Competition by Private Carriers in International Commercial Satellite Traffic: Conceptual and Historical Background

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I- INTRODUCTION

The aim of this essay is to provide a historical and theoretical context from which to judge the present controversy regarding competition in North Atlantic commercial satellite services. The

approach will be to supply the reader with both information and methodologies on which to base a decision about this important policy issue, rather than to make such a decision on the reader's behalf.

The balance of the paper is organized as follows. Section II presents a chronology of policy precedents regarding the role of monopoly and competition for telecommunications facilities and services. All of the cases reviewed involve either international markets or satellites, and usually both. They include the Communications Satellite Act; the original and renegotiated INTELSAT agreements; the U.S. President's Task Force on Communications Policy; the domestic satellite debate in the United States; the Authorized User Decision and its reversal by the Federal Communications Commission (FCC); INTELSAT'S policy of leasing transponders for domestic satellite systems; and recent policy hearings and stucies of the U.S. Congress regarding competition policy in telecommunications.

Sections III and IV present arguments respectively against and for the introduction of competition with INTELSAT. While current policy interest focuses on the high-density North Atlantic routes, the reasoning is couched in a more general framework. It makes use of the historical data marshalled in Section II, perspectives drawn from economic theory, and U.S. foreign policy considerations. Much of the conceptual material stems from recent advances in industrial organization theory, including the notions of economies of scope, sustainability of natural monopoly, and contestability of market structure. Other theory deals with competition as an efficient and

autonomous information source; optimal pricing and economic welfare; and, within the context of pricing theory, the issue of "cream-skimming" which has been so central to the transatlantic competition debate.

Foreign policy areas to be explored include INTELSAT's global price averaging as an engine of international telecommunications development assistance among 103 nations. More generally, we will examine INTELSAT as a U.S. foreign policy success and discuss the extent to which foreign policy considerations can offset objectives based on economic reasoning.

Section V presents a summary and tentative conclusions.

II- HISTORICAL PERSPECTIVE

This section explores important policy actions regarding competition and private entrepreneurship in the provision of telecommunications facilities and services, many of them directly involving international satellite traffic.

A- The Communications Satellite Act of 1962

The first artificial satellite was launched by the Soviet Union in 1957, and the United States soon followed suit. As satellites became commercially viable for communications purposes in the early 1960s, Congress considered whether private or public ownership and operation would be preferable. There was no debate about "monopoly" per se--the scarcity of the new resource made the selection of a single provider a foregone conclusion.[1] Instead, debate centered around the question of whether the monopoly should be awarded to private interests or retained by the Federal government. Arguments

for Federal ownership stressed the unknown aspects of the infant technology and warned against a "sellout" to private interests (see Kinsley, 1976). Those favoring private ownership, in turn, disagreed with each other as to whether the satellite enterprise should belong to existing overseas carriers--AT&T, Western Union International, RCA Globcom, and ITT--or whether the public at large should own the shares. After acrimonious debate, private ownership was decided upon, and as a compromise half of the stock of the newly formed Communications Satellite Corporation (Comsat) was purchased by existing carriers, while the other half was sold to the public at large. The carriers sold their interest during the 1970s.

Comsat, then, was awarded a monopoly in U.S. commercial satellite traffic overseas. The technology was too new to consider any domestic applications, or the possibility of two or more firms competing for the overseas market. With demand and supply at very low levels, economies of scale seemed strong enough to argue for entrusting the market to a single carrier.

3- The INTELSAT Agreements

The original INTELSAT agreements (U.S. Department of State, 1964) concluded in 1964 were negotiated at American instigation among nineteen mostly industrialized countries, basically those with earth stations or the prospect of soon obtaining one. The dramatic successes of the early transatlantic television transmissions made possible first by experimental and then by INTELSAT satellites increased the number of countries wishing to accede to the agreements. Thus, the original agreements were made provisional in nature to accommodate those countries wanting to share in the

technology but not desiring to perpetuate the predominant position of the United States in satellite, launch, and earth station technology. Overall policy direction as well as medium-term management was therefore temporarily vested in an Interim Communications Satellite Committee (ICSC) on which voting quotas reflected investment shares. Day-to-day operation was contracted out to Comsat, acting as INTELSAT's Manager.

The permanent or definitive agreements (U.S. Department of State, 1971) were arduously renegotiated during 1969-1971 and entered into force early in 1973. These replaced the ICSC with a Board of Governors which still votes by investment shares, but on which smaller users have more rights of representation and greater protection against undue influence by a small number of large users. In addition, two overarching membership structures were created for long-range policy matters, each having one vote per member: the Assembly of Parties, composed of the states that had signed the intergovernmental agreement; and the Meeting of Signatories, consisting of operating entities designated by those governments.

Two elements of the INTELSAT agreements are important for present purposes. First, INTELSAT was established along cooperative lines, in both the technical and, one can argue, the informal sense of the word. As an economic cooperative of investors and users (see Snow, 1976, pp. 147-149; Colino, 1983, Appendix No. 12), INTELSAT was financially structured so as to balance out the investors' desire for high tariffs and the users' incentive for low tariffs. By periodically aligning investment quotas with recent past usage

shares for each Signatory, INTELSAT makes the tariff level technically irrelevant. For cases of temporary imbalance of ownership and usage, as well as for non-using investors and non-member users, the tariffs are set at a level that pays INTELSAT members a cumulative annual return of 14% on their net investment. Reflecting dramatic advances in technology and increases in usage, the original annual rate of $32,000 for a single voice-grade channel has now dropped to below $5,000.

A second issue in renegotiating the agreements, crucial to the purpose of this article, involved the prohibition of systems competing with INTELSAT. By the late 1960s, such a threat had already become commercially feasible. The Canadian domestic system was already in operation, Indonesia's Palapa system was being designed, and the regional systems in Europe and among the Arab states were under consideration. In the original agreements INTELSAT's members had awarded the organization exclusive rights to operate "the" global commercial satellite system, although in the context of the mid-1960s the possibility of credible competition was still remote. This had changed five years later, and the issue of separate systems was easily the most controversial during the process of renegotiation.

Basically, the industrialized members of INTELSAT other than the United States wanted to reserve the right to participate in separate international or regional systems, partly as a counterpoise to what they regarded as continued American domination in INTELSAT, and partly to subsidize national efforts in promoting domestic aerospace and satellite industries. The United States and most developing

members of INTELSAT, on the other hand, favored--often for different reasons--the retention of a tight monopoly for INTELSAT in international traffic. Many observers believe that the United States threatened to make launch vehicles unavailable if prohibitions against INTELSAT competitors were not strong enough. The resulting compromise appears in the language of Article XIV of the renegotiated intergovernmental agreement (U.S. Department of State, 1971). In it, domestic facilities separate from INTELSAT are allowed subject only to consultation with the Board of Governors concerning "the technical compatibility of such facilities and their operation with the use of the radio frequency spectrum and orbital space by the existing or planned INTELSAT space segment" (Article XIV(c)). "International public telecommunications," however, are subject not only to technical compatibility, but also to consultation with the Board of Governors "to avoid significant economic harm to the global system of INTELSAT" (Article XIV(d)).

C- The Authorized User Decision and Its Reversal

The Communications Satellite Act referred to "authorized users" and "authorized entities." Since these were further unspecified in the act, many large user groups sought to obtain access to INTELSAT directly through Comsat rather than first going through the international common carriers. The FCC determined in its 1966 Authorized User Decision (Nelson, 1977, pp. 65-66) not to allow this bypass, declaring Comsat's role that of a "carrier's carrier." At issue was whether Comsat would be allowed to introduce more competition into the U.S. market for overseas carriage by INTELSAT. The international carriers argued that they were disadvantaged in

any such competition, as they could not directly approach INTELSAT but had to go through Comsat. The decision reflected the extreme market segmentation orientation of the FCC in the mid-1960s, generally under the influence of the large carriers whose representatives still sat on Comsat's board of directors. Recently, in the interest of competition and deregulation, the FCC has overturned the Authorized User Decision, and Comsat can now compete directly with certain large users for INTELSAT traffic (U.S. Senate, 1983, p. 122).

