External MPC UNIT

**Discussion Paper** No. 3

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by Joanne Cutler

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# Core Inflation in the UK

By Joanne Cutler*

March 2001

*Abstract*

This paper presents a new measure of core inflation for the UK based on the idea that it is the persistence of individual inflation rates which matters in measuring the level of underlying inflation. The measure is based on the same components as RPIX, but it weights individual price changes by their past persistence, instead of their importance in households' budgets, to derive a persistence-weighted core inflation measure, or RPIXP for short. This operationalises Blinder's concept of core inflation as the durable or persistence part of aggregate inflation. The paper evaluates this new measure against existing measures in terms of its ability to predict future RPIX inflation. It finds that the new RPIXP is a good predictor of RPIX 6 months and 12 months ahead, and outperforms most other core inflation measures, as well as current RPIX itself, in its predictive ability. Surprisingly, RPIX excluding food and energy - which is a popular way of measuring underlying inflation - is a poor predictor of RPIX. One reason is that this measure excludes non-seasonal food prices which are highly persistent in the UK.

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## Introduction

The recent fluctuations in oil prices have increased the attention given to measures of core inflation which strip out the effects of temporary disturbances or 'shocks' from headline measures of inflation. The idea is that these measures provide a better indicator of underlying inflation, and that monetary policy will be more efficient - in the sense of achieving a target level of inflation while minimising output volatility - if it responds to movements in underlying inflation and ignores temporary fluctuations.

A number of central banks use measures of core inflation to help determine the appropriate stance of monetary policy – some are shown in Table 1. The US Federal Reserve Board, Bank of Canada and European Central Bank, for example, publish measures of Consumer Price Inflation excluding food and energy and, for the latter two, indirect taxes. The Bank of Thailand uses a similar measure as its inflation target. Up until 1997, the Reserve Bank of New Zealand published a core inflation rate which excluded the effects of interest rates, housing costs and one-off price shocks but it has since switched to a simpler measure based on consumer prices excluding credit services. In the UK, the Monetary Policy Committee's target is itself a core inflation measure – retail prices excluding mortgage interest payments (RPIX). The justification for stripping out mortgage interest payments is that these are closely related to changes in short term interest rates. So policy changes have a 'perverse' effect on inflation with increases in interest rates leading to higher inflation in the short run. The Bank of England's *Inflation Report* also presents a variety of core inflation measures, including measures of domestically generated inflation and RPIY, which is based on RPIX excluding indirect tax changes.

**Table 1: Central Banks use of core inflation measures**

| **Central Bank** | **Core inflation measure** | **Use** |
|---|---|---|
| | | |
| Bank of Canada | CPI excluding food, energy and indirect taxes | Indicator* |
| US Federal Reserve Board | CPI excluding food and energy | Indicator |
| European Central Bank | HICP excluding food, energy and duties | Indicator |
| Reserve Bank of New Zealand | CPI excluding credit services | Indicator |
| Reserve Bank of Australia | Range of measures | Indicators |
| Bank of Thailand | CPI excluding raw food and energy | Target |

* Published alongside headline measure and target range in Monetary Policy Report.

This paper seeks to evaluate selected measures of core inflation for the UK using a criterion suggested by Blinder, namely that core inflation should be a good predictor of future inflation, which we take to be the annual inflation rate of RPIX since this is the inflation rate targeted by the MPC. The paper also develops and tests a new persistence-weighted core inflation measure, which uses the same components as RPIX but weights individual inflation rates by their persistence over the past, instead of budget weights. This operationalises Alan Blinder’s concept of core inflation as the durable or persistent part of aggregate inflation.

The structure of the paper is as follows. In Sections 1 and 2, we discuss the theory of core inflation and desirable properties of a good measure. Section 3 presents a selection of simple measures of UK core inflation. Section 4 introduces a new measure of UK core inflation. Section 5 evaluates the performance of this new measure against existing ones by testing how well these are able to predict future RPIX inflation, and Section 6 concludes.

## 1. Theory of core inflation

### 1.1. Core inflation as a signal extraction problem

Most economists would characterise inflation as a monetary phenomenon in the long run. If a sector-specific shock occurs that leaves aggregate supply unchanged then, in the absence of a change in the money stock growth rate, increases in the prices of some goods must be matched by decreases in the prices of others, leaving the aggregate inflation rate unchanged. There are issues about how to operationalise this concept of inflation, to do with the choice of monetary aggregate and how to deal with the instability of money demand relations which weakens the link between monetary aggregates and inflation.

But more important for our purposes, there is disagreement over the usefulness of this scenario for the short to medium run analysis of inflation. There are several reasons why relative price changes may affect aggregate inflation in the short run. First, most price indices are partial in the sense that they monitor a subset instead of every single price change in the economy, and so may suffer from measurement error. Second, they do not take account of short run substitution between purchases in response to relative price changes; for example, in the UK, the RPIX uses fixed spending weights which are only updated annually. Third, prices may not be fully flexible in the short to medium run. If firms tend to adjust their prices slowly then the falls in other prices described in the previous paragraph do not occur immediately. As a result, the rise in prices in specific sectors will affect the aggregate inflation rate. These reasons motivate Bryan and Cecchetti to search for a core inflation measure:

*"the measurement of aggregate inflation as a monetary phenomenon is difficult, as nonmonetary events, such as sector-specific shocks and measurement errors, can temporarily produce noise in the price data that substantially affects the aggregate price indices at higher frequencies"* *(1994)*

At one level then, the problem of core inflation is an attempt to distinguish sector specific shocks from aggregate shocks. Monetary authorities wish to respond to the latter only, since this is the element of inflation which is common to all goods in the economy and also the part over which monetary policy has the most control.

There are various approaches to this signal extraction problem. The simplest one is to simply take moving averages of past headline inflation rates to smooth through any transitory fluctuations. A more common approach is to calculate the headline rate excluding prices in those sectors believed to experience a high incidence of sector specific shocks. The most commonly excluded prices are: seasonal foods; energy; and duties/indirect taxes. A more sophisticated filtering procedure is to exclude outlying price changes on the grounds that these 'unrepresentative' observations are likely to reflect relative rather than generalised price changes (the so-called trimmed mean approach is described later).

Beyond these simple statistical measures, others have estimated small macro models and attempted to pin down core inflation using restrictions suggested by economic theory e.g. see Quah and Vahey for an SVAR approach for the UK (1995). A recent paper by Folkertsma and Hubrich (2000) questions the usefulness of this approach, which we do not consider further in this paper. There are many good literature surveys of these various approaches for the interested reader (see Roger (1998) and Wynne (1999) for recent ones).

