

Please note: this submission is accompanied by 3 Annexes transmitted as separate documents:

- A. Symmetric Indices, Weight Smoothing and the Generalised Mean.
- B. Alternative ways of estimating OOH costs and Private Rents.
- C. Interpretation of Implied Weights for Elementary Aggregates.

Section One: Measuring prices across the economy

1. Should ONS identify a main measure of price change across the economy?

- a. Yes - Agree (however I assume that this refers only to Consumer Prices). Whole economy inflation should include the Government and Business sectors and is measured by the GDP deflator. Those whose interest is whole economy inflation should not look to a Consumer Price Index but to the GDP deflator. Also, those concerned with uprating issues should also be looking to a measure of average earnings not prices, though a consumer price measure remains important also.

1a. Why? Please provide any comments below:

Except as otherwise stated, I agree with the Johnson Review on this matter, though I would not use CPIH as the starting point. The aim would be to produce a multi-purpose measure of Consumer Price changes, having a role similar to that which the RPI used to have in the UK. As with the RPI, some users will inevitably want Components and Variants of the main index (e.g. in the RPI context we have RPIX and the Rossi index which have been preferred for different purposes). The BoE may prefer to target a Component or Variant.

The Index used should be a measure of the cost of Goods and Services, not a "Cost of Living Index" (COLI). The term COLI suggests that a utility adjusted measure of the cost of Goods and Services can be defined and estimated. This is not the case, since utility is subjective and individual. It cannot be objectively measured even for individuals, still less for a population of many individuals, each with different utilities for different outcomes. All attempts to estimate a COLI rely on unsubstantiated assumptions and in some cases assumptions which are contradicted by the data. Prejudicial terminology in this area should also be eliminated. This includes the terms "COLI", superlative index and Fisher "Ideal" index (just drop the word ideal). I suggest that COLI be replaced by "utility-adjusted cost of Goods and Services" and superlative index by "utility-adjusted index".

In order to represent consumer behaviour in a satisfactory way, the annual review of the price basket and its weights should be retained and annual chain linking used to create a long term time series from a string of short term series. In the year between chain links the basket and its weights should be kept constant at all levels, inc. elementary aggregate level (insofar as this can be reasonably achieved).

The fact that weights vary so much (even between years and at high levels of aggregation) shows the need to smooth weights and not assume that short term changes represent any real change in consumer preferences. The degree of statistical noise (including seasonal variation) is such that stability in weighting both between and within years is essential. One particular consequence of this is that the Geometric Mean (Jevons formula) which implies monthly weight changes towards products with lower percentage price rises is unacceptable. (See Annex C).

If yes: 2. What should this measure be?

a. CPIH, as recommended in the Johnson review. The CPIH includes owner-occupiers' housing costs. It does not currently hold the *National Statistics* designation (although its re-assessment is due to commence shortly). The index is a UK measure, designed by ONS to meet UK needs. - No.

b. the CPI, ONS's current headline measure. The CPI is an EU measure, designed by Eurostat to ensure comparable consumer prices statistics across the EU. - No.

c. other (please provide details). - Yes. I think a new index is now needed. For the sake of argument I will call this CPI(2). This should be subject to continuous improvement. If CPI(2) achieves general acceptance then the existing CPI should be renamed back to HICP and CPI(2) could then be renamed CPI. HICP would be used only for international comparisons and the RPI would ultimately be phased out in favour of CPI(2). Initially, CPI(2) should be an "experimental statistic".

2a. Why? Please provide any comments below:

All existing indices are unsatisfactory in some way or another. CPIH has been the subject of very great criticism both on principle and because of numerical results. Publication of CPIH (per se) should be discontinued. Instead, different measures of OOH costs should be calculated and published (together) as separate series, along with the appropriate weights for them, to allow evaluation of the best option (which may take a few years). I would expect about 4 such measures to be produced. These would include the RPI method, the RE method, the NA method and also a method based on Full User Cost centred upon opportunity cost (see Annex B). Such a publication should also include estimates of how the CPI would have been affected by each of the candidate OOH methodologies had they been incorporated into the CPI. Opportunity cost corresponds quite closely to the idea of affordability of housing, being based on both house prices and interest rates.

[The problems that have been found with the RE methodology also indicate severe problems with measurement of private sector rents and this should be another area of urgent investigation] (see Annex B).

The general framework for CPI(2) should initially be the same as the CPI as this is a modern framework (in contrast to the RPI framework which has out of date classifications, weighting and coverage). However, CPI(2) should be subject to continuous improvement and the most important issues should be tackled first. The OBR paper on this subject shows that these are:

a) the formula for elementary aggregates.

