Mechanism of and Way to Understand Indices of Industrial Production

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Table of Contents

Introduction

Importance of the Indices of Industrial Production

The Indices of Industrial Production are to systematically grasp activities relating to production, shipment and inventory in Japan. Factories in Japan have manufactured various products, and the Indices of Industrial Production have been prepared as a comprehensive indicator of wide-ranging production activities for such products, and are regarded as some of the most important indices among economic indices.

As well as being used to grasp production trends in mining and manufacturing industries, the indices are utilized to grasp changes in the whole economy from economic activities relating to goods, such as whether products are used as Final Demand Goods or as Producer Goods. Why are the Indices of Industrial Production, such as the Production Index included in them, important for observing movements of the whole economy?

The first reason is that mining and manufacturing industries account for a large part of economic activities in Japan

Though mining and manufacturing industries account for 18% (2012) of the entire economic activities of Japan (GDP), some industries, including the wholesale industry, the retail industry and the transport industry, closely connect with production activities of mining and manufacturing industries as they engage in the economic activity of distributing mining and manufacturing products. For this reason, with these relevant industries are taken into account, the weight of mining and manufacturing industries amounts to approximately 40% of the GDP of Japan.

The second reason is that the Indices of Industrial Production respond sensitively to economic conditions

Production in mining and manufacturing industries shows huge fluctuations depending on economic conditions. Characteristically, it shows significant reactions to the economic situation; for example, production is reduced and inventory adjustment takes place when inventory piles up due to an economic depression. On the other hand, inventory is accumulated in prospect of an expansion of demand when the economic situation improves. Economic fluctuations, such as an inventory cycle, can be understood from the Indices of Industrial Production. On the other hand, tertiary industries such as the service industry do not indicate significant fluctuations, compared with secondary industries such as the manufacturing industry. For this reason, changes in the GDP tend to be generated from the category of mining and manufacturing industries, and movements in the Indices of Industrial Production can indicate the direction of change in the GDP.

The third reason is to do with the swiftness of the indices

A preliminary report on the Indices of Production, Shipments and Inventory is published by late in the following month. Among indices which represent movements of the actual economic activities, these indices are among those published earliest. Further, the Indices of Production Forecast, which are a part of the Indices of Industrial Production, show a prospective Production Index for the next two months. For economic policies and corporate activities, it is extremely important to quickly judge the present economic situation, and the Indices of Industrial Production are widely utilized for this purpose.

Chapter I Outline of the Indices of Industrial Production

Section 1 Mechanism of the Indices of Industrial Production

1. What is an index?

An index is a representation of the magnitude relation of statistics of the same type in the form of a ratio.

The merits are: [1] it is easy to compare
[2] Measurements in different units can be aggregated

For instance, in examining whether a particular economic activity has become active or sluggish, or whether a price has risen or lowered, it is relatively easy to do so in the case of individual items of individual factories and stores. Whether the production of a passenger car, Model A, has increased at a factory, or whether the price of a particular bland beer has risen at a liquor shop can be found out by examining changes in the respective items. However, in the case of a factory manufacturing trucks and motor vehicle parts in addition to passenger cars, an increase in the entire production cannot be observed in a simple manner. Similarly, it is not easy to observe price increase in the whole of a liquor shop whose, if the shop sells soy-sauce products, canned foods as well as beer. Besides, if one extends the geographical scope of his/her examination to the entire Japan or a prefecture in an attempt to cover the overall economic activities, the examination will be very complicated, as not only passenger cars and beer but also entirely different products are produced through different manufacturing processes and are sold through different trading forms under different price structures. To integrate and convert these into numerical data such as the level of production activity and the level of commodity prices in the whole mining and manufacturing industries, it is necessary to exercise statistical ingenuity in various ways.

Monetary amount are often used as a very useful method for expressing the entire scale of a specific activity. Despite different activity forms such as production, consumption and so forth depending on items, the conversion of such forms into monetary forms, namely a production value and an amount of consumption, is to organize them into common units, enabling the size of the entirety to be expressed by aggregating them. However, the method of conversion into monetary amounts does not help judge, for example, whether increase in the production value is due to increase in the production quantity or simply due to increase in the relevant prices. This is because monetary fluctuations are made up of quantitative changes as well as price changes. In addition, it is difficult to judge whether increase in the consumption expenditure of households is due to increase in the volume of consumption of goods or due to increase in prices. Indices such as the “quantity index” and the “price index” are regarded as some of the tools to be used to find out whether such fluctuations are due to increase in the volume of production or consumption, or due to increase in prices.

Furthermore, though indices are utilized mostly for temporal comparisons (for instance, the situation one month ago or one year ago), they are also employed for geographical comparisons (for instance, between Prefecture B and Prefecture C).

2. Quantity Index and Price Index

Monetary fluctuations are made up of price fluctuations and quantitative fluctuations. However, it is not clear whether a fluctuation is generated due to increase in the price or in the quantity.

Amount of Money = Quantity x Unit Price

Consequently, indices are regarded as a statistical tool to express such fluctuations on an individual basis.

The index showing price fluctuations is called a price index (or goods price index). Typical indices of this type include the Corporate Goods Price Index (CGPI) and the Consumer Price Index (CPI). In contrast, the index showing quantitative fluctuations is called a quantity index. Typical indices of this type include the Indices of Industrial Production.

As monetary fluctuations are logically mixtures of quantitative fluctuations and price fluctuations, amounts of money are often divided by a price index to convert them into a series without price fluctuations contained in it. In this case, the original monetary series is called the "nominal amount," the series after the division by a price index is called the "real amount," and the price index used is called the "deflator." The monetary series is often converted into a ratio which is 100.0 in the base period, and the index using the monetary series is called the "Nominal Amount Index," and the index using the real amounts is called the "Real Amount Index." The Real Amount Index is the same as a quantity index on a conceptual basis. In the Indices of Industrial Production, this Real Amount Index is applied to some items.

However, the multiplication of the relevant goods price index by the quantity index does not necessarily accord with the Nominal Amount Index. This is because of the fact that the Indices of Industrial Production, and the goods price index which is a deflator observe different, respective economic activities, and thus the consistency of the weights and selected items among such indices is not secured. Consequently, as often it is not possible to find a price index whose defined scope of items corresponds to that of the Indices of Industrial Production, or which is applicable to an extent similar to the Indices of Industrial Production, nominal amounts are used for some items. It requires attention when these indices are observed together.

Real Amount	**=**	**Nominal Amount**	**÷**	**Price Index**
↑		↑		↑
Excluding price fluctuations		**Including price fluctuations**		**Deflator**

3. What are the Indices of Industrial Production?

- The Indices of Industrial Production are quantity indices representing quantitative fluctuations excluding price fluctuations.

- It is expressed in the form of a ratio with 100.0 in the base period. The base period for the current Indices of Industrial Production is the year 2010.

  Their coverage is mining and manufacturing industries, from which representative products are selected. In the indices, the levels of the production and shipment quantities of such products in the base period are set as 100.0.

- These indices created according to individual items are called “individual indices.” The weights which indicate the importance levels of items and industries are applied to the individual indices to calculate their weighted averages, and the resultant indices representing the entire mining and manufacturing industries are called, “integrated indices.” Weights are calculated on the basis of the monetary amounts in the base period.

- Apart from such individual indices and integrated indices, “indices by industry” are created, which include such industries as the iron and steel and the transport equipment as these constitute breakdowns of the integrated indices. Furthermore, “indices by use of goods” are created by restructuring goods according to economic usage of goods, which include the classification by Investment Goods and that by Consumer Goods.

Three Elements of Indices

1. Base Period
2. Selected Items
3. Weights

4. Base Period for Indices

The base year is 2010.

Both individual indices which show changes in each item and integrated indices which show changes in the whole are expressed in the form of a ratio which is 100.0 in the base period. Further, weights are prepared on the basis of the statistics in 2010. The base period is set as the year 2010 uniformly not only for the Indices of Industrial Production but also for other indices such as the CGPI, CPI and Trade Index. The reason for this uniform base period is to enable comparisons and integration processing to be implemented smoothly when indices mutually refer to each other.

However, the base year of the Input-Output Table (Basic Table), which is created by using various statistics just like indices, has been changed, as the survey year of the Economic Census was set for 2011.

Grounds

The "Statistical Standards for Indices as of the base period" (the Establishment of Statistical Standards in March 2010) have determined, "The base period for indices shall be updated every five years and shall be those years whose last digit in the western calendar is either 0 or 5."

Accordingly, the new base period was set for 2010 after the previous base year of 2005. Through the update of the base period, indices have been set as 100.0 as of the new base year. At the same time, weights have been revised to be adapted to the industrial structure in the new base year, and items have been replaced with those reflecting recent economic activities.

Necessity of Revision

As weights are fixed at the base year, indices may lose touch with the actual industrial structure and represent a distorted version of the actual situation, since the prices of items and the industrial structure change each year. Besides, when those items which did not exist or had little effect on the whole at the time of the base year have developed significantly later, indices are required to be calculated with such items, otherwise indices may end up as an insufficient reflection of recent activities. Consequently, it is necessary to update the base period after an adequate period of time. For this reason, a revision takes place every five years. However, as changes in the industrial structure occur rapidly in recent years, weights are updated annually rather than being fixed for five years, in order to use them as reference to see whether the current indices accurately catch the actual situation. That is to say, the annual "chain index" which utilizes the weights of the year previous to the year concerned is prepared for reference.

5. Monthly Data and Selected Items

Monthly data mainly originate from the Current Production Statistics

There is an extremely wide range of product types produced from production activities of mining and manufacturing industries. It is virtually not possible to conduct a survey on all of such products monthly and prepare indices covering all the products. Therefore, among such products, main products representing respective economic activities are chosen as the selected items. Indices are prepared to express transitions of the whole on the basis of changes in these particularly selected items.

"The Current Production Statistics Survey" conducted monthly by the Ministry of Economy, Trade and Industry (METI) is a large-scale statistical survey on production activities for products of mining and manufacturing industries. This statistical survey covers a very wide range: the production of products of those mining and manufacturing industries under the control of the METI, the actual shipments, inventory and production capacity with regard to such products, the status of facilities, etc. A large part of the monthly basic data for the Indices of Industrial Production is obtained from the aggregate values of the statistical survey. However, for the purpose of preparing the Indices of Production Forecast, the "Survey on Production Forecast in Manufacturing" is conducted separately.

Selection of Items

With work efficiency taken into account, the Indices of Industrial Production adopt over 60% of the number of the items used in the Current Production Statistics as the items for the indices, in order to make the indices represent activities of the whole with as few items as possible. Specifically, all the items of the Current Production Statistics are lined up in descending order of their production values according to industry type, the items are added up in that order until the aggregate value reaches approximately 90% of the whole industry, and those added items are adopted as the selected items. As the Current Production Statistics covers approximately 60% of the domestic manufacturing industry, the representativeness rate of the Indices of Industrial Production in the entire mining and manufacturing industries amounts to approximately 57%.

Moreover, items are examined comprehensively in the selection; items expected to develop or decline and future trends of new products are taken into consideration. However, although this approach is sufficient in terms of its coverage of the entire mining and manufacturing industries, items must be selected in a way that ensures the representativeness of the indices from the aspect of its classification by industry as well as by use of goods. The distribution condition of items is not the same for each classification, and thus the further the classification is sub-divided, the more it is necessary to increase the number of the selected items.

Items outside Jurisdiction

In relation to items not covered by the Current Production Statistics, the statistical data of such items are obtained in cooperation with other ministries and agencies (the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Land, Infrastructure, Transport and Tourism, and the Ministry of Health, Labour and Welfare) and private organizations (brewers' associations, Japan Sugar Refiners' Association, etc.) taking relevant statistics.

Nearly 10% of the entire items of the 2010-based indices are data from other organizations, which include items relating to rail vehicles, medicinal products and foods.

6. Number and Units of Selected Items

Number of Selected Items

The number of the selected items for the Production Index is 487 items for the entire mining and manufacturing industries. Among these items, the Current Production Statistics prepared by the METI are used for 447 items, and other sources are used for 40 items. The number of the selected items for the Production Index is the same as the number for the Index of Shipments, however the same number for the Index of Inventory is 348 items, relatively fewer than the number for the Production Index etc. This is because there are some made-to-order products whose inventory is not required and those items whose inventory data cannot be obtained. Furthermore, the Index of Inventory Ratio excludes those items with peculiar changes and thus contains 336 items, which is 12 items less than the number for the Index of Inventory.

Units of Selected Items

With regard to the measurement units of 487 items adopted to the Production Index, weight units such as ton are used for nearly 50% of the items, and the number of machines, pieces and so forth are used as units for nearly 30% of the items. In addition, volume units, such as kiloliter and square meter, and monetary amounts are used as measurement units. Among the items, approximately 10% use monetary amounts as their measurement units. The reason for using monetary amounts as a unit is that a simple aggregation of quantities may be regarded as inappropriate for expressing production activities in the case of a mix of things with different qualities existing under one item. However, as fluctuations in monetary amounts include fluctuations in both quantity and price, price fluctuations are also contained in this case. Hence, the CGPI of the Bank of Japan is used to exclude price fluctuations, thereby adjusting monetary amounts to reflect only quantitative fluctuations.

(Refer to p.3 “1-1-2 Quantity Index and Price Index”)

Long-term Products

The production of some industrial products takes two months or sometimes one year or longer from start to completion. Such products are called “long-term products.” In the Current Production Statistics Survey, such products are appropriated as production at the time of the completion of their production. However, appropriating all of the production activities at the time of completion is not appropriate, since the activities are carried out throughout the period from the start of production to the completion. From the series of the Production Index, the monthly production quantity (the quantity of activities) is required to be used. Consequently, the “monthly progress quantity” is surveyed in the Current Production Statistics Survey.

Among all the items of the Production Index, four items adopt the “monthly progress quantity.”

7. Formula for Calculating the Indices

There are some different formulas for indices such as the "Laspeyres formula," the "Paasche formula" and the "Fisher formula." For the Indices of Industrial Production, the Laspeyres Formula is adopted.

Firstly, given that p: Price, q: Quantity, n: Number of Items, t: Compared Time and Base Period: $t = 0$, the total value in the base period is:

$\sum_{i=1}^{n} p_{i0}q_{i0} = p_{10}q_{10} + p_{20}q_{20} + p_{30}q_{30} + p_{40}q_{40} + \cdots p_{n0}q_{n0}$

After omitting the number of items (n),

$= \sum p_0 q_0$

Next, when a given compared time is t, the total value at the compared time is:

$\sum_{i=1}^{n} p_{it}q_{it} = p_{1t}q_{1t} + p_{2t}q_{2t} + p_{3t}q_{3t} + p_{4t}q_{4t} + \cdots p_{nt}q_{nt}$

After omitting the additional character for items in the same manner,

$= \sum p_t q_t$

Accordingly, when the value index is Vt at the time of t, then:

$$Vt = \frac{\sum_{i=1}^{n} p_{it}q_{it}}{\sum_{i=1}^{n} p_{i0}q_{i0}} = \frac{\sum p_t q_t}{\sum p_0 q_0}$$

Meanwhile, changes in the value (= the quantity x the price) can be limited to quantitative changes by replacing the price at the compared time with the price in the base period. This formula is called the "weighted arithmetic average method based on weights fixed in the base period" = the Laspeyres formula, which is expressed in the following formula:

$$Q_t^{L} = \frac{\sum p_0 q_t}{\sum p_0 q_0}$$

For the Indices of Industrial Production, this formula is adopted.

The Laspeyres formula index calculates prices at the compared time by using the prices in the base period, and consequently the index does not express the status of activities in the case of significant changes in price between the base period and the compared time. A distortion of this kind is called "bias", and on the basis of the formula, it is called "Laspeyres bias."

Normally, as prices tend to lower often due to mass production, overvalues may be caused by using the prices in the base period in which the relevant unit prices are higher than those at the compared time. Therefore, it is usual that there will be upward bias. The Indices of Industrial Production have also upward bias when a time point is far from the base period. For this reason, a base revision takes place every five years.

8. Calculation of Weights

Weights indicate the importance levels of items and industries relative to the entire mining and manufacturing industries. Specifically, it is the composition ratio of the values of economic activities to be observed, such as production and shipment, in the base period. Weights are calculated from the composition ratio of the relevant monthly average value in the base period: for the Production Index based on value added weights, the monthly average value added in 2010; for the Index of Shipments, the monthly average of the shipment value in 2010. As reference data, the Census of Manufactures is used in preparing weights for the manufacturing industry, and the "Economic Census for Business Activity"* is used in preparing weights for the mining industry. Besides, some parts are calculated with supplementary materials such as the Current Production Statistics with some improvements and adjustments. The value added and the production value of the manufacturing industry are calculated in the following manner on the basis of the survey items of the Census of Manufactures. For the mining industry, the calculation of weight is performed in line with the Trends of the Japanese Mining Industry.

Formulas for Production Value and Value Added

Production value = Value of shipments etc.
+ (Year-end value of product inventory
- Value of product inventory at the year beginning)
+ (Year-end value of semi-manufactured goods and unfinished products
- Value of semi-manufactured goods and unfinished products at the year beginning)

Value added = Production value - Internal excise tax included in Value of shipments
- Cost of raw materials, fuels and electricity consumed, and subcontracting orders
- Depreciation

Inflation

In preparing the Indices of Industrial Production, not all the products of the domestic mining and manufacturing industries can be adopted as the selected items. Accordingly, an issue arises as to how to deal with no-selected industries (those industries whose item is not selected) and the value of the items of non-selected industries. In the Indices of Industrial Production, non-selected industries are represented by the selected industries.

Specifically, the "inflation of industry" and the "inflation of individual items" are performed in the calculation of weights. The inflation of industry is to add non-selected industries to the selected industries (inflating the selected industries). The inflation of individual items is to add the weights of non-selected items of an industry to the selected items of the same industry. If weights are calculated only on the basis of the selected items, the weights of those industries with a high number of the selected items become large. As a result, changes in products of the industries of Iron and steel and Chemicals are reflected in the whole more than the actual situation, as the two industries adopt items meticulously for each of their production stages. On the other hand, changes in products of Machinery industry are reflected rather weakly in the whole, as its selected items are relatively rough despite an actually high number of its product items. For this reason, changes in non-selected items of Machinery industry, such as the item on intermediate processed products, are represented by changes in finished products by using inflated weights. The same applies to industries; inflated weights allow changes in non-selected industries to be reflected in the whole.

* The "Trends of the Japanese Mining Industry" was an annual survey conducted until 2005, and now it is conducted every five years within the framework of the "Economic Census."

[Reference]

Weights by Industry for Indices of Production, Shipments, Inventory and Inventory Ratio

Industry Type	Production (Value Added)	Shipments	Inventory	Inventory Ratio
Mining and manufacturing	10000.0	10000.0	10000.0	9617.5
Manufacturing	9978.9	9985.7	9988.1	9690.8
Iron and steel	391.1	638.7	1382.7	1327.4
Non-ferrous metals	232.5	322.5	306.5	306.5
Fabricated metals	418.1	366.7	435.0	410.7
General-purpose, production and business oriented machinery	1273.1	1085.6	1127.1	1082.5
Electronic parts and devices	818.6	711.1	368.3	368.3
Electrical machinery	667.7	570.5	371.0	235.6
Information and communication electronics equipment	453.4	489.5	234.2	234.2
Transport equipment	1912.4	2218.9	1013.1	1013.1
Ceramics, stone and clay products	315.8	221.6	643.2	624.3
Chemicals	1277.4	1040.9	1413.1	1413.1
Petroleum and coal products	175.8	624.8	497.5	497.5
Plastic products	507.5	421.2	661.4	661.4
Pulp, paper and paper products	203.6	212.2	340.3	321.5
Textiles	183.4	133.4	421.3	421.3
Foods and tobacco	613.9	579.3	326.5	326.5
Other manufacturing	534.6	348.8	446.9	446.9
Rubber products	161.0	126.7	141.2	141.2
Furniture	67.3	54.7	100.9	100.9
Printing	197.1	68.1	—	—
Wood and wood products	58.4	57.4	126.4	126.4
Other products	50.8	41.9	78.4	78.4
Mining	21.1	14.3	11.9	11.9
<Reference>				
Industries (Mining and manufacturing, Electricity and gas, Heat supply and Water)	10607.1	10837.4	10000.0	9702.7
Electricity and gas	560.0	692.9	—	—

Note: Although the weights of the "Index of Inventory Ratio" by item are the same as those of the Index of Inventory, the value for "Mining and manufacturing" is not 10000.0 because some items are not the selected items.

