Croatian Bureau of Statistics

38th Voorburg Group Meeting on Services Statistics

Tel-Aviv, Israel
23rd October to 27th October, 2023

Cross cutting topic

Production of a deflated index of turnover in Croatia

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CONTENTS

INTRODUCTION

In Croatia, there is a growing importance of the services sector and a need for volume measure of services. According to the new European Business Statistics Regulation, the compilation of index of service production will be mandatory from 2024. As from 2023, volume turnover indices of service activities are published monthly on the dissemination site of the Croatian Bureau of Statistics the STS Database (Short-term Business Statistics Database) in the area Services under the heading Volume turnover indices of service activities − monthly data. Monthly indices on the basis of 2015, working-day adjusted, seasonally and working-day adjusted and unadjusted, are submitted to Eurostat on a regular monthly basis and are available on Eurostat's website with indicators of all EU Member States with which they are comparable.

The purpose of this paper is to specify procedures in the Croatian Bureau of Statistics (CBS) for the production of a deflated index of turnover (ISP), which includes the process of ISP calculation (detection of deflators, deflation, estimation method, disaggregation method and index calculation), seasonal adjustment, data processing and dissemination of results.

2. GENERAL INFORMATION

The main purpose of ISP is to measure short-term changes in services production. Such an indicator fills an important gap in Short-term Statistics (STS) and provide information on the most recent developments on services in deflated terms similar to the currently available production (volume) indicators for industry and construction, and the indicator for the volume of retail trade. ISP could be combined with volume indicators for industry, construction and trade to generate an overall production volume indicator for the business economy as total market production index (TMPI). The tracking of short-term movements in services production should improve business-cycle analysis in the area of services in general. As regards individual service industries, it should enable us to identify turning points in economic development and improve forecasts.[1]

In EU requirements, the new EBS Regulation requires production variable which, among others, also includes the services sector. In the past, CBS produced only volume of sales for retail trade (G47), as required by STS Regulation. Since 2016, Croatian ISP was gradually developed through EU grants. CBS started first with developing the following activities: H Transportation and storage, H 49 Land transport and transport via pipelines, 50 Water transport, H 51 Air transport, H 52 Warehousing and support activities for transportation, H 53 Postal and courier services, I Accommodation and food services activities, I 55 Accommodation, I 56 Food and beverage services activities. In the second project, CBS was concentrated only on the section G Wholesale and retail trade; repair of motor vehicles and motorcycles consisting of three divisions (G 45 Wholesale and retail trade and repair of motor vehicles and motorcycles and G 46 Wholesale trade, except of motor vehicles and motorcycle and G 47 Retail trade, except of motor vehicles and motorcycles). With the last EU grant, from 2018 to 2019, the following activities were developed: J 59 Motion picture, video and television programme production, sound recording and music

[1] Eurostat ISP Task Force Guide on developing an Index of Service Production (ISP), 2015

publishing activities, J 60 Programming and broadcasting activities, L 68 Real estate activities, M 74 Other professional, scientific and technical activities, N 77 Rental and leasing activities and N 82 Office administrative, office support and other business support activities. Now, all activities are covered and CBS is completely in line with the new EBS Regulation for small countries. As from 2023, volume turnover indices of service activities are published monthly on the dissemination site of the Croatian Bureau of Statistics the STS Database (Short-term Business Statistics Database) in the area Services under the heading Volume turnover indices of service activities – monthly data. Monthly indices on the basis of 2015, working-day adjusted, seasonally and working-day adjusted and unadjusted, are submitted to Eurostat on a regular monthly basis and are available on Eurostat's website with indicators of all EU Member States with which they are comparable.

In order to establish the methodology for ISP production, all available sources for deflators were explored, procedures to be used determined and the whole statistical process was defined. To find out more about the methodology for ISP production, available sources such as Guide for developing an Index of Services Production (Eurostat ISP Task Force, 2015), Compilation Manual for an Index of Services Production (OECD, 2007) and Handbook on Prices and Volume Measures for National Accounts (Eurostat, 2001) were researched. Reports from other countries were also checked to find out their experiences in developing ISP. Within CBS, some useful meetings with the Industry Department and National Accounts were held.

In Croatia, the services sector has great economic importance. It is a fast growing economy sector of the Republic of Croatia. Over 60% of business entities have registered service activities, with over 50% of employees and turnover, while its share in total value-added amounts is almost 50%.

Table 1 shows the actual distribution of turnover and value added for the service sectors in business economy of the Republic of Croatia by activity sections. In the services sector, the highest share of turnover (35,9%) and value added (18,2%) of business economy of Republic of Croatia was recorded in section G Wholesale and retail trade; repair of motor vehicles and motorcycles.

Table 1 Share of the services sector in turnover and value added of business economy of the Republic of Croatia by activity sections, 2021

NACE Rev. 2 code	Net turnover	Value added
G Wholesale and retail trade; repair of motor vehicles and motorcycles	**35,9%**	**18,2%**
H Transportation and storage	4,3%	5,5%
I Accommodation and food service activities	3,4%	5,4%
J Information and communication	4,4%	7,6%
L Real estate activities	1,0%	1,6%
M Professional, scientific and technical activities	3,8%	6,0%

N Administrative and support service activities	1,8%	2,6%
(G-NXK) Total services	**54,6%**	**46,9%**

Source: Structural business statistics of the Croatian Bureau of Statistics, Main Structural Business Indicators of Enterprises, 2021

Table 2 shows the actual distribution of turnover, value added, enterprises and people employed in the services sector. In the services sector, the highest share of turnover (65,7%), value added (38,7%) and employment (39,7%) was observed in the section G Wholesale and retail trade; repair of motor vehicles and motorcycles. The highest share of enterprises (26,2%) was recorded in the section G Wholesale and retail trade; repair of motor vehicles and motorcycles and in the section M Professional, scientific and technical activities.

