years, it is evident that after an initial period of fanfare, realized has been a flatering and hesitant process".

Two important conclusions can be deduced from the above quotations. First, it appears that the liberalized barriers to entry have introduced some relative innovative competitors in the industry, especially in the data transmission market, but that their survival is not so certain. It appears that both the FCC and the competitors have not realized that there exist other economic and structural barriers to entry, which are still present even after the legal barriers are removed. (See the next sub-section for more details and also Section 5). Second, AT and T reacted to competition in both legal and economic (pricing and "innovative" services) terms, which gives evidence to the argument that AT and T is more concerned with potential rather than effective competition. In terms of regulation, it appears that an important challenge to the FCC is to set appropriate rules and incentives for permitting and eventually increasing both potential as well as effective competitions.

4.2.2 Structural and Economic Barriers to Entry

The above comments have pointed out that even if the FCC has reduced the legal barriers associated with interconnect and intercity services, there still does exist some other barriers which are such that the

impact of the FCC decisions relating to entry have not been as important as it was initially expected. It has been noted that these results can be a reflection of the manner by which the industry was regulated. Welch (opt. cit. page 8), for example, has noted. "Even without being very efficient, a new entrant is able to undercut AT and T because of a regulated rate structure built up over the years with the approval and guidance of the regulatory commissions. Because the new entrants are able to compete effectively on a price basis, there is no reason for them to be technically innovative...". This quotation implicitly refers to the cream-skimming argument advanced by the carriers to object to the competition in this industry. But here it is used as an explanation for illustrating why the competitors have not been innovative, especially in the interconnect market.

Apart from this reason, one can identify five significant economic and structural barriers to entry which confront the existing and potential entrants in the industry (see Trebing and Melody, opt. cit., pages 107 to 110):

1. the industry structure in the U.S. which is characterized by a holding form of organization. In such a setting, new entrants can be admitted under conditions that severely limits their freedom of action, for example the need to contract for utilizing the local loops;

2. the profits of new entrants must be plowed back for growth and marketing efforts rather than put into product innovation;

3. the new entrants are dependent upon an administrative-judicial process both for entry and for expansion, e.g. Court decision on MCI's Execunet;

4. the continuing confrontation between the state commission and the FCC; and

5. AT and T's reactions relating to entry both in terms of product and service differentiation and price strategies.

5. Pricing Policies in the Telecommunications Industry

5.1 General Pricing Principles

In the preceding section, a description of how the FCC allowed competition in the interconnect and intercity markets was provided. An evaluation of this new policy also has been made in relation both to companies reaction to entry and the stated objectives of the FCC. It was concluded that potential competition was probably as effective an instrument as real competition for motivating the common carriers to adapt themselves to the needs of the small and medium size customers. However little has been stated about pricing strategies both from a carriers' and commission's perspectives. The pricing of services and various barriers to entry are two sides of a coin. Pricing is as important an instrument as entry.

The section is organized as follows. We first review the pricing principles which prevail in a completely regulated monopoly environment and those which occur when competition is introduced. The following sub-section discusses pricing policies suggested and often applied for pricing competitive services. Finally, experiments applying usage sensitive pricing in three areas of telecommunications are reviewed and evaluated in a last sub-section.

5.1.1 Monopoly Context

In a world of complete monopoly structure, determination of a price structure cannot be dissociated with the fact that the common carriers are regulated according to certain established principles. In fact, the adoption of a specific price structure is the second step in the regulatory process, the first step being the determination of the utility's total revenue requirement. In calculating the revenue requirement financial record of a historical test year is often used to calculate accounting revenues, expenses, net investment and rate of return on capital. On the basis of this revenue requirement rate increases or decreases, expressed in revenue terms, are ordered. The implementation

of specific rate changes is generally left to the carrier. In addition, this same framework of analysis is used for allocating AT and T's costs and revenues among regulatory juridictions and for regulating revenue requirements in the other public utility industries.

In a complete monopoly regulated context, tariffs are priced on broad, aggregate service categories on one hand, and the telephone companies are primarily interested with overall return on net capital investment instead of being concerned with the particular rate of return associated with a particular piece of equipment, on the other hand. In this specific context of regulation, three broad principles pricing are applied by the carriers: price averaging, service differentiation and service prohibitions:

a) price averaging: averaging involves charging the same rate for a service when the costs of supplying various customers differ in a some significant respect. When applied to major nationwide service classifications, rate averaging has the same characteristic as the revenue requirement in that it represents aggregations of many different prices and quantities of different types of services provided in different locations under widely varying circumstances. For example, in exchanges where total telephone count falls within a given range, customers are charged the same rate for local service even though costs may vary substantially. Long distance messages are priced on the basis of distance covered and of the time of calling, even if costs vary considerably depending upon for example, traffic density. It should be noted that the carrier's fear that the new entrants would only enter markets where traffic was heavy and profits very high is a result of system wide rate averaging. In "An Economic Framework for Policy Action in Canadian Telecommunications", in Telecommunications for Canada, op. cit., C. Beigie (page 127) suggests four possible explanations for price averaging. First, averaging may be necessary because it is impractical to measure variations from the mean. Second, many of the decisions affecting the cost of supplying service to specific customers are based on system considerations over which the customer has no control. Third, averaging seems to meet criteria of non-discriminatory conduct in a legal

or social sense, and four, price averaging may increase total revenues of telecommunications carriers. Another reason which Beigie does not consider is the existence of external economies can justify cross-subsidy when it takes the form of rate averaging;

b) service differentiation: differentiation involves charging different rates for services which may of may not have similar costs. Carrier charges what the traffic can bear i.e. standard value-of-service approach. For example, the local business telephone service charge is substantially higher than the one for the local residential service. Taking the price averaging into account, service differentiation permits the carriers to recoup marked differences in cost. It also provides a means for the carriers to earn different rates of return on individual service offerings by exploiting the variations in demand elasticities;

c) service prohibitions: telephone companies have provided what they term end-to-end communications service. In case the subscriber wants to attach foreign equipment to the telephone network for example, he losses the right to telephone service. This policy was approved by filed tariffs before the regulatory agencies.

These general pricing principles raise a certain number of policy issues, in regard to the objectives pursued by a tariff structure. For example, both price averaging and service differentiation may have a negative effect in terms of the degree of efficiency with which resources are employed since they do not reflect their proper costs, especially as the subscribers can abuse of the network. Moreover, price averaging does channel income from one group of customers to another, and perhaps from the customers to the owners of the company. A service differentiation principle can permit the achievement of an objective of financing the basic service by those which are more able to pay of those for whom service is a luxury. A second issue concerning this principle relates to structural conditions in telecommunications industry: existing carriers can limit entry e.g. attempting to bid away existing rivals' markets by financing the competitive services by the monopolistic ones. Finally, strict prohibitions preclude competitive entry at any

stage of the telecommunications process thus preventing the introduction of cost-reducing innovations in the industry, except by the carriers themselves.

5.1.2 Competitive Environment

The environment of a regulated monopolist offering all the services ceased with the Carterfone and the MCI decisions, decisions which enabled competitors to interconnect foreign of equipment to the telephone network and permitted the construction and ownership of private line networks. The FCC reduced service prohibitions which have characterized the tariff structure in the monopoly context. Consequently, the common carriers are now confronted with unregulated competitors and, at the same time, are still regulated on the same basis as previously. Telephone companies are still obligated to supply monopoly services such as basic service. It is evident that the philosophy underlying the pricing of the various services has envolved in accordance with deregulation. The telephone companies, the FCC and the state commissions are attempting to establish new pricing guidelines, even if motivations are quite different. Even though no unanimous consensus has emerged, it appears that most of parties agree on three principles: first, to substitute cost-of-service for the value-of-service approach, second to substitute tariff unbundling for a price averaging i.e. price all components in accordance with associated costs; and third, to recognize explicitly that the basic service has to be financed by the more elastic ones through rules ensuring the appropriate degree of cross-subsidization achieved or guaranteed. These principles are clearly contrary to those retained in a regulated monopoly environment. Although the new competitive environment is certainly the main reason for explaining this change, two other reasons may also be important. First, technology has envolved to permit metering usage more cheaply and second, the inflation combined with regulatory lag.

Even if many regulators recognize the necessity of presenting costing study for various services, there is no consensus on whether costing studies should be based on an embedded (fully allocated) costs or long-run marginal costs, and what form(s) the tariffs should be

taken. The FCC still advocates the fully distributed cost as the only valid basis for pricing the various services but, some state commissions e.g. New York Public Service Commission, advocate long run incremental costs approach as the only valid method for pricing. In other respects, AT and T has advocated the use of the so-called inverse elasticity rule together with the long run incremental cost as a rationale for its new pricing proposals. The main problem with cost-of-service approach concerns the assigment of the common costs. Some state commissions for example force the regulated companies under their control to adopt a two-tier pricing approach for terminal equipment charges while others object to this type of pricing. However, in those state commissions which have revised to a significant degree their tariff structure, a non-linear (e.g. two-part or multipart tariff) schedule has been adopted. For example, directory assistance charges have been adopted compared to linear or flat rate schedules. Even the FCC has held an inquiry on the application of multi-schedule rates for the Private Line service.

The discussion about the various possible forms and basis for tariffs also have another interesting implication, namely that the industry and the regulators have engaged in a reexamination of various objectives and roles that can be associated with the tariffs. And in this context it is not surprising to note emphasis on the capital attraction function of the tariffs, or rational use of the network, or redistributional impact of the tariffs, or that rates must be designed that they be easily understood by the public and administered correctly and impartially by the company. The consequences of such a debate will undoubledly be a compromise among the various functions that pricing of services should achieve.

5.2 Competitive Services Pricing

5.2.1 Intercity Services Pricing

A large portion of the intercity telecommunications market between major metropolitan areas is now subject to competition by the relatively newly specialized communications companies. This has emerged

because of steps ~~limitated~~ initiated by the FCC to foster market entry. The Above 890 Decision, the MCI decision and the creation of a new class of carriers, namely the specialized common carriers are testimony to this. Recently, the Court of Appeals has ordered AT and T to provide interconnection for the MCI's Execunet service. The common carriers were opposed to competition for many reasons but they argued that new competitors would enter only lucrative markets where excess profits exist and leave the unprofitable markets for the regulated common carriers. It is the so-called cream-skimming argument which is a reflection of the rate averaging approach so far utilized by the carriers. By electing to serve only the most profitable routes, these carriers are able to price services considerably below the average prices for similar services provided by the telephone common carriers.

AT and T's reaction to this threat of competitive entry was vigourous in terms of both services offered (WADS, WATS, Dataphone) and price response. The Bell System's price response was to drastically alter the structure of its private line rates by introducing its TELPAK (A, B, D, D) rate classification for private line service. TELPAK provided significant quantity discounts for the purchase of packages of circuits between two points instead of the purchase of private lines as individual circuits. Also, AT and T has filed a tariff revision with the FCC for a "Hi-Lo" rate structure for intercity private line voice grade services. This appears to be AT and T's first departure from nationwide rate averaging (Welch, op. cit., p. 32). Finally, Bell is definitively engaged in the development of long-run incremental cost approach for pricing.

These price responses were not introduced without problems since they were not acceptable to the FCC or AT and T's competitors. For example, the Commission disallowed many of the discounts included in the various TELPAK tariffs on the grounds that the services furnished under this heading and those furnished under other private line tariffs were "like" communications services and therefore there were no significant cost differences between furnishing a number of channels to one customer under TELPAK as opposed to furnishing the same number to more

customers under ordinary private line tariffs. Consequently, TELPAK was considered discriminatory. Also, the Commission concluded that there was no competitive necessity for TELPAK A and B since private line tariffs were reasonably competitive with the cost of private microwave systems. Also, the Commission argued that the full distribution of historical cost should be the sole criterion for pricing. This philosophy was presented in the request made by the FCC in 1965 and it required Bell to perform a "seven-way cost study" which was essentially a fully-allocated embedded-cost study of all interstate services based on relative use of all equipment and facilities. Competitors were afraid that AT and T would use its monopoly power to subsidize competitive services through selective price cuts. MCI, for example, believed that if AT and T used existing facilities, then rates should reflect the costs of existing facilities as well as the incremental expenses of providing the service. It should be noted that these "preoccupations" of MCI can be understood in the light of the FCC study (Docket no. 16258) which indicated that Bell had been pricing substantially below cost in markets where potential competition existed and above cost for monopoly services.

