U.S.-Japan Trade Relations in Telecommunications Equipment Markets

テレビコミュニケーション
設備市場に於ける
日米通商関係

Leland L. Johnson

Center for U.S.-Japan Relations
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The Center for U.S.-Japan Relations (CUSJR) was established in 1989. Its mission is to provide research and analysis that will improve public policies related to the U.S.-Japan relationship. The research focus is on economic, political and foreign policy bilateral issues, with attention paid to the broader Asian context of the relationship. Research is intended to foster public understanding of current and potential controversial issues and to encourage dialogue between U.S. and Japanese government agencies, private corporations and research institutions.

Recent projects include: an analysis of the consequences of increased U.S.-Japan competition and hostility; an analysis of Japanese pricing policies; and an examination of the usefulness of current institutions in negotiating fairness disputes between the two countries.

Funding support for the Center comes from American sponsoring companies (Boeing Commercial Aircraft, Motorola, United Airlines, and Xerox) and Japanese corporate sponsors (Hitachi, IBM Japan, Kawasaki Heavy Industries, Kobe Steel, Minebea, and Toshiba). The Center’s research activities are also supplemented by governmental and academic research grants. The Advisory Board, which meets twice yearly, consists of senior representatives from our sponsoring companies, business and academic leaders and former government officials.

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- Develop comprehensive, unbiased research to benefit the public and private sector.

- Promote informed discussion of U.S. and Japanese relations among high-level government officials and policy analysts in both countries.

- Foster increased understanding for government and business leaders, the media and general public about the key issues and problems likely to affect the relationship.

- Provide “early warning” of potential areas of conflict within the bilateral relationship.
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Preface

This study was supported by The RAND Center for U.S.–Japan Relations with partial funding from the John and Mary R. Markle Foundation. It is one of a series of studies sponsored by the Center that deal with economic, social, and political factors relevant to interactions between the two countries. The report focuses on telecommunications because this sector has played a prominent role in straining trade relations. The study addresses two questions: How are trade relations between the two countries being affected by changes in market structure and technological advances? What does this experience imply for future trade relations? It examines past trade disputes and their resolution, the role of trade agreements, and potential new sources of trade tension. The evidence offers some hope that trade tensions between the two countries in the telecommunications field will be less severe in the future than in the past.

Commensurate with the broad charter of the Center, the study is addressed to a wide audience—government agencies in the two countries and elsewhere, private firms in the worldwide electronics industry, consumer groups, and the academic research community.
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Summary

The U.S. telecommunications trade deficit with Japan has risen during the last decade and some have alleged that Japan has engaged in "one-sided" trade and "unfair" competition. The telecommunications sector has played a prominent role in straining U.S.-Japan relations and it is representative of broader concerns about the loss of U.S. competitiveness in "high-tech" fields. For this reason, it has been singled out for special treatment in U.S. trade legislation.

With a time frame starting in the late 1970s, this study addresses two overarching questions: How are trade relations between the two countries being affected by changes in market structure and technological advances? In light of those changes, are trade tensions in the future likely to be more serious or less so than in the past?

We single out changes in market structure and technological advance because of their prominence in telecommunications. Both the United States and Japan have experienced a shift from monopoly toward competitive markets; technological advance is strikingly illustrated in the emergence of cellular telephones, high definition television (HDTV), and other services.

This study undertakes three case studies:

- **Wireline Telephone Equipment.** We compare the evolution of American Telephone & Telegraph (AT&T) and Nippon Telegraph and Telephone (NTT), both of which have seen their monopoly power erode as a consequence of technological advances and procompetitive government action. AT&T is a long-distance telephone service provider and the world's largest telephone equipment supplier. NTT, which provides local and domestic long-distance service in Japan, has emerged as the world's largest telephone service company. Of key importance are (a) factors that affect AT&T's ability to compete in world markets with Japanese and other firms, (b) NTT's procurement practices with respect to domestic and foreign equipment suppliers, and (c) the effects of U.S.-Japan trade agreements, especially the NTT Procurement Agreement negotiated in 1980.

- **Cellular Telephone Equipment.** Cellular service, which is growing very rapidly in Japan, the United States, and elsewhere, provides instructive contrasts to the wireline experience and insight into future U.S.-Japan trade relations.
• **High Definition Television.** This case, which focuses on broadcasting in contrast to point-to-point wireline and radio-based service, is included for two reasons. First, Japan's head start in developing HDTV triggered widespread concerns about whether U.S. competitiveness has declined and whether a need exists for a proactive U.S. industrial policy. Second, the United States is now leapfrogging Japan in perfecting technology to transmit HDTV signals—a development with implications for future trade relations.

**Market Structure and Technological Advance**

Government-imposed constraints on AT&T, before the divestiture of 1984, compromised the U.S. presence in international telecommunications markets because (a) AT&T was confined to domestic markets by the terms of the 1956 Consent Decree, (b) the tie to Western Electric reduced the size of the U.S. domestic market available to other U.S. firms as a base to facilitate their participation in foreign markets, and (c) the Consent Decree's patent licensing requirements strengthened the position of foreign firms.

The terminal equipment certification and registration program, overseen by the Federal Communications Commission (FCC), opened the U.S. market to imports of this equipment in the 1970s. The move helped to break the Bell System's monopoly, but without comparable trade liberalization measures at the time by Japan or other major countries.

In Japan, the government privatized and restructured the market for both wireline and, later, for cellular service. In the cellular field, especially, we have seen the growth of joint ventures and greater accessibility to the Japanese market. The cellular experience highlights how control over use of the radio spectrum for wireless telecommunications services is a key government instrument.

During the 1980s, Japan emerged as the world leader in developing HDTV technology based on analog transmission techniques. The early work in Japan was so promising that a cooperative U.S.–Japan effort was mounted to perfect technical standards for HDTV program production for potential adoption by all countries as a worldwide standard.

Subsequent breakthroughs in digital transmission and video compression, in the hands of U.S. firms, have radically altered the situation. Digital techniques, superior to analog, are emerging for HDTV, with Japanese firms no longer in the lead.
Future Trade Tensions

Although the evidence is mixed, this study suggests that trade tensions between the United States and Japan in the telecommunications field will be less severe in the future than in the past. Trade agreements, growing competition, and technological advance are helping to make Japan's home market for telecommunications equipment more accessible to foreign participation. The diminishing role of the protected home market as a base for expansion of domestic suppliers into export markets may help to assuage the concerns about "unfairness" and "discriminatory treatment" that have marked U.S.-Japan trade relations in the past.

Before the 1980s, NTT maintained a large, essentially closed, domestic market with its family of wireline equipment suppliers, which were active in foreign markets as well. The subsequent NTT Procurement Agreement, along with other trade agreements, has helped to open the home market.

Cellular telephony has emerged as both a competitor and a complement to wireline service. Slow growth of cellular service in Japan during the early years denied Japanese suppliers a large domestic market that would have assisted them abroad. Indeed, some Japanese suppliers of cellular telephones have sold only in foreign markets. In addition, the growth of new Japanese cellular carriers in competition with NTT has created opportunities for equipment purchases from foreign suppliers, albeit only after resolution of a trade dispute with the United States. Digital cellular service as a supplement to today's analog service has further opened Japan's market to outsiders—as providers of hardware, as partners in R&D programs, and as investors.

In the prospective HDTV industry, adoption of U.S.-developed technologies would probably have little effect on the geographical location of manufacturing activities. A more obvious benefit lies in the potential inflow of patent licensing royalties. But more important is the fact that development of digital transmission and signal compression technologies will bring a wide range of telecommunications applications. Leadership by U.S. firms, aided by their participation in HDTV, may help to assuage concerns about the erosion in recent decades of U.S. competitiveness in "high-tech" industries and help reduce pressures for adopting a protective industrial policy that might add to trade tensions.

Foreign participation in ownership of Japanese corporations—for example, the removal of the ban on foreign ownership of NTT shares and the presence of
foreign firms as co-investors among recently formed digital cellular carriers—may further strengthen perceptions of fairness in trade relations.

The continued growth of multinational firms may also help to improve trade relations. By spreading R&D, manufacturing, and management among countries—frequently through joint venture—multinational firms may help to assuage concerns about one-sided benefits of trade between countries and lead to a stronger spirit of shared purpose.

At the same time, optimism must be tempered with caution. This study identifies a specific possible source of future trade tension. If large flat screens become technically and economically feasible for HDTV receivers, flat panel manufacturing may take place in Japan rather than the United States because of Japan’s strong lead in this field. This situation could trigger demands for protection of a U.S. flat panel industry to assure U.S. access to “critical technologies” for widespread commercial and military applications. This potential for future trade tension is highlighted by the fact that in the United States, antidumping penalties are currently in place against imports of flat panel displays from Japan.

Other dangers must also be kept in mind: Joint ventures among multinational firms may help reduce trade tensions, as suggested above, but disputes may arise about the mutual benefits of these activities if, for example, Japanese firms are perceived to be benefiting from U.S. technology on a largely one-way street.

Finally, although enhanced market accessibility may, on balance, reduce trade tensions, no simple positive relationship exists between the two. Trade tensions result from a set of complex factors, including the nature of expectations by the parties in question. Once a market is opened, trade tensions may emerge for reasons that would not have otherwise existed—as illustrated by the issues of competitive parity that led to a trade dispute in Japan’s cellular market. More generally, the relationship between market accessibility and trade tensions depends on the array of issues that arise, the priorities among these issues, and the skill of trade negotiators in dealing with them.
概要

日米間のテレコミュニケーション貿易赤字はここ10年間上昇を続け、日本は「一方的」貿易慣行、「不公平」競争に従事して来ていると一部から非難されている。テレコミュニケーション分野は日米関係緊張に著しく寄与しており、「ハイテク」分野での米国の競争力喪失の原因として深刻に懸念されている代表的なものとなっている。この為、米国通商立法府で特別な取引圧力を要することとして注目されている。

１９７０年代後半から現在に至る期間を対象に、本研究レポートは２つの代表的な問いを検討する：両国間の通商関係は市場構造の推移と技術進歩によりどのように影響されているのか。これらの変化に照らし合わせると、将来の通商緊張は過去よりももっと緩和するのだろうかそれとも緩和されるのだろうか。

テレコミュニケーションに於いて重要な位置を占めていることから、市場構造の推移と技術進歩を特に取り出して検討する。米国も日本も独占市場から競争市場へと推移を経験してきた。技術進歩はセキュラー・テレフォン、高解像度テレビ（HDTV）、その他のサービスの台頭に如実に現われている。

本研究レポートでは、次の３つのケースを取り上げる：

* 電話線を用いた電話設備：アメリカ電気電話会社（AT&T）と日本電気電話公社（NTT）を比較する。両者は技術進歩と政府の競争政策方針の結果として自分達の独占基盤が崩れしていくのを目の当たりに見て来た。AT&Tは長距離通話サービスの供給者で、世界最大の電話サービス会社として出現してきた。キーポイントとなるのは（a）世界市場で日本及びその他の会社と競争する為のAT&Tの能力に影響する要素と、（b）国内海外設備サプライヤーに関するNTTの調達慣行、そして（c）日米通商協約、特に１９８０年に交渉されたNTT調達契約の効力である。

* セキュラー・テレフォン設備：日本、アメリカ、その他の地域で急速に成長しているセキュラー・サービスは電話線での経験とは対照的な教訓、将来の日米通商関係への洞察を提示している。

* 高解像度テレビジョン：ポイント・ツ・ポイント（ある地点からある地点までの）電話線及び無線サービスに反して放送に焦点を絞っているこのケースは、次の２つの理由で本レポートに取り上げられている。まず第一に、日本が誰よりも先駆けてHDTVを開発したことか、米国の競争力が後退してしまったのではないか、順
市場構造及び技術進歩

（a）A T& Tは1956年の同意審査の条件によって国内市場にのみ制限され、（b）ウェスタン・エレクトリック社との提携が、海外市場参入を助長するための基盤として他の米国企業が利用できる国内市場のサイズを縮小し、（c）同意審査に基づく特許認可要件が外国企業の立場を強化した為に、1984年の（独占基盤）制限以前の、政府によるA T& Tへの抑制が、国際テレコミュニケーション市場での米国の存在を弱体化していった。

連邦通信委員会（F CC）が統括している端末装置認証及び登録プログラムによって、1970年に米国市場は当装置輸入の為に解放された。この動きはベル・システムの独占を打破するには役立ったが、当時日本及び他の主要国によるこれに匹敵する貿易自由化対策がないままに実施された。

日本政府は、電話線、後にセリュラー・サービスを民営化し、その為の市場を再構築化した。特に、セリュラー分野では、ジョイント・ベンチャーの台頭と日本市場へのより解放された接続の機会を経験してきている。セリュラーでの経験を通じて、無線コミュニケーション・サービス用の無線スペクトラム使用をコントロールすることが政府にとっていかに重要であることがあると改訂されたのである。

1980年代に、日本はアナログ送信技術に基づくHDTV技術の開発で世界のリーダーとして出現してきた。日本での初期の業績がありにも将来有望に思わせていたので、後日世界規格として全世界で採用される為のHDTVプログラム製作用技術基準を完成する目的で、日本協力体制がとられるまでに事態は進展した。

その後、米国企業の手で、デジタル送信及びビデオ・コンプレッション分野の大躍進が見られた結果、事態は大きく変わってしまった。アナログよりも優れているデジタル・テクニックがHDTV用に出現してきており、日本企業はもはやリーダーではなくなってしまったのである。
将来の通商緊張

明确な証拠があるわけではないが、本研究レポートでは、通信機器の分野に於ける日米間の通商緊張度は将来に於いて過去よりは緩和されるであろうと示唆している。通商協定、増大化する競争、そして技術的進歩が目指す国際市場を象徴しているものがある。国際市場は将来、さらに拡張されるものと考えられている。国内市場は経済の成長を反映し、過去に於いて日米通商関係を特長づけていた「不公平さ」と「差別的取り扱い」の懸念を緩和するのに役立つであろう。

1980年以前には、NTTは、海外市場も活発に営業活動をしていた。電気通信設備のサプライヤーと共に、大規模ではあるが本質的には単独的な国際市場を行っていた。その後、NTTとの国際的な協議が進められ、この国際市場の解放の一助となっている。

セリュラー電話系は、競合相手及び電話線サービスと互いに補足し合うものとして出現してきた。初期のセリュラー・サービスが日本で余り伸びなかったことから、日本のサプライヤーにとっては海外市場で大きく貢献したであろう。国内市場の獲得に結びつかなかった。事実、日本のセリュラーやデフォン・サプライヤーは海外市場でのみ販売活動をしている。更に、米国の通商摩擦を解決後でのことにも拘らず、NTTと競合する新しい日本のセリュラー・企業の台頭は、外国サプライヤーからの設備供給機会を創造している。今日のアラーム・サービスを補助する意味でのデジタル・セリュラー・サービスは、更に、ハードウェア供給者、R&Dプログラムのパートナー、そして投資家としての外部者で日本市場を解放することになったのである。

将来のHDTV業界は、米国の開発した技術を採用しても製造活動の場所選択に多大の問題はないであろう。より明確な利点は将来の特許権可ロイヤルティーからの収益である。しかし、それにより更に重要なことは、デジタル送信とシグナル・コンプレッション技術の開発が広範囲にわたりテレコミュニケーションの応用をもたらすであろうという要素である。米国企業のリーダーシップは、HDTVへの参与に助長されて、ハイテク産業に於ける米国の競争力がここ数10年を維持し、又、通商緊張を刺激し得る産業保護政策採用への圧力低下に役立つであろう。

外国人（企業）の日本企業所有への参加、例えば、NTT株外国人所有停止令の解消や最近設立されたセリュラー会社の間に外国企業が共同出資家として名を連ねること等が、通商関係上公平だという認識強化に更に役立つであろう。

国策省企業の絶え間ない増加も通商関係改善に役立つことが出来る。"しばしばジョイント・ベンチャーを通して、"外国間R&D、製造、及び経営基盤を拡大することに
よって、多国籍企業は、②国間通販での一方的利用の問題に対する懸念を軽減し、目的を分からせているのだという自覚を以て強く導き出すことが出来るであろう。

同時に、楽天主義は注意をもって調節していかなければならない。本レポートは将来の通販経済における特有の要因を指摘する。例えば、大型平圧スクリーンがHDTV受信機関に技術的にも技術的にも実行可能となると、日本がこの分野で確実なリードを保持しているので、その平圧パネルの製造を通商国よりは、日本国内で実現されるであろう。そうなると、広範囲な商業及び軍事用途のある「致命的な技術」へ米国が確実に接近出来るように米国平圧スクリーン業界保護へ向けて強い要求がだされるきっかけであろう。この将来の通販経済の可能性は、現在、米国で、反ダンピング懲罰金が日本からの平圧パネル表示板の輸入に対して課されている事実によっても明白である。

その他にも余り留めておかねばならない危険性がある：多国籍企業間のジョイント・ベンチャーは上記の通り、通販経済は緩和する手助けにはなるが、万が一、例えば、日本企業の方が主として一方的に米国技術から恩恵を被っていると認識された場合には、これからの対面の相互利用に関し紛争が持ち上がってくる可能性は十分ある。

最後に、市場接近性が助長されることは、全体としては、通販経済を軽減するかも知れないが、②国間には簡単な肯定的関係のみが存在しているわけではない。通販経済は関係当事者が持っている期待内容も含めて一連の複雑な要素から結果するものである。市場が一旦解放されると、日本のセリュアル市場で通販経済に至った競争力等価の問題でも明らかのように、解放前には存在していなかった理由からの通販経済が生じてくる可能性もある。もっと一般的にいえば、市場接近性と通販経済の関係は、生じて来る多数の問題点、これら問題の優先性、そして問題を対処する通販交渉者の技能に左右されるということもある。
Acknowledgments

The author is deeply grateful to the numerous business and government officials in Japan and the United States whose patient responses to questions and contributions of written material made this study possible. Extensive detailed comments on a draft were provided by Ronald Cass, Dean of the School of Law, Boston University, and by RAND colleague Julia Lowell. Additional helpful comments were made by Professor Minoru Sugaya, Keio University, and by Dr. Yoshinobu Komomi, Management Consultant.

The usual disclaimer that the author is solely responsible for errors of fact and interpretation holds with particular force in this case, where the subject is so complex and controversial.
1. Introduction

For more than a decade, the telecommunications sector has played a prominent role in straining U.S.-Japan relations. The U.S. telecommunications trade deficit with Japan has risen rapidly and some have alleged that Japan has engaged in "one-sided" trade and "unfair" competition. The sector is representative of broader concerns about the loss of U.S. competitiveness in "high-tech" fields and it has been singled out for special treatment in U.S. trade legislation.

