

# Seasonal Adjustment of Quarterly National Accounts at Statistic Sweden

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Anders Jäder



# Which series are seasonally adjusted?

- Production side:
  - 24 series on different aggregation levels
  - E.g. value added in construction or wholesale and retail trade.
- Expenditure side:
  - 14 series on different aggregation levels
  - E.g. import of goods, household consumption
- Hours worked:
  - 22 series on different aggregation levels
  - E.g. hours worked in construction or wholesale and retail trade.
- The above are the series published. More series are adjusted but not published. E.g. sent to EU.



# Examples of seasonal effects

- Ice-cream consumption (high in summer, i.e. in the third quarter)
- Total consumption (High before Christmas, i.e. forth quarter)
- Changes in inventories in retail trade (negative in forth quarter)
- Production (low in summer due to vacations)



# Why we seasonally adjust

- We want to remove the variation in the series that is caused by the changes of season. We want to measure changes in the economic activity.
- We can measure the change since the same quarter the previous year, but:
  - That measures what has happened during the last year, not since the last quarter which is more interesting.
  - That presumes that the seasonal component is constant over time.
- Seasonal adjustment removes the seasonal component so that successive quarters can be compared. But:
  - Estimation of seasonal components is difficult. Gives less reliable estimates.



# Why we seasonally adjust

- From our latest press-release:
  - “Sweden's GDP increased by 4.6 percent in the second quarter, working-day adjusted and compared to the second quarter of 2009. Seasonally adjusted GDP increased by 1.9 percent compared with the first quarter of 2010.”
- We stress the evolution since the same quarter the previous year because of the uncertainties of seasonal adjustment.
- BEA in the United States uses almost only seasonally adjusted figures. From their press release:
  - “Real gross domestic product [...] increased at an annual rate of 1.7 percent in the second quarter of 2010, (that is, from the first quarter to the second quarter)”
- BEA's annual rate  $\approx 4 \times$  Statistic Sweden's seasonally adjusted rate.



# Working day adjustment

- Since we want to measure the economic activity we don't want differences in the number of working days between quarters to influence the estimates.
- Working day factors are included in the regression part of the seasonal adjustment model.
  - $\text{Factor} = \ln(\text{number of working days in average quarter} / \text{number of working days quarter } q)$
- One working day extra in a quarter implies about 1,5% extra working time (5-day working week). The effect of this on e.g. production or number of hours worked is estimated in the seasonal adjustment. (1% extra working days  $\rightarrow$  approx 0,3% extra GDP)



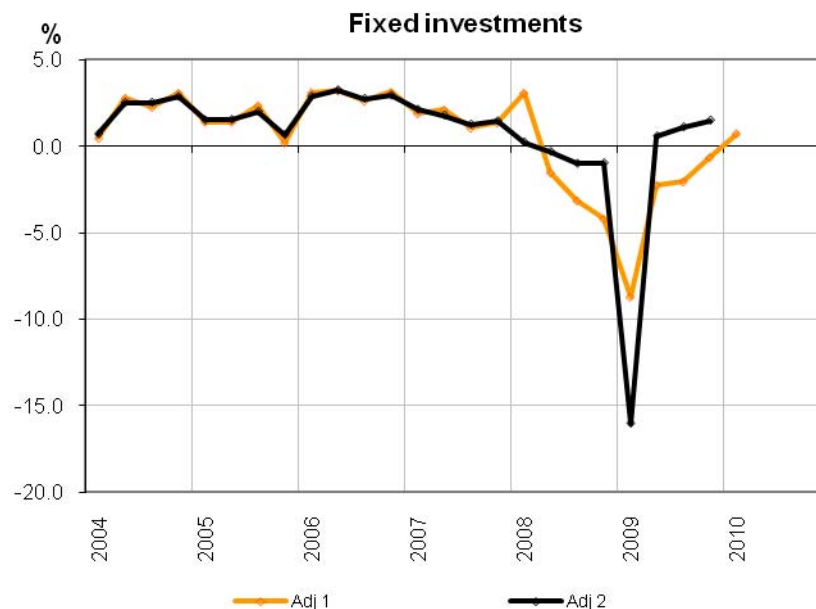
# Working day adjustment

- When comparing to the same quarter the previous year working day adjusted series are used for production side and number of hours worked. Non-working day adjusted series is used for expenditure side. (e.g. consumption and investment is judged independent on the number of working days)
- Seasonally adjusted figures are both seasonally- and working day adjusted.
- Earlier we assumed different working weeks in different industries (5-days, 6-days, continuous production). Led to aggregation problems.
- For the seasonally adjusted series we now use 5-day working week for all series (also on expenditure side).



