

ARTICLE

# THE CHALLENGES TO ECONOMIC MEASUREMENT ARISING FROM INFLATION IN THE POST-PANDEMIC WORLD

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## Abstract

The pandemic caused expenditure shares to vary more than usual, leading to serious ramifications when combined with the fact that the expenditure shares used to calculate CPI inflation are 1–2 years old. This caused a potential bias in the measurement of inflation. We also look at the cost-of-living crisis and found that the lags in updating the expenditure shares for energy and food led to an underestimate of inflation in 2022. Inflation also has a large effect on the measurement of the public sector deficit. With a high debt-GDP ratio and high inflation, there was a substantial inflation tax.

**Keywords:** Inflation; Economic Measurement; CPI

**JEL codes:** E01; E31; E62

You might recall the pandemic. This caused a great challenge to the Office for National Statistics (ONS) and other national statistical institutions (NSIs) when it came to measuring inflation. The thousands of prices collected to construct the measure of inflation, whether CPI or CPIH, are weighted using expenditure weights. Now, before the pandemic, the expenditure shares varied very little from year to year.

However, expenditure shares moved a lot starting in 2020.

When inflation was measured in 2020 during the pandemic, the expenditure shares used were from 2018. Because expenditure shares moved slowly and took time to measure accurately, they were using expenditure shares from two calendar years ago. However, as Sir Ian Diamond outlined in his Deane–Stone lecture in 2021<sup>1</sup>, the ONS ‘sped up’ during the pandemic. One of the features was that the lag was reduced from 2 years to 1 year: thus, in 2021, they used the expenditure shares from the pandemic year 2020; in 2022, they used their shares from 2021.

This is shown in [Table 1](#): the middle column gives the year CPI was calculated. The first row gives the year the expenditure data came from. The last column is a measure of reliability, of which more later.

Now, I will note that there were lots of issues around the measurement of inflation during the pandemic, which I am NOT going to discuss here. I wrote a blog for NIESR during the pandemic, which covered these issues and others<sup>2</sup>, and the ONS also covered this in detail.

Why am I focusing on expenditure shares? In economic theory, expenditure shares can vary for two reasons: first, relative prices change, and second, real income changes. The two are related of course, but

<sup>1</sup>See <https://www.cambridge.org/core/journals/national-institute-economic-review/article/role-of-an-nsi-in-a-pandemic/B708CC55E1943D1B308C03F7A2D381BA>

<sup>2</sup>See Dixon (2020)

**Table 1.** Expenditure weights used for measuring inflation

Data	CPI and CPIH	Quality
2018	2020	Actual
2020	2021	estimated
2021	2022	estimated
2022	2023	estimated
2022	2024	Actual

CPI/CPIH weights updated January each year.

economists have long sought to separate income from substitution effects. In the case of Cobb–Douglas preferences, these two always cancel out and expenditure shares remain constant. For homothetic preferences, used very commonly in macroeconomics and international trade theory, expenditure shares only depend on relative prices: real income has no influence on expenditure patterns. But in general, of course, both real income and relative prices have an effect, about which I will return to. There is a third effect, which is preferences and habits, which were also not doubt at play as well, as they changed during the pandemic.

So, let us examine the expenditure shares used by the ONS in calculating CPI inflation. We will first take a shorter look and compare the 2020 shares with the 2021 and 2022 shares. The 2020 shares were based on 2018 pre-pandemic data: the 2021 shares were based on the pandemic year (2020) data<sup>3</sup> and the 2022 shares on the 2021 data. The year 2021 was not exactly ‘post-pandemic’, but certainly reflected more ‘new normal’ patterns of expenditure. The 2024 weights reverted to the 2-year lag, using the (updated) 2022 weights.<sup>4</sup>

To refresh your minds, the 12 COICOP divisions for household expenditure are listed here: they have ‘two digits’ (01, 02, 03, ... 12) and the corresponding expenditure shares for CPI from 2024 from the ONS:

1	2	3	4	5	6	7	8	9	10	11	12
FOOD AND NON-ALCOHOLIC BEVERAGES	ALCOHOLIC BEVERAGES AND TOBACCO	CLOTHING AND FOOTWEAR	HOUSING, WATER, ELECTRICITY, GAS AND OTHER FUELS	FURNITURE, HOUSEHOLD EQUIPMENT AND MAINTENANCE	HEALTH	TRANSPORT	COMMUNICATION	RECREATION & CULTURE	EDUCATION	RESTAURANTS AND HOTELS	MISCELLANEOUS GOODS AND SERVICES

The ‘Big 5’ CPI shares are 11 Restaurants and Hotels, 09 R&C, 07 Trans, 04 Housing Water and Energy, and 01 Food NAB. In CPIH, 04 is even bigger (314 or 31.4%) with the rest smaller.

First, we compare the expenditure shares used to construct CPI in 2020 with 2021 across the 12 COICOP divisions: the total weight is 1,000 and we have the change in shares expressed as parts per mille, so that a change of 10 represents a change of 1 percentage point in the expenditure share. This is shown in [Chart 1](#).

This shows us the big changes in expenditure shares as a result of the pandemic. If we use the cut-off of 0.5 percentage points (five on the vertical axis), we can see that all types of expenditure showed major changes *except* for the four listed. There were particularly ‘big’ changes in Restaurants and Hotels, Recreation and Culture (both reduced) and Food and Non-Alcoholic Beverages (which increased). Recall, these were the expenditure weights that the ONS was using to calculate the inflation figures for 2021 compared to that of 2020, which were based on data from 2020 and 2018, respectively. Note that the 2021 figures introduced in January 2021 were, to some extent, ‘estimates’ of the shares in 2020 (since the full information had not come in from 2020).

<sup>3</sup>Used 2020 Q1 to Q3 and “estimated” Q4. See Coronavirus (COVID-19) and Consumer Price Inflation weights and prices: 2021 (ONS) for details. This method was replicated in the 2022 and 2023 updates.

<sup>4</sup>See Consumer price inflation, updating weights: 2024 (ONS)

