Cross cutting topic

Production of a deflated index of turnover (ISP) in Croatia

**The 38th Voorburg Group Meeting on Services Statistics
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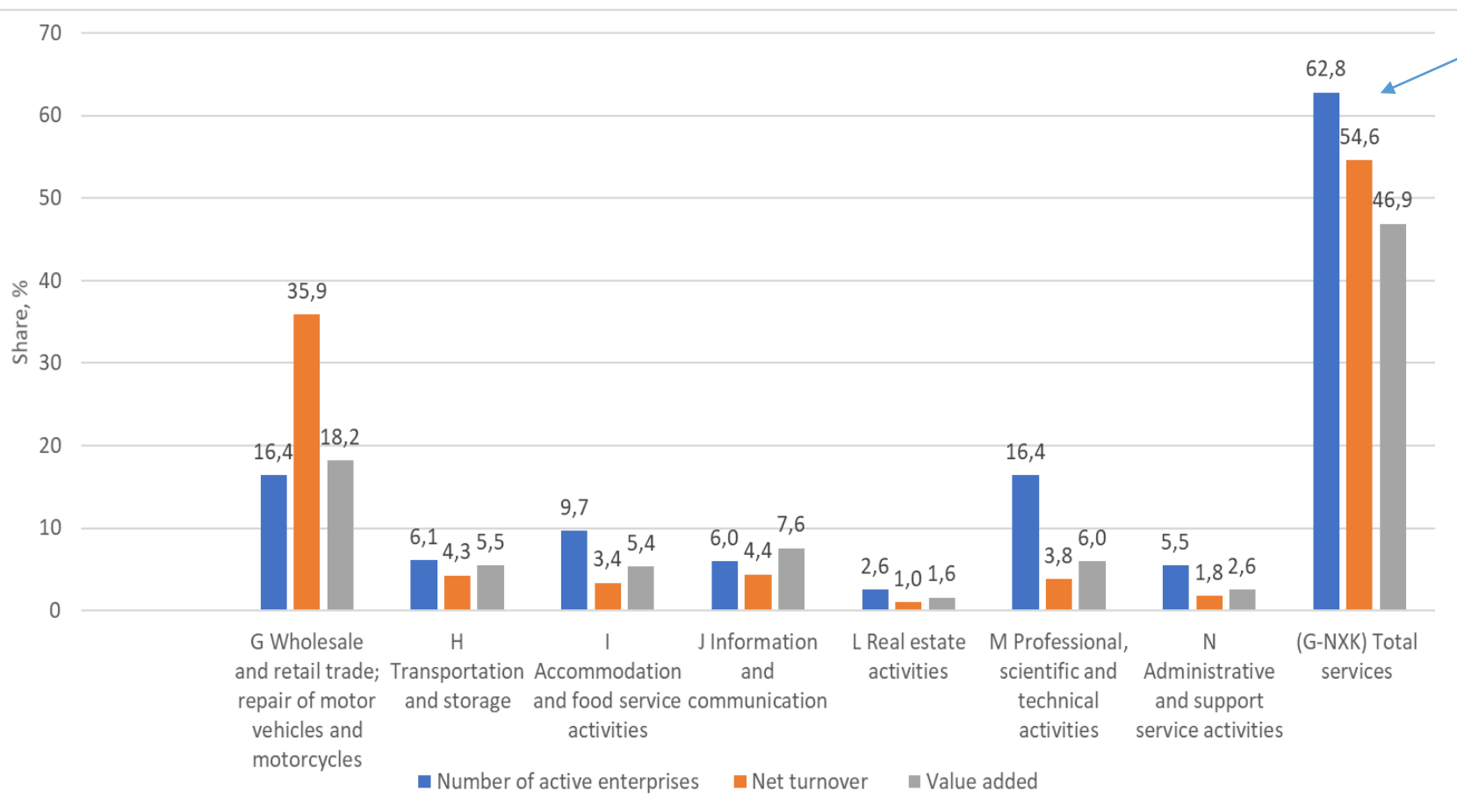
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General aspects

