Economic and Finance statistics

Quarterly National Accounts

Walther Adler, Destatis

EUROPEAN MASTER IN OFFICIAL STATISTICS
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Overview

1. Scope and sources of Quarterly National Accounting (QNA)
   - 1.1 QNA – reasons and features
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2. Specific QNA compilation techniques
   - 2.1 Benchmarking to annual data
   - 2.2 Quarterly chain-linking
   - 2.3 Seasonal and calendar adjustment
3. Eurostat QNA related activities
   - 3.1 QNA transmissions and validation
   - 3.2 Further reading

1.1 QNA – reasons and features

Why NA at quarterly frequency?

- **Year** is the evident accounting period (annual national accounts; ANA), but
- **Quarter** (or even month) can be used for more up-to-date accounting:
- Quarterly accounts form a quick and compact picture for the economic development in the new quarters for economic analysis and decision-making.
- QNA are in principle a higher frequency version of ANA, i.e. they
  - use the same classifications and definitions and
  - follow the same accounting rules – *but*
  - the applicable data basis at the recent end of a series is often less complete.

1.1 QNA – reasons and features

What are the main features of QNA?

- **Timeliness** is more important for QNA than for ANA.
- The **time series** perspective dominates in QNA over the structural perspective in ANA.
- **Seasonally adjusted** data are more important than original series.
- Volume **growth rates** are more important in QNA than levels.
- QNA are **benchmarked** to ANA, i.e. consistent with more comprehensive information in past periods.

1.2 Source data aspects

Specific QNA compilation aspects

- Many source statistics are **annual**, i.e. available only well after Q4 (e.g. business surveys t +15 months; SUT t + 36 months).
- Indicators of economic activity used instead are frequently based on statistics with smaller sample sizes and/or reduced coverage (**STS** vs. SBS)
- Many monthly/quarterly source statistics do not follow **ESA concepts**.
- Production cycles **longer than the reference period**:
  - Typical for production e.g. in construction, shipbuilding, plant engineering, agriculture
  - Along the lines of work-in-progress delineation in ANA: split into periods
- **Low frequency** (e.g. once a year) payments for permanent activities:
  - Payments valid for several quarters must be allocated to the accrual periods
  - Only purely ad-hoc payments are to be recorded in the pay-off period

1.2 Source data aspects

Overview on main data sources (t+2 months)

- Output approach (O): (ESA TP table T0101)
  - Good quarterly sources for many NACE branches (→ STS), …
  - but not necessarily for all (e.g. some services).
- Expenditure approach (E):
  - Good sources for C, G, X-M (goods), …
  - but issues in GFCF (I') and especially in inventories.
  - Sometimes output indicators have to be used for expenditure items (C).
- Income approach (I):
  - Good sources for wages, taxes (possibly only late in the quarter), …
  - but difficult for operating surplus (= often determined as a residual).

1.2 Source data aspects

Main data sources (2)

- Most reliable approach depends on sources:
  EU + EFTA: generally Output and Expenditure (IE, IS: Income and Expend.)
- Closely related data:
  - BOP → GNI and saving for the total economy
  - General government Quarterly Account → Quarterly Accounts by Institutional Sector
- Further details on sources and methods:
  - QNA inventories: https://ec.europa.eu/eurostat/web/national-accounts/methodology/member-states-accounts/qna-inventories
  - Eurostat-OECD employment questionnaires: https://ec.europa.eu/eurostat/web/national-accounts/methodology/member-states-accounts/employment-questionnaires

2 Specific QNA compilation techniques

Determination of the current end of a series

- QNA rely on more limited data sources in general than ANA
  → need for more statistical and econometric techniques

- Direct approach:
  - Similar data sources as in ANA are available quarterly (or even monthly)
  - Hence, similar compilation techniques are applicable
  - Nevertheless, lacking data e.g. for the last month of a quarter have to be modeled

- Indirect approach:
  - Statistical and econometric estimations based on ANA and short-term indicators
  - Extrapolation of present time series with approximated change rates
  - Alongside “clean” mathematics, assessments of skilled NA specialists play a major role

