

# Inflation with Covid Consumption Baskets

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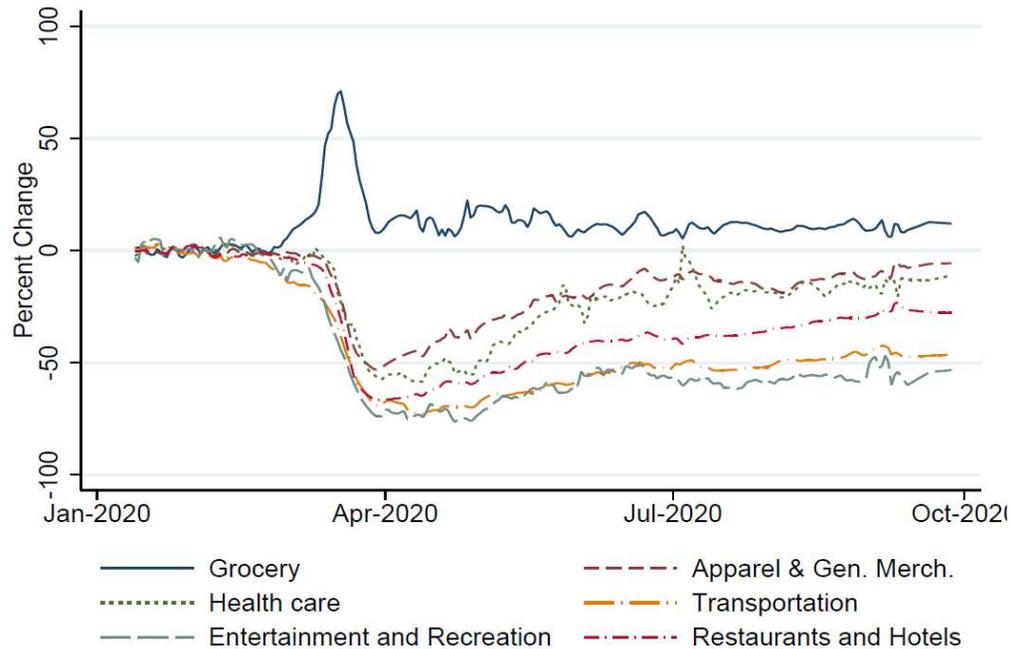
## Motivation

- Consumer Price Indices (CPIs) measure the price of a fixed basket of goods and services over time
- In most countries, this basket is updated once a year with data collected using expenditure surveys with a lag
  - In the US the basket weights were last updated in December 2019 with data collected in 2017-2018
- This could severely bias inflation estimates during the Pandemic
  - Diewert & Fox (2020), Soloveichik (2020)
  - Tenreyro (2020), Lane (2020)
  - Reinsdorf (2020)

## Summary of Results

- Covid-basket inflation is higher than the official US CPI
  - Impact is largest in the first 3 months of the Pandemic
  - By May, over 0.8% more inflation than measured by the CPI
- The reason is that people were consuming more food (inflation) and less transportation and recreation (deflation)
  - Inflation is highest for low-income households
- Similar result for Core inflation → less weight on some non-energy transportation subsectors experiencing deflation
- Similar results in 12 out of 19 other countries
  - Direction of the bias depends on weights + sectoral inflation dynamics

# US Consumption patterns have changed dramatically during Covid



(a) Consumer Spending (Opportunity Insights)

[www.tracktherecovery.org](http://www.tracktherecovery.org)

- Expenditure change computed by OI from US credit and debit card transactions
- Similar patterns in other countries / papers
  - Carvalho et al (2020)
  - Baker et al (2020)
  - Andersen et al (2020)
  - Coibion et al (2020)

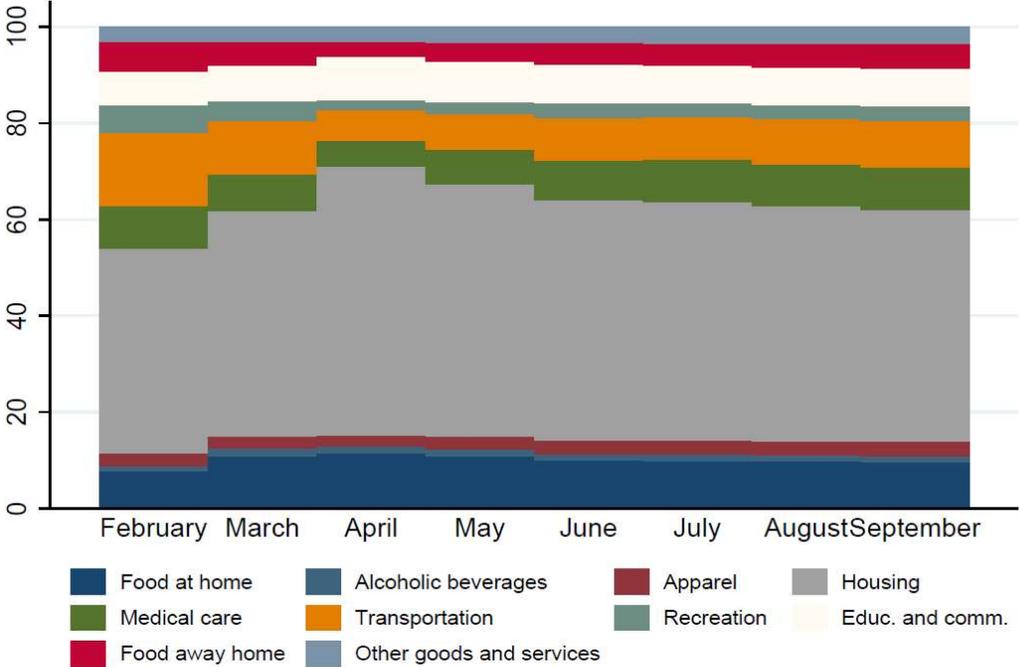
## Matching CPI Categories

US CPI Category	OI Expenditure Category	OI Expenditure Change (April 2020 monthly average)
Food at Home	Grocery	12.3
Alcoholic Beverages*	Grocery	12.3
Apparel	Apparel and General Merchandise	-41.0
Housing**	-	0.0
Medical Care	Health Care	-52.2
Transportation	Transportation	-70.1
Recreation	Entertainment and Recreation	-71.1
Education and communication**	-	0.0
Food Away from Home	Restaurants and Hotels	-61.9
Other Goods and Services***	Total	-26.8

Table A1: Matching US CPI and Expenditure Categories

Notes: \*Assumes the same expenditure change as “Groceries”. \*\*Assumes no change in expenditures. \*\*\*Assumes the same change as the total expenditure.

