How to synthesize or decompose IIPs to compute user-defined series indices

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1. Introduction

The Indices of Industrial Production (IIPs) have the advantage of being able to sensitively reflect economic trends and of becoming available more frequently and earlier than national economic accounting data. They are important indicators for grasping the economic situation and are actually used in various economic analyses. The IIPs are created not only for the most commonly used industrial averages, but also for each industry and good. There are quite a few official IIP series that have been published. By synthesizing or decomposing these official series, we can compute indices for industries and goods that official series have failed to cover. However, correct methods for long-term comparison of the user-defined series are not necessarily recognized. Sometimes, inappropriate methods or analyses are conducted among researchers. In this paper, we show the method for computing connected indices for the user-defined series in an easy-to-understand manner using computation examples, so as to contribute to the effective and appropriate implementation of economic, energy supply/demand, and other analyses using IIPs.

2. Computation of user-defined series IIPs

Added value may be used as a weight to compute weighted averages of indices as user-defined series of IIPs. For instance, the index for "chemical industry (excluding pharmaceuticals) (1110000000)" may be subtracted from the index for "chemical industry (1109000000)" to compute the index of pharmaceuticals for which there is no official series.[1]

Table 1: Production indices for chemical Industry and chemical industry (excluding pharmaceuticals) (1Q2022)

(100 for 2020)	Weight (added value)	1Q2022
Chemical industry	1233.0	104.9
Chemical industry (excluding pharmaceuticals)	1014.3	103.7

The pharmaceutical production index in the first quarter of 2022 can be computed as (104.9*1233.0-103.7*1014.3)/(1233.0-1014.3)=110.5.
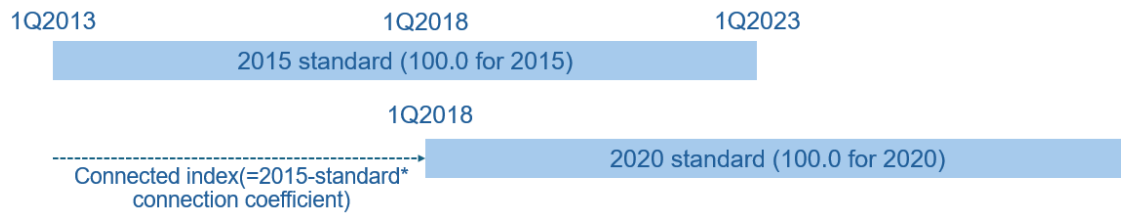
3. Connection coefficients and connected indices[2]

However, the IIP standard is updated every five years to reflect the latest industrial structure. In the latest update, the 2020 standard was adopted in June 2023. Based on each standard, official series for up to 10 years are published. As a matter of course, however, indices based on different standards cannot be compared. On the other hand, indices that are comparable over 10 years may not be sufficient for long-term analysis. Used in such a case is a connected index obtained by converting the old-standard index to the new-standard index.

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[1] IIPs include production, shipment, inventory, production capacity, and capacity utilization rate indices. In the following, however, production indices alone are used.

[2] See "Outline of IIPs (2020)" by the Economic Analysis Office, Research and Statistics Department, Minister's Secretariat, Ministry of Economy, Trade and Industry, at
https://www.meti.go.jp/statistics/tyo/iip/gaiyo.html#cont3 (accessed on April 3, 2024), and
"Structure and Interpretation of IIPs (2014)" by the Economic Analysis Office, Research and Statistics Department, Minister's Secretariat, Ministry of Economy, Trade and Industry, at
https://www.meti.go.jp/statistics/tyo/iip/pdf/b2010_mechanism_iipj.pdf (accessed on April 3, 2024)

Figure 1 Illustration of connection coefficient and connected index

A connection coefficient is used to adjust the index under the old standard to the new standard to compute a connected index. The old-standard index is multiplied by the connection coefficient computed with the following equation to determine the connected index comparable to the new-standard index.[3] When either the original index or the seasonally adjusted index is connected, the seasonally adjusted index is used to compute the connection coefficient.

$$\text{Connection coefficient} = \frac{\text{New-standard Jan-Mar average index 2 years before a new standard year}}{\text{Old-standard Jan-Mar average index 3 years after an old standard year}}$$

A connection coefficient to convert a 2015-standard index to a 2020-standard index is computed from the index for the first quarter of 2018.[4] For example, the connection coefficient for converting the 2015-standard index for the chemical industry to the 2020-standard index is 109.8/104.3 = 1.053 as shown in the table below:

Table 2 Chemical industry index (1Q2018)

	1Q2018
2015 standard (100 for 2015)	104.3
2020 standard (100 for 2020)	109.8

For representative industries and goods, however, connected indices have been published for a certain period of time. If they are sufficient, there is no need for analysts to compute connection coefficients or connected indices by themselves.