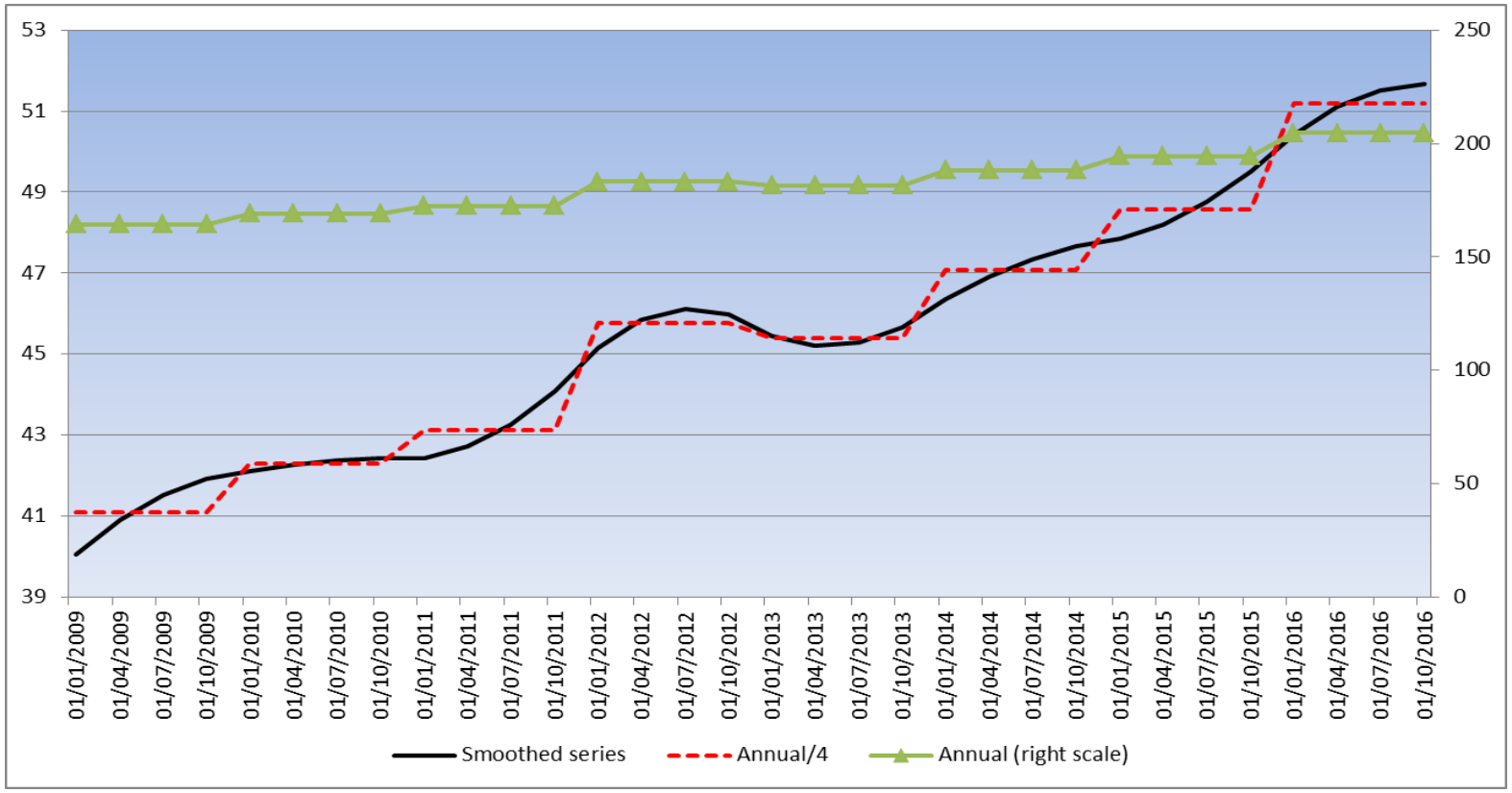
2.1 Benchmarking to annual data

Aim and statistical methods

- Prerequisite: construct of quarterly time series from existing annual data!
- What do we want to achieve?
  - QNA estimates shall follow the behaviour of the indicator
  - Temporarily consistency with ANA
- Main methods / steps:
  - **Smoothing** annual data (without additional information, e.g. an indicator)
  - Numerical methods: **Denton** method (Benchmarking)
  - Statistical models (e.g. **Chow-Lin** temporal disaggregation method)
  - **Regression** between the annual variable and an annualised indicator