9. Individual Index and Integrated Index

Individual Index

The index for an individual item can be easily calculated by dividing its production quantity or price by its actual value in the base period and subsequently by multiplying it by 100. This actual value in the base period is called the “base quantity” or “base price,” and the index of the quantity or price of such individual item is called the “individual index”.

Integrated Index

The index which organizes individual indices into overall values is called an “integrated index,” and the method for this organization is called the “integration formula” or simply a formula. There are various methods devised for the integration formula, and calculation results vary depending on which formula is adopted. Quantity and price fluctuations of individual items can be obtained from actual values, such as the production quantities and prices, without making such values into an index. That is to say, an index is devised originally for the purpose of preparing an integrated index, and an individual index is just an element for preparing an integrated index.

Selection of Formula

To more appropriately express the status of those economic activities for which observation is desirable, and to prepare an index which enables operational efficiency, the selection of a formula to adopt is an extremely important matter. The Indices of Industrial Production adopts the weighted arithmetic average method based on weights fixed in the base period, which comprehensively calculates the weighted averages of individual indices on the basis of the weights of the base period. This formula is called the Laspeyres formula, used for the CGPI and the CPI. Alternatively, there is a method called the Paasche formula whose comprehensive calculation involves the replacement of weights for each observation time point rather than fixing them in the base period. However, it usually requires a huge workload and time to calculate weights in order to adopt the Paasche formula, and thus the release timing is significantly affected. The advantage of the Laspeyres formula is that weights are not required to be calculated for each calculation as it fixes weights in the base period. Accordingly, the Laspeyres formula does not take time to calculate indices and enables efficient preparation of timely indices.

(Refer to p.8 “1-1-7 Formula for Calculating the Indices”)

Original Indices and Seasonally-Adjusted Indices

Those indices which are calculated from actual monthly values are called “original indices,” and further called “individual original indices” or “integrated original indices.” Meanwhile, those indices from which seasonal fluctuations repeating in the same manner every year in a one-year cycle are removed are called “seasonally-adjusted indices,” and further called “seasonally-adjusted individual indices” or “seasonally-adjusted integrated indices.” Seasonally-adjusted integrated indices are calculated directly from integrated original indices. (Refer to p.28 “Chapter I Section 3 Seasonal Adjustment”)

10. Calculation of the Indices

There are two methods for preparing an integrated index by adding up individual indices: one is "weighted average method" with use of weights, and the other is the "method of summation" that adds up amounts of money. The calculation procedure of each of the two methods are explained below with specific example values.

Suppose that the production of steel materials and passenger cars in one region in October and November 2013 would be as follows. Also, suppose that there would be no production of other items, or, even if there was such production, the level of its effects on the production of the whole would be ignorable. How much would the mining and manufacturing production in this region increase in November in comparison with the previous month? Compare it by calculating the Production Index based on the production value weights.

	Production Quantity of Steel Materials	Production Quantity of Passenger Cars	Individual Index for Steel materials	Individual Index for Passenger Cars
October 2013	8496 thousand tons	932 thousand cars	105.4	110.3
November 2013	7989 thousand tons	864 thousand cars	99.1	102.2
Monthly average quantities in 2010	8058 thousand tons	845 thousand cars	100.0	100.0
Monthly average unit prices in 2010	52 thousand yen/ton	1420 thousand yen/car	—	—

(1) Weighted average method

[1] Calculation of Weights

Calculate weights from the composition ratio of the production values by item in 2010. Suppose that the monthly average production quantity of steel materials in 2010 was 8058 thousand tons and that of passenger cars was 845 thousand cars. Also, suppose that their average prices in the same period were 52 thousand yen per ton and 1420 thousand yen per car, respectively.

The monthly average production values in 2010 were:

Production value for steel materials	8,058 thousand tons × 52 thousand yen/ton	=	419,016 million yen (25.9%)
Production value for passenger cars	845 thousand cars × 1420 thousand yen/car	=	1,199,900 million yen (74.1%)
Total			1,618,916 million yen (100.0%)

Accordingly, the production value weights were 25.9% for steel materials and 74.1% for passenger cars.

[2] Calculation of the Individual Indices

Next, calculate the 2010-base individual indices for steel materials and passenger cars in October and November 2013. As the base is 2010, divide the actual values of each month by the respective monthly average production quantities in 2010. In so doing, the actual values in the base period are called “base quantities” (or “base prices” in the case of a price index). Indices are usually rounded off to one decimal place and expressed up to one decimal place.

[Individual Indices]

	October 2013	November 2013
Steel materials	$\frac{\text{8496 thousand tons}}{\text{8058 thousand tons}} \times 100.0 = 105.4$	$\frac{\text{7989 thousand tons}}{\text{8058 thousand tons}} \times 100.0 = 99.1$
Passenger cars	$\frac{\text{932 thousand cars}}{\text{845 thousand cars}} \times 100.0 = 110.3$	$\frac{\text{864 thousand cars}}{\text{845 thousand cars}} \times 100.0 = 102.2$

[3] Calculation of the Integrated Index

By using the weights calculated in [1], weight and average the individual indices to calculate the integrated index.

[Integrated Index]

	October 2013	November 2013
Steel materials	$0.259 \times 105.4 = 27.3$	$0.259 \times 99.1 = 25.7$
Passenger cars	$0.741 \times 110.3 = 81.7$	$0.741 \times 102.2 = 75.7$
Total	109.0	101.4

As a result, the integrated Production Index for Mining and manufacturing in the region were 109.0 in October 2013, and 101.4 in November 2013. Compared with the previous month, the production in November was $101.4 \div 109.0 = 0.930$, meaning that a fall by 7.0% was indicated.

The method of preparing an integrated index by creating weights from the composition ratio of values in the base period and subsequently by multiplying the individual indices at the compared time by such weights is called the “weighted average method.”

(2) Method of Summation

[1] Calculation of Production Values

Calculate the production values by multiplying the production quantities in each month by the average prices in the base period in 2010, and add them up.

	October 2013	November 2013
Steel materials	8496 thousand tons × 52 thousand yen/ton = 441,792 million yen	7989 thousand tons × 52 thousand yen = 415,428 million yen
Passenger cars	932 thousand tons × 1420 thousand yen/ton = 1,323,440 million yen	864 thousand tons × 1420 thousand yen = 1,226,880 million yen
Total	1,765,232 million yen	1,642,308 million yen

Therefore, the actual production values as of October and November 2013 on the basis of the price assessment of 2010 were 1,765,232 million yen and 1,642,308 million yen, respectively.

[2] Indexation of Production Values

The monthly average production value in 2010 was 1,618,916 million yen. Convert the actual production values calculated in [1] into 2010-base indices.

October 2013

$$\frac{1{,}765{,}232 \text{ million yen}}{1{,}618{,}916 \text{ million yen}} \times 100.0 = 109.0$$

November 2013

$$\frac{1{,}642{,}308 \text{ million yen}}{1{,}618{,}916 \text{ million yen}} \times 100.0 = 101.4$$

As shown above, the method for preparing an integrated index by assessing the quantities at the time point to be observed on the basis of the prices in the base period, converting them into amounts of money and subsequently adding them up is called the method of summation.

(3) Methods of Summation and Weighted Average

Please compare the calculation results of the two integrated indices. Despite the two different calculation methods, the results are the same. This means that, in the integrating calculation of quantity indices, the two methods concerned are the same: the method that calculates the weighted arithmetic averages of individual indices on the basis of weights from the composition ratio of values in the base period, and the method that converts the quantity of each item into an amount of money according to its price in the base period, adds up such amounts and divides them by the amounts in the base period.

$$Q_t = \frac{\Sigma p_0 q_t}{\Sigma p_0 q_0} = \frac{\Sigma p_0 q_0 \times \left(\frac{q_t}{q_0}\right)}{\Sigma p_0 q_0} = \Sigma \frac{p_0 q_0}{\Sigma p_0 q_0} \times \left(\frac{q_t}{q_0}\right) = \Sigma \frac{w_0}{\Sigma w_0} \times \left(\frac{q_t}{q_0}\right)$$

↑ Method of Summation

↑ Weighted Average Method
The method to integrate individual indices by using weights

q_0 = Individual quantity in the base period　　p_0 = Individual unit price in the base period
q_t = Individual quantity at the compared time　　w_0 = Individual weight (composition ratio of values by item in the base period)

In actual calculation of indices, the weighted average method is employed in many cases with the simplicity of its calculation and its controllability taken into consideration. The Indices of Industrial Production are also calculated with this method.

11. Classification by Industry and the Japan Standard Industry Classification

The basic classification used for the Indices of Industrial Production is the classification by industry. This is created in conformity with the "Japan Standard Industry Classification."* The Japan Standard Industry Classification was established as the uniform classification standard to make mutual comparisons of industrial statistics easy, which classifies industries according to the types of products, production facilities, technology, the types of raw materials, etc. In general, a statistical survey targeting business establishments classifies them into an industry according to their main activity despite the fact various economic activities are conducted in such business establishments. However, the classification of indices by industry is a system to show activities of industries through activities of these industries' items by classifying each of such items into the industry which primarily produces the item.

The main classification system by industry for the Indices of Industrial Production is prepared with the indices' characteristics, such as their convenience of use and limitation with regard to data, taken into account. "Mining" which is a Division under the Japan Standard Industry Classification is an industry in the indices, and the Major groups of "Manufacture of general-purpose machinery," "Manufacture of production machinery" and "Manufacture of business oriented machinery" are organized into an industry. Further, "Rubber products" "Wood and wood products" and so forth whose weights are small, which are organized into the industry of "Other manufacturing." With "Mining and manufacturing" and "Manufacturing," the number of industries in the classification by industry is 19 in total, counting "Other manufacturing" and "Mining" as one industry respectively.

Industrial classification classes are set as sub-levels of the main industrial classification. Such Classes are composed of those according to the detailed classification of the Japan Standard Industry Classification (for instance, "Boilers and power units" under "General-purpose, production and business oriented machinery," and "Household electrical machinery" under "Electrical machinery"), and those restructured for specific analytical purposes (for instance, "(Specially listed) Passenger cars, buses and trucks" and "Transport equipment [excluding ships and ship engines, rail vehicle and aircraft]"). As a result, the number of the main industries and industrial classification classes released in the Indices of Production and Shipments has reached 150. This number is less for the Indices of Inventory and Inventory Ratio, as some industries do not contain a series of sub-classifications relating to inventory.

In addition to "Mining and manufacturing" that represents the activities of the whole mining and manufacturing industries, the reference series named "Industries (Mining and manufacturing, Electricity and gas, Heat supply and Water)" is released, which is composed of the mining and manufacturing industries and the industry sectors of electricity, gas, heat supply and water supply.

The Japan Standard Industry Classification was revised in March 2009 which led mainly "General machinery" and "Precision instruments" to be reorganized into "General-purpose machinery," "Production machinery" and "Business oriented machinery." Despite this, they are listed as reference series in the base revision of 2010 with consideration for their usability in past industrial classifications.

* Prepared by the Ministry of Internal Affairs and Communications As a statistical standard for showing results of a statistical survey by industry, this Classification is to classify all economic activities relating to production or provision by business establishments, aiming to improve the objectivity, mutual comparability and use of statistics.

[Reference]

Main Classifications and Classes by Industry for the Indices of Production, Shipments and Inventory

2000	Mining and manufacturing
2A00	Manufacturing
2AA0	Iron and steel
2AAA	Crude steel (incl. Semi-finished steel)
2AAB	Hot rolled steel
2AAC	Steel pipes and tubes
2AAD	Cold finished steel
2AAE	Metallic coated steel
2AAF	Steel castings and forgings
2AAZ1	(Specially listed: Ordinary steel)
2AAZ2	(Specially listed: Special steel)
2AB0	Non-ferrous metals
2ABA	Refining of non-ferrous metals
2ABC	Copper and copper-base alloys and aluminum rolling products
2ABD	Electric wires and cables
2ABE	Non-ferrous metal castings
2AC0	Fabricated metals
2ACA	Fabricated structural metal products
2ACB	Metal products of building
2ACC	Equipment for heating and kitchen
2ACD	Other metal products
2AD0	General-purpose, production and business oriented machinery
2ADA	General-purpose machinery
2ADAA	Boilers and power units
2ADAB	Fans, pumps and oil hydraulic equipment
2ADAC	Conveying machinery
2ADAD	Refrigerating machines and appliances
2ADAE	Parts of general-purpose machinery
2ADB	Production machinery
2ADBA	Engineering and construction machinery
2ADBB	Chemical machinery
2ADBC	Daily lives industry machinery
2ADBD	Semiconductor and flat-panel display manufacturing equipment
2ADBE	Industrial robots
2ADBF	Agricultural machinery
2ADBG	Metal cutting machinery
2ADBH	Metal forming machinery
2ADBI	Textile machinery
2ADBJ	Molds and dies
2ADBK	Tools for machines
2ADBL	Other production machinery
2ADC	Business oriented machinery
2ADCA	Measuring machine and instruments
2ADCB	Optical equipment
2ADCC	Other business oriented machinery
2AE0	Electronic parts and devices
2AEA	Electronic parts
2AEB	Semiconductor devices
2AEC	Integrated circuits
2AED	Semiconductor parts
2AF0	Electrical machinery
2AFA	Electrical rotating machinery
2AFB	Electrical stationary machinery
2AFC	Switching devices
2AFD	Household electrical machinery
2AFE	Wiring devices and luminaries
2AFF	Associated electronic equipment
2AFG	Electrical measuring instruments
2AFH	Batteries
2AFI	Other electrical machinery
2AG0	Information and communication electronics equipment
2AGA	Communication equipment
2AGB	Household electronic machinery
2AGC	Electronic computers
2AGD	Other information and communication electronics equipment
2AH0	Transport equipment
2AH0	Transport equipment (excl. ships and ship engines, rail vehicle and aircraft)
2AHA	Passenger cars
2AHB	Buses
2AHC	Trucks
2AHD	Bodies for motor vehicles
2AHE	Motor vehicle parts
2AHF	Motorcycles
2AHG	Industrial vehicles
2AHH	Aircraft
2AHI	Ships and ship engines
2AHJ	Rail vehicle
2AHZ	(specially listed: Passenger cars, buses and trucks)

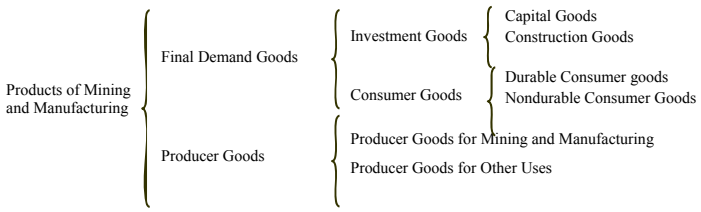
2AI0	Ceramics, stone and clay products
2AIA	Glass and glass products
2AIB	Cement and cement products
2AIC	Ceramics wares
2AID	Fine ceramics
2AIE	Other ceramics, stone and clay products
2AJ0	Chemicals
2AJ0	Chemicals (excl. Drugs)
2AJA	Fertilizers
2AJB	Industrial sodium chemicals
2AJC	Industrial inorganic chemicals, pigment and catalyst
2AJD	High compressed gas
2AJE	Aromatic hydrocarbons (Petroleum origin)
2AJF	Cyclic chemicals and synthetic dyes
2AJG	Industrial organic chemicals
2AJH	Plastic
2AJI	Synthetic rubbers
2AJJ	Sensitive materials for photography
2AJK	Soap, synthetic detergent and surface-active agents
2AJL	Cosmetics
2AJM	Paints and printing inks
2AJN	Drugs and medicines
2AJZ	Specially listed: Petroleum chemical products)
2AK0	Petroleum and coal products
2AKA	Petroleum products
2AKB	Coal products
2AL0	Plastic products
2AM0	Pulp, paper and paper products
2AM0	Pulp
2AM0	Paper
2AM0	Paperboard
2AM0	Converted and processed paper
2AN0	Textiles
2ANA	Carbon fiber
2ANB	Chemical fiber
2ANC	Spun yarn
2AND	Woven fabrics
2ANE	Dyeing and finishing processes
2ANF	Clothes
2ANG	Other textile products
2AO0	Foods and tobacco
2AOA	Meat products
2AOB	Dairy products
2AOC	Processed marine products
2AOD	Processed vegetables and fruits products
2AOE	Oils and fats, seasoning
2AOF	Other foods
2AOG	Beverages
2AOH	Alcohol
2AOI	Tobacco
2AP0	Other manufacturing
2APA	Rubber products
2APB	Furniture
2APBA	Metal furniture
2APBB	Wooden furniture
2APC	Printing
2APD	Wood and wood products
2APE	Other products
2APEA	Watches and clocks
2APEB	Musical instruments
2APEC	Stationery
2APED	Toys
2APEE	Leather products
2B00	Mining
2C01	Industries (Mining and manufacturing, electricity and gas)
2C02	Industries (Mining and manufacturing, electricity, gas, heat supply and water)
2CAA	Electricity and gas
2CAB	Heat supply
2CAC	Water
3410	Machinery industry
3411	Machinery industry (excl. ships and ship engines, rail vehicle and aircraft)
3412	Electrical machinery (former classification)
3416	General machinery (former classification)
3417	Precision instruments (former classification)
3413	Information and technical electronics equipment for capital goods
3414	Information and technical electronics equipment for consumer goods
3415	Information and technical electronics equipment for producer goods

12. Classification by Use of Goods

Apart from the classification by industry, the "Goods Classification Index" is prepared for the Indices of Industrial Production as a special classification system which classifies and reorganizes products according to their original economic usage. This classification divides products of the mining and manufacturing industries into "Producer Goods" which are to be re-input into production activities as intermediate products, and into "Final Demand Goods" which depart from production and are handled as final products.

"Producer Goods" are those goods which are to be reused as raw materials in production activities, and its recipients include not only the mining and manufacturing industries but also widely defined production activities including agriculture, service industries and public services. Those goods used in production activities of the mining and manufacturing industries, such as crude steel which is a raw material for steel materials, pig iron which is the raw material of crude steel, and various parts of electrical products and passenger cars, are classified as "Producer Goods for Mining and Manufacturing." Further, such goods as jet fuel oil used for air transport are classified as "Producer Goods for Other Uses." "Final Demand Goods" are divided into "Investment Goods" for capital formation and "Consumer Goods" for consumption mainly by households. Furthermore, "Investment Goods" are divided into "Capital Goods" for equipment investment which include chemical machinery, metal processing machinery and computers, and "Construction Goods" for construction investment which include cement and aluminum sashes. "Consumer Goods" are also divided into "Durable Consumer Goods" such as television sets, watches and clocks, and into "Nondurable Consumer Goods" such as socks, beer and cosmetics.

Although products to be exported depart from production activities in Japan, they are classified according to their original, economic use in the same manner as above. Therefore, those goods to be used for overseas production activities as raw materials are classified as "Producer Goods."