The introduction of competition into both the intercity transmission market, and the terminal equipment has implications that necessitate reevaluation of the current separations procedures, current revenue settlements or division of revenue procedures and rates charged for the various services in both the state and interstate juridictions. In effect, the following issues are underly previous discussion of permitting competition into these markets, issues for which there is no clear consensus:

a) to what extent should the existing common carriers be allowed to abandon their rate averaging in specific markets to compete with specialized and other common carriers?

b) how much protection should be given to the new specialized carriers and what form of protection should this take assuming that the FCC desires the "existing carriers to compete fairly and fully in the sale of specialized services"?

c) what should be the proper basis for costing the services and consequently for defining cross-subsidy?

It is evident that these issues are intimately related. Moreover, they are also related to the provision of newly competitive services e.g. data transmission and to fostering competition in other markets, e.g. in interconnect, and alternatively the manner by which common carriers are regulated. Some of these issues as examined in the following sub-section where the pricing problems in the competitive interconnect markets will be reviewed. It is important to note that the resolution of the problems in this market parallel to a certain extent those discussed in the intercity service context.

Underlying all of the aforementioned issues is the fact that barriers to entry and prices are tied together. (In Appendix B at the end of the report, a formal model is presented which attempts to determine a pricing strategy for the monopolist that will prevent entry in the regulated industry. It is demonstrated that if the monopolist selects a price-output vector which is in accordance with the "inverse elasticity concept", then its profits are equal to those permitted by the regulators, and furthermore"it will be rewarded by protection from the threat to entry" (Baumol, Bailey, Willig, A.E.R. June 1977)). From a public policy viewpoint our analysis suggests that the public interest (or social welfare) is best served by encouraging a monopolist to price in anticipation of entry rather than in response to it. That is, "the monopolist should be encouraged to set prices and output that are socially desirable in the first place, knowing that otherwise entry may threated, rather than changing his prices case by case every time entry seems imminent or actually takes place" (idem).

5.2.2 Terminal Equipment Pricing

5.2.2.1 Residential Telephone Sets: Tariffs and Installation Fees

In the previous section, many examples were given to illustrate the FCC's move toward more competition. In many respects, the

FCC's efforts and industry reaction to regulation versus deregulation is best illustrated by the current dispute over terminal equipment. For example, the U.S. Supreme Court has recently upheld a FCC rule which required telephone utilities to allow customers to interconnect their phone to the telephone network. In previous Carterfone decision, solely the business customers could attach a variety of terminal apparatus to the telephone network. The present decision extends this possibility to residential customers.

The decision of the Court had at least four implications:

a) freedom of choice: some companies such as Rochester Telephone Corporation offered their customers the choice of buying already installed telephone equipment, or as in California, have expanded the number of customer-owned equipment which can be attached to the telephone network e.g., extension telephones, private branch exchanges (PBX), key telephone systems. It should be noted that since 1975, the California Public Utilities Commission has allowed interconnection of such devices as recorders, answering machines and call diverters to the telephone network if such equipment met some prescribed standards;

b) tariffs revisions: utilities, among them 20 AT and T's subsidiaries, must file requests for rates to fit the new system. As a result, telephone companies have submitted proposals for reducing both the basic monthly charges and the extension phone charges: reductions change between 55 to 70 cents. For example, Northwestern Bell Telephone Company in Nebraska asked for 55-cent reduction both in the cost of dial service and extension phones, and a 70-cent reduction for push button phones. New York Telephone Company and Illinois Bell Telephone Company requested 70-cent reduction in the basic monthly charge. The same is the case for the Central Telephone Company of Florida. Also, Chesapeake and Potomac Telephone Company have asked for a reduction of the residential customers of 65 and 70-cent for basic monthly charge and a reduction of $1 for touch-tone telephone set. It should be noted however, that this company has also asked for the permission to charge $30 for a service call to homes with customer-owned equipment

but nothing otherwise. Finally, the Rochester Telephone Corporation, where only 350 out of 24,000 customers have declined to buy their set at a cost between $20. and $25., has asked equipment owners to pay $7. per month for access to the telephone system and to pay for repairs based on costs;

c) multipart installation fees: telephone companies have modified their installation fees for nonrecurring or one-time charges. The companies have not asked for eliminating all charges but in fact are permitted to charge for wiring, maintenance, testing and some associated costs. Historically, these charges were not intendend to cover costs and in fact those costs were recovered through monthly rates. Now mainly because of increasing customer mobility together with increasing labor rates, these costs have increase dramatically. Also, many companies have recognized the need to put the increasing costs on those customers rather than averaging costs among all customers. The consequence is a multipart non-recurring pricing structure which has resulted in: 1) higher charges; 2) greater regulatory justification; and 3) relating various charges with the work functions actually performed. For example, five elements and their approximate relative costs can be identified (taken from L.M. Schmidt, Analysis of Communications Utility Rating Structures, Pricing Plans and Programs, paper presented at the NARUC Annual Regulatory Studies Program, Michigan State University, July 1978):

1. Service ordering charges which cover work done in receiving, recording and processing information necessary to execute customer requested service. The respective charges for residential and business service are $15. and $20. for the initial service ordering and $9. and $12. for the subsequent ones.

2. Line connection charges which apply to work done in the central office and outside plant facilities to make the facilities workable to the customer's premises. These charges are $4. for residentials and $5. for business.

3. Premises visit charges which cover travel costs required to perform work functions within the customer's permises. The charges amounted to $7. for both classes of customers.

4. Wiring charges which apply to work done to install, extend, or wire and associated connecting apparatus. The standard wiring charges are respectively $10. and $15. for residential and business customers; pre-installed wiring charges are $25. for the private customers and zero for the business.

5. $2. for station connection charges which apply to work performed at the customer's premises to install, move or change a telephone or other single line terminal equipment.

d) monopoly and competitive markets: the regulated telephone companies must now operate in an industry subject to more and more competition but, at the same time, they must still supply a monopolistic regulated service, i.e. the local service. Consequently, the telephone companies are looking for a new pricing philosophy, e.g. the two-tier, for pricing equipment facilities and services. Also, this simultaneous presence of both kinds of markets raises the cross-subsidy problem of financing competitive by the monopolistic services. These two issues are examined in the following sub-section.

5.2.2.2 Two-Tier Tariff Philosophy

a) Examples

Subsequent to the introduction of competition at the terminal equipment level, state commissions and companies have looked for new pricing schemes to cost utilities' equipment and services. For example, some years ago, the New York Public Service Commission approved a request for a two-tier rate design for the New York Telephone Company for PBX service. The two-tier tariff essentially consisted of a fixed A rate design to recover capital costs and a variable B rate designed to recover current operating expenses plus taxes. Under the company's proposal, the customer was guaranteed the PBX service over the 15 years

average service life of the equipment. During the first 6 or 7 years, the customer paid the monthly tariffs A and B and after this period only tariff B. From time to time, the Tier A could be increased to reflect increases in the acquisition and installation costs. However, the increases would, in all cases, apply to new customers only, customers whose contracts predate Tier A rate increase would continue to pay the prices specified in their original agreement. This is not the case for the Tier B rate. Because operating costs are subject to change as price levels change generally, this rate is variable and can be changed from time to time subject to commission approval. It must be noted that even if all Tier A payments have been completed, title and ownership of the equipment, even though located on the customer's premises remain in the telephone company.

The introduction of this pricing philosophy was not without problems. In effect, for the competitors of New-York Telephone Company in the PBX market, Tele Resources Inc., this tariff design was anti-

a) two-tier tariffs were derived from articicially low investment figures based on unjustified assumptions;

b) the tariffs did not provide a security against underestimates of future costs used in the calculation of the A rates;

c) the tariffs discriminated against PBX customers who take service at different times;

d) the tariffs failed to provide for an explicit statement that the A rate was subject to modification by the commission;

e) the proposed two-tier tariff would not for the above reason be compensatory.

The Commission noted that there was a very high probability that the two-tier rate would not only be fully compensatory but also would

make a substantial net contribution to meet the revenue requirement of other services. Accordingly, the Commission found that the rates would be compensatory.

Even if the competitors did not succeed in preventing the application of the two-tier tariffs in New York state, they had more success before the Massachussett Supreme Court. Intervenors in a New England Telephone and Telegraph Company case before the Rhode Island Commission argued that the implementation of two-tier tariff pricing in the PBX market would result in the elimination of competition in this market. The Commission found the following points noteworthy:

a) the company's present market position,

b) whether the two-tier concept was exclusionary in nature thereby artificially perpetuating its market position,

c) the nature of the two-tier offering,

d) applicable case law interpreting the anti-trust laws.

The Commission found that the New England Telephone and Telegraph Company's position in the PBX-Centrex services, key systems and interconnect voice services market one of dominance. It also found no authority which would exclude the telephone company from using marketing concepts which were in common usage in competitive markets and are currently used by competitors. Consequently, the Commission found no discrimination in the modification of the A rate at different times. Finally, it found no discrimination in relation to the telephone company's other customers because it is inherent in all utility rate structures that there are rate differences between different categories of customers. However, the Commission rejected this pricing philosophy, at least as it was proposed. Moreover, the Massachussett Supreme Court has affirmed an order of the state's department of public utilities which rejected a tariff filling based on a two-tier plan of the New England Telephone and Telegraph Company for a Dimension PBX. The Supreme Court rejected those plans as being unduly discriminatory because the service could create cumulative revenue deficiencies over longer periods of time, such that overall state wide rate of return adjustments

might be necessary to recover the deficiencies. Also, the Court was afraid of cross-subsidization of this service by the others when a) the department authorized a general increase in the Company's rate of return; b) when income taxes rise; and c) when changes in depreciation methodology produce losses.

In summary, taking these aforementioned experiences into account, it seems that the regulators have placed the regulated telephone companies and their terminal equipment customers at a distinct disavantage relative to the newer competitors. Among reasons for justifying this assertion are the following:

a) the regulators have given preference to the position of the competitors on such issues as two-tier pricing and the pricing of terminal equipment;

b) the regulators have diluted the advantages to customers of two-tier tariffs by asserting the right to modify the fixed portion (Tier A rate) of the tariff. Such was the case for the New England Telephone and Telegraph Company which asserted the commission's power to change Tier A rates at any time, including Tier A rates for existing customers. In contrast, in the case of the Chesapeake and Potomac Telephone Company, the company was ordered to file new Tier A rates at least annually for prospective application to future customers only;

c) the two-tier pricing has been largely limited to situations where stand-alone customer premises equipment is involved. This pricing concept is now only being applied to new service offerings, and is not being retroactively applied to existing services. Thus, the plan is not available to users of older type key and PBX systems, nor is it available to any Centrex customers;

d) AT and T has argued that unrestricted attachment of subscriber equipment would render economic harm to operating telephone companies, implicitly assuming that competitive subsidized monopoly services. This argument has been found correctly by some state com-

missions. But investigations by the FCC and by several state commissions including the New York Public Service Commission found that cross-subsidization moved in the other direction: revenue from monopoly markets subsidize the competitive terminal equipment market.

b) Cross-Subsidy

The previous two cases exemplify the fact that one of the main issues behind the discussion and application of a two-tier tariff philosophy was the cross-subsidy issue. However, this very complex issue has never been properly resolved, mainly because there does not exist a unique definition of cross-subsidy on one hand and because some separation rules must be retained on the other hand. For example, some writers and regulators have advanced the idea that subsidies of the terminal equipment can be found to exist because of one or more of the following reasons:

a) terminal equipment rates are set below the fully allocated cost of services;

b) terminal equipment rates are below the current replacement costs;

c) terminal equipment has been found to be subsidized by calculations which eliminates certain services and rate elements which produce substantial contribution and which, if included in the calculation would not have shown that the cross-subsidization conditions were satisfied.

For example, the New York Public Service Commission found that the New York Telephone Company's revenues from its terminal equipment offerings fell dramatically short of covering both embedded costs and current costs. And, it seems (see Kahn, Applications of Economics to Utility Rates Structures, Public Utilities Forthnightly, Jan 19, 1978) that the preponderant portion of this huge revenue deficiency was covered by interstate separations; every time an operating company installs a new switchboard, something like 20% of the capital charges are allo-

cated to interstate services under current separations methods. The result is that the charges for interstate usage were grossly inflated by nearly 40% according to AT and T estimates (1974 data).

Consequently, the cross-subsidy issue can be summarized by the following questions: should a fully distributed or a marginal cost approach be advocated. Second, which separating rules should be employed? Both questions are very complex because of the monopolistic/competitive environment and the FCC's goals.

At one extreme, one finds the proponents of the fully distributed costs. For example, the Common Carrier Bureau Chief stated in docket 18128 that "the results of fully distributed costs constitute the only valid basis upon which the Commission can effectively evaluate Bell's justification of its proposed rate structures". In addition, the proponents of fully allocated costs believe that it is fair that each service pays some fair share of the common costs of the business. But as nobody has a clear criterion for fairness, the regulatory commissions must make decisions without analytical guidance. Finally, those in favor of the fully allocated cost test appear interested in cost-rate relationship for individual service. But only broad service categories, such as "basic exchange" are considered. Thus, if a fully allocated cost test discloses that "basic exchange" is subsidizing "vertical services", the implication is advanced that <u>all</u> classes of basic "exchange" service contribute equally to that subsidy.

