Overview of International Recommendations for the Index of Industrial Production (IRIIP 2010)

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Outline

- Purpose of the IIP

- Background

- Current publication – IRIIP 2010

- Methods to calculate the IIP

- Stages for constructing the IIP

- Additional issues

- Key recommendations

Purpose of the IIP

- The Index of Industrial Production (IIP) reflects the *change of the volume* of goods and/or services produced over time

- Purpose: to provide a measure of the short-term changes in *value added* over a given reference period

- IIP is a *volume index* (as opposed to price index), therefore shouldn't be influenced by price fluctuations.

Index of Industrial Production (Manufacturing) in 2015
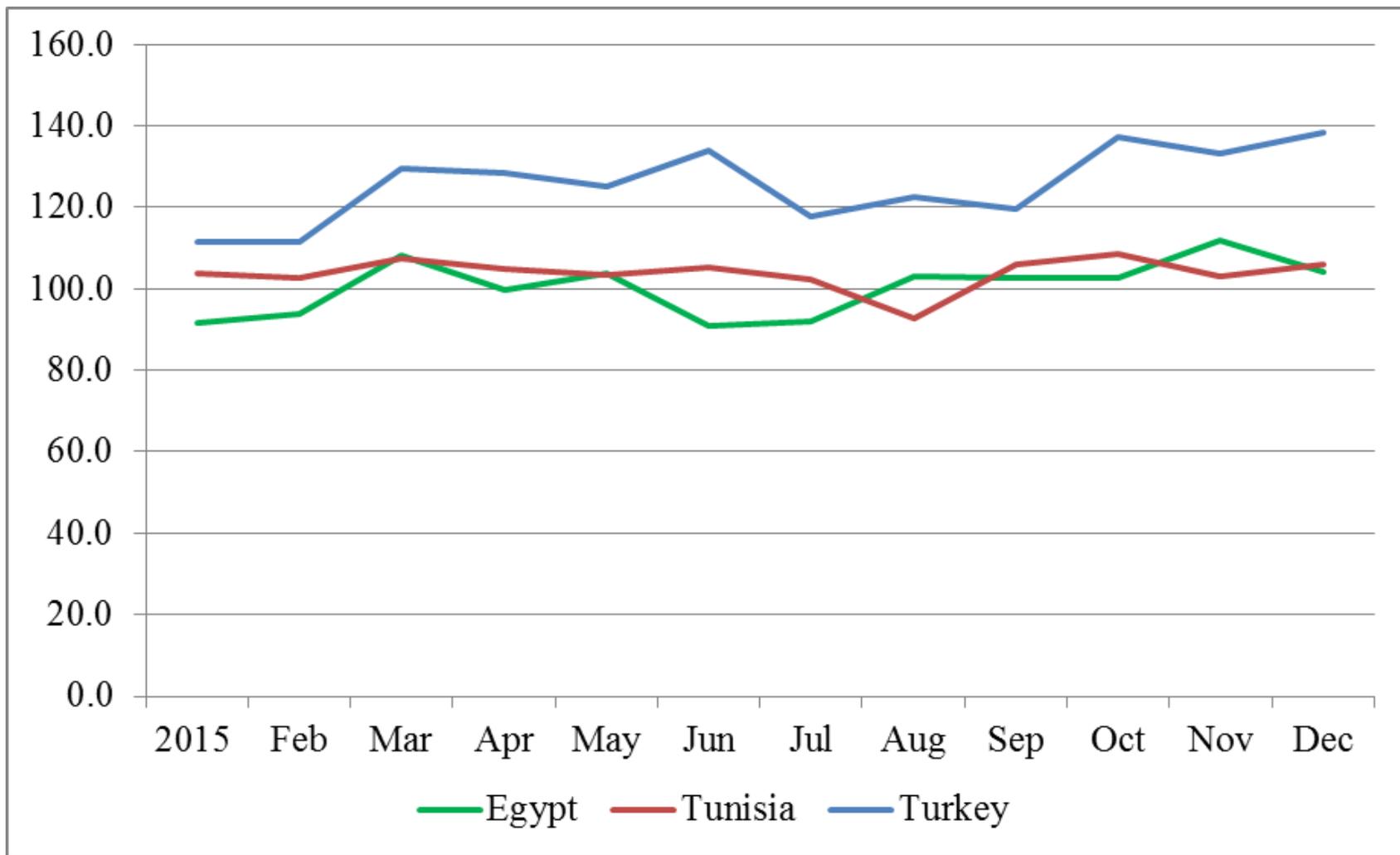
History