Table 2 Structure of the services sector of the Republic of Croatia by activity sections, 2021

NACE Rev. 2 code	Number of active enterprises	Number of employees	Net turnover	Value added
G Wholesale and retail trade; repair of motor vehicles and motorcycles	**26,2%**	**39,7%**	**65,7%**	**38,7%**
H Transportation and storage	9,7%	11,7%	7,8%	11,7%
I Accommodation and food service activities	15,4%	16,8%	6,3%	11,5%
J Information and communication	9,6%	8,9%	8,1%	16,3%
L Real estate activities	4,2%	1,4%	1,9%	3,5%
M Professional, scientific and technical activities	**26,2%**	12,3%	6,9%	12,8%
N Administrative and support service activities	8,7%	9,2%	3,3%	5,5%
(G-NXK) Total services	100,0%	100,0%	100,0%	100,0%

Source: Structural business statistics of the Croatian Bureau of Statistics, Main Structural Business Indicators of Enterprises, 2021

Table 3 shows the movement of shares in total number of active enterprises according to NACE Rev. 2. Within the total number of active enterprises in 2021, the most represented were enterprises in the activities of Wholesale and retail trade; repair of motor vehicles and motorcycles (16.5%) and Professional, scientific and technical activities (16.4%).

Table 3 Shares in the total number of active enterprises according to NACE Rev. 2

NACE Rev 2. Code	2019	2020	2021
G Wholesale and retail trade; repair of motor vehicles and motorcycles	**17,8%**	**17,2%**	**16,5%**
H Transportation and storage	6,6%	6,2%	6,1%
I Accommodation and food service activities	10,5%	10,1%	9,7%
J Information and communication	5,3%	5,7%	6,0%
L Real estate activities	2,6%	2,5%	2,6%
M Professional, scientific and technical activities	15,7%	16,2%	16,4%
N Administrative and support service activities	5,6%	5,4%	5,5%

Source: Business demography statistics – Statistical Business Register (SBR) of the Croatian Bureau of Statistics, 2021, provisional data

3. PROCESS OF ISP CALCULATION

The whole statistical process of ISP calculation is implemented through the following steps:

1. Gathering of all the sources, needed for the ISP calculation
   - Nominal turnover from MTOS database[2]
   - SBS Structural business statistics
   - Monthly consumer price indices (CPI)
   - Monthly Producer Price Indices (PPI)
   - Quarterly Agriculture Price Indices (API)
   - Quarterly Service Producer Price Indices (SPPI)
   - Monthly Index of Average Gross Salaries (IAS)
   - Quarterly House Price Index (HPI)
   - Physical indicators (PHI)

2. Estimation of monthly indices for the groups for which the quarterly indices are determined as deflators. This has been done by means of two different procedures:
   - Estimation (forecast) of monthly indices on the basis of auxiliary indices or historical indices in the months when the quarterly indices are not yet on disposal.
   - Disaggregation of quarterly price indices when the quarterly indices are on disposal. With this procedure monthly indices for all three months of the quarter are estimated at once.

[2] MTOS database contains turnover data from regular statistical Monthly Survey on Service Activities combined with the data from administrative source (VAT)

3. Deflation of the nominal turnover in order to get the deflated turnover

4. Calculation of the annual "real indices" (indices calculated from deflated turnover) on the level of 4-digit NACE groups (4-digit indices) or 3-digit NACE groups (3-digit indices).

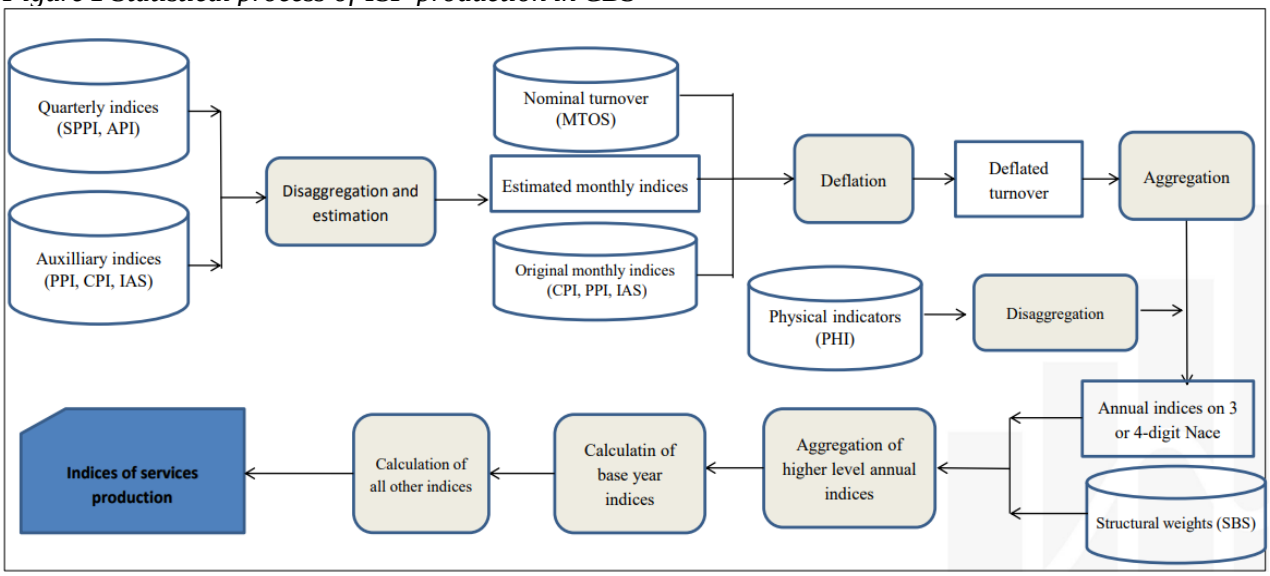
- Disaggregation of quarterly base-year index series
- Calculation of annual indices from base-year indices

5. Calculation of annual indices for higher level activity groups, by calculating weighted arithmetic mean of the 4-digit level indices or 3-digit level indices.

