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An experimental index to measuring inflation in the Covid-19 pandemic[1]

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[1] This presentation was prepared for the WSC. The views expressed are those of the authors and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the event.

EUROPEAN CENTRAL BANK

EUROSYSTEM

An Experimental Index to Measuring Inflation in the COVID-19 Pandemic

July 2021

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IFC participation - 63rd ISI World Statistics Congress

Overview

Main questions:

1. **What is the magnitude of the pandemic triggered consumption changes?**
   - Could this be approximated in a timely manner?
   - How do they compare to HICP yearly weights?
2. **How does a time-varying weights price index for the EA look like?**
   - What are the challenges?
3. **And how does such an index compare to the HICP?**
   - Pre-COVID-19 and after?
4. **What are the take-away point with respect to availability of data?**

Results:

1. **We have estimated timely consumption weights using publicly available data.**
   - This data reasonably match the official HICP weights of the year after.
2. **We have constructed a time-varying weights price index for the EA.**
   - This index captures substitution only to some extent, given data limitations. Monthly re-weighting could lead to chain-drift.
3. **The index is running higher than HICP but converging.**
4. **Granularity of input data matters, the formula choice matters less.**

Overview

1. Introduction
2. **Similar exercises**
3. Methodology
4. Results
5. Take-away points

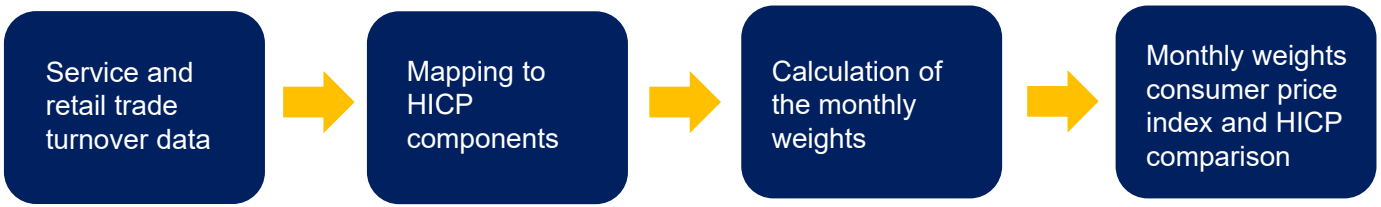
Our contribution is closely related to recent papers:

1. **Literature on (Covid-induced) changes in spending composition:**
   - Cavallo (2020) for the US, Hood and Driessen (2020) for the US, Surico et al. (2020) for the UK, Carvalho et al. (2020) for Spain.
2. **Literature on time-varying weights price indexes:**
   - Cavallo (2020) for several countries, INSEE & BdF (2020) for France, Jaravel and O'Connell (2020) for the UK, Alvarez and Lein (2020) for Switzerland, Huynh et al. (2020) for Canada, ONS (2020) experimental index for the UK.

Overview

Methodology: the steps

Stylized steps to construct a timely monthly index:

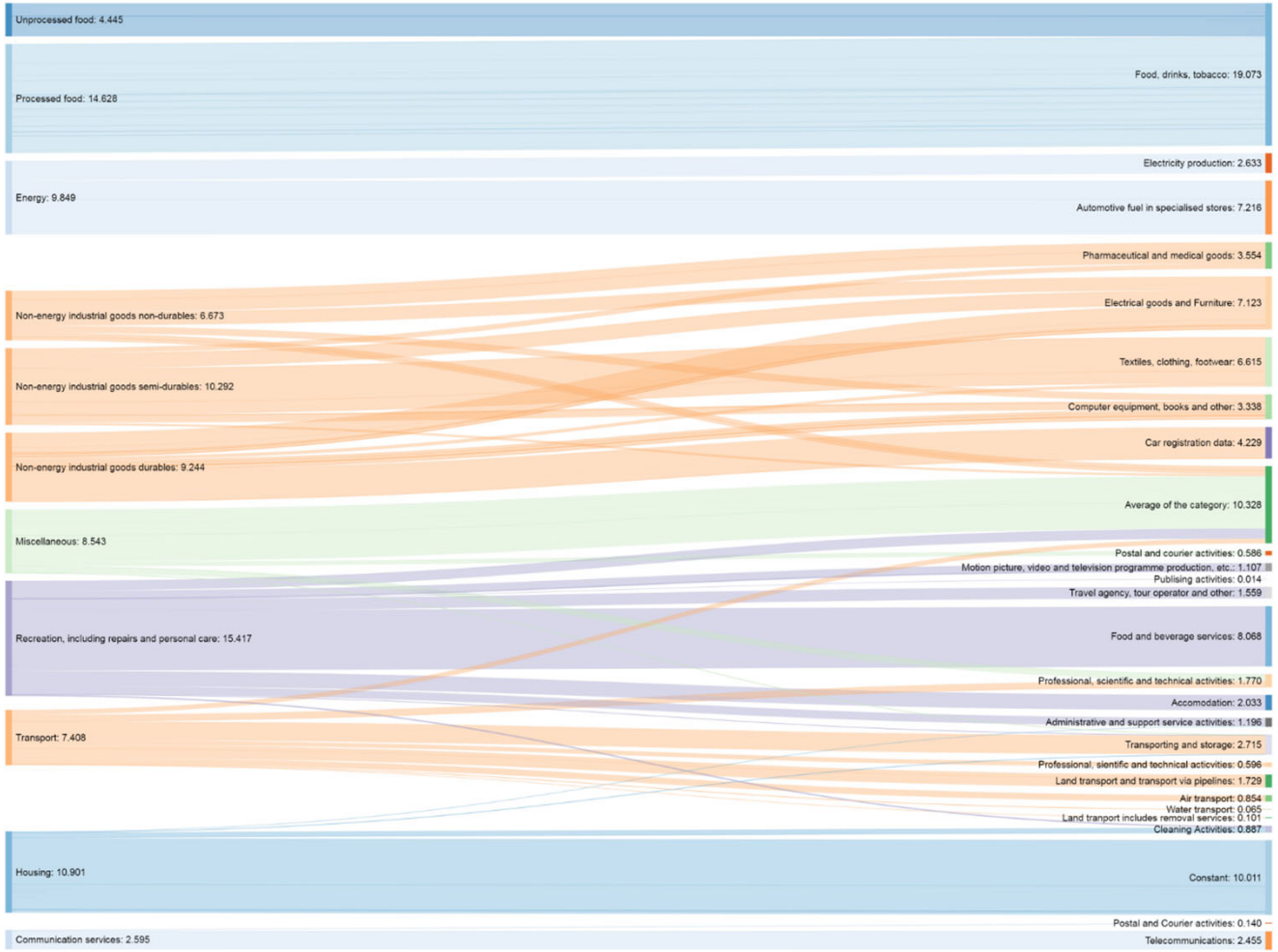


In order to construct a time-varying weights price index, 4 main steps are necessary:

1. **Identify (publicly available) data sources for consumption weights.**
   - Price data are the same of HICP (we assume same scope and coverage).
2. **Match the (publicly available) consumption data to the existing COICOP categories.**
3. **Choose the frequency of the weights update of the index (monthly?).**
4. **Choose the formula of the index (Fisher?).**

Methodology: Step 2 – Matching source data with COICOP categories

COICOP categories



Input data match (NACE Rev 2)

Summary:

Categories with granular matching: durables, semi-durables, non-durables, recreation, transport, and communication.

Categories with some detailed matching: part of miscellaneous services. The rest is assumed to grow at the same rate of the aggregate of the category.

Categories with only aggregate matching: unprocessed food, processed food, and energy.

- **Other:** nominal spending on housing services are random walked.
- **Scope and coverage:** for simplicity we have assumed the same scope and coverage of the HICP. In principle, this can be changed but non-trivial work would be required if, say, non-market prices have to be included.