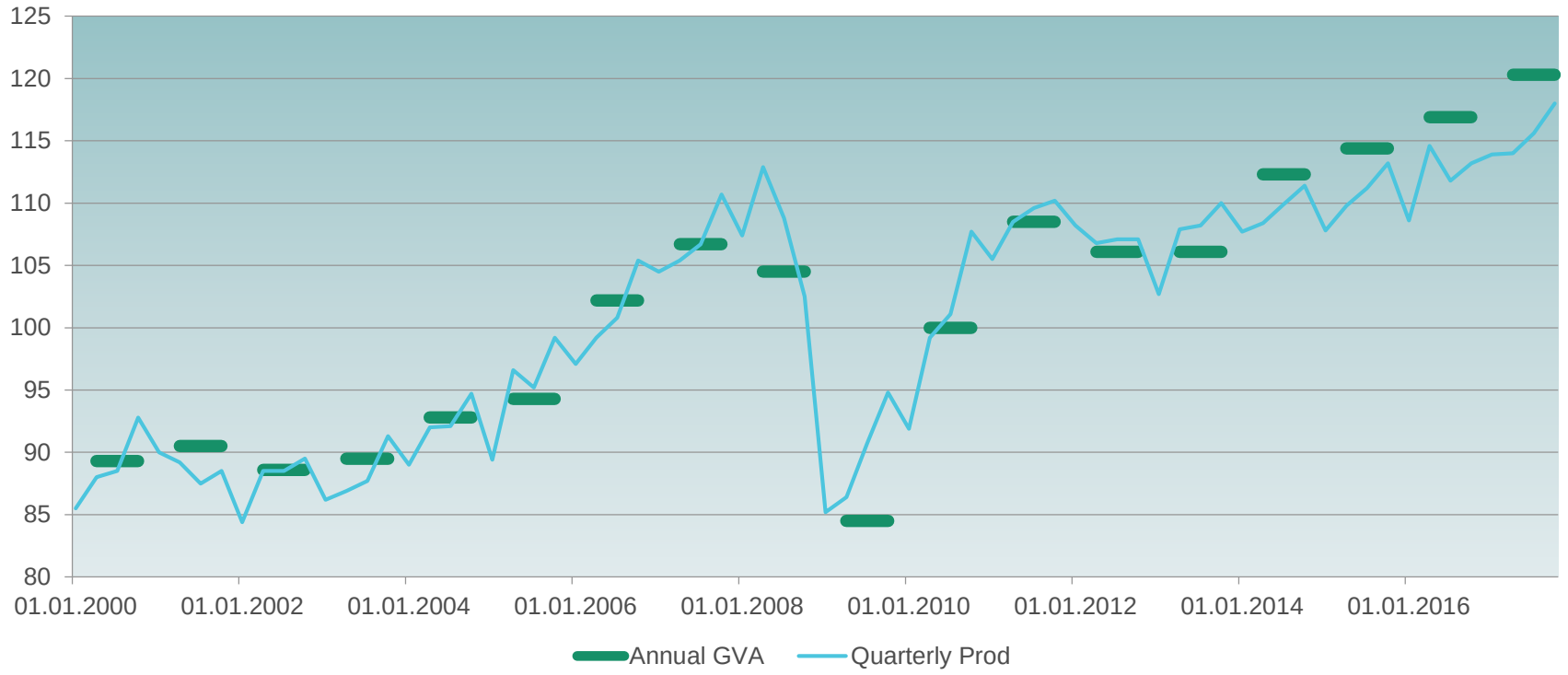
2.1 Benchmarking to annual data

Smoothing - Boot, Feibes and Lisman (1967)



