STATISTICAL CALCULATION OF INDUSTRIAL PRODUCTION

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Abstract – *This work will explain the growth of the standards for measurement and calculation of industrial production over the past 60 years. International standards led by the UN have been implemented in statistical systems around the world including the European Statistical Commission as well as the Republic of Serbia. Throughout the work the index of industrial production will be explained and its importance in the evaluation of an economy as a very important indicator. IIP is used not only to measure industrial production of a country but is also used in future forecasting of economic activities. Also in the work, the statistical survey for measurement of industrial production in the Republic of Serbia will be explained in detail describing the questionnaires, scope, and coverage.*

1. INTRODUCTION

Measuring industrial production is one of the most important surveys in statistics. By measuring industrial production, the data collected can have many important roles in economic activates like measuring inflation, and influence on GDP. The calculation of industrial production is presented through index numbers. The IIP (index of industrial production) can be used to assess the performance of an economy. Index numbers allow for countries to make comparisons with each other in order to evaluate their industry when compared to others.

For the index to be useful in an international context, it is also important that the index numbers be compiled on a comparable basis. The indices can then be compared one with another to show changes in total production, and in the main industrial groups, both for important regions and for the world as a whole. Comparisons are made with similar populations, national income and etc.

In order for comparisons to be made, countries must conduct research using the same standards for collecting and measuring data. Since all countries around the world are unique in their own ways, each conducted research using different types of methods, so an international standard needed to be established for all.

The UN (United Nations) was the first organization to gather and form international standards for gathering industrial production data and measuring the index of industrial production. The collection of index numbers by the UN started in 1950, when recommendations which outlined the methods to be used in compiling index numbers of industrial production were formed. Over the last 60 years many changes have taken place, due to the changing environment of statistical standards and the need for fast and accurate data.

2. INDEX OF INDUSTRIAL PRODUCTION (IIP)

In order to accurately compile an index of industrial production, as mentioned international standards were formed by the UN. These standards broke down the way data was collected about industrial production into categories and sectors. This was necessary in order for the index of industrial production to be correctly compiled.

The System of National Accounts describes production as "an activity, carried out under the responsibility, control and management of an institutional unit, which uses inputs of labor, capital, and goods and services to produce outputs of goods and services. The economic analysis of production is mainly concerned with activities that produce outputs of a kind that can be delivered or provided to other institutional units. When constructing an IIP only production by units classified to selected activities within this more narrowly defined scope are of interest. For the purposes of precision and practicality, an industry classification is used to identify these in-scope units. [1]

The International Recommendations for Industrial Statistics (IRIS) 2008 defines the scope of industrial production as B (Mining and quarrying), C (Manufacturing), and D (Electricity, gas, steam and air conditioning supply). Traditionally the index of industrial production is commonly understood to be limited to the production of non-agricultural commodities and to exclude construction output.[2]

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[1] Department of Economics and Social Affairs, "*International recommendations for the Index of Industrial Productions"*, United Nations Publication, ISBN: 978-92-1-161532-6, 2010.

[2] United Nations Statistical Commission and Economic Commission for Europe, "*Terminology on statistical metadata"*, Conference of European statisticians statistical standards and studies – No. 53, 2000.

When constructing an index of industrial production, the objective is to measure short-term volume changes in value added. This is achieved, in practice, by first identifying variables (or indicators) and determining methods, along with an agreed scope and classification system, to collect these data variables from the appropriate business population. Techniques are then required to obtain volume measures from the collected data.

Volume measures of industrial production can be presented in either monetary terms or index numbers. Often the choice of presentation is linked to historical preferences as both presentation forms possess advantages and disadvantages.

An index is a numerical scale that is derived from observed facts and is used to describe relative changes over time. It can be used to describe how variables including prices, costs or quantities change over time. An index is typically expressed as per cent of a base value, which by convention is one hundred (100.0).

The Index of Industrial Production expresses changes in the volume of industrial production and is calculated as the ratio of the physical volume of an industrial group's industrial production over an observed period of time and the same industrial group's physical volume of production over a base period of time.[3]

3. THE BUSINESS REGISTER AND IIP

The statistical business register is an essential tool for data collection. A statistical business register is a register of business units engaged in production of goods and/or services. The business unit of the business register is usually the enterprise and has identifiable links to their establishments and is classified by economic activity.

The business register provides the basis from which a sampling frame is identified. A list of all economic units in the industrial sector is selected from the business register to form the sampling frame. The sampling frame should include:

- all accurate and up to date data items associated with units that are required for stratification, sample selection and contact purposes, for example, industrial and geographical classifications, size variables (in terms of number of persons employed, turnover etc.), name, postal and location address and description of the unit, telephone number and preferably a contact name; and

- all the active units, without omission or duplication, that are in the survey target population.

A selection of units from the sample frame is then made and it is from these units that data required for the compilation of the IIP are requested. This is referred to as the sample selection. A sample survey normally provides an efficient method for obtaining statistical information from large populations without the enormous costs and large human resource requirements of census-type enumerations.

To keep the coverage of the business register as representative as possible, it must contain current information on its constituents. This means the register is maintained over time to take note of the changes in the enterprise dynamics. For example, an enterprise may merge or split up, change production activities, or move location, while new enterprises may be created and existing enterprises may cease to exist. Unless the business register is regularly maintained, it will quickly loose its value as the source of sample frames/selections.

