APPENDIX 2:

Telecommunications Services in

Japan's Corporate Service Price Index (CSPI)

A. Business Model

Telecommunications services are divided into three categories: fixed telecommunications services, mobile telecommunications services, and services of inter-telecommunications companies. Fixed telecommunications services provide transmission services by using telecommunications networks, mainly constructed of copper and fiber cables, to communicate between fixed-point-of-transmission senders and receivers. Mobile telecommunications services provide transmission services with portable equipment, such as cellular phones. One role of inter-telecommunications service is to supplement the transmission networks of telecommunications companies to provide their own services.

Telecommunications companies can be divided into two classifications: 1) those belonging to one of the three major groups, and 2) everyone else. In the first group, companies belong to the Nippon Telegraph and Telephone Corporation (NTT) group, the KDDI group, or the Japan Telecom (JT) group. Each group consists of a number of companies by type of service, such as fixed telecommunications services and mobile telecommunications services, or by area of service provided. In the second group, 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 into small groups of companies or are independent. In addition, the number of emerging companies has recently increased as a result of deregulation regarding entry restrictions. They are generally small in size, but they may succeed in breaking through the existing telecommunications industry and play a role in effecting great change in the industry, because they always try to lower existing service prices and to provide new services at reasonable prices.

Fixed telecommunications services are, for example, fixed telephone services, Integrated Services Digital Network (ISDN), leased circuits, and data transmission services. Fixed telephone services and ISDN produced a 5,049 billion-yen output during the fiscal year of 2000.[1] The NTT group holds 84 percent share of the output, the KDDI group holds 9 percent, the JT group holds 5 percent, and other emerging companies hold 2 percent. Leased circuits produced 878 billion yen during the fiscal year of 2000, of which the NTT group holds 74 percent share of the output, the KDDI group holds 8 percent, the JT group holds 5 percent, and other emerging companies hold 13 percent. Data transmission services produced 382 billion yen during the fiscal year of 2000. 58 percent of that went to the NTT group, versus 26 percent for the KDDI group, 12 percent for the JT group, and 4 percent for the other emerging companies.

Mobile telecommunications services consist of cellular phone services, PHS services, and pager services. Cellular phone services produced 5,617 billion-yen in output during the fiscal year of 2000.[2] This is the first time the sum of output of domestic fixed

[1] The figures cited in this paragraph are from the "Nikkei Communications 2001. 7. 2 No.345" compiled by the Nikkei Business Publications, Inc. These figures include output for households, which is beyond the scope of the Corporate Service Price Index (CSPI) compiled by the Bank of Japan.

[2] The figures cited in this paragraph are from the "Nikkei Communications 2001. 7. 2 No.345" compiled by the Nikkei Business Publications, Inc. These figures include output for households,

telephone services and ISDN has been exceeded by that of cellular phone services. The NTT group holds 62 percent share of the output, the KDDI group holds 23 percent, and the JT group holds 15 percent. All cellular phone service companies, which stand by area of providing services, belong to one of the three major groups.

PHS services produced 404 billion-yen in output during the fiscal year of 2000.[3] The KDDI group, the NTT group, and others. The KDDI group holds the largest share of the output.

Pager services are decreasing their shares as other mobile services like cellular phone services and PHS services increase. The NTT group and other independent pager service companies provide the services. The NTT group holds the largest share of the output.

Services of inter-telecommunications companies are represented by connecting services of networks between telecommunications companies. Telecommunication companies utilize the networks of others to expand their own networks, depending on the transmission of users. Output of the services during the calendar year of 1995 was about 55 billion yen.[4]

which is beyond the scope of the CSPI compiled by the Bank of Japan.

[3] The figures cited in this paragraph are from the "Nikkei Communications 2001. 7. 2 No.345" compiled by the Nikkei Business Publications, Inc. These figures include output for households, which is beyond the scope of the CSPI compiled by the Bank of Japan.

[4] The figure cited in this paragraph is the estimated number used for weight calculation of the CSPI. The estimation is based on "1995 Input-Output Table for Japan," compiled by the Statistics Bureau, Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT).