Classifications	Definitions
Final Demand Goods	Goods which are not input as materials, into mining and manufacturing or other industries.
Investment Goods	Total of capital goods and construction goods
Capital Goods	Products which are purchased by the sectors except for households, provided that, in principle, they have one or more years of an assumed durable term and are purchased at a relatively high unit price.
Construction Goods	Building materials and fixtures accompanying buildings, such as sanitary ceramic wares, and materials for civil engineering projects
Consumer Goods	Products for households
Durable Consumer Goods	Consumer goods purchased by household, which, in principle, have one or more years of assumed durability and are purchased at a relatively high unit price.
Nondurable Consumer Goods	Consumer goods which, in principle, are assumed to have a durable term less than a year, and are purchased at a comparatively low unit price.
Producer Goods	Products which are re-input into mining and manufacturing and other industries as raw materials, including enterprise consumption goods but excluding construction goods
Producer Goods for Mining and Manufacturing	Products which are re-input into mining and manufacturing in the process of production as raw materials, fuels, parts, containers, expendables, tools, etc.
Producer Goods for Other Uses	Raw materials, fuels, parts, containers, expendables and enterprise consumption goods for industries other than mining and manufacturing

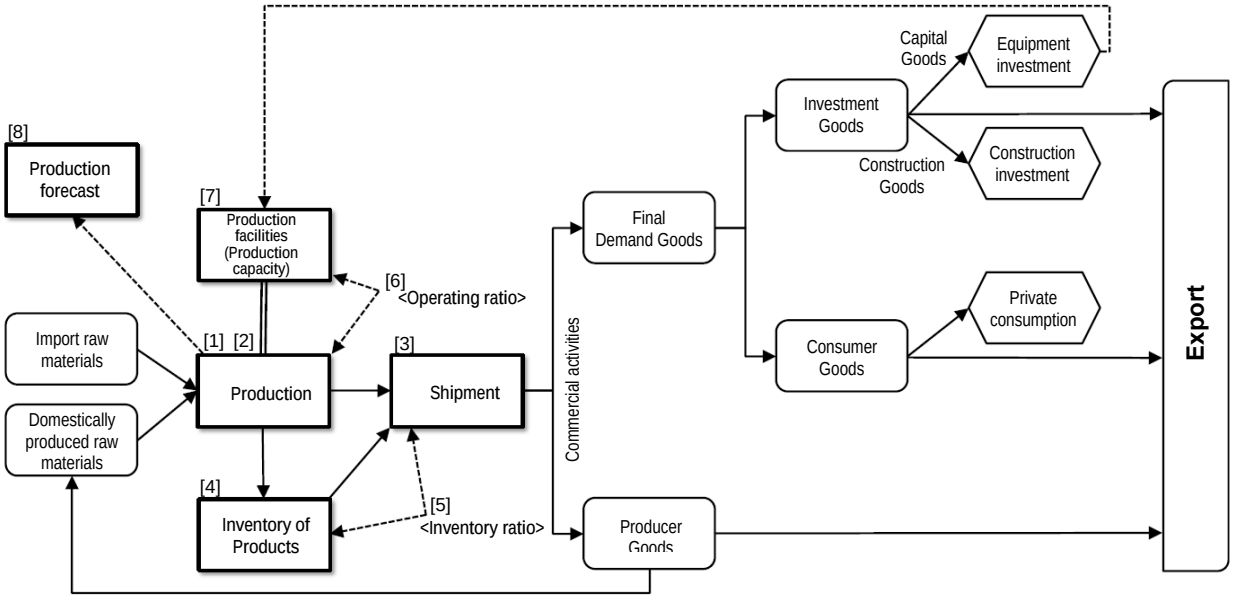
Section 2 Explanation of the Indices of Industrial Production

1. System of the Indices of Industrial Production

(1) Flow of industrial production activities

In Japan, approximately 430 thousand mines and factories* engage in various forms of production activity. The manufacture of products requires facilities and raw materials, depending on production activities. Manufactured products are shipped domestically or overseas directly or through commercial activities. Some products are not shipped and remain as inventory, while the inventory of products manufactured in the previous month or before is shipped. Shipped products can be largely divided into intermediate products to be reused as raw materials or fuels in production activities, and into final products which are, for example, consumed by individuals, or used as construction materials or as parts of production facilities.

Flow of Industrial Production Activities



(Note) The numbers in brackets correspond to "Types of the Indices of Industrial Production" on the next page.

* From the survey results of the Census of Manufactures in 2010 etc. (Ministry of Economy, Trade and Industry)

(2) Types of the Indices of Industrial Production

The eight types of the Indices of Industrial Production listed in the table below have been prepared as a single system to observe transitions of the whole mining and manufacturing activities.

The METI prepares and publishes these indices monthly. Further, eight Bureaus of Economy, Trade and Industry, which are local branch offices of the METI, and each of the prefectures prepare indices covering their own areas. (The METI prepares only [1] and [3] to [5].) (Refer to p.61 "Chapter III Regional Indices")

Types of the Indices of Industrial Production

Index Types	Numbers of Selected Items for the Indices (at the time of Preliminary Report)	Time for Release	
		Preliminary Report	Revised Report
[1] Production Index (value added weight)	487 (459)	○	○
[2] Production Index (production value weight)	487 (459)	○	○
[3] Index of Producer's Shipments	487 (459)	○	○
[4] Index of Producer's Inventory of Finished Goods	348 (341)	○	○
[5] Index of Producer's Inventory Ratio of Finished Goods	336 (329)	○	○
[6] Index of Operating Ratio	160		○
[7] Index of Production Capacity	160		○
[8] Index of Production Forecast in Manufacturing	195	○	

(Note) The numbers in brackets correspond to "Flow of Industrial Production Activities" on the previous page.

Though the term, the "Indices of Industrial Production," means these eight indices in a broad sense, in many cases, it means the Indices of Production, Shipments and Inventory. Further, it may only mean the Production Index (value added weight) in some cases. Moreover, the Indices of Production (production value weight) and Production Forecast in Manufacturing are not designated as key indices.

2. Production Index

It is an index indicating transitions of the level of the entire mining and manufacturing activities, regarded as a main index for the Indices of Industrial Production. It is called "IIP," which is the abbreviation of its English name, "Index of Industrial Production." However, the "IIP" generally means the "Indices of Industrial Production" containing the Indices of Shipments and Inventory.

When the economy in and outside Japan improves, domestic and overseas demand will increase, energizing domestic production activities to meet such demand. On the other hand, when the economy goes into a recession, the situation will become sluggish. As the Production Index accurately represents the status (size) of production activities in each month in Japan, the observation of the index enables the situation of production activities in Japan to be grasped. On this basis, it is regarded as one of the important economic indices.

There are two types of the Production Index: the production value weight type and the value added weight type. As these types of the Production Index actually behave very much in a similar way, it is usual that the Production Index based on value added weights is used, unless in the case of a rigorous analysis. Normally, the Production Index means the one with value added weights, and it is the one published in all newspapers and the like monthly, unless specially stated otherwise.

It converts production quantities classified by item into individual indices and calculates their weighted averages with production value weights or value added weights.

Production Index Based on Production Value Weights

This index involves the values of mining and manufacturing products produced at factories which are aggregated as weights without any change. It is created for the purpose of observing movements of production in an integrated manner by associating them with shipment and inventory.

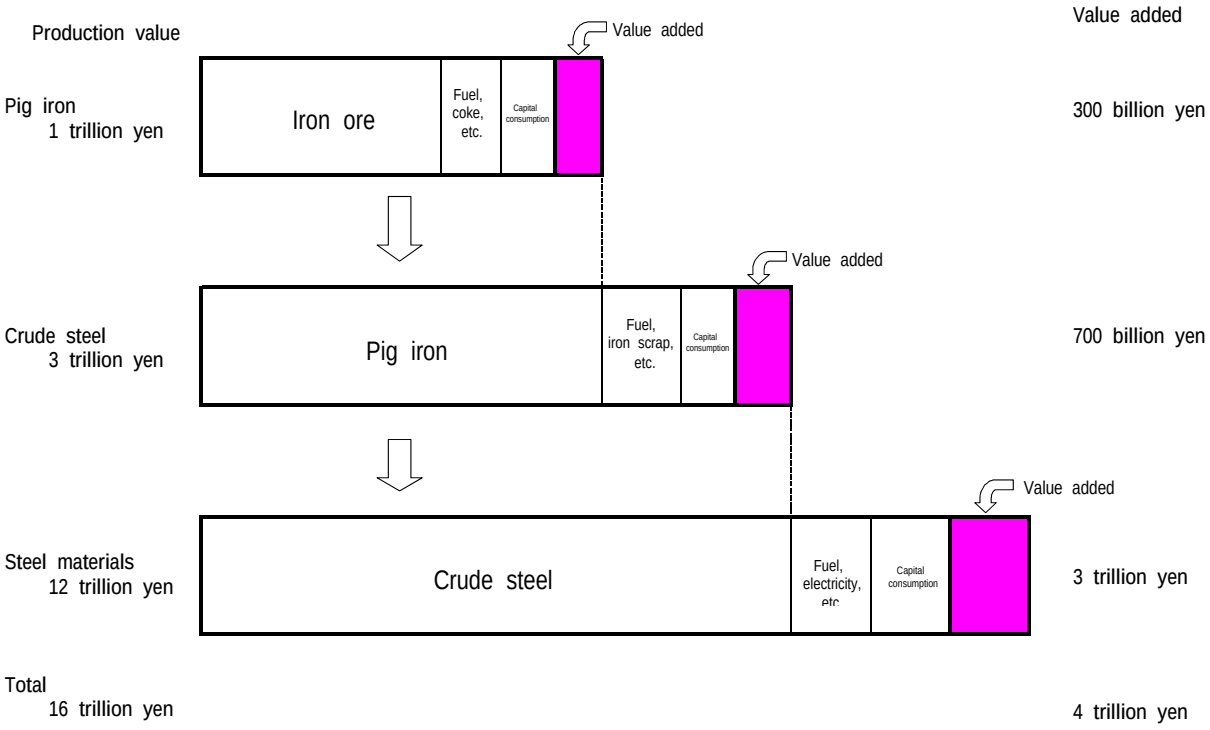
Production Index Based on Value Added Weights

A value added is the value of a mining and manufacturing product (production value) after the costs of raw materials, fuel, electricity and so forth produced by other industries are subtracted from the value. As this index excludes the part of the product's value which is produced by other industries, it leads to the pure production value (the newly created value) of the industry concerned (item). It is possible to find out how much new value is produced by which industry by creating weights with value added. In the case of production value weights, it is difficult to find out how much new value is actually generated, as the production value increases even due to an increased input of raw materials.

What is value added?

Value added is a monetary expression of value newly added in the process of production activities. It is an amount of money after the costs of raw materials and fuel consumption required for production activities are subtracted from the production value and further the amount of wear-and-tear of the machines and equipment used for such production activities is subtracted from the production value. For instance, in the case of the production of passenger cars, steel and painting materials produced by production activities of the industries of Iron and steel and Chemicals are used as raw materials, and the value of these materials is included in the production value. With regard to energy such as electricity and fuel, the cost of the consumption of such energy is also included in the production value. Furthermore, machines and equipment is worn down when production activities are carried out. Accordingly, the true size of production activities cannot be shown unless the costs of raw materials and fuel consumption and the amount of wear-and-tear of machines and equipment are subtracted from the production value of the relevant item. On this basis, the Production Index based on value added weights is used as the index to represent the true picture of production activities.

Relation between Production Value and Value Added



3. Indices of Shipments, Inventory and Inventory Ratio

As is the case for the Production Index, these are important indices indicating trends in the shipment of products manufactured through production activities of the mining and manufacturing industries and the status of inventory of such products.

Index of Producer's Shipments

This index shows the status of trade of mining and manufacturing products (shipment from factories) at the level of the producer. Shipments increase as demand for products grows strong during a period of economic expansion, whereas such demand becomes weak during an economic slowdown leading to decline in shipment. Consequently, it is possible to observe trends in demand by using the Index of Shipments. This index is calculated by converting the shipment quantity by item at the level of the producer into an individual index and by calculating its weighted averages with a shipment value weight.

Index of Producer's Inventory of Finished Goods

This index shows the status of inventory of products remaining in the hands of the producers. Inventory level falls as shipment rises with an economic expansion, and consequently it is necessary to accumulate inventory by activating production. On the other hand, inventory level rises as shipment declines due to an economic slowdown, which requires inventory adjustment by suppressing production. This is what is called an inventory cycle, and movements of the inventory of products are very important in observing the situation of production activities. In addition, as the characteristics of the index, it moves slightly later than economic performance. This index is calculated by creating an individual index of a quantity of inventory classified by item and by calculating its weighted average with an inventory value weight.

(Refer to p.52 "2-1-8 Economic Fluctuations and Inventory Trends")

Index of Producer's Inventory Ratio of Finished Goods

This is an index to plainly show trends in demand for mining and manufacturing products by associating movements of shipment with those of inventory and by observing these movements. With regard to the timing of economic performance, a peak of economic performance tends to antecede an economic trough, and a cyclical bottom tends to slightly antecede a business peak. Consequently, this index is extremely important as a lead indicator of economy in observing economic performance. The calculation of an integrated index employs the method that finds a ratio of the shipment quantity and the inventory quantity for each item, converts it into an individual index and calculates its weighted average based on an inventory value weight.

These indices are simply called "Index of Shipments," "Index of Inventory" and "Index of Inventory Ratio," omitting the words "Producer's" and "Finished Goods."

In addition to such series as indices classified by industry and the index for the overall industry, the classification of these indices by use of goods is prepared, just as is the case for the Production Index.

4. Indices of Operating Ratio and Production Capacity

The Index of Operating Ratio indicates the operation status of each type of facility in business establishments, and the Index of Production Capacity is the indexation of production capacity when various facilities are in full operation. Both of the indices are important in relation to the economic climate and trends in the capital investment of corporations. Their coverage is manufacturing industries, and the mining industry is not covered.

Only the indices classified by industry are released, which cover 35 industries including "Manufacturing." However, their classification by use of goods is not prepared.

Index of Operating Ratio

For each item, the ratio of the potential production quantity with use of the facilities owned by business establishments and the actually produced quantity is calculated and made into an individual index which is set to be 100.0 = the base year. Subsequently, its weighted average is calculated with a value added weight.

Despite a request for the publication of an actual operating rate level which shows full operation as 100, instead of an index form, such level is not currently released. The reason for not releasing it is that although the current Index of Operating Ratio is very much sufficient as an index to observe rise and fall of the monthly operating rate, its precision is not sufficient to examine the overall level of the actual operating rate. However, in a trial calculation, the average actual operating rates in the base period of 2010 were 76.7% for Manufacturing, 77.6% for Machinery industry and 75.3% for Manufacturing excluding Machinery industry. By multiplying these rates by the Index of Operating Ratio as of the relevant time point, it is possible to find a rough indication of the actual operating rate level.

Index of Production Capacity

For each item, an individual index is calculated from the relevant production capacity. Its weighted average is calculated on the basis of the separately estimated, value added production capacity (the value added by item for the relevant unit, which is used in creating the Production Index based on value added weights, × the production capacity) as a weight. Production capacity by item is obtained from the survey item "Production Capacity" of the Current Production Statistics Survey etc. In such survey, a specific calculation method is set for each item after setting uniform calculation standards which are common to the entire production facilities of the manufacturing industry, with an eye on individual activities of the apparatus industry, the processing and assembling industry, etc.

Operating Ratio = Production Quantity ÷ Production Capacity

[Reference]

Mechanism of the Indices of Operating Ratio and Production Capacity

Most of the items whose facilities or capacities are surveyed in the Current Production Statistics Survey are the selected items for the Indices of Operating Ratio and Production Capacity. Although their selected items do not correspond to the number of the items for the Production Index due to discrepancies in the item definition, the number of the selected items for each of the Index of Operating Ratio and the Index of Production Capacity is 160.

Wide ranging production facilities are actually used depending on items, such as furnaces, ethylene plants, assembly lines and weaving machinery. Further, there are cases where one facility is used for producing multiple types of item, and where various facilities are used for producing one type of item. On this basis, it is not easy to measure an operating ratio and production capacity with specific figures, compared with production, shipment or inventory. For this reason, for a production capacity survey, minimum conditions to be unified and standardized are taken into consideration, uniform calculation standards for measurement are set, and on these bases, a calculation method for specific production capacity is determined in accordance with the actual situation of production activities. In light of this, business establishments are asked to report. However, the number of the selected items has become significantly less than that of the Production Index, reflecting the difficulty of the survey.

The Indices of Operating Ratio and Production Capacity covers the industry of Manufacturing, but not Plastic products or Foods and tobacco, though these two industries are covered by the Production Index. Among the industries under “Other manufacturing,” only the industries of Rubber products, Furniture and Stationery are covered. Further, ships and rail vehicle under the industry of Transport equipment, and drugs under the industry of Chemicals are excluded. Regarding classification, only the classification by industry is prepared. As their representativeness rates are lower than that of the Production Index, and their coverage is narrower.

Their weights are as follows: the monthly average value added in 2010 for the Index of Operating Ratio; and the monthly average, estimated, value added production capacity in 2010 (the estimate made by calculating the potential production quantity of each item = capacity, and subsequently by multiplying it by the average unit price and the percentage of the value added) for the Index of Production Capacity.

5. Indices of Production Forecast

The Indices of Production Forecast are to forecast the production in the next two months on the basis of production plans of companies, and are the only indices that quantitatively forecast prospect. Their coverage is Manufacturing, and Mining is not covered.

Although the Indices of Production, Shipments and Inventory are all those indices with regard to past records, the Indices of Production Forecast show companies' present production prospect and their prospective production levels in accordance with their plans. For this reason, the indices are used to judge the prospect of production activities. Each company is asked to monthly report its future production prospect and plans with specific figures, such as the number of machine units, the quantity and weight of its products and so forth. The indices are calculated on the basis of such figures.

With regard to the method of creating the indices, a survey which targets companies actually conducting production activities relating to the main 195 items of Manufacturing is conducted to look into the following production quantities known/expected on the 10th day of each month: "the actual amount in the previous month," "the forecasted amount for the current month" and "the forecasted amount for the following month." With the results of this survey, the Indices of Production Forecast are calculated by creating individual indices and by calculating their weighted averages based on value added weights.

Only the Indices of Production Forecast classified by industry that cover 12 industries including "Manufacturing" are released. Further, the Indices of Production Forecast classified by use of goods are released for reference since the 2010 base. In addition, the Realization Ratio and the Amendment Ratio are calculated and released.

Realization Ratio

This Ratio shows to what extent the amount for the current month forecasted in the previous month has been actualized after one month when the actual figure for the current month is available.

$$\text{Realization Ratio} = \frac{\text{Actual production amount for the previous month in the current forecast survey}}{\text{Forecasted production amount for the current month in the previous forecast survey}}$$

(Note) Calculated from the integrated index

Amendment Ratio

The Amendment Ratio shows to what extent the current month's amount forecasted in the previous month has been revised as the forecasted amount for the current month after one month has passed.

$$\text{Amendment Ratio} = \frac{\text{Forecasted production amount for the current month in the current forecast survey}}{\text{Planned production amount for the following month in the previous forecast survey}}$$

(Note) Calculated from the integrated index

Each company may not always accomplish the forecasted production, changing its production plan according to economic conditions. Therefore, it is possible to observe changes in corporate sentiment with regard to production activities by referring to transitions of the Realization Ratio and the Amendment Ratio.

[Reference]

Comparison of Indices Classified by Industry

2010-based Classification by Industry	Indices of Production, Shipments, Inventory and Inventory Ratio	Indices of Operating Ratio and Production Capacity	Indices of Production Forecast in Manufacturing
Mining and manufacturing	○	×	×
Manufacturing	○	○	○
Iron and steel	○	○	○
Non-ferrous metals	○	○	○
Fabricated metals	○	○	○
General-purpose, production and business oriented machinery	○	○	○
Electronic parts and devices	○	○	○
Electrical machinery	○	○	○
Information and communication electronics equipment	○	○	○
Transport equipment	○	○	○
Ceramics, stone and clay products	○	○	× (*)
Chemicals	○	○	○
Petroleum and coal products	○	○	× (*)
Plastic products	○	×	×
Paper, pulp and paper products	○	○	△ (Pulp and paper)
Textiles	○	○	× (*)
Foods and tobacco	○	×	×
Other manufacturing	○	○	○ (Other)
Rubber products	○	× (*)	× (*)
Furniture	○	× (*)	×
Printing	○	×	×
Wood and wood products	○	×	×
Other products	○	× (*)	× (*)
Mining	○	×	×
(Reference)			
Industries (Mining and manufacturing, electricity and gas)	○	×	×
Industries (Mining and manufacturing, electricity and gas, heat supply and water)	○	×	×
Manufacturing (excl. Machinery industry)	×	○	×
Machinery industry	○	○	×
Electrical machinery (former classification)	○	○	×
General machinery (former classification)	○	×	×
Precision instruments (former classification)	○	×	×
Electricity and gas	○	×	×
Heat supply	○	×	×
Water	○	×	×

(Note) The industries with "*" indicate that they are partly or wholly included in "Other manufacturing" or "Other."

