United Nations Economic Commission for Europe
Statistical Division

Joint ECLAC/ESCWA webinar on prices:
Innovation and integration of statistical operations
4-5 April 2023

New data sources and resilient production systems for the CPI

Carsten Boldsen, UNECE
(carsten.boldsen@un.org)

Overview

1. Need for more resilient production systems
2. From survey to multiple source based CPI
3. New data sources
4. References

1. Need for more resilient production systems

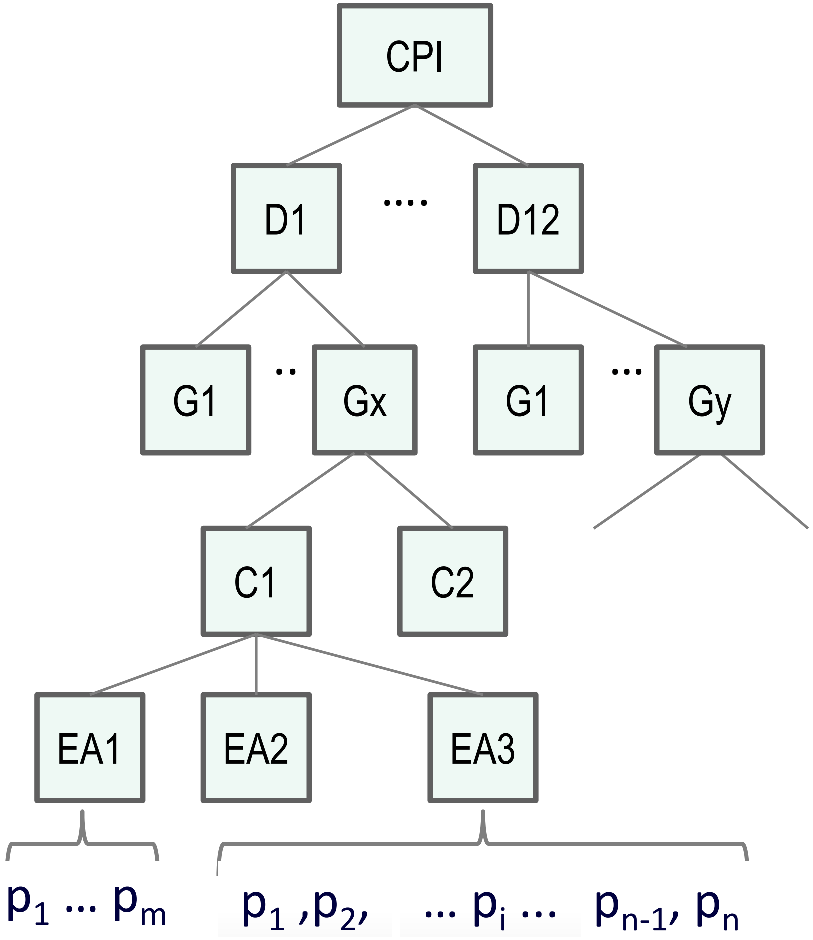
Problems caused by Covid-19 lockdown

- Closed outlets and markets
- Price collectors not available or not allowed to enter outlets
- NSO Staff not able to work or work remotely

NSO challenges

- Organising and conducting data collection
- Compiling CPI of best possible quality
- Publication: meeting user needs and maintain public trust in CPI

1. Need for more resilient production systems



All-items CPI

Divisions

Groups

Classes

Elementary Aggregates

Individual prices

1. Need for more resilient production systems

Lessons learned

- Develop more resilient production systems
- Apply multiple data sources and multiple data collection methods/tools - move towards multi-source & multi-mode production systems
- Integrate contingency procedures in the regular production process - complete from data collection, processing, imputation & calculation methods and dissemination

2. From survey to multiple source based CPI

Traditional survey based CPI

- Targeted sample of outlets and products (goods & services)
- Price collection through surveys to outlets or by price collectors
- Ongoing replenishment of sample and regular/occasional resampling of all outlets
- Control and full information of individual observations
- Checking and validation of many individual observations
- Allows estimation of statistical uncertainty (in theory)
- Monthly (quarterly) production cycle
- Relative expensive and long production time

