

# Nowcasting Manufacturing Value Added across countries: The present and the future

Valentin Todorov  
v.todorov@unido.org<sup>1</sup>

<sup>1</sup>United Nations Industrial Development Organization, Vienna

3-4 February 2020



- 1 The UNIDO databases
- 2 Nowcasting MVA
- 3 Metadata and the operational framework
- 4 Summary and conclusions



# Outline

- 1 The UNIDO databases
- 2 Nowcasting MVA
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# Structural statistics for industry: UNIDO databases

## UNIDO databases

- Cover the manufacturing sector
- Refer to economic statistics, mainly production and trade related, not technological or environmental data
- Include statistical data from the annual observation within the quality assurance framework (no experimental or one-time study data)
- Official data supplied by NSOs (abided by the resolution of UN Statistics Commission)
- Further details: <http://stat.unido.org>
- Follow the **UNIDO Quality Framework** (Upadhyaya and Todorov, 2019)



## Main data sources

### Information about the domestic production

By ISIC at 3- or 4-digit level (readily available at the National statistical offices).

1. Employment (number of employees)
2. Compensation of employees
3. Gross output
4. Intermediate consumption
5. Value added
6. Gross fixed assets at the end of the reference year and the gross fixed capital formation
7. Index numbers of industrial production



## Main data sources (2)

### Foreign trade statistics

Available from e.g. UN COMTRADE.

1. Export of manufactured goods
2. Import of manufactured goods

For an overall assessment of the performance of the manufacturing sector in relation to the economy as a whole, data are needed on the following indicators:

1. Population
2. Gross domestic product (GDP)
3. Manufacturing value added (MVA)



# UNIDO industrial statistics databases: summary

- **INDSTAT DB**
- **MINSTAT DB**
- *by ISIC and by country*

- Number of establishments
- Number of employees
- Number of female employees
- Wages and salaries
- Gross output
- Value added
- Gross fixed capital formation
- Index numbers of industrial production

- **MVA DB**
- *by country*

- GDP at current prices
- GDP at constant prices
- MVA at current prices
- MVA at constant prices
- Population

- **IDSB**
- *by ISIC and by country*

- Output =  $Y$
- Import =  $M$
- Export =  $X$
- Apparent consumption =  $C$

$$C = Y + M - X$$



# Estimating the Manufacturing Value Added

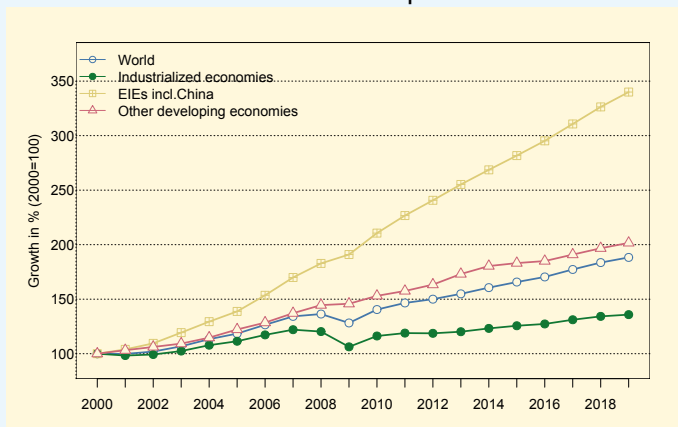
## Manufacturing Value Added

- **MVA** is the key indicator of a country's industrial production
- Published in UNIDO's **International Yearbook of Industrial Statistics**
- Main data source is **National Accounts Main Aggregates Database** of UNDESA
- Data missing for many countries and years
- A time-gap of at least one year (between the latest year and current year)
  - ▶ Using data from other sources
  - ▶ Nowcasting methods to fill in the missing data up to the current year



# Using MVA estimates

Overall growth trends of world MVA by selected country groups at constant 2015 prices