Different formula options:

– Laspeyres index (Etienne Laspeyres (1871)). Used in HICP.

$$P_L = \frac{\sum(p_t \cdot q_{t-1})}{\sum(p_{t-1} \cdot q_{t-1})}$$

– Paasche index (Hermann Passche (1874)).

$$P_P = \frac{\sum(p_t \cdot q_t)}{\sum(p_{t-1} \cdot q_t)}$$

– Fisher index

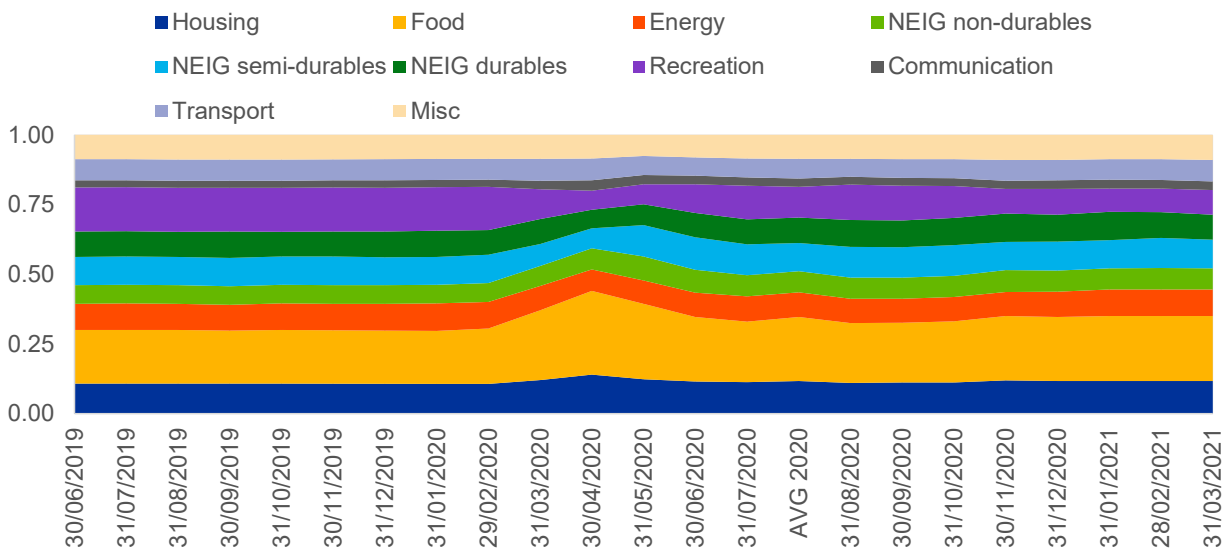
$$P_F = \sqrt{P_L \cdot P_P} = \sqrt{\frac{\sum(p_t \cdot q_{t-1})}{\sum(p_{t-1} \cdot q_{t-1})} \cdot \frac{\sum(p_t \cdot q_t)}{\sum(p_{t-1} \cdot q_t)}}$$

Note: the more frequent the weights update, the less important the choice of the formula. If weights are monthly, the difference becomes (almost) trivial.

Overview

Consumption changes during COVID-19 in the EA

Relative consumption weights
(relative percentage)



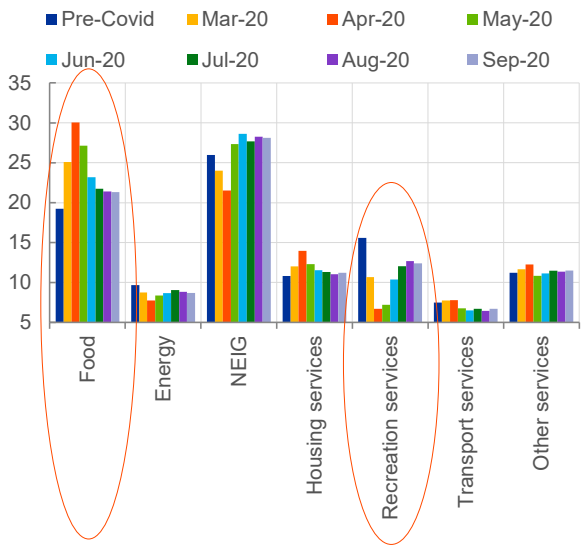
Sources: Eurostat and Author's calculations.

Note: The chart shows the weights for each category at different points in time. For each category, the weight presented is the relative weight.