Telecommunications is defined here as encompassing the equipment needed for communication by radio and wireline, along with the services produced by that equipment. Thus, it includes local and long-distance voice, data, and video services provided by telephone companies, broadcasting stations, and other entities, and the suppliers of equipment to these entities and their customers.

This study concentrates on equipment, a key component of international trade in telecommunications that has been a major concern in U.S.-Japan relations. We treat telecommunications services only as they bear upon the demand for equipment.¹

Trade Patterns

Unfortunately, no single series of statistics shows trade flows for telecommunications equipment consistently over time. The best single series for "communications products" is developed by the Electronic Industries Association from data reported by the U.S. Department of Commerce, shown in Figure 1.1.² The deficit with Japan rose rapidly during the early 1980s and has

¹For example, U.S. imports of telecommunications equipment amounted to about $5.7 billion in 1987 (Electronic Industries Association, 1988, pp. 123-127). In services, the largest category, involving payments by U.S. telephone companies to their foreign counterparts to terminate calls originating in the United States, amounted to $2.7 billion in 1987 (U.S. Federal Communications Commission, 1990, p. 17). Both trade figures exclude Canada and Mexico. Another major service category is international value-added network services (IVANS) for which good international trade data are not available. For descriptions of the IVANS market with respect to U.S.-Japan trade relations, see Grier (1992), pp. 25-29, and U.S. Department of Commerce (1990), pp. 138-139.

²This category includes equipment for telephone switching and transmission; telephone, facsimile, and other "customer premises" facilities; data communications; cable television; cellular radio; and satellite communications. Some equipment included in our definition of telecommunications, such as television receivers, is included in "consumer electronics" rather than in communications products. Data shown in Figures 1.1, 1.2, and 1.3 are deflated by use of the Gross Domestic Product Price Index (1982 = 100).
remained nearly constant in recent years. With Japan trade excluded, the United States has consistently enjoyed a surplus.

The pattern is mirrored in the data largely for more general electronics equipment trade. Figure 1.2 shows the shift from surplus to deficit in 1983, and Figure 1.3 illustrates Japan's role in that shift.

**Trade Tensions**

In the face of U.S. trade deficits with Japan and complaints about outsiders' lack of access to Japan's domestic markets, a U.S. Congressional Task Force was formed in 1978 to examine the situation in telecommunications and other fields. The procurement practices of Nippon Telegraph and Telephone (NTT), the (then) monopoly supplier of domestic telephone service, came under particular scrutiny. After meeting with NTT officials, the Task Force observed that "NTT does not appear to have any awareness of the incredibly serious trade problems

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3In addition to communications products, electronics trade includes three other categories: consumer electronics, electronic components, and computer and industrial electronics. For detailed breakdowns, see Electronic Industries Association (annual).
Figure 1.2—U.S. Electronics Exports and Imports

Figure 1.3—U.S. Electronics Trade Balance
between our nations or that NTT procurement policies in particular are one of the sorest points in our bilateral trade."4 The Task Force concluded that

It appears that the Japanese are using their protected home market to improve their telecommunications technology while exporting as much as they can into the open American market. Since telecommunications is one of the industries "of the future," this type of one-sided and unfair trade competition is particularly serious.5

Along with such alleged unfair trade practices, much concern has been expressed about declining U.S. competitiveness, where high-tech industries are seen as key. As the late Senator John Heinz observed in 1987:

We are used to discussing the import problems of steel, textiles and apparel, and footwear. . . . But what about machine tools, semiconductors, computers and telecommunications. . . . These are not our classical "low-tech" industries. . . . These are indicators of the future—the sectors on which the next generation of our economy will be based; yet they are slipping away from us just as surely as the "old" industries have been eroding.6

Similar apprehension led to the singling out of telecommunications when the U.S. Congress enacted the Telecommunications Trade Act of 1988, as part of the Amended Section 301 of the Trade Act of 1974.7 Telecommunications was targeted in part because, many believed, the United States had benefited only marginally from existing telecommunications trade agreements with Japan. Thus, a basic objective of the new legislation was "to ensure that countries which have made commitments to open telecommunications trade fully abide by these commitments."8

To meet this objective, Section 1377 of the Omnibus Trade and Competitiveness Act of 1988 requires that the United States Trade Representative (USTR) review annually all trade agreements involving telecommunications products or services to determine whether the foreign country is in compliance with the agreement. A determination of noncompliance is treated as an "unfairness" determination under Section 301 of the Act, which requires imposition of sanctions within 30 days.

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5 Ibid.
7 For a comprehensive legal discussion, see Grier (1992), pp. 7-8.
The preceding developments occurred within heated, and continuing, debate about the nature of Japan’s industrial policy. It is commonly said that for particular “strategic” industries (such as telecommunications), trade protection is accorded to the home market to provide a base for export expansion. By nurturing the home market free of foreign competition, it is argued, domestic firms move down the learning curve and become progressively better able to expand into foreign markets.\(^9\)

Consistent with the above argument, this study suggests that a large home market can help (or a small market can hurt) a firm’s foreign operations. The leading example lies in cellular telephony, where Japanese firms experienced limited success in marketing cell site equipment abroad during the 1980s, at least in part because of Japan’s small domestic cellular market.

However, such a connection between home and foreign markets is but one consideration in assessing the pros and cons of an industrial policy aimed at protecting the home market from outside competition. Analysis of these pros and cons goes beyond the scope of this study, with the reader guided instead to the preceding footnote references. Suffice it to say that the greatest dangers posed by such an industrial policy are that (a) protection may, mistakenly, be accorded to inefficient firms whose operations impose costs on the home country in excess of the benefits conferred by export expansion, and (b) other countries may retaliate. We single out these two points because of their particular relevance to the experience in High Definition Television (HDTV) discussed in Section 4.

**Purpose, Methodology, and Organization**

With a time frame starting in the late 1970s, this study addresses two overarching questions: How are trade relations between the two countries being affected by changes in market structure and technological advances? In light of those changes, are trade tensions in the future likely to be more serious or less serious than in the past?

We single out changes in market structure and technological advance because of their prominence in telecommunications. Both the United States and Japan have experienced a shift from monopoly toward competitive markets; technological

\(^9\)The protection of strategic industries as a way to further national interests, the Japanese experience, and implications for trade policy in the United States and elsewhere are subjects of a literature approaching mountainous proportions. For overviews and many cites, see Krugman (1986); Johnson, Tyson, and Zysman (1989); Lawrence (1990); and Patrick (1986).
advance is strikingly illustrated in the emergence of cellular telephones, HDTV, and other services. The advantages enjoyed by one nation in a particular telecommunications market can be strengthened, or perhaps shattered, by such developments. Moreover, a focus on market structures and technological advance sheds light on several questions of broad concern:

- **What has been the role of government in trade relations between the two countries?** By examining how governments influence market structure and the environment in which technological advance occurs, we may gain a better understanding of key links between government action and the workings of international trade.

- **In what ways, if any, has protection of Japan's domestic market afforded a base for export expansion in the telecommunications field?** Competitive pressures and new technologies may alter the role of the home market, with significant effects on foreign trade.

- **What has been the nature of telecommunications trade disputes between the United States and Japan and how were they resolved?** Increased competition and technological advance can both trigger, and help to resolve, trade disputes.

- **What is the nature of trade agreements between the two countries, and what have been their effects?** Such agreements can foster competition and hasten adoption of new technologies.

- **What new sources of trade tension may arise between the two countries?** Answers to the preceding questions may help us to anticipate future problems and to devise precautionary measures.

In general, then, examination of market structures and technological advance can contribute to a better understanding of past and present trade relations and offer insight into what the future may hold.

The study draws from information in books and journal articles, news services, government documents, and unpublished materials, supplemented by personal interviews with government and industry officials in Japan and the United States. It focuses on three case studies in the telecommunications sector:

- **Wireline Telephone Equipment.** We compare the evolution of American Telephone & Telegraph (AT&T) and NTT, both of which have seen their monopoly power erode as a consequence of technological advances and procompetitive government action. AT&T is a long-distance telephone service provider and the world's largest telephone equipment supplier. NTT, which provides local and domestic long-distance service in Japan, has
emerged as the world’s largest telephone service company. Of key importance are (a) factors that affect AT&T’s ability to compete in world markets with Japanese and other firms, (b) NTT’s procurement practices with respect to domestic and foreign equipment suppliers, and (c) the effects of U.S.–Japan trade agreements, especially the NTT Procurement Agreement negotiated in 1980 in the aftermath of the Congressional Task Force Report noted above.

- **Cellular Telephone Equipment.** This rapidly growing market, in Japan, the United States, and many other countries, offers instructive contrasts to the wireline experience, as well as insight into future U.S.–Japan trade relations.

- **High Definition Television.** This case, which focuses on broadcasting in contrast to point-to-point wireline and radio-based service, is included because (a) the development of HDTV, some have said, demonstrates the decline in U.S. competitiveness and the need, argued in some quarters, for a proactive U.S. industrial policy, and (b) despite Japan’s head start in developing HDTV, the United States is now leapfrogging Japan in perfecting technology to transmit HDTV signals—a development with implications for future trade relations.

Our three cases, however, do not cover all relevant experiences in the equipment field—for example, trade agreements on communications satellite procurement and network channel terminating equipment. Including such topics would not alter the conclusions of this study. Moreover, excellent discussions of these examples are already available.¹⁰

Sections 2, 3, and 4 treat the three cases—wireline, telecommunications, cellular telephone and HDTV—as listed above. Section 5 covers major conclusions.

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2. Wireline Telephone Equipment

This section examines wireline telephone service as a complement to the radio-based (nonwireline) cellular telephone sector discussed in Section 3. Both markets consist of the three categories of equipment—transmission, switching, and user terminals (e.g., telephone sets)—required for end-to-end communications service. After tracing the evolution of AT&T as a player in world markets, we shift to NTT’s contrasting experience and then to trade agreements between Japan and the United States, where the NTT Procurement Agreement is especially important. Finally, we examine the foreign trade role of the New Common Carriers (NCCs) in Japan’s long-distance domestic telephone service, before moving to conclusions.

AT&T Before and After Divestiture

Before its divestiture on January 1, 1984, AT&T was the parent company of the privately owned Bell System. AT&T’s Long Lines Department supplied long-distance services, and the affiliated 24 Bell Operating Companies (BOCs) provided local service to about 80 percent of the telephones in the United States. The remainder were served by some 1500 “independent” telephone companies. Then, as now, the U.S. Federal Communications Commission (FCC) had regulatory jurisdiction over interstate and international services, and state public utility commissions exercised jurisdiction over intrastate services.

AT&T had its own manufacturing subsidiary—Western Electric—which supplied virtually 100 percent of the Bell System’s needs. Participation by outside firms was limited to sales of equipment to Western Electric, which served as the procurement middleman for the Bell System. AT&T also owned Bell Laboratories, which worked closely with the BOCs and Western Electric to develop and commercialize new products. In short, the vertically integrated Bell system offered little leeway for participation by outside firms—whether domestic or foreign.

The Consent Decree of 1956

For decades, many people had been troubled by Western Electric’s role as a captive supplier to AT&T Long Lines Department and to the BOCs. Allegations
were common that the Bell Companies were paying excessive prices for Western Electric equipment, and that the introduction of competition among suppliers would serve the public interest.\footnote{As one analyst describes the situation, "state and local [regulatory] commissioners suspected, in the absence of adequate cost accounting, that Western Electric charged exorbitant (i.e., monopolistic) prices for its equipment, prices that the operating companies willingly passed on to customers." Vierot (1989), p. 47.}

Seeking to force the divestiture of Western Electric, the U.S. Department of Justice brought suit against AT&T in 1949. In response, AT&T argued strenuously that close ties through common ownership were vital to stimulating technological advances and incorporating them into the network. It was not enough, AT&T maintained, for outside suppliers to provide equipment according to specifications. Rather, they must work directly with the purchaser during the design and operation phases to ensure that the equipment meets the purchaser's needs. The ties of common ownership, AT&T maintained, were vital to assuring a close working relationship.

AT&T's arguments were bolstered by the strong ties between telephone companies and equipment suppliers elsewhere (although not always through common ownership). In the United States, the two largest independent telephone companies—GTE and United Telecommunications—also had manufacturing subsidiaries. Bell Canada had ownership ties with Northern Telecom, Deutsche Bundespost had Siemens as a preferred supplier, British Telecom relied on Plessey/Stromberg-Carlson, and NTT had a "family" of domestic suppliers discussed below.\footnote{Duane and Edgar (1988), fn. 41.}

The suit was settled under terms of the Consent Decree of 1956, without AT&T being forced to divest Western Electric. The Decree stipulated only that (a) AT&T confine its activities to domestic regulated common carrier services (i.e., telecommunications services regulated by federal or state regulatory agencies), (b) Western Electric engage in manufacture of equipment solely for use by the Bell System,\footnote{There were certain exceptions to these restrictions, including the right for Western Electric to manufacture equipment for the U.S. government. Brock (1981), p. 192.} and (c) the Bell Companies license their patents under reasonable and nondiscriminatory terms to all applicants.

The rationale for confining AT&T and its Western Electric subsidiary to domestic regulated common carriage arose from the fear of cross-subsidy: With an equipment supplier tied to its regulated telephone service, an unconstrained AT&T could, many feared, undercut other manufacturers in both domestic and foreign markets and compensate by hiking prices to its monopoly telephone rate
payers. Only by confining AT&T’s activities to the domestic regulated sphere, so
the argument went, could this danger of unfair competition be averted.

Whatever protections the Consent Decree afforded against cross-subsidy, it
essentially guaranteed that Western Electric would play no significant role in
foreign markets—a restriction that AT&T was willing to accept. Virtually all of
Bell’s activities were already within domestic common carriage. Moreover, the
domestic market was large, rapidly growing, and profitable. AT&T faced a
multitude of challenges and opportunities without venturing into foreign fields.

Despite the Justice Department’s goals, the Consent Decree did nothing to open
Bell procurements to outsiders. But cracks were beginning to appear as a
consequence of continued technological advances. Most notably, an outside
procurement by the BOCs, involving digital switching from Northern Telecom (a
Canadian firm), occurred in the early 1980s. Northern Telecom’s lead in digital
switching was so commanding that, in this particular case, it was able to
overcome the BOC’s reluctance to deal with outsiders.

The third aspect of the Consent Decree, involving patent licensing, had long-run
implications for foreign trade perhaps no less important than the continuing tie
between the Bell companies and Western Electric.

Licenses [with certain exceptions] were required to be issued to any
applicant at a “reasonable royalty” with provision for the court to set the
royalty if the parties could not agree. AT&T was also required to provide
technical information along with patent licenses on payment of reasonable
fees. . . . The total effect [of these requirements] was not greatly different
than the situation before the Consent Decree except that the licensee had a
legal right to the license and technical information and was not dependent
on potential changes in Bell policies.

The rationale for these patent requirements arose also from AT&T’s monopoly
status. Because Bell Labs R&D activities were supported by monopoly telephone
rate payers, AT&T had a special obligation, it was argued, to channel quickly and
fairly the fruits of those activities back to rate payers. This objective could best be
met by enforcement of liberal access to Bell patents.

The licensing requirements helped to assure the dissemination of knowledge
from the pioneering work at Bell Labs to both domestic and foreign firms. For

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4 As two analysts describe the situation, “Northern Telecom . . . grabbed market share from
AT&T in the early 1980s before any other markets in the world were open to bid. NT had an early
lead in digital switches, and its first-mover advantages allowed it to maintain almost half the U.S.
market, even after AT&T introduced its 5ESS digital switch.” Vietor and Yoffie (1991), p. 31.
example, the transistor licensing agreements "caused a great upsurge in transistor manufacturers and a rapid drop in transistor prices." Along with others, Japanese firms benefited.

The Emergence of Competition

While the Consent Decree did not end the debate about the need for divestiture, new pressures emerged to transform U.S. telecommunications markets. First, as a consequence of actions by the FCC and the courts, competition developed in the domestic long-distance market. AT&T’s monopoly was breached by an FCC decision in 1959 to permit large private firms to operate microwave transmission facilities for their own use. From that opening, pressure mounted during the late 1960s and into the 1970s to permit new carriers to deal with the public. By 1989, two major competitors to AT&T in the interstate telephone market—MCI and US Sprint—recorded revenue shares of 14 percent and 10 percent, respectively.7

Second, the terminal equipment market was opened to competition. Before the late 1960s, customers were permitted to attach to the network only equipment supplied directly by the local telephone company (whether a BOC or an independent). This equipment, called "terminal," "customer premises," or "interconnect" equipment, includes ordinary telephones, key telephones (i.e., multiple-line telephones), private branch exchanges (PBXs), and other attachments such as computer modems and facsimile machines. AT&T vigorously defended its prohibitions on outside attachments on grounds that total control by the telephone company was necessary to prevent improper attachments from causing malfunctions or other harm to the network.

However, in 1968 the Carter Electronics Company, which had sought to connect its "Carterphone" private two-way radio systems to the network, brought an antitrust case against AT&T. After the court passed the matter back to the FCC for action, the FCC decided in favor of Carter.

This successful challenge to AT&T’s monopoly triggered further demands for establishing regulations and guidelines to facilitate more general competitive entry into the terminal market. After years of contentious debate, the FCC adopted a terminal registration and certification program in 1975. Manufacturers were required to submit samples to a series of tests specified by the FCC to ensure that use of the equipment would not harm the network. After successful

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6Ibid., p. 194.
testing, the FCC affixed a certification number to attest that the equipment was safe for use.\textsuperscript{8}

The FCC's registration and certification program opened the floodgates to imports. Manufacture of the relatively simple equipment in question—telephones, answering machines, memory dialing attachments—was precisely the sort in which other countries had a comparative advantage. Both foreign-owned and U.S.-owned companies were attracted to locating their manufacturing activities outside the United States. As a case in point, all of the cordless telephones that AT&T sells under its name in the United States are manufactured abroad.

The debate surrounding these regulatory actions emphasized the potential national benefits of altering AT&T's market structure to reduce prices, improve services, and encourage technological advance. Policymakers did not consider the effects on international trade because, at that time, concerns about U.S. trade deficits and U.S. competitiveness in world markets had not yet emerged.

\textit{The Divestiture}

In face of the above, the strategy of confining AT&T to regulated monopoly markets was not viable. Technological advances and public policy responses eroded the Bell monopoly. AT&T necessarily found itself operating in a mixture of monopoly and increasingly competitive markets. Inevitably, new assertions were voiced of AT&T anticompetitive behavior toward newcomers who, to provide long-distance end-to-end service, depended on the BOC's local monopoly networks. At the same time, policymakers remained worried about the tie between the local telephone monopoly and Western Electric.

