VOORBURG GROUP ON SERVICE STATISTICS

15th Meeting

Madrid, Spain
18-22 September 2000

Wireless Communications Index Of the US Bureau of Labor Statistics

&

Mobile Telecommunications Services in the Corporate Service Price Index (CSPI) of Japan[1]

Junko Kunihiro
Yuko Koga
Kuniko Moriya

Research and Statistics Department
Bank of Japan

Anthony Hill

Producer Price Index
US Bureau of Labor Statistics

[1] The views about Japan stated herein are those of the authors and are not necessarily those of the Bank of Japan or the Research and Statistics Department.

I. Summary

Japan
Mobile telecommunications services are changing at a rapid speed because of technological innovations and a high level of competition among providers. Mobile telecommunications services have grown dramatically in recent years, and in particular from last year when mobile terminal equipment began to provide Internet access services. The pace of growth of these services continues to accelerate.

The compilation of indexes for mobile telecommunications services requires special attention. This is because the content and quality of these services are always changing. Prices are moving downward due to rapid technological innovation and high competition among providers.

To maintain the accuracy of indexes in this rapidly changing environment, constant and careful monitoring of market trends is essential.

United States
Wireless telecommunications, not surprisingly, shares many similarities with wired telecommunications. Consumer services tied to voice communications share most of the same service features with wired telecommunications. Therefore, it is not surprising to see service and pricing similarities. A similar pricing methodology to wired telecommunications was employed. As various communications technologies converge in the future, differences may well emerge between these seemingly similar services as they evidence different advantages for convergence given their different underlying technologies.

II. Introduction

United States
The paper provides a detailed recounting of the nature of the wireless telecommunications industry in the United States of America. The following topics are treated in turn: 1) types of services and industry outputs, 2) the business model, 3) sample design, 4) industry recordkeeping practices, 5) publication structure and the relation to the CPC, 6) pricing methodology, 7) technical concerns, 8) survey vehicles, 9) future industry trends, and 10) the need for future work. Wireless telecommunications is an emergent new technology that is still very much in its early growth stage.

Japan
This paper provides the outline of the mobile telecommunications industry in Japan, as well as the characteristics of the index compilation of its prices in the Corporate Service Price Index (CSPI) by the Bank of Japan.

Columns in this paper are as follows: 1) definitions of industry outputs and types of services, 2) business model, 3) sample design, 4) industry recordkeeping practices, 5) publication structure and relationship to the CPC, 6) pricing methodology, 7) technical concerns, 8) survey vehicles, 9) future industry trends, and 10) need for future work.

Mobile telecommunications services need a “network” to provide their services. “Network” is the key word in compiling indexes of mobile telecommunications services for the CSPI. Upon designing sample frames, defining items and designing classifications for the publication, choosing price data to be collected from companies, the structure and function of the “network” is scrutinized.

Of course, “network” is key not only for the mobile telecommunications services but also for fixed telecommunications services and other telecommunications services, since all telecommunications services need a “network” to provide their services.

A "network" of telecommunications services is like a cobweb. Points are connected to other points by various nodes and lines. Sometimes, a network will want to connect to other networks to provide broader services. In this case, different kinds of telecommunications services interact and use each other's networks. For example, to call from a cellular phone to a fixed telephone, the network of the cellular phone and the fixed telephone have to be connected.

These connections complicate index compilation and make it difficult to explain mobile telecommunications services without referring to related telecommunications services. For this reason, some columns below refer to other telecommunications services such as fixed telecommunications services.

For an overview of telecommunications services in Japan, see Appendix 1.

III. Definition of Industry Outputs/Types of Services

Definition of Industry Outputs

United States
The primary output of wireless telecommunication is that of placing parties in communication with each other through a radio network, parallel to the traditional wireline network of the telephone system.

Japan
Mobile telecommunications services provide voice or data transmission services by using portable equipment such as cellular phones, pagers. Fixed telecommunications services also provide the same services, except for the function of portability.

For an overview of mobile telecommunications services in Japan, see Appendix 2.

Types of Services

Japan	United States
The types of services currently provided are **cellular phone services**, **Personal Handyphone System (PHS) services**, and **pager services**. **Cellular phone services** provide voice transmission services and data transmission services for mobile users. The digital radio telecommunications systems used are personal digital cellular (PDC) or cdmaOne. The frequency bandwidth used for telecommunications is around 800 MHz or 1.5 GHz. The PDC adopts a radio transmission method called "time division multiple access (TDMA)," while cdmaOne adopts "code division multiple access (CDMA)." Data transmission speed is from 9,600 bps to 14.4 kbps for the line-dominated type of switching and from 14.4 kbps to 64 kbps for the packet type. As for the voice transmission services, phone calls to cellular phones, PHS phones, and fixed telephones are available.[2] Some of the cellular phone companies have started international telephone services by allowing roaming, which allows their mobile equipment to be	**Cellular and other (Voice Grade) wireless services** Cellular telephone services include Traditional Cellular Service, Personal Communications Service (PCS), and Enhanced Specialized Mobile Radio (ESMR) and are defined as being "voice-grade" and interactive. These services allow customers to converse or send data similar to a wireline service. There are three types of voice grade wireless services: **Traditional Cellular Service, Enhanced Specialized Mobile Radio (ESMR),** and **Personal Communications Services (PCS**). The distinction between these is primarily in how they are licensed and in the frequency and power level used in transmitting and receiving. To the buyer, the technical differences between the three are not noticeable. The services can be augmented with add-on features or services such as voice-mail. **Traditional Cellular Service** licenses were sold corresponding to regions known as Metropolitan Statistical Areas (MSA) and Rural Statistical Areas (RSA) as determined by the Federal Communications Commission. In the 1980's, there were about 300

[2]Phone calls to fixed telephones in foreign country are included in " international fixed telephone call." For details of items adopted by the CSPI, see Appendix 6.

used abroad. Cellular phone equipment provided by these companies can be used in Korea and Hong Kong from April 2000, in the USA from July 2000, and in Australia from August 2000.

