INFLATION WITH COVID CONSUMPTION BASKETS

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ABSTRACT

The Covid-19 Pandemic has led to changes in consumer expenditure patterns that can introduce significant bias in the measurement of inflation. I use data collected from credit and debit transactions in the US to update the official basket weights and estimate the impact on the Consumer Price Index (CPI). I find that the Covid inflation rate is higher than the official CPI in the US, for both headline and core indices. I also find similar results with Covid baskets in 10 out of 16 additional countries. The difference is significant and growing over time, as social-distancing rules and behaviors are making consumers spend relatively more on food and other categories with rising inflation, and relatively less on transportation and other categories experiencing significant deflation.

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1 Introduction

The Covid-19 Pandemic has led to lockdowns, mobility restrictions, and social-distancing rules that are dramatically changing consumer expenditure patterns in many countries.[1] In particular, consumers are spending less on transportation, hotels, restaurants, and recreation, while expenditures on food and other groceries have increased in both absolute and relative terms.

These sudden changes in expenditure patterns can introduce significant biases in the Consumer Price Indices (CPIs) used to measure inflation, as noted by Diewert and Fox (2020). Most National Statistical Offices (NSOs) update their CPI expenditure weights once a year, often with lagged expenditure data. The US Bureau of Labor Statistics (BLS), for example, updated the weights in December 2019 using expenditure information collected back in 2017-2018.[2] While this practice may be reasonable in normal times, it makes inflation indices much harder to interpret during the Pandemic, as recently noted by central bankers such as Tenreyro (2020) and Lane (2020).

In this paper, I empirically study the impact that changes in expenditure patterns are having on the measurement of CPI inflation in 17 countries. I use high-frequency estimates of spending based on transactional data to build updated CPI weights and compute alternative "Covid Basket" price indices.

I start with the US, where card-based expenditure data are publicly available as part of the Opportunity Insights Economic Tracker at Harvard and Brown University, described in Chetty et al. (2020). I first show that headline Covid inflation is higher than what the CPI reflects. By April 2020, the annual inflation rate of the US Covid index was 1.06%, compared to only 0.35% of the equivalent CPI (all-items, US city average, not seasonally adjusted). The difference is significant and growing over time, as new social-distancing rules and preferences prevent consumer spending in categories that are experiencing deflation, such as transportation, and induce more expenditure in food and other groceries, where prices are increasing over time. I also find similar results when I focus on the Core CPI, implying that the bias is not limited to

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[1]See Chetty et al. (2020), Carvalho et al. (2020), Baker et al. (2020), Andersen et al. (2020), Dunn et al. (2020), and Coibion et al. (2020).

[2]Most NSOs compute a Lowe Index formula at upper levels of aggregation. This introduces small adjustments that account for relative price changes across categories every month, but they have little impact on the basket weights because quantities are assumed to be fixed. See Bureau of Labor Statistics (2020a) for an archive of BLS weights over time.

the behavior of food and energy.

Next, I estimate the impact in 16 additional countries. To build a unique Covid basket for each country, I update the official CPI weights with the same relative changes across categories observed in the US. Consistent with the previous results, I find that in 10 countries the Covid inflation rate is higher than that of the official CPI. In the other 6 cases, however, the inflation rate is lower, highlighting the fact that the CPI bias can go in any direction, depending not only on the changes in the basket weights but also on the inflation rates experienced by each CPI subcategory.

My results have important implications for policy-makers trying to respond to the crisis. They suggest that the cost of living for the average consumer is higher than estimated by the official CPI, implying that real consumption is falling more quickly over time. The welfare effects are particularly relevant during this crisis, where a large share of the population is becoming unemployed. My results also highlight the divergence in sectoral inflation rates that reflect different demand and supply shocks across categories in many countries. This particular behavior of inflation during the Pandemic tends to amplify the CPI *basket bias* identified in this paper.

2   Data and Methodology

To build the "Covid Basket," I start with daily measures of the change in US consumption patterns since January 2020, available at the Opportunity Insights (OI) Tracker[3]. These estimates, shown in Figure 1, are produced using transactional data collected from credit and debit card transactions in the US, as described by Chetty et al. (2020).