Hopes for a solution came out of a suit brought by the Department of Justice against AT&T in 1974. After years of judicial proceedings and attempted legislative solutions, the case was settled in 1982 with a Modification of Final Judgment (MFJ) of the 1956 Consent Decree.

Under terms of the MFJ, 22 BOCs were divested from the parent AT&T and organized within seven regional holding companies (RHCs) to provide local telephone service.\textsuperscript{9} AT&T was to continue with long-distance service and—freed

\textsuperscript{8}Because implementation of the FCC's rules was more complex for key telephones and PBXs, adoption of a program for these devices was delayed until 1978.

\textsuperscript{9}AT&T sold its minority ownership share in the two other BOCs, leaving them to operate as independent companies.
of the terms of the 1956 Consent Decree—it was permitted to enter unregulated markets. Bell Laboratories was split in two. One portion, still called Bell Laboratories, remained with AT&T; the other half, Belcore, was to serve collectively the seven regional companies. Western Electric, renamed AT&T Technologies, remained a subsidiary of AT&T. The BOCs were permitted into unregulated markets in cases where the court was satisfied that anticompetitive behavior would not be a threat. But three specific restrictions were imposed on the BOCs: They were not permitted to manufacture telecommunications equipment, provide long-distance telecommunications services, or offer information services within their own telephone service territories.\textsuperscript{10}

The rationale for the settlement rested in the notion that local service was inherently a monopoly, while long-distance service was potentially competitive. Forcing AT&T to divest itself of the BOCs would free it to operate in competitive markets, while the BOCs would retain the monopoly portion of the former Bell System. The Western Electric/captive supplier problem was solved by leaving the manufacturer with the “competitive” AT&T, and prohibiting the “monopoly” BOCs from engaging in manufacturing, thereby facilitating access by both domestic and foreign suppliers to BOC procurements.\textsuperscript{11}

However, virtually from the day the MFJ went into effect the BOCs have resisted the manufacturing prohibition, as well as the others. Reminiscent of the arguments by AT&T, before divestiture, the BOCs emphasize their inability to take full advantage of the fruits of their R&D and corporate expertise when they are forced to deal only at arm’s length with outsiders. They also assert that entry into manufacturing would contribute to U.S. competitiveness in foreign markets, especially against Japanese suppliers. A common response is that even if the BOCs were permitted into manufacturing, they might do so through foreign manufacturing affiliates.

In light of these conflicting considerations, Congressional legislation has been written, but not yet passed, to permit the BOCs into manufacturing. In some cases, restrictions would be imposed on import content.\textsuperscript{12}

\textsuperscript{10}After a series of court decisions, the ban on provision of information services was lifted in 1991.

\textsuperscript{11}This solution has been under severe strain because the local telephone market is also becoming increasingly competitive. However, a discussion of these aspects would fall beyond the scope of this study.

\textsuperscript{12}One piece of legislation specified that “for the aggregate of telecommunications equipment . . . manufactured and sold in the United States by such affiliate in any calendar year, the cost of components manufactured outside the United States contained in the equipment [shall] not exceed 40 percent of the sales revenue derived from such equipment.” H.R. 1527, 102nd Cong., 1st Sess., March 20, 1991.
AT&T and Other U.S. Firms in World Markets

AT&T emerged from the MFJ as the world’s largest supplier of telecommunications equipment with revenue of $11.0 billion in 1989 (see Table 2.1). But only 8 percent of its sales were accounted for outside of its home area—much lower than the percentage recorded by most other major suppliers. Because of AT&T’s dedication to serving the needs of the Bell system before divestiture, it was not well positioned to move into foreign markets against firms that had always depended on foreign markets for a good share of their revenues.

AT&T’s situation was well described by two analysts:

AT&T remained the most feared company amongst all the major competitors in the world. By virtue of its scale and scope, every leading Japanese and European executive we interviewed believed that AT&T had the financial and technological wherewithal to be the global telecommunications leader. However, there was an equal consensus among these same executives that AT&T’s lack of strategic focus across business units and its slow learning about international competition threatened to disable AT&T’s advantages.13

To be sure, since divestiture AT&T has made progress as a major player in foreign markets. Before the MFJ, AT&T was reported to have no more than 100

<table>
<thead>
<tr>
<th>Company</th>
<th>Revenue, 1989 ($ billions)</th>
<th>Percent of Sales Outside Home Areaa</th>
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<tbody>
<tr>
<td>AT&amp;T (United States)</td>
<td>11.0</td>
<td>8</td>
</tr>
<tr>
<td>Alcatel (France)</td>
<td>9.8</td>
<td>27</td>
</tr>
<tr>
<td>Siemens (Germany)</td>
<td>8.1</td>
<td>41</td>
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<tr>
<td>Northern Telecom (Canada)</td>
<td>5.9</td>
<td>5</td>
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<tr>
<td>NEC (Japan)</td>
<td>5.3</td>
<td>25</td>
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<tr>
<td>Ericsson (Sweden)</td>
<td>5.1</td>
<td>37</td>
</tr>
<tr>
<td>Bosch (Germany)</td>
<td>2.6</td>
<td>8</td>
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<tr>
<td>Fujitsu (Japan)</td>
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<td>23</td>
</tr>
<tr>
<td>Toshiba (Japan)</td>
<td>1.0</td>
<td>30</td>
</tr>
</tbody>
</table>

SOURCE: Vietor and Yoffie (1991), Table 5.

aHome areas are the regions immediately surrounding the firm’s home country—North America for AT&T, Europe for firms based in Europe, and Asia for firms based in Japan.

employees outside the United States. It had 22,000 by 1991.\textsuperscript{14} By 1990, AT&T's international equipment sales exceeded $1.5 billion—more than a sixfold increase in only six years.\textsuperscript{15} Still, $1.5 billion as a percentage of total revenue was much smaller than that of its major competitors. Also, the base on which the sixfold increase was computed, recorded a year after the divestiture, was very small.

AT&T's greatest strengths are in central office switching and large PBXs. But it has had difficulty in gaining ground in new markets. For example, it sought business from NTT, but lost out to Northern Telecom for a central office switch procurement (reportedly valued at $250 million over five years).\textsuperscript{16} Its most notable successes have been in a few European and Asian countries (The Netherlands, Spain, Italy, Korea, Taiwan, and Indonesia).

However, it has maintained a strong position in the United States. By 1990, AT&T and Northern Telecom each had about 50 percent of the U.S. market for central office switching equipment, with only small intrusions by other suppliers. Similarly, European firms continued to dominate the European market and Japanese suppliers captured virtually all major Japanese procurements. This pattern is not surprising because in central office switching, particularly, it is important for purchasers to have long-term working relationships with suppliers, so that traditional sources retain an advantage. For that reason, despite the spinoff from Western Electric, the BOCs have maintained strong ties with AT&T in meeting their central office switching needs.

An important measure of AT&T's performance is in markets outside the United States, Europe, and Japan, where in any event purchasers depend on foreign vendors. Europe's Alcatel, Siemens, and Ericsson, along with Japan's NEC, account for about 80 percent of this market for central office switching.\textsuperscript{17} Here, too, ties with traditional (non-AT&T) suppliers have remained strong.

Although other U.S. firms had been active in foreign markets, as shown in Table 2.2, they are much smaller than AT&T. This situation reflects another consequence of the Bell System's domination of the domestic market before divestiture. Whether or not domestic markets are protected by national government policy, the existence of a strong domestic base is important to firms

\textsuperscript{14}Financial Times, October 7, 1991, Sec. IV, pp. XXII.
\textsuperscript{15}Ibid.
\textsuperscript{16}Vito and Yoffie (1991), p. 36.
\textsuperscript{17}Ibid., Chart 11.
Table 2.2
Largest U.S. Telecommunications Equipment Suppliers

<table>
<thead>
<tr>
<th>Company</th>
<th>Worldwide Sales, 1989 ($ billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>11.2</td>
</tr>
<tr>
<td>Motorola</td>
<td>4.0</td>
</tr>
<tr>
<td>IBM/Rolm(^a)</td>
<td>2.9</td>
</tr>
<tr>
<td>GTE</td>
<td>2.6</td>
</tr>
<tr>
<td>Rockwell</td>
<td>0.8</td>
</tr>
</tbody>
</table>

\(^a\)IBM transferred controlling interest in Rolm to Siemens in a joint venture formed in 1989. GTE has sold its interests in central office equipment to AT&T and its interests in PBX equipment to Fujitsu.

engaged in worldwide competition. It is no coincidence that all the foreign suppliers listed in Table 2.1 have large domestic markets. In contrast, the lack of access to the Bell System severely limited the domestic market available to non-Bell U.S. equipment suppliers. The best opportunities involved sales to independent telephone companies and participation in other areas, such as in radio dispatching, that lay outside the Bell monopoly. Thus, the very presence of the Bell System had a depressing effect on the size and numbers of U.S. equipment firms in foreign markets.

The Bell System's adverse effect on the ability of other U.S. firms to compete in world markets is reflected in the fact that in 1978—when the United States was running a surplus in its telecommunications and, more generally, its electronics trade accounts—it ranked only fourth among the principal exporting nations of telecommunications equipment, with a $155 million trade surplus in telephone and telegraph equipment. At the same time, the United States was overwhelmingly the largest user of telecommunications services, with about 37 percent of the world's telephone subscriber lines.\(^{18}\)

National Benefits from Multinational Firms

The major firms noted in Table 2.1 have manufacturing facilities, and in some cases R&D activities, in the United States—a situation that raises the question of

whether it is the ownership of firms or U.S. imports and exports that are important for analysis and policymaking. A leading example is Northern Telecom, where revenues are about one-half those of AT&T shown in Table 2.1. Although 52 percent of its stock is in the hands of Bell Canada, large stockholdings are in the hands of foreigners, including U.S. citizens.\textsuperscript{19} Moreover, by 1984 its 14 manufacturing plants, 14 R&D facilities, and more than 100 sales and service centers in the United States employed a total of 17,000 people. In 1983, Northern Telecom exported almost $100 million in products from its U.S. facilities.\textsuperscript{20} An interesting question—one that cannot be answered here—is how the benefits to the United States would have differed if AT&T, rather than Northern Telecom, had captured the NTT switching equipment contract noted above.

A Recapitulation

From the preceding analysis, four points are notable for subsequent comparisons with Japan’s experience:

- The structure and regulation of AT&T, before divestiture, compromised the U.S. presence in international telecommunications markets because (a) AT&T was itself confined to domestic markets by the terms of the 1956 Consent Decree, (b) the tie to Western Electric reduced the size of the domestic market available to other U.S. firms as a base to facilitate their participation in foreign markets, and (c) the Consent Decree’s patent licensing requirements strengthened the position of foreign firms.

- Long-term ties between purchaser and vendor are important, particularly in the central office switch market. To outsiders, business practices based on such ties may appear to be “discriminatory”—a situation relevant in the following assessment of NTT.

- The rationality of a firm is only one of several characteristics that must be considered in assessing the benefits of that firm’s activities in a given country. The extent of its share ownership, manufacturing, and R&D activities in that country is also relevant.

\textsuperscript{19}Privately owned Bell Canada is Canada’s largest supplier of telephone service, with service to six million subscribers.

\textsuperscript{20}U.S. Congress (1984), pp. 84-85.
The Restructuring of NTT

Before 1952, Japan's domestic and international telephone and telegraph services were held as a monopoly by the Japanese Ministry of Communications. In 1952, the Ministry was abolished and Nippon Telegraph and Telephone was established as a separate public corporation. A year later, the international division of NTT—Kokusai Denshin Denwa (KDD)—was separated and reconstituted with partial private ownership. The Ministry of Postal Services was expanded and renamed the Ministry of Posts and Telecommunications (MPT) to provide regulatory oversight of NTT and KDD.

Unlike AT&T, NTT has never had ownership interests in manufacturing, although it works very closely with a small group of domestic firms. Collaboration with its suppliers is facilitated by its extensive laboratory facilities, similar in function to AT&T's Bell Labs.

During the 1970s, pressures mounted to restructure NTT, triggered in part by a desire to reduce the inefficiencies of public corporations.²¹ In 1982, Japan's Commission on Administrative Reform recommended that (a) NTT be privatized and separated, within five years, into a long-distance company and into several local companies, and (b) the market be opened to competition for long-distance (but not for local) service. After a year of debate and compromise, a package of reforms emerged that was similar to those recommendations, except that divestiture was not included. Its key elements were:

- NTT would be reorganized as a private joint-stock corporation.
- NTT would be permitted to engage in activities outside of domestic telecommunications service, subject to MPT approval.²²
- No less than one-third of NTT's stock would be held by the government.²³
- No foreigners would be permitted to hold NTT stock.
- Review of the NTT law would occur within five years.
- Separation of NTT from manufacturing activities would continue.

²¹As three analysts describe the situation, "At first Japan National Railways was the prime target for privatization, but soon telecommunications services and the cigarette industry also came under scrutiny." Nambu, Suzuki, and Honda (1989), p. 149.
²²NTT has vigorously exercised its freedom to diversify into national and international ventures. Among the more than 120 affiliations in joint ventures, as of late 1989, it had established a joint venture with IBM Japan, and another with three of its major suppliers, NEC, Hitachi, and Fujitsu. Akhavan-Majid (1990), p. 167.
²³This stipulation ensures that no change in bylaws can occur without government concurrence.
The Telecommunications Business Law and the Nippon Telegraph and Telephone Corporation Law implemented the reforms. NTT was privatized under terms of the NTT Corporation Law, with stock offerings to the public. However, a sharp drop in stock prices after early sales led the Ministry of Finance to retain two-thirds of NTT’s stock—higher than the one-third minimum holding required by law.

The Telecommunications Business Law was the instrument for introducing competition. It established two types of carriers—Type I and Type II—which are subject to different regulatory regimes.

Type I carriers own their facilities, such as transmission and switching equipment, while Type II carriers lease facilities from Type I carriers or from others. Permission is required from MPT before a Type I carrier may be established, and its proposed services are subject to MPT approval. Similar to ratemaking criteria in the United States, the Act prescribes that rates “must be fair, considering costs, and not be discriminatory.”24 Foreign investment in a Type I carrier is limited to 30 percent.

Type II carriers are divided into two categories—special and general. Special Type II carriers offer nationwide services or international value-added services, while general ones operate in regional or local markets. A special Type II carrier must register with the MPT before starting business and must report to MPT the rates it proposes to set before implementing them. But in neither case is approval required by the MPT. General Type II carriers are required only to notify the MPT when starting their business. No restrictions are imposed on foreign investment in Type II carriers.

As of October 1, 1991, Type I carriers, in addition to NTT, consisted of three long-distance domestic and two international carriers, seven regional carriers, three satellite systems, and numerous mobile telephone and radio paging providers. Thirty-three special Type II carriers and 960 general Type II carriers were in operation.25

Of primary importance here are the three new Type I domestic long-distance carriers:26

- DDI Corporation, with ownership interests held by Sony, Mitsubishi, Kyosera, and 200 other companies.

• Teleway Japan, a joint venture sponsored by the Ministry of Construction and Japan Highway Public Corporation.

• Japan Telecom, a joint venture sponsored by Japan National Railways.

The five-year review of NTT as stipulated in the NTT Corporation Law was conducted in 1990. In its final report based on the review, MPT recommended the divestiture of NTT, resulting in a single long-distance and single large local company—but not until 1995.

The proposal to divest NTT was not adopted by the Cabinet because of strong opposition by the Ministry of Finance and NTT. The bitter debate was resolved in favor of not imposing divestiture at that time, but another examination of NTT's structure was to be undertaken within five years.27 The bar on foreign shareholding was lifted on August 1, 1992, with foreigners permitted to hold up to 20 percent of NTT's stock.28

Growing Trade Tensions

Tension between the United States and Japan in the telecommunications field arose some years before NTT's privatization and the introduction of competition. The U.S. merchandise deficit with Japan, which had remained below $2 billion from 1973 to 1975, rose to over $5 billion in 1976 and to over $8 billion in 1977.29 In 1977, U.S. imports of network telephone and telegraph equipment from Japan of $35 million far exceeded U.S. exports to Japan of $4.5 million.30 Such disparities led to an investigation in 1978 by a U.S. Congressional Task Force of U.S.–Japan trade practices, as noted in Section 1.

NTT was a particular target for investigation because it relied almost exclusively on a family of domestic producers, as shown in Table 2.3. As the U.S. Comptroller General described the situation in 1979:

Roughly 96 percent of NTT's procurement is on a negotiated basis, largely from NTT family members. The remaining 4 percent is on the basis of tenders from "designated" suppliers with only 0.4 percent of these tenders

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27 For a more detailed discussion of the 1990 review and subsequent events, see Kojo and Janisch (1991), pp. 332-339.

28 Report from Japan, Yomiuri Shimbun, July 2, 1992, p. 7. Restrictions or prohibitions on foreign ownership are common in other countries. In the United States, a license to open a broadcasting station requires that foreign capital be limited to less than 20 percent of the total, and foreigners are prohibited from assuming executive positions; in Canada, foreign capital in telecommunications carriers is limited to less than 20 percent; no foreign capital is allowed in France Telecom and in Deutsche Bundespost Telekom.


30 Ibid., p. 33.
Table 2.3
NTT Procurement: 1981

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Sales to NTT ($ millions)</th>
<th>% Share of NTT Procurement</th>
<th>% Share of Company Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEC</td>
<td>533</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Fujitsu</td>
<td>346</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Oki Electric</td>
<td>189</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Hitachi</td>
<td>173</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>


being awarded to foreign suppliers. ... NTT’s customary advice to most
foreign manufacturers attempting to market equipment in Japan is to
suggest that the manufacturer select a Japanese licensee to produce the
equipment in Japan, thereby ensuring that the equipment will meet NTT
standards.31

Such close supplier relationships were no different, in principle, from those noted
above with respect to the United States and elsewhere. Recall that AT&T, at that
time, had supplier ties no less strong than NTT’s. Any attempt by outsider firms
to gain access to the BOCs would also have encountered resistance. But the large
telecommunications trade deficit with Japan made NTT vulnerable to criticism.

