ADVISORY PANEL ON CONSUMER PRICES – STAKEHOLDER

Import, Energy and Labour intensity of CPI

This work had to be postponed in response to wider prioritisation efforts. We are looking into establishing new workflows on this topic for later in the year

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Purpose

1. This paper is to gather stakeholder views on our updated estimates of the import, energy, and labour intensity of CPI, which includes proposed communications to best meet user needs. Out import intensity and energy intensity estimates are currently not produced on a consistent basis. We are looking to align these to improve their coherence, and we then propose to produce new labour intensity estimates on the same basis.

Actions

2. Members of the Panel are invited to:
   a) Provide views on the proposed methodological updates to how we produce import, energy and labour intensity estimates of CPI and CPIH, specifically your feedback as to whether these are theoretical and practical improvements from a user perspective.
   b) Provide views on how best to communicate the contributions of imports, labour, and energy to headline CPI(H) inflation, specifically whether to use 'fixed' or 'relative' buckets of intensity, and how to address the time-varying feature of the new approach.
   c) Offer views on whether to treat rents as a separate category for import intensity and labour intensity, as is currently the case for energy intensity.

1. Background

Consumer price inflation has been a topic of much interest over the last few years, primarily reflecting the demand and supply shocks of the Covid-19 pandemic and the Russian invasion of Ukraine. An historically tight UK labour market has also led to domestic inflationary pressures in recent years. This has led to a focus on understanding domestic and global inflation, but also the direct and indirect effects of these types of inflationary shocks.

There has been stakeholder interest in understanding these changes to consumer price inflation, specifically the impacts of import, energy, and labour on the price movements of the goods and services in the CPI basket. This builds on previous work estimating the import intensity, and more recent research to estimate the energy intensity of the CPI and CPIH. The estimates of import intensity are currently published monthly, together with the CPI bulletin, while the analysis of energy intensity was a one-off publication.

We propose some methodological improvements, which we feel would improve the coherence and consistency of these estimates. We are also proposing to produce new estimates for the labour intensity of CPI and CPIH. We also propose a time-varying feature of these estimates, which would capture the changes over time in the backwards- and forward-linkages of the production of these

goods and services. Finally, we propose a quarterly publication process where all intensity estimates (imports, labour, and energy) are published in a single unified dataset.

2. Methodology

To estimate the import, energy, and labour intensity values, we use the Supply-Use Tables (SUTs) and Input-Output Analytical Tables (IOATs) to calculate the proportion of costs accounted for by each input (imports, energy, and labour) in the production of different goods and services. This is done as a proportion of purchasers' prices to most closely reflect the prices faced by consumers, including taxes less subsidies, direct imports, and distribution costs. We include a step to allocate the import, energy or labour usage of wholesalers and retailers to products based on their relative use, as wholesale and retail services are not bought directly by consumers but instead included within consumer prices.

This is an improvement on existing the methodologies for import and energy intensity for a few reasons.

- The new method consistently uses household spending at purchaser's prices, whereas the previous estimates used whole-economy spending for energy intensity and household spending for import intensity.
- It consistently uses the whole supply chain response per unit of final output, inclusive of indirect effects via intermediate products.
- It uses actual Blue Book data on distributors' trading margins allocated to households instead of an approximation based on households' share in total use of output.
- The base year for the IOATs is updated every 5 years instead of being set at a fixed point in time. We use revised data which is no longer open for Blue Book updates.
- Given the new allowed scope for intensities to change over time we propose using 'relative' buckets instead of the existing 'fixed' buckets (more details below).

3. Calculations

To calculate our estimates of imports, labour, and energy intensity we aggregate the effects via the following three channels.

- Effects via domestic output at basic prices,
- Effects via direct imports of goods and services,
- Effects via distributor trading margins.

These three channels, together with taxes less subsidies on final products, account for household final consumption expenditure at purchasers' prices which is our targeted variable. The sections below briefly explain the calculation for import, labour, and energy intensity relevant to each of these parts of household spending.