# Covid Consumption Weights



$$s_t^i = \frac{P_t^i Q_t^i}{\sum_i P_t^i Q_t^i} = \frac{s_0^i \Delta e^i}{\sum_i s_0^i \Delta e^i}$$

(b) Covid Basket Weights

# The US Covid Basket    April 2020

CPI Category	Monthly CPI Inflation	Changes in weights		Incidence	
		Weight CPI	Weight Covid CPI	CPI	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

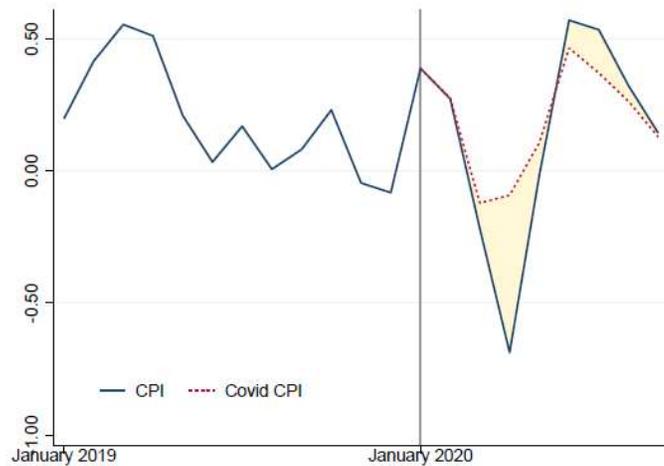
Divergence  
in inflation



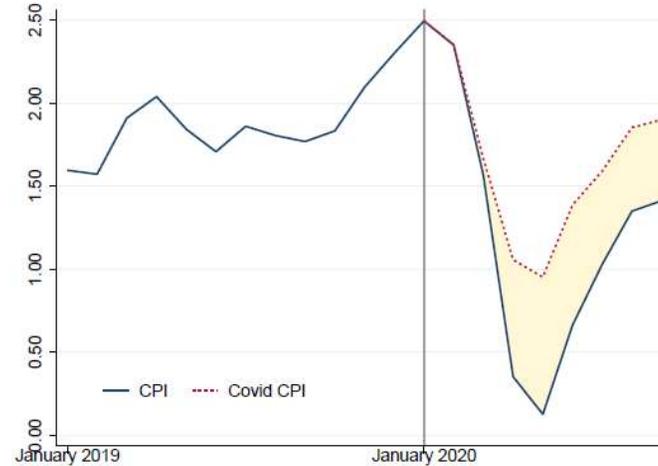
Table 2: US CPI Weights and Incidence - April 2020

- More weight on food, a sector experiencing more inflation
- Less weight on transportation, a sector experiencing significant deflation

## Impact on US Headline



(a) Monthly Inflation Rate (%)



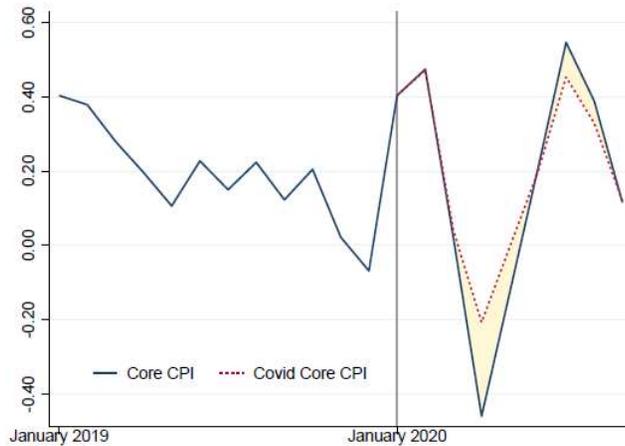
(b) Annual Inflation Rate (%)

Figure 2: US Inflation During the Covid Pandemic

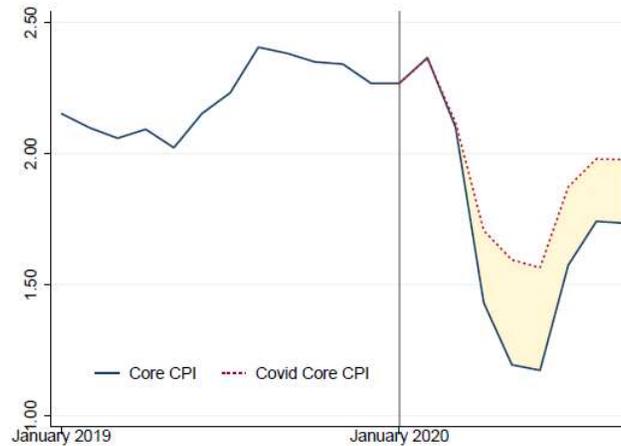
Notes: These graphs show the all-items, US city average, not seasonally adjusted CPI, and an equivalent index constructed using estimates of the consumption expenditure shares under lockdown.

- March-May → Covid inflation was much higher → by May, over 0.8% more annual inflation than measured by the CPI
- June August → bias reverses direction, but accumulated difference remains at 0.5%

## Impact on US Core



(a) Monthly Inflation Rate (%)



(b) Annual Inflation Rate (%)

Figure 3: US Core Inflation During the Covid Pandemic

Notes: These graphs show the all-items less food and energy, US city average, not seasonally adjusted CPI and an equivalent index constructed using estimates of the consumption expenditure shares under lockdown.