Share of the services sector in non-financial business economy by activity sections, 2021

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

Growing importance of services sector in non-financial business economy

- Need for volume meassure of services

- EU requirements – new EBS Regulation require production variable for services sector

- Purpose: to measure short-term changes of services production

- Could be combined with other STS volume indicators (industry, construction) to generate an overall production volume indicator – TMPI (Total Market Production Index)

General aspects, cont

- From 2016 to 2019 - Croatian ISP was gradually developed through EU grants; all available sources for deflators have been explored and whole statistical process have been defined

2016-2017

- **H Transportation and storage** (H 49, H 50, H 51, H 52, H 53)
- **I Accommodation and food services activities** (I 55, I 56)

2017-2018

- **G Wholesale and retail trade; repair of motor vehicles and motorcycle** (G 45, G 46)
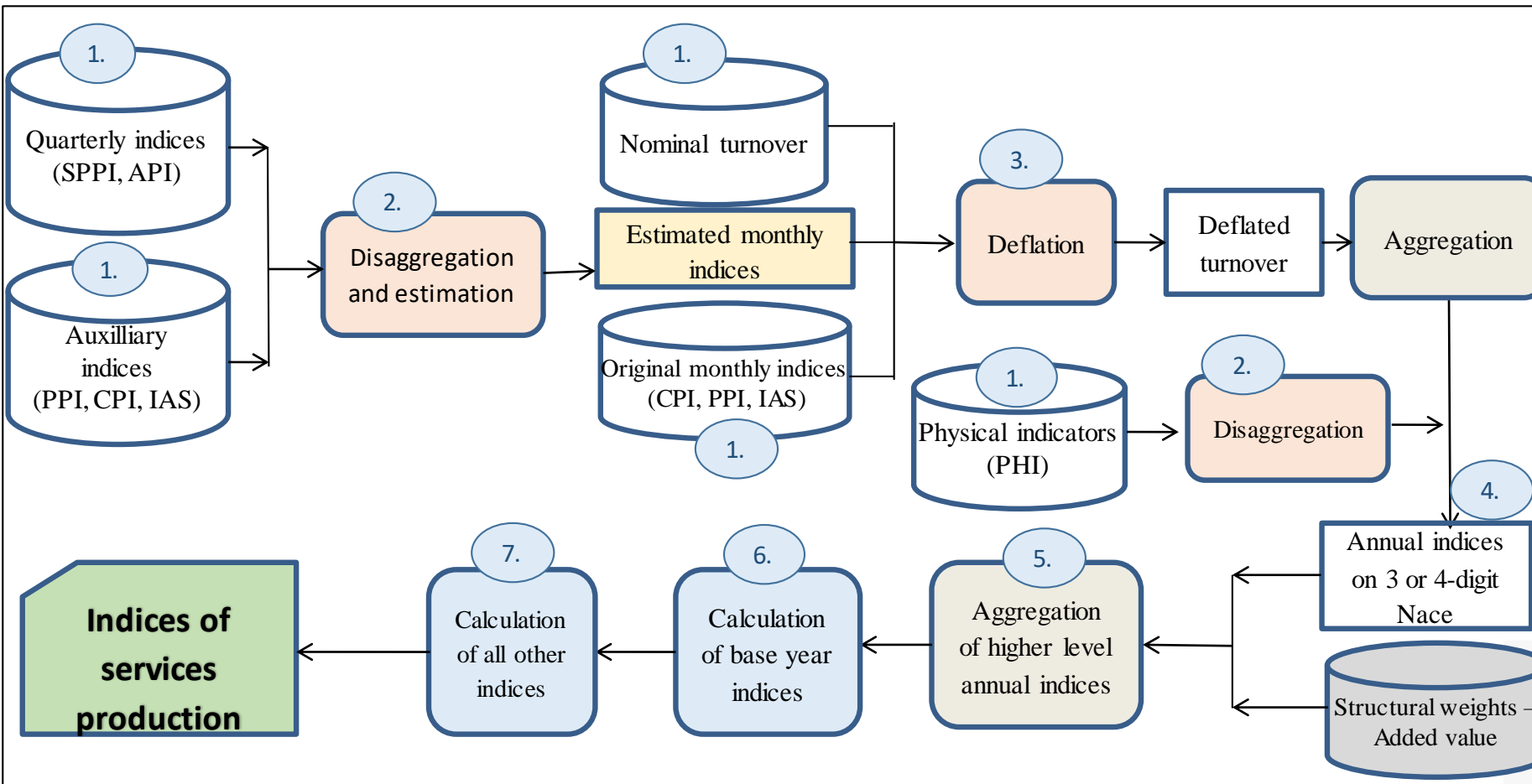
2018-2019