### 1.2 A persistence approach

Blinder (1997) defines the problem of core inflation in a different way, identifying core inflation as the durable or persistent component of aggregate inflation. The persistent part of inflation should capture the 'on-going' element of price changes and therefore be correlated with future inflation, which is ultimately what policy makers care about in a forward-looking policy framework:

*"as a Central Banker…..[t]he name of the game then was distinguishing the signal from the noise, which was often difficult. The key question on my mind was typically: What part of each monthly observation on inflation is durable and what part is fleeting……To me the durable part of the information in each monthly inflation report was the part that was useful in medium and near-term inflation forecasting"*

(Federal Reserve of St Louis Review, May/June 1997)

There are many different possible explanations of the high degree of persistence observed in aggregate inflation rates in the UK and other countries. The nature of the monetary policy regime, and the degree of accommodation of shocks, is likely to play some role. But 'real' factors like the nature of underlying economic shocks, and the pricing behaviour of firms are likely to be important as well. Changes in sectoral prices may be persistent, even if prices are fully flexible, if the underlying supply or demand shocks themselves are persistent. Similarly, even if shocks are transitory, the effect of sectoral price changes on aggregate inflation can be persistent if firms are not able to change their prices frequently. The stickiness of price adjustment might, in turn, reflect small menu costs of price adjustment (Ball and Mankiw (1995)) or the nature of contracting in goods and labour markets. There is a lot of research interest in trying to explain the relative importance of these different factors in determining inflation persistence. The aim of this paper is not to try to model the causes of persistence, instead we are interested in uncovering whether there is information in the persistence properties of disaggregated price data which can help to predict future RPIX inflation.

Blinder's conceptual approach suggests that we should focus on the persistence of underlying price changes in estimating core inflation, instead of attempting to strip out certain sectors or sector-specific shocks. In particular, we want a measure which gives a high weight to very persistent price changes, and downweights those which have little or no persistence, on the grounds that persistent price changes are likely to carry more information about future inflation. In Section 5 we introduce a new measure of core inflation for the UK which attempts to operationalise this.

Before describing existing measures of core inflation for the UK and introducing this new persistence weighted measure, we first of all consider desirable criteria of any core inflation measure against which we can evaluate different measures.

## 2. Desirable criteria for a measure of core inflation

Roger (1997) proposes three criteria to be satisfied by any candidate measure of core inflation. These are that the measure is: timely (if the measure is only available with a long lag, that will reduce its value to policy makers); robust and unbiased (ideally, the difference between the average rate of inflation of the core measure and the headline measure should be zero over a long time period since any systematic differences will impair the credibility of the measure); and verifiable (the measure should be easy to reproduce and track, to ensure its high credibility with people outside the Central Bank).

Wynne (1999) agrees with these criteria and proposes others as well, suggesting that the measure: be forward looking in some sense; have a track record of some sort; be understandable by the general public; have some theoretical basis, ideally in monetary theory and that its history does not change each time there is a new observation. [1]

Consistent with Wynne's idea that the measure be forward-looking, Blinder (1997) and Lafleche (1997) evaluate core inflation measures by their information content in terms of

[1] A different set of criteria have been proposed by Marques et al (2000). This is based on the statistical observation that inflation is non-stationary over certain sample periods. The authors argue that a necessary condition for any core inflation measure is that it cointegrates with aggregate inflation. The theoretical notion that the inflation rate is non-stationary is controversial.

forecasting the headline inflation rate.

The weight which policy-makers attach to each of the above criteria will depend on the intended use of the core inflation measure. Conceptually, a distinction can be made between measures designed for policy assessment (e.g. to define an inflation target), and those designed to help set policy to achieve a given objective (e.g. as leading indicators of the inflation target). If the core inflation measure is intended as a target variable, it is crucial that it is credible, transparent, and not subject to revision, in order to facilitate policy assessment. The emphasis here is on finding a good 'clean' measure of underlying inflation which excludes transient fluctuations, and perhaps also price disturbances which are 'out of the control' of the monetary authorities. If, however, the core inflation measure is designed to help set policy then, taking account of the lags between changes in monetary policy and changes in inflation, we would expect it to contain information about future inflation. The focus is on finding a good leading indicator of inflation, rather than on measuring the true current inflation rate. That said, the distinction is less obvious in practice, and empirical approaches to core inflation tend to strip out similar sorts of shocks whether the measure is intended as a target or as a leading indicator.

In the UK, the MPC's target is defined in terms of the annual change in RPIX so clearly any core inflation measure cannot be an alternative or additional target. There is only one instrument for monetary policy and this could pose a dilemma if different targets sent conflicting signals about the appropriate stance of monetary policy. However, core inflation measures can and do play a useful role as leading indicators of inflation.

There is an issue about how much bias matters for measures which are used as leading indicators. Many existing core inflation measures appear to have a different average inflation rate than the headline or target inflation rate. Of course, some differences are to be expected, to the extent that any core inflation measure has predictive power, during a period of falling RPIX inflation it should be expected to remain below the target variable. Systematic differences may pose more of a problem. If these are sufficiently constant, then the measure can be adjusted in a simple way to retrieve the usefulness of the measure as a leading indicator, but bias may reduce the credibility of the measure outside the Central Bank. This will be discussed a bit more later on.

The following section looks at selected UK core inflation measures.

## 3. Selected measures of UK core inflation

Existing simple statistical measures of core inflation for the UK can be classified into four broad types, those which:

A) **Exclude erratic components** based on prior assumptions about the prevalence of supply shocks in certain sectors.

B) **Exclude one-off known shocks** on an ad hoc basis e.g. tax changes.

C) **Exclude inflation outliers**, that is individual inflation rates which are a long way from the average inflation rate – the so-called trimmed mean and weighted median approach discussed later. The components which are excluded can change over time since the trimming is done at a cross-sectional level each period.

D) **Re-weight individual components** to maximise the signal-to-noise ratio of the core inflation measure. For example, Dow (1994) suggests choosing weights that are inversely related to the volatility of individual prices, as measured by the relative standard deviation of past inflation rates.

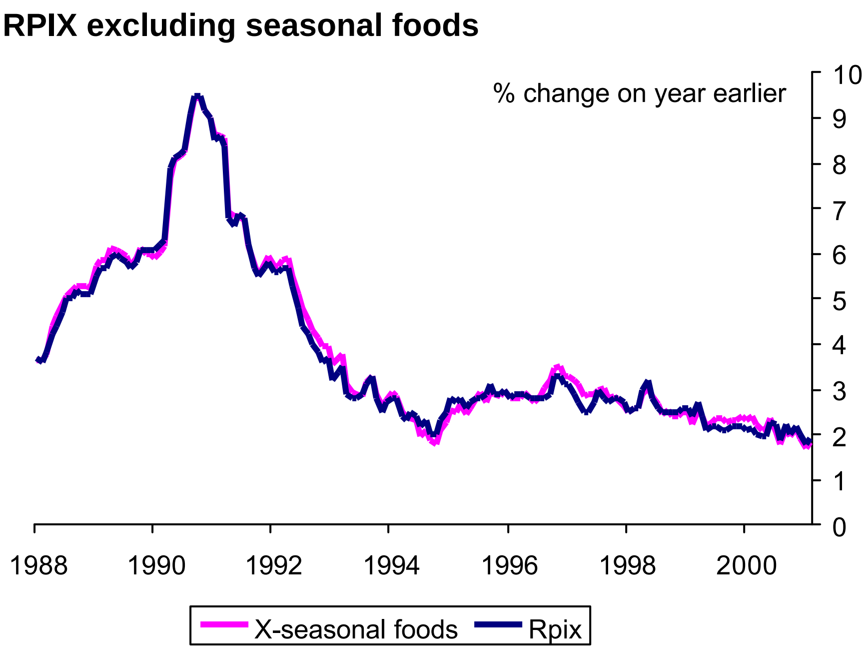
The first three can be thought of as excluding components – either altogether or on an ad hoc basis or outlying price changes – while the last can be thought of as applying a different weighting scheme in the aggregation of individual price changes. The next section presents some examples of these different kinds of measures for the UK.