- Covid Core inflation → less weight on some non-energy transportation and recreation sectors experiencing deflation

## PCE Core

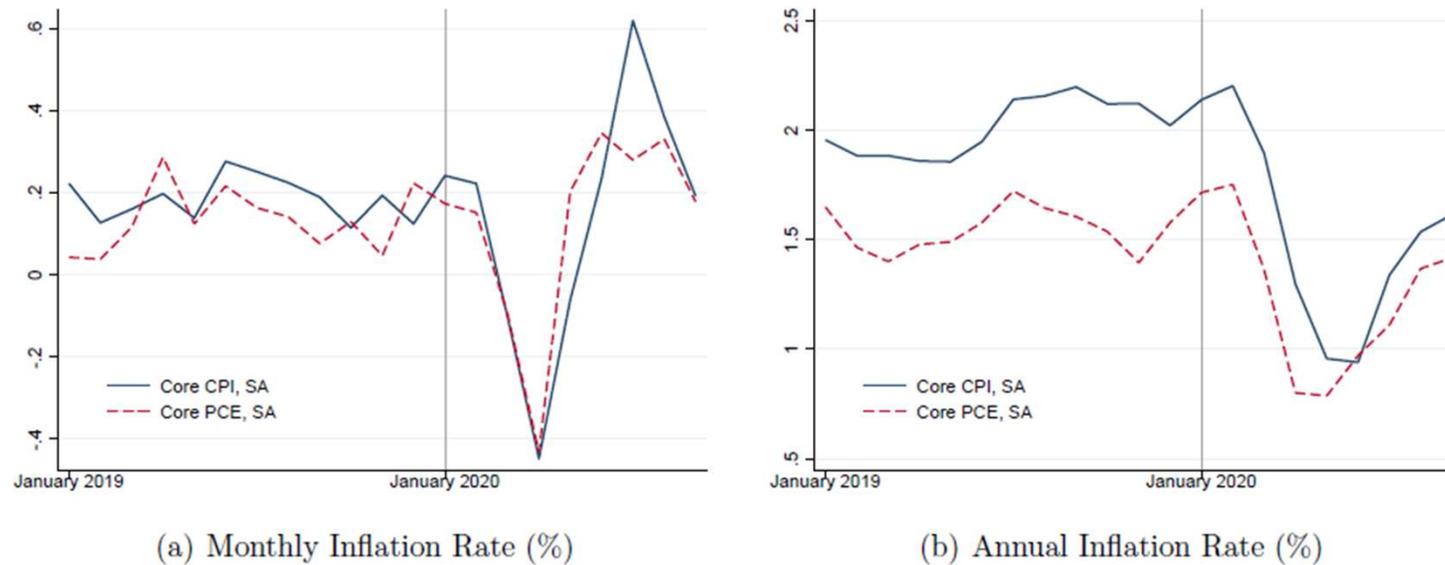


Figure 4: US Core CPI and Core PCE

Notes: The PCE Core Index is published by the Bureau of Economic Analysis (BEA) with seasonal adjustments. For comparison purposes, the Core CPI shown here is also the seasonally-adjusted version.

- PCE Core does not seem to have adjusted in the first quarter after the Pandemic

## Covid Inflation by Income Levels

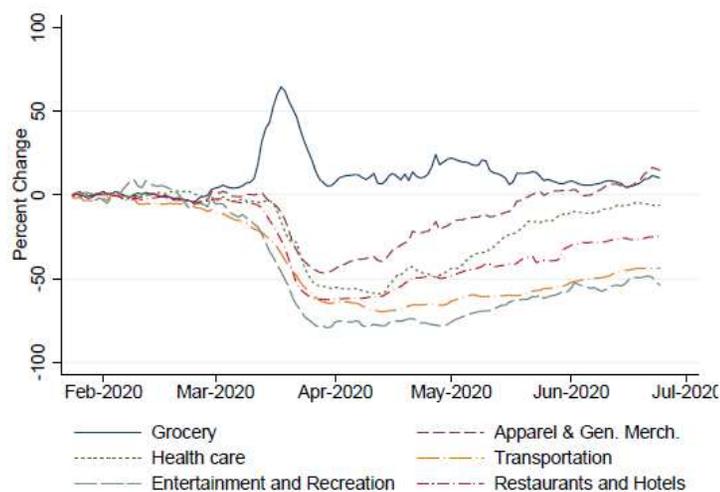
- I use the 2018 BLS CEX survey to build CPI weights for the lowest and highest income quintiles

Category	CPI	Low Income	High Income
Food at home	7.58	10.84	7.20
Alcoholic beverages	1.02	0.63	1.39
Apparel	2.81	2.95	3.91
Housing	42.11	42.11	37.75
Medical care	8.83	9.89	8.33
Transportation	15.74	14.84	19.57
Recreation	5.82	5.47	6.94
Education and communication	6.77	3.37	4.29
Food away from home	6.19	5.58	6.94
Other goods and services	3.13	4.32	3.66

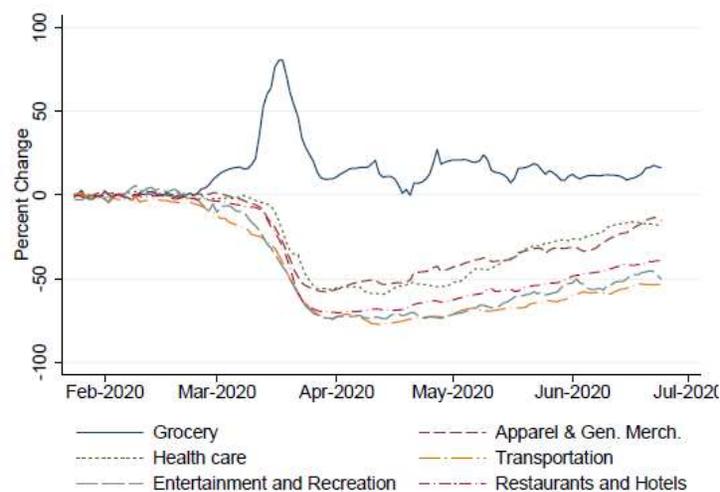
Table 2: CPI Basket Weights by Income Group (%)

## Covid Inflation by Income Levels

- I update income-specific weights with daily OI expenditure data across sectors for the same quintiles