At the other extreme is Bell's long run incremental costing approach. Under this approach, the net contribution over-directly assigned cost from non-basic services, including terminal equipment, is to be maximized, i.e. the price to be charged is set on the basis of a contribution maximizing analysis: the (price-quantity) level which produces the greatest contribution toward meeting corporate common costs. In this spirit, the Missouri Public Service Commission has admitted that the appropriate approach for tarifying the service is the cost-of-service approach. It ordered South-Western Bell Telephone Company to segregate it services into three categories: competitive

services, basic consumer services and other services. It also required that an econometric analysis be applied so that:

a) competitive services generate the largest practical level of contribution to the joint and common costs and to basic services;

b) the third category of services be priced in a way to provide contributions to the basic consumer services taking certain social and economic considerations into account. Then rather than allowing what the traffic can bear, the commission will make sure that appropriate social and consumer economic factors are taken into account; and

c) the basic services be priced to recover the residually required revenues.

The New York Public Service Commission also advocated the philosophy that terminal equipment be priced at current costs, costs which may be taken as a proxy for marginal cost (especially in the absence of economies of scale). In addition to economic efficiency, the Commission took into account the higher elasticity of demand for these services. But since all rates cannot be set at incremental costs without violating the total revenue requirement,"economic logic would argue that for setting rates for more elastic services at that level, using the revenue surplus (a) to subsidize truly basic service, the demand for which is almost certainty less elastic, and (b) to enable rates in the long lines part of the business to be priced downward toward marginal costs, if it is genuinely the case that the situation here is still one in which marginal costs are below average revenue requirements" (Kahn, A., Applications of Economics to Utility Rate Structures, Public Utilities Fortnightly, Jan 19. 1979, p. 15). The Commission accepted the social policy of throwing more of the burden of revenue requirements over to interstate usage that can be justified on incremental cost principles as a means of subsidizing the availability of telephone service on as nearly a universal basis as possible.

Finally, it may be worth mentioning that Senator Hart speaking at the North American Telephone Association Congress (Washington, Sept 77), stated that the Communications Reform Act would sanction, for the interconnect industry market, the incremental cost pricing approach.

The previous examples should not give the impression that most people advocate the long run incremental analysis as the basis for pricing the services. Professor W. Melody for example in Interservice Subsidy: Regulatory Standards and Applied Economies in Essays on Public Utility Pricing and Regulation, Trebing editor, Michigan State University, 1971, has presented arguments rejecting the incremental analysis and advocates fully distributed cost as the principle of service pricing, given the present regulatory mechanism in the telecommunications industry. For Professor Melody, "what is needed for decision making by both management and regulator are specific models based upon an understanding of the particular characteristics of the industry and its market" (idem page 210).

Before leaving the subject of fully allocated cost versus incremental cost analysis, it is worth mentioning that the implementation of long run incremental cost pricing is still a long way off. Among the reason for this, one can mention the following three (see Selwyn, L., Pricing Telephone Terminal Equipment under Competition, Public Utility Forthnightly, Dec 8, 1977):

1) the long run incremental analysis implies a profit maximization objective; but this attitude is inconsistent with the very foundations of public utility regulation which are such that the company be allowed a "just and equitable rate of return on its rate base";

2) long run incremental analysis requires precise estimation of the demand curve faced by the telephone company for each category of service. But the estimation of a demand function cannot, with the existing information, be made by anything much "above that of an educated guess";

3) finally, the requirement that incremental avoidable cost be accurately determined requires that different costs be determined for new and for existing customers, and that such differences then be reflected in the ultimate rate policy. For example, Bell has used the current replacement cost as a proxy for the incremental cost of pricing the new customers, and avoidable cost for pricing the existing ones in view of recognizing three kinds of costs:

a) nonfugible capital cost of installation whose value only exists if the investment is used to provide service to the customer for whom it was installed;

b) fungible capital costs: costs which could be transfered to a new customer should the existing customer discontinue his service at some future date. The mechanism for implementing such a policy is known as "vintaging" of rates, with different rates applying dependent upon the date or original installation. This policy exists in numerous forms throughout the U.S. most commonly referred to under the rubric of "grandfather" tariffs;

c) recurring noncapital-related operating expenses which would persist at prevailing price levels, as long as the customer continues to receive the service.

Even if one recognizes these difficult problems for applying a marginal cost approach to pricing terminal equipment, and in fact, other competitive services, it is fair to state that this approach is being proposed and more often tried in an increasing number of U.S. states.

5.3 Usage Sensitive Pricing

5.3.1 Timing Single Message

Three main reasons have created incentives for the telephone companies to make their rates more usage sentisive. The first

is that in the 1950's and 1960's, the companies were engaged in massive investment programs for satisfying a growing demand, i.e. an increasing use of telephone service by existing customers. The consequence have been an increase in cost, but, since local telephone services was still provided mainly on a flat-rate basis, there was no corresponding increases in the revenues. Also rates were for the most part designed using broad averages, where such averaging had not reflected usage or time-of-day cost factors. The second reason is the emergence of new technology in the data processing which has opened the way to pricing schedules with greater selectivity in determining customer charges according to actual service provided by that equipment. But note that the cost of metering is not zero: this cost must then be compared with the potential savings obtained from a more rational use of the network. The third reason is that the Supreme Court has required that telephone utilities allow customers to own their own phones. The new situation has put pressure on companies to review their pricing philosophy. For example, the Bell System has been engaged in a long run incremental analysis for pricing its services.

Usage sensitive pricing in the telecommunications industry can be applied in many possible areas but in particular to the following: timing single message unit calls, peak and off-peak pricing of local calls, charges for directory assistance calls, determining adequacy of residence-business differentials.

A usage sensitive pricing approach permits company to

a) be more responsible in changing consumer environment;
b) account for different calling habits;
c) capture inflation and its impact;
d) maintain low basic monthly service charges; and
e) allocate resource efficiently.

One of the economic functions of the tariffs is to influence the behavior of the customers, in particular in their utilization of the telecommunications network. The price structure must be designed

that the subscribers make a rational use of the facilities, i.e. the tariffs must, in one way or another, directly correlate with costs. For this reason, some state commissions and some companies have introduced studies or put this type of price structure into practice in local service. Note that this new pricing philosophy has been facilitated by the fact that many people have now the opportunity to buy their terminal equipment and consequently, companies must clearly identify the cost to use the telephone network.

The Ohio and California Public Utility Commission and the New York Public Service Commission have permitted the adoption, at least on an experimental basis, a tariff schedule reflecting usage sensitive pricing. Ohio permits the utility to implement rate schedules based upon the distance and duration of each call made. A choice is offered to customers to continue with a (higher than previously) flat-rate pricing. The California Commission approved "time telephone rates"; however the utility must introduce a single-message rate-timing method for those who use the utility's 60 calls a month rate service. The New York Commission has reduced the minimum charging time for intrastate toll calls from three to two minutes, recognizing that the marginal cost of the third minute is positive. It also introduced a day-night differentials for intrastate toll calls and in the charges for local messages. Third, it ordered the New York Telephone Company to substitute for the 50 "free" message units allowance for local service a fixed monetary allowance that would be used up more or less depending upon whether the messages were placed on or off the system peak; and fourth, it ordered that optional service be offered with timing of local messages and a cost-based charge per minute, accompanied by a correspondingly cost-justified reduction in either the basic monthly charge or in the rate for individual messages. It should be noted that the New York Commission has both simultaneously adopted a usage sensitive pricing and peak load pricing approaches (see below). The Missouri Public Service Commission has approved a plan for South Western Bell Telephone Company to study the basic telephone charges; the study will determine the feasibility of basing charges on time of day and week, duration, distance and frequency of calls.

But even if the above examples give the impression that the usage sensitive pricing for local messages is accepted, problems still arise. For example, one can ask for definition of usage? What kind of usage generates costs? Are originating minutes the causal factor or could the termination of calls and usage also generate costs? And, in terms of cross-subsidization, "If one assumes that originating minutes are a proxy of usage cost, it appears that residence customers are being subsidized by business and key system customers. However, if two-way busy hour call are used as the measure or usage, residence customers could be viewed as subsidizing business usage" (see L. Schmidt, op. cit. pages 8 and 9). Of course, these questions are strongly related to the problem of analyzing telecommunications demand. And it is clear that more empirical and experimental studies will be required to give a definitive answers to these questions.

5.3.2 Peak-Load Pricing for Local Calls: New York Experiment

Adoption of a system of peak and off-peak charges for local telephone calls is an application of a usage sensitive pricing principle in the telecommunications industry. The New York Telephone Company embarked on such an experiment in November, 1975. Implicit in this experiment was the fact that local calls vary significantly according to time-of-day and consequently the variations rise to varying levels of the network cost per call. In what follows the results of this experiment will be briefly discussed. These results are taken from "Response of Local Telephone Usage to Peak Pricing" by J. Hopley, paper presented at Michigan State University, July 30, 1978.

Accordy to Hopley, four factors must be considered and evaluated carefully for implementing a peak load pricing approach.

a) the cost factor: this is very important because of the large scale costs which must be incurred to install measuring equipment. The Company spent about 8% of the total construction outlay for that year for implementing usage sensitive pricing, which was

approximately 50-cent per customer, per month;

b) the rate structure and charge levels: essentially the potential difficulties to understand a peak load schedule, the revenues it can generate and consequently the adjustments in the basic service charge for local telephone service;

c) the customer understanding and reaction to peak load pricing: this is a factor which is crucial to the success of this multi-tier tariff;

d) the capital savings from shifted calls: this is an important economic factor because, to the extent that calls are shifted due to peak and off-peak prices, expenditures for future plant capacity will be lessened.

Taking these factors into account, the Company implemented the following two-tier time period in the Downstate New York Metropolitan Area and the Buffalo Metropolitan Area in Nov, 1975. During the week, the peak message unit charge was chosen to be the pre-existing 8.2 cents between 9am to 9pm. The off-peak rate was discounted by 27% to 6.0 cents between 9pm to 9am and applied also to all the week-ends days. The following considerations underlied this rate structure:

a) 8.2 cents was above the peak period embedded cost of the call (6.5 cents) and the price level generated significant contribution to the joint and common costs of the firm to maintain low basic exchange rates;

b) off-peak charge was also above the embedded cost during off-peak periods;

c) the two-tier peak and off-peak rate schedule represented a fairly easy schedule for customers to understand.

With this two-tier tariff structure, and after moving through many study offices, "it can be concluded that the 27% discount on the off-peak message unit charge for local telephone calls placed after 9pm on week days, and on all hours on the week-end caused less than one per cent shift in total load" (page 15). Consequently, no capital construction projects for added call capacity were deferred to future periods. If this were the only objective of peak and off-peak pricing, it is sure that the costs exceed the benefits. But some other objectives were also taken into account, and especially the relationship of price with the cost, the provision of pricing equity, and finally the provision of economic opportunity for shifting calls to the off-peak period. And, according to the author, these three objectives were reached (page 17).

Taking this relative success (or failure) into account, the Company intends to propose an advanced pricing system by introducing a three-tier Peak-Shoulder-Off-Peak schedule employing 60% after 11pm. The results are awaited.

5.3.3 Directory Assistance

A third important area where a usage sensitive approach has been employed for pricing is directory assistance service. Until recently, Telephone users commonly regarded directory assistance as simply a free service that the telephone company has provided. Taking the different calling habits of the subscriber into consideration, increases in the various costs, competition at the terminal equipment level, has created the necessity to revise the non-charge associated with this service. For example, the New York Company estimated this service would cost $100 million in 1975. In 1971, the loaded operator cost of directory assistance to one Bell Telephone Company was $23 million, approximately 50-cents per customer per month. In 1975, it was $40 to $50 million range without including expenses for equipment, buildings and directories (see Zachry Jr. C., Usage Sensitive Pricing for Directory Assistance, Public Utilities Forthnightly, Dec 8, 1977). Charging for directory assistance is part of the Bell Sys-

tem's nationwide strategy to move toward usage sensitive pricing. Also, nationwide studies have demonstrated that about 20% of the customers make more than 80% of the calls for directory assistance. Moreover, more than 60% of the numbers requested from directory assistance were in the telephone directory.

Consequently, because directory assistance service has been supported by all customers while only a few receive the most benefit, flat-rate pricing policies are now considered inequitable by some commissions. For example, a Florida commissioner reflected that the furnishing of directory assistance without charge constituted an unfair burden upon the general body of rate payers in that relatively few subscribers used the service beyond the six calls per month allowance.