As for the data transmission services, mail between cellular phones, e-mail and Internet access services are available.

Personal Handyphone System (PHS) services provide voice transmission services and data transmission services for mobile users. Their services are similar to cellular phone services. The difference between PHS services and cellular phone services is the radio telecommunications system, which is called the "personal handyphone system," and the level of frequency bandwidth used for PHS services is around 1.9 GHz. Because of the radio telecommunications system adopted by PHS services, the quality of voice transmissions is clearer and average data transmission speed is faster than that of cellular phone services, which is between 32 kbps to 64 kbps. On the other hand, there is less mobility than with the cellular phone. Transmitting and receiving in a high-speed moving car or train is sometimes impossible because of technical limitations in the radio telecommunications system. The personal handyphone system uses TDMA as a radio transmission method, which is the same as PDC for cellular phone services.

As for the voice transmission services, phone calls to PHS phones, cellular phones, and fixed phones are available.

As for the data transmission services, mail between PHS phones, e-mail, and Internet access services are available.

Pager services provide data transmission services. Pager services are declining because they are being replaced by growing cellular phone services and PHS services. Pager services remain popular among some business users because the cost is lower than that of cellular phone services and PHS services, while sufficient services are provided. In short, pager services are regarded as high cost performance services by some business users. Their most advanced radio telecommunications system is FLEX-TD. Services are provided using frequency bandwidth around 280 MHz.

licenses distributed for urban areas and about 400 for rural areas. There were only two licenses available for each MSA or RSA.

Enhanced Specialized Mobile Radio (ESMR) systems operate at a lower frequency and higher power settings than cellular service. ESMR uses an improved "push to talk" technology previously only used by dispatch services for taxicabs and mobile repair operations. This type of service is dominated by one company, Nextel, which holds about 95% of the market.

Personal Communications Services (PCS) are provided in the same manner as conventional cellular systems except that license areas are much larger. Licenses for service areas were auctioned based on Rand McNally Major Trading Areas (MTA). These systems work at a higher frequency and lower power settings, which requires more cell stations in a given area. There were about 5 licenses auctioned per MTA, which greatly increased competition in each area.

Paging
Paging is defined as "less than voice-grade" because it involves only the sending of characters and/or numbers. Paging services however, can include customer notification of voice mail messages waiting at a voice mailbox provided by the paging company. This service allows messages to be sent to a subscriber. Messages can be delivered or stored for later delivery. The messages can be just numbers or characters and numbers.

IV Business Model

A. Industry Organization

United States
Providers of cellular and paging services can vary widely in size. The largest service providers of cellular services also tend to be large providers of paging services; whereas, the largest providers of paging services do not tend to be large cellular providers. Almost all companies seem to separate their cellular and paging operations from all other operations even in allied fields (pager sales vs. paging service). Paging or "messaging" establishments tend to be very concentrated. The largest company has approximately 22.5% of the market and the top four have 53% of the market. Cellular service is also concentrated although not to the same degree. The largest establishment has 10% of the market while the largest four have 33% and the top ten have 59% of the market. The large corporations in this industry tend to establish separate operating companies in different local areas. This helps them closely manage local and regional markets and cope with the differences in the different markets.

The qualitative difference between companies and the services they provide is in technology. Larger companies tend to have more advanced switching technology which allows smooth transition from one cell to another. The difference in the services a company offers is in the various contracts or plans offered and special features. Another variable is the geographic range covered by the service. Service areas are categorized as local, regional, or national.

Japan
There are three major groups of telecommunications service companies in Japan. Each group consists of a number of companies that specialize in a certain type of services, such as mobile telecommunications services, international telecommunications services, and domestic fixed telephone services (see Appendix 3). There are mobile telecommunications service companies in each group. They vary in the types of services provided, such as cellular phone services and PHS services, and also in the service area. In addition, there are pager service companies and other types of telecommunications service companies, such as domestic telephone companies mainly providing fixed local telephone services and thousands of Internet service providers that either organize small group of companies or are independent.

All cellular phone services companies belong to one of the three major groups. The NTT group consists of nine companies, which also provide PHS services and pager services. The group holds a 58 percent market share in the number of users as of 31 July 2000. The DDI group has 12 companies. It has a 26 percent share. The JT group has nine companies and has a 16 percent share. There are 54 million cellular phone users and 62 million fixed telephone users as of 31 July 2000. The former is expected to exceed the latter in the near future.

The NTT group developed from the "Nippon Telegraph and Telephone Public Corporation." The DDI group and the JT group have established one of the NCCs (New Common Carriers: see page 6). Details are mentioned below.

Two of the three major groups have PHS service companies. Other PHS service companies are organizing a small group. The DDI group has only one company that provides PHS services, but it has 57 percent of the number of users as of 31 July 2000. The NTT group has nine companies as mentioned above. They have a 27 percent share. The Astel group, which is a small group organized by the other PHS service companies, has 10 companies. They hold a 16 percent share. The total number of PHS users in Japan is 6 million as of 31 July 2000.

One of the three major groups has pager service companies. Other pager service companies are independent. In the NTT group, there are nine companies as mentioned. They hold a 76 percent share in terms of the number of users as of 30 June 2000. The total number of pager users in Japan is 2 million as of 30 June 2000. The number of users has declined by half in the past year, because of growing cellular phone services and PHS services.

Looking back, we see that many mobile telecommunications service companies have been set up and their services expanded in response to technological innovation and deregulation in telecommunications services.

