Outline of the Industrial Production Index

Economic Analysis Office

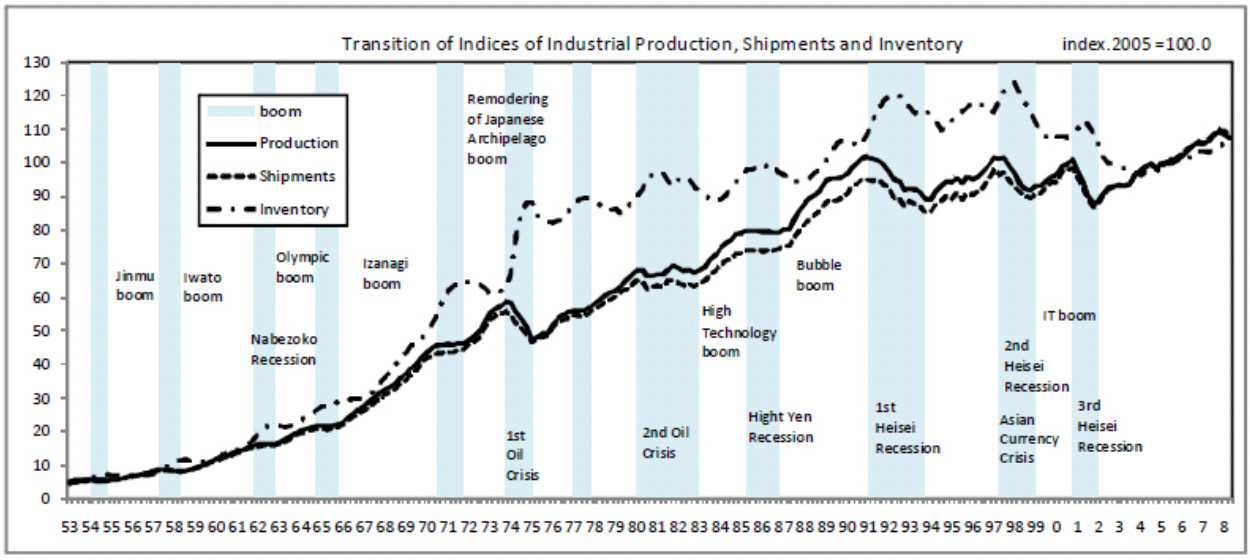
Research and Statistics Department

Economic and Industrial Policy Bureau

Ministry of Economy, Trade and Industry

Contents

Changes in Indices VS Business trends



Indices of Industrial Production (IIP)

Individual index Monthly production / Monthlyaverage production in 2005

Composite index Weights — Summarize the individual indices according to their importance (the importance of the item or the sector the entire industry)

Chapter 1

Outline of the Index

1. What is the Index?

The index represents the magnitude relation among statistical values of the same kind in a form of ratio. The index indicates in the ratio in which the one, that becomes a criterion, is assumed to be 100. Therefore, the index can easily compare temporal variation and locational variation.

2. Purpose to prepare the Index

Locational comparison: Comparing the production and the trend of the price in each area at the same point of time

> The boom and bust among areas as well as the prosperity of industries in each area can be grasped.

Temporal comparison: Grasping the change of the production and the trend of the price from the past to the present

> The feature of the production trend is clarified by comparing the data of certain consecutive time point with that of another consecutive time point.

However, indices are used most frequently for the purpose of temporal comparison, and are normally used not only for comparison of two points of time, but also for comparison of consecutive points of time; namely, time series.

3. Types of Indices

Three elements to grasp the production activity

$$\text{Value of production} = \text{Manufacturing quantity} \times \text{Unit price}$$

The index prepared about the above-mentioned elements is called Monetary index, Quantum index, and Price index relatively.

Monetary index:	This is the index to represent fluctuation of the value of production (quantity and price)….trade value index
Quantum index:	This is the index to represent fluctuation of actual quantity only without price fluctuation….Industrial production index
Price index:	This is the index to represent fluctuation of actual price only without quantitative fluctuation….Corporate goods price index, Consumer price index

4. Concept of Indices

(1) Preparing the index by items (the individual index)

> It is able to grasp the trend of the production of an individual item by making it an index.

The method to convert the production result by items to the quantum index. (Although the obtained value is multiplied by 100 actually, in this text, the formula might be omitted.)

Example 1: Year-on-year…Index that makes the previous year as the base period (Link relative)
The base period varies according to the time point.

Year-on-year of year (t) = Manufacturing quantity in year(t) (Comparison period) ／ Manufacturing quantity in year (t-1) (Base period)
Year-on-year of year (t+1) = Manufacturing quantity in year (t+1) (Comparison period) ／ Manufacturing quantity in year (t) (Base period)
Year-on-year of year (t+2) = Manufacturing quantity in year (t+2) (Comparison period) ／ Manufacturing quantity in year (t+1) (Base period)

Example 2: Fixed base index…Comparison period ／ Base period
The value at the same time point as all time points in the period to be gasped will be the base period. Generally, when it is called an index, it doesn't mean Year-on-year but this.

Index of year (t) = Manufacturing quantity in year (t) (Comparison period) ／ Manufacturing quantity in year (t) (Base period) = 100
Index of year (t+1) = Manufacturing quantity in year (t+1) (Comparison period) ／ Manufacturing quantity in year (t) (Base period)
Index of year (t+2) = Manufacturing quantity in year (t+2) (Comparison period) ／ Manufacturing quantity in year (t) (Base period)

Table A Production result by items in certain region, Year-on-year and Fixed base index

	Production result		Production result		Fixed base index (Base year = 2000)	
Item	Steel	Passenger car	Steel	Passenger car	Steel	Passenger car
Unit	t	cars	%	%	%	%
Year						
2005	598,000	80,500	-	-	100.0	100.0
2006	556,700	81,000	93.1	100.6	93.1	100.6
2007	587,500	83,600	105.5	103.2	98.2	103.9
2008	553,800	81,100	94.3	97.0	92.6	100.7

Table B Unit price by items

Item	Steel	Passenger car
Unit	1,000 yen/ton	1,000 yen/car
2005	95	1,500
2008	70	2,000

(2) Preparing the composite index

It is necessary to grasp the whole production activity in the nation or in a region. The composite index is able to represent the overall trend that cannot be grasped with individual data.
→ To prepare the composite index is the final target of preparing individual indices.

Concept of Composite index

× (1) Preparing the composite index by the aggregated amount of the Manufacturing quantity of each item

Even if the manufacturing quantities of items with the different unit of measure are summed up, it becomes a meaningless index. Also, only because the unit of measure is rounded up, the numerical value is varied.

Calculating, based on Table A, the base period as 2005 and the comparison period as 2008.

$$\frac{553{,}800 + 81{,}100}{598{,}000 + 80{,}500} = 93.6 \quad \rightarrow \quad \frac{5{,}538 + 81{,}100}{5{,}980 + 80{,}500} = 100.2$$

× (2) Calculating the individual indices of each item and assuming the mean value of them to be a composite index

The problem of the unit is resolved by having the index by items. However, it was assumed that the proportions of the manufacturing quantity of two items, that is 598,000 tons and 80,500 cars, had the same influence level for the whole.

→ It becomes a meaningless index as well as foregoing (1) because it doesn't have an objective proof.

$$\frac{92.6 + 100.7}{100.0 + 100.0} = 96.7$$

○ (3) Preparing the composite index by the aggregated amount of the value of production of each item

The problem of variation in unit is resolved by using the integrated unit of value. Also, the level of importance of each item is taken account. However, the problem due to the relation of [value = quantity x unit price] arises. It contains the fluctuating factors of both quantity and price. Accordingly, even though the manufacturing quantity is the same as before, if the price rose, it turn out that the production activity rose. Consequently, the reading of the result becomes difficult.

Calculating by using the unit price of Table B

$$\frac{553{,}800 \times 70 + 81{,}100 \times 2{,}000}{598{,}000 \times 95 + 80{,}500 \times 1{,}500} = 113.2$$

○ (4) Preparing the composite index by the aggregated amount of the value of production that was calculated using the price of each item at the base period. It is able to represent only the fluctuation of quantity by fixing price.

$$\frac{553{,}800 \times 95 + 81{,}100 \times 1{,}500}{598{,}000 \times 95 + 80{,}500 \times 1{,}500} = 98.1$$

In the Industrial production index, the Composite index is prepared according to the concept of foregoing (4).

This is called the Laspeyres formula quantum index.

Chapter 2

Industrial Production Indices

1. Definition of Production Activities

Primary industry

Agriculture, forestry, fishery

Secondary industry

Mining, construction, manufacturing

Tertiary industry

Electricity, gas, heat, and water supplies; information and communications; transport; wholesale and retail; financing and insurance; real estate, restaurants and lodging; services; public services

2. Scope of Industrial Production Indices

Mining and manufacturing (including electricity and gas services for reference sake) in the secondary industry

3. Purpose of Preparation

For quantitative understanding of the transition of production activity levels and its trends more rapidly and more adequately

4. Feature and Importance

(1) Sensitive to economic trends

(2) Preliminary report (published at the end of the next month)

(3) Industry-related activities have considerable impacts on our economic activities (gross domestic product).

