

Maintenance and development project of the Volume Index of Industrial Output

Final report

Abstract

This document describes the maintenance and development project of the volume index of industrial output. Document describes among other things the status before the project, objectives, change of the base year, speeding up the publication and seasonal adjustment and experiences from the project. See Contents on the next page.

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1. Introduction

1.1. Starting points of the project

The volume index of industrial output is a central short-term trend indicator for industry. Statistics Finland is responsible for the production and publication of the index. The legal basis is stipulated in the Council Regulation 1165/98.

The volume index of industrial output is a sample statistics describing the relative change in the volume of industrial output compared to a certain basic time period. According to STS regulation, the basic period of the volume index should be changed every five years. The statistical unit of the production of the index is local kind-of-activity unit, which refers to an economic unit where as similar goods and services as possible are produced under the same owner or supervision usually in one location. The establishment may as such form an enterprise (single-establishment enterprise) or it can be a clearly defined part of an enterprise multi-establishment/multi-activity enterprise (Structural statistics of manufacturing and construction 1998, Manufacturing 2000:4, Statistics Finland 2000, p. 16). To attain a large gross production value coverage, the largest establishments of each industry are selected to the sample. Inquiry forms requesting information primarily about the output volumes of central output commodities are sent monthly to the establishments selected to the sample. In some cases enterprises may also give data in a centralised manner on all their establishments. If the volume data are not received on the monthly level, the value of output or deliveries and input data (consumption of raw materials and energy) are asked as substitutive data. The value data are deflated by means of the producer price index for manufactured products. The inquiry is mandatory (Statistics Act 62/1994).

The data on the volume index of industrial output are published as industry-specific index series. The indices are calculated as original, working day adjusted, seasonally adjusted and trend series. Working day adjustment was made on the basis of working hours in the industry in different months. Working hours on different days were inquired from establishments in connection with the change of the base year and seasonal adjustment was made using the X11-ARIMA method.

1.2. Objectives of the project

The maintenance and development project of the volume index of industrial output was started on 9 October 2000. The following primary objectives were set for the project:

The aim of the development is to calculate the volume index of industrial output with the new base year from the beginning of 2002. This change is based on international agreements and the European Union's Regulation on short-term statistics according to which the base year and the calculation method of the index are revised in years ending in 0 or 5, which means that the base year should be changed into 2000 at the latest during 2003.

Another intention was to examine the calculation methods of different indices and possibly shift from the weight index of the base year to the calculation of the variable weight index. The faster structural change of the economy has resulted in that the weight index of the base year can cause biased results. If the volume changes of industries and the relative price changes correlate negatively, the chain index yields a smaller volume growth than the fixed weight index of the base year. In case of positive correlation, the chain index produces a smaller volume growth than the fixed weight Laspeyres index. The variable weight index adds flexibility to the calculation by allowing inclusion of new industries and industry changes of establish-

ments every year. Eurostat, the Statistical Office of the European Community, recommends introduction of variable weights into the calculation of the volume index of industrial output, which practice is already used in the United States, for example.

The objective of the project was also to examine the implementation of the seasonal adjustment and working day adjustment of the volume index on the basis of a model. One reason for this was Eurostat's recommendation for using model-based seasonal adjustment. Usable model-based methods were either X12-ARIMA or TRAMO/SEATS. The X11-ARIMA method has been previously used in seasonal adjustment, in which the suitability of six time series models to the time series is tested and an optimally simple model that is suitable is selected, in practice the first of the six. It was decided in the project to use the X12-ARIMA method that is more extensive than the one used before.

In connection with the development the intention was also to speed up the publication of the volume index of industrial output from the present 45 days to 30 days without sacrificing quality as well as to consider an alternative releasing practice. The development of the adp-system was also regarded as important.

A further aim was to contribute to the quality change problem jointly with the development project of the producer price index and to change the adp-system for allowing quality changes to be taken into account. This objective was defined in the report of the convergence project of electronic industry data of 29 November 2000.