Abolition of the Raw Materials Index

Among the Indices of Industrial Production, the Raw Materials Index that was prepared to observe trends in raw materials for production activities was abolished after the last index prepared as of December 2000.

The Raw Material Index consisted of the three indices of Raw Material Consumption, Raw Material Inventory and Raw Material Inventory Ratio, covering the industry of Manufacturing.

These indices were created and released for the purpose of precisely grasping the inventory of import raw materials as it was essential to observe the import quantity of such materials and movements of the inventory under the import quota system during and 1960s, which led the indices to focus on material-based industries. On the other hand, despite the fact that processing industries tended to use a wide range of components and items which were handled as raw materials, in comparison with material-based industries, only limited items such as integrated circuits and cathode-ray tubes were regarded as raw materials. As various forms of supply of such component raw materials were available, and as their quality could change significantly, it was extremely difficult to accurately understand them with limited data from the Current Production Statistics Survey.

Meanwhile, the environment surrounding statistical surveys grew tough as there was a strong demand for reduction of the burden on participants required to fill in survey sheets, which further rendered an enhancement of surveys on raw materials difficult.

Against this background, the system of the Raw Material Index turned out to stand apart from the actual situation of industrial activities, with changes in the industrial structure within the economy of Japan. Moreover, the significance of grasping the actual industrial activities through trends in raw materials became small.

For those reasons, the 45-year long Raw Material Index was abolished after the 1995-based index was prepared.

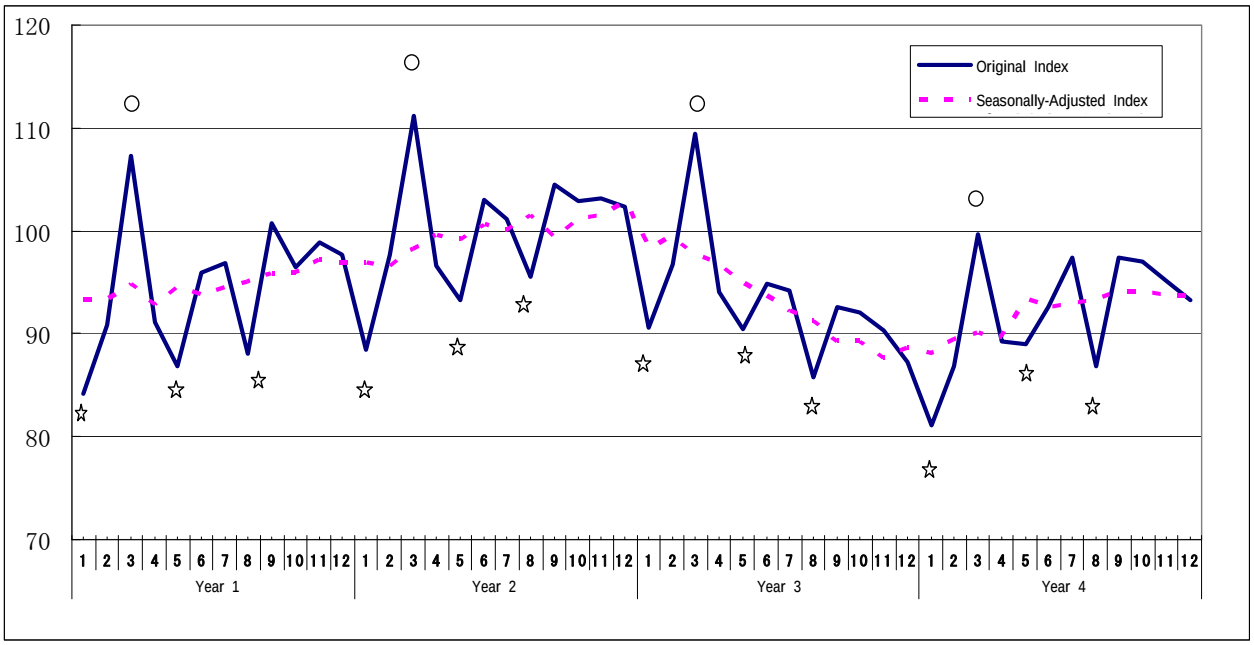
Section 3 Seasonal Adjustment

1. The Indices of Industrial Production and Seasonal Fluctuations

The solid line shown in the graph below indicates monthly transitions of the Indices of Industrial Production during a period of some years. From the graph, it is not easy to understand trends in recent production activities as the monthly fluctuating range was wide. The first glance of the graph gives us an impression that the level of the indices in Year 2 was higher than the level in Year 4, and that the production activities were growing weak from Year 3 through into Year 4. However, a close look at the monthly movements indicates that the level was lower in January of Year 2 than March of Year 4. This does not support the first impression of the graph.

Let us track back the graph more in detail. The level was extremely low in January, May and August of Year 4 (with a star), compared with the months surrounding these. Further tracking-back of the graph shows that the level was also low in January, May and August of Year 3, compared with the months surrounding these. The same trend appeared in Year 1 and Year 2. In contrast, the level in March of Year 4 (with a circle) was higher than in the months surrounding March. A closer look reveals that the level in March was higher than February and April in all Year 3, Year 2 and Year 1. Hence, it is clear that the production activities of the mining and manufacturing industries have a pattern; they fall in January, May and August from the respective previous months every year (they rise in the respective following months: February, June and September from the respective previous months), and rise in March compared with February (they fall in April). Movements repeating in the same manner during a year according to the months every year are called “seasonal fluctuations.”

Monthly Transitions of the Indices of Industrial Production



2. Adjustment in Seasonal Fluctuations

When we look at the graph on the previous page again, it shows that the production activities in January of Year 2 were surely lower than those in March of Year 4. However, in terms of seasonality, the production was the highest in March during a year, whereas it was the lowest in January during a year. In many cases, we observe the indices every month for judging not only the seasonality of the indices but also whether recent trends are upward or downward. A valid conclusion cannot be reached by attempting to judge trends through simply comparing the production level at the bottom in January and at the peak month in March according to its seasonality.

On this basis, how about using some method to pre-estimate a one-year seasonal fluctuation pattern and observing whether the level is high or low on that basis? That is to say, as the production in January is the lowest in comparison with the other months, it is regarded as in good shape despite decline from December if the extent of such decline is smaller than the decline in the average year. In the same manner, when the extent of increase in March is smaller than the increase in the average year, the production is considered to slow down. In this way, it is possible to observe trends without seasonality. This is the concept of "seasonal fluctuation adjustment,"

The most common method of seasonal fluctuation adjustment is to prepare an index to express the annual season pattern in advance (this is called a "seasonal index") and adjust fluctuations by employing this index. In general, a pre-adjustment index is divided by a seasonal index to adjust seasonal fluctuations. An index after seasonal fluctuation adjustment is called a "seasonally-adjusted index," and an index before such adjustment is called an "original index."

The dot-line in the graph on the previous page shows the result of the seasonal adjustment made by the method developed by the U.S. Census Bureau, "the U.S. Census Bureau's method (X-12-ARIMA)." According to the graph, the bottoms in January, May and August and the peak in March in each year were adjusted, and the level in March of Year 4 was considerably lower than the level in and around January of Year 2.

[Reference] Fluctuating Factors of Time-Series Data

Fluctuations in economic time-series data such as the Indices of Industrial Production are caused by a variety of factors, which can be in general classified into the following four types of elements.

- Trend factor: those fluctuations which persist in one direction (rise or fall) for a long term
- Cyclical factor: typical fluctuations for the economy which are mainly long-term ones (a cycle of three to fifteen years) undulating and repeating rise and fall
- Seasonal factor: regular waves with a one-year cycle
- Irregular factor: irregular fluctuations generated in a short period of time due to an unexpected factor

When economic time-series data (original index) is O, it can be expressed as the following multiplication (multiplication model) in general.

O	=	T	×	C	×	S	×	I
Original index	=	Trend fluctuation	×	Cyclical fluctuation	×	Seasonal fluctuation	×	Irregular fluctuation

3. Factors of Seasonal Fluctuations in Mining and Manufacturing

Seasonal fluctuations can be generated by various factors. The production activities of the mining and manufacturing industries include a wide range of forms, such as petroleum refinery, yarn spinning, steel rolling and IC assembly, and accordingly factors for their seasonal fluctuations also differ. Seasonal fluctuations of the entire mining and manufacturing industries are formed through being multiplied by or offset against seasonal fluctuations of these individual production activities. Of course, there are cases where such fluctuations are formed by factors common to the whole industry.

Common Factors

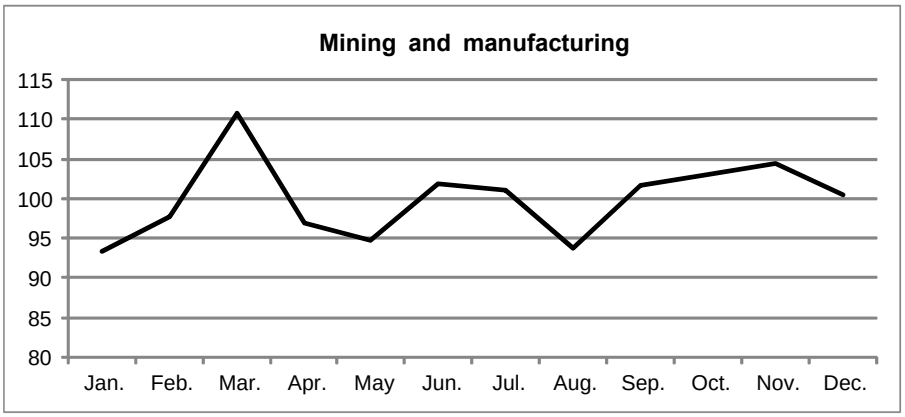
The first factor is the difference in the monthly number of operating days. The most significant reason for a seasonally low production level in January and August as shown above is that there are many work sites reducing their production during the New Year's break and summer holidays. Further, the production in May is also low due to the consecutive holidays called the "Golden Week."

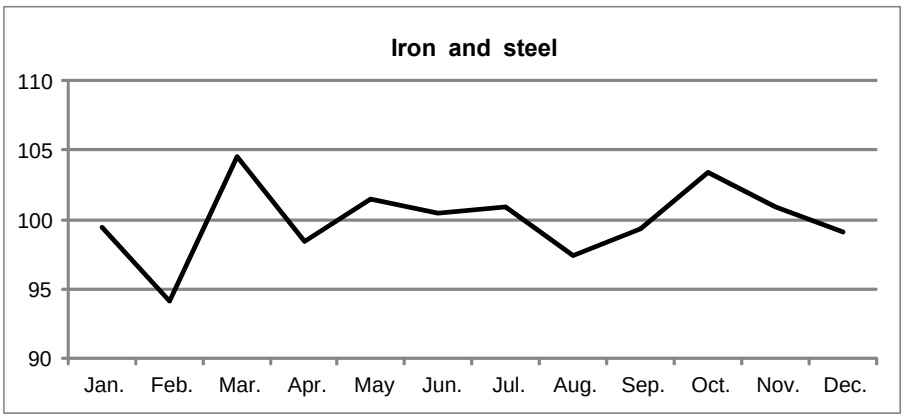
Another common factor is the division of fiscal years and quarterly periods. The finance of the national government and the local governments is based on the fiscal year system in which various policies including budget use are implemented in each fiscal year. This influences, directly or indirectly, the seasonal pattern of production activities. Moreover, the introduction of the quarterly settlement system in corporate accounting has led production plans and demand forecast to be prepared quarterly and revised frequently by individual industries. In particular, as March is the end of a fiscal year and thus the annual settlement period, many companies increase their production and shipments. Consequently, the production activities of the entire mining and manufacturing industries draw a seasonal peak in March.

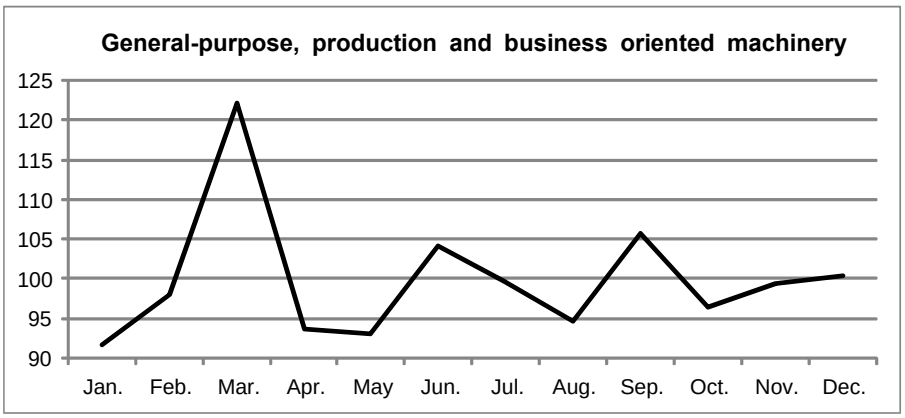
Seasonal Fluctuation Factors Peculiar to Industries and Individual Items

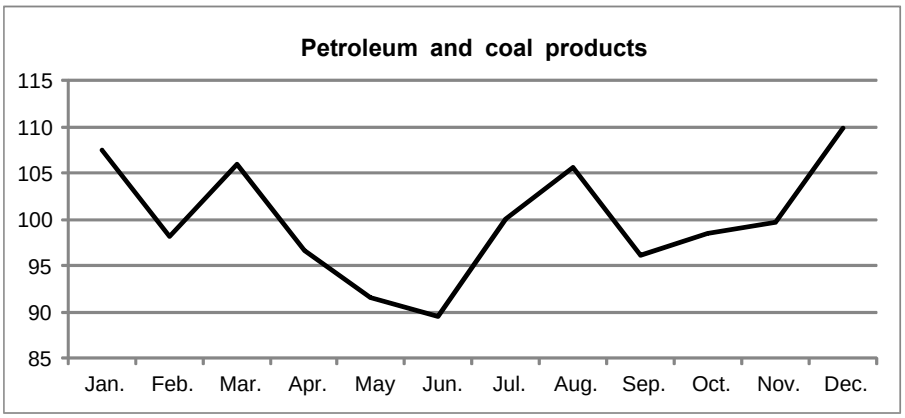
Factors of seasonal fluctuations peculiar to individual industries and items differ in distinctive ways. Although the climate does not affect production conditions in comparison with its effects on agricultural products, it causes fluctuations to such production activities as foods in which agricultural products are used as raw materials. On the other hand, factors regarding demand include air-conditioning equipment and carbonated drinks whose peak comes in summer, and lamp oil and oil burners whose peak comes in winter. Furthermore, there are various products, demand for which grows strong seasonally due to social practice and customs such as midyear gifts (Chugen), year-end gifts (Seibo), Christmas and new school years. Apart from these, the production of some products of the apparatus industry is suspended in the season when the demand for them is not strong, and instead regular repair is conducted during that season.

Seasonal Fluctuations in Main Industries of the Indices of Industrial Production









4. History of Seasonal Adjustment Method

Although the current method for seasonal adjustment is "the U.S. Census Bureau's method (X-12-ARIMA)," the "MITI Method,"[*1] uniquely developed by the former Ministry of International Trade and Industry, was used as the method for seasonal adjustment until the 1990-based indices. This was a method developed when the 1960-based indices were revised. It was improved within the base revision in 1975 and renamed the "MITI Method III," and further improved partially in the base revision in 1985 and renamed the "MITI Method III R." It was used until the base year of 1990. Subsequently, the U.S. Census Bureau's method has been employed since the 1995-based indices.

The "Seasonal Adjustment Study Group" was established to revise the "MITI Method III R" for the following reasons: it was the time to revise the "MITI Method III R" since a long time had passed from the start of its use; questions arose concerning whether or not fluctuations generated from the different configuration of the day[*2] significantly affected seasonally-adjusted indices more than before, as the economy had entered a period of low growth; and further, with the release of the "X-12-ARIMA," an improved version of "the U.S. Census Bureau's method (X-11)" that had been widely used worldwide, there was a growing expectation that a day adjustment program would be developed in Japan by using the "X-12-ARIMA." As a result of the deliberation by this Study Group as a key group, it was changed to the X-11 Default of the U.S. Census Bureau's method of X-12-ARIMA from the base year of 1995. Later, from the Revised Report for March 2000 in the course of the 1995 base period, it was further changed to the X-12-ARIMA. The same adjustment method has been used since the 2000 base.

The U.S. Census Bureau's method is a general-purpose method aiming to be applied to a very wide range of indices, which is a more complex calculation system than the MITI Method. Its features are:

[1] It estimates outliers and fluctuations due to the day configuration by using time-series models and removes them from the original series. → Preliminary adjustment part

[2] To supplement missing items due to a moving average, it estimates forecasted values of the original series and adds such values to the original series. → Moving average part with X-11

[3] All diagnosis results are outputted: for instance, whether or not seasonality is removed, and whether or not option results are valid. → Ex-post judgment part

The X-12-ARIMA was developed in order to improve the X-11, and the effectiveness of its function of adjusting outliers and the day is considered to be more stable than the X-11. Until the base revision in 2005, leap years as well as the day configuration has been adjusted in the Indices of Industrial Production. In order to respond to huge economic changes such as those caused by Lehman's fall, the detection of outliers has been conducted since the annual amendment of 2009.

[*1] The abbreviation of the Ministry of International Trade and Industry

[*2] The "MITI Method III R" was also to calculate fluctuated values generated from the day configuration, just as was the case for the U.S. Census Bureau's method (X-11). However, the Indices of Industrial Production consisted of those series which were adjustable according to time points and those which were not. Consequently, this adjustment was not made.

Section 4 From Survey to Release

1. Basic Data for the Indices

In preparation of the Indices of Industrial Production, results and operational data of approximately 27 types of statistical surveys are used, which include the "Current Production Statistics Survey" conducted by the METI and other surveys conducted by other ministries and agencies and private organizations. These surveys are prepared in cooperation with a great number of people such as survey participating business establishments, statistical investigators, and the personnel of the local governments.

The main statistical data monthly used for preparing the Indices of Industrial Production are from the Current Production Statistics Survey. This survey is a statistical survey not only for the purpose of creating indices but also for an overall purpose taking account of individual administrative needs, such as grasping of trends in the demand for individual items and the status of facilities. In this regard, the Indices of Industrial Production are fundamentally different from the CGPI and the CPI, because unique statistical surveys are conducted for the preparation of the latter two.

In addition to the aforementioned statistical surveys, results of various other statistical surveys conducted by other ministries and agencies and private organizations are used as the basic data for preparing the Indices of Industrial Production.

In relation to the basic data for the calculation of weights for the 2010-base indices, as reference, results of the "Census of Manufactures" are used for the industry of Manufacturing, and results of the "Economic Census for Business Activity" are used for Mining.

Such statistical surveys as the Current Production Statistics Survey and the Census of Manufactures which are prepared by requiring reports directly from survey targets are called "primary statistics." Those statistics, such as indices, that are created by compiling or estimating various primary statistics are called "processed statistics" or "secondary statistics." The precision of such processed statistics largely depends on the specific details and precision of their primary statistics, which are their basic data, let alone the theoretical meticulousness of their construction. The advantages and disadvantages of primary statistics are naturally reflected in processed statistics. The mechanisms and precision of the Current Production Statistics Survey and the Census of Manufactures are closely associated with those of the Indices of Industrial Production.