B. Government Regulation

Companies wishing to enter the telecommunications industry as Type I Telecommunications Business need to obtain prior permission from the Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT). While companies wishing to start their business categorized as Type II Telecommunications Business need to obtain registration from the MPHPT or report notification to the MPHPT, depending on the type of services that they want to start.

Under the Telecommunications Business Law, all telecommunications service companies are defined by the facilities they own. Companies that have their own facilities are categorized as Type I Telecommunication Business. Companies that don't have their own facilities are categorized as Type II Telecommunication Business.

The NTT Law restricts a part of the NTT group—the NTT holding company, Nippon Telegraph and Telephone East Corporation (NTT-East), and Nippon Telegraph and Telephone West Corporation (NTT-West)—regarding their business. For example, areas of providing services and types of them are restricted by the Law.

To revise price tables, telecommunications companies need to report notification to the MPHPT. There is an exception regarding connecting services. That is the case of revising access charges, which are paid by telecommunications companies for usage of the networks of other telecommunications companies. Prior permission from the MPHPT is required.

C. Pricing Methodology

We compile ten items of telecommunications services in the Corporate Service Price Index (CSPI).[5] For fixed telecommunications services, we survey six items: "domestic fixed telephone services," "international fixed telephone services," "Integrated Services Digital Network (ISDN)," "data transmission services," "domestic leased circuits," and "international leased circuits." For mobile telecommunications services, we survey three items: "cellular phone services," "Personal Handyphone System (PHS) services," and "pager services." For services of inter-telecommunications companies, we survey one item: "access charges." They are classified by type of services defined by telecommunications network, not by industry.[6] For the publication structure of the CSPI and its relationship to the Central Product Classification (CPC) Version 1.0., see Chart 1.

Telecommunications services adopted in the CSPI are defined by focusing on a "network" for providing telecommunications services. "Network" is the key word in compiling indexes of telecommunications services. To define items, to design classification for the publication, and to choose price data being collected from companies, the structure and function of the "network" is scrutinized.

A "network" of telecommunications services is like a spider's web. Points are connected to other points by various nodes and lines. For example, telecommunication companies,

[5] "Item" is the lowest index aggregation level that is published in the CSPI.

[6] The CSPI adopts a classification system based on type of service. In the classification system, outputs of each company are categorized by the type of service. This is different from the industry classification system, in which outputs are categorized by the major output of each company. In the industry classification system, all outputs of each company are counted in one industry, although minor output can be quite different from the output of the industry in which the company is categorized.

Therefore, the item "cellular phone services" in the CSPI, for example, includes cellular phone services only. Even if the providers supply services categorized in other fields, they are not included in the item "cellular phone services."

which are categorized as Type I Telecommunication Business under the Telecommunications Business Law, have their own facilities. However, they need to supplement their networks by connecting to other networks to provide broader services, according to users' needs. More concretely, 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 each output of telecommunications services. For detailed definitions of items of the CSPI, see Chart 2.

In compiling an index for each item, actual transaction prices or model prices reflecting both average revision rate of price table and discount rate are surveyed. By this method, we can trace main transaction prices of telecommunications services.

Alternative method would be the average unit price per contract method. However, 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 fee 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 fee, will also change. Considering that the various kinds of noises are large enough to distort the quality of data, the average unit price has not been adopted as price data for the CSPI.

A detailed explanation of our method follows.

C-1. Fixed telecommunications services

C-1-1. Domestic fixed telephone services

Domestic fixed telephone services provide voice transmission services from a fixed place of transmission to its receivers by using analog lines between senders and a "group unit center (GC)." GC is the bundling place that transfers the transmission efficiently from senders to receivers through other GCs. Usually, the line between senders and the GC is made of copper cable. When senders install modems between digital equipment such as personal computers and the line, data transmission on the line-dominating switching system is also available by the fixed telephone services. But the transmission speed is limited to 33.6 kbps (kilobit per second) by the current technology, because the digital data must be converted to analog to transmit by analog lines.