Effects of current changes in consumption patterns on inflation

Consumption weights compared to pre and post COVID – in 2020

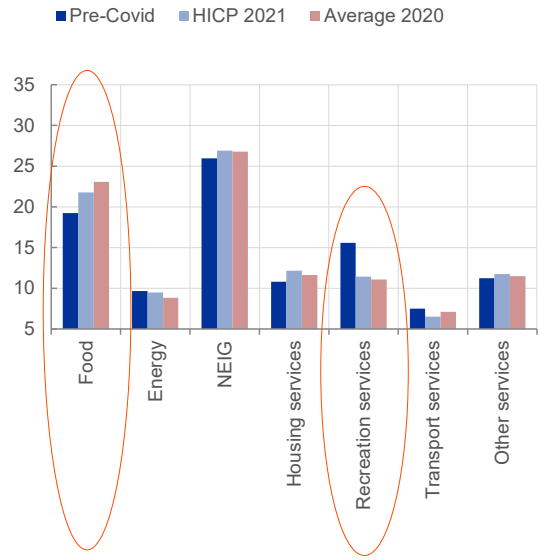
(relative percentage)



Sources: Eurostat and ECB staff calculations.
Notes: Bar show the weight relative percent.

Consumption weights compared to pre and post COVID and HICP 2021 weights

(relative percentage)

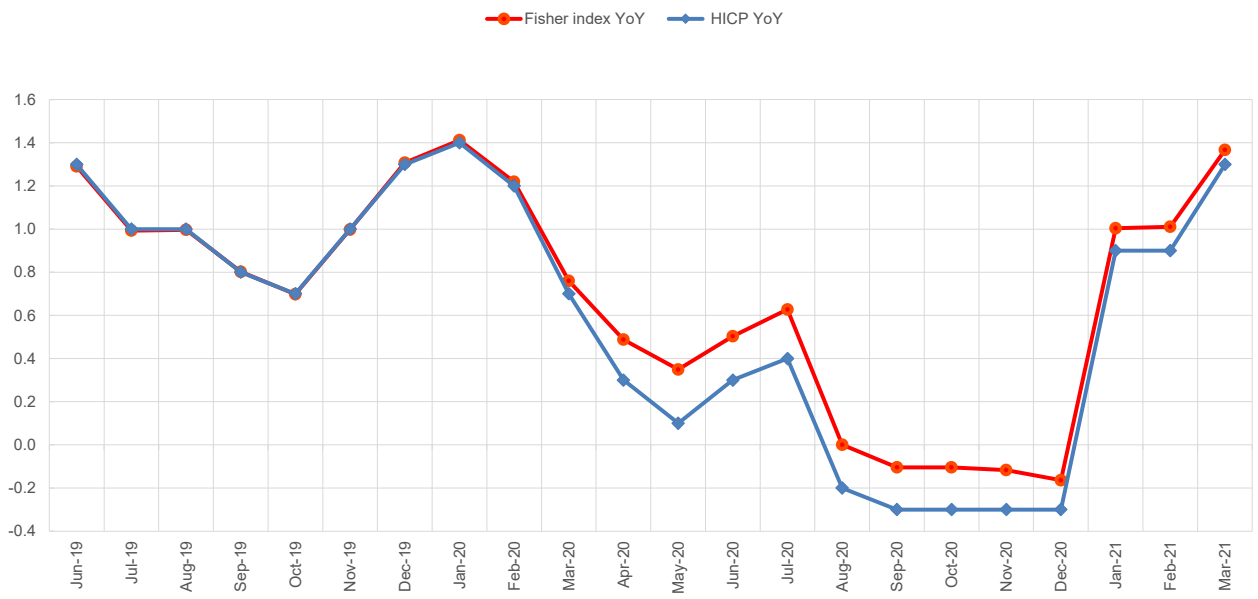


Sources: Eurostat and ECB staff calculations.
Notes: Bar show the weight relative percent.

Monthly experimental index

HICP vs Monthly weights index

(year on year changes)