4. Computing connected indices for user-defined series

When user-defined series indices computed according to Section 1 are used for long-term comparison, their connected indices may have to be created. In this regard, a common mistake is to synthesize or decompose published connected indices to compute user-defined connected indices. For instance, the connected index for the chemical industry under the 2020 standard in the first quarter of 1978 is published as 44.4 and that for the chemical industry (excluding pharmaceuticals) as 65.9. If the weight under the 2020 standard is mistakenly used to compute the connected index for pharmaceuticals, a negative figure ((44.4*1233.0-65.9*1014.3)/(1233.0-1014.3)=-55.3) may be produced as an incomprehensible value.

When a user-defined connected index is created, the same procedures as those for using a connection coefficient for a user-defined index may be taken as follows:

(1) Create a new-standard user-defined index

(2) Create an old-standard user-defined index

(3) Compute a connection coefficient from the new- and old-standard user-defined indices shown in (1) and (2)

(4) Compute a user-defined connected index from the old-standard user-defined index in (2) and

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[3] However, it should be noted that the connected index is only for convenience.

[4] While connection coefficients for IIPs are described above, it should be noted that connection coefficients for consumer price and other indices are different from them. (See: https://www.stat.go.jp/data/cpi/2020/kaisetsu/pdf/3-6.pdf)

the connection coefficient in (3)

Figure 2 Procedures to compute the connected index for a user-defined series from Series A and B
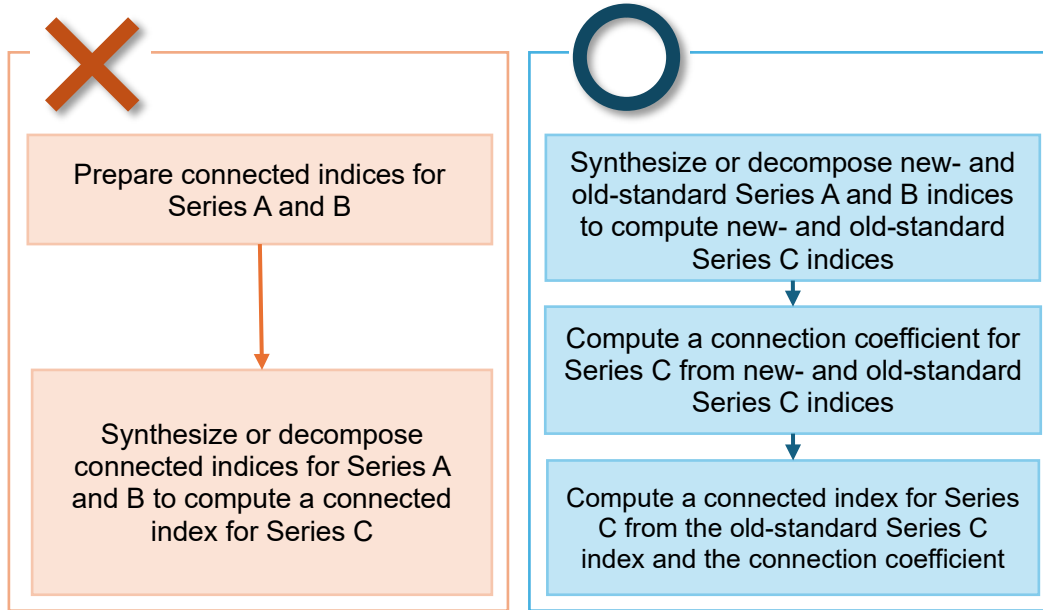
The following case is for computing a 2020-standard connected index for pharmaceuticals in the first quarter of 2013:

(1) Create a 2020-standard index for pharmaceuticals

Table 3: 2020-standard indices for the chemical industry and chemical industry (excluding pharmaceuticals) (1Q2018)

(100 for 2020)	Weight (added value)	1Q2018
Chemical industry	1233.0	109.8
Chemical industry (excluding pharmaceuticals)	1014.3	114.0

The 2020-standard index for pharmaceuticals in 1Q2018 is computed as (109.8*1233.0-114.0*1014.3)/(1233.0-1014.3)=90.3.