(a) Low Income



(b) High Income

Figure A2: Changes in US Consumer Spending, by Income Level

## Covid Inflation by Income Levels

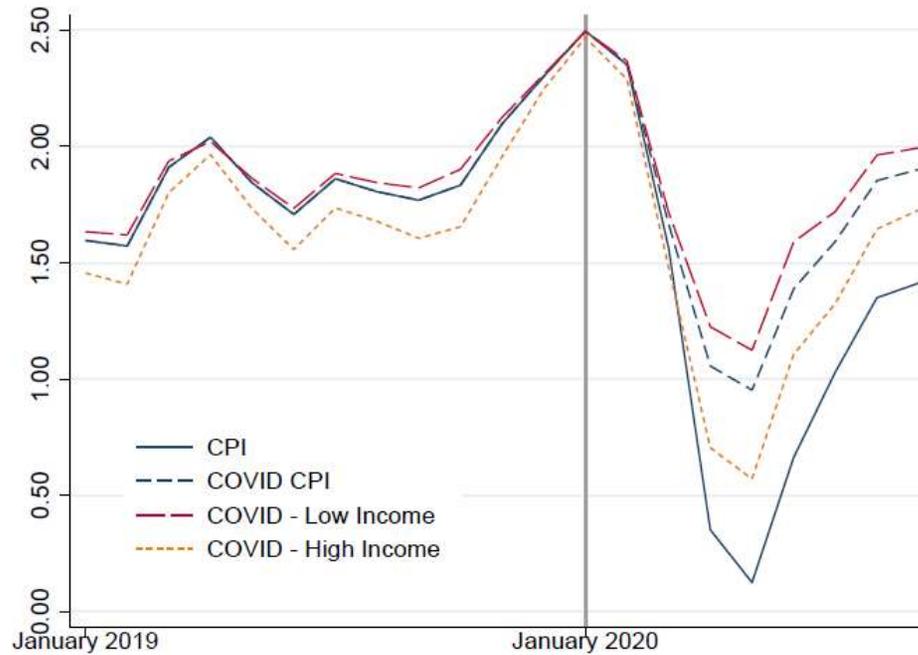


Figure 5: US Annual Inflation with Covid Expenditure Baskets

- Covid inflation is higher for low-income households → spend relatively more on food and less on transportation

## Covid inflation is higher in many other countries

- I update official CPI weights in 19 other countries → using Carvalho et al (2020) Spanish data for European countries, and Opportunity Insights US data for the rest.

Country	Annual Inflation (12-month change, %)		Difference
	CPI	Covid CPI	
Brazil	2.30	3.19	0.89
Uruguay	9.83	10.48	0.65
Chile	2.33	2.90	0.58
US	1.35	1.85	0.50
Southafrica	2.98	3.37	0.39
Korea	0.66	0.96	0.30
France	0.30	0.52	0.22
Colombia	1.82	2.02	0.20
Japan	0.31	0.50	0.19
Spain	-0.02	0.16	0.18
Canada	0.10	0.20	0.10
Russia	3.57	3.67	0.10
UK	0.31	0.37	0.06
Greece	-1.31	-1.40	-0.10
Argentina	41.22	41.07	-0.15
Ireland	-1.14	-1.46	-0.31
Italy	0.65	0.28	-0.36
Turkey	10.94	10.55	-0.39
Netherlands	0.41	-0.24	-0.65
Germany	-0.05	-0.74	-0.70

Table 3: CPI and Covid Inflation in August 2020

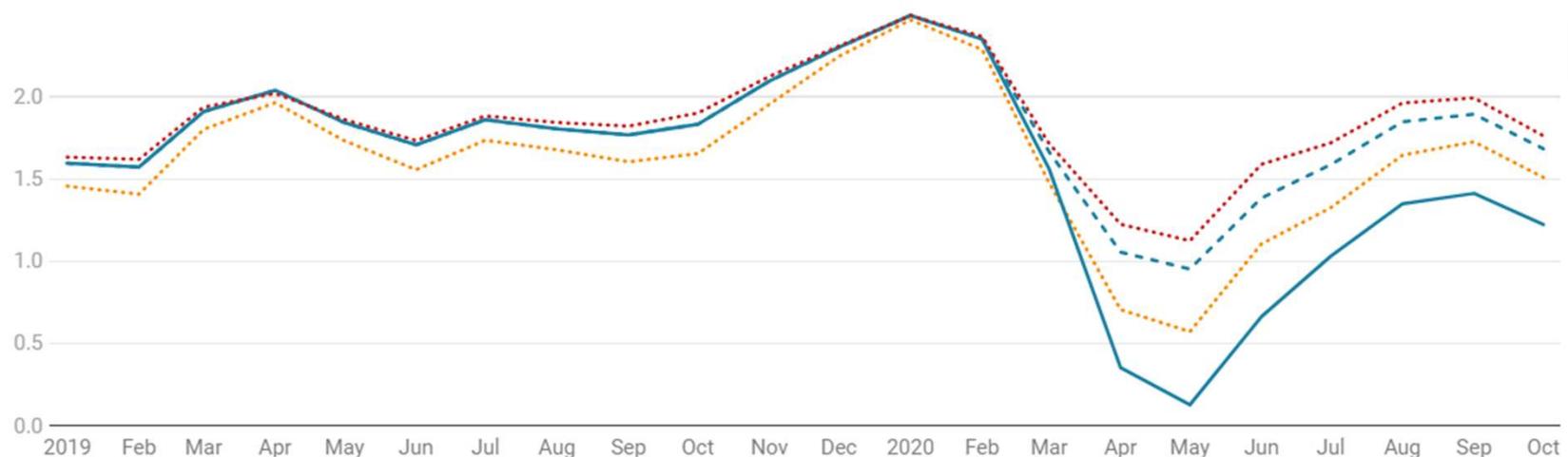
- Higher Covid inflation in 12 countries
  - Similar reasons: more food inflation, less transportation deflation (see appendix)
- Direction and size of the bias depends on weights + the behavior of sectoral inflation rates

## Live Results Online

- Updated results in <https://projects.iq.harvard.edu/covid-cpi>
- All data and code are also there → can be used to extend analysis to other countries

### US Covid Inflation (All-items, 12-month changes)

— CPI — Covid CPI — Covid - High Income — Covid - Low Income



Note: The high-income and low-income series are not updated in real time because the data from opportunityinsights.org required to construct them are not publicly available.

