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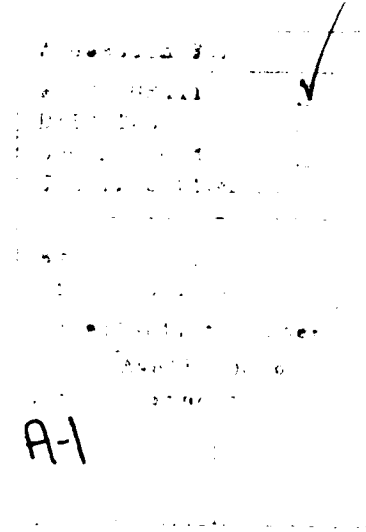
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The Contributing Role of the Regulatory Environment

Transatlantic Fiber Optic Cable Investments

by

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2dLt. USAF

36 pages

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Harvard University
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Master in Public Policy

Abstract

This paper analyzes the contributing role which the regulatory environment plays in shaping the assumptions made for current and planned fiber optic cable investments in the Atlantic Ocean. The conceptual model is simple and allows for an effective and systematic analysis of the situation. The model first suggests that certain economic factors exist that are significant to the investor's decision — in this case demand estimations, profit, technological development, and the role of satellites. Then the model proposes that the regulatory environment can alter a carrier's expectations regarding any of the factors by sending certain signals to industry (especially through the requirements it imposes, its expressed views and decisions). That is, the way an industry is regulated may potentially alter demand expectations, profit margins, the pace of technological development and the future role of satellite. It is this potential regulatory intervention and incentive-making, as it can affect investment decisions, that is the focus of this exercise.

Chapter 1 introduces the current and proposed levels of investment in the Atlantic region as well as the framework of the analysis. Chapter 2 analyzes the economic factors considered by business in making transatlantic fiber optic cable investments, to establish if assumptions about them were realistic. Chapter 3 uses examples to demonstrate how regulatory signals are sent to industry participants, and how these signals allow (and perhaps, encourage) carriers to make their assumptions about demand, profit, technology, and the role of satellites. It then discusses the implications of these investments on the industry, prices and consumer welfare. Chapter 4 discusses conclusions and the further development of this model to address the complex issues and interactions that surround these investment decisions.

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Bibliography

- "Competition in Telecoms." Financial Times November 14, 1990:16.
- "Fastest Cable on Atlantic Route." Financial Times 6 July 1990: 15f .
- "No Need for Phone Cartels." Financial Times April 17, 1990:18a.
- "Ringing in Global Networks." Financial Times July 24, 1990: 29h.
- "Sprint, C&W go Global." Telephony April 30, 1990: 15.
- "Telecommunications Survey" The Economist March 10, 1990.
- "The Impact of Divestiture: A Five-Year Industry Retrospective." Trends in Communications Policy (Economics & Technology, Inc.) February 1988:3-7.
- "Transatlantic Carriers Move to Lower Tariffs and Open Markets." Telecommunications December 1990:15-6.
- "UK Proposes Sweeping Changes in Telecom Policy." Telecommunications January 1991:13-4,16.
- Acton, Jan Paul and Ingo Vogelsang. "Telephone Demand Over the Atlantic: Evidence of Country-Pair Data." 31 May 1988.
- Alleman, J.H. (University of Nebraska at Omaha) and P.N. Rappoport (Temple University). "Simulation of Alternative Settlement Procedures for International Telecommunications Service." 1989.
- Allen, David. "The Breakup of the American Telephone Company." March, 1991.
- Andrews, Edmund L. "New Competition in the Sky, And Just in Time for the War." The New York Times 10 February 1991: C10-12.
- Antonelli , Cristiano. "The diffusion of Information Technology and the Demand for Telecommunication Services" Telecommunications Policy September 1989:255-264
- Bernard, Keith E. "Doing Business in Europe." Telecommunications Policy August 1990:279-282.
- Blustain, Harvey, Guenther, Richard, Lawlor, John, and Paul Polishuk (IGI Consulting Inc.) "Volume II: Fiber Optic Technology and Long Distance Networks." U.S. Long Distance Fiber Optic Networks: Technology, Evolution, and Advanced Concepts. October, 1986.
- Bradsher, Keith. "New Fiber-Optic Cable Will Expand Calls Abroad, and Defy Sharks." New York Times 15 August 1990:D7.

- Breyer, Stephen. Regulation and its Reform. Cambridge, Massachusetts: Harvard University Press, 1982.
- Carnevale, Mary Lu. "FCC Opens Study Today of Competition Within Long-Distance Telephone Sector." Wall Street Journal March 8, 1990:A4.
- Carnevale, Mary Lu. "MCI, British Telecom Paln to Construct Trans-Atlantic Cable to Meet Demand." Wall Street Journal November 6, 1990:A4(E) A8(W).
- Carsberg, Sir Brian. "International Telephony: Simple Resale and Control of Prices" Office of Telecommunications publication: October 1, 1990.
- Cheong, K. "Telephone Tariff Cuts and Traffic Volumes." Financial Times April 24, 1990: 23a.
- Commission of the European Communities. "Report on the State of Implementation." (of the Green Paper). XIII/235(90): April 1990.
- Commission of the European Communities. "Towards a Dynamic European Economy -- Green Paper on the Development of the Common Market for Telecommunications Services and Equipment." COM(87)290: June 11, 1987.
- Crandall, Robert W. and Kenneth Flamm. Changing the Rules. Washington, D.C.: The Brookings Institution, 1989.
- Crockett, Barton. "Brokerage is Bullish on Global Net Savings" Network World January 29, 1990 (International Networks).
- Crockett, Barton. "New Compression Methods, Muxes Spark Global Nets" Network World February 12, 1990:29-30.
- Dixon, Hugo. "A Jigsaw Puzzle with Missing Pieces." Financial Times October 3, 1990:21.
- Dixon, Hugo. "Cartel Distorts World Economy." Financial Times 19 April 1990: S. III, p. IX.
- Dixon, Hugo. "OfTel to Probe International Pricing." Financial Times April 10, 1990: 1c.
- Dixon, Hugo. "Phone Cartel Faces up to Inevitable Change." Financial Times April 5, 1990: 4d.
- Dixon, Hugo. "Phone Club Days are Numbered." Financial Times May 15, 1990: 6g.
- Dixon, Hugo. "Reconnecting Charges With Costs." Financial Times April 3, 1990:1c.
- Dixon, Hugo. "Support for Reforms in Phone Call Pricing." Financial Times May 10, 1990: 4a.
- Gibbs, Brian and Joseph Roussel. "Focus on Europe 1992: What Opportunities does Europe 1992 offer to Network and Service Providers?" Telecommunications August 1989: 5+.

- Grawert, Ron and Brian Hughes. "Private Networks: A Changing International Perspective." Telecommunications November 1987:31,33-4.
- Hansell, Kathleen J. and Fran M. Putney. "New Options for TA Digital Services." Telecommunications June 1989:27-8, 62.
- Heywood, Peter (Data Communications Int'l). "The Coming Transatlantic Price Wars." Data Communications January 1991:101-104, 108.
- Johnson, Leland L. "Anticompetitive Use of Excess Capacity in International Telecommunications." Telecommunications Policy September 1989:223-232.
- Johnson, Leland L. "International Telecommunications Regulation." Newberg, Paula R. (ed) New Directions in TC Policy. Durham, NC: Duke University Press, 1989: 92-122.
- Kahn, Alfred E. The Economics of Regulation. Cambridge, Massachusetts: The MIT Press, 1988.
- Keck, Donald and Robert B. Vandewoestine. "Updating the Art." Telephony 28 March 1988: 46,48,50,52.
- Koepp, Stephen. "London Calling, on a Beam of Light." Time January 19, 1987.
- Kraushaar, Jonathan M. "Fiber Deployment Update." Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, February 28, 1990.
- La Blanc, Elizabeth A., Ann M. Wolf, Richard M. Wolf and Robert E. La Blanc. "From Copper to Fiber: Technology Comes Home." Telephone Engineer & Management (TE&M) January 15, 1990: 54,56-7.
- Leadbeater, Charles. "BT Squares up to its International Competition" Financial Times May 11, 1990: 8c.
- Mansell, Robin. (Science Policy Research Unit, University of Sussex, Brighton, Sussex) "Telephone Pricing: the Danger of even Greater Distortions." (letter) Financial Times April 6, 1990: 27a.
- Mason, C. and J. Williamson. "MCI, BT Lead New Trans-Atlantic Cable Project." Telephony November 12, 1990.
- Morant, Adrian. "Optical Fiber Gets Down to Business." Telephone Engineer and Management 1 Sep 1989: 61-5.
- Negrin, Alan E. "Loop carrier systems of the 1990s: Digital or Optical?" Telephony March 13, 1989: 29-30, 32.
- Noam, Eli M. "Network Pluralism and Regulatory Pluralism." Newberg, Paula R. (ed) New Directions in TC Policy. Durham, NC: Duke University Press, 1989: 66-91.
- Noll, Roger G. "Telecommunications Regulation in the 1990's." Newberg, Paula R. (ed) New Directions in TC Policy. Durham, NC: Duke University Press, 1989: 11-48.