Two differences between the Japanese and American situations contributed to
the trade imbalance. First, NTT’s suppliers were free to vigorously compete in
world markets, while Western Electric was not. Sales by the four major suppliers
to NTT constituted only a portion of their production, as shown in Table 2.3.
Among the benefits of working with NTT was the collaboration afforded with
NTT’s laboratories. NTT’s R&D budget ran to 248 billion yen (about $1.8 billion)
in 1990, amounting to 4.1 percent of NTT’s operating revenues.32 As described
by a U.S. Department of Commerce study (1986, p. 86):

As a large consumer of advanced electronic products, NTT has helped
underwrite commercial development costs as well as assisted in product
and system definitions. NTT’s long-term support of its key supplier
companies has, in addition to accelerating commercial production of a
number of products and systems, facilitated the Japanese manufacturing
firms’ movements into international markets. NTT has thus played an
integral role in the emergence of the Japanese electronics industry.

32Nippon Telegraph and Telephone (1990), pp. 24, 33. R&D expenditures rose from 140 billion
yen in 1986 to 248 billion yen in 1990.
Second, asymmetry existed in the flow of technical information and patent rights. This study has not uncovered any evidence to suggest that NTT was required to provide reasonable and nondiscriminatory access to its patents in a manner similar to the terms imposed on AT&T in the Consent Decree of 1956.

The NTT Procurement Agreement

At about the time of the U.S. Task Force investigation, the subject of NTT procurement emerged during the Tokyo Round of the General Agreement on Tariffs and Trade (GATT). Previously, trade negotiators had discussed issues about appropriate international trade rules for government procurement of goods and services, in response to the common use of "buy national" provisions in government procurement codes. These discussions, continued in the Tokyo Round, led to negotiations involving the European Economic Community (EEC), the United States, and Japan. A leading issue involved "entity coverage"—that is, which government agencies would be covered in rules negotiated for open bidding and other policies to assure nondiscriminatory treatment of prospective domestic and foreign suppliers.

The original Japanese offer in mid-1978 for entity coverage included only central government ministries such as the Ministry of Finance. However, the annual procurements of these entities over a three-year period ran to only about $3.5 billion, compared with the entity coverage offered by the United States of $16 billion and EEC entity coverage of $10 billion. Negotiations to improve Japan's offer led to the U.S. request that Japan include in its offer the nation's public corporations (Kosha). The largest were NTT (before the privatization of 1985), the Japan National Railways, and the Japan Tobacco Monopoly Corporation, which together accounted for about 85 percent of the total employment recorded by some 112 Japanese public corporations. NTT was the largest of these three, with annual purchases exceeding $3 billion.

Although amenable to the inclusion of NTT, the Japanese government—led by its Ministry of Finance and Ministry of International Trade and Industry (MITI)—was unable to act in the face of NTT's strong resistance. The government's difficulty arose from three sources. First, in terms of statutory control, the public corporations were granted wide discretion in conducting their routine operations. With respect to NTT, the law did not clearly extend the MPT's supervisory control to encompass NTT's procurement practices.

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Second, informal mechanisms of government control were weak. One such mechanism involved placing retiring government officials (generally at age 55) in both the public and private sectors. One analyst observed:

The Ministry of Finance, for example, places a significant number of retiring officials among the major city banks. This facilitates a free flow of information and ideas and provides an avenue for influence—albeit both ways.  

Such ties were weaker in telecommunications because the MPT had not been able to place many of its retiring officials with NTT.

Third, NTT's strong ties with its equipment suppliers strengthened its case against inclusion in the government's GATT negotiations. Similar to the arguments that AT&T used against the U.S. Department of Justice, NTT mentioned that such close ties were vital to the efficient continued development of the telecommunications network. The situation for government policymakers was complicated by NTT's highly technical arguments, which outsiders had great difficulty evaluating. The complex nature of NTT's business—one that could be run well only by the "experts"—gave NTT a measure of independence from government control not found among other public corporations.

NTT's intransigence continued to compromise the Japanese government's position during the Tokyo Round negotiations. According to one account, "one MITI official remarked that NTT has become so strong that it was now 'beyond all reach of MITI's industrial policy.'" NTT's ability to insulate itself from government control was not well understood by U.S. negotiators. One analyst concluded, "as a result, the Japanese government's inability to offer NTT in the early stage of the talks was generally perceived by U.S. officials as a conscious decision not to cooperate."

Further difficulty arose because NTT's procurement needs did not fit well into the GATT procurement code. GATT arrangements are geared to off-the-shelf procurements, where mechanisms for arm's-length transactions and nondiscriminatory treatment can most easily be implemented and enforced. In contrast, much of NTT's procurement is for new types of equipment for which negotiated bidding and joint research and development projects are appropriate.

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34 ibid., p. 193.
35 ibid., p. 196.
36 ibid., p. 195.
As the talks progressed, NTT faced increasing domestic pressures to yield. Especially important, the Administrative Management Agency of the Japanese government issued a report in mid-1979 critical of NTT's closed procurement practices and inefficient internal management.\(^3^7\)

In response to these pressures and in light of NTT's special procurement needs, negotiations for the NTT portion of government procurement were separated from the multilateral Tokyo Round talks and conducted on a bilateral basis between the U.S. and Japanese governments. A key to eventual agreement was establishment of separate “tracks” for NTT procurement to accommodate the variety of NTT’s equipment needs.

Final agreement, covering both Japanese government procurement under the GATT code and results of the bilateral negotiations, was reached in December 1980. Japan was to open more than $8 billion of its government procurement to international competition on a nondiscriminatory basis. NTT procurement accounted for $3.3 billion. About $1.5 of this amount was included under a procurement track for competitive bidding procedures under the GATT code. The remainder was divided among tracks subject to negotiated bidding and joint R&D projects.\(^3^8\)

The NTT agreement, initially covering a three-year period, has been renewed three times. The latest renewal, at the end of 1992, is to expire at the end of 1996.

NTT’s procurements fall into the following categories.

**Track I**—Products covered by the GATT Code on government procurement.

**Track II**—Initial procurement of equipment already on the market, perhaps subject to modifications.

**Track III**—Initial procurement of equipment, not on the market, to be developed jointly by NTT and its suppliers.

**Tracks IIA and IIB**—Follow-up procurement of items initially procured under Tracks II and III.\(^3^9\)

Bidding procedures and other information needed by prospective suppliers are provided in detail in NTT procurement documents, which are translated into English.\(^4^0\) In addition, NTT engages in a variety of promotional activities to

\(^{37}\)Ibid., p. 233.


\(^{39}\)Other procedures govern procurement of communications satellites and supercomputers.

\(^{40}\)See, for example, NTT (1991a).
encourage foreign participation in bidding, facilitated by its operation of eight overseas offices.

Evaluation by U.S. sources of the effectiveness of these procedures was mixed during the early years. A survey conducted during negotiations for renewing the NTT Procurement Agreement in 1983 led the U.S. General Accounting Office (GAO) to conclude:

Although sales of U.S.-made equipment to NTT, Japan's government-run telecommunications corporation, have not met U.S. Government expectations, American business still believes it can use the Agreement to penetrate the NTT market. U.S. firms generally favor extending the Agreement beyond its December 31, 1983 termination date. \(^41\)

Evidence of the agreement's longer-term quantitative effects is shown in Figure 2.1. An initial jump occurred in procurement from the United States, followed by a recent sharp upturn. This upturn may reflect (a) increased effectiveness of NTT's vendor outreach program, perhaps because of continuing pressures from U.S. government and private sources; (b) increased competition between foreign suppliers and NTT's traditional domestic sources; (c) pressures on NTT to seek the lowest cost sources, including foreign firms, because of competition from the new common carriers, as discussed below, or (d) changes in exchange rates that reduced the yen prices of imports from the United States. Unfortunately, evidence is not available to disclose the actual role that each of these factors, or others, has played.

Although data for 1992 are incomplete, it is notable that in September 1992 AT&T was awarded a multiyear NTT contract worth about 14 billion yen, or $110 million, for a traffic management and administration system. The new system, to become operational in 1994, is designed to significantly enhance NTT's ability to manage its network and its growing volume while improving customer service. \(^42\)

The periodic renewals suggest that the Agreement appears to have worked well from both U.S. and Japanese perspectives. But developments during 1992 raised the possibility of a new period of uncertainty and potential trade tension. According to one account:

MPT has expressed to the U.S. government its desire to cancel the Japan-U.S. agreement on NTT telecommunications equipment procurements at

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\(^41\)U.S. General Accounting Office (1983), cover.
the end of this year when the agreement expires. MPT aims to "shift from bilateral to multilateral rules" by absorbing the agreement into the government procurements accord to be made final at the GATT Uruguay Round. U.S. officials seeking an agreement have expressed strong opposition to MPT's views, however, meaning negotiations concerning the issue are likely to be stalemated.\footnote{Telecommunications Weekly, Tokyo, Vol. 8, No. 13 (3/28/92-4/3/92), p. 1.}

Pressures for nonrenewal came from several directions. First, the Agreement and its subsequent renewals were reached between the U.S. and Japanese governments, despite the change in NTT's status in 1985 involving privatization and restructuring. Thus, a government-to-government agreement, it was argued, is no longer appropriate. A counter argument is that a government-to-govemment agreement remains appropriate because the Japanese government still holds more that 50 percent of NTT's stock and exercises control over NTT's budget and other matters.

Second, complaints were voiced that the provisions for open procurement procedures and nondiscrimination impose a handicap on NTT in competition with other entities (such as the Type I and Type II carriers previously discussed)
who are free of such constraints. This interesting argument suggests how a trade agreement may be easier to apply against a monopolist than against a firm facing competition.

Third, European manufacturers complain of unfair treatment. Although most-favored-nation status is accorded under the bilaterally negotiated Agreement, more than 90 percent of NTT’s foreign procurements are from U.S. sources. Coverage of NTT’s procurements under the GATT code now being negotiated in the Uruguay Round would, presumably, help to alleviate complaints about discriminatory treatment.

Despite these complaints, the Agreement was renewed—without change—for another three years. Whether these complaints will persist, to complicate U.S.–Japan trade relations in later years, remains to be seen.

Other Trade Agreements

Two other agreements figure in U.S.–Japan trade relations in the telecommunications field: the Interconnect Market Understanding and the Market-Oriented Sector-Specific Talks.

The Interconnect Market Understanding

At the time the NTT Procurement Agreement was negotiated, a second U.S. government initiative involved terminal or interconnect equipment such as telephones and PBXs. Before 1980, NTT (like AT&T) had a monopoly over the supply of most terminal equipment. Although the equipment was manufactured by outside suppliers, telephone subscribers were permitted to obtain the equipment only through NTT. After 1980, the market was liberalized to permit subscribers to procure equipment directly from suppliers, but with NTT having a continued monopoly over the first telephone on the subscriber’s premises.

By itself, this liberalization did not assure equitable entry by foreign firms because of complex and time-consuming equipment testing and certification procedures established to assure compliance with technical standards. Questions arose about whether these technical standards and compliance procedures were

44In such comparisons (and in Figure 2.1) Northern Telecom is regarded as a U.S. source.
45The major exception was large PBXs, where NTT permitted direct dealings between the supplier and user. Sciberras and Payne (1986), p. 35.
necessary only to ensure technical compatibility without harm to the network, or whether they were designed to favor domestic suppliers. Under the liberalization, NTT retains the responsibility to inspect and approve equipment for compliance with technical requirements before it can be connected to the network.

The two countries negotiated an Understanding on Japan’s Interconnect Market that became effective on January 1, 1981—the same effective date as the NTT Procurement Agreement. Through the Understanding, the Japanese government made it easier for U.S. and other foreign firms to obtain NTT approval to sell interconnect products in the domestic interconnect market—estimated at a value of about $1 billion annually. Accordingly, NTT revised its rules to permit acceptance of test data from foreign firms and laboratories to fulfill approval requirements and expedite NTT’s inspection of the subscriber’s installation of equipment. Thus, this program was similar to the FCC’s testing and certification program, insofar as both sought to facilitate competition in the user terminal market.

We do not have comprehensive evidence about how exports of interconnect equipment to Japan have been affected by the Understanding. However, according to limited evidence collected by the GAO, NTT has moved in concrete ways to comply with terms of the Understanding.

As of April 1983, NTT had approved all requests to sell or install U.S.-made interconnect equipment in Japan. These approvals involved 147 different type products of 40 U.S. firms. Five U.S. firms had been granted type-approval to sell 11 types of equipment, including headsets, telephone sets, PBX equipment, and acoustic couplers. NTT also granted individual document approval allowing customers to install 136 types of U.S.-made equipment.46

More generally, the GAO concluded that

The American suppliers we contacted were generally optimistic about their future participation in Japan’s interconnect market. Although obtaining NTT approval can be an expensive and time-consuming process, they generally believed that NTT was acting in good faith to implement the Understanding and believed that their interconnect business will increase with the growth of the market.47

47Ibid. The GAO (p. 16) went on to report that “An official of one U.S. firm told us that market prospects are promising and that his firm’s sales may reach $10 million by 1984, representing about 3 to 4 percent of a significant product segment of Japan’s interconnect market. American suppliers are particularly interested in the interconnect business generated by NTT’s Information Network System effort, through which it plans to develop a nationwide digitalized and integrated telecommunications system by the end of the century.”
The Market-Oriented Sector-Specific Talks

In response to continuing large U.S. trade deficits with Japan during the early 1980s, the Market-Oriented Sector-Specific (MOSS) Talks were initiated in 1985 to address issues of market access for telecommunications, electronics, medical equipment/pharmaceuticals, forestry products, and (subsequently in 1986) transportation machinery/auto parts. Rather than seeking to set specific trading goals or quotas, the talks focused on identifying and removing tariff and nontariff trade barriers in the selected sectors.

In the telecommunications sector, the talks concentrated separately on wired and nonwired services (the portion dealing with nonwired services is treated with cellular telephony in Section 3). An accord was signed in April 1985—the same time as NTT’s privatization—dealing with issues of standards, certification, testing of terminal equipment, and value-added networks (VAN) services.

Going beyond the earlier Interconnect Market Understanding, the MOSS talks led to simplifications in the application and approvals procedures for interconnect equipment. The Japan Approval Institute for Telecommunications was established as an agency, independent of NTT, to determine conformity with technical standards.

Data on how U.S. exports to Japan may have been affected by the MOSS talks are not available. However, in 1988 the GAO reported the results of a questionnaire sent to U.S. firms doing business in Japan:

Over half of the questionnaire respondents indicated that the MOSS agreements helped greatly in assuring fair treatment for approving telecommunications products. However, their assessments varied greatly over how much the telecommunications MOSS talks helped in increasing access to the Japanese market. All respondents noted that the efforts by their firms in Japan were a primary factor in changing Japanese business opportunities, with more than half indicating that the MOSS talks were beneficial. Five companies responded that congressional pressure was also a major factor.

The New Common Carriers

In addition to the effects of NTT’s reforms and formal government agreements, a significant change has occurred in Japan’s market for domestic long-distance telephone service. As noted above, three facilities-based (Type I) New Common
Carriers (NCCs) have emerged—DDI, Japan Telecom, and Teleway Japan. As shown in Figure 2.2, they started service in 1987, with rates substantially lower than those charged by NTT. Subsequently, both NTT and the NCCs have reduced rates, with the NCCs continuing to undercut NTT. National market shares for the NCCs are still low—12.6 percent for telephone service and 11.4 percent for leased circuits. But the market share for certain city pairs, especially Tokyo-Osaka, is much higher. One reason for the growth of the NCCs is that their owners (consisting of many of Japan’s largest corporations) prefer using the NCC’s services as a substitute for NTT (the bulk of whose shares is held by the government).

With the new competition, one would expect NTT to be more concerned about cutting its costs where possible and, more generally, increasing its operating efficiency. Indeed, as a reflection of the inefficiencies under which it operated before the reforms of 1985, it reduced its employment from 327,000 in 1982 to

![Graph](image)

**Figure 2.2—Telephone Rate, 3 Minute Call, Tokyo-Osaka, Peak Period**

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51 According to one report, the NCC market share on this route exceeded 40 percent in 1990. Kojo and Janisch (1991), p. 323.
283,000 by 1989,\textsuperscript{52} and its plans call for a further reduction to 230,000 by 1995.\textsuperscript{53} Similarly, if foreigners can supply equipment of given specifications more cheaply than can its family of suppliers or others with which it has close ties, we would expect NTT to move away (albeit slowly) from traditional suppliers. We would expect similar behavior by the NCCs—all the more so because, starting afresh, they would not suffer the disruption of breaking away from traditional suppliers.

At the same time, NCC’s need to interconnect with NTT to provide end-to-end service also affects their choices. Compliance with technical standards to ensure compatibility among equipment is facilitated if the NCCs select from the same suppliers NTT uses.

Comprehensive procurement data for the NCCs are not available. A few specific foreign procurements have been reported by the MPT. DDI purchased a digital switching system from DSC Communications Co. (a U.S. firm) in 1986; the Japan Communications Satellite Co. ordered a satellite from Hughes Communications, and the Space Communications Corporation placed a similar order with Ford Aerospace. These satellite purchases will total about 150 billion yen over several years—more than double the total foreign procurement of 60 billion yen recorded by NTT for 1990.\textsuperscript{54}

Conclusions

\textit{Commonly Held View of Industrial Policy Does Not Fit}

NTT was essentially closed to foreign suppliers before 1981, and its relations with domestic suppliers facilitated their entry and expansion into foreign markets—consistent with an industrial policy based on the notion that a protected domestic market provides a foundation for entry into foreign markets. But the situation in Japan was not primarily a consequence of central government pressure (implemented, for example, by MITI), but rather a result of NTT’s own strong preferences for its family of suppliers—preferences not unlike those of AT&T or European telephone companies. During the trade negotiations, MITI and other government agencies were in favor of including NTT in the coverage of the trade agreement. It was NTT’s own resistance (reinforced by its independence) that was a source of frustration to both U.S. and Japanese negotiators. Thus, this case

\textsuperscript{52}ibid., p. 321.
\textsuperscript{53}NTT (1990), p. 9.
seems not to fit into the mold of the commonly described industrial policy orchestrated by a central agency, such as MITI. However, the available evidence is sketchy and covers only a short time span. Detailed analysis over a longer span of NTT's activities would extend our knowledge of Japanese trade practices.

**Markets Are More Accessible**

Two key factors have helped to make the Japanese market more accessible to foreign suppliers. First, trade agreements have played a role. The evidence is clearest for NTT, whose U.S. procurement as a percentage of total procurement rose significantly in the early 1980s and again in 1991. At the same time, we must note possibilities for new trade tensions if the NTT Agreement is not renewed at the end of 1992.

