KÖZPONTI STATISZTIKAI HIVATAL

MÓDSZERTAN
AZ ALAPOKTÓL KEZDVE

Special Outlier Treatment Technique in Seasonal Adjustment for Handling the Effect of COVID-19

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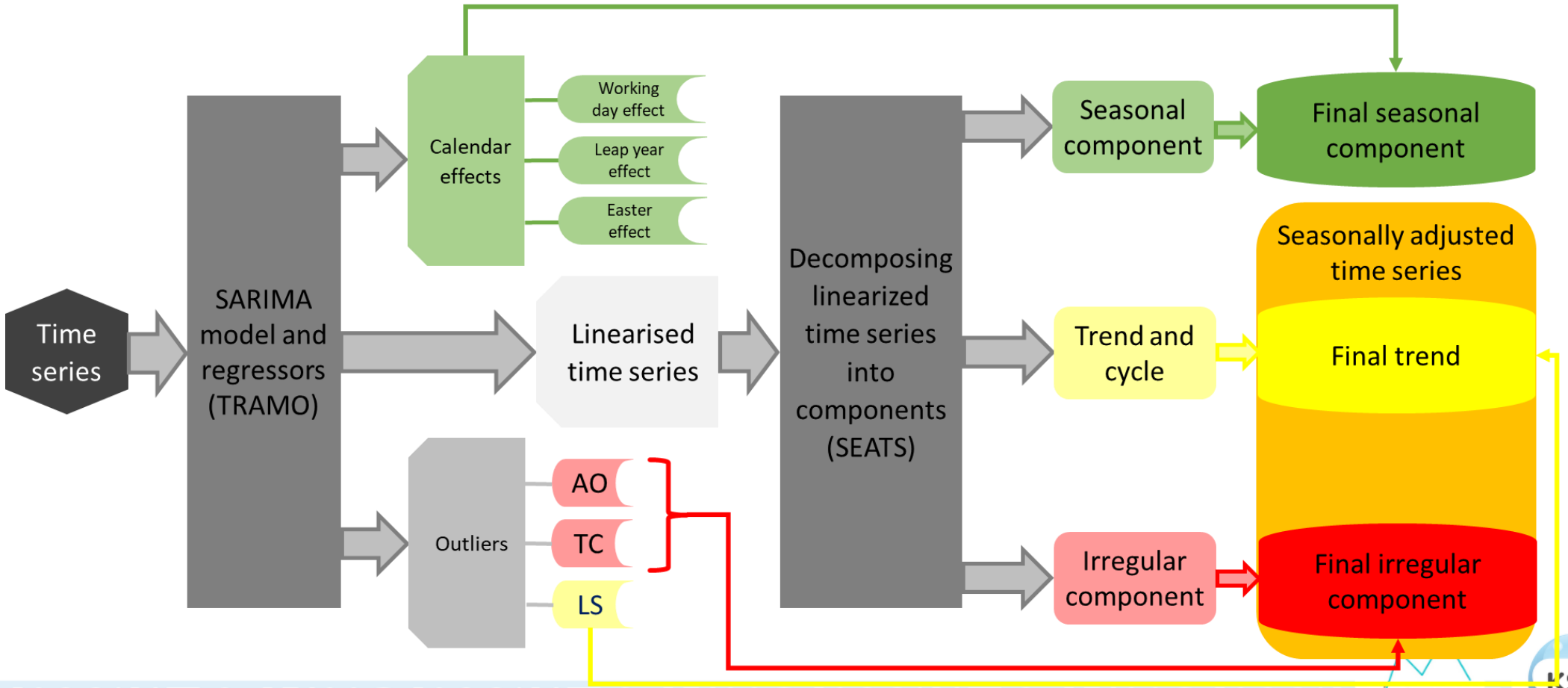
HCSO

Introduction

- We are from the Methodology Department from the Hungarian Central Statistical Office.
- In HCSO seasonal adjustment is partly centralised process.
  - Mathematical statistical modelling is our responsibility
  - Colleagues from Subject Matter Department have special expert knowledge of their own time series
- Around 1000 time series are seasonally adjusted with TRAMO-SEATS method, in JDemeta+ 2.2.0.
- Full model revision is made yearly and partial concurrent (last outliers) data refresh strategy is used during the year.

Method of seasonal adjusment



Effect of COVID-19 in Hungary

- During the first pandemic wave there was a very strong lockdown in Hungary from the middle of March until around July 2020.
- The second wave was less strict, started at the end of 2020.
- The third wave started in February 2021 and officially ended on 1st of July 2021. The lockdown was limited because of the vaccination.
- **The first three waves had both a short and a long term effect on our time series. (Not only in the irregular but also in the trend component.)**
- The fourth wave started at the end of 2021 without any strong effect on our data.

