

**QUALITY ADJUSTMENT METHOD IN PREPACKAGED  
SOFTWARE IN JAPAN'S 2000 BASE  
CORPORATE SERVICE PRICE INDEX**

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## **Introduction**

In the 2000 base Corporate Service Price Index (hereafter the CSPI) to be published at the end of 2004, we plan to divide the item, "Software development," into "Custom software" and "Prepackaged software." In the past, the main software development services were large-scale developments that were made-to-order for specific customers like large banks. However, small-scale and diversified software developments, which use standardized prepackaged software to suit the needs of customers, have grown. For these reasons, the division of "Software development" can be regarded as reflecting the present situation of Japan's software products market.

The problem is how to cope with rapid quality improvement in this field. Especially, prepackaged software is periodically upgraded, as new functions and utilities are added. Therefore, to produce constant quality price indexes, it is essential to evaluate such changes in quality when in upgrading. This paper overviews prepackaged software in the CSPI and describes our method of quality adjustment.

## **Prepackaged Software in the CSPI**

The inter-corporate transaction value of Japanese prepackaged software industry was 2.01 trillion yen, calculated from the transaction value of intermediate sectors of the IO tables in 2000. This amounts to 1.6 percent of the total transaction value of the 2000 base CSPI. While American software companies like Microsoft dominate the market for operating systems, word processing, and spreadsheets, Japanese software companies have developed more business-oriented prepackaged software in recent years. Consequently, prepackaged software products are now in wide use in various business environments.

Our samples of prepackaged software in the 2000 base CSPI are, by and large, classified into four categories: inner management software such as accounting and payroll management, database software for sales or customer management, middleware for computer operations, and computer-aided engineering software. Price data are, in principle, actual transaction prices, but they tend to equal list prices because discount sales are not currently common in Japan's prepackaged software market.

Competitiveness among products in the prepackaged software market depends on function. In fact, prepackaged software is often upgraded without any change in prices. Therefore, the movements of the CSPI count on the price change caused by the quality change in upgrading.

### **Which Quality Adjustment Method?**

The CSPI employs quality adjustment by several methods. For the upgrading of prepackaged software, the overlap method, the hedonic regression method, and the production cost method seem to be applicable. In practice, however, there is no choice but to rely on the production cost method for quality adjustment.

In the market for prepackaged software, the moment a new version is introduced, an old one usually disappears. Because the overlap method is based on the condition that both the new and old versions simultaneously stay in the market, it is not applicable for quality adjustment of prepackaged software.

The hedonic regression model is also inapplicable due to problems with model specification and lack of relevant data. The hedonic method requires identified characteristics for each regression model corresponding to product, but it is difficult for us to identify characteristics of prepackaged software. Even if we specify some characteristics, it is unrealistic to collect enough data for differentiated software products to estimate robust hedonic regression.

On the other hand, the production cost method depends on the availability of cost information. In this regard, we can obtain data from financial reports, in which the software publisher must add up development costs. Furthermore, they are obliged to divide development costs into costs stemming from quality improvement and maintenance costs. Therefore, such information enables us to employ the production cost method for quality adjustment for prepackaged software.

### **Application of Production Cost Method for Prepackaged Software**

In applying the production cost method for prepackaged software, we should note the

characteristics peculiar to software products. That is, the marginal production cost of software is negligible in the sense that it can be copied infinitely without significant additional costs, while fixed costs such as research and development costs are sunk. Thus, the production costs for the additional upgrading of prepackaged software mean not marginal production costs but unit production costs. This is different from other products.

Considering such characteristics, we must transform the total cost for upgrading into unit value by setting an expected shipment quantity. The unit cost critically depends on the assumption of the shipment quantity.

In practice, for the purpose of applying the production cost method for prepackaged software, we regularly collect the following information from software publishers.

- . Information about new versions.
- . Cost of upgrading (excluding maintenance costs—only costs that leads to quality improvement).
- . Expected sales quantity of new versions. If not available, sales quantity of old version.
- . Transaction price per license of surveyed package.

When the new version appears, we judge whether it includes additional improvements. For example, if the upgrading is a mere program change for the maintenance or the removal of bugs and errors, we use the direct comparison method for the sample replacement. When the new version has a substantial change to provide us with additional improvements, we apply the production cost method by calculating a proxy for the value of quality improvement as follows:

Proxy for the value of quality improvement = total cost of upgrading/estimated sales quantity.

This value is cost per shipment in upgrading. We use this cost as the value of quality improvement for quality adjustment.

One problem in the production cost method is the quality of information. Accounting

guidelines in Japan require the disclosure of the cost for upgrading of prepackaged software, and we can obtain this cost information in detail. The real problem is that research and development costs often include upgrading costs for several software products. Therefore, we must abstract the production cost for the sampled products so that we evaluate the quality improvement of our sample product. To solve this problem we calculate the revenue share of our sample product to the total products and treat this share as that of the production costs of the sampled products to the total products on the assumption that the rate of margin (the ratio of production cost of certain product to its revenue) is the same among several bundled products.

Table 1 shows an example. Suppose that the total upgrading cost including enterprise server edition is 30 million yen. The revenue share of the stand-alone edition is 0.74, and the expected shipment of the new stand-alone version is 1,710. Then we can obtain average cost of upgrading: 12,982 yen.

$$\underline{30,000,000 \text{ yen} * 0.74 / 1710 = 12,982 \text{ yen}}$$

This is the value of quality improvement.

Given that the transaction price remains unchanged at the level of 160,000 yen, the quality ratio (quality of old version/quality of new version) is

$$\underline{160,000 \text{ yen} / (160,000 \text{ yen} + 12,982 \text{ yen}) = 0.925}$$

As a result, we conclude that the upgrading of the prepackaged software decreases the CSPI by 7.5 percent.

### **Concluding Remarks**

The price movement of prepackaged software in the CSPI depends on the evaluation of upgrades because it is often the case that the list price remains unchanged for upgrades. Without applying the production cost method, we could not have opened up the introduction of prepackaged software to the CSPI. However, it should be noted that the above method calculates unit production costs by dividing the expected sales quantity or realized sales quantity of the old version. We should check the appropriateness of the

index even after publishing the 2000 base CSPI.

Table1

**Example of Quality Adjustment**

Product	Product A (stand-alone edition)	Product A consists of stand-alone and enterprise server edition.
Frequency of upgrades	About once a year	
Transaction price	160,000 yen (no change)	No change for a few years
Period of new version release	February 2003	
Period of previous version release	December 2001	
Total upgrade cost including enterprise server edition.	30 million yen	This development cost including enterprise server edition.
Revenue share of stand-alone edition	0.74	Use for estimating the development cost of stand-alone edition.
Expected shipment of new version in stand-alone edition	1,710	Shipment of stand-alone edition at last year.
Average cost of upgrading	22.2 million yen/1,710.12,982 yen	Value of quality improvement.

Value of quality improvement

= (total upgrade cost including enterprise server edition \* revenue share of stand-alone edition) /  
(expected shipment of new version in stand-alone edition)

= 30 million yen \* 0.74 / 1710

= 12,982 yen