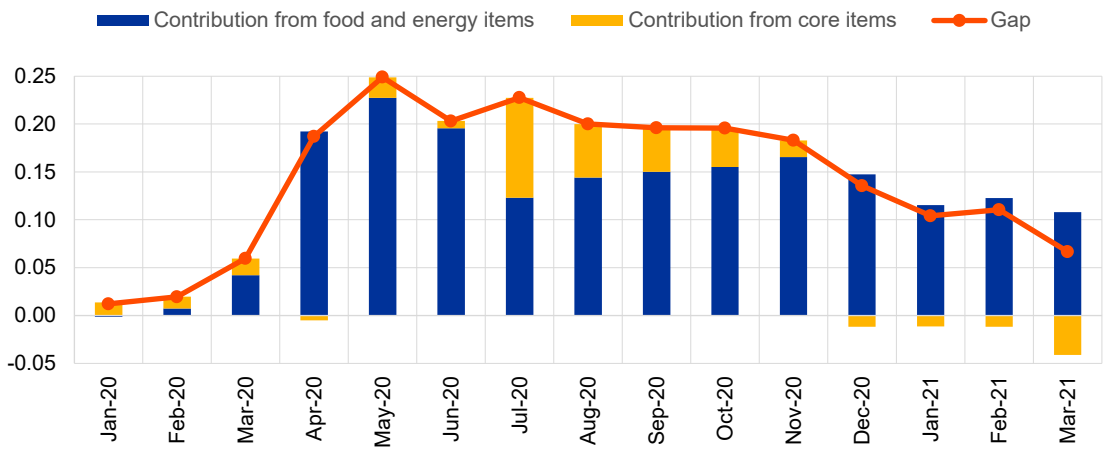


Sources: Eurostat and Author's calculations.

Monthly experimental index

Gap between HICP and the monthly weights index

(year on year changes)



Sources: Eurostat and ECB staff calculations.

Note: The line is calculated as the difference between a monthly index and published y-o-y HICP figures.

Overview

On the consumption side:

- Consumption patterns have significantly deviated post Covid-19 shock from their pre Covid-19 trend.
- Consumption patters are slowly returning to pre-COVID levels (at the aggregate categories), although spending on food remains a bit higher and spending on recreation remains low.

On the inflation side:

- The “structural” gap was about 20-25bps on YoY rates.
- Post Covid-19 shock, the gap has widened as consumption dropped for relatively higher inflation items (such as recreation services).
- The gap across food and energy remains positive but less pronounced. Overall, the gap for total inflation is currently almost zero.

Lessons learned:

- A time-varying weight (consumer) price index can be constructed (and possibly improved in the future) for the EA, despite data limitations.
- Monthly weights update can lead to chain drift.
- The formula choice for the index matters less if weights are updated frequently (monthly). However, it does play a role when weights changes are big (i.e. COVID case).
- There is a direct relationship between the granularity of input data and the magnitude of the substitution bias that can be captured.

Thank You!

Background Slides

Step 1: identify data sources for consumption weights.

In general, we can think of a (consumer) price index as divided in 2 categories (in terms of input data sources):

Goods	Services
Food	Services excluding housing
Energy	Housing services
Non-energy industrial goods	Miscellaneous services

General on data sources: a summary

- **Available data sources:**
  - **Direct measures:**
    - National accounts
      - Quarterly and COICOP 3 level
      - T+9 month reporting deadline since the last month of each year
    - Consumer survey
      - In principal every 5 years (countries could run it annually)
      - When not run annually, yearly updates using national accounts aggregates
  - **Indirect measures:**
    - Short term business statistics (STS) and other sources
      - Monthly frequency
      - 1-3 months delay

Methodology: Step 1 - Identify consumption data sources

Food and Energy

Input data based on the short term business statistics (STS) from Eurostat.
No detailed matching.

- Retail trade turnover:
  - Monthly frequency.
  - Seasonally and calendar adjusted.
  - Compiled according to classification of economic activity (NACE Rev. 2, Eurostat).
  - Fixed base year Laspeyres type volume-index.

Methodology: Step 1 - Identify consumption data sources

Non-durable / Semi-durable / Durable goods

Input data based on the short term business statistics (STS) from Eurostat. Detailed matching.

- Retail trade turnover
  - Monthly frequency.
  - Seasonally and calendar adjusted.
  - Compiled according to classification of economic activity (NACE Rev. 2, Eurostat).
  - Fixed base year Laspeyres type volume-index.

Methodology: Step 1 - Identify consumption data sources

Services excluding housing

Input data based on the short term business statistics (STS) from Eurostat. Detailed matching (except for "miscellaneous services").

- Services turnover
  - Monthly frequency.
  - Seasonally and calendar adjusted.
  - Compiled according to classification of economic activity (NACE Rev. 2, Eurostat).
  - Fixed base year Laspeyres type volume-index.

Housing services

No available information for the EA on quantities of housing services at a monthly frequency.