Source: Cavallo (2020) Inflation with Covid Consumption Baskets • Get the data • Created with Datawrapper

## Concluding Remarks

- Cost of living has risen faster than the CPI suggests during the Pandemic
  - Particularly for low-income households, who consume relatively more food
- Bias depend on changes in weights + divergence in sectoral rates → temporary?
- Results go against traditional CPI substitution bias (i.e. Laspeyres CPI tends to overestimate inflation) → no substitution with Pandemic? → large demand shocks / inelastic demand?
- Results help explain recent spike in consumer inflation expectations
  - Growing literature documents how consumers use their personal shopping experience to form expectations (Bruin et al (2011), Cavallo et al (2017), D Acunto et al (2019))



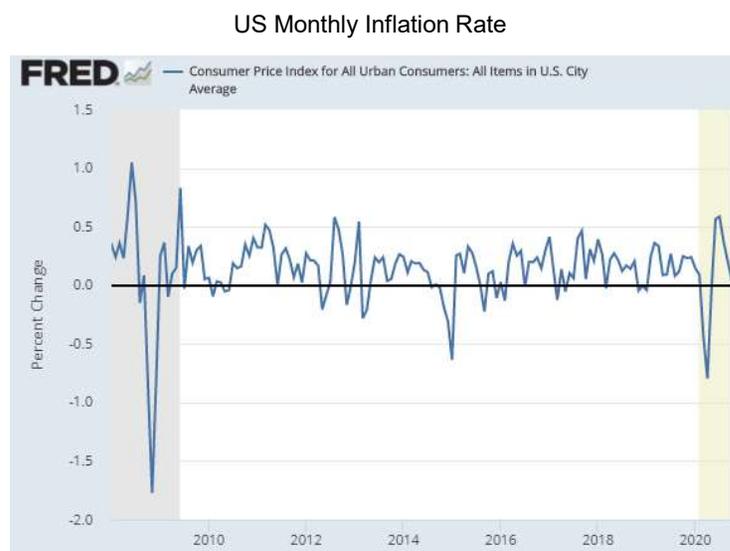
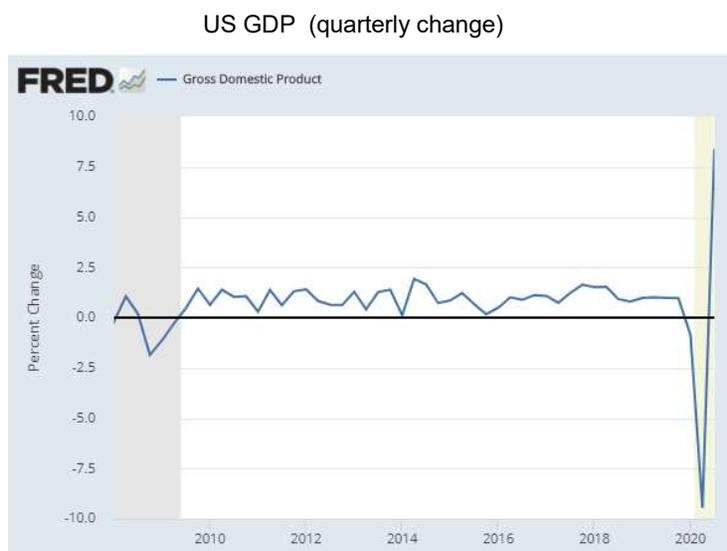
FEDERAL RESERVE BANK of NEW YORK

### Inflation Expectations Move Higher at the One- and Three-Year Horizons

The year-ahead median inflation expectation increased to 2.9 percent in July, from 2.7 percent in June, a level above its twelve-month trailing average of 2.5 percent. Similarly, the three-year-ahead median inflation expectation rose to 2.7 percent in July, from 2.5 percent in June. Respondents below age 40 drove the increase at both horizons. The measure of disagreement (the difference between the 75th and 25th percentiles of inflation expectations) also increased at both horizons in July.

## Concluding Remarks

- Covid dynamics: output collapsed but inflation remained relatively stable



- This paper → inflation is even more resilient when we take into account changes in consumption patterns
- Cavallo & Kryvtsov (2020) → Supply disruptions (stockouts) are affecting inflation dynamics in this crisis

# Appendix

## Category Matching - US

US CPI Category	OI Expenditure Category	OI Expenditure Change (April 2020 monthly average)
Food at Home	Grocery	12.3
Alcoholic Beverages	Grocery	12.3
Apparel	Apparel and General Merchandise	-41.0
Housing*	-	0.0
Medical Care	Health Care	-52.2
Transportation	Transportation	-70.1
Recreation	Entertainment and Recreation	-71.1
Education and communication*	-	0.0
Food Away from Home	Restaurants and Hotels	-61.9
Other Goods and Services**	Total	-26.8

Table A1: Matching US CPI and Expenditure Categories

Notes: \*Assumes no change in expenditures. \*\*Assumes the same change as the total expenditure.

## Category Matching - COICOP

COICOP Code	COICOP Category	OI Expenditure Category	OI Expenditure Change (April 2020 monthly average)
100	Food and Non-Alcoholic Beverages	Grocery	12.3
200	Alcoholic Beverages and Tobacco	Grocery	12.3
300	Clothing and Footwear	Apparel and General Merchandise	-41.0
400	Housing, Water, Electricity, Gas and other Fuels	-	0.0
500	Furnishings, Household Equip. and Maint. of the House	Total	-26.8
600	Health	Health Care	-52.2
700	Transport	Transportation	-70.1
800	Communications	-	0.0
900	Recreation and Culture	Entertainment and Recreation	-71.1
1000	Education	-	0.0
1100	Restaurants and Hotels	Restaurants and Hotels	-61.9
1200	Miscellaneous Goods and Services	Total	-26.8

Table A6: Matching CPI and Expenditure Categories in other Countries

## Headline CPI

	Monthly Inflation Rate (1-month change, %)		Annual Inflation Rate (12-month change, %)	
	CPI	Covid CPI	CPI	Covid CPI
January	0.39	0.39	2.50	2.50
February	0.27	0.28	2.35	2.35
March	-0.22	-0.12	1.56	1.67
April	-0.69	-0.09	0.35	1.05
May	-0.02	0.11	0.13	0.95
June	0.57	0.46	0.66	1.39
July	0.53	0.37	1.03	1.59
August	0.32	0.26	1.35	1.85
September	0.14	0.13	1.41	1.90

Table A2: US Inflation During the Covid Pandemic

Notes: This table shows the monthly and annual inflation rate in the all-items, US city average, not seasonally adjusted CPI, and an equivalent index constructed using estimates of the consumption expenditure shares during the Covid Pandemic.