## A) Excluding erratic components

### - X-Seasonal Foods

The justification for excluding seasonal foods prices from RPIX is that month-to-month fluctuations in these prices can be erratic reflecting transient, weather-related factors. The RPIX index is not seasonally adjusted so such fluctuations will distort high frequency inflation data. Chart 1 plots annual RPIX and RPIX excluding seasonal foods. The two series are similar. This partly reflects the small weight of seasonal foods in the RPIX index (less than 2%), but it also suggests a degree of regularity in the seasonal pattern of food prices which means that using 12-month inflation rates can reduce distortions from this source.

**Chart 1**

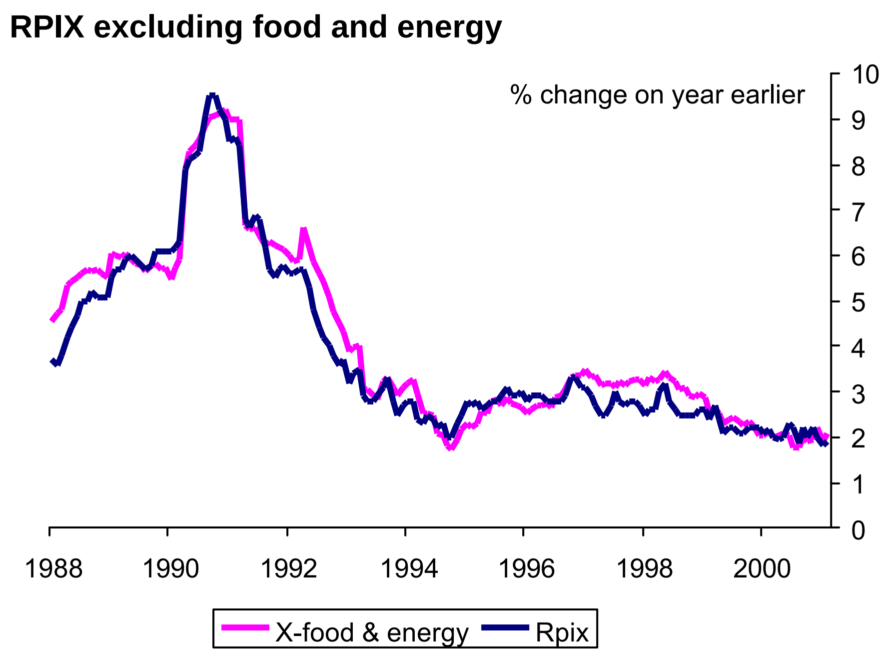


## - X-Food and Energy[2]

Measures of core inflation excluding food and energy are probably the most well-known and commonly used. Energy prices are excluded because of the perceived high incidence of supply shocks which are generally thought to be self-reversing. These prices are singled out because price movements tend to be large and these items have a relatively large spending weight in headline inflation measures (petrol/oil accounts for around 5% of RPIX). With respect to the food components, some organisations exclude just seasonal foods (e.g. Bank of Thailand) while others exclude non-seasonal/processed foods as well (e.g. the US Fed).

Chart 2 shows RPIX inflation excluding all food and energy. RPIX diverged from this measure of underlying inflation on two obvious occasions: 1992 and 1997-98. In 1992 both energy and food price inflation declined sharply but this proved to be temporary and was unwound in 1993. Similarly in 1997, food and energy made a negative contribution to RPIX, but this was short-lived and was unwound in 1999. By the beginning of 1999, RPIX was just a little lower than towards the end of 1996 (2.6% cf 2.9%) but had 'see-sawed' between 2.4% and 3.2% in the interim. RPIX-X food and energy by contrast was much smoother, at a little over 3% over this period. On both occasions the changes in food and energy prices proved to be temporary, perhaps justifying ignoring these items in policy setting.

**Chart 2**



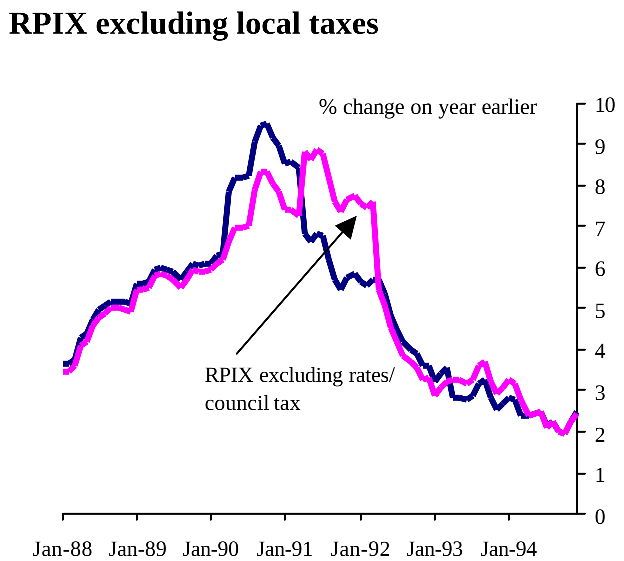

[2] Food includes seasonal and non-seasonal foods; energy comprises fuel and light plus petrol/oil (see Annex A).

**B) Excluding one-off known shocks**

**- X-local authority taxes**

If there are obvious and known shocks to the headline inflation rate, which are sector specific, it may be useful to try to exclude these. For example, there is a noticeable acceleration in inflation in 1990. RPIX inflation accelerated from 6.4% (March 1990) to a peak of 9.5% (September 1990) and then fell back a year later to 6.8% (April 1991). This reflects distortions arising from sharp changes in local authority taxes, which increased at an annual average rate of 34% between April 1990 and March 1991 and then fell by 29% between April 1991 and March 1992. If this distortion is stripped out, the hump shape in RPIX is more protracted: underlying inflation remained high during the period 1990 to 1992, suggesting more momentum behind the inflationary pressures which had built up towards the end of the 1980s. This episode illustrates how removing one-off, known shocks can provide a better gauge of underlying inflation.

**Chart 3**

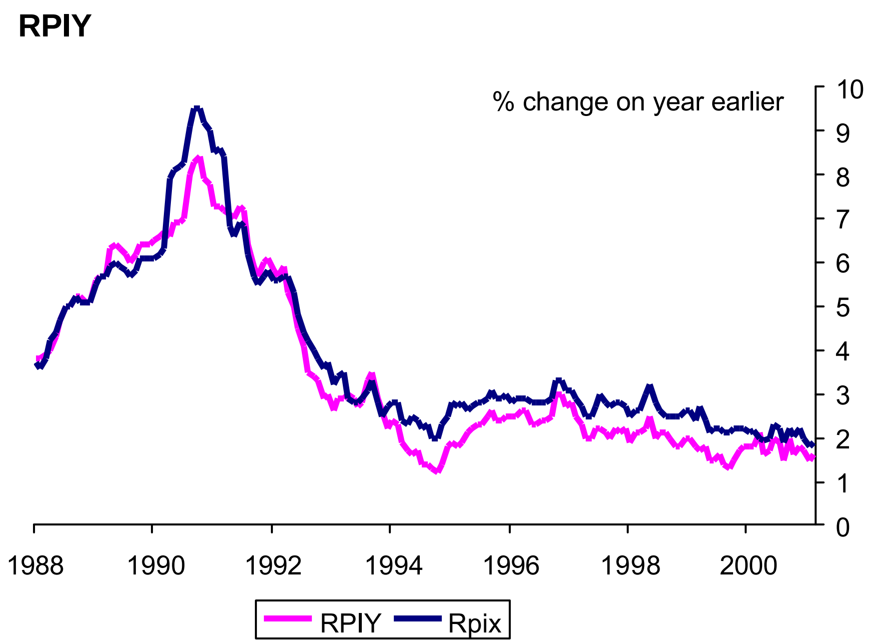


- **X-Indirect taxes**

Other price changes commonly excluded from core measures are indirect tax changes. Unlike shocks to seasonal food prices, tax changes can be 'permanent' in the sense that their effects on relative prices are not subsequently unwound. Even so their direct effects on the inflation rate are temporary. For example, a large change in the duty charged on alcohol will affect the annual RPIX inflation rate when it is implemented, and again a year later when the price change drops out of the calculation, but have no long lasting effects. Because such changes frequently distort RPIX via Budget changes, these are often stripped out.

