**The rise and rise of inflation**

*Where did our current measures of consumer price inflation come from? Who made the important changes that led to the sophisticated methodology we use today, and when were those changes made? Rob O’Neill, Jeff Ralph and Paul Smith explore the history of one of our most important economic indicators*

Inflation is a curious thing. Unlike the more abstract economic indicators one might read or hear about in the news – things like gross domestic product or net exports – inflation is something we can all see and feel. As a measure of the general change in prices of goods and services, it is most noticeable at the checkout, at the point when you realise that the same basket of food cost more this year than last year. But inflation does more than simply reflect changes in prices; it is also used to adjust incomes. Companies use it to set cost-of-living salary increases for their workers, and governments to adjust the value of state pensions and benefits.

Given such important roles in society, inflation measures are some of the most prominent of official statistics. They also can be among the most controversial. In the UK, changes in the measures used to adjust incomes and expenditures have been argued over for many years. Since 2011, the government has used one measure, the Consumer Prices Index (CPI), to set the value of benefits like pensions and tax allowances. Meanwhile, it uses another measure, the Retail Prices Index (RPI), to determine the cost of things like student loan interest and rail fares. As CPI inflation is usually lower than RPI (because of the form of the index; see “Price index formulae”), this has reduced some of the payments that individuals receive relative to the amount they pay for certain goods and services.

This inevitably has stirred much debate among politicians, economists and statisticians, and in January, Mark Carney, the Governor of the Bank of England, urged the UK government to abandon RPI (bit.ly/2E5fgRm). But were Carney to get his wish, this would not be the end of the story. Measures of inflation will continue to evolve, much as they have done for the past 300 years.

In this article, we examine the origins of inflation measurement and how various alterations have improved a statistic which has a direct impact on all our lives – and potentially our bank balances.

**The history of an indicator**

Prices and their movements play an important role in the economic activity of governments, businesses and individuals. While the prices of individual goods and services change in different ways, the overall movements can be summarised using the tools from the statistical discipline known as “index numbers”.1 In the UK, the Office for National Statistics (ONS) produces monthly consumer price index numbers known as the “general level of prices” (bit.ly/2E9Bgyh), and the change in the general level of prices is known as the rate of inflation.

Producing a measure of the general level of prices requires a substantial volume of data to be collected and the application of a complex methodology – but it essentially involves a “basket of goods”, chosen to represent items available to consumers. In 2017, there were over 700 items in the UK basket, and the basket is updated each year to reflect changes in consumer purchasing habits and new products coming onto the market.

The price of an item in the basket varies according to where it is bought, the type of retail outlet it is bought from and the brand of item. Prices for items in the UK basket are collected across 150 locations and 20 000 retail outlets to reflect all of these factors. Central price collection is sufficient for about 140 items where national pricing policies apply; internet prices are also collected. In total, 180 000 price quotes are collected each month.

The expenditure shares for goods and services are collected through a combination of survey data and other data sources. Price changes for the items in the basket are combined with weights that account for the proportion of household expenditure they represent.2

To reach this current state of knowledge and practice required a long period of development, and the story of this development has been put together in our recent book, *Inflation: History and Measurement*.3 It begins three centuries ago.

**1700 to 1879**

Bishop William Fleetwood was perhaps the first scholar of prices and their movements. In the early 1700s, he investigated the rule that Fellows of an Oxford college must resign their fellowship if their income exceeded £5, which had been instigated in the period 1440-60. By looking at the costs of various commodities, and eventually using the prices of “corn [wheat], meat drink and cloth”, he concluded that £5 in income in 1440-60 was equivalent to £25-£30 in 1686-1706, thus making the terms of the rule seem unfair to fellows. This approach already contains some of the foundations for price measurement – a basket of goods (in this case with only four items), and a range of prices which are averaged in some way and compared across periods. Fleetwood did not consider relative weights for his items, but the changes in the prices of his commodities were sufficiently similar that this did not make much difference.