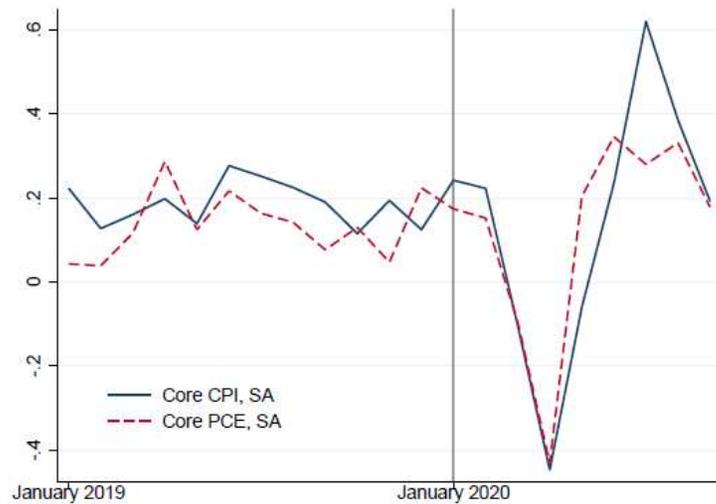
## Core CPI

	Monthly Inflation Rate (1-month change, %)		Annual Inflation Rate (12-month change, %)	
	Core CPI	Covid Core CPI	Core CPI	Covid Core CPI
January	0.40	0.40	2.27	2.27
February	0.47	0.47	2.37	2.36
March	0.02	0.04	2.10	2.12
April	-0.46	-0.21	1.43	1.71
May	-0.13	0.00	1.20	1.60
June	0.21	0.20	1.18	1.57
July	0.55	0.45	1.58	1.87
August	0.39	0.33	1.74	1.98
September	0.12	0.12	1.74	1.98

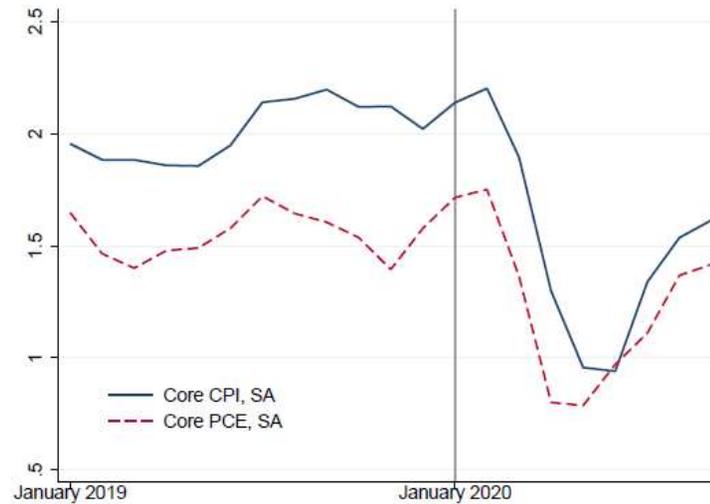
Table A4: US Core Inflation Rates During the Covid Pandemic

Notes: This table shows the monthly and annual inflation rate in the all-items less food and energy, US city average, not seasonally adjusted CPI and an equivalent index constructed using estimates of the consumption expenditure shares during the Covid Pandemic.

# PCE Core



(a) Monthly Inflation Rate (%)



(b) Annual Inflation Rate (%)

Figure 4: US Core CPI and Core PCE

Notes: The PCE Core Index is published by the Bureau of Economic Analysis (BEA) with seasonal adjustments. For comparison purposes, the Core CPI shown here is also the seasonally-adjusted version.