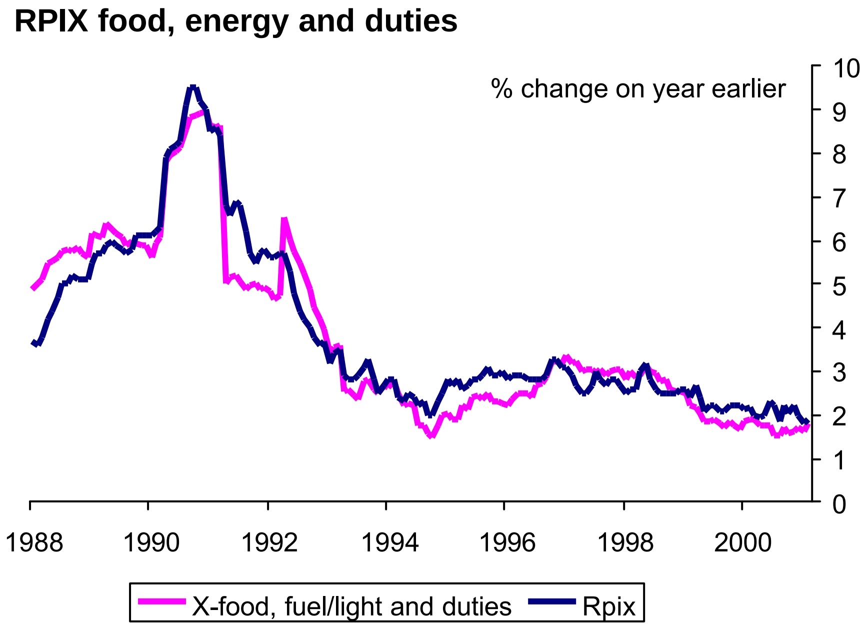
A more comprehensive approach to excluding indirect taxes is to weight price changes by their spending weights excluding the indirect tax/duty component, as used by the National Statistics office when calculating RPIY. Chart 4 shows RPIY tracks RPIX reasonably closely up until the mid-1990s when it moves below RPIX and stays there. The main reason for this was the imposition of the fuel escalator and the overindexation policy. More recently, the gap has narrowed reflecting the abolition of the automatic fuel escalator.

**Chart 4**




A core inflation measure which subsumes the above approaches is RPIX-X food, energy, and duties. This measure appears more erratic than RPIX, particularly in the early 1990s, but more recently has tracked RPIX rather more closely (see Chart 5).

**Chart 5**




## C) Excluding outlying price changes

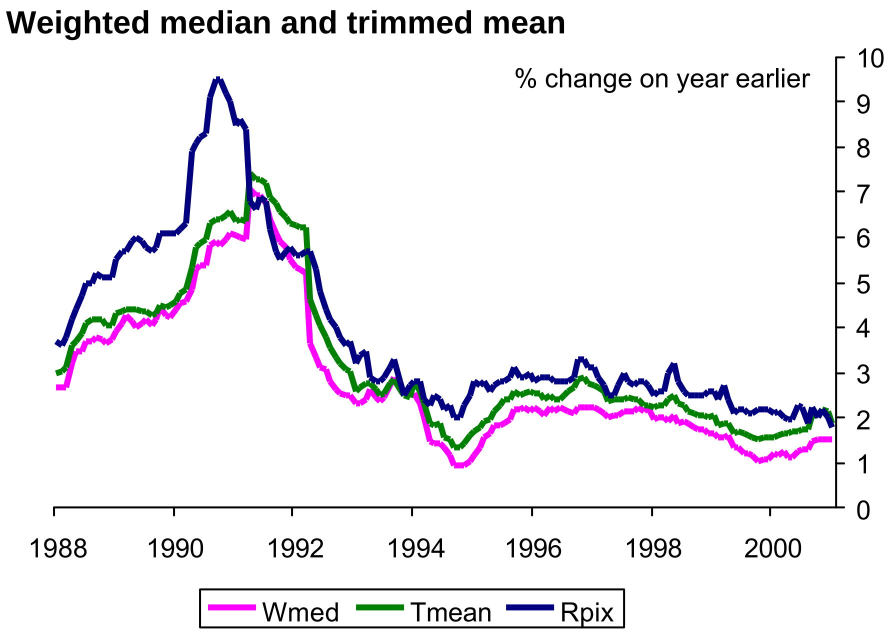
### Trimmed mean approach

Bryan and Cecchetti (1993) propose a measure of core inflation which excludes outlying price changes, that is individual price changes which are very different from the average. The justification for the trimmed mean is that outlying inflation rates which are not representative of average price changes in the economy are more likely to reflect relative price changes with no effect on inflation in the long run.

The trimmed mean is derived as follows. All price changes are ranked in order of the size of price change. The number of times a particular item appears in the distribution is set equal to its budget weight, so if energy has a spending weight of 5% in RPIX its inflation rate appears 5% of the time in the distribution. The top and bottom tail of the distribution is then trimmed to exclude 'extreme' price changes, and the average price change of the remaining items gives the 'trimmed mean'. The weighted median uses the median instead of the mean of measured price changes (in the untrimmed distribution) and, like the trimmed mean, gives less weight to inflation outliers. A trimmed mean RPIX inflation rate for the UK, excluding the largest and smallest 15% of monthly price changes, appears regularly in the Bank's *Inflation Report* and is reproduced in Chart 6 alongside the weighted median and RPIX.[3]

[3] See Bakhshi and Yates (1999) "To trim or not to trim" for more details.

Chart 6




The measures presented above seem to meet the (minimum) criteria for these to be useful for policy purposes. These are based on the same data as RPIX, and are therefore as timely as RPIX and not subject to revision. They are also easily understood, and transparent. The measures vary in terms of their coverage. RPIX excluding food, energy and duties, and the trimmed mean (applying a 15% symmetric trim) are the most narrow, both accounting for around two-thirds of the RPIX basket only. In terms of bias, the trimmed mean appears to be systematically lower than RPIX which suggests that it is doing more than just excluding relative price disturbances.[4]

However, the above measures all share an important conceptual shortcoming, which is that they do not take explicit account of the *persistence* of individual price changes in their construction. If persistent price changes contain more information about future inflation, as Blinder suggests, we want to give these a high weight in core inflation. In the trimmed mean approach, large persistent price shocks could be outliers in the inflation distribution for a number of consecutive periods, in which case, these will be stripped out and the measure will ignore potentially useful information about future inflation.

The next section derives an alternative core inflation measure for the UK which weights RPIX components by the persistence in their inflation rates over the past, instead of traditional spending weights.