(4) Possible to grasp inventory adjustments as a factor of economic fluctuation

5. Structure of Industrial Production Indices

(1) Scope: Mining and manufacturing

(2) Base period: average in 2005 = 100

(3) Calculation method: Fixed weighted arithmetic mean over base period (Laspeyres formula)

(4) Basic system: Production, shipment and inventory amount applying quantity by item to be used for individual index

(5) Weight: Each amount of money component ratio in 2005 (Added value amount, production amount, shipment amount, inventory amount)

(6) Seasonal adjustment: US Census Bureau method (X-12-ARIMA)

(7) Publishing: Preliminary report: Latter half of the next month

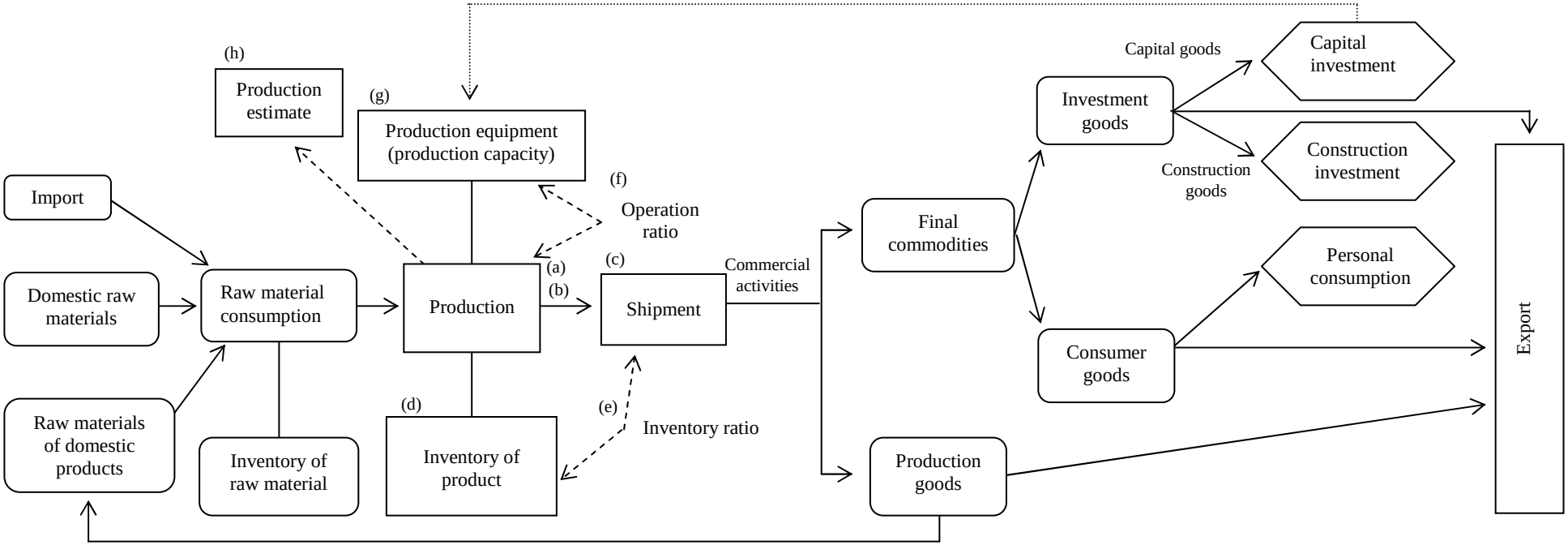
Final report: Middle of the month after next month

6. History

Ministry of International Trade and Industry prepared and published the 1946-based production index in 1950. In 1953, indices of shipment, inventory, capacity, and operation factor were published in addition to the 1950-based production index. The inventory ratio was added in the 1955-based indices published in 1957, thereby establishing the current index system. Since then, the base year has been revised every five years, and the system has come down to the present[1].

[1] As of October 2008, the 2005-base production indices have been published.

7. Type


(h)
Production estimate
(g)
Production equipment (production capacity)
Import
(f)
Operation ratio
Domestic raw materials
Raw material consumption
Production
(a)
(b)
(c)
Shipment
Commercial activities
Final commodities
Capital goods
Capital investment
Investment goods
Construction goods
Construction investment
Personal consumption
Consumer goods
Export
Raw materials of domestic products
Inventory of raw material
(d)
Inventory of product
(e)
Inventory ratio
Production goods

Category of index	Weight base value	Variation	No. of items
(1) Production index (value-added weight)	Value-added	Production volume	496
(2) Production index (production weight)	Value of production	Production volume	496
(3) Index of producers' shipment)	Value of shipment	Shipment volume	496
(4) Index of producers' inventory of finished goods)	Value of producers' inventory of finished goods	Inventory volume	358
(5) Index of producers' ratio of inventory to finished goods	Value of producers' inventory of finished goods	Inventory volume / Shipment volume	342
(6) Operation rate index	Value-added	Production volume / Production capacity	163
(7) Index of production capacity	Value of production capacity (Value added appraised)	Production capacity	163
(8) Index of manufacturing production forecast	Value-added	Production volume	195

(1) & (2) Production index

The main index among industrial production indices is the Production Index. The production index varies with monthly production volume as the variance and consists of two categories of indices; namely 1) the index weighted with value-added, and 2) the index weighted with value of production itself. The production index weighted with value-added is prepared to grasp levels and trends of production in the mining and manufacturing industries, and is an important index since it shows trends matching with fluctuations of real GDP (gross domestic product). Meanwhile, the production index weighted with production value is prepared to consistently grasp production activities of goods in the cycle of production, shipment, and inventories. In most cases, the production index refers to the production index weighted with value-added.

(3) Shipment index

The index of producer's shipments of finished goods varies with monthly shipment volume as the variance and weighted with shipment value. The index is used for grasping trends in supply and demand.

(4) Inventory index

The index of producer's inventory of finished goods varies with the volume of inventory of finished goods as of the end of each month as the variance, and is weighted with value of inventory (monthly average in the base year). This index represents trends in levels of inventory, which means finished goods left at producers' hands without being shipped, and, like the shipment index, is useful for grasping trends in supply and demand of finished goods.

(5) Index of ratio of inventory to finished goods

The index of producers' ratio of inventory to finished goods varies with the ratio of inventory volume to shipment volume (inventory volume / shipment volume) as the monthly variance and is weighted with value of shipment of finished goods (monthly average in the base year). This index is used for grasping trends in supply and demand of finished goods, showing

supply and demand situations of produced finished goods; whether they are in the phase of inventory accumulation or unplanned buildup of inventory (upward trend), or in the stage of inventory reduction or unintended falling of inventory (downward trend). Since the numerator and denominator of the variance are rates (inventory / shipment), the index is called index of ratio.

Items having extremely high seasonality, such as oil heaters, are excluded from adoptable series, since their inventory rate themselves fluctuate greatly. Although the weight of the inventory ratio is applied to weighting of inventory, the weight decreases by the portion of commodities without inventory ratio series, despite being in inventory series. Consequently, the weight of the inventory ratio does not reach 10,000.0.

(6) Index of production capacity

The concept of production capacity is defined as the technically-feasible maximum production volume with given production equipment and under given production conditions. The index of production capacity is an index which varies with production capacities of various production equipment as the variance, being weighted with value-added to be created under the full-scale operations of production equipment in the base year, and represents the amount of value-added which can be created under full-scale operation of the entire manufacturing industry as compared with that in the base year.

(7) Operating rate index

The operating rate index varies with the level of operation of production equipment (real operating rate: actual production volume at the point of time / technically feasible maximum production volume at the point of time) as the variance, and is weighted with value added in the base year. This index is also the index of rate, like the index of producers' ratio of inventory to finished goods.

(8) Index of manufacturing production forecast

The index of manufacturing production forecast is prepared based on the Survey of Manufacturing Production Forecast ("Forecast Survey"). The Forecast Survey researches actual production in the previous month, production forecasted for the current month as of the 10th of each month, and production plan for the following month on a volume basis. The index of manufacturing production forecast is prepared on the basis of findings of the Forecast Survey. The index enables one to grasp production plan for the future on a volume base, and consequently, enables one to take a reading of business mind from the production plan two months ago to the final actual production thanks to surveys covering three periods taken at the same point of time; that is, the projection for the following month, forecast for the current month, and the actual production in the previous month. In other words, for the same point of time, the following rates for projection can be computed.

Amendment ratio = Forecast for the current month (t) in the current survey (t) / Plan for the following month (t) in the previous survey (t-1)

Realization ratio = Actual for the previous month (t-1) in the current survey (t) / Forecast for the current month (t-1) in the previous survey (t-1)

For example, if the realization ratio is more than 100, it shows that companies made a greater production than the initial plan, and if it is less than 100, it indicates that the actual production

fell short the plan. We can say that business mind is on an upward trend in the case of more than 100 and on a downward trend in the case of less than 100. In addition, the same applies to the amendment ratio.

8. Classification

(1) Industry classification

Based on the Japan Standard Industry Classification, with more or less rearrangement for index

Mining and manufacturing

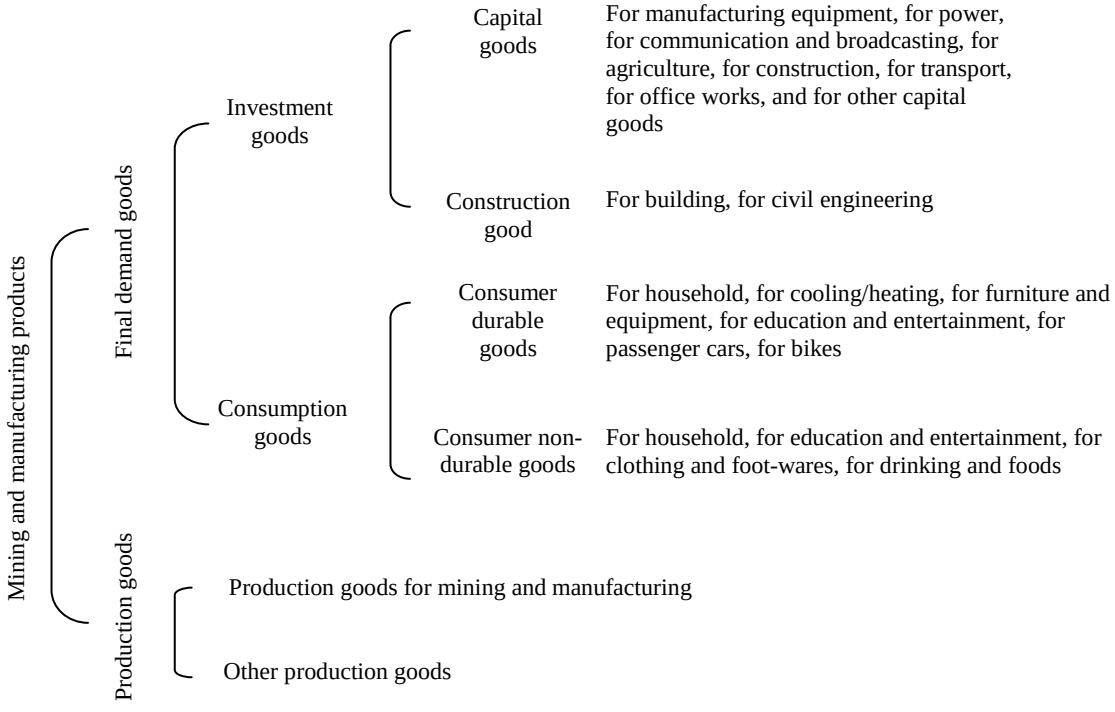
Manufacturing

1) Iron and steel
2) Non-ferrous metals
3) Metals
4) General machinery
5) Electrical machinery
6) Information and communication
7) Electronic parts and devices
8) Transport equipment
9) Precision machinery
10) Ceramics, stone and clay products
11)Chemicals
12) Petroleum and coal products
13) Plastic
14) Pulp, paper and paper products
15) Textiles
16) Foods and tobacco
17) Other manufacturing
17-1) Rubber products
17-2) Leather products
17-3) Furniture
17-4) Printing industry
17-5) Wood and wood products
17-6) Other products

Mining

(2) Special classification

Classification based on economic purposes of products (by commodity)



9. Base period

The Statistics Council made it a rule to set the base period for index at either 0 or 5 of the end numeral of calendar year. (Statistics Council Report; March 20, 1981)[2].