CPI(2) should be based upon the Generalised Mean (or Power Mean) – (see Annex A for detail on this proposal). This has a variable parameter P . Initially, P should be set at 0.5. This value represents a mid-point between the Arithmetic Mean (Carli formula) and Geometric Mean (Jevons formula). Research should then be conducted on the optimal value of P for each category of goods/services in the index. For this purpose a “target weighted index” should be used (see Annex A). I think that, if this is once done, people will look back on the present situation (which limits itself to just 3 formulae) as archaic. The generalised mean offers an infinite range of options which can be tailored to the product category and its associated data source which may vary from one country to another.

(cont).

b) the treatment of OOH costs.

CPI(2) should initially omit OOH costs except in so far as they are already included in the CPI. When a new methodology for calculating OOH costs is generally agreed, it should be incorporated into CPI(2), with appropriate weight changes.

c) In addition, issues to do with data collection, quality adjustment and product replacement have been shown to be very important and need high priority treatment. Products should not be replaced between chain links as this may cause a downward bias in the index. At chain link points, the discontinuity in average price should be carefully assessed for credibility, since large discontinuities may constitute price increases disguised as quality improvement.

This may be a major cause of under-estimation of inflation and needs to be properly quantified and assessed.

CPIH has become associated with the RE methodology for OOH costs and I have suggested above that it no longer be published per se. Some people have problems with this RE approach in principle because it is a proxy or imputation of actual costs. Certainly this becomes a problem in assessing the plausibility of RE measures as there is no actual measure or benchmark with which to compare.

Others are more concerned with the plausibility of the numerical results (not least because CPIH has increased more slowly than the CPI over the period analysed). The ONS methodology, which involves attempting to match comparable properties is fundamentally flawed and quite counter-intuitive. The alternative, which is to monitor the average cost of rents over time is far better and is used by others (inc. VOA) for measuring rental changes. The idea that one can match properties based on minimal information, in the way one might try to match TV sets (itself a fraught issue) is ridiculous.

The consequence of the present methodology is that ONS estimates rental increases at about half the average of other sources (1.5% vs 3% per annum). In an attempt to reconcile these different estimates, ONS claims that this is due to quality improvement in rental properties. Yet its own paper shows that average floor space of rental properties has fallen from 77 to 74 sq. metres between 2008 and 2012 (based on the EHS). Also the average number of bedrooms has fallen. This looks like a quality reduction not a quality increase. So the actual rise in private rents (after quality adjustment) has probably been more than 3% per annum over the period analysed by ONS. According to the Chancellor in his 8th July budget, social housing rents have risen by about 4% per annum between 2010 and 2015, so how plausible is an increase of 1.5% in private market rents?

Furthermore, if outlier treatment is applied to the ONS methodology, the estimate of annual change rises from 1.5% to 3.2%. This is due to the specific methodology that has been used by ONS. Outlier treatment would be far less necessary if a measure of average rents was used.

Further evidence can be obtained from CPIH weights which ONS has published for the period 2005 to 2015. This shows a 43% rise in the weight for "Actual Rents for Housing" over this period, suggesting that, even after allowing for the growth in private sector renting, rents have grown significantly faster than the average rate of inflation.

I am also concerned that ONS may not be including all the costs of renting, which can include Agents fees, Non-refundable (or partially refunded) deposits, Council Tax and Compulsory Maintenance Fees.

3. Should its production be governed by legislation? - No

3a. Why? Please provide any comments below:

I don't think that legislation to require its production is needed. The pressure of user demand is enough to ensure that. For example, the Producer Price Index (PPI) is regularly produced without a legal requirement that it be so, and is widely used for contractual purposes (especially in the private sector).

Legislation concerning the specification or methodology of the index would be highly undesirable as it would prevent the application of user needs and best practice as judged by the ONS and advised by the technical and stakeholder panels governing Consumer Price Indices.

One should bear in mind however, that if such an index becomes widely adopted for contractual or other purposes, existing laws such as the law of Contract and of Judicial Review will automatically apply. So I think it important that it is clearly stated from the outset that the specification and methodology of the index will change over time (sometimes in significant ways) in order to meet user needs and maintain best practice over time.

Section Two: Measuring consumer price inflation for different household types

4. Should ONS seek to measure changes in prices, as experienced by different households?

- i. Yes - as recommended by the Johnson Review.

4a. Why? How often? Please provide any comments below:

As per the Johnson Review.

There are already some measures in this area, viz. The 2 pensioner indices and the Rossi index, both produced in the RPI framework. These need to be transferred to the CPI framework which is a more modern one.

If yes:

5. How should ONS seek to do so?

- i. Using a payments-based approach. - No
- ii. On the same basis as existing measures such as CPI. - Yes, but subject to changes as suggested for CPI(2) above.
- iii. Via another means (please provide details) - No.

5a. Why? Please provide any comments below:

I see no point in inventing yet another framework. It would cause confusion and increase costs considerably. It would also not be likely to make very much numerical difference in the long term.

