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Updating Inflation Weights in the UK and Germany during COVID-19

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ABSTRACT: The COVID-19 pandemic altered consumption patterns significantly in a short period of time. However, official inflation statistics take time to reflect these changes in the weights of the CPI consumption basket. Using credit card data for the UK and Germany, we document how consumption patterns changed and we quantify the resulting inflation bias. We find that consumers experienced a higher level of inflation at the beginning of the pandemic than what a fixed-weight inflation (or the official-weight) index suggests and a lower inflation thereafter. We also show that weights can differ among age groups as well as between in-person and online spenders. These differences affect the purchasing power of the population heterogeneously. We conclude that CPI inflation indexes based on frequently updated weights can provide useful inputs to assess changes in the cost of living and, if shifts in consumption patterns prove persistent, determine the need to introduce new official weights and inform monetary policy.

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WORKING PAPERS

Updating Inflation Weights in the UK and Germany during COVID-19

Prepared by Francesco Grigoli and Evgenia Pugacheva[1]

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1 Introduction

In response to shocks that change consumption habits, inflation basket weights can become outdated and result in a mismeasurement of inflation (Diewert and Fox, 2020). Statistical agencies around the world obtain the weights of the consumption basket from surveys, which inherently have a delay with respect to the moment in which inflation is measured. This is problematic when price shocks lead consumers to substitute away from products and services that become relatively more expensive. If that happens, official inflation statistics would underweight cheaper items, effectively producing an upward inflation bias.

Similarly, consumers may react to shocks that put a hard constraint on what goods and services they can purchase. COVID-19 is a case in point, as it forced consumers to switch across consumption categories (Baker et al., 2020; Surico, Känzig and Hoke, 2020; Tenreyro, 2020) and to favor e-commerce (Alcedo et al., 2022). As households responded to the spread of the virus by self-isolating and governments introduced lockdown measures, consumers significantly changed their consumption patterns. Evidence on the US, for example, suggests that during 2020 and 2021 households' spending on transport, restaurants, hotels and recreation collapsed, largely because consumers could not leave their homes and non-essential businesses were shut down; at the same time, spending on groceries boomed (Chetty et al., 2020). The COVID-19 related changes in consumption patterns happened over a short period of time. As a result, statistical agencies could not update the associated weights in the CPI basket accordingly, producing a bias in the inflation statistics (Reinsdorf, 2020).

In this paper, we first analyze changes in consumption patterns related to COVID-19 using credit card spending data in the UK and Germany from the start of the pandemic until early 2022. Then, we adjust the CPI inflation basket weights accordingly to provide a (quasi) real-time measure of inflation.[1] Comparing our measure of inflation to a fixed-weight inflation index as well as to the official inflation index, we quantify the inflation bias.[2] Finally, using data disaggregated by gender, age groups, income level, as well as information about whether transactions took place in person or online, we examine whether the bias varied across different segments of the population.

We find that consumption baskets changed dramatically during the pandemic in the UK and Germany. In 2020, spending on transportation contracted significantly in both countries, likely reflecting mandates to close businesses as the vaccine was being devel-

[1] We use the term 'quasi' because there is still a time lag between when credit card transactions take place and the moment in which data become available.

[2] In the UK, weights are updated annually, while in Germany they have been last updated in 2015.

oped. The negative changes were largely compensated by spending increases in other categories: "food and non-alcoholic beverages", "alcoholic beverages and tobacco", and "furniture, household equipment and maintenance". In 2021, some heterogeneity emerged, reflecting differences in lockdown restrictions, the progress of vaccination, and how quickly consumers shift away from high inflation goods and services. For instance, the UK started to show a rebound in spending on "hotels and restaurants" and relatively less spending on "food and non-alcoholic beverages" before Germany. Heterogeneity becomes marked in 2022, as the UK continued to show a faster catching up with pre-pandemic trends than Germany.

What do these results imply in terms of inflation mismeasurement? We find that in the initial months of the pandemic inflation was higher—i.e., negative inflation bias—than what a fixed-weight or official inflation index suggests. However, while in the UK the inflation bias reached -0.2 percentage points and lasted only for a few months, in Germany the trough was at -0.6 percentage points and the negative inflation bias protracted through the beginning of 2021. Starting in mid-2020, the fixed-weight inflation index in the UK was already overweighting CPI categories that saw a reduction in spending, while in Germany this happened only at the beginning of 2021. In both countries, the positive inflation bias peaked at 0.5 percentage points at the end of 2021.

Our results suggest that the inflation bias was heterogeneous across segments of the population. We find that the older age groups suffered the largest deviations—positive and negative—from a fixed-weight inflation index, as they tend to use transportation relatively less and instead spend more on "food and non-alcoholic beverages" and on "alcoholic beverages and tobacco". The gender information of the account holder is limited to the UK data and it shows that men and women roughly experienced the same inflation bias. In contrast to the evidence for the US (Cavallo, 2020), we find that differences across income groups are small. One way to rationalize these results is to relate them to the lower income inequality in the UK and Germany compared to the US, which likely make consumption baskets more similar across income levels. Another explanation may be related to the higher urgency that low-income consumers have to shift their consumption to lower inflation CPI categories. Finally, we also compare the inflation bias for in-person transactions and online ones. We document that while for the UK there was no difference in the early stages of the pandemic, in Germany online transactions became more expensive at a faster pace than in-person ones. This, however, was reverted in 2021 and 2022, when the inflation of online transactions was less than the inflation for in-person transactions.

Slow updating of CPI weights is usually a minor concern as consumption patterns

tend to evolve slowly (Reinsdorf, 2020). However, shocks that have an immediate impact on how people allocate income to consumption goods and services can affect the accuracy of the CPI index. International standards allow for a maximum period of five years between updates of the CPI weights (IMF, 2020). In a context characterized by swift shifts in consumption patterns that appear to reflect some persistent changes in preference parameters, this time interval appears too long and can potentially induce large mismeasurements. At the same time, too frequent updates to CPI weights can also be problematic because spending changes are still occurring and may merely reflect temporary factors, fluctuations in economic activity, or stockpiling.[3] We argue that developing real-time CPI inflation indexes based on more frequently updated weights can provide useful inputs to understand changes in the cost of living and, if changes in consumption patterns prove persistent, determine the need to introduce new official weights and inform monetary policy decisions.[4]

This paper is related to the literature examining the inflation bias during the COVID-19 pandemic. Cavallo (2020) provides evidence on the US as well as other countries. However, he assumes that changes in consumption in the US were the same as in other countries. Compared to this study, we focus on the two largest European economies—the UK and Germany—and use actual credit card transaction amounts to quantify the inflation bias. Focusing on the UK and Germany has also the advantage that the use of credit card data is relatively more common than in other large European countries such as France, Italy, and Spain.Other studies on this issue include Benchimol, Caspi and Levin (2021) on Israel, Seiler (2020) on Switzerland, and Reinsdorf (2020) on Canada and the US. All these papers, however, cover the initial months of the pandemic, while we extend the analysis to 2022, which is when most restrictions were lifted and vaccination became more widely available. In addition, we extend the study of the heterogeneity in the inflation bias to more segments of the population and to online versus in-person transactions.