One objective of the charge plan was to reduce the number of calls made to directory assistance by encouraging customers to use their directories and personal number sources. And it seems that this objective had been achieved. Certain companies have noticed a volume reduction of greater than 60%. Also, before directory assistance pricing, 24% of the directory assistance calls originated from business customers, and only 20% after this introduction. The Colorado Commission has found that almost any form of nonselective charging plan has a substantial repressive effect on directory assistance calls. It is however important to note that the revenue obtained from the repricing directory assistance are minor in relation to the decrease in expenses when the directory assistance calls volumes are drastically reduced.

Among the various state commissions which have put such a plan in practice, examples are: Colorado Commission, the North Carolina Commission, the Washington Utilities and Transportation Commission, the New York Public Service Commission, the Wisconsin Commission and the Ohio Public Utilities Commission.

The most significant factor associated with the directory assistance repricing plans is the financial impact of the various plans on telephone companies. The various repricing plans put in practice

can be identified by various billing and service parameters. Among them, one can state the following five points:

1) selectivity: full service (i.e. charging only on those requests for number in the directory assistance user's local directory) versus non selective (charging for all directory assistance calls);

2) amount of rate deduction: the per line per month reduction in local service rates specified in the plan;

3) allowance or breakpoint: the number of directory assistance calls that can be made each month with no additional charge or at a reduced rate;

4) charge per call up to the allowance: reduced rate up to the breakpoint;

5) charge per call over the allowance.

In conclusion, independent of the repricing plans, it appears that there exists good deal of consensus among the state commissions and the companies that a world of no-charge for directory assistance will terminate in the near future.

6. Rate of Return Regulation

6.1 Regulation and Competition

Up to recently entry of competitors into the telecommunications industry have forced both the regulators and the common carriers to consider implementing new pricing strategies. It was also noted that the common carriers are sitll regulated while competitors are not. As noted earlier, the determination of a price structure for the various services is only the second step in the regulatory process, the first one being the determination of the total revenue requirement. Recall that total revenue requirement is essentially obtained by multiplying an allowed rate of return by a proper rate base and by adding allowable operating expenses. The existence of this self-financing constraint raises many problems. For example, the common carriers argue that, because of existence of this financing constraint, they will be forced to price their monopolistic services substantially higher than marginal costs if competition imposes that they priced their competitive services at that level. Also, some of the powers which are currently in the hands of the regulators to determine revenue requirement will have to be reevaluated due to the existence of competition; e.g., depreciation expenses are a prerogative of the regulators, but with the presence of competition at the interconnect market level, these expenses will be more and more dictated by the market forces. Most writers and managers agree that present rates are too low, but the regulators are in a conflicting situation because they are subjected to pressures to hold down the price of service. Technical advances provide opportunities for cost and service advantages but, at the same time, threaten to shorten the useful lifes of terminal and transmission facilities. Thus, an historical approach to depreciation tends to delay the implementation of new technology, to pass greater costs to future customers and ultimately to create injustices in the new competitive/monopolistic environment. Moreover, it has been suggested that revenues, costs and investments associated with the unregulated activities of a local common carrier not be considered in the de-

termination of the rate levels for the regulated services provided by that carrier. Finally, it can be noted that some authors (like R. Alden, opt. cit. page IV-6) have suggested that the process by which a "reasonable rate of return" is defined be simplified: for example, a procedure would be to "pegged" lower and upper limits of "reasonable rate of return" to one or more national economic statistics. Consequently, as these examples show, the historical process of regulation was behind the facts and comments stated in the previous sections of this report. One important question remains:the FCC would like to increase competition in the telecommunication, what form should regulation take? Even if it is an important subject, it is fair to say that not too much has been written on this subject, (except by those who suggest complete deregulation). The Telecommunications Policy Task Force and Mr. Alden have briefly tasked the subject. It is clear that more studies are needed on this important subject.

The object of the present section is more limited: recent rate hearings dealing essentially with the treatment and computation of the rate base and of the rate of return for the common carriers are reviewed.

6.2 Regulation and Inflation

The regulatory process is being revised because of the liberalized barriers to entry in both the intercity and interconnect markets. But this process is also subject to criticisms because of the very high rate of inflation and the increased importance of the regulatory lag. For example, since 1964, the yield on utility bonds has doubled going from 4.5% up to 9.2%. Also, the average common book equity is almost the same, i.e. 11.4% which consequently means that the real rate of return has gone down. Consequently, the utility's stock prices has felt of 50% and the price-earnings ratio, market to book value and the interest debt coverage ratio, all have fallen off by 60%. (These data are taken from D. West, "Adjusting Rates to Cost of Capital", Public Utilities Forthnightly, Sept 15, 1977). Also, because of the existence of more and more

pressure and informed groups of customers, delays in the tariff revision are becoming more and more important, which in turn means that the current form of regulatory process utilizing adversary proceedings is becoming extraordinarily costly and inefficient for regulating utilities. The commissions can no longer use traditional method of utility rates and charges on the basis of application of strictly determined rate of return to a past historical cost rate base. A further direct effect of continuous inflation on regulation is the necessity for almost continuous rate proceedings. Consequently, some state commissions and companies have tried to suggest new measures, or modification of the old ones, to adjust the rate levels. For example, some state commissions have introduced an attrition allowances in their rates, but some such as the Virginia Public Utility Commission, objected mainly because of the difficulties of measuring the impact of attrition, i.e. the erosion of earnings due to inflation, following a rate determination. In addition, some state commissions are looking for some almost automatic adjustments in the rates, are studying adjustments of the tariffs without going to a full-scale rate cases, are permitting automatic changes in band rates by telephone companies because of growth of exchanges. For example, in 1975, the New Mexico State Corporation Commission put into effect an innovative system with respect to the rate of return. Basically, the system calls for a quarterly check of the public service company's net income to determine if it provides a rate of return on equity (not on the rate base) of 14%, plus or less one percent. If the net income is such that the resulting rate of return is greater than 14.5%, rates are reduced and if the rate of return is less than 13.5% rates are increased. It should be noted, as Kahn and Baumol have identified, that it is regulatory lag, almost alone, that moderates the inherent cost-plus character of regulation, and provides both an incentive and pressure, between rate decisions, for improved efficiency.

The main issues of the recent rate hearings center on rate base computation and especially whether or not to include construction work in progress, the computation of the rate of return, whether or not to include charitable contributions, lobbying expenses, and reason-

able adjustments for known changes after the end of the test period, and the appropriate method of depreciation i.e. the flow-through approach versus normalization. (The normalization approach should require that ratepayers be charged a fictitious tax expense and the excess tax charges are accumulated in a deferred account and flowed back to income over the period of the service life of the property giving rise to a tax liability. With a flow-through approach, the tax savings would be immediately flowed through to operating income that is, the ratepayer would be charged during each year only for income taxes actually incurred by the utility). Most commissions have forbidden that charitable and lobbying expenses be taken into account in the computation of the revenue requirement but most have agreed to incorporate adjustments for known changes, such as wage increases computation. Almost all commissions (a noticeable exception being the California Public Utilities Commission) have retained the normalization approach with regard to accelerated depreciation mainly as a way of generating internal funds. However, deferred tax reserve are treated as interest-free capital in the determination of the rate of return.

6.2.1 Computation of the Rate Base

The rate of inflation has an immediate impact on the value of the plant investment or rate base of the carrier. But surprising enough, little attention has been paid in the rate hearings to the old controversies relating to reproduction versus original cost rate bases. There is a decided trend away from a value or reproduction or even fair type for evaluating the rate base in determining total allowable revenues. The majority of American juridictions insist on original cost rate bases. Of course, this approach is valid only if appropriate compensation is made at the other stage of the rate-making procedure. For example, many state commissions have utilized either the year-end or projected year rate base for coping with inflation. Kahn (in Can and Economist Find Happiness Setting Public Utilities Rates, Public Utilities Fortnightly, Jan. 5, 1978) has stated that the "utility companies and regulators have come to recognize the immensely greater importance that the costs which are reflected in rates are reasonably representative of the circumstances in the (future)

period during which the rates will be in effect rather than of some outdated test year" (page 12). For example, the Main Public Utilities Commission, the Ohio and the Maine ones adopted an historical test year adjusted for known and measurable changes.

The second aspect underlying rate base determination is whether to include construction work in progress. The proponents for its inclusion argue that the company requires funds for financing its construction program, and if not included, this will have negative impact on the cost of capital and consequently on the required rate of return. Opponents argue that by including construction work in progress present customers are financing future subscribers. In other words, this issue carries with it an intertemporal cross-financing aspect. A suggestion has been made as a compromise which essentially consists of estimate the portion of the construction program being undertaken which will satisfy the future demands of the present customers and the portion which will serve the future customers not yet connected to the lines. More informations must be given to the regulators to permit such an analysis. However it appears (see Jones, Public Utility Fortnightly, aug. 14, 1977) that 21 commissions have included in the original rate base of the carriers plant held for future use and plant acquisition adjustments for calculating the revenue requirment.

6.2.2 Computation of the Allowed Rate of Return

The crucial issue in the current regulatory process is the determination of the rate of return that the carrier should be allowed to earn on its rate base. For many authors, only one variable is employed in the rate-making process i.e. the rate of return; for example Kahn (opt. cit) has written that "anything that might be accomplished by altering the rate base can just as effectively be secured by varying the allowable rate of return". Equally for West in Public Utility Fortnightly, Sept. 15, 1977" the most important contribution regulation can make to assist utilities in acquiring required new fund is the determination and allowance ofa proper and adequate rate of return", and "further by adjusting the rate of return, regulatory commissions can increase or decrease

the income of the utility". Finally, Jones (opt. cit.) has noted that "the most important method of compensating for attrition is the proper recognition of inflationary aspects in the determination of the fair and reasonable rate of return". In other words, the fair rate of return, even if it is the most important means, is not an end in itself: it is used to determine the adequacy of earnings. The determination of the rate of return must be strongly related to the cost of capital i.e. the utility must meet the investor's terms if it wants his capital. It then follows that the rate of return (especially on equity) must be allowed to vary with respect to economic conditions and must include the following three components: the pure interest rate, the compensation for inflation and the compensation for risk.

The measurement of the rate or return is of utmost importance. Among the estimating methods suggested are price/earnings ratio, the discounted cash flow method, the equality between the market and the book values and the capital asset pricing method. Many state commissions favor asset pricing method. Many state commissions favor the discounted cash flow method as this method is strongly related to the cost of capital, but some commissions based their decisions on the equality between market to book values using the standard dilution and windfall gain arguments.

Finally, some state commissions have recently modified the allowed rates of return where the evidence pointed to service deficiencies or efficiencies. For example, North Carolina Utility Commission imposed .45 percent revenue penalty upon Norfolk and Carolina Tel. and Telegraph Co. in an attempt to correct a history of inadequate service. Also California Public Utilities Co. reduced the Pacific's revenue requirement because the company has encountered difficulties in completing primary and regrade service orders within reasonable lenghts of time.

In summary, we believe that the commissions will focus their attention more on determining the proper rate of return instead of the other components of the revenue requirement.

7. Summary and Conclusions

7.1 Summary of the U.S. Experiment

Since the Carterfone-MCI decisions, what are the long term implications of allowing competition in the telecommunications industry and, to what extent is U.S. experience relevant to the Canadian scene? Before suggesting some possible answer to these two questions, the highlights of U.S. experience during the past ten years are summarized below.

1. Common carrier reaction: because of effective and potential competition, common carriers have reacted with non-price and price strategies. In terms of non-price strategies, the results have been positive, given that carriers have introduced new services particularly to small and medium-size customers. Concurrently, the carriers have attempted both to introduce or sustain legislation to prevent competition in the industry and to require that the equipment attached to the telephone network meets certain technical requirements specified by them. On the pricing side, the carriers have been engaged in a vast project to price their services and equipment on the basis of incremental costing. It appears that the carriers recognized earlier than the FCC that liberalized barriers to entry were strongly linked to pricing. But, the telephone companies have not met with too much success with this strategy. The FCC has objected to almost all tariff proposals.

2. New entrant attitude: if one evaluates the results of entry of competitors in telecommunications by examining the impact of innovation, results are ambiguous. They are positive for the data transmission market, and relatively negative for interconnection. In addition, it appears that new entrants have elected to serve only the most profitable routes, practicing cream-skimming and thereby confirming the argument preventing entry. It is quite possible this attitude can be a reflection of the price averaging philosophy retained by the companies and the regulators over the years. During this short period of observation, new entrants have

been confronted to barriers of entry other than legal ones and these are certainly more difficult to eliminate, i.e. the economic and the structural barriers to entry. It is then clear that, in a way or another, new entrants have to a certain extent been dependent on regulators for expanding their activities.