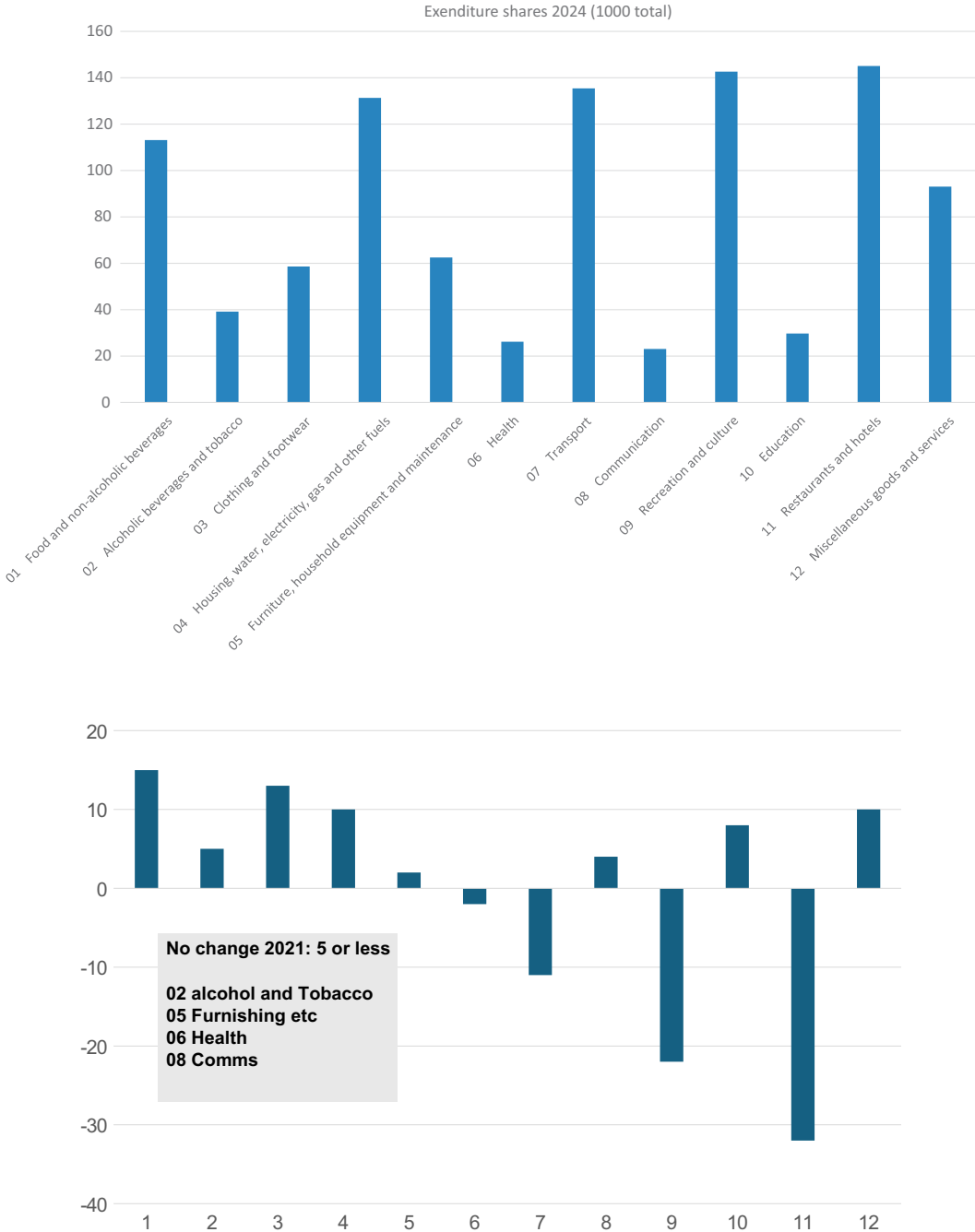


Chart 1. Change in expenditure share by COICOP division 2020–2021: parts per 1,000

Now let us move on a year: in [Chart 2](#), we now compare the weights of 2022 with 2020, shown in brown, with the grey ghost bars being the ones from the previous figure.

These expenditure bars represent the ‘new normal’: 6 of 12 COICOP categories are ‘back to normal’ (changes of <0.5 percentage points compared with 2020) including Restaurants and Hotels. However,

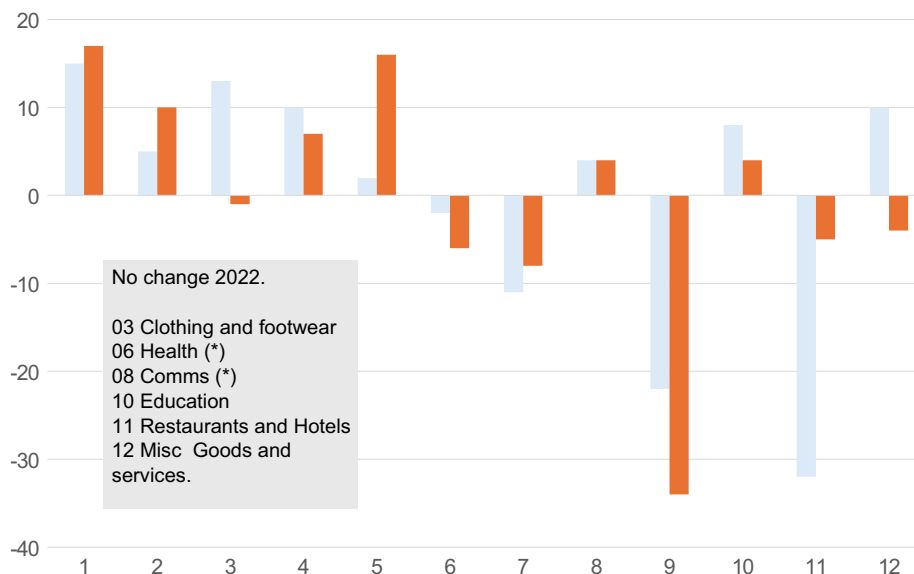


Chart 2. Change in expenditure share by COICOP division 2020–2022: parts per 1,000

some big changes have persisted: Food and Non-alcoholic beverages have increased even more, and Recreation and Culture remain much lower. In addition, we can see Housing Water and Energy (05) creeping up, about which more later. Again, the 2022 weights were partly estimates, since in January 2022 the data from 2021 was not all ‘in’.

Now, to give some context to these figures, we look at Chart 3, which compares expenditure shares used in 2008 and 2019, and changes over more than a decade. These are in green and we show the ghost bars for the other two figures for comparison. There were some big changes between 2008 and 2019, but smaller than the changes in the previous figures. These represent secular slow-moving changes that accumulated over the 11 years, rather than the sudden shifts in the ghost bars from the previous figures, which happened over a year or two. This just shows how significant the shifts in expenditure were as we move forward in measuring inflation from 2020 to 2022.

If I were an economic historian, and I was measuring inflation in the period from 2020 to 2022, I would calculate inflation figures differently. For example, I could use the actual concurrent expenditure shares for each year: I would use the 2020 shares for 2020, and the 2021 and 2022 shares for these years. The ONS used the 2018 shares for 2020, the 2020 shares for 2021 and the 2021 shares for 2022. Why does the ONS use this method? It is a simple issue of data availability. The ONS can get expenditure shares from the Living Cost and Food Survey, which has a significant lag. It can also get its shares from the GDP data (Household Final Consumption Expenditure (HHFCE)), but again this does not settle down from revisions until the Blue Book comes out in October each year and has the figures up to the *previous* calendar year. The ONS could go back and revise the CPI data as it does the GDP data. However, the ONS (and its predecessors) have always had a ‘no revisions’ policy for CPI (CPIH, RPI, RPIX etc.). Again, the reasons for this ‘no revisions’ policy lie beyond the scope of this lecture but relate primarily to the use of CPI for indexation of various things such as pensions, regulated prices and so on.