2. From survey to multiple source based CPI

New data sources

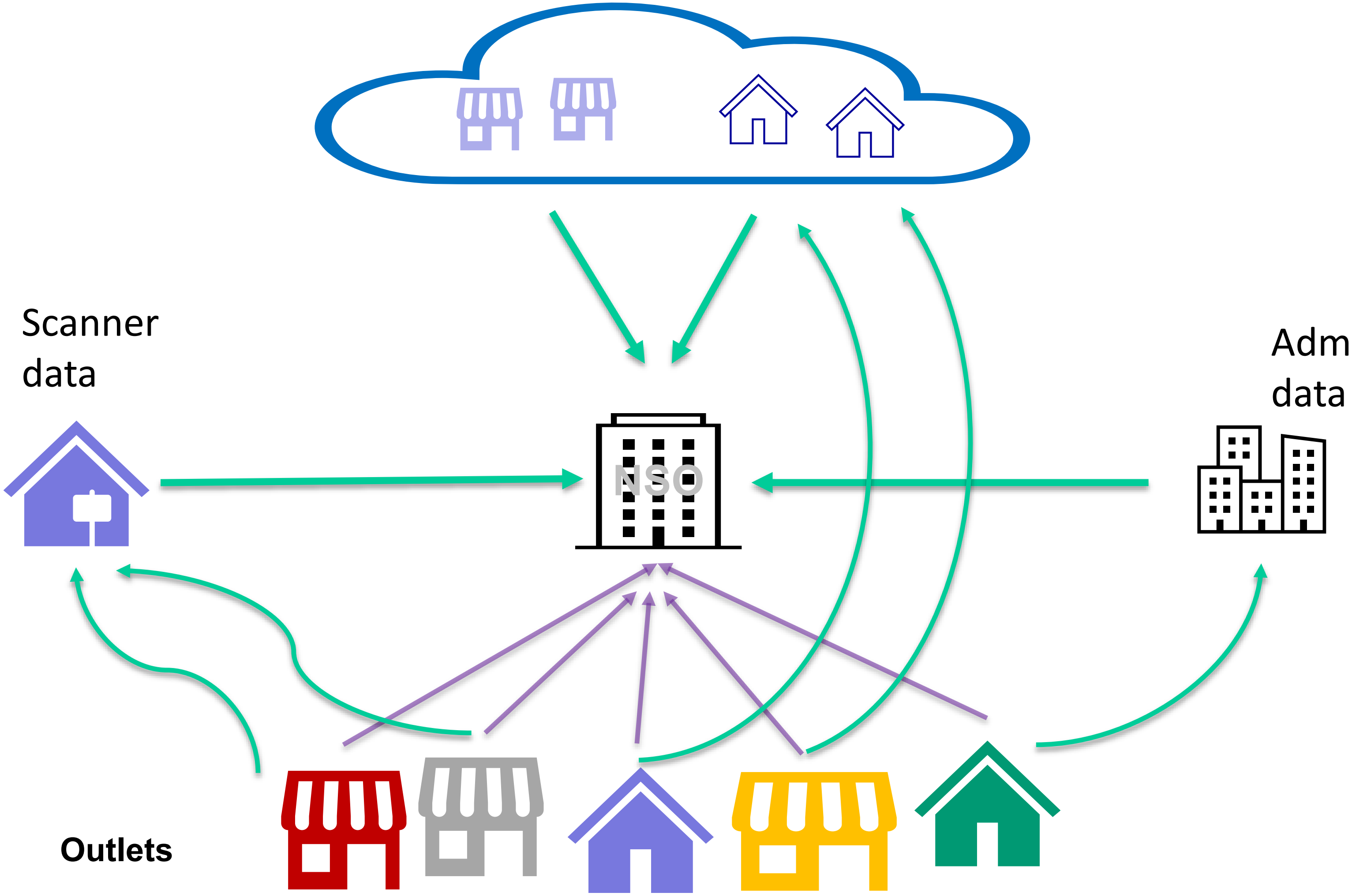
- The web
- Scanner data
- Administrative data

Drivers towards new data sources

- ICT development & growing availability of data (less so for services)
- Potentially available for free or at low cost
- Reduce costly manual price collection and response burden
- Improve efficiency, coverage, frequency and timeliness
- Competition from other providers of alternative price measures

➡ **New paradigm in CPI compilation**

2. From survey to multiple source based CPI



Scanner data

NSO

Admin data

Outlets

3. New data sources - scanner data

Different uses of scanner data

- Testing of survey based CPIs
- For sampling and weighting purposes
- Complement existing survey based sample
- Replace survey based prices

Acquisition of scanner data

- Reach out & establish cooperation
- Getting access, clarify legal, economic & IT issues
- Consider risks and dependency

Scanner data

Coding and classification

Typical variables in scanner data

Variable
Date
Outlet ID
Region
Retailer classification
Product identifier (PI)
Description
Quantity sold
Turnover