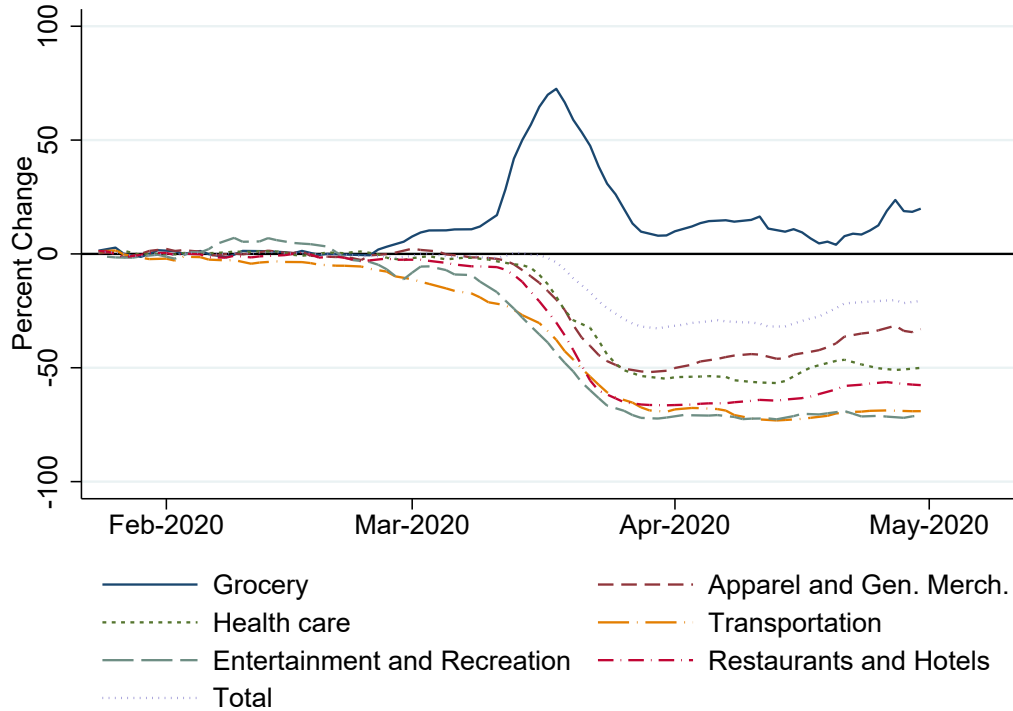[3]See https://opportunityinsights.org/

Figure 1: Changes in US Consumer Spending During the Pandemic

Notes: This graph shows the cumulative expenditure change across categories of goods and services in the US since January 2020. These estimates are publicly available on the Opportunity Insights (OI) website, https://opportunityinsights.org/, and are produced using data collected from credit and debit card transactions by Chetty et al. (2020).

I combine these estimates with official CPI data from the official NSO in each country, including the Bureau of Labor Statistics in the US. In most cases, I use the CPI sector series that form the first level of disaggregation of the headline CPI (all-items, not-seasonally adjusted), as well as the latest available weights in the official CPI basket.

The matching of the OI categories with the CPI sectors requires some assumptions. Table 1 shows the correspondence for the US data. To improve the matching, I split the CPI for "Food and Beverages" into three additional subcategories. About six categories are then closely matched in both datasets. For "Food at Home" and "Alcoholic Beverages," I use the OI "Grocery" category. For "Food Away from Home," I use the OI category for "Restaurants and Hotels." For "Other Goods and Services," I assume that the expenditure changes are equal to those of the whole OI basket ("Total"). Finally, for "Housing" and "Education and Communication," I assume that expenditures in these categories have not changed, which seems a reasonable assumption during the first months of the Pandemic.

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 1: 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.

To estimate the expenditure shares in the Covid basket, I start with the latest official CPI weights and multiply them by the average percentage change in the corresponding expenditure category each month. The new weights are then re-computed as a share of the total, to account for the fact that total expenditure is also falling over time.

Formally, the Covid weights are given by:

$$s_t^i = \frac{P_t^i Q_t^i}{\sum_i P_t^i Q_t^i} = \frac{s_0^i \Delta e^i}{\sum_i s_0^i \Delta e^i} \tag{1}$$

where P_t^i and Q_t^i are the prices and quantities of CPI category i at time t, and $\Delta e^i = \frac{P_t^i Q_t^i}{P_0^i Q_0^i}$ is the change in expenditure. Equation 1 highlights the fact that these are *relative* weights, so the importance of a category in the basket can change even when its expenditure is not affected.

The aggregate CPI and Covid price index are computed using the weighted sum of the changes in the CPI sectoral indices, using weights s_0^i and s_t^i, respectively.