- Obuchowski, Janice. "The State of the Union in Telecommunications Regulation." Telecommunications January 1990: 25,27.
- Organization for Economic Co-operation and Development (OECD). "Satellites and Fibre Optics: Competition and Complementarity," 1988.
- Passell, Peter. "Simulating Competition" New York Times November 7, 1990:D2.
- Poe, Robert. "Fiber Capacity Galore." Communications Week February 25, 1991: 25.
- Reich, Robert B. The Work of Nations. New York: Alfred A. Knopf, 1991.
- Shooshan & Jackson, Inc. "The Impact of Regulation and Public Policy on Telecommunications Infrastructure and US Competitiveness." Northeast-Midwest Institute. April 1989.
- Sikes, Alfred C. "The FCC's Regulatory Agenda." Telecommunications January 1991:21-2.
- Tagare, Sunil. "Investment Frenzy." Telephony August 28, 1989:50-2,54.
- Telecommunications Costing in a Dynamic Environment (Proceedings of the Bellcore - Bell Canada Conference in San Diego, California, USA) April 5-7, 1989.
- Ungerer, Herbert. Telecommunications in Europe. Luxembourg: Office for Official Publications of the European Communities, 1988.
- Vallance, Iain. (Chairman, BT, 81 Newgate St, EC1) "Telephone Rates and the UK Review." (letter) Financial Times April 5, 1990: 17a.

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April 1991

Executive Summary

This paper analyzes the contributing role which the regulatory environment plays in shaping the assumptions made for current and planned fiber optic cable investments in the Atlantic Ocean. The conceptual model is simple and allows for an effective and systematic analysis of the situation. The model first suggests that certain economic factors exist that are significant to the investor's decision — in this case demand estimations, profit, technological development, and the role of satellites. Then the model proposes that the regulatory environment can alter a carrier's expectations regarding any of the factors by sending certain signals to industry (especially through the requirements it imposes, its expressed views and decisions). That is, the way an industry is regulated may potentially alter demand expectations, profit margins, the pace of technological development and the future role of satellite. It is this potential regulatory intervention and incentive-making, as it can affect investment decisions, that is the focus of this exercise.

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CHAPTER 1: INTRODUCTION

1.1. Background and Problem Statement

Since the first transatlantic fiber-optic cable, TAT-8¹, was laid in 1988, telecommunications carriers have made numerous, and perhaps excessive, plans for subsequent cables. The PTAT-1, the first *private* transatlantic cable, was laid in 1989. The US International Service Carriers² plan to follow suit by laying the TAT-9 in 1991. Likewise, in 1992, the PTAT-2 is supposed to be installed...and the investment does not stop here! The TAT-G1³, to Germany, begins operations in 1993, and according to Robert Poe, this proposed venture triggered MCI and British Telecom (BT) to unveil plans for the TAT-X that same year. MCI and BT have since merged TAT-X with the TAT-9A, proposed by AT&T, France Telecom and Mercury Communications, Ltd. (MCL), which itself was proposed in response to TAT-X.⁴ (See Section 3.1.1 for a graphic display of the current and planned fiber optic cable investments).

1 TAT refers to TransAtlantic Telecommunications cable.

2 United States International Service Carriers (USISCs) are carriers (referred to collectively) that take part in each of these international ventures. Of these, AT&T has the majority interest, owning about 73% of USISC shares in the TAT-8 and 75% of USISC shares in the TAT-9.

3 AT&T and Deutsche Telecom are primary participants in this venture.

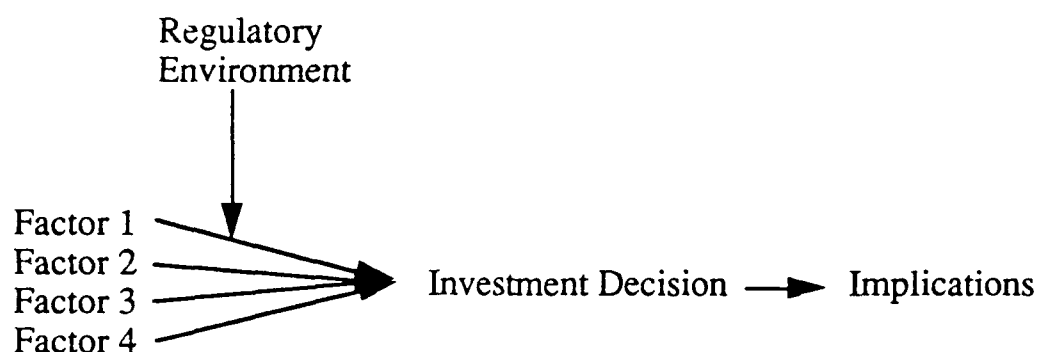
4 Other planned cables include the TAT-10, TAT-11 and TAV-1 (a transatlantic video cable planned for the mid-90's that will carry 144 broadcast-quality video channels, or more than 250,000 telephone circuits). According to one source, the TAT-9A and TAT-G1 have since been renamed to follow the chronological order of other USISC transatlantic cables; thus, they will take the place of the TAT-10 and TAT-11, and these will be renamed TAT-12 and TAT-13. Because the former names tie these cables more clearly to their origins, the cables will be addressed as initially named throughout this paper.

There are several reasons why so many carriers are making transatlantic cable investments, though not all are obvious. Some are unmistakably economic in nature, including an expected boom in demand, a profit incentive, lower-cost technological developments, and an expected shift of user preference from satellite to cable. Less obvious is the fact that the pro-competitive stance of US regulators in the Federal Communications Commission (FCC) might encourage these cable investments. This powerful body (the FCC) could halt the deployment of many of these fiber cables if it deemed necessary,⁵ and because of this, likely plays a critical role in these investment decisions.

It is this less obvious factor, the role of the regulatory environment, which will be the focus of this paper. By using a simple model (See Figure 1.1), this paper will attempt to determine if the regulator contributes to current investment decisions being made by helping to shape the assumptions that the carriers make about these investments. To do this effectively and systematically, this policy analysis exercise proposes to: examine the nature of the cable investments that are sanctioned by the regulatory environment; highlight the regulatory setting that has contributed to making these investments attractive; and discuss the industry, price and consumer welfare implications of such investments.

⁵ For example, the FCC could deny applications or institute prohibitive rules that would make it difficult or impossible to make these investments.

Figure 1.1



1.2. Approach / Overview

Since the investment possibilities in a regulated industry depend as much on the economic as well as the regulatory elements, this paper will address both. However, the emphasis will remain on the latter because the regulation of an industry can potentially affect demand expectations, profit margins, the pace of technological development and the loading requirements between transmission mediums (in this case, between cable and satellite).⁶ So, while it is important to understand obvious economic considerations, it is at least equally, if not more, important to understand any intervening regulatory incentives. Thus, Chapter 2 will highlight some general trends in the aforementioned economic areas, namely expected demand, profit incentives, changes in technology, and the role of satellites. Chapter 3 will address the regulatory environment — the kinds of incentives it

⁶ There is actually an interplay between the regulatory environment and these economic factors, but for simplicity and clarity, this paper will focus on one side of the interplay, the regulatory environment's effect on the factors considered.

gives, the implications these may have on the industry, and further implications on price and consumer welfare. Finally, Chapter 4 will draw conclusions based on the observed influences of the regulatory environment, particularly the FCC. (For an explanation of the additional information sources for research, see Appendix 1).

CHAPTER 2: ECONOMIC CONSIDERATIONS

Today, telecommunications developments seem almost boundless. Two cases in point are "telematics" and fiber optic cables. The former allows telecommunications and data processing to converge and has helped to spur the demand for new data transmission services. The latter brings the domain of television broadcasting closer to that of telecommunications, making it more likely that telephone companies will get involved in cable television, with the possibility of delivering HDTV via fiber cable.⁷ In addition to these developments, the growth of multinational corporations has pushed networks towards globalization. To cater to such customers, telecommunications service providers have changed their products and strategies. As one example, US Sprint and C&W agreed to jointly produce Global Fon products that would be backed by one-stop global support services, as well as services on their Global Virtual Private Network.⁸ Trends such as these help describe the context in which expectations within the telecommunications industry are developing today. Expectations of booming demand, high profitability, cheaper and better technology, and user preference of cable over satellite are the subject of this chapter.

7 Elizabeth A. La Blanc, Ann M. Wolf, Richard M. Wolf and Robert E. La Blanc, "From Copper to Fiber: Technology Comes Home." Telephone Engineer and Management (TE&M) January 15, 1990: 57.

8 "Sprint, C&W go Global." Telephony April 30, 1990: 15.

2.1. Demand

Recent literature suggests that a large, anticipated growth in demand for data services is one reason for the multitude of cable investments being made. There are at least two explanations for this. First, due in part to the deregulation efforts in the US and pending data services liberalization in Europe, competing firms are placing more emphasis on special user needs, allowing customer demands to take on more importance. Second, demand elasticity assumptions are such that competition and reductions of prices for these services are expected to lead to dramatic volume increases. There is much evidence supporting the first assertion, much ambiguity surrounding the second. These two issues are discussed below.

2.1.1. The Changing Role of the Customer

Telecommunications companies have been developing their skills in many areas — service, marketing, productivity, flexibility, and innovation — to appeal to special user needs and growing user sophistication.⁹ Bruce Bond, director of corporate strategy for BT, emphasizes the importance of carrier adaptability to consumer needs as he foresees intensifying competition between international operators “for the accounts of perhaps only 1,000 leading international companies”.¹⁰ Because of the limited number of accounts,

9 One example is the ongoing optimization of new fiber products for specialized applications, such as transoceanic submarine cables. Donald Keck and Robert B. Vandewoestine. “Updating the Art.” Telephony 28 March 1988: 46.