[4] This reflects the fact that the distribution of price changes is skewed to the right over this period. Rogers has suggested trimming the right hand 'tail' of the distribution by more than the left to overcome this bias.

## 4. A persistence-weighted core inflation measure

### 4.1 Construction

Our persistence weighted core inflation measure – denoted RPIXP hereafter - comprises the same components as RPIX and is derived using a high level of disaggregation across 80 categories. It is constructed as follows[5]:

**Step 1**: To estimate the persistence weights, we run a first order autoregressive model for each RPIX component using monthly data and annual inflation rates:

$$_{i,t} = a_i + r_i \quad _{i,t\ 12} \qquad \textbf{(equation 1)}$$

The estimated coefficient $r_i$ is a measure of the persistence of that component's past annual inflation rate. If $r_i$ is negative this is taken as evidence of quick mean reversion in the annual inflation rate of that component, which is consequently assigned a zero weight in RPIXP to exclude it on the grounds that it has extremely low persistence. For the majority of items with a positive $r_i$, their weight is simply equal to the size of the persistence coefficient, with the positive weights normalised to sum to unity.

There are two points to note about the weights. First, we allow the weights to change each year to allow for changes in the time series properties of the underlying price components. This is implemented by estimating the equation recursively adding an extra year's worth of data and updating the persistence coefficient as we go forward in time. The only restriction is that the weights are constant *within* years, to mirror the treatment of the spending weights in the construction of RPIX and ensure that our measure is reasonably smooth, or at least not artificially more volatile than RPIX. Second, the weights are calculated using *past, known* information only. For example, the 1999 weights for component i are based on the persistence coefficient from a regression over the period January 1976 to December 1998, and those for 2000 on information between January 1976 and December 1999 and so on. This ensures that the measure is computable in real time going forward.[6]

**Step 2**: Each individual monthly inflation rate is multiplied by its (relative) persistence weight and these weighted inflation rates are summed to produce an estimate of the aggregate

[5] I would like to thank Andy Brigden for his invaluable help in programming this procedure.
[6] The first complete year for which we have annual inflation rates for all 80 or so components is 1976. We use five years worth of data for the first regression, 1976:1 to 1980:12, so 1982 is the first year for which we have the annual RPIXP inflation rate. The regression is rolled forward in each subsequent year in a recursive way. So the weights for 1997 will be based on a regression over the sample period 1976 to 1996, those for 1998 will be based on 1976 to 1997, and so on. For the depreciation component which is only available from 1995 we use a regression for the whole period, 1995-2000 since the persistence weight was found to be stable.

1-month core inflation rate.  These are used to create a price index[7] and the 12-month change in the index gives the persistence weighted annual core inflation rate.

## 4.2 The persistence weights

Chart 7 shows a snapshot of the estimated persistence weights in 1985, 1990 and 1999 aggregated into the main RPIX categories (more details are given in the annex).  There are several points to note:

The weights are plausible.   Categories which stand out as having a relatively high persistence weight are non-seasonal foods; household goods and services; and clothing and footwear.  Those assigned a low weight reflecting weak persistence include seasonal foods; catering; energy; leisure services (includes holidays); duties; and housing (rents, water).  Indeed, seasonal foods are assigned a zero weight in every year reflecting quick mean reversion in their inflation rates.  Other sub-categories which are frequently assigned zero weights include restaurant meals, CDs, toys, and holidays.

The persistence weights are stable over time.  This will help to dampen the low- frequency volatility of the core inflation estimate.  Within this pattern of overall stability, however, it is interesting to note that the relative persistence of goods attracting duties has risen, while that of clothing & footwear has declined – though movements are small.  The decline in the persistence of clothing and footwear prices could reflect intensified competitive pressures in this sector and more frequent price adjustment.

Chart 8 compares the persistence weight of RPIX categories with their spending weights in 1999.   This can help assess existing measures of core inflation which rely on excluding certain items altogether to see if these implicitly take account of persistence.  For example, if the persistence weight of food and energy is always very low, then excluding these prices may result in a reasonably good proxy of core inflation.  Non-seasonal foods stand out as having a highly persistent inflation rate suggesting these should have a high weight in core inflation instead of being excluded altogether.  The persistence weight of energy is similar to its relative budget weight, but this masks a virtually zero persistence weight for petrol and oil compared to a budget weight of 4.5% (see annex).  The fact that the weight of energy as a whole, which also includes electricity and gas, is positive suggests that it is a mistake to throw away information about all of these prices by excluding them altogether as in the RPIX-X food and energy measure.

[7] This method of constructed the annual RPIXP inflation rate reduces the effect of step changes in the weights on the measure.

**Chart 7**

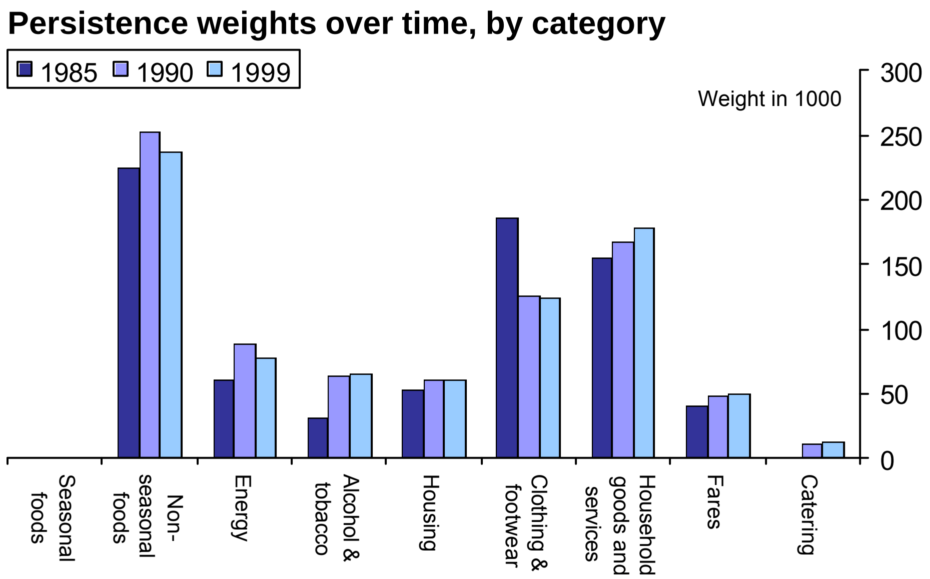
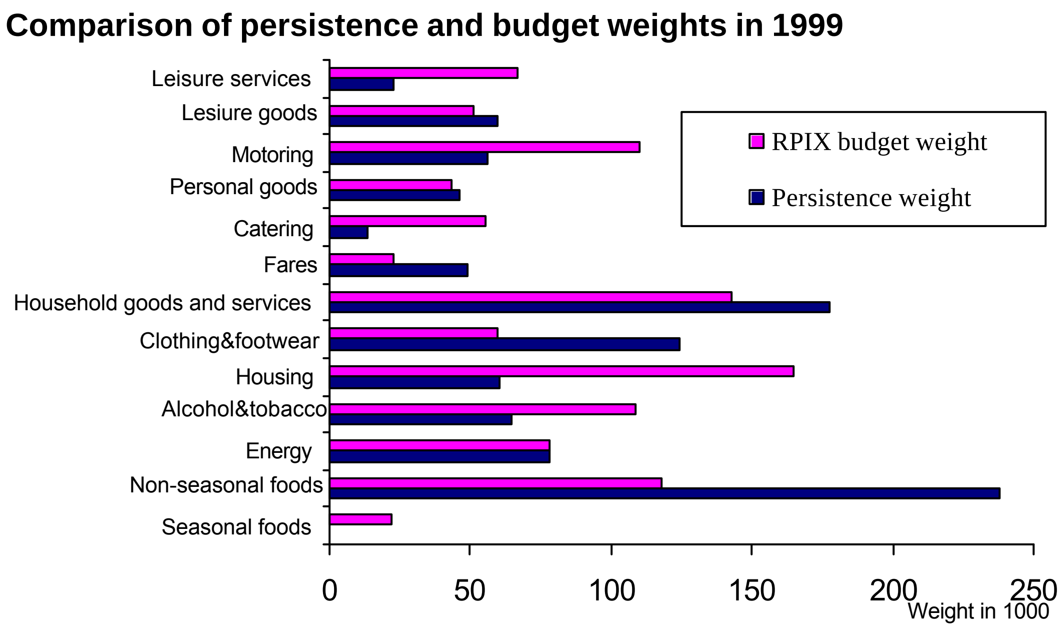