Prices of domestic fixed telephone services consist of base fee and per-call charges. Discounts are included in the price data if they are considered as representative (most popularly transacted) of price movement.

For the base fee, monthly charges are surveyed. The base fee is the charge for giving the right to use fixed telephone services with certain registered numbers for a month.

For the per-call charges, two types of pricing methodology are adopted. The first takes up charges of representative calls per three minutes as price data. They are, for example, a) middle-distance call on weekdays during the daytime, and b) long distance call on weekdays during the nighttime and on weekends. The second type adopts charges of all calls by reflecting the average revision rate of the price table to the base price level, such as 1,000 yen in January 1995, as price data. In both cases, price changes (excluding discounts explained below) are reflected in the indexes when the price table is revised.

For the per-call charges, discounts are included if they are considered as representative price movements of the services. In reflecting discounts to the indexes, “on a real-time basis” and “on a retroactive basis” are adopted. In August 2000, a retroactive index revision to reflect discounts obtained “on a retroactive basis” was undertaken for the first time. The actual effect of the revision is shown in Chart 3.

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: under the condition that calls on weekdays during the daytime, along with a long-term contract discount of 1-2 years, are representative for per-call charges provided by a company:

Regular price for a per-call charge:
100 yen per 3 minutes on weekdays during the daytime (A)
Discount rate for long-term contract
(contracts of 1-2 years) : 5% (B)
Price data for the CSPI : 95 yen = 100 yen ∗ (100% - 5%) (C)

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 obtain (C). Then put (C) into the CSPI indexes.

When it is impossible to reflect the discounts on a real-time basis because the effect of discount can be captured after the index calculation and its release, such as at the time of calculating the P/L of service providers, they are reflected “on a retroactive basis.” An example is as follows:

Regular price for a per-call charge:

100 yen per 3 minutes on weekdays during the 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 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 have been reported by the surveyed companies (B), multiply (A) by (100% - B), and obtain (C). Replace (A) by (C) at the time the discount was actually applied retroactively in the CSPI.

If an average discount rate for the previous period is available, that discount rate 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).

An experimental case, in which the figures are fiction, to cope with discounts in the CSPI can be seen in Chart 4.

C-1-2. International fixed telephone services

International fixed telephone services provide mainly voice transmission services from fixed places in Japan to other fixed places or to mobile phones overseas.

For tracking prices of international fixed telephone services, per-call charges are surveyed. There are two types of pricing methodology adopted. The first type takes up charges for representative calls per three minutes as price data. They are, for example, a)

a call to Korea, Taiwan, United States, United Kingdom, Australia, and African countries on weekdays during the daytime, b) a call to Taiwan, United States, and United Kingdom on weekdays during the midnight or early in the morning. The second type adopts the charges of all calls by reflecting the average revision rate of the price table to the base price level, such as 1,000 yen in January 1995, as price data. In both cases, price changes (excluding discounts explained below) are reflected in the indexes when the price table is revised.

Discounts are included if they are considered as representative of price movement. The scheme of reflecting discounts is the same as that of "domestic fixed telephone services." For the effect of retroactive index revision undertaken in October 2000, see Chart 3.

C-1-3. Integrated Services Digital Network (ISDN)

Integrated Services Digital Network (ISDN) provides a digital network that can transmit various types of transmission, such as voice and data, on the line-dominating switching system, and data transmission on the packet switching system. Transmission from a fixed place to receivers is operated by a digital line between senders and the GC. This is different from that of "domestic fixed telephone services." The line is made of copper or fiber cable. When senders adopt copper cable, transmission speed is limited to 144kbps by the current technology. While when users adopt fiber cable, transmission speed is currently available by 1.5 Mbps (megabit per second).

For tracking prices of ISDN, base fee and per-call charges are surveyed respectively. Discounts are included in the per-call charges for domestic transmission. The scheme of reflecting discounts is the same as that of "domestic fixed telephone services."

For the base fee, monthly charges are surveyed. The base fee is the charge for giving the right to use ISDN with certain registered numbers for a month.