# Outlier

- Tramo/Seats tests for outliers in the series. A fixed critical value of 3,5 is used for outlier detection. This can lead to big changes in the estimates when a test statistic is over the critical value in one adjustment and below in the next adjustment:





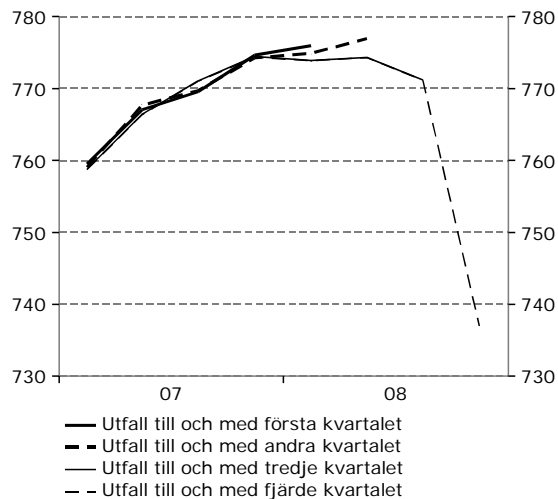
# Outlier

- Forth quarter 2008: Financial crises!
- GDP fell 4,9% compared to Q4 2007.
- Tramo/Seats classified GDP of Q4 2008 as an outlier. Never happened before. The seasonally adjusted estimate was -5%. (If as published by BEA -20%!)
- Not much time to decide what to do but we decided to increase the critical value for outlier detection → Published value -2,4%.
- Experts consulted after publication (e.g. Maravall) didn't say this was wrong.
- Users did not like the revisions to previous periods

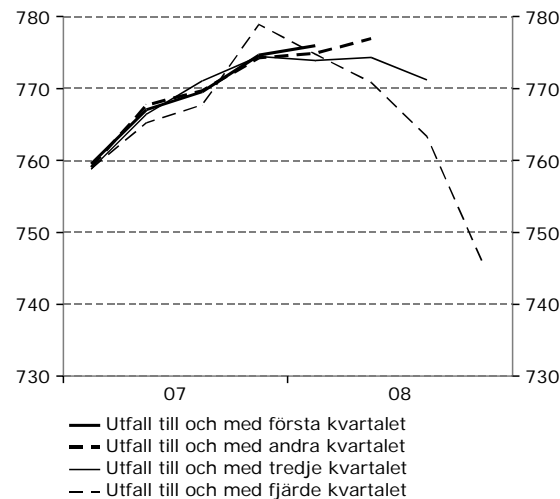


# Outlier

## Original critical value



## Changed critical value



- We changed back to original critical value in next publication.
- Outliers discussed intensively at Eurostat. Many countries have introduced outliers in GDP (e.g. Finland)

# “Sum consistency”

- Before: Each series was adjusted with best possible model for that series and with the most suitable working day adjustment for each series. The adjustment for each series was probably good but inconsistencies between series was common.
- We want e.g. the following to be true also for the adjusted series:
  - $GDP = Consumption + Investments + Inventories + Export - Import$
  - $Total\ export = export\ of\ goods + Export\ of\ services$

# “Sum consistency”

- Possible reasons for inconsistencies:
  - Different ARIMA models chosen for different subseries
  - Differences in working day adjustments over series
  - Differences in outlier detection
  - The non-adjusted series is not sum consistent due to chain-linking.
  - **Main reason: Seasonal adjustment is a non-linear one variable operation.**
- Some have suggested using multivariate seasonal adjustment and state space models. Doctor David Findley, one of the developers of X12-ARIMA:  
“It is incredibly naïve to believe that that will work in practice”.