D- The President's Task Force on Communications Policy

Late in the Johnson administration, the President's Task Force on Communications Policy, chaired by Eugene Rostow, issued its final report. It urged continued support of INTELSAT as a single global system:

> The global system enables substantial economies of scale to be realized. This is true because large satellites are capable of flexibility in use and provide high communications capacity and lower costs per channel. They also permit economies in the use of earth stations....There are other important advantages to a global system in integrated system planning, financing, procurement, management, and control (U.S. President's Task Force, 1968, p. 12).

In addition, requests had been filed with the FCC since the mid-1960s to establish domestic satellite systems in the United States, and the Task Force addressed this issue. Again on the grounds of economies of scale in production and management, it recommended that Comsat be selected as the sole purveyor of domestic satellite services (Snow, 1976, pp. 103-104).

While the Task Force's report became an instant dead letter after the inauguration of the Nixon administration a month later, it

is significant in being one of the first policy documents to make explicit use of the "natural monopoly" argument, at that time equivalent to the existence of scale economies, to justify prohibiting competition in satellite facilities and services.

E- "Open Skies" in U.S. Domestic Satellite Services

Early in 1970 the Nixon White House issued a memorandum to the FCC chairman urging exactly the opposite policy, on the basis that "no natural monopoly conditions appear to exist in the provision of specialized communications via satellite" (U.S. Office of the President, 1970). Further, it proposed to allow

> competition [in providing a domestic satellite system] to act within well-defined limits necessary to preclude anti-competitive practices and to assure that the competition works toward the public interest (U.S. Office of the President, 1970).

As later implemented by the FCC, this policy became known as the "Open Skies" approach to domestic satellite systems in the United States (Nelson, 1977). In opposition to the chosen entity approach used with INTELSAT internationally, the FCC implemented a policy of almost maximum competition in the domestic market. As a result, a number of systems have evolved gradually since the early 1970s, and by all accounts have provided a broad range of new and conventional services at acceptably low prices. This differs from the domestic policy of a number of countries, such as Canada and Indonesia, where early government entrepreneurship rather than market forces determined the pace of introduction, usually through a single entity. Other countries, however, notably Japan, Australia, and the United Kingdom, have adopted the evolutionary, market-based approach of the United States, albeit with less competition.

F- INTELSAT's Domestic Transponder Leasing Program

Article 8 of the INTELSAT Operating Agreement requires, or has been interpreted to require, that average-cost pricing be the guiding rule of the global system's tariff structure:

> INTELSAT space segment utilization charges...shall have the objective of covering the operating, maintenance and administrative costs of INTELSAT, the provision of such operating funds as the Board of Governors may determine to be necessary, the amortization of investment made by Signatories in INTELSAT and compensation for use of capital by Signatories.

This policy was confirmed by the ICSC's Finance Subcommittee as early as 1971, before the Operating Agreement had entered into force:

> We recommend that the method to be adopted as the norm [for INTELSAT charging policy] should consist of dividing total system costs, or total apportioned costs of the capacity providing the service or facility in question, by the number of units of that service or facility expected to be requested (INTELSAT, Interim Communications Satellite Committee, 1971, p. 3).

INTELSAT's policy decision to begin leasing whole, half, and quarter transponders for domestic usage on a pre-emptible basis--a policy still essentially intact today--was adopted in the early 1970s, when the organization faced a situation of considerable excess capacity under the average-cost pricing regime. The Finance Subcommittee touched on the general topic of marginal (incremental) cost pricing in the following statement:

> Circumstances [might] arise...in which an incremental cost approach might be thought justified in the interests of earning revenue from otherwise idle capacity. But it would be very important to avoid creating serious anomalies by comparison with other INTELSAT tariff offerings. If, for example, transponders were made available to meet special requests it would be unreasonable to deny Signatories already using the space segment the opportunity to make similar application, and if the rate were a favorable one it would enable Signatories with large voice circuit requirements to economize, at the expense of INTELSAT

> revenues, in their space charges (INTELSAT, Interim Communications Satellite Committee, pp. 10-11).

This describes, of course, the basic problem of separability of user groups in price discrimination. It was solved quite handily by INTELSAT's decision, in 1973 at the instance of Algeria, to charge what was essentially a marginal-cost price ($1,000,000 annually, subsequently reduced to $800,000) for a transponder to be used exclusively for domestic purposes, and subject to service pre-emption (there has not yet been a service pre-emption on any leased transponder). Regarding this departure from INTELSAT's global, average-cost pricing policy, the Finance Subcommittee stated that "most" of its members

> agreed that it would be in the interest of INTELSAT to establish...a new type of space segment utilization for domestic services, using spare capacity at a reduced charge. It seemed reasonable...to expect that by this means traffic could be attracted to, or retained by, the INTELSAT system on a scale which would improve the financial position of INTELSAT as a whole and effect a reduction in the space segment cost for each user in the whole system (INTELSAT, Board of Governors, 1973, p. 15).

Today, INTELSAT leases transponders to thirty-one different countries (see Pelton, 1984, p. 21) for a broad range of domestic purposes, including drilling platforms at sea, communications with non-contiguous national territory, and general economic development programs.

One can interpret the purpose and motivations of INTELSAT's transponder leasing policy from a number of viewpoints. It can, for example, be seen as an exercise in marginal-cost pricing. This, incidentally, would not be consistent with the profit-maximizing behavior usually attributed to a monopolist, which is to produce at

the level for which marginal cost equals marginal revenue. More plausibly, perhaps, it can be regarded as a type of value-of-service pricing (price discrimination). This means that the value of a service to the user (as measured by the price elasticity of demand of its consumers) is inversely proportional to the price charged--the assumption being that domestic customers are more price-responsive than international users. A refined version of value-of-service pricing is Ramsey pricing, which is used when marginal-cost pricing fails (as it does in the presence of economies of scale) to recover total operating costs. Ramsey prices are markups from marginal cost in inverse proportion to the price elasticity of demand for each user group. Both marginal-cost and Ramsey pricing have widely recognized optimality (welfare-maximizing) properties (see Ramsey, 1927; Baumol and Bradford, 1970).

Aside from these more technical interpretations, INTELSAT's transponder leasing decision can be seen in a broader policy context. First, it can be regarded as an effort to meet the needs of the developing and European countries, which constitute the bulk of transponder lessees; each group, for often conflicting reasons, had been critical of vestiges of United States domination in INTELSAT in the early 1970s. For purposes of this essay, the most relevant interpretation of the transponder leasing decision would be to consider INTELSAT's action as an attempt to forestall the establishment of separate domestic or regional systems that would otherwise have accommodated the traffic that INTELSAT was subsequently able to attract. Thus the threat (as opposed to the

reality) of competing separate systems was able, in this view, to galvanize INTELSAT to depart quite radically from the average-cost pricing principles enshrined in its Operating Agreement. The ability of potential competitors to enter and exit a market at relatively low cost and thus to affect the behavior of the monopolist or incumbent firm--even if actual entry does not occur--is a salient feature of the theory of contestability of market structure to be examined in Section IV, where it will be applied to the North Atlantic competition issue.

G- Recent FCC and Congressional Attitudes

In this final part of Section II we survey two recent committee reports which convey the mood of Congress and summarize the position of the FCC toward competition in international telecommunications. Issued during the early part of the first Reagan administration, they are indicative of the strong support that deregulation of the telecommunications industry has found in the United States. While the work of both committees was completed before the specific issue of competition for INTELSAT's North Atlantic routes arose, the reports serve to illustrate the technological, economic, political, and often ideological environment within which American policy toward such competition will be developed, chosen, and carried out.

Late in 1981, the majority staff of the Subcommittee on Telecommunications, Consumer Protection, and Finance of the House Committee on Energy and Commerce issued "Telecommunications in Transition: The Status of Competition in the Telecommunications Industry" (U.S. House of Representatives, 1981). Its major conclusions included the following:

> There is general agreement that a more competitive environment...is desirable....[R]ecently, because of the major changes in technology, there is the possibility that today's limited alternatives can develop to the point where competitive market forces will govern the industry (U.S. House of Representatives, 1981, p. XI).