Outliers used under normal circumstances

Additive outlier (AO): when the effect influences the value of only one observation.

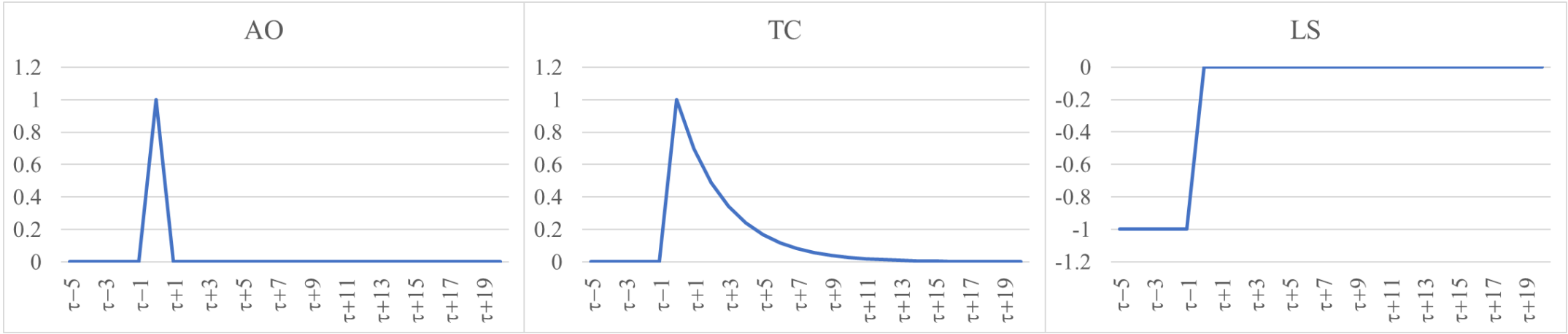
Temporary change (TC): starts with one extremely high or low value, later on the deviation gradually decreases and at last the process returns to the initial level.

Level shift (LS): from a given point in time, further values of the time series are shifted by the same value permanently changing the level of the time series.

$$x_t = \begin{cases} 1 & if \quad t = \tau \\ 0 & otherwise \end{cases}$$

$$x_t = \begin{cases} 0.7^{t-\tau} & if\ \tau \le t \\ 0 & otherwise \end{cases}$$

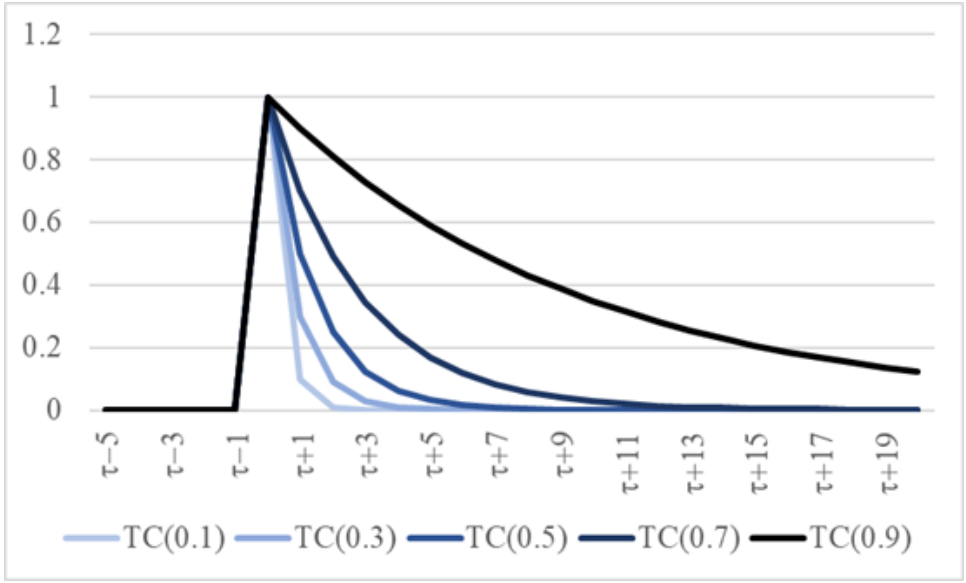
$$x_t = \begin{cases} -1 & if \quad t < \tau \\ 0 & otherwise \end{cases}$$



Our solution

- It was found that transitory change (TC) with a small modification is often a good solution: In JDemetra+ the δ is 0.7, but theoretically, δ can be anything between 0 and 1 (noted by $\mathrm{TC}(\delta)$).
- The smaller the δ parameter, the faster the process returns to its initial level.