However, there are workarounds (also used by the BEA in the US) to deal with this data limitation.

- Solutions:
  - Develop a model (typically based on demographic trends) to forecast housing services at medium-term (near-term can be then interpolated).
  - Random walk nominal spending (pretty reasonable assumption in the short-term, given the persistency of the series).

Conceptual issues: Granularity of input data

The more granular the source data, the more substitution an index can capture. Total vs Core inflation in our exercise.

- **For total inflation:** we work at COICOP 2 level (aggregate 11 categories)
  - **Reason:** there are no granular data for food and energy. HICP weights are effectively used until that level.
  - **Implication:** Only very large swifts between aggregate categories can be captured by the index.

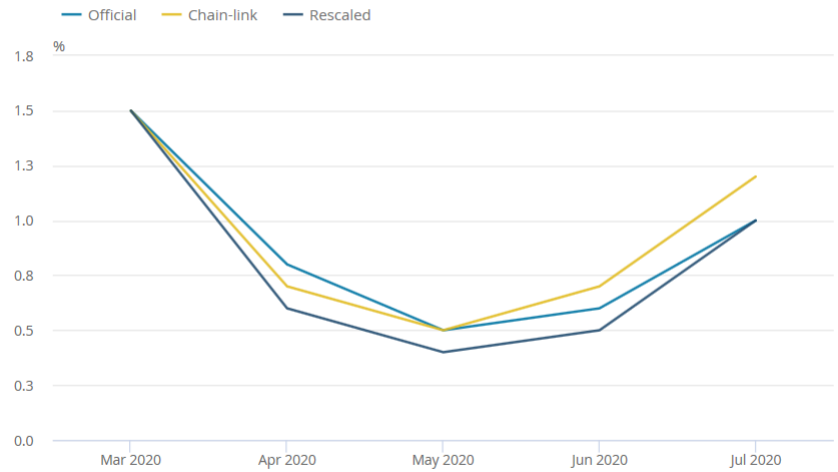
- **For core inflation:** we **could** work at COICOP 5 level
  - **Reason:** we do have more granular data (plus some reasonable assumptions for the missing COICOP 5 level categories for which we do not have a 1:1 match).
  - **Implication:** The index runs lower than HICP (similar to PCE for the US) because we capture more substitution.

ONS results

ONS showed that both, a chained-linked and a re-scaled index were/are running lower than official CPI for the UK.

Figure 1: 12-month growth rates of the rescaled basket of CPIH have consistently been lower than the chain-linked official rate

12-month growth rates of CPIH official, chain-linked and rescaled, UK, March 2020 to July 2020

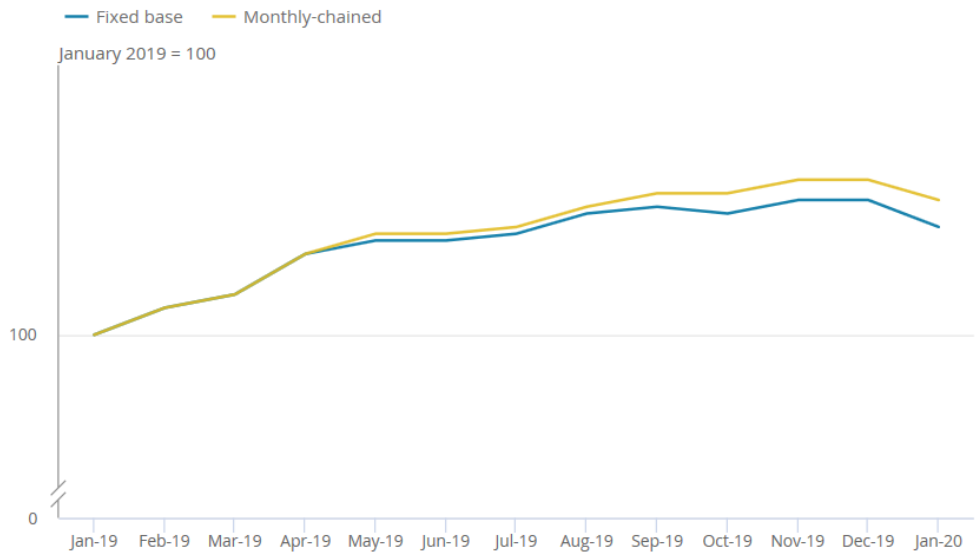


Source: Office for National Statistics – Consumer Prices Index including owner occupiers' housing costs

Chain drift bias.