Further:

> The policy debate has now shifted to how best to create a competitive marketplace for common carrier and other telecommunications technologies...the debate is now between those who feel that it is government regulation which stands in the way of a fully competitive marketplace, and those who believe that a combination of deregulation and some active regulatory involvement is necessary to make the transition from essentially noncompetitive markets to fully competitive ones while continuing to protect the public (U.S. House of Representatives, 1981, p. XII).

In discussing international telecommunications, the Subcommittee staff reviewed recent FCC actions, including the reversal of the Authorized User Decision, to document the Commission's efforts to extend deregulation into the international arena:

> These decisions demonstrate the Commission's attempt to transfer its recent domestic policy orientation toward deregulation and structural reform to overseas markets. In particular, the Commission seems determined to remove traditional dichotomies in the provision of facilities or services, allowing uniform access to international or domestic markets. These decisions promote freedom of entry and provide customers with greater choice or control over the means by which they meet their communication needs.
>
> However, important vestiges of behavioral regulation remain, and there are still formidable barriers to further competition which FCC policy has failed to diminish: foreign entities consistently oppose the Commission's competitive initiatives (U.S. House of Representatives, 1981, p. 138).

Because of such opposition, the FCC has not yet been able to stimulate as much competition abroad as at home:

> The FCC's program for stimulating competition in overseas telecommunications markets has not had the impact of its domestic efforts....the opposition of foreign correspondents to competition is a crucial barrier and the

one which is least likely to be overcome (U.S. House of Representatives, 1981, p. 157).

For these reasons

> it appears that "the jury is still out" on the long term efficacy of the Commission's attempts to create international competition (U.S. House of Representatives, 1981, p. 139).

The Senate Committee on Commerce, Science and Transportation has issued an even more recent (March, 1983) report entitled "Long-Range Goals in International Telecommunications and Information: An Outline for United States Policy."[2] While the House report responded primarily to the domestic situation, including attempts to rewrite the Communications Act of 1934, the Senate paper is set in a more international context and seems more defensive and ideological in nature, reacting in part to the heavily politicized atmosphere at the 1982 International Telecommunication Union (ITU) meeting in Nairobi. It also covers INTELSAT-related issues in greater detail. The report was prepared by the staff of the National Telecommunications and Information Administration (NTIA) of the Department of Commerce.

The report begins by asserting two overarching "principles of policy" in U.S. telecommunications and information, namely to

> enhance the free (without restriction or control) flow of information across national borders, with limited exceptions condoned only for the most compelling reasons; and
>
> promote an international environment for the provision of telecommunications and information facilities, services, and equipment...in which maximum reliance is placed on free enterprise, open and competitive markets, and free trade and investment with minimum direct government involvement or regulation (U.S. Senate, 1983, p. 12).

Citing the International Telecommunications Act of 1982 with

particular reference to the international sphere:

> The policy of the United States is to rely wherever and whenever possible on marketplace competition and the private sector to provide international telecommunications services, and to reduce or eliminate unnecessary regulation. This is based upon the...belief that competition enhances technological innovation, efficiency, and provision of services to the public at reasonable rates. When it is necessary to regulate international telecommunications services, it must be the absolute minimum necessary to achieve the purposes of [this] act (U.S. Senate, 1983, p. 12).

The NTIA report asserts in passing that INTELSAT is a "triumph" of U.S. foreign policy (U.S. Senate, 1983, p. 114), and then discusses the issue of competing "regional" satellite systems--a designation that indicates the wholly unanticipated nature of proposals for private North Atlantic satellites financed by U.S. entrepreneurs that were to reach the FCC soon thereafter. Competition today, it notes, is "a reality in the U.S. domestic, if not international, satellite market" (U.S. Senate, 1983, p. 117).

The NTIA staff is careful to point out that Article XIV(d) of INTELSAT's intergovernmental agreement contains no specific prohibition of the establishment of a separate system even if the prescribed coordination with the Board of Governors discloses the potential of "significant economic harm" to INTELSAT (U.S. Senate, 1983, p. 119). Finally, correspondence in 1981 between the FCC chairman and the Under Secretary of State is cited to the effect that

> members [of INTELSAT] may decide to rely on space segment facilities separate from the Intelsat global system to meet their international public telecommunications service requirements (U.S. Senate, 1983, p. 119).

Further,[3]

> [C]ertain exceptional circumstances may exist where it

> would be in the interest of the United States to use domestic satellites for public international telecommunications with nearby countries.

This policy, the NTIA report concludes,

> affirms this country's strong support for Intelsat, but recognizes that under certain exceptional circumstances, it would be in the interest of the United States and other countries to authorize use of domestic satellites for international communications (U.S. Senate, 1983, pp. 119-120).

In addition, many respondents to the NTIA study

> agreed that the United States should continue to support Intelsat, but suggested that U.S. carriers should be able to use competitive, non-Intelsat space segment for regional communications (U.S. Senate, 1983, p. 120).

The report does not address the apparent conflict between INTELSAT as a U.S. foreign policy "triumph" and the possible symbolic and economic damage that separate traffic and systems--supported by current American deregulatory policy--might inflict on that organization. This is a theme that is constantly used by INTELSAT officials in opposing separate North Atlantic facilities (see Colino, 1983, pp. 25-28; Alegrett, 1984a, p. 23; Alegrett, 1984b, p. 46).

As these policy documents suggest, there is ample evidence that in examining the North Atlantic traffic controversy, the United States will be animated more strongly by technical arguments and political beliefs regarding the efficacy of competition and free markets than by the real and symbolic achievements that INTELSAT represents for U.S. foreign policy.

III- ARGUMENTS AGAINST COMPETITION IN THE NORTH ATLANTIC COMMERCIAL SATELLITE MARKET

In this section we examine the economic and foreign policy considerations that have been advanced for maintaining monopoly against competitive entry. Some of these arguments are quite general and abstract, while others have been adapted specifically to the issue at hand. Most, however, will be discussed in the framework of telecommunications markets.

A- Natural Monopoly, Economies of Scale and Scope, and Sustainability of Monopoly

By far the most common defense of monopoly in any public utilities market is the alleged presence of what is usually called "natural monopoly." Traditionally, this has often meant nothing more nor less than economies of scale in a single output: the average cost of production declines, over the relevant range, as output increases. In other words, any given level of output can be produced more cheaply by a single producer than by two or more who split the market, assuming that all producers have the same cost function (i.e., the same technology).

A more recent concept used to define natural monopoly is that of cost subadditivity, emanating from the sustainability of monopoly/contestability of market structure literature.[4] Costs are said to be subadditive when the cost $C(x)$ of producing a total amount x of a single output is less than the cost $C(x_1) + C(x_2)$ of having two firms produce amounts x_1 and x_2, respectively, where $x = x_1 + x_2$.

In a single-output setting, economies of scale and cost subadditivity are the same. Rarely, however, does a firm produce only a single output, particularly in the telecommunications

sector. Most large carriers, for example, provide both video and data services along with telephony. Even telephony cannot be considered a single commodity, since it can be classified into submarkets based on time of day, length of transmission, route density, and so forth. Although there is a temptation from an engineering perspective to assume that telecommunications providers supply a single output called "bandwidth" or perhaps "bits of information," a more fruitful approach is to differentiate markets and products whenever variations in the price elasticity of demand are observed, as between, for example, residential and commercial users.

For decades, policy analysis of "natural monopoly" in public utilities was chained to the unlikely assumption of a single output. Since the mid-1970s, analysis of the multi-product case has resulted in a number of striking new insights. An important one for this discussion is that of economies of scope. Consider a firm producing two outputs at levels x and y, respectively, at a cost C(x,y). We define cost subadditivity for this multi-product cost function by the condition

$$C(x,y) < C(x_1, y_1) + C(x_2, y_2)$$

for all combinations $x = x_1 + x_2$ and $y = y_1 + y_2$. In other words, natural monopoly can now occur under two quite separate conditions. First, two smaller firms can produce the same mix of products but on a smaller scale, e.g. $x_1 = x_2 = x/2$ and $y_1 = y_2 = y/2$. In this case, subadditivity would require

$$C(x,y) < 2C(x/2,y/2),$$

which is a multi-product version of economies of scale.[5] The

second possibility, which has no single-product analogue, is that each of two smaller firms completely specializes in one of the two outputs, e.g. $x_1 = x$, $x_2 = 0$, $y_1 = 0$, and $y_2 = y$. Then

$$C(x,y) < C(x,0) + C(0,y).$$

In this case, we say that the cost function exhibits economies of scope, meaning that a single producer can produce more cheaply than two firms each specializing in one of the outputs. Generalization to any number of outputs and firms adds no essentially different conclusions. Intermediate cases of partial specialization and partial diversification, capturing economies of both scale and scope, are of course more probable than the polar examples shown.