3.1 Effects via domestic output at basic prices

We use the UK input-output analytical tables (IOAT) to decompose household use of domestic output at basic prices. The IOT product-by-product matrix shows the direct use of each product as an input to produce other products, including its own output. The tables also show the primary inputs of these products, which are:

- imports,
- compensation of employees,
- gross operating surplus (GOS) and mixed income (MI),
- taxes less subsidies on products and production.

To calculate each products' intensity by primary input, we use the ***Effects matrix***. This matrix shows the *total* impacts on the economy per unit of final use, including the *direct* and *indirect* use of inputs. The *Effects matrix* is derived via matrix multiplication of the *'A' matrix* and the *Leontief inverse* matrix.

- ***The 'A' matrix*** of coefficients shows the *direct* input requirements (rows) per unit of output (columns). It is equivalent to the IOT product-by-product matrix recalculated as proportions of total domestic output at basic prices.
- ***The Leontief inverse*** shows the input requirements per unit of final use. It allows the user to calculate the *total* requirements for products across the economy based on a change in final use. The *direct*, *indirect*, and *total* use concepts are important to interpret the Leontief inverse.

For more information on the interpretation and use for the *Effects matrix*, the *'A' matrix*, and the *Leontief inverse*, please see *Input-output analytical tables: Guidance for use*.

As the IOATs explicitly show the usage of primary inputs such as imports and labour, we can explicitly estimate import and labour intensity across the supply chain using the *Effects matrix*. The labour intensity is based on compensation of employees which is a separate line in the IOAT.

To reconcile our estimates of energy intensity with this framework, we define energy intensity as intermediate consumption of domestic and imported *energy* products directly embedded into final output and indirectly used in the production process via *non-energy* intermediate products. We identified the following products as energy products.

- **CPA_B05**: Coal and lignite
- **CPA_B06 & B07**: Extraction of crude petroleum and natural gas, and mining of metal ores
- **CPA_C19**: Coke and refined petroleum products
- **CPA_C20B**: Petrochemicals
- **CPA_D351**: Electricity; transmission and distribution
- **CPA_D352_3**: Gas; distribution of gaseous fuels through mains; steam and air conditioning supply

All other intermediate products are by extension defined as non-energy products which indirectly use energy products as inputs.

3.2 Effects via direct imports of goods and services,

Household use of *direct* imports of final goods and services, as reported in the SUT's, informs our estimate of overall import intensity. We are not able to estimate the energy content of *direct* imports

of final goods and services because our IOAT dataset does not cover the global supply chain. Therefore, this global energy content of direct imports of final goods and services is not measured by our estimates of energy intensity.

3.3 Effects via distributors' trading margins

Distributors trading margins (DTM's) are calculated by summing output at basic prices of wholesale and retail services. These are reported in the following three CPA groupings.

- Wholesale and retail trade of motor vehicles and motorcycles (CPA_G45)
- Wholesale trade services, except of motor vehicles and motorcycles (CPA_G45)
- Retail trade services, except of motor vehicles and motorcycles (CPA_G45)

Households do not directly consume wholesale and retail services. Instead, this output is embedded in the price of other goods and services consumed by households as a distributor trading margin.

The output of these retail and wholesale services on a CPA basis will have its own coefficients within the *Effects matrix* and the *'A' matrix* as described above. Therefore, we can calculate the impact of each primary input and the energy intensity of wholesale and retail trade, and subsequently filter these effects into distributors trading margins allocated to households' use of final goods and services to inform our estimates of overall import, labour, and energy intensities.

3.4 CPA-COICOP conversion

All calculations to this point were done using the CPA classification of household expenditure. To make the data relevant to inflation and the CPI(H) these figures need to be converted to COICOP. We use the published converter for this purpose – *CPA-COICOP Converter for HHFCE (1997 to 2020)*.

