Cost of Living Symposium

Estimated Inflation by Household Characteristics

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Abstract Price changes, as measured by the Consumer Price Index (CPI) had remained relatively stable for the last number of years, with annual changes in the CPI remaining under +2.0% between September 2012 and June 2021 inclusive. While prices decreased on an annual basis through much of 2020, inflation has been increasing since April 2021 and has been at least 5.0% since October 2021. The annual inflation rate of 9.2% measured in October 2022 is the highest seen since Quarter 2 1984 when annual inflation stood at 9.7%. The increasing rate of inflation since the middle of 2021 has prompted a greater interest in price change and its effect on households. The CPI is designed to measure the annual rate of inflation, i.e. the change in the average level of prices for consumer goods and services. Thus, the CPI is a measure of average inflation, based on average expenditure weights. However, every household has its own unique consumption pattern and therefore its own personal experience of inflation. Households that spend a higher proportion of their total expenditure on goods and services that are increasing in price by more than the rate of inflation, will experience higher inflation than the CPI average rate. While it would not be feasible to calculate inflation for each individual household, research in Ireland and other countries has highlighted the value of compiling inflation estimates for different groups or cohorts of the population. This paper begins by presenting the history of changes in the cost of living in Ireland over the last 100 years and outlines how the drivers of those price changes have evolved over time. It then presents results from the Household Budget Survey (HBS) which can be used to estimate inflation rates for various household groups. Estimated rates of inflation for the five-year period up to September 2022 are presented for households grouped by equivalised gross household income deciles, by household tenure, by the location of the household (urban/rural), by the age of the household reference person, and by the composition of the household. Finally, the paper demonstrates how those estimated inflation rates for the various household groups have evolved in the last five years.

Keywords: inflation, Ireland, households, expenditure, Consumer Price Index
JELs: D19, E31, R29

1. INTRODUCTION

The Consumer Price Index (CPI) which is compiled by the Central Statistics Office (CSO) is designed to measure the annual rate of inflation in Ireland, i.e. the change in the average level of prices paid by households for consumer goods and services. The index follows established international practice for consumer price indices. The CPI measures the change in the level of prices paid by households for a fixed basket of goods and services. Price indices for each CPI item are calculated and then weighted together by the proportion of total consumer expenditure that is spent on each, to give the total Consumer Price Index.

The fixed basket of goods and services measured in the CPI is comprehensively updated every five years based on the CSO's Household Budget Survey (HBS). The HBS provides a detailed profile of household expenditure, item by item. Following each HBS, the CSO reviews the basket of goods and services included in the CPI. The HBS is also used, together with other data, to establish the weights (i.e., the relative importance of each item as a share of total consumer spending) used in calculating the index and these weights are updated annually. The expenditure weights used in calculating the CPI represent expenditure on consumer goods and services by private households, visitors to Ireland, and institutional households. The most recent HBS, measuring expenditure by private households, was in 2015/16. An update to the HBS was delayed in 2020 due to the COVID-19 pandemic.

Collection of HBS data started in July 2022 and will continue for at least 12 months after which the HBS data will be analysed before being used to update the basket of goods and services for the CPI.

The CPI is a measure of *average* inflation, based on *average* expenditure weights. However, every household has its own unique consumption pattern and therefore its own personal experience of inflation. Households that spend a higher proportion of their total expenditure on goods and services that are increasing in price by more than the rate of inflation, will experience higher inflation than the CPI average rate. While it would not be feasible to calculate a CPI for each individual household, research in Ireland and other countries has highlighted the value of compiling inflation estimates for different groups or cohorts of the population (see *Bibliography*).

The increasing rate of inflation since the middle of 2021 has prompted greater interest in price change and its effect on households. A paper by the Central Bank of Ireland in February 2022 addressed the topic of Household characteristics, Irish Inflation and the cost of living (Lydon, 2022).

This paper contains similar analyses at a more detailed level and provides estimates up to September 2022. The estimated breakdowns of the CPI results by household characteristics from September 2017 up to September 2022 are calculated by combining the CPI results with more detailed expenditure data from the 2015/16 HBS. The household groups analysed include households grouped by equivalised gross household income deciles, by household tenure, by the location of the household (urban/rural), by the age of the household reference person, and by the composition of the household.

2. TRENDS IN THE CONSUMER PRICE INDEX

The detailed analysis in this paper focuses on the period up to September 2022 but Consumer Price Index results were available for November 2022 when the paper was being prepared. Prices in Ireland, as measured by the CPI have been rising on an annual basis since April 2021, with annual inflation of 5.0% or more recorded in each month from October 2021 to November 2022. The CPI release for November 2022 showed that prices for consumer goods and services in November 2022 had increased by 8.9% on average compared with November 2021. Prices in the 12 months to October 2022 rose by 9.2%; that was the highest rate of inflation since Quarter 2 1984 when annual inflation stood at 9.7%.

This follows a long period of low inflation, i.e., while prices rose by 8.9% in the last year (November 2021 to November 2022), they only rose by 7.5% in the entire 10 years before that (November 2011 to November 2021). Average annual inflation to November 2022 was 7.8% and had been above 7.5% in only three other time periods in the last 100 years (see Figure 1): from 1940 to 1943 (4 years), from 1951 to 1952 (2 years), and from 1970 to 1984 (15 years).