10. Item selection

To prepare the indices every month, the results of the Current Survey on Products are used. As the indices item, 1,120 items out of about 1,800 items of the Current Survey on Products are selected (consolidated to 448 items as the indices item). Consequently, about 90% of products are covered in terms of monetary amounts. In addition, 496 items in sum total are selected as the items of the Industrial Production Indices by also using the results of statistical surveys done by other government agencies. (Please refer to previously cited "7. Type" about the number of items in each index.)

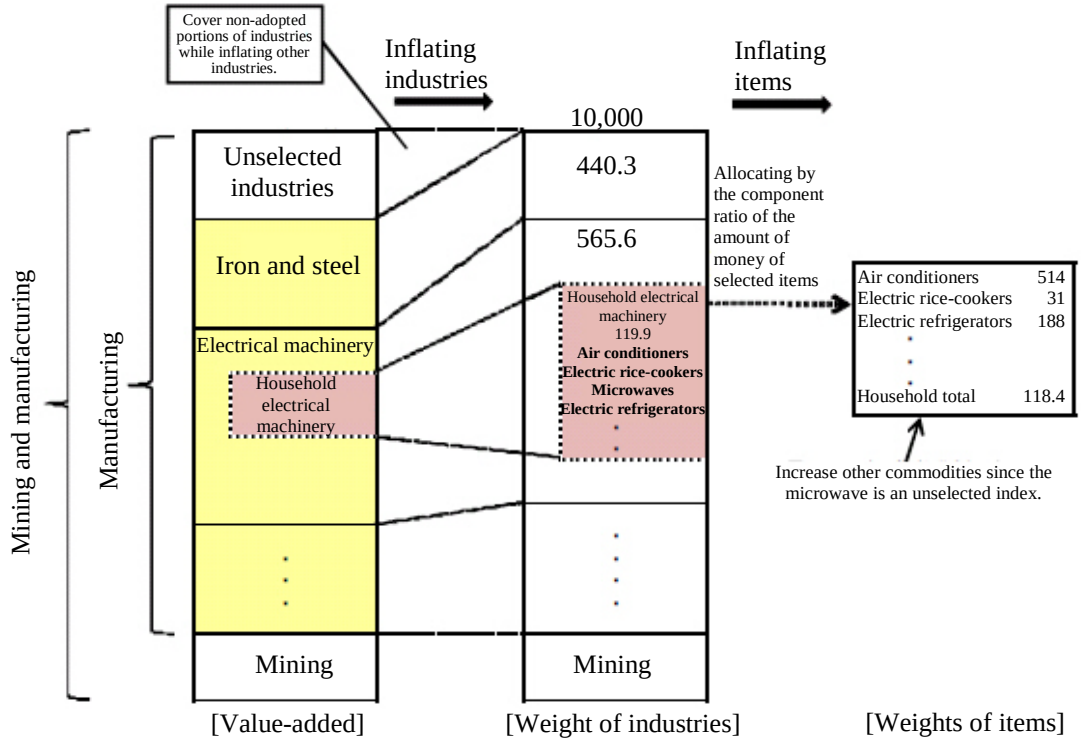
Index of Manufacturing Production Forecast uses the result of Survey of Manufacturing Production Forecast, which is designed to prepare this index, as basic data.

11. Weight

The Industrial Production Indices uses the result of the Census of Manufacture as basic data to figure out the weight.

The weight is represented by the component ratio in which the amount of money of the mining and manufacturing industry is assumed as a whole to be 10,000. Adjustment is made by adding the amount of money of unselected items and industries to those of selected items and industries.

Figuring out the weight of Industrial Production Indices



[2] This is because the frequent revision of base year may cause problems on both work load and convenience for users. According to this report, various economic indices have been revised uniformly to improve convenience for comparison between indices.

12. Seasonal adjustment method

(1) What is seasonal adjustment?

An index is used as a tool for economic analysis in various ways. The most frequently employed manner of use is observation of short-term trends. In this case, if a seasonal fluctuation repeated on a one-year cycle is included, it becomes difficult to judge whether the economy is on an upward trend or whether it shows only effects from a seasonal factor. For this reason, the "seasonal adjustment" to eliminate seasonal variations from original series is carried out. When grasping trends based on original series, comparison with the preceding month cannot be done easily. Consequently, generally the comparison on a year-to-year basis is adopted, but seasonally adjusted series are available for comparison with the preceding month, due to the reason above. This enables one to judge the business trend from the latest trend.

(2) Variation factors in time series data

Fluctuations seen in economic time series data are caused by various factors. Generally, those factors can be classified into the following four kinds.

- Trend factor: A fluctuation continuing in a unilateral direction (rising or falling) for a long period
- Cyclical factor: A fluctuation represented by business fluctuations, repeatedly rising and falling in the manner of a wave
- Seasonal factor: A periodical wavy motion on a one-year cycle
- Irregular factor: A short-term fluctuation caused by unexpected factors

If economic time series data are zero (0), the following equation applies.

O	=	T	×	C	×	S	×	I
Original series	=	Trend factor	×	Cyclical factor	×	Seasonal factor	×	Irregular factor

In the analysis of economic time series, any one of four factors above is often taken out or eliminated; this is called time series dissolution.

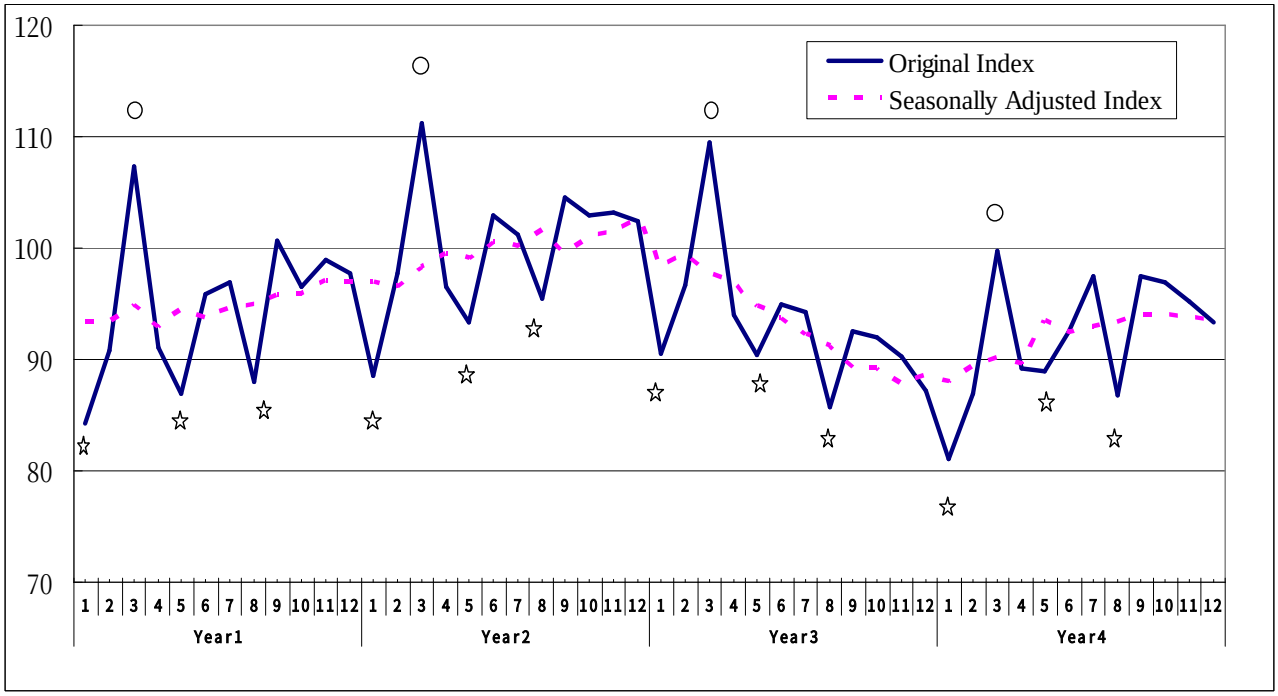
(3) Causes of seasonal variations

Causes of seasonal variations are as follows:

- Natural conditions: ····· Variations caused by changes in natural phenomena including weather and temperature
- Number of business days: ····· Variations caused by fewer business days (operating days) than other months including summer holidays and New Year vacation
- Management conditions: ····· Variations caused by increased sales or receiving orders from the viewpoint of considerations for operating results for the term
- Effects from demand side: ···· Variations caused by a sudden increase in consumer spending due to a bonus month
- Effects from supply side: ····· Variations in production activities due to seasonal restrictions of raw materials, materials, and power

These seasonal variations change their patterns according to changes in economic or social environments due to lapse of time.

Original Index and Seasonally-Adjusted Index



[Example] Method to prepare the seasonal indices

Several methods are available for preparation of a seasonal index. Here, the method of monthly averages will be explained as a simple example.

Year/Month	1	2	3	4	5	6	7	8	9	10	11	12
2003	87.2	91.1	103.4	90.6	899.4	94.5	96.8	84.3	99.4	99.4	96.2	97.4
2004	90.5	95.6	110.8	97.1	91.1	102.1	102.3	91.7	103.9	98.3	101.4	99.1
2005	92.3	97.5	112.4	97.5	92.8	103.1	99.7	93.0	104.6	100.2	104.3	102.6
2006	94.3	100.7	115.0	101.4	96.7	107.5	104.8	98.4	109.4	107.7	109.6	108.1
2007	98.5	103.6	117.3	102.4	101.3	108.9	108.1	102.9	109.6	113.4	113.1	109.7
Monthly average	92.6	97.7	111.8	97.8	94.3	103.2	102.3	94.1	105.4	103.8	104.9	103.4
Seasonal index	91.77	96.83	110.80	96.93	93.46	102.28	101.39	93.26	104.46	102.87	103.96	102.48

<Calculation method>

1) Calculate the average of the same month of each year (for five years).