Second, the emergence of competing carriers in Japan provides further opportunities for foreign suppliers (most notably in the satellite field); but an impediment may exist because of the need for technical standards compatible with those of NTT—a need that may trigger preferences by competitors for NTT's traditional suppliers.

The U.S. market has also become more accessible to foreign suppliers. Before divestiture, AT&T was largely closed to foreign procurements. No less significant than the divestiture, the deregulation of terminal equipment during the 1970s opened a large U.S. market that had previously been a part of the AT&T monopoly.

**Constraints on AT&T Weakened the U.S. Trade Position**

The court-imposed constraints on AT&T, embodied in the 1956 Consent Decree, barred the world's largest equipment supplier from competing in world markets. Moreover, AT&T was required to license Bell Labs patents, with accompanying technical information, under reasonable and nondiscriminatory terms. This study has not uncovered any evidence that R&D entities in Japan faced similar patent licensing obligations. Moreover, the presence of such a large AT&T monopoly restricted the size of the domestic markets available to other U.S. firms to facilitate entry into foreign markets.

**Trade Negotiators Face Special Difficulties in Telecommunications**

The historical patterns of supplier preferences by NTT and AT&T are not unique. The experience in Japan, the United States, and Europe suggests that economic
and technical reasons exist for long-term supplier relationships, at least for central office equipment. But these relationships can appear discriminatory and unfair to outsiders. Thus, for example, how can one say whether undue preferences for domestic suppliers remain in the NTT procurements shown in Figure 2.1? With the many tradeoffs involved, how does one distinguish between merely plausible reasons and the real reasons for a particular procurement decision? These questions are more difficult to answer in telecommunications than, say, in primary commodities where product quality is more easily evaluated. For this reason, trade disputes that hinge on complex technical characteristics as in telecommunications may be more nagging and difficult to resolve than is commonly true elsewhere.

**Multinational Firms Complicate Assessment of Trade Benefits**

The distinction between “national” and “foreign” firms is obviously fuzzy. With manufacturing, R&D, and management scattered around the world, the benefits of a multinational firm to particular countries are hard to assess. Northern Telecom’s multination operations, discussed above, is but one example. In closing, we pose a general question: in what ways do the benefits of a firm to a given country vary as a consequence of whether the firm is headquartered in Tokyo, New York, or London?
3. Cellular Telephone Equipment

We move now to a related sector of the telecommunications field where technological advances have opened new and rapidly growing markets. Examination of the roles of major players sheds additional light on the forces that have shaped U.S.–Japan trade relations.

After noting the nature and growth of cellular telephony, we address the development of technical standards and subsequent worldwide commercialization, with emphasis on U.S. and Japanese experience. We next describe the emergence of competing cellular providers in Japan, the trade conflicts that subsequently arose between the two countries, and the resolution of these conflicts. Finally, before drawing conclusions, we discuss the development of digital cellular telephony (as distinguished from today’s analog service) and personal communications services as important markets in future trade flows.

The Nature and Growth of Cellular Service

For decades, engineers and others have sought better ways to free telephone users from the fixed locations dictated by the wireline network. Various forms of mobile radio services were devised, but they all suffered from severe capacity limitations because of their need for scarce radio spectrum space. Only a small number of users could simultaneously be served without unacceptable levels of signal interference.

A major breakthrough came in the form of cellular telephony. Here, a given geographical area is overlaid with a pattern of cells, each several miles in diameter. Radio transmitters and receivers (base stations) in each cell are connected to switching centers for access to the nationwide—and worldwide—telephone system. Because the same radio frequencies can be used by cells separated by an appropriate distance, the capacity of a system covering a metropolitan area is many times greater than that of conventional mobile service.

However, developing a practical system of spectrum reuse was not easy. Among the challenges was the transfer or “hand off” of the customer from one cell to another, as the customer moves among the cells, without disruption of service. Moreover, the base stations, mobile telephone switching offices, and users’ telephone equipment must be designed to work together, which requires the development of appropriate technical compatibility standards.
After these problems were solved during the 1970s, commercial service was started in Japan in 1979, in the United States in 1983, and in most other countries during the 1980s, as shown in Table 3.1.

Cellular telephony is enjoying rapid growth worldwide. In the United States, about 6.4 million subscribers had signed up by the end of 1991, triple the number recorded three years earlier.\(^1\) In Japan, about 1.1 million subscribers were reported by the end of 1991, more than four times the number recorded three years earlier.\(^2\) In terms of penetration rates, the United States and Japan reported 26 and 9 subscribers, respectively, per 1000 population. (The world's highest penetration rates are in Scandinavian countries—Sweden, Finland, and Norway—for which the figures in 1991 were 67, 58, and 54, respectively.)

Standards Setting and Commercialization

The U.S. Experience

Responding to the shortcomings of mobile telephone technology, the FCC, in 1970, requested proposals for development of more advanced systems for use in the United States. AT&T offered a cellular system proposal that led to the FCC's allocation of 40 MHz of spectrum in the 800 MHz range for cellular use. In 1977 the FCC accepted a proposal by Illinois Bell for tests of cellular technology in the Chicago area, using AT&T cellular technology and telephone units supplied by Motorola and Oki (a Japanese firm). A similar trial using Motorola cellular

<table>
<thead>
<tr>
<th>Early Cellular Adopters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
</tr>
<tr>
<td>Saudi Arabia</td>
</tr>
</tbody>
</table>

SOURCE: U.S. Department of Commerce (1992), Table 22.


\(^{2}\)U.S. Department of Commerce (1992), Tables 8, 9.
system equipment and telephone units was conducted in the Baltimore/
Washington area by American Radio Telephone Service.

In 1980 the FCC began to establish procedures for issuing licenses required for
offering cellular service in particular local markets. Licensing requirements,
schedules, and equipment specifications were announced in 1982, based on the
technical standards—the Advanced Mobile Phone System (AMPS)—developed
by AT&T and Motorola. Commercial cellular service was initiated in the United
States in 1983. With the AT&T divestiture in 1984, the regional Bell Operating
Companies established cellular subsidiaries. As shown in Table 3.2, by 1991 42
countries had selected AMPS systems, serving over 8 million subscribers.

In accordance with the FCC’s decision, two competing entities are granted
licenses to operate in each metropolitan or rural area. One entity is generally the
telephone company that provides wireline telephone service to the area, the other
is a non-wireline company or a telephone company that provides wireline service
elsewhere. Subscribers buy their telephones from either independent dealers or
from agents of the cellular companies, rather than leasing them from the cellular
company. The market in the United States is deregulated, with each service
supplier free to set its subscriber rates without government approval. Moreover,
widespread buying and selling of licenses has occurred, with some cellular
operators greatly expanding their geographical coverage through buying out or
merging with others.

Table 3.2
World Cellular Market by System Type: 1991

<table>
<thead>
<tr>
<th>System Type</th>
<th>Thousands of Subscribers</th>
<th>Percent of Total Subscribers</th>
<th>Number of Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMPS</td>
<td>8,174</td>
<td>59</td>
<td>42</td>
</tr>
<tr>
<td>TACS</td>
<td>2,215</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>NMT 900</td>
<td>907</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>NMT 450</td>
<td>893</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Other 800</td>
<td>861</td>
<td>6</td>
<td>1*</td>
</tr>
<tr>
<td>Other 450</td>
<td>711</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>13,761</td>
<td>100</td>
<td>108b</td>
</tr>
</tbody>
</table>


*Japan.

Some countries are double-counted if they have multiple systems
of different types.
Experience in Japan and Other Countries

In contrast to the U.S. experience, a cellular system was developed in Japan by NEC to be operated as a national monopoly by NTT. NEC used technical standards different from the AMPS standards, although it selected the same radio frequency region of 800 MHz. The system went into service in 1979, making Japan the first country to offer cellular telephony. But Japan stands virtually alone in adopting technical standards that are not used elsewhere, as shown in Table 3.2.

Japan was able to move more quickly than the United States, despite the pioneering U.S. experimental efforts, because it did not face the same delays in establishing procedures for assigning spectrum rights to competing local service providers. With NTT as Japan's monopoly provider, the assignments by the MPT were straightforward.

The Scandinavian countries were also early adopters (see Table 3.1). A consortium of Finland, Denmark, Sweden, and Norway, in cooperation with Ericsson (a Swedish-owned firm), developed the Nordic Mobile Telephone (NMT) standard for operation in the 450 MHz region (in contrast to the 800 MHz region for AMPS). Table 3.2 shows that by 1991 NMT 450 technology had been adopted by 24 countries accounting for 893,000 subscribers. NMT 450 is attractive in that use of lower frequencies permits greater transmitter range, thereby reducing the number of cell sites required to cover a given geographical area. But the reduced number of cell sites also reduces the leeway for spectrum reuse, thereby cutting capacity. The system is most applicable to countries with low urban population densities that limit traffic demands.

In response to this capacity limitation, a more advanced system NMT 900, operating in the 900 MHz region, was introduced in 1986. By 1991 nine countries, with a total of over 900,000 subscribers, had adopted NMT 900 (see Table 3.2).

Another cellular system—Total Access Communications System (TACS)—is a derivative of AMPS technology modified for the 900 MHz range. First introduced in the United Kingdom in 1984, TACS had been adopted in 21 countries, encompassing 2.2 million subscribers by 1991.

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3In the United States, it took several years to establish mechanisms for licensing, which involved tortuous comparative hearings in the issuance of some licenses and use of lotteries for others. Details of this experience are recounted in Mitchell (1992). The delays at the FCC met with widespread criticism. For an analysis of the equivalent monetary losses caused by these delays, see Rohlfis et al. (1991).


Cell Site Equipment

Although NEC played a central role in the development of cellular service in Japan and has been the monopoly supplier of cell site equipment to NTT, it has not been a leader in marketing cell site equipment abroad. As shown in Table 3.3, by 1991 NEC had sold equipment to 11 countries, compared with 25 for Motorola and 43 for Ericsson. The U.S. market is especially important, since it accounts for about 46 percent of the world’s total subscribers. NEC had sold equipment to only eight local cellular operators in the United States, compared to 148 for AT&T, 177 for Motorola, and 82 for Ericsson. Another Japanese supplier—Mitsubishi through Astronet—had sold 25 systems in the United States, also a small proportion of total worldwide cellular sales.

Two factors are at least partially responsible for the weak Japanese performance in world markets. First, the adoption of separate standards was a handicap. The manufacture of cell site equipment specialized to the Japanese market afforded less opportunity for exploiting economies of scale in manufacturing equipment suitable for wider use.

Second, the very slow growth of cellular service in Japan did not provide a large domestic market that would have established a base for market entry elsewhere.

Table 3.3

Cellular Systems, Cumulative Sales: 1991

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Headquarters</th>
<th>No. of Countries Sold To</th>
<th>System Sales in United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ericsson</td>
<td>Sweden</td>
<td>43</td>
<td>82</td>
</tr>
<tr>
<td>Motorola</td>
<td>United States</td>
<td>25</td>
<td>177</td>
</tr>
<tr>
<td>NEC</td>
<td>Japan</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Nokia-Mobira</td>
<td>Finland</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>NovAtel</td>
<td>Canada</td>
<td>7</td>
<td>25</td>
</tr>
<tr>
<td>Northern Telecom</td>
<td>Canada</td>
<td>5</td>
<td>108</td>
</tr>
<tr>
<td>Plexsys</td>
<td></td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Siemens</td>
<td>Germany</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Alcatel</td>
<td>France</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>AT&amp;T</td>
<td>United States</td>
<td>3</td>
<td>148</td>
</tr>
<tr>
<td>Philips</td>
<td>Netherlands</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Italtel</td>
<td>Italy</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Astronet</td>
<td>Japan*</td>
<td>1</td>
<td>25</td>
</tr>
</tbody>
</table>

*80 percent held by Mitsubishi.

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5Ibid., Table 20.
Figure 3.1 depicts the slow penetration of NTT’s system during most of the 1980s; only after 10 years of operation—in 1989—did the penetration rate exceed 5 telephones per 1000 population. In contrast, the 5 percent level was exceeded in the United States after only four years. By early 1985, five years after Japan’s introduction of cellular services, only about 40,000 subscribers were recorded—less than one-half of the 92,000 recorded for the United States by the end of the first year of U.S. service.\textsuperscript{6}

Limited choice of telephone units (described below) and weak incentives by NTT to encourage growth—since doing so would threaten to siphon traffic from its existing wireline pay phone service—discouraged would-be subscribers. Charges, including a 200,000 yen deposit shown in Figure 3.2, were held constant until after the NTT privatization in 1985.\textsuperscript{7}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure3_1}
\caption{Comparative Cellular Penetration Rates}
\end{figure}

\textsuperscript{6}EGIS (1991), p. 4; U.S. Department of Commerce (1992), Table 19.

\textsuperscript{7}In contrast to constraint rates in Japan from 1979 to 1985, subscriber rates have dropped substantially in the United States. According to Herschel Shostack Associates, the “full effective cost” of cellular service had fallen by about 30 percent during the first two years of service, and by more than 50 percent during the first seven years of service. “New Directions in Cellular,” Telestrategies Conference, Washington, D.C., July 28, 1992.
AT&T’s situation stands in interesting comparison to NEC’s. AT&T has been quite successful in the U.S. market, with 148 system sales to cellular operators (mostly BOCs). Although AT&T was centrally involved (with Motorola) in developing the AMPS standards that have been adopted by many countries, and it has a large domestic market that would exploit scale economies to assist in selling elsewhere, by 1991 it had sold systems to only two other countries (the Dominican Republic and Korea).

The most plausible explanation for AT&T’s experience lies in the effects of the 1952 Consent Decree. AT&T’s difficulty in entering the foreign cellular field may be one more of the long-term effects of its having been excluded from foreign markets. In contrast, Motorola and Ericsson had a long history of worldwide operation, unfettered by such government-imposed restrictions.

It is also notable that most of AT&T’s success in the U.S. market has been with BOCs. The close working relations between AT&T and its BOCs before divestiture were not totally severed as a consequence of the divestiture. As in the
case of central office equipment discussed in Section 2, AT&T has maintained a strong position here with respect to the BOCs.8

Telephone Terminals

In Japan, NTT supplies cellular service and the telephone units as a package. Thus, users are not free to buy their own telephones for use with NTT’s cellular network.9 Telephone units are supplied almost entirely by Japanese firms. The one exception is Motorola, which has sold to NTT a small number of units built to the Japanese standard.10

In contrast, U.S. subscribers purchase their telephone units and cellular services on an unbundled basis. A large number of foreign cellular telephone manufacturers participate in the highly competitive U.S. market, as shown in Table 3.4. Japanese firms hold a collective market share exceeding 50 percent.

Some of these firms have assembly operations in the United States, in partial response to dumping penalties that were imposed in 1985 on a number of Japanese firms. These penalties, shown in Table 3.5, reflect the difference between the U.S. price and the (higher) Japanese price, or the cost of the product in Japan, as estimated by the U.S. Department of Commerce.11 The imposition of these penalties contributed to the establishment or expansion of U.S. manufacturing facilities of the affected firms as a way to reduce the import content, and hence the penalty.

The Emergence of Competition in Japan

Under the 1985 reforms, which established procedures for licensing Type I and Type II carriers, competition was widely seen as desirable because NTT, as a

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8To be sure, when cellular service was initiated in the United States in 1983 the BOCs were still tied to Western Electric and to AT&T, since the divestiture was not effective until January 1, 1984. But terms of the divestiture were announced in 1982. Had the BOCs not wanted Western Electric cell site equipment, they would probably have insisted on outside procurements (with the Northern Telecom procurement discussed in Section 2 serving as a precedent). Otherwise they would have risked being disadvantaged by their competitors, who were free to seek equipment from other suppliers.

9This practice was consistent with NTT’s supply of terminals before the partial deregulation of the wireline terminal market and, in the United States, with the Bell system’s control over terminals before the deregulation of the U.S. terminal market discussed in Section 2.

10During fiscal years 1987 to 1990, NTT is reported to have purchased 30,000 Motorola units out of a total procurement of 560,500 units—giving Motorola a market share of 5 percent. The remainder was supplied by five Japanese companies. EGIS (1991), p. 133.

Table 3.4

Cellular Telephone Manufacturers Cumulative Sales,
U.S. Market: 1988

<table>
<thead>
<tr>
<th>Rank</th>
<th>Brand/Manufacturer</th>
<th>Market Share (Percent)</th>
<th>Country of Manufacture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motorola</td>
<td>16</td>
<td>United States</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Audiovox/Toshiba</td>
<td></td>
<td>Japan</td>
</tr>
<tr>
<td>3</td>
<td>OKI</td>
<td></td>
<td>Japan, United States</td>
</tr>
<tr>
<td>4</td>
<td>NovAtel</td>
<td></td>
<td>Hong Kong, Korea</td>
</tr>
<tr>
<td>5</td>
<td>Panasonic</td>
<td></td>
<td>Japan, United States</td>
</tr>
<tr>
<td>6</td>
<td>Mitsubishi</td>
<td></td>
<td>Japan</td>
</tr>
<tr>
<td>7</td>
<td>NEC</td>
<td>66</td>
<td>Japan, United States</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>General Electric</td>
<td></td>
<td>United States</td>
</tr>
<tr>
<td>9</td>
<td>Fujitsu</td>
<td></td>
<td>Japan</td>
</tr>
<tr>
<td>10</td>
<td>E. F. Johnson</td>
<td></td>
<td>United States</td>
</tr>
<tr>
<td>11</td>
<td>Radio Shack/Tandy Mobira</td>
<td></td>
<td>Korea</td>
</tr>
<tr>
<td>12</td>
<td>Mobira</td>
<td></td>
<td>Finland, United States</td>
</tr>
<tr>
<td>13</td>
<td>Technophone</td>
<td></td>
<td>United Kingdom</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>


*Includes assembly operations.

Table 3.5

Dumping Margin Penalties: November 1985

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Percent</th>
<th>U.S. Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matsushita (Panasonic)</td>
<td>106.60</td>
<td>Yes</td>
</tr>
<tr>
<td>NEC</td>
<td>95.57</td>
<td>Yes</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>87.83</td>
<td></td>
</tr>
<tr>
<td>OKI</td>
<td>9.72</td>
<td>Yes</td>
</tr>
<tr>
<td>Hitachi</td>
<td>2.99</td>
<td></td>
</tr>
<tr>
<td>Toshiba</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>All Others</td>
<td>57.81</td>
<td></td>
</tr>
</tbody>
</table>


monopolist, had failed to encourage the growth of cellular. One prospective applicant, Daini Denden, offered to use Motorola equipment, which was based on internationally accepted standards (TACS), in contrast to NTT’s proprietary strategy. Accordingly, Daini Denden (DDI) approached the MPT, which is responsible for issuing the necessary licenses to operate as a Type I carrier.