- **J Information and communication** (J 58, J 59, J 60, J 61, J 62, J 63)
- **L 68 Real estate activities**
- **M Professional, scientific and technical activities (**M 69, M 70, M 71, M 73, M 74)
- **N Administrative and support service activities** (N 77, N 78, N 79, N 80, N 81, N 82)

▪All activities are covered and CBS is completely in line with the new EBS Regulation for small countries
▪Since January 2019 data on ISP has been provided to Eurostat (monthly, T+60)
▪Since January 2023 - published nationally in STS Database

▪Periodicity: Monthly
▪Indices: Unadjusted, Calendar adjusted and Seasonally adjusted
▪First reference period: January 2010

Process of calculation

Abbreviations:
SPPI Service Producer Price Indices
PPI Producer Price Index
CPI Consumer Price Index
API Agriculture Price Index
IAS Index of average gross salaries
PHI Physical Indicators- transport of goods

1. Gathering of all the sources

2. Disaggregation and estimation of monthly indices for the groups for which the quarterly indices are determined as deflators

3. Deflation of the nominal turnover

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

5. Aggregation of higher level annual 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

➢ *Available sources*

- Nominal turnover from regular Monthly Survey on Services Activities combined with the data from administrative source (VAT)

- Deflators - Price indices with the fix base year, since January 2024 (2021=100)
  - SPPIs are the best defltors for ISP
  - For service activities where SPPIs are not available other sources are used as deflators:
    - Monthly Consumer Price Indices (CPI)
    - Monthly Industrial Producer Price Indices (PPI)
    - Quarterly Agriculture Price Indices (API)
    - Index of Average Gross Sallary (IAS) – monthly
    - PHI (phisical indicators) – quarterly (ton/km of reilway transport, ton/km of pipeline transport and ton/km in transport on inner waters)

- Table of chosen deflators by the Nace classes can be found in Appendix1. of paper Production of a deflated index of turnover in Croatia on Agenda & Documents - 38th Meeting of Voorburg Group on Service Statistics (voorburg-telaviv2023.co.il)

➤ Available sources, cont.

- Weights for all deflators
- Structural weights
  - The Added Value from the SBS data were used for the calculation of the structural weights
  - Annually update of weights (available t-2)
  - The basic level of weighting is 3 or 4-digit Nace level

Estimation and disaggregation method

1. **Quarterly indices are on disposal** - quarterly indices need to be disaggregated on three monthly indices. Two methods are used for dissagregation:	**Auxilary index method** • mostly CPI are used as auxilary source and disaggregation is made using the formula: $I_Q^i = I_Q * \frac{M_A^i}{\overline{M_A^Q}}$, where: I_Q^i $(i\epsilon\{1,2,3\})$ first, second and third month in quarter, M_A^i are suitable auxilary monthly indices and $\overline{M_A^Q}$ is average of three auxilary monthly indices inside the quarter • If there is more than one auxilary index for one SPPI in one service activity they should be reduced to one index value using formula $I = \frac{\sum_{i=1}^n w_i \cdot I_i}{\sum_{i=1}^n w_i}$
	Linear interpolation method • assumption of this method is that the monthly movement of prices inside one quarter is similar. It means there are three identical indices „month-on-previous-month" which are aggregated in quarterly index. • For constant monthly growth inside the quarter, growth "quarter-on-previous-quarter" is used. • Mathematical calculation of this indices with this method is shown with formulas: • $I_Q^1 = I_Q * \frac{3}{1 + I_{Q/Q-1} + (I_{Q/Q-1})^2}$ • $I_Q^2 = I_Q * \frac{3}{1 + I_{Q/Q-1} + (I_{Q/Q-1})^2} * I_{Q/Q-1}$ • $I_Q^3 = I_Q * \frac{3}{1 + I_{Q/Q-1} + (I_{Q/Q-1})^2} * (I_{Q/Q-1})^2$ Where I_Q^1, I_Q^2 and I_Q^3 monthly indices for first, second and third month in the quarter; I_Q is quarter index and $I_{Q/Q-1}$ is chain index „quarter-on-previous-quarter"