2. Statistical Surveys for Calculation of Weights

Mainly, the “Census of Manufactures” and so forth are used for the calculation of weights for the Indices of Industrial Production.

Census of Manufactures

As the current Indices of Industrial Production is based on the 2010 base, the value added, production value, shipment value and inventory value, which are the weights of the indices, are calculated on the basis of the monthly average values of these in 2010.

Being the main basic data for the calculation of weights for the industry of Manufacturing, the Census of Manufactures is a survey that the METI currently implements at the end of December every year, targeting business establishments under the category of Manufacturing. It is commonly known as “the Industrial Census.” The survey is conducted in years ending with “0” or “5,” which are to be the base years for indices, and in the middle years ending with “3” or “8.” All business establishments under Manufacturing were surveyed in the past. However, since 2010, business establishments with four or more employees are surveyed. For this reason, figures for business establishments with one to three employees are estimated for use. The survey items are extremely wide-ranging, including the value of manufactured goods shipments, the value of raw materials consumption, the value of inventory of manufactured goods, raw materials and fuels and the value of inventory of semi-manufactured goods and unfinished products. There are two types of survey sheets on the basis of the number of employees: the type for business establishments with 30 or more employees and the type for business establishments with 29 employees or less. The details of the latter type are simplified. The survey method is as follows; the investigator collects the self-enumerated survey sheet filled in by the reporting person (the target business establishment), and the sheet is submitted to the METI (our ministry) through the municipality or prefecture. The preliminary report of the survey results are released in late September in the following year. The revised report is divided into some types, which are released from March to August in the second year after the survey year.

Trends in the Japanese Mining Industry

For the calculation of weights for Mining, the Trends of the Japanese Mining Industry were used. This survey was implemented every year by the METI, targeting mainly those business establishments to which the Mining Act applied to find out about their production values, values of raw materials consumption, values of materials, fuels and electricity consumption, and their employees.

The Trends of the Japanese Mining Industry was implemented every year until 2005. Subsequently, it has been incorporated into the “Economic Census” held every five years, and is implemented with its coverage extended to the entire industries under Mining.

3. Data for the Calculation of the Monthly Indices

The data for the calculation of monthly indices include statistical data from the Current Production Statistics and from outside the METI, and such data is used for the Indices of Production, Shipments and Inventory and for the Indices of Operating Ratio and Production Capacity. Also, data from the Survey of Production Forecast is used for the Indices of Production Forecast.

Current Production Statistics Survey

A large part of the monthly quantity data by item for the Indices of Industrial Production is obtained from results of the Current Production Statistics Survey conducted by the METI. This is a very large-scale statistical survey to inquire into the production, shipment, inventory, production capacity and facilities of business establishments, such as factories and mines, producing approximately 1,800 target mining and manufacturing products. The forms and production processes of such manufactured products differ among them, and thus the survey is conducted by using over 110 different formats of the survey sheet according to the characteristics of individual production processes. The survey method also varies in form; the self-enumeration survey sheet is filled in by the reporting person (the target business establishment), and there are two routes of the submission of the sheet: collection by the investigator or forwarding the sheet by mail. For some cases, the sheet is to be sent to the METI (our ministry) indirectly through the prefecture or a Bureau of Economy, while, in other cases, it is sent directly to the METI. Further, apart from mailing, the online version of the survey with use of a computer and the Internet has gone into full-scale operation since January 2000. The preliminary report of survey results is released at the end of the following month after the month subject to the survey, at the same time as the release of the Indices of Industrial Production. The revised report is released in the middle of the second month after the month subject to the survey.

Statistical Data from Outside the METI

For those items not covered by the Current Production Statistics Survey, figures from statistical surveys and operational data of other ministries and agencies and private organizations are used. The following surveys are used: with regard to shipbuilding and rail vehicle, the Survey on Shipbuilding and Engineering and the Survey on Current Rolling Stock Production conducted by the Ministry of Land, Infrastructure, Transport and Tourism; for medicinal products, the Statistics of Production by Pharmaceutical Industry conducted by the Ministry of Health, Labour and Welfare; and the Current Production Statistics Survey conducted on some foods by the Ministry of Agriculture, Forestry and Fisheries. In addition, figures relating to meat products, alcoholic beverage and drinks are obtained from relevant, cooperating organizations. The items covered by these surveys amount to 40 items among the selected 487 items of the Production Index.

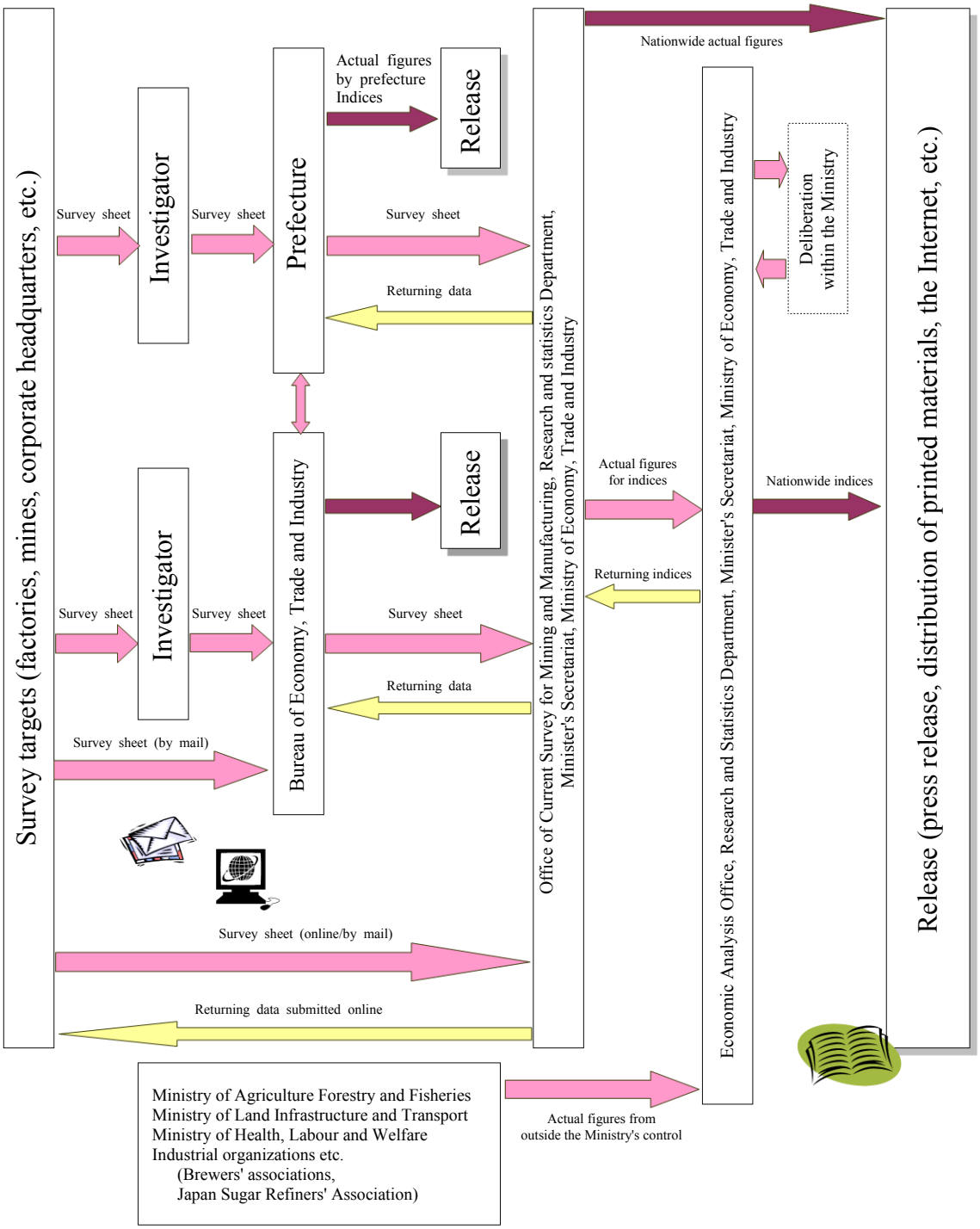
Survey of Production Forecast

A survey is conducted every month in order to create the Indices of Production Forecast, which is formally called the “Survey on Production Forecast in Manufacturing.” For each selected item of the Indices of Production Forecast, those companies accounting for approximately 80% of the relevant production quantity in the Current Production Statistics Survey are the targets of the Survey of Production Forecast, and their “Actual production amount for the previous month,” “Forecasted production amount for the current month” and “Planned production amount for the following month” are surveyed. With regard to the aggregation results, only the Indices of Production Forecast for Manufacturing/the Indices of Production Forecast by industry are released at the same as the preliminary report of the Indices of Industrial Production.

The selected items of the Indices of Production Forecast = Forecast Survey Items are determined by taking account of the size of the weights of the Indices of Industrial Production, and the potential of the survey. The number of the items amount to 195 items.

[Reference]

From Collection of Survey Sheets for the Current Production Statistics Survey to Release of the Indices



4. Preliminary Report and Revised Report

The monthly release of the Indices of Industrial Production takes place twice in the forms of a preliminary report and a revised report. A preliminary report is published in a brochure titled “Indices of Industrial Production (Preliminary Report),” and in the website of the METI, at the end of the following month after the month subject to the relevant survey. At the same time, in addition to the preliminary figures of the Production Index (value added weight), the Index of Producer’s Shipments, the Index of Producer’s Inventory of Finished Goods and the Index of Producer’s Inventory Ratio of Finished Goods, the preliminary results of the Survey on Production Forecast in Manufacturing (= the Indices of Production Forecast) and the main items of the Current Production Statistics Survey are published.

Furthermore, the revised report is published in the form of a brochure titled “Indices of Industrial Production (Revised Report)” in the middle of the second month after the month subject to the survey. At the same time, the Indices of Operating Ratio and Production Capacity are also published.

These indices are published monthly in “Economic and Industrial Statistics” (issued by the Research institute of economy, trade and industry) with results of other statistical surveys implemented by the METI. Further, trends in production, supply and final demand are analyzed on the basis of the Indices of Production, Shipments, Inventory and Inventory Ratio covering the periods of January to March, April to June, July to September and October to December. Such analysis is released quarterly under the name of “Analysis of All Industrial Activities.”

As the Production Index based on production value weights is not used frequently, both its preliminary and revised reports are released and made available to browse at the Economic Analysis Office, Research and Statistics Department, Ministry of Economy, Trade and Industry.

5. Retrospective Calculation with Annual Revision and Base Revision

Annual Revision

In the case of the Current Production Statistics Survey, every year, at the stage where all the figures for a given year have become available, the actual figures are fully revised retrospectively up to the figures in January of the previous year. On this basis, the revised values are set. After the figures of other surveys are revised with those revised figures, the Indices of Industrial Production are fully recalculated. Concurrently, the seasonal index is recalculated, and the seasonally-adjusted index is recalculated with the new seasonal index. This process is called an "annual revision," and its results are released in the revised report for February (mid-April) (the Indices of Production Forecast in Manufacturing are published on the Internet at the same time). The "Yearbook of Indices of Industrial Production" that compiles these revised figures after the annual revision is published around June.

Base Revision

In a base revision that takes place every five years, each index is retrospectively created up to two years prior to the base year. In the case of the 2010-based indices, the indices are calculated on the basis of a new base retrospectively up to January 2008. Those indices based on any other base year prior to January 2010 are connected to the indices based on the respective bases up to January 1978 by using the connected indices stated on the next page. Additionally, the retrospective connected indices up to January 1978 are published on the website.

On the presumption that a base revision takes place every five years as it has done so, the 2010-based indices are created and published monthly until the preliminary report for April 2018, and it will be switched to the 2015 base from the revised report for April 2018.

The 2015-based indices will be revised retrospectively up to two years prior to the base year. Hence, after a revision, the 2015 base is applies to the indices for January 2013 to the indices for January 2018, during which the indices based on the former base overlaps with the indices based on the new base.

6. Connection of the Indices

In the examination of the economic status from a long-term perspective, it is possible to see rough movements during a whole year. However, as economic peaks and bottoms are found in the middle of a year, a more meticulous examination requires monthly or quarterly observation. Accordingly, it is necessary to create an index which enables the connection of monthly or quarterly indices with different base years and enables a continuous observation of transitions of such indices. The index created for such purpose is called a "connected index."

In the case of the 2010-based indices, the indices have been created retrospectively up to January 2008, and thus the 2010 base is used up to that point of time. For the indices for and prior to December 2007, as shown below, consider the ratio of the level of the 2010-based, seasonally-adjusted indices for January to March 2008 to the level of the 2005-based seasonally-adjusted indices for January to March 2008 as the "linking coefficient," and simply multiply it by the level of the indices based on the former base.

$$\text{Connected index} = \frac{\text{2010-based average indices for January to March 2008 (seasonally-adjusted)}}{\text{2005-based average indices for January to March 2008 (seasonally-adjusted)}}$$

In addition, for the connection of the 2005 based indices and the 2000-based indices, use the same calculation with the ratio for January to March 2003. By repeating this, it is possible to create the connection indices for the 2010 base. Among the connected indices created in this manner, the monthly connected indices classified by industry and use of goods are published up to those indices for January 1978. With regard to yearly, fiscal-year-based and quarterly connected indices for the overall mining and manufacturing industries, the indices retrospectively up to 1953 are published.

[Reference] Points to Note in Relation to Connected Indices

[1] Connected indices are those linking two series of indices based on different bases at the middle point of the two series. That is to say, connected indices are created by multiplying indices based on a past base by the same coefficient for the purpose of integrating the levels (the base periods) of indices based on multiple, different bases with different weight structures, selected items, industrial classifications, and seasonal adjustment methods.

[2] Accordingly, the older the base of indices is, the more the number of multiplications by the linking coefficient is required. Therefore, differences caused by rounding-off in calculations are accumulated in the level of the indices. Additionally, the extent of such differences differs depending on the age of the base period. From this, connected indices are not to be used for the calculation of a rate of change such as a percent change from the previous month and a percent change from the previous year. Instead, for the calculation, the indices of the original base year (the indices for five years before and after the base year of the indices concerned) are required to be used. Hence, a percent change from the previous month and a percent change from the previous year do not change because of the fact that indices are connected.

[3] However, for the calculation of a ratio crossing the connecting point (for example, between December 2007 and January 2008) (the percent change in January 2008 relative to the previous month and the percent change in January 2008 relative to the same month in the previous year, the percent change in January to March 2008 relative to the previous period and the percent change in January to March 2008 relative to the same period in the previous year, the percent change in 2008 relative to the previous year, etc.), only the indices based on the older base between two series of the relevant indices are to be used.

Chapter II Way to Understand the Indices

Section 1 Method for Analyzing the Indices

1. Rate of increase

In order to judge whether an index in a month or year is high or low, often a ratio of the month/year to another month/year is calculated, and the sizes of the two series of index are compared. This ratio is called a "rate of increase." In particular, "the percent change from the previous month" and "the percent change from the previous year," which are a ratio of the month/year concerned to the immediately previous month/year, are often used for observing trends. Although these are expressed in a percent like 106.4% and 97.5%, 100 is often subtracted from it. Accordingly, it is expressed in an increase/decrease rate like a 6.4% rise and a 2.5% fall. Furthermore, instead of rise and fall, expressions such as increase and decrease, or simply up and down may be used (the Research and Statistics Department uses rise/fall for indices, and increase/decrease for figures).

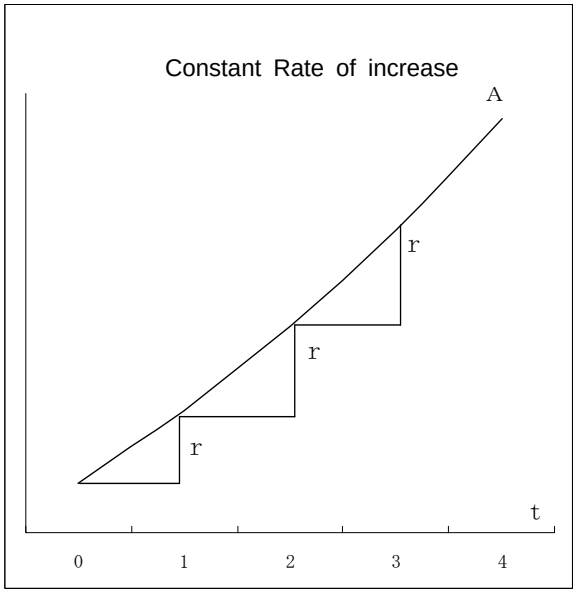
For example, when an index in 2007 was 92.0 and the index in 2008 was 94.9, the percent change from the previous year in 2008 was a 3.2% rise.

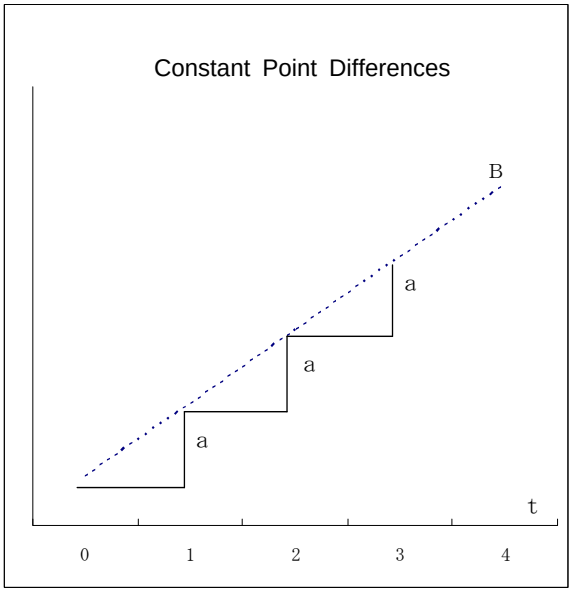
$$\frac{94.9}{92.0} \times 100.0 = 103.2$$

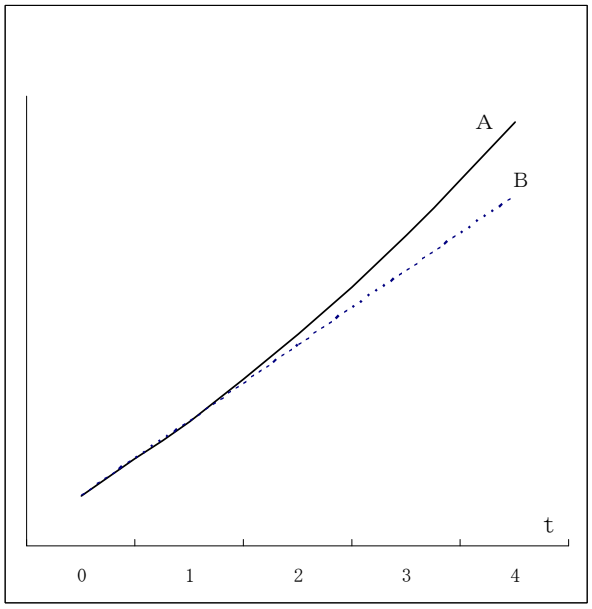
Naturally, the difference between 2008 and 2007 was a different value from 94.9 − 92.0 = 2.9. A simple difference between the values of indices is called a point difference in distinction to a percent. In this example, we say, "2.9 points rise in 2008 against the previous year." However, in general, a percent as in "the percent change from the previous year" is used more often: for instance, "a 3.2% rise."

If, for example, the percent change from the previous year rises at the same percent every year, an index draws a curve line like Line A in the graph on the next page. In contrast, if the point difference compared with the previous year is the same every year, the index draws a straight line like Line B in the graph. With regard to Line B, the calculation of the percent change from the previous year shows that the figures gradually decrease year by year. As illustrated by the chart, when the percent change from the previous year is relatively small and its period is short, the difference between the rate of increase and the point difference is not so great that the point difference can be used as a substituting, simplified method. However, for a proper analysis, these two require to be clearly distinguished.