6. Calculation of base-year indices (for all levels) by using the annual index and base-year index from the same month of the previous year.

7. Calculation of all other indices from the base-year time series indices.

Figure 1 Statistical process of ISP production in CBS



Abbreviations:

SPPI Service Producer Price Indices
PPI Producer Price Index
CPI Consumer Price Index
API Agriculture Price Index
IAS Index of average gross salaries
HPI House Price Index
PHI Physical Indicators- transport of goods
SBS Structural Business Statistics

3.1 NOMINAL TURNOVER AND STRUCTURAL WEIGHTS

Since 2017, the Croatian Bureau of Statistics has supplemented the quarterly dynamics of conducting turnover survey with the monthly dynamics. The data is based on the Monthly Report on Service Activities and administrative data sources (databases of value added tax reports). The series are transmitted to Eurostat and nationally disseminated at the division level, within the t+60 days deadline, which is in line with the new EBS Regulation.
For the purpose of the survey, the sampling method is used and the sample is selected once a year. The sample is based on size and annual turnover of business entities for the previous year. All medium-sized and large enterprises are taken over from the Statistical Business Register. Units marked in the Register as small ones are also included if they exceed the determined threshold according to the turnover. The total sample consists of about 14 680 units, of which 1 000 of them are included in the regular Monthly Report on Service Activities (USL-M form).

The main purpose is to measure the change dynamics of the phenomenon instead of its level. The monthly index of turnover changes in the services sector is an important economic indicator for short-term monitoring and analysis of economic development.

The STS Regulation defines turnover as the totals invoiced by the observation unit during the reference period, and this corresponds to market sales of goods or services supplied to third parties. Turnover also includes all other charges (transport, packaging, etc.) passed on to the customer, even if these charges are listed separately in the invoice. Subsidies received from public authorities or the institution of European Union are also included. Turnover excludes VAT and other similar deductible taxes directly linked to turnover as well as all duties and taxes on the goods or services invoiced by the unit. Reduction in prices, rebates and discounts as well as the value of returned packing must be deducted. Price reductions, rebates and bonuses conceded later to clients, for example at the end of the year, are not taken into account.

For turnover in administrative source the closest approximation of turnover is the value of goods and services delivered to third parties that are declared to Tax Authorities for the purpose of VAT payments −VAT declarations.

The added value from the SBS data were used for the calculation of the structural weights. For all service activities except for Trade the basic level of indices calculation, where the weighting approach begins, was the 3-digit NACE level, while for Trade (G45 and G46) the basic level, where the weighting approach begins was 4-digit NACE level.

3.2 DEFLATORS

Deflators are appropriate price indices that are used to transform nominal turnover into real (deflated) turnover by deflation procedure. The most appropriate deflators are services producer price indices (SPPIs). However, those indices are not always on disposal for all service activities, so additional sources are used in these cases. These additional sources are in most cases consumer price indices (CPIs), and in some cases indices of average gross salaries (IAS). Its important that all deflators are price indices with the fix base year. Table of chosen deflators by the Nace groups and classes can be found in Appendix1.

For the procedure of calculation of the deflators, the data sources were used for two different purposes:

- Quarterly or monthly price indices that are used as a base source for the determination of the deflators.
- Monthly price indices that are used for disaggregation of quarterly base source indices into monthly indices.

Services Producer Price Index (SPPI) The main aim of the index is measuring the dynamics of price changes, which reflect the conditions of supply and demand on the service market. These indices are used in macroeconomic analyses and as deflators for the conversion of services producer prices values into volume measures. Most of the indices are quarterly based, but some are monthly. For the deflation purposes these indices are used as a base source. The compilation of SPPI in Croatia relies on B2All concept. SPPIs in Croatia cover services provided to households, businesses, government and for export. SPPI weights are updated annually; data on turnover share according to the group of services are collected for a previous year by using the SPPI survey carried out during the first quarter each year. The base period in SPPI is the last quarter of a previous year. SPPI series are calculated using the chain linking approach.

Consumer Price Index (CPI) The Consumer Price Index measures the changes in the prices of goods and services acquired, used or paid over time by the reference population (private households) for consumption purposes. The classification of products used in the CPI is based on the European Classification of Individual Consumption according to Purpose (ECOICOP). Indices are published on a monthly basis. For the deflation purposes these indices are used as a base source and as auxiliary source for disaggregation of quarterly SPPIs. The main data source for determining the weights used in the calculation of the CPI is the Household Budget Survey (HBS). This data source is supplemented by available additional data sources (administrative data or data obtained directly from suppliers). For the CPI, annually update of weights is used. The weights used for calculating the indices reflect the relative importance of the sampled goods or services in the total consumption of households within the domestic territory. For now, the CPI is used as it is without adjustment for VAT.

Industrial producer price index (PPI) The industrial producer price index measures the changes of producer prices of manufactured goods produced in the Republic of Croatia and sold by producers on the domestic (Croatian) and/or non-domestic (non-Croatian) market. Industrial producer price indices for the total industry, according to the National Classification of Activities (NKD) 2007 sections (B – E) and divisions (05 − 36) are calculated by using the weighted procedure according to the Laspeyres formula, where weights represent the value of products sold on the domestic and non-domestic market according to the Nomenclature of Industrial Products (NIP) from results of the PRODCOM Survey on Industrial Production (IND-21/PRODCOM/G form). The total industrial producer price index is composed of two subindices, that is, the industrial producer price index on the domestic market and the industrial producer price index on the non-domestic market. The weighting system is changed every five years, while weights are partly corrected every year, in relation to changes in prices. All industrial producer prices are recorded as transaction prices in effect on the 15th day of the month indicated. PPI is used as a base source and

as auxiliary source for disaggregation. We use Industrial producer price indices for the total industry, according to the Nace sections, divisions and groups.