3   Impact on US Inflation

I start with the results for the US, where both CPI and Covid expenditure estimates are publicly available. Figure 2 and Table 2 show the impact that the new weights have on both the monthly and annual inflation rates of the US CPI.
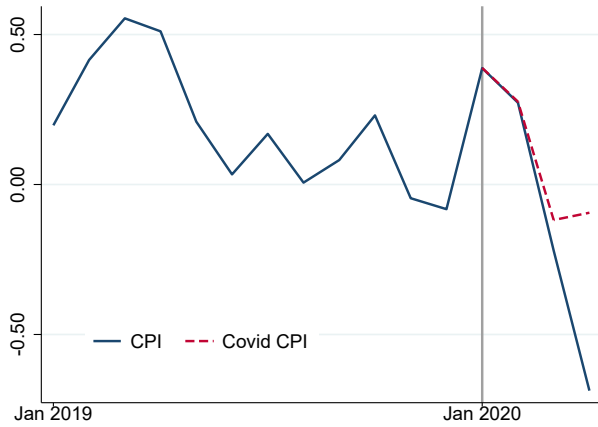
(a) Monthly Inflation Rate (%)   (b) Annual Inflation Rate (%)

Figure 2: US CPI with Covid Expenditure Weights

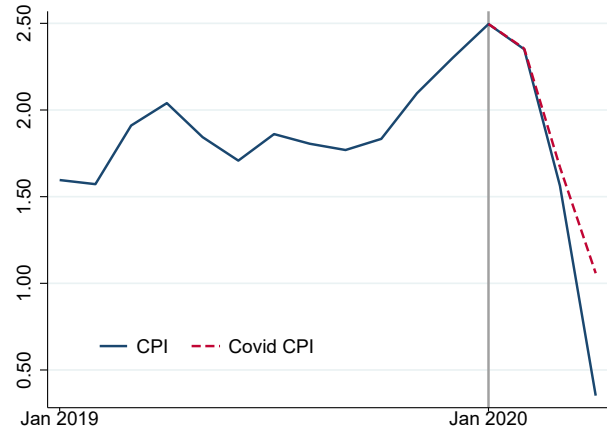Notes: These graphs show the all-items, US city average, not seasonally adjusted CPI, and an equivalent index constructed using estimates of the consumption expenditure shares under lockdown. The vertical gray line marks the start of the Covid Pandemic in January 2020.

The official all-items CPI was relatively stable in January and February but started showing deflation in March and April. The Covid index had a similar trend, but the magnitude of the decline was significantly smaller. In March, the Covid index fell only -0.12%, compared to a fall of -0.22% in the CPI. In April, the difference became more evident, with the Covid CPI falling by only -0.09%, compared to a fall of -0.69% in the CPI. The impact on the annual inflation rate is also significant. By April, the Covid index had an annual inflation rate of 1.06% compared to 0.35% in the official CPI.

	Monthly Inflation Rate		Annual Inflation Rate	
	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	1.06

Table 2: US Inflation Rates 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.

To illustrate what is driving these results, Table 3 shows the category weights and incidence details for April. The second column has the monthly CPI sector inflation used in both the official and Covid indices. The third and fourth columns show the CPI and Covid weights in each category. Finally, the last two columns show the incidence that each category has on the total monthly inflation rate. The incidence is simply the monthly inflation rate multiplied by the weight, so that the sum of all the incidence numbers in the last column is equal to the -0.09% monthly inflation rate for the Covid CPI.

CPI Category	Monthly CPI Inflation	Weight		Incidence	
		CPI	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

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.

Table 3 shows that the US Covid inflation rate is higher because there is more weight in categories that had a positive inflation rate, and less weight in categories experiencing significant

deflation. In particular, the weight for "Food at Home" rose from 7.58% to 11.28%, increasing the incidence of this category by 0.1%. At the same time, the weight for "Transportation" fell from 15.74% to 6.25%, increasing the incidence on the total monthly inflation rate by about 0.47%. The weights of "Housing" and "Education and Communication" also rose significantly. However, these two categories had little impact on Covid inflation so far because their sectoral inflation rates were close to zero percent in April.

3.1   Core CPI

The Covid basket bias is also present in the core index that excludes food and energy, as shown in Table 4. The Covid Core deflation in April was only half of that in the Core CPI, while the annual inflation rate is at 1.73% compared to the 1.43% in the official Core index. To build these indices, I dropped all food series and split the "Housing" and "Transportation" categories to remove their energy components. I also made similar assumptions for the consumer spending patterns at the category level, with details provided in the Appendix.

	Monthly Inflation Rate		Annual Inflation Rate	
	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

Table 4: 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.

The Covid Core CPI has more inflation because there is less weight in subcategories such as "Public Transportation," "New and Used Motor Vehicles," and "Motor Vehicle Insurance," all of which are experiencing significant deflation.