The study of price change measurements in the 18th century, including the Dutot and Carli indices (see “Price index formulae”), began to establish a mathematical basis for the subject, but it was only with the work of Arthur Young and the Scottish economist Joseph Lowe that weights were systematically included in index number formulae. As a result of his contribution, Lowe is often described as the “father of index numbers”, as he is credited with developing the concept of the relative price change of a constant basket and the index formula associated with it.

Price researchers in the 18th and 19th centuries had to gather their own price information from whatever sources they could, and much of the progress was made with producer prices (charged by manufacturers) rather than consumer prices (charged by retailers). William Stanley Jevons investigated the impact of the Californian gold rush on the value of gold by comparing what gold could buy. He espoused the geometric mean index which is now named after him and extended his researches in a paper read at an Ordinary Meeting of the RSS – one of a long line of papers on producer prices read to the society. (These Ordinary Meetings continue today as “Discussion Meetings”.)

The basic framework for prices was completed in the 1870s through the work of Etienne Laspeyres, who proposed an index which can be written in a form where price change is weighted by expenditure shares in the base period, and Hermann Paasche, who proposed one weighted by shares in the current period. But this still left a lot of scope for further development, and it would take some time before the framework was consolidated. In particular, it was not straightforward to collect information on expenditure shares (in any period) when researchers were responsible for their own data collection.

**1880 to 1946**

Growing political pressure for a better understanding of both the “course of prices” and household expenditure at the end of the 19th century drove the development of a measure of the general level of prices. While far-sighted individuals had established the theoretical and practical foundations of such measures, it was recognised that the resources of the state were required to produce a national measure and it was the Board of Trade who took on the responsibility in the UK. Before 1903, only limited data on household expenditure and retail prices were available. By 1914, the Board had carried out a substantial amount of work to obtain household expenditure data and to develop the means to collect retail prices on a regular basis. They produced the first UK consumer price index at the start of the First World War, the “cost of living index”, based on data from working class households.

Prices rose rapidly in the initial months of the war – the Board of Trade Gazette for September 1914 reported that food prices had risen by 15% in the first eight days of August. While this rate of increase was not maintained, prices continued to rise. The government was keen that rising prices should not lead to industrial unrest, which would hamper vital war work, so they encouraged industrial wage boards to adjust wages in line with the cost of living index for essential workers. This was an important development – the adjustment of wages by a price index, or “indexation”, has become an established mechanism for attempting to maintain the value of wages and benefits in response to rises in prices. Between the wars, the adjustment of wages by the cost of living index was extended to include other workers, including those in the public sector; the Ministry of Labour estimated that by 1922, three million workers were on what were known as “sliding scales”.4

By the 1930s, the methodology of the index had come under increasing scrutiny and attracted criticism. A major concern arose from the use of expenditure weights derived from a household expenditure survey carried out in 1904 (with some updates for 1914). It was not until 1936 that the government agreed to carry out a new household expenditure survey; it went ahead over the years 1937-38. More than 10 000 households supplied expenditure data, a fivefold increase on the sample achieved in 1904. However, the onset of the Second World War prevented the incorporation of the revised expenditure shares.

**1947 to 1989**

After the war, consumer prices were badly out-dated, with expenditure patterns still based on data from 1904. To help choose from the options for updating the index, a Cost of Living Advisory Committee was appointed. On its recommendation, a new Interim Index of Retail Prices was first produced in 1947. This index used a much-expanded basket and implemented the expenditure shares from the 1937-38 budget survey. Criticisms of the resulting index led to the reconvening of the Advisory Committee and eventually to a new budget survey in 1953-54 and further expansion of the basket. All these changes were brought together in the Retail Prices Index (RPI), which was published from January 1956. The RPI was supported by a regular annual budget survey from 1957, and, after some further deliberation, a three-year average was used to update the weights to keep them current.