## Using MVA estimates

Table 1.1 DISTRIBUTION OF WORLD MVA AMONG SELECTED COUNTRY GROUPS, 2005-2019

Year	Industrialized Economies						Developing and Emerging Industrial Economies							
	Europe		East Asia	West Asia	North America	Others	Regional groups				Development groups			
	EU <sup>a/</sup>	Other					Africa	Asia and Pacific	Europe	Latin America	Emerging Industrial Economies	China	Other Developing Economies	Least Developed Countries
	Percentage share in world total MVA (at constant 2015 prices)													
2005	23.7	3.3	14.1	0.5	24.8	2.5	1.8	20.4	2.0	6.9	15.1	13.7	1.8	0.5
2010	20.2	3.0	13.7	0.5	21.0	2.1	2.0	29.2	1.8	6.5	15.3	21.5	1.9	0.8
2011	20.3	3.1	13.3	0.5	20.2	2.0	1.9	30.3	2.0	6.4	15.3	22.7	1.9	0.7
2012	19.4	3.1	13.2	0.5	19.7	2.0	2.0	32.0	1.8	6.3	15.3	24.1	1.9	0.8
2013	18.7	3.0	13.0	0.6	19.6	1.9	2.0	33.1	1.9	6.2	15.2	25.2	2.0	0.8
2014	18.7	2.9	13.0	0.5	19.2	1.8	2.1	34.0	1.9	5.9	15.1	26.0	2.0	0.8
2015	18.8	2.8	12.9	0.5	18.7	1.8	2.0	35.0	1.9	5.6	15.0	26.7	2.0	0.8
2016	18.9	2.7	12.9	0.6	17.9	1.7	1.9	36.1	1.9	5.4	15.0	27.5	1.9	0.9
2017 <sup>b/</sup>	18.8	2.7	12.8	0.5	17.7	1.6	2.0	36.8	2.0	5.1	14.9	28.1	1.9	1.0
2018 <sup>c/</sup>	18.6	2.6	12.6	0.5	17.6	1.6	1.9	37.7	2.0	4.9	14.8	28.9	1.9	0.9
2019 <sup>c/</sup>	18.3	2.6	12.4	0.5	17.5	1.5	2.0	38.7	1.9	4.6	14.6	29.7	1.9	1.0
	Percentage share in world total MVA (at current prices)													
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2012	19.5	3.7	15.4	0.5	17.8	2.0	2.0	30.9	2.0	6.2	16.0	22.5	1.9	0.7
2013	19.9	3.6	13.5	0.5	17.8	2.0	2.0	32.3	2.2	6.2	15.9	24.1	2.0	0.7
2014	20.1	3.4	13.0	0.5	17.6	1.9	2.1	33.3	2.1	6.0	15.4	25.3	2.0	0.8
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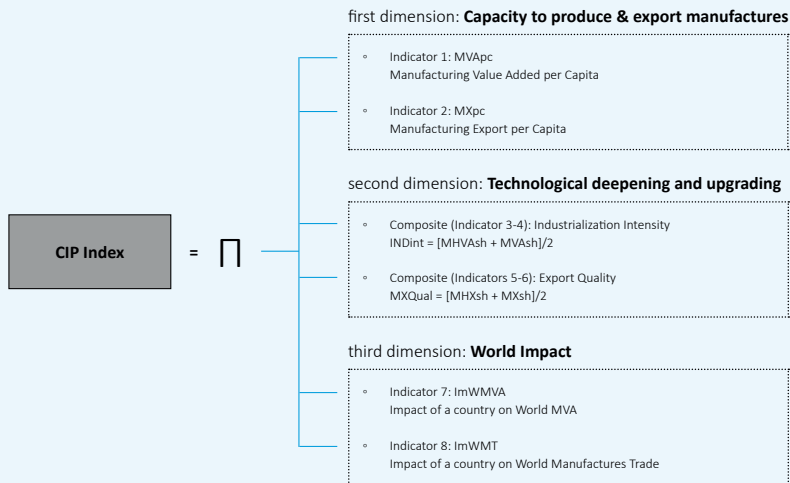
a/ Excluding non-industrialized EU economies.

b/ Provisional.

c/ Estimate.



# Using MVA estimates: Competitive Industrial Performance (CIP) index



# Using MVA estimates: Monitoring SDG 9 indicators

Based on its mandate, UNIDO focuses on the SDG9

**Goal 9:** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

- Target 9.2
  - ▶ 9.2.1 Manufacturing value added (share in GDP, per capita)
  - ▶ 9.2.2 Manufacturing employment, in percent to total employment
- Target 9.3
  - ▶ 9.3.1 Percentage share of small scale industries in total industry value added
  - ▶ 9.3.2 Percentage of small scale industries in loan or line of credit
- Target 9.4
  - ▶ 9.4.1 CO2 emission per unit of value added
- Target 9.5
  - ▶ 9.5.1 Percentage share of medium and high-tech (MHT) industry value added in total value added



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# Nowcasting MVA

- A good nowcasting method is not only a method with a low mean absolute error, but it also needs to satisfy the following three requirements:
  - ▶ R1. The nowcasts produced by the method are little influenced by revisions of single observations in the data.
  - ▶ R2. The nowcasts should be plausible given the past values of MVA.
  - ▶ R3. The nowcasting method should not only be accurate on average, but also accurate for all countries.