Agricultural price index (API) API is used as a base source. The surveys of the Croatian Bureau of Statistics and administrative data are the basis for the calculation of quarterly and annual price indices in agriculture. Average producer prices are those including taxes (excluding VAT), while subsidies are excluded. For the API, update of weights is every five years. For the calculation of the monthly ISP there is a need to disaggregate the quarterly API into three monthly indices. For disaggregation, we used the auxiliary index method. That method is used when auxiliary indices are on disposal. Main auxiliary monthly indices for disaggregation of the API are: consumer price indices and producer price indices.

Index of average gross salaries (IAS) Monthly gross earnings include all kinds of net pays on the basis of employment plus participation, co-payments, contributions and taxes, as prescribed by law. Indices are published on a monthly basis. For the deflation purposes, these indices are used only as an auxiliary source for disaggregation of quarterly SPPIs in cases where there is no suitable CPI.

House price index (HPI) The house price index covers all transactions of dwellings made by households independently from their previous owners and independently from their final use. Transaction prices include the value of land.

3.3 DEFLATION

CBS uses deflation on micro level for the calculation of ISP. Due to the small number of reporting units in some of the NACE Rev. 2 groups used for the initial calculation of indices, we decided to make further aggregation of these groups in order to have a sufficient number of units in all of these "base NACE Rev. 2 groups". To solve this issue, we introduced another level of NACE aggregation, which is incorporated into the calculation procedure. A correspondence code list with links between the initial and new NACE groups was prepared and provided to an IT expert, which then adjusted the procedure of indices calculation.

Deflation is performed in few steps:

- For every reporting unit *i*, for which nominal turnover is available, appropriate group of deflation *g* is added according to its activity code

- According to the group of deflation decided upon in the previous step, every reporting unit gets appropriate deflator $DgmM$. It is done by using the deflators table.

- Deflated turnover $TimD$ for unit *i* in month *m* is calculated using the formula:
  $$TimD = TimN / DgmM * 100$$

3.4 ESTIMATION AND DISAGGREGATION METHOD

The procedure for the calculation of monthly deflators on the basis of quarterly indices (including disaggregation) works well only when it is applied on the historical data, when all quarterly indices are already available and when they can be directly disaggregated and then used for the deflation. However, we face a different situation in the case of "regular production". Namely, in this case the monthly SPPIs have to be produced and provided in time at T+60 after the end of the reference month (e.g. for January 20123, it has to be provided at the end of March 2023). At the time, the quarterly SPPIs are not available yet. Moreover, they are only available at T+90 after the end of the quarter (end of 3rd month of the quarter). In our case, this is at the end of June 2023. This means that monthly indices for all three months of the quarter at that point of time have to be forecasted without the quarterly index. Also, in this case two different approaches is used, depending on the availability of auxiliary monthly indices.

1. Estimation of deflators in the case when quarterly indices are not at disposal yet

a) If the auxiliary indices are at disposal, estimates are obtained by using the following formula for auxiliary method:

$$I_Q^M/\emptyset 2015 = (I_Q^{M-1}/\emptyset 2015) \cdot \frac{I_{AUX}^M/\emptyset 2015}{I_{AUX}^{M-1}/\emptyset 2015}, \qquad (2.1)$$

where

$I_Q^M/\emptyset 2015$ … deflator that is estimated

$I_Q^{M-1}/\emptyset 2015$ … deflator from the previous month (already calculated − estimated in the processing for the previous month)

$I_{AUX}^M/\emptyset 2015$ … monthly auxiliary index for the current month

$I_{AUX}^{M-1}/\emptyset 2015$ … monthly auxiliary index for the previous month

Example: We want to estimate the monthly deflator for group 521 for January 2018. The quarterly SPPI index for 5224 that is "originally" used as a source is not available yet, the auxiliary source in this case is monthly CPI index 073. We estimate the deflator for January 2023 by taking the deflator from December 2022 and multiply it by ratio of base-year auxiliary index for January 2023 and base-year auxiliary index for December 2022.

b) If auxiliary indices are not at disposal, estimates are obtained by using the following formula for linear method:

$$I_Q^M/\emptyset 2015 = (I_Q^{M-1}/\emptyset 2015) \cdot \frac{I_Q^{M-12}/\emptyset 2015}{I_Q^{M-13}/\emptyset 2015}, \qquad (2.2)$$

where

$I_Q^M/\emptyset 2015$ ... deflator that is estimated

$I_Q^{M-1}/\emptyset 2015$ ... deflator from the previous month (already calculated-estimated in the processing for the previous month)

$I_Q^{M-12}/\emptyset 2015$ ... deflator for the same month of the previous year
$I_Q^{M-13}/\emptyset 2015$ ... deflator for month M-1 of the previous year

Example: We want to estimate the monthly deflator for group 639 for January 2023. The quarterly SPPI index for 5224 that is "originally" used as a source is not available yet. We estimate deflator for January 2023 by taking the deflator from December 2022 and multiply it by ratio of deflators for January 2022 and deflator for December 20121.

2. Quarterly indices are not at disposal (there is no disaggregation)
   a) Groups where there is at least one monthly price index included as input source
   Eventual quarter indices in this group are ignored. Deflator is calculated only on the basis of the monthly indices. If there are several monthly indices, weighted arithmetic mean is used again.