Figure 1: Average annual inflation 1923-2022
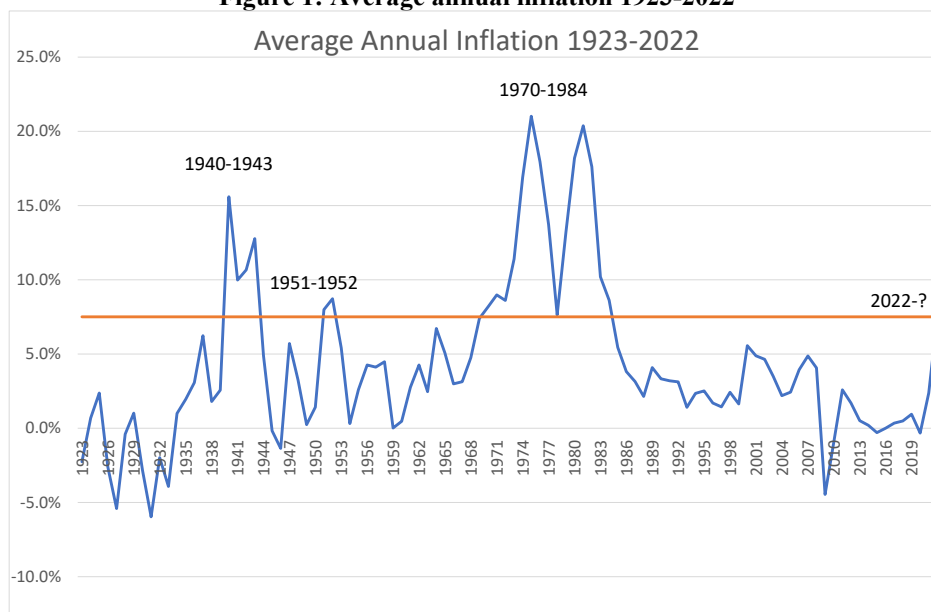
3. DRIVERS OF INFLATION

Prices on average, as measured by the CPI, were 8.9% higher in November 2022 compared with November 2021. Table 1 shows that the most notable changes in the year were increases in Housing, Water, Electricity, Gas & Other Fuels (+27.1%), Food & Non-Alcoholic Beverages (+11.2%), Alcoholic Beverages & Tobacco (+9.1%) and Transport (+7.9%). There were decreases in Education (–7.1%) and Miscellaneous Goods & Services (–0.2%).

Table 2 shows the contribution of each 2-digit Classification of Individual Consumption by Purpose (COICOP) division to the overall change in the CPI of 8.9% in the 12 months to November 2022. The largest contributor to the CPI was Housing, Water, Electricity, Gas & Other Fuels which contributed half of the increase, i.e. 4.5 percentage points of 8.9%. The other divisions which caused the largest upward contribution to the CPI in the period were Food & Non-Alcoholic Beverages (+1.3 percentage points), Restaurants & Hotels (+1.2 percentage points) and Transport (+1.1 percentage points).

Figure 2 shows the evolution of the contribution of the COICOP divisions to the annual change in the overall CPI from January 2007 through to November 2022. While the annual CPI rate during this period ranged from as low as almost –6.6% in September 2009 up to +9.2% in October 2022, a couple of COICOP divisions seem to be driving the changes whether negative or positive. These divisions include Housing, Water, Electricity, Gas & Other Fuels, Food & Non-Alcoholic Beverages, Transport and Restaurants & Hotels.

Table 1   Consumer Price COICOP Division Indices - November 2022

| COICOP Division		Weights	Consumer Price Index (CPI)		Percentage changes				
		2022	Dec. 2016=100	Dec. 2011=100	1 month		3 months		12 months
01	Food and Non-Alcoholic Beverages	11.417	106.4	100.2	0.7		2.4		11.2
02	Alcoholic Beverages and Tobacco	5.634	122.6	140.0	-0.4		0.6		9.1
03	Clothing and Footwear	4.714	91.4	78.4	1.9		5.7		1.9
04	Housing, Water, Electricity, Gas and Other Fuels	16.394	155.5	155.8	0.6		10.9		27.1
05	Furnishings, Household Equipment and Routine Household Maintenance	5.142	92.0	78.3	0.0		1.0		4.2
06	Health	3.209	109.1	112.1	0.4		0.5		2.1
07	Transport	13.968	123.7	118.0	0.3		-3.2		7.9
08	Communications	3.250	90.9	83.1	0.0		-0.2		0.2
09	Recreation and Culture	7.356	104.9	100.6	0.0		0.4		2.4
10	Education	1.735	100.1	121.5	-0.4		-6.4		-7.1
11	Restaurants and Hotels	15.150	121.3	132.5	0.0		-0.7		7.6
12	Miscellaneous Goods and Services	12.030	97.6	113.3	0.1		0.5		-0.2
	ALL ITEMS	**100.000**	**116.0**	**117.4**	**0.3**		**1.9**		**8.9**
	Of which:								
	Goods	44.027	108.2	98.1	0.5		2.1		9.4
	Services	55.973	121.6	133.6	0.2		1.8		8.6
	Energy Products	8.385	189.5	175.4	0.2		13.7		43.1
	Utilities and Local Charges	3.654	219.3	244.2	0.0		27.8		62.9
	Alcohol	8.984	113.9	123.4	-0.2		-0.2		7.3
	Tobacco	2.387	138.5	177.8	0.2		3.4		5.2
	Mortgage Interest	2.764	131.6	82.4	5.4		15.9		21.0
	Services excluding Mortgage Interest	53.209	121.1	139.8	-0.1		1.2		7.9

