Is our core rotten? – November 2017

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Abstract

Our current preferred measure of core inflation – headline CPI excluding food and energy – remains an ad hoc measure born out of supply shocks in the 1970s. This note presents an alternative measure based on the New Keynesian conception of core as the 'sticky' part of inflation – a theoretically more appropriate measure. Luckily, a theoretically-appropriate sticky-price inflation measure looks remarkably similar to CPI excluding food and energy, despite being constructed completely differently.

1   Introduction

In the late 1970's central banks focused their attention on a measure of inflation excluding food and energy prices – dubbed core inflation – after facing a significant oil price shock and drought.[1] Exclusion-based measures of inflation such as *excluding food and energy* have been pervasive in monetary policy discussions ever since. From an optimal policy perspective, the rationale behind such core inflation measures make sense. A central bank can do nothing about relative price shocks from flexible prices such as food and energy, which respond quickly to developments in supply and demand. Responding to anything other than the second-round *effects* can also be costly. But the rationale for only excluding food and energy prices, or treating all food products equal, has no basis in fact or theory. These prices are generally the most common sources of relative price shocks, but are not the only flexible prices in an economy, and not always the most flexible.

A better measure of core inflation needs to be grounded in the definition of core inflation, modern theory of monetary policy and welfare economics. This note creates such a measure called "sticky-price inflation".[2] Of course, creating and using such a measure as a target for monetary policy requires micro-price-level data, lots of analysis, and hours of talking to the public. A policymaker may not care too much for this route and rather want to know if such a measure looks anything like CPI excluding food and energy. Surprisingly sticky-price inflation and the exclusion-based measure – *excluding food and energy* – look remarkably similar with completely different information sets. Headline CPI excluding food and energy is an appropriate proxy for a more theoretically-founded core measure despite its ad hoc foundations. This conclusion says nothing about an "optimal" core inflation measure, however. [3] The rest of the note covers the basics of the sticky-price inflation measure and its comparison to headline inflation excluding food and energy.

2   Why do we care about sticky-prices?

Some prices are stickier than others. In South Africa (SA), consumer prices on average change every five months; with the most frequent prices changing every month and the least frequent changing every 7 years. Firms that change prices less often generally need to take account of the likely path of future inflation when setting these prices if they want to maximise profits. For example, when an insurance company sets medical aid prices on an annual basis it needs to decide what it expects inflation to be over that period to ensure that its price is optimal. In contrast, when petrol prices change on a monthly basis, these changes are driven by contemporaneous developments in the exchange rate or the international price of oil. Therefore, prices that are sticky contain more forward-looking information and can be exploited to uncover inflation expectations and underlying, or core, inflation.

Targeting prices that are more sticky is also optimal from a welfare perspective. Walsh (2009) shows that inflation leads to the highest welfare loss in sectors where prices are more sticky (or more persistent) with few

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[1]   Restrictions to oil supply introduced by the Organization for Petroleum Exporting Countries (OPEC) substantially increased the price of oil in the late 1970s.

[2]   The Atlanta Fed also create and track such a measure: https://www.frbatlanta.org/research/inflationproject/stickyprice.aspx.