For the per-call charges for domestic transmission, two types of pricing methodology are adopted. The first takes up charges for representative calls per three minutes as price data. They are, for example, a) middle distance call on weekdays during the daytime, b) long distance call on weekdays during the nighttime and on weekends. The second type adopts charges of all calls by reflecting the average revision rate of the price table to the base price level, such as 1,000 yen in January 1995, as price data. In both cases, price changes (excluding discounts explained above) are reflected in the indexes when the price table is revised.

For the per-call charges for international transmission, calls per three minutes to a) North America, b) United Kingdom, c) Hong Kong, d) Australia, and e) Africa are surveyed.

C-1-4. Data transmission services

Data transmission services provide networks that are settled by various types of transmission methods, such as that on packet switching, and that of the Internet.

For tracking prices of data transmission services, two types of monthly charges are surveyed: a) charges for using the packet switching type of network, and b) charges for accessing the Internet. As for b), two types of charges by different ways of accessing the Internet are surveyed: access by leased circuits, and dial-up. Further, four types of transmission speed for accessing by leased circuits are surveyed: 64 kbps, 128 kbps, 1.5 Mbps, and 6 Mbps.

C-1-5. Domestic leased circuits

Domestic leased circuits provide private transmission lines, which are available only for contracted customers. There are both analog and digital leased circuits. As for the analog

type of leased circuits, voice transmission is available. When users adopt modems between digital equipment such as personal computers and the line, data transmission is also available. But the transmission speed is limited to 33.6 kbps, because the digital data must be converted to analog to transmit by analog lines. As for the digital type of leased circuits, the transmission speed is generally faster. There are many types of digital transmission speed. Currently, those of 50 bps through 600 Mbps are available.

For tracking prices of domestic leased circuits, monthly fees for the analog circuits and digital circuits are surveyed. Discounts are included if they are considered as representative of price movement. The scheme of reflecting discounts is the same as that of "domestic fixed telephone services."

For both analog and digital circuits, two types of pricing methodology are adopted. The first type takes up monthly fees for specifying representative services. These services are divided by terms of type of circuit and category of distance for the analog circuits and by terms of transmission speed and category of distance for the digital circuits. The examples of the analog circuits are: a) long distance for voice transmission, and b) long distance for voice and data transmission, while those of the digital circuits are: a) short distance at 64 kbps, and b) long distance at 1.5 Mbps. The second type adopts monthly fees for representative types of circuits by reflecting the average revision rate of the price table to the base price level, such as 1,000 yen in January 1995, as price data. In both cases, price changes (excluding discounts explained above) are reflected in the indexes when the price table is revised.

C-1-6. International leased circuits

International leased circuits provide private transmission lines, which are available only for contracted customers, for intermediate transmissions from Japan to foreign countries. There are both analog and digital leased circuits. For analog, voice transmission is

available. When users install modems between digital equipment such as personal computers and the line, data transmission is also available. But the transmission speed is limited to 33.6 kbps, because the digital data must be converted to analog to transmit by analog lines. As for the digital type of leased circuits, transmission speed is generally faster. There are many types of digital transmission speed, from 12.5 bps to 150 Mbps currently.

International leased circuits supplied by Japan's providers must connect with other parts in three ways: 1) from senders to the starting point of international leased circuits provided by Japan's providers, 2) from the end of the circuits provided by Japan's providers, which is the starting point of other international leased circuits supplied by providers abroad, to the end of the circuits supplied by providers abroad, and 3) from the end of the circuits provided by providers abroad to receivers.

For tracking prices of both analog and digital circuits, monthly fees for specifying representative services are surveyed. Examples are voice transmission to the United Kingdom for analog circuits, data transmission at 64 kbps to Hong Kong, at 1.5 Mbps to the United Kingdom, and at 2.0 Mbps to the United States for digital circuits. Price changes (excluding discounts explained below) are reflected in the indexes when the price table is revised.

Discounts are included if they are considered as representative of price movement. The scheme of reflecting discounts is the same as that of "domestic fixed telephone services."