Comparison between Rate of increase and Point Difference







When point differences are constant, the rate of increase in each year slows down as follows.
The achievement in the first year is set as 1, and the point difference in each year is set as *a*.

Rate of increase in Year 1 a

Rate of increase in Year 2 $\dfrac{a}{1+a}$

Rate of increase in Year 3 $\dfrac{a}{1+2a}$

$\vdots$ $\vdots$

Rate of increase in Year n $\dfrac{a}{1+(n-1)a}$

2. Percent Change from the Previous Month and Percent Change from the Same Month in the Previous Year

The explanation of the rate of increase so far is based on the percent change from the previous year. The same is true in relation to the percent change from the previous month. However, the point that requires attention in the case of the percent change from the previous month is whether the relevant indices are seasonally adjusted or not. As explained above, the original indices include seasonal fluctuations repeating every year. It is not appropriate to judge solely from the percent change from the previous month whether the month concerned was strong or at a low ebb. Hence, when trends of each month are to be grasped from the percent change from the previous month, the seasonally-adjusted indices are used.

On the other hand, instead of the percent change from the previous month in the seasonally-adjusted indices, trends are often grasped from the percent change from the same month in the previous year. As the percent change from the same month in the previous year means a comparison with the same month one year ago under the seasonally same conditions, this also means that seasonal fluctuations are excluded from the comparison. For this reason, it is widely utilized not only for indices but also as an elementary tool for observing economic time-series and analyzing trends. However, as the percent change from the same month in the previous year is obviously affected by trends in the same month of the previous year, it is necessary to find out about such trends in advance. It is necessary to take note of any anomalous movement in the figures in the same month of the previous year due to special factors, in order to avoid misleading others.

In lining up the percent changes from the same month in the previous year in chronological order to observe whether the speed of rise of the series has recently increased or slowed down, the trends in the previous year are required to be understood. The graph on the next page exemplifies changes in the percent change from the same month in the previous year in the case where monthly movements in the current year are the same but movements in the previous year were different. This should help you understand that even where monthly movements in the current month are the same, the transition of the percent change from the same month in the previous year shows a different shape when movements in the previous year were different.

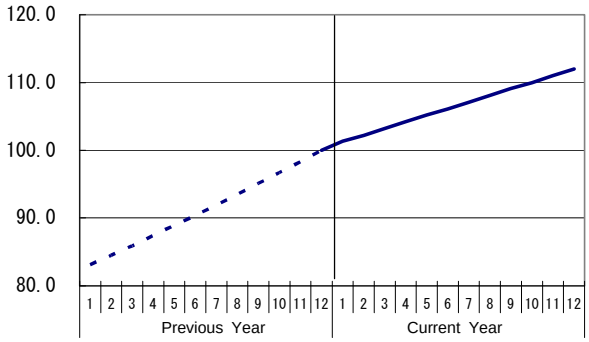
Percentages to Be Calculated and Indices to Be Used

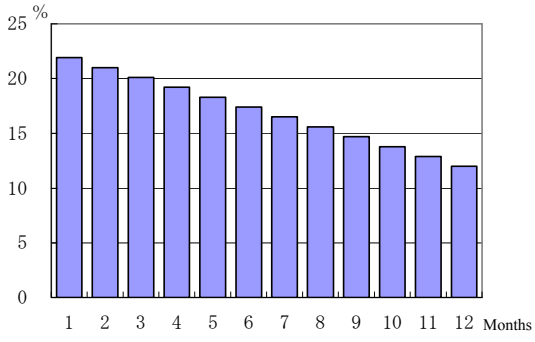
Percent Change from Previous Month, Percent Change from Previous Period	⇦ **Seasonally-Adjusted Indices**
Percent Change from Same Month in Previous Year, Percent Change from Same Period in Previous Year Percent Change from Previous Year, Percent Change from Previous Fiscal Year	⇦ **Original Indices**

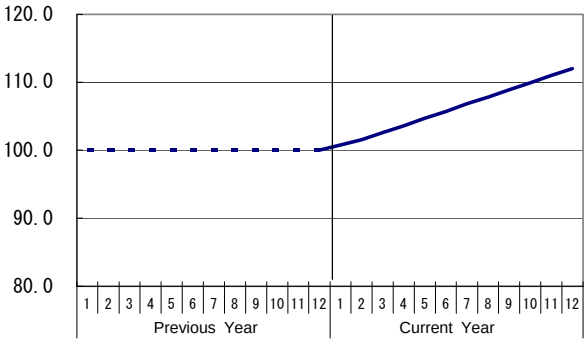
Transitions of the Indices and Percent Change from the Same Month in the Previous Year

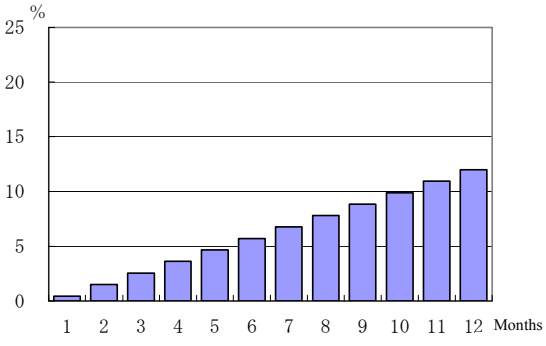
Transitions of indices

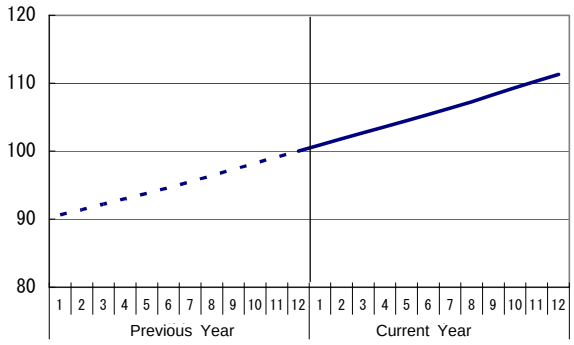
Percent change from the same month in the previous year

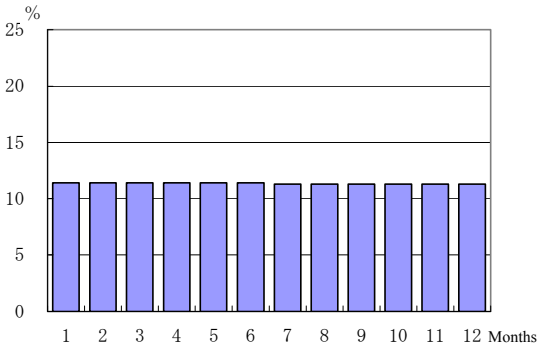


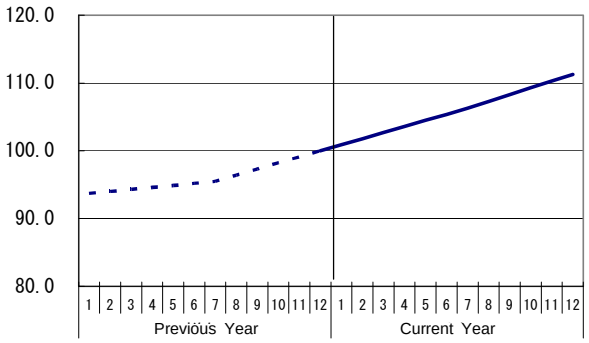


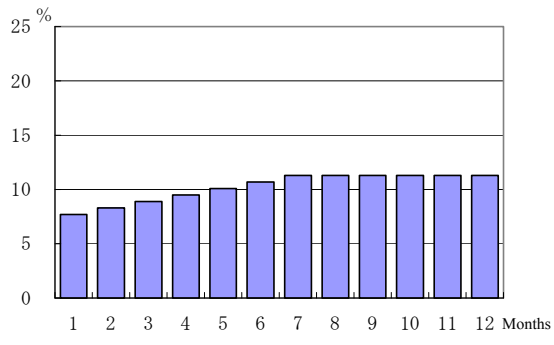












3. Average Rate of increase

With regard to a specific index, the size of the percent change from the previous month over recent past months and the size of the percent change from the previous month in a particular period in the past are often compared to see whether the recent speed of rise is high or not in comparison with the said period in the past. For instance, there are cases where the rise speed of the production of the mining and manufacturing industries some months after the economy hit a cyclical bottom and has started recovering, and the rise speed of it in the previous period of economic recovery are compared to see which is how high. In such cases, the monthly average rates of rise in the respective periods are compared. Assume that the Indices of Industrial Production from March to August in a year shifted as follows.

	March	April	May	June	July	August
Indices	108.3	109.5	111.5	111.1	112.1	113.3
Percent change from the previous month (%)	—	101.1	101.8	99.6	100.9	101.1

The monthly average rate of increase is in general calculated with a geometric average.

$$\sqrt[5]{1.011 \times 1.018 \times 0.996 \times 1.009 \times 1.011} = 1.009$$

The reason for using a geometric average is that the rate of increase is originally calculated in the form of a ratio. When there was a 0.9% rise monthly during the given period, this means that the level of the indices grew from 108.3 to 113.3. Accordingly, from the start, the results are the same even where the rate of increase in August relative to March is calculated to find the 5th root.

$$\sqrt[5]{113.3 \div 108.3} = \sqrt[5]{1.046} = 1.009$$

However, given this extent of a rate of increase and this extent of a period of time, the calculation with an arithmetic average instead of a geometric average does not make a huge difference.

$$\frac{(1.1) + (1.8) + (\blacktriangle 0.4) + (0.9) + (1.1)}{5} = 0.9\ (\%)$$

*"▲" is the same as "—".

4. Moving Average

After the start of production, economic events that the indices are used to express do not necessarily change constantly in accordance with certain rules but change in various ways as such events are affected by factors inherent in themselves and by other surrounding conditions. Transitions of seasonally-adjusted series of the Indices of Industrial Production show, for example, that a significant rise is followed by a remarkable fall in the following month, and that rise and fall repeat within a short period of time. Fluctuations due to incidental factors in each month are called "irregular fluctuations." In the case of individual items, irregular fluctuations in production activities are identifiable to some extent, such as decline in production due to an accident, last-minute demand before increase in the prices of products and subsequent reactive decline, effects of the climate on foods whose raw materials are agricultural products and on heating, ventilation and air-conditioning equipment, etc. However, a close examination of these reveals that extremely wide-ranging factors are generated in combination with each other, such as changes in the circumstances surrounding the transportation of raw materials or products, the replacement of facilities and defects in them, losses caused by the reassignment of workers, and delay with regard to contracts and acceptance inspections. It is not easy to grasp these in an integrated and quantitative manner. Further, in the case of an integrated index, the part in which irregular fluctuations in individual items are canceled out by each other are intricately interlaced with the part in which such fluctuations have synergistic effects on each other, as mentioned above. It is virtually impossible to measure these.

For us to judge, from indices, whether production activities are on an upward trend or a declining trend, or whether such activities are at a transitional stage from rise to fall, the observation of indices requires to remove not only already-explained seasonal fluctuations but also irregular fluctuations. However, as explained, it is virtually impossible to accumulate and remove irregular fluctuations in each item. Consequently, an alternative method requires to be devised. The simplest method for doing this is to "average" irregular fluctuations. To average literally means the averaging of irregularities. To remove irregular fluctuations from time series = to average them, a specific method for this is "moving average."

There are various methods available for moving average depending on periods to be averaged. Furthermore, although there is a slightly advanced method of weighted moving average, we introduce a simple and frequently-used calculation method of the three-month (simplified) moving average in this section. In relation to a monthly original index such as the one in the table on the next page, its averages for three consecutive months (for instance, January, February and March) are calculated. The figure for the middle month of February is set. Next, the same calculation for February to April is performed, and the figure for March is set. Subsequently, the same calculation is repeated for March to May and onward.

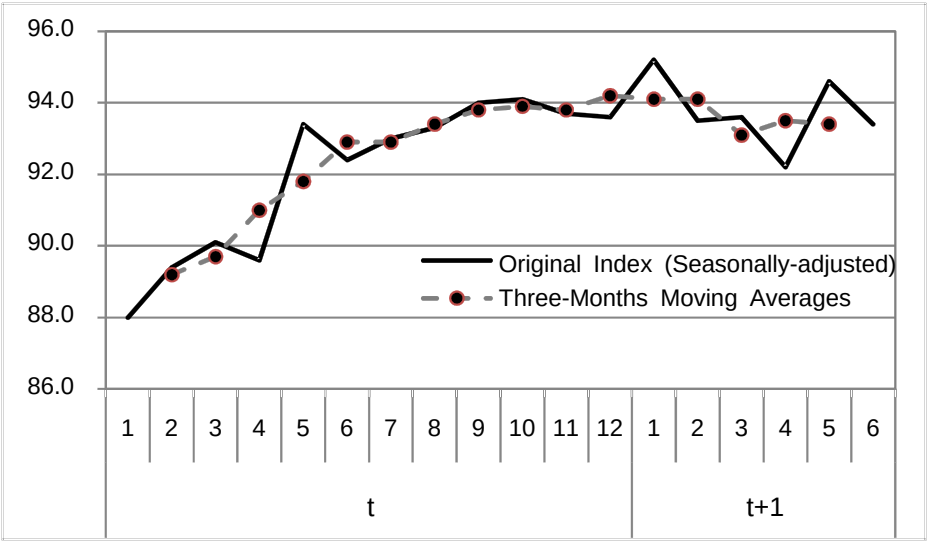
January	
February	(88.0 + 89.4 + 90.1) ÷ 3 = 89.2
March	(89.4 + 90.1 + 89.6) ÷ 3 = 89.7
	⋮
November	(94.1 + 93.7 + 93.6) ÷ 3 = 93.8
December	

The results of these calculations are shown in the table below. The percent changes from the respective previous months in the original index fluctuate within a range between the maximum of 4.2% rise and the minimum of ▲ 1.8% fall, whereas the percent changes from the respective previous months in the moving averages are within a range between the maximum of 1.4% rise and the minimum of ▲ 1.1% fall. This should clearly show that the method of moving average is to average irregular fluctuations of the original index. The chart below is the graph of these percent changes. However, this method has a weakness; it generates missing items in the first and last months of the index (those months which cannot be calculated). Consequently, as shown in the graph, moving averages only up to November can be obtained, if the latest data for the calculation of three-month moving averages is the one for December. As we would like to obtain information which is as new as possible, this point is rather inconvenient. Though many ideas have been studied to compensate this weakness, the details of such ideas are omitted.

Calculation of Three-Month Moving Averages

Years	Months	Original Index (Seasonally-adjusted)		Three-Months Moving Averages	
			Percent change from previous month (%)		Percent change from previous month (%)
t	1	88.0	—	—	—
	2	89.4	1.6	89.2	—
	3	90.1	0.8	89.7	0.6
	4	89.6	- 0.6	91.0	1.4
	5	93.4	4.2	91.8	0.9
	6	92.4	- 1.1	92.9	1.2
	7	93.0	0.6	92.9	0.0
	8	93.3	0.3	93.4	0.5
	9	94.0	0.8	93.8	0.4
	10	94.1	0.1	93.9	0.1
	11	93.7	- 0.4	93.8	- 0.1
	12	93.6	- 0.1	94.2	0.4
t+1	1	95.2	1.7	94.1	- 0.1
	2	93.5	- 1.8	94.1	0.0
	3	93.6	0.1	93.1	- 1.1
	4	92.2	- 1.5	93.5	0.4
	5	94.6	2.6	93.4	- 0.1
	6	93.4	- 1.3	—	—

Comparison of the Original Index and Three-Month Moving Averages



5. Annual Rate (Instantaneous Wind Velocity)

With regard to monthly indices, for a comparison of rise speeds in different periods, we have explained that the calculation of their monthly average rates of rise by using a geometric average is useful. This rate of increase is also simply called a "monthly rate." However, not all economic indices around us are monthly observable ones; some of them can be obtained only quarterly or annually. In order to compare these indices, it is useful to have a monthly rate converted into an annual rate of increase by multiplying it by 12. This type of rate of increase converted into an annual growth is called an "annual rate" relative to a monthly rate.

Let us use the aforementioned example of transitions of the Indices of Industrial Production from March to August.

March	April	May	June	July	August
108.3	109.5	111.5	111.1	112.1	113.3

These are converted into an annual rate.

$$\left(\sqrt[5]{113\ .3 \div 108\ .3}\right)^{12} = 1.114$$

Therefore, it is an annual 11.4% rise. As an analogy, newspapers often call an annual rate as "instantaneous wind velocity."

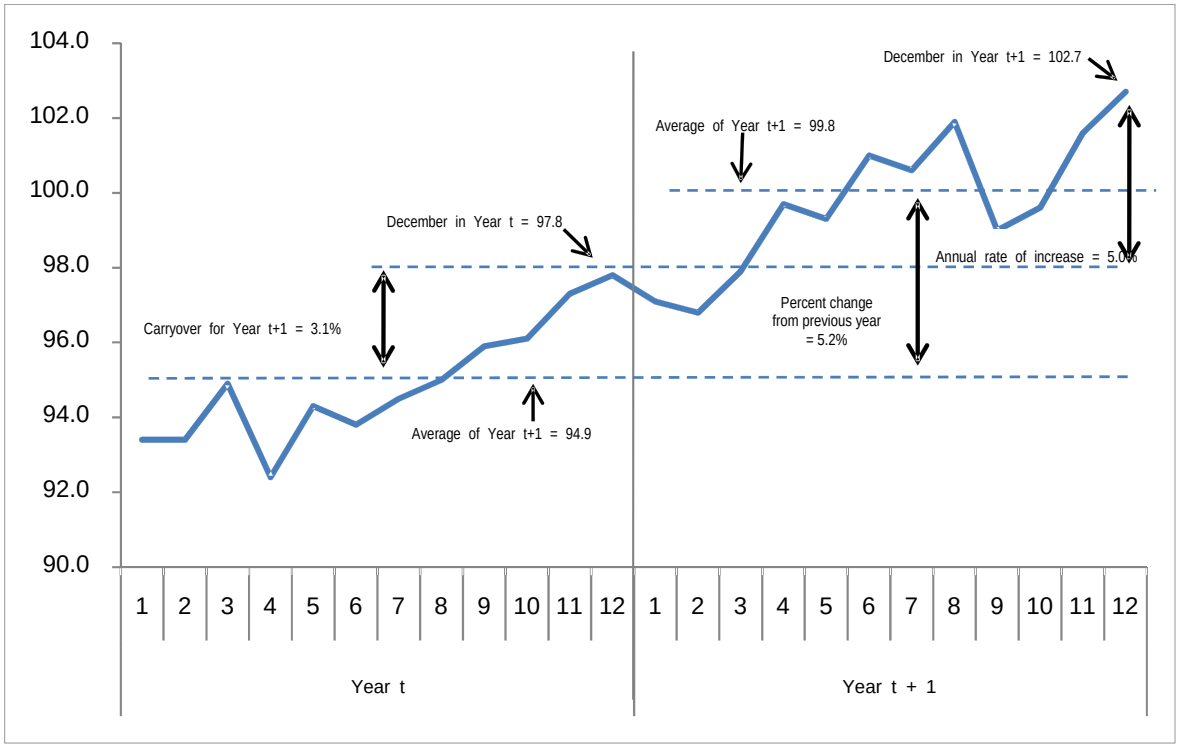
Bear in mind that an annual rate represents just the speed of rise during the period subject to observation, and does not accord with the percent change from the previous year. The percent change from the previous year depends on the speed of rise in the previous year as well as the speed in the current year. Please look at "2-1-2 Percent Change from the Previous Month and Percent Change from the Same Month in the Previous Year" on page 62. This should clearly show that even where the speed of rise in the current year is the same, the percent change from the previous year is different when movements in the previous year were different.