3. FCC goals: at the federal regulatory level, even if the FCC did not have any precise idea of the extent to which competition should be introduced, it was definitely engaged in liberalizing entry. Its great faith in the virtues of competition was sufficient motivation for justifying its philosophy. However, on the pricing side, the FCC has been unable to establish clear guidelines upon which the carriers can construct their tariffs. Perhaps this ambivalence reflects FCC's belief that new entrants required protection. Currently discussion centers on fully distributed cost versus incremental costs as the appropriate basis for pricing. The problem is further complicated by fact that there is no consensus between the FCC and the state commission. Carriers cannot be expected to produce two sets of accounts, one to satisfy both the FCC and another for those state commissions which require the incremental cost approach. However, there is consensus that a cost-of-service rather the value-of-service approach should be used for pricing. Also, it is now becomming clear that an "unbundling" tariff's philosophy should prevail. Also, the FCC has explicitly recognized that the basic service should be cross subsidized by the other services provided by the carriers.

4. State commission goals: even if the preoccupations of the state commissions differ from those of the FCC, the latter have been forced to modify their thinking, particularly with the advent of competition at the interconnect level. Moreover, in states engaged in a profound revision of their tariff schedules, most have adopted non-linear pricing schemes, e.g. multi-part tariffs for installation charges, peak-off-peak periods, and directory assistance charges. However, the main issues discussed at the rate hearings relate mostly to components of the total revenue requirement, the treatment of inflation and of regulatory lag, double leverage and the calculation of the appropriate rate of return on a particular rate base. Some state commissions have introduced, on an experimental

basis, novel plans to resolve some of these issues, e.g. the Mexico Public Service Commission has introduced a partial automatic rate increase whenever the inflation rate rises above a predetermined level. More discussion is now centered around the rate of return because it appears that all other issues can be resolved by appropriately manipulating this parameter. Recently, two state commissions have modified the level of this rate, taking the quality of service into account. This procedure can be such that the rate of return would no longer be correlated to the cost of capital. Rate of return regulation provides the regulator with the possibility of reducing all issues to one parameter.

State commissionners have an additional incentive to maintain a total revenue requirement rather than continuously reviewing the rate structure for unlike other industries, e.g. oil. The difference of emphasis comes from the fact that in those industries the main concern is the pricing of a non-renewable resource and in telecommunications the main issue is rather the extent to which the industry should be deregulated Pricing is not so crucial in telecommunications except to the extent that this industry can help to reach society's broader objectives of saving scarce energy resources.

The advent of competition thus has forced both the carriers and the regulators to think seriously about the regulatory environment, for example, regulation's impact on the allocation of resources, objectives of the regulators, and the identification of the various goals which underly each instrument of control, e.g. barriers to entry, tariffs and depreciation policy. Underlying all these issues also is the important question of whether or not it is fair only to regulate carriers. While subject to much discussion, the problem in the U.S. is still in its infancy. More research is required before definitive answers can be obtained.

7.2 Uncertainty of Future

In view of the recent U.S. experience can we come to any conclusions on whether the competitive process should be accelerated or, stopped and

as a corollary, in what direction should enhanced competition in the industry? Any answer to this question, however, must be considered in the context of the uncertainties which face the telecommunications industry:

1. Communications Act of 1978: the telephone industry in attempting to formulate proposed solutions formed a Telecommunications Policy Task Force committee in 1977 to provide to the U.S. Congress a conceptual framework for a telecommunications industry structure. Four alternative approaches were identified:

a) reject competition and establish legal monopoly;
b) react to the existence of competition;
c) accept competition and define its boundaries;
d) plan for full competition.

It is somewhat surprising that the Task Force did not consider a fifth approach consisting of competition and defining a limited monopolistic sector. The draft of the Communications Act of 1978 appears to suggest this approach. That legislation, if it is accepted as it now stands, would have a profound impact in the telecommunications industry in the U.S. For example, one of the important issue is that all intercity services will come under the responsibility of the federal juridiction (contrary to the present situation where only interstate services are under the FCC juridiction). Also two bodies will be created. One will be responsible for regulatory affairs, while the other will study and evaluate the policy problems in the industry (note the analogy with the Bill C-16 in Canada). Also the Act proposes the creation of a Universal Compensation Fund to maintain toll and local exchange telephone services rates at affordable levels. It is clear that a cost separation settlement rule must be used for determining the access cost to the local exchange network. But, more importantly, the Act explicitly recognizes that some services must contribute to the provision of others. Finally, the Act will prevent vertical integration between a carrier and a telephone equipment manufacturer.

2. Innovation process: the rate of innovation in telecommunications will be accelerated in the coming years, posing new problems for the regulators. For example, IBM is a shareholder of a company (Satellite Business Service) which has planned to lauch in 1981 a Hughes satellite. This satellite will no longer need any earth station, solely an antenna on the roof of a building. A new service will be created which completely by-pass the local network. An unanswered question is whether this service contribute to the Universal Service Compensation Fund?

3. New competitors: until recently entrants in the industry were relatively small (both in terms of capital invested and in terms of revenues) compared to AT and T. But it is easily forecasted that other giants like IBM and XEROX will enter into the industry in the near future. IBM will supply the SBS, and XEROX has expressed a desire to create its own public microwave network. Consequently, taking into accounts the financing power and the technical capabilities of these competitors, the telecommuncations industry will be more appropriately characterized by an oligopoly structure rather than by monopoly/competition. And, it is certain that in this new context, it will be more important to ask why the common carriers should be regulated and not competitors. Also given any decision what allowance will be made for a period of transition?

4. Current inquiries: the FCC is currently engaged in four important inquiries: MTS/WATS market structure, computer revolution, telegraph market structure and Unified System of Account. The results of the inquiries will certainly have an impact on the future of the industry.

I would like to make the following comment about the Unified System of Account's inquiry, (comments which are to a certain extent applicable to the Canadian Cost Inquiry Commission). It is my belief that the way of approaching this issue is strongly dependent of the future of the industry structure. For example, if competition increases some issues such as the cross-subsidy will be resolved by the market

forces and no regulation will be necessary. In other words, the kind of data which will be necessary regulating the industry is not the same if the industry is competitive rather than a monopoly one. In the first case, data relating to the forecast e.g. demand, technological advances, etc... would be more appropriate while in the second case data which are currently available will still be necessary.

To conclude it is still premature to try to evaluate the long term impact of allowing competition in the telecommunication industry.

7.3 Implications for Canadian Scene

Three main issues for an appropriate policy for the telecommunications industry have been discussed in the U.S. The first issue was the extent to which competition should be allowed in the industry. The legislator's answer has been that maximum competition must be introduced in telecommunications to ensure efficiency and the quickest development of and introduction of new technologies. Local service, however, will still be regulated. The second main issue concerns the possibility that the carriers engage in other activities than supplying "telecommunications services"; even if the answer is not as clear as in the previous issue, it appears that the common carriers will be permitted to engage in other activities except that they will no longer be vertically integrated. However a definite policy has still not emerged delinating the domain of activities that should be regulated. The third issue relates to the determination of the level of government which will be responsable for the regulation of telecommunication services. In the new Telecommunications Act, this issue has been resolved by permitting the federal agency to regulate intercity services. Here again, the common carriers and the regulators (federal and state) are still looking for a new regulatory process that will first take the new structural context of the industry into account and second, will reduce the delay and money spent at rate hearings.

In Canada, the same issues have been discussed but, it is fair to state that no consensus has still emerged from the various committees and studies. The question to pose then whether the (tentative) conclusions of the U.S. experience is relevant in the Canadian context. We believe that U.S. experience does not provide the necessary guidepost indicating the likely direction of the Canadian telecommunications industry. The reasons are as follows:

1. Industry structure: industry structure in both countries is different. For example, a holding structure characterizes the U.S. telecommunications industry and the companies are vertically integrated. In Canada, except for Bell Canada which in a certain sense is a holding company, vertically integrated, other carriers are whether public entreprises owned by the provincial governments subsidiaries of Bell Canada or as in B.C. Telephone, a subsidiary of a foreign company. The public entreprises are not vertically integrated: B.C. Telephone buys most its equipment from GTE subsidiaries.

2. Regulatory Setting: in the U.S., the interstate services are currently regulated at the federal level and intercity and local services are States regulated. Also, the FCC has established separation rules for splitting the common costs of providing various services. In Canada, the situation is completely different. Most of carriers are regulated at the provincial level, while Bell Canada, B.C. Tel. amd CN/CP Telecommunications are federally regulated. Tariffs for interprovincial services are calculated by TCTS which is not regulated.

3. Objectives of Regulators: even if the goals of the FCC and of the CRTC are similar, there is one important exception. In Canada, there is a strong emphasis on the content of the programs, and consequently on preserving "Canadian identity" by promoting est-west cultural exchanges. This objective has of course some strong implications for pricing.

4. Potential Competitors: given the potential market size and the relative importance of Bell-Northern, it is evident that the potential competition by Canadian companies should be relatively small. The competition can come only from U.S. subsidiaries established in Canada e.g. IBM

Canada. The impact of allowing competition in telecommunications must also take account of its impact on the various Canadian industries.

In addition to the above elements, the probable impact of the following forthcoming decisions and law should be taken into account in any study about the Canadian scene, namely the introduction of a new communications act (Bill C-16), CN/CP and TCTS interconnection, the conclusions of the Restrictive Practice Commission on the Bell-Northern vertical integration and finally the revision of the Canadian constitution.

It can be tentatively concluded that in Canada the telecommunications industry will be, at least in a foreseable future, characterized by a regulated competition structure (rather than oligopoly) and consequently it appears to be safe to say that the actual regulatory process will remain unchanged, as far as main issues are concerned. Consequently, the way the Cost Inquiry has approached the problem of service costing should have importance for the future.

Appendix A

Brief review of some theories of regulation

Introduction

Public utilities entreprises, and in particular the carriers in telecommunications industry are regulated by various means including price regulation. The Central tasks of regulation are as follows

a) to determine who receives the benefits and the burdern of regulation;

b) what form regulation takes;

c) what are the effects of regulation upon the allocation of resources and various governmental objectives.

In the present sub-section, only point a) will be discussed b) and c) were discussed at length in the text of the report. Essentially, we propose to review critically the two opposite theories of economic regulation. (The critical review of these theories is based essentially on the Posner's article "Theories of Regulation", The Bell Journal of Economies, autumn 1974). These are

a) "Public Interest" Theory. This theory maintains that regulation has arisen in response to the demand from the public to correct inefficient or inequitable market practices.

b) the "Capture" Theory: which holds that regulation comes from the demands of interest groups in conflict in order to maximize the income of their respective members.

In those places where the objectives of telecommunications are discussed, I have attempted to classify those objectives under one or the other theories. Since the subject matter is still in its infancy, a definitive view of these matters cannot be expected. It should also be recognized that the various means of regulation will be different if government objectives relating to the telecommunications industry were interpreted in terms of one theory of regulation or another. Vertical integration and the enlargement of competition can also be examined in the context of those theories.

The "Public Interest" Theory

There are at least three versions or formulations of this theory.

a) Original Theory. Two hypotheses appear to underly the economic thought pertaining policy in between 1887 and 1958.

1. Economic markets are extremely fragile and apt to operate inefficiently (or inequitably) if left alone.

2. Government regulation is virtually costless.

Behind each scheme of regulation, market imperfection could be discerned e.g. economies of scale or externalities.

This formulation is unacceptable for at least three reasons:

1. Most empirical work has shown that regulation is not positively correlated with the presence of external economies or diseconomies, or with monopolistic markets structure.

2. The conception of government as a costless and effective instrument for altering market behaviour is now not accepted.

3. Theoretical as well as empirical work have demonstrated that particular schemes of government regulation cannot be explained on the ground that they increase the wealth or, by any widely accepted standard of equity or fairness. (See, for example, Coase R.H., "The Federal Communications Commission". Journal of Law and Economics, vol. 2, no 2, Oct. 1959, pp. 1-40).

b) A Reformulation. The first reformulation of the "public interest" theory of regulation held that regulatory agencies are created for bona fine public purposes, but are mismanaged with the result that objectives are not always achieved.

This reformulation seems unacceptable for at least two reasons:

1. It fails to recognize the socially undesirable results of regulation are frequently desired by groups influential in the inactment of the legislation setting up the regulatory framework. For example, it appears that AT and T pressed for state regulation in order to eliminate competition.