However, as an economic historian, I would have no such constraint and could use concurrent shares ‘with the benefit of hindsight’. In fact, economic theory would suggest that I could use a mixture of ‘base-weighted’ expenditure shares to construct a ‘Laspeyres’ type index, alongside a concurrent weighted ‘Paasche’ index. As Fisher argued back in 1922, you can then obtain a ‘superlative’ or ‘ideal’ index and

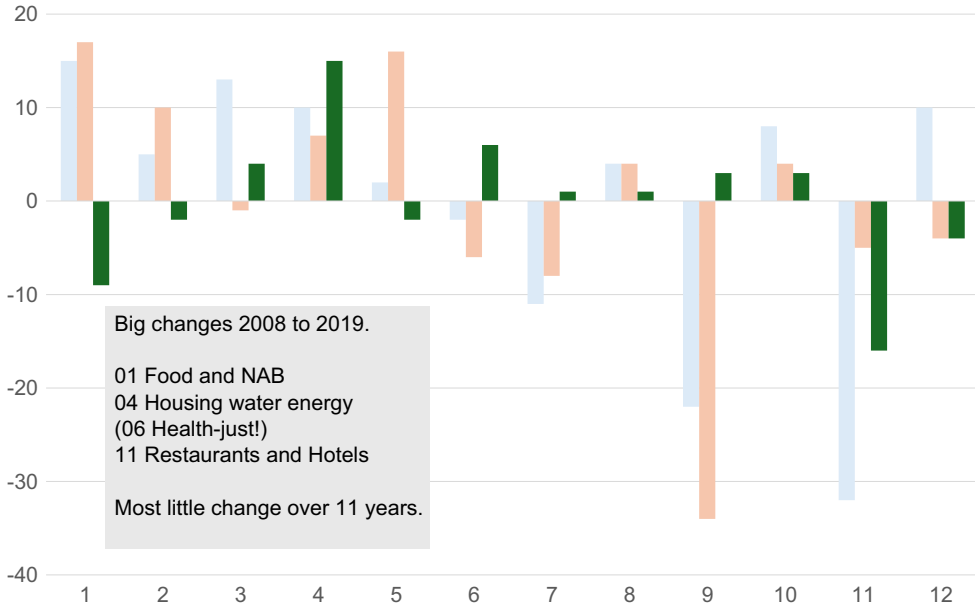


Chart 3. Change in expenditure share by COICOP division 2008–2019: parts per 1,000

combine the two by taking a geometric average. This is exactly what my PhD student Aftab Chowdhury and I have done for the period 2020–2022 across a range of OECD countries using quarterly or monthly GDP data. We can compare the ‘official CPI’ with the ‘True’ CPI inflation as measured using a Fisher index. For those interested in the details, see Chowdhury and Dixon (2024).

For the United Kingdom, the Fisher index and the official CPI are very similar, as we can see in Chart 4. Despite the big changes in expenditure shares, the effects cancel out so that Fisher and official figures are quite close.

However, for the United States, where expenditure changes were of similar magnitudes, the two are quite different, as shown in Chart 5. Fisher inflation was higher in the pandemic (about 1 percentage point) and lower in 2021 by a similar amount. It ‘crosses over’ in 2020 Q4. Looking across all OECD countries, we see a mixed story: in some countries, the Fisher inflation is less than the official rate over the whole period (this includes Japan, Canada, Netherlands and Türkiye); in two countries, Fisher inflation is more in both years (Poland and Iceland). For most, it is a mixed story above/below in 2020 and the opposite in 2021. Again, you can see the details in Chowdhury and Dixon (2024).

So, that brings us to our first conclusion. *The large and rapid shifts in expenditure shares since the pandemic have caused a major issue for how we measure inflation.* Whereas before the pandemic, expenditure shares moved slowly, since 2020, they have moved much more rapidly. This means that we need to look much more carefully at the official inflation figures to understand what they mean as economic statistics. Since the official CPI uses expenditure shares from a year or more in the past, this compounds the problem: expenditure shares are shifting and, in addition, we are measuring inflation using old weights. However, there is a clear conclusion for economic researchers: if they are looking at inflation time series that include the period 2020–2022, they should use a Fisher index in preference to the official CPI.

This leads us to our second take on this same issue. The spike in inflation post-COVID. This can be divided into three stages:

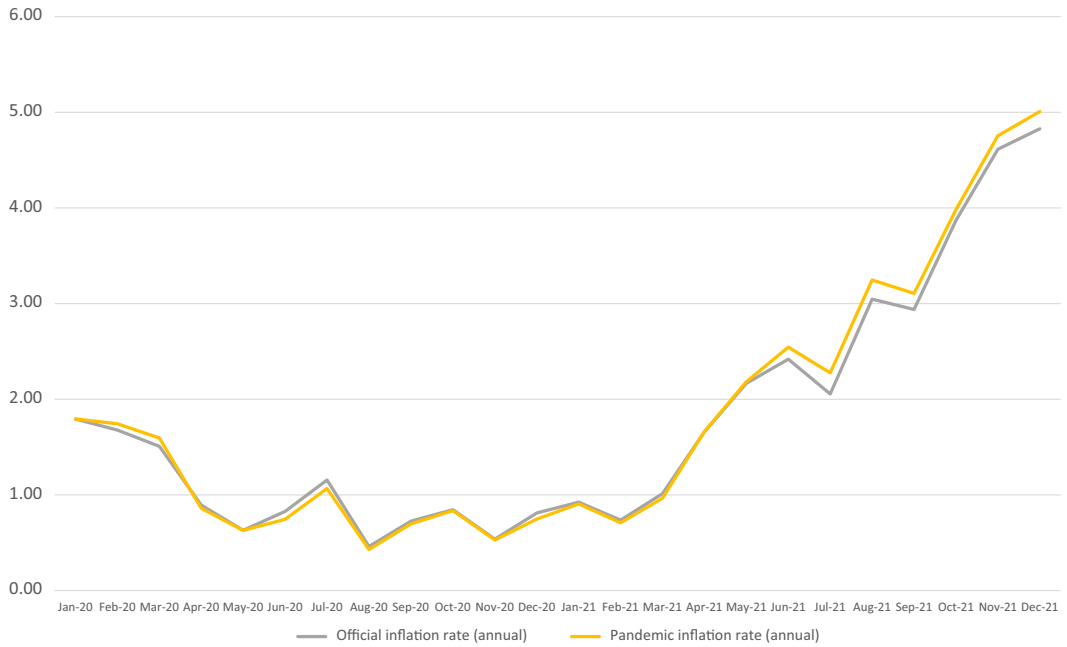


Chart 4. Official CPI and Fisher index UK 2020–2021

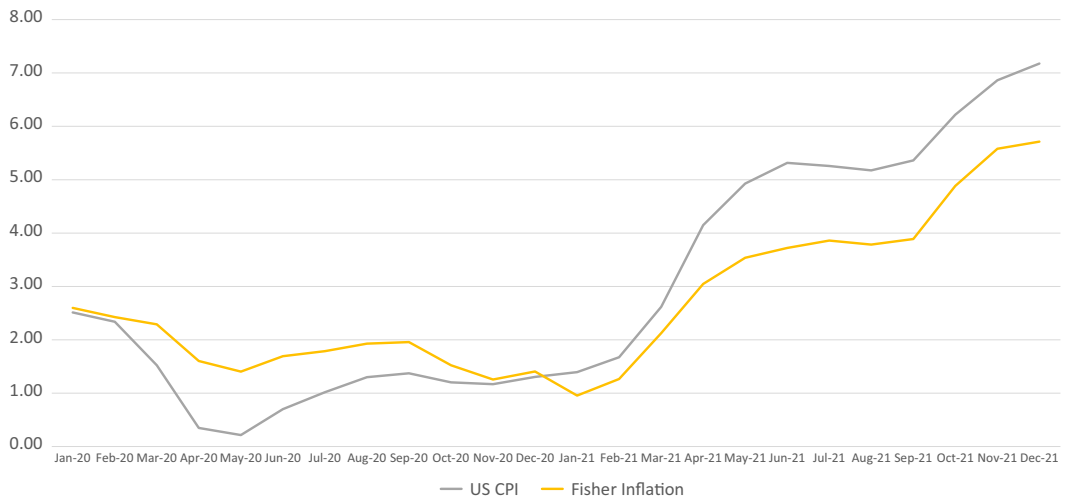


Chart 5. Official US CPI and Fisher index US 2020–2021

Stage 1: supply chain issues mid-2021 to January 2022. It became apparent that supply chains were taking longer than expected to re-boot after the pandemic. Inflation rose from 2% to 5.5%. Remember the queues of container ships at Ningbo (China) and San Diego (USA).