Economies of scope, akin to the older concepts of joint and common costs, reflect complementarities in the production process. They are vital in considering the nature of the cost function and its implications for regulatory policy in the face of claims regarding the presence of "natural monopoly." Before turning to the case of INTELSAT and competing systems, we must add one final element to our conceptual tool kit, that of sustainability of natural monopoly.

In a single-output case, a firm with natural monopoly--economies of scale--need not worry about market entry by competitors. Any firm producing at a lower scale will incur higher average prices and can be undersold by the incumbent firm, thus eliminating financial incentives for small-scale entry. Thus, the traditional rationale for government regulation of single-product monopolists has been to protect the public from profit-maximizing behavior on the part of the monopolist rather than to protect the monopolist from entry.

In the multi-product case, however, an incumbent firm enjoying cost subadditivity or natural monopoly--and thus generally benefiting from economies of both scale and scope--might still fail to prevent profitable entry by rivals. Such competitors would typically choose to produce a proper subset of what is offered by the incumbent, for example by specializing in one or more individual product lines. In other words, although a single firm--by virtue of cost subadditivity--is always able to offer a given market basket of outputs at least cost, there exist cases in which rival firms still have financial incentives to enter the market and compete away part of the incumbent's business. When this happens, the incumbent must cut back production, and the overall cost of the same total market output rises. This is the case of an unsustainable natural monopoly. If no such incentives for profitable entry exist, the monopoly is said to be sustainable (see Baumol et al., 1982, pp. 192-198; Sharkey, 1982, pp. 84-110).

The existence of unsustainable multi-product natural monopolies is a vital public policy question for regulatory authorities.[6] Two examples from the telecommunications sector will be used to illustrate this, and then we will discuss implications for INTELSAT.

In its ultimately unsuccessful defense against divestiture, AT&T drew heavily on sustainability theory, much of which had been developed by microeconomists at its own Bell Laboratories as well as at Princeton University. The argument was basically that AT&T was an unsustainable natural monopoly, and that while new entrants, if admitted, could prosper by competing away some of AT&T's business, overall costs to consumers would rise (see Evans, 1983; MacAvoy and

Robinson, 1983). A second instance derives from an important study of west German telecommunications policy by economists consulting for the German Monopoly Commission in 1981.[7] At issue was whether the German Bundespost, that country's telecommunications carrier, should be prohibited from entering newly developing terminal equipment markets as a matter of pro-competitive principle. The economists argued that it would be unwise to prohibit the Bundespost from entering; in fact, it should be required to enter. In that way, they observed, any economies of scope the Bundespost enjoyed in providing both transmission and terminal equipment services, conceived of generically as two separate outputs, could be realized. If the Bundespost did in fact possess both economies of scope and a sustainable monopoly, they argued, this would be revealed through the process of competition with smaller terminal equipment suppliers, who would presumably be unable to hold their own and would exit the market. An important proviso to this conclusion was that pricing or accountancy sleight-of-hand was to be prohibited so that the Bundespost could not subsidize its terminal equipment service to drive away possibly lower-cost competitors. A question left unanswered was whether, if the Bundespost had an unsustainable monopoly, competition should be excluded so as to minimize overall production costs to consumers.

INTELSAT is clearly a multi-output enterprise. Its service offerings are differentiated by technical features (voice, data, video); by route; by region (Atlantic, Pacific, and Indian Ocean); by user restrictions (pre-emptible transponder leases); and by many other criteria. Does it have economies of scale and scope, is it a

natural monopoly, and, if so, is it a sutainable one?

One important point often cited in defense of INTELSAT (see Colino, 1983, p. 45 and Appendix 5) is that it represents only about ten per cent of total satellite communications costs, the remaining ninety per cent residing in earth station and various terrestrial transmission expenses. Reference is often made to the claim that from an engineering point of view, system "optimization" would be possible only if the same entity operated both the earth and space segments. What is probably meant by this is that there are economies of scope in provicing both earth and space segments through a single entity rather than through over one hundred (INTELSAT and 108 Signatories, each of the latter with its own earth segment). Due to the political and institutional impossibility of unifying the earth and space segments--which is not at issue in the North Atlantic route debate--we will neglect this rather obvious source of potential economies in what follows.

Even in the space segment, it is conceivable and perhaps probable that INTELSAT enjoys a multi-output natural monopoly and economies of scope.[8] Suppose that there are three homogeneous outputs which we will call voice, video, and data service, and that INTELSAT presently supplies respective levels x, y, and z of those services. Cost subacditivity, the salient property of its natural monopoly, would then assure that no combination of two or more firms--presumably including INTELSAT--could provide output bundle (x,y,z) at lower cost. Assume, however, that INTELSAT's natural monopoly is unsustainable. One consequence of that unsustainability could be that two competing firms or systems, specializing in video

and data, respectively, might find financial incentives to compete away all or part of INTELSAT's business in those services. In the case of complete specialization, we would then have the output vector (x,0,0) for INTELSAT, (0,y,0) for the video firm, and (0,0,z) for the data enterprise. Each would be earning a profit and would thus have a financial incentive to remain in the market. Yet cost subadditivity would assure that

$$C(x,y,z) < C(x,0,0) + C(0,y,0) + C(0,0,z),$$

i.e. that the same output after entry is produced at a higher overall cost, to the presumed detriment of users as a whole. The important public policy issue is whether, under such circumstances, INTELSAT's unsustainable natural monopoly should be artificially sustained by entry restrictions and/or moral suasion by INTELSAT's membership, based on positive findings of "significant economic harm" under Article XIV(d). To be sure, we have established a case for economic harm to satellite users as a whole. A case for harm to INTELSAT itself would have to be based on the consequences of losing certain categories of traffic to higher-cost competitors as well as on a lack of diversification of output. This might be difficult to do in an environment of exponentially rising traffic.

There are other possibilities as well. Even though technical properties of the geostationary orbit or the earth's terrain may afford economies of scope in multi-region or global satellite services, the natural monopoly on which such economies are based might be unsustainable.[9] Subglobal systems, perhaps specializing in particular ocean regions or other geographic areas, would then have financial incentives for market entry, even though

subadditivity would assure that any given combination of regional outputs would be more expensively provided by two or more systems than by the global system alone.

Finally, in a cooperative of owners and users, such as INTELSAT, the threat of competition can come from within as well as from outside. Individual user groups within an unsustainable natural monopoly can "secede" and create their own facilities or systems more cheaply for themselves but to the detriment of users as a whole. This may well have been the cost dynamic behind the establishment several years ago of INMARSAT, the global maritime satellite system. Perhaps heavy users of maritime communications, consisting of a small subset of INTELSAT members plus the Soviet Union, perceived that it was possible to specialize in the maritime satellite market profitably, although INTELSAT may have been able to provide any given vector of both maritime and public services at a lower price. Similar considerations might explain INTELSAT's disinclination or inability to specialize in other areas, such as aeronautical or land-based mobile services.

It should be clear that any of the questions posed regarding the existence and extent of natural monopoly, economies of scale and scope, or sustainability of natural monopoly for INTELSAT must depend for their answers on (1) the existence and availability of complete, reliable, and accurate cost data; and (2) correct specification and estimation of the relevant cost functions. This is a task of urgent priority if important policy issues are to be resolved on a reasonably objective basis. Economies of scale, for example, have been estimated for the first decade of INTELSAT

operation (see Snow, 1975); in addition, more recent studies are extant.