C-2. Mobile telecommunications services

C-2-1. Cellular phone 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) and 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.[7] Calls from fixed telephones to cellular phones are also included in the item of "cellular phone services" of the CSPI. Cellular phone companies started offering international telephone services in April 2000 by allowing "roaming," which allows their mobile equipment to be used abroad.

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

For cellular phone services, base fees and per-call charges are surveyed respectively. Discounts are included if they are considered as representative of price movement. The scheme of reflecting discounts is the same as that of "domestic fixed telephone services." For the effect of retroactive index revision undertaken in October 2000, see Chart 3.

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

For the per-call charges, charges of all calls by reflecting the average revision rate of the

[7]Phone calls to fixed telephones in foreign countries are included in "international fixed telephone call." For a definition of items adopted in the CSPI, see Chart 2.

price table to the base price level, such as 1,000 yen in January 1995, are adopted as price data. There are exceptions of data transmission services and international telephone services that are not included in the charges. Price changes (excluding discounts explained above) are reflected in the indexes when the price table is revised.

C-2-2. Personal Handyphone System (PHS) services

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 PHS services differ from cellular phone services in the sense that PHS uses a radio telecommunications system, which is called the "personal handyphone system," and that the level of frequency bandwidth used for PHS services is around 1.9 GHz. Because of these differences, the quality of voice transmissions is clearer and average data transmission speed, which is between 32 kbps to 64 kbps for the line-dominated type of switching, is faster than those of cellular phone services, which is between 9600 bps to 14.4 kbps. On the other hand, PHS has less mobility than the cellular phone. More concretely, it is sometimes impossible for PHS to transmit and to receive in a high-speed moving car or train because of technical limitations in the radio telecommunications system.

As for the voice transmission services, phone calls to PHS phones, cellular phones, and fixed phones are included in the item of "PHS services" of the CSPI. Calls from fixed telephones to PHS phones are also included in that item of the CSPI.

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

For PHS services, base fees 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 fee,

monthly charges are surveyed. For the per-call charges, the charges for a representative call for three minutes are surveyed as price data. There are four types of combinations of senders and receivers: 1) from PHS to PHS, 2) from PHS to domestic fixed telephones, 3) from PHS to cellular phones, and 4) from domestic fixed phones to PHS. In each type of combination, representative calls are surveyed. For example, as for calls from PHS to PHS, a) calls within the minimum unit of area where the senders are located, on weekdays during the daytime, and b) long-distance calls on weekdays during the daytime are selected as price data. Discounts are not included, because discounts are not dominant in this market at present and their price movements are parallel to regular price movements.

C-2-3. Pager services

Pager services provide data transmission services. Demand for pager services is declining because they are being replaced by growing demands from 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. Their most advanced radio telecommunications system is FLEX-TD. These services use frequency bandwidth around 280 MHz.

For pager services, monthly charges are adopted as price data.

C-3. Services of inter-telecommunications companies

C-3-1. Access charges

Access charges are the charges to connect to a telecommunications network supplied by major domestic telecommunications companies to other telecommunications companies that have the intention to supplement their telecommunications networks to adjust to customer needs. Charges per three minutes are surveyed.

D. Limitations and Concerns Regarding Published Data

D-1. Limitations in the chosen pricing methodology

D-1-1. 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 of the revision of the price table. The weights are compiled by sales of each segmentation. Each segmentation is divided by the criteria of day (e.g., weekday, weekend), time (e.g., early in the morning, daytime, nighttime, midnight), and distance of call. If new or modified services are introduced on a large scale at the same time of the revision, or if the sales ratio of each segmentation is greatly changed due to the revision, the bias caused by these factors may be significant.

D-2. Quality adjustment

D-2-1. Quality improvement in clearness of voice on mobile phones

Due to technological innovation in terms of radio telecommunications systems, the quality of voice through mobile phones, such as cellular phone and PHS phones, is improving, but the price tables are unchanged in response to this improvement. Since we don't have a good way to solve this problem, we have not yet been able to adjust this quality improvement. If we could reflect this quality improvement into the index, the downward price movement would be greater.