- Index of Industrial Production has been calculated since the 1920s
  - UNSD has collected series going back to 1938

- Methodology was described in 1950 UN Manual on "Index of industrial production"
  - Number 1 in series of publications on international recommendations and guidelines (Series F)

History

- The 1950 manual was not updated (until recently)
- However, related guidance materials were published:
  - Guidelines on Principles of a System of Price and Quantity Statistics, 1977
  - Manual on Producers' Price Indices for Industrial Goods,1979

History

- Why a revision of the IIP publication?
    - The previous UN publication on the IIP was published in 1950
    - Methods and approaches have changed over time (e.g. fixed weight vs. chain approaches, volume extrapolation vs. deflation, etc.)

History

- Why a revision of the IIP publication?
  - Various related standards and international recommendations have been updated in the past:
    - International Recommendations for Industrial Statistics 2008
    - System of National Accounts 2008
    - Producer Price Index Manual (IMF, 2004)
    - Classifications (ISIC Rev.4, CPC ver. 2.1)
  - These changes needed to be reflected in the updated IIP text

Current publication

- International Recommendations for the Index of Industrial Production (IRIIP) 2010
  - Approved by the Statistical Commission in 2010
  - Still need type-setting
  - A recent version available at:

  https://unstats.un.org/unsd/industry/docs/f107_edited.pdf

Publication structure

- Part I includes a description of the international recommendations, covering scope, fundamental concepts, etc.
  - It is encouraged that countries comply with the recommendations set out in Part I.

- Part II includes international guidance to assist countries in implementing these recommendations
  - It presents a set of methods (categorized as 'preferred', 'alternative' and 'other') and variables for each ISIC Rev. 4 class in scope of this publication for the compilation of an IIP, based on current country practices.

Summary of major changes

- Scope
  - Enlarged definition of "industrial production"

- Recommended calculation method
  - <u>Deflation</u> vs. volume extrapolation

- Frequency of weight updates
  - <u>Annual updates</u> vs. 5-year updates
  - <u>Chain-linking</u> vs. fixed-weight approach

Other recommendations, such as on seasonal adjustment or dissemination issues reflect an update of previous recommendations as well.

Scope of industrial production

- Updated to reflect changes in International Recommendations for Industrial Statistics (IRIS) 2008

- Include the following sections in ISIC, Rev.4
  - B – Mining and quarrying
  - C – Manufacturing
  - D – Electricity, gas, steam and air conditioning supply
  - *(new)* E – Water supply; sewerage, waste management and remediation activities

Two main methods to calculate the IIP

- ## Deflation
  - Generally recommended in the IRIIP 2010

- ## Volume extrapolation
  - Relied upon in the 1950 IIP manual
  - Although not preferred, still works for certain industries, such as mining and quarrying, manufacturing service industries, or where production of a single product can extend over many months

Different approaches

Common goal: to measure <u>volume</u> changes over time

The measurement should not reflect price changes in the measurement period

- Deflation
  - Use a price deflator to remove the price component from an overall value measure, isolating the volume component

- Volume extrapolation
  - Build a measurement that uses only volume changes at detailed level

Different approaches

- Deflation
  - IIP = (Value$_1$ / Price Index) / Value$_0$ * 100.0
  - Start from the level where price index is available
  - Producer Price Index (PPI) is recommended

- Volume extrapolation
  - IIP = Volume$_1$ / Volume$_0$ * 100.0
  - Start from elementary / product level
  - Volume measures include physical quantity of output (preferred), labour input or materials consumed

Deflation

Production of woven fabrics, ISIC class 1312				
Period (t)	Current value (v_t)	Price index (p_t)	Volume measure ($V_t = v_t / p_t$)	Volume relative ($R_t = V_t / V_0$)
0	$110.00	100.0	$110.00	
1	$120.00	107.2	$111.94	1.0176
2	…	…	…	…