B- Competition in Services Rather Than Facilities

INTELSAT may find it in its interest to make facilities available for lease to firms that resell them, providing what are called value-added or resale services in a slightly different domestic context. This would be an alternative to establishing separate transmission facilities to furnish such services. In this way INTELSAT would retain its facilities monopoly but would move down the marketing chain to the status of a wholesaler in some of the services for which its facilities were ultimately used.

While the economic issues are difficult to sort out here, one might argue as follows. By providing circuits to wholesalers for later resale as value-added services, INTELSAT could retain the benefits of economies of scale. If separate facilities were established, by contrast, this would cause a loss of economies of scope. If INTELSAT has a natural monopoly that is strongly unsustainable, it might be possible for competitors to invest heavily in duplicate or parallel facilities and still have a financial incentive for entry. Perhaps an analogue of the indefeasible rights of usage provided to cable users could be established for certain categories of INTELSAT customers wishing to resell their circuits over an extended period of time (see Colino, 1983, Appendix No. 9, for a description of INTELSAT's leased services for private use).

If separate facilities are uniformly opposed by INTELSAT members, the concept of value-added circuits is unacceptable to most

telecommunications providers outside the United States (see Noam, forthcoming 1985). This might pose a political barrier to their accommodation on INTELSAT facilities and a greater spur to completely separate systems, again to the detriment of the user community as a whole.

C- Habit, Preference, and Stability

Recent studies of international telecommunications deregulation have included conjectures about preferences for the status quo based upon plausible organizational and psychological motives. In Australia, for example, a substantial measure of price stability and predictability may well be preferred by most of the population to prices that fall erratically in an environment of deregulation (see Lamberton, forthcoming 1985). Noam (forthcoming 1985) has discussed such phenomena extensively in the context of European PTTs.

Distributional matters are also paramount in deregulatory questions. Even when economic welfare as a whole increases, the welfare of certain individual user groups (the poor, rural customers, low-volume users) may well decline. Explicit subsidies to correct these difficulties are often proposed by economists. Direct subventions are more efficient in a purely technical sense than is the retention of the subsidy pattern implicit in most telecommunications pricing schemes, but they are often politically impracticable.

Part of INTELSAT's unanimous opposition to competing North Atlantic facilities may well come from the fact that most of its Signatories are either PTT administrations or other entities in telecommunications ministries, with various organizational and

psychological motives for opposing change. These motives may very well have validity in terms of human and material resources, and should be considered to the extent possible in the overall calculus of costs and benefits brought to bear on the ultimate policy decision.

D- Cooperation Instead of Competition

Among the many non-Marxian socialist approaches to economic organization, the cooperative movement still retains some of its nineteenth-century appeal and following. INTELSAT, as noted, is technically an economic cooperative of owners and users. Another related line of thought is that of the German "social economy" [Gemeinwirtschaft] school still used by labor, Social Democrats, and other groups to oppose private provision of telecommunications and other public utilities in that country (see Snow, 1984). Voge (forthcoming 1985) has argued that cooperation is more important than competition in modernizing French telecommunications, just as the Socialist electoral victory of 1981 is seen more as a mandate for decentralization of the historically overcentralized French state than for deregulation of various sectors of the economy.

Spokesmen for INTLESAT have invoked similar themes in arguing against the introduction of competition (see Colino, 1983, pp. 8-12 and 25-28; Alegrett, 1984a, p. 23; Alegrett, 1984b, p. 46), citing the harmony and cooperation that INTELSAT has displayed in its twenty years of efficient and apolitical existence. Indeed, there is a sentiment toward INTELSAT among its members and many American proponents much akin to the supportive attitude toward AT&T before the first big competitive incursions by Microwave Communications,

Inc. (MCI) in the 1960s or before its recent divestiture (see Noam, forthcoming 1985). Part of this attitude can be summarized by the aphorism, "If it works, don't fix it."

Nonetheless, however strong the verbal appeal of the argument for cooperation instead of competition, it does not have anywhere near the theoretical buttressing of the natural monopoly arguments set forth above.[10]

E- The Cream-Skimming Argument

Another defense of INTELSAT against competitive incursions, one employed with particular frequency on the high-traffic North Atlantic route, is that of cream-skimming. It goes like this: INTELSAT, obliged by treaty to engage in globally averaged pricing, will have its highly profitable dense traffic routes competed away by entrants not so constrained, who will underprice INTELSAT on those routes and ignore the thin-traffic routes INTELSAT must serve at a loss.

This is a quite accurate summary of the dilemma faced by INTELSAT. It is not qualitatively different from the arguments used by American communications and transportation carriers when faced with domestic ceregulation.

Much has been written about cream-skimming in the regulatory and other literature (see, for example, Kahn, 1971, Vol. II, pp. 220-246), but the essence of the problem is easy to state. Cream-skimming is made possible by competitive entry to markets which were previously part of a cross-subsidizing monopoly. Competition, however, forces costs to be aligned with prices in each market; otherwise, the incumbent firm would either be underbid and

lose customers (in markets where its prices exceeded costs) or lose money (in markets where its costs exceeded prices).

By interpreting its agreements regarding global and non-discriminatory pricing (U.S. Department of State, 1971, Article V(d), p. 13) strictly, INTELSAT has indeed made itself vulnerable to cream-skimming by competitors planning to enter its lower-cost, high-traffic routes such as the North Atlantic. Preliminary INTELSAT cost studies, at least those during the 1970s (see Snow, 1975, and Snow, 1979), do indeed indicate a subsidy of the Pacific and particularly of the Indian Ocean regions by the Atlantic.

Two options appear warranted if INTELSAT wishes to foreclose the option of "cream-skimming" to potential competitors. First, more complete and sophisticated cost studies should be conducted to determine wheter (1) potential competitors would have the same technology (and therefore the same cost function) as INTELSAT; and (2) whether INTELSAT's current global tariff structure sets prices above costs in the North Atlantic region. With the continuing rapid evolution of launcher and satellite technology, the answers to these questions may well change every few years.

INTELSAT could decide to adopt regionally disaggregated pricing to counter threats to entry in its high-density, low-cost routes. As we have seen, it has already departed from average-cost pricing with its transponder lease program; in addition, other services, such as television, are priced in a manner different from the global averaging approach (see Snow, 1976, pp. 80-81). Yet all such departures have been for specialized services other than public, commercial, international telephony. It appears clear at this point

that (1) INTELSAT would need to amend its agreements (see U.S. Department of State, 1971, Article XVII, pp. 53-54) to allow explicitly for departures from globally averaged prices for its primary service; and (2) such a change would be politically difficult if not impossible, since a policy question of this magnitude would be resolved on a one-country, one-vote basis, and more countries probably receive subsidy than provide subsidy with the global averaging policy. We shall now examine this distributional issue from a foreign policy perspective.

F- U.S. Foreign Policy Considerations

Fear of damage from competition to INTELSAT is fed by many concerns other than those that can be expressed in a "technical" (engineering, economic, legal) framework. INTELSAT is regarded by most of its member countries and proponents as the embodiment of an apolitical, non-ideological international organization that has harnessed a new technology for the good of mankind. Developing nations have gained access to telecommunications services they could not otherwise have afforded, and the industrialized world has shared in the technology and aerospace contracting needed to maintain the system. While there were complaints from both European and developing countries about American domination during the early years of INTELSAT, these have become less numerous and strident since the renegotiation of INTELSAT's agreements and with the decline of American usage from over one-half to less then one-fourth of the system. One is hard pressed indeed to find a similarly successful international organization anywhere in the world; there is certainly none providing commercial services on the scale that

INTELSAT does (see Snow, 1976, pp. 144-145).

Global cost averaging was mentioned in the preceding subsection as the potential cause of cream-skimming on the North Atlantic route. Symmetry and fairness demand that positive aspects of this implicit subsidization now be discussed. The net flow of benefits to the (mostly developing) countries of the Pacific and Indian Ocean regions can be seen from one perspective as an extremely successful and unprecedented exercise in multilateral telecommunications development assistance, the kind of "foreign aid" that both donor and recipient nations dream of but seldom achieve through conventional assistance mechanisms, whether bilateral or multilateral. The precise ways in which telecommunications can accelerate economic development--or is itself in part a consequence of such development--are as yet poorly understood (see Saunders et al., 1981, and Hudson et al., 1979). Nevertheless, it is clear that a minimum level of telecommunications infrastructure, including both domestic and international links, is a prerequisite to sustained economic development.