However, a second prospective applicant, Teleway Japan, also approached the MPT with a proposal to enter the cellular market using NTT’s technical standards, thereby facilitating use of the same types of equipment sold to NTT.
The Teleway consortium had strong industry and government connections, with partnerships that included Toyota, Nissan, Tokyo Electric Power, and others. In contrast, DDI was backed by less well-established—though successful—firms such as Kyocera Corporation, a manufacturer of ceramic and electronic components.

MPT initially concluded that not enough radio spectrum would be available for two entrants to compete with NTT, and that it was unlikely that two additional firms could both make a profit. After continued dispute, MPT suggested that the two potential entrants form a single venture to compete with NTT. But each continued to insist on being the one selected. Among the controversies was DDI’s proposal to use Motorola’s system, meaning that two incompatible systems would operate side by side; Japan Teleway’s approach of adopting NTT’s standards would ensure compatibility between the two systems. One official of Japan Teleway said, “We think the N.T.T. system should be adopted…. In the United States and Europe, everyone uses one standard in one area.” Compatibility was advantageous insofar as telephones manufactured for one system could be used on the other. But operation of two different systems could also be beneficial if their varying features expanded subscriber choice. Indeed, Motorola argued that its system was less expensive, offered better voice quality, and a wider array of services.

Complaints were voiced that Motorola was unwilling to modify its system for compatibility in Japan, although Japanese manufacturers were willing to adapt to the U.S. market. This asymmetry in behavior arose because adoption of Japan-specific standards by U.S. firms would be potentially unattractive, in light of the small Japanese market. In contrast, adoption of U.S. standards by Japanese firms would provide access not only to the U.S. market but also to other countries in which U.S. standards were adopted. Thus, a number of Japanese cellular telephone manufacturers, using the AMPS standard, enjoyed success in the American market and in many other countries. Similarly, adoption of TACS or NMT standards provided access to yet other groups of countries.

Indeed, a number of Japanese manufacturers do not sell to NTT, either because they have chosen not to design to NTT’s standards or because they have been

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12 Attempts by the MPT to make business judgments about the viability of proposed services strained relations with U.S. officials who took the view, common in the United States, that market forces—not government agencies—should dictate the number of entrants, with each entrant facing the risk of failing in return for the potential of success and high profits.


14 This advantage is less important in Japan where cellular telephones are leased from the carrier. If the telephone is purchased by the subscriber (as in the United States), system compatibility gives the subscriber the freedom to switch carriers while continuing to use the same telephone.
unable to penetrate the Japanese market for other reasons. We have here an example of participation in foreign cellular markets without the help of a domestic base, in contrast to the situations enjoyed by NTT’s family of suppliers, discussed in Section 2.

After months of stalemate and continued U.S.-Japan trade tension, the MPT decided to allow both Japan Teleway—through its joint venture Nippon Idou Tushin (IDO)—and DDI to construct cellular systems in separate markets. The area surrounding Tokyo and extending to Nagoya (the Kanto and Chubu regions) would be served by IDO; the remainder of the country (including Osaka) would be served by DDI, while both areas would remain covered by NTT. Thus, NTT would face either IDO or DDI as a competitor in each local market.

The two NCCs’ carriers entered the market in 1989 and have grown rapidly. By the spring of 1991, two years later, the market share (in terms of number of subscribers) was 16 percent and 19 percent, respectively, for IDO and DDI, while NTT’s market share had fallen to about 65 percent.

The rapid growth of NTT’s competitors was helped by two factors. First, NTT was more constrained by the MPT in cutting prices than were IDO and DDI. The MPT, which has the responsibility for approving price changes, was reluctant to let NTT price aggressively, presumably because of a desire to ensure that the NCCs had a good chance to succeed. It was only in mid-1985—nearly five years after service was started—that MPT approved the first revision in NTT’s cellular usage rates.

Second, NTT was slow to offer compact lightweight telephones in the hand-held portable market, which has grown much faster than the automobile cellular market. In early 1990, Motorola introduced through DDI the MicroTAC, which was the lightest and smallest portable phone on the market at that time. More than a year later, NTT introduced its MOVA portable series, after an accelerated development program involving four Japanese manufacturers. In the meantime, IDO introduced the Minimo portable phone, manufactured by Matsushita.

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15Such manufacturers include, for example, Uniden, Clarion, and Shinton. EGIS (1991), p. 132.
16Ibid., p. 13.
17MPT News-Japan, September 2, 1991. The changes in rates were fairly modest. For example, the rate per three minutes for calls within service areas up to 160 kilometers was reduced by 7 percent and 6 percent, respectively, for daytime and nighttime usage.
18By March 1992, the hand-held portable market was estimated to constitute 61 percent of total sales. EGIS (1991), p. 15.
Trade Tensions and Their Resolution

Entry of the two new carriers, with Motorola playing a prominent role in one, did not end trade tensions between the two countries. IDO's heavily industrial Tokyo-Nagoya area is a more attractive cellular area than the less densely populated areas served by DDI elsewhere in Japan.

Moreover, IDO and NTT have an advantage over DDI in another respect. If DDI subscribers want to use their phones outside of DDI territory, they must make arrangements with NTT for "roaming" service. The incompatibility of DDI's Motorola system with NTT requires that telephones incorporate NTT's roaming function along with a new phone number for DDI subscribers while roaming outside of DDI's territory. These telephones are heavier and bulkier than other TAC telephones supplied by DDI. The roaming requirements pose a severe handicap in the hand-held portable market, where light weight and compactness are especially important. In contrast, since the IDO system was technically compatible with NTT's, the use by IDO subscribers of the NTT network outside of IDO's territory was facilitated.

The MPT maintained that no radio spectrum space was available to give DDI a roaming capability in the Tokyo area. But the MPT subsequently allocated some bandwidths to a new service called "Convenience Radio Telephone" which, according to one report, was "a lower-quality service promoted by some well-connected Japanese concerns."19 This action immediately brought forth assertions of discriminatory treatment toward non-Japanese firms.

In the spring of 1989, the U.S. government, through the U.S. Trade Representative (USTR), threatened a variety of trade sanctions against Japan unless American companies were afforded access to the Tokyo cellular market.20 This action was taken under Sec. 1377 of the Omnibus Trade and Competitiveness Act of 1988, which requires that the USTR annually review each telecommunications trade agreement, including the MOSS Agreement, as noted in Section 2.

After investigation, the USTR determined that inadequate transparency in the MPT's procedures for allocating radio frequencies was inconsistent with the MOSS Agreement.

MPT prohibits one cellular radio system, which uses U.S. equipment, from operating in the Tokyo and Nagoya area, despite the recent identification

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20 Ibid., p. D1.
of spectrum which would make "roaming" into that market feasible. The competing Japanese system can "roam" throughout the country.

To some American observers, Motorola's exclusion from Tokyo was "another case in which Japan had made a show of allowing American competitors into the country while keeping them out of the most lucrative markets."21 To the Japanese, however, the dispute was seen as

a result of American arrogance and impatience. They say Motorola is unwilling to modify its products to satisfy Japanese technical standards, or to wait until the next generation of phones bridges the differences between those standards and Motorola's.22

A potential remedy involved allocating a portion of IDO's radio spectrum to operate a TACS system (compatible with DDI's system for roaming) constructed by a U.S. supplier alongside IDO's (and NTT's) existing systems. The USTR requested that 5 MHz be granted for that purpose. Japanese officials responded that no more than 2 MHz could be made available in light of the already crowded radio spectrum space. After further arguments that 2 MHz would be insufficient for profitable operation, Japanese officials offered another 3 MHz. "MPT will make available the additional 3 MHz to IDO in its territories and the same 3 MHz to DDI in its territories (i.e., nationwide) in order to satisfy user needs, when the 2 MHz is forecasted to be fully utilized."23

This approach provided the basis for an agreement between the two countries in June 1989. A U.S. supplier would have access to the Tokyo market with the 2 MHz available through IDO, and with another 3 MHz to be made available when needed. In response, IDO started design of the TACS system in the fall of 1989, initially to cover 23 wards in Tokyo and to be operational by the end of 1991. In May 1990, during the design phase, IDO decided on the basis of competitive bids that it would buy $35 million worth of equipment from Motorola.24

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21 Ibid., p. D1.
22 Ibid.
24 U.S. International Trade Commission (1991a), p. 125. According to one report, "Initially, IDO resisted the directive to install TACS, despite the government's offer of low-interest loans to help with the estimated 10 billion yen ($63 million) cost. Now, however, IDO appears eager to install TACS and believes it will be able to capitalize on interest in the MicroTAC throughout the rest of the country. Offering two cellular standards [TACS and the NTT standard] may boost IDO's sales." Galbraith (1990), p. 34.
Development of Digital Service

Because of capacity limitations imposed by radio spectrum limitations for analog service, some countries plan to add digital transmission before mid-decade. Japan has allocated radio spectrum space to digital service in the 800 MHz region—the same range in which the analog services of NTT, IDO, and DDI are now operating—and is also allocating spectrum in the higher 1.5 GHz region. Similar to the arrangement for analog, NTT will have digital spectrum assignments to enable it to cover all of Japan, and IDO and DDI will have assignments within their respective current territories. Two additional carriers have been authorized to provide digital service in the 1.5 GHz region.

Foreign Involvement

Japan's plans are especially notable because these digital networks involve foreign participation. Under a Track III (joint development) procurement, NTT selected Motorola, Ericsson, and AT&T, along with six Japanese manufacturers, to participate in development of its digital cellular network. In mid-1990, DDI announced the selection of Motorola and Ericsson, along with NEC, to participate in the joint development of its systems. Later in 1990, IDO announced the selection of AT&T, along with NEC and Fujitsu, to participate in the joint development of its system. In addition, NTT picked Motorola's design for the digital voice CODEC that converts the wave pattern of the human voice into the required pattern of digital pulses. Under terms of the agreement, Motorola must publish its design and must license it to other companies free of charge.

Tokyo Digital Phone Corporation, one of the two ventures that will use the 1.5 GHz region for digital service, plans to inaugurate service in July 1994. Its largest investor is Japan Telecom. Among others are East Japan Railway, Pacific Telesis International, Metrophone Service, Cable & Wireless, Toyota Motor Corp., and Nippon Steel Corp. Ericsson and Toshiba have established a joint venture to design and manufacture the cellular equipment. Ericsson will own 60 percent and Toshiba 40 percent of the venture, which is expected to have sales of over $250 million in 1994.25

The second venture, TU-KA Cellular Tokyo Inc., plans to start in April 1995. Its largest investors are Nissan Motor Co. and DDI Corp. Among the others are Nippon Motorola, Sony Corp., Hitachi, KDD, British Telecom, GTE, US West,

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25Telecommunications Reports, August 10, 1992, p. 11.
and Nynex.\textsuperscript{26} Motorola will supply the cell site equipment to cover the regions of Tokyo, Kanagawa, Chiba, and Saitama.\textsuperscript{27}

Thus, these two carriers include a number of foreign-affiliated firms—Pacific Telesis International, Nippon Motorola, GTE, US West, and Nynex—representing U.S. interests, along with British-owned Cable & Wireless and British Telecom, among others.\textsuperscript{28}

\textit{Compatible Technical Standards}

Another aspect of Japan’s digital plans is notable. All the carriers are adopting technically compatible standards—Time Division Multiple-Access (TDMA). This move will help to preclude the emergence of technical barriers to interconnection of the sort that generated the trade dispute about roaming discussed above.\textsuperscript{29}

**The Separation of NTT's Mobile Services**

Finally, as one ingredient of the reforms instituted in 1985, NTT’s mobile services, including cellular, were spun off into a separate subsidiary in mid-1992. As discussed in Section 2, divestiture of NTT’s long-distance and local markets has long been an issue. Although divestiture has not been imposed, one consequence of the debate has been NTT’s agreement to separate its mobile services from its other services. The mobile-service subsidiary is initially wholly owned by NTT, but plans call for ownership shares to be sold later to outsiders. According to one report, “MPT expects that realization of fair and effective competition in the mobile communications market and the ensuing vitalization of the market will result in reductions in rates and more sophisticated and diversified services—which boils down to more benefit for the public.”\textsuperscript{30} The evolving independence of the new subsidiary, combined with expanding competitive pressures from Type I carriers, may contribute to opening the cellular market further to the most attractive equipment suppliers—whether domestic or foreign. Here, as in the wireline services discussed above,

\textsuperscript{26}MPT, \textit{MPT News}, May 18, 1992, p. 3.
\textsuperscript{28}For Tokyo Digital, foreign ownership shares constitute 23 percent of the total, of which about 70 percent is U.S. For TU-KA Cellular, foreign ownership constitutes 23 percent of the total, of which about 65 percent is U.S. International Trade Administration, U.S. Department of Commerce (unpublished data).
\textsuperscript{29}In addition to technical compatibility, roaming will require interconnection of carrier switches and agreements among the carriers about billing, division of revenues, and other operating matters.
\textsuperscript{30}MPT, \textit{MPT News}, July 1, 1992, p. 3.
competitive market pressures as a substitute for traditional monopoly will likely become increasingly important determinants of international trade flows.

**Personal Communications Services**

PCS is an advanced version of today’s cellular services, with cell diameters measured in yards instead of miles and telephone units that are lighter, smaller, and less expensive to use. With the mobility afforded by “vest pocket” units, PCS may eventually permit assignment of telephone numbers to persons not tied to specific geographical locations. In addition to handsets, PCS applications will include portable wireless facsimile machines, wireless PBXs, advanced paging devices, and wireless electronic mail services. In the words of the FCC:

> The advent of PCS could have a great impact on the future development and configuration of all telecommunications networks. Many PCS applications will create new markets and provide a greater level of competition in many segments of the telecommunications industry. PCS could also increase productivity and efficiency across a broad array of industries and have a positive impact on the international competitiveness of the nation’s economy.\(^{31}\)

Responding to the interest and enthusiasm in the telecommunications community, the FCC is moving quickly to set down ground rules for assigning radio spectrum rights for the new service.\(^ {32}\)

Early versions of PCS, called “telepoint” or CT-2, are basically cordless payphones with the user able to call out, but not to receive calls.\(^ {33}\) More advanced versions use the signaling capabilities of the wireline network to provide full two-way service. Many experiments and marketing trials of CT-2 applications are being conducted in the United States and in Europe (most notably, in the United Kingdom). As of mid-1992, 140 applications had been filed with the FCC for experiments in the United States, and 119 experimental licenses had been issued.\(^ {34}\)

Among the equipment suppliers, Motorola and Omnipoint Data Co., both U.S. firms, are playing a prominent role. The most notable U.S. experiments involving Japanese interests are (a) a PCS test supported jointly by Bell South and Sony—but with handsets made in the United Kingdom\(^ {35}\)—and (b) a wireless PBX

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\(^{32}\) Ibid.
\(^{33}\) As a substitute for incoming calls, a pager can alert the individual to return a call.
\(^{35}\) *Advanced Wireless Communications*, June 29, 1991, pp. 10-14.
test supported jointly by Southwestern Bell and Matsushita, with the system to be manufactured by Matsushita.\textsuperscript{36}

In Japan, NTT is developing its Personal Handy Phone system for widespread service planned for 1994. It has selected Motorola for joint development of outdoor base station equipment. In addition to Motorola, NTT has selected four Japanese suppliers for the project: Fujitsu, Matsushita, Mitsubishi, and NEC.

PCS will play an important role in international trade if it develops as many predict. PCS might provide a good substitute for conventional wireline links between the user locations and the telephone central office—a development that would add greatly to mobility while eroding the monopoly that local telephone companies now hold by virtue of their control over the local wireline link to the nationwide network. In this case, radio-based systems could be substituted, in many applications, for wired terminals and local wire telecommunications infrastructure. In light of the rapid pace of experimentation and plans for commercialization, such substitution could be well under way before the end of this decade.

For our purposes, the most notable aspect of PCS is that developments are taking place with joint participation by domestic and foreign firms in both the United States and Japan. This situation stands in contrast to the Japanese wireline market of the late 1970s when NTT dealt with its family of domestic suppliers to the virtually complete exclusion of foreign entities.

Conclusions

Four major conclusions emerge from the preceding discussion: (a) Japan's strategy for development of cellular services was very different from that for wireline services, (b) the Japanese cellular market is now much more open to outside suppliers than was earlier the case, (c) competition and technological advance have both triggered trade disputes and helped to open Japan's market to foreign suppliers, and (d) long-term supplier ties are important in determining the pattern of trade flows.

A Different Development Strategy

In Section 2, we saw that Japanese equipment suppliers benefited from a largely closed domestic market and close working relations with NTT in the late 1970s,

\textsuperscript{36}ibid., January 8, 1992, pp. 1–2. The wireless PBX permits cordless mobility within an office complex and permits relocations of telecommunications terminals without costly rewiring.
which provided a base for overseas expansion—a strategy that triggered allegations of unfair competition. In contrast, although Japan was the first country to implement cellular service, it did not have a substantial cellular market until the late 1980s, after service was already widely available elsewhere. NEC—the main beneficiary of cellular collaboration with NTT—trailed Motorola, Ericsson, and AT&T in foreign markets for cell site equipment. This outcome may have resulted, at least in part, because NEC had a small domestic Japanese market to draw from. As for telephone units, some Japanese manufacturers sold nothing to NTT and were thus wholly dependent on foreign markets.

**A More Accessible Japanese Market**

The Japanese domestic cellular market is more accessible now than at the time service started in Japan in 1979. The only significant early foreign involvement was the sale by Motorola of telephone units to NTT. The emergence of competing carriers brought further entry, including both telephone units and cell site equipment. Implementation of digital transmission is bringing yet greater participation in the form of joint R&D activities and expanded sales of equipment from European sources (Ericsson) as well as from U.S. sources (Motorola and AT&T). Development of PCS in Japan and the United States is also marked by joint activities by domestic and foreign firms.

**Competition and Technological Advances**

Competition and technological advances have triggered trade disputes as well as opened the Japanese market. Recall the trade dispute at the time of the pending decisions about whether one cellular carrier or two would be licensed to compete with NTT and the resolution of the dispute that led to foreign entry. Further dispute arose when technical limitations made roaming more difficult for one competitor than for the other. The dispute was partially resolved by forcing IDO to provide two cellular networks designed to different technical standards. The use of digital transmission will more fully resolve the roaming issue because all digital cellular carriers will use the same standards.