3. Quarterly indices are at disposal − Disaggregation of quarterly indices

a) If the auxiliary indices are at disposal, disaggregation is obtained by using the formula for the auxiliary index method

- If there are several auxiliary indices for one quarterly index, they are aggregated to one value by using the formula for weighted arithmetic mean.
- When for each quarterly index we have just one auxiliary index we apply the following formula for disaggregation

$$I_Q^i = I_Q * \frac{M_A^i}{M_A^Q} \qquad (1.1)$$

where I_Q^i ($i\epsilon\{1,2,3\}$) are first, second and third month of the quarter, M_A^i are the respective auxiliary monthly base-year indices and $\overline{M_A^Q}$ is the average of the three auxiliary monthly base-year indices inside the quarter.

b) If the auxiliary indices are not at disposal, disaggregation is obtained by using the following formula for linear method:

$$I_Q^1 = I_Q * \frac{3}{1+I_{Q/Q-1}+(I_{Q/Q-1})^2}$$

$$I_Q^2 = I_Q * \frac{3}{1+I_{Q/Q-1}+(I_{Q/Q-1})^2} * I_{Q/Q-1}$$

$$I_Q^3 = I_Q * \frac{3}{1+I_{Q/Q-1}+(I_{Q/Q-1})^2} * (I_{Q/Q-1})^2 \qquad (1.2)$$

where I_Q^1, I_Q^2 and I_Q^3 are monthly indices for first, second and third month of the quarter respectively, I_Q is the (base-year) quarterly index and $I_{Q/Q-1}$ chain "quarter to previous quarter" index.

As a result of disaggregation all price indices are now at disposal at the monthly level. These monthly indices are aggregated into one deflator by using the formula for weighted arithmetic mean.

Schematically, the procedure can be summarised as follows:

<table>
<tr><td rowspan="2">Quarterly indices are at disposal</td><td>Disaggregation</td><td colspan="2">Calculation of deflators</td></tr>
<tr><td>AUX method: Formula 1.1
LM method: Formula 1.2</td><td colspan="2">Weighted arithmetic mean</td></tr>
<tr><td rowspan="3">Quarterly indices are not at disposal</td><td rowspan="3">(No disaggregation)</td><td colspan="2">Calculation of deflators</td></tr>
<tr><td>At least one monthly index: Weighted arithmetic mean</td><td></td></tr>
<tr><td rowspan="2">Only quarterly indices</td><td>AUX method: Formula 2.1</td></tr>
<tr><td>LM method: Formula 2.2</td></tr>
</table>

3.5 INDEX CALCULATION

The volume turnover index of service activities is calculated by deflating the nominal turnover of service activities at the micro level using different price indices. First, the annual indices are calculated at the elementary level of the NKD 2007 group or class.

When physical indicators are used instead of price indices, deflation is not performed, but these indices are used directly instead.

For aggregation at higher NKD levels (groups, divisions, sections), the Laspeyres-type index is calculated using weights (value added variable) from structural business statistics. The weights are updated every year and refer to the period t-2.
Base year indices are then calculated, which are further used for seasonal and working-day adjustments.

Calculation of monthly services production indices is implemented trough the following steps:

• Calculation of the index "current month according to the same month of the previous year" for the elementary level – NACE Classes (4-digit level) for Trade and NACE Group (3-digit level) for all other service activities. The index is calculated as a "direct aggregation index". The index is calculated by taking into account only the units for which the data on turnover is available from both periods.

$$I_{M/M-12}^{Nace3} = \frac{\sum_i T_i^M}{\sum_i T_i^{M-12}} \cdot 100$$, where

T_i^M ... deflated turnover in current month (M)

T_i^{M-12} ... deflated turnover in the same month of previous year (M-12)

- The index is calculated by taking into account only units for which we have data on turnover from both periods (matched units).

• For the higher level sub-groups (Groups, Divisions and Section), the annual index is calculated as an "average index", using the formula for weighted arithmetic mean of NACE 4-digit level indices, where weights are structural weights from the SBS data.

$$I_{M/M-12}^{Nace2} = \frac{\sum_{i=1}^{n} w_i \cdot I_{M/M-12}^{Nace3,i}}{\sum_{i=1}^{n} w_i},$$

where w_i are the structural weights for Nace 3 groups , obtained from the SBS database.

• The index "current month according to the average of base year 2015" (base index) is calculated by chaining approach. The base index from the same month of the previous year is multiplied by the year-to-year growth in the respective activity group. The year-to-year growth is the annual index, calculated in the first step of the procedure, divided by 100.

The base index is calculated by the following formula:

$I_{M/\emptyset 2010} = I_{M/M-12} \cdot I_{M-12/\emptyset 2010}/100$, where

$I_{M/\emptyset 2010}$ ... base index for current month (M)

$I_{M-12/\emptyset 2010}$ ... base index for the same month of previous year (M-12)

$I_{M/M-12}$ ...yearly index for the current month (calculated as described above)

• All other indices are calculated from the time series of base indices by using the chaining approach.

4. SEASONAL ADJUSTMENT

Seasonal adjustment is done by Sampling, Statistical Methods and Analyses Department in CBS. In the process of seasonal adjustment, the software package JDemetra+ 2.2.4 is used and seasonal and calendar adjustment have been done by using the X13 ARIMA method. This process identifies and assesses seasonal and working/trading day effects in time series by using statistical models and procedures.

ISP data are published on a monthly basis on the base year 2015. The first reference period for the ISP series is January 2010. Seasonal adjustment is done for 36 series (G_NXK, H_N, G, H, I, J, L, M, N, G45, G46, H49, H50, H51, H52, H53, I55, I56, J58, J59, J60, J61, J62, J63, L68, M69, M702, M71, M73, M74, N77, N78, N79, N80, N81, N82). The results of seasonal adjustment are seasonally and calendar adjusted indices, calendar adjusted indices and trend indices. The seasonally and calendar adjusted indices imply that the gross indices are adjusted for seasonal and calendar effects. Indices adjusted in that way and associated rates of change in two consecutive observations are used to compare data with data from the previous month. Calendar adjusted indices imply that the gross indices are adjusted only for effects that arise from annual differences in the number of working or trading days in a month, or the dates or days of public holidays. Indices adjusted in that way and associated inter-annual rates of change are used to compare data with data from the same month of the previous year.