$$x_t = \begin{cases} \delta^{t-\tau} & \text{if } \tau \leq t, \\ 0 & \text{otherwise} \end{cases}$$



TC(δ) in practice

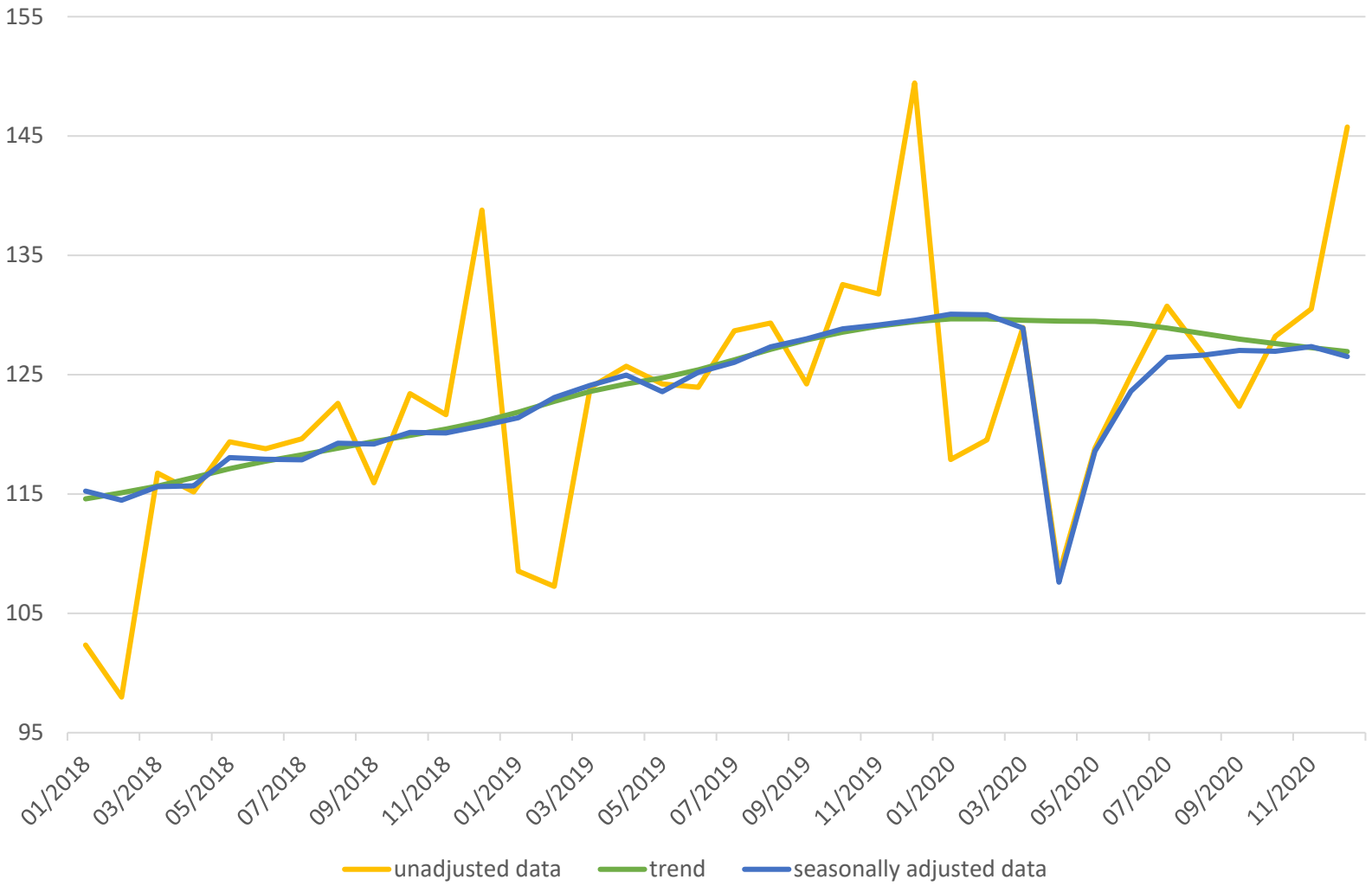
$$Y_t = T_t + S_t + I_t$$

$$TC(\delta)$$

We have not found an exact method to calculate the δ parameter.
We define regressors in Excel with $\delta \in \{0.1, 0.2, \dots, 0.9\}$ and $\tau \in \{03.2020, 04.2020, \dots\}$, import them to JDemetra+ as user define variables, and put them always to the irregular component.
We use additive outliers for 3-4 months then try to find a proper $TC(\delta)$ outlier.
We try to find a δ, where

- the decreasing rate of $TC(\delta)$ is similar to the decreasing scale of the AO values,
- the automatic outlier detection does not find outliers soon after τ,
- the figures of the time series seem to be good,
- the test statistics of the seasonal adjustment are good.