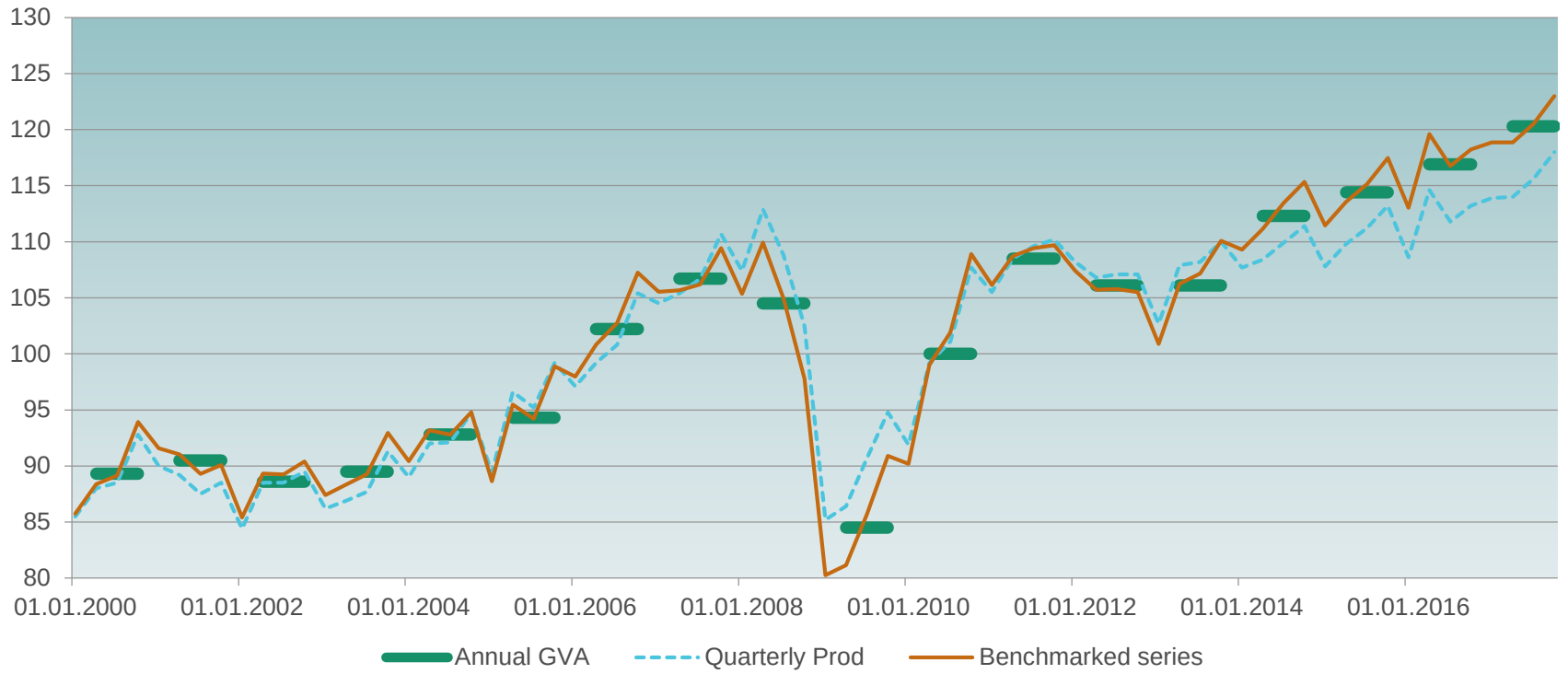
2.1 Benchmarking to annual data

Quarterly indicators as a benchmark



2.1 Benchmarking to annual data

Result of the Denton method



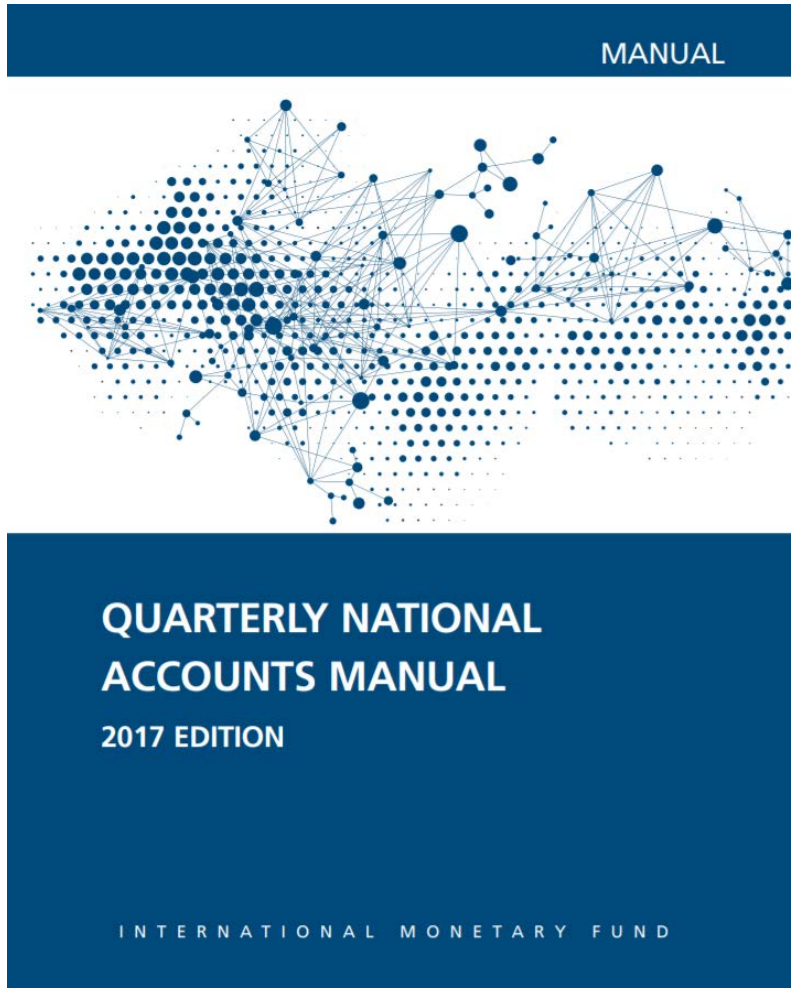
2.2 Quarterly chain-linking

Requirements and methods

- The **Annual Overlap method** (AO) is the common practice in EU countries (with few exceptions)
  - Pro: easiest computation, consistency with annual chain-linked volume data
  - Con: Break between the chain-linked data of Q4 and Q1
- The **One quarter overlap method** is also possible
  - Pros: smoothest transition between quarters, standard method of price statistics
  - Con: quarterly data don’t aggregate exactly to the corresponding direct annual index
- **The Over the year overlap method** is not recommended
  - Con: strong changes in relative quantities and prices may result in distorted seasonal patterns in the linked series

2.2 Quarterly chain-linking

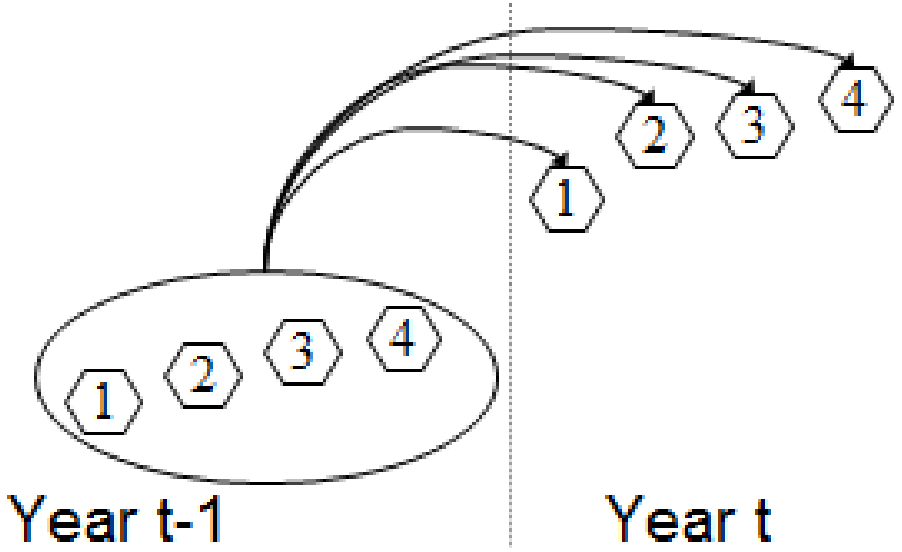
The Annual Overlap method (AO); step by step



- IMF Statistics Departement: Quarterly National Accounts Manual – 2017 edition, Washington (DC) 2018.
- Chapter 8, p. 185-187
- https://www.imf.org/external/pubs/ft/qna/

2.2 Quarterly chain-linking

The Annual Overlap method (AO); principle



- The AO implies compiling estimates for each quarter at the weighted annual average prices of the previous year.
- The annual data at previous year's prices provide the linking factors to scale the quarterly data upward or downward.
- The AO requires quarterly volume measures at previous year's prices and annual current price data.

2.2 Quarterly chain-linking

The Annual Overlap method (AO); step 1

- Calculate quarterly volume indices from the previous year:

$$q^{y-1\rightarrow(s,y)} = \frac{k^{y-1\rightarrow(s,y)}}{C^{y-1}/4} \text{ for } y = 2,3,\ldots$$

and $s = 1,\ldots,4,$

where

$k^{y-1\rightarrow(s,y)}$ is the volume measure in quarter s of year y at the prices of the previous year and C^{y-1} is the current price data for year $y-1$.