Estimation and disaggregation of monthly indices (cont.)

	Estimation and disaggregation method
2.Quarterly index is not yet available, forecasting is made:	If auxilary indices are not available, quarterly index (on base year) from the same quarter of previous year is used and is disaggregated with **linear interpolation method**
	If auxilary indices are available, estimates are obtained combining quarterly index from previous year (on the base year) and current auxilary index in **auxilary index method**
3. Derivation from monthly indices	In case when monthly indices are used as deflators (there is no quarterly indices) No need for disaggregation, monthly index is directly used as deflator In case when there is more than one monthly index they should be reduced to one index using the weights

➢ Deflation

- CBS uses deflation on micro level for the calculation of ISP

- In order to perform a deflation two main inputs are used:
  - **Nominal turnover on micro level** – data from regular monthly survey on services turnover are used (MTOS database).
  - **Set of deflators** – indices on the base year, mostly price indices (SPPI, CPI, API, PPI, HPI) but, if price indices not available, other indices are used (IAS, PHI). Some of indices are on quarterly basis and have to be disaggregated and some are on monthly basis.

- In separate document deflators table is saved as a list of deflators for appropriate activity level

➢ Deflation (cont.)

- 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 group of deflation decided in previous step every reporting unit gets appropriate deflator D_g^{Mm}. It is done by using the deflators table.
  - Deflated turnover T_{im}^D for unit *i* in month *m* is calculated using the formula:

$$T_{im}^D = T_{im}^N / D_{gm}^M * 100$$

➢ Index calculation

- First the index „month-on-the-same-month-of-previous-year" is calculated for elementary level – Nace 3 or 4 digit

- Most of the indices are calculated using the deflated turnover

- Formula used for calculation is: $I^{Nace3}_{M/M-12} = \dfrac{\sum_i T_i^M}{\sum_i T_i^{M-12}} \cdot 100$

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

- Only units for which turnover in both periods are available are taken into index calculation

➢ Index calculation (cont.)

- When physical indicators are used instead of price indices (for groups 49.2, 49.5 and 50.2), deflation is not performed, but these indices are used directly instead.

- Indices of phicisal production – quarterly indices on the base year
  - Disaggregated on monthly level using the linear interpolation method

➢ Index calculation (cont.)

- For aggregation at higher NACE 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

- Next step is calculation of „base index" (month-on-the-base-year)

$$I_{M/\emptyset 2015} = I_{M/M-12} \cdot I_{M-12/\emptyset 2015}/100 \quad \text{where}$$

$I_{M/\emptyset 2015}$ is base index for a current month (M)

$I_{M-12/\emptyset 2015}$ is base index for a same month of the previous year (M-12)

$I_{M/M-12}$ is a yearly index for a current month

- Base year indices - further used for seasonal and working-day adjustments

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

- 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).

- Seasonally adjusted time series are revised every month (all values backwards) due to revision of original series

- Direct Seasonal adjustment approach is used

- For the length of seasonal filters, automatic procedure is used in ARIMA X13

- National calendar of holidays for Croatia is used in X13ARIMA method

- Type of outliers detected: Level shifts (LS), Additive outliers (AO) and Transitory changes (TC) are tested

- Most common are LS's and AO's

- 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

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

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

- Future plans :
  - automatization of deflators updating
  - improving data quality
  - further good cooperation with the National Account

Thank you!

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