Administrative data sources can also be used for statistical purposes. Data and information from government administrative record keeping operations are increasingly becoming one of the major sources from which economic statistics can be compiled in many countries. These data are the result of government operations which require respondents to furnish information due to legislative provisions. As a result the administrative data generally has a complete or near complete coverage of the administrative target population. A by-product of this process of data collection is its use for statistical purposes. The use of administrative data sources should therefore be considered in the context of the IIP. However, some potential disadvantages do exist. These include differences in concepts, definitions and units between the administrative source and statistical standards. [4]

4. MEASURING INDUSTRIAL PRODUCTION IN THE REPUBLIC OF SERBIA

In the Republic of Serbia, the gathering and measurement of industrial production is carried out by the Statistical Office of the Republic of Serbia. Within the last 10 years, harmonization has taken place with all international standards that are followed by the UN and the European Statistical Commission. Statistical data is gathered on a monthly and annual basis. The data is collected by sending out questionnaires to reporting units which fulfill the proper requirements and standards to be a reporting unit.

Reporting units that provide data on industrial production are local manufacturing units of registered

[3] Groebner D., Shanon P., Fry P. and Smith K *"A Decision-Making Approach"*, Business Statistics, vol. 18, 2000.

[4] European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank, *"System of National Accounts 2008 (2008 SNA)"*, ISBN 978-92-1-161522-7, 2009.

companies in the sectors of mining and quarrying, manufacturing and production and supply of electricity, gas and water sector classification, as well as parts of the non-industrial enterprises engaged in industrial activity.

The Republic of Serbia Statistical Office calculates the production indices using the chain Laspeyres approach. This is comprised of two phases:

1) indices for classes, groups and divisions are calculated on the basis of data on quantities, which are collected monthly and on the basis of weights by products/services. The weight for the product is the value added per unit of measurement for the product.

2) the index for the overall industry, sections, and Main Industrial Groupings (MIGs) is calculated on the basis of the index of divisions and weight by divisions. The weight for divisions is the percentage of value added of the overall industry. Weights for divisions and products are corrected once a year. Complete weight change is done once in five years, but in the event of specific difficulties in the economy and society the cited period may be longer. The last general weight revision has been performed on the basis of 2005 data.

Data are collected monthly with imputation based on historical data to estimate for cases of non-response. The measurement of physical output is the primary method used to obtain industrial production volumes. Seasonal and working day adjustments are applied to the data and form the basis of the published results.

4.1. MONTHLY SURVEY

The monthly survey is used to collect industrial output from reporting units in order to calculate index number on a monthly basis. Two questionnaires are used for the collection of data on industrial production output:

- Questionnaire IND-1, which serves the purpose of collecting data on the total produced quantities, sub-contracted produced quantities, quantity of stocks at the end of the reporting months and on sold industrial products from the beginning of the current year;

- Questionnaire for small-size business entities IND-sample, which serves the purpose of collecting data on monthly basis as regard the income generated by the sale of own products and services of producers belonging to the section “Manufacturing”.

The reporting units are requested to indicate the total production that, the products should be indicated in all units of measurements. If the reporting units are engaged in sub-contracted production, i.e. is dealing with raw materials for third parties account, it should be indicated in a separate row along with the relevant code, name, all units of measurement which are provided from the Nomenclature and a note explaining its nature. Stocks of finished products refer to the situation at the end of the reporting month. The sale of products is meant to be the quantities of products that are dispatched to third parties and for which an invoice has been delivered.

Data on the economic activity of a set of business entities, which are not covered by the survey IND-1, serves the purpose of estimating the monthly index of production trends for that set and the purpose of correcting the monthly industrial production index of manufacturing and overall industry.

4.2. ANNUAL SURVEY

The annual survey IND-21 is used to collect data on industrial production: quantities of stocks at the beginning of the year, total production (within which data of total quantity produced and data of sub-contract quantities produced are shown separately), quantities of products for intermediate consumption, quantities at the end of the year, quantity and value of product sold.

Reporting units and statistical units (survey coverage)

These are enterprises registered in sections: B (mining and quarrying), C (manufacturing) and D (electricity, gas, steam and air conditioning supply), as well as sections of non-industrialized companies engaged in the industrial activity.

Questionnaire IND-21 is intended to follow reporting units with 20 or more employees, which makes at least 90% of the domestic product value for each production division.

Reporting units should provide the Annual questionnaire of industry for the previous year to the relevant regional office no later than 10th April of the current year.

4.3. COVERAGE

IND-1 follows reporting units with 20 or more employees, which make up at least 80% of the gross domestic product for each area of production.

Reporting units that are not covered by questionnaire IND-1 and have less than 50 employees are monitored by sampling method that is carried out through a questionnaire IND-sample.

For the first results of IND-1 the response percentage was 95%. If there is no answer, estimation is done by using results from the previous period. For IND-sample the response percentage was 35%.[5]

[5]] Sajt Republičkog zavoda za statistiku: http://webrzs.stat.gov.rs/WebSite/

5. CONCLUSION

Finally, we can conclude that the international statistical standards set by the UN for measuring industrial production since 1950 until today have made great progress in the way we gather data about industrial production. This progress has lead to a more accurate and precise way of measuring and calculating the index of industrial production IIP.

By having global standards and regulations countries that act in accordance with these standards allow their data to be shared and compared to other countries so they can easily assess their economic situation with other similar industries.

By accurately measuring industrial production and calculating the IIP, the sharing of industrial data is easily available through statistical publications to all. In the future, this will allow progress to be made in the way industrial production is measured and calculated, which will allow countries to have an improved insight into their economic activities.

In early 2001, the Republic of Serbia has also started with the implementation of international standards for the calculation and measurement of industrial production. Today the Statistical Office of the Republic of Serbia is almost fully compliant with all standards, regulations, and nomenclatures of the international community. This will allow for improvement in the survey in its future work to better gather and analyze data.

LITERATURE

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[5] Sajt Republičkog zavoda za statistiku: http://webrzs.stat.gov.rs/WebSite/