6. Carryover and Percent Change from the Previous Year

The percent change from the previous year is a rate of growth from the annual average indices in the previous year to those in the current year. As stated above, although the percent change from the previous year naturally differs depending on transitions of the indices in the current year, transitions in the previous year also significantly affect the percent change from the previous year.

For convenience of explanation, suppose that the annual rate from January to December in the current year is zero, which means that during the year, the indices have remained at the same level as in December of the previous year. In this case, the percent change from the previous year is the ratio of the level as of December in the previous year relative to the average level in the previous year. In considering the relation between the speed of rise during the current year and the percent change from the previous year, it is useful to take account, in advance, of the ratio of the average of the previous year relative to the level of December in the previous year. This ratio is commonly called "carryover." When a carryover is large, the percent change from the previous year becomes large even where the rate of increase is small. When a carryover is small or negative, the percent change from the previous year does not easily become large although the rate of increase is large to some extent. This relation is illustrated in the graph below.

Relation among the Percent Change from the Previous Year, Carryover and Annual Rate of increase



7. Rise Contribution Ratio and Contribution Level

Individual indices by item are combined to form the indices by industry and further form the integrated Indices of Industrial Production. Hence, movements of an integrated index are the accumulation of movements classified by item. Movements in the production, shipment and inventory of individual items are composed of the part which are affected by prosperous conditions and economic downturn of the overall economy at a macro level, and the part which fluctuates due to factors peculiar to individual industries or items. When movements due to factors peculiar to industries and items are integrated into the mining and manufacturing industries, they are canceled out in accordance with the law of great numbers. Consequently, effects of those factors common to the whole tend to appear frequently. On the other hand, often there are cases where peculiar movements have a significant effect on the whole as such movements synergize each other.

The first purpose of the Indices of Industrial Production is to observe trends in general production activities. In exploring fluctuating factors of an integrated index, such factors are very often explained according to each industry or item by taking advantage of the characteristics of the integrated index that the index can be created by accumulating items. The calculated composition ratio of the extent of effects of industries and items constituting a breakdown of the overall industry against rise in the overall industry is called a “rise contribution ratio” or simply a “contribution ratio.” Further, the distribution of it to the rate of increase of the overall industry is called a “contribution level” or a “contribution portion.” The rise contribution ratio and the contribution level in the example on the next page are calculated.

Calculation of Rise Contribution Ratio and Contribution Level

Industry Type	Weights	Current Year	Previous Year	Point Differences	Point Differences × Weights	Rise Contribution Ratio	Contribution Level	Rate of increase
	W	A	B	(A - B)	(A - B) × W			(A - B)/B
Overall Industry	100	112.8	106.0	6.8	680	100.0	6.4	6.4
a. Transport	50	110.0	104.0	6.0	300	44.1	2.8	5.8
b. Chemicals	30	128.0	120.0	8.0	240	35.3	2.3	6.7
c. Iron and steel	20	97.0	90.0	7.0	140	20.6	1.3	7.8

(1) Point differences in the indices by industry between the current year and the previous year are calculated.

a. Transport 110.0 - 104.0 = 6.0

b. Chemicals 128.0 - 120.0 = 8.0

c. Iron and steel 97.0 - 90.0 = 7.0

(2) These are multiplied by the respective weights.

a. Transport 6.0 × 50 = 300

b. Chemicals 8.0 × 30 = 240

c. Iron and steel 7.0 × 20 = 140

These totals are equal to the value found by multiplying the point difference in the integrated index by the weight.

300 + 240 + 140 = (112.8 - 106.0) × 100 = 680

(3) These are converted into composition ratios (%), and the resultant ratios are the rise contribution ratios.

a. Transport 300 ÷ 680 = 44.1

b. Chemicals 240 ÷ 680 = 35.3

c. Iron and steel 140 ÷ 680 = 20.6

(4) These rise contribution ratios are multiplied by the rate of increase of the overall industry, and the results of this are the contribution levels.

a. Transport 44.1 × 6.4 = 2.8

b. Chemicals 35.3 × 6.4 = 2.3

c. Iron and steel 20.6 × 6.4 = 1.3

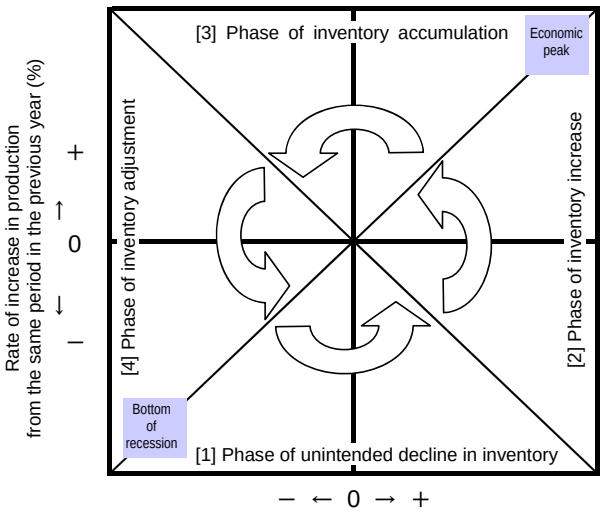
From these results, a. Transport has made the largest contribution, followed by b. Chemicals and c. Iron and Steel in order. A comparison of these with the order of the sizes of the rates of rise shows that a high rate of increase does not necessarily mean a high contribution ratio. The size of a contribution ratio is determined by the overall size of the weight and index level as well as the rate of increase.

8. Economic Fluctuations and Inventory Trends

(1) Chart of Inventory Cycle

To promptly judge economic fluctuations, the observation of inventory is effective. This is because changes in inventory have significant effects on production activities. Firstly, with demand starting growing strong, inventory temporarily declines. Secondly, when companies accumulate inventory in prospect of an expansion in demand, production activities are further enhanced. On the other hand, when inventory is piled up due to low demand, companies judge that they are holding excess inventory and suppress their production, leading production activities to slow down. As Shown above, inventory situation normally goes around the following four phases: "[1] Phase of unintended decline in inventory" → "[2] Phase of inventory increase" → "[3] Phase of inventory accumulation" → "[4] Phase of inventory adjustment." This is shown by the "Chart of Inventory Cycle." By observing the current inventory situation, it is possible to forecast future production activities to some extent.

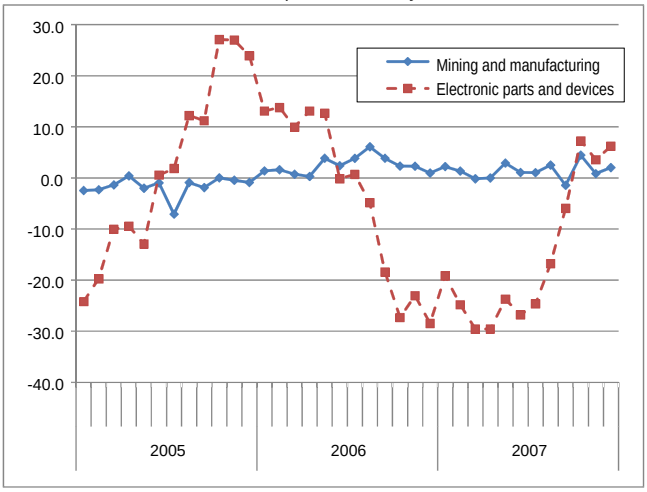
Chart of Inventory Cycle (Conceptual Chart)



(2) The balance between Shipments and Inventory

Meanwhile, the "The balance between Shipments and Inventory" is used to forecast an economic prospect by using the difference between the rates of increase in shipment and inventory. This is calculated by subtracting the percent change in inventory from the previous year from the percentage change in shipment from the previous year. The The balance between Shipments and Inventory becomes positive when increase in shipment exceeds that in inventory, and goes negative when it falls below. Therefore, an expansion of the extent of increase means the inventory level has been low due to a large volume of shipment and thus it is necessary for companies to activate production activities to return the inventory back to the proper level. On the other hand, an expansion of the extent of decline means that it is necessary to adjust the inventory to reduce the inventory level. Accordingly, the The balance between Shipments and Inventory can be one of the useful tools for forecasting future production trends.

Chart of Shipment/Inventory Balance



Section 2 Long-term Analysis with the Indices

1. History of the Preparation of the Indices of Industrial Production

The history of the preparation of the Indices of Industrial Production by the METI started from the "1931- to 1933-Based Indices of Industrial Production" prepared by the then Ministry of Industry (the predecessor of the former Ministry of International Trade and Industry [presently, the METI]) prior to the Second World War. These indices were production indices based on value added weights in relation to 31 items on mining and manufacturing products (including electricity and gas), created in 1934 retroactively up to January 1930. Subsequently, as the wartime appearance had been growing strong, the publication of statistical materials became difficult and the preparation of the indices was interrupted.

After the war, basic statistics were developed and the preparation of indices was restarted. In May 1950, the Ministry of International Trade and Industry published the Production Index based on the 1946 base as a trial calculation. At that time, the Economic and Science Section of the GHQ created production indices as required for the execution of occupation policies. Further, the Economic Stabilization Agency, which was the predecessor of the former Economic Planning Agency of Japan (presently, the Cabinet Office) and private entities such as Diamond, Inc., Toyo Keizai, Inc., and Kokumin Keizai Research Institute published their own production indices.

However, it was confusing for users to have various types of production indices. As a large part of their monthly basic data depended on current production statistics, such indices were narrowed down to those prepared by the Ministry of International Trade and Industry. Subsequently, the indices went through improvements with the 1949 base and then the 1950 base. With the 1955 base, the indices were integrated into the current Indices, and the preparation method was also mostly established. In addition to the Production Index, the Indices of Shipments, Inventory, Operating Ratio, Production Capacity. Raw Materials, and Dealers' Inventory were created on the basis of the 1950 base and the 1953 base, and uniformly revised with the 1955 base, leading to the development of the current system of the Indices of Industrial Production. Afterward, the base has been revised every five years until today as was done so in 1960, 1965, 1970, 1975, 1980, 1985, 1990, 1995, 2000 and 2005.

In 1971, the Indices of Production Forecast were originally created on the basis of the 1969 base. Later, as is the case for other indices, the base has been revised every five years since the 1970 base. Further, the Index of Dealers' Inventory was abolished after the 1985-based index had been prepared, as it was no longer possible to continue the publication of the index as an accurate integrated index due to decline in the number of its selected items after the "Machinery and Appliances Distribution Survey" had been ended with its last survey results for March 1990, and as consequently the importance of its existence became weak. As the Raw Materials Index did not any longer reflecting the actual situation due to limitation on basic data, the significance of their existence became weak as was the case for the Index of Dealers' Inventory, and were abolished after the indices for December 2000 were created during the 1995 base period.

2. Percent Change in the Indices of Industrial Production from the Previous Year

Originally, the Indices of Industrial Production are created for the main purpose of observing short-term trends such as monthly movements, though often long-term analyses are required. For example, there are cases where it is necessary to see which is higher, the recent pace of increase in production or the same pace in the past during a high growth period. Since the current 2010-based indices have been created retrospectively up to January 2008, it is possible to calculate a percent change from the relevant previous year since 2009 and compare the two sizes. In relation to the percent change from the previous year prior to January 2008, indices based on a past base are used for such change for five years; for example, as the 2005-based indices are retroactive up to 2003, they can cover percent changes from 2004 to 2007; and in the same manner, percent changes from 1999 to 2002 are covered by the 2000-based indices. In so doing, in the year at the turn of a base year, the percent change from the previous year cannot be directly calculated; for example, in the case of 2008 which is in the 2010 base period, its previous year of 2007 is in the 2005 base period. For that reason, in such a case, the percent change of the previous year published in the previous base year is to be used.

As the 2005-based indices were created up to the preliminary report for April 2013 when the 2010-based indices were announced, it is possible to calculate the percent change from the previous year after 2008 (however, 2012 was prior to the annual revision). However, when the indices based on a closer base are published, these indices may replace those indices with an older base (see the next page). Furthermore, the 1970-based indices went through a change in their weights and an interim correction after their figures amended through the annual revision in 1973 had been confirmed, before the base revision in 1975. This means there are two series of figures for 1973 on the basis of the 1970-base. However, this correction only meant to be an exceptional measure, and it is considered to be more appropriate that the percent change from the previous year should be calculated with the figures before the interim correction as 1972 and 1973 used the same weights.

The table on the next page shows the Indices of Industrial Production from the 1955 base to the 2010 base, which means it chronologically lists the percent changes in the indices from the respective previous years and the percent changes in the indices from the respective, previous fiscal years (the ratio of each fiscal year to the previous fiscal year starting from April to March in the following year) from 1954.

Transitions of Percent Change in the Indices of Industrial Production from Previous Years (Fiscal Years)

Base year	Year/Fiscal year	Percent change from previous year	Percent change from previous fiscal year
1955	1953	-	-
	1954	8.4	3.7
	1955	7.6	11.7
	1956	22.4	24.1
	1957	18.1	12.5
1960	1958	0.2	2.8
	1959	20.1	25.2
	1960	24.8	22.5
	1961	19.4	18.5
	1962	8.3	4.7
1965	1963	10.1	15.3
	1964	15.7	12.6
	1965	3.7	3.2
	1966	13.2	17.1
	1967	19.4	18.6
1970	1968	17.7	17.2
	1969	16.0	16.7
	1970	13.8	10.8
	1971	2.6	2.0
	1972	7.3	*10.8
1975	1973	*17.5	*14.8
	1974	- 4.0	- 9.7
	1975	- 11.0	- 4.4
	1976	11.1	10.8
	1977	4.1	3.2
1980	1978	6.2	7.0
	1979	7.3	8.0
	1980	4.7	2.2
	1981	1.0	2.0
	1982	0.3	- 0.6

Base year	Year/Fiscal year	Percent change from previous year	Percent change from previous fiscal year
1985	1983	3.6	6.4
	1984	9.4	8.4
	1985	3.7	2.5
	1986	- 0.2	- 0.2
	1987	3.4	5.9
1990	1988	9.5	8.9
	1989	5.8	4.3
	1990	4.1	5.0
	1991	1.7	- 0.7
	1992	- 6.1	- 6.3
1995	1993	- 4.5	- 4.0
	1994	0.9	3.0
	1995	3.2	2.1
	1996	2.3	3.4
	1997	3.6	1.1
2000	1998	- 7.2	- 7.0
	1999	0.2	2.6
	2000	5.7	4.3
	2001	- 6.8	- 9.1
	2002	- 1.3	2.8
2005	2003	3.3	3.5
	2004	4.9	3.9
	2005	1.3	1.6
	2006	4.5	4.6
	2007	2.8	2.6
2010	2008	- 3.4	- 12.7
	2009	- 21.9	- 9.5
	2010	15.6	8.8
	2011	- 2.8	- 0.7
	2012	0.6	- 2.9

Note: 1. * means the rate of growth before the interim correction.

2. The rates of growth in the shaded areas are calculated with the indices based on the respective previous bases.

3. Transitions of Production Activities in Mining and Manufacturing

Sixty-three years have passed since the end of the World War II, and during these years, Japan has gone through a remarkable development and has become a major economic power on a global scale. This period can be largely divided into four phases: [1] After the post-war reconstruction and the high-growth period, [2] Two oil crises, [3] The high-yen recession and the subsequent, so-called "bubble" economy expansion, and [4] the long-term stagnation called the "Lost ten years" and the subsequent, gradual and long-term expansionary phase. The examination of these phases with the rate of increase of the Indices of Industrial Production enables clear understanding of the status of production activities during the period.

Let us observe the past transitions of the percent change from each of the previous years in light of the table on the previous page. The highest percent change from the previous year was in 1960, followed by 1956 and 1959, each indicating a remarkably high rate of increase of over 20%. On the other hand, the indices were low in 1974 and 1980, immediately after the first oil crisis, which gives evidence of the seriousness of the stagnant production activities during this period. Further, there was a decline in 1986 for the first time in 11 years due to a shape appreciation of the Japanese yen, though it marked an increase again from 1987. In 1992 and 1993, the production activities experienced the first decline for two consecutive years since 1974 and 1975, indicating sluggish trends. With various economic measures, the activities hit the lowest point and shifted to a gradual rise. Subsequently, poor domestic demand led upward trends to be weakened. Consequently, in 1998, there was the second greatest fall after 1975. In 2000, though the indices increased as supported by IT-related demand and export, they fell again for two consecutive years from 2001. Thereafter, they had a long-term, gradual rise until 2007, mainly due to export.

How has the recent pace of increase changed in comparison with such pace in the high-growth period? Since 1974, the only percent change from the previous year that exceeded 10% was the one in 1976. During 20 years from 1954 to 1973, there were 13 times where the percent change from the previous year showed a double-digit change. It is clear that the recent pace is slow, compared with the one during the high-growth period.

Further, in 2009, there was a record fall of 21.9% due to the economic recession due to the financial crisis of 2007-2008.

The details above cover the pace between January and December based on the calendar year. The rate of increase can be viewed slightly differently if it is based on the fiscal year basis starting from April to March in the following year. Although it is the same that the percent change from the previous year exceeded 20% three times, in the fiscal 1956, fiscal 1959 and fiscal 1960, the order of these sizes changed. The order of the sizes of decline in the fiscal 1974 and in the fiscal 1975 also reversed. In addition, there were a slight fall in the fiscal 1982, and a fall for three consecutive fiscal years from the fiscal 1991 to fiscal 1993. After 1974, there was a double-digit growth only in the fiscal 1976. During the period of 20 years from the fiscal 1973, there were 15 double-digit rises. Accordingly, the rate of increase changes a little even where the period from January to March shifts only slightly.

4. Economic Trends from the Aspect of Connected Indices

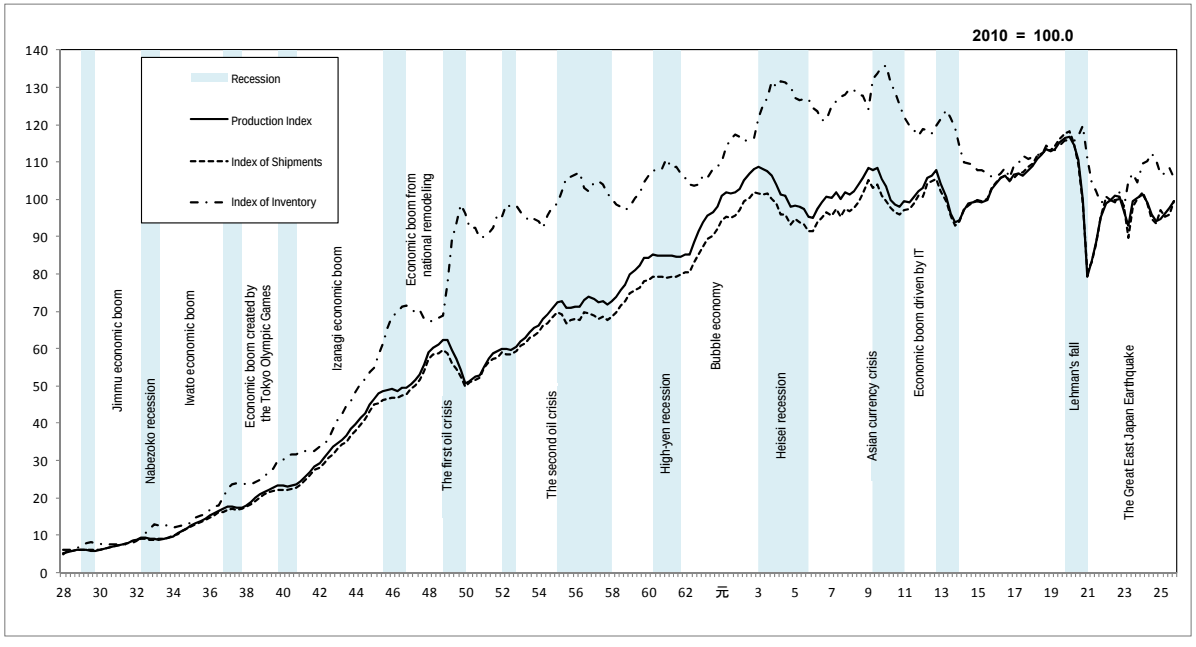
As stated above, connected indices have been calculated and published retrospectively up to January 1978. Further, when it comes to the Indices of Industrial Production, the quarterly, yearly and fiscal-year-based indices have been published retrospectively up to 1953. However, in comparing two series of the indices which are far from each other in terms of years, it is necessary to take note of the accumulation of differences in the connection of the two. In addition, as the level of the connected index for 1953 on the basis of the 2010 base is 5.4 for the overall mining and manufacturing industry, it is necessary to note huge errors generated from rounding-off. For this reason, the connected indices by industry for 1977 or earlier are not released.