3.2   Other Downward Biases

My findings explore what happens with the expenditure basket at upper levels of the CPI, but there are related measurement challenges at lower levels of aggregation as well. Diewert and Fox (2020) describe the *disappearing goods* bias, which occurs when some products' prices are

no longer available to construct elementary price indices at the most disaggregated level of the CPI. For example, the share of products with missing prices in the US CPI rose from 14% in April 2019 to 34% in April 2020. In part, this reflects the challenges of collecting data during this period (the BLS suspended physical data collections in March). Still, some prices are likely missing due to stock-outs that resulted from the surge in panic-buying and supply disruptions caused by the Pandemic.[4] As Diewert and Fox (2020) note, the out-of-stock products are likely to have higher market-clearing prices than those for continuing goods, potentially introducing an additional downward bias on the CPI that reinforces the results in my paper.

The Pandemic is also likely to introduce an *outlet* bias, as a large share of total spending moves online. In Cavallo (2017), I showed that multi-channel retailers tend to have identical prices offline and online, so the products bought in this type of retailer (often under the "pick up in store" modality) are not likely affected. However, the use of online delivery platforms, such as Instacart and Shipt in the US, has soared during the Pandemic. Most retailers in these platforms tend to have higher prices than in their physical stores.[5] If this is not accounted for in the data collection methodology used by the NSO, the change in spending outlets could cause another downward bias in the CPI.

4   Impact in other Countries

In this section, I show similar results in 16 other countries using the same methodology with two differences. First, these countries use the COICOP consumption classification system, which is different from the one applied by the BLS in the US.[6] Still, the matching and assumptions are similar to those used in Table 1, as shown in the Appendix. Second, I do not have updated expenditure estimates in other countries, so I assume that the change in spending for each category during Covid is the same as in the US. The Covid shares are different in every country because I start with the official CPI weights and update them under the assumption that the relative changes in spending are similar to those experienced in the US. This provides a rough approximation to the potential impact that the Covid consumption basket has in each of these countries.

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[4]See Bureau of Labor Statistics (2020b)

[5]See Instacart (2020) and Shipt (2020)

[6]See UN (2018) "Classification of Individual Consumption According to Purpose (COICOP)" for details.

Table 5 compares the CPI and Covid inflation. I focus on the monthly and annual inflation for April, with detailed weights and estimates shown in the Appendix.

	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.

In the top panel, I show those countries where the Covid Inflation rate is higher than that of the fixed-basket official CPI. Consistent with the US results, in most of these countries the higher Covid inflation rate is driven by an increase in spending in "Food and Beverages" and a decrease in the weight of "Transportation."

The bottom panel shows that some countries are experiencing *less* inflation with the Covid basket. This highlights the fact that the bias can go in any direction because it depends not only of the changes in the basket weights but also on the inflation rates in each CPI sector. In Germany, for example, there is less Covid inflation because there is less weight on "Recreation and Culture," a category that had a surprising inflation rate of 4.23% during April. In Ireland, there is less Covid inflation because there is more weight on "Housing," which is having significant

deflation. Something similar occurs in Greece and Italy, where there is also less weight on "Restaurants and Hotels," a category that is experiencing a surprising positive inflation rate in both countries. In the Netherlands, there is also less weight on "Restaurants and Hotels" with a positive inflation rate. Finally, the UK is the only country that is still experiencing deflation in "Food and Beverages," where the weight has increased significantly.

Overall, my results outside the US should be seen as rough approximations to the Covid inflation rates. An improved set of estimates requires updated Covid expenditure data in each country. Some NSOs have started to produce experimental indices with ad-hoc adjustments to the baskets, as in ONS (2020). Future research could help expand these efforts and account for detailed Covid expenditure estimates using transactional data sources in each country.

5   Conclusion

There is a growing awareness among academics, central bankers, and the financial media about the challenges of measuring and interpreting inflation during the Pandemic.[7] A major concern is that consumption patterns are greatly impacted by the lockdowns and social-distancing behaviors, introducing significant bias into the measurement of CPI inflation.

I use estimates of the changes in consumption expenditures, obtained from US credit and debit card transactions by Chetty et al. (2020), to update the basket of CPI weights and study the effect on US inflation. I also provide estimates for the potential impact in 16 other countries. In most cases, I show that the Covid price index has more inflation than the official CPI. By April 2020, for example, the annual US all-items inflation rate was 1.06% with the Covid basket and only 0.35% with the official CPI weights. The difference is large and is growing over time, as consumers spend more on food and similar categories experiencing inflation, and less on transportation and related categories with significant deflation.

These results have important implications for policy-makers trying to respond to the crisis, as they suggest that the cost of living for the average consumer is higher than implied by the official CPI. The welfare implications are particularly relevant for people losing their jobs during the Pandemic. To further understand this impact, future research could try to estimate the Covid basket of different population groups, including low-income households.

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[7]See Diewert and Fox (2020), Tenreyro (2020), Lane (2020), and Wolf (2020).

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