2) The monthly average is a seasonal model value. Apply indexation to each monthly average value on the assumption that the gross average value of monthly averages is 100.0, to thereby obtain seasonal index.

   Since the gross monthly average value is 100.9, multiply each monthly average by 0.99108 (100.0 / 109.9 = 0.99108).

(4) Seasonal adjustment of industrial production indices

Industrial production indices are seasonally adjusted using the "X-12-ARIMA" method developed by the U.S. Census Bureau to eliminate seasonal factors and factors related to the day of the week and national holidays.

Calculation of the seasonal index uses monthly data for seven years. Accordingly, the seasonal index for 2007 is calculated for the seven years from 2001 to 2007. In addition, for 2008, the seasonal index for 2007 is used provisionally. In this case, the day of the week and national holidays are translated into those in 2008.

13. Publicizing

(1) Publications (Report)

- Production/shipment/inventory index preliminary report
  Latter half of next month
- Production/shipment/inventory index final report
  Middle of the month after the next month
- Yearbook of Industrial Production Indices
  June every year
- Yearbook of Industrial Production Indices by region
  Around December every year

Apart from above, the index data are available via Internet etc..

(2) Index series that are made public

- Composite index: Original index and seasonal adjustment index
  Production/producer shipment/producer product inventory/producer product inventory ratio index
  Operation ratio index, production capacity index (original index only)
- Individual index: Original index and seasonal adjustment index
  Production/producer shipment/producer product inventory/producer product inventory ratio index
  Operation ratio index (not including a part of items), production capacity index (original index only)
- Index of Production Forecast in Manufacturing
  Original index of composite index, seasonal adjustment index, achievement ratio and correction ratio

14. Base revision

Since the Industrial Production Indices prepares monthly indices based on the industrial structure in the base period, it becomes to fail to reflect the actual condition of economy along with change in the industrial structure as the time passed away from the base period.

For example, the upward bias due to the growing items arises. The relative price of growing items will decrease due to decrease in the production cost caused by volume efficiency as the production level rises. If the growing items are estimated from the higher price at the base period, they are

overestimated. After all, the upward bias is included in the composite index. Accordingly, it is necessary to revise the base period for a fixed period of time[3].

(1) Revision of weight

Since the weight of the Industrial Production Indices is fixed at the base period, the weight is renewed to the one that reflects updated industrial structure by the base revision. A result of the "Census of Manufacturer" which covers all manufacturers at home is principally used as the fundamental data for figuring out the weight.

(2) Revision of Item selection

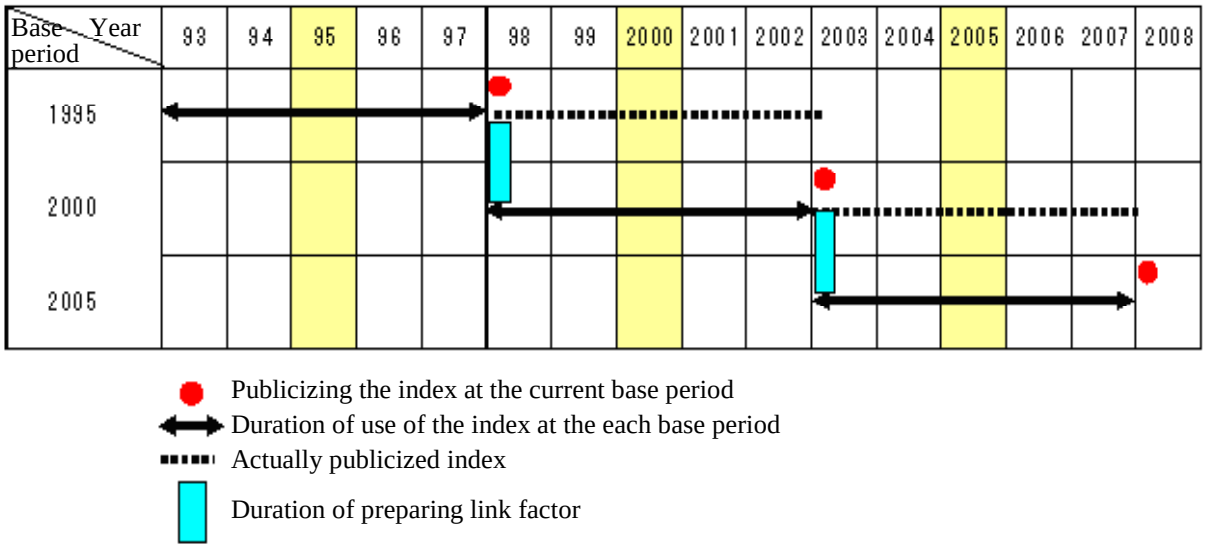
Industrial Production Indices is selecting minimum necessary items, which is able to represent the trend of the production activities of the time as a whole, as index items. However, as time progresses, items which represent the trend of the production activities change because of qualitative changes, new products, and production stoppages. Therefore, it is necessary to revise the selected items and to review the representativeness.

(3) Revision of classification

Industry classification of the Industrial Production Indices is prepared based on the "Japan Standard Industry Classification". Industry classification is changed in concert with the revision or change of the Japan Standard Industry Classification. Apart from the Industry classification, a convenient classification for analysis is newly established.

(4) Index calculation period and connection

Although the index calculation period includes two years respectively before and after the base year, the index is used until the next base revision is completed.
A join index is to make serial observation possible with recalculating indices of difference base years to become commensurate, and generally connect the former base index to the index of the latest base year.



[3] Refer to “9. Base period” in Page 11.

Method to prepare the joint index

To connect the 2000-based index to 2005-based index (2005-year base period link factor: L_{2005}

$$L2005 = \frac{\text{Average index from January to March 2003 of 2005 -based indices (Seasonal adjustment index)}}{\text{Average index from January to March 2003 of 2000-based indices (Seasonal adjustment index)}}$$

Using the above link factor, the 2005-based connection index is established

2005-based connection index =

L2005 × (2000-based index (1998-2002), 2000-based connection index (1978- 1997))

Note: Since 1978, the connection index is publicized.

15. Overall assessment

Brief comments are made on the state of production trends at publication of the monthly preliminary report.

(1) July 2008 Preliminary Report

—Production remaining weak—

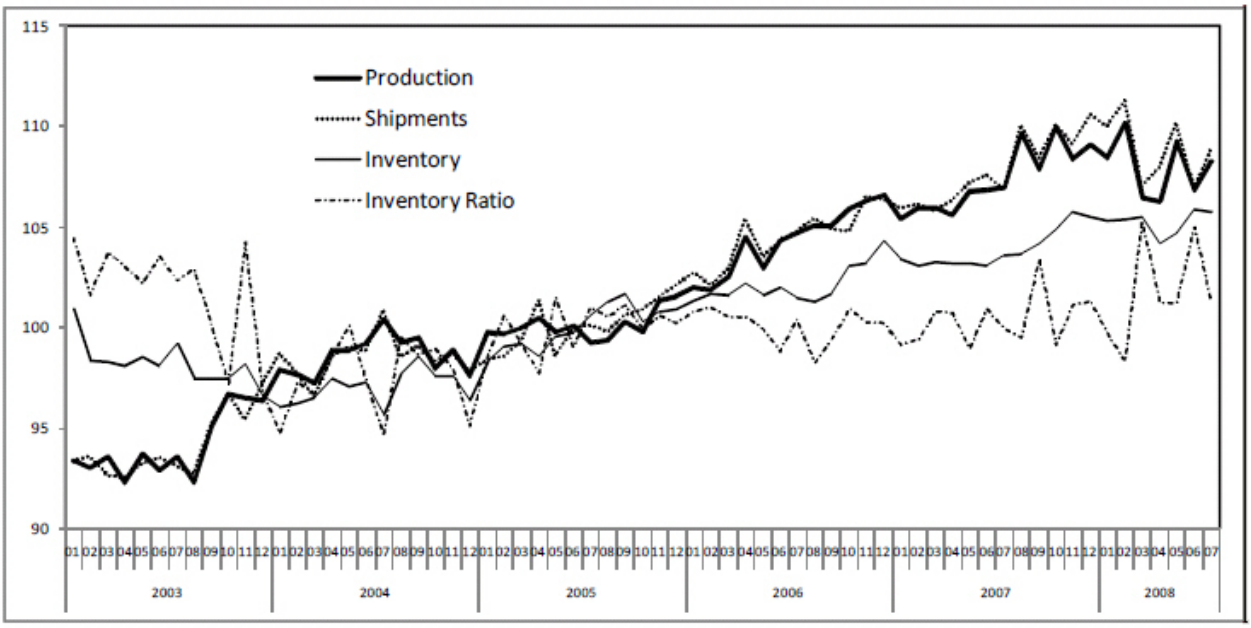
In this month, production and shipment are rising, inventory and inventory ratio are declining. According to the Survey of Manufacturing Production Forecast, after falling in August, production forecast was to rise in September. On the whole, production remains weak.