The converter tells us which share of each product's output by CPA classification to apportion to a specific COICOP class. Once we have the intensities for these COICOP classes, we use the CPI and CPIH weightings to calculate the intensities for the 12 divisions and for consumer prices overall.

Some COICOP classes, such as package holidays and council tax, require approximations as these do not correspond to any CPA category. Similarly, some COICOP classes, such as the various types of insurance and the individual types of alcohol, are more granular than our CPA breakdown. In these cases, we use the higher aggregates (overall insurance and overall alcoholic beverages) to approximate these individual components.

We are looking for feedback on whether this reconciled methodology and calculations described in Sections 2 and 3 are appropriate for user needs.

4. Publication and communication

We propose to publish our updated back series such that intensity values are updated every 5 years, reflecting the most up to date SUTs and IOATs, based on the following years:

IOATs	Time Period
2005	Jan 2005 – Dec 2009
2010	Jan 2010 – Dec 2014
2015	Jan 2015 – Dec 2018
2019*	Jan 2019 – now

Note:

1. Data for 2005 are provided on a different classification basis to later years so work is underway to confirm if it will be possible to estimate intensity values on the same basis for that year, if not, 2010 estimates will be applied back to 2005.
2. 2019 is used rather than 2020 to avoid the expected data issues from the first year of the pandemic.

The back series of contributions to CPI and CPIH would be published such that contributions from 2006-2010 reflect the import, energy and labour intensity values based on the 2005 IOATs and SUTs (if possible). The contributions from 2010-2015 would reflect intensity values based on 2010 IOATs and SUTs. Those from 2015-2019 would reflect intensity values based on 2015 IOATs and SUTs, and those from 2019 to the present would reflect the latest intensity values, which are based on 2019 IOATs and SUTs. Subsequent updates to intensity estimates will be made every 5 years and/or when deemed appropriate.

Another methodological change is around how we estimate the respective contributions to the annual change in CPI and CPIH.

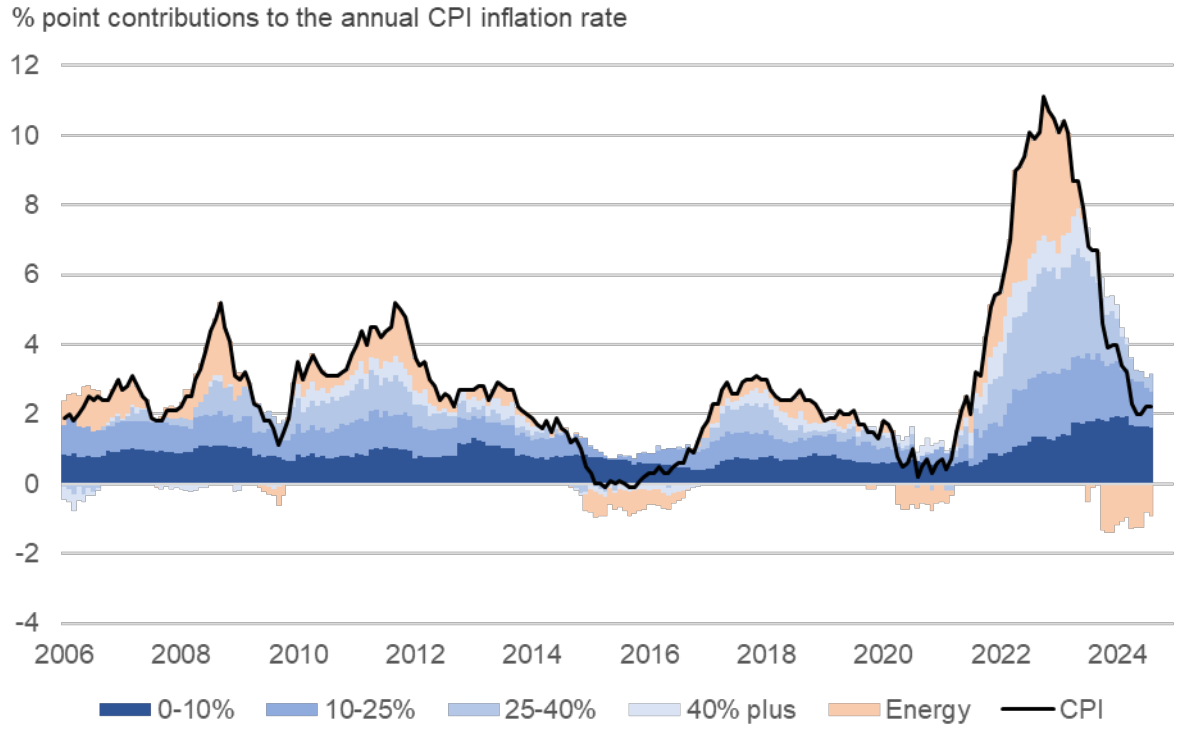
For import intensity we currently publish CPI(H) contributions based on 'fixed' buckets which corresponded to roughly equal parts of the basket by weight at the time when these were first estimated based on 2015 IOATs. Energy components are treated as a separate category as they account for a large and often volatile part of the basket which is typically driven by global factors.