I am not committed to any particular “approach” (such as payments-based or acquisitions-based). I believe a good Consumer Price Index will tend to consist of a mixture of different approaches for different parts of the index as has been the case with the RPI. I would like to see a version of the “Full User Cost” approach tried for OOH costs (see Annex B).

Section Three: The RPI

6. Do you use the following indices?

i.RPIJ ¹	No
ii.Tax and price Index	No
iii.RPIY ²	No
iv.RPI pensioner indices	No
v.Component indices of the RPI	Yes
vi.Any other RPI analytical- or sub- index	Yes – the formula effect

6a. If yes, for what purposes? Please provide any comments below:

To understand movements in the overall RPI and also for comparison with alternatives.

So long as the RPI is produced it is essential that all components are published too. This includes publication of the formula effect between the RPI and CPI.

There has been a lot of criticism of the RPI surrounding the issue of chain drift. This is quite unjustified. I have shown that the difference in chain drift between the RPI and CPI at the All items level is approximately 0.02% per annum. This is based on ONS published data on the size of the formula effect. There are much greater sources of error associated with the CPI because of its use of the Geometric Mean (Jevons) formula, which biases the CPI downwards by progressively increasing the weight of products with low % price rises relative to those with greater % price rises (see Annex C).

7. Do you agree that the below indices should be discontinued?

i.RPIJ	Yes
ii.Tax and price Index	Yes
iii.RPIY	Yes
iv.RPI pensioner indices	See below
v.Component indices of the RPI	No
vi.Any other RPI analytical- or sub-index	See below

7a. If yes, why? Please provide any comments below:

The Rossi index and Pensioner indices should be moved to the CPI framework rather than discontinued completely.

So long as the RPI is produced it is essential that all components are published too. This includes publication of the formula effect between the RPI and CPI.

Moreover I think it is important that in future a breakdown of the formula effect be published by category of goods/services so that we can tell where the greatest problems lie. Such a breakdown probably needs to be linked with the weight of each category in the CPI. I realise that the RPI and CPI use different classification systems above the item level. I suggest that the CPI classification system be used for this purpose.

8. Do you have any views on what ‘freezing’ changes to the RPI should mean in practice? Please provide comments.

I think any suggested improvements to the RPI should be considered by the new governance panels and recommendations made on a case by case basis. This process should be guided by the following considerations:

- a) One important reason for continuing production of the RPI is to allow comparison with the HICP/CPI. The difference between the two is an indication of the degree of error that there may be in the measurement of inflation. I would not therefore change the RPI elementary aggregate formulae as these allow calculation of the “formula effect”. This is an important user requirement in its own right.
- b) The treatment of OOH costs has undergone major changes in the RPI in the past and there is no reason in principle why further changes should not be made.
- c) Improvements in data collection and quality adjustment/product replacement should logically be applied across the board so that all the indices start from a common information base.

Given the above, I believe the RPI and its components and remaining variants should be re-designated as National Statics, since they serve a clear user need and are subject to continuous improvement with the exception of the formulae for elementary aggregation which would be deliberately frozen to meet the user need of calculating the formula effect. Alternatively the formula effect could itself be designated a National Statistic, though this seems an artificial way of proceeding.

It should be borne in mind that current international standards are about 20 years old and that a new set of international standards is due to develop. The Jevons formula is on the way out and the sooner the UK recognises this the better.

Section Four: Evolving Consumer Price Statistics

9. Are the priorities identified by ONS in its forward work plan appropriate?

b. No

9a. Why? Please provide your comments below:

a) I think that EU compliance issues should have a very low priority unless they are important to the UK. In the light of the forthcoming in/out referendum on the EU, the UK should seek derogations on EU requirements pending the result of the referendum.

b) The highest priority in ONS work should be given to those matters which create a large difference between the RPI and the CPI. These are the formula effect and the treatment of OOH costs. In addition, some issues of data collection and quality adjustment/product replacement may affect both indices and be significant numerically. These should also have high priority.

c) I support the use of scanner data and other sources which capture volume as well as price information as such data can help to resolve the formula effect issue. I am not in favour of using web scraping as it provides no volume information and does not represent the way people actually shop online (it is not possible to know whether any transactions at all have taken place at some price scraped off the web). Weighting should take account of online shopping through stratification, but the basic principle (stated in the Johnson Review) is that prices should be collected as closely as possible to the way people actually do their shopping.

d) I am opposed to further work on “superlative indices” as they represent a diversion from the “cost of goods and services” principle in favour of an undefined concept of “cost of living (COLI)”.