After World War II, telecommunications services in Japan were initiated by the Nippon Telegraph and Telephone Public Corporation and the Kokusai Denshin Denwa Corporation (KDD).[3] The former was a 100 percent government-owned organization that had a monopoly on domestic telecommunications services. The latter was a private company regulated by the Kokusai Denshin Denwa (KDD) Law which had a monopoly on international telecommunications services. After the deregulation of entry restrictions in 1985, new companies or the so-called New Common Carriers (NCCs) were established and started providing domestic fixed telephone service for long-distance.[4]

Technological innovations have permitted mobile telecommunications services to develop and new companies have been established. Most of them were subsidiaries of Nippon Telegraph and Telephone Corporation (NTT) or the NCCs. Because of the regulations creating service partitions, new services were launched through subsidiary companies. Even after the deregulation in 1985, each company was permitted to do business only in one field of telecommunications services.[5]

After the deregulation in 1996, mergers to integrate partitioned services have been growing to increase efficiency and improve competitiveness.

1. Degree of vertical integration

Japan	**United States**
In the field of mobile telecommunications services, the degree of vertical integration is quite low. A few kinds of equipment related to mobile telecommunications services such as cellular phone, personal digital assistants (PDA) for data transmissions are sold by providers, and a few services such as insurance services which cover equipment losses and breakdowns are provided by them as well.	There is limited vertical integration in this industry. Along with providing services, establishments may also sell cellular phones and pagers.

[3] More precisely, the Kokusai Denshin Denwa Corporation (KDD) was founded as a private company in April 1953 by the Kokusai Denshin Denwa (KDD) Law, separating it from Nippon Telegraph and Telephone Public Corporation, which was founded in 1952.

[4] In 1985, Nippon Telegraph and Telephone Public Corporation was privatized and renamed Nippon Telegraph and Telephone Corporation (NTT) by the Nippon Telegraph and Telephone Corporation (NTT) Law. In July 1999, NTT was divided into the Nippon Telegraph and Telephone East Corporation (NTT East), Nippon Telegraph and Telephone West Corporation (NTT West), NTT Communications Corporation (NTT Com), and other telecommunications services related companies. They make up the current group companies of NTT, which are under a single holding company.

[5] Telecommunications services had been partitioned until the change of administrative policy announced by the Ministry of Posts and Telecommunications (MPT) through the publication of "Manual for Market Entry into Japanese Telecommunications Business" in January 1996. The partitions included domestic local telephone services, domestic long-distance telephone services, cellular and car phone services, PHS services, pager services, international telephone services, and satellite telecommunications services.

2. Outsourcing/resellers

Japan	United States
Mobile telecommunications companies use other telecommunications companies' networks to complete their own network. Mutual use is triggered by individual phone calls. Companies compensate each other for mutual use of networks at an agreed upon rate.	The main type of outsourcing or reselling is through roaming charges. Each cellular company operates in a particular area where it owns a license. When a customer is outside of this area, calls made or received are "roaming" calls. Almost all cellular companies have agreements with other companies to provide service to customers outside the company's operational area. Roaming calls are usually charged to the customer at a higher rate than non-roaming calls. Cellular providers compensate each other for these calls at an agreed upon rate.

3. Array of services provided

Japan	United States
Mobile telecommunications services provide voice and data transmission services. For voice transmission services, domestic telephone services are provided by all of the mobile telecommunications service companies. A few companies have started to provide international telephone services by roaming. For data transmission services such as mail between cellular phones or PHS phones, transmitting and receiving of e-mail, and access to the Internet are available. See Appendix 4.	Various services may be offered including voice mail, call waiting, caller-ID, three-way calling, and call forwarding. Many cellular companies provide free information about movies, restaurants, shopping, and a variety of other topics accessed through a special phone number. For a fee, customers can subscribe to receive updates on various news topics which are displayed on the screen of their cellular phone. Also, some providers are now able to allow their customers to access e-mail over their cellular phone. Many cellular phone companies are offering "family plans" which provide a phone to each family so they can communicate immediately with each other.

B. Identification of operating units and record centers

Japan	United States
A record center exists in each company. Most of the companies locate this function in the finance section or the planning section.	This industry is limited to establishments providing communication services using radiotelephone transmissions. Regular telephone services, including microwave relays, are excluded. However, radiotelephone service, a service of regular telephone companies, is included in this industry. Establishments providing maintenance services on communications equipment, billing services, etc. are classified in various Business Services. Records for large corporations are maintained at the company headquarters. Even when the company has established separate regional corporations, the headquarters usually keeps price data.

C. Governmental Regulation

Japan	United States
All companies wishing to provide mobile telecommunications services need to get permission to do business from the Ministry of Posts and Telecommunications (MPT). Mobile telecommunications companies are categorized under the Telecommunications Business Law as Type I Telecommunication Business, of which companies provide services with their own facilities.[6] To revise price tables, companies need to report to the MPT.	The wireless communication industry is closely regulated in the US by the Federal Communications Commission (FCC). The FCC begins by auctioning licenses for the various types of wireless communications. These licenses permit the owner to use certain frequencies at particular power levels. The licenses can be freely sold to other companies. Prices for wireless communications are completely deregulated and can be changed freely. In the US, the Federal Government regulates inter-state trade while state governments regulate intra-state trade. The Federal Government has determined that all radio wave communications are, by their nature, inter-state because these waves are not confined to state borders. Therefore, there are almost no state regulations regarding wireless communications. All regulation comes from the Federal Government through the FCC.

D. Public ownership/government subsidization

Japan	United States
Large companies providing mobile telecommunications services are publicly owned and their stocks are traded on a major exchange. Small companies providing mobile telecommunications services are held privately. In both cases, most of the companies are subsidiaries. Therefore, it is often the case that stocks of their parent companies are traded publicly while their own stocks are not. There is no government subsidization in this industry. The NTT Law regulates the NTT holding company and restricts its stock holdings by foreign agents, but nine mobile telecommunications companies in the NTT group, which are called the NTT DoCoMo group, are not subject to this restriction.[7]	All of the larger cellular phone providers are publicly owned corporations whose stock is traded on a major exchange. Many of them are subsidiaries of traditional telephone service companies. The smaller providers may be privately held companies. Paging service providers tend to be smaller corporations but all of the largest are still large enough to be publicly owned and traded or are subsidiaries of large corporations. There is no government subsidization in this industry.