1.3. Connections to other projects

The project collaborated with Statistics Finland's quality change project.

2. Schedule of the project

The preparation for the maintenance and development project of the volume index of industrial output was started on 9 October 2000. The definition phase was initiated on 15 February 2001 and it comprised an interest group survey, a description of the present state, a problem analysis, a survey of development needs and a definition of objectives. The final report of the definition phase was completed on 3 April 2001. The planning phase began next on 17 March 2001. The planning phase progressed according to schedule and ended on 26 September 2001. The meetings of the project and management teams handled the database model, entity relationship models, calculation formula and quality changes. The most important tasks of the implementation phase, from 26 September to 15 November 2001, were finalisation of the database model, programming of calculation, determination of the index calculation method and introduction of the preliminary data entry application. The application and index calculation were tested in the testing phase. At the end of the implementation and testing phases the revised volume index of industrial output was taken into use according to schedule on 28 February 2002.

3. Resources and management of the project

3.1. Resources and costs

The project management team included Kari Molnar (Chair), Raili Broas (Economic Statistics division), Raimo Nurminen (Economic Statistics division), Ilkka Lehtinen (Prices and Wages Statistics division) and Matti Parkkinen (Business Structures division). Kari Rautio (Project Manager) and Rami Peltola (Secretary) also took part in the meetings of the management team.

The project team consisted of Kari Rautio (Project Manager), Aki Savolainen, Rami Peltola, Tiina Lanu (IT Services division), Marjatta Suomalainen (IT Services division) and Seppo Suomalainen (IT Services division). Reetta Moilanen joined the project team on 1 May 2001 and Olli Hedman replaced Marjatta Suomalainen on 1 June 2001. The support persons of the project were Sirkku Mertanen (IT Services division) in SYSRAK matters, Jan Nokkala (Business Trends division) in methodological issues and Perttu Pakarinen (IT Services division) in SAS questions.

3.2. Project management

The meeting schedule of the project management team and the matters discussed were preliminarily decided at the first meeting as were the deadlines for different phases of the project on which the meeting schedule was based. The management team convened 12 times during the project and minutes were taken at the meetings.

The project team met considerably more often, 23 times in all. A more specified schedule for the project was defined in its working plan. In addition to the project plan, plans were also drafted concerning the calculation system, methodological research and system testing. Memos were written on the present state of the volume index of industrial output, user cases, index calculation and database model, and final reports were written about each phase. The schedule of the project plan changed its form slightly as the project proceeded but the final schedule was adhered to.

4. Progress of the project

4.1. Preparation for the project (9 Oct. 2000-14 Feb. 2001)

The project was started on 9 October 2000. The actual preparation for the project began at a seminar on 1 December 2000 when the resources, means and objectives available to the project were defined. In the preparation phase the management team of the project was formed and a specified working plan was prepared on the basis of the present state of the volume index of industrial output.

4.2. Definition phase (15 Dec. 2001-3 April 2001)

The definition phase took a little over one month. The definition phase was started by describing the present state and by going through all the phases of the production process. The tasks of the definition phase also included an interest group survey, a description of development needs and a proposal for a general solution. During the definition phase a report of that phase was prepared, containing sections on interest groups, present state and development needs. The first version of the index calculation formulas was also completed during this phase.

4.3. Planning phase (4 April 2001-25 Sept. 2001)

The planning phase was begun in April 2001 and it lasted over five months. In accordance with the System development model of Statistics Finland, the work was started by defining blueprints of the system more accurately. There were certain problems in defining the objectives, for which reason the number and description of user cases changed often in the course of the planning phase and the project. The progress of the project was also held back to some extent by summer holidays. During the planning phase a report was made on user cases and a preliminary database model was planned, both of which were approved. The report of the planning phase was also completed in the course of that phase.