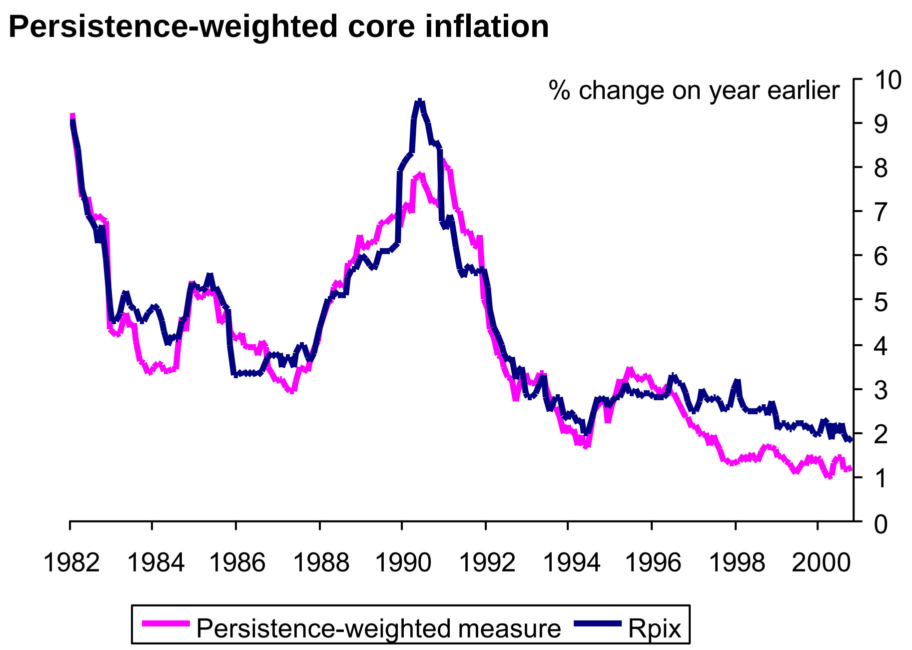

**Chart 8**




4.3 RPIXP (January 1982 – February 2001)

The persistence-weighted core inflation series is shown in Chart 9 alongside RPIX. It tracks RPIX reasonably closely up to 1996, but a few points stand out as interesting. RPIXP suggests that the peak in inflation in the early 1990s was lower, and occurred slightly later, than RPIX: a peak of 7.9% in April 1991 instead of 9.5% in October 1990. This suggests that there was more momentum behind the inflationary pressures which built up during the late-1980s boom than is apparent in RPIX. Thereafter RPIXP declines sharply, as does RPIX, but the downward trend is temporarily interrupted in 1993 when RPIXP turned upwards rising from 2.6% in January 1993 to 3.3% in September 1993. It is possible that this is picking up some underlying inflationary impulse from Sterling's exit from the ERM in the previous year which is obscured in RPIX. RPIXP shows a faster acceleration of inflation over 1995, but then shows a sharper decline, falling below RPIX in October 1996 where it has remained. From 1998, RPIXP has been broadly stable at a little over 1%, but well below RPIX and the inflation target.

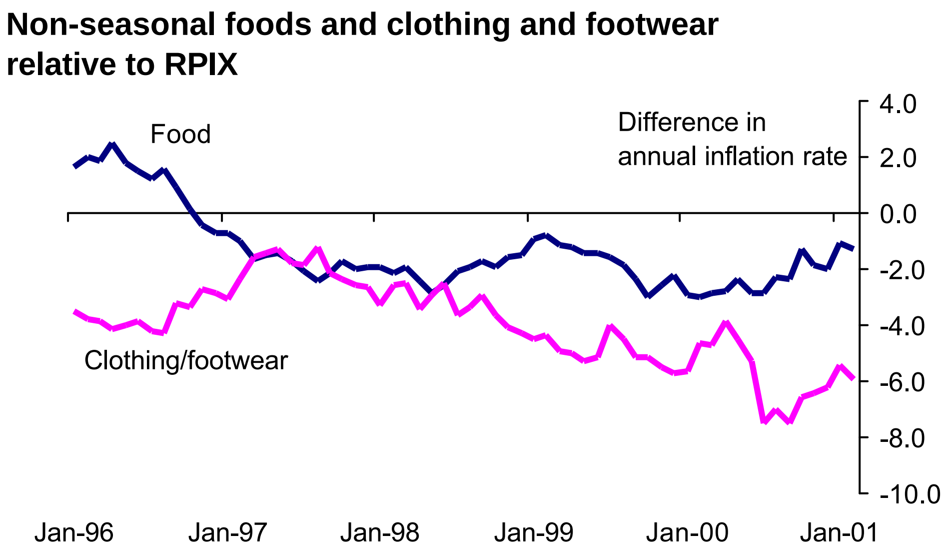
**Chart 9**




The opening up of a wedge between RPIXP and RPIX is partly explained by the weakness of non seasonal food, and clothing and footwear, prices reflecting global oversupply (see Chart 10).[8] These items are given a high weight in RPIXP relative to (their budget weight in) RPIX (see Chart 7).

[8] Another possible explanation considered is that I have excluded categories (on the grounds that their past inflation rates show little or no persistence) which have systematically higher inflation rates than RPIX over this period. However, the excluded categories do not have systematically higher inflation rates than RPIX over these years – these are: oil/fat, eggs, tea, sugar, potatoes, vegetables, fruit, restaurant meals, take-aways, council tax, water, insurance/ground rent, tax and insurance, toys/sports goods, tv licences, foreign and UK holidays.

**Chart 10**




## 5. Evaluation of different core inflation measures

### 5.1 Predictive ability

Given the variety of available measures of core inflation for the UK, which measure is to be preferred? To answer the question empirically we use the criterion suggested by Blinder and others, namely that core inflation should be a good predictor of future inflation. [9] Specifically, we want a measure which can predict the annual inflation rate of RPIX, the inflation rate targeted by the Monetary Policy Committee in the UK.

The measures we compare are:

a) X- seasonal foods;
b) X-food and energy;
c) RPIY;
d) X-food, energy and duties;
e) Trimmed mean;
f) Weighted median;
g) Persistence weighted measure (RPIXP).

