Chapter 4

On the Estimation and Properties of Sectoral Export Unit Value Indices:

Focusing on Fixed-weighted and Chain-weighted Indices of IDE

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1. Introduction

Quantitative Analysis of the recent changes in foreign trade structure of developed and developing countries/regions requires trade price indexes by detailed industrial classification, which is indispensable to examining the factors behind the structural changes and measuring each contribution of them. However, the current information about sectoral trade price indexes is not satisfactory in developed countries, even in newly industrializing countries. It is due to the limited availability of quantity information and the revision of standard international trade classification mainly for the newly developed machinery products, whose share in the total trade is increasing rapidly.

IDE has started a research project on foreign trade index, the aims of which are, first to construct consistent trade flow matrix of the world by country and by commodity and, second to formulate time series of trade price and quantity indexes at the detailed sectoral level This chapter intends to examine the properties and qualities of the export price indexes of IDE by comparing IDE series with relevant price index.

2. Method of formulating trade price index

Generally, price index measure is classified by the method of aggregation and the choice of the base period with which all other periods are compared. As for the former, there are Laspyres, Paashe and Fisher formula. As for the latter, two types of indexes are developed, namely fixed-weighted index and chain-type weight index.

IDE project has managed to formulate trade price indexes in the two stages. Firstl, fixed weight index of Laspyres, Paashe and Fisher formula were constructed. The base period of indexes, which is fixed for the five years, is moved every five years, and finally the price indexes with different base period are linked together to derive long-term index with a common base period of 1995. Secondly, chain weight indexes of Laspyres, Paashe and Fisher formula were computed. Specifically, the rate of change indexes are constructed by changing the base period every year and then the successive multiplication of these indexes are made to obtain a consistent time series with 1995 as the base period.

3. Properties of Fixed-weighted Export Unit Value Indices

3.1 Export Value Coverage in the Formulation of Indices by Industrial Sector

Looking at the average coverage on a value base for the US and Japan from 1970–2001/2. Of the 13 sectors, which were comparable over the entire period, the coverage is greater than 70% for 10 sectors for Japan and 5 sectors for the US. The average figures for coverage overall are lower for the US, and the coefficients of variation are higher than those for Japan.

3.2 Comparison of Estimated Series

To examine the properties of the export unit value indices of IDE using fixed-weighted formulas and to examine whether they can be employed as price indices in the analysis of exports, we attempted to compare them with export price indices published domestically.

3.2.1 Results of Comparisons and Interpretation

(1a) US: Comparison between BLS and IDE

Comparison was possible between BLS and IDE series for 10 sectors in the metal products and machinery-related sectors for the 13-year period between 1989 and 2001.

In the BLS series, six sectors showed a rising trend, 2 showed a falling trend, 1 demonstrated cyclic fluctuations and 1 remained steady. In the IDE series, only 3 sectors showed a rising trend. 3 showed a falling trend, 1 demonstrated cyclic fluctuations and 1 remained steady. The remaining 2 sectors displayed opposite trends in the first and second halves of the period.

Fluctuations in both series were similar for 3 sectors: Non-ferrous metals, which fluctuated cyclically, office equipment, which showed a falling trend, and automobiles, which showed a rising trend. A jump was observed in the IDE series for automobiles between 1998 and 1999, but this was thought to be the result of a problem in the original data rather than a reflection of the real situation. The IDE series showed wide amplitude of fluctuation for the remaining 7 sectors, with jumps observed in specific years. The IDE series do not adjust changes in quality, and therefore differences in the magnitude of trends and cases of opposite trends being displayed in comparison to the BLS series were expected. However, the fact that apparently discontinuous annual changes could be observed in the IDE series may be considered to be the result of fluctuations in data coverage and abnormal fluctuations in individual indices.

(1b) Japan: Comparison between Ministry of Finance (MOF) and IDE

MOF and IDE series are both formulated using export unit values and the same formulas, and therefore it was predicted that the series would be basically identical. However, the sector classifications used differ, with MOF employing classifications based on the HS system and IDE employing SITC classifications.

Overall trends and fluctuations in trends are extremely similar in both series. However, there is a significant difference in the magnitude of change between 1987 and 1988 in the case of iron and steel, and this causes the pattern of fluctuation to differ. With respect to the series for other sectors, disparities exist in the index series for the 1980s, and therefore differences in the average rate of change are displayed when rising trends from 1980 to 2000 are determined.

(2) Comparison of Japan, South Korea and Taiwan

Five sectors, consisting of iron and steel, non-ferrous metals, metal products, general machinery and electrical machinery, were compared for these three countries. Looking at iron and steel, we find the fluctuations in indexes for South Korea and Taiwan virtually identical from 1980–1987, while trends for Taiwan and Japan are similar from 1989–1999. All three countries have displayed similar falling trends since 1995.