(2) Production trend assessment (at the time of Preliminary report)

From November 2002 to June 2003:	**Production remaining weak**
July to August:	**Production leveling off**
September to February 2004:	**Industrial production showing signs of recovery**
March to August:	**Production on a moderate upward trend**
September to September 2005:	**Production leveling off**
October to May 2006:	**Production on a moderate upward trend**
June to January 2007:	**Industrial production on an upward trend**
February to April:	**Production on a moderate upward trend**
May to July:	**Production leveling off**
August to November:	**Production on a moderate upward trend**
December to April 2008:	**Production leveling off**
May:	**Production leveling off, but slightly weakening**
June to July:	**Production remaining weak**

Changes in the Indices of Industrial Production, Shipments, Inventory and Inventory Ratio

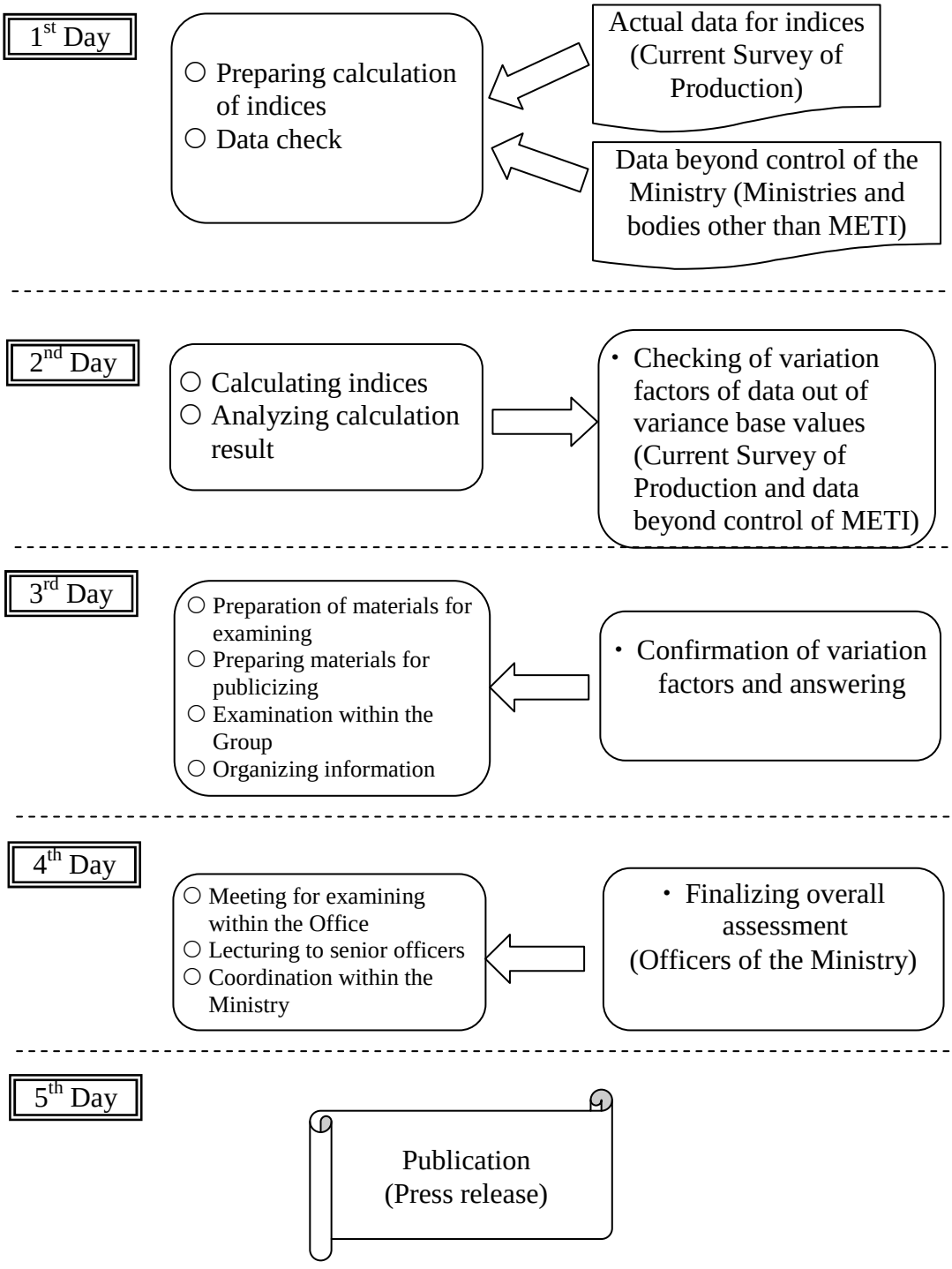
Seasonal Adjustment Index 2005=100



[Reference 1] Annual compensation

Every year, Current Survey of Production makes data corrections or subsequent data additions, which are made from offices, final figures retrospectively up to January to December last year. In Industrial Production Indices, Original index is recalculated according to these final figures. At the same time, the seasonal index is calculated. At the same time, the seasonal index is computed, and then the seasonal adjustment index is re-calculated based on the newly revised seasonal index. (Until then, the seasonally-adjusted index is tentatively calculated with the seasonal index in the previous year.) This is called the annual compensation. After the compensation, Production index, Shipment index, Inventory index, Operation ratio index, and Production capacity index are publicized in the February final report published in the middle of April every year. Index of Production Forecast in Manufacturing is publicized in the March preliminary report published in late April.

[Reference 2] Monthly work for the preparation of indices of production, shipment, and inventory



[Reference 3] Inventory cycle

This graph is the one that plotted year-on-year of production and inventory. It is able to grasp the state of factors of economic fluctuation from this graph.

Inventory accumulation phase: Expanding and booming period

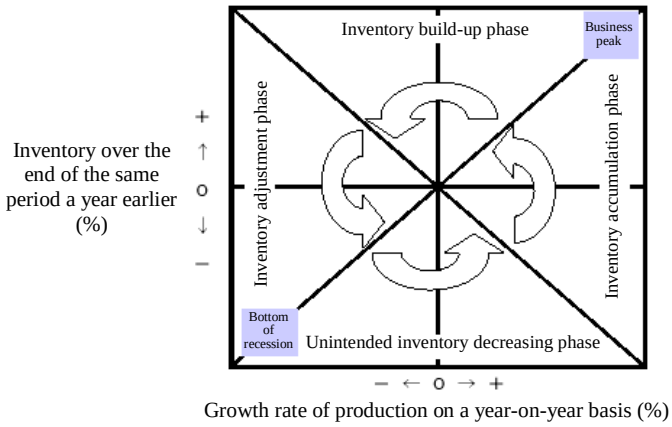
Inventory build-up phase: Transition period from booming (peak) to stagnation

Inventory adjustment phase: Stagnation period

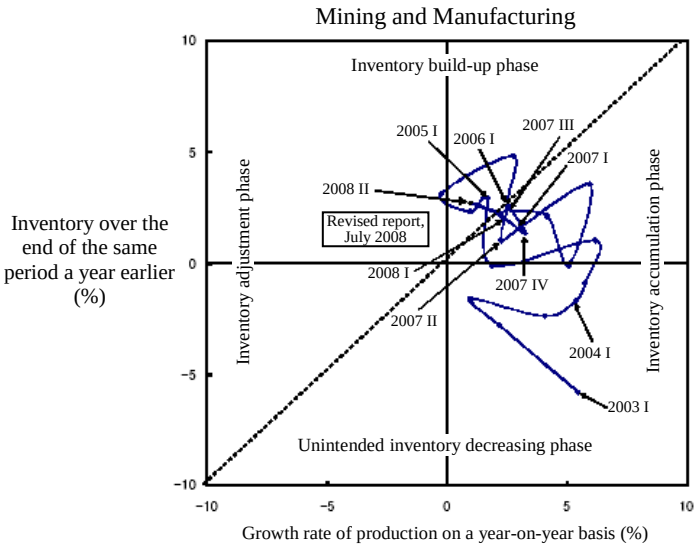
Unintended inventory decreasing phase: Transition period from stagnation (trough) to expanding

The vicinity in figure that intersects with the line by 45 degrees is a turning point of economic climate.

Business cycle chart (Example)



(Actual)



Drill in the Industrial production index

1. Calculation of the individual index (the index by items)

The index of individual item is easily obtained by dividing manufacturing quantity or shipping quantity by these at the base period and multiplying by 100. A time point to be the basis is called the base period, a value at the base period is called the base quantity, and a time point to be compared is called the comparison period.

Drill 1

Table 1 shows the quantities of 4 items. Among them, let's calculate the individual index in June 2008 about crude steel.

First step: Calculate base quantity

* The base quantity is a value at the base period. In the case of industrial production indices, since the base period is now year 2005, the base quantity is the monthly average for year 2005. The base quantity should be calculated to the first decimal place while rounding off the second decimal place.

Second step: Calculate individual index

* An index is the value calculated by dividing a value at the comparison period by a base quantity. The index is normally represented by multiplying by 100. The index should be calculated to the first decimal place while rounding off the second decimal place.

2. Calculation of the composite index by the Laspeyres formula

(1) Calculation of composite index using the aggregate method

This is a method to use the ratio of production value, which is obtained by calculation on fixed price at the base period, at the base period and the comparison period to the total amount of value.

Drill 2

Based on the unit price in 2005 shown on Table 1 and 2, let's calculate the composite index in June 2008.

* An index is normally represented by multiplying by 100. Calculate the index to the first decimal place while rounding off second decimal places.

$$\frac{\text{Total value of production for June 2008 measured with the 2005-price}}{\text{Total of monthly average value of production in year 2005 measured with the 2005-price}} = \frac{\sum (\text{Year 2005-unit price x volume of production for June 2008})}{\sum (\text{Year 2005-unit price x base quantity})}$$

(2) Calculation of the composite index by the weighted mean method

This is a method to calculate the composite index by adding the level of importance to the individual index by using the weight that is calculated from the composition ratio of the production value by item at the base period.

Drill 3

Based on Table 1 and 2, let's calculate the composite index in June 2008.

First step: Obtain the weight in the beginning. Obtain the production value by multiplying the monthly average price in 2005 by the base quantity, and then calculate the composition ratio. This turns out to be the weight.

* A weight should be calculated to fourth decimal places while rounding off the fifth decimal place.

Second step: Calculate individual index

* An index is normally represented by multiplying by 100. The index should be calculated to the first decimal place while rounding off the second decimal place.

Third step: Calculate the composite index by having the weighted mean by using the weight as the individual index.

* The weighted mean method refers to an average calculated by dividing the total of values obtained by multiplying the weight by an individual index for each item and dividing the total value by the total of weights.

3. Calculation of the seasonally-adjusted index

The seasonal index is prepared to remove the effect by the increase and decrease of the operation days every month and the seasonal factor in the item (or the type of business). The seasonally-adjusted index is prepared by using this seasonal index.
The index obtained in Drill 1 - 3 is called the **original index** and the index adjusted the seasonal factor is called the **seasonally-adjusted index**.

Drill 4

Let's prepare the seasonally-adjusted index of air conditioner in June 2008 by using the seasonal index data on Table 4.

First step: **Let's calculate the original index of air conditioner from Table 1.**
Second step: **The seasonally-adjusted index is obtained by dividing the original index by the seasonal index.**
Original index / Seasonal index = Seasonally-adjusted index

* The seasonally-adjusted index should be calculated to the first decimal place while rounding off the second decimal place.
Original index / Seasonal index × 100 = Seasonally-adjusted index.