D-2-2. Quality improvement in terms of equipment for PHS services

Due to technological innovation in equipment for PHS services, the numbers of accidental switch-off of calls 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.

D-3. New item bias concerns

Technological innovation occurs very rapidly in the field of telecommunications services and bears new services. However, we always try to keep up with the changes caused by the technological innovation for compiling the accurate price index.

For example, The number of mobile data transmission, such as accessing the Internet and exchanging e-mail by cellular phones and PHS phones, not by personal computers, has soared. The number of data transmission services users by cellular phone exceeded 40 million in 31 June 2001. We are now studying ways to survey the prices of these mobile data transmission services.

Concern in the near future would be how to treat ADSL (Asymmetric Digital Subscriber Line), new technology that can change transmission speed by copper cable dramatically. How can we adjust this quality change of copper cable for surveying the item of "domestic fixed telephone services" in the CSPI? Or should we recognize ADSL as a new item of services? We are now studying various adjustment methods. As the sales of ADSL are increasing, we have started to study how the ADSL services should be captured in the CSPI.

D-4. Concerns about the accuracy of index movement and other related index movement concerns

D-4-1. Bundling contracts within telecommunications services

Bundled services within telecommunications services are increasing due to accelerated competition among telecommunications companies. It is very difficult for us to capture

the prices of each individual service, because bundled services often offer various types of discount plans. We are now discussing this matter with the telecommunications companies.

D-4-2. 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 becomes impossible to do separate price surveys, we will have to reclassify the index.

E. Analysis of "Goodness" of Published Data

We have compiled indexes of telecommunications services for more than 15 years, starting in January 1985. The indexes generally show a decreasing trend, reflecting the strong competition induced by deregulation and the technological innovation.[8] Because the telecommunications industry can enjoy the merits of economies of scale, they have an incentive to increase their customer bases by competing fiercely and lowering prices. We can see the downward trends by looking at three different periods: from 1985 through 1995, from 1996 through around 2000, and from around 2000 to the present. Each period has different factors that have influenced the downward price trend, but all factors can be classified uniformly as either strong competition among telecommunications companies as a result of deregulation or quality improvement of telecommunications services due to technological innovation. The decreasing trend of the indexes during the first period, from 1985 through 1995, was mainly due to deregulation of entry restrictions. The

[8] See Chart 5 for the developments of indexes of telecommunications services. Graphs of the indexes are available.

downward trend during the second period, from 1996 through around 2000, was due to the mixture of further deregulation of entry restrictions, deregulation in the supervision of pricing, and technological innovation. The declining trend of the third period, from around 2000 to the present, was mainly owed to technological innovation and continued competition. The third period shows the largest decline—an annual average of around 6 percent.

E-1. Decreasing trend during the first period—from 1985 through 1995

Until 1985, Japan's telecommunications industry was dominated by only two organizations: the Nippon Telegraph and Telephone Public Corporation and the Kokusai Denshin Denwa Corporation (KDD). The former was a 100% government-owned organization, which 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.[9]

The first step of deregulation was carried out in 1985. Nippon Telegraph and Telephone Public Corporation was privatized and renamed Nippon Telegraph and Telephone Corporation (NTT) by the enforcement of the NTT Law. The entry of new companies, so-called New Common Carriers (NCC), was allowed by the Telecommunication Business Law. This deregulation induced competition between telecommunications companies. Thus the service prices have decreased.

However, even after deregulation, each company was permitted to do business only in one field of telecommunications services, and the number of companies in each field was

[9] The Kokusai Denshin Denwa Corporation (KDD) was founded as a private company in April 1953 by the Kokusai Denshin Denwa (KDD) Law, separated from the Nippon Telegraph and Telephone Public Corporation, which was founded in1952.

also regulated.[10] During this deregulation process, the authorities paid special attention to "maintaining a stable supply of telecommunications services," and to "preventing excessive competition among telecommunications companies."