Digital transmission has provided more opportunity for foreign entry, and the development of PCS may offer yet other opportunities. Without the technological advances that brought forth cellular service, and the competition that emerged after the NTT reforms, the Japanese market might still be characterized by a tight linkage between NTT and its domestic suppliers, with significant foreign entry afforded only through formal trade agreements.
Remaining Puzzles

Two aspects of Japan’s cellular experience remain puzzling: the selection of standards different from those used elsewhere, and the cellular market’s slow growth in Japan during most of the 1980s.

Unique Technical Standards

One could speculate that Japan had hoped to have its standards adopted by other countries (in competition with AMPS, TACS, and NMT) to facilitate Japanese entry into foreign markets. If this motivation existed, the outcome was a total failure. No other country followed Japan’s lead. Moreover, no evidence uncovered in this study suggests that Japan mounted a vigorous international campaign to have its standards adopted elsewhere.

Another possibility is that Japan picked separate standards to provide trade protection for its domestic cellular industry. The requirement to design standards unique to Japan raised the costs of foreign entry into the Japanese market. Operating under separate standards, NTT could work with its domestic family of suppliers in establishing cellular service with less danger of unfair trade complaints from the outside than might be true of other kinds of nontariff trade barriers.

If trade protection had been the motivation, however, this strategy also had a downside: Unique domestic standards reduced the value of the domestic market as a base for Japanese exports. Although Japanese manufacturers of cellular telephone units were able to sell widely in foreign markets despite this problem, the difficulties faced by manufacturers of cell site equipment (NEC and Mitsubishi) in selling abroad were exacerbated by the need to design to standards different from those used domestically.

Slow Early Cellular Growth

This phenomenon could be explained a number of ways: NTT’s relative inefficiency, before privatization, which may have led to neglect of cellular as well as other markets in which it held a monopoly; limitations on radio spectrum availability; or unattractive cellular cost and performance characteristics arising from the selection of technical standards less suitable than those adopted elsewhere.

One major factor was the capacity constraint imposed by Japan’s allocation of only 25 MHz of radio spectrum to cellular in contrast to 40 MHz allocated in the
United States. This limited spectrum allocation, combined with Japan’s very high population density in Tokyo and Osaka, saturated the capacity of individual cells, even at low overall subscriptions to cellular. It was only as NTT adopted additional techniques to conserve spectrum space that subscriptions could continue to expand. With spectrum being the primary constraint to growth, NTT was free to charge relatively high prices for cellular service without additional adverse effects on business growth.

But this discussion leaves open the question of why Japan allocated only 25 MHz to spectrum. This study has uncovered no evidence that Japan faced more serious spectrum management problems than has the United States or other countries in which cellular service has grown rapidly.

Similarly, rapid cellular growth occurred in some countries (e.g., Australia, Norway) where cellular providers were also government-owned monopolies. The fact that no other country adopted the Japanese technical standards suggests that they were less attractive than others; but we have no quantitative evidence about the effects on Japanese cellular system cost and performance.

In short, the early history of Japanese cellular development is sketchy and merits further investigation to shed light on Japan’s telecommunications development strategies.
4. High Definition Television

From the preceding examination of the telephone industry, we move to HDTV—a portion of the consumer electronics market related to telecommunications (television broadcasting) and to computers. In the words of one analyst,

HDTV represents the next generation of television, which promises household consumers a dramatically improved picture, comparable to that of film or twice as sharp as that of conventional sets. HDTV also represents a new era in consumer electronics (televisions, videocassette recorders, and the like) that will use the more sophisticated electronic technologies and components common to advanced digital computers and information systems. This connection is expected to create dramatic new opportunities for the consumer electronics industry and the computer industry to benefit from each other’s innovations, such as HDTV and interactive personal computers.¹

Our emphasis is on HDTV because Japan’s early lead in this field has fueled concern about the competitiveness of the United States in electronics and related high-tech industries, as well as concern about the need for an industrial policy to strengthen the U.S. R&D and manufacturing base. Moreover, the HDTV market contains ingredients that could create future tensions in trade relations between the two nations. This section addresses the reasons for Japan’s early lead in HDTV, the resulting concerns about U.S. competitiveness, recent technological breakthroughs that are permitting the United States to leapfrog Japan’s efforts, and implications for long-term trade relations.

Japan’s Early Lead

Japan started development of HDTV in the early 1970s, long before other nations recognized the potential of this new service. Nippon Hoso Kyokai (NHK), Japan’s Public Broadcasting Corporation which operates alongside advertiser-supported commercial broadcasters, has played a central role in this development. Financed almost entirely from “receiving fees” paid by Japan’s 32 million households, NHK devotes most of its revenues to the programming and operation of its domestic television and radio broadcasting stations. It also has a strong commitment to advancing broadcasting technology.

In this latter role, NHK was attracted to the potential of HDTV because the technology would provide the base for expanding high-technology exports, as a follow-on to the success that Japan had achieved in the worldwide market for conventional color TV receivers.

In contrast, the United States showed little early interest in HDTV because (a) it would increase broadcasting costs without increasing advertising revenue, (b) no way was known at the time to deliver HDTV on the 6 MHz terrestrial channel used for conventional television, (c) cable television operators, who might have offered HDTV on a viewer subscription basis, were preoccupied with expanding their markets with conventional television, and (d) no U.S. public or private organization had the mission and the money for activities comparable to those of NHK.

Technical standards for ensuring satisfactory performance of HDTV equipment were important in HDTV development. We look here at two types of standards—one relating to program production, the other to transmission. Production standards have to do with format of the programming. For example, the competition between the BETA and VHS video cassette formats represented a rivalry between two production standards. Transmission standards have to do with how the signal should be designed (e.g., should it use analog or digital techniques) to carry the program from a broadcasting station or other source to the television receiver.

**Program Production Standards**

Three production standards are used worldwide. The National Television System Committee (NTSC) standard is used by the United States, Japan, Canada, Mexico, and 18 other countries. The number of scanning lines (525) affects the resolution or sharpness of the picture. The field rate—the number of "snapshots" taken by the camera per second—is designed to be nearly the same as the 60 Hz electric current used in the countries of adoption. The aspect ratio of 4:3 is the width-to-height ratio of the television screen. The SECAM (sequential color and memory) standard, adopted by France, the USSR, and about 40 other countries, has a greater number of lines than NTSC and a 50 Hz field rate for compatibility with the 50 Hz electric power of these countries. The PAL (phase alternate line) standard, used by West Germany and 62 other countries, is similar in many ways to SECAM.

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2. The NTSC comprised industry representatives who agreed to this standard for black and white broadcast television in 1940 and for color television in the early 1950s.
Although these standards have served society well, they are based on early post-World War II technologies and, in the case of NTSC, even on prewar technologies. Subsequent advances, including revolutionary developments in the computer field, now enable design of technically superior standards.

In response to the perceived opportunities, NHK began work on HDTV in the early 1970s. Its studies showed that the number of lines should exceed 1000 (for a resolution comparable to that of 35 mm film), and that wider aspect ratio screens than those in use today (in the neighborhood of 16:9 in contrast to 4:3) would add significantly to viewer satisfaction. Moreover, NHK came upon a particularly attractive number—1125 lines. In addition to affording high resolution in HDTV applications, this number provided a basis for relatively easy conversion to existing standards. That is, a videotape shot at 1125 lines could, with simple conversion devices, be played on NTSC, SECAM, or PAL studio equipment to transmit a conventional picture to existing receivers.\(^3\)

Consequently, the 1125-line approach held promise as the basis for a worldwide production standard. A program recorded at 1125 lines with the 60 Hz field rate could be converted with all existing broadcasting systems for reception as conventional television. At the same time, if all other countries also adopted the 1125/60 standard, the program could be distributed worldwide and received on HDTV receivers (with a suitable transmission system) at much higher resolution.

Greater interest in HDTV was expressed in the United States after hardware demonstrations by NHK and Japanese manufacturers. A cooperative effort emerged between the two countries to perfect the 1125/60 standard and to promote it as the HDTV standard to be adopted by all countries.\(^4\) However, opposition from European countries in the late 1980s prevented the approach from being adopted as a worldwide standard. Other countries—notably West Germany, France, and the United Kingdom—expedited development of a European standard within the “Eureka” program—a joint activity among numerous European countries directed to various R&D activities including HDTV. This work culminated in a “1250/50” standard in competition with the Japanese-led initiative.

Subsequently, support in the United States for the 1125/60 approach has weakened because European opposition has made adoption of a single worldwide standard unlikely, continuing technological advances have strengthened alternatives, and concerns about Japanese inroads into the U.S.

\(^3\) Johnson (1990), p. 9.
\(^4\) For a detailed discussion of the nature of this collaborative effort, see Johnson (1990).
electronics market have become more widespread—a situation that might worsen with adoption of a Japanese-originated standard.

**Early Commercialization**

Despite the fragmentation of standards development, NHK and Japanese manufacturers have continued to perfect equipment based on the $1125/60$ standard. HDTV studio equipment is now being marketed and a number of programs have been produced with the $1125/60$ standard. Even if no other countries adopt this production standard, these programs can be transmitted (presumably with relatively simple conversion devices) on NTSC, PAL, and SECAM equipment used for conventional broadcast.

Transmission of HDTV on a demonstration basis began in Japan in mid-1989 with use of a direct broadcast satellite channel for one hour daily. Service was expanded to eight hours daily in late 1991. Not surprisingly, the market is severely limited because of high receiver costs. However, technological advances are affording substantial cost reductions. According to a recent announcement, Sony has priced its 32-inch HDTV set at 1.3 million yen ($10,000), compared to 4.1 million yen ($31,500) for its 36-inch HDTV model and 2.4 million yen ($18,500) for a model from Toshiba Corp. that was previously the cheapest available. “Sony said it was able to cut costs through a new large-scale integrated circuit developed jointly with Hitachi Ltd., Fujitsu Ltd. and Texas Instruments Japan Ltd., cutting the number of chips to one-fifth that of other models.”

**Transmission Standards**

In addition to program standards, Japan was a pioneer in the development of HDTV transmission standards. From the earliest days, it was generally recognized in Japan that, for two reasons, HDTV programs would be transmitted to households by direct broadcast satellites (DBS). First, HDTV involves an information transfer rate five times greater than the rate required for NTSC broadcast. Thus, HDTV requires more radio spectrum per channel than the 6 MHz used for NTSC service—a demand on spectrum space more easily accommodated by satellites than by terrestrial broadcast. Second, satisfactory reception quality in Japan’s mountainous terrain would be easier to ensure with line-of-sight satellite reception.

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Consequently, NHK developed a family of standards—called MUSE—for transmission of HDTV signals.\textsuperscript{6} One MUSE system—MUSE-E—occupies 9 MHz for use with Japan’s current HDTV satellite service. Another—Narrow MUSE—is designed for 6 MHz terrestrial broadcast for possible use in the United States, discussed below.

Existing and planned HDTV service is entirely separate from Japan’s terrestrial service. An “enhanced definition” service (EDTV) is being implemented to improve reception from terrestrial broadcasts, but with the same 525-line format and 6 MHz bandwidth used for NTSC service.

\textit{Alarm in the United States}

Although a cooperative U.S.-Japan effort had earlier emerged to promote the 1125/60 standard for worldwide use, erosion of the domestic U.S. consumer electronics market and mounting concern about the future electronics industrial base have generated pressures for an independent U.S. strategy.\textsuperscript{7}

Especially noteworthy is the growing market share of foreign firms in the U.S. market for television receivers. Japanese firms hold nearly 50 percent of the market; the only U.S.-owned firm—Zenith—has about 12 percent.\textsuperscript{8} No less important, well-known U.S. names are now on the television receivers of foreign-owned firms. After acquiring RCA in 1985, GE sold the consumer electronics portion of GE/RCA in 1987 to Thomson, owned by the French government. Other U.S. television operations have been acquired by Philips—a firm headquartered in The Netherlands.

To be sure, all major receiver manufacturers, whether domestic or foreign-owned, maintain extensive activities in the United States. Most large color television sets sold in the United States are manufactured or assembled there, in part because of the high cost of transporting large and fragile picture tubes. In contrast, Mexico has become a center for assembly of low-end color sets. For example, Zenith, the only major U.S.-owned firm remaining in the industry, operates one television and one picture tube plant in the United States and imports 60 percent of the receivers it sells in the United States from Mexico.\textsuperscript{9}

\textsuperscript{6}MUSE stands for “Multiple Sub-Nyquist Encoding,” the process by which the 22 MHz baseband NHK studio system is compressed to a lower bandwidth.

\textsuperscript{7}Johnson (1990), pp. 18–28.


\textsuperscript{9}Deltz (1991), p. 36. This situation is similar to that of Northern Telecom discussed in Section 2. Both cases raise the question of how benefits to the United States of a firm’s activities within its borders differ, according to whether the firm is domestically or foreign owned.
Nevertheless, some are concerned about foreign control, where strong relationships exist among technological advances in the electronics field. As one U.S. Congressman concludes:

HDTV is going to require increasingly sophisticated chips and semiconductors. HDTV also is likely to cause technological advancements in photonics, fiber optics, microprocessing and other related industries. If foreign competitors control HDTV, they will have a major advantage in developing these other new technologies, causing a further erosion in America’s ability to remain competitive in electronics. And if there is one industry that is undeniably critical to the economic stability of this nation it is the electronics industry.\(^{10}\)

In light of these relationships, recommendations have occasionally been made (but not implemented) to channel large-scale government support to HDTV and related technologies. Most notably, in 1989 the American Electronics Association (AEA), representing a large group of U.S.-owned firms in the electronics field, proposed a plan for about $1.3 billion in government funding tied to the proposed formation of the “ATV [Advanced Television] Corporation.” This would be an industry-led body that, with government support, “would monitor and guide development of a U.S.-based ATV [advanced television] industry and support component industries, emphasizing weak or threatened sectors.”\(^{11}\)

Under the AEA plan, $500 million in government guaranteed loans and $500 million of direct government loans would be available to participants in the ATV partnership to manufacture and market advanced television products.

**Breakthroughs in the United States**

*Emphasis on Terrestrial Broadcasting*

In the midst of the above debate, the FCC started considering strategies for commercializing HDTV in the United States. In contrast to Japan’s approach, the FCC calls for today’s terrestrial broadcasters to play a major role in the delivery of HDTV. This situation reflects at least in part the strong political influence of broadcasters in the United States. If HDTV becomes popular, through satellite and cable delivery, the audiences available to broadcasters will shrink unless they too are able to offer HDTV service. The problem for broadcasters is compounded by continuing arguments by other radio spectrum users that too


\(^{11}\)American Electronics Association (1989).
much spectrum space has already been allocated to television broadcasting and that some of it should be made available for other uses.\textsuperscript{12}

In response to opportunities for improving service in the United States, a number of “proponents” have come forth with proposals for terrestrial broadcast of either HDTV or EDTV. To help evaluate these approaches, the FCC established in 1987 the Advisory Committee for Advanced Television Service (ACATS) with membership drawn from television broadcasting networks and stations, equipment manufacturers, cable television systems, and other groups. In addition, the Advanced Television Test Center (ATTC), with the responsibility of testing the alternatives under simulated field conditions, was established in 1988 by the National Association of Broadcasters, commercial television networks, and others.

By the end of 1989, nine transmission systems had been proposed for ATTC evaluation.\textsuperscript{13} Two were from NHK—the “MUSE-6” for enhanced NTSC (EDTV) service on existing 6 MHz channels and “Narrow MUSE” to provide HDTV also on a 6 MHz channel. Both came out of NHK’s work in satellite-based transmission systems noted above.

Soon thereafter, the FCC decided that it will not pick an EDTV standard until it has decided on an HDTV standard.\textsuperscript{14} This decision has narrowed the testing to five proposed HDTV systems. By considering HDTV first, the FCC hoped to ensure that broadcasters would not be saddled with a less attractive EDTV system, in competing against DBS and cable operators who would be free to offer HDTV. But the decision also represented a severe challenge because proponents were called upon to demonstrate satisfactory HDTV reception when transmission is squeezed into the same 6 MHz bandwidth used for NTSC broadcast.

At that time, all of the proposed systems, including NHK’s submissions, were designed around analog transmission, which has been the dominant mode since the inception of telecommunications. The alternative—digital transmission—has the desirable characteristics of compatibility with computers and other digital-based equipment. But digital transmission was generally considered impractical

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\textsuperscript{12} Consideration of these demands by competing users is contained in an ongoing FCC proceeding in its General Docket No. 85-172. There the FCC proposed sharing or reallocating of UHF channels in eight large urban areas to private land mobile radio service, but has postponed further action until after decisions are made about the allocation of spectrum space to HDTV.

\textsuperscript{13} A listing of the early proponents of these systems and a more detailed treatment of this history are in Johnson (1993), pp. 22–31.

\textsuperscript{14} For a recapitulation of the FCC’s deliberations and decisions, see U.S. FCC (1992b).
for television broadcasting because it would require more spectrum space than analog techniques for either HDTV or NTSC applications.

**Emergence of Digital Video Compression**

The situation changed in mid-1990, with a startling announcement by General Instrument (GI). It proposed for FCC evaluation an all-digital transmission system based on its DigiCipher video compression system. With adequate video compression, enough information for satisfactory HDTV reception could be squeezed into a 6 MHz channel. Moreover, a compressed digital HDTV signal could be transmitted at lower power than required for NTSC analog broadcast, permitting greater use of the radio spectrum without signal interference. For example, an HDTV signal could occupy a channel that, if used for NTSC broadcast, would cause interference with a nearby occupied NTSC channel.

After GI’s move, other HDTV proponents—except NHK—rushed to modify their proposals to incorporate digital transmission. Success critically depended on development of a satisfactory video compression technique—an area of technology where NHK lagged behind other major players.

After consolidations and dropouts, five HDTV systems are currently included in the FCC’s testing program, as shown in Table 4.1. All are digital except for the NHK submission, which remains analog. Laboratory testing of the systems was completed at the end of 1992, field testing is to take place during 1993, and a final FCC selection is due by the end of 1993.

After the FCC selection, each existing broadcaster will be entitled to a 6 MHz channel for transmission of HDTV, in addition to its 6 MHz channel now used for NTSC broadcast. After HDTV service has grown to a suitable level (during the next century), NTSC service is to be phased out. Thus, the channels now used for NTSC will be vacated for use elsewhere, and all television broadcasting will be in HDTV.\(^{15}\)

At this writing, laboratory testing of the systems listed in Table 4.1, including the NHK entry, has been completed. On the basis of the preliminary findings, a consensus is emerging that digital transmission will be preferred to analog.