e) Regarding transparency and processes, I support most of this work. In particular, I agree that ONS should provide detailed evidence and research to support the choice of formula at the elementary aggregate level. I also favour smoothing of weights over time and would go further than the Johnson Review and use a 3 year moving average for all weighting above the elementary aggregate level. The degree of unexplained volatility justifies a high degree of smoothing. I also agree with the proposals for improved commentary on weight changes and quality adjustment/product replacement.

f) Weight smoothing also means that “implied” weights at elementary aggregate level should be approximately constant within the year between chain links. This implies use of a formula other than the Geometric Mean(Jevons).

g) An important matter not mentioned is the treatment of “fashion goods”. Diewert has recommended that these should be excluded from the index and this should be a high priority. Exclusion of luxury goods should also be considered so that the index properly relates to its purpose of measuring the cost of essential and normal expenditure. Fashion Goods and Luxury goods are inter-related and a combined approach would be desirable.

h) I also think it is time that the cost of Financial services, esp. debt interest was included in the index. An attempt should be made to include what is called FISIM in the National Accounts. This interacts with the proposal for measurement of OOH costs.

10. Should ONS include council tax in the CPIH?

a. Yes, but it should be CPI(2) not CPIH. - see earlier.

10a. Why? Please provide your comments below:

I think people regard Council Tax as one of the costs of home ownership and the RPI already takes account of that. Those in private rented accommodation pay Council Tax either as part of Rent or as a separate payment.

Council Tax is a payment for local authority services and is broadly related to the amount of OOH cost incurred. This is done through the banding system of the Council Tax. The usual criterion for inclusion of a tax is whether it relates to the degree of expenditure. The Council Tax qualifies approximately in this regard.

ANNEX A

Symmetric Indices, Weight Smoothing and the Generalised Mean

Recent discussions in the RPI/CPI User Group have referred to “Superlative” and Symmetric Price Indices.

“Superlative Indices”

The OECD defines superlative indices as:

“price or quantity indices that are ‘exact’ for a flexible aggregator. A flexible aggregator is a second-order approximation to an arbitrary production, cost, utility or distance function. Exactness implies that a particular index number can be directly derived from a specific flexible aggregator”.

It is probably not obvious from this definition, that superlative indices are all about the Cost of Living (COLI) concept. I have expressed elsewhere that I am opposed to the COLI approach and so will not give much further attention to “superlative” indices.

This note is therefore concerned with Symmetric Indices.

Symmetric Indices.

The OECD defines a symmetric index as:

“an index that treats the two periods being compared symmetrically by giving equal weight, or importance, to the price and value data in both periods. The price and value data for both periods enter into the index number formula in a symmetric or balanced way”.

In most cases we are comparing the base period with the current period and for the RPI and CPI the base period is the month of January each year. Price data is treated symmetrically in all index formulae proposed, so it is the value data, or weights, which are the issue. This matter does really apply to unweighted indices, though these are very important in attempting to approximate a weighted index.

There is a significant overlap between “superlative” and symmetric indices consisting notably of the Fisher, Walsh and Tornquist indices. The best known of these is the Fisher index which is the geometric mean of the Laspeyres and Paasche indices. The Laspeyres index uses base period weights and the Passche index uses current period weights. The Walsh and Tornquist indices appear to give similar numerical results to the Fisher index.

However, there are other symmetric options such as the Marshall-Edgeworth index and the Current Year Lowe (CYL) index. The CYL index gives every month of the current year, a weight which is the average of expenditure weights for all of the months of that year (note: the month of January needs to be treated differently in the UK as it is the chain link month. When comparing January of year t with January of year t-1, the January weight used for the CYL needs to be the average of the January t and January t-1 weights).

The CYL option is rarely mentioned, but has a significant advantage over the others in that its weights are based on a full calendar year and therefore smooth out the noise present in estimated weights. This noise is significant even at high levels of aggregation and even between years. A CYL index is symmetric not just between base and current periods, but also between all months in the current year. It also represents a “fixed basket” within each year, while allowing for changing consumer expenditure patterns between years via chain-linking. This is in line with the objective of a measure of the cost of Goods and Services (as opposed to a COLI).

Use of unweighted formulae.

None of these indices (except the unweighted indices) can be calculated in “real time” because the information needed to calculate weights is not available at the time the index needs to be calculated. We are therefore looking for a “target index” which we would ideally use. We then try to approximate this with an index formula which can be calculated in real time. Of necessity this will have to be an unweighted index. Options for an unweighted index include the well known Carli, Jevons, Dutot indices and also the Generalised Mean. All unweighted indices are approximations to the target index and therefore potentially biased. The objective is to minimise the bias.