IIP: $I_0 = 100.0$

$I_t = R_t * I_0$

$I_1 = 1.0176 * 100.0 = 101.8$

Volume extrapolation

Production of crude petroleum, ISIC class 0610		
Period (t)	Volume = output quantity (V_t)	Volume relative ($R_t = V_t / V_0$)
0	20,000 barrels	
1	22,000 barrels	1.10
2	…	…

IIP: $I_0 = 100.0$

$I_t = R_t * I_0$

$I_1 = 1.10 * 100.0 = 110.0$

Different approaches

- Deflation
  - Need data only at the more aggregated level
  - Less work on data collection and processing
  - Deflator (price index) is required
  - PPI is recommended as deflator for compiling IIP
  - Deflation should be done at lowest level, i.e. 4-digit industry level

- Volume extrapolation
  - Need data for a detailed set of products
  - Higher work load for the team

Different approaches

- Deflation
  - Better accommodate a heterogeneous product mix
  - Quality changes are accounted for in the deflator (price index)

- Volume extrapolation
  - Shifting of production between products can negatively influence the data quality.
  - Difficult to account for quality changes

Different approaches

- Deflation *(recommended)*
  - Calculation and data quality depend on the quality of the deflator (price index)

- Volume extrapolation
  - Usage limited to industries with only a small set of products, with little change in product quality, or where production of a single product can extend over many months
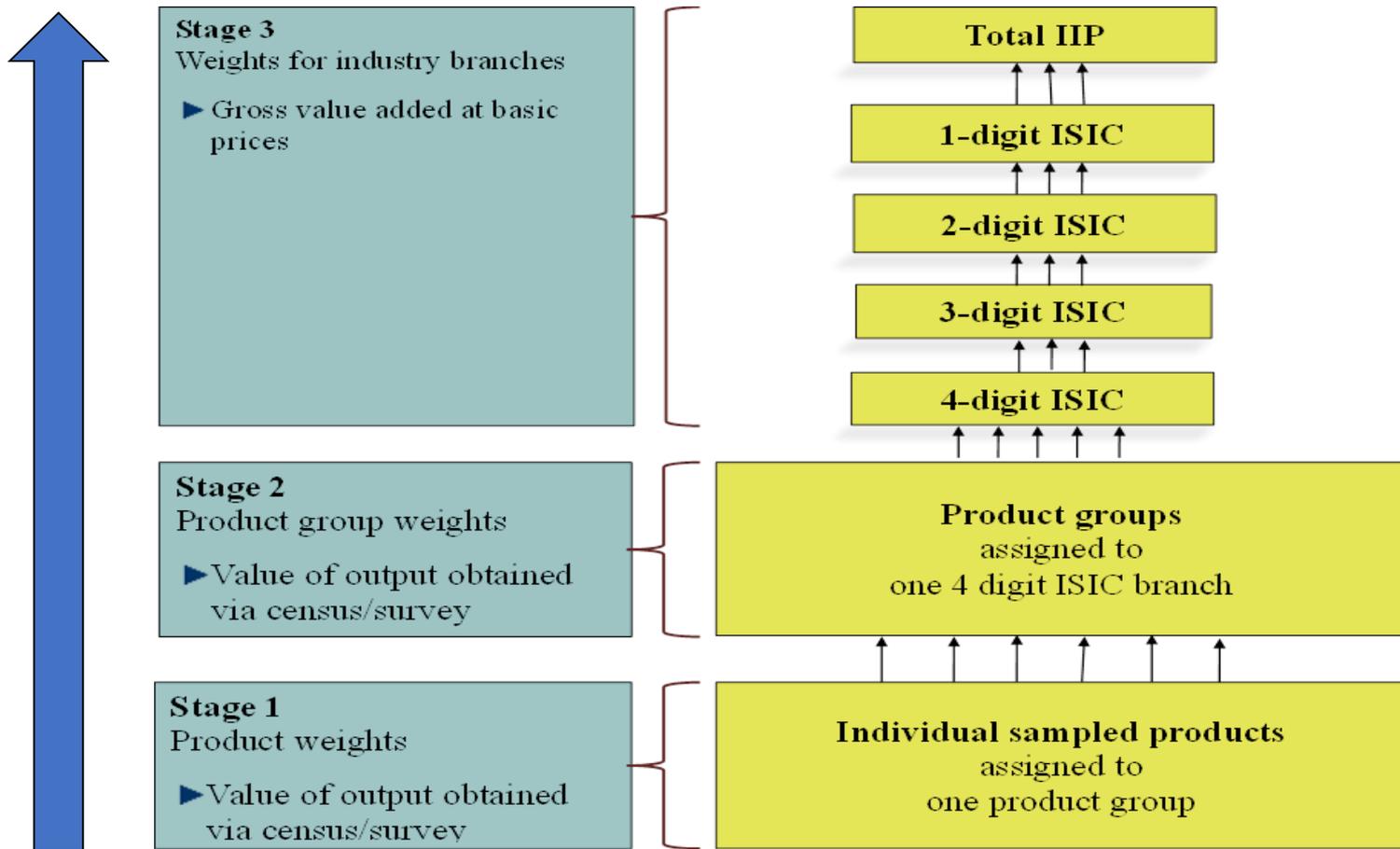
Fundamental stages for constructing the IIP