Use product code and/or description to classify and aggregate observations into CPI product groups / elementary aggregates

- Link PI to CPI product codes
- Text analysis / machine learning

Scanner data

Going into scanner data

- Make a plan, what are the goals
- Step-by-step approach

1) **Research**
2) **Testing**
3) **Implementation**

- Begin with more standardized markets with less product turnover, replacements and quality changes
- Gradually move on to more difficult products

Scanner data

Issues down the line

- Quality control and data validation
- Product churn (products leaving or entering market)
- Relaunches (same product launched with new code)
- Aggregating across time (unit prices)
- Calculation formulas, weighting
- Risk of drift using high-frequency weight and price data
- Multilateral price indices

Web prices

Prices available on the web includes

a) **Physical outlets with no web sale only advertising prices**

b) **Web outlets only**

c) **Physical outlets with online sale**

Web prices

a) Physical outlets with no web sale only advertising prices

- Collect prices manually or by web scraping
- Products should be available in physical outlet
- Ensure list prices correspond to actual in-store sale prices
- Integrate in CPI like ‘normal’ survey prices

Web prices

b) Web outlets only

- Collect prices manually or by web scraping
- Include as new outlets, usually by linking to show no price change
- Ensure list prices correspond to actual sale prices
- Include delivery charges (CPI Manual 5.18-5.19, 5.196, 11.57 and 11.78- 11.79)

- By linking web outlets into the CPI, we miss possible price decreases, and the CPI will overestimate cost-of-living
- Consider differences in price ***levels*** and in price ***changes*** between web outlets and physical outlets

Web prices

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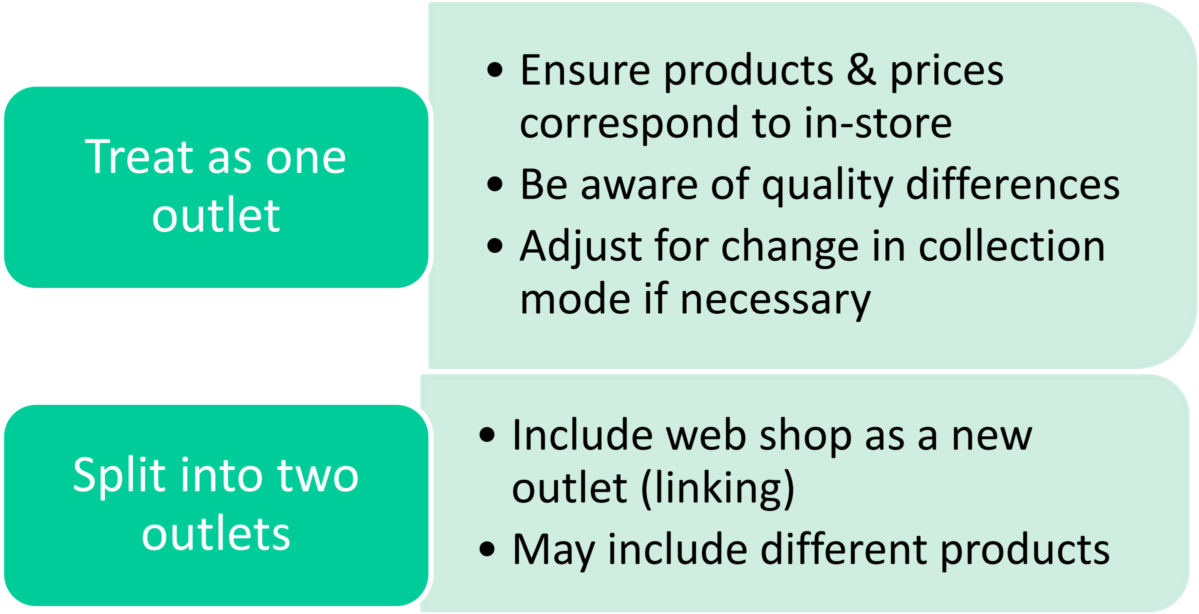
c) Physical outlets with online sale

Two options to include prices from the web outlet



Treat as one outlet

- Ensure products & prices correspond to in-store
- Be aware of quality differences
- Adjust for change in collection mode if necessary

Split into two outlets

- Include web shop as a new outlet (linking)
- May include different products

Web prices

Product offer definition

Dimensions

Time	Outlet	Product	Collection mode

Principle: Compare like with like (matched-model methods)