[6] Under the Telecommunications Business Law, all telecommunications service companies are defined by the facilities they own. Companies which have their own facilities are categorized as Type I Telecommunication Business. Companies which don't have their own facilities are categorized as Type II Telecommunication Business. This law does not cover broadcasting services, since the Broadcasting Law regulates them.

[7] The NTT Law forces the government to hold at least 33 percent of the NTT holding company's stocks and restricts maximum foreign ownership ratio to 20 percent. At present, the government holds 53 percent of the shares.

V. Sample Design

A. Sample frames

1. Stratification variables – relation to classification structure

Japan	United States
In the CSPI, the classification system is based on the contents of services. The weights are calculated by the value of individual services provided. In defining the contents of services, the "networks" used for mobile telecommunications play key role. Services provided by a same company are often classified as different services because of the difference in networks used. It is different from the industry classification system, in which weights are based on the outputs of each individual industry.[8] Following this classification system, the mobile telecommunications industry is divided into three strata: cellular phone services, PHS services, and pager services. We refer to sales statistics and the list of providers categorized by the types of services compiled by the MPT for designing the sample frames of the CSPI as they have the same classification system.	The industry is divided into four explicit strata that correspond to the FCC licensing classifications. These strata include Traditional cellular telephones, PCS, ESMR, and Pagers. Airplane phones and train phones were truncated. Traditional cellular, PCS, ESMR, and Paging services are treated as separate establishments even when owned by the same company and at the same address. The frames represent those establishments that have their own facilities. Resellers of cellular and paging services exist but are relatively small compared to non-resellers. Data regarding resellers and their revenues are unavailable and thus are not part of the sample frame. The stratification also corresponds with the organization of the industry. Each type of service uses different types of frequencies and different power levels.

2. Alternative Frames

Japan	United States
There is an alternative sample frame. We could divide by Law: the Telecommunication Business Law and the Regulations for Enforcement of the Telecommunication Business Law. But there is a limitation in the availability of data necessary for classification. For example, there are no data to distinguish prices of "mobile" from "fixed." Under the Telecommunication Business Law, telecommunications service companies are divided into Type I and II.[9] Type I companies need to get permission to do business, because they have their own facilities, such as a wired line, cell stations etc., and these facilities are required to meet government regulations. Type II companies only need to provide notification or register to do business, because they don't have their own facilities.	The administrative frame generally used by BLS in establishment based surveys is derived from mandatory filing for unemployment insurance purposes. This frame was not used for this industry. The lack of stratification variables by FCC licensing classification was one limitation. The need to identify units by licensing geographic area was the second limitation. The source for information on establishments in the traditional cellular strata, the PCS strata, and the ESMR strata is the Cellular Telecommunications Industry Association (CTIA). The traditional cellular strata consists of those licenses awarded in the 1980's auctions for cellular service. This is a limited number, with only two carriers for each license area. The CTIA "Wireless Marketbook" lists the current owners of the license. The PCS frame is the same kind of frame except with

[8] In the industry classification system, each company is categorized by its major output. That means all output of each company are counted to one industry, even though their minor output is quite different from the output of the industry in which the company is categorized.

[9] The MPT allows entry into the mobile telecommunications business by permission to enter, notification or registration depending on the field. Its authority is derived from the Telecommunication Business Law, which covers not only mobile telecommunications services, but also fixed telecommunications services and other telecommunications services.

The Regulations for Enforcement of the Telecommunication Business Law identifies three Type I services: voice transmission, data transmission and leased circuit.	the winners of the 1990's PCS license auctions listed. The ESMR frame consists of four companies with Nextel representing approximately 95% of the frame. The frame for paging came primarily from the Personal Communications Industry Association (PCIA). The PCIA provided a list of the top 30 paging companies based on subscriptions. The top 25 companies of those thirty were chosen as well as a random sample of fifteen additional paging establishments.

B. Identifying the sample unit – record center relation to classification structure

Japan	**United States**
Most companies categorize data by types of services, e.g., cellular phone services, PHS services, etc. This fits the classification system of the sample frames adopted by the CSPI.	Corporations in this industry that have cellular and paging operations usually set up separate companies in each service area. Companies keep records that correspond to the classification structure. They are able to provide information on the amount of each service that is used and the revenue received for each type of service. Data are kept at the corporate headquarters location for all operations nationwide. Therefore, the corporate headquarters unit can report on each separate operating company. These operating companies are established on a metropolitan area basis for cellular operations.

C. Reporter burden issues

Japan	**United States**
Most companies are very cooperative when it comes to price surveys. But since they are very busy as a result of intense competition, we take great care not to put too many burdens on them. We always try to collect sufficient data to maintain the accuracy of the index at a minimum cost, both for surveyed companies and for us.	The small number of firms operating in each area was a confidentiality and burden constraint for Traditional cellular services. In this industry license areas coincide with metropolitan areas. There are only two licenses allocated per Metropolitan Statistical Area (MSA) or Rural Statistical Area (RSA). Therefore companies regard this data as extremely sensitive and can be reluctant to provide it. The companies feared that it would be easy for competitors to figure out the pricing in their company. The increased competition due to the growth of PCS companies has eased these fears. It was a burden for the large companies in the industry to report as many prices as would be needed. Large corporations operate in dozens of different areas but they set up separate companies for each area. Although these regional companies operate separately, their records are generally maintained through the head office. The index would require a quote for each different area but all the quotes would have to come from the same place. That would require a single reporter to report for dozens of different areas.

	The practice of obtaining an average weighted price should allow reporters to maintain some anonymity and will take into account the various options available for the many types of plans. The worksheets may seem complex at first glance and this may pose a problem for some reporters. Reporters are usually able to build a simple program that can easily extract the needed numbers from the company's existing accounting systems into a spreadsheet.

