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Japan's Corporate Services Price Indexes for
Commercial and Industrial Machinery Repair and
Maintenance Services

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*The views stated herein are those of the author and not necessarily those of the Bank of Japan.

Introduction

The Bank of Japan (BOJ) currently publishes two price indexes for “Commercial and Industrial Machinery Repair and Maintenance” services in Japan’s Corporate Services Price Index (CSPI).

- Machinery repair and maintenance (except Electric & electronic products)
- Electric & electronic product repair and maintenance

This document describes the methodology used to calculate these indexes.

1. Definition of the service being priced

Establishments in this industry engage in repairing and maintaining machinery, such as general machinery, construction & mining machinery, and electrical machinery, apparatus, & appliances. Establishments which engage in automobile repair are excluded from this industry.

2. Pricing unit of measure

In the Commercial and industrial machinery repair and maintenance industry, there are typically two types of pricing mechanisms. One is a “*flat fee for service,*” where a set price is given for a service provided. This pricing mechanism is usually used for periodic repair and maintenance services.

The other is charging *a fee based on the amount of labor and parts used in the repair and maintenance services.* This pricing mechanism is usually used for fully-customized, one-off repair and maintenance services.

The BOJ currently surveys repair and maintenance services of the following nine types of machinery:

- Plants
- Construction and mining machinery
- Special industrial machinery
- Metal working machinery
- Copying machinery
- Electricity distribution and control apparatus
- Computer-related machinery
- Communication equipment
- Medical equipment

The following price determining characteristics are specified with respondents’ assistance:

Plants repair and maintenance

- *Types of plants* – Chemical, Steel, Oil, etc.
- *Types of clients*
- *Types of services* –Welding maintenance, Piping maintenance, etc.
- *Number of plants*
- *Periodic or on-demand maintenance*

Construction & mining machinery repair and maintenance

- *Types of machinery* – Power shovels, etc.
- *Types of clients*
- *Types of services* –Engine maintenance, Lamp assembly maintenance, etc.
- *Number of units*
- *Periodic or on-demand maintenance*

Special industrial machinery repair and maintenance

- *Types of machinery* – Elevators, Air conditioners, Semiconductor manufacturing equipment, etc.
- *Types of clients*
- *Types of services* –Compressor maintenance, General maintenance, etc.
- *Number of units*
- *Periodic or on-demand maintenance*

Metal working machinery repair and maintenance

- *Types of machinery* – Lathes, Grinding machine, etc.
- *Types of clients*
- *Types of services* – Overhaul of lathes, General maintenance, etc.
- *Number of units*
- *Periodic or on-demand maintenance*

Copying machinery repair and maintenance

- *Types of machinery* – Copying machinery
- *Types of clients*
- *Types of services* – General maintenance, copying counter-based maintenance, etc.
- *Number of units*
- *Periodic or on-demand maintenance*

Electricity distribution & control apparatus repair and maintenance

- *Types of machinery* – Boilers, Pumps, Turbines, etc.
- *Types of clients*
- *Number of units*
- *Periodic or on-demand maintenance*

Computer-related machinery repair and maintenance

- *Types of machinery* – Computers, Servers, etc.
- *Types of clients*

- *Number of units*
- *Periodic or on-demand maintenance*

Communication equipment repair and maintenance

- *Types of machinery* – Modems, Cellular phones, Telephone switchboards, etc.
- *Types of clients*
- *Number of units*
- *Periodic or on-demand maintenance*

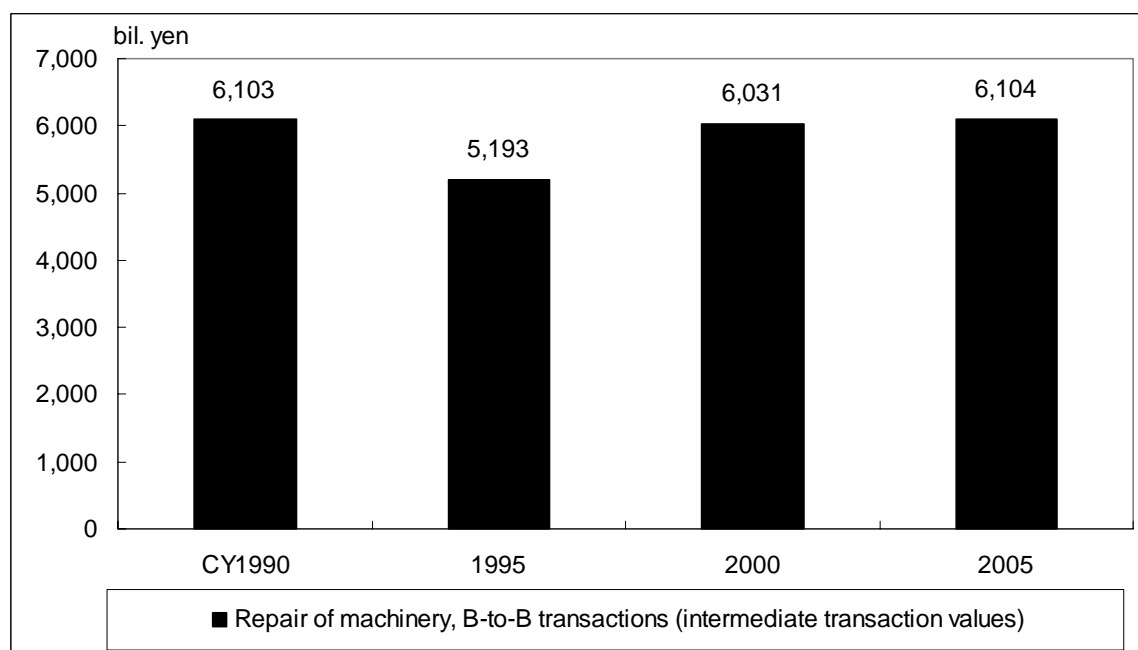
Medical equipment repair and maintenance