Figure 4: Over time, the difference between the fixed base and monthly-chained index grows because of chain drift

Comparison of a fixed base index and a monthly chained index, UK, January 2019 to January 2020



Cavallo (2020) – (Paasche?)-type CPI index

Cavallo (2020) estimates a “Covid CPI” for several countries (includ

	Monthly Inflation		Annual Inflation	
Country	CPI	Covid CPI	CPI	Covid CPI
Argentina	1.74	1.91	44.67	45.10
Brazil	-0.28	0.20	2.10	2.76
Canada	-0.63	-0.36	0.08	0.54
Chile	-0.14	0.06	3.32	3.66
France	-0.01	0.23	0.53	0.87
Japan	-0.07	0.08	0.08	0.21
Korea	-0.63	-0.44	-0.02	0.33
Spain	0.39	0.48	0.00	0.01
Turkey	0.78	1.08	11.02	11.59
Uruguay	2.06	2.72	10.80	11.56
US	-0.69	-0.09	0.35	1.06
Germany	0.55	0.46	0.89	0.80
Greece	-0.14	-0.11	0.02	-0.26
Ireland	-0.42	-0.50	-0.35	-0.59
Italy	0.42	0.22	1.25	0.76
Netherlands	0.93	0.51	1.11	0.77
UK	-0.19	-0.28	0.87	0.81

Table 5: CPI and Covid Inflation Rates in April 2020

Notes: The top panel shows countries where the Covid inflation is higher than the fixed-basket CPI. The bottom panel shows countries where the Covid inflation is lower than the fixed-basket CPI. Covid inflation rates are constructed using official CPI weights in each country updated by the relative changes across categories observed in US data. Details on the incidence of CPI categories on the monthly inflation rate in each country are shown in the Appendix.

Cavallo (2020)

Cavallo (2020) argues that “Covid CPI” is running higher (in US) because household have been spending proportionally more

inflati

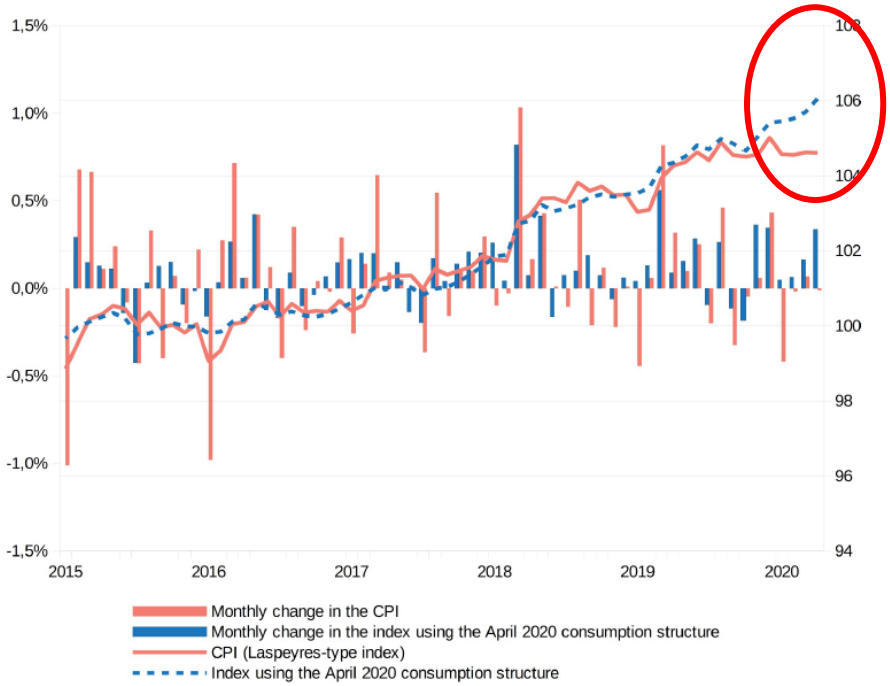
CPI Category	Monthly CPI Inflation	Weight CPI	Weight Covid CPI	Incidence CPI	Incidence Covid CPI
Food at Home	2.67	7.58	11.28	0.20	0.30
Alcoholic Beverages	0.30	1.02	1.52	0.00	0.00
Apparel	-4.38	2.81	2.20	-0.12	-0.10
Housing	-0.03	42.11	55.80	-0.01	-0.02
Medical Care	0.28	8.83	5.60	0.02	0.02
Transportation	-4.97	15.74	6.25	-0.78	-0.31
Recreation	-0.27	5.82	2.23	-0.02	-0.01
Education and Communication	0.13	6.77	8.97	0.01	0.01
Food Away from Home	0.15	6.19	3.13	0.01	0.00
Other Goods and Services	-0.04	3.13	3.03	0.00	0.00