2.2 Quarterly chain-linking

The Annual Overlap method (AO); step 2

- Link the quarterly volume indices using annual overlaps:

$$q^{1\to(s,y)} = Q^{1\to 2}\cdot Q^{2\to 3}\cdot\ldots\cdot Q^{t-1\to t}$$
$$\cdot\ldots\cdot Q^{y-2\to y-1}\cdot q^{y-1\to(s,y)}\cdot 100\,,$$

where

$$Q^{t-1\to t} = \frac{K^{t-1\to t}}{C^{t-1}}$$

are the annual links (i.e., the annual growth rates), with

$K^{t-1\to t}$ being the volume measure of year t at the prices of year $t-1$ and

C^{y-1} is the current price data for year $y-1$.

2.2 Quarterly chain-linking

The Annual Overlap method (AO); step 3

- Re-reference the quarterly chain series to a chosen year instead year 1:

$$q^{r\to(s,y)} = \frac{q^{1\to(s,y)}}{Q^{1\to r}} \cdot 100 \text{ for } y = 2,3,\ldots,$$

$$s = 1,\ldots,4, \text{ and } 1 \le r \le y,$$

where

$Q^{1\to r} = Q^{1\to 2} \cdot Q^{2\to 3} \cdot \ldots \cdot Q^{r-1\to r}$ is the annual chain index for year r.

The chain indices $q^{r\to(s,y)}$ can be expressed in monetary terms by multiplying the entire series by the (rescaled) annual current price data of the reference year.

2.2 Quarterly chain-linking

The Annual Overlap method (AO); numerical example

Year/ Quarter	Current Prices			Previous Year's Prices			Volume Measures (Previous Year = 100)			Chain-Indices with Annual Overlap (2010 =100)			Chain Volume Measures with Annual Overlap in Monetary Terms			
	(1)			(2)			Step 1			Step 2			Step 3			
	A	B	Sum	A	B	Sum	A	B	Sum	A	B	Sum	A	B	Sum	Discrepancies
2010	600.0	900.0	1,500.0							100.00	100.00	100.00	600.0	900.0	1,500.0	*0.0*
2011	660.0	854.9	1,514.9	643.1	867.9	1,511.0	107.18	96.43	100.73	107.18	96.43	100.73	643.1	867.9	1,511.0	*0.0*
2012	759.0	769.5	1,528.5	746.2	782.5	1,528.7	113.05	91.53	100.91	121.17	88.27	101.65	727.0	794.4	1,524.7	*–3.3*
2013	948.8	615.6	1,564.4	955.1	609.0	1,564.1	125.83	79.14	102.33	152.47	69.86	104.01	914.8	628.7	1,560.2	*–16.6*
q1 2011	159.7	218.9	378.6	156.6	221.1	377.7	104.38	98.27	100.71	104.38	98.27	100.71	156.6	221.1	377.7	*0.0*
q2 2011	163.2	213.7	376.9	159.2	218.1	377.3	106.15	96.92	100.61	106.15	96.92	100.61	159.2	218.1	377.3	*0.0*
q3 2011	167.4	210.6	378.0	162.5	214.9	377.4	108.35	95.51	100.65	108.35	95.51	100.65	162.5	214.9	377.4	*0.0*
q4 2011	169.7	211.7	381.4	164.8	213.8	378.6	109.84	95.04	100.96	109.84	95.04	100.96	164.8	213.8	378.6	*0.0*
q1 2012	174.2	204.1	378.3	170.0	210.4	380.4	103.00	98.45	100.43	110.39	94.94	101.17	165.6	213.6	379.4	*–0.2*
q2 2012	180.4	201.4	381.8	176.9	203.4	380.3	107.19	95.19	100.42	114.88	91.79	101.15	172.3	206.5	379.3	*–0.5*
q3 2012	188.9	192.3	381.2	187.0	195.2	382.3	113.35	91.35	100.93	121.49	88.09	101.67	182.2	198.2	381.3	*–0.8*
q4 2012	215.5	171.7	387.2	212.3	173.4	385.7	128.68	81.15	101.85	137.91	78.25	102.60	206.9	176.1	384.8	*–1.8*
q1 2013	224.7	166.0	390.7	223.6	166.0	389.6	117.83	86.29	101.95	142.77	76.17	103.63	214.2	171.4	388.6	*–3.1*
q2 2013	235.8	156.3	392.1	237.0	154.8	391.7	124.89	80.44	102.52	151.33	71.01	104.20	227.0	159.8	390.8	*–4.0*
q3 2013	242.9	148.5	391.4	245.4	146.3	391.7	129.30	76.05	102.49	156.68	67.13	104.18	235.0	151.0	390.7	*–4.6*
q4 2013	245.4	144.8	390.2	249.1	142.0	391.1	131.30	73.79	102.35	159.09	65.14	104.03	238.6	146.6	390.1	*–4.9*
Sum of Quarterly Values																
2011	660.0	854.9	1,514.9	643.1	867.9	1,511.0	107.18	96.43	100.73	107.18	96.43	100.73	643.1	867.9	1,511.0	*0.0*
2012	759.0	769.5	1,528.5	746.2	782.5	1,528.7	113.05	91.53	100.91	121.17	88.27	101.65	727.0	794.4	1,524.7	*–3.3*
2013	948.8	615.6	1,564.4	955.1	609.0	1,564.1	125.83	79.14	102.33	152.47	69.86	104.01	914.8	628.7	1,560.2	*–16.6*

2.3 Seasonal/calendar adjustment

ESA 2010 Transmission Programme requirements and publication

- **ESA 2010 TP, page 65, FN (1):** "Quarterly data are to be provided in non-seasonally adjusted form, as well as in seasonally adjusted form (including calendar adjustments, where relevant). Seasonally adjusted quarterly data in the previous year's prices are not to be provided. The provision of quarterly data that only include calendar adjustments is voluntary."
- Eurostat publishes four types of QNA series in Eurobase:

GDP and main components (output, expenditure and income) [namq_10_gdp]

Last update: 17-05-2017

Table Customization show

TIME | GEO | S_ADJ

Unit of measure: Chain linked volumes (2010), million units of national

National accounts indicator (ESA 2010): Gross domestic product at market prices

S_ADJ \ TIME, GEO	2015Q4 Switzerland	2016Q1 Switzerland	2016Q2 Switzerland	2016Q3 Switzerland	2016Q4 Switzerland	20 Swit
Unadjusted data (i.e. neither seasonally adjusted nor calendar adjusted data)	166,132.3	163,168.1	165,464.2	165,343.1	167,208.6	
Seasonally adjusted data, not calendar adjusted data	164,276.2	164,488.5	165,722.2	165,618.8	165,691.7	
Calendar adjusted data, not seasonally adjusted data	165,968.8	163,232.9	165,241.1	165,334.4	167,259.2	
Seasonally and calendar adjusted data	164,118.3	164,550.3	165,502.0	165,609.4	165,739.4	

2.3 Seasonal/calendar adjustment

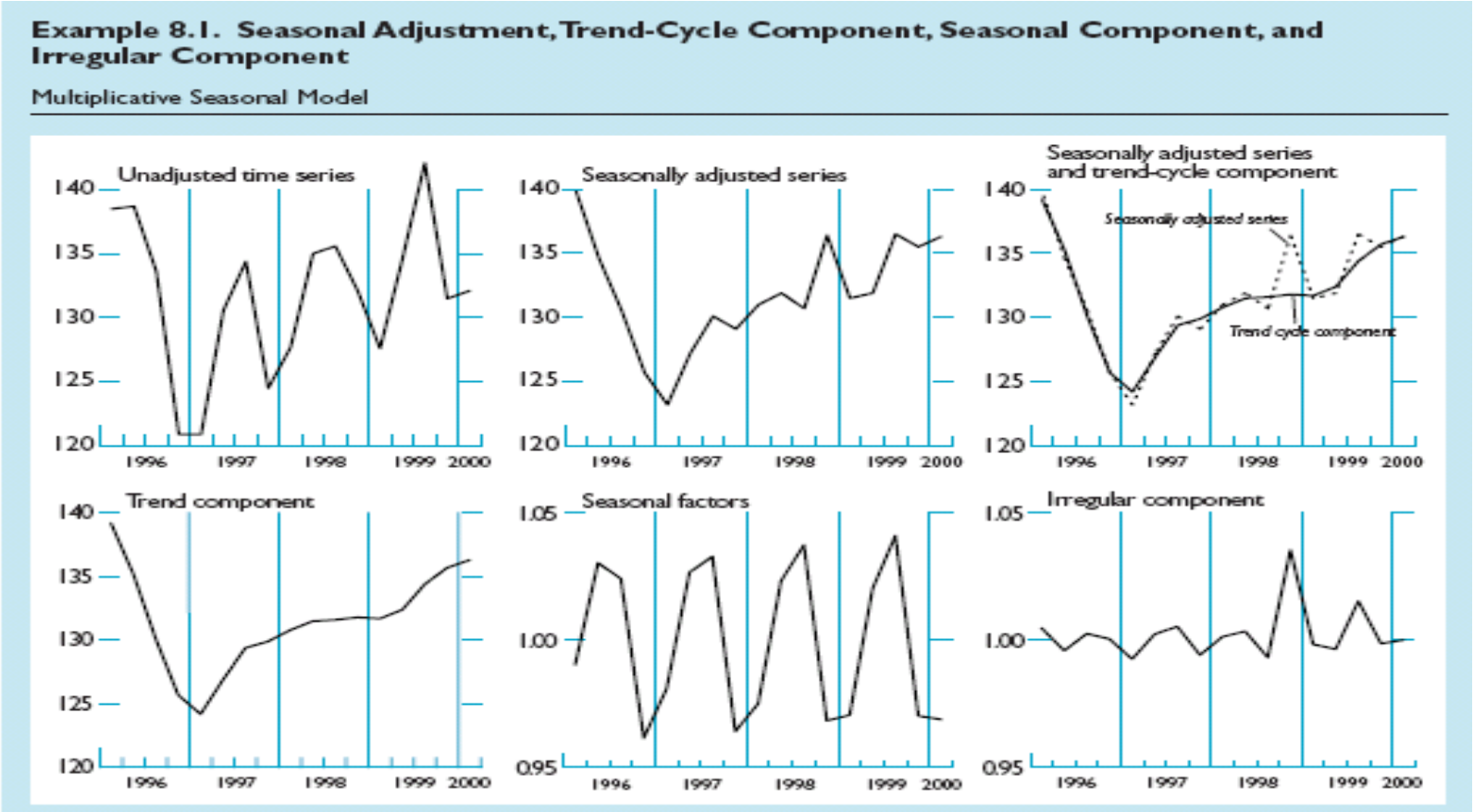
Decomposition of time series

A time series consists of three main components:

1. Trend-cycle: long-term trend + business cycle
2. Seasonal and calendar effect:
   - Seasonal effect: reasonably stable in terms of annual timing (Christmas, holidays, administrative deadlines, weather). Part of the seasonal effect is calendar-induced (fixed holidays, length of month).
   - Non-seasonal calendar effects: not stable in terms of annual timing (number and composition of working days, leap year effect, moving holidays e.g. Easter)
3. Irregular component: effects that are unpredictable in terms of timing, impact and duration (outliers, natural disasters, strikes…)