- *Types of machinery* – CT-scan equipment, Flat panel detectors, etc.
- *Types of clients*
- *Number of units*
- *Periodic or on-demand maintenance*

3. Market conditions and constraints

a. Size of industry

Since Japan's CSPI covers service products that are provided by businesses to other businesses, the business-to-business transaction values estimated in the Input-Output tables provide the size of industry.



Source: 2005 Input-Output Tables for Japan, Statistics Bureau of Japan

The estimated business-to-business transaction value for this industry in 2005 is 6,104 billion yen (equivalent to 76 billion U.S. dollars, 63 billion Euros). The

industry accounts for 2% of the total value of business-to-business services transactions in Japan.

b. Special conditions or restrictions

Commercial and industrial machinery repair and maintenance services are provided by various types of establishments. Specialized machinery repair establishments provide the services as primary products. Furthermore, manufacturers and distributors (wholesalers and retailers) also provide the repair and maintenance services as secondary products. Therefore, price surveys are required to grasp price developments in the market as a whole, covering the three types of establishments.

c. Record keeping practices

The lack of comprehensive official statistics for this industry provides a challenging environment for Japan's price surveys. For the selection of respondents and service products to be surveyed, the BOJ estimates the market share of service products provided by specialized machinery repair establishments, manufacturers, and distributors. The following statistics are used for the market share estimates:

- *Survey on Service Industries*
- *Census of Manufacturers*
- *Census of Commerce*
- *Capital Stock Estimates*

4. Standard classification structure and detail related to the area

Classification according to the Japan Standard Industry Classification (JSIC)¹

The table below presents the structure and definitions in the JSIC.

Division	Group	Class	
R	Services, N.E.C		
	901	Machine repair shops, except electrical machinery, apparatus, appliances and supplies	
		9011	General machine repair shops, except construction and mining machinery
		9012	Construction and mining machinery repair shops
	902	Electrical machinery, apparatus, appliances and supplies repair shop	
9021		Electrical machinery, apparatus, appliances and supplies repair shop	

¹ Japan Standard Industry Classification, Rev.12, November, 2007.

Comparison to ISIC Rev.4

JSIC 901 and 902 most closely compare to the following ISIC codes: 3312, 3313, 3314, 3315, 3319, 9511, and 9512. The table below provides the classification structure and definitions in ISIC Rev4.

Section	Division	Group	Class	
C	Manufacturing			
	33	Repair and installation of machinery and equipment		
		331	Repair of fabricated metal products, machinery and equipment	
			3312	Repair of machinery
			3313	Repair of electronic and optical equipment
			3314	Repair of electrical equipment
			3315	Repair of transport equipment, except motor vehicles
3319	Repair of other equipment			
S	Other service activities			
	95	Repair of computers and personal and household goods		
		951	Repair of computers and communication equipment	
			9511	Repair of computers and peripheral equipment
			9512	Repair of communication equipment

The major difference between the ISIC and the JSIC is that the ISIC explicitly includes categories for machinery repair services under “Manufacturing,” while the JSIC does not. According to the explanatory notes for the JSIC, the JSIC generally recognizes that establishments which conduct manufacturing, processing, and repairing of various types of machinery and components are classified in “Manufacturing.”

5. Evaluation of standard vs. definition and market conditions

Given the nature of the market described in section 3, potential service providers are, specialized machinery repair and maintenance establishments, manufacturers, and distributors. The ISIC, however, has no categories for machinery repair services in section “G - Wholesale and retail trade.”

6. National accounts concepts and measurement issues for the area related to GDP measurement

Since the 2008 SNA does not provide explicit guidance on the measuring of output of “Commercial and industrial machinery repair and maintenance” services, the general guidance on output of services is used for GDP measurement. The output of this service would include all costs (the cost of

machinery parts used for repair and maintenance services is also included). The concepts and definitions underlying the CSPI, which surveys service charges including all costs, fit well with the concepts and definitions underlying the 2008 SNA.

7. Pricing method and criteria for choosing various pricing methods

The selection of the pricing method will depend on the type of pricing mechanisms used for a particular service, i.e., whether *flat fees* or *pricing based on the amount of labor and parts* are used.