10 Charles Leadbeater. “BT Squares up to its International Competition” Financial Times May 11, 1990: 8c. Also, BT expects to make profits in two ways: 1) by boosting its share of international phone calls (currently the most profitable part of the business)¹⁰ and 2) from managing large corporate networks on

telecommunications companies may have to compete intensely with each other — business customers may thus gain a greater influence in shaping the service offerings, as more companies compete to provide services to them.

The greatest push is thus foreseen for customers with business and data communications needs. Because businesses seek innovation, as well as ease and speed of communications to lower their transaction costs, they are the likely client for any new telecommunications service provider. In fact, in pursuit of these potential customers, Peter Heywood, Data Communications International, predicts “coming transatlantic price wars” as capacity, competition and deregulation increase in this area of communications.¹¹ Competition has already created a downward pressure on prices for transatlantic leased lines, more for the western half of the connection than the eastern half. To get an idea of the scope and price comparison of transatlantic offerings (in data services) from the US side as well as the European side, please see Appendices 2 and 3.

2.1.2. Demand Elasticity Considerations

Let us now turn to the subject of demand elasticity to see if expectations of highly elastic demand are warranted in those areas where business customers will be sought. For transatlantic telephone service, the price elasticity of demand for calls originating in the US was estimated at -1.84 for 1982-86, while that of calls terminating in the US was estimated

behalf of MNC's. Hugo Dixon. “A Jigsaw Puzzle with Missing Pieces.” Financial Times October 3, 1990: 21.

¹¹ Peter Heywood (Data Communications Int'l). “The Coming Transatlantic Price Wars.” Data Communications January 1991: 101.

at -.78 for 1983-86.¹² Though these estimates are only to 1986, they are significant because price decreases offered by carriers for this service occurred primarily during this time (See Table 2.1). However, according to K. Cheong, of National Economic Research Associates, residential demand may be more sensitive to price than business demand, leading to an even lower elasticity for business customers.¹³ This statement indicates that though carriers may be seeking to stimulate demand for private/leased lines, businesses may not require an ever increasing amount of services or capacity to conduct their business, regardless of changes in price. It appears, then, that reductions in prices offered by carriers may not stimulate as large a demand as anticipated for business services.

12 Acton, Jan Paul and Ingo Vogelsang. "Telephone Demand Over the Atlantic: Evidence of Country-Pair Data." 31 May 1988. In their elasticity calculations, Acton and Vogelsang did find that there is an externality created by a party that does not have to pay for being called; this helps explain the difference in the number of calls originating and terminating in the US — in 1984, 48% more transatlantic calls originated in the US than in Europe, and in 1989, 63% more transatlantic calls originated in the US than in Europe. This type of externality highlights the other factors that must be considered when estimating demand elasticity in the telecommunications industry, where (as stated by David Allen and Cristiano Antonelli) demand is more a function of user-value, as well as other dynamic externalities and learning processes.

13 K. Cheong. "Telephone Tariff Cuts and Traffic Volumes." Financial Times April 24, 1990: 23a.

Table 2.1

Price Trends for Transatlantic Calls

Call From -> To	1981	1983	1985	1986	1987	1988	1989-90
France -> US (FF)	12.00	14.40	12.86	12.86	12.86	7.85	7.85*
FRG -> US (DM)	7.33	7.33	4.65	4.65	3.67	3.67	3.22*
UK -> US (£)	0.82	0.57	0.65	0.66	0.70	0.70	0.67*
US -> FR/FRG/UK (\$)	4.05†	2.37	2.17	1.94	1.94	1.94	1.71/1.77/ 1.44**
(First Minute)							
US -> FR/FRG/UK (\$)	1.35	1.33	1.22	1.09	1.09	1.09	1.06/1.09/ 0.94**
(Add'l minute)							

*Source: Lynx Technologies, Inc and "Voicebook Tariffs" (These values are the same for 1/89 and 4/90)

**Source: Economics and Technology, Inc (These values are as of 11/90)

†AT&T's initial period changed from 3 minutes to 1 minute in 1982, accounting much of the decrease.

Source for other values: AT&T tariffs provided to the FCC and discussed in "The Balance of Payments Deficits" (Kenneth B. Stanley, 12/12/88). All rates are standard, per minute, nominal rates for transatlantic calls. For calls originating in the US, however, a higher first minute charge exists.

Demand elasticity considerations are further muddled by the current system of international settlements, which maintains prices at an artificially high level and thus indirectly obstructs any possible stimulation of business demand. Let me give a simplified example to explain how this works. In a bilateral settlement where calls are made between country X and country Y, X pays Y for using Y's network to terminate X's call. Likewise, Y pays X for using X's network to terminate Y's call. If the traffic flow is not even between the two countries, the one which originates the most calls makes a net loss.¹⁴ This payment, based on a unit charge for the calls made, has nothing to do with prices charged to the end user. This is because unit charges are determined by bilateral negotiation between carriers, while end user prices may be subject to regulatory review (especially in the US). Therefore, the international settlements system makes it difficult for carriers to lower end-user prices in order to stimulate demand because the greater the

14 This has historically been the US situation. In 1970, the balance of payments deficit for international communications services was \$40.2 million; in 1987, the deficit grew to \$1.7 billion (including payments to Mexico and Canada).

number of customers they attract by lowering their prices, the larger the carrier's payout will be as a proportion of its revenue.

Thus, we see that while business customer needs are being met by specialized carrier offerings, demand elasticity considerations do not indicate that there will be a boom in telecommunications demand that would justify the rate of planned investment in the Atlantic region.

2.2. Profit Incentives: The PTAT-1

Closely related to booming demand is another expectation that encourages transatlantic cable investments, namely high profits that lead to a short payback period. Long distance telecommunications has traditionally been one of the most profitable areas in the industry. This same profit incentive was evident with the PTAT-1, installed only one year after the TAT-8.¹⁵ In fact, one source states that the investment actually paid for itself in the first 9 to 18 months! This suggests an incredible level of profitability for a cable investment with an estimated life of 24 years. This level of profitability, however, may become questionable in the carriers' minds as more and more investors enter the market.

¹⁵ It is important to note the difference between a private undertaking, the PTAT-1, and the other cable investments in the TAT- series. The majority owners of PTAT-1, US Sprint and C&W, originally expected to sell capacity to non-telecommunication entities, such as businesses wishing to add bulk digital transmission capacity to their private networks. This is different from the TAT- series cable objectives -- these sell services, not capacity to users. According to a reliable source, within the first 12-18 months (this is a conservative estimate), project managers realized that their targeted customer base would not be as profitable as hoped for, so the capacity was sold to telecommunications carriers to fill some of the capacity. This same source indicates that there is perhaps 10-15% of this capacity remaining for private use. This change of customer base further indicates that either 1) business demand is not currently booming and/or 2) business revenues are not as profitable as regular phone service.

2.3. Technological Developments

In addition to demand and profit expectations, recent developments in cable and other technologies have been a motivating factor for making transatlantic cable investments. While there are many indicators of technological improvement, this section will focus on increased optical fiber capabilities and decreased cable costs, to be discussed in further detail below.

2.3.1. Cable Capabilities and Costs

Over the last fifty years, there have been tremendous advances in long-distance cable transmission modes and capabilities. Transmission technologies have evolved from open wire and twisted pairs, to coaxial cables and microwave radio, and finally to optical fiber, which became a viable medium for transoceanic transmission after the tremendous cost decreases of the 1980's¹⁶(See Table 2.2).

Table 2.2

<u>Loop Technology Network</u> <u>Progression</u>		
Time Period	Transmission Methods/medium	Control Method
Pre World - War II	Copper Conductors	Electromechanical
1950's -1970's	Analog carrier on copper conductors	Electronics/hardware
1970's - 1980's	Digital carrier on copper conductors	Electronics/hardware
1990's - 2000	Optical fiber	Electronics/software

Source: Telephony/13 March 1989, p. 29

16. Robert W. Crandall and Kenneth Flamm. Changing the Rules. Washington, D.C.: The Brookings Institution, 1989: 20.

Optical fiber has several advantages over its metallic predecessors, including lower maintenance costs, immunity from electrical surges and its ability to provide new services¹⁷ because of the phenomenal capacity it offers. The technology, itself, is improving at a dramatic pace. This is evident in the increasing bit rate (See Table 2.3), greater bandwidths and extended transmission distances.

Table 2.3

Bit Rate Evolution[†]		
Date	Bit Rate	No. of Channels
1980	34 Mbps	500
1983	140 Mbps	2000
1987	560 Mbps	8000
1991	2.4 Gbps	32000
1996	9.6 Gbps*	128000

† This figure shows the evolution of bit rates since 1980, the dates for each rate indicating not laboratory demonstration or first installation, but rather the start of volume deployment.

* This prediction assumes that demand will be great enough to support such technology.