The following graph intentionally starts from 1953 to see the quarterly transitions of the Indices of Production, Shipments and Inventory from the high-growth period.

According to the graph, the scale of fall in 1974 and 1975 immediately after the first oil crisis is clear. The pace of rise until 1973 and the subsequent pace of rise clearly differ, evidencing the results of the observation of the percent changes from the previous years above.

The shaded periods in the chart show the periods of economic recession. The periods of economic expansion before the first oil crisis had a name. The longest economic boom period was the economic expansion from February 2002 to October 2007 (tentative decision). On the other hand, the longest economic downturn was the one after the second oil crisis (approximately for three years). The average total length of one cycle of the economy is around four years, consisting of two and half years for an economic expansion period and one and half years for a recession period. The relation between movements of production and inventory and economic phases shows that production declines or slows down before and after an economic peak and rises in the same period as a bottom of recession, whereas inventory has a turning point sometime after an economic peak and bottom.

Transitions of the Indices of Production, Shipments and Inventory



5. Changes in the Industrial Structure from the Aspect of Indices

Indices are created for analyzing trends by lining them up in chronological order. However, apart from such analyses, they can be utilized for other economic analyses in various ways by taking advantage of the structural characteristics of indices. In this section, let us look at changes in the industrial structure with reference to weights. Weights used for indices are compositional ratios of value added. From this, it is possible to have an overview of changes in the industrial structure from the past to the present time by comparing value added weights classified by industry for the Production Index based on different bases.

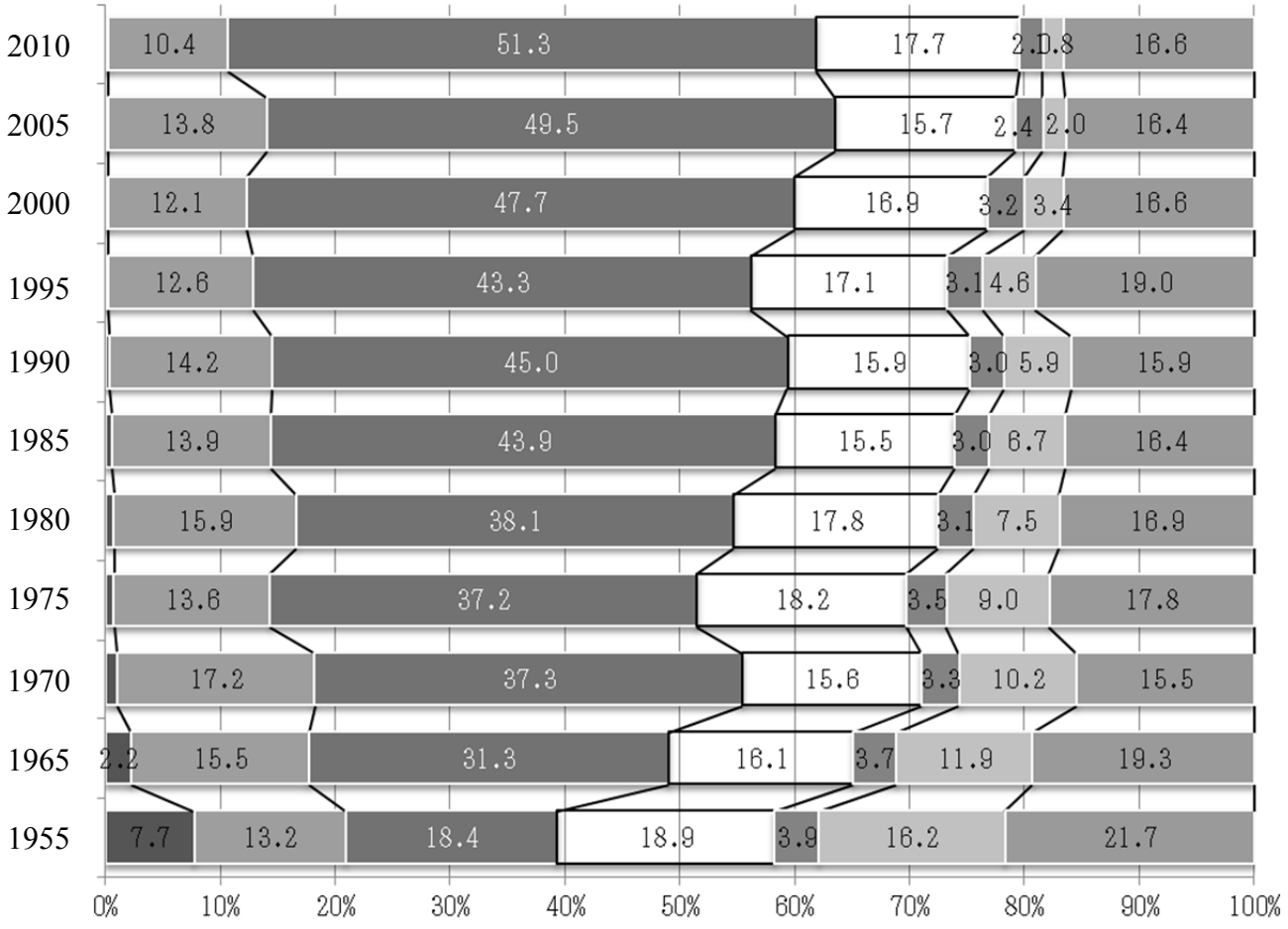
The chart on the next page is the percentage bar chart showing the value added weights for the indices based on each base year of 1955, 1970, 1980, 1985, 1990, 1995, 2000 and 2005. With the graph on the previous page, roughly, 1955 was the period when Japan was heading toward a high-growth period after the post-war confusing period. 1970 was the period when Japan became a major economic power by mostly accomplishing high-growth and when a wave of internationalization, such as trade conflict and yen appreciation, was about to come. 1980 was the period when the economy was entering a recession due to the second oil crisis once again after recovering from the first oil crisis. 1985 was a stable period after economic expansion, despite a sharp hike in the yen in the latter half of the year. 1990 was the period of a so-called bubble boom as the economy expanded after the strong recovery following the yen appreciation. 1995 was the period when the economy was entering a low growth period after recovering gradually from the recession following the economic bubble burst. 2000 was the period when the economy was temporarily shored up by information technology. 2005 was the period of a long-term, gradual economic expansion after the IT-led economy slowed down.

The graph shows that Machinery industry that accounted for less than 20% in 1955 developed dramatically during the high growth period in 1970 to reach near 40%, and has further continued expanding even in the current low growth period, accounting for approximately 50% and serving as an engine of the mining and manufacturing industries. On the other hand, the industry of Textiles accounted for nearly the same composition ratio as the ratio of Machinery industry in 1955. However, it declined to 0.8% in 2010 as the production gradually shrunk with the volume of import increasing. In the same manner, though Mining, including the coal industry as its typical example, had a composition ratio of less than 10% in 1955, it drastically dropped due to energy shift, resulting in less than 1% after 1970. Considering the entirety of Iron and steel, Non-ferrous metals, Fabricated metals, Ceramics, stone and clay products, Chemicals, and Petroleum and coal products collectively as the material-based industry, its total accounted for over 30% in 1955 and then way below 30% in 2010.

An examination of Foods and tobacco, Plastic products and Other manufacturing as one group shows that the group expanded as Plastic products grew since 1975. However, the food industry had been on the decline due to increase in imports. This led the group to move around 17%, except in 1995 when there was an increase as the industry of “Newspapers and publishers” was newly incorporated.

On the other hand, Machinery industry has consistently developed since 1955. Although it shrunk after the bubble economy, it started expanding again and grew over 50% in 2010.

Transitions of Value-Added Weights Classified by Industry



- Mining
- Iron and steel, Non-ferrous metals, and Fabricated metals
- Machinery industry
- Ceramics, stone and clay products, Chemicals, and Petroleum and coal products
- Pulp, paper and paper products
- Textiles
- Foods and tobacco, Plastic products, and Other manufacturing

6. Changes in Selected Items

The selected items for the Indices of Industrial Production are selected on the basis of the representativeness (size of weight) of items, as an important requirement, in relation to the mining and manufacturing industries in the relevant base year. Accordingly, an examination of changes in the selected items enables us to understand trends of the times, such as the introduction of new products and conversely the declination of products.

Main Newly-Selected and Abolished Items for 1990-2010 Bases

	Main Newly-Selected Items	Main Abolished Items
The 1990 Base	Steel and stainless doors Office computer Industrial television devices Automatic transmission Fluorine resin Non-woven fabric	Solar-powered water heaters Electric fans KD set (passengers cars) Fishing net Lead pencils
The 1995 Base	Semiconductor products machinery Digital and color copying machines Pagers Car navigation system Small sized sealed lithium ion rechargeable batteries Silicon wafers	Domestic sewing machines Electronic calculators Telephone sets and answering machines Headphone stereos Cassette tape recorder with radio
The 2000 Base	Optical fiber core wires Flat-panel display products machinery Tickets vending machines Liquid crystal display television DVD video Metal oxide semiconductor ICs (CCD) Low-malt beer	Electrostatic indirect copying machines Word processor Cordless phone Pagers Video disk players Rayon yarn
The 2005 Base	Engine-powered air conditioners Automatic dish washers and driers Optical disks Photovoltaic modules PDP modules Carbon fiber Toilet stools with washer/seat heater	Power tillers Rice planting machines Tobacco vending machines Facsimiles PHS Video tape recorders Cathode-ray tubes for color television sets 35mm cameras
The 2010 Base	Solar battery cells Engines for motor vehicles Aircraft parts Non-alkali glass substrates Corrugated cardboard boxes	Laminated springs Optical disks Electric washing machines DVD video Motorcycles (125 ml. or less)

Chapter III Regional Indices

1. Outline of Regional Indices

Other than the nationwide Indices of Industrial Production, regional versions of the indices are also prepared. Eight Bureaus of Economy, Trade and Industry from Hokkaido to Kyushu, which are local branch offices of the METI, prepare the indices covering their own areas. The Bureaus prepare the Indices of Production (value added weights), Shipments, Inventory and Inventory Ratio classified by industry and use of goods, as is the case for the nationwide indices. Among the Bureaus, the Chubu Bureau of Economy, Trade and Industry creates the Production Index for Tokai Region (Gifu, Aichi and Mie Prefectures) among its areas. The Hokuriku Branch for Electricity and Gas Operation creates the Production Index for Hokuriku Region (Toyama, Ishikawa and Fukui Prefectures).

Further, the local governments create the indices for their own areas. In the case of Hokkaido, the Hokkaido Bureau of Economy, Trade and Industry creates indices as the Bureau covers only one prefecture. Each local government creates the Production Index (value added weights), and approximately two-thirds of the local governments also create the Indices of Shipments and Inventory. The majority of the local governments create both indices classified by industry and those classified by use of goods, though some only create the former. Among regional indices by industry, some do not adopt the main industrial classification adopted by the nationwide indices, or integrate the main industrial classification into their own classification, in order to match the economic situation of their regions.

These indices are basically prepared in conformity with the preparation guidelines for the nationwide indices. Accordingly, each of such indices covers the mining and manufacturing industries and is calculated with the weighted arithmetic average method based on weights fixed in the base period (the Laspeyres formula) on the basis of the 2010 base. As the basic data for the preparation of the indices, the Census of Manufactures is used for the calculation of weights, and current production statistics are used for the monthly performance of each item, as is the case for the nationwide indices. With regard to those selected items which are not covered by the Current Production Statistics Survey, survey results are obtained from outpost agencies of the other ministries and agencies, such as the Ministry of Agriculture, Forestry and Fisheries, and industrial organizations in the region concerned, though some local governments conduct their own surveys in relation to particular items for the purpose of preparing indices.

2. Relation between the Nationwide Indices and Regional Indices

Those indices prepared by a Bureau of Economy, Trade and Industry do not necessarily accord with the integrated indices of the relevant local governments within the area of the Bureau. Moreover, the indices integrating those indices prepared by all the local governments or the indices integrating the indices of each of the Bureaus of Economy, Trade and Industry do not necessarily match the nationwide indices completely. The first reason for this is that the selected items consist of those items chosen in accordance with the characteristics of each region. The selected items for the nationwide indices are chosen from the perspective that such items represent the production activities of the whole country, whereas items which represent the production activities of the region concerned are selected for the relevant regional indices. Even where an item has a large weight in terms of the entire nation, it will not be adopted in a region if its composition ratio in the region is small. On the other hand, those items not adopted to the nationwide indices should be selected for regional indices if they are regionally important, and should be reflected in movements of regional indices. The second reason for the non-matching is the non-consistency of weights. In the Census of Manufactures, which serves as the basic data, the total of regional figures is treated as the nationwide figure. However, the extent of the representativeness of the selected items differs regionally, and thus there is no consistency in the method for the inflation in the calculation of weights. The indices of each region are designed to adapt to the regional, economic characteristics in order to enable the indices to most accurately reflect the activities of the region.

As the indices of each region appropriately represent the production activities of the region, the extent of non-consistency is not significant between the indices integrating regional indices into a nationwide level and the nationwide indices. For this reason, integrated indices for a particular region may be created to adapt them to a particular analysis purpose.

[Reference] (1) Table of Production Index Weights (Value Added) by Industry, for Each Bureau of Economy, Trade and Industry

	Nationwide	Hokkaido	Tohoku	Kanto	Chubu	Specially listed		Kinki	Chugoku	Shikoku	Kyushu	Okinawa
						Tokai Region	Hokuriku Region					
(Base values of weights: million yen/month)	7,392,845	129,443	439,371	2,830,421	1,319,559	1,158,219	216,984	1,333,829	545,480	223,422	566,548	12,166
Mining and manufacturing	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0	10,000.0
Manufacturing	9,978.9	9,858.7	9,979.8	9,972.0	9,991.5	9,992.6	9,996.4	9,995.5	9,986.7	9,981.9	9,958.6	9,829.1
Iron and steel	391.1	750.4	270.4	284.1	385.0	394.7	243.4	478.4	768.6	96.1	569.3	386.1
Non-ferrous metals	232.5	43.6	244.3	253.0	213.2	172.1	464.6	167.7	268.0	804.3	207.3	58.6
Fabricated metals	418.1	654.6	400.9	485.3	345.9	301.5	601.8	569.5	361.1	361.6	410.8	1,231.3
General-purpose, production and business oriented machinery	1,273.1	490.3	1,469.3	1,177.7	1,074.7	990.1	1,273.8	1,735.9	1,118.7	1,003.3	1,119.2	–
General-purpose machinery	418.6		287.6	416.8	340.1	330.0	282.0	781.3	388.1	483.6	312.7	–
Production machinery	701.2		789.1	606.2	677.9	598.6	961.9	794.2	662.3	519.7	574.7	–
Business oriented machinery	153.3		392.6	154.7	56.7	61.5	29.9	160.4	68.3	–	231.8	–
Electronic parts and devices	818.6	1,168.5	1,687.4	591.9	1,101.1	951.0	2,075.7	618.7	706.5	1,579.8	1,229.9	–
Electrical machinery	667.7		434.6	926.5	531.0	561.6	600.2	895.5	252.2		452.0	–
Information and communication electronics equipment	453.4		917.9	617.2	317.2	313.0		339.2	235.1		123.5	–
Transport equipment	1,912.4	700.1	828.1	1,862.0	3,259.3	3,648.8	393.0	835.4	2,351.6	708.0	2,448.7	–
Ceramics, stone and clay products	315.8	603.8	375.6	231.7	340.5	354.7	322.7	533.5	189.3	238.3	390.7	1,806.7
Chemicals	1,277.4	433.3	807.8	1,514.6	757.2	692.3	1,347.9	1,678.1	1,644.2	2,292.9	760.1	962.2
Petroleum and coal products	175.8	352.0	74.4	230.1	133.4	150.7	–	107.2	327.1		65.8	
Plastic products	507.5	120.4	286.3	464.1	571.4	585.4	511.5	525.2	435.5	407.0	317.6	174.5
Pulp, paper and paper products	203.6	1,191.6	321.5	178.5	75.4	66.4	204.9	137.2	163.7	739.3	205.1	164.0
Textiles	183.4	109.5	248.6	87.1	190.0	139.8	836.7	294.3	310.4	369.2	164.6	113.2
Foods and tobacco	613.9	2,422.1	1,061.8	413.8	307.4	307.3	401.8	668.0	378.2	1,052.4	964.0	4,255.3
Other manufacturing	534.6	472.1	625.3	654.4	388.8	363.2	718.4	411.7	476.5	329.7	530.0	849.0
Rubber products	161.0	–	191.5	151.8	167.8	183.8	–	116.7	85.0	69.6	283.2	–
Furniture	67.3	158.9	61.7	63.8	92.3	64.6	–	60.2	225.0	46.4	83.2	–
Printing	197.1	346.4	180.3	301.4	68.3	59.3	165.0	168.8	37.2	87.7	81.8	663.4
Wood and wood products	58.4	313.2	120.9	48.9	48.6	42.2	71.6	26.3	93.5	98.2	71.7	13.8
Other products	50.8	–	70.9	88.5	11.8	13.3	481.8	39.7	35.8	27.8	10.1	–
Mining	21.1	141.3	20.2	28.0	8.5	7.4	3.6	4.5	13.3	18.1	41.4	170.9
(Reference) Machinery industry	5,135.2	2,358.9	5,368.7	5,175.3	6,283.5	6,464.7	4,397.9	4,436.5	4,664.1	3,291.1	5,373.3	–
Seasonal adjustment method (Production Index)	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA	X-12-ARIMA
ARIMA Model	(0 1 2) (0 1 1)	(2 1 0) (0 1 1)	(2 1 0) (0 1 1)	(0 1 0) (0 1 1)	(0 1 0) (0 1 1)	(0 1 0) (0 1 1)	(0 1 0) (0 1 1)	(0 1 0) (0 1 1)	(1 1 0) (0 1 1)	(0 1 1) (0 1 1)	(0 1 1) (0 1 1)	(0 1 1) (0 1 1)
Day adjustment	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted	2 days adjusted
Holiday adjustment	Done	Done	Done	Done	Done	Done	Done	Done	Done	Done	Done	Done
Leap year adjustment	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion	Adjusted after conversion
Target period	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96	At the time of 96
Type of Outliers/Period of Outliers	TC2009.02 TC2011.03	TC2009.02 AO2011.03	TC2009.02 TC2011.03 TC2011.04	LS2008.12 TC2009.02 TC2011.03	LS2008.12 TC2009.02 LS2011.03	LS2008.12 TC2009.02 TC2011.03 TC2011.04 AO2011.11	LS2008.11	LS2008.11 LS2009.01 AO2009.08 AO2011.02	LS2008.11 TC2009.01 TC2011.03	–	TC2011.03	–

Note 1) No index is released for "General-purpose, production and business oriented machinery" in Kanto and "(Reference) Machinery industry" in Shikoku.
2) "General-purpose, production and business oriented machinery" in Shikoku is the total of its "General-purpose machinery" and "Production machinery."
3) "Other products" in Hokuriku includes its "Rubber products" and "Furniture."
4) "Other manufacturing" in Okinawa is the total of its "Non-ferrous metals," "Textiles," "Printing" and "Wood and wood products."
5) The Statistics Division, Department of Planning, Okinawa Prefectural Government prepares the indices for Okinawa.