[9] As Woodford (1994) notes the leading indicator properties of any variable – be it core inflation or anything else – depend on the policy reactions to it. If policy responds in an optimal way to deviations of an indicator from target, that should eliminate its predictive power in equilibrium. We think Woodford's point may have less force here since the MPC uses different measures of underlying inflation in it's assessment of inflation pressures and these, in turn, are only one part of the information set used for policy setting.

A natural starting point is to compare the errors made from using the above measures of core inflation to forecast future RPIX inflation. Table 2 compares the mean squared errors using a) to g) where:

$$Mean\ Squared\ Error\,(MSE) = \frac{1}{T}\sum_{i=1}^{T}\left(\pi_t^{CORE} - \pi_{t+h}^{RPIX}\right)^2$$

We consider predictive ability at h=6, h=12, h=18 and h=24 months ahead, a similar horizon spanned by the Bank of England's *Inflation Report* forecast and fan charts. The comparison is over the sample period January 1988 to January 2001 because measures a) to d) are only available back to 1988.

The final column of Table 2 ranks the measures; the lower the MSE the better the predictor and the rank is based on an average of the MSE across all four forecast horizons. RPIY, RPIX X-food, energy and duties, and RPIXP, rank the highest in terms of predicting RPIX inflation, outperforming current RPIX as a predictor of itself. The trimmed mean and weighted median are the worst performers. Similarly, core inflation measures which strip out seasonal foods, or food and energy, do badly.

**Table 2: Ranking of core inflation measures by ability to predict RPIX inflation, As measured by MSE(1)**

| | **Forecast horizon** | | | | |
|---|---|---|---|---|---|
| **Sample: Jan 1988 – Jan 2001** | 6 months ahead | 12 months ahead | 18 months ahead | 24 months ahead | **Ranking** |
| | | | | | |
| RPIX | 0.8 | 2.0 | 3.2 | 4.8 | **4** |
| X-seasonal foods | 0.9 | 2.1 | 3.3 | 4.9 | **5** |
| X-food and energy | 1.2 | 2.5 | 3.6 | 5.1 | **6** |
| RPIY | 0.8 | 1.7 | 2.7 | 4.1 | **1** |
| X-food, energy and duties | 0.9 | 1.9 | 2.7 | 4.0 | **2** |
| Trimmed mean | 1.8 | 2.8 | 3.7 | 4.7 | **7** |
| Weighted median | 2.3 | 3.1 | 3.8 | 4.6 | **8** |
| RPIXP | 1.0 | 1.8 | 2.9 | 4.4 | **3** |

5.2 Bias

One of the reasons why the trimmed mean and weighted median perform poorly is that they appear to be systematically biased with respect to RPIX, and are lower than RPIX for most of the sample period. Between January 1988 and January 2001, the average annual inflation rate of the trimmed mean and weighted median is 3.3% and 2.9%, compared to 3.9% for RPIX (see table 3).

| **Table 3: Are core inflation measures biased?** | |
|---|---|
| **Sample: Jan 1988 – Jan 2001** | **Average difference between annual rate of core and RPIX (p.p.)** |
| | |
| X-seasonal foods | +0.1 |
| X-food and energy | +0.2 |
| RPIY | -0.4 |
| X-food, energy and duties | -0.1 |
| Trimmed mean | -0.6 |
| Weighted median | -1.1 |
| RPIXP | -0.3 |
| | |
| Memo item: RPIX inflation rate | 3.9 |

5.3 Predictive ability over and above current RPIX

A stronger test of the predictive power of the core measures is to ask whether these carry information about future RPIX over and above current RPIX. In other words, can we do better than using a naive rule of thumb to predict RPIX, which is that RPIX in a year's time will be equal to current RPIX. To test this, we run the following regression again on annual inflation rates:[10]

$$\pi_{t+h}^{RPIX} = a + b\,\pi_t^{CORE} + (1 - b)\,\pi_t^{RPIX} + e_t \qquad \textbf{(equation 1a)}$$

If $b$=0 core inflation has no role in explaining future RPIX inflation over and above current RPIX. If $b$=1 then core inflation perfectly explains future inflation and current RPIX adds nothing. If 0<$b$<1 then core inflation helps to predict future inflation in addition to current RPIX, and if 0.5<$b$<1.0 then it outperforms current RPIX. The constant in the equation allows for systematic bias in the core inflation measure which should help the predictive performance of the trimmed mean and weighted median.

[10] Newey-West corrected standard errors are used to take account of the overlapping nature of the data.

The results from OLS regressions are shown in Table 4 over the page for the 6 months and 12 months forecast horizon. [11] At the 12 months ahead horizon, RPIY, the X-food, energy and duties and RPIXP, have the highest predictive power, with $>0.5$ and significant at the 10% level suggesting that they all outperform current RPIX in predicting RPIX. At the shorter 6 months horizon, only RPIY and RPIXP have a positive coefficient which is significant at the 10% level suggesting they are useful for shorter term forecasting of RPIX inflation as well.

The other core measures have negative and/or insignificant coefficients suggesting little predictive power over and above lags of RPIX inflation. The weighted median and trimmed mean have low coefficients which are not significantly different from zero at either the 6 months or 12 months ahead horizon. The fact that the trimmed mean and weighted median measures do badly even when we include a constant in the regressions suggest that the bias is not sufficiently constant to adjust for this in a simple way when interpreting movements in these measures in terms of what they may be telling us about future RPIX inflation.

RPIX excluding seasonal foods has a negative coefficient, which is insignificant at a 12 months ahead horizon. A negative coefficient implies that the measure is misleading since, if core is higher than current RPIX, this tells us that future RPIX will be lower rather than higher than current RPIX.

[11] The use of annual inflation rates results in a moving average error, so we use Newey-West standard errors in the hypothesis testing for all the results reported in this section which are robust to this econometric problem. The equations pass a Chow forecast test for structural breaks in 1992, 1995, and 1997.

| **Table 4: Does core inflation help to predict RPIX inflation?** $\pi_{t+h}^{RPIX} = \alpha + \beta\,\pi_t^{CORE} + (1-\beta)\,\pi_t^{RPIX}$ | | | | |
|---|---|---|---|---|
| Sample: Jan 1988 – Jan 2001 | 6 months ahead (h=6) | | 12 months ahead (h=12) | |
| | | t-statistic (1) | | t-statistic (1) |
| | | | | |
| X-seasonal foods | -1.49 | -1.9 | -0.82 | -0.8 |
| X-food and energy | -0.37 | -0.9 | -0.43 | -0.7 |
| RPIY | 0.63 | 1.7 | 1.35 | 2.1 |
| X-food, energy and duties | 0.28 | 1.4 | 0.73 | 2.3 |
| Trimmed mean | -0.08 | -0.3 | -0.03 | -0.1 |
| Weighted median | 0.06 | 0.2 | 0.21 | 0.5 |
| RPIXP(2) | 0.37 | 1.7 | 0.70 | 1.7 |

(1) Based on Newey West standard errors which are robust to the serial correlation in the equation's residuals.
(2) The beta coefficient for the 12-months ahead forecast for RPIXP over the full sample period it is available (Jan 1982 – Jan 2001) is 0.61, with a t-statistic of 2.3.