E-2. Downward trend during the second period—from 1996 through around 2000

The second step of deregulation took place in the second half of the 1990s. Cross-market entries such as those between domestic and international telephone services were permitted from 1996 to 1997.[11] Entries of domestic non-telecommunications companies and foreign telecommunications companies were also allowed in 1997 and from 1998 to 1999 respectively.[12]

This deregulation has intensified price competition. This has led to accelerated price reductions and diversification in the combinations and classifications of services and

[10] Telecommunications services had been partitioned by the Regulations for Enforcement of the Telecommunication Business Law until its revision in January 1996. The partitions included domestic local telephone services, domestic long-distance telephone services, cellular and car phone services, PHS (Personal Handyphone System) services, pager services, international telephone services, and satellite telecommunications services.

[11] In January 1996, the "Manual for Market Entry into Japanese Telecommunications Business," which allows telecommunications companies except for the NTT and KDD to operate in multiple telecommunications fields, was announced by the Ministry of Posts and Telecommunications (MPT), (currently the MPHPT). Furthermore, in June 1997, the NTT Law and the KDD Law were revised. By the revision, NTT was allowed to start international telecommunications services through a subsidiary company, and KDD was allowed to start domestic telecommunications services.

[12] In May 1997, companies in domestic non-telecommunications industries were allowed to enter the telecommunication field by the revision of the Telecommunication Business Law.

In February 1998, the regulation that set the maximum ratio of foreign capital in Japanese telecommunications companies (one-third at most) was removed, except for NTT and KDD, by the revision of the Telecommunication Business Law and the Radio Law. In November 1998, the regulation on KDD, of which the maximum foreign ownership ratio had been limited to one-fifth, was removed by the abolishment of the KDD Law. Furthermore, in July 1999, NTT was divided according to the revision the NTT Law in June 1997, and the regulation on the NTT Communication Corporation, one of the descendants of the NTT, was removed. The maximum foreign ownership ration under regulation for the NTT had been limited to one-fifth.

charge systems.

The pricing of telecommunications services had been regulated, requiring prior permission by the Ministry of Posts and Telecommunications (MPT). In cellular phones, PHS (Personal Handyphone System), and pager services, this regulation was eased in December 1996, shifting from prior permission to notification, due to the revision of the Regulations for Enforcement of the Telecommunication Business Law. As for domestic and international telecommunications services, similar deregulation took place in November 1998 due to the revision of the Telecommunication Business Law.[13] Competition among telecommunications companies was thus intensified and the related prices plummeted.

Technological innovation in the telecommunications industry has lowered prices by both internal technological innovation and by the intensified competition. For example, with these technological innovations, easy-to-carry terminal machines and lighter and smaller units for cellular phone services were introduced. These innovations have made the demand for cellular phone services soar. The prices have been lowered because such huge demand has lowered cost per unit and intensified price competition in cellular phone services, as cellular phone services companies have scrambled to acquire new customers.

E-3. Declining trend during the third period—from around 2000 up to date

Technological innovation in telecommunications services field has been accelerated recently and many new technologies have been introduced. For example, new services such as ADSL (Asymmetric Digital Subscriber Line) have been introduced to the market as mentioned in section D-3. Charges for accessing the Internet have decreased. Quality of voice through mobile phones is improving due to technological innovation in terms of

[13] NTT was an exception to the deregulation.

radio telecommunications system, as mentioned in section D-2-1. Those downward price movements are reflected in the index, although it cannot be said to be sufficient due to the difficulties of quality adjustment.

As for domestic fixed telephone services, the fierce competition for providing new services among carriers to expand their customer bases has continued. This can be seen in the steep decline of the index of that item.

In conclusion, we generally have succeeded in capturing the dynamic changes in telecommunications service price developments for more than 15 years based on the intensified competition and the rapid changes in technology. This result also shows that the methodologies explained in this paper are valid. Of course, many new services are emerging in the telecommunications services field. Thus we must keep tackling the problems of handling services price data to keep up with the change and the innovation of telecommunications field to compile accurate price indexes.