1. Product data are collected and each product is assigned to a product group. Product data are then combined using weights to produce data for the product groups.

2. Industry data are produced by assigning product groups to industry classes and combining product group data using weights. Each product group is assigned to just one industry (for example, an ISIC, Rev.4, class).

3. Upper-level indices are calculated in line with the industry classification structure.

Aggregation

Stage 3
Weights for industry branches

► Gross value added at basic prices

Stage 2
Product group weights

► Value of output obtained via census/survey

Stage 1
Product weights

► Value of output obtained via census/survey

Total IIP

1-digit ISIC

2-digit ISIC

3-digit ISIC

4-digit ISIC

Product groups
assigned to
one 4 digit ISIC branch

Individual sampled products
assigned to
one product group

Weighting data

- IIP, *being a volume index*, is a weighted average of the proportionate changes in the volumes of a specified set of goods or services between two periods of time

- Laspeyres index *(recommended)*
  - Require only a <u>single</u> set of prices from base period as weights
  - Less costly and time-consuming
  - Widely used

- Formula

$$I_t = \sum_i w_{i,0} \frac{q_{i,t}}{q_{i,0}} ; \quad w_{i,0} = \frac{p_{i,0} q_{i,0}}{\sum_j p_{j,0} q_{j,0}}$$

Where $w_{i,0}$ is the relative share (of "value added") for product, product group or industry i in the base period 0

Using weights to compile indices

	Base period (*period 0*)				Current period (*period t*)	
	Share of output	Weight	Quantity	Index	Quantity	Index
Product A	70%	**0.7**	150	100.0	170	**113.3** (= 170/150*100.0)
Product B	30%	**0.3**	100	100.0	120	**120.0** (= 120/100*100.0)
Total	100%			100.0		**115.3** (= 0.7*113.3+0.3*120.0)

The weight attached to each product determines the impact that the volume change of that product will have on the overall index. Therefore the total index (115.3) remains closer to the index for product A (113.3).

Weighting data

- Product weights
  - Used to combine product data to form product groups
  - Reflect *relative importance* of selected sample products
  - Should be a product's share of <u>output value</u> in the product group

- Product group weights
  - Used to combine product groups into industries
  - Generally obtained through product censuses or business surveys
  - Each product group is assigned to just one ISIC 4-digit industry

- Industry-level weights (1-, 2-, 3- and 4-digit levels of ISIC)
  - Should be shares of <u>gross value added</u> at base prices by industry
  - Obtained through annual national accounts compilation or other comprehensive data sources

Step-by-step guide in the publication

- Deflation
    - IRIIP 2010, section 5.5.1 contains a detailed example for compiling a monthly Laspeyres IIP using the deflation method
    - Each step includes a description, relevant formulae, and illustration through the use of data

- Volume extrapolation
    - IRIIP 2010, section 5.5.2 contains another example for compiling IIP using the volume extrapolation method