# Income Levels Fixed vs Covid

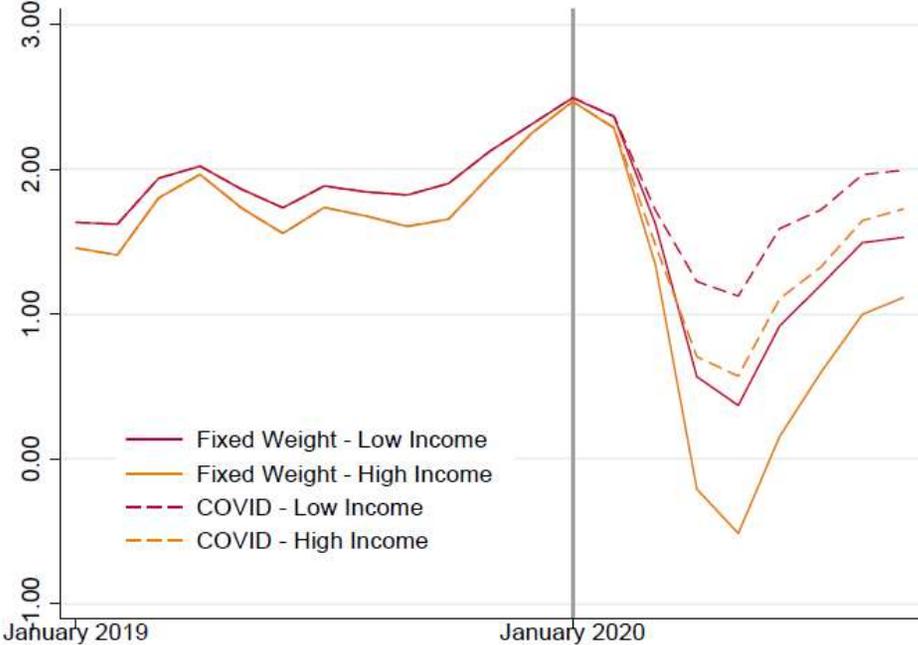


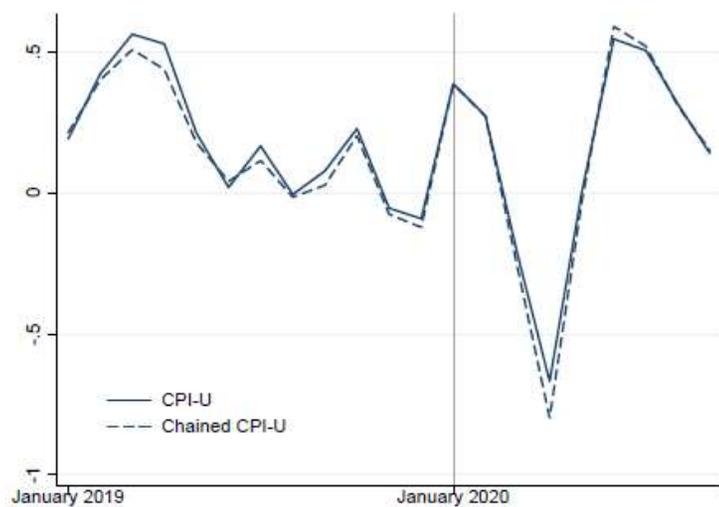
Figure A3: US Annual Inflation by Income, with Fixed and Covid Weights

# US Core Details April 2020

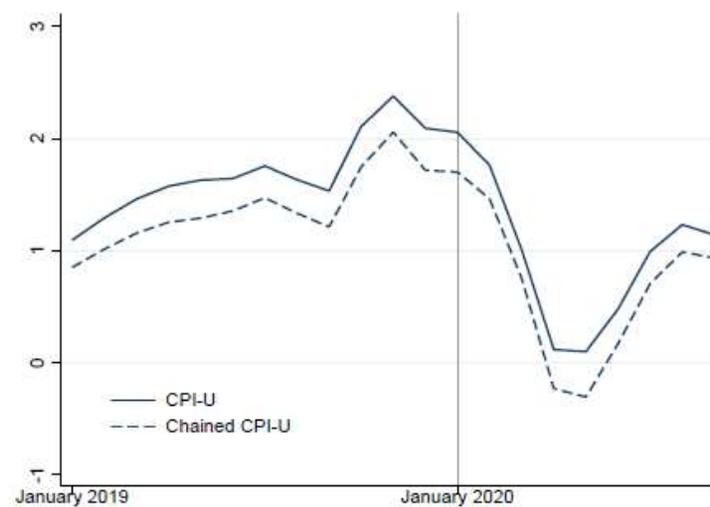
Table A3: US Core - Weight and Incidence in April 2020

CPI Series	Expenditure Change (vs December 2019, %)	CPI Monthly Inflation Rate (4/2020, %)	CPI weight (%)	Covid CPI weight (%)	CPI Incidence	Covid CPI Incidence	Additional Incidence
Alcoholic beverages	12.89	.3	1.02	1.93	0	.01	0
Apparel	-42.54	-4.38	2.81	2.69	-.12	-.12	.01
Household furnishings and operations	0	.4	4.6	7.67	.02	.03	.01
Shelter	0	-.03	33.16	55.3	-.01	-.02	-.01
Water and sewer and trash collection services	0	.13	1.08	1.81	0	0	0
Medical care	-54.12	.28	8.83	6.76	.02	.02	-.01
Motor vehicle fees	-69.97	-1.06	.57	.29	-.01	0	0
Motor vehicle insurance	-69.97	-7.7	1.7	.85	-.13	-.07	.07
Motor vehicle maintenance and repair	-69.97	.08	1.08	.54	0	0	0
Motor vehicle parts and equipment	-69.97	-.53	.4	.2	0	0	0
New and used motor vehicles	-69.97	-.54	7.28	3.64	-.04	-.02	.02
Public transportation	-69.97	-7.39	1.27	.64	-.09	-.05	.05
Recreation	-72.98	-.27	5.82	2.62	-.02	-.01	.01
Education and communication	0	.13	6.77	11.29	.01	.01	.01
Other goods and services	-27.64	-.04	3.13	3.77	0	0	0

# US Chained CPI



(a) Monthly Inflation Rate (%)

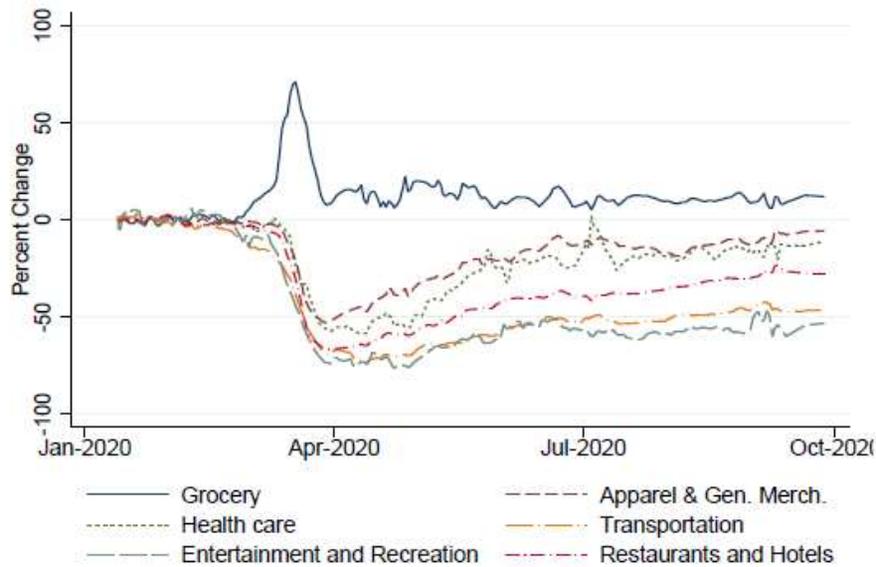


(b) Annual Inflation Rate (%)