Volume index of retail sales



Multiplicative model

Working day effect

Leap year

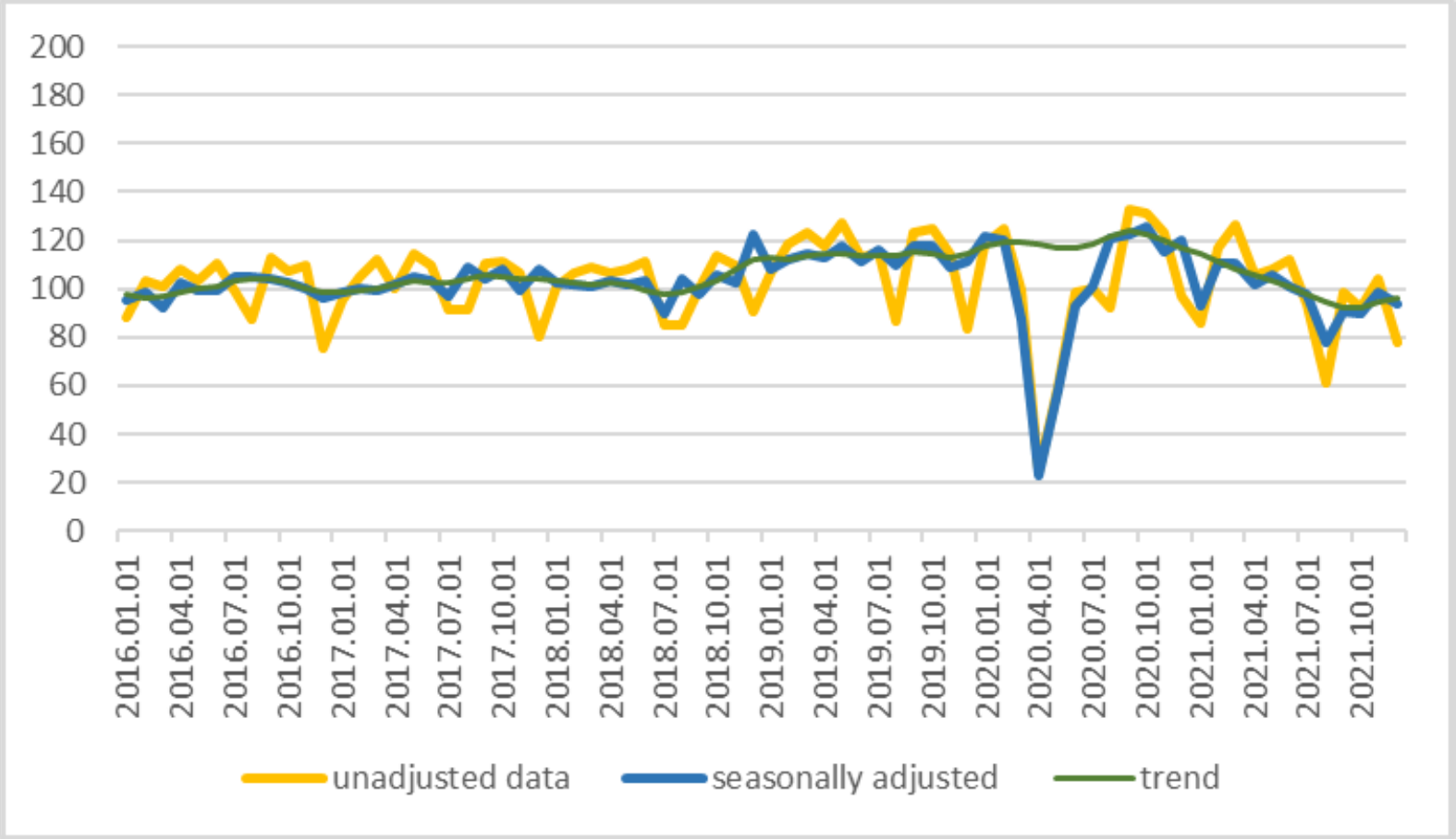
Easter effect

Rank: (0,1,1)(0,1,1)