# Nowcasting MVA

- GDP data are available up to the current year:
  - ▶ For earlier years the actual GDP values are used
  - ▶ For the most recent one or two years the GDP values are derived from the nowcasts of GDP growth rates reported in the *World Economic Outlook of IMF* (see Artis, 1996)
- MVA—a time-gap of at least one year: nowcasting
- MVA is strongly connected to the GDP
- ⇒ this suggests to nowcast MVA on the basis of the estimated relationship between contemporaneous values of MVA and GDP
- We want a parsimonious nowcasting model (Marcellino (2008) has shown that in general simple linear time series models can be hardly beaten if they are carefully specified)



## Nowcasting MVA—the model

- We consider models based on the following general representation of MVA:

$$MVA_{i,t} = MVA_{i,t-1}(1 + gMVA_{i,t})$$

where the MVA growth rate is modelled as

$$gMVA_{i,t} = a_i + b_i gGDP_{i,t} + c_i gMVA_{i,t-1} + e_{i,t}$$

and  $e_{i,t}$  is white noise.

- This general model can be specialized down to four different models (see Boudt, Todorov and Upadhyaya, 2009)





# Nowcasting MVA—Outliers (example)

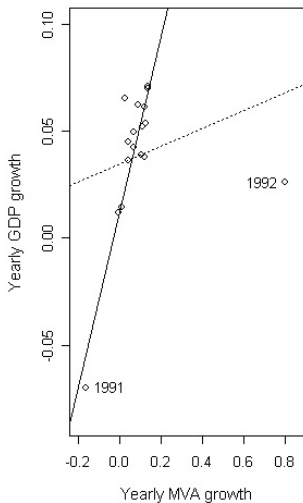
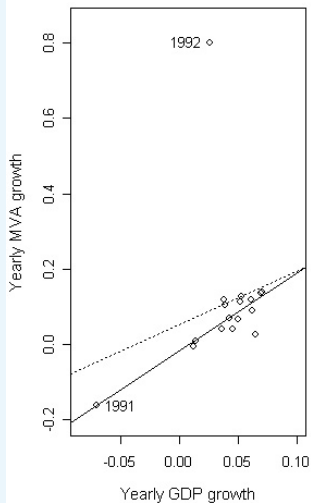


# Nowcasting MVA—estimation

- The standard OLS estimator may be biased because of
  - ▶ violation of the assumption of exogeneity of the regressors with respect to the error term
  - ▶ presence of outliers in the data
- What are outliers?
  - ▶ atypical observations which are inconsistent with the rest of the data or deviate from the postulated model
  - ▶ may arise through contamination, errors in data gathering, or misspecification of the model
  - ▶ classical statistical methods are very sensitive to such data
- For this reason we also consider a robust alternative to the OLS estimator, namely the MM-estimator



# Nowcasting MVA



# Nowcasting MVA—MM-estimator

- Robust methods: produce reasonable results even when one or more outliers may appear in the data
- The MM-regression estimator is a two step estimator:
  - ▶ First step—S estimates
  - ▶ This estimate is used as a starting value for M-estimation where a loss function is minimized that downweights outliers
- Has a high efficiency under the linear regression model with normally distributed errors
- Because of the S initialization it is highly robust
- For details see Maronna et al. (2006)
- R code available in package **robustbase**



# Nowcasting MVA—assessment

- Pseudo out-of-sample nowcast accuracy comparison between the methods (6 models and 2 estimator choices, 12 in total)
  - ▶ Mean Absolute Percentage Error (MAPE)
  - ▶ The proportion of observations for which the Absolute Percentage Error (APE) exceeds 10% and 20%
- The Analysis is based on all 200 countries
  - ▶ Aggregates of all countries
  - ▶ Splitting the sample into the countries for which the share of MVA in GDP is below/above its median value



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# Metadata in the International Yearbook of Industrial Statistics

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<sup>a/</sup> Excluding non-industrialized EU economies.

<sup>b/</sup> Provisional.

<sup>c/</sup> Estimate.



# Metadata in the online database INDSTAT



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Welcome Valentin Todorov  
UNIDO STATISTICS DATA PORTAL

HOME DATABASES PRODUCTS RESOURCES SDG9 CIP MY PORTAL HELP LOGOUT
f t v in

Selected Database: INDSTAT 2 2019, ISIC Revision 3:

CHANGE SELECTION

Change Layout
Show Graph
Download data
Load Queries

Switzerland

Value added

Units
  Thousands
  Millions
  Billions

National Currency
  USD

Click on [i](#) to view additional information.