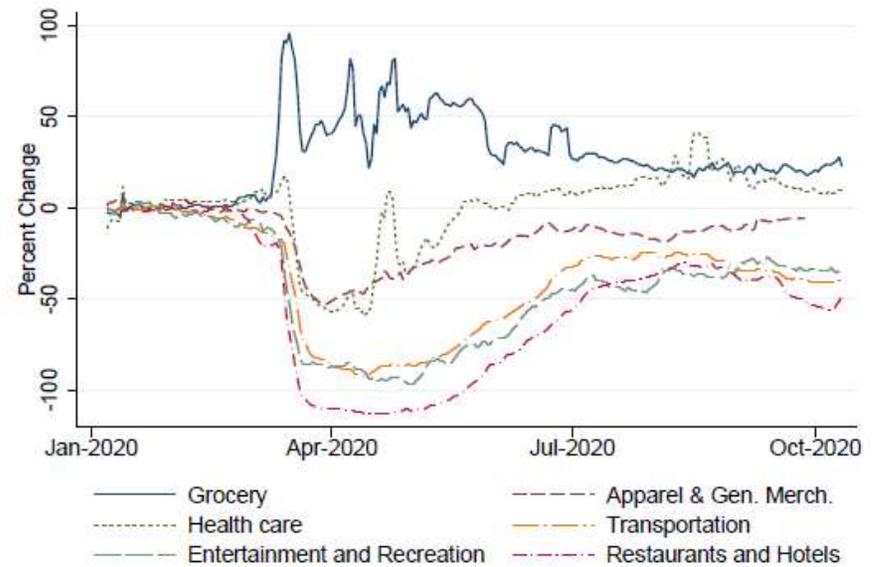
Figure A1: US CPI and Chained CPI

Notes: These series are not seasonally adjusted to match the CPI indices used in the main results of the paper. The vertical gray lines mark the start of the Covid Pandemic in January 2020.

# Covid Spending Patterns US vs Spain



(a) Covid Spending in the US (Opportunity Insights)



(b) Covid Spending in Spain (BBVA Research)

Figure A4: Covid Consumer Spending in the US and Spain

Notes: Figure (a) shows the expenditure change across categories of goods and services in the US. These estimates are computed by Chetty et al. (2020) using data collected from credit and debit card transactions, and are publicly available at the Opportunity Insights (OI) Track the Recovery website ([tracktherecovery.org](http://tracktherecovery.org)). Figure (b) shows the expenditure change across categories of goods and services in Spain. These estimates are computed by Carvalho et al. (2020) also from data collected from credit and debit card transactions, and are publicly available at the BBVA Research website ([www.bbva.com/en/special-section/charts/](http://www.bbva.com/en/special-section/charts/)).

# Other Countries

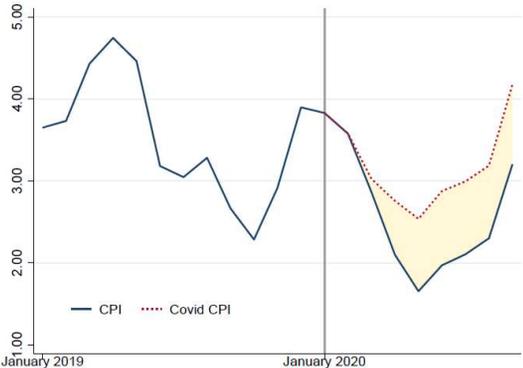


Figure A6: Annual CPI Inflation with Covid Basket Weights - Brazil

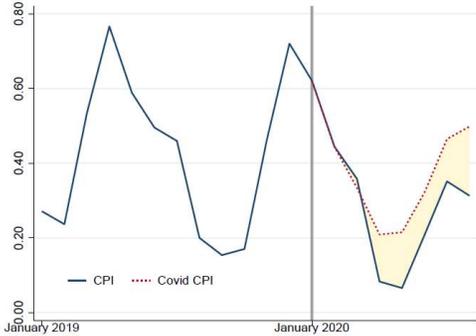


Figure A15: Annual CPI Inflation with Covid Basket Weights - Japan

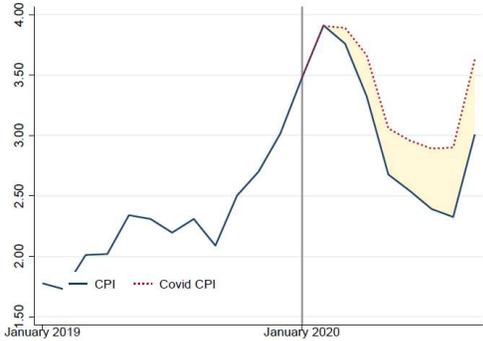


Figure A8: Annual CPI Inflation with Covid Basket Weights - Chile

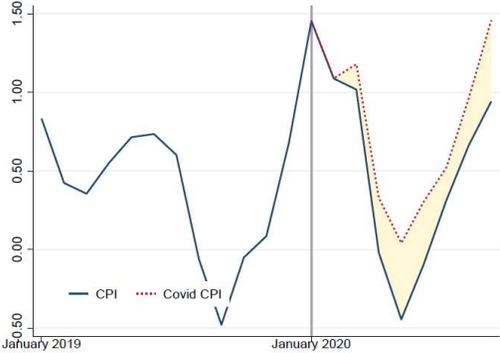


Figure A16: Annual CPI Inflation with Covid Basket Weights - Korea

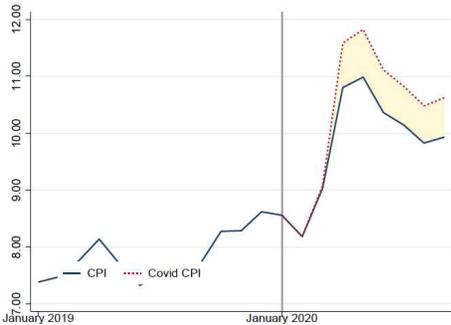


Figure A22: Annual CPI Inflation with Covid Basket Weights - Uruguay