4. Calculation of the individual original index by using deflator

Most of the units of the items in the industrial production index are measured by the quantity including ton, piece, and unit. However, some items are measured by the amount of money. The reason comes from that since there are of varying qualities in the same item, a simple total of the quantity seems not suitable to represent the production activity. However, the fluctuation of the quantity and the price is included in the fluctuation of the amount of money. The industrial production index which is a quantum index has to be limited to the fluctuation of the quantity excluding the fluctuation of the amount of money. Therefore, the fluctuation of the price is converted to that of the quantity by using the price index which represents the fluctuation of the price. This is to substantialize and called Deflate. The price index to be used is called the deflator.

Drill 5

Input and output device on Table 5 is one of the items that have the amount of money as the unit. Let's deflate the value of production of this input and output device in June 2008 by using the deflator. Also, let's prepare the original index on the basis of deflated data.

First step: Deflate is obtained by dividing the value of production by deflator.

Value of production / Deflator = Real value of production

Second step: The original index is obtained by dividing the deflated data by base quantity.

Real value of production / Base quantity = Original index

5. Preparation of the index for analysis

(1) Preparation of the composite index from the individual index extracted arbitrarily

To observe the impact of heat wave on the mining and manufacturing industry, it is also able to prepare the heat wave related index from the extracted items which are related to the heat wave.

Drill 6

Let's prepare the composite index of the heat wave related items in June 2008 on the basis of Table 3 as well as the weight on Table 2.

Specifying air conditioner and soft drink as the heat wave related items and processing the individual index of these items into the composite index by the weighted mean method.

* Use original index for preparation of the composite index.

(2) Preparation of the index excluding the index of the heat wave related items from the composite index

To observe the composite index of the mining and manufacturing industry eliminating the impact of the heat wave related items, it is able to prepare something like the composite index of the mining and manufacturing industry (excluding the heat wave related items). When the index to be actually published is prepared, it is necessary to prepare the composite index by accumulating items other than the heat wave related items. However, let's prepare the composite index (excluding the heat wave related items) by more simple and easy way here.

Drill 7

Let's prepare the composite index (excluding the heat wave related items such as air conditioner and soft drink) in June 2008.

Step: Let's prepare the composite index (excluding the heat wave related items) by using the index of the heat wave related items obtained in Drill 6 and the composite index obtained in Drill 3.

$$\frac{\text{Composite index} \times \text{Weight of Composite index} - \text{Index of the heat wave related items} \times \text{Weight of the index of the heat wave related items}}{\text{Weight of Composite index} - \text{Weight of the index of the heat wave related items}}$$

6. Contribution ratio and contributing level

The Fluctuation of the composite index is an accumulation of the fluctuation of the individual index.

The movement of production, shipment, inventory, and the like of an individual item has the part which is affected by the boom and bust in economy and other part which fluctuates due to the intrinsic factor of the business or the item itself. In order to find out the variation factor of the composite index, the explanation that the variation is contributed by the factor of the business or the item is frequently observed by using the feature of the composite index which consisted of the accumulation of items. In doing so, it is necessary to know which business or item how much affects the fluctuation of the composite index. How much did the business or the item, which are the components of the index, affect on the rise of the composite index. Calculated composition ratio of these is called the ratio of contribution to increase or simply the contribution ratio. Further, the contribution ratio, which is allocated to the increase ratio of the composite index, is called the contribution degree or the extent of contribution.

Drill 8

Let's calculate the contribution ratio and the contribution degree of the iron and steel industry, the electric machinery industry, and the textile industry on the basis of Table 6.

* Contribution ratio is the one to indicate the extent that the components of the composite index affect on the increase of the composite index in the composition ratio.

$$\text{Contribution ratio} = \frac{\{(\text{Index by industry for the current year} - \text{Index by industry for the preceding year}) \times \text{a weight of each industry}\}}{\{(\text{Composite index for the current year} - \text{Composite index for the preceding year}) \times \text{composite weight}\}} \times 100$$

* Contribution degree is the one to indicate the extent that the increase or decrease of the components of the composite index affect on the increase or decrease of the composite index.

Contributing level = Contribution ratio by industry × Rate of increase of the composite index ÷ 100

Table 1 Transition of production result by item

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
Base quantity					
2005	Jan.	8,590	456	13,373	532
	Feb.	8,094	665	14,888	685
	Mar.	8,716	852	16,444	860
	Apr.	8,732	848	15,764	876
	May	9,140	876	14,694	934
	Jun.	8,841	975	14,278	1,078
	Jul.	9,012	851	13,632	1,065
	Aug.	9,067	297	13,299	1,014
	Sept.	8,873	284	13,698	877
	Oct.	9,205	348	13,150	814
	Nov.	9,079	356	12,197	728
	Dec.	9,095	349	11,800	698
	⋮	⋮	⋮	⋮	⋮
2007	Jan.	9,338	355	7,013	624
	Feb.	8,945	425	7,747	652
	Mar.	9,300	588	8,509	946
	Apr.	9,181	661	8,420	936
	May	9,625	642	7,123	923
	Jun.	9,420	763	7,008	1,031
	Jul.	9,551	725	6,793	1,105
	Aug.	9,397	331	6,620	1,047
	Sept.	9,209	244	7,141	875
	Oct.	9,736	231	6,889	878
	Nov.	9,451	284	6,514	749
	Dec.	9,565	288	6,419	747
2008	Jan.	9,519	306	6,017	683
	Feb.	8,654	440	6,788	760
	Mar.	9,590	515	7,338	1,033
	Apr.	9,476	667	7,189	1,083
	May	10,034	737	6,346	1,098
	Jun.	9,454	856	6,362	1,105

Table 2 A variety of information by item

	Crude steel	Air conditioner	Clothes	Soft drink
Unit	1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
Base quantity				
Unit price at 2005	32,000	70,000	2,000	11,000
Value of production				
Value of production total				
Composition ratio (Weight)				

Table 3 Transition of production index by item (Original index)

(2005=100.0)

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
2005	Jan.	96.8	76.5	96.0	62.8
	Feb.	91.2	111.5	106.8	80.9
	Mar.	98.3	142.9	118.0	101.6
	Apr.	98.4	142.2	113.1	103.4
	May	103.0	146.9	105.4	110.3
	Jun.	99.7	163.5	102.5	127.3
	Jul.	101.6	142.7	97.8	125.8
	Aug.	102.2	49.8	95.4	119.7
	Sept.	100.0	47.6	98.3	103.6
	Oct.	103.8	58.4	94.4	96.1
	Nov.	102.4	59.7	87.5	86.0
	Dec.	102.5	58.5	84.7	82.4
	⋮	⋮	⋮	⋮	⋮
2007	Jan.	105.3	59.5	50.3	73.7
	Feb.	100.8	71.3	55.6	77.0
	Mar.	104.8	98.6	61.1	111.7
	Apr.	103.5	110.8	60.4	110.5
	May	108.5	107.6	51.1	109.0
	Jun.	106.2	127.9	50.3	121.8
	Jul.	107.7	121.6	48.7	130.5
	Aug.	105.9	55.5	47.5	123.6
	Sept.	103.8	40.9	51.2	103.3
	Oct.	109.8	38.7	49.4	103.7
	Nov.	106.5	47.6	46.7	88.5
	Dec.	107.8	48.3	46.1	88.2
2008	Jan.	107.3	51.3	43.2	80.7
	Feb.	97.6	73.8	48.7	89.7
	Mar.	108.1	86.4	52.7	122.0
	Apr.	106.8	111.8	51.6	127.9
	May	113.1	123.6	45.5	129.7
	Jun.				

Table 4 Seasonal index by item

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
2008	Jan.	101.31	67.75	91.02	72.03
	Feb.	91.58	104.93	101.59	81.13
	Mar.	100.00	139.84	112.48	110.27
	Apr.	98.82	143.07	109.70	110.92
	May	103.62	150.61	100.41	110.22
	Jun.	101.11	174.86	98.39	111.89

Table 5 Changes in production values and deflators of input devices

		Value of production (Million yen)	Deflator
Base quantity		77,545.9	
2008	Jan.	39,565	123.0
	Feb.	42,959	113.3
	Mar.	52,251	93.2
	Apr.	43,719	111.3
	May	46,402	104.6
	Jun.	45,468	93.4

Table 6 Contribution ratio and contribution degree

Industry	Weight W	Prev. year A	Current year B	Difference of index (B-A)	Difference of index × Weight (B-A)*W	Contribu-tion ratio	Contribu-tion degree	Increase rate (B-A)/A
Composite index	100.0000	106.0	112.8	6.8	680	100.0	6.4	6.4
a. Iron and steel industry	50.0000	104.0	110.0					5.8
b. Electrical machinery industry	30.0000	120.0	128.0					6.7
c. Textile industry	20.0000	90.0	97.0					7.8

Table - Reference Transition of production index by item (seasonally adjusted)

(2005=100.0)

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
2005	Jan.	96.2	103.2	106.5	92.2
	Feb.	95.3	99.2	102.1	98.4
	Mar.	98.4	102.5	107.0	100.7
	Apr.	98.9	108.5	103.3	109.8
	May	100.7	99.5	102.3	104.1
	Jun.	99.9	99.7	101.9	108.8
	Jul.	100.8	101.1	99.2	104.5
	Aug.	101.5	100.9	98.5	104.9
	Sept.	100.0	99.6	95.6	92.9
	Oct.	100.3	98.1	94.2	90.4
	Nov.	102.3	91.2	93.2	88.3
	Dec.	102.3	89.1	92.2	105.6
	⋮	⋮	⋮	⋮	⋮
2007	Jan.	104.6	84.2	55.1	98.2
	Feb.	106.0	67.5	53.2	92.5
	Mar.	104.6	70.8	53.9	104.3
	Apr.	105.2	74.6	54.5	98.4
	May	104.3	74.3	51.4	100.1
	Jun.	105.0	73.1	51.1	108.9
	Jul.	106.1	83.4	50.2	112.0
	Aug.	105.1	122.2	50.2	115.2
	Sept.	105.6	88.5	49.5	99.9
	Oct.	106.8	77.2	49.3	100.0
	Nov.	107.2	74.8	48.9	96.6
	Dec.	108.1	68.8	48.9	103.0
2008	Jan.	105.9	75.7	47.5	112.0
	Feb.	106.6	70.3	47.9	110.6
	Mar.	108.1	61.8	46.9	110.6
	Apr.	108.1	78.1	47.0	115.3
	May	109.1	82.1	45.3	117.7
	Jun.	105.4		46.4	116.6

[Answers]

Drill in the Industrial production index

1. Calculation of the individual index (the index by items)

The index of individual item is easily obtained by dividing manufacturing quantity or shipping quantity by these at the base period and multiplying by 100. A time point to be the basis is called the base period, a value at the base period is called the base quantity, and a time point to be compared is called the comparison period.