2. No sound theory has yet been proposed or evidence presented to explain why the agencies should be expected to be less efficient that other organizations.

c) A Further Reformulation. This reformulation now incorporates two new factors which were previously ignored:

1. The non-operational character of many of the tasks that have been assigned to the regulatory agencies. This does now explain why legislature assign such tasks to agencies.

2. The cost of effective legislative supervision of the agencies' performance.

Once one introduces these two factors in the "public interest" theory of regulation, the idea that regulation is an honest but frequently an unsuccessful attempt to promote the public interest becomes more plausible.

The Capture Theory: the Economic Theory of Regulation

The capture theory like the "public interest" theory has many formulations. However, it is the economic version which will be reviewed. Essentially, this theory is based on the two simple but important facts:

1. Since the coercive power of government can be used to give valuable benefits to particular individuals or groups, economic regulation can be viewed as a product whose allocation is governed by laws of supply and demand. This hypothesis has as the consequence of directing attention to factors bearing on the value of regulation to those who value it the most on one hand, to focus attention to the factors bearing on the cost of obtaining regulation, on the other hand.

2. The second is that the theory of cartels (or cooperative games) may help to locate the supply and demand curves.

However there are at least two reasons why the pattern of regulation and the pattern of private cartelization are different.

1. Demand for regulation is greater among industries for which private cartelization is unfeasible or a very costly alternative.

2. Favorable regulation requires, in addition to the cooperative action of firms, the intervention of the political process. And this political dimension of regulation requires

two modifications of the theory of cartels when applied to regulation.

a) The degree of participation in a coalition seeking protective regulation is greater, the greater is the asymetry among the positions of the industry members.

b) The determinants of political influence in regulation must be worked into the supply side of the market.

In conclusion, two comments are made:

1. The economic theory of regulation is still not very well defined in the sense that it is at best a list of criteria, most of them coming from the theory of cartelization, relevant to predicting whether or not an industry will obtain favorable legislation.

2. This theory, when pushed to its logical extreme, excludes the possibility that a society might establish institutions that enable genuine public interest considerations to influence the formulation of policy.

Appendix B

Economies of Scale and Sustainability of Multiproduct Monopoly

B.1 Economies of Scale and Multiproduct Monopoly

The following definitions (see Baumol, A.E.R., Dec. 1977) are needed to characterize precisely a natural monopoly which supplies many services.

Definition 1: Suppose that a monopolist supplies N=1, ..., n services at the respective levels $y_1, \ldots, y_n$, and for producing these products, it necessitates a certain number of inputs in quantities $x_1, \ldots, x_r$. Then, there exists strict economies of scale in the production of N outputs if, consequent to an increase of all the inputs by a certain factor, all the outputs are increased by a greater factor. For example, if all the inputs are doubled, then all the outputs will be more than doubled.

However, this definition is too general for suitable testing; also, it is the custom to define a natural monopolist by some properties of its cost function. This motivates the following definition which states that it is always cheaper, i.e. less costly, for a society to have a single firm producing whatever combination of outputs than to have multifirm production, each one producing only a fraction of the outputs (and also not necessarily all the outputs).

Definition 2: A cost function C(y) is strictly and globally subadditive in the set of services if for any output vectors $y^1, \ldots, y^m$ of the products, the following relation is verified

$$C(y^1 + y^2 + \ldots + y^m) < C(y^1) + C(y^2) + \ldots + C(y^m).$$

The step cost function retained in the NPPS model is an example of a subadditive cost function (see diagram below). Another example is a cost function which is linear but having a constant term representing the fixed cost. For example, in the case of two outputs, the cost function can be written as follows

$$C(y_1, y_2) = a + b_1 y_1 + b_2 y_2$$

with a, b_1 and b_2, all positive. It is clear that if one takes any two vectors $y^a = (y_1^a, y_2^a)$ and $y^b = (y_1^b, y_2^b)$, the following relation will be verified

$$C(y^a) + C(y^b) = 2a + b_1(y_1^a + y_1^b) + b_2(y_1^b + y_2^b)$$
$$> a + b_1(y_1^a + y_1^b) + b_2(y_2^a + y_2^b) = C(y^a + y^b)$$

It is important to stress the predominant role played by the fixed cost, the variable a, in this example (and, in fact, in all the examples that we can construct).

Finally, consider the following (concave) function

$$TC = y_1^{\frac{1}{2}} + y_1^{\frac{1}{4}} y_2^{\frac{1}{4}} + y_2^{\frac{1}{2}},$$

for example for the level of outputs $y_1^a = y_2^a = 1$. Then

$$TC(y_1^a, 0) = 1, \quad TC(0, y_2^a) = 1$$

and $$TC(y_1^a, y_2^a) = 1 + 1 + 1 = 3 > TC(y_1^a, 0) + TC(0, y_2^a) = 1 + 1 = 2.$$

Then this cost function is not subadditive.

In the context of a single product, the concept of economies of scale is equivalent to the property that the average costs are decreasing once that output is increased. However, in the case of a multiproduct firm, one is unable to construct an unambiguous index of output for a set of heterogeneous products, so the concept of average cost is ill-defined; but if one restricted to the case where the various outputs are increased proportionaly, one can define the concept of <u>ray average cost</u> as follows. Suppose that a given output vector y^a is increased or decreased proportionally by a certain factor, let say $k > 0$. (Of course, in the case of an increase $k > 1$ and in the decreasing case $0 < k < 1$). This operation is equivalent to tracing of a line starting at zero and passing it through a given output vector. Then, ray average cost (RAC) is simply the total cost of producing ky^a divided by the factor k. Formally,

$$RAC = C(ky^a)/k.$$

In this context of varying in fixed proportions a given bundle of services, it is interesting to know how the value of the ray average cost is modified as the scale factor is changed. By anology with the situation in the single product case, it is necessary that the ray average cost decreases as the scale factor is increased. This remark motivates the following definition.

<u>Definition 3</u>: The ray average cost will be said to be declining along a ray if, for a given bunk of products, the ray average cost is decrea-

sing as the scale factor is increased. Formally, one must have

$$(C(ky^a)/k) > (C(vy^a)/v)$$

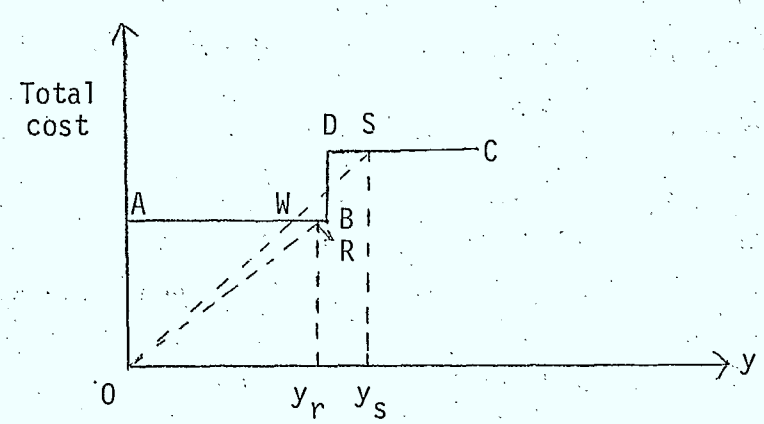
for all $v > k > 0$. In particular, if $k = 1$, one must have

$$C(vy^a) < vC(y^a)$$

for all $v > 1$ meaning that once the outputs are expanded proportionaly by a factor v, the total cost associated with this new level of production must be lower than the total cost associated with the initial level of production times the scale factor.

We will explain more fully this definition by considering again the two cost functions described after definition 2, i.e. the step cost function and the linear one with a constant term or fixed cost. In particular, we will show that the concept of subadditivity along a ray (i.e. in the context of a given bundle of products produced in fixed proportions) <u>is not sufficient</u> for the property of declining ray average cost. In other words, two cost functions (as in our examples) can be subadditive but only one can have the property that along a ray the average cost is decreasing.

Then consider the following diagram in which the total cost is a (step) function of the output vector y, where OA > BD meaning that the fixed costs are larger when the plant has to be put in operation than the ones which must be encounter when the plant must be enlarged.



This cost function is subadditive for the following reasons. First, the total cost for any output produced by one firm alone cannot exceed OA + BD. Second, the total cost of any output produced by two or more

firms cannot be less than 2(OA), the fixed costs of the two firms. Since, by assumption, OA > BD, the following relationships are verified:

$$TC_1 \leq OA + BD < 2(OA) \leq TC_2 + TC_3$$

where TC_1 refers to the total cost of any output by a single firm and $TC_2 + TC_3$ refers to the total cost of production by the two (or more) firms.

For this step function, ray average cost at y_s is defines as OS/Oy_s, and ray average cost at y_r is equal to OR/Oy_r. And it is easy to see that even if y_s is larger than y_r,

$$(OS/Oy_s) > (OR/Oy_r)$$

and consequently, the ray average cost at y_s is greater than the ray average cost at y_r (where of course $y_r = vy_s$, $v > 0$, for a certain value of v).

Consider now the following cost function

$$C(y) = a + b_1y_1 + b_2y_2$$

with a_1 b_1 and $b_2 > 0$. It is immediate that

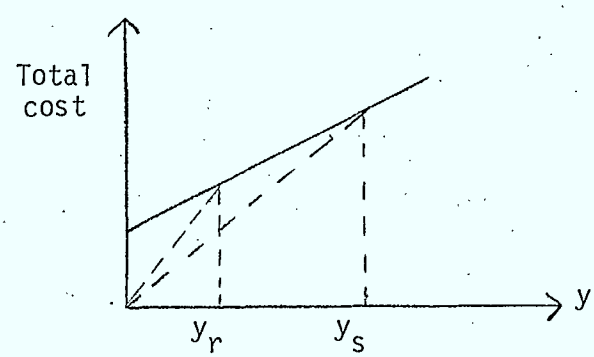
$$C(ky^a)/k = (a/k) + (b_1y_1^a + b_2y_2^a)$$

and $$C(vy^a)/v = (a/v) + (b_1y_1^a + b_2y_2^a).$$

As, by hypothesis, $v > k > 0$, one has $(a/k)>(a/v)$ and consequently

$$C(ky^a)/k > C(vy^a)/v,$$

and consequently the average cost along a ray is declining.



It is important to note that the case so far studied concerns only the situation where the production of an output vector is

varied proportionaly. But even in this particular context, the following two additional remarks should be made to empirically measure the concepts so far defined.

a) We have established so far that the critical concept for defining a natural monopoly was the concept of (ray) subadditivity. And we have seen that for two particular cost functions average costs can be declining or increasing in a certain domain. Consequently, it is too demanding a test of natural monopoly to require that the average costs be declining as the production is increased, only the property of subadditivity has to be verified.

b) The proof of subadditivity requires a global description of the shape of the entire cost function from the origin up to the output considered, the reason being that for a multifirm situation, it must not be profitable for a firm to produce a subset, even a very small one, of that output. But, this situation creates the necessity to obtain statistical data which are not usually available.

We now come to the truly multiproduct situation, i.e. we will characterize the total costs as output proportions are varied. Let suppose the following situation where one considers simultaneously the vector y^a and the vector y^b, two vector of outputs, which for a certain set of prices yield the same revenue. In order to capture the idea of interproduct complementarity, less costly to produce a mixture of these two output vectors than to produce each one separetely. Formally, one has the following definition.

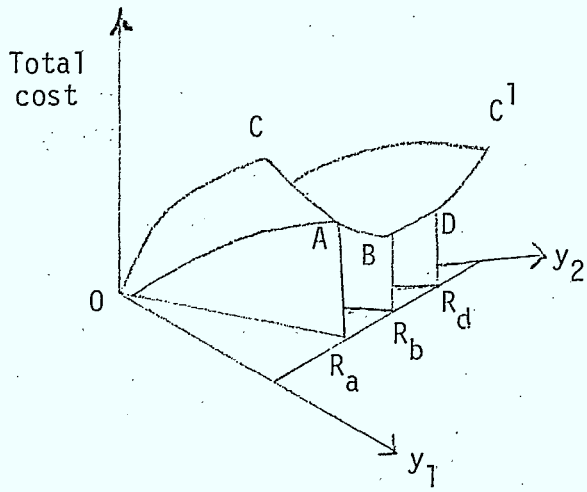
<u>Definition 4</u>: The total cost function $C(y)$ is said to be <u>transray convex</u> at y if there exists a set of product prices $w_1, \ldots, w_m$ such that for every two output vectors y^a and y^b yielding the same revenue (i.e. $\sum_i w_i y_i^a = \sum_i w_i y_i^b$), one has

$$C(ky^a + (1-k)y^b) \leq kC(y^a) + (1-k)\ C(y^b)$$

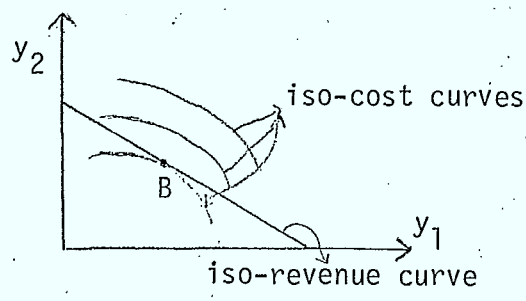
for any $0 \leq k \leq 1$.