The paper is organized as follows. Section 2 provides a brief description of the data. Section 3 presents the methodology. Section 4 documents how consumption baskets changed since the beginning of the pandemic. Section 5 presents the results about the inflation bias. Section 6 concludes.

[3] In addition, while sub-annual chaining might make the weights more relevant for measuring inflation over the short run, this would come at the cost of posing a risk of chain drift distortion over the longer run.

[4] Reinsdorf (2020), along similar lines, recommends the use of a supplementary COVID-19 basket for analytical purposes without risking the long-run accuracy of the CPI. Statistical offices in the UK and Germany produced reports to analyze the impact of COVID-19 on the CPI index in the early stages of the pandemic (ONS, 2020; Koch and Erdemsiz, 2020).

2 Data

We rely on credit card data for the UK and Germany from Fable Data, which collects hundreds of millions of transactions on consumer spending from 2017 onward.[5] Each transaction is associated with an anonymized account owner, of which we observe gender and age and can infer the income level.For each transaction we also observe who is the merchant selling these goods and services, along with the corresponding merchant category code (MCC) that falls within 62 broader categories. We use this information to identify the types of goods and services being sold to consumers. Another feature of the data is that we can differentiate between online and in-person transactions.

As consumers may open and close credit card accounts, the data is subject to challenges of both consumer growth and consumer churn. To mitigate these concerns, Fable Data uses criteria based on account owners individual spending patterns to construct a consistent "core panel" of consumers that are likely to remain in the dataset. A limitation of the data is that we do not observe whether a person owns more than one account or if the same account is used by more than one person.

We ensure that the sample we work with is representative of each country's private consumption dynamics by aggregating credit card spending at the country-quarter level and comparing it with national accounts data. Figure 1 show that the growth rate of credit card spending tracks closely the growth rate of private consumption from national accounts data. The correlation for the UK is 86 percent and for Germany is 93 percent.

For the purposes of the analysis, we aggregate the data at the Merchant Category Code (MCC)-month level. In subsequent exercises we introduce an additional aggregation level to uncover heterogeneous effects across population groups or spending modalities. This additional level is, alternatively, age groups, gender, income groups, and in-person/online transactions. We then map the credit card transactions to each upper-level CPI categories, which are the same for the UK and Germany. For three of the 12 CPI categories (i.e., "Housing, water, electricity, gas and other fuels", "Communication", and "Education"), we cannot associate any MCC,[6] hence we assume that spending in these categories did not change. Table 1 presents the mapping between CPI categories and MCC in detail.

[5] Fable Data also provide information on other types of transactions, but since credit card ones account for the majority of transactions at the time of writing this paper, we restrict our sample to those. See www.fabledata.com for more information.

[6] For certain transactions, such as utilities, education, and some durable goods, cash payments or direct deposits are more common than credit card payments.

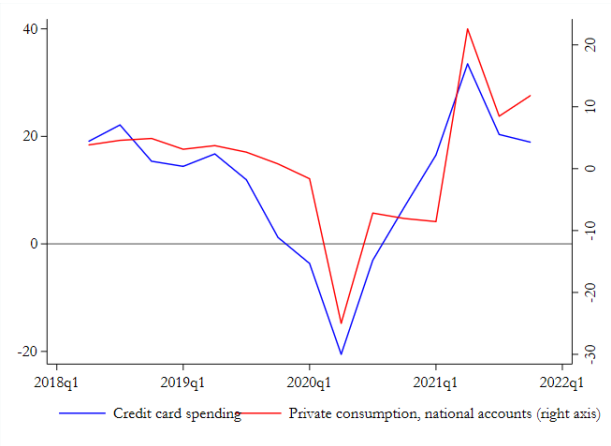
Table 1: Mapping between CPI categories and MCC

CPI category	MCC
Food and non-alcoholic beverages	Grocery/Bakery/Confectionery, Wholesale Clubs
Alcoholic beverages and tobacco	Beer & Wine
Clothing and footwear	Clothing & Apparel,
Housing, water, electricity, gas and other fuels	-
Furniture, household equipment and maintenance	Home Furnishings/Appliances, Department Stores, Hardware Stores and Garden Centres
Health	Drug Stores and Pharmacies, Medical
Transport	Airports, Automotive Services, Bicycles, Auto Stores, Travel & Tourism, Cruises, Public transport, Airlines, Auto Dealers, Taxicabs and Limousines, Car Rental, Fuel/Service Station, Hotels/Motels/Inns/Resorts
Communication	-
Recreation and culture	Video/Video Streaming Services, Online Gaming/Media/Books, Entertainment Leisure, Stationery, Pet Supplies and Veterinary Services, Recreation, Music Streaming Services, Sporting Goods
Education	-
Restaurants and hotels	Food & Beverage (Restaurants/Bars/Takeaway/Delivery)
Miscellaneous goods and services	News Stands, Duty Free Store, Government Related, Ambulance Services, Charity, Storage, Other Business Services, Health and Beauty Shops, Laundry/Dry Cleaners, Antique/Pawn Shops, Personal Services, Memberships & Organizations, General Contracted Services, Gambling/Betting

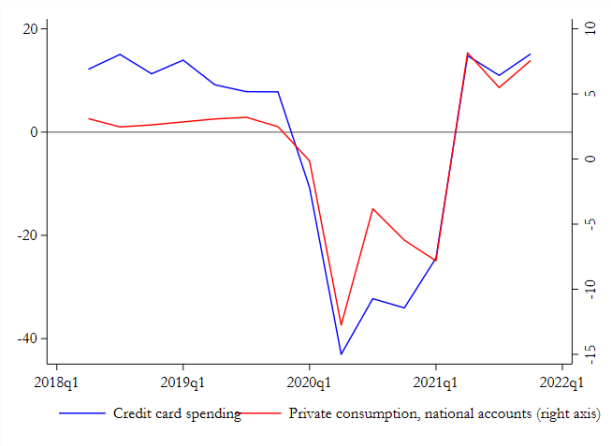
Notes: The table reports the mapping between the upper CPI categories and the MCC. The upper CPI categories are the same for the UK (https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/l55o/mm23) and Germany (https://www.destatis.de/EN/Themes/Economy/Prices/Consumer-Price-Index/_node.html).

Figure 1: Private consumption, comparison with national accounts data
(Year-on-year growth rate, percent)

(a) UK



(b) Germany



Notes: Credit card data is aggregated at the quarterly frequency.

3 Methodology

As in Cavallo (2020), we update the weights of the CPI consumption basket—the COVID-19 weights—multiplying the official CPI weights as of the beginning of the COVID-19 pandemic by the percent change in credit card spending aggregated at the CPI category level[7]

$$\omega_{i,t}^{COVID-19} = \frac{P_{i,t}Q_{i,t}}{\sum_i P_{i,t}Q_{i,t}} = \frac{\omega_{i,0}\Delta e_i}{\sum_i \omega_{i,0}\Delta e_i} \tag{1}$$

where $P_{i,t}$ and $Q_{i,t}$ are the prices and quantities of CPI category i in month t, and Δe_i is the percent change in credit card spending ($P_{i,t}Q_{i,t}/P_{i,0}Q_{i,0}$). Both for the UK and Germany, the first COVID-19 cases were registered in January 2020, so we use that as our base month ($t = 0 =$ Jan 2020).[8] Since we rescale each CPI category's COVID-19 weight by the sum of all COVID-19 weights, the relevance of each category in the CPI basket can change even when its spending did not. This means that, even for categories such as "Housing, water, electricity, gas and other fuels", "Communication", and "Education" for which we cannot assign any MCC, their COVID-19 weight will be varying. However, at least for the latter two categories weights were small even before the pandemic.