VI. Industry recordkeeping practices

A. Data availability

Japan	**United States**
Tables of charges and fees for services are publicly shown either in a catalog or on each company's Web site. Since detailed information on sales of each service is not disclosed, it is hard to choose representative services for price collection based on public data. We need to have access to each company directly to get the information.	Price data is available in many places such as Internet web sites, local retail outlets, etc. However these sources only have rate plans for customers opening new accounts rather than the rate plans actively being billed. Further, not all discounts are published or publicly available. These prices are not a comprehensive set of industry prices. The pricing methodology permits companies to use information from existing accounting data. Companies already keep track of the amount of each service that is used and the revenue generated by each service. The methodology allows companies to average the various plans and special features to provide a weighted average price. This prevents competitors from estimating the number of customers or market share held by a reporter.

B. Composite goods and bundling

Japan	**United States**
Although companies seem to have segmented data necessary for the price index, prices are often collected on a bundled service basis or a representative service basis. This is because of the cost of reporting on a segmented basis and the confidentiality of the data.	Similar services are bundled and revenues per unit are averaged using weights corresponding to the amount of the service that is used. Service bundles are similar to services provided by wired telecommunications carriers. These include call waiting, call forwarding, 3-way conferencing, no answer transfer, and voice messaging. A very new feature in the U.S. is internet access. The pricing method does not try to identify certain service plans that are typical for the company. It would be difficult to find a truly representative model service plan to price because new plans are constantly being introduced while old plans also continue to be used. However, companies do keep records of how many people use each feature and how often they are used. This allows them to provide weights for each type of service.

VII. Publication structure and relationship to the CPC

United States

- **Wireless Telecommunications**
  - **Primary Services**
    - **Cellular and other wireless services, except paging**
    - **Paging**

Japan

There are three items in the indexes for mobile telecommunications services:

- **Mobile telecommunications services**
  - **Cellular phone services**
  - **PHS services**
  - **Pager services**

For details, see Appendix 5.

A. Definition of the publication structure

Japan	**United States**
Index items of cellular phone services and PHS services cover only prices of voice transmission services. At present they don't cover the prices of data transmission services. Pager services cover data transmission services. In making the publication structure, the "network" has been focused on, except for data transmission services in cellular phone services and PHS services. For details see Appendix 6.	The publication structure consists of Traditional cellular service, ESMR, PCS, and paging services. This structure only includes providing communication services using radiotelephone transmissions. Regular telephone services, including microwave relays, are excluded. However, radiotelephone service, a service of regular telephone companies, is included in this industry. Establishments providing maintenance services on communications equipment, billing services, etc. are classified in various Business Services.

B. Why the structure was chosen and not other alternatives

Japan	**United States**
1. Reasons for adopting the publication structure The "network" is almost equal to the contents of services provided to users.[10] In capturing the precise price movements, classifying each service by the network used seems to be the best way of categorization, because the price movements seem to be highly dependent on the networks used. Although the volume of data transmission services has increased during the past year, these services are not covered in the CSPI. We have not been able to catch up with this change yet.	This structure was chosen because it is the best method for capturing changes in use of all primary and secondary services. It also allows the company to use its existing accounting data without revealing sensitive data. The publication structure is consistent with the bundling concept discussed earlier. Competing technologies in the telecommunications industry are direct substitutes and therefore are included in the same cell.

[10] There are a few exceptions in the case of calls from a fixed telephone to cellular phone or PHS phone. For details, see Appendix 6.

[11] For fixed telecommunications services, see Appendix 4.

There is also a good reason in terms of data collection. The data for weight calculation and prices on this basis are easy to collect from official statistics and surveyed companies. **2. Alternative publication structure** The alternative may be the publication structure based on infrastructure used for services, namely wired or wireless telecommunications. The problem of this idea is that most of the mobile telecommunications services use both wired and wireless infrastructure in their networks and the costs and prices of services are calculated on network basis rather than infrastructure basis. Also, the contents of the services provided to users are dependent on networks used, rather than infrastructure. This is the main reason why the CSPI focuses on networks in formulating the publication structure of mobile telecommunications services for the CSPI. To understand the relationship between the "network" and the infrastructure of each service item, see Appendix 7.[11]	

C. Relationship of publication structure to the CPC

Japan	**United States**
Code 8412 wireless telecommunications services in the CPC Ver.1.0 is the closest to our category of mobile telecommunications services. But the stratification variable is different. Our category of mobile telecommunications services is defined by the contents of services provided as described in the former column VII-B. That of the CPC Ver.1.0 is defined by the service infrastructure: i.e., how services are provided. The antonym of "mobile telecommunications services" in our stratification is "fixed telecommunications services." Both services are provided by wired and wireless infrastructure. For corresponding code numbers of the CPC Ver.1.0 and the CSPI, see Appendix 5.	This structure corresponds with CPC V1.0 code 8412. CPC categorizes Telecommunications Services as Group 841 which is divided into Wired telecommunication services (8411), Wireless telecommunications services (8412), and Satellite telecommunications services (8413). Wireless telecommunications includes the provision of access to wireless telecommunications facilities (e.g. cellular, paging, and PCS) for the transmission of voice, data, text, sound, and full motion picture video between network termination points.

VIII. Pricing methodology

A. Methodology chosen, including examples

Japan

For cellular phone services, base fare and per call charges are surveyed respectively. Discounts are included if they are considered as representative in price movement. Representative services; i.e., most popular services, are chosen for price data.

For the base fare, monthly charges are surveyed. The base fare is the charge for giving right to use cellular phone services with a certain registered cellular phone number for a month.

For the per call charges, two types of pricing methodology are adopted. The first type takes up charges for a representative call as price data. The second type adopts charges of all calls by reflecting average revision rate of price table to the base price level, such as 1,000 JPN yen in January 1995, as price data. In both cases, price changes (excluding discounts explained below) are reflected to the indexes only at the timing of a revision of the price table.