Source: Telephone Engineer and Management 1 Sep 89: 64

While a thorough review of the technology that has led to these improvements is beyond the scope of this paper, a look at some of the results of these developments will prove illuminating. Consider the TAT-8 for example. It requires repeaters¹⁸ approximately every 50 miles in order to boost the deteriorating signal. It also has enough capacity for almost 38,000 simultaneous phone calls. The TAT-9, on the other hand, is

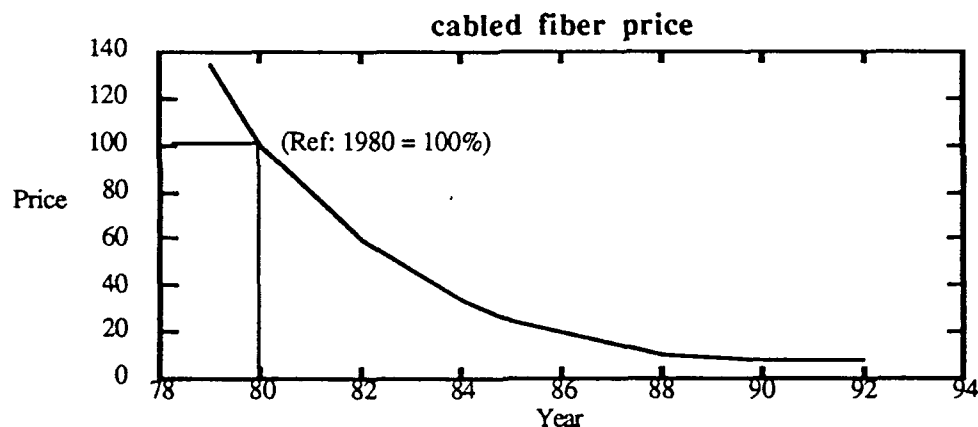
17. Alan E. Negrin. "Loop carrier systems of the 1990s: Digital or Optical?" Telephony March 13, 1989: 29.

18. "Repeaters are \$800,000 torpedo-shaped blocks of electronic circuitry encased in steel placed along a fiber optic cable to renew the signal, which fades over distance." See Bradsher, Keith. "New Fiber-Optic Cable Will Expand Calls Abroad, and Defy Sharks." New York Times 15 August 1990:D7.

expected to have a repeater every 70-85 miles¹⁹ and can carry almost 76,000 simultaneous calls.²⁰

Meanwhile, technological developments have also led to significant cost savings, for example, the tenfold decrease in the price of fiber cable per unit length (See Figure 2.1). In addition, Sunil Tagare²¹ predicted that the cost per voice-circuit-year would be as low as \$165 after PTAT-1 went into operation, a decrease from \$900 for the TAT-7, the last coaxial transatlantic cable.²²

Figure 2.1



Source: Telephone Engineer and Management 1 Sep 89: 64.

¹⁹ Ibid.

²⁰ Bell Lab tests show that solitons can travel thousands of miles down an erbium treated fiber without a boost. See "Fastest Cable on Atlantic Route." *Financial Times* 6 July 1990: 15f.

²¹ Mr. Tagare is a senior analyst and director of the Underseas Consulting Group at Kessler Marketing Intelligence in Newport, RI (KMI specializes in fiber optics and communications)

²² Sunil Tagare. "Investment Frenzy." *Telephony* August 28, 1989:50-2,54.

Technology, then, not only allows for greater capacity but also for lower costs. In fact, the FCC estimated that the average cost per minute of using transatlantic cables fell from \$2.53 in 1956 to \$.04 in 1988 and should fall to \$.02 in 1992.²³ However, Peter Radley, director-technical of the UK's STC Telecommunications, points out that while costs of fiber cable have reduced due to technology and production volume, further significant cost reductions are unlikely, though technological improvement will likely continue.²⁴

2.3.2. Fiber Optic Cable Market Trends

The investments made possible by technological changes are reflected in current market trends. On a worldwide basis, the fiber optic cable market has grown tremendously since 1985, as evidenced by Table 2.4. In 1989, current investment in transoceanic fiber ventures was estimated at over \$1.5 B with an estimated 50% increase expected in 1990 alone. By 1996, some estimate that over \$6 B will be invested.²⁵

23 See Hugo Dixon. "Cartel Distorts World Economy." Financial Times 19 April 1990: S. III, p. IX.

24 Adrian Morant. "Optical Fiber Gets Down to Business." Telephone Engineer and Management 1 Sep 1989: 64.

25 Jonathan M. Kraushaar. "Fiber Deployment Update." Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, February 28, 1990: 22.

Table 2.4

	Fiber Optic Cable Market							Relative Share	
	(Billions of 1985 Dollars Invested per Year)								
	'85	'86	'87	'88	'89	'90	%*	'85	'90
Canada	.03	.04	.06	.06	.06	.06	15.2	4.2	5.7
France	.05	.04	.05	.07	.07	.07	8.6	6.7	6.7
Germany	.03	.06	.08	.09	.08	.07	21.6	3.8	6.7
Italy	.03	.03	.04	.04	.04	.04	7.6	4.1	3.9
Japan	.10	.10	.12	.11	.12	.13	5.4	13.9	12.0
Spain	.00	.00	.02	.03	.03	.04	72.9	.40	3.9
United Kingdom	.05	.06	.07	.07	.07	.07	8.0	6.6	6.5
United States†	.28	.28	.26	.25	.25	.25	-2.2	40.2	24.0
Other Countries	.14	.24	.20	.24	.27	.32	18.0	20.1	30.6
World Total	.70	.85	.89	.95	.99	1.05	8.5	100	100

* %: Average annual growth in 1985 dollars

† Though in the US, the fiber optic cable market seems to have decreased in relative terms, possible explanations include: the decline in the value of the dollar, decreased costs of fiber cables in the United States (compared to other countries in Europe), greater amounts of earlier investments and network development at a rate that is unnecessary and cannot be sustained.

Source: OMSYC 90 (Telecommunication Statistics)

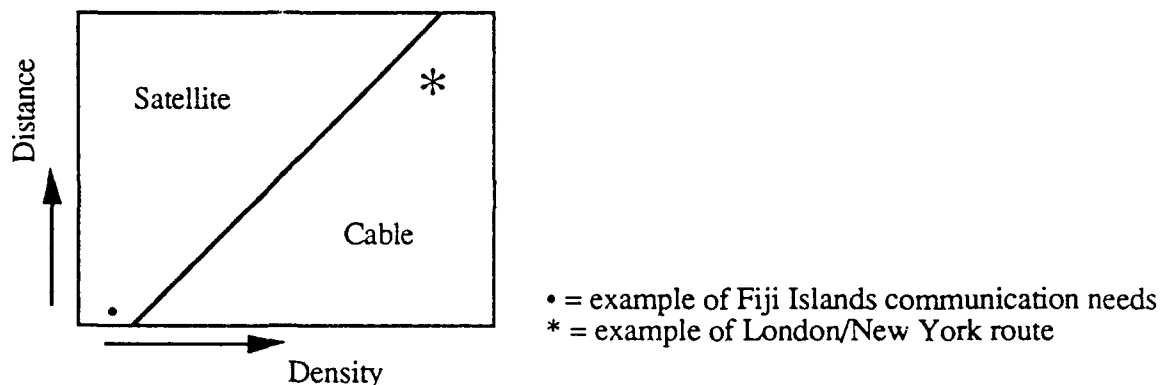
2.4. The Role of Satellites

Along with the expectations discussed so far, an anticipated decrease in the role of satellites is also motivating current transatlantic cable investment decisions. This decreased role is primarily due to the type of route the transatlantic region offers, namely a long-distance, high density route, optimally suited for optical fiber cable transmission. Figure 2.2 below is a conceptual representation of the respective strengths that satellite and cable offer, as a function of distance and density.²⁶ Transatlantic traffic is represented in the upper right-hand corner. Though cable seems a logical choice for such a route, in the past,

26 There is no fixed dividing line (as shown) between the two; this is merely done for conceptual simplification.

capacity constraints prevented it from taking over the satellite transmission role. The last of the transatlantic coaxial cables only had about a 4000 telephone circuit capacity.²⁷ Thus, by 1987, over two-thirds of transatlantic traffic was transmitted via satellite.

Figure 2.2



Satellite capacity still handles the majority of transatlantic traffic. But, this situation may change as far as US international service carriers are concerned, especially once present cable/satellite loading agreements with Communications Satellite Corporation (Comsat) expire. Should technology continue to develop as it has been, there is no reason why cable could not take over most of the market which satellites serve — from analog²⁸ and digital telephone services, to business services, to television.

27 See Herbert Ungerer, *Telecommunications in Europe*. Luxembourg: Office for Official Publications of the European Communities, 1988. This is a great improvement from the first transatlantic coaxial cable, the TAT-1, installed in 1956, which could only carry 36 simultaneous phone calls, but the current coaxial cables are still dramatically inferior to the first fiber-optic cable, the TAT-8, which can carry approximately 40,000 simultaneous phone calls.

28 Analog transmissions can be digitized and then sent over cable.

2.4.1. Satellites as an Alternative

For the transatlantic route, telephone service carriers do not see satellite as a better alternative to cable, despite cost differences.²⁹ This is greatly due to the fact that these cost differences are not reflected in price differences for satellite and cable services.³⁰ There are several reasons why satellite and cable pricing seem inconsistent with cost per circuit estimates, including: the cost of the Comsat middleman, with whom carriers must deal to get Intelsat transponder access; the desire of AT&T and other dominant foreign carriers to promote their cable facilities³¹; and simple corporate preference for the security and timeliness offered by the cable transmission medium³². With no great price differential

29 Intelsat awarded a \$400 million contract in October 1988 for five satellites. With a capacity of 18,000 voice grade circuits and 3 TV channels each, the cost per circuit would be almost 7 times more costly on the TAT-9 cable than the Intelsat VII satellite, and this does not include the TV capacity available.