Additional issues

- Re-weighting
  - Weight updates
  - New weights to account for new products

- Weight updating frequency
  - Product weights

    Less frequently updated, owing to resource and data constraints
  - Product group weights

    Should be updated more frequently, at least every 5 years
  - Industry-level weights

    Annual update

Fixed-weight vs. chain-linked approach

- Fixed-weight (not recommended)
  - Weights updated at five-year intervals
  - Need to re-calculate the *entire* historical series from basic data *each time* the weights are updated

- Chain-linked (recommended)
  - Weights updated annually
  - Two series calculated with different weights (old and new) are linked / spliced together to produce one coherent series

Additional issues

- Linking
  - Data are compiled with the new weights only for periods close to the reference period and the series is then linked to the historical portion
  - Three linking methods are available: one-quarter overlap technique, annual overlap technique, and over-the-year technique

- Re-referencing
  - Updating the new reference period to equal 100.0

Additional issues

- Linking
  - For each period that needs to be chain-linked,

    $$\text{link factor} = \frac{\text{Index}_{\text{oldbase}}}{\text{Index}_{\text{newbase}}}$$

  - Apply it to the indices *only in this particular period*

- Re-referencing

  - Re-reference factor $= \dfrac{\text{Index}_{\text{newbase}}}{\text{Index}_{\text{oldbase}}}$

  - Apply it to *all values* of the index series

Linking and re-referencing IIP

	2005	2006	2007	2008	Notes
Old reference period = 2005	100.0	109.57			
Re-weighting 2007		= 100.0	103.46		Link factor (L_1) = 109.57 / 100.0
Linking 2007			113.36		= 103.46 * L_1
Re-weighting 2008			= 100.0	105.48	Link factor (L_2) = 113.36 / 100.0
Linking 2008				119.57	= 105.48 * L_2
Chain-linking	100.0	109.57	113.36	119.57	
New reference period = 2007			= 100.0		Re-reference factor (R) = 100.0 / 113.36
Re-referencing	96.75	96.77	100.0	105.48	

Re-weighting, linking and re-referencing an index

Quarterly Laspeyres volume index with annual chain-linking, using the annual overlap method

| | | | | | | At constant prices of: | | | | | | Chain-linked index |
| | | | | | | 2005 | | 2006 | | 2007 | | |
Basic data	Quantities a	Quantities b	Prices a	Prices b	Total at current prices	Level	Index 2005 = 100	Level	Index 2006 = 100	Level	Index 2007 = 100	2005 = 100
2005	**270**	**244**	**10.0**	**5.0**	**3920.00**	**3920.00**	**100.00**					**100.00**
2006-q1	74.2	63.6	9.8	5.2	1057.88	1060.00	108.16					108.16
2006-q2	72.8	64.2	9.3	5.8	1049.40	1049.00	107.04					107.04
2006-q3	75.3	65.6	8.6	6.1	1047.74	1081.00	110.31					110.31
2006-q4	76.7	67.6	8.3	6.5	1076.01	1105.00	112.76					112.76
2006	**299**	**261**	**9.0**	**5.9**	**4230.90**	**4295.00**	**109.57**	**4230.90**	**100.00**			**109.57**
2007-q1	77.1	65.5	8.1	6.7	1063.36			1080.35	102.14			111.91
2007-q2	76.3	66.2	7.8	6.9	1051.92			1077.28	101.85			111.59
2007-q3	77.8	68.2	7.6	7.3	1089.14			1102.58	104.24			114.21
2007-q4	78.8	69.1	7.3	7.5	1093.49			1116.89	105.59			115.70
2007	**310**	**269**	**7.7**	**7.1**	**4296.90**			**4377.10**	**103.46**	**4296.90**	**100.00**	**113.35**
2008-q1	80.1	70.2	7.1	7.9	1123.29					1115.19	103.81	117.68
2008-q2	79.5	72.2	6.9	8.2	1140.59					1124.77	104.71	118.69
2008-q3	81.1	71.9	6.5	8.8	1159.87					1134.96	105.65	119.76
2008-q4	83.3	72.7	6.3	9.1	1186.36					1157.58	107.76	122.15
2008	**324**	**287**	**6.7**	**8.5**	**4610.30**					**4532.50**	**105.48**	**119.57**