Information on the Generalised Mean can be obtained via Wikipedia, which provides a better explanation than I could provide here. Essentially, it represents an infinity of different formulae, with a variable parameter P . The choice of P determines the formula and one is not constrained to just a few options. If $P=1$, the formula is the Carli (Arithmetic Mean). $P=0$ corresponds to the Jevons formula (geometric mean). Other well known options include $P=2$ which is the Root Mean Square (widely used in mathematics and statistics) and $P=-1$ which gives the Harmonic Mean (occasionally referred to). The Dutot formula is not a generalised mean, but it is the ratio of two generalised means each with parameter 1.

In my view, the best unweighted option is the Generalised Mean, because it involves a free parameter which can be varied to provide the best approximation to the target index whatever that may be. Also this parameter can be varied by product and data source so as to provide the best approximation to the target. Estimation of the parameter will rely on data prior to the index period, but that is about the best we can do and is much better than making an assumption based on no evidence (as is the case with the Jevons, Carli and Dutot indices). The estimated value of P will vary from one product to another and will depend on the data source (so it could be different between countries, for example). However, even a rough and ready “split the difference” option with $P=0.5$ is likely to be better than use of the Jevons formula.

How does this affect the measured rate of inflation? - basically, the larger the value of P , the greater will be the measured rate of inflation. The Carli formula ($P=1$) is by no means the highest reasonable value. There is evidence that both the RPI and CPI underestimate inflation under certain circumstances. The RMS formula ($P=2$) may sometimes be the most reasonable value, especially when there is a positive correlation between price and volume (for example oil and gas, summer holidays, Christmas presents).

I think the target index should be a CYL index (for reasons given above). Alternatively, it could be a moving average of 2 or 3 years which include the current year. This would also be a symmetric index with a “fixed basket” within year.

ONS has already conducted research on the best unweighted index to approximate various target indices. This was however limited to the alcohol sector and did not include the CYL as one of the possible targets. I would urge, as high priority, a continuation of such research, to include the CYL and to widen the scope of the study to other sectors. It should also consider the Generalised Mean as an additional unweighted option, and which would be expected to outperform other unweighted options (given the right parameter value). A summary of ONS' results is given below along with a pro forma for the results I would like to see produced. It seems likely that, in terms of numerical results, the CYL would fall between the Fisher and Laspeyres indices and that the Generalised Mean (with parameter 0.5) would fall between the Carli and Jevons formulae. If so, this would be strong

support for the Generalised Mean and with a parameter higher than 0.5, probably nearer to 1.0 (viz. The Carli formula).

Table as published by ONS

Average Relative Bias, Alcohol Data (%)		
	Index estimator (from Samples)	
Target Index (Population)	Arithmetic Mean (Carli)	Geometric Mean (Jevons)
Carli	-0.04	-0.74
Jevons	0.79	0.08
Fisher	0.33	-0.38
Laspeyres	-1.24	-1.93
Geometric Laspeyres	-0.58	-1.28

Desired Table (pro forma)

Average Relative Bias, Alcohol Data (%)			
	Index Estimator (from Samples)		
Target Index (Population)	Arithmetic Mean (CARLI)	Geometric Mean (Jevons)	Generalised Mean (parameter P=0.5)
Paasche			
Fisher	0.33	-0.38	
CYL			
Laspeyres	-1.24	-1.93	

Gareth Jones
24th July 2015.

ANNEX B

Alternative ways of estimating OOH costs and Private Rents

An Alternative Approach to measuring OOH costs

1. The measurement of OOH costs is discussed in section 9 of the Johnson Review of Consumer Price Statistics. The main recommendation is the continuation of the Rental Equivalence methodology in CPIH. However in sub-section 9.14 there is mention of emerging work based on rental equivalence and financial opportunity cost. The OOH capital costs are then taken as the larger of rental equivalence cost and financial opportunity cost. In addition, OOH running costs would need to be added to give total OOH cost. Running Costs include Repair and Maintenance, Insurance costs and recurring taxes (unless these are already included in rent).
2. This recognition of the importance of Opportunity Cost is welcome. It is a major weakness of both the the Net Acquisitions approach and the current RPI methodology that this consideration is omitted (though the RPI does include mortgage interest payments, which account for part of the opportunity cost, but mixed with financial service costs). One advantage of the Rental Equivalence approach is that there is an implicit attempt to include opportunity cost, since it is a major cost of the landlord which is passed on in rent. Moreover the opportunity cost of the land value is included, because that is a real cost.
3. Before CPAC recommended the use of the RE methodology it also considered a version of the Full User Cost methodology, called Narrow User Cost (see Johnson Review section 9.6). This attempted to include Opportunity Cost minus Capital Gain by using “real” rather than nominal interest rates. The results were however considered implausible and this approach was abandoned. This was unfortunate because an alternative variation of Full User Cost might have produced reasonable results.
4. Full User Cost = Mortgage interest payments and related fees and charges
+ Opportunity cost of the non mortgaged part of the property (inc. land value)
+ Depreciation of the building (but not the land)
+ Running Costs & Transaction Costs
- Capital Gain
5. The first modification needed is to remove the Capital Gain term. We should be looking at the realised capital gain of the household sector. Although individuals may be realising capital gains (and losses) the household sector is normally making positive Net Acquisitions and is not realising any capital gain when taken as a whole.
6. Then, reorganising the first two terms, we have a modified version of Full User Cost