The revision of previously published seasonally and calendar adjusted indices is due to several causes. The most common cause is a change in estimated parameters of existing statistical models while conducting new estimates, which occurs due to new observations. Other causes are changes in source data (revision of original series) or in applied statistical models. Seasonally adjusted time series are revised every month (all values backwards) due to revision of original series. Adequacy of models is checked by built-in diagnostic indicators in ARIMA X13 after each new observation is added. Seasonal and trend filters, ARIMA models and calendar regressors are fixed during the year but revised at the end of a year for reference period m12. Direct Seasonal adjustment approach is used. For the length of seasonal filters, automatic procedure is used in ARIMA X13. For the majority of series, multiplicative decomposition of seasonal adjustment is performed. If the series has zero and negative values, then this series must be additively adjusted. If the series has a decreasing level with positive values close to zero, then multiplicative adjustment must be used.

Calendar effects have significant impact on time series movement, the most common of which are the effect of moving holidays, the effect of the leap year, the effect of different number of working days and composition of working days. The most important moving holiday in Croatia is Easter, not only because it moves between days, but also because it moves between months since it can occur in March or April. Each series is tested for presence of Easter effect and automatic procedure in X13 ARIMA is used. National calendar of holidays for Croatia is used in X13ARIMA method.

Default critical value in the automatic detection procedure of outliers is used (ARIMA X13). The critical value for outlier detection is 4. Type of outliers detected: Level shifts (LS), Additive outliers (AO) and Transitory changes (TC) are tested. Most common are LS's and AO's. Automatic procedure is used in ARIMA X13. Outliers for which a clear interpretation exists are included as regressors in the model. E.g. COVID-19 crisis is modelled as LS, AO or TC depending on the impact on the data in each time series.

5. DATA PROCESSING

ISP calculation was done through the web-based application. The application performs index calculation for a chosen year and month. Possible results in the application are: ISP series, deflated turnovers, all indices for all periods, comparison preliminary data and final data and comparison value indices and volume indices.

List of procedures to be carried out in order to ensure the regular production of ISP calculation:

1) Procedures that are carried out on an annual basis
- To insert a new set of metadata for the new reference year into the file Deflators_IT.xlsx. Special care should be taken to preserve the formats in the Excel cells. Changes in metadata should be carried out only exceptionally (e.g. if new SPPI index is introduced).
- To add SBS data (which serve as structural weights) for year Y-1. For the months when SBS data for Y-1 is not at disposal yet, data from Y-2 should be written into year Y-1.

2) Procedures that are carried out on a monthly basis
- To insert the monthly input data (monthly price indices) into the excel templates. Special attention should be paid to the formatting of the inserted data. All the formats should be preserved from month to month.
- To carry out the procedure for calculation of indices.
- To carry out validation of indices that were produced in a current month. The following validation procedures is recommended to be carried out every month:
- Verification of deflators for all the groups were calculated.
- Detection and verification of the highest/lowest values of the yearly indices (indices according to the same month of the previous year).
- For the "non-seasonal activities" also detection and verification of the highest/lowest values of the monthly indices (indices according to the previous month).
- Lastly, for the main activity groups the comparison with the nominal indices of turnover should be carried out.

3) Procedures that are carried out on quarterly basis:
- To insert the quarterly input data (quarterly price indices and quarterly "physical indices") into the excel templates. Special attention should be paid to the formatting of the inserted data. All the formats should be preserved from quarter to quarter.

6. PRESENTATION AND DISSEMINATION OF RESULTS

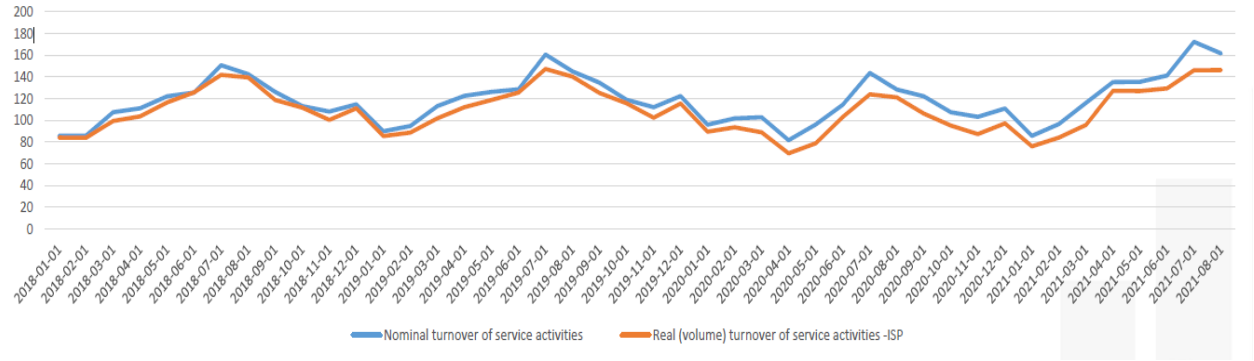
Since January 2023, the monthly indices on the 2015 base, working-day adjusted, seasonally and working-day adjusted and unadjusted, are regularly submitted on the monthly basis to the Eurostat within t+60 days deadline and are available on the Eurostat's website, together with the indicators of all EU Member States they are comparable to. The time series of the volume turnover indices of service activities are published on the dissemination site of the Croatian Bureau of Statistics in the

STS Database (Short-Term Business Statistics Database) in the field Services under the headings Turnover Indices of Service Activities − monthly data. On the quarterly basis, ISP data are regularly submitted to National Account for calculation of quarterly GDP.