2.3 Seasonal/calendar adjustment

Stylized graphical example



2.3 Seasonal/calendar adjustment

Recommended Software **JDemetra+**

- Recommended as software for SA of official statistics within ESS and ESCB.
- Tools within JDemetra+ ("core engines") comprise all applications necessary to conduct seasonal and calendar adjustment of high statistical quality.
- The results of JDemetra+ testing, in particular by the Seasonal Adjustment Centre of Excellence:
  - Large-scale testing
  - Reproducing seasonal adjustment processes
  - Functional testing compared to TRAMO-SEATS and X-13ARIMA-SEATS applications
- JDemetra+ is a free open-source software (FOSS) and available here: https://ec.europa.eu/eurostat/cros/content/software-jdemetra_en

3.1 QNA transmissions and validation

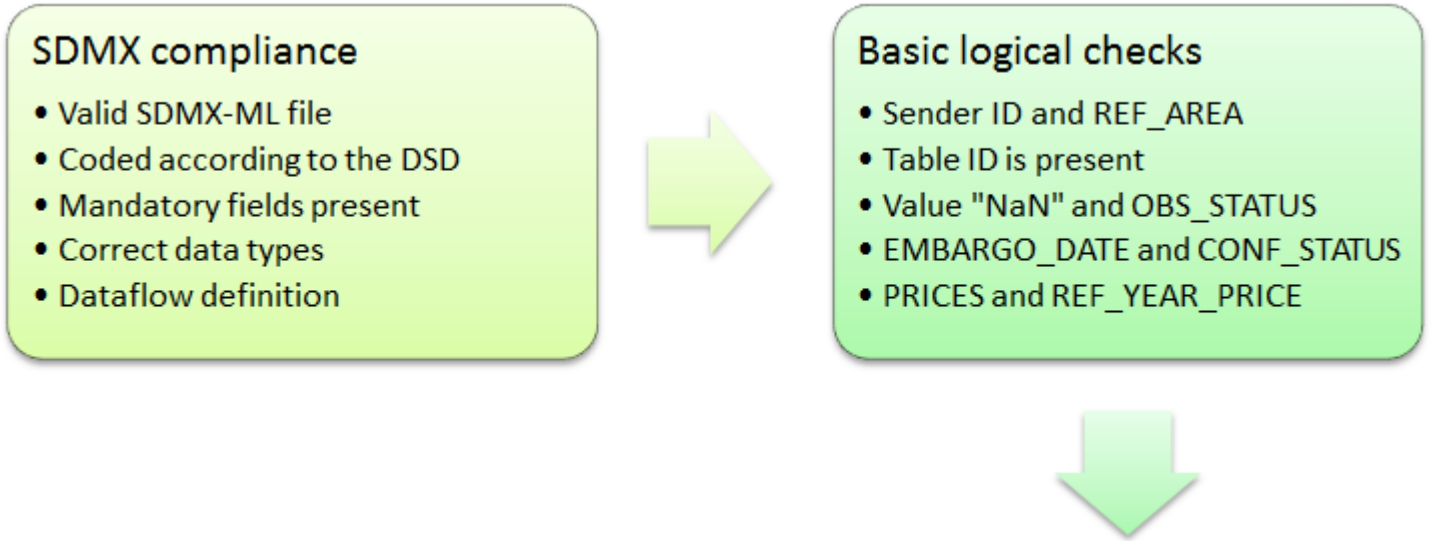
Data transmissions

- One legal requirement (T+2 months).
  But the factual transmissions by NSIs are quite heterogeneous :
  - ESA 2010 TP: QNA at 60 days (from 2014Q3 onwards)
  - Most countries now produce flash estimates 30-45 days after the reporting period
  - In some cases flash estimates include O/E/I (FR, NL, AT)
  - Transmission pattern for regular revisions: T+2M; some retransmit with SA 85/90 days)
  - Normally limited revisions except for benchmark or major revisions of entire time series; but practices vary
  - Eurostat/CMFB guidance on revisions: Practical guidelines for revising ESA 2010 data