30 US carriers, on average, price 56- and 64- Kbit/s cable services 5% below IBS (Intelsat Business Service) rates, while most European administrations (except for Germany, Sweden and Switzerland) offer these services on TAT-8 at prices 3-12% lower than the same data rates on IBS routes. For 1.544Mbps or higher data rates, US TAT-8 rates are higher than IBS rates by 7-40%, whereas European rates provide a wide range of prices, some lower and others higher than IBS rates. See Kathleen J. Hansell and Fran M. Putney. "New Options for TA Digital Services." Telecommunications June 1989:27-8, 62.

31 At the end of 1983, AT&T had 41.7% (4664 circuits) allocated over cable. As it invested in more cable capacity, it loaded more traffic onto it, having 51.9% (9416 circuits) allocated over cable by year end, 1987. It is also important to note that before MCI and US Sprint had planned to have significant ownership of cable facilities, they loaded more than 60% of their circuits on satellite. This indicates that satellite was probably cheaper for them; also, with no vested interest in cable and demand for fiber technology not as great as it is today, they could pursue the cheaper alternative.

32 Satellites transmissions have a time delay because of the distance the signal must travel. While a time delay should not matter for data transmissions, it does hinder smooth voice transmissions.

between satellite and cable services that could lure businesses to change its preference³³, cable will continue to be favored.

This evidence does not suggest the complete demise of satellite use as the primary transmission medium,³⁴ though it does herald future change. Leading international carriers still engage in a system of route redundancies to lessen customer risk.³⁵ But, the use of satellites to offer back-up routes may shift to cables as extra cable capacity offers different routing options for carriers in the future. Investor expectations of the diminishing role of satellites are thus reinforced with each new addition of fiber optic cable capacity.

2.4.2. Satellite Market Trends

The diminishing role of satellites is also reflected in decreasing satellite investment (See Figure 2.3). While the total market for satellites grew 4.2% (in 1985 dollars) to \$1.4 billion in 1985, investment has continuously declined since then. Europe's relative share of the satellite market has remained relatively constant at about 30.5%, while the US share has decreased from 33.4% to 28.4%. OMSYC suggests that the market has likely levelled out after an initial investment phase.

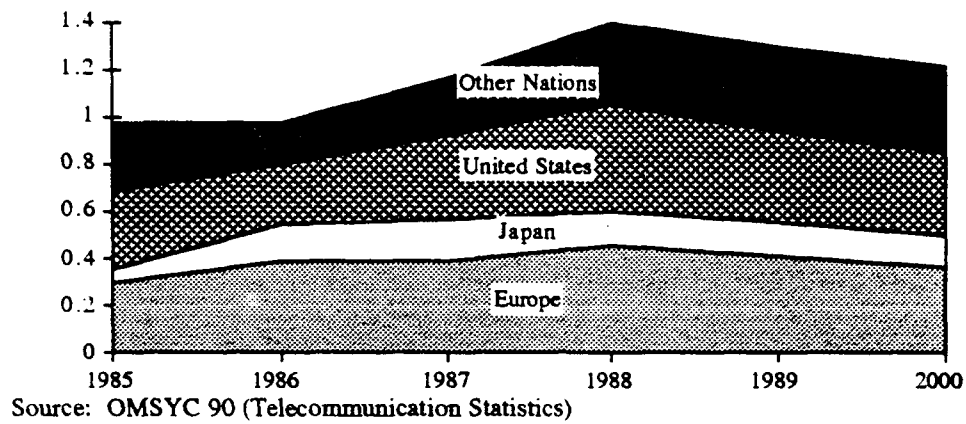
33 See Appendix 2 for an example of cable/satellite price differences.

34 For distant and undeveloped countries, satellites will still continue to be the transmission medium of choice.

35 Kraushaar estimates that carriers typically experience fewer than four outages/ cable breaks per thousand route miles per year . But, since a cable break can take up to six months to locate and repair, a back-up is advisable — see Stephen Koepp. "London Calling, on a Beam of Light." *Time* January 19, 1987.

Figure 2.3

World Market of Satellites (Billions of 1985 dollars)



CHAPTER 3: THE REGULATORY ENVIRONMENT

In Chapter 2, expectations concerning certain economic dimensions of a cable investment were analyzed. Prior to the analysis, this paper stated that carriers were anticipating a large demand growth, a highly profitable investment, greater technology developments, and a decreasing competitiveness from satellites. In the analysis, we found that: demand perceptions may be unwarranted; the margin of profits may decline as more players enter the market; technology developments continue to inspire investment plans; and despite lower satellite costs, other advantages of cable (as viewed by customers and carriers) may start deteriorating the satellite customer base. There is an interesting discrepancy between prior assumption and reality. This discrepancy is at least partially attributable to the regulatory environment that has contributed to making these investments attractive. It is these regulatory incentives and regulatory views which are the subject of this chapter.

3.1. Contributing Role of the Regulatory Environment

The regulatory environment, especially the FCC in the US, has sent various signals to the industry players; this environment has at least allowed, if not encouraged, the assumptions the carriers have made regarding the future prospects of current investment decisions. Examples of contributing regulatory behavior include: 1) the FCC has not critically addressed the inflated demand forecasts that have been characteristic of satellite and cable service carriers; 2) the FCC encourages competition and invites profit-seeking behavior to bring prices down; 3) the FCC has bowed to repeated arguments claiming that the US R&D effort would suffer if international carriers were not allowed to install their

transatlantic cables; and 4) the FCC had until 1988 imposed 50/50 cable/satellite loading requirement on AT&T "so as to allow Comsat a reasonable opportunity to earn its revenue requirements".³⁶ These examples, of course, do not paint a complete picture of regulatory incentives given to carriers, but give us a few hints about the effects that a regulatory environment can have on assumptions made and actions taken by industry participants.³⁷ The following sections of the chapter will discuss these in greater detail.

3.1.1. Demand Forecasts

Demand forecasts in the telecommunications industry have been chronically overestimated in the past, and current evidence does not suggest that this is likely to change in the future. As one example, AT&T traffic estimates at the end of 1984 predicted an annual growth of almost 17% by 1991, requiring more than 36000 circuits. But, a January 1987 forecast showed a growth rate of about 10%, making the total for 1991 equal to only about two-thirds of the previous estimate.³⁸ Media sources today report an estimated annual expected growth of 15-20% — is this realistic, given past errors? If such a demand

36 Leland L. Johnson "International Telecommunications Regulation." Newberg, Paula R. (ed) New Directions in TC Policy. Durham, NC: Duke University Press, 1989: 110.

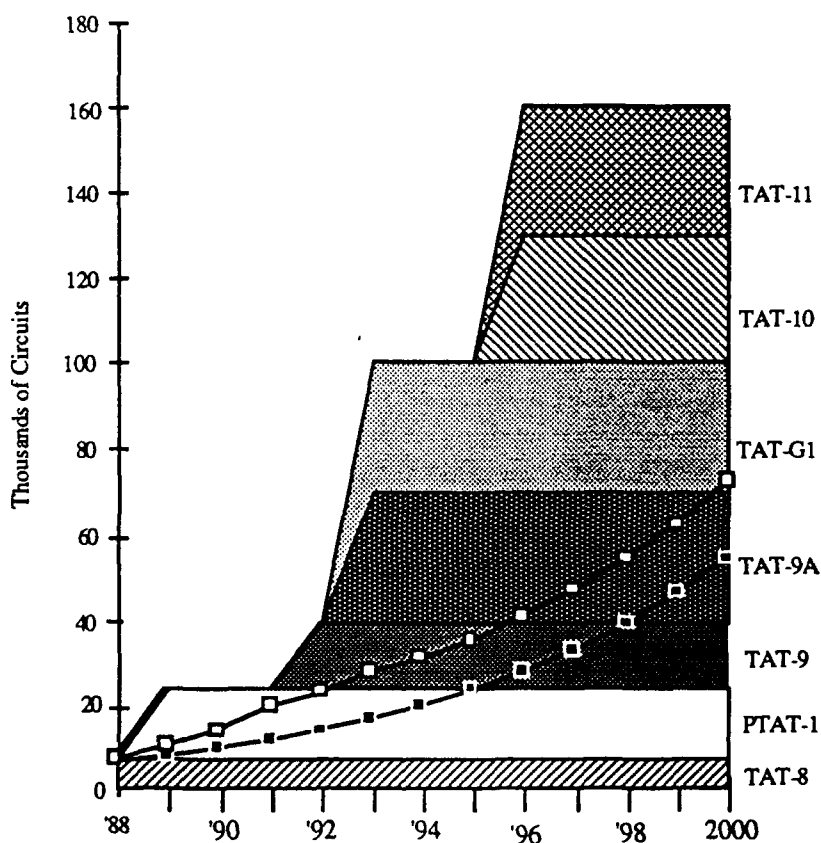
37 In fact, this is not intended to paint a complete picture. This simplified interaction is described so that one may get a glimpse of the impact that signals sent by the regulatory environment have on industry decisions.