= Mortgage fees and charges (plus interest rate margin on mortgages)
+ Opportunity cost of the whole property (inc. land value)
+ Depreciation of the building (but not the land)
+ Running Costs & Transaction Costs

Interest rate margin is the average difference between mortgage rates and rates available to savers, applied to the amount of the mortgage. Fees and charges include arrangement fees and valuation fees, etc. Together these make up the Financial Services costs of financing a house with a mortgage.

7. Given that housing is a medium term investment, it is reasonable to use the yield on, say, gilts with 3-5 years to maturity as the interest rate to be applied to the full market value of a property in calculating the opportunity cost. A deduction for income tax could also be made at an average rate of, say, 30% which allows for the fact that most home owners will have marginal income tax rates of either 20% or 40%.

8. This leads to the following definition of Full User Cost:

= Mortgage fees and charges (plus interest rate margin on mortgages)
+ $0.7 \times (\text{Full market value of property} \times \text{medium term nominal interest rate})$
+ Depreciation of the building (but not the land)
+ Running Costs & Transaction Costs

9. Comparison with the RPI methodology

9.1 The above approach would be much less sensitive to changes in bank base rate. The RPI has at times been very volatile because of the strong link between mortgage rates and bank base rate in the UK (e.g. in 2009, the RPI annual change became significantly negative, while the CPI annual change remained significantly positive).

9.2 Opportunity cost would be fully represented, while it is only partially captured in the RPI. Depreciation would not be over-estimated, whereas it is over-estimated in the RPI by including land value.

10. Data Sources

10.1 Data is required both for weighting and for rate of change of each of 4 terms in the above formula. I believe that there is already adequate data available to calculate the Opportunity Cost and Running Costs & Transaction Costs terms.

10.2 The first term relating to mortgages would require a change in the information collected from mortgage lenders. However, there are relatively few large mortgage lenders, so this should not be a major problem. Alternatively, this first term could simply be omitted as an approximation (at least until a proper data source is developed).

10.3 Depreciation can be dealt with in two alternative ways. One is to modify the RPI methodology by replacing a House Price Index by an Index of House Building Costs (such an index has normally been available from the Department of BIS, though is temporarily suspended pending introduction of new methodology). The weight required is available from National Accounts and is already used in the Net Acquisitions methodology which ONS has provided for Eurostat. The other approach to depreciation is to use an index of Renovation Costs as is already constructed for the Net Acquisitions methodology.

An Alternative way of using VOA data to estimate private market rents.

11. Whatever decision is taken on the measurement of OOH costs there is a need to accurately measure changes in rents. The rental sector (inc. both social and market renters) now accounts for over 35% of households. Of these nearly 20% are market renters.

12. Although I did not attend the ONS event on 20th Feb, I have now received copies of the slides

for the presentations. One of the VOA slides highlights weaknesses in the data source they have. There is no legal requirement on landlords to provide data and no standard format for data provision.

13. My suggestion therefore is that instead of ONS trying to produce statistics from the VOA microdata, they instead use the VOA database as a Register upon which to base a survey (under the Statistics of Trade Act) to collect under law the required data in the required format and detail.

14. The first step must surely be to obtain a Data Sharing Order (covering the whole of the UK) so that ONS can obtain a complete copy of the VOA database(s). At present ONS seems to rely on cooperation and does not have microdata access for England.

15. Obviously a survey of this kind would have to have a sample size far below that of the VOA register. So results would not so easily permit regional and local analyses, but should provide a good national measure of rental inflation. Regional and sub-regional analyses could then be estimated using a reliable national benchmark, together with the local variations which can be calculated from VOA microdata. Estimation should be based on Average Rents and not on the current ONS methodology which attempts to match properties, since such a methodology is clearly underestimating rental changes.

Gareth Jones
24th July 2015

RPI/CPI and the FORMULA EFFECT
(revised version - 25th Jan. 2012))

Gareth Jones

Interpretation of Implied Weights for Elementary Aggregates

1. Summary

1.1 The government has asserted that the geometric mean (GM) formula used by the CPI represents consumer behaviour in relation to product substitution in response to price increases and in particular to changes in relative prices. It has been asserted that it represents substitution of more expensive by cheaper brands or variants of an item in the index price basket.