We have isolated here an "externality" of INTELSAT's pricing philosophy, meaning that the diffuse and poorly identified benefits of the subsidy in terms of global telecommunications development (and aerospace industry promotion in the industrialized world) are not captured in the conventional cost-benefit calculus applied to its tariff structure (see Leff, 1984). The standard reply of the neoclassical economist is that it is more economically efficient (welfare-maximizing) to align costs with prices using competition and to convert the subsidy into an explicit aid package; as we have

noted, however, this would be politically and institutionally impossible.

IV- ARGUMENTS FOR COMPETITION IN THE NORTH ATLANTIC COMMERCIAL SATELLITE MARKET

This section examines reasons advanced for allowing competition with INTELSAT on its North Atlantic routes. Once again, as with the reasoning in Section III, the arguments are generalizable to other satellite markets and often to other enterprises or industries.

Section IV is briefer than Section III, but not because the arguments for competition are necessarily less numerous or valid than those against it. On the contrary, the general deregulatory atmosphere and mindset in United States during the last decade has engendered a plethora of strong arguments for deregulation which are so widely known and accepted that they will not be repeated here in detail. These include considerations such as the political and economic desirability of less government regulation and entrepreneurship; market competition as a more efficient decision-maker and allocative mechanism than bureaucratic fiat; and the unresponsiveness of large, monopolistic enterprises to needs of particular user groups. Our attention here will be focused instead on more specialized and less broadly disseminated reasons for competition in telecommunications. Many of these arguments were first formulated with specific reference to the domestic American situation, however, and apply only with attenuated force and generality to the international setting in which INTELSAT operates.

A- Diversity of Services and Other Dynamic Considerations

It has been seen that once multi-product output is considered,

traditional conclusions regarding economies of scale and other cost relations had to be modified in a qualitative way. This point applies with particular force when we take so-called dynamic factors into account.

Most economic reasoning is cast in a static mold for mathematical tractability and ease of theorizing. There are at least two aspects of competition in telecommunications, however, which cannot receive adequate appreciation in a static framework. The first point is that over time, new services emerge, and existing services can become better and more reliable. Thus, analysis based on a fixed set of outputs as the arguments of a cost function cannot do justice to the importance of new services and technologies. Baugncum (forthcoming 1985), for example, lists "costs of foregone diversity" as one of two major penalties to be paid by countries continuing to entrust telecommunications services to a single supplier. The list of new services and techniques in telecommunications is long and varied, including, of course, satellite transmission itself. Secondly, technological change causes the cost function to shift over time, allowing more output to be obtained from a given set of inputs. These dynamic efficiencies due to changes in the cost function (technology) over time are to be distinguished from the static cost savings made possible by economies of scale and scope within a given technology (see Snow, forthcoming 1985a).

The burden of economic evidence to date is that these kinds of dynamic efficiencies emerge more naturally and easily in a regime of competition than one of monopoly. This can be seen in the pressure

from the business user community, consisting often of multinational corporations as prime movers, to have European PTTs introduce new services vital to conducting international business (see Noam, forthcoming 1985). User groups and others have argued that national telecommunications monopolies do not have adequate financial incentives to offer such services. In addition, incentives to pursue and adopt more efficient, cost-saving technologies are generally greater in enterprises facing competition or at least having a break-even constraint than in monopolies that can count on taxpayer subsidies to cover their losses.

3- Contestability of Market Structure

A succinct description of market contestability theory is beyond the scope of this essay (see Baumol et al., 1982, pp. 4-8; Sharkey, 1982, pp. 151-156). The basic idea, however, is that if markets dominated by a monopolist are relatively easy (inexpensive) to enter and exit, the mere threat, if not necessarily the reality, of entry by rival firms will exert discipline on the incumbent firm to innovate and to price according to cost rather than to earn monopoly profits. Much of the theory of contestable markets centers around the question of how high entry and exit costs are for potential rivals in monopoly markets; what assumptions the incumbent and rival firms make about each other's potential behavior; and what the effects of both entry and the threat of entry are upon the incumbent firm if a market is truly contestable, i.e. amenable to relatively costless entry and exit by rivals:

> ...the incumbent may be vulnerable to entry by many firms, each planning to operate on a modest scale or in a specialized manner. Such latent competition may still

> suffice to force the incumbent to operate efficiently, to adopt useful innovations without delay, and to adopt an optimal vector of prices. In such a case, it may be essential to avoid any public policy that imposes additional impediments to entry or that imposes inappropriate pricing constraints upon incumbents, preventing them from adjusting prices in accord with competitive presures (Baumol et al., 1982, p. 469).

In the absence of comprehensive, reliable, and accessible cost studies, we cannot determine whether the North Atlantic is a "contestable" market for commercial public satellite communications. There is some behavioral evidence, however, that it is. Consider first two of INTELSAT's recent service innovations, Vista service for developing countries (see Pelton, 1984) and INTELSAT Business Service (IBS) (see Perillan, 1984) for international business applications. Certainly IBS approximates to some degree the types of service proposed by potential North Atlantic entrants. And the introduction of Vista, along with earlier INTELSAT concessions on domestic transponder leasing and small earth stations, is surely not unrelated to the threat of entry by domestic or regional satellite systems into markets oriented to the needs of developing nations.

One major impediment to the costless market entry and exit of rival firms, and thereby to the contestability of such markets, is the presence of sunk costs (see Bailey and Baumol, 1984, pp. 113-115). Sunk costs are a special case of fixed costs (costs insensitive to the level of output) that cannot be rediverted or recovered if a project is terminated: they are "the difference between the ex ante opportunity cost of the funds and the value that could be recovered, ex-post, if it is decided to terminate the

project" (Sharkey, 1982, p. 156). Sharkey notes that the capital cost of an airplane to enter a particular market is not sunk, since the airplane could later be used in a different market at almost no additional cost. It would likewise appear that the fixed costs of satellite systems are not sunk, since satellites can be repositioned in the geosynchronous orbit at the relatively modest cost of their on-board fuel. Similarly, their antennas can be reoriented to accommodate new markets should the one entered prove unremunerative. This is additional documentation that satellite markets are in general contestable; it corroborates the behavioral evidence from INTELSAT that we have already noted.

We conclude with data suggesting that telecommunications markets in the United States and the United Kingdom are contestable. The Competitive Carrier proceeding of the FCC, begun in 1979, had the effect of facilitating competitive entry into the U.S. domestic satellite market, making it easier for "non-dominant carriers" to "institute or discontinue service," i.e. to reduce entry and exit costs (Lipman, 1984, p. 49). The private Mercury consortium was established in the United Kingdom, it seems, precisely to provide a competitive check on the monopolistic power of British Telecom (BT). Although Mercury's incursion into BT's market share has been quite modest to date, evidence suggests that the mere threat of such entry has galvanized British Telecom management to new levels of efficiency and customer awareness (see Jonscher, forthcoming 1985).

C. Optimal Pricing to Maximize Economic Welfare

The discussion of cream-skimming in Section III noted that competition has the effect of forcing prices to align themselves

with costs market by market, and thereby, following accepted canons of neoclassical economics, to maximize economic welfare. Given what INTELSAT perceives to be an absolute prohibition against relaxing its global pricing policy, competitive entry into its low-cost North Atlantic market could indeed inflict "significant" economic harm upon it--harm so extensive, in fact, as to constitute an argument against allowing such competition. Thus, discussion of cream-skimming was included in Section III, devoted to arguments opposing competition. From a broader perspective, however, the creation of welfare-maximizing prices afforded by competitive entry is obviously a consideration in favor of competition.

Measures of global welfare, however, ignore distributional aspects of pricing, as we noted in discussing the development externality features of INTELSAT's globally averaged tariff. Much of the current European coalition opposing deregulation there, which Noam has characterized as the "postal-industrial complex," is composed of groups that would probably become net losers (the poor, the rural, large and well connected contractors) in any redistribution of telecommunications costs and benefits, even though the overall welfare level would increase as a result (Noam, forthcoming 1985).