For both the base fare and the per call charges, discounts are included, if they are considered as representative price movements of the services. In reflecting discounts to the indexes, two schemes: "on a real time basis" and "on a retroactive basis" are adopted.

In cases when it is possible to reflect the price movement due to discounts into the CSPI without delay, they are reflected "on a real time basis." An example is as follows:

Regular price for a per call charge:
100 JPN yen per 3 min. on weekdays during daytime (A)
Discount rate for long-term contract
(contracts of 1-2 years) : 5% (B)
Price data for the CSPI : 95 yen = 100 JPN yen ∗ (100% - 5%) (C)
Under the condition that long-term contract discount of 1-2 years is representative for per call charges provided by the company.

The actual process of compiling and publishing the index is as follows.

Survey the regular price for the service (A) and the accompanying representative discount rate (B). Multiply (A) by (100% - B), and get (C). Then put (C) into the CSPI indexes. See Example 1 in Appendix 8.

In cases when it is impossible to reflect the discounts on a real time basis, they are reflected "on a retroactive basis." An example is as follows:

Regular price for a per call charge:
100 JPN yen per 3 min. on weekdays during daytime (A)
Ex post average discount rates of all the calls
during the survey period: 10% (B)
Price data for the CSPI : 90 yen = 100 JPN yen ∗ (100% - 10%) (C)

The actual process of compiling and publishing the index is as follows.

Survey the regular price for the service (A). Publish the index calculated from the regular price for the time being. After the average discount rates of all the calls during the survey period has been reported by the surveyed companies (B), multiply (A) by (100% - B), and get (C). Replace (A) by (C) in the CSPI by revising retroactively. See Example 2 in Appendix 8.

If an average discount rate for the previous period is available, it is used for the index calculation provisionally $(C)^P$. When the actual discount rate for the surveyed period is reported, $(C)^P$ is replaced by (C).

For an example of price data including discounts, see Appendix 9.

For PHS services, base fare and per call charges are adopted as price data to be collected from companies. They are parallel to those of cellular phone services. For the base fare, monthly charges are surveyed. For the per call charges, the charges for a representative call are surveyed as price data. Discounts are not included, however, because discounts are not common in this market at present and their price movements are parallel to regular price movements.

For pager services, charges for one month are adopted as price data.

United States

Cellular, PCS, and ESMR are tracked similarly. Differences are based on the price of the total service package including the monthly access, usage charges, and features. The reporter begins participation in the index by filling out a worksheet. (see Appendix 10) Part one of the worksheet includes three steps. Step 1 is to determine all the different types of charges possible including all optional features whether they are billed or free. Next they enter the total number of units used of each type of service. Step 3 is to enter the total number of access lines or subscribers and to divide the total units by the number of subscribers. This gives the average number of charged units per subscriber. Part two of the worksheet calculates the average revenue per unit for each service. First the reporter enters the total net billed revenue for each type of charge. The net billed revenue is divided by the total number of units to give the average revenue per unit. Finally, part three of the worksheet computes the average revenue bill. The average number of units per subscriber is multiplied by the average revenue per unit to produce a total weighted average.

For Paging, there are only six basic services offered currently. These are the combination of the two types of paging (numeric and alphanumeric) and the three types of service areas (local, regional, and national). The first step is to ascertain the ratio of revenue represented by the six categories of service for each company. The next step is to determine the ratio, in billed units, of all the billed components to each of the six services. (see Appendix 10)

B. Alternative methodologies, why they were not chosen

Japan	**United States**
Average unit price per contract may be considered as an alternative price datum. The average unit price is the divided total revenue, including discounts, of all phone calls by the number of contracts. But under this method, changes of quality or quantity may be included in the price movements because the charge system consists of two parts: the base fare and per call charges. Depending on the distance, length, time of calls, and the type of receivers of counterparts, the quality or quantity of per call charges for one month will change, while the number of users, who all pay a base fare, will also change. These monthly fluctuations in terms of quality and quantity may include seasonal factors, such as greetings for the New Years celebrations, or irregular factors, such as earthquakes or typhoons, and accidents on trains or subways. Considering that the various kinds of noises stated above are large enough to distort the	An alternative to this method would be to re-price service contracts or plans. This was not chosen because it is difficult to determine a contract that would adequately represent customers or price movements. The practice in the industry of service based on contracts and plans results in many types of contracts being in effect at any given time. The service fee for a certain plan will not change over time, it is constant. To add new services or increase prices companies will introduce new contracts with these changes. Customers may continue with the old contract or migrate to a new one. There are customers continuing with old contracts that are not currently offered and many discounts that are not offered to the public. Even if a contract were found that was a good representation, it might never change.

quality of data, the average unit price was not adopted as price data for the CSPI.	

C. Limitations in the chosen methodology

Japan	United States
1. Limitation in the survey of per call charges based on average revision rate The average revision rate is normally calculated using weights of the nearest term and also does not account for quality changes, when new or modified services are introduced upon the revision of price table. The bias caused by these factors may be large, if the weights used are distorted by irregular events or the quality of new and old services differ substantially. **2. Limitation in reflecting discounts on a retroactive basis** There is a limitation in reflecting discounts. First, the index must be revised retroactively to reflect the impact of discounts on prices, since most of the relevant data are collected under delay. In addition, monthly data on discounts are not available because the surveyed companies calculate their average discount rates on an annual or semi-annual basis in most cases. To compile the CSPI, the same discount rate is employed until the next terms' discount rate is calculated.	The chief limitation in the methodology is that of introducing new features. New features can be introduced frequently in this industry because it is such quickly improving technology. When they are introduced, there is not a clearly proper method of introducing them into the index. The method gathers information on a specific set of features. When new ones are added by the company, they might draw new customers and allow an increase in prices which will increase revenues. It would be necessary to be aware of these new services otherwise the revenue and weights of other services would be incorrect.