The existing import intensity groups are:

- 0-10%
- 10-25%
- 25-40%
- 40%+
- Energy

These are shown in Figure 1.

Figure 1: CPI contributions by import intensity, existing publication

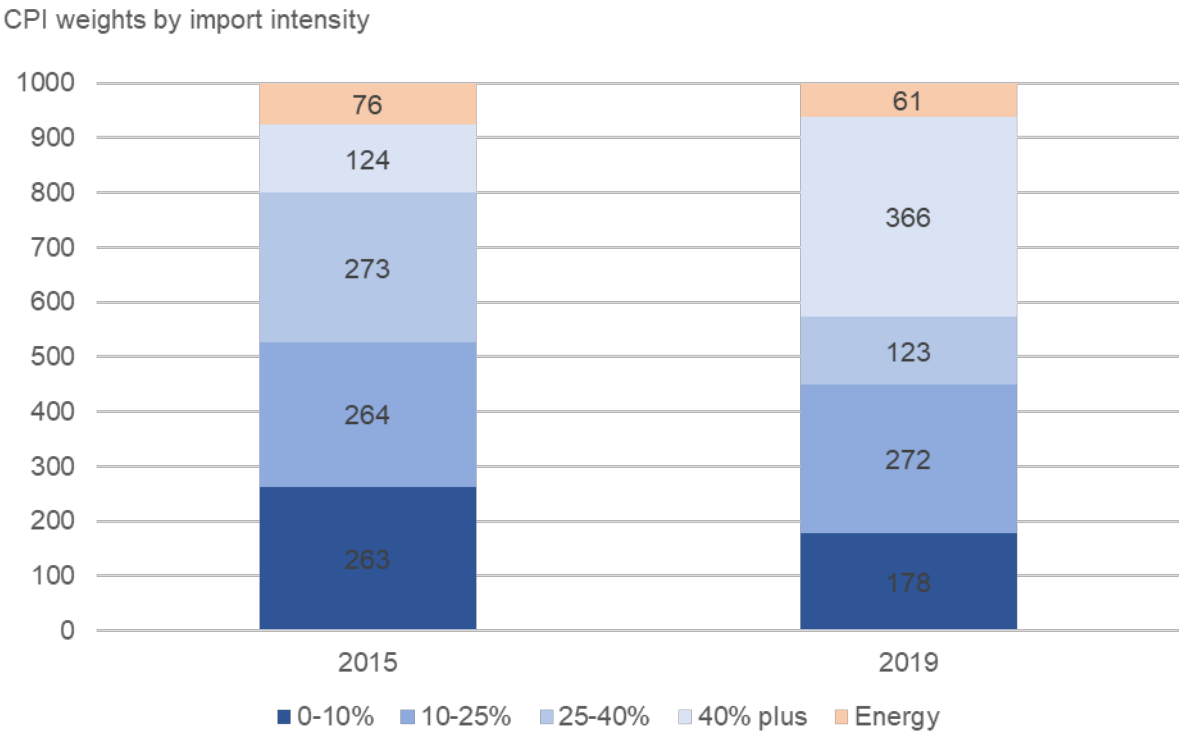


Note: These data are our existing publication using 2015 IOATs and Blue Book 2018.