[7] Benchimol, Caspi and Levin (2021) use the same approach to compute the adjusted CPI weights using credit card data for Israel.

[8] On January 29 the UK registered the first two cases in York, while on 27 January 2020 the first case in Germany was confirmed near Munich (https://www.ecdc.europa.eu/sites/default/files/documents/communicable-disease-threats-report-1-february-2020.pdf.

Updating CPI weights using credit card data can only provide an approximation of how actual spending patterns evolved. As the COVID-19 pandemic led consumers to use relatively less cash, credit card data may overstate spending growth on items that consumers used to buy with cash prior to the beginning of the pandemic. Also, as credit card data classifies transactions based on the type of merchant, transactions occurring at merchants selling different goods (e.g., hypermarkets) may introduce a bias as a detailed breakdown at the CPI good level is not available.[9]

As a last step, we compute the COVID-19 inflation index by weighting the sum of the changes in the CPI categories' indices using the COVID-19 weights in equation (1)

$$\pi_t^{COVID-19} = \sum_{i \in CPI} \omega_{i,t}^{COVID-19} \frac{CPI_{i,t}}{CPI_{i,t-12}} \tag{2}$$

and we compare it with a Laspeyres index of inflation (i.e., the change in the fixed-weight CPI), π_t^0

$$\delta_t^{\pi} = \pi_t^0 - \pi_t^{COVID-19} \tag{3}$$

where Δ_t^{π} is the inflation bias.

One should note that, by holding weights fixed, the Laspeyres inflation index generally results in higher inflation compared to a varying-weight inflation index as it does not allow consumers to move spending away from categories experiencing rising prices. However, in the case of Germany the official CPI inflation index is effectively a Laspeyres index as the German Federal Statistical Office (GFSO) did not change the survey-based weights over the sample period. In the case of the UK weights were updated once a year by the Office of National Statistics (ONS), so we also report the results comparing the COVID-10 inflation index to the official CPI inflation index in Appendix A.[10]

4 Changes in consumption baskets

In Figure 2, we plot the evolution of the COVID-19 weights over time. Both for the UK and Germany, the most striking changes in the immediate aftermath of the COVID-19 outburst are related to "Food and non-alcoholic beverages," which increased significantly, and "Transport" and "Restaurants and hotels," which contracted abruptly. Some of these

[9] Another potential issue related to the use of credit card data to obtain accurate measures of CPI weights include the representativeness of credit card data across income groups and locations.

[10] As noted by Cavallo (2020), the COVID-19 inflation index in equation (2) differs from a Paasche index, which fixes weights to the last period. It is instead similar to a chain-weighted index, where weights are updated gradually.

changes reverted as the vaccination campaign began and health conditions improved. For example, the weight of "Restaurants and hotels" at the end of the sample is roughly similar to the pre-pandemic weight for Germany, and it is even larger for the UK. Yet, the weight for "transport" remained subdued in both countries, suggesting some permanent changes in consumption habits.

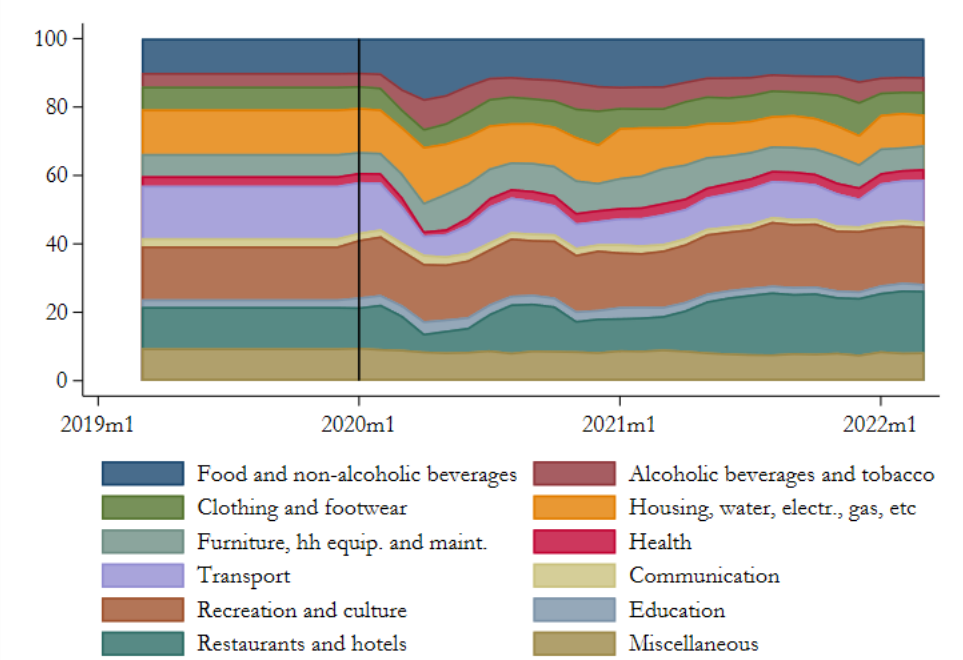
To get a clearer picture of how the CPI consumption basket changed, we average the COVID-19 weights by year and we compare them to the pre-pandemic weights, which we call fixed weights. Figure 3 reports the differences by CPI category with respect to fixed weights in percentage points for 2020, 2021, and 2022 up to March. As noted in Section 3, in the case of Germany weights have not been updated since 2015, so fixed weights and official weights are the same. Despite the UK has been updating CPI weights regularly, the updates do not determine any significant difference in our results, so we focus on differences with respect to fixed weights and report differences with respect to official weights in Figure A.1 of Appendix A. In the discussion below we focus on the categories for which we could map MCC to the CPI categories.

In the first year of the pandemic, the changes in the consumption baskets was concentrated in only a few categories, with striking similarities between the UK and Germany (panel 3a and 3b). The largest difference was observed for "transport", which contracted by about 6 percentage points in both countries. The weight for the category "Restaurants and hotels" also shrunk, but by only 1.8 percentage point in the UK and 1.6 percentage points in Germany. These declines likely reflect the mandates to close businesses as the vaccine was being developed. The negative changes were largely compensated by increases in both countries in the weight for "food and non-alcoholic beverages" by over 3 percentage points and in the weight for "alcoholic beverages and tobacco" by almost 3 percentage points; as well as an increase in the weight for "furniture, household equipment and maintenance" by about 2.5 percentage points in the UK and slightly less than 2 percentage points in Germany.