1.2 This note shows that this is not correct and that the geometric mean in fact implies substitution of brands with high percentage increases by brands with lower percentage price increases and takes no account of the price levels or even relative price levels of the different brands. This revised version has an annex containing examples which illustrate this behaviour, the first of these being one used by the National Statistician in response to the original version of this note. There are also some other changes to facilitate understanding of these results, though the basic argument and results are unchanged.

1.3 Note that the findings do not depend on any additional assumptions, such as the form of consumers' utility function, and are derived purely from the GM formula as used in the CPI. Nor do the findings regarding changes in weights (as opposed to volumes or quantities) depend on whether real income and expenditure are rising, constant or falling.

1.4 It is argued that the actual implications of the GM formula (as opposed to the unsupported assertions made about it) are implausible as a representation of consumer behaviour and that consequently the GM formula should not be used in the measurement of inflation.

1.5 Reference:

Consumer Price Indices Technical Manual - Office for National Statistics (2010)
(pages 12 and 83).

2. Context

2.1 What follows applies to the different brands or varieties of an item in the price index basket. There are in fact many such items but the formula effect only applies to the different brands/varieties of an item. It does not affect higher levels of aggregation of the price indices where a weighted arithmetic mean is used in both RPI and CPI, and this is a generally accepted practice internationally.

2.2 The indices can be written in the general form:

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$$I(t,0) = (i)\text{sum} [u(i,t) * (p(i,t)/p(i,0))]$$

Here the term $(i)\text{sum}$ is used to denote the sum over suffix i of the expression following. Also $u(i,t)$ is the implied weight of brand/variant i at time t and $p(i,t)$ is the price of brand/variant i at time t . ($p(i,0)$ is the price at the base period 0 of brand/variant i).

2.3 Drawing on page 12 of the ONS technical manual gives the following implied weights for the AR and RA formulae:

AR Formula (Arithmetic Mean):

$$u(i,t) = 1/n \quad \text{for all } i \quad (\text{independent of } t).$$

RA Formula (Ratio of Averages/Aggregates):

$$u(i,t) = p(i,0) / (j)\text{sum } p(j,0) \quad (\text{independent of } t).$$

3. Implied weights for the GM Formula

3.1 These are not given in the ONS manual. However the GM formula is given on page 83 as:

$$I(t,0) = G(t,0)$$

where $G(t,0) = (n)\text{root} [(j)\text{prod } p(j,t)/p(j,0)]$ assuming that there are n brands.

Here the notation $(n)\text{root}$ denotes the n 'th root of the expression following and $(j)\text{prod}$ denotes the product over suffix j of the expression following.

This can be re-expressed as:

$$I(t,0) = (1/n) * (i)\text{sum} [(p(i,t)/p(i,0)) * (p(i,0)/p(i,t))] * G(t,0) .$$

$$\text{So } u(i,t) = (1/n) * (p(i,0)/p(i,t)) * G(t,0) \quad \underline{\text{which varies with } t}.$$

3.2 Therefore $(i)\text{sum } u(i,t) = A(0,t) * G(t,0) .$

$$\text{where } A(0,t) = [(1/n) * (i)\text{sum } p(i,0)/p(i,t)]$$

Now using the inequality of the arithmetic and geometric means,

$$A(0,t) \geq G(0,t)$$

$$\text{So } (i)\text{sum } u(i,t) \geq G(0,t) * G(t,0) = 1.$$

The extent to which $(i)\text{sum } u(i,t)$ exceeds unity can be judged from numerical

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evidence of the formula effect difference between the RPI and CPI. This has generally been in the range from 0.5% to 1.0%, though it varies substantially between elementary aggregates and to a lesser degree over time. Subject to these variations, we can therefore say that $\sum u(i,t)$ will be in the range 1.005 to 1.01. This would appear to be a very good approximate linearisation of a highly non-linear formula, especially as we are mainly concerned with changes in $u(i,t)$ over time rather than with the absolute levels of the $u(i,t)$. The above expression for the $u(i,t)$ can therefore be regarded as a good approximation to the implied expenditure weights of the GM formula.

3.3 Then, looking at changes over time, we have:

EQUATION A: $u(i,t)/u(i,t-1) = G(t,t-1) * p(i,t-1)/p(i,t)$.

This is the key substitution formula for implied brand weights under GM. Brands with lower than average percentage price changes will see increases in weight and those with above average percentage price changes will see reductions in weight (since $G(t,t-1)$ is the geometric average of the price relatives between time $t-1$ and time t). This is independent of the rate of change of real income/expenditure.

3.4 We can also derive a substitution formula for sales volumes/quantities as opposed to expenditure weights. The weights $u(i,t)$ can be written as:

$$E(i,t)/E(t) \quad \text{where } E(t) = \sum E(i,t) ,$$

$E(i,t)$ is the expenditure on brand i at time t and $E(t)$ is total expenditure at time t .