Notes: See Background Notes for definition of COICOP divisions, goods, services and utilities and local charges. Restaurants and Hotels (COICOP 11) includes alcoholic beverages consumed on licensed premises. Alcohol constitutes part of COICOP 02 (off-licence sales) and part of COICOP 11 (alcohol consumed on licensed premises) giving a combined index for alcohol.
Source: Table 2 of the Consumer Price Index November 2022 release available at https://www.cso.ie/en/releasesandpublications/ep/p-cpi/consumerpriceindexnovember2022/.

Table 2   Contributions to the change in the All Items CPI - November 2022

	COICOP Division	Percentage contributions		
		1 month	3 months	12 months
01	Food and Non-Alcoholic Beverages	0.08	0.28	1.28
02	Alcoholic Beverages and Tobacco	-0.02	0.03	0.52
03	Clothing and Footwear	0.08	0.24	0.10
04	Housing, Water, Electricity, Gas and Other Fuels	0.13	1.92	4.46
05	Furnishings, Household Equipment and Routine Household Maintenance	0.00	0.05	0.22
06	Health	0.01	0.02	0.07
07	Transport	0.04	-0.46	1.09
08	Communications	0.00	-0.01	0.01
09	Recreation and Culture	-0.01	0.02	0.17
10	Education	-0.01	-0.10	-0.13
11	Restaurants and Hotels	0.00	-0.12	1.15
12	Miscellaneous Goods and Services	0.02	0.06	-0.03
	All Items % change	*0.3*	*1.9*	*8.9*
	Goods	0.19	0.92	4.16
	Services	0.13	1.04	4.75
	Energy Products	0.01	1.37	3.64
	Tobacco	0.00	0.08	0.13
	Mortgage Interest	0.16	0.43	0.58

Notes: For the percentage contributions, the sum of the 2-digit COICOP divisions may not equal the All Items % change due to rounding differences. Source: Table 3 of the Consumer Price Index November 2022 release available at https://www.cso.ie/en/releasesandpublications/ep/p-cpi/consumerpriceindexnovember2022/.

Figure 2: Contributors to overall CPI percentage change in 12 months, January 2007 to November 2022

Source: https://data.cso.ie/table/CPM11
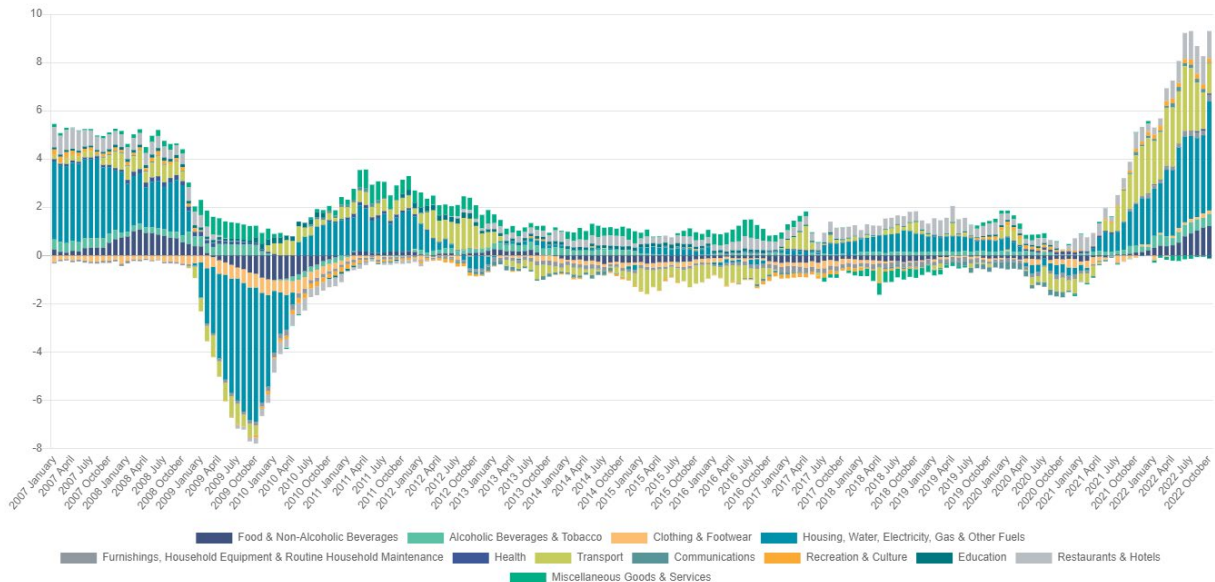
4. HOUSEHOLD BUDGET SURVEY

The Household Budget Survey (HBS) provides the detailed item by item profile of expenditure used in establishing the basket of goods and services measured by the CPI. The results of the HBS can be broken down to show the spending patterns of different types of household. Results from the 2015/16 HBS on how households' pattern of spending on goods and services differs depending on household characteristics, as shown in Table 3, tell us that:

The proportion of spending on Rent was higher among:

- Households with lower gross household income
- Households that rent privately in comparison to households that rent from a local authority
- Urban households
- Households where the reference person is aged under 35 years
- Households of one adult with children

The proportion of spending on Electricity, Gas & Other Fuels was higher among:

- Households with lower gross household income
- Households that either own their home outright or rent from a local authority
- Rural households
- Households where the reference person is aged 65 or over
- Households of one adult or one adult with children

The proportion of spending on Transport was higher among:

- Households with higher gross household income
- Households that own their home (outright or with a mortgage)
- Rural households
- Households where the reference person is aged 35 to 64 or aged 65 or over
- Households of two or more adults

Table 3   Proportion of expenditure by household characteristics, Household Budget Survey 2015/16

	01. Food & Non-Alcoholic Beverages	02. Alcoholic Beverages & Tobacco	04.1 Rent	04.2 Mortgage Payments	04.5 Electricity, Gas & other Fuels	07. Transport	11. Restaurants & Hotels	Other	Total
All Households	*12.7*	*2.5*	*6.7*	*9.0*	*5.4*	*14.2*	*7.0*	*42.5*	*100.0*
1st (Lowest) Income Decile	16.0	3.3	15.9	3.7	7.4	10.4	5.2	38.1	100.0
2nd Income Decile	17.0	3.4	12.3	3.7	8.4	9.7	5.5	40.0	100.0
3rd Income Decile	16.9	3.4	10.8	4.2	7.0	12.3	5.5	39.9	100.0
4th Income Decile	15.7	3.4	10.0	5.7	6.7	12.8	5.4	40.3	100.0
5th Income Decile	14.2	2.9	7.9	7.7	5.9	13.7	5.8	41.9	100.0
6th Income Decile	13.6	2.6	5.4	7.7	5.5	15.0	7.2	43.0	100.0
7th Income Decile	12.4	2.2	4.9	9.9	5.1	15.6	7.2	42.7	100.0
8th Income Decile	11.0	2.1	4.3	11.1	4.6	14.5	7.8	44.6	100.0
9th Income Decile	10.5	1.9	4.2	11.2	4.2	16.9	8.1	43.0	100.0
10th (Highest) Income Decile	8.9	1.8	3.8	13.9	3.9	14.9	8.5	44.3	100.0
Owned Outright	15.3	2.7	0.1	0.0	7.0	17.7	7.5	49.7	100.0
Owned with Mortgage	11.1	2.1	0.1	20.0	4.5	14.0	6.9	41.3	100.0
Rented from Local Authority	17.4	5.0	17.9	0.0	7.5	9.1	5.9	37.2	100.0
Rented from Private Owner	11.3	2.5	28.5	0.0	4.6	11.1	6.9	35.1	100.0
Urban	12.1	2.7	8.9	9.3	5.1	12.7	7.4	41.8	100.0
Rural	14.1	2.0	1.5	8.5	6.0	18.1	6.2	43.6	100.0
Reference Person aged under 35	10.4	2.2	19.7	6.4	4.0	12.4	7.8	37.1	100.0
Reference Person aged 35 to 64	12.4	2.5	4.6	11.5	5.1	14.6	7.0	42.3	100.0
Reference Person aged 65 or over	16.5	2.7	2.0	1.0	8.2	14.9	6.5	48.2	100.0
1 adult	12.0	2.8	9.7	6.9	8.1	13.0	6.8	40.7	100.0
1 adult with children	14.0	3.1	21.2	5.1	6.7	8.1	4.2	37.6	100.0
2 adults	12.9	2.9	6.5	6.4	5.9	15.4	8.0	42.0	100.0
2 adults with 1 to 3 children	12.0	1.8	6.9	14.3	4.7	13.3	5.7	41.3	100.0
3 plus adults	12.8	2.8	5.6	6.1	4.6	15.4	8.3	44.4	100.0
Other households with children	14.1	2.2	4.5	11.9	4.7	13.3	5.9	43.4	100.0

Source: Table 1.2 of the Estimated Inflation by Household Characteristics September 2022 release available at
https://www.cso.ie/en/releasesandpublications/frp/frp-eihc/estimatedinflationbyhouseholdcharacteristicsseptember2022/.

5. ESTIMATED INFLATION BY HOUSEHOLD CHARACTERISTICS - SEPTEMBER 2022 RESULTS

The Consumer Price Index (CPI) subindices were combined with detailed expenditure data from the 2015/16 Household Budget Survey (HBS) to calculate estimated inflation rate in the five years from September 2017 to September 2022, for the following groups:

- Households grouped by equivalised gross household income (deciles)
- Households grouped by type of tenure
- Urban and rural households
- Households grouped by the age of the household reference person
- Households grouped by composition

The method used to calculate the estimated inflation rates for the various household groups is as described in the Appendix at the end of this paper.

In the tables and commentary, the following periods are distinguished:

(i)   Overall period (five years) from September 2017 to September 2022;
(ii) The period (four years) from September 2017 to September 2021;
(iii) The 12 months (one year) from September 2021 to September 2022.

In the five years from September 2017 to September 2022, the CPI increased by 12.9%, most of this increase being concentrated in the final 12 months. Between September 2017 and September 2021 (four years), the CPI increased by 4.4%; and in the 12 months from September 2021 to September 2022, the CPI increased by 8.2%. See Table 4.