Problems

- Is the product in the outlet and on the web the same?
- Are there quality differences (including in the service provided)?
- How to treat price differences (genuine or quality differences)?
- Delivery charges – ensure documented and consistent treatment

Web prices – web scraping

Types of web scraping

- **Targeted web scraping**
  - Replace traditional price collection
  - Scrape predefined product offers; manual collection of failures
  - Index calculation stays the same

- **Bulk web scraping**
  - Find as much relevant information from selected URLs as possible
  - Scrape all product information
  - Failures because of changes in URLs or pages structure etc.: fix manually or semi-automatically
  - Calculate index based on collected prices (after validation/filtering)

Web prices – web scraping

❖ **API (Application programming Interface)**

Access to usually more stable data bases underlying web pages

Begin with targeted web scraping

Obtain practical experiences and gradually extend the scraping

Coding and maintaining the scraper – 3 strategies:

- **In-house:** requires skills and training (HTML, URLs, scraper software, e.g., R or Python or others)
- **Third-party applications** (rarely free & inconvenient when changes are needed)
- **Outsource**

Web prices – web scraping

Steps in web scraping

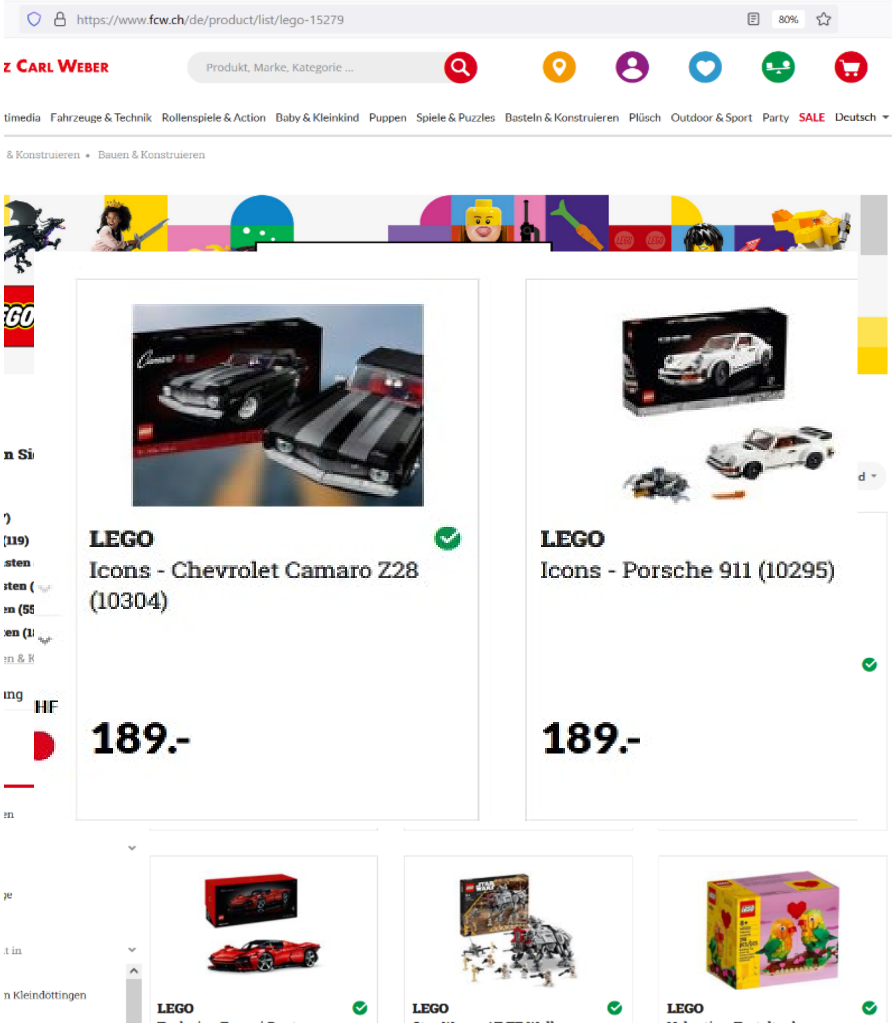
- Investigate the website/URL to be scraped
- Ensure access to scrape – check/ask/notify owner
- Identify required information: product identification, product description and price
- Code a programme to scrape the website, use, e.g., R or Python
- Run the programme, collect the prices and metadata and save in database

Risks

Consider risks associated with web scraping to avoid malware and ensure confidentiality. Use stand-alone PC / separate IP address for the scraper