In case a telecommunications monopoly is retained, however, tariff structures are still available that can greatly increase the level of overall economic welfare above that provided either by global averaging or by political compromises. The best known of such tariff policies is Ramsey pricing, which has already been mentioned. We now discuss Ramsey pricing further, first in the

context of an important study of the West German Bundespost's tariff policy, and then by relating Ramsey prices to INTELSAT and to the sustainability property.

Neumann, Schweizer and von Weizsäcker (1983; see also Neumann, forthcoming 1985) examined the welfare-theoretic consequences of using Ramsey pricing for the Bundespost in 1978. They took two generic services, local and toll telephony. Following almost universal practice, the Bundespost prices local calls below cost and toll calls above cost, providing a net subsidy from toll to local users. Determining the relevant costs and elasticities, they concluded that Ramsey prices for these two services--marked up from marginal cost in inverse proportion to the respective price elasticities of demand so as exactly to capture operating costs--would have provided a net overall welfare gain of over DM 1 billion in 1978 alone.

If INTELSAT can stave off competitive entry and thereby prevent the alignment of cost with price on each of its routes or submarkets, the option of Ramsey pricing offers some noteworthy benefits. The first has to do with the sustainability of its (presumed) natural monopoly, which we have defined in terms of the inability of potential rivals to enter its submarkets profitably. One important result of sustainability theory with respect to pricing is that under quite general conditions, Ramsey prices render a natural monopoly sustainable against competitive entry (see Baumol et al., 1982, pp. 208-217; Sharkey, 1982, pp. 101-102). Thus, in addition to the welfare-maximizing properties of Ramsey prices under conditions (such as scale economies) where marginal-cost pricing

does not recover total operating costs, Ramsey prices would have the additional merit of rendering INTELSAT's natural monopoly sustainable. An incumbent with a truly sustainable natural monopoly, in turn, need not worry about the threat of entry--any such attempt would fail, unless it were subsidized to allow a strategic foothold to be gained by competitors.

Finally, it is possible to interpret various of INTELSAT's tariff offerings as embodiments of inverse-elasticity pricing (see Snow, 1976, pp. 43-45; Snow, 1977b, pp. 15-21), although the more technical Ramsey criterion has certainly not been taken into explicit account. Even global averaging offers a greater excess of price over (regionally disaggregated) cost for low-elasticity users (predominantly in the Atlantic region) than for higher-elasticity users (predominantly in the Pacific and Indian regions). Likewise, transponder leasing for pre-emptible domestic service provides advantageously low prices for mainly high-elasticity user groups (developing countries, in general) while retaining higher average-cost prices for users at large, having on balance a lower price elasticity of demand.

We note in conclusion two practical impediments to Ramsey-type pricing structures.[11] First, their calculation depends critically upon the quality of the theory, methodology and data used to estimate the relevant costs and elasticities.[12] Second, they are often politically unrealistic. For example, the Ramsey pricing scheme assumed for the welfare study of Bundespost tariff policy would have almost doubled the price of local service while reducing toll charges by about thirty per cent (Neumann et al., 1983, p. 83).

D- Stimulation of Overall Traffic by Competition

The claim has been made (see Fishman, 1984, p. 112) that in today's overall context of exponentially increasing traffic, competition on the North Atlantic route might actually increase INTELSAT's own traffic, other things equal. A less extreme version of this argument is that this high rate of traffic growth would quickly compensate any absolute loss suffered by INTELSAT due to competitive encroachments.

This reasoning is reminiscent of similar claims made with respect to the quite different setting of the fast food industry. Anecdotal evidence suggests that when Fast Food Chain B locates one of its restaurants immediately adjacent to an existing restaurant of Chain A, Chain A can occasionally increase its business at that location. The economic theory behind this alleged phenomenon is as yet poorly understood, but one could argue as follows. Instead of being substitutes, the services offered by competing satellite carriers (say) are in fact complements: the use of one stimulates rather than depresses the use of the other.[13] Users purchasing specialized video or data services on a small, rival carrier, for example, might find their public telephony requirements on the same route increased as a result.

Much of this reasoning depends upon assumptions about what market niche is being targeted by competitors: (1) services that INTELSAT has no intention or capability of offering in any case; (2) services that INTELSAT would offer only if they were offered competitively; (3) services that INTELSAT would offer only if there were a credible threat of their being offered competitively; or (4)

services that INTELSAT would offer in any event, regardless of competitive considerations. Naturally, perceptions by INTELSAT and its potential competitors as to what markets would be involed in the case of competition differ widely and are interdependent, and one is tempted to suggest a game-theoretic approach as the most appropriate analytical perspective (see Sharkey, 1982, Chapter 6). In any event, only the actual process of competition, as opposed to *a priori* reasoning, could determine with certainty how markets, demand, supply, and prices would interact. At this stage the claim that alternative competitive offerings on North Atlantic satellite routes would stimulate rather than depress INTELSAT's traffic, *ceteris paribus*, is speculative indeed.

E- Competition as an Efficient Discovery Procedure

This final argument offered in favor of competition is general enough to encompass all the rest as special cases. It derives ultimately from the insights of F.A. Hayek, the Nobel laureate economist of the Austrian school.

While closely allied with the neoclassical outlook, Austrian school economists regard the *process* of competition as uniquely beneficial and efficient, aside from its effects on prices and resource allocation. Hayek (1968; see also Knieps et al., 1981) considers competition as a decentralized, non-bureaucratic, efficient "discovery procedure" or information system. For example, the best way to determine what market-clearing price and quantity would prevail if competition were to exist would be simply to allow competition to exist, rather than to estimate supply and demand curves and determine where they intersect.

We have already noted a telecommunications setting in which this reasoning has been applied. The German Monopoly Commission saw no reason to exclude the Bundespost from terminal equipment markets as a matter of general principle, perhaps on the grounds that it would have an "unfair" competitive advantage. Instead, they argued that the Bundespost should be required to compete with private suppliers. The process of competition itself would then "discover" whether the Bundespost had a cost advantage--in this case, economies of scope between the provision of network transmission and terminal equipment services. This "discovery" would be costless, non-bureaucratic, and both more dependable and less tedious than gathering the data and estimating the cost functions required for a theoretical model that would answer the same qustion.

In the context of the North Atlantic satellite market, this argument would go as follows. Neither INTELSAT nor any potential competitors should be excluded from competition on a priori grounds, assuming that routine technical and financial safeguards were enforced. The ensuing competition itself would reveal the underlying cost relationships in the most efficient manner. Several facts, indeed, could be "discovered" by such competition.

First, INTELSAT might not be a natural monopoly at all, given its current level of output. In other words, it might not exhibit cost subadditivity. Diseconomies of large-scale organization, for example, might make it possible for INTELSAT and one or more competitors to produce a given output vector more cheaply than could INTELSAT itself. Second, INTELSAT might have a natural monopoly that is sustainable, perhaps by using Ramsey pricing instead of

average-cost pricing. In this instance "competition" would consist of the failure of competitors to attain long-term economic viability at prices they must charge to attract customers from INTELSAT; they would ultimately exit the market. Third, INTELSAT might have an unsustainable natural monopoly. Here, as in the first case of no natural monopoly, competitors would be able to enter successfully. Thus, the mere presence of successful competitors would be unable to distinguish between lack of natural monopoly and presence of unsustainable natural monopoly; additional information, perhaps including cost function estimation, would be necessary. The most important public policy decision would be whether to provide artificial "sustenance" to an unsustainable natural monlpoly, for example by prohibiting entry. This would appear to be the theoretical basis of the debate surrounding the economic coordination mechanism of Article XIV(c).

Finally, we note that ease of market entry and exit, a prerequisite for market contestability, also contributes to the process of competition as an efficient discovery procedure and information system. The more costlessly rival firms can enter and exit previously monopolized markets, the more quickly information regarding underlying competitive conditions can be "discovered."