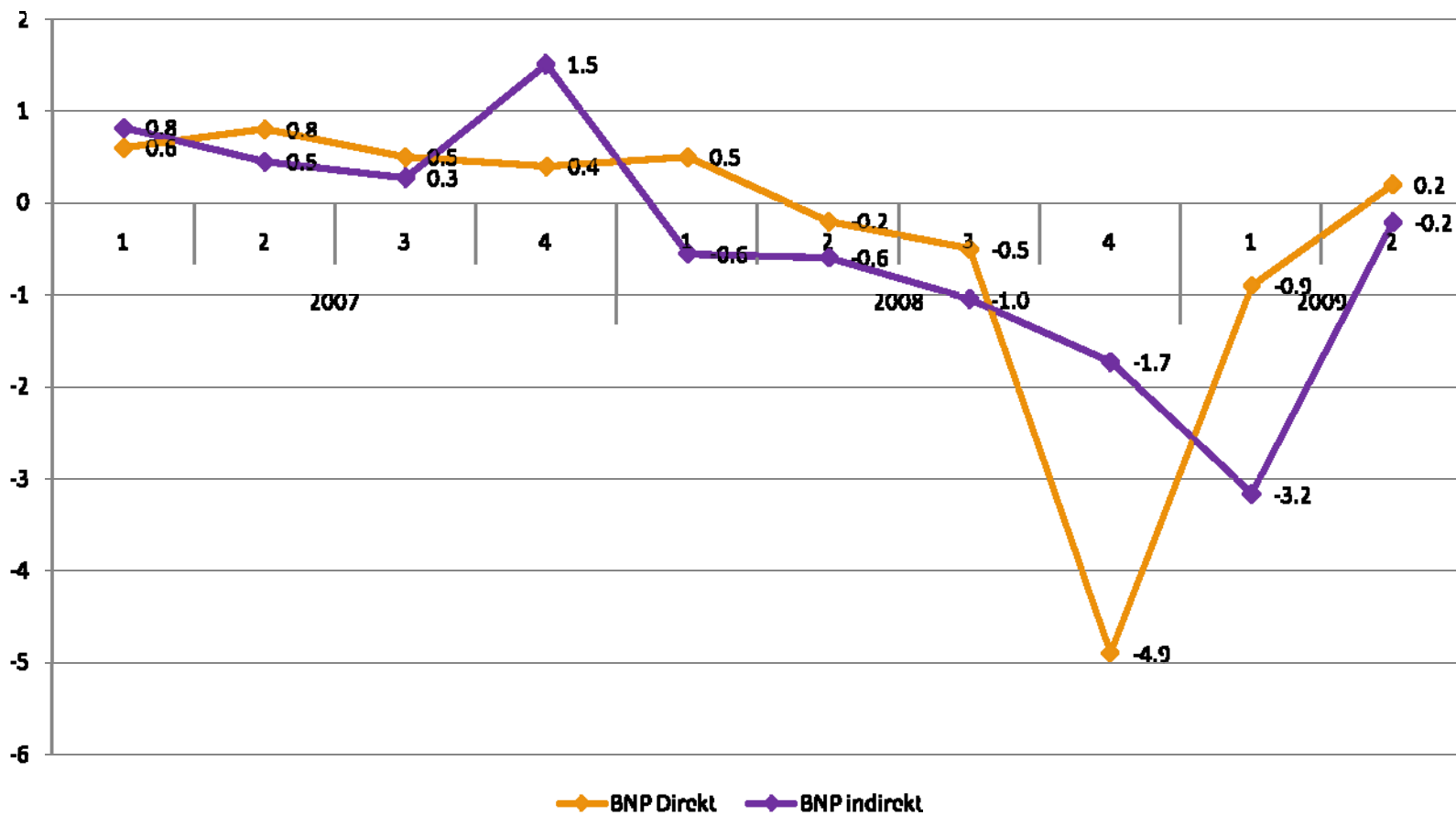
# “Sum consistency”

- Possible solution to inconsistencies: Use indirect adjustment, i.e. adjust all series on a detailed level and sum the adjusted series to higher aggregates.
  - Not favored by users.



# GDP directly and indirectly adjusted

Statistiska centralbyrån Statistics Sweden



# “Sum consistency”

- Our solution in recent project:
  - I. Seasonally adjust GDP directly
  - II. Seasonally adjust the subseries directly.
  - III. Adjust the subseries so that their sum is equal to GDP.
- The discrepancy between GDP and the subseries is distributed on the subseries in relation to the size of the subseries (in million SEK) and in relation to the uncertainty in the seasonal adjustment of the series (measured as the variance of the irregular component).
- Tests have shown that this method minimizes the negative effects on the directly adjusted series