The testing plan of the application was decided upon at the end of the planning phase. The revision of the PowerBuilder application was begun on 1 September 2001, when Olli Hedman and Tiina Lanu started to build up the new application utilising parts of the old application.

With relation to the planning phase, a discussion session was arranged with Professor Yrjö Vartia on index theory at the end of May 2001. In June a seminar was held for the planning and implementation phases, where the user cases, the database model and the work in the coming months were discussed.

4.4. Implementation phase (26 Sept. 2001-15 Nov. 2001)

The most important tasks of the fairly short implementation phase were finalisation of the database model, finalization of the calculation programs, determining of the index calculation model and introduction of the preliminary data entry application.

During the implementation phase the final variable weight index calculation method was approved and test calculations were made by establishment and industry from 1995 onwards.

At the end of this phase the Sybase database was completed, though without having been tested more widely. The data needed for testing had been entered to the Sybase database. The complete but untested software components and calculation system were also put in working order.

4.5. Testing phase (16 Nov. 2001-31 Dec. 2002)

The testing phase was started in line with the original plan in November. The first tests of the application and the calculation program had already been done during the implementation phase, however. Orvokki Kosonen, Paula Siira, Hilikka Sortala and Reetta Moilanen were primarily in charge of application testing. The testing progressed according to the testing plan starting from content testing and ending in testing the whole system. Kari Rautio, Rami Peltola, Aki Savolainen, Seppo Suomalainen and Reetta Moilanen took part in calculation testing. In December 2001 industry-specific data were transferred to the new database starting from the year 1995. The data for December 2001 were also transferred to the new application so that comparison could be made between the new and old calculation systems.

In November 2001 a small-scale discussion session was arranged for the members of the press to discuss the possibility to change into a new press release practice and to survey the quality of the information needed by the media. On 18 January 2002 a training and presentation event was arranged for all who had taken part in the project.

4.6. Implementation (1 Jan. 2001-28 Feb. 2002)

The implementation phase was started with a task connected to the turn of the year. The data were copied from the old system to the new one at the beginning of January. The volume data concerning January were stored both in the old and new applications so that comparison could be made for index calculation. This was part of the risk management plan.

The volume index of industrial output for January 2002 was released on 28 February according to schedule. The published volume index of industrial output had been calculated by the new variable weight index calculation method with the base year 2000=100 and by using the new method-based seasonal adjustment and work-

ing day adjustment model. The press release practice was also renewed to refer to the seasonally adjusted figures.

4.7. Termination of the project (31 March 2002)

The last meeting of the project management team was arranged for 18 March 2002 when the final report was to be approved and decisions made on possible further actions. According to the original working plan of the project the project was to terminate at the end of March by which time the calculation rules have been finalised, the guidelines for the use of the new application have been prepared and the concepts relating to the volume index of industrial output have been updated to the concept metadatabase.

5. Objectives and results

The objectives set for the revision of the volume index of industrial output were achieved well during the project. The quality of the volume index was improved considerably. The volume index is now published with a time lag of just 30 days from the end of the reference period and is thus the fastest in the European Union.

5.1. Base year 2000 and variable weights

From the beginning of 2002 the new base year 2000 was taken into use. The calculation of the variable weight Laspeyres index was started according to original plan. The index was calculated genuinely from 1995 onwards and the old series were chained starting from 1985.

In the variable weight index weights are changed yearly both within the industry and between industries. The weights within the industry are mainly derived with direct inquiries and the weights between industries are obtained from the structural business statistics of manufacturing. The final weight structure of the year in question is taken into use when the structural business statistics of manufacturing are complete and the final annual volume index has been calculated. The problem with the variable weight index is that the time series is not additive, that is, the index series of a less detailed industry level cannot be calculated directly by weighting from more detailed industry levels. However, the variable weight index increases the flexibility of the calculation by enabling inclusion of new industries and industry changes of establishments every year.