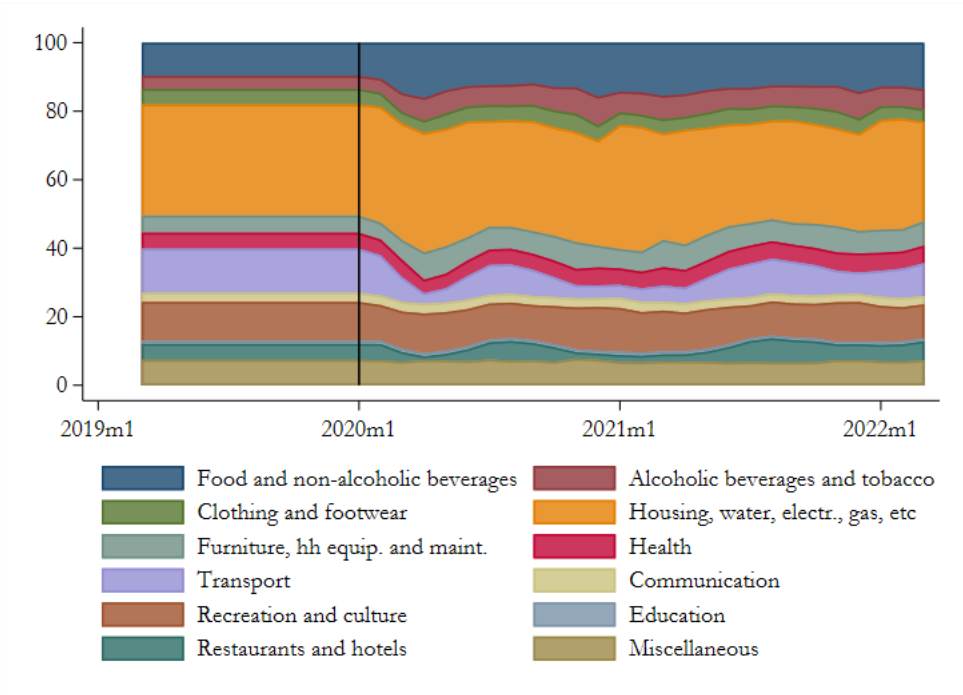
In 2021, we observe some heterogeneity in the changes of the consumption baskets of the two countries (panel 3c and 3d). While the weight for "transport" remained significantly below the pre-pandemic level in both the UK and Germany, "restaurants and hotels" rebounded in the UK (accounting for an increase in its weight by about 3 percentage points) and remained subdued in Germany. The weight for "Food and non-alcoholic beverages" continued to be larger than before the pandemic, but the positive change in Germany is as large as 4 percentage points and it is only half of that in the UK. Similarly, the weight associated to "alcoholic beverages and tobacco" remained significantly higher in Germany than in the UK. Smaller but opposite changes appear for "clothing

Figure 2: COVID-19 weights

(a) UK



(b) Germany



Notes: The black vertical lines denote the start of the COVID-19 pandemic.

and footwear" and "recreation and culture", with increases in the UK and declines in Germany. "Furniture, household equipment and maintenance" continued to display a positive change in both countries of about 2 percentage points.

The cross-country heterogeneity becomes even more apparent in the first few months of 2022 (panel 3e and 3f). The "transport" category started to show signs of catching up in both countries compared to the pre-pandemic weights, but at a faster pace in the UK. At the same time, while the weight for "restaurants and hotels" was 6 percentage points larger than before the pandemic, it was only half of a percentage point higher in Germany. Other increases in both countries were concentrated in "food and non-alcoholic beverages", "furniture, household equipment, and maintenance", and "alcholic beverages and tobacco", but these were below 1 percentage point in the UK and between 2 and 3.5 percentage points in Germany.

5 Inflation bias

We now turn to examine if the changes in the consumption patterns that took place during the COVID-19 pandemic led to any over- or under-estimation of CPI inflation. To do that, we examine the evolution of the inflation differential in equation (3), which can be interpreted as the bias that is induced by relying on a fixed-weight inflation index instead of an index based on COVID-19 weights (i.e., in which weights are updated in quasi real time based on credit card consumption data). We first present the results based on aggregate data and then we discuss the heterogeneity across different segments of the population.

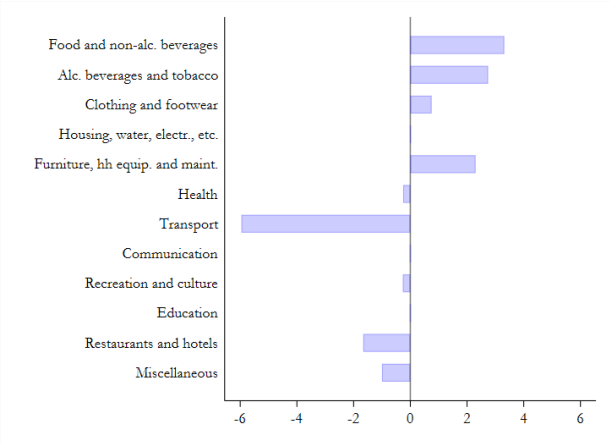
5.1 Aggregate data

Figure 4 plots the inflation differential starting in January 2020, which is when the UK and Germany registered their first COVID-19 cases.[11] During the early months of the pandemic, COVID-19 inflation was higher than what a fixed-weight inflation index suggests, as indicated by the negative differential. However, there is a substantial difference between the UK and Germany. In the UK, COVID-19 inflation was higher only for a few months and only marginally—0.2 percentage points at most. In Germany, the changes in consumption patterns implied a significantly higher inflation—by more than 0.6 percentage points—and for a protracted period of time, including all 2020 and the beginning of

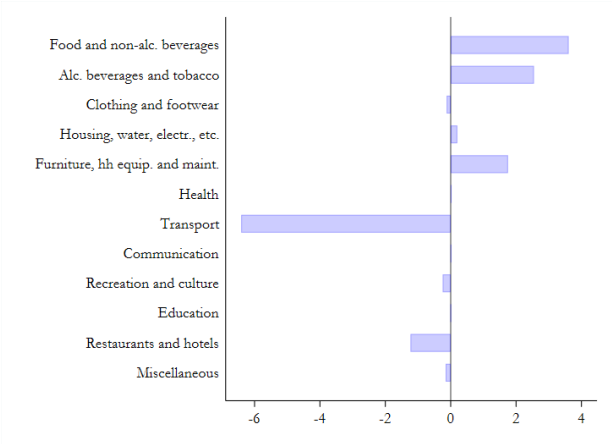
[11] Figure A.2 in Appendix A presents the inflation bias computed with respect to the official inflation index for the UK.

Figure 3: Changes in the CPI consumption basket since the start of the pandemic (Percentage points)

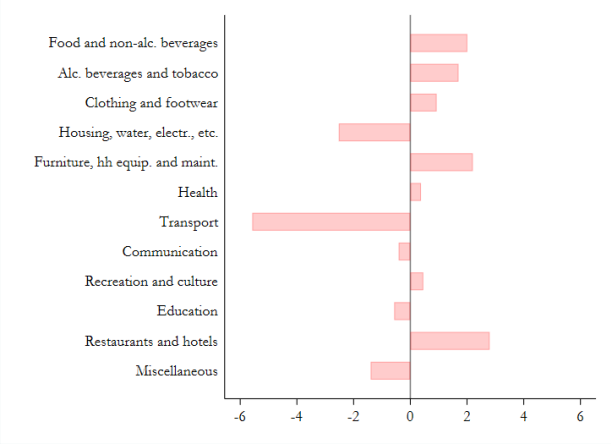
(a) UK, 2020



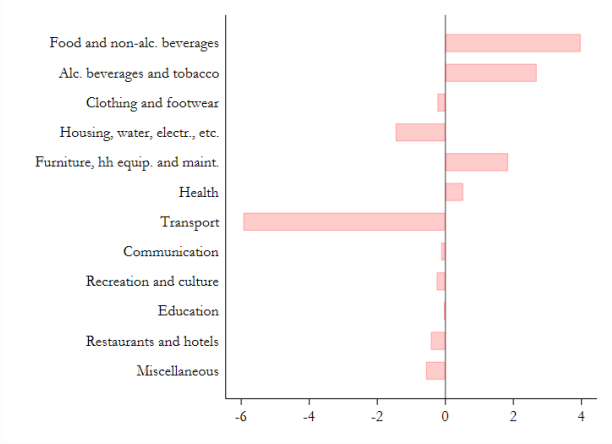
(b) Germany, 2020



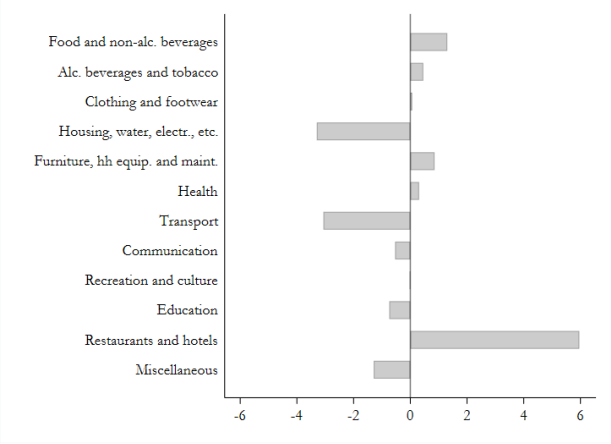
(c) UK, 2021



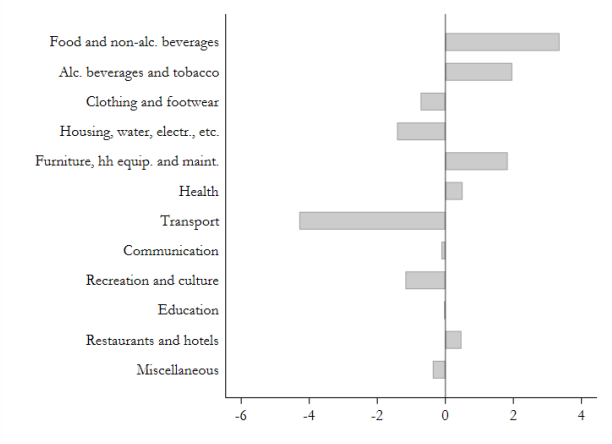
(d) Germany, 2021



(e) UK, 2022



(f) Germany, 2022



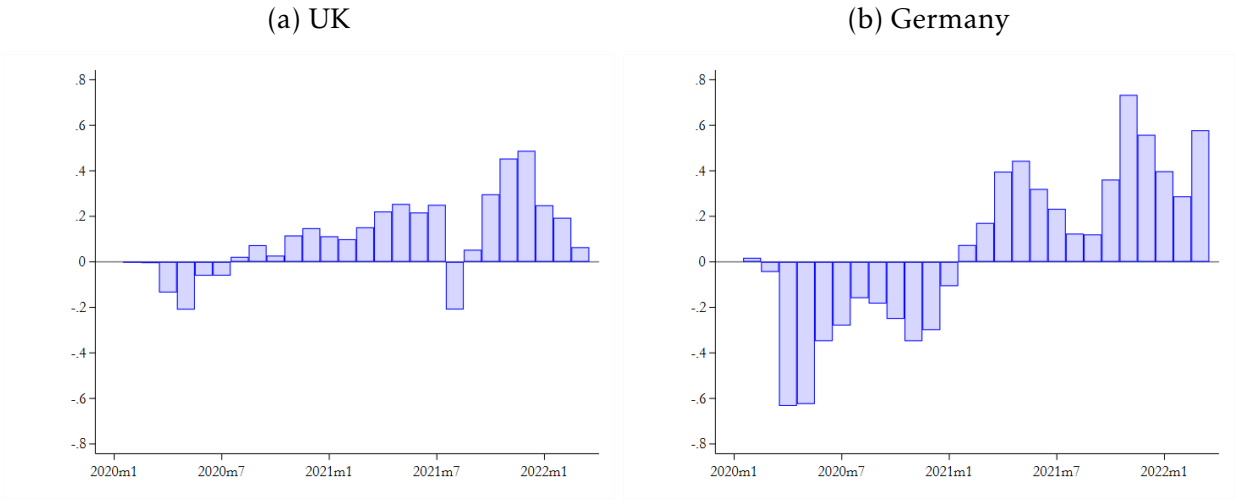
Notes: The panels display the average difference in percentage points between the COVID-19 weights and the CPI weights as of January 2020.

2021.

Since mid-2020, COVID-19 inflation in the UK started to fall below fixed-weight inflation, with the bias progressively increasing until the second half of 2021. These dynamics reflect a shift away from high inflation categories. That is, the fixed-weight inflation index was over-weighting CPI categories that saw a reduction in spending. In August 2021, the differential turned negative again likely reflecting the peak of a new wave of infections and the associated tightening of lockdown stringency which forced consumers to spend more on higher inflation CPI categories. However, as infections declined and the vaccination campaign continued, the bias turned positive, reaching half of a percentage point towards the end of 2021, suggesting that inflation was significantly lower than what is suggested by the Laspeyres index.

In Germany, inflation was significantly and persistently higher than what is implied by the fixed-weight inflation index until the beginning of 2021. Since then, the inflation differential turned positive reaching 0.5 percentage points in May 2021, then it declined but remained in positive territory, and finally it increased again. By the end of 2021, inflation computed using the COVID-19 weights was below the fixed-weight inflation by as much as 0.7 percentage points, suggesting that consumers were able to shift their spending to CPI categories that experienced smaller price increases.

Figure 4: Inflation bias
(Percent)



Notes: The panels show the differential between the COVID-19-weight inflation and the fixed-weight inflation, computed based on year-on-year changes.

In Tables 2 and 3, we present a decomposition of the inflation differential at its peak

and trough. Specifically, we report the components that enter its calculation: the percent change in the price index of each CPI category along with the COVID-19 and pre-pandemic weights, and the respective incidences (i.e., the inflation rate multiplied by the weight).

In the UK, COVID-19 inflation exceeded fixed-weight inflation by 0.2 percentage points in May 2020. As it is clear from Table 2, this is because the fixed-weight inflation index significantly under-weighted CPI categories that experienced positive inflation, such as "food and non-alcoholic beverages" and "alcoholic beverages and tobacco". At the same time, it over-weighted CPI categories that had a negative inflation reading as "transport". This was only partially compensated by "furniture, household equipment, and maintenance", which is under-weighted in the fixed-weight inflation index and registered a negative inflation rate; and by "restaurants and hotels", which was over-weighted in the fixed-weight inflation index and registered a positive inflation rate. In November 2021, the COVID-19 inflation index was 0.5 percentage points above the fixed-weight inflation. At that time, all CPI categories recorded positive inflation rates. However, the fixed-weight inflation index heavily over-weighted "transport" that alone contributed almost a full percentage point to the inflation differential. This was in part compensated by the under-weighting on "restaurants and hotels", "clothing and footwear", and "alcoholic beverages and tobacco".

In the case of Germany, the trough was also in May 2020 when COVID-19 inflation exceeded fixed-weight inflation by 0.6 percentage points. In Table 3, we show that the main driver of the underestimation of inflation is "transport". The fixed-weight inflation significantly over-weights this CPI category, which experienced a significant reduction in prices. The "transport" differential for May 2020 is -0.4 percentage points. In addition to that, "food and non-alcoholic beverages" and "alcoholic beverages and tobacco" suffered sizeable increases in prices at a time in which the fixed-weight inflation was under-weighting these categories. The peak of Germany's inflation bias was in December 2021, when the inflation differential reached 0.7 percentage points. Similar to the case of the UK, all categories experienced price increases at that time, with "transport" prices rising by almost 15 percent. As "transport" was significantly under-weighted, this contributed to almost a full percentage point upward bias in the inflation estimation. "Food and non-alcoholic beverages" and "alcoholic beverages and tobacco", however, contributed to reduce the inflation bias, as these categories were still over-weighted.

Table 2: Decomposition of the inflation differential at peak and trough, UK

	Inflation	Weights		Incidence	
		Fixed	COVID-19	Fixed	COVID-19
Trough, May 2020					
Food and non-alc. beverages	1.8	99	164	0.18	0.30
Alc. beverages and tobacco	2.6	39	82	0.10	0.22
Clothing and footwear	-3.1	64	59	-0.20	-0.18
Housing, water, electricity, etc.	-1.2	129	147	-0.16	-0.18
Furniture, hh equipment and maint.	-0.8	61	104	-0.05	-0.08
Health	0.7	27	14	0.02	0.01
Transport	-1.7	148	65	-0.25	-0.11
Communication	4.0	21	24	0.08	0.10
Recreation and culture	2.0	168	161	0.33	0.32
Education	2.7	29	33	0.08	0.09
Restaurants and hotels	2.0	118	63	0.23	0.12
Miscellaneous	1.2	97	83	0.11	0.10
Peak, November 2021					
Food and non-alc. beverages	4.2	99	124	0.41	0.52
Alc. beverages and tobacco	3.8	39	61	0.15	0.23
Clothing and footwear	4.1	64	96	0.26	0.40
Housing, water, electricity, etc.	6.9	129	86	0.89	0.59
Furniture, hh equipment and maint.	7.3	61	68	0.44	0.49
Health	2.1	27	33	0.06	0.07
Transport	11.9	148	81	1.76	0.96
Communication	0.7	21	14	0.01	0.01
Recreation and culture	3.1	168	176	0.51	0.54
Education	4.5	29	19	0.13	0.09
Restaurants and hotels	6.0	118	166	0.71	0.99
Miscellaneous	1.6	97	76	0.16	0.12

Notes: Fixed weights refer to the last pre-pandemic observation. The incidence is computed as inflation rate multiplied by the weight. The sum of the incidence numbers across all CPI categories is equal to the CPI inflation rate.

Table 3: Decomposition of the inflation differential at peak and trough, Germany

	Inflation	Weights		Incidence	
		Fixed	COVID-19	Fixed	COVID-19
Trough, May 2020					
Food and non-alc. beverages	4.2	97	139	0.41	0.58
Alc. beverages and tobacco	2.9	38	67	0.11	0.19
Clothing and footwear	0.1	45	45	0.00	0.00
Housing, water, electricity, etc.	0.9	325	343	0.28	0.29
Furniture, hh equipment and maint.	1.0	50	80	0.05	0.08
Health	1.5	46	43	0.07	0.07
Transport	-4.5	129	42	-0.59	-0.19
Communication	-0.2	27	28	-0.01	-0.01
Recreation and culture	0.0	113	112	0.00	0.00
Education	-2.2	9	10	-0.02	-0.02
Restaurants and hotels	2.1	47	20	0.10	0.04
Miscellaneous	2.1	74	72	0.15	0.15
Peak, December 2021					
Food and non-alc. beverages	4.6	97	125	0.44	0.58
Alc. beverages and tobacco	3.1	38	74	0.12	0.23
Clothing and footwear	1.9	45	51	0.09	0.10
Housing, water, electricity, etc.	3.9	325	286	1.26	1.11
Furniture, hh equipment and maint.	4.3	50	77	0.22	0.33
Health	1.6	46	53	0.08	0.09
Transport	14.9	129	68	1.93	1.02
Communication	1.6	27	24	0.04	0.04
Recreation and culture	4.5	113	115	0.51	0.52
Education	1.9	9	8	0.02	0.02
Restaurants and hotels	4.0	47	46	0.19	0.19
Miscellaneous	4.1	74	73	0.30	0.30

Notes: Fixed weights refer to the last pre-pandemic observation. The incidence is computed as inflation rate multiplied by the weight. The sum of the incidence numbers across all CPI categories is equal to the CPI inflation rate.

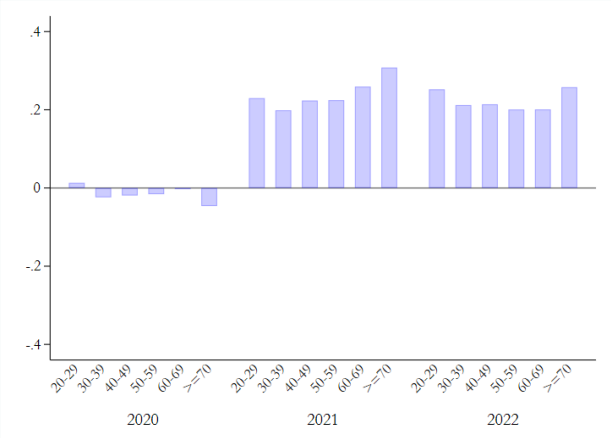
5.2 Heterogeneity

The credit card consumption data provided by Fable Data include some demographic characteristics of the account holders, as well as a measure of income. This allows us to investigate how the inflation bias was distributed across different segments of the population.

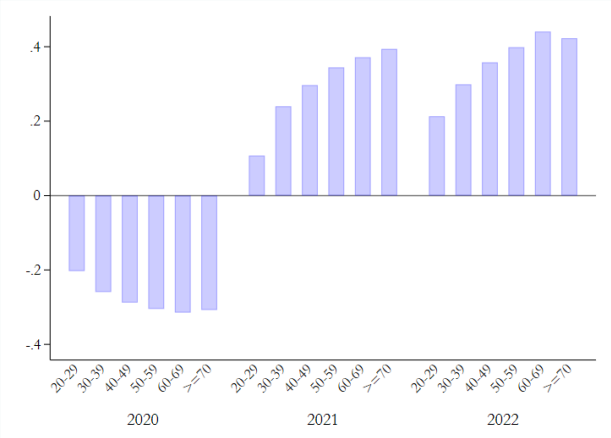
We start with age groups. We observe 10-year age groups from 20 to 69 years old, as well as the 70 plus category.[12] Thus, we collapse the data by age group and compute the inflation differential for each one of them. Figure 5 reports the results for the UK and Germany. For both countries, we find evidence that the older age groups suffered the largest negative and positive inflation bias. The age group that saw the largest negative inflation bias in 2020 in the UK was the 70 plus, as shown in panel 5a. In Germany, all age groups experienced a more sizeable negative bias in 2020, but the bar chart in panel 5b suggests that older people suffered the largest increases in prices. In 2021 and 2022, the bias was in the opposite direction, but the older age groups are still the ones that recorded the largest deviation from a fixed-weight inflation index. These results reflect the fact that older people tend to use transportation relatively less and instead they spend more on food, alcoholic and non-alcoholic beverages, and tobacco.

Figure 5: Inflation differential by age
(Percent)

(a) UK



(b) Germany

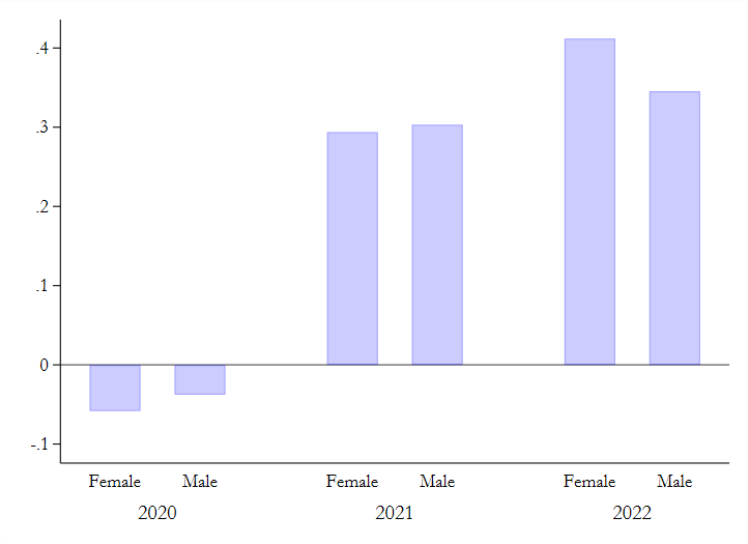


Notes: The panels show the differential between the COVID-19-weight inflation and the fixed-weight inflation by age group.

[12] Raw data include a "≥ 70" category and a "over 80" category. We combine these two into a "Over 70" category.

We repeat the same analysis differentiating account holders by gender. Unfortunately, this disaggregation is only provided for the UK. The results in Figure 6 indicate that the inflation bias was roughly the same for men and women in 2020 and 2021. In 2022, we find a slightly higher bias for women (of about 0.1 percentage points). This is almost entirely explained by lower inflation for women in "furniture, household equipment, and maintenance" reflecting the relatively lower spending in this category.

Figure 6: Inflation differential by gender, UK
(Percent)



Notes: The panels show the differential between the COVID-19-weight inflation and the fixed-weight inflation by gender.

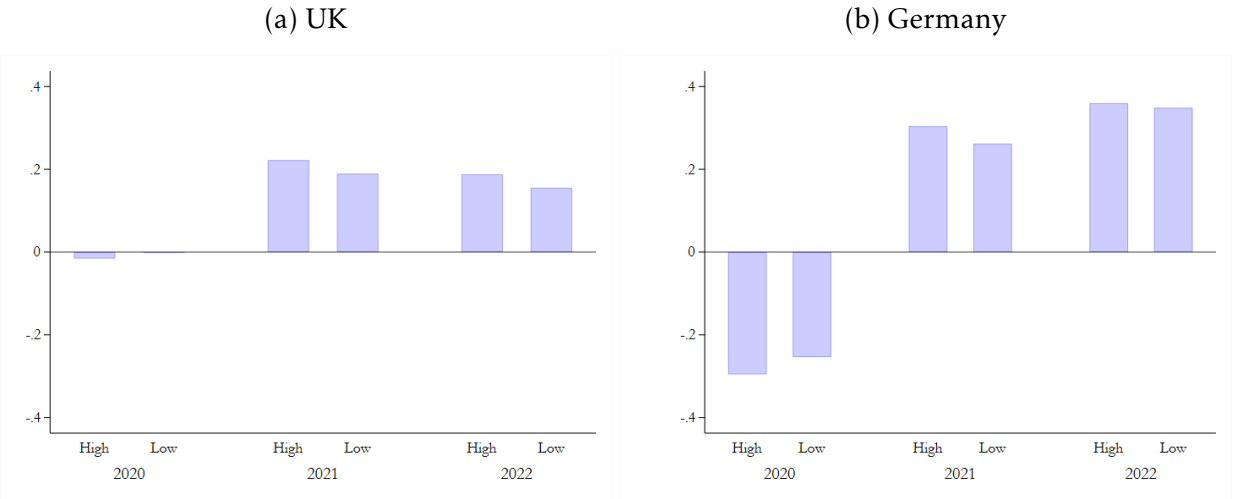
The level of income is not observed. However, in the case of the UK, we proxy that by calculating total spending in 2018 (i.e., before the pandemic started) for each neighborhood, which are classified as ONS supergroups. We label the two highest spending neighborhoods as "high income" (i.e., cosmopolitans and affluent London) and the two lowest spending neighborhoods as "low income" (i.e., constrained city dwellers and hard-pressed living). In the case of Germany, Fable data classify credit card accounts in three income groups based on the per-capita income of the zip code associated to the accounts. For this exercise we focus only on low and high income accounts, dropping mid-income ones.[13]

The results in Figure 7 display a similar inflation bias for high income and low income

[13]This is in line with the construction of the income groups in Chetty et al. (2020). As we are using a subset of the full sample to define high-income and low-income categories for both the UK and Germany, the results may not match the ones presented in Section 5.1.

consumers, which reaches 0.2 percentage points in the UK and 0.4 percentage points in Germany. The differences in the inflation bias between the income groups is at most 0.1 percentage points, indicating that high-income consumers suffered similar inflation. These results are in contrast with the ones for the US of Cavallo (2020), who finds that inflation was significantly higher for low-income households in the first months after the beginning of the pandemic. One possible rationalization is that income inequality is lower in the UK and Germany compared to the US, so consumption baskets are more similar across income levels. Another explanation may be related to the higher urgency that low-income consumers have to shift their consumption to lower inflation CPI categories.

Figure 7: Inflation differential by income
(Percent)

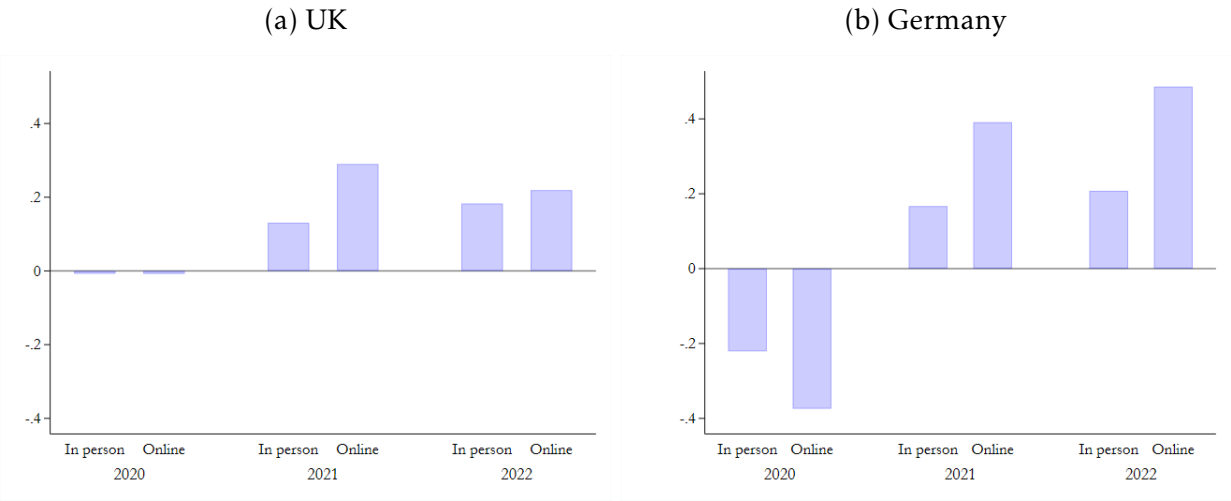


Notes: The panels show the differential between the COVID-19-weight inflation and the fixed-weight inflation by income. In the case of the UK, income is proxied by spending in 2018 for each ONS supergroup. High-income includes "cosmopolitans" and "affluent London", low-income includes "contrained city dwellers" and "hard-pressed living". In the case of Germany, income is proxied based on the per-capita income of the zip code associated to the user account.

As a final step, we examine differences in inflation for in-person and online transactions. In 2020, the share of online transactions in total transactions increased significantly as many non-essential business were required to shut down both in the UK and Germany. The inflation bias, however, was zero for in-person and online transactions in the UK. In Germany the inflation bias was negative, at 0.2 percentage points for in-person transactions and 0.4 for online transactions, suggesting that online transactions became more expensive at a faster pace than in-person transactions. The cross-country difference is likely related to the relatively larger share of online transactions in the UK even before

the start of the pandemic. In 2021 and 2022 the bias turned positive for all transactions in both countries, even though for online transactions it was almost twice as large in Germany (0.4 to 0.5 percentage points) than in the UK.

Figure 8: Inflation differential for person and online transactions
(Percent)



Notes: The panels show the differential between the COVID-19-weight inflation and the fixed-weight inflation distinguishing online transactions and in-person transactions.

6 Conclusions

Changes in consumption patterns can make the weights associated to the items in the CPI consumption basket obsolete and generate a bias in the measurement of inflation. The COVID-19 pandemic came with significant shifts in consumption due both to voluntary distancing of people and the introduction of lockdown measures that forced many non-essential businesses to shut down. Using credit card spending data for the UK and Germany we document that spending on transportation collapsed in both countries in the first year of the pandemic. However, this was largely compensated by spending increases in groceries, furniture, household equipment, and maintenance. In 2021 and 2022, differences in lockdown restrictions, the uneven progress in vaccination, and the consumers' reaction shifting away from high inflation goods and services generated some cross-country differences, with the UK's spending on hotels and restaurants rebounding sooner than in Germany.

We then build a (quasi) real-time measure of inflation based on new weights con-

structed from credit card data. Comparing it with a fixed-weight inflation index and the official inflation index reveals that COVID-19 weight inflation was higher in the first year of the pandemic, and lower thereafter. We also show that older age groups suffered the largest inflation bias in either direction and that online transactions became initially more expensive and then cheaper, while differences across gender and income groups were negligible.

While international standards allow for a maximum period of five years between updates of the CPI weights, in a context characterized by swift and persistent changes in consumption patterns take place, this time interval appears too long and can potentially induce large mismeasurements. Too frequent updates, on the other hand, can also be problematic because spending changes are still occurring and may just reflect temporary factors or stockpiling. We argue that developing real-time CPI inflation indexes based on more frequently updated weights can provide useful inputs to assess changes in the cost of living and, if shifts in consumption patterns prove persistent, determine the need to introduce new official weights and inform monetary policy decisions.

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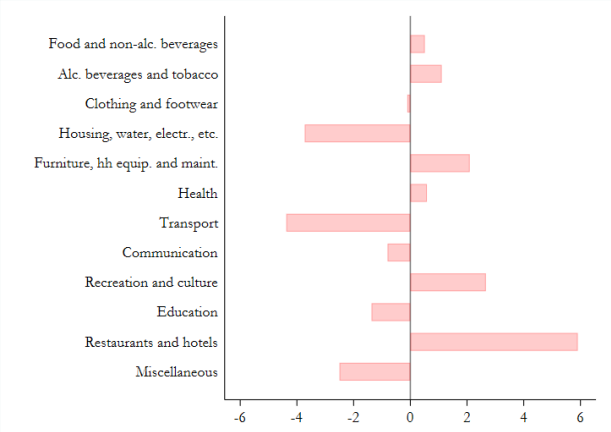
Appendix

A Comparison with official statistics for the UK

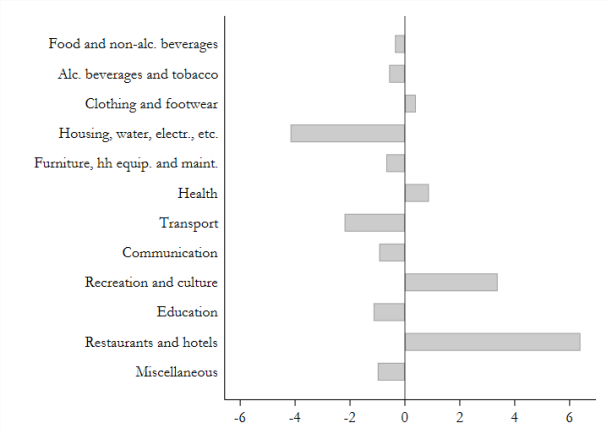
Figure A.1: Changes in the CPI consumption basket wrt official one, UK
(Percentage points)

(a) 2020

(b) 2021

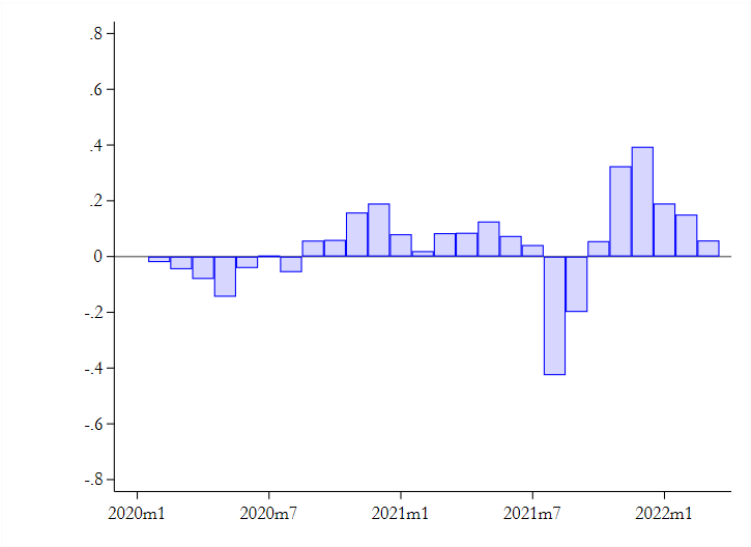


(c) 2022



Notes: The panels display the average difference in percentage points between the COVID-19 weights and the ONS' CPI weights.

Figure A.2: Inflation bias, UK
(Percent)



Notes: The panels show the differential between the COVID-19-weight inflation and the official inflation, computed based on year-on-year changes.

PUBLICATIONS

Updating Inflation Weights in the UK and Germany during COVID-19

Working Paper No. WP/2022/204