However, as we have calculated import intensity estimates for other years, we have found that the existing 'fixed' buckets based on 2015 IOATs no longer consistently reflect equal parts of the CPI basket (see Figure 2). For example, the share of the CPI basket accounted by the '25-40%' import intensity bucket halved from about 27% in 2015 to about 12% in 2019 while the share of the '40% plus' bucket has tripled from about 12% to about 37%. This occurs for several reasons including revisions to national accounts, annual updating of CPI(H) weightings, and improvements in our methodology, as well as shifts in the import use of the economy over time.

These shifts in concentration of expenditure into a specific intensity bucket have implications in considering the contributions to CPI by import intensity, as the interest is in the price effect of those goods and services in these buckets, not their expenditure shares. We would ideally want these buckets to have a similar weight for the purposes of understanding the respective contributions. As such, it might be better to have 'relative' buckets, rather than 'fixed' ones – that is, these would not be based on set values for import intensity and instead we would use a relative ranking.

Figure 2: Proportion of the CPI basket, by weight, fitting into each import intensity group



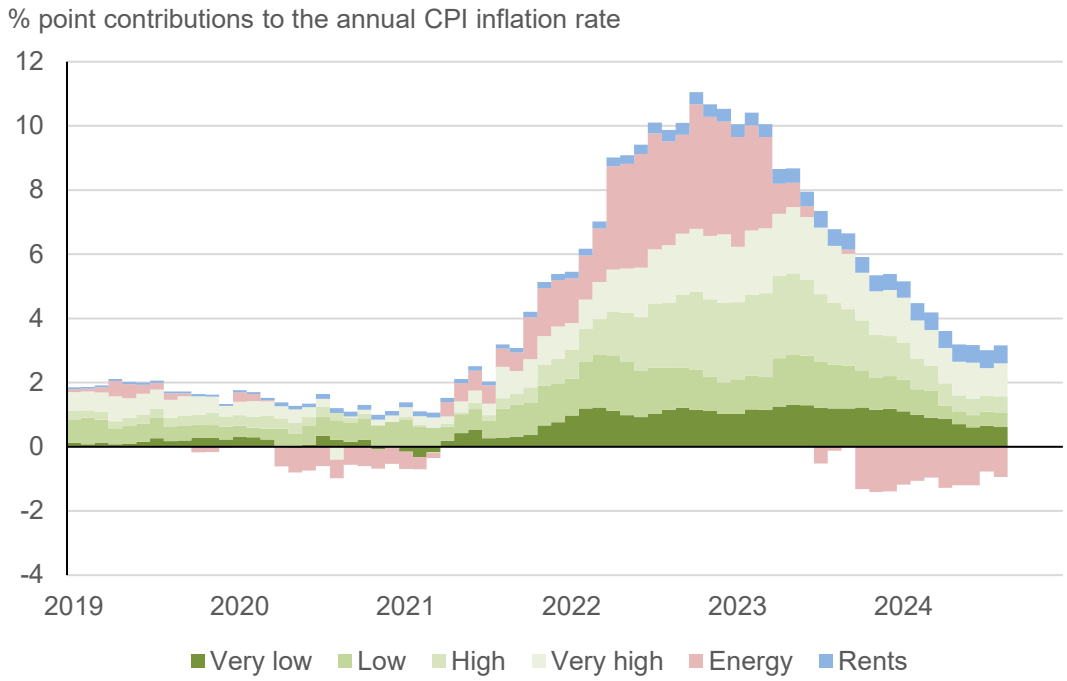
Note: Data are still being finalised. Estimates for 2015 are existing published estimates based on Blue Book 2018. Estimates for 2019 are preliminary unpublished estimates based on Blue Book 2023.