5.2. Seasonal and working day adjustment

The seasonal adjustment and working day adjustment of the volume index of industrial output were made model-based using the X12-ARIMA method. This method was adopted because it is more reliable and of higher quality than the X11-ARIMA method.

In the X12-ARIMA method the regression model is used to describe the seasonal variation of the series, its long-term development and other important features such as deviating observations and working day adjustment. Seasonal adjustment is made separately for all series that have already been weighted (=direct method). The series of the main industries can be assumed to change more evenly than the series of the more detailed level and in the model-based seasonal adjustment the seasonal adjustment of an evenly changing series can be made considerably more reliably and better. Working day adjustment is also made model-based. The production raising or lowering effect is estimated for each day of the week. The working day adjustment of the volume index is made on the basis of hours worked per day inquired from establishments in connection with the change of the base year. X12-

ARIMA enables model-based working day adjustment, which is recommended for use by Eurostat, for instance. The coefficient for working day adjustment is formed by calculating the number of days of the week in all months, and the ARIMA model is used to describe the seasonal variation and trend of the series. The remaining irregular variation is explained in the regression model by the number of days of the week. The calendar used in the estimation of the effects of working days and in the forming of the final working day adjustment coefficients does not take into account the effect of Finland's public holidays. If the series does not have an ARIMA model, working day adjustment has not been made at all.

5.3. Adp-system

Technical facilities were built to the calculation system for making quality corrections and it was decided to consider the adoption of the actual quality change coefficients in connection with the annual volume project. The forms were supplemented with a section on quality changes where changes in headings are asked directly from data providers.

The revised application brought with it several changes to amend ease of use, data verification and printout production. For example, the data entry display was improved so that notifications of major changes appear on display and the stored data have to be accepted separately for calculation. These measures enhance the quality of the data. With the new application it is also possible to follow the accumulation of returned forms and initiate index calculation.

The most important in the production of the application was to amend the errors of the old application and the clumsiness hampering its use. On account of new data contents and new database table headings all the 30 or so data windows were revised. For some a larger overhaul was made, thus rendering data transfer between the application and the database more straightforward. New features were also added to the application, such as calculation of heading weights dynamically, a facility for saving quality changes, bar graphics for monitoring returned forms, production of request letters more flexibly than before, various auxiliary communication means and starting of batch run-type programs such as index calculation and so-called end-of the year runs from inside the application.

5.4. Speeding up of the publication

The process to speed up the collection of data for the volume index was already initiated in 1999 with intensified monitoring of response and issuing of reminders. In 2000, the press release at the total industry level was published with a delay of 30 days and in the following year this was extended to cover all the main industries. In 2001, the final index by main industry was still published with a delay of 45 days. As of the beginning of 2001, an agreement was made with representatives of data suppliers that data on output would be supplied within 15 days from the end of a reference month, which facilitated releasing the final index publication with a delay of 30 days. Issuing of reminders by both telephone and letter has been intensified throughout the speeding up process.

6. Further measures

The most important further measure is the development of the annual volume index of industrial output which is planned to start on 1 April 2002.

Guidance for the new application will also be prepared during spring 2002. The application will be developed continuously as regards problems found in normal use.

7. *Experiences*

The division of the project in accordance with the System development model of Statistics Finland into definition, planning, implementation, testing and adoption phases was a good solution for this project. As the old system is in some respects insufficiently documented, one of the major tasks in the definition phase was to describe the present state and in the planning and implementation phases to document index calculation.

The project kept well to its schedule and was at times even ahead of the plan, but only at the end of the testing phase the pace of work stepped up due to problems found in index calculation.

The meetings of the project management team almost every month were sufficient for steering the project and for tackling the problem issues. The composition of the management team was advantageous to the project, although it could have included a representative from the industrial structural business statistics.

The several meetings of the project team kept the co-operation with the IT personnel close, despite some changes of persons. There were some problems with exchange of information at the start of the implementation phase but they were resolved by means of informal meetings and a feedback facility added to the application.