IX. Technical concerns

A. Quality adjustment

Japan	United States
1. Quality adjustment between unlimited and limited services If the services surveyed have changed from unlimited services to limited services, quality adjustment is very difficult. For example, there was pager services for one month costing 2,000 JPN yen with unlimited use. However, the provider revised the menu and started to charge 1,000 JPN yen with limited use: 200 times at maximum. How should we adjust the quality difference between the two? To solve this problem, we asked the provider the average times of use in the former service and calculated the average fee per transmission. By comparing the prices per transmission between the two, we have adjusted the quality difference. **2. Quality improvement in clearness of voice on cellular phones** Due to the technological innovation in terms of radio transmission system, the quality of voice through cellular phone is improving, but the price tables are unchanged in response to this improvement. We have not been able to adjust this quality improvement up to the present. Also we don't have a good idea to solve this problem for the time being. If we could reflect this quality improvement into the index, the downward price movement would be greater. **3. Quality improvement in terms of equipment for PHS services** Due to the technological innovation in equipment for PHS services, accidental switch-offs of calls made in a high-speed car or train are declining. We have not been able to adjust this quality improvement up to the present, since it is very hard to measure the value of the quality improvement of this type. If we could reflect this quality improvement into the index, the downward price movement would be greater.	The methodology reduces the need for quality adjustments with existing services. The use of average weighted prices will adjust for the changing popularity of the services provided.

B. New item bias concerns

Japan	United States
1. Dramatic increase in data transmission services Data transmission services became part of cellular phone services and PHS services in April 1996 and November 1996, respectively. These services are mail services between cellular phones and PHS phones. The WAP protocol and the compact HTML protocol, allow terminal equipment of cellular phones and PHS phones to access the Internet without connecting to a personal computer. Internet access services by cellular phones and PHS phones started in February 1999 and January 2000, respectively. E-mail services that use both phones started from February 1999 and March 1998, respectively. Use of these data transmission services has soared. For example, the number of data transmission services users by cellular phone exceeded 15 million in 31 July 2000. We are trying to capture the volume of these services, and if we confirm that the volume exceeded the minimum required to be adopted by the CSPI, we will start price collection as soon as possible. **2. International telephone services by roaming** Cellular phone companies have started providing international telephone services through roaming. As a result, we have to start thinking about the popularity of these services. When considering whether these services should be taken into the CSPI, contracts between foreign countries' cellular phone companies and domestic phone companies must be studied. If domestic cellular phone companies are charged for connecting networks to those of foreign cellular phone companies, then we must decide whether this service too should be taken into the CSPI.	There is a strong concern about new item bias. New services in this industry are expected to be introduced frequently and to become popular quickly. When completely new services are introduced there is concern about when to include them and how to adjust for their weight. The introduction of new products or service features after the index reference date is problematic for a Laspeyres index. However, if the index is not augmented to show these new services, new item bias would result.

C. Impact of customization on the pricing methodology

Japan	United States
At present, we don't see any special customization in the pricing methodology for mobile telecommunications services. Although there are many kinds of plans or discounts available, all of them are currently published.	Customization is fully captured by the pricing methodology. The diverse plans and services can be included by obtaining the weighted average of each service rather than trying to establish typical plans to re-price. This is because new plans are continuously being introduced to new customers. While old customers are allowed to move into new plans, they are also able to continue with their previous service plan. The different

	plans also include many types of discounts that are not always available and sometimes are only available to particular clients such as corporate customers. Therefore, there can be hundreds of slightly different service plans in effect at any time. Even the uncommon features are given a relative weight and are included in the index.

D. Problems defining and surveying the appropriate unique item caused by data availability

Japan	**United States**
Thus far, we don't have any problems in terms of data availability. However, we make efforts to maintain a good relationship with reporters to ensure that data is available. There must be a common understanding of the definition of the data with reporters and make sure that it is maintained even if the people who are in charge of this work changes.	There is not really a problem defining and surveying the appropriate item as long as the services a company offers stay the same. If new services are introduced and are not identified, new item bias will result.

X. Survey vehicles

A. Methods used to secure initial sample unit cooperation

Japan	**United States**
In order to begin a price survey with a certain company, we usually visit the company and ask for their cooperation. We also explain the outline and goal of the survey. If the company is located in a remote area, this process is sometimes done by phone and mail upon the company's consent. We make great efforts to conduct the survey in an efficient way so that sufficient data are obtained while burdens on surveyed companies are minimized. We also make sure that definitions of the price data are well understood.	Cooperation was obtained through personal visits by knowledgeable field economists. This agency sends fully trained economists to make the first contact with sample units. These economists enlist cooperation, gather preliminary information, and help the reporter begin sending the re-pricing information.

B. Methods used to re-price

Japan	**United States**
In the middle of every month, reporters are requested to send back the previous month's price data by mail. If reported prices change from the previous month, BOJ researchers make phone calls to get the background of price changes. This process is effective in preventing false reports.	Reporters in this industry are asked to provide the information used to calculate a weighted average for customers in an operational area. Revenues and number of customers in an area are used to develop an average profile but are not needed if the reporters can make the calculation themselves. They are usually able to set up a spreadsheet and extract the data each quarter from the company database. They can either e-mail the spreadsheet as an attachment or send it on a disk through regular mail.

C. Strategies to secure and maintain data quality

Japan	United States
When surveyed prices are no longer representative of defined services, the prices will be replaced. The initiative of this replacement is taken either by the reporter or the BOJ. BOJ researchers constantly monitor the market and when a new service appears, they scrutinize it and consider whether it should be included in the survey. Keeping a good relationship with reporters is essential to collect information on market trends quickly and efficiently.	Secure computer systems keep the data confidential. The industry analyst maintains data quality by reviewing the data for any abnormalities. The analyst contacts companies regarding any drastic changes or new services being introduced. If a reporter has not reported in some time the analyst contacts the company to determine if there is a problem and how to fix it. The analyst also maintains files on the industry and the company and keeps track of developments in the industry.