When repair and maintenance companies charge flat fees, data on the flat fee for the specified repair and maintenance service should be collected. In this case, *the Direct use of prices of repeated services* method is used.

On the other hand, when repair and maintenance companies base their charges on the amount of labor and the parts used, *the Model pricing method and Time-based pricing (charge-out rates)* are employed.

Direct use of prices of repeated services

When this method is employed, the respondent specifies a representative transaction at the start of the survey.

Box 1. Example: Repair and maintenance service for elevators

Type of machinery:	Elevators with monitoring systems
Client:	A
Type of services:	Full-maintenance services
Number of units:	6 units
Periodic or on-demand:	Periodic

→ Monthly charges are collected from the respondent.

Model pricing method

When this method is employed, the respondent specifies a representative contract/model and estimates prices for the "model" services.

Box 2. Example: Repair and maintenance service for power shovels at time t

Type of machinery:	Power shovel, product code "ABC-1"
Client:	B
Type of services:	Oil filters maintenance
Number of units:	1 power shovel
Parts required:	2 oil filters, product code "F-123"
Man-hours required:	0.5 hours for maintenance, 2 hours for travel
Technician's level:	Level-2
Periodic or on-demand:	On-demand

→ Prices are estimated as follows:

$$\begin{aligned}
 P_{t=n} &= \text{Total Parts cost}_{t=n} + \text{Travel cost}_{t=n} + \text{Charges for maintenance}_{t=n} \\
 &= \text{Parts cost}_{t=n} \times \text{Number of parts required}_{t=0} \\
 &\quad + \text{Charge-out rate}_{t=n} \times \text{Travel time required}_{t=0} \\
 &\quad + \text{Charge-out rate}_{t=n} \times \text{Maintenance time required}_{t=0}
 \end{aligned}$$

At time0, the cost of oil filters is \$20 per unit and the charge-out rate for a level-2 technician is \$ 12 per hour.

The price at time0, assuming that two oil filters are required, is estimated as follows:

$$P_{t=0} = \$20 \times 2 + \$12/\text{hour} \times 2\text{hours} + \$12/\text{hour} \times 0.5\text{hours} = \$70.$$

At time1, the cost of oil filters has been decreased to \$18, while the charge-out rate for a level-2 technician has increased to \$16 per hour.

The price at time1, again assuming that two oil filters are required, is estimated as follows:

$$P_{t=1} = \$18 \times 2 + \$16 / \text{hour} \times 2\text{hours} + \$16 / \text{hour} \times 0.5\text{hour} = \$76.$$

Time-based pricing (charge-out rates)

When this method is employed, the prices of services per unit of labor input are surveyed in the case where the quality of the product is proportional to the quantity of labor input. At the start of the survey, the respondent specifies a representative service and technicians' /engineers' level in skill.

Box 3. Example: Repair and maintenance service for plants

Type of plants: Chemical
Client: C
Type of services: Welding maintenance
Technician's level: Level-3
Periodic or on-demand: Periodic

→ Prices are estimated as follows:

$$P_{t=n} = \text{Total revenue}_{t=n} \div \text{Unit of labor input (Man-hours required)}_{t=n}$$

At time0, the man-hours required consist of two level-3 technicians working 3 hours each, and the total revenue is \$150.

The price at time0 is estimated as follows:

$$P_{t=0} = \$150 \div (\text{Two level-3 technicians} \times 3 \text{ hours}) = \$25.$$

At time1, the man-hours required consist of three level-3 technicians working 5 hours each, and the total revenue is \$300.

The price at time1 is estimated as follows:

$$P_{t=1} = \$300 \div (\text{Three level-3 technicians} \times 5 \text{ hours}) = \$20.$$

8. Quality issues

In order to keep the unit of measure constant over time, the BOJ asks respondents to specify the technology-related characteristics, such as technicians' / engineers' levels in skill, man-hours, and parts needed for providing repair and maintenance services.

9. Evaluation of comparability with turnover measures

The concepts and definitions underlying the calculation of turnover and of the CSPI are very similar. For the CSPI's weight calculation, the intermediate transaction values estimated in the Input-Output Tables are used. The Input-Output Tables are compiled on an activity-basis, which covers the turnover derived not only from specialized machinery repair and maintenance establishments, but also from manufacturers and distributors.

10. Summary

The BOJ currently publishes two price indexes for “Commercial and Industrial Machinery Repair and Maintenance” services: “Machinery repair and maintenance (except Electric & electronic products)” and “Electric & electronic product repair and maintenance.”

Various types of establishments provide the services. Specialized machinery repair establishments provide the services as primary products. Furthermore, manufacturers and distributors also provide the repair and maintenance services as secondary products. Therefore, price surveys covering all providers of repair and maintenance services are required to grasp price developments in the market as a whole.

The selection of the pricing method will depend on the type of pricing mechanisms used for a particular service, i.e., whether *flat fees* or *pricing based on the amount of labor and parts* are used. When repair and maintenance companies charge flat fees, *the Direct use of prices of repeated services* method is used. Whilst they base their charges on the amount of labor and the parts used, *the Model pricing method and Time-based pricing (charge-out rates)* are employed.