\(^{15}\)If none of the proposed HDTV systems are deemed to be satisfactory, the FCC reserves the option of considering less technically demanding EDTV alternatives as a replacement for NTSC broadcasting.
Table 4.1
HDTV Systems in FCC Evaluations

<table>
<thead>
<tr>
<th>Name</th>
<th>Sponsor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow MUSE</td>
<td>NHK</td>
</tr>
<tr>
<td>DigiCipher</td>
<td>American Television Alliance (General Instrument, MIT)</td>
</tr>
<tr>
<td>Digital spectrum compatible HDTV</td>
<td>Zenith, AT&amp;T</td>
</tr>
<tr>
<td>ATVA progressive system</td>
<td>American Television Alliance (General Instrument, MIT)</td>
</tr>
<tr>
<td>Advanced digital-HDTV</td>
<td>Advanced Television Research Consortium (David Samoff Research Center, North American Philips, Thomson Consumer Electronics, NBC, Compression Labs)</td>
</tr>
</tbody>
</table>


According to one report, "most experts believe MUSE now has little chance of adoption by the FCC."16

Program standards to be adopted are also in doubt. The 1125/60 standard can be converted for use by the digital transmission systems tested—but at a cost in terms of money and possibly performance. Other possibilities are a 1050 line standard (twice the NTSC 525-line specification) and use of progressive scanning as a substitute for interlaced scanning.17

In response to this turn of events, Japan is moving in new directions. The MPT is planning to consider a proposal to create a "Digital Movies Laboratory" in 1993, with the objective of centralizing development of a second generation of digital television by 2001. Dubbed "Ultra Definition Television," the system would incorporate a universal coding technology to handle transmission of both HDTV and NTSC television—along with computer video graphics, videotape, and other materials—to improve on the systems now being tested in the United States.

17Interlaced scanning, which is used throughout the world today, involves scanning every other line in the frame and filling in the blanks with another set of lines, while the progressive approach involves scanning sequentially. The relative merits of the two approaches are currently being debated. A good discussion is contained in Zenith (1992).
According to one observer, "the Japanese have admitted defeat, and their strategy now is to leapfrog the leapfrogger." ¹⁸

**Implications for Future Trade Relations**

What difference will it make in U.S.–Japan trade relations whether a digital approach, rather than NHK’s analog transmission system, is selected by the FCC, and whether a program standard other than the 1125/60 approach is adopted by HD TV broadcasters? In response, we consider the treatment of patent licensing, the manufacture of receivers and electronic components, and effects on U.S. competitiveness in the high-technology arena.

**Patent Rights**

The nationality of the firms holding the “winning” patents will affect the origins and destinations of licensing payments. Selection of HDTV standards developed by U.S.–owned firms would generate an inflow of funds from licensees domiciled in other countries. However, the level and composition of payments would depend on the terms and conditions of the patent licensing in question. In the words of the FCC, “The [HDTV] testing procedures already require proponents to submit, prior to testing, a statement that any relevant patents they own would be made available either free of charge, or on reasonable, non-discriminatory terms.” ¹⁹ The FCC is leaving open the question of whether it “can or should exercise greater regulatory control over a selected system’s patent practices.” ²⁰

This situation is reminiscent of one in the 1950s when RCA’s system for displaying color television was selected by the NTSC as the basis for a standard subsequently adopted by the FCC for mandatory use in the United States. The NTSC standard was also adopted by Japan, Canada, and other countries, while two color standards developed in Europe—PAL and SECAM—were adopted in Europe and elsewhere. ²¹ RCA’s patent rights associated with the NTSC standard resulted in an inflow of royalties from foreign manufacturers. The FCC selected

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¹⁹U.S. FCC (1992b), para. 68. A stipulation is commonly attached by standards setting or certifying bodies that the “winners” make available relevant patents under reasonable and nondiscriminatory terms. The HDTV tests by ATTC are being pursued under the patent policies promulgated by the American National Standards Institute, a large standards certifying organization in New York City.
²¹For a detailed history of this experience, see Ileson and Johnson (1986).
the NTSC standard with the understanding that these royalties were to be reasonable and nondiscriminatory, in line with the plans for HDTV.

Manufacturing

It is generally agreed that the large picture tubes used for HDTV reception will dictate that the bulk of manufacturing continue within the United States, regardless of which transmission and program standards are used. As a working party of the ACATS has described the situation:

Given the high transportation costs of cabinets and large displays, there is little possibility that receiver manufacture could shift from the United States to the domiciles of the Japanese, Korean, or European consumer electronics firms who own most of the television receiver production capacity in the United States. However, if a U.S.-Mexico Free Trade Agreement is consummated, it is possible that a substantial share of NTSC and ATV receiver manufacture could shift to Mexico.22

However, another factor could affect outcomes—the possible emergence of flat panel displays for HDTV use. Although eventual consumer demand for HDTV is unclear, we do know that the advantage of HDTV over conventional reception is most apparent with large screen sizes. Within a typical household’s space, a large FPD (“the picture on the wall”) could be more easily accommodated than the displays afforded by today’s cathode tube or projection receivers. The high cost and performance limitations of FPD technology render it infeasible for HDTV in the near term. However, FPDs are attractive for an increasingly large range of other applications—laptop personal computers being one. Japanese firms have taken the lead in development and manufacture of FPDs, with the United States as a major market.

Depending on transportation costs, labor costs, and many other factors, manufacture of HDTV receivers might shift from the United States to Japan or other countries as flat screen or other technologies are adopted. More generally, manufacturing will tend to concentrate in those geographical areas with a comparative advantage in manufacturing the particular kinds of receivers in question, regardless of the nationality of firms holding the relevant patent rights. The adoption of non-Japanese standards, rather than the 1125/60 program standard or a MUSE transmission standard sponsored by NHK, will probably little affect the geographical location of manufacturing.

U.S. Competitiveness

The link between adoption of U.S.-developed digital technologies for HDTV and U.S. competitiveness in the high-technology arena is of key relevance here. The importance of digital transmission and video compression extends far beyond HDTV. These technologies have truly revolutionary implications for telecommunications because they promise to greatly increase the efficiency of using scarce radio spectrum resources as well as to expand the capacity of wireline transmission systems. The ability to squeeze a high-quality HDTV signal into a conventional NTSC channel is but one example.

Digital transmission and signal compression are planned for near-term use on some of today's communications satellites to expand their capacity to transmit conventional television signals to broadcasting stations and cable systems for retransmission to viewers. For example, in November 1992 General Instrument—the developer of DigiCipher and one of the HDTV entrants shown in Table 4.1—was reported near final agreement with the Public Broadcasting Service (PBS) for multichannel compression service. Under the agreement, PBS is to procure GI equipment to supply programming via satellite to its 180 affiliated stations, with a satellite transponder supplying four NTSC channels instead of one.23

Among the other applications, cable television operators and telephone companies that may enter the cable business are hoping to use these techniques. Digital transmission and video compression are planned for in a new high-power Hughes satellite system, which will broadcast directly to viewers starting in 1994. Increasing interest is being expressed in the possibilities of converting today's single-channel broadcasters into multichannel providers of conventional television, in addition to the potential emergence of HDTV.24

The development and application of these digital techniques is in the hands of U.S. firms. Adoption of digital standards for HDTV would contribute further to U.S. leadership on the cutting edge of telecommunications technologies.

Of key importance is the possibility that adoption of digital HDTV standards, by assuaging widely expressed concerns about loss of U.S. competitiveness in high-technology fields, will weaken whatever pressures would otherwise arise to adopt a U.S. industrial policy based on trade protection of high-technology

24The strikingly rapid development of digital transmission and video compression, and the growing interest in applications, are chronicled in a variety of telecommunications news services. See, for example, Broadcasting (weekly).
industries. Avoiding such an industrial policy would be desirable insofar as the policy might lead to protection of inefficient firms and create trade tensions through threats of retaliation from Japan and elsewhere.  

Again, however, the eventual use of flat screen displays for HDTV could also affect outcomes. Current U.S. antidumping measures now in place, and concerns about U.S. dependence on "critical technologies," suggest possible tensions in future U.S.-Japan trade relations.

In 1990, a group of U.S. display manufacturers brought an antidumping suit on grounds that FPDs "are being, or likely to be, sold in the United States at less than fair value . . . and that there is a reasonable indication that an industry in the United States is materially injured, or is threatened with material injury, or the establishment of an industry in the United States is materially retarded, by reason of imports from Japan of FPDs." By making comparisons of prices charged in the United States by Japanese firms and market values in Japan, the petitioners alleged differences ranging from 70 percent to 318 percent.

The petition triggered intense controversy within the U.S. computer industry. Most notably, some U.S. computer manufacturers opposed the petition on grounds that they were heavily dependent on Japanese sources for FPDs and that antidumping duties would substantially raise their costs. In 1991, after more than a year of investigation, the U.S. Department of Commerce imposed antidumping duty margins of 62.67 percent on imports of active-matrix liquid crystal displays and 7.02 percent on electroluminescent displays.

If FPDs are eventually developed for HDTV use, controversy reminiscent of this antidumping case could arise. Indeed, because flat panel displays have widespread commercial and military uses, in addition to residential HDTV, the controversy might expand to issues of whether the United States is becoming overly dependent on foreign sources for critical technologies. One can imagine protective measures being urged for a domestic FPD industry, along with counter-complaints that these measures would unduly raise prices of HDTV receivers, computers, and other end products. In short, the emergence of flat screen HDTV technology could trigger new trade tensions.

25 If U.S.-developed HDTV standards were adopted by the FCC as a trade protection device, we could expect an increase, rather than a decrease, in trade tensions as other countries respond. However, mounting evidence is demonstrating the superiority of digital transmission on strictly technical and economic grounds. Attention today centers around specific digital alternatives for given applications, while interest in analog techniques is waning.

26 Federal Register, August 14, 1990, p. 33146.

27 Ibid.

Conclusions

The HDTV experience leads to four major conclusions:

- Japan's home market is not likely to provide a strong base for export expansion in HDTV receivers with cathode ray tubes, as was the case with cellular telephony discussed in Section 3. In any event, manufacture (but not necessarily design) of large receivers for the U.S. market will probably remain in the United States.

- The FCC's selection of transmission standards will determine the direction of payments for patent rights. However, the magnitude of these flows will be affected by requirements that patent rights be granted under reasonable, nondiscriminatory terms.

- U.S. leadership in development of HDTV, leapfrogging over the earlier Japanese lead, may mitigate trade tensions by helping to reduce long-term pressures for adoption of a U.S. protectionist industrial policy.

- The use of FPDs for HDTV may generate trade tensions. Japan's lead in FPD technology and the possibility that FPDs will be regarded as embodying critical technologies could lead to demands in the United States for protection of the FPD industry, going beyond the antidumping measures already in place.
5. Conclusions

This study suggests that trade tensions between the United States and Japan in the telecommunications field will be less severe in the future than in the past, owing partly to changes in international telecommunications markets since the late 1970s. Trade agreements, growing competition, and technological advance are helping to make Japan's home market for telecommunications equipment more accessible to foreign participation. The diminishing role of the protected home market as a base for expansion of domestic suppliers into export markets may help to assuage the concerns about "unfairness" and "discriminatory treatment" that have marked U.S.-Japan trade relations in the past.

As we saw in Section 2, NTT had earlier maintained a large, essentially closed, domestic market with its family of wireline equipment suppliers, which were active in foreign markets as well. The subsequent NTT Procurement Agreement, along with other trade agreements, has helped to open the home market.

Cellular telephony has emerged as both a competitor and a complement to wireline service. Slow growth of cellular service in Japan during the early years denied Japanese suppliers a large domestic market that would have assisted them abroad. Moreover, the growth of new Japanese cellular carriers in competition with NTT created opportunities for foreign entry, albeit only after resolution of a trade dispute with the United States. Digital cellular service as a supplement to today's analog service has further opened Japan's market to outsiders—as providers of hardware, as partners in R&D programs, and as investors.

Foreign participation in ownership of Japanese corporations—for example, the removal of the ban on foreign ownership of NTT shares and the presence of foreign firms as co-investors among the recently formed digital cellular carriers—may further strengthen perceptions of fairness in trade relations.

The growth of multinational firms may also help. By spreading R&D, manufacturing, and management among countries—frequently through joint ventures—multinational firms may help to assuage concerns about one-sided benefits between countries and lead to a stronger spirit of shared purpose. A leading example is the IBM-Toshiba-Siemens venture announced in July 1992 to develop advanced semiconductors and manufacturing processes. The agreement, among many in the electronics and other fields, may help to deflect
concerns about U.S. competitiveness that could otherwise lead to demands for home market protection—demands that would complicate trade relations with Japan and other countries. In the words of one report about the IBM-Toshiba-Siemens agreement:

The agreement should help shift the [U.S.] debate over technology policy away from the “us-against-them” approach and towards a more reasoned analysis of how U.S. industry can maintain access to critical technologies.1

The large U.S. deficits with Japan in telecommunications may or may not drop below today’s levels. But the balance of trade by itself should not be of primary policy concern. Of greater significance are the circumstances under which particular deficits or surpluses arise. A trade environment in which governments are not seen to be behaving unfairly (as by protecting a large domestic market to strengthen their exporters) will contribute to better relations between the two countries—and with other countries as well.

At the same time, optimism must be tempered with caution. This study identifies one specific possible source of future trade tension. If large flat screens become technically and economically feasible for HDTV receivers, flat panel manufacturing may take place in Japan rather than in the United States because of Japan’s strong lead in this field. This situation could trigger demands for protection of a U.S. flat panel industry to assure U.S. access to “critical technologies” with widespread commercial and military applications.

Other dangers must also be kept in mind: Joint ventures among multinational firms may help reduce trade tensions, as suggested above, but disputes may arise about the mutual benefits of these activities if, for example, Japanese firms are perceived to be benefiting from U.S. technology on a largely one-way street.

Moreover, although enhanced market accessibility may, on balance, reduce trade tensions, no simple positive relationship exists between the two. Trade tensions result from a complex set of factors, including the nature of expectations by the parties in question. For example, the closed U.S. market for terminal equipment before deregulation in the 1970s did not trigger notable complaint by foreigners, because no strong hope existed at the time that outside pressure would end the Bell monopoly. The push for deregulation came from U.S. domestic sources, not from foreign ones. Once a market is opened, trade tensions may emerge for reasons that would not otherwise have existed—as illustrated by the issues of parity among competing carriers that led to a trade dispute in Japan’s cellular

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market. More generally, the relationship between market accessibility and trade tensions depends on the array of issues that arise, the priorities among these issues, and the skill of trade negotiators in dealing with them.

To conclude, it is useful to recapitulate very briefly major findings of this study in the form of answers to the questions posed in Section 1.

**What has been the role of government in trade relations between the two countries?** The actions of both governments have had a profound impact on telecommunications. On the U.S. side, the government-imposed constraints on the predistributed AT&T compromised the U.S. presence in international telecommunications markets because (a) AT&T was confined to domestic markets by the terms of 1956 Consent Decree, (b) the tie to Western Electric reduced the size of the domestic market available to other U.S. firms as a base to facilitate their participation in foreign markets, and (c) the Consent Decree’s patent licensing requirements strengthened the position of foreign firms.

The terminal equipment certification and registration program, overseen by the FCC, opened the U.S. market to imports of terminal equipment in the 1970s. The move helped to break the Bell System’s monopoly, but without comparable trade liberalization measures by Japan or other major countries.

In Japan, government action brought the privatization and restructuring of the market for both wireline and, later, for cellular service. In the cellular field, especially, we have seen the growth of joint ventures and greater accessibility to the Japanese market. Of critical importance is government control over use of radio spectrum, where we saw, for example, that spectrum allocations for IDO’s TAC-based service in the Tokyo area expanded the opportunities for foreign participation.

**In what ways, if any, has protection of Japan’s domestic market afforded a base for export expansion in the telecommunications field?** Historically, protection was in the form of NTT’s preference for its family of suppliers and virtual total exclusion of foreign entities. However, this preference was not unlike that of AT&T for dealings with Western Electric before the divestiture. To a degree, such preferences reflect the economic and technical advantages of long-term supplier relationships, aside from any government policy with respect to protection of domestic markets to aid export expansion.

In cellular services, Japan’s domestic market has not provided a significant base for export expansion because of slow domestic market growth during the early years and differences between technical standards in Japan and those used elsewhere.
What has been the nature of telecommunications trade disputes between the United States and Japan and how were they resolved? Large U.S. deficits with Japan fueled disputes about NTT's exclusionary procurement practices. Government negotiations led to a procurement agreement under which imports from foreign sources have increased during the last decade. The emergence of competitive carriers, and expanded pressures for economic efficiencies as the monopoly held by NTT further erodes, will strengthen incentives for nondiscriminatory procurement.

The development of cellular telephony led to disputes about access to the Japanese market by U.S. firms, because the competing carriers had adopted different technical compatibility standards. Government negotiations resolved the immediate problem by putting competing carriers on more equal footing to facilitate entry by foreign suppliers. Subsequent commercialization of digital transmission will contribute further to equal treatment among carriers insofar as all digital carriers will operate on common technical compatibility standards.

What is the nature of trade agreements between the two countries, and what have been their effects? The NTT Procurement Agreement, the Interconnect Market Understanding, and the MOSS Agreement have facilitated entry by U.S. suppliers through the measures taken by NTT for open bidding and other nondiscriminatory practices, the simplification of procedures for certifying compliance by foreign equipment with national technical standards, and establishment of a new agency (the Japan Approval Institute for Telecommunications) independent of NTT to determine conformity with technical standards.

Response by the U.S. business community to these agreements has generally been favorable. Aside from data on NTT procurements from foreign suppliers, no systematically collected data exist to show the effects of these agreements on trade.

A complication arises from the fact that trade negotiators face special difficulties in telecommunications. The experience in Japan, the United States, and Europe suggests that economic and technical reasons exist for long-term supplier relationships. But these relationships can appear discriminatory and unfair to outsiders. With the many tradeoffs involved, how does one distinguish between merely plausible reasons and the real reasons for a particular procurement decision? These questions are more difficult to answer in telecommunications than, say, in primary commodities where product quality is more easily evaluated. For this reason, trade disputes that hinge on complex technical
characteristics, as in telecommunications, may be more nagging and difficult to resolve than is commonly true elsewhere.

What new sources of trade tension may arise between the two countries? This study suggests that, in telecommunications, trade tensions will be less severe in the future than in the past. But this optimism must be carefully hedged. We can visualize many sources of future difficulty. Two possibilities identified here are disputes about renewal of the NTT Procurement Agreement and U.S. trade protection of flat panel displays for HDTV and other applications.
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