This concept of transray convexity is also referred to as <u>economies of scope</u> (see Panzar and Willig, <u>Q.J.E.</u>, August 1977).

Graphically, this concept can be illustrated as follows



This figure shows that the transray cross section $CABDC^1$ reaches its lowest points in the interior of the diagram where the two services are produced together. Also, along any ray OR_a, OR_b, etc..., the average cost is decreasing. This diagram can also be reproduced equivalently in the following one where the cost associated with the various levels of the outputs are "projected" in the plane (y_1, y_2).



Here, the iso-revenue curve corresponds to the "line" $R_aR_bR_d$ in the previous diagram. It can be interpreted as all the combinations of the two outputs which give the same revenue. Also, each iso-cost curve corresponds to the combinations of all outputs which cost the same amount and as one moves to the right the costs are increased. Finally, if the cost is to

be minimized along an iso-revenue curve, the point B will corresponds to the minimum of cost, given a certain iso-revenue curve, and it is an interior point, i.e. production of y_1 and y_2 simultaneously.

Before giving an example with a particular cost function exhibiting this property, I would like to state the following result. We have said that the concept of subadditivity is the critical concept for defining a natural monopoly. So, it is important to know the <u>sufficient conditions</u> associated with a cost function which guarantee this property of subadditivity. It can be shown, and the last two diagrams can be useful in this context, that if the cost function has simultaneously the property of having its ray average costs strictly declining and is transray convex, then it will be subadditive. Then, instead of testing for subadditivity of the cost function, it is equivalent to verify if the cost function has the afore-mentioned two properties.

In order to precise the idea on a particular example, consider the following cost function in two outputs.

$$TC = b_o + b_1 y_1 + b_2 y_2 + b_3 y_1 y_2 \qquad (1)$$

where it is assumed that b_o, b_1 and b_2 are positive, and b_3 is negative. Firstly, this function is declining ray average cost as the following relation is verified

$$TC(vy_1, vy_2) < vTC(y_1, y_2)$$

for all $v > 1$. To show that it is transray convex, one must first note that y_2 can be express in terms of y_1 in the following manner.

$$y_2 = -wy_1 + k$$

with $w > 0$. When this relation is substituted in the cost function, one has

$$TC = b_o + kb_2 + (b_1 - wb_2 + kb_3)y_1 - wb_3 y_1^2.$$

Taking the second derivative of this relation, one can check that it is equal to $-2wb_3$ which is positive as $b_3 < 0$ by hypothesis. But this is precisely the condition for the function to be convex along a certain transray cross-section. Finally, taking the result that declining ray average cost combined with transray convexity are sufficient for subadditivity, it then follows that the cost function in our example is subadditive.

It can be of interest to know the steps that must be performed in order for testing the presence or absence of subadditivity, in the context of the telecommunications industry. First, an investment cost function for the carrier must be constructed, taking all the services (or a subset) into account. The shape of the cost function must be known from the origin (situation of zero output) up to the current levels of outputs. Of course, the resulting cost function must not prejudge the existence of subadditivity but must be such that will enable us to detect such a characteristic. Second, with the data characterizing the levels of the outputs, like ccs, number of channels, (like the b's in the previous example) must be made for defining completely the cost function. Finally, depending of the sign and may be the magnitude of the estimated values of the parameters, the presence (or absence) of subadditivity should be detected.

B.2 Sustainability of a Natural Monopoly

From a regulatory policy viewpoint, the relationship between barriers to entry and tariffs is very important. In effect, both of them are important instruments in the hands of the government for reaching certain objectives, it is then crucial that some consistencies be established between them. So, an important policy question is the following: which price structure can be imposed which will be in accordance with a liberalized entry in the industry? It is almost evident that some forms of cross-subsidization (like financing the competition services by the monopolistic ones) must be eliminated. But can we say more? Also, what is the impact of such tariff structure once the redistributional aspects of the tariffs are taken into account? This last problem will be studied in Appendix C. But trying to answer the previous question, one must first know if, under certain hypotheses, they are pricing strategies which prevent entry in the industry, and if it is which pricing schemes will prevent this entry. Both aspects of the problem will be studied via the concept of sustainability of natural monopoly and, in particular, we will establish the pricing schemes which guarantee this sustainability. The concept of

sustainability, relatively recent in the litterature, is an important one (Panzar and Willig The Bell Journal of Economics, vol. 8, no. 1, spring 1977): "The issue of the sustainability of natural monopoly is one which must be thoroughly examined before public policy options towards entry can be intelligently formulated" (page 2).

By definition, one will say that a monopoly is sustainable if the monopolist can find a set of prices and a set of products which will deter the entry of rivals or competitors into the industry i.e. no firm will find it profitable to enter even if regulatory bodies were to permit it. It is important to remark that the new entrant is not necessarily required to satisfy all demands, but can instead split the market in an any manner he wishes. In other words, we allow the possibility of cream skimming. But before going on, one can ask if the concept of sustainability and the concept of subadditivity are equivalent. Remember that in the previous section we have shown that the concept of subadditivity of the cost function was the critical one for defining a multiproduct natural monopoly. As it is intuitively evident that subadditivity is a necessary condition for sustainability (since otherwise there will be no cost advantage of having a single firm producing all the outputs), it is not a sufficient condition as the following example shows. In the preceeding section it was shown that the step linear cost function was subadditive and that the (ray) average cost at y_r was lower than the average cost at y_s. Consequently, it follows that the customer coalition whose quantity demanded is y_r will have an incentive to break off from the large coalition and provide that output for itself. Then, the two concepts are not equivalent. The following intuitive reason can be putted ahead for explaining this situation (see Baumol, Baley, Willig, in "Weak Indivisible Hand Theorems on the Sustainability of Multiproduct Natural Monopoly, A.E.R. vol. 67, no. 3, june 1977): the failure of subadditivity requires the existence of at least one way of breaking up the monopoly coalition into subcoalitions in such a way that each and every subcoalition can potentially benefit (i.e. by a potential redistribution of the benefits or gains of at least one subcoalition) from the split, but the failure of sustainability requires only that at least one of them benefits from the split.

As the subadditivity of the cost function is not sufficient for ensuring us that the monopolist will be protected against entry, some other condition(s) are then needed. One of these conditions is the so-called Ramsey rule, or the "inverse elasticity concept". By definition, and if one assumes that the cross-elasticities of demand are zero, the Ramsey rule requires that its price of the various services be set so that its percentage deviation from marginal cost is inversely proportional to the service's price elasticity demand. Mathematically, one has

$$((p_i - MC_i)/p_i) = (k/\varepsilon_i)$$

where k is a positive constant, ε_i is the price elasticity of demand for good i and MC_i is the marginal cost of the service i. It can be shown (see Baumol and Bradford, A.E.R., June 1970) that this rule is the socially optimal pricing scheme for a multiproduct monopolist operating under a profit constraint. And according to this rule the social welfare will be optimized by causing unequal deviations (from marginal cost) in which services with elastic demands are priced at levels close to their marginal costs. For example, if the monopolist supplies a monopolistic service such as the local exchange and a competitive one e.g. private line and if one assumes that the price elasticity is larger for the private line service then according to Ramsey rule, its tariff should be closer to its marginal cost than for monopolistic service. The more inelastic a service is, the larger its contribution to the overhead expenses. Ramsey rule can then be seen as an optimal way of determining a discriminatory set of prices needed to obtain a required profit.

We can now state the following result (see Baumol, Bailey, Willig, op. cit. for a demonstration) which combines some characteristics of the cost function, described in the previous section, with the Ramsey rule in view of obtaining sufficient conditions for sustainability of natural monopoly.

Proposition: Let assume that the cost function is strictly declining ray average cost and transray convex, then the Ramsey optimal price output vectors are sufficient to guarantee sustainability.

In other words, if the monopolist has a cost function which verifies the stated hypotheses (hypotheses which are identical to those used in the previous section for determining sufficient conditions for subadditivity) and if it selects a price-output vector which satisfies the inverse elasticity concept, i.e. the Ramsey rule, then its revenue requirement is satisfied and by the above proposition "its vertue will be rewarded by protection from the threat to entry" (Baumol and al., page 351).

From a monopolist viewpoint this result suggests that it is encouraged to set prices in anticipation of entry than in response to it and, moreover, in so doing, the public interest is best served (i.e. the social welfare is maximized). In other words, the interest of the monopolist and the one of the society go in the same direction (at least in the context of the present model).

But, and this is an important policy question: for various reasons, the regulator can forbid any form of cross-subsidization among customers and services, i.e. it can prevent the application of the Ramsey rule by the monopolist. It then follows that sustainability and subsidy-free tariffs can conflict with one another. In effect, the proposition says that under certain hypotheses for the cost function, Ramsey prices are sufficient to guarantee that no competitor will survive if he enters the industry, even if the government were to eliminate barriers to entry. The monopolist has in his hand a possible strategy for preventing or detering any competition by establishing an optimal cross-subsidy price structure. It is easy to construct examples showing that the revenues generated by application of the Ramsey formula are not in the core of a cost-sharing game, where the core is defined as the set or prices (or revenues), which are subsidy free (see the following appendix for more details). Consequently, if the government should wish to increase competition in the telecommunications industry, one way of acomplishing this is by forbidding any cross-subsidization among the services i.e. by preventing the application of the inverse elasticity rule by Bell would make it easier for an entrant to achieve fianncial viability. But if

the Ramsey rule cannot be applied, the objectives of free entry and efficiency in the production cannot be met simultaneously (then entry restrictions must be reconsidered by the policy makers!). For example, Sanderg (Bell Journal, vol. 6, no. 1, spring 1975) has presented a model where, in a sequence of unrestricted price moves and countermoves, the single firm can always undercut a competitor in each round. Finally, as this rule maximizes social welfare (consumer's surplus and producer's surplus), one has to evaluate the benefits of increased competition versus the loss for the society by departing from the Ramsey rule.

We would close this section by the following two remarks.

Remark 1: The formal models presented in this appendix have many limitations. In particular, three are noted:

a) they are static; it is evident that some dynamic considerations must be introduced in one way or another before definite conclusions can be formulated, in particular as technological innovations are essentially a dynamic process;

b) they do not incorporate the non-zero cross-elasticities among the services. Even, if the writer thinks that this rule will just reinforce the previous results, they must be formally introduced in the analysis in order to look at the precise results. Moreover, these elasticities can be at the heart of some policy problems, and the definition problem of the network. For example, "private line subscribers to an MCI service between St-Louis and Chicago cut down their use of the Bell System long distance service drastically" (Rostow, op. cit. p. 51). Also, MCI and others have argued that there exists a high degree of cross-elasticities between MTS, DDD, private line, WATS, or TELPAK (idem, p. 52). Clearly, there is a need for generalization of the models discussed;

c) they do not take simultaneously competitive and monopolistic services into account, as it is now in reality. But, if one assumes that the monopolistic services are less elastic than the competitive ones, there are no reasons a priori why Ramsey rule cannot be applied. For example, in the course of the study of the rate levels made by AT and T for its seven major groups of interstate services, it was found that the monopoly voice services earned a higher rate of return on allocated investment relative to the overall rate of return for all interstate services than did TELPAK and the record-telegraph services, a result which is in accordance with the Ramsey rule.

Remark 2: In a recent study, Willig and Bailey (Income Distributional Concerns in Regulatory Policy-Making, manuscript, 1978) report on the redistributional impact of ajusting the 1973 tariffs structure for the DDD telephone services in the United States in accordance with the Ramsey rule. First, they found that day calls had the largest relative mark-up of price over marginal cost for any given mileage band, and that they also had the lowest elasticities. Inversely, evening calls had the lowest relative deviation of price form marginal cost and the highest elasticities. These results are of course in accordance with the Ramsey rule. But, looking across mileage bands, the long-haul calls had both the highest relative mark-up of price over marginal cost and the highest elasticities, contradicting the inverse elasticity rule. Second, they calculated the Ramsey optimal prices and found that welfare maximization required that short-haul price should increase, long-haul prices decrease, night-weekend prices should remain relatively unchanged, day prices should generally rise and evening prices should generally fall. Finally, they found that this policy of changing prices in the locally best direction results in a not too much significant social improvement for residential consumers by income class. But more importantly for our purposes here, they showed that it was possible to determine, under certain hypotheses, compute and eventually apply some optimal (Ramsey) prices which as we have seen can prevent entry by new competitors and increase the social welfare of the society.