Fluctuations for the three countries are also very similar in the sector of non-ferrous metals. Japan and Taiwan display identical trends throughout the 1980s, while trends in South Korea and Taiwan are similar throughout the 1990s.

This type of similarity was not observed in the metal products and machinery sectors. In the case of metal products, the series for both Japan and Taiwan show comparatively smooth fluctuations, while the indices for South Korea are unstable, showing a zigzag trend. The trends for Taiwan and Japan are extremely similar during the 1980s, but in the 1990s the series for Taiwan remains stable while the series for Japan displays a rising trend.

A rising trend was displayed in the general machinery sector for all three countries until 1995; the series for South Korea fluctuated wildly until 1995, since when the level has dropped significantly. This is in part an effect of exchange rates following the Asian currency crisis, but this factor is not in itself sufficient to explain the trend.

Japan and Taiwan display virtually identical trends in the electrical machinery sector until 1993. After this year Taiwan displays a falling and rising pattern of fluctuations, with a symmetrical pattern being displayed by South Korea. Given Japan's relatively smooth fluctuations, these patterns are difficult to explain. It will be necessary to examine the possibility of differences in the commodities included in the electrical machinery sector or abnormal fluctuations in unit values.

4. Properties of Chain-weighted Export Unit Value Indices

In formulating chain-weighted indices, the rate of change indexes are constructed by changing the base period very year and then the successive multiplication of these indexes are made to obtain a consistent time series with 1995 as the common base period.

4.1 Coverage of Export Value by Industrial Sector/Country

We first calculated averages for coverage of export value over the entire period (1970–2002/3) for six countries: Japan, the US, South Korea, Taiwan, China and Singapore.

Looking at the results by country, we find that while only indices from 1985 can be used for China, indices of every sector for the other five countries are usable from 1970. This is the major characteristic of chain-weighted as opposed to fixed-weighted indices. Viewed by sector, all the countries have low coverage in the timber and wood product and machinery-related sectors; in the machinery-related sectors, the coefficient of variation of coverage is greater than it is in other sectors.

To test similarities in coverage by sector between countries, the coefficient of correlation between pairs of countries for 20 sectors was determined. The pairs of countries with a coefficient of correlation greater than 0.7 were: Japan–South Korea; US–China; US–Singapore; South

Korea–China; and China–Singapore.

Comparison of the US and China showed a similar pattern by sector than that of Japan and South Korea, and coverage for the machinery sectors was the lowest of any sector for both countries.

4.2 Comparison of Results of Estimations

4.2.1 Correlation between Chain-weighted and Fixed-weighted Indices

To examine the degree of similarity between fluctuations in chain-weighted and fixed-weighted unit value indices by sector, coefficients of determination were calculated for the two types of index series for the period from 1970.

While there was a slight difference in terms of whether a trend existed or not in the unit value indices, significant disparities were observed in trends for both chain-weighted and fixed-weighted indices in sectors with coefficients of determination of less than 0.8. By contrast, in sectors with coefficients of determination greater than 0.90, there were no significant differences between the different forms of index.

Looking at results by country, we find in the case of Japan that of 14 determined sectors, 8 have a coefficient of determination greater than 0.9. In the case of South Korea, there are significant differences between the two forms of index in every sector. By contrast, 11 of the 17 sectors for Taiwan have coefficients of determination greater than 0.9.

4.2.2 Study of Indices by Country

(1) Japan: the divergence between the two types of indices is highest for the paper and pulp, electrical machinery and transport machinery sectors. In the paper and pulp sector, fixed-weighted indices are consistently higher than chain-weighted indices until 1987, but from 1988 the two series are virtually identical. Considering that value coverage is higher for the chain-weighted indices, there is a strong possibility that faults have occurred in the fixed-weighted indices between 1987 and 1988.

(2) The US: As for the US, there was significant divergence between the two series in the majority of the sectors looked at, and fixed-weighted indices could not be formulated for machinery-related sectors. Divergence between the series was high in agriculture, forestry and fisheries, mining, timber and wood products and petroleum and coal.

(3) South Korea: The level of similarity between the series is low for South Korea in comparison to the other countries and region, and only four sectors (foodstuffs, clothing, rubber products and iron and steel) possess a coefficient of determination greater than 0.9.

(4) Taiwan: Taiwan resembles Japan in terms of the degree of similarity between the index series, with 11 of the 17 sectors possessing a coefficient of determination greater than 0.9. Here, we will compare the chemical products, general machinery, electrical machinery and transport machinery sectors, all of which have low coefficients of determination.

5. Conclusion

In addition to looking at fixed-weighted indices, this study of unit value indices estimated by IDE examined the properties of chain-weighted indices. With regard to chain-linked indices, a comparison of indices for the same sector between countries remains to be conducted. In addition, the issue of adjustment for quality in unit value indices remains to be addressed, and it will be necessary to compare output price and unit value indices using more detailed sector classifications.