Also $E(i,t) = Q(i,t) * p(i,t)$ where $Q(i,t)$ is the volume/quantity

of sales of brand i at time t (as opposed to the value of such sales).

Using the substitution formula for weights (EQUATION A) we therefore obtain:

$$Q(i,t)/Q(i,t-1) = (E(t)/E(t-1)) * G(t,t-1) * [(p(i,t-1)/p(i,t))]^2 .$$

If real incomes are constant and expenditure is a constant proportion of income we have:

$$E(t)/E(t-1) = G(t,t-1) \text{ and hence:}$$

EQUATION B: $Q(i,t)/Q(i,t-1) = [G(t,t-1)]^2 * [(p(i,t-1)/p(i,t))]^2$

This is the substitution formula for volumes/quantities and is similar in form to that for weights except that the right hand side of EQUATION B is the square of that for EQUATION A.

4. Conclusions

4.1 Unlike the AR and RA formulae, the implied weights of the GM formula vary on a monthly basis.

4.2 Those brands whose weights increase will be those whose percentage change in price is below average, while weights will decrease for brands with percentage price changes above average.

4.3 These changes in weights are not dependent on whether real income/expenditure is rising, constant or falling. This seems unlikely in practice as one would expect substitution to cheaper brands when real incomes are falling and to more expensive ones when real incomes are rising.

4.4 If real income and expenditure are constant, the volume/quantity of sales varies in a similar way to the weights but to a greater degree.

4.5 The changes in weights and sales volumes do not depend on the price levels of brands but only on their percentage rates of price change. This is contrary to assertions made by the government and others.

4.6 Thus, under GM, if a more expensive brand has a lower than average percentage price increase, its share in expenditure and in sales volume will increase. In the case of expenditure shares this will occur even if real incomes are falling. For sales volumes it will depend on how total real expenditure is changing .

4.7 The fact that substitution under GM is independent of price levels (and also of the rate of change of real income/expenditure) makes it implausible as a representation of consumer behaviour and therefore unsuitable for use in an inflation measure (the annex to this note contains examples which illustrate this).

ANNEX

Examples of GM implied substitution.

1. Each of the three examples below involves an elementary aggregate with two brands/varieties A and B. In each case brand A costs 50p in period t-1 and rises by 20% to 60p in period t. In each case brand B rises by 5% between period t-1 and period t, but the initial price level in period t-1 varies between examples. This is the only variation between the three examples.
2. In example 1, brand B starts at a price of 60p (this corresponds to the example raised by the National Statistician in response to the original version of this note). In example 2, the starting price for brand B is 120p and in example 3 it is 240p. Because the percentage price increases are the same in all three examples, the GM formula predicts the same degree of substitution (from brand A to brand B) in all three cases.

Example 1

Brand A 50p rises to 60p

Brand B 60p rises to 63p

Price differential falls from 10p to 3p

Price ratio falls from 120% to 105%

Example 2

Brand A 50p rises to 60p

Brand B 120p rises to 126p

Price differential falls from 70p to 66p

Price ratio falls from 240% to 210%

Example 3

Brand A 50p rises to 60p

Brand B 240p rises to 252p

Price differential rises from 190p to 192p

Price ratio falls from 480% to 420%

3. Inflation, Income and Expenditure

3.1 In all three examples, average inflation as measured by the AR formula is 12.5% and as measured by the GM formula is 12.25%. Given the GM context of these examples the figure of 12.25% will be used. In the above note this figure derives from the fact that $G(t,t-1) = 1.1225$. It will be assumed that real incomes are constant and that expenditure is a fixed proportion of income. This assumption does not affect the changes in implied weights as given by EQUATION A, but does ensure that EQUATION B applies to changes in volumes of sales.

4. Degree of substitution

4.1 In all three examples the GM formula implies a fall in weight for brand A of 6.5% (with a fall in sales volume of 12.5%). It also implies a rise in weight for brand B of 6.9% (with a rise in sales volume of 14.25%).

4.2 In example 1, substitution to the more expensive brand can be achieved (for a given income) with only a small change in the total volume (of all brands) purchased since after the price change the price ratio of the two brands is only 105%. In example 2, however a large reduction in total volume purchased is necessary to allow substitution to the more expensive brand since the price ratio is 210%. In example 3, where the price ratio is 420%, more than 4 units of brand A must be sacrificed to fund the purchase of one unit of brand B. This will only occur if the perception of utility of brand B is 4 times that of brand A, which seems unlikely. In general the utility of money is less than linear so one would expect a similar situation with regard to price.

4.3 Therefore, while some substitution to the more expensive brand (B) might be plausible in example 1, any substitution in example 2 would be expected to be much lower. In example 3 substitution in favour of brand B would be expected to be lower still. So the fact that GM implies the same degree of substitution in all three examples is implausible.