XI. Future trends expected to affect the industry

United States

The new trend in the industry is the introduction of what is called 3rd Generation (3G) wireless communications. These new technologies introduce the ability to transmit and receive larger amounts of information than was possible with preceding technologies. This allows wireless phones to access the internet. With traditional cellular operations, a telephone call would open a channel to a cell and the signal would be in use for the duration of the call. 3G technology breaks down data into packages of information and sends them to a cell that forwards them to the final receiver where they are reassembled. The packaging of information is known as General Packet Radio Service (GPRS) and allows more information to be sent at once. This means that more phones can use the same airwaves at the same time and more information can be transmitted faster than before. This method of packaging information and sending it is similar to the way the internet works which allows the phones to work so well with the internet.

In addition, some major cellular phone making companies have teamed up to develop a standard for how content from the Internet is filtered for mobile communications. This standard is called Wireless Application Protocol (WAP). WAP is a set of rules for transforming internet information so it can be displayed on the small screen of a mobile telephone or other portable device. WAP converts internet pages and information into a simple format. Further in the future, Mobile Station Application Execution Environment (MExE) will permit more complex data to be transmitted. It will allow JAVA based graphics.

Europe, North America, and Japan each have different standards for digital cellular communications. These incompatible standards do not permit travelers to use phones internationally. Over the next few years 3G technologies will converge allowing customers to roam between international networks. Each of the existing standards are compatible with GPRS, only requiring modifications of current networks.

Mobile internet access has been slower to catch on in the US than in other countries mainly because of the limitations on bandwidth a company can control. Transmitting internet type information requires more bandwidth than simple voice transmissions but in the US a carrier can own no more than 45 megahertz of spectrum in any one market, less than in most other countries. Previous auctions included bandwidths that were narrower and not useful for mobile internet access. The FCC recently auctioned larger spectrums of bandwidth which has helped companies move quicker in offering internet access. Wireless companies are asking for the government to relax these restrictions further so they can offer better internet services.

Another development in the US wireless communications industry is the creation of an electronic exchange called e2open.com by IBM. The project will handle internal purchasing requirements for most of the large telecommunications equipment companies including Nokia, Motorola, Nortel Networks, Ericsson, and Philips. The system is a joint venture which is expected to cut costs by handling the companies' procurement needs.

Technology advancement is expected to further consolidate the industry. Companies with smaller bandwidths to control will not be able to offer the same scope of services that are offered by larger companies. At the same time, larger companies searching for more bandwidth to consolidate with what they already own, will be looking for acquisitions.

Japan

1. 3rd generation cellular phone services

At present, PDC and cdmaOne are adopted as the radio telecommunications system for cellular phone services in Japan. However one cellular phone company has announced plans to introduce a new radio telecommunications system called "international mobile telecommunications (IMT-2000)" from May 2001. The IMT-2000 will adopt a radio transmission method called "direct spread-code division multiple access (DS-CDMA)." All other companies are expected to introduce the same system eventually. They will adopt a radio transmission method called DS-CDMA or "multi carrier-code division multiple access (MC-CDMA)." The system will expand to all of Japan by around 2004.

Similar shifts to 3rd generation cellular phone services have started or will start worldwide. In the US, the shift is from cdmaOne to IMT-2000, while in Europe, from "global system for mobile telecommunications (GSM)" to IMT-2000.

2. Installation of Java to cellular phones

From autumn 2000, Java will be installed in the cellular phone equipment of some companies. The volume and content of data transmission services will increase. It might cause a bias in the weights of the CSPI.

3. Bluetooth technology

The new bluetooth technology, which is a radio telecommunications system, could be a breakthrough that links mobile telecommunications equipment and electric equipment, such as personal computers, digital cameras, microwave ovens, and televisions. New services may appear by combining telecommunications services with the electric equipment. We may need to think of new items to adopt and to reclassify in the CSPI.

XII. Need for future work

A. Concerns about survey methods employed and the need for time series analysis and possible methodological changes

Japan	**United States**
The market for telecommunications services changes so quickly that we have hard time catching up. Special care should be taken to keep pricing method relevant and ensure that it is not out of date. We continue to make efforts to improve index accuracy, especially to reflect discounts and other price movements caused by revision of price tables or the introduction of new services.	The only major concerns with the survey methods are with the problem of introducing new services. When new services are available in wireless communications they need to be introduced into the index. If they are not introduced the revenue will be incorrectly weighted towards other features. When new services are included in the index it is necessary to adjust the weights. The difficulty is in determining how to adjust the index to account for the new weights and new services.

B. Concerns about the accuracy of index movement and other related index movement concerns

Japan	United States
1. Bundling contracts with services in other fields Bundled services with other services such as information services through Internet access seem to be increasing. When it is impossible to have separate price survey, we will have to reclassify of the index. **2. Introduction of new services** Many kinds of new services are being introduced in the field of data transmission services and international cellular telecommunications services as mentioned in column IX-B. Coping with these phenomena is a big challenge. Now we are studying those services and discussing how to cope with them.	If revenues increase because of new services being introduced, the weights of old services will be wrong. This could cause index bias. Without the introduction of new services, the methodology should be sufficient for capturing genuine price movements.

XII. Conclusion

Japan

Mobile telecommunications services are changing at a rapid speed because of technological innovation and intensive competition. We have to watch these movements carefully and think about how to cope with them to improve our index accuracy.

Exchanges of information and experience among countries in this field and reviews to improve each country's price indexes have become increasingly important. This is because telecommunications services are growing and being increasingly transnational.

United States

Rapid changes in technology are causing fast paced changes in underlying technology and available service features. Increased competition from service providers using different technologies is causing significant price competition. This has resulted in an extremely dynamic industry characterized by frequent product innovation and complex competitive pricing strategies. This has led us to develop a pricing methodology sensitive to competitive discounting. Also, a periodic augmentation process must be operationalized to allow for new services and features to be included in the survey data.