Amounts are in current national currency (Francs)

	2010 <i>i</i>	2011 <i>i</i>	2012 <i>i</i>	2013 <i>i</i>	2014 <i>i</i>	2015 <i>i</i>	2016 <i>i</i>	2017 <i>i</i>
15 Food and beverages	7674192383	8243258789	8728661987	9488210205	9407595797 <i>i</i>	9767546508	9868598328	10604138198 <i>i</i>
16 Tobacco products	...	...	...	...	...	...	...	...
17 Textiles	837566040	806120361	724385254	646696777	701795837	684417114	638966187	686590489 <i>i</i>
18 Wearing apparel, fur	375165527	382968842	345921082	364774902	320290039	369600189	261647980	281149485 <i>i</i>
19 Leather, leather products and footwear	139272278	155061081	149939316	151	Metadata for Switzerland/Value added/2017/15 Food and beverages		114689034	123237194
20 Wood products (excl. furniture)	3299745361	3396922119	3597579346	3444	Special note UNIDO Estimate		3228191162	3468799122 <i>i</i>
21 Paper and paper products	1343998169	1321593628	1176734375	1103	1991	...	945966492	1016472561 <i>i</i>
22 Printing and publishing	2617876953	2418977539	2161223389	1991	...	...	...	...
23 Coke, refined petroleum products, nuclear fuel	...	...	...	...	...	109673325	111189714 <i>i</i>	...
24 Chemicals and chemical products	23943925782	23688969727	26187191406	26431715332	25927821778	28974473144	29941469726	32173108305 <i>i</i>
25 Rubber and plastics products	3055846191	3027635254	2896215088	2870925049	2873500732	2733610352	2793746582	3001973924 <i>i</i>
26 Non-metallic mineral products	2781304500	...	2719277344	2744614258	2839005859	...	...	...
27 Basic metals	1873067139	2031078247	1698749756	1648442871	1635458862	1509156128	1501641480	1613563877 <i>i</i>
28 Fabricated metal products	9304050781	10019681641	8874141602	9176619141	9037837891	8794690430	8917290039	9581925698 <i>i</i>
29 Machinery and equipment n.e.c.	12360311035	13122135742	12915271728	12646351806	12960023682	12647886841	12478319702	13408370895 <i>i</i>
30 Office, accounting and computing machinery	1887670731 (30F <i>i</i> )	21183091797 (30F <i>i</i> )	22009017578 (30F <i>i</i> )	21772863281 (30F <i>i</i> )	22241753906 (30F <i>i</i> )	19617322266 (30F <i>i</i> )	18274148438 (30F <i>i</i> )	19636182267 (30F <i>i</i> )





# Operational framework: stages

## Data transformation at UNIDO Statistics

The main objective of data transformation is to convert national data into an international statistical product. National data inherently differ by currency, national adaptation of industry classification, reference periods, etc.

- **Stage 1**—responses to national questionnaires. Detection and if possible correction of obvious reporting errors
  - ▶ Used for pre-filling the following edition of the questionnaire
  - ▶ Data are considered official
- **Stage 2**—incorporation of published national data.
  - ▶ Inconsistent data are corrected using supplementary information from national publications
  - ▶ Published in International Yearbook of Industrial Statistics
  - ▶ Data are considered official



## Operational framework: stages

- **Stage 3**—disaggregation of data. Data are adjusted to eliminate the departures from the level of ISIC aggregation
  - ▶ using national and international sources
  - ▶ using supplementary data
- **Stage 4**—automatic disaggregation and interpolation. Missing data are estimated applying related proportion or interpolation whenever applicable
  - ▶ For ISIC Revision 3, 2-digit only
- **Stage 5**—estimation of provisional data for the latest years.
  - ▶ Selected variables only



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# Summary and conclusions

- UNIDO Statistics mandate: maintain global industrial statistics databases
- To allow cross-country comparison of the current industrial economic situation, nowcasts of manufacturing value added are needed
- We considered nowcast methods that exploit the relationship between MVA and GDP and the fact that accurate nowcasts of current GDP are available from external sources. Best performance is achieved when using
  - ▶ Stationary variables (eg growth rates)
  - ▶ Robust estimation procedures
  - ▶ Rolling estimation window for robustness to structural breaks
- Data quality framework



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# Inclusive and Sustainable Industrial Development

Creating shared prosperity | Safeguarding the environment



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