[3]   see Ruch et al. (2016) and Clark (2001) for a discussion on optimality. Clark (2001) argues that policymakers and analysts have reached consensus on the defining properties of a good measure of core inflation. These include that is must track the components of inflation that persist for several years, help predict future headline inflation over the medium term, be less volatile, and be simple. One important omission from this list is that it must be grounded in the theory used by central banks.
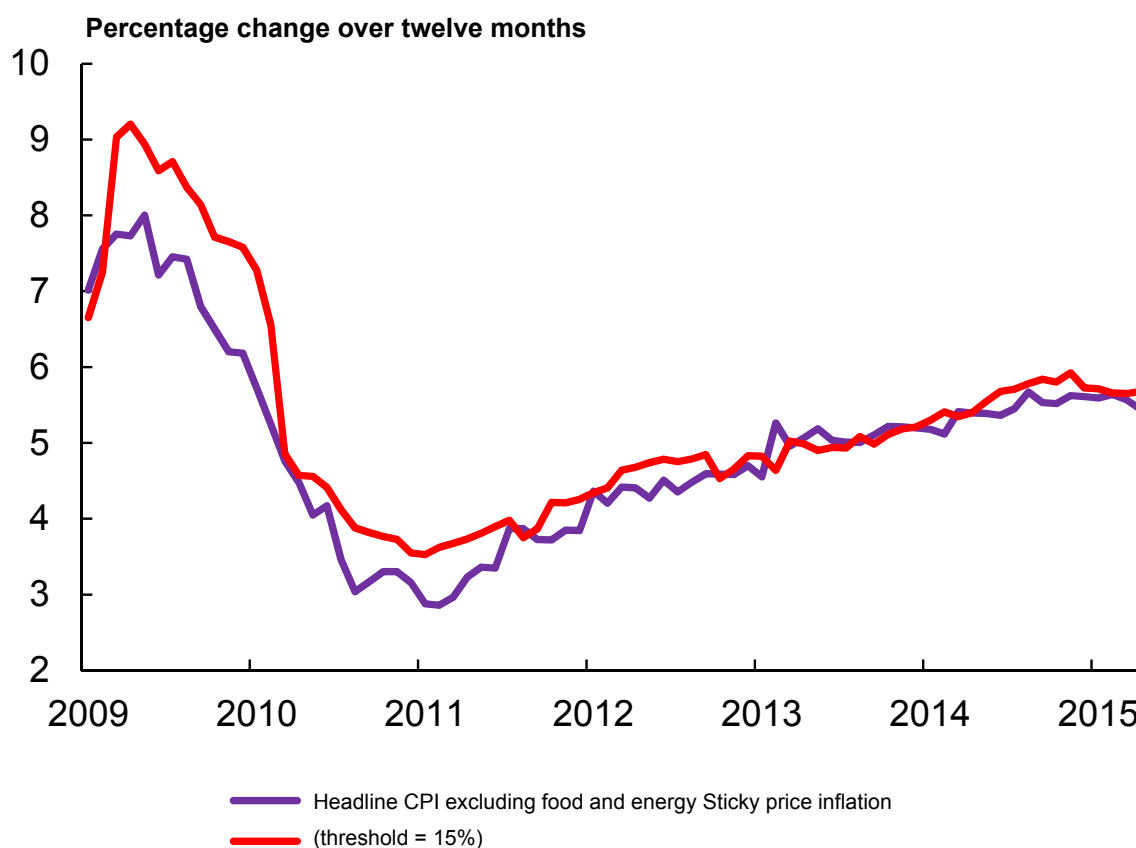
welfare costs when relative price shocks dissipate quickly. New Keynesian models such as Clarida et al. (2002), Aoki (2001), and Bodenstein et al. (2008) show that targeting core (or domestic) inflation rather than headline CPI leads to households maximising their welfare.

3 How does sticky-price inflation compare with core inflation?

In order to create a sticky-price inflation measure we have to decide which 'sticky' prices to include. If we choose prices that change 10% of the time, then only prices that change once every 10 months are included. If, however, we choose 50%, then we include prices that change once every two months. Choosing a point to censor the data remains generally ad hoc and can be based on the median, minimising the signal-to-noise ratio, or theory. Since sticky-price inflation is about trying to create a core inflation measure more grounded in economic theory, theory is what we look to. Reiff and Várhegyi (2013, pg. 7) show that using a threshold of 15% ensures that "the extent of forward-lookingness is always more than 60 percent".

Figure 1 plots core inflation against the theory-based sticky-price inflation measure from 2009 to April 2015.[4] Sticky-price inflation includes all prices that change less than 15% of the time, or once every $6\frac{1}{4}$ months.[5] The actual sticky-price inflation measure has a mean frequency of price change of 9.1%, with prices changing once every 11 months. The two measures are remarkably similar, with a correlation of 0.95 and an average absolute difference of 0