Drill 1

Table 1 shows the quantities of 4 items. Among them, let's calculate the individual index in June 2008 about crude steel.

First step: Calculate base quantity

* The base quantity is a value at the base period. In the case of industrial production indices, since the base period is now year 2005, the base quantity is the monthly average for year 2005. The base quantity should be calculated to the first decimal place while rounding off the second decimal place.

Second step: Calculate individual index

* An index is the value calculated by dividing a value at the comparison period by a base quantity. The index is normally represented by multiplying by 100. The index should be calculated to the first decimal place while rounding off the second decimal place.

First step: Currently, the base period for the Industrial production index is year 2005. In this instance, the base quantity is a value of the monthly average for a year of 2005. Base quantity rounds off the second place of the decimal point and displays up to the first place of the decimal point.

$$\frac{8{,}590 + 8{,}094 + 8{,}716 + 8{,}732 + 9{,}140 + 8{,}841 + 9{,}012 + 9{,}067 + 8{,}873 + 9{,}205 + 9{,}079 + 9{,}095}{\text{Twelve months}}$$

= 8,870.3

The base quantity of crude steel is 8,870.3.

Second step: Divide the quantity at the comparison time point (June 2008) by the base quantity. It is a common practice to express the index by multiplying the calculated value by 100 usually. The index as well as the base quantity displays up to the first place of the decimal point.

9,454 (June 2008) / 8,870.3 (Base quantity) = 1.06580・・・・

1.06580・・・・× 100.0 =106.6

The individual index of crude steel is 106.6.

In a similar way, index calculations about other 3 items give a result on Table 3.

2. Calculation of the composite index by the Laspeyres formula

(1) Calculation of composite index using the aggregate method

This is a method to use the ratio of production value, which is obtained by calculation on fixed price at the base period, at the base period and the comparison period to the total amount of value.

Drill 2

Based on the unit price in 2005 shown on Table 1 and 2, let's calculate the composite index in June 2008.

* An index is normally represented by multiplying by 100. Calculate the index to the first decimal place while rounding off second decimal places.

$$\frac{\text{Total value of production for June 2008 measured with the 2005-price}}{\text{Total of monthly average value of production in year 2005 measured with the 2005-price}} = \frac{\sum(\text{Year 2005-unit price x volume of production for June 2008})}{\sum(\text{Year 2005-unit price x base quantity})}$$

Please refer to Drill 1 for how to calculate the base quantity.

$$\frac{(32{,}000\times 9{,}454)+(70{,}000\times 856)+(2{,}000\times 6{,}362)+(11{,}000\times 1{,}105)}{(32{,}000\times 8{,}870.3)+(70{,}000\times 596.4)+(2{,}000\times 13{,}934.8)+(11{,}000\times 846.8)}\times 100.0$$

$$=\frac{387{,}327{,}000}{362{,}782{,}000}\times 100.0 = 106.8$$

(2) Calculation of the composite index by the weighted mean method

This is a method to calculate the composite index by adding the level of importance to the individual index by using the weight that is calculated from the composition ratio of the production value by item at the base period.

Drill 3

Based on Table 1 and 2, let's calculate the composite index in June 2008.

First step: Obtain the weight in the beginning. Obtain the production value by multiplying the monthly average price in 2005 by the base quantity, and then calculate the composition ratio. This turns out to be the weight.

* A weight should be calculated to fourth decimal places while rounding off the fifth decimal place.

Second step: Calculate individual index

* An index is normally represented by multiplying by 100. The index should be calculated to the first decimal place while rounding off the second decimal place.

Third step: Calculate the composite index by having the weighted mean by using the weight as the individual index.

* The weighted mean method refers to an average calculated by dividing the total of values obtained by multiplying the weight by an individual index for each item and dividing the total value by the total of weights.

First step: The numerical value of the denominator of the formula in Drill 2 is the production value by items at the base period.

Crude steel	32,000 × 8,870.3	= 283,849,600	**0.7824**
Air conditioner	70,000 × 596.4	= 41,748,000	**0.1151**
Clothes	2,000 × 13,934.8	= 27,869,600	**0.0768**
Soft drink	11,000 × 846.8	= 9,314,800	**0.0257**
Total		362,782,000	**1.0000**

Second step: The individual index is obtained by the following formula.
Manufacturing quantity in June 2008 / Base quantity × 100.0
Please refer to Drill 1 for how to calculate the individual index.

Crude steel	9,454 / 8,870.3 × 100.0	= 106.6
Air conditioner	856 / 596.4 × 100.0	= 143.5
Clothes	6,362 / 13,934.8 × 100.0	= 45.7
Soft drink	1,105 / 846.8 × 100.0	= 130.5

Third step: Calculate weight x individual index by items, and divide this total by the total value of weight.

The value is corresponding with the index value obtained in Drill 2. In the calculation to obtain the composite index of quantum index, the method to obtain the weighted mean of the individual index by the weight according to the money amount composition ratio at the base period is same as the method to divide the total quantity by items in the form of money amount according to the price at the base period by the amount of money at the base period (price at the base period x base quantity).

Laspeyres formula

$$Q_t = \frac{\Sigma p_o q_t}{\Sigma p_o q_o} = \frac{\Sigma p_o q_o \times \left(\frac{q_t}{q_o} \right)}{\Sigma p_o q_o} = \Sigma \frac{p_o q_o}{\Sigma p_o q_o} \times \left(\frac{q_t}{q_o} \right) = \Sigma \frac{w_o}{\Sigma w_o} \times \left(\frac{q_t}{q_o} \right)$$

↑ Aggregative method

↑ Weighted mean method
Method to integrate the individual indices by weight

q_o = Individual quantity at the base period p_o = Individual quantity at the comparison period
q_t = Individual unit price at the base period W_o = Individual weight (Money amount composition ratio by items at the base period)

3. Calculation of the seasonally-adjusted index

The seasonal index is prepared to remove the effect by the increase and decrease of the operation days every month and the seasonal factor in the item (or the type of business). The seasonally-adjusted index is prepared by using this seasonal index.
The index obtained in Drill 1 - 3 is called the **original index** and the index adjusted the seasonal factor is called the **seasonally-adjusted index**.

Drill 4

Let's prepare the seasonally-adjusted index of air conditioner in June 2008 by using the seasonal index data on Table 4.

First step: **Let's calculate the original index of air conditioner from Table 1.**
Second step: **The seasonally-adjusted index is obtained by dividing the original index by the seasonal index.**
Original index / Seasonal index = Seasonally-adjusted index

* The seasonally-adjusted index should be calculated to the first decimal place while rounding off the second decimal place.
Original index / Seasonal index × 100 = Seasonally-adjusted index.

First step: Already calculated in Second step of Drill 3 (Refer to Table 3).

856 / 596.4 ×100.0 = 143.5

Second step: The original index of air conditioner in June 2008 is 174.86.

143.5 / 174.86 ×100.0 = **82.1**

The seasonally-adjusted index of air conditioner is 82.1.

In a similar way, the calculation of seasonally-adjusted index about other three items gives the result on the table - Reference -.

When it comes to the industrial production index, usually it means the seasonally-adjusted index.

4. Calculation of the individual original index by using deflator

Most of the units of the items in the industrial production index are measured by the quantity including ton, piece, and unit. However, some items are measured by the amount of money. The reason comes from that since there are of varying qualities in the same item, a simple total of the quantity seems not suitable to represent the production activity. However, the fluctuation of the quantity and the price is included in the fluctuation of the amount of money. The industrial production index which is a quantum index has to be limited to the fluctuation of the quantity excluding the fluctuation of the amount of money. Therefore, the fluctuation of the price is converted to that of the quantity by using the price index which represents the fluctuation of the price. This is to substantialize and called Deflate. The price index to be used is called the deflator.

Drill 5

Input and output device on Table 5 is one of the items that have the amount of money as the unit. Let's deflate the value of production of this input and output device in June 2008 by using the deflator. Also, let's prepare the original index on the basis of deflated data.

First step: Deflate is obtained by dividing the value of production by deflator.

Value of production / Deflator = Real value of production

Second step: The original index is obtained by dividing the deflated data by base quantity.

Real value of production / Base quantity = Original index

Step 1 45,468 / 93.4 × 100.0 = 48,681

Hereby, the batch of the price fluctuation in the data of the input and output device has been removed.

Step 2 48,681 / 77,545.9 × 100.0 = 62.8

Original index of the input and output device in June 2008 is 62.8.

5. Preparation of the index for analysis

(1) Preparation of the composite index from the individual index extracted arbitrarily

To observe the impact of heat wave on the mining and manufacturing industry, it is also able to prepare the heat wave related index from the extracted items which are related to the heat wave.

Drill 6

Let's prepare the composite index of the heat wave related items in June 2008 on the basis of Table 3 as well as the weight on Table 2.

Specifying air conditioner and soft drink as the heat wave related items and processing the individual index of these items into the composite index by the weighted mean method.

* Use original index for preparation of the composite index.

Step: Preparing the composite index of air conditioner and soft drink in June 2008 on the basis of the weight on Table 2 as well as the original index on Table 3. Please refer to the third step of Drill 3 about the weighted mean method.

$$\frac{143.5\times 0.1151+130.5\times 0.0257}{0.1151+0.0257}=\frac{19.8707}{0.1408}=141.1$$

The heat wave related index turns out to be 141.1.

(2) Preparation of the index excluding the index of the heat wave related items from the composite index

To observe the composite index of the mining and manufacturing industry eliminating the impact of the heat wave related items, it is able to prepare something like the composite index of the mining and manufacturing industry (excluding the heat wave related items). When the index to be actually published is prepared, it is necessary to prepare the composite index by accumulating items other than the heat wave related items. However, let's prepare the composite index (excluding the heat wave related items) by more simple and easy way here.

Drill 7

Let's prepare the composite index (excluding the heat wave related items such as air conditioner and soft drink) in June 2008.