3.1 QNA transmissions and validation

Format and basic logical validation checks

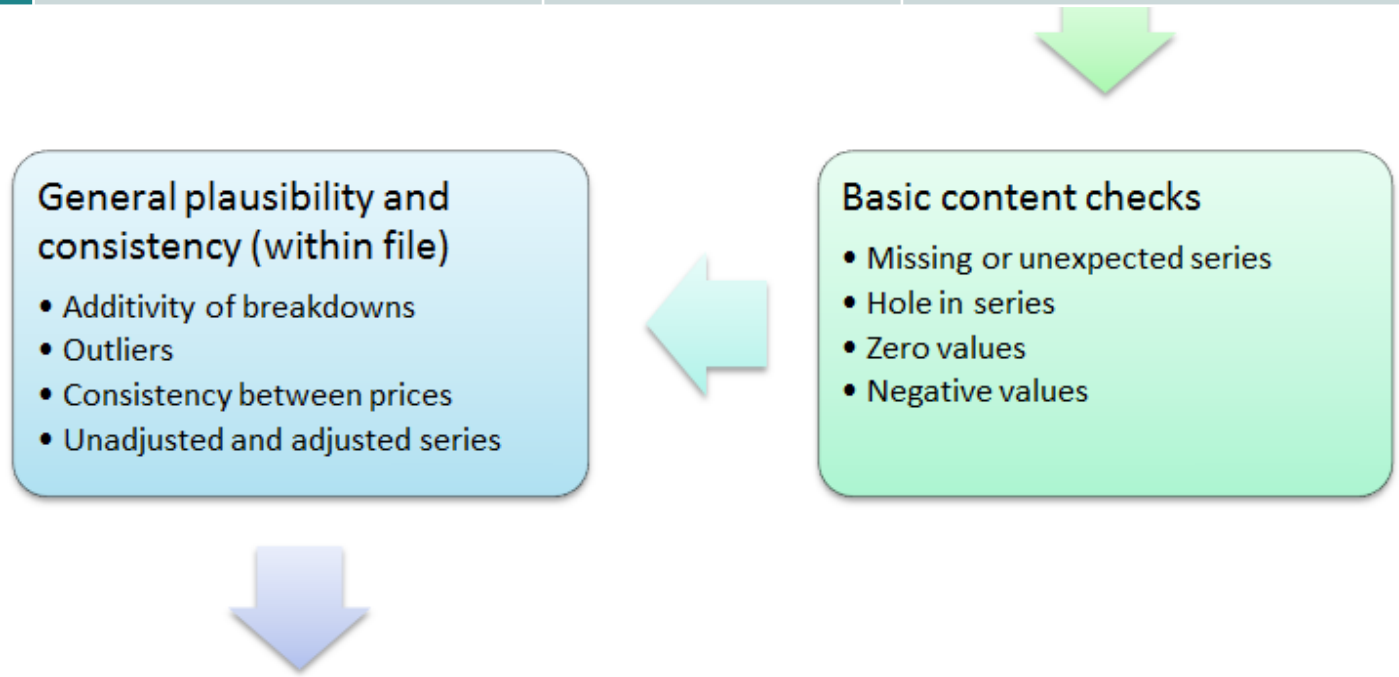
Level	Description	Scope	ESA 2010 Relevance
0	Format and file structure	Same file	SDMX standard compliance
1	Cells, records, file	Same file	Basic logical checks, flags…



3.1 QNA transmissions and validation

Basic content and plausibility checks

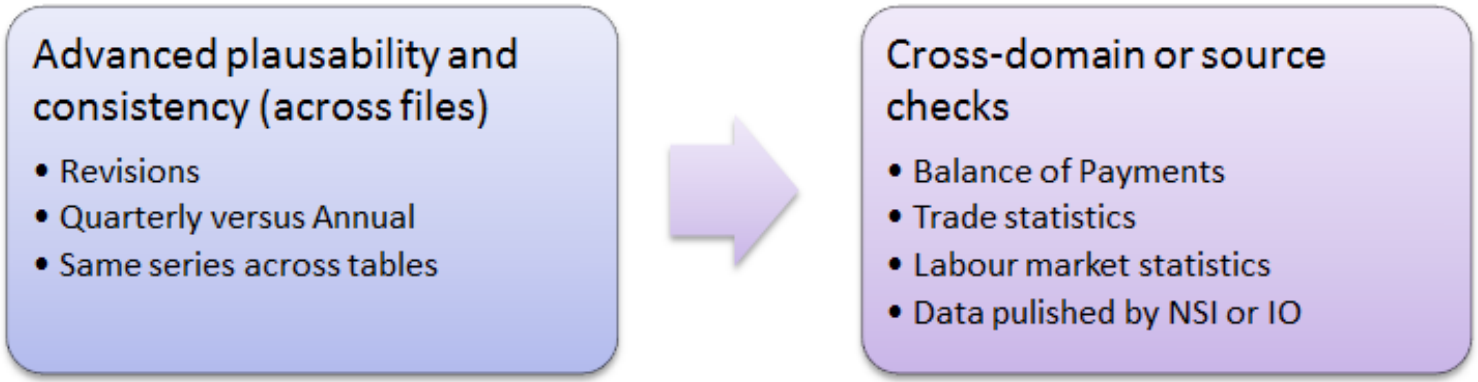
Level	Description	Scope	ESA 2010 Relevance
1	Cells, records, file	Same file	Missing, zero, negative values… Additivity and price consistency checks



3.1 QNA transmissions and validation

Advanced plausibility checks

Level	Description	Scope	ESA 2010 Relevance
2a	Revisions and time series	Between files	ESA includes full time series within the same file.
2b	Between correlated datasets	Multiple files	Between (sub-)tables
3	Mirror checks	Different sources	Not applicable
4	Consistency checks	Between domains	e.g. to Balance of Payments
5	Consistency checks	Between organisations	Not applicable



3.2 Further reading

Official publications

- Eurostat Handbook on Quarterly National Accounts (2013) http://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-GQ-13-004
- IMF Quarterly National Accounts Manual (2017) http://www.imf.org/external/pubs/ft/qna/
- The ESS guidelines on temporal disaggregation, benchmarking and reconciliation (2018 edition) https://ec.europa.eu/eurostat/documents/3859598/9441376/KS-06-18-355-EN.pdf/fce32fc9-966f-4c13-9d20-8ce6ccf079b6
- Handbook on Seasonal Adjustment (2018 edition) https://ec.europa.eu/eurostat/documents/3859598/8939616/KS-GQ-18-001-EN-N.pdf/7c4d120a-4b8a-441b-aefd-6afe81a7cf59
- JDemetra+ officially recommended as software for the seasonal adjustment of official statistics https://ec.europa.eu/eurostat/cros/content/download

Thank you! Any questions?