38 Ibid, p.105-6. Forecasting errors are not the sole domain of AT&T. US Sprint erred in its forecasts of private users of the PTAT-1, so much so that it went from a planned 100% private user carriage, to about 89%, and down to about 10-15% within 18 months. Intelsat also chronically overestimates its circuit needs. For example, in 1981, Intelsat estimated that about 55,000 circuits would be required for 1985, but the actual year-end 1985 figure was 26% lower, at about 40,000 circuits. Similarly, in 1987, Intelsat estimated it would need about 56,000 circuits by year-end, but the actual figure (after only one year!) was 14% lower, at about 48,000 circuits.

growth, say 18%, were indeed realistic, it would look like the black dotted line in the graph below; it would still be far surpassed by capacity supply estimates. Currently, the number of voice circuits supplied on fiber optic cables is expected to reach 100,000 in the Atlantic region by 1996 (See Figure 3.1). The figure below illustrates that given these unlikely assumptions, there would still be a tremendous amount of capacity supplied relative to capacity demanded.

Figure 3.1

Cable Supply/Demand (#Circuits)



* Capacity for TAV-1 and coaxial cables are not included. PTAT-1 capacity does not include its spare fiber capacity. TAT-9A assumes the capacity of the prior planned TAT-X, and TAT-G1 also assumes the same technology. The TAT-10 and TAT-11 assume the same capacity as the TAT-9A and TAT-G1, though they will likely have more capacity given the evolution of technology. None of these allows for DCME (Digital Circuit Multiplication Equipment) which allows 5 times as many voice paths per circuit.

The dotted lines are the forecasted demand. The greater demand line is based on US Sprint internal data. The lower demand line is based on an 18% annual growth, starting from a point where the TAT-8's capacity is filled as of 1988, an extremely conservative and unrealistic starting point, given the FCC's own conclusions about the capacity that would still be available on TAT-8 after TAT-9 was introduced.

The evidence does not indicate that any measures have been taken to decrease the likelihood of carriers overestimating demand. Thus, by not having some kind of mechanism by which demand estimates are scrupulously examined, or by not having some policy that might automatically reduce demand estimates based on historically similar conditions, the regulatory environment has indirectly contributed to promoting the belief of a coming boom in demand. Even if there were to be a large growth in demand, it is doubtful that it would meet current expectations as depicted by capacity offerings.

3.1.2. Profit-Seeking

Besides allowing current demand estimates to go relatively unchecked, the regulatory environment has also helped to promote profit-seeking behavior in the Atlantic region. The FCC wants firms that will compete to bring the prices down in overpriced segments of the industry. The FCC is getting cream-skimmers that are not creating a significant downward pressure on price.³⁹

Because of the dynamics of the international arena, other factors must be addressed before one can expect prices to drop significantly. The international settlement system is probably the greatest hindrance to competitive results. Without a change in this system,

³⁹ This refers particularly to international telephone service prices, not private line prices, where the revenue shares, as well as the profits, are not as big. As one example, In 1989, AT&T's (which has about 84% of the combined US international telephone and private line market) revenues were \$2.945 billion for international telephone service and only \$42.5 million for private line services. Though competition may occur in the latter, this will only affect a minority part of AT&T's revenues.

standard rates will likely remain relatively unchanged (since the significant price decreases already occurred following the divestiture of AT&T of 1984-86). Anyone who gets involved now, or relatively soon, is hoping to take advantage of large profits and short payback periods. These "competitors" are expecting prices⁴⁰ to remain fairly steady. It probably will...for a while, at least.

By prematurely inviting competition in the transatlantic region, the FCC has created incentives for this type of cream-skimming behavior. Unfortunately, many other cable investors are expecting to enter the market at a later time and be as profitable as TAT-8 and PTAT-1, when this may not be the case.⁴¹

3.1.3. US R&D Effort

The FCC has also indirectly signalled the telecommunications industry that technological developments will continue unhindered. In order "to avoid confrontation in an area where definitive answers are in any event elusive," the FCC allowed arguments linking cable investments with the US R&D effort to be made by international carriers.⁴² The claim was that continued underseas cable R&D would be discouraged "with the possible result being the demise of the US cable system industry".⁴³ This argument was

40 They expect prices for the most profitable segment of the market, namely international telephony, to remain relatively unchanged.

41 Not having access to proprietary information, it is reasonable to assume that it would take a tremendous decrease in price for an investment not to pay for itself in less than 24 years.

42 Leland L. Johnson "Anticompetitive Use of Excess Capacity in International Telecommunications." Telecommunications Policy September 1989:228.

43 Ibid.

one among many made for the TAT-7. Similar arguments were made for the TAT-8. Because of its inability to find the truth of the matter, it has given an indirect boost to the cable industry and carriers wishing to make underseas cable investments.

3.1.4. The Balanced Loading Requirement

A final example of regulatory incentives given to carriers can be seen in the shift away from a balanced loading requirement. By doing away with the 50/50 cable/satellite mandated loading for AT&T, the FCC cracked open the door for carriers, like AT&T and US Sprint, to make considerable gains by investing in cable. This action signalled the decreasing importance of ensuring even growth between the two transmission mediums. It allows the carriers to envision a further decreasing satellite role vis-a-vis cable. In fact, international carriers have done more than form a vision — by planning their transatlantic cable investments, they are making that vision a reality.

3.2. The Current Situation: Undesired Implications?

Thus far, this chapter has described a situation in which the regulatory environment sends signals (through expressed views and decisions) to telecommunications carriers and investors that affect the assumptions they make about the future state of important economic factors, whether rightly or wrongly. These and other intervening signals (which are beyond the scope of this exercise) have helped to bring us to the current market situation. These signals, while sometimes ambiguous and faulty⁴⁴, may have many indirect and far-reaching implications because of the decisions industry players make (based partly on their

⁴⁴ These might include: allowing overly optimistic demand estimates to factor into one's investment calculations or calling for cream-skimmers when other obstacles have not been eliminated first.

perception of the signals). This section will examine the implications on the industry, specifically in terms of capacity and competition.

3.2.1. Excess Capacity

In part because the FCC does not have unambiguous methods⁴⁵ for weighing the factors considered for transatlantic cable investments, the question of excess capacity has become a very real concern. As an example of this, in the late 1970's, the FCC initially decided that the TAT-7, the last transatlantic coaxial cable, would not be "required to satisfy capacity needs or to maintain adequate service reliability."⁴⁶ Yet, arguments, such as the interests of international comity, and others⁴⁷ were strong enough (and politically heated enough) to eventually sway the FCC and get the application for construction approved. Again with the TAT-8, the FCC initially concluded that if the cable were delayed for two years to 1990, there would still be approximately 20% excess capacity in North Atlantic facilities⁴⁸. Nevertheless, the carriers eventually got it approved. These two examples highlight growing concerns of excess capacity.

45 While the FCC is systematic in requiring carrier information with which it can weigh certain criteria (such as legal and political considerations, economic impacts on carriers and users and other technical issues), decisions made seem to usually be affected by well-crafted and convincing arguments from each side, subjective views and interpretations of the commissioners, ambiguity, etc.

46 Op cit, Johnson, p. 227.

47 Ibid. TAT-7 arguments included: service reliability, service quality being better than satellites, cable costs being lower than satellites, the resulting discouragement of R&D in the cable industry, diversity needs of national security, and promoting 'international comity' with the CEPT countries joint owners.

48 Ibid. These facilities include both cable and satellite.

Historically, then, and no doubt for political reasons, the FCC has not firmly stood by its own conclusions when addressing questions of excess capacity. True, reaching accurate and definite conclusions about arguments that carriers put forth in support of their cable investments can be nearly impossible. It is important to realize, though, that in this instance, many signals from the FCC and other sources⁴⁹, help give rise to large, and likely excessive, cable circuit capacity by allowing such investments to be made.

3.2.2. True Competition?

The threat of excess capacity brought on by recent developments leads one to question if competition is actually occurring in the transatlantic region. Johnson points out that excess capacity can do one of two things: 1) encourage entry because the incumbent's costs would be higher than the competitor's, or 2) discourage entry as the incumbents reduce or threaten to reduce prices in response to new entry.⁵⁰ The first proposal seems highly unlikely because dominant carriers, such as AT&T, have already made (at least) adequate returns on past transatlantic cable investments. However, the second proposal is very likely. One could realistically see the overestimated demand forecasts as part of an attempt to acquire excess capacity and thus discourage competition.⁵¹ As long as cables are primarily owned by the dominant carriers of any given country, these same carriers "can

49 The signals previously discussed in Section 3.1 are only a few of the many signals which the FCC will send and which carriers will receive.

50 Leland L. Johnson "International Telecommunications Regulation." Newberg, Paula R. (ed) New Directions in TC Policy. Durham, NC: Duke University Press, 1989: 92-122.