Independently chain-linked annual indices

|						Level	Index	Level	Index	Level	Index	2005 = 100
2005						3920.00						**100.00**
2006						4295.00	109.57	4230.90				**109.57**
2007								4377.10	103.46	4296.90		**113.35**
2008										4532.50	105.48	**119.57**

Seasonal Adjustment

- Main aim: to filter out seasonal fluctuations and typical calendar effects

- Seasonally adjusted data can only complement, but cannot replace original data

- To be performed only when there is clear statistical evidence and an economic explanation of the seasonal/calendar effects

- Various statistical models and software packages available

Index of Industrial Production for the United Kingdom in 2017
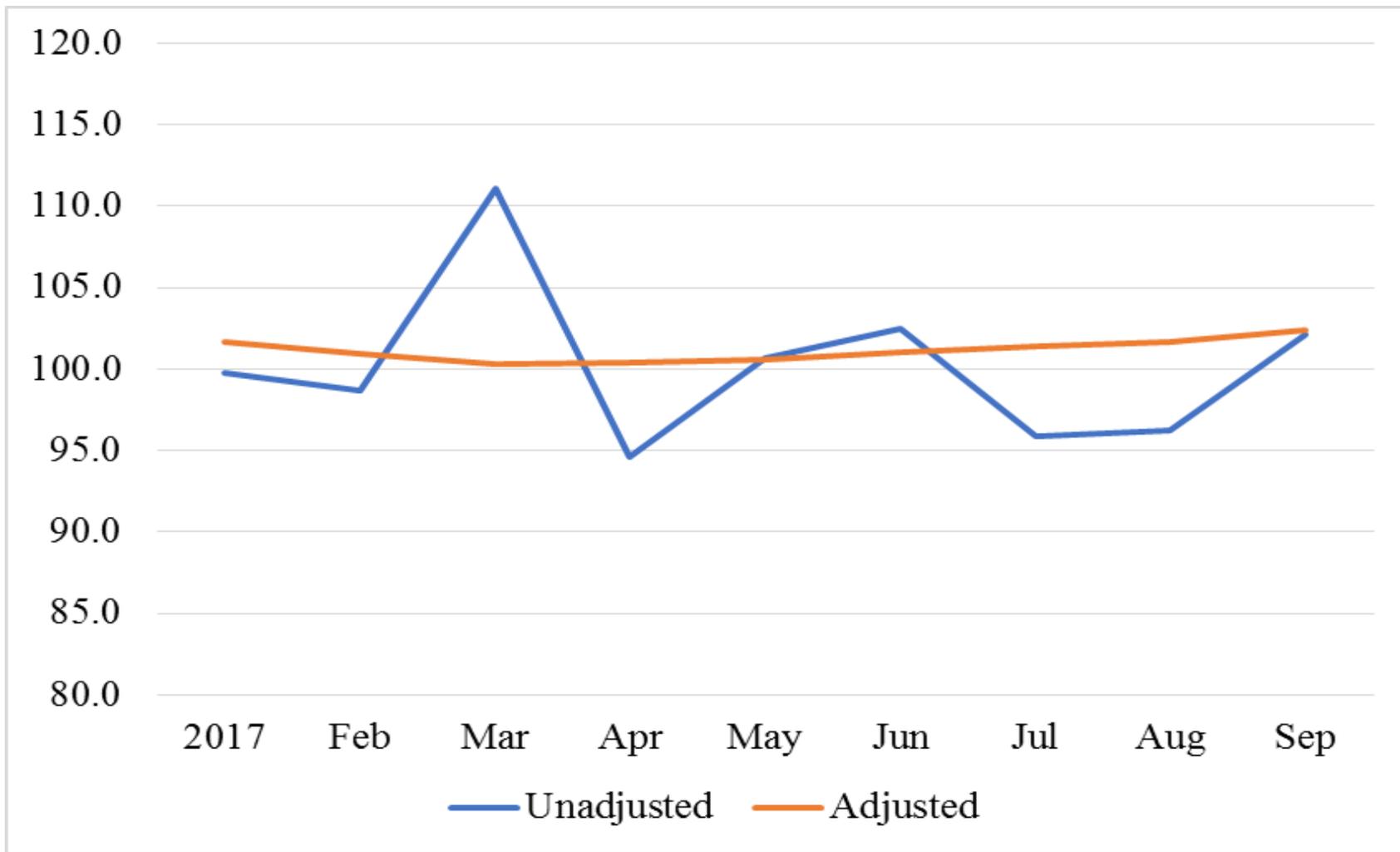
Comparing sub-annual index numbers with other data