One proposal is based on how we recently produced estimates of the energy intensity of the CPI basket. Here, we took the approach of using 'relative' buckets rather than 'fixed' buckets. This was a one-off publication, but we are now looking to incorporate updated energy intensity estimates, with a consistent back-series, into our regular publication. These would correspond to roughly equal parts of the basket by weight, excluding energy and rents as separate categories, and thresholds for inclusion in each bucket would move as needed over time to still correspond to roughly equal parts of the basket, as follows:

- Very low
- Low
- High
- Very high
- Energy
- Rents

These are shown in Figure 3. Rents were included separately in this case as they have a high weight and were distorting the boundaries between groups, but we judged that energy is unlikely to be a key driver of changes in rental prices. The same could be said for imports so an additional question is whether it would be better to treat rents as a separate category as well as energy.

Figure 3: CPI contributions by energy intensity, existing publication



Note: These data are our existing publication using 2019 IOATs and Blue Book 2022.

The boundaries for these groups were derived by taking the class-level energy intensity values and ranking them, from low to high, then adding the weights together to get values of cumulative weight. We separated out the energy classes (gas, electricity, other household fuels, and fuels and lubricants for transport) and rents then calculated the total weight of the remainder of the basket. We estimated boundaries between groups based on quartiles of the remaining whole basket weight (excluding energy and rents), such that the threshold for a class being in one group or the next would depend on where the cumulative weight was closest to the quartile of the total basket weight (excluding rents or energy).

In the illustration in Figure 4 we can see an example of this. The total weight of the CPI basket is 1000. When we remove energy and rents classes the remaining weight is 842. Splitting this equally into quarters gives us weight thresholds of 210.5, 421.0, and 631.5. To calculate which classes should fall into the first group (ie, 'very low' energy intensity) we rank the classes by weight and see that the closest cumulative weight to our first quartile is 207, which is reached at class 10. All classes with an energy intensity value below 1.025% therefore meet the criteria for being in the lowest quartile of the basket by energy intensity. This is then repeated for cumulative weights of 421.0 and 631.5 to identify the classes belonging to the other groups (low, high, and very high).

Figure 4: Illustration of the grouping of classes by energy intensity

Class	Energy Intensity	Weight	Cumulative weight			
9.6	0.0000	31	31		Total weight of basket	1000
12.5.3/5	0.1662	5	36		Total weight excl energy and rents	842
12.5.4	0.1662	3	39			
12.5.2	0.1662	1	40		Quartiles	210.5
03.1.2	0.2837	42	82			421
03.2.1	0.2861	9	91			631.5
09.1.1	0.5457	5	96			
09.1.2	0.5457	2	98			
09.5.1	0.6430	3	101			
09.5.2	0.6430	3	104			
12.6.2	0.6548	15	119			
03.1.3	0.7178	6	125			
12.7	0.7908	14	139			
12.3.1	0.8209	9	148			
12.1.1	0.8283	6	154			
07.1.2/3	0.8284	3	157			
05.3.1/2	0.9102	11	168			
09.3.2	0.9479	10	178			
10	1.0243	29	207	1.025	Threshold	
02.1.2	1.0281	9	216			
02.1.1	1.0281	6	222			
02.1.3	1.0281	6	228			
2.2	1.0281	21	249			
03.1.4	1.0352	1	250			
09.1.3	1.0384	4	254			
8.2/3	1.0516	22	276			
05.1.2	1.0590	5	281			

4.1 Trade-offs

There are trade-offs between presenting intensity values in fixed or relative groups. Fixed groups make it clear that you are picking up classes with intensity values within a certain range at each point in time (ie, 0-10%, 10-25%, 25-40%, and 40% plus, for example). However, those categories might become less proportionate over time and are to some extent arbitrary being based on equal portions of the basket at some specific point in time. Conversely, relative groups allow us to show the contribution that a roughly consistent proportion of the basket makes over time, but it does not directly capture changes in the same value of intensity over time. In either case, the exact classes in each group will change over time as their intensity values change.