The Advisory Committee (under several names) continued to meet and make recommendations for improvements to the index. One recurring problem was how to include owner-occupier’s housing costs in the RPI. From the beginning, this had been based on imputed rents: an estimate of how much it would cost you to rent your own home. But when interest rates became volatile in the early 1970s, there was concern that the imputed rents were not reflecting mortgage costs. A technical working party examined this topic and considered whether mortgage interest payments could be used instead. This was controversial; mortgage payments include a capital repayment element that should conceptually be excluded from the index, concerned as it was with goods and services that were contemporaneously consumed. However, the working party recommended moving to mortgage interest, and this decision was reaffirmed in 1986 alongside some other changes.

**1990 to 2011**

The development of the RPI continued in the 1990s with one of the main changes coming in the way prices were collected for the index. Prior to 1995, prices were collected by staff from local job centres, a practice which was criticised in a National Audit Office report of the index and its cost.5 In 1994, a contract was awarded to TNS, a market research company, who employed a force of price collectors to visit shops and identify prices of items for incorporation into the index. This allowed for further innovations in the index, such as a more random sampling of shopping locations, as well as subsequent developments in communications with price collectors via handheld electronic devices.

The RPI had been established as the UK’s main measure of inflation for close to 50 years when, in 1996, the European Union required member states to begin producing a Harmonised Index of Consumer Prices (HICP), for which the methods were defined in regulations. This new index had little immediate impact on the UK inflation landscape, but in 2003, it was announced that the HICP would be renamed as the Consumer Prices Index (CPI) and would form the basis of the new inflation target for the purpose of setting monetary policy. In 2010, the Government went further and indicated that the CPI would play a wider role in the uprating of benefits and payments, most noticeably forming part of the “triple-lock” on pensions. The introduction of the CPI, which differed from the RPI in several notable ways, sowed the seeds for a number of subsequent discussions relating to inflation measurement.

A further notable development in the measurement of price changes came in 2004, with the first use of hedonic regression analysis for the pricing of some items. This technique used details about the characteristics of products, alongside their prices, to help identify the prices of standard specification products where there was a significant amount of technological innovation, such as mobile phones. This represented a significant departure from the standard practice of using only prices for identifiable goods for inclusion in the basket; however, the practice is still not used widely in the construction of the indices, though it remains a current area of research interest for economists and price statisticians.

**2012 to 2017**

More recently, the methodology of consumer price indices has come under particular scrutiny. Two topics have dominated the discussion: firstly, the difference between the CPI and the RPI arising from the use of different formulas at the lowest level of the indices, known as the “formula effect” and secondly, the method for including owner-occupiers’ housing costs in the CPI.

At the lowest level of a consumer price index, weighting information is not usually available and price changes are combined using “unweighted formulas”. The RPI uses arithmetic formulas and the CPI uses a combination of arithmetic and geometric formulas; this results in a lower value for the CPI in most situations. The size of the formula effect had approximately doubled in 2010 as a result of a change in price collection instructions for clothing items. This led to calls for the ONS to investigate the choice of unweighted formulas in consumer price indices.

The question of the “best” formula to use at the lowest level, the “elementary aggregate level”, had been explored before and opinions differed. ONS reviewed previous work and carried out further research. An international expert, Professor Erwin Diewert, was commissioned to review the methodology used in the RPI and CPI and to recommend improvements. In the part of his report on the formula effect, he recommended that the geometric mean be adopted for both the RPI and the CPI.6 The National Statistician also sought the views of the user community through a consultation. After considering both the expert advice and user views, the National Statistician recommended to the UK Statistics Authority that the RPI did not meet international standards and that a new index – the RPI with a geometric formula, or RPIJ – be created. She also recommended that the RPI should continue in its current form to maintain its value as a long-running series. The RPIJ was introduced in March 2013.