Appendix C

Pricing

C.1 Production Definitions and Pricing Principles

It has been noted in the text that the telecommunications industry is itself an instrument in the hands of the government to achieve some of its objectives. It follows that this industry, by the various services supplied, can be studied both from an efficiency as well as an equity perspective. For example, the government must take all means to ensure that services supplied by the carriers are provided at the lowest possible costs including a return to the shareholders. This is the efficiency point of view. On the other hand, the government would like, for example, to reallocate the resources of the economy to be more socially acceptable; for example to guarantee a certain minimal revenue to all the citizens. This is the equity point of view. Taking into account this dual perspective is important because the government can manipulate the tariff structure to reach certain objectives of efficiency as well as equity aspects. Moreover, as already noted these two points of view can be in conflict; a compromise between the efficiency and the equity often has to be made. Of course, the resulting compromise depends on a number of factors, which in turn depend critically on the nature of the outputs or services supplied.

In the economic literature, three types goods are distinguished: private, public, and merit. Generally speaking, a private good is one whose consumption or utilization by an economic agent excludes its consumption (or utilization) by another agent. The network when "all the lines are busy" is an example. With a public good, consumption by an individual does not preclude consumption by another e.g. a television program. It should be noted, however that some goods have a dimension of a public good but only within limits; these goods are often referred to as "public goods subject to congestion" e.g. most of the

transmission facilities, network in telecommunications industry, highways in the transportation. Finally, there are merit goods which by definition are those commodities or services which by their very nature are private but the merits (or acquisition) of which are judged so powerful by the society as a means to reaching some redistributive objectives that they are provided to the largest number of citizens. The school system is an illustration of a merit good. In the following it is shown that each of these classes of goods introduces different pricing policies and consequently have completely different policy implications.

To stress the idea that a pricing policy is strongly dependent on the nature of the product, assume that our economy constains solely private goods. In such economy, the following results, are noteworthy:

a) every firm will sell its product at the marginal cost in order to maximize its profit;

b) at the equilibrium, the tariffs will be such that an optimal allocation of resources will result. In other words, if all economic agents act in such a way as taking these "signals" as given, then it will not be possible to reallocate the various goods in such a way that nobody will be penalized (less satisfactory);

c) optimal decision of agents will be obtained in a decentralized manner, i.e. without having any knowledge of the decisions of other agents. Of course, the price system is the instrument of decentralization;

d) except for b), no formal equity criteria are taken into account. Consequently, the resulting allocation ca be judged unacceptable once equity considerations are introduced in the analysis.

Now assume a public good is introduced in such an economy and the good is supplied under the conditions of increasing return of scale.

In this new "economy", the above results are modified as follows:

a) From an efficiency viewpoint, a tariff structure must now satisfy the following three criteria:

1. it must enable the total costs of the firm to be recovered;

2. it must be designed that no customer willing to pay at least the marginal cost is turned away;

3. there are no sales below marginal cost, and in fact, some products must be sold at a price higher that marginal cost in order to pay for fixed costs;

b) Ideally, the cost of the public good must be paid by the users of that good. But, since this kind of good can be consumed simultaneously by many persons, there is some incentive for some person to become a "free rider", i.e. not paying for the good but still consuming it. The price system alone is insufficient for optimal allocation of resources; a coercive agent has to be introduced in this economy.

c) An immediate consequence of (b) is that decentralization in this economy is still not possible, some knowledge of the actions of other players become necessary for optimal allocation of resources. The presence of large economic externalities emphasizes this point.

Finally, assume that a merit good is introduced in our private economy. The following problems arise:

a) Since by its nature a merit good incorporates some redistributive aspect, it follows that in our economy equity crite-

ria must be defined before a social welfare function can be derived. But the problems underlying this are enormous.

b) By definition a merit good is given free or partly free to certain groups in the society, a second question is by which means such an industry will be financed, be self-financed with its consequent cross-subsidy problem, or by some forms of taxation? However, in both cases one has to know the impact of the financing on the allocation of resources.

c) A consequence of (a) and (b) is that an authority must exist in this kind of economy for coordinating the allocating of resources. It then follows that a price system alone is unable to permit the attainment of an optimum.

Concerning the services supplied by the telecommunications industry, it is almost evident that they have characteristics of each of these goods. For example, if one divides the various services into the following three components: access to the network, utilization of the facilities, and content of the service, one can say that the service has a public, private and also a merit good perspective. Consequently, one can imagine that there is no cost (or a fixed one) for obtaining access to the network, that the utilization of the network should be priced at its marginal cost and that the content of say the television programs be subsidized by some means or another. Of course, there is a complementary aspect behind these components, but even here depending on which component the society would like to promote, a different tariff structure should result.

C.3 Pricing Schemes and the Stability of the Coalition

Appendix B has demonstrated that barriers to entry and pricing rules were closely related, and dependent upon the characteristics of the cost function associated with the telecommunications industry. In parti-

cular, given the properties of declining average costs along a ray and transray convexity of the cost function, it was noted that the Ramsey rule was a sufficient condition for protecting the monopolist against any entry in the industry. And this rule was seen as an optimal way of discriminating among the users of the services, in the context of uniform (or linear) prices or tariffs i.e. payment for using telecommunications services increases with their consumption. But clearly there is a need to consider nonlinear prices, i.e. multipart tariffs (usage-sensitive pricing), as the following examples show (section 6 in the core of the text gives additional examples). Recently, telephone companies and regulatory commissions have been moving toward imposing usage charges for local telephone calls due to the combined forces of inflation, increased local usage, and competition from independent firms that sell terminal equipment and supply private tool lines to business customers. Also AT and T reported that it is moving in the direction of usage-sensitive pricing. Moreover, in a context of multipart tariffs, such phenomenon as quantity discount and block tariffs can be captured. Finally, Prof. Kahn and some others have argued that the problem of reduction of revenues from terminal services and from business and other long distance subscribers consequent to the introduction of competition could be resolved by adopting usage-sensitive pricing for household subscribers, the reason being that the burden of increased rates would fall mainly on those who use the telephone most (as it is a classic argument advanced by the general carriers that competition will increase the residential subscriber rates). All of these examples then show the necessity to go beyond the uniform tariff rule and consider the multipart tariffs schemes. But what pricing rules can be "appropriate" if price discrimination and multipart tariffs are permitted? In the following we will consider this question and supply some answers.

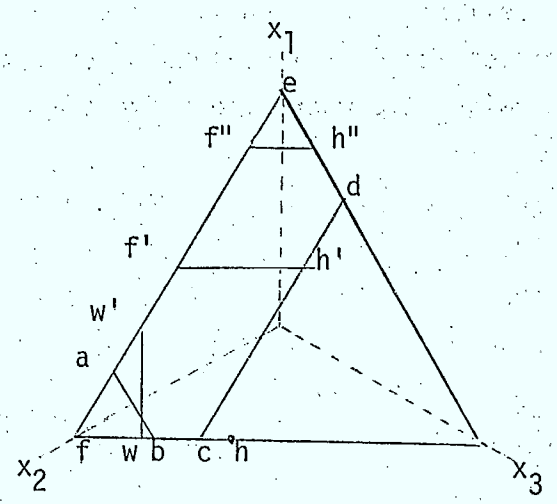
Moreover, the last but not least important function of tariffs, is that any tariff structure carries with it some redistributional implications, i.e. redistribution between the customers and the shareholders, and between customers. The cross-subsidization issue can be usefully examined in this context of redistribution. In fact,

it can be seen as an illustration of Posner's argument that regulation is a (hidden) form of taxation (or redistribution). In the previous appendix, we have briefly reported on a study made by Willig and Bailey on how the tariffs based on the Ramsey rule can be modified with a view to increasing the social welfare of the society. Also, Feldstein (A.E.R., March 1972) has incorporated distributional equity in an attempt to determine an optimal structure for public utility prices. It is important to note that a redistributional policy can conflict with an efficiency objective. As an example, it can be imagined a price structure which, for equity reasons, is outside the core of a "revenues-sharing" game (see Faulhaber, Bell Laboratories, May 1975). Below, other examples, based on the various well-known pricing schemes are enumerated. In fact, the purpose of this appendix is: to determine which pricing rules are appropriate if price discrimination and multipart tariffs are permitted, if distributional aspects and some stability definition are simultaneously taken into account.

We now formulate a model which attempts to evaluate some non-linear (multipart) pricing schemes in relation to what has been stated previously. The model will be cast in terms of a game because this permits the establishment of significant similarities, differences and stability properties of the various pricing methods considered. Consider the following game where the players are the customers and producers of the service. In this game, a potential customer is characterized by a demand curve, derived by assuming that income elasticity is zero (this assumption can be made when the total amount of money spent on the good is a small fraction of income as it is the case for most of the customers of telecommunications). The producer is described by the cost of production. In this game, we assume that the average cost is decreasing, and that only one good is produced but allow for different demand curves, e.g. peak and off-peak periods for the MTS service. For each customer, the benefit is the difference between his total utility or welfare from the service purchase and the total charge for the service (i.e. the so-called consumer's surplus). For the producer, the benefit is profit. Of course, in the context of a decreasing cost industry, marginal cost pricing is eliminated as a stable pricing scheme as the bene-

fit to the producer is less than zero. This game becomes one of determinating how the benefits are to be distributed between the customers and, of course, selecting a method of distributing the benefits is tantamount to selecting a pricing rule. For this game, it is possible to demonstrate that the associated characteristic function is convex and consequently, that the core exists. It must be remembered the core is the set of revenues or prices which are such that there is not any incentive for the players to break up from the big coalition. The definition of the core is then a minimum criteria for a viable solution. The core is large and contains, the Shapley value (for more details and a proof of this proposition, see Sorenson, Tschirhart, Whinston, A Theory of Pricing Under Decreasing Costs, A.E.R., September 1978). Unless one is willing to make ethical judgments, the problem of selecting a unique outcome remains. In what follows, the traditional price methods and their relationship to the core are examined; also some game theoretic core solutions are discussed.

The discussion of the multipart tariff schemes will rest on the following diagram where the x_i's represent the "pay-offs" (profit for the producer, surplus for the consumers).



Note that the points a b c d e represents the core of the game. It is clear that we are looking for pricing schemes which are "completely"

contained in this region, since we are looking for those schemes which maintain all customers together.

The first pricing method considered is the discriminating two-part tariffs where the producer is allowed to maximize profit. With this pricing scheme, the producer tries to capture every bit of consumer's surplus by establishing "personalized" price for each consumer. In terms of the figure, the profit maximizing allocation is given by point e. Even if this point is included in the core of the game, one can raise objections to this allocation from an equity point of view.

The second pricing method is the discriminating two-part tariffs where the welfare of the consumers is maximized. Here, the entrepreneur's profit is constrained to a positive quantity (the case of regulated monopolist for example). The solution of this problem conducts to a set of allocation which are not guaranteed to be in the core of the game. Dependent the allowed rate of return for the monopolist, the sets of allocation are represented respectively by lines fh, f'h' and f"h" in the diagram. Since some allocations are not in the core, some groups of consumers can do better by dropping out of the grand coalition and contracting separetely with the entrepreneur.

The third pricing scheme is the so-called uniform two-part tariff where the "licence fee" or fixed tariff are the same for all consumers, that is, the welfare implications are similar to the ones obtained with the preceeding pricing scheme except that an additional constraint (all the consumers pay the same fixed charge) is added. Here again, the allocation is not unique, and there are some allocations which are in the core of the game and others which are outside. Uniform tariff structures therefore also have instability problems. In terms of the diagram, the resulting set of allocation corresponds to the line ww'.

We will like to complete this review of some pricing schemes by considering two game theoretic solutions that select a (single) al-

location which is in the core of the game, i.e. the Shapley value and the nucleolus.

By definition, the Shapley value is a ponderate sum of the incremental benefit obtained once a player or consumer joins a coalition. The advantage of using the Shapley value as a pricing rule is that if consumers agree the axioms are fair, then they must accept the consequences, given by this pricing rule. However, it is difficult to say whether the allocation which results from the Shapley value is fair or not because one has to compare the entrepreneur's payoff with the ones of the consumers.

The nucleolus is a solution concept which, by definition, maximize the payoff of the least well-off coalition. Of course, a consumer may agree to maximize the payoff to the least well-off coalition if he fells he may be in that coalition.

A final comment about these two concepts can be made. By convexity of the characteristic game, both solutions are in the core of the game and consequently result in stable allocation. Also, both yield lump sum charges that can be interpreted as two-part tariffs.

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