Table 4 shows that, in the five years from September 2017 to September 2022, the overall CPI was 12.9% but inflation, in that period, was highest for Electricity, Gas & Other Fuels which was up 85.1% followed by Rent which was up 27.5%. This means that household groups that have higher than average proportion of their expenditure on Electricity, Gas & Other Fuels or on Rent, will have higher than average inflation over the five years from September 2017 to September 2022.

In the 12 months to September 2022, Table 4 shows that the overall CPI was 8.2% but inflation, in that period, was highest for Electricity, Gas & Other Fuels which was up 49.6% followed by Transport which was up 11.3% and Rent which was up 10.0%. Thus, household groups that have higher than average proportion of their expenditure on two of the three categories of Electricity, Gas & Other Fuels, Transport, or Rent will have higher than average inflation over the 12 months to September 2022.

Table 4   Change in All Items CPI and selected subindices, September 2017 to September 2022 (5 years), September 2017 to September 2021 (4 years) and September 2021 to September 2022 (1 year)

	01. Food & Non-Alcoholic Beverages	02. Alcoholic Beverages &Tobacco	04.1 Rent	04.2 Mortgage Interest Payments	04.5 Electricity, Gas & other Fuels	07. Transport	11. Restaurants & Hotels	CPI All Items
Sep-2017 to Sep-2022 (5 years)	5.4	20.5	27.5	16.5	85.1	21.7	16.9	12.9
Sep-2017 to Sep-2021 (4 years)	-4.0	12.5	15.8	8.3	23.7	9.4	8.6	4.4
Sep-2021 to Sep-2022 (1 year)	9.9	7.1	10.0	7.6	49.6	11.3	7.6	8.2

Source: Table 1.1 of the Estimated Inflation by Household Characteristics September 2022 release available at https://www.cso.ie/en/releasesandpublications/frp/frp-eihc/estimatedinflationbyhouseholdcharacteristicsseptember2022/.

The methodology used for the analysis in this paper takes account of the differences of expenditure observed for the various household groups from the 2015/16 HBS (Table 3) with the differences observed for inflation for the various subindices (Table 4) to estimate inflation rates by household group for the 12 month and five-year periods to September 2022.
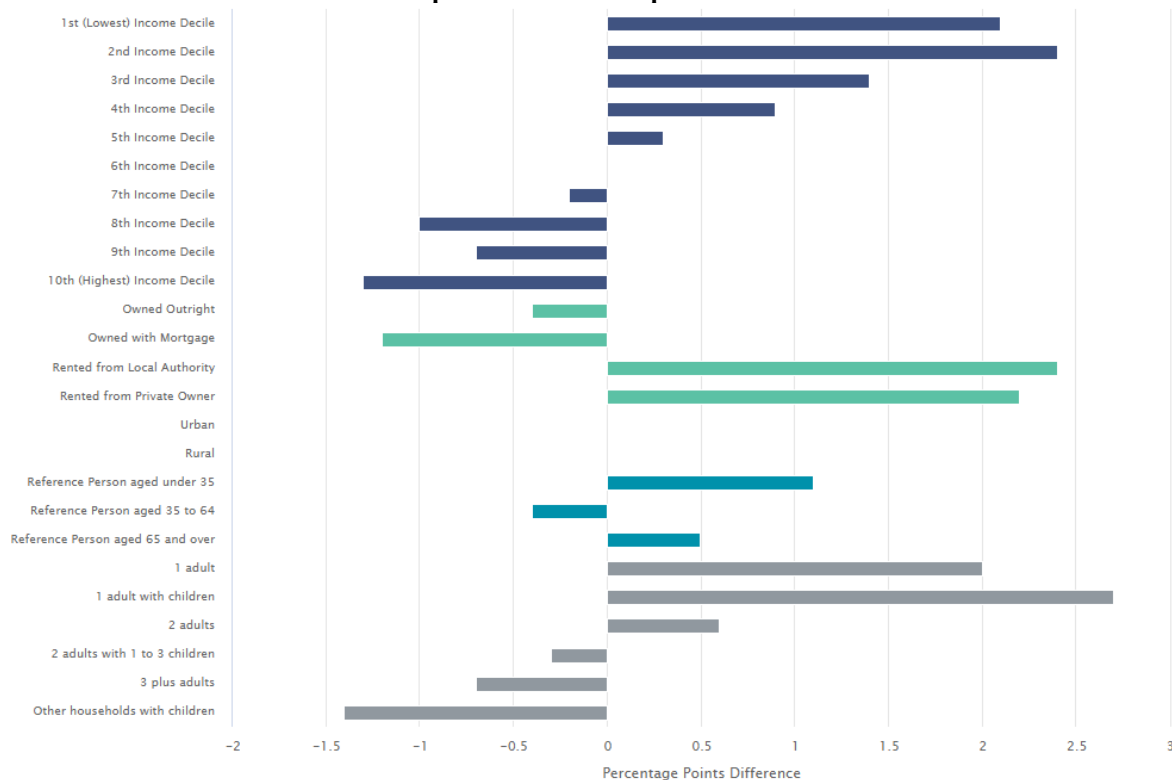
September 2017 to September 2022 Results

Figure 3 shows the difference from the overall CPI increase of 12.9% for different household groups for the five years from September 2017 to September 2022. All of the household categories in the analysis had estimated inflation of 11.5% or more in the five years from September 2017 to September 2022. This ranged from 11.5% for Other households with children (households containing two adults with more than three children, or households containing three or more adults with children) to 15.6% for households containing one adult with children.