V- CONCLUSIONS

The historical survey in Section II indicates an evolution from monopoly to competition in U.S. telecommunications generally, and in the domestic satellite market in particular. The crucial turning point, if one can be identified, came in 1968-69. In the final

weeks of the Johnson administration, the President's Task force on Communications Policy recommended that Comsat be awarded a monopoly for domestic satellite service. Within a year, the incoming Republican administration had disagreed with the Task Force on the existence of scale economies and urged the FCC to promote competition. The Commission implemented this as its Open Skies program. The Competitive Carrier satellite proceedings at the FCC are a more recent manifestation of this same deregulatory process (see Lipman, 1984).

In addition, we have seen that Congress and NTIA, based on recent policy documents, are quite strongly pro-competitive in telecommunications matters, including (in the case of NTIA) international satellite service. Congress, NTIA, and the Department of State are providing input to the White House on the North Atlantic satellite issue; the White House will in turn recommend a policy to the FCC. Of these actors, all but the Department of State show an increasing historical sympathy to competition in telecommunications markets. If a voice of restraint is heard, it will probably be that of State, which on foreign policy grounds may urge moderation of the government's zeal to deregulate INTELSAT. Two aspects of this countervailing foreign policy issue have been mentioned: INTELSAT as a real and symbolic U.S. foreign policy success, which its member states do not wish to see dismembered by "economic zealots"[14]; and INTELSAT as a unique multilateral exercise in telecommunications development assistance for its less developed members, and in aerospace technology and industrial contracting for its industrialized members.

Sections III and IV reviewed powerful arguments both for and against allowing competition. The strongest reason for prohibiting competition with the global system is the necessity of protecting an unsustainable natural monopoly, if natural monopoly cost conditions (subadditivity) are indeed found to exist. Wise public policy in such a situation would dictate the protection users' interests by favoring the lowest-cost production option, namely a single service provider. This is a static argument which may need to be refined to take into account dynamic factors such as service diversity and stimulation of new technologies. U.S. foreign policy considerations also have a strong appeal but will probably not be decisive.

The strongest pro-competitive arguments cited here include the greater product diversity and attention to users' needs that seem to flourish when competition--or perhaps merely the threat of competition, following contestability theory--is allowed. INTELSAT, however, was seen to be increasingly responsive to special user needs even without actual competition. Another benefit of competition--its role as an efficient and autonomous discovery procedure and information system--also provides a persuasive case for its adoption under quite general circumstances. Due to distributional and political considerations, however, we have seen that welfare-maximizing tariff structures such as Ramsey pricing, despite their theoretical appeal, are less politically realistic and amenable to implementation.

Most of the arguments pro and contra that have been assembled here--and indeed most of the historical policy decisions as well--depend for their validity on certain theoretical propositions

that can be corroborated or refuted only by empirical evidence. The empirical element, however, has been conspicuously absent in this essay; this is because so few comprehensive, reliable, and accessible studies have been undertaken. It seems almost certain that U.S. policy toward competition in international satellite markets will soon be decided upon in the absence of any such studies. The "technology" for this kind of empirical inquiry--theory, methodology, and data gathering and analysis--exists today as the economist's state of the art. What is lacking is the political will to make resources available to conduct studies of this nature.[15]

It was promised at the outset that no decision about the issue of competition on INTELSAT's North Atlantic route would be made on the reader's behalf, and we trust that this has been the case. Theoretical arguments and historical precedents have been adduced, but empirical studies still remain to be conducted.[16] Will competition itself--which we have not hesitated to characterize as an efficient information system--provide the only information about the consequences of a fateful public policy decision?[17]

ENDNOTES

[1] Ito (forthcoming 1985) suggests that as technological advances reduce the scarcity of telecommunications capacity, there is a natural evolution from monopoly to regulation.

[2] U.S. Senate, 1983. For a complete reproduction of this document with accompanying policy discussion and analysis, see Leeson, 1983, and Sterling, 1984.

[3] U.S. Senate, 1983, p. 119. For a description of non-INTELSAT satellite arrangements between the United States and Bermuda, and between the United States and Canada, see Colino, 1983, Appendix No. 4, pp. 6-7.

[4] The most complete single compilation of sustainability and contestability theory is Baumol et al., 1982. This is reviewed in Spence, 1983. A more accessible introduction is in Sharkey, 1982. Bailey and Friedlaender, 1982, provides a bibliographic essay. Baumol, 1982, is a useful summary and recapitulation. Coursey et al., 1983, furnishes experimental results regarding natural monopoly and contested markets, while Shepherd, 1984, is a critical assessment of contestability theory. Bailey and Baumol, 1984, is an application to deregulatory issues in the United States, including telecommunications.

[5] See Baumol et al., 1982, Chapter 3 for a multi-product generalization of returns to scale using the concept of ray average costs.

[6] It is not yet possible to give general criteria for prices that will insure sustainability. Ramsey prices, however, have been shown to assure sustainability under quite broad conditions. See Sharkey, 1982, pp. 100-102.

[7] Knieps et al., 1981. For a more thorough discussion of this report in the overall context of West German telecommunications policy see Snow, 1982, and Snow, 1983.

[8] The claim has been made (see Colino, 1983, p. 32) that "INTELSAT is not a monopoly" since it does not behave like a monopoly; that is, it does not earn monopoly profits by restricting

output, for example. In discussing whether INTELSAT is a natural monopoly we will use a property of the cost function, namely subadditivity, rather than a behavioral criterion.

9 Such global unsustainability is suggested by the statement that "[o]n individual routes or satellites, due to concepts of global interconnectivity...the INTELSAT system is highly inefficient" (Colino, 1983, p. 13).

10 Even modern adherents of the social economy tradition, for example, have criticized its lack of theoretical rigor. See Snow, 1984, pp. 12-13.

11 It was because of political considerations and the difficulty of estimating price elasticities of demand for different user groups that Knieps et al. (1981) did not recommend the use of Ramsey pricing in West German telecommunications tariffs.

12 Taylor (1980) contains a survey and critique of telecommunications demand pricing, while Courville et al. (1983) covers a broad range of other techniques. Evans (1983) illustrates the estimation of multi-product cost functions.

13 One theoretical difficulty with this line of reasoning is that markets are defined in part by the presence of substitute rather than complementary products, i.e. objects having a positive rather than a negative cross-elasticity of demand with each other.

14 The expression is that of Noam (forthcoming 1985) in reference to European views of the AT&T divestiture.

15 Similar frustration has been expressed about the difficulty of attracting funds for international collaborative studies of telecommunications policies. See Snow (forthcoming 1985b).

16 The two most carefully conducted studies to date are those of Dale N. Hatfield Associates (1983), done for a potential INTELSAT competitor, and Walter Hinchman Associates, Inc. (1984), carried out at the behest of INTELSAT. The former argues, based on INTELSAT's published operating reports and using an arbitrary allocation of net investment by region, that the Atlantic and Indian Ocean regions received subsidies from the Pacific region in 1981. This is at variance with INTELSAT's claim that its Atlantic traffic subsidizes the other regions. The Hinchman report stresses the effect of INTELSAT's substantial and continuing excess capacity. It concludes that neither of two proposed competing systems could be commercially viable unless INTELSAT "were precluded either by law or policy from making cost-based adjustments in its 'charges' for incremental capacity to satisfy incremental or specialized user requirements" (Walter Hinchman Associates, Inc., 1984, p. xix). Finally, it concludes that "no simple, straightforward attempt to segregate [INTELSAT's] capabilities or costs by ocean region, route, or other category of service or operation" can disaggregate costs by region and thereby shed light on the controversial question of interregional subsidies (p. xix).

Neither of these reports undertakes to estimate a cost function for INTELSAT, so it is not surprising that their results are contradictory and inconclusive.

17 On November 29, 1984, the Reagan administration announced that it would support a policy allowing limited competition with INTELSAT (Stuart, 1984). Offerings of rival firms were to be restricted to intracompany video, data and voice transmissions.

Interfirm communications of any kind, as well as telephone calls between individuals, could not be carried by new entrants. An administration spokesman was quoted as saying that the endorsement of limited competition sought to reconcile the conflicting goals of protecting INTELSAT's revenue base and of encouraging competition and diversity of services in international satellite traffic.

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