51 Ibid.

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⁴⁴ These might include: allowing overly optimistic demand estimates to factor into one's investment calculations or calling for cream-skimmers when other obstacles have not been eliminated first.

keep competitive suppliers from emerging by strategic use of excess capacity in facilities that they own themselves."⁵²

In fact, a review of the history of recent FCC decisions is consistent with the hypothesis that US carriers, in cooperation with foreign PTTs, seek to invest in excess capacity to serve as a barrier against competitive entry, according to Leland Johnson.⁵³ One example supporting this assertion is the case of the PTAT-1. Less than a year after the TAT-8 was laid, the PTAT-1 was installed (with more than twice the capacity of the TAT-8!). But, the other international service carriers (led by AT&T) felt that this required a response (the TAT-9) because, among other things, they argued: 1) PTAT-1 did not have a direct link to Spain to interconnect with the planned Mediterranean MAT2 and EMOS1 fiber cables, and 2) PTAT-1 did not have the acceptance of other carriers. Of course it did not have their acceptance! If the foreign carriers approved of the PTAT-1, they would be exposing their monopoly carrier's home traffic to future competition.⁵⁴

Market relations also seem to make a competitive situation almost impossible in the transatlantic region. US Sprint's and C&W's PTAT-1 was thought to provide competition, but because it later sold capacity to telecommunications service carriers to help fill its own capacity, it no longer remains a distinct competitor. MCI was going to follow suit and provide competition to AT&T by proposing the TAT-X with BT, but this proposal was merged with the TAT-9A, announced by AT&T, France Telecom and Mercury

⁵² Ibid.

⁵³ Leland L. Johnson. "Anticompetitive Use of Excess Capacity in International Telecommunications." Telecommunications Policy September 1989:223-232.

⁵⁴ Ibid.

Communications Ltd. If carriers, such as MCI and Mercury, are joining hands with the dominant carriers with whom they compete at home, it is not likely that they will be able to provide real competition. Reporter Hugo Dixon describes this by stating, "Concern not to enrage AT&T, for example, seems to be the main reason that BT has not tried to compete head on with the US company in providing international services from America."⁵⁵ (emphasis added)

Thus, while liberalization has occurred to varying degrees within various countries' boundaries, significant steps have not been taken to reach across national frontiers.⁵⁶ True international competition, in the sense of two countries competing for each other's domestic consumers for international service, is being resisted by actions like investing in excess capacity. In fact, "investments in excess cable capacity by existing US carriers may help prevent a reduction in their market share of both domestic and international traffic by discouraging construction of transoceanic facilities that could be connected to competitive domestic networks".⁵⁷ This evidence of planned cables indicates that AT&T is trying to maintain not only international,⁵⁸ but in this sense, also domestic long-distance traffic.

55 Hugo Dixon. "A Jigsaw Puzzle with Missing Pieces." Financial Times October 3, 1990:21.

56 Because of the constant change that is going on in this industry, there may already be initial attempts to compete globally, to which I has not given due notice. David Allen states initial steps are already being taken.

57 Leland L. Johnson. "International Telecommunications Regulation." Newberg, Paula R. (ed) New Directions in TC Policy. Durham, NC: Duke University Press, 1989: 92-122.

58 As of the end of 1989, AT&T's share of international telephone and private line revenues for overseas communications services was 83.8%, followed by MCI, with 10.2% and US Sprint with 4.4%.

The market relations and merged investment plans, however, do suggest that while dominant carriers may not be competing against themselves in the transatlantic region, they may, in a larger sense, be poisoning themselves for future global competition. The dominant carriers may be seeking to insulate themselves from competition for their home base because this would threaten their future global competitiveness.⁵⁹ There is evidence of the tensions that dominant carriers feel as they face the increasing pressure to compete on a global scale. In fact, Iain Vallance, BT's Chairman, states, "You can't actually defend your home base properly unless you have the capability of raiding and attacking in other markets elsewhere, particularly the home bases of the major multinationals."⁶⁰

In the industry, one can see that several indirect implications of regulatory signals (and other signals that have not been addressed) given to industry participants may arise. Two such implications are discussed above. Though excess capacity and the lack of real competition are attributable to many things, one cannot deny that regulatory action/views have played a contributing role. By influencing the way certain factors are perceived, the regulatory environment has allowed transatlantic investments to be viewed in a more favorable light by potential investors.

⁵⁹ In fact, David Allen suggests that the telecommunications industry is moving more towards this global competition. At the same time, in his view, if one compares the US Regional Bell Operating Companies, with their court-granted monopolies, as parallel to the European PTT's, it seems likely that some local monopoly will persist.

⁶⁰ Hugo Dixon. "A Jigsaw Puzzle with Missing Pieces." Financial Times October 3, 1990:21.

3.3. Further Implications

While the previous section proposes a likely market situation of excess capacity⁶¹, used by dominant carriers to keep true competition from occurring (at least as a precursor to global competition), this market situation also has implications for price and consumer welfare. It is to these that we now turn.

3.3.1. Price and Consumer Welfare

With the surge of investment that will occur in this decade, there are two foreseeable pricing developments that could occur: 1) collusion to maintain the same level of prices, despite the amount of unused capacity that will be available and 2) price war, as carriers try to lure a finite number of customers to use their capacity. Should collusion occur, it will most likely happen as carriers refuse to lower prices even when they are more than able to do so. This type of behavior would ultimately diminish consumer welfare, by not passing the benefits of reduced costs on to them. However, collusion would be difficult to detect because regulators do not know what a reasonable price floor or price ceiling is in telecommunications (especially since there are so many interconnected costs in a network).

One way to prevent this collusion might be to redefine market share; that is, if the FCC wants bona fide competition, it could limit the dominant carrier's share in transatlantic cable investments. This would not immediately lead to reduced prices, because barriers

⁶¹ An analysis of much technical and proprietary information would be needed to prove such an assertion. This is beyond the scope of this paper, so the current situation, as analyzed by the author, will be treated as a possibility.

such as the international settlement system, provide disincentives to carriers from any one country to unilaterally reduce prices. And even when accounting rates⁶² are renegotiated, carriers will be reluctant to give up the high profit margins they have so long enjoyed. But, limiting carrier shares in planned investments may be a first step and, in fact, may be the logical action to take *before* other barriers are taken down, so that true competition, and not oligopolistic or cartel behavior (as some claim exists), can successfully develop.⁶³

On the other hand, should price war result, it will most likely happen when carriers realize that the demand for their services is simply not there. At the same time, price war could mean that the carriers that are best established in the market might price below marginal cost, in an attempt to drive the smaller competitors out of the market. Price war could lead to waste, rate instability and reductions in service quality⁶⁴. This second scenario, however, seems a little less likely because of the 'inbreeding' in the established joint ventures (for example, AT&T owns major portions of the TAT-8, TAT-9, TAT-9A, etc... and it is unlikely it would want to lower its own profits unless it could drive out any real competition, should it exist).

62 These bilaterally-negotiated rates determine the amount paid in an international settlement.

63 Such interference would not likely fare well with carriers that are seeking to compete globally and would hinder developments toward globalization — while promoting a global system is important for those who prefer to measure welfare from a global perspective, this idea will have less weight for those who measure welfare based on that of their nation-state and its citizens. Global perspective, such as this, is important to consider. Yet, it does not seem to be currently taken seriously as a necessary policy perspective, and so it will only be mentioned as a possible way to look at the industry. See Reich, Robert B. The Work of Nations. New York: Alfred A. Knopf, 1991 and reactions to his views in various popular newspapers and magazines of March/April 1990.

64 If pricing is below marginal costs, a company may not have sufficient funds to reinvest appropriately in the network infrastructure, should such investment be needed.

The above discussion shows, then, that not only do carrier decisions and planned investments have implications for the industry, in terms of capacity and competition, but also, for the future state of prices and consumer welfare

CHAPTER 4: SUMMARY / CONCLUSIONS

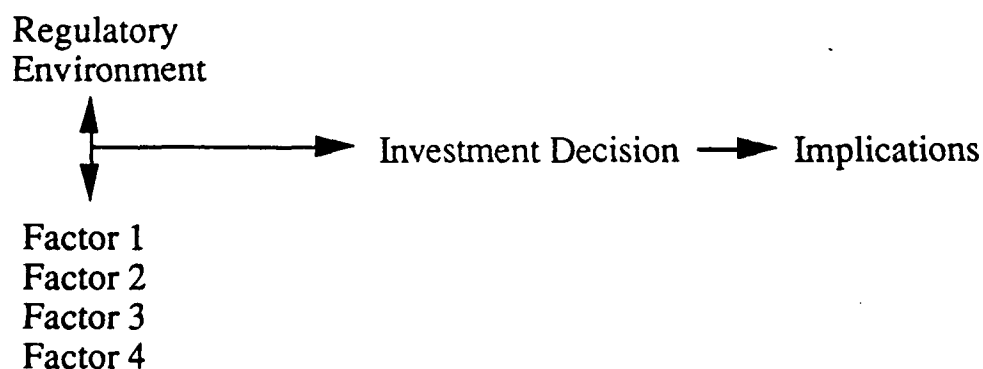
By examining current and planned telecommunications developments in the transatlantic area, this paper has attempted to use a simple model to describe the contributing role which the regulatory environment plays in shaping assumptions made for fiber optic cable investments. Chapter 2 analyzed the economic factors considered by business in making transatlantic fiber optic cable investments, to establish if assumptions about them were realistic. Demand and profit expectations did not seem to hold, while technology and satellite assumptions seemed reasonable. Chapter 3 used examples to demonstrate how regulatory signals are sent to industry participants, and how these signals allow (and perhaps, encourage) carriers to make their assumptions about demand, profit, technology, and the role of satellites. It then discussed the implications of these investments on the market, prices and consumer welfare.