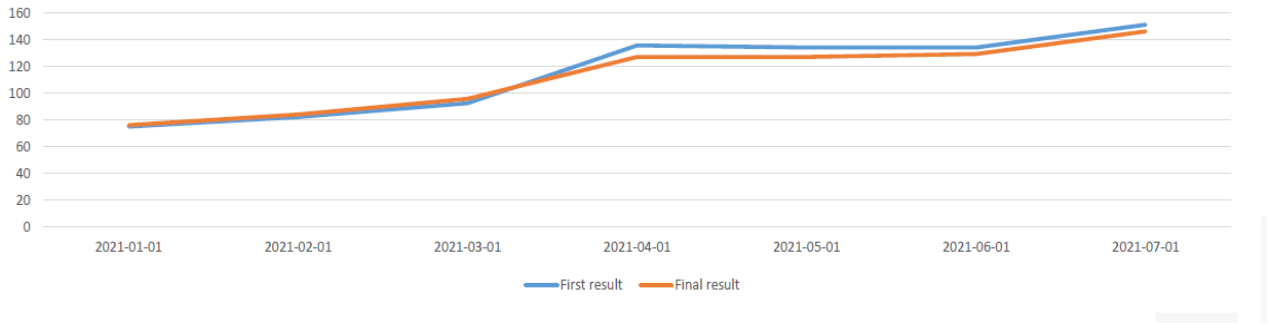
Monthly analysis of ISP data consists of the analysis of differences between nominal and volume turnover index, detections of changes between first and final results, calculation of monthly change rate (the data that are compared to those of the previous month) and calculation of yearly change rate (the data compared to those of the same month of the previous year).

Graph 1 shows very similar movement of original nominal and real (volume) service turnover data for G-NXK.

Graph 1 Movement of original nominal and real (volume) service turnover data for G- NXK (Indices 2015=100)



Graph 2 Movement of the first and final results for G-NXK (Indices 2015=100)



7. CHALLENGES AND FUTURE PLANS

The calculation process for ISP is quite complex. The main challenge in the calculation process of ISP lies in combining multiple sources derived from various surveys with specific methodology for each of them. Knowledge of all these methodologies is necessary for good analysis of the ISP results.

In Croatia, ISP indicator is fairly new and it is understandable that there is still room for improvement. Future plans for improvement of ISP consist of automatization of deflators updating, improving data quality and further good cooperation with the National Account. Improving data quality will be done by developing new deflators, introducing new, better deflators and improving disaggregation and estimation methods. Now, if the auxiliary indices are not at disposal disaggregation and estimation are obtained by using the formula for linear method. However, another method is being considered in the future. In some activities, where the linear method is using the significant difference between first and final result was noticed. Since 2023, the Import Price Indices are available and the inclusion in the calculation is being considered in the future. Also, until the end of 2023 all SPPIs according to the new EBS Regulation will be available and the plan is to include them in the ISP calculation in 2024. Upgrading the ISP application with the implementation of automatization of deflators and with the new tables for analysing will result in faster and better analyses.

At present, the use of ISP in the NA is still in experimental phase but in the future the plan is to use ISP directly in the calculation of constant prices instead of nominal indices and the implementation of turnover indices of services activities directly in the calculation of current prices.

APPENDIX 1.
Table 1. Chosen deflators by the Nace Rev.2

Nace Rev.2	Periodicity	Source	Disagg. method	Auxiliary source	SPPI	CPI	PPI	API	HPI	IAS
4511	M	CPI				0711				
4519	M	CPI				0711				
4520	M	CPI				0723				
4531	M	CPI				0721				
4532	M	CPI				0721				
4540	M	CPI				0712				
4540	M	CPI				0723				
4611	M	CPI				0112				
4611	M	PPI					101			
4611	M	PPI					131			
4611	M	PPI					132			
4611	M	PPI					133			
4612	M	CPI				0453				
4612	M	PPI					192			
4612	M	PPI					244			
4612	M	PPI					201			
4613	M	CPI				0431				
4613	M	CPI				0561				
4613	M	PPI					16			
4613	M	PPI					203			
4613	M	PPI					23			
4614	M	PPI					28			
4615	M	PPI					257			
4615	M	PPI					259			
4615	M	PPI					275			
4615	M	PPI					310			
4616	M	PPI					13			
4616	M	PPI					14			
4616	M	PPI					15			
4617	Q	API	AUX	PPI			10	05		
4617	Q	API	AUX	PPI			11	07		
4617	Q	API	AUX	PPI			10	06		
4617	M	PPI					12			
4618	M	PPI					SECTION C			
4619	M	PPI					SECTION C			

4621	Q	API	AUX	CPI		0111		01		
4621	Q	API	AUX	CPI		0111		02		
4621	Q	API	AUX	CPI		0111		03		
4622	Q	API	AUX	CPI		0933		042		
4623	Q	API	AUX	PPI			101	11		
4624	M	PPI					151			
4631	Q	API	AUX	PPI			103	06		
4631	Q	API	AUX	PPI			103	041		
4631	M	CPI				0116				
4631	M	CPI				0117				
4632	M	CPI				0112				
4632	M	PPI					101			
4633	Q	API	AUX	CPI		0114		121		
4633	Q	API	AUX	CPI		0114		122		
4633	M	CPI				0115				
4633	M	PPI					105			
4633	M	PPI					104			
4634	M	PPI					11			
4634	M	CPI				012				
4634	M	CPI				021				
4635	M	PPI					12			
4635	M	CPI				022				
4636	M	PPI					107			
4636	M	PPI					108			
4636	M	CPI				0118				
4637	M	CPI				0121				
4637	M	CPI				01191				
4637	M	PPI					108			
4638	M	PPI					102			
4638	M	CPI				0113				
4639	M	PPI					10			
4639	M	PPI					11			
4639	M	PPI					12			
4641	M	PPI					13			
4641	M	CPI				052				
4642	M	PPI					14			
4642	M	PPI					152			
4642	M	CPI				0312				
4642	M	CPI				0321				
4643	M	PPI					275			
4643	M	CPI				053				