Web prices – web scraping - example

Find website



https://www.fcw.ch/de/product/list/lego-15279 80%

z Carl Weber

Produkt, Marke, Kategorie ...

timedia Fahrzeuge & Technik Rollenspiele & Action Baby & Kleinkind Puppen Spiele & Puzzles Basteln & Konstruieren Plüsch Outdoor & Sport Party SALE Deutsch

& Konstruieren • Bauen & Konstruieren

n Si

(119)

HF

LEGO
Icons - Chevrolet Camaro Z28 (10304)

189.-

LEGO
Icons - Porsche 911 (10295)

189.-

n Kleindottingen

LEGO

LEGO

LEGO

Investigate HTML code

```
<div class="containerSelect">
  <div class="productGridElement">
      <span class="fullName">
         <a href="https://www.fcw.ch/de/product/lego-
icons-chevrolet-camaro-z28-10304-880446" title="LEGO
Icons - Chevrolet Camaro Z28 (10304)"><span
class="manName">LEGO</span><br />Icons - Chevrolet
Camaro Z28 (10304)</a>
     <div class="priceAndActionButtons">
             <div class="generalPrice">
               189.-
     </div>
  <div class="productGridElement">
      <span class="fullName">
         <a href="https://www.fcw.ch/de/product/lego-
icons-porsche 911-10295-880546" title="LEGO Icons –
Porsche 911
```

Web prices – web scraping - example

Programme web scraper

```
# Python – web scraping for FCW, Geneve, Lego products
import requests
from bs4 import BeautifulSoup
import pandas as pd
URL = "https://www.fcw.ch/de/product/list/lego-15279"
page = requests.get(URL)
soup = BeautifulSoup(page.content, "html.parser")
lego_products = soup.find_all('div',class_="productGridElement")
for product in lego_products:
   description = product.find('span',class_="fullName").text
   price = product.find('div', class_='generalPrice').text
   print(description,price)
```

```
OUTPUT
LEGOIcons - Chevrolet Camaro Z28 (10304)         189.-
LEGOIcons - Porsche 911 (10295)                  189.-
LEGOMinifigures - Minifiguren Serie 24 (71037)     4.95
```

Administrative data

Administrative data are data kept by private or public organisations for admin purposes

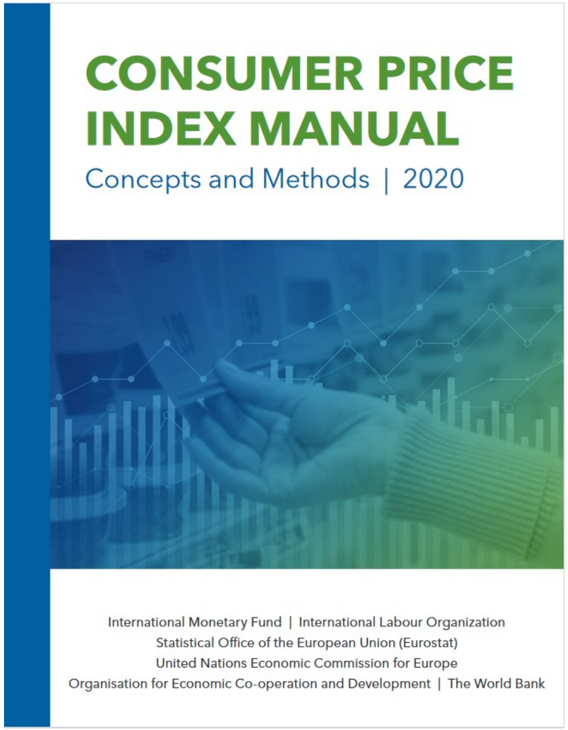
- Offer broad (sometimes full coverage)
- Often available in (semi-) controlled and subsidized markets, e.g.
  - Energy
  - Transport
  - Cars/motor vehicles
  - Health (e.g., prescriptive medication)
  - Housing
  - Education
  - Insurances

Administrative data

Way forward

- Investigate what admin sources are available
- Reach out to holders of admin data
- Ensure access, consider legal and confidentiality issues
- Perform research and tests
- Implementation