Key stakeholders from the Bank of England, HMT, and OBR expressed a preference to have access to the class-level contributions for each of the underpinning IOTs, equivalent to Figure 5 but adjusted for new methodology, 5-year changes in base year, and inclusive of estimates of energy and labour intensity by class. This would provide flexibility to their own analytical uses, including being able to replicate what we would publish. For general users, however, we want to be able to present the data in a format that is more useable on its own.

Figure 5: Existing publication of import intensity estimates by individual CPI class

CPI Import Intensity of Household purchases, COICOP class level categories			
COICOP CSDB_Index	COICOP Class level item	Direct Import Penetration	Total
D7D5	01.1.1 : BREAD & CEREALS	22.4%	34.6%
D7D6	01.1.2 : MEAT	30.2%	41.7%
D7D7	01.1.3 : FISH	32.2%	39.0%
D7D8	01.1.4 : MILK, CHEESE & EGGS	21.5%	31.1%
D7D9	01.1.5 : OILS & FATS	32.5%	38.0%
D7DA	01.1.6 : FRUIT	37.6%	47.6%
D7DB	01.1.7 : VEGETABLES INCLUDING POTATOES AND OTHER TUBERS	38.2%	44.9%
D7DC	01.1.8 : SUGAR, JAM, HONEY, SYRUPS, CHOCOLATE & CONFECTIONERY	29.1%	34.1%
D7DD	01.1.9 : FOOD PRODUCTS	31.7%	37.8%
D7DE	01.2.1 : COFFEE, TEA, COCOA	29.8%	34.3%
D7DF	01.2.2 : MINERAL WATERS, SOFT DRINKS AND JUICES	20.2%	29.1%
D7DG	02.1.1 : SPIRITS	8.0%	9.3%
D7DH	02.1.2 : WINE (INC PERRY)	8.0%	9.3%
D7DI	02.1.3 : BEER	8.0%	9.3%
D7CB	02.2 : TOBACCO	8.0%	9.3%
D7DK	03.1.2 : GARMENTS	39.2%	39.8%
D7DL	03.1.3 :OTHER ARTICLES OF CLOTHING & ACCESSORIES	28.6%	30.5%
D7DM	03.1.4 : DRY-CLEANING, REPAIR AND HIRE OF CLOTHING	0.5%	10.3%
D7CD	03.2 : FOOTWEAR INCLUDING REPAIRS	46.0%	46.4%
D7CE	04.1 : ACTUAL RENTS FOR HOUSING	0.0%	6.8%

Using relative groups would also allow us to use the same labelling structure for import, energy, and labour intensity groups – ie, very low, low, high, and very high, corresponding to intensity thresholds applicable to each measure. For example, for import intensity approximately 25% of the basket (excluding energy) has an import intensity below 10.9% in the latest data, while for energy approximately 25% of the basket (excluding energy) has an intensity value below 1.6% and for labour approximately 25% of the basket (excluding energy) has a labour intensity below 23.4%. While the labels would not correspond to the same intensity values across the different measures, these would be picking up the same concept, which is that they relate to quartiles of the basket by weight.

As requested by our stakeholders we would like to publish contributions to CPI and CPIH for all classes, which would allow users to produce their own analysis using different groupings, but for more general users, and for analytical purposes, we feel it would still be beneficial to present grouped estimates of import, energy, and labour intensity.

We are looking to understand what users would find most helpful and stakeholder preferences between 'fixed' and 'relative' groupings, and the corresponding treatment of rents.

Thank you.

Macroeconomic Insights team
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