Step: Let's prepare the composite index (excluding the heat wave related items) by using the index of the heat wave related items obtained in Drill 6 and the composite index obtained in Drill 3.

$$\frac{\text{Composite index} \times \text{Weight of Composite index} - \text{Index of the heat wave related items} \times \text{Weight of the index of the heat wave related items}}{\text{Weight of Composite index} - \text{Weight of the index of the heat wave related items}}$$

Please refer to the third step of Drill 3 about the weighted mean method.

Step $\dfrac{106.8 \times 1 - 141.1 \times 0.1408}{1 - 0.1408} = \dfrac{86.9331}{0.8592} = 101.2$

The composite index (excluding the heat wave related items) turns out to be 101.2.

6. Contribution ratio and contributing level

The Fluctuation of the composite index is an accumulation of the fluctuation of the individual index.

The movement of production, shipment, inventory, and the like of an individual item has the part which is affected by the boom and bust in economy and other part which fluctuates due to the intrinsic factor of the business or the item itself. In order to find out the variation factor of the composite index, the explanation that the variation is contributed by the factor of the business or the item is frequently observed by using the feature of the composite index which consisted of the accumulation of items. In doing so, it is necessary to know which business or item how much affects the fluctuation of the composite index. How much did the business or the item, which are the components of the index, affect on the rise of the composite index. Calculated composition ratio of these is called the ratio of contribution to increase or simply the contribution ratio. Further, the contribution ratio, which is allocated to the increase ratio of the composite index, is called the contribution degree or the extent of contribution.

Drill 8

Let's calculate the contribution ratio and the contribution degree of the iron and steel industry, the electric machinery industry, and the textile industry on the basis of Table 6.

* Contribution ratio is the one to indicate the extent that the components of the composite index affect on the increase of the composite index in the composition ratio.

$$\text{Contribution ratio} = \frac{\{(\text{Index by industry for the current year} - \text{Index by industry for the preceding year}) \times \text{a weight of each industry}\}}{\{(\text{Composite index for the current year} - \text{Composite index for the preceding year}) \times \text{composite weight}\}} \times 100$$

* Contribution degree is the one to indicate the extent that the increase or decrease of the components of the composite index affect on the increase or decrease of the composite index.

Contributing level = Contribution ratio by industry × Rate of increase of the composite index ÷ 100

First step: Calculating the difference of the index by industries between current year and previous year about each industry.

a. 110.0－104.0＝6.0
b. 128.0－120.0＝8.0
c. 97.0－ 90.0＝7.0

Second step: Multiplying the each difference by weight.

a. 6.0×50＝300
b. 8.0×30＝240
c. 7.0×20＝140

The total of these calculations becomes 680 and equal to the solution of multiplying the difference of the composite index by weight.

(112.8-106.0) × 100.0 = 680

Third step: Calculating the each composition ratio.

Dividing by the total (the solution of multiplying the difference of the composite index by weight).
This turns out to be the contribution ratio.

a. 300÷680×100＝**44.1**
b. 240÷680×100＝**35.3**
c. 140÷680×100＝**20.6**

Fourth step: Multiplying the each contribution ratio by

This turns out to be the contribution degree.

a. 44.1×6.4÷100＝**2.8**
b. 35.3×6.4÷100＝**2.3**
c. 20.6×6.4÷100＝**1.3**

Looking at this result, the contribution of the iron and steel industry is the largest, and, next, order of the electric machinery industry and the textile industry. Comparing this with the order of the largeness of the increase rate, the one that has the high increase rate doesn't have always the large contribution ratio. The largeness of the contribution ratio is determined by the comprehensive largeness including the weight and the index level as well as the increase ratio.

Table 1 Transition of production result by item

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
Base quantity		8,870.3	596.4	13,934.8	846.8
2005	Jan.	8,590	456	13,373	532
	Feb.	8,094	665	14,888	685
	Mar.	8,716	852	16,444	860
	Apr.	8,732	848	15,764	876
	May	9,140	876	14,694	934
	Jun.	8,841	975	14,278	1,078
	Jul.	9,012	851	13,632	1,065
	Aug.	9,067	297	13,299	1,014
	Sept.	8,873	284	13,698	877
	Oct.	9,205	348	13,150	814
	Nov.	9,079	356	12,197	728
	Dec.	9,095	349	11,800	698
	⋮	⋮	⋮	⋮	⋮
2007	Jan.	9,338	355	7,013	624
	Feb.	8,945	425	7,747	652
	Mar.	9,300	588	8,509	946
	Apr.	9,181	661	8,420	936
	May	9,625	642	7,123	923
	Jun.	9,420	763	7,008	1,031
	Jul.	9,551	725	6,793	1,105
	Aug.	9,397	331	6,620	1,047
	Sept.	9,209	244	7,141	875
	Oct.	9,736	231	6,889	878
	Nov.	9,451	284	6,514	749
	Dec.	9,565	288	6,419	747
2008	Jan.	9,519	306	6,017	683
	Feb.	8,654	440	6,788	760
	Mar.	9,590	515	7,338	1,033
	Apr.	9,476	667	7,189	1,083
	May	10,034	737	6,346	1,098
	Jun.	9,454	856	6,362	1,105

Table 2 A variety of information by item

Unit	Crude steel	Air conditioner	Clothes	Soft drink
	1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
Base quantity	8870.3	596.4	13934.8	846.8
Unit price at 2005	32,000	70,000	2,000	11,000
Value of production	283,849,600	41,748,000	27,869,600	9,314,800
Value of production total	362,782,000			
Composition ratio (Weight)	0.7824	0.1151	0.0768	0.0257

Table 3 Transition of production index by item (Original index)

(2005=100.0)

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
2005	Jan.	96.8	76.5	96.0	62.8
	Feb.	91.2	111.5	106.8	80.9
	Mar.	98.3	142.9	118.0	101.6
	Apr.	98.4	142.2	113.1	103.4
	May	103.0	146.9	105.4	110.3
	Jun.	99.7	163.5	102.5	127.3
	Jul.	101.6	142.7	97.8	125.8
	Aug.	102.2	49.8	95.4	119.7
	Sept.	100.0	47.6	98.3	103.6
	Oct.	103.8	58.4	94.4	96.1
	Nov.	102.4	59.7	87.5	86.0
	Dec.	102.5	58.5	84.7	82.4
	⋮	⋮	⋮	⋮	⋮
2007	Jan.	105.3	59.5	50.3	73.7
	Feb.	100.8	71.3	55.6	77.0
	Mar.	104.8	98.6	61.1	111.7
	Apr.	103.5	110.8	60.4	110.5
	May	108.5	107.6	51.1	109.0
	Jun.	106.2	127.9	50.3	121.8
	Jul.	107.7	121.6	48.7	130.5
	Aug.	105.9	55.5	47.5	123.6
	Sept.	103.8	40.9	51.2	103.3
	Oct.	109.8	38.7	49.4	103.7
	Nov.	106.5	47.6	46.7	88.5
	Dec.	107.8	48.3	46.1	88.2
2008	Jan.	107.3	51.3	43.2	80.7
	Feb.	97.6	73.8	48.7	89.7
	Mar.	108.1	86.4	52.7	122.0
	Apr.	106.8	111.8	51.6	127.9
	May	113.1	123.6	45.5	129.7
	Jun.	106.6	143.5	45.7	130.5

Table 4 Seasonal index by item

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
2008	Jan.	101.31	67.75	91.02	72.03
	Feb.	91.58	104.93	101.59	81.13
	Mar.	100.00	139.84	112.48	110.27
	Apr.	98.82	143.07	109.70	110.92
	May	103.62	150.61	100.41	110.22
	Jun.	101.11	174.86	98.39	111.89

Table 5 Changes in production values and deflators of input devices

		Value of production (Million yen)	Deflator
Base quantity		77,545.9	
2008	Jan.	39,565	123.0
	Feb.	42,959	113.3
	Mar.	52,251	93.2
	Apr.	43,719	111.3
	May	46,402	104.6
	Jun.	45,468	93.4

Table 6 Contribution ratio and contribution degree

Industry	Weight W	Prev. year A	Current year B	Difference of index (B-A)	Difference of index × Weight (B-A)*W	Contribu-tion ratio	Contribu-tion degree	Increase rate (B-A)/A
Composite index	100.0000	106.0	112.8	6.8	680	100.0	6.4	6.4
a. Iron and steel industry	50.0000	104.0	110.0	6.0	300	44.1	2.8	5.8
b. Electrical machinery industry	30.0000	120.0	128.0	8.0	240	35.3	2.3	6.7
c. Textile industry	20.0000	90.0	97.0	7.0	140	20.6	1.3	7.8

Table - Reference Transition of production index by item (seasonally adjusted)

(2005=100.0)

		Crude steel	Air conditioner	Clothes	Soft drink
Unit		1,000 tons	1,000 units	1,000 suits	1,000 kilolitre
2005	Jan.	96.2	103.2	106.5	92.2
	Feb.	95.3	99.2	102.1	98.4
	Mar.	98.4	102.5	107.0	100.7
	Apr.	98.9	108.5	103.3	109.8
	May	100.7	99.5	102.3	104.1
	Jun.	99.9	99.7	101.9	108.8
	Jul.	100.8	101.1	99.2	104.5
	Aug.	101.5	100.9	98.5	104.9
	Sept.	100.0	99.6	95.6	92.9
	Oct.	100.3	98.1	94.2	90.4
	Nov.	102.3	91.2	93.2	88.3
	Dec.	102.3	89.1	92.2	105.6
	⋮	⋮	⋮	⋮	⋮
2007	Jan.	104.6	84.2	55.1	98.2
	Feb.	106.0	67.5	53.2	92.5
	Mar.	104.6	70.8	53.9	104.3
	Apr.	105.2	74.6	54.5	98.4
	May	104.3	74.3	51.4	100.1
	Jun.	105.0	73.1	51.1	108.9
	Jul.	106.1	83.4	50.2	112.0
	Aug.	105.1	122.2	50.2	115.2
	Sept.	105.6	88.5	49.5	99.9
	Oct.	106.8	77.2	49.3	100.0
	Nov.	107.2	74.8	48.9	96.6
	Dec.	108.1	68.8	48.9	103.0
2008	Jan.	105.9	75.7	47.5	112.0
	Feb.	106.6	70.3	47.9	110.6
	Mar.	108.1	61.8	46.9	110.6
	Apr.	108.1	78.1	47.0	115.3
	May	109.1	82.1	45.3	117.7
	Jun.	105.4	82.1	46.4	116.6