Outliers

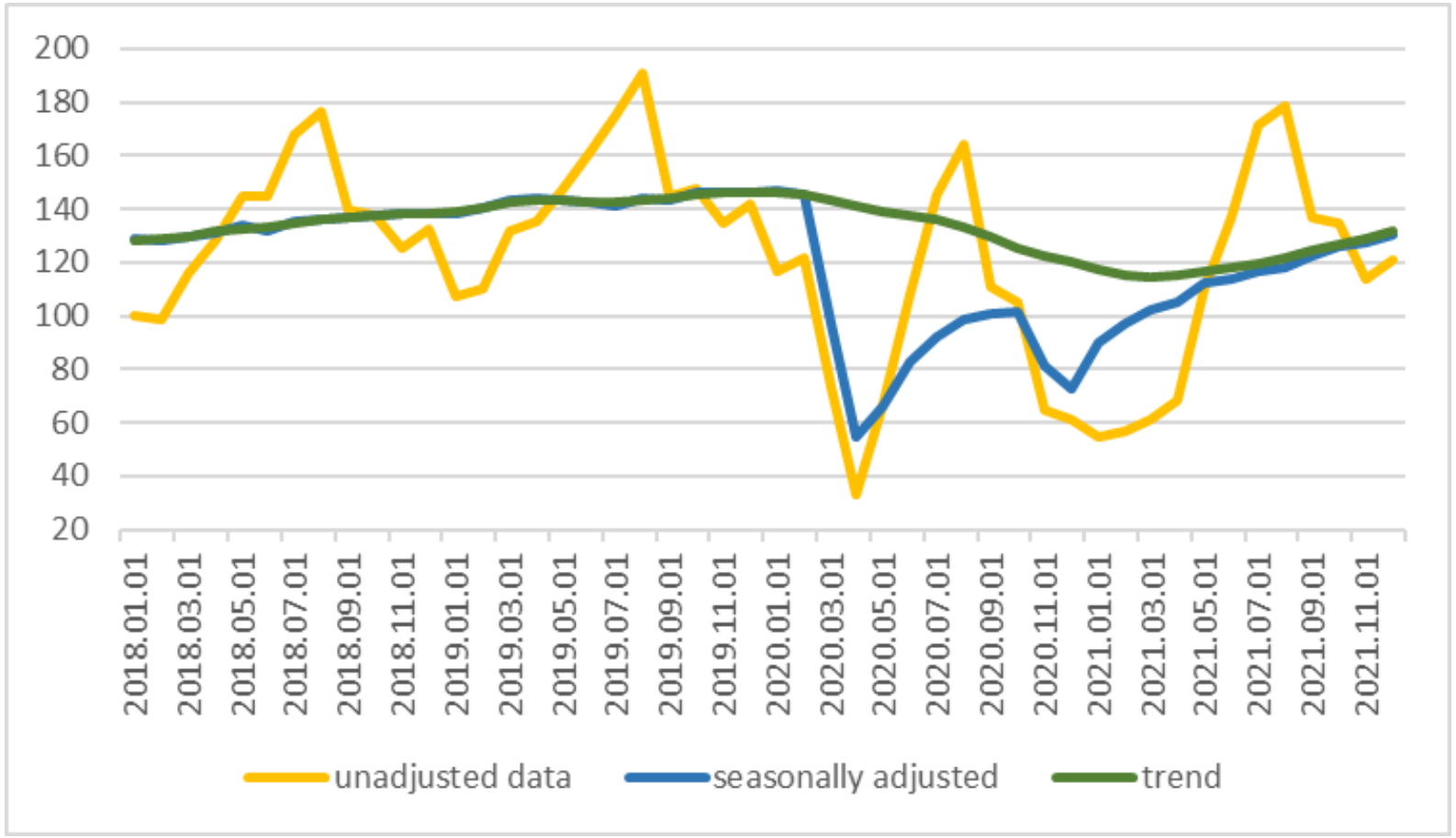
TC(4-2020) $\delta = 0.5$

Manufacture of transport equipment



Outliers
AO(3-2020)
TC(4-2020) $\delta = 0.4$
AO(01-2021)
AO(08-2021)

Public catering



Outliers
AO(3-2020)
TC(4-2020) $\delta = 0.8$
AO(11-2020)
TC(12-2020) $\delta = 0.5$

Conclusion and further research

- TC with modified TC-rate can be a good solution to handle the effect of COVID-19, it may be good for other situations too.
- Mostly it helped us to find a proper trend component, however, the effect of TC is a part of irregular component.
- There is still no exact method to estimate this parameter, further developments are needed in this direction.

Speed Talk Session 3 | Q2022 (stat.gov.lt)