The limitations of this model and the scope of this paper do not allow the conclusion that the regulator is the major catalyst to these investment decisions, but they indicate that the regulator does, in fact, play a contributing role, by helping to shape assumptions made by carriers. In this context, this analysis allows us to make several conclusions: 1) signals are in fact, given by the regulator that can in turn affect the way economic factors enter into a business decision (the strength of these signals cannot be determined by this model); 2) it is important that the regulator have an idea of the kinds of signals he may be giving to the industry (through the requirements he imposes, and through his expressed views and decisions), so that unwanted behavior is not encouraged; and 3) the regulator must ensure that data requirements (i.e. demand forecasts, revenue

projections) are such that they allow him to better consider the likely impact of the signals he will give (i.e. expectations of a boom in demand, or of high profits). These points seem to be common sense, but they are especially critical to remember given the implications of the current situation. While it seems obvious that regulators would endeavor to do these things, they may sometimes be taken for granted, and a seemingly minor decision could have a larger impact than anticipated.

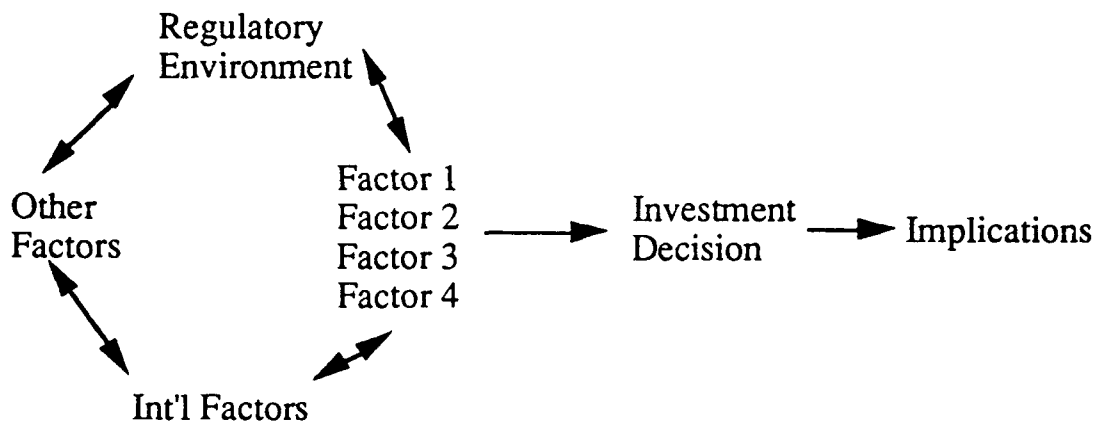
This model is not able to adequately address the interplay of factors, international tensions or other considerations adequately. One way in which it could be further refined would be to add a dimension of interplay between the regulatory environment and the factors considered (See Figure 4.1), that is, not only how the regulatory environment affects assumptions made about the factors, but how the evolution of these factors over time in turn affects the regulatory environment.

Figure 4.1



A further step, involving more detail and complexity, would add these other tensions and considerations. (See Figure 4.2)

Figure 4.2



Accomplishing this, however, would require intimate knowledge about the industry, the various political players, and a sound understanding of other cultures and international tensions.

Additional Sources

Information regarding the general trends in the industry was acquired primarily through a literature survey and discussions with David Allen. Other information was acquired through various sources, including Economics and Technology Inc. and Lynx Technologies Inc., consulting firms; phone discussions with people at US Sprint, AT&T, Comsat and Intelsat (these will remain anonymous), and Ken Stanley, Common Carrier Bureau, FCC; various FCC dockets and papers, as well as documents filed at the FCC.

Transatlantic Offerings: US Carriers

Carrier	Satellite Links	Fiber Optic Links	Published Discounts	Monthly Rental (64KBit/s) Satellite/Fiber	Comments
Alpha Lyracom Space communications Inc. (Pan American Satellite)	4 US and 6 European earth stations support Private International Data Services	None	Based on contract duration and user's monthly bill	\$4000 / N/A	25% price cut planned for early this year
AT&T International	5 earth stations support IBS	Tat-8 and PTAT-1	Based on contract duration and user's monthly bill	\$3000 / \$3400	None
IDB Communications Group Inc.	17 earth stations support IBS	TAT-8 (via WorldCom) and PTAT-1	Based on contract duration and use of multiple circuits	\$2800 / \$2800	Occasionally uses audio-video circuits on PAS-1 and Intersputnik
MCI Communications Corp.	10 earth stations support IBS	TAT-8 and PTAT-1	Based on contract duration and user's monthly bill; discount for satellite backup of fiber lines	\$2640 / \$2300	None
Overseas Telecommunications Inc. (OTI)	14 earth stations support IBS	TAT-8 and PTAT-1	Based on use of diverse primary and backup circuits	\$2900 / 2600	None
Satellite Transmission and Reception Specialists (STARS)	3 earth stations support IBS	TAT-8 (via WorldCom) and PTAT-1	Based on contract duration, use of multiple circuits, and early payment	\$3650 / \$4000	Operates from teleport facilities in Houston and Sylmar, CA
TRT/FTC Communications Inc.	6 earth stations support IBS	TAT-8 and PTAT-1	Based on user's monthly bill for primary and backup circuits	\$3800 / \$2800	Jointly owned by Pacific Telecom Inc. and France Telecom
US Sprint	None	TAT-8 and PTAT-1	Based on contract duration	N/A / \$2900	Plans to offer IBS satellite service this year; discounts based on user's monthly bill pending
Vitacom Corp.	IBS earth station at customer site	None	None	\$2270 / N/A	Supplies earth station equipment for PAS-1
World Communications Inc. (WorldCom)	3 earth stations support IBS	TAT-8 and PTAT-1	Based on contract duration and user's monthly bill	\$3950 / \$3700	Rate reductions on fiber services pending

IBS= Intelsat Business Service POP=Point of Presence PAS-1=PanAmSat service

Monthly rental rates are from NY to the UK, except for the following: STARS US termination is in Houston, and Alpha Lyracom US termination is in Miami.

Sources: Carriers and KJH Communications (Atlanta)

Reproduced in part from Data Communications, January 1991, p.102.8

Transatlantic Offerings: European Carriers

Country / Carrier	Satellite Links	Fiber Optic Links	Published Discounts	Monthly Rental (64KBit/s) Satellite/Fiber	Comments
Belgium / Régie des Télégraphes et des Téléphones	1 of 3 earth stations supports IBS	Various routes to TAT-8 and PTAT-1	Based on contract duration and user's monthly bill	\$5590 / \$5590	Duplicate international gateway will allow diverse routing (2nd half 1991); VPN interconnection agreement is with MCI and AT&T
Denmark / Telecom Denmark	1 earth station supports IBS	TAT-8	None	\$5033 / \$5033	Discounts negotiated on a case-by-case basis
France / France Telecom International	4 of 7 earth stations support IBS	TAT-8 in France and PTAT-1 in the UK	Based on contract duration and user's monthly bill	\$4770 / \$4490	ISDN links with AT&T
Germany / Deutsche Telekom	5 earth stations support IBS; 1 supports PAS-1	Various routes to TAT-8 and PTAT-1	None	\$6100 / \$6100	Discounts under consideration; PanAmSat representative Infoware GmbH (Cologne) recently won VSAT license
Ireland / Telecom Ireland	2 of 3 earth stations support IBS	TAT-8 in the US and PTAT-1	Based on contract duration and for combined primary and backup circuits	\$4550 / \$4550	Major price cuts and bigger discounts for European private lines are planned
Italy / ItalCable	1 of 4 earth stations supports IBS	TAT-8 and PTAT-1 through US Sprint and C&W	None	\$11220 / \$11220	Circuits routed through operating centers in Rome, Milan, and Palermo
Netherlands / PTT Telecom	3 earth stations support IBS	Various routes to TAT-8 and PTAT-1	Based on contract duration and user's monthly bill	\$5290 / \$4930	None
Spain / Telefónica	1 of 4 earth stations supports IBS	See comments	None	\$9570 / \$9570	Owens 2 Mbit/s capacity on TAT-8, used mainly for switched services
Sweden / Swedish Telecom International	1 earth station support IBS	TAT-8 and PTAT-1	Based on contract duration	\$5270 / \$5270	Vesatel VSAT service now half owned by Netherlands PTT
Switzerland / Swiss PTT	4 earth stations support IBS	Various routes to TAT-8 in the UK and France	Based on contract duration (for satellite only)	\$7210 / \$7210	Cut IBS tariffs by 20% to 30% in January 1989
UK / British Telecommunications PLC	3 earth stations support IBS; 1 supports PAS-1	TAT-8 and PTAT-1	Based on contract duration and user's monthly bill	\$4900 / \$4900	Resale of private network capacity approved by UK government
UK / Mercury Communications Ltd.	4 earth stations support IBS	TAT-8 and PTAT-1	Based on contract duration and user's monthly bill	\$3920 / \$3920	Offers diverse routing service at extra cost; VPN interconnection agreement with US Sprint

IBS= Intelsat Business Service PAS-1= PanAmSat service VSAT=Very Small Aperture Terminal

Monthly rental rates are for one-year contracts for continuous duplex service, excluding tax. Ireland tariffs were awaiting government approval at the time of publication.

Sources: Carriers and KJH communications (Atlanta)

Reproduced in part from *Data Communications*, January 1991, p. 103-4.