Five-year inflation estimated for households in the lowest income decile was 2.1 percentage points higher than the CPI average, at 15.0%. The estimated inflation for households in the highest income decile over the same five years was 11.6%.

Figure 3 shows that the following household groups were estimated to have experienced higher inflation than the overall CPI increase of 12.9% from September 2017 to September 2022 (five years):

- Households with lower gross household income
- Households that rent their home
- Households where the household reference person is aged under 35
- Households where the household reference person is aged 65 or over
- Households of one adult (with or without children)
- Households comprising two adults (without children)

Figure 3: Estimated Difference from CPI Inflation (12.9%) by Household Characteristics September 2017 to September 2022

Source: CSO Ireland
Highcharts.com

Source: Figure 2.1 of the Estimated Inflation by Household Characteristics September 2022 release available at https://www.cso.ie/en/releasesandpublications/frp/frp-eihc/estimatedinflationbyhouseholdcharacteristicsseptember2022/summaryofmainresults/
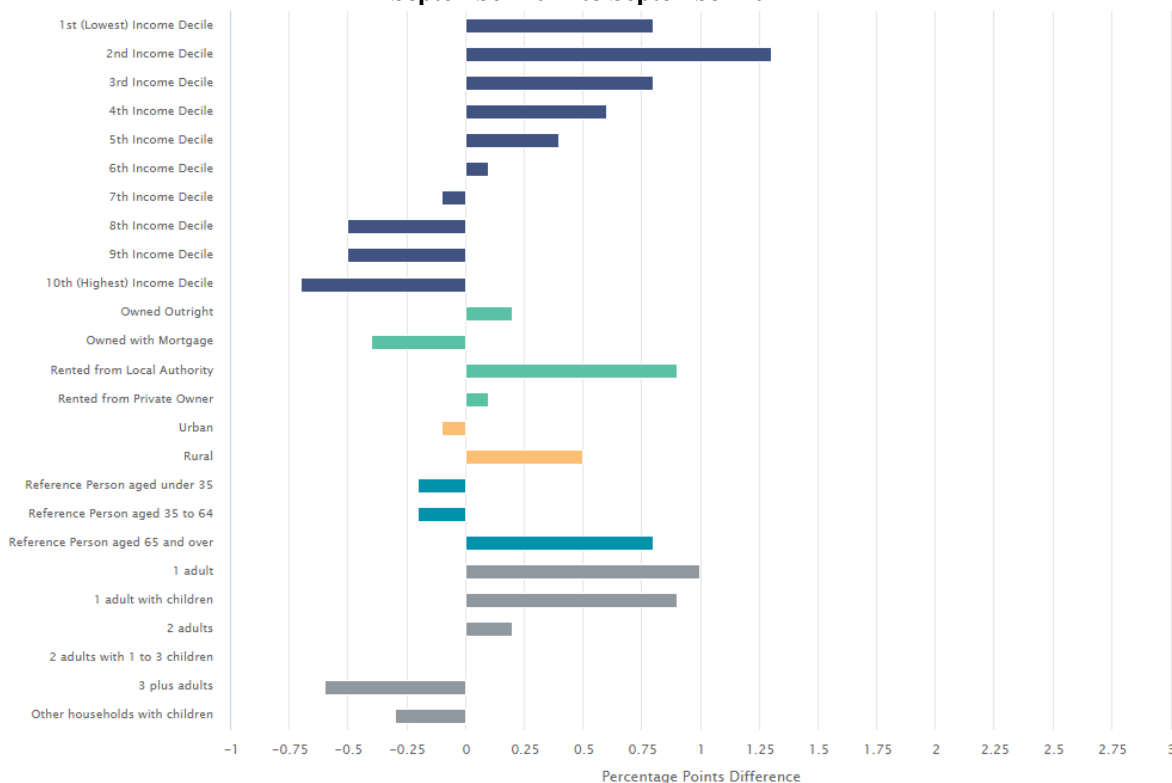
September 2021 to September 2022 Results
Figure 4 shows the difference from the overall CPI increase of 8.2% for different household groups in the 12 months from September 2021 to September 2022. All categories of household in the analysis had estimated annual inflation of 7.5% or more in the year to September 2022. This ranged from 7.5% for households in the highest income decile up to 9.5% for households in the second lowest income decile.

In the past year, from September 2021 to September 2022, the following categories of household were estimated to have experienced higher inflation than the overall CPI increase of 8.2%:

- Households with lower gross household income
- Households that are owned outright
- Households that rent their home
- Rural households
- Households where the household reference person is aged 65 or over
- Households of one adult (with or without children)
- Households comprising two adults (without children)

Figure 4: Estimated Difference from CPI Inflation (8.2%) by Household Characteristics September 2021 to September 2022

Source: CSO Ireland
Highcharts.com

Source: Figure 2.2 of the Estimated Inflation by Household Characteristics September 2022 release available at
https://www.cso.ie/en/releasesandpublications/frp/frp-eihc/estimatedinflationbyhouseholdcharacteristicsseptember2022/summaryofmainresults/

6. LIMITATIONS OF ANALYSIS

There are several limitations to this analysis that should be taken into consideration when the results are being reviewed.