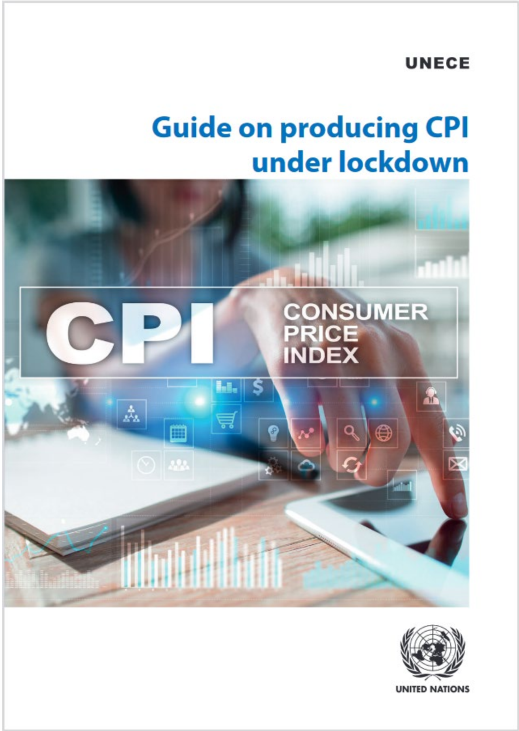
4. References



CONSUMER PRICE INDEX MANUAL

Concepts and Methods | 2020

International Monetary Fund | International Labour Organization
Statistical Office of the European Union (Eurostat)
United Nations Economic Commission for Europe
Organisation for Economic Co-operation and Development | The World Bank



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Guide on producing CPI under lockdown

UNITED NATIONS

4. References

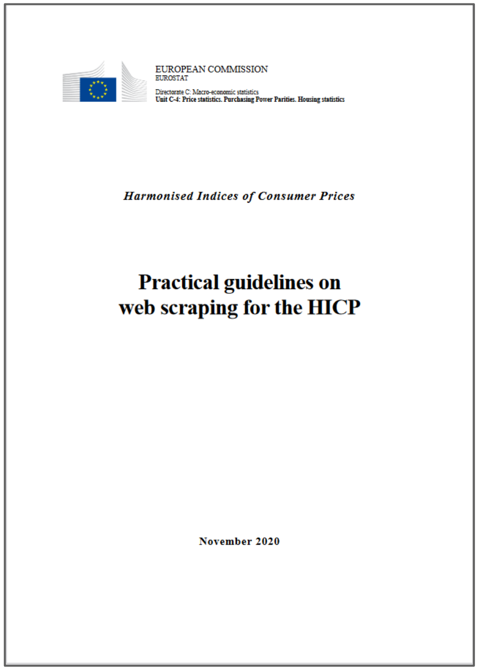
Guide on Multilateral Methods in the Harmonised Index of Consumer Prices

2022 edition

48.274
44.274
62.630
65.296
77.503

MANUALS AND GUIDELINES

eurostat



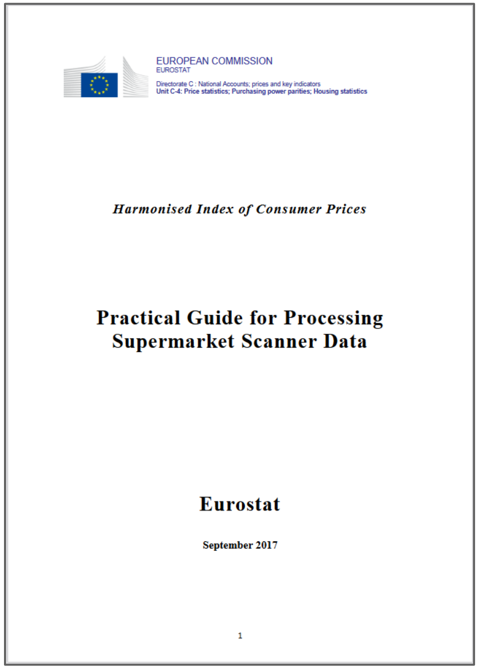
EUROPEAN COMMISSION
EUROSTAT

Directorate C: Macro-economic statistics
Unit C-4: Price statistics. Purchasing Power Parities. Housing statistics

Harmonised Indices of Consumer Prices

Practical guidelines on web scraping for the HICP

November 2020



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Directorate C : National Accounts; prices and key indicators
Unit C-4: Price statistics; Purchasing power parities; Housing statistics

Harmonised Index of Consumer Prices

Practical Guide for Processing Supermarket Scanner Data

Eurostat

September 2017

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4. References

Proceedings from:

CPI Expert Group (https://unece.org/expert-group-consumer-price-indices)

Ottawa Group (https://www.ottawagroup.org/)

UN Task Team on Scanner data

https://unstats.un.org/bigdata/task-teams/scanner/index.cshtml

Next: **CPI Expert Group Meeting 7-9 June 2023, Geneva**

https://unece.org/info/Statistics/events/372536