### 5.4 Are the results robust to including more lags?

Table 4(b) shows the predictive power of the core inflation measures, allowing for lags of core inflation and RPIX in equation 1b. The results are similar to those shown in Table 2: the sum of the coefficients on the core inflation terms is highest for RPIY, RPIXP and the X-food, energy and duties measure, indicating that these have high predictive power for RPIX over and above current and lagged RPIX itself. The sum of the coefficients on RPIX X-seasonal foods is also high, but a Wald test indicates that these are jointly insignificant.

| **Table 4(b): Does core inflation help to predict RPIX inflation?** $\pi_{t+h}^{RPIX} = \alpha + \sum_0^4 \beta_i\,\pi_{t-i}^{CORE} + \sum_0^4 \gamma_i\,\pi_{t-i}^{RPIX}$ | | | |
|---|---|---|---|
| | 12 months ahead | | |
| | $\sum_0^4 \gamma_i$ | $\sum_0^4 \beta_i$ | Wald test statistic for null: $\sum_0^4 \beta_i = 0$ |
| | | | |
| X-seasonal foods | -0.07 | 0.81 | 0.50 |
| X-food and energy | 1.31 | -0.57 | 0.33 |
| RPIY | -1.12 | 1.80 | 0.01* |
| X-food, energy and duties | -0.06 | 0.81 | 0.01* |
| Trimmed mean | 1.14 | -0.52 | 0.21 |
| Weighted median | 0.81 | -0.14 | 0.70 |
| RPIXP | -0.14 | 0.82 | 0.01* |

(1) * denotes rejection of the null at the 5% level.

## 7. Conclusions

This paper has presented a new measure of core inflation for the UK which operationalises Blinder's concept of core inflation as the durable or persistent component of aggregate inflation. This is done by weighting individual price changes of RPIX components by the relative persistence of their past inflation rates, instead of their importance in households' budgets. The idea is that persistent price changes carry more information about future inflation and therefore should be given a high weight in core inflation.

The new measure, RPIXP, is a good predictor of RPIX 6 months and 12 months ahead. It outperforms most other core inflation measures, as well as current RPIX itself, in terms of predictive ability. By contrast, measures such as RPIX excluding food and energy, and the trimmed mean, have poor predictive power over our sample period. These measures take no explicit account of the persistence of individual price changes in their construction and it is argued that they may exclude important information about underlying inflation.

RPIXP suggests that disinflationary pressures were more intense in the second half of the 1990s in the UK. It has been consistently below RPIX since the Autumn of 1996 reflecting the weakness of non-seasonal food, and clothing and footwear, prices where competitive pressures were intensified by the strength of sterling, the Asian crisis and global oversupply. These items have a high weight in a persistence-based core inflation measure. The wedge between RPIXP and RPIX has narrowed more recently, as RPIX has declined. The new measure suggests that underlying inflation was just 1.2% in February, and that RPIX will remain below its target level of 2.5% for at least the next 6 to 12 months.

Obviously a forward-looking monetary policy framework such as the UK's cannot rely on a single indicator - be it core inflation or anything else. But our research suggests that a persistence-weighted measure of core inflation can be a useful indicator of future inflation especially at the one year ahead horizon. Essentially, the measure exploits the fact that there is statistical information in the time series properties of the disaggregated components of RPIX which is useful for predicting future inflation.

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**Comparison of persistence and budget weights (1999)**

| **RPIX item** | Persistence weight | Budget weight |
|---|---|---|
| **Non-seasonal foods** | | |
| Bread | 2.9% | 0.5% |
| Cereals | 2.0% | 0.3% |
| Biscuits | 1.6% | 0.8% |
| Beef | 2.1% | 0.4% |
| Lamb | 0.5% | 0.1% |
| Pork | 0.9% | 0.2% |
| Bacon | 0.8% | 0.2% |
| Poultry | 0.0% | 0.5% |
| Other meat | 0.0% | 0.7% |
| Fish | 2.4% | 0.2% |
| Butter | 1.4% | 0.1% |
| Oil and fat | 0.0% | 0.1% |
| Cheese | 2.5% | 0.3% |
| Eggs | 0.0% | 0.1% |
| Milk | 1.6% | 0.6% |
| Milk products | 2.1% | 0.4% |
| Tea | 0.0% | 0.1% |
| Coffee | 0.8% | 0.2% |
| Soft drink | 0.6% | 1.1% |
| Sugar | 0.0% | 0.1% |
| Sweets chocolates | 1.2% | 1.3% |
| Other foods | 1.1% | 1.4% |
| **Seasonal foods** | | |
| Potatoes | 0.0% | 0.2% |
| Vegetables | 0.0% | 0.6% |
| Fruit | 0.0% | 0.6% |
| **Catering** | | |
| Restaurant meals | 0.0% | 2.7% |
| Canteen meals | 1.3% | 0.6% |
| Take aways | 0.0% | 2.1% |
| **Alcohol and tobacco** | | |
| Beer | 2.4% | 4.0% |
| Wine | 2.0% | 2.8% |
| Cigarettes | 0.6% | 2.9% |
| Other tobacco | 1.3% | 0.2% |
| **Housing** | | |
| Rent | 2.0% | 4.8% |
| Housing depreciation | 1.6% | 3.8% |
| Council tax | 0.0% | 3.5% |
| Water | 0.0% | 1.3% |
| Repairs and maintenance | 2.6% | 1.2% |
| DIY | 1.3% | 0.7% |
| Insurance and ground rent | 0.0% | 1.1% |

| | | |
|---|---|---|
| **Fuel and light** | | |
| Coal | 2.5% | 0.1% |
| Electricity | 2.0% | 1.7% |
| Gas | 2.4% | 1.4% |
| Oil and other fuel | 0.5% | 0.2% |
| **Household goods** | | |
| Furniture | 2.2% | 2.1% |
| Furnishings | 2.2% | 1.3% |
| Appliances | 1.5% | 0.9% |
| Other equipment | 3.0% | 0.7% |
| Consumables | 1.9% | 1.6% |
| Pet care | 0.1% | 0.9% |
| **Household services** | | |
| Postage | 0.7% | 0.1% |
| Telephones | 0.7% | 1.9% |
| Domestic services | 2.8% | 1.1% |
| Fees and subcriptions | 2.4% | 2.8% |
| **Household services** | | |
| Clothing men | 2.8% | 1.3% |
| Clothing women | 1.9% | 2.1% |
| Clothing children | 2.8% | 0.7% |
| Clothing other | 2.3% | 0.8% |
| Footwear | 2.6% | 1.2% |
| **Household services** | | |
| Personal articles | 0.0% | 1.3% |
| Chemist goods | 1.7% | 1.8% |
| Personal services | 2.8% | 1.5% |
| **Motoring** | | |
| Purchase cars | 2.7% | 6.1% |
| Maintenance cars | 2.3% | 2.4% |
| Petrol and oil | 0.1% | 4.5% |
| Tax and insurance | 0.4% | 2.3% |
| **Fares** | | |
| Rail fares | 1.2% | 0.5% |
| Bus and coach fares | 1.5% | 0.5% |
| Other travel | 2.0% | 1.2% |
| **Leisure goods** | | |
| Audio visual | 1.4% | 1.1% |
| CDs tapes | 0.0% | 0.6% |
| Toys and sports goods | 0.0% | 1.3% |
| Books and newspapers | 2.0% | 1.3% |
| Garden products | 2.8% | 0.6% |
| **Leisure services** | | |
| TV licences | 0.0% | 1.1% |
| Entertainment and other recreation | 2.2% | 2.1% |
| Foreign holidays | 0.0% | 3.2% |
| UK holidays | 0.0% | 0.6% |
| | 100.0% | 100.0% |