Household Budget Survey (HBS)
The HBS data used to produce this household characteristics analysis of the CPI is from 2015/16. The survey usually takes place every five years but was delayed because of the COVID-19 pandemic. Collection of data for the HBS started in July 2022 and will continue for at least 12 months. The HBS data will then need to be analysed before being used to update the CPI basket of goods and services and rebase the CPI.he years since the 2015/16

HBS have seen considerable changes, notably the disruptions to society and economy caused by the pandemic particularly over the course of 2020/21, resultant changes in consumption behaviour, international supply chain problems, energy-related price inflation, continuing pressures in the housing market, climate change, and the more recent impacts of the war in Ukraine. While the HBS will not distinguish any of these factors individually, we can reasonably expect that the consumption patterns measured by the 2022/23 HBS will be different from 2015/16. Some goods and services will account for a greater share of private household expenditure, and some a lower share, in 2022/23 than in 2015/16. It can also be expected that differences between categories of households may have changed. These changes will, in turn, impact on the calculation of estimates of inflation by household characteristics. The extent of these changes will not be known until results are available from the 2022/23 HBS.

Pricing assumptions inherent in CPI compilation

In compiling a breakdown of the CPI by household groups, an inherent assumption is that all households and household groups are subject to the same price changes. This may not be true. In the overall CPI, this issue is addressed by selecting a broad range of price quotations for each item. However, households in lower income deciles may tend to buy different brands and shop at different outlets than households in higher income deciles. The price changes for these different brands and outlets may differ. Another example is that rural households may buy more items from smaller shops and less from national chains than urban households, and again the price changes may differ. In estimating a breakdown of inflation by household categories, this analysis aims to take account of the different mix of goods and services purchased by each category of household. However, it cannot take into account differences in the prices – and crucially the monthly changes in those prices – encountered by each category of household.

Understanding results that seem counter-intuitive

The results can sometimes appear counter-intuitive. For example, households paying a mortgage had lower inflation than households that own their homes outright. While households paying a mortgage probably do have higher outgoings than a household that owns their home outright, mortgage interest payments had relatively low inflation over the period covered by this analysis. Thus, households making large mortgage interest payments would have seen overall lower inflation.

Another counter intuitive result is that two adults with children have lower inflation than households with just two adults. Households with children have higher proportions of spending on food and clothing. These had relatively low inflation over this period, so the inflation for households of two adults with children is lower.

Even when the results seem intuitive, it is important to realise that they are not inevitable. For example, households in lower income deciles had higher estimated inflation than households in higher income deciles. This is because households with lower incomes spend a higher proportion of their expenditure on Rent and Electricity, Gas & Other Fuels, and these items had high inflation over the period. But households with higher incomes spend a higher proportion of their income on Transport and on Restaurants & Hotels, and price increases in these sectors may, at certain times, drive their estimated inflation higher than households with lower incomes.

7. CONCLUSION

Although there are limitations to the analysis undertaken in this paper, it has been shown that inflation can be estimated by household characteristics for different time periods using results from the Household Budget Survey (HBS) combined with price changes for sub-indices for the Consumer Price Index (CPI). This analysis focused on the five-year and 12-month periods up to September 2022 and found that inflation tended to be higher than average inflation as measured by the CPI for households in the lower equivalised income deciles in both time periods and lower than average inflation for households in higher income deciles.

However, when we look at some of the other household characteristics, we can see differences emerge in the estimated inflation for the different time periods. When we look at the age of the household reference person for example, the estimated inflation in the five-year period is expected to be highest for households where the reference person is aged under 35 years while households where the reference person is aged 65 years and over are estimated to have the highest inflation in the last 12 months. The difference in the impact on ages in the two time periods is because high Rent inflation over the five-year period causes inflation to be higher for households where the reference person is aged under 35 years, while the high inflation for Electricity, Gas and Other Fuels in the 12-month period leads to higher inflation for 65 and over households.

There was no difference between estimated inflation for urban and rural households over the five years to September 2022 (both 12.9%) while inflation in the 12 months to September 2022 was estimated to be 0.6

percentage points higher for rural households than urban households (8.7% and 8.1% respectively). High transport inflation in the 12-month period has resulted in higher inflation for rural households.

The differences observed for the different time periods occur because the drivers of inflation change over time. Thus, the impact of inflation can appear different depending on the length and timing of the reference period being looked at; this is something that needs to be borne in mind when considering the differential impact of inflation on household groups.

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APPENDIX - METHODOLOGY

The Consumer Price Index (CPI) for month t is given by the formula

$$I_{0,t} = \sum_i \frac{p_i^t}{p_i^0} w_i^0$$

where p_i^t and p_i^0 are the prices of item i in month t and month 0 (the base month) respectively, and w_i^0 is the weight or expenditure share of item i for month 0. The weights w_i^0 for each item in the CPI basket are adjusted every December to reflect changes in expenditure patterns. The most important source for annual updating of these weights is the Household Final Monetary Consumption Expenditure (HFMCE) data from the National Accounts for the preceding year. The CPI is calculated using these weights until the following December, and the annual indices are chained to produce a multi-year CPI.