- Recommendation
  - Attempt to compare sub-annual IIP with other data sources, such as national accounts.

- Benchmarking
  - Create a new high frequency series (the benchmarked series) through adoption of the movement of the observed frequent series (the indicator) at the level of the benchmarks
  - Generally performed at the end of a survey cycle and before the seasonal adjustment process
  - Proportional Denton method is preferred

Key recommendations

1. **Statistical units, classifications & business register**

    *   Recommendations outlining: statistical units to use; classifications; use of business registers; and data sources (incl. administrative data sources).

2. **Frequency**

    *   Publication recommends <u>monthly</u> compilation of the IIP so that turning points in economic activity can be identified as early as possible.

Key recommendations

3. Scope of the IIP

Scope is defined to cover activities in sections B - E of ISIC Rev.4, i.e. Mining and quarrying, Manufacturing, Electricity, gas steam and air-conditioning supply, as well as water supply, sewerage, waste management and remediation activities.

- Section E contains new areas for inclusion in the IIP.
- This scope coincides with the scope of the International Recommendations for Industrial Statistics (IRIS) 2008, which includes the index numbers of industrial production in its list of recommended indicators.

Key recommendations

4. Index formula

- <u>Laspeyres index</u> is recommended

Preferred due to feasibility

5. Weights and updates

- Annual update of weights should be carried out to provide an up-to-date weighting structure for the index.
- Weights should ideally be National Accounts <u>gross value added</u> figures – adjustments necessary to make them timely available.
- <u>Chain linked</u>, rather than fixed base indices are recommended.

Key recommendations

6. Calculation methods

- <u>Deflation</u> should be used to obtain volume estimates from value data, rather than volume extrapolation method
    - <u>PPI</u> is recommended as deflator
    - Deflation should be done at lowest level, i.e. 4-digit industry level
- Volume extrapolation still works for certain industries, such as mining and quarrying, manufacturing service industries, or where production of a single product can extend over many months.

Key recommendations

7. Variables to be used

- To approximate industrial production for the IIP, <u>output measures</u> (value or physical quantity of output) are preferred over input measures (labour or materials consumed)

  - E.g. relationship between labour and production value is affected by various factors, including quality, efficiency, etc.

- The publication provides suggestions for preferred, alternate and other methods for the use of variables in the IIP calculation.

  - Specific suggestions for each ISIC industry at 4-digit level in section 7.3 - Recommended variables and methods for calculating an IIP for each class of ISIC, Revision 4

Key recommendations

8. Data adjustments

- Adjustments should be made for quality changes, either
  - Through the correction of PPI used in deflation

  or

  - By adjusting input data when volume aggregation is used

- Seasonal adjustment, if needed, should be applied to the IIP data at the lowest level of aggregation

Key recommendations

9. **Dissemination**

- The publication outlines elements / requirements for the dissemination of IIP data
- General requirements for international reporting are set in the International Recommendations for Industrial Statistics (IRIS) 2008
- Limited historical data from UNSD
  https://unstats.un.org/unsd/mbs/app/DataSearchTable.aspx
  - Unadjusted annual, quarterly and monthly data from 2009 – 2016 (data collection currently suspended)
- Quarterly IIP 2017 Q2 from UNIDO
  https://stat.unido.org/database/Quarterly%20IIP%202017%20Q2

References

- IRIIP 2010 *(awaits type-setting)*
  https://unstats.un.org/unsd/industry/docs/f107_edited.pdf

- System of National Accounts (SNA) 2008
  https://unstats.un.org/unsd/nationalaccount/sna2008.asp

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Thank you!

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