Stage 2: Ukraine and the surge in energy prices. February to December 2022. CPI Inflation peaked at 11.1% in October 2022.

**Table 2.** Expenditure shares used for CPI: food and domestic energy

	COICOP	2020	2021	2022	2023	2024
Food	01.1	8.8%	10.1%	10.5%	10.7%	10.1%
Electricity, gas and other fuels	04.5	3.3%	3.3%	3.6%	4.9%	4.1%
<b>Total</b>		<b>12.1%</b>	<b>13.4%</b>	<b>14.1%</b>	<b>15.6%</b>	<b>14.2%</b>
Fuels and lubricants	07.2.2	3.1%	2.7%	3.1%	3.1%	3.1%
Data year		2018	2020	2021	2022	2022
Reliability		Actual	Estimated	Estimated	Estimated	Actual

Stage 3: fall in energy prices and inflation. In 2023, inflation fell from 10% to 4%. We are still in this stage...

We can call Stages 2 and 3 the ‘cost-of-living crisis’ when poorer households had to choose between heating and eating. From a measurement perspective, this too provided a measurement issue. In the cost-of-living crisis, two categories of expenditure were particularly hard hit: food and domestic energy. These two expenditure types have relatively small shares of CPI but domestic energy prices, in particular, saw a spectacular increase in 2022. I will track these through the years 2020–2024. The CPI expenditure shares are shown in [Table 2](#):

Clearly, both heating and food are ‘necessities’. As their price rises relative to CPI, their expenditure share *increases*. This will happen, for example, with *Stone-Geary Preferences* (named after Richard Stone who names this lecture and founder of Irish Central Statistical Office Roy Geary)<sup>5</sup>: there is a minimum level of consumption, after purchasing which the residual income is allocated across different goods and service in fixed shares.

The normal weights for domestic energy were about 3.3%. For reference, I also put in the shares for Fuel and Lubricants. Clearly, petrol and diesel prices also spiked in 2022 but the expenditure share was more or less constant, indicating that households were able to cut back a lot in their consumption volumes of petrol and diesel as prices rose. It is also noteworthy that although the share of energy expenditure rose, it rose less than if households had maintained their energy consumption: a lot of us learned to survive at a lower temperature. The behaviour of food and energy price levels is shown in [Chart 6](#), which shows the three phases of the post-pandemic spike in inflation. In [Chart 6A](#), the same information is shown in terms of the year-on-year inflation.

The key point to note is that the big increase in domestic energy prices happened in 2022, when the weights were low (reflecting what happened in 2021). The big fall in energy prices happened in 2023 when the weights were big, reflecting the high expenditure shares of the previous year. Aftab Chowdhury and I wrote a prospective NIESR paper on this in July 2023, but can now update it with the quarterly HHFCFE expenditure from the latest Blue Book. We were able to use these to make a ‘true inflation’ Fisher index and compare it to the ONS measure. We were able to do this by the month.

As we can see, the true inflation was greater in 2022 by about 0.5–1.0 pp and close to the official CPI in 2023, except for the last 2 months when true inflation was 0.8 pp less than the official rate. The role of domestic energy was perhaps less important in 2023 as inflation had become more widespread (with a big rise in service sector inflation).

However, we can see that the cost of living was even worse than we thought in 2022. The peak of inflation was 11.6% in October 2022 rather than the official 11.1%.

The third point I want to make is that the cost-of-living crisis affected poorer households much more because they spend larger proportions of their income on food and energy. This has meant that the difference between plutocratic and democratic measures of inflation increased. The difference between

<sup>5</sup>See Geary (1950), Stone (1954).

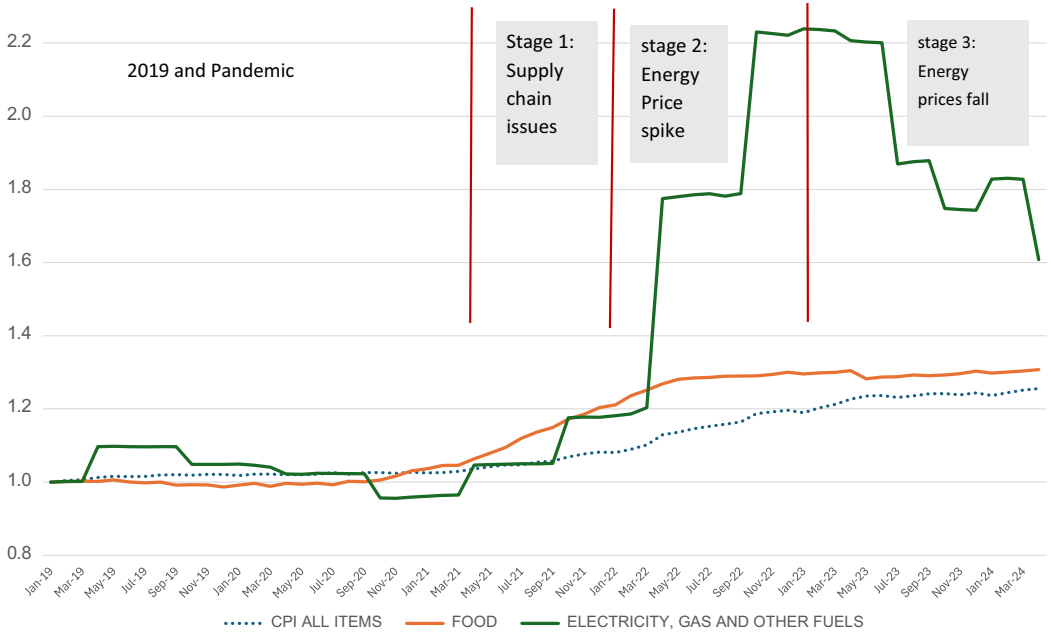


Chart 6. Food, energy and CPI levels

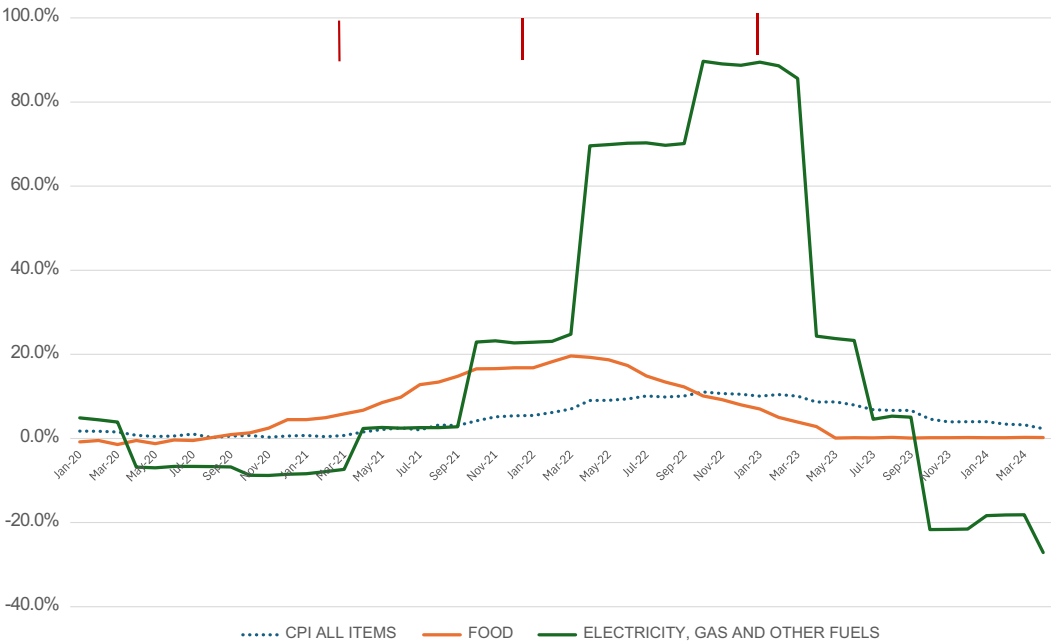


Chart 6A. Food and energy inflation (year-on-year)