In this analysis we make the simplifying assumption that all households are subject to the same price changes, so $\frac{p_i^t}{p_i^0}$ for expenditure item i will be the same for all households. By combining these universal price changes with weights $w_{i,h}^0$ that differ for each household group h, we produce indices specific to household groups.

$$I_{0,t}^h = \sum_i \frac{p_i^t}{p_i^0} w_{i,h}^0$$

These weights are constant from December to December, and the annual indices are chained to produce a multi-year index for household group h.

The data for estimating how the weights $w_{i,h}^0$ differ for household groups come from the 2015/16 Household Budget Survey (HBS).

There were 6,839 households that participated in the 2015/16 HBS. Detailed expenditure was recorded for each household. Many characteristics of the household were also recorded, such as number of adults and children, gross household income, whether the household owned or rented their home, the age of the household reference person, and whether the household is in an urban or rural location. These characteristics allow us to analyse specific household groups within the HBS dataset. Each household in the HBS sample has a grossing factor which ensures that the total expenditure is representative of the population.

The following are the steps in producing indices for different household groups.

Step 1. Summarize all data by COICOP group
The CPI data is broken down into subindices which follow the international COICOP classification (Classification of Individual Consumption by Purpose). As a first step in estimating indices for different household groups the following data are all summarised by COICOP group:

1) The detailed expenditure for each household in the HBS sample
2) The CPI annual item weights
3) CPI indices from September 2017 to September 2022

Step 2. Produce annual updates of HBS file that are CPI consistent
We use the HBS dataset of 6,839 households surveyed in 2015/16 to generate CPI-consistent HBS data for each year from December 2016 to December 2021. Each household $h's$ expenditure on COICOP group i in the year t is calculated as:

$$e_{h,i,t}^{CPI} = e_{h,i}^{HBS} \times \frac{w_{i,t}^{CPI}}{w_i^{HBS}}$$

Where $e_{h,i,t}^{CPI}$ is the adjusted level of expenditure for household h on COICOP group i for year t, consistent with the CPI weights for year t.
$e_{h,i}^{HBS}$ is the expenditure recorded by the HBS for household h, on COICOP group i.
$w_{i,t}^{CPI}$ is the proportion of total CPI expenditure spent on COICOP group i in year t.
w_i^{HBS} is the population proportion of total expenditure spent on COICOP group i according to the HBS.

The result of these adjustments is that there are now annual iterations of the HBS data, where the population proportion of the expenditures for each COICOP group equals the CPI weight for that year.

The adjustment factors $\frac{w_{i,t}^{CPI}}{w_i^{HBS}}$ that make the HBS file CPI-consistent are close to 1 in many cases, meaning that only small adjustments each year are made to each household $h's$ expenditure on a COICOP group i. For some COICOP groups the adjustments can be large. This occurs if:

i)   The COICOP group is one where the HBS tends to underestimate true expenditure, possibly due to under-reporting. The COICOP group 02.1 'Alcoholic Beverages' is an example of this, and so the adjustment factor is more than 1.

ii)   The HBS records expenditure on mortgage payments, but the CPI weight for COICOP group 04.2 is for mortgage **interest** payments. The HBS estimate is therefore higher than the CPI annual weights so the adjustment factor is less than 1.

iii)   CPI weights include expenditure by visitors to Ireland and by institutional households. This expenditure is not captured by the HBS which surveys private households only. For some COICOP groups (e.g. 11.2 Accommodation services) the CPI weight is bigger than the HBS weight for this reason, and so the adjustment factor is more than 1.

Note that the adjustment factor $\frac{w_{i,t}^{CPI}}{w_i^{HBS}}$ is the same for all households. The assumption is that where there are differences between the HBS and CPI-consistent expenditure totals for a given COICOP group, the reasons and proportionate effect of the differences are uniform across households.

Step 3. Calculate annual weights for each household group
We can now take subsets of the CPI-consistent annual HBS data for each household group we are analysing. We calculate annual expenditure weights by COICOP group for each household group subset:

- households grouped by equivalised gross household income (deciles)
- households grouped by type of tenure
- urban and rural households
- households grouped by the age of the household reference person and
- households grouped by composition

Step 4 Calculate estimated price index for each household group
An estimated price index for each household group I_{HG} is calculated by the formula

$$I_{HG}^t = \sum_i I_i^t \, w_i^{HG}$$

Where I_i^t is the price index for COICOP group i at time t, and w_i^{HG} is the weight for household group HG for COICOP group i. The weights w_i^{HG} change annually (see Step 2 above) so this is an annually chained index.

The total inflation, or annual change in the index, for each household group is a sum of the contributions of each COICOP group. The contributions are the product of the inflation and the weight for that COICOP group. As the weights differ by household group, the contribution of a COICOP group to overall inflation will also differ by household group.

Equivalised income groups
Equivalised gross household income is used to assign households to income deciles. The modified OECD scale is used. This scale assigns a value of 1 to the first household member, 0.5 to each additional adult, and 0.3 to each child (aged under 14 years). In this scale, a household with two adults and two children would have an equivalised household size of 2.1 (1+0.5+0.3+0.3). If this household had an income of €500 per week, its equivalised income is calculated as €500/2.1 = €238. For a household of one adult with an income of €250 per week, the equivalised income is calculated as €250/1 = €250. In this example the first household would be assigned to a lower income decile than the second household.