4644	M	PPI					204			
4644	M	PPI					231			
4644	M	PPI					234			
4644	M	CPI				054				
4644	M	CPI				05611				
4645	M	PPI					204			
4645	M	CPI				12132				
4646	M	PPI					21			
4646	M	CPI				0611				
4647	M	PPI					310			
4647	M	PPI					274			
4647	M	CPI				051				
4648	M	PPI					265			
4648	M	PPI					321			
4648	M	CPI				1231				
4649	M	CPI				054032				
4649	M	PPI					162			
4649	M	PPI					172			
4649	M	PPI					323			
4649	M	PPI					324			
4651	M	CPI				0913				
4651	M	PPI					262			
4652	M	CPI				0820				
4652	M	PPI					263			
4661	M	PPI					283			
4662	M	PPI					284			
4663	M	PPI					289			
4664	M	PPI					289			
4665	M	PPI					31			
4666	M	PPI					289			
4669	M	PPI					28			
4671	M	CPI				0722				
4671	M	PPI					192			
4672	M	PPI					24			
4673	M	PPI					16			
4673	M	PPI					203			
4673	M	PPI					23			
4674	M	PPI					252			
4674	M	PPI					257			
4674	M	PPI					281			
4674	M	PPI					259			

4675	M	PPI					20			
4676	M	PPI					171			
4676	M	PPI					221			
4676	M	PPI					201			
4677	M	PPI					SECTION E			
4690	M	PPI					SECTION C			
491	Q	SPPI	AUX	CPI	491	0731				
492	Q	SPPI	LM		492					
493	Q	SPPI	AUX	CPI	493	0732				
494	Q	SPPI	LM		494					
495	Q	SPPI	LM		495					
501	Q	SPPI	AUX	CPI	501	07341				
502	Q	SPPI	LM		502					
503	M	CPI				0734				
504	Q	PHI	LM							
511	M	SPPI			511					
512	M	SPPI			511					
521	Q	SPPI	AUX	CPI	521	073				
522	Q	SPPI	AUX	CPI	5224	073				
522	Q	SPPI	AUX	CPI	522	073				
531	Q	SPPI	AUX	CPI	531	0810				
532	Q	SPPI	AUX	CPI	532	0810				
551	Q	SPPI	AUX	CPI	551	11201				
552	Q	SPPI	AUX	CPI	552	11202				
553	Q	SPPI	AUX	CPI	553	11202				
559	Q	SPPI	AUX	CPI	559	11203				
561	M	CPI				11111				
561	M	CPI				111121				
561	M	CPI				111122				
561	M	CPI				111123				
561	M	CPI				1112				
562	M	CPI				11111				
562	M	CPI				111121				
562	M	CPI				111122				
562	M	CPI				111123				
562	M	CPI				1112				
563	M	CPI				11111				
563	M	CPI				111121				
563	M	CPI				111122				
563	M	CPI				111123				

563	M	CPI				1112				
581	Q	SPPI	AUX	CPI	58	0951				
581	Q	SPPI	AUX	CPI	58	0952				
581	Q	SPPI	AUX	CPI	58	0953				
582	Q	SPPI	AUX	CPI	58	09133				
591	Q	SPPI	LM		591					
592	Q	SPPI	AUX	CPI	592	0914				
601	Q	SPPI	AUX	CPI	601	09423				
602	Q	SPPI	AUX	CPI	602	09423				
611	Q	SPPI	AUX	CPI	611	08301				
612	Q	SPPI	AUX	CPI	612	08302				
613	Q	SPPI	AUX	CPI	613	08303				
619	Q	SPPI	AUX	CPI	619	08305				
620	Q	SPPI	AUX	CPI	62	09133				
631	Q	SPPI	AUX	CPI	631	0913				
639	Q	SPPI	LM		639					
681	Q	SPPI	AUX	IAS	681				68	68
682	Q	SPPI	AUX	CPI	682	04110				
683	Q	SPPI	AUX	IAS	683				68	68
691	Q	SPPI	AUX	CPI	691	127041				
692	Q	SPPI	LM		692					
702	Q	SPPI	AUX	IAS	702					70
711	Q	SPPI	AUX	IAS	711					71
712	Q	SPPI	AUX	IAS	711					71
731	Q	SPPI	AUX	CPI	731	127043				
732	Q	SPPI	AUX	CPI	732	127043				
741	Q	SPPI	AUX	IAS	711					74
742	M	CPI				09425				
743	M	IAS								74
749	M	IAS								74
771	Q	SPPI	AUX	CPI	771	07241				
772	Q	SPPI	AUX	CPI	772	0932				
773	Q	SPPI	AUX	IAS	773					77
774	Q	SPPI	AUX	IAS	774					77
781	Q	SPPI	AUX	IAS	78					78
782	Q	SPPI	AUX	IAS	78					78
783	Q	SPPI	AUX	IAS	78					78
791	Q	SPPI	AUX	CPI	79	0960				
791	Q	SPPI	AUX	CPI	79	11201				
799	Q	SPPI	AUX	CPI	79	0960				
799	Q	SPPI	AUX	CPI	79	11201				

801	Q	SPPI	AUX	IAS	80					80
802	Q	SPPI	AUX	IAS	80					80
803	Q	SPPI	AUX	IAS	80					80
811	Q	SPPI	AUX	CPI	812	04441				
812	Q	SPPI	AUX	CPI	812	04441				
813	Q	SPPI	AUX	CPI	812	04441				
821	Q	SPPI	AUX	IAS	821					82
822	Q	SPPI	AUX	IAS	822					82
823	Q	SPPI	AUX	IAS	823					82
829	Q	SPPI	AUX	IAS	829					82

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