The second major topic addressed in this period was the choice of the method to account for owner-occupiers’ housing costs. For most items in a consumer price index, a good or service is bought outright and consumed quickly; however, durable items can be paid for and provide benefits over an extended period. Owner-occupied housing is one of these durables and can be considered to “supply shelter services” over a long period of time. But houses also act as an investment, and it is challenging to separate out the investment value; investments are not included in a consumer price index.

After much deliberation by experts advising the ONS and a public consultation, the method of rental equivalence was chosen. Including this in the consumer price index led to a new measure, the CPIH, which is currently ONS’s main measure of inflation.

**A look to the future**

The compilation of measures of inflation in the UK has come a long way from the rudimentary measure compiled by William Fleetwood. Although not all the changes have been well received, they have clearly been well intentioned, evaluating the often-confusing evidence and making choices with the goal of improving the measure of price change. Given the rapid changes in the last 50 years, no doubt driven by technological developments, it would be foolish to think that the current measures of inflation available in the UK will not see further changes. For example, the potential to use web-scraped data sets and the emerging analyses of the inflation experiences of population subgroups are already generating experimental series. Development is also underway on Household Costs Indices which are intended to provide a measure which is closer to the actual experiences of households. This last development has emerged since our book went to press. The only thing that seems certain is that the way in which inflation is estimated will continue to evolve.

**About the authors**

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**About the book**

*Inflation: History and Measurement,* by Rob O’Neill, Jeff Ralph and Paul A. Smith, is out now, published by Palgrave Macmillan. *Significance* readers can claim a 20% discount on the purchase price of the book using the code PM18TWENTY at bit.ly/2BcWhtf.

**References**

1. Ralph, J., O’Neill, R. and Winton, J. (2015). A Practical Introduction to Index Numbers, Wiley
2. ONS (2014). Consumer Price Indices Technical Manual, 2014 Edition. Newport: Office for National Statistics.
3. O’Neill R., Ralph J. and Smith P. A. (2017). Inflation: History and Measurement. Basingstoke: Palgrave Macmillan.
4. Searle, R. (2015). Is there anything real about real wages? *The Economic History Review* **68** 145-166.
5. NAO (1990). Report by the Comptroller and Auditor General: the Retail Prices Index, HC239. London: HMSO.
6. Diewert, W.E. (2012). Consumer price statistics in the UK. Available from www.ons.gov.uk/ons/guide-method/user-guidance/prices/cpi-and-rpi/erwin-diewert-report-on-consumer-price-statistics-in-the-uk.pdf.

**Box 1: Price index formulae**

The choice of formula to combine price change and expenditure weighting data is a crucial element of the methodology. The formulas are of two types: weighted and unweighted. For specific items, such as: “800g white sliced loaf bought in an independent store in a specific region”, weighting is not available and unweighted formulas are used – this is the case for about two-thirds of items.

**Unweighted formulas**

  

The CPI and CPIH use the Jevons formula to combine price changes in almost all cases with the Dutot for the remainder. For the RPI, the Carli and the Dutot are used equally.

**Weighted formula**

When weighting information is available, the Lowe formula is used:



In the above formulas, *p0i* and *pti* are the prices of the *i*th item at time periods 0 and *t*. *qbi*, is the quantity of item *i* at time period *b*. *si*0*b*is the expenditure share of item *i* with the prices taken from time period 0 and quantities taken from time period *b*. The Laspeyres index is obtained as a special case when *b =* 0, and the Paasche index when *b* = *t* 1.

**Box 2: UK consumer price indices over time**

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| Cost of living index | 1914-1946 |
| Interim index of retail prices | 1947-1955 |
| Retail prices index (RPI) | 1956- |
| Consumer prices index (CPI) | 1997- |
| Retail Prices Index with Jevons formula (RPIJ) | 2013\*-Jan 2017 |
| Consumer prices index with owner occupiers’ housing (CPIH) | 2013\*- |

\* RPIJ and CPIH had reconstructed histories at the time of their introduction.