Table 3: US CPI Weights and Incidence - April 2020

Notes: The CPI weight is the share of expenditure in a given category over total expenditures. Note that categories that experience no change in spending over time can have higher Covid weights as a share of the decreasing total expenditure basket. The incidence is the monthly inflation rate multiplied by the weight. The sum of all the category incidence numbers is equal to the monthly inflation rate.

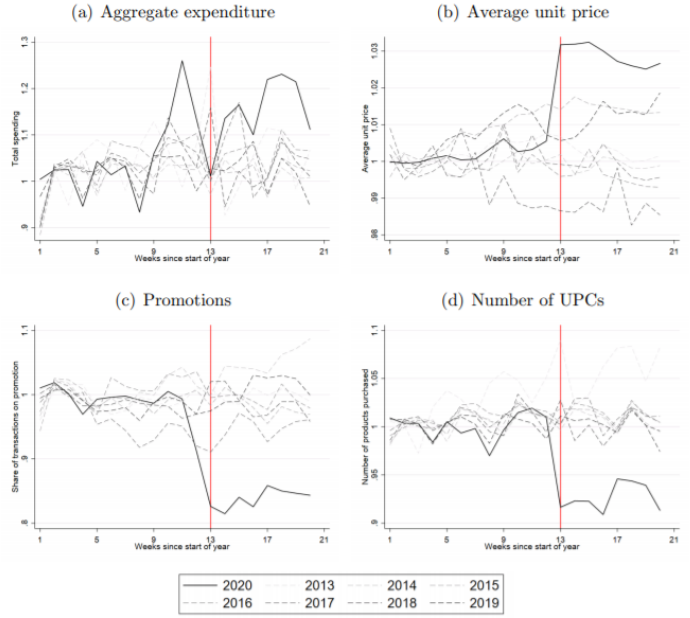
INSEE: “Paasche-type CPI” using the April 2020 consumption structure.

Figure 1 : The Consumer Price Index and an alternative index using the consumption structure observend in April 2020



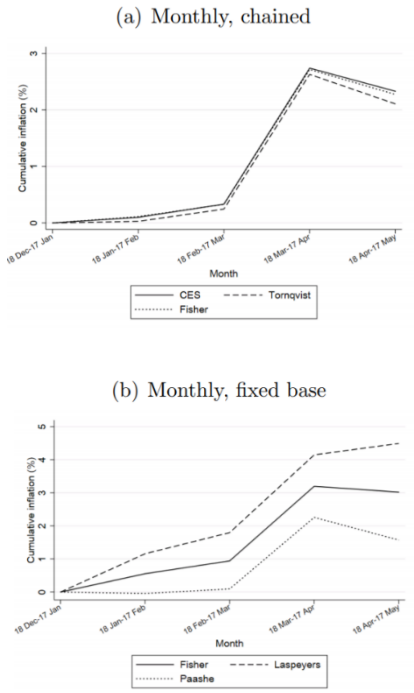
Jaravel and O'Connell (2020)

Figure 1: *Stylized Facts*



Notes: Panel (a) shows total expenditure, panel (b) average unit price, panel (c) shows the share of transactions that involve a price or quantity promotion and panel (d) shows the number of unique UPCs purchased, in each of the first 20 weeks of the year. Panel (b) conditions on UPCs purchased in all weeks (which account for around 77% of total expenditure). In each case the line is normalized by the mean value in the first four weeks. The red vertical line denotes the first week of lockdown.

Figure A2: *Aggregate Inflation in 2020, different indices*



Imputation: larger need for imputation during pandemic