(2) Create a 2015-standard index for pharmaceuticals

Table 4: 2015-standard indices for the chemical industry and chemical industry (excluding pharmaceuticals) (1Q2013, 1Q2018)

(100 for 2015)	Weight (added value)	1Q2013	1Q2018
Chemical industry	1093.0	97.8	104.3
Chemical industry (excluding pharmaceuticals)	856.0	97.1	107.0

The 2015-standard index for pharmaceuticals in 1Q2018 is computed as (104.3*1093.0-107.0*856.0)/(1093.0-856.0)) = 94.5. Similarly, the index in 1Q2013 is computed as 100.3.

(3) Compute a connection coefficient

Based on the 1Q2018 indices in (1) and (2), the connection coefficient for pharmaceuticals is computed as 90.3/94.5 = 0.955.

(4) Compute the connected index from the 2015-standard index and the connection coefficient

A 2020-standard connected index for pharmaceuticals in the first quarter of 2013 is computed as

100.3*0.955=95.8, which is obtained by multiplying the 2015-standard index in (2) by the connection coefficient in (3).

5. Cases for utilization of user-defined series connected indices

By creating user-defined series connected indices, we can find the long-term trends of various industries and goods. For instance, let us take up a 2020-standard connected index for pharmaceutical production. In the fourth quarter of 2020 amid the COVID-19 pandemic, the index plunged 10.3 points from the previous quarter to 94.9. In the fourth quarter of 2008, just after the bankruptcy of U.S. investment bank Lehman Brothers, which triggered the global financial crisis, the index posted a far slower decrease of 1.0 points from the previous quarter. Even given that the production level at the time of the Lehman bankruptcy was 20-30% lower than the current level, the quarterly fall of 1.0 points is far slower than in the fourth quarter of 2020. The index trend in 2008 indicates that the pharmaceutical industry is less susceptible to economic fluctuations than generally believed, while that in 2020 demonstrates how serious supply chain disruptions under the COVID-19 pandemic were.

Figure 3 2020-standard index for pharmaceuticals
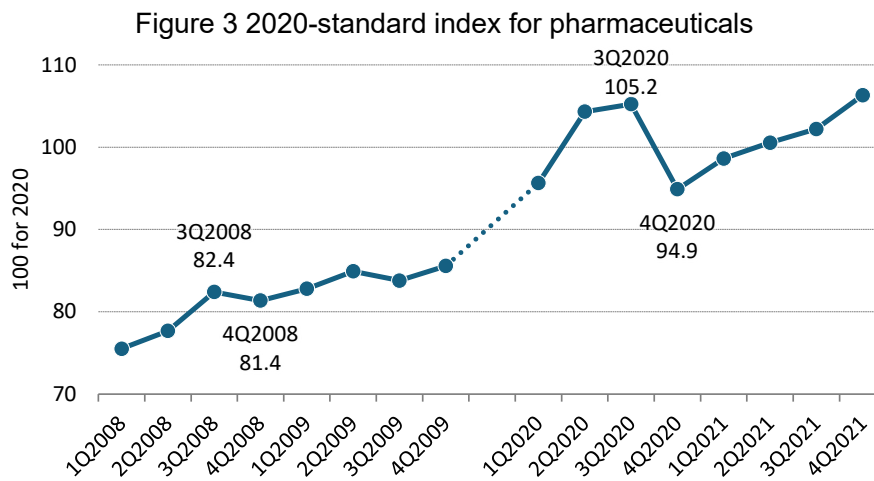
6. Conclusion

Although we computed seasonally adjusted quarterly indices in this paper, the same computation method can be used to calculate connected indices for original indices, as well as calendar-year, fiscal-year, and monthly series. It would be beneficial to use the method summarized above to create user-defined series connected indices for finding long-term trends for industries and goods for which no official indices have been published and for analyzing economic, energy supply/demand, and other trends.

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