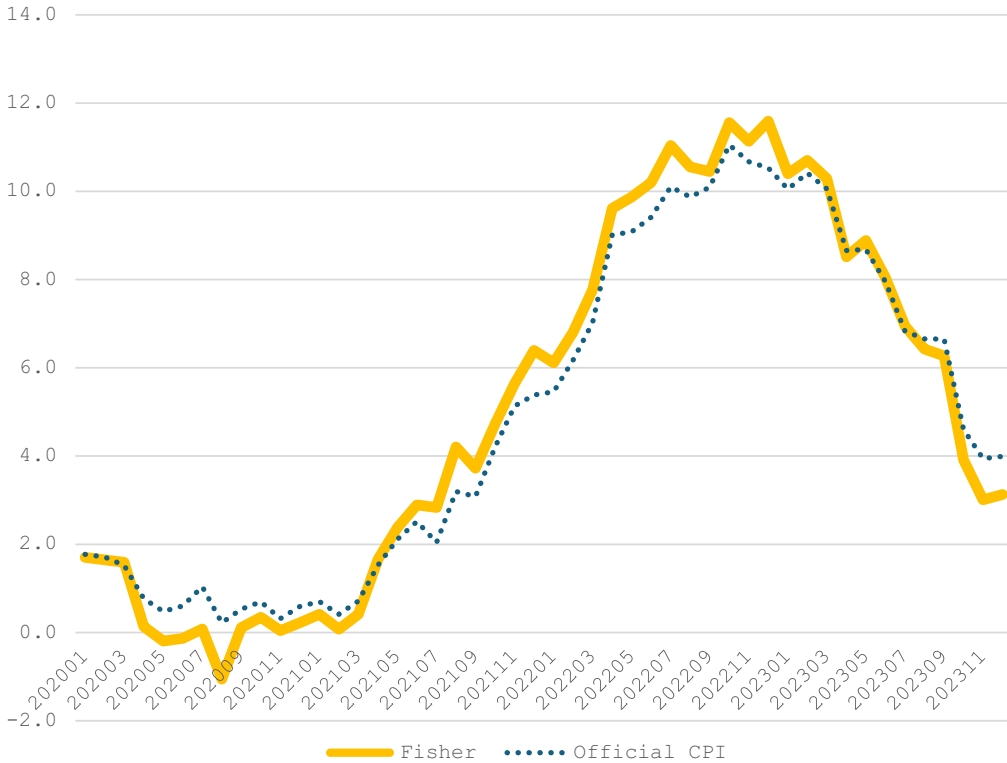


Chart 7. CPI Inflation Rate versus Fisher UK

plutocratic and democratic measures deserves wider recognition. The idea of a democratic weighting was first put forward by Sigbert Prais in 1959, who was then a researcher at NIESR.<sup>6</sup>

The current CPIH and CPI (and to a lesser extent the old RPI) are ‘plutocratic’: the expenditure shares are obtained by adding up the expenditures of all households, rich and poor, and then measuring the shares. A ‘democratic’ measure measures directly the expenditure shares of individual households and then averages across households. Back in 2014, Tanya Flowers and Philip Wales at the ONS in Newport initiated the development of the Household Cost indices (HCIs), which were an alternative measure of inflation based on several features that diverged from the CPI, including democratic weighting and the inclusion of mortgage costs. The ONS has been updating its HCI since then and this yields some further insights for how we interpret CPIH and CPI inflation.

Now, most people agree that democratic weighting makes more sense, and I certainly agree with this. However, it did not seem to make much difference whether you used plutocratic or democratic measures in the 2010s.

However, with the cost-of-living crisis, we have seen much more divergence. We will look at the period 2022–2023. First, a direct comparison between the ONS HCI and CPI in [Chart 8](#):

We can see that the HCI is much higher than the CPI. The peak inflation for HCI was 12.7% as opposed to the official CPI peak of 11.1%. We can get an idea of the importance of democratic weighting by looking at the ONS data comparing CPI(D) with CP in [Chart 9](#), where we have replaced CPI with a stacked column, which is CPI in blue, plus the difference between CPI(D) and CPI (in red) as a stacked column: CPI(D) is red plus blue. HCI remains the same as a line.

<sup>6</sup>Prais (1959).

10 Dixon

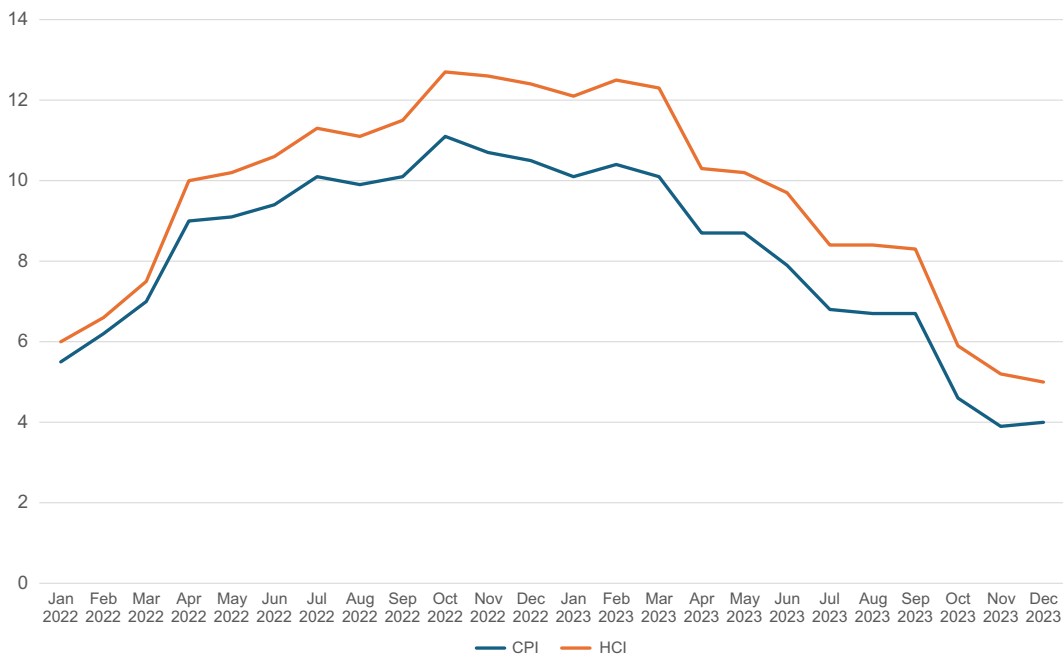


Chart 8. CPI and HCI 2022–2023

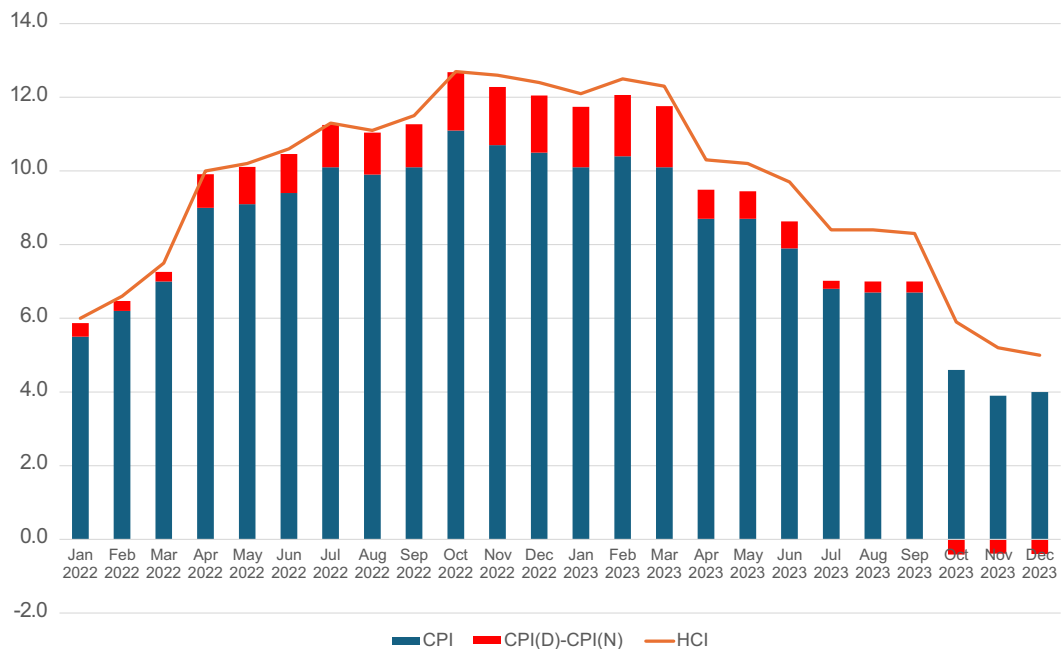


Chart 9. CPI, CPI(D), and HCI

We can see that the blue and red stacked column—CPI(D)—is just below HCI until April 2023, indicating that it is the democratic weighting that caused most of the difference before then. The peak inflation for the democratic CPI(D) in October 2022 is the same as HCI at 12.7%. The difference between the two comes from the fact that poorer households have a bigger weight on the two types of expenditure with high inflation.

Later on in 2023 and 2024, the effect of the increased mortgage payments included in HCI kicks in and CPI(D) falls behind HCI and becomes more similar to CPI (the red bits get smaller).

What is the conclusion? Well, if we believe in democratic weighting for inflation, the official statistics CPI and CPIH certainly understated ‘true’ inflation during the cost-of-living crisis (a difference of up to 1.7 percentage points). CPI and CPI(D) diverged.

This reinforces the point that the post-pandemic shifts in expenditure and lags in updating the official expenditure shares also meant that CPI and CPIH understated inflation in 2023. The fact that the cost-of-living crisis had a far greater effect on poorer households made the plutocratic nature of the official measure more divergent from the democratic.

### Inflation and debt

We need to look at the effect on inflation on debt and loans. In my time at NIESR, I have focused on two aspects of this: the effect of inflation on people with mortgages and how we interpret public sector deficits when there is inflation.

Turning very briefly first to mortgages, the easy part: I wrote a piece on this for the Economic Observatory—How does inflation affect mortgages in light of rising interest rates? Mortgages are almost always agreed in terms that there is *fixed nominal sum* to be repaid over a given time horizon. The nominal interest rate on this debt might be fixed for a period or vary according to some rule (e.g., tracking the Bank of England rate, or simply being set by the mortgage provider).

Inflation has a clear and unambiguous effect on the outstanding nominal debt: it reduces it in real terms. If you owe £100 and there is 10% inflation, then the real value of your debt declines by 10% in real terms. Inflation redistributes money from lender to borrower. However, that is not the end of the story of course, but once you understand that borrowers tend to be made better off by inflation, the solutions to the mortgage crisis become easier to find. You alleviate the cash flow issues of higher interest rates with (partial) mortgage holidays, re-mortgages and so on. The government did do this to some extent but, in my opinion, not enough was done to ease the cash flow issues associated with the crisis. The key is to get lenders to understand the reality of the situation: namely that inflation is ‘paying off’ the mortgages even if no actual payments were made.

A key variable to understand is the real interest rate. Keeping things simple, we can define this as the nominal interest rate minus the inflation rate (expected inflation rate), Irvin Fisher’s celebrated definition (the very same Fisher who took the geometric averages of Paasche and Laspeyres indices).

The real interest rate can be thought of as the interest rate adjusted for the effect of inflation on the outstanding debt. If there is 10% inflation, then the real interest rate is the nominal interest rate minus 10%. We can think of two cases: one where the nominal interest rate is 2% and inflation is zero, and one where inflation is 10% and the nominal interest rate is 12%. These are in some sense the same: the real value of the outstanding debt declines by 10% but the nominal interest rate is 10% higher, which compensates the lender for this loss in value. Now, we have been living in<sup>7</sup> a world of near-zero interest rates from January 2009 in the GFC to Mid-2022. Real interest rates have thus been negative. Lenders have not been compensated for the loss in value of their loans due to inflation.

Real interest rates remained negative until October 2023 when there was a historic ‘crossover’ when CPI inflation became less than the Bank of England rate marking the end of the historical anomaly that

<sup>7</sup>In fact, the lender would still be worse off because HMRC views the whole interest payments as ‘income’ and, as such, subject to tax. The tax system is not inflation neutral and taxes nominal income, not real income in this case.

was negative real rates (there has never been another period of negative real rates lasting 13 years). Generally, I believe that equilibrium real interest rates are positive (or at least non-negative), so that the MPC rate should be greater than or equal to the inflation rate. We have now entered a new era where this reality is back, which is all good from my perspective.

What does this have to do with recent events? We now turn to the impact of inflation on public debt. If you look at debt in real terms, there is no doubt that the inflation spike was good for the public finances. There were several reasons for this: public-sector real wages fell and there was fiscal drag as tax thresholds were not updated, to name a few. However, the main one from my point of view was that inflation reduced the real value of the public debt.

While being 65 has its disadvantages, it does have advantages as well, and not just the free bus pass. I lived through the great inflation of the 1970s and was interested in what was happening to the British economy: I did my A-level Economics from 1974 to 1976 and my PPE degree from 1977 to 1980. Trying to link the inflation that was going on around me to what I was studying occupied my teenage mind almost as much as listening to the latest Roxy Music album or Sex Pistols single.

My Tutor at Balliol was Andrew Graham, whom I must thank for nurturing in me an interest in the British economy, even down to recommending to all Balliol PPE-ists that they subscribe to the *National Institute Economic Review* and the CSO Economic Trends. In my final year, he handed over to me a paper by the two Bank of England economists, Christopher Taylor and Andrew Threadgold. The title was “‘Real’ national saving and its sectoral composition’ (see also Threadgold and Taylor 1980). Threadgold and Taylor’s, 1979 analysis had the following purpose:

The principal object of this paper is to offer some quantitative estimates of inflation-adjusted saving and financial surpluses/deficits for the main sectors of the economy (persons, companies, general government etc.) and for the economy as a whole.

The need to inflation-adjust these deficits had gone dormant during the great moderation, with low inflation and a low debt-to-GDP ratio—remember when it was 34%? However, post-GFC, the debt-to-GDP ratio has ballooned and even more so post-pandemic. Even inflation at the modest range 5%–10% is going to imply a lot of ‘inflation adjustment, as we shall see.

When I saw that there was a real possibility of inflation ‘taking off’ because of the Russian invasion of Ukraine, or more accurately the ensuing sanctions, I encouraged colleagues at NIESR to get some indication of how large this effect might be. So what did we find?

If we take a nominal bond with a redemption value of £100 and there is 10% inflation, then a year later when it comes to repaying the £100 that £100 is worth 10% less in real terms. Inflation means that there has been a ‘flow’ between the lender (who bought the bond) and the borrower (who issued the bond), despite no subsequent transaction having occurred. ‘Inflation adjustment’ means measuring this effect.

This is a big job if you want to cover the whole economy (firms, households etc.), so we just focused on the public finances. The key economic statistic that needs adjusting is the government deficit: leaving out the many alternative definitions, we can simply think of it as  $G-T$  (primary deficit) plus interest payments ( $rB$ ) to get the full deficit. The point is that an inflation-adjusted budget deficit will include the effect of inflation on ‘reducing’ the real debt obligations of the government.

So, how do you measure this? First, we need to exclude the inflation-indexed debt: as the name suggests, this is automatically inflation-adjusted. Once we have done that, it is simple to calculate the ‘inflation tax’ on the remaining outstanding government debt. The precise method we adopted is outlined in Box B of the Autumn 2022 NIESR *Economic Outlook* and I would like to thank my co-authors Hailey Low and Urvisch Patel in helping me carry this out. Hailey and I also updated this in later Economic Outlooks. First, let us look at how big it is: unsurprisingly, with a debt GDP in nominal bonds of around 75% and inflation in 2023 of 10%, the effect was large!

In [Chart 10](#), we can see that the blue inflation tax (per quarter) can be very big: at the height of inflation in 2022 Q3, it totalled over £60bn and turned the deficit into an inflation-adjusted surplus (in green and red, respectively). The Liz Truss black hole becomes a white dwarf to use an astronomical

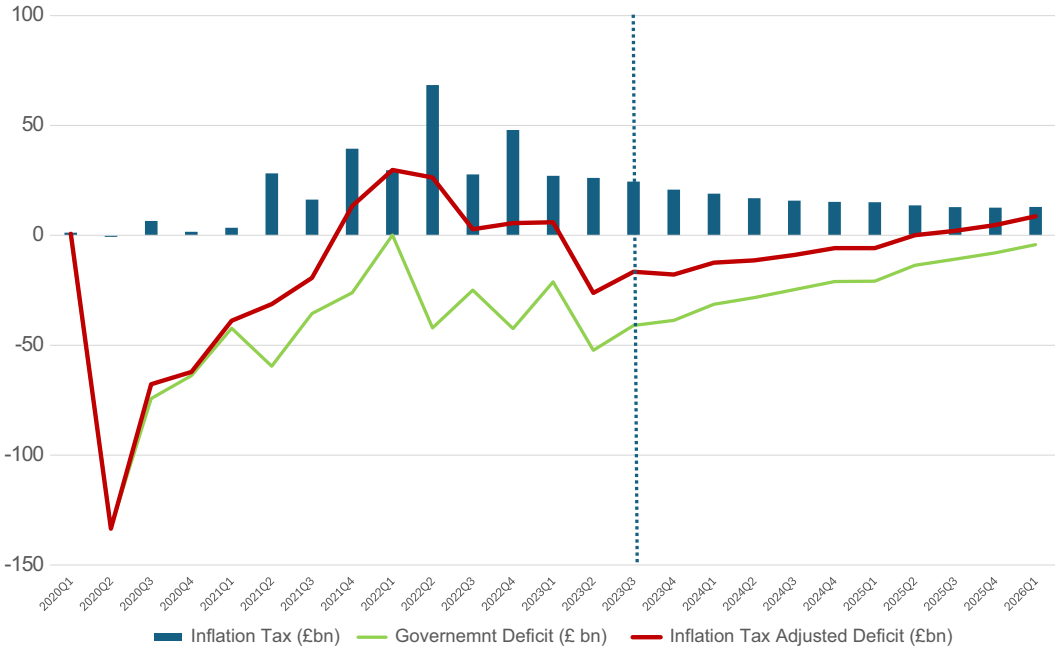


Chart 10. Inflation tax and inflation-adjusted Budget deficit (£bn)



Chart 11. GDP deflator and CPI inflation compared 2022–2023

analogy. The vertical dotted line represents the time of the Autumn Outlook and to the right is the forecast (which hopefully will be updated in future outlooks). However, it is interesting to note that the size of the inflation tax was forecast to remain large going forward: about \$8bn per quarter (reflecting a very large public debt).

Why is it important that we measure this inflation-tax effect? It is crucial because it gives a better view of fiscal sustainability than the raw deficit. If the inflation-adjusted deficit is in surplus, it means that the debt-to-GDP ratio will probably not be increasing (with the proviso that GDP is not decreasing) even if the raw deficit is possibly quite large. The inflation tax provides a better indicator of the ‘fiscal space’ available to the government. Indeed, the raw deficits were very large in 2022 going into 2023, in large part due to the Energy Price Guarantee (EPG) and related fiscal measures to protect households and, to a lesser extent, firms from the effects of the energy price spike. Despite this, the debt–GDP ratio did not go up. I would argue that this was due to the inflation tax. If the government had sustained a similar deficit starting from a much lower level of debt, or had most of the debt been indexed, then the inflation tax would have been much smaller and the debt-to-GDP ratio would certainly have increased significantly as a result of the EPG.

Is the idea of an *inflation tax* some unorthodox economic concept coming from somewhere like MMT or Marxist economics? No, it is an entirely central part of orthodox macroeconomic theory. I have taught the theory (though not the measurement) for nearly three decades as part of the third year of my macroeconomics courses at York and then Cardiff, and also as part of my PhD courses at Cardiff (and as a guest lecturer on PhD programmes in several other countries). It forms part of my first lecture in the Cardiff Monetary Policy course, which is closely based on Carl Walsh’s textbook. You have the following equation, the household budget constraint (a screenshot from my lecture notes):

- We can write the budget constraint as:

$$c_t + k_t + m_t + b_t - \tau_t = f(k_{t-1}) + (1 - \delta)k_{t-1} + (1 + i) \frac{b_{t-1}}{1 + \pi_t} + \frac{m_{t-1}}{1 + \pi_t} \quad (2)$$

The inflation tax is there in the last two terms with the Greek ‘pi’ in the denominator: an increase in inflation leads to a reduction in the real value of bonds and money, reducing what households can do on the LHS. Now, in aggregate, the bond term drops out: the bond-holders loss is the bond issuers’ gain. However, the most important issuer of bonds is the government, so the ‘inflation tax’ on bonds in effect shifts purchasing power from the household to the government, and that is exactly what the inflation adjustment of the government deficit is aiming to capture in measurement terms. I think that when economists move to central banks or the ONS, they forget the macroeconomics they were taught or simply do not make the link between the theory and measurement because they never really studied economic measurement as undergraduates or graduates.

The OBR does not like the idea of the inflation tax. They argue that using CPI inflation is not correct: we should rather use the GDP deflator. Now, the GDP deflator is measured from the ratio of nominal GDP to Real GDP (Chained volume measure). In growth terms, the year-on-year growth and inflation rates are linked by the following identity:

$$\prod_{Def} \equiv g_{nom} - g_{CVM}$$

The GDP is not really a deflator, it is an *implied deflator*. The estimates of real GDP (CVM) and nominal GDP are made without it. They are then used to define it.

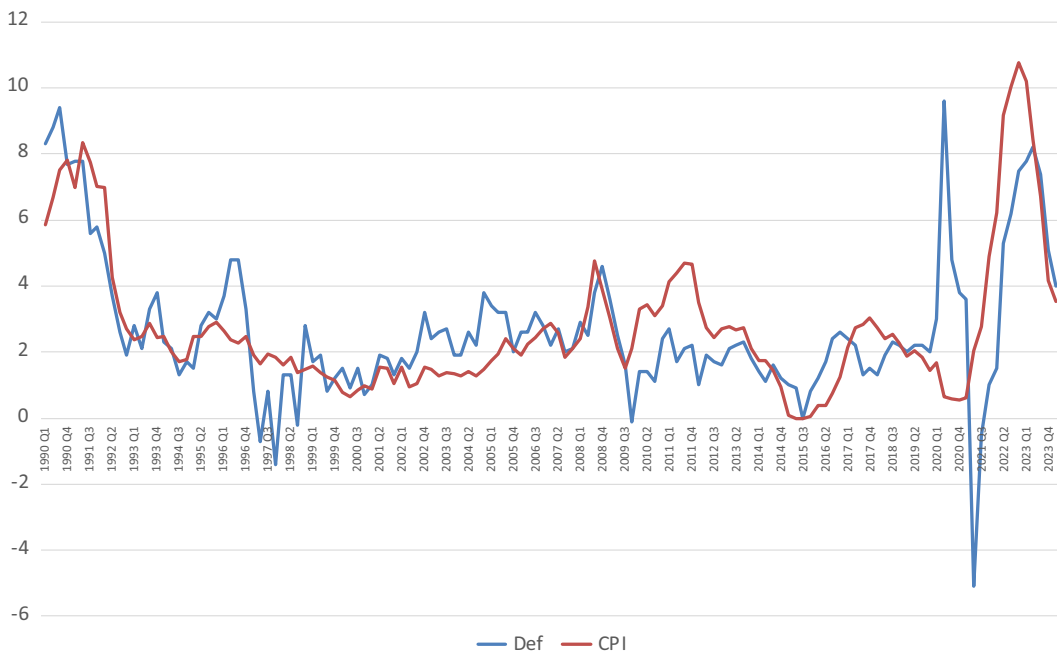
Why does this matter? About 30% of GDP is non-market activity: 10% imputed rents of owner-occupied housing and 20% of government output in the form of education, Health and other things. There is also about 16% private sector investment, leaving about 64% for household consumption (which includes the 10% imputed OOH element, which is part of CPIH but NOT CPI). Thus, the GDP deflator

reflects what is going on in the non-market economy and investment. Now, in the pandemic year, there were lockdowns and social distancing; this caused a major reduction in the measured output of health and education (Jagjit Chadha and I wrote a brief piece on this for the Treasury Select Committee). This reduction in real GDP caused a spike in the deflator. The next year saw a bounce back and resultant negative deflation in 2021.

However, in ‘normal times’, the GDP deflator follows CPI pretty closely. We could use the GDP deflator to inflation adjust public deficits. This needs to be discussed in more detail. However, for me, there are practical issues with the GDP deflator.

My main reasons for preferring to use CPI to measure the inflation tax are threefold. First, the GDP deflator relies on the estimation of real and nominal GDP. Reliable estimates of these take quite some time to settle down. The Blue Book published in October gives the first reliable balanced estimates for the previous year. The estimates of the previous two or three quarters are often subject to revision, which implies a corresponding revision to the deflator. If you are trying to estimate the inflation tax going from a particular point in time, you are on much firmer ground if you use CPI inflation rather than the GDP deflator.

Second, it is households (and firms) who ultimately pay the inflation tax. It is the value of their nominal assets (mainly in the form of bank deposits), which are eroded by inflation. To understand this, we must realize that while government bonds are held by financial institutions such as the Bank of England (Asset Purchase Facility), commercial banks and so on, inflation generally has direct offsetting effects on the two sides of their balance sheets: their assets (the government bonds) go down as do their liabilities (deposits of households, or in the case of the APF reserves of commercial banks). The net effect of inflation of financial intermediaries will be quite small. The main burden of the inflation tax falls on households and firms. The correct numeraire for households is the CPI index. Most people would have no idea what the GDP deflator is.



GDP deflator and CPI 1990–2023.

Third, in the long run, the two move closely together: the mean over the period 1990–2023 is 2.7% for the deflator and 2.8% for CPI. Things went a bit crazy for the GDP deflator in 2020 and 2021, but we can see that in 2023 they have moved together quite closely.

## Conclusions and recommendations

What have we learned?

1. In the post-pandemic world, expenditure shares have shifted around. This has caused issues that caused CPI to underestimate inflation in 2022: Fisher inflation was 11.6% in October (0.5% higher than CPI). The Fisher measure should be used by applied macroeconomists.
2. The difference between democratic and plutocratic measures of inflation became large in the 2022 inflation spike: democratic CPI(D) reached a level of 12.7%, which is well above the official plutocratic measure.
3. Public finances are distorted by inflation. The current methods of reporting do not take into account the considerable effect of inflation on transferring wealth between the private sector and the government (the inflation tax). Now that the debt GDP is so high and likely to remain so for many years to come, even quite modest rates of inflation will imply a significant inflation tax and the inflation-adjusted public deficit is a more reliable measure of the fiscal stance than the raw data.
4. There is, of course, a case for inflation adjusting across all institutional sectors of the economy, firms, households and so forth. This is a bigger task, but one that should be done to get a full picture of the effects of inflation.
5. A final comment on the ONS: they are currently developing a digital transformation, part of which is utilizing big data, such as store scanner data. This will enable much more rapid measuring of expenditure shares and a wider range of prices. This will involve using multilateral index methods, such as GEKS-Törnqvist. Multilateral index methods are designed to deal with changing expenditure shares, so the issue I have identified will be reduced when the new methodology becomes used to construct the CPI data.

Do I have any recommendations for the ONS and other NSIs across the world?

- A. A retrospective ‘ideal’ measure of inflation along the lines of a Fisher or Törnqvist index should be published. While it need have the status of an official statistic, it would provide a more accurate historical measure of inflation that could be used by researchers using historical data (e.g., macroeconomists studying inflation). (The US PCE inflation measure uses the Fisher method.)
- B. The democratic measures of inflation should be given more prominence. From what I can make out, the CPI team at ONS calculates CPI(D) in a very timely manner. Again, while this need not be an official statistic, it could be reported more prominently as part of the CPIH/CPI releases rather than in the appendices of the HIC data (currently, Tables 26 and 27).
- C. The ONS should develop and publish an inflation-adjusted measure of the Government deficit, as should the OBR. While I understand that the ONS often looks abroad to get guidance on statistical methodology, why not be a world leader? The IMF should also do this: there are many countries with elevated inflation and this might also be of relevance to them as well. The method would need to be developed, our ‘inflation adjustment’ is just a proof-of-concept and there are many details to iron out.

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ONS: The data sources for this talk.

Price inflation tables. Updated every month.

Household cost indices. Updated a few times per year.

Consumer trends. Updated every 2 months.

Quarterly National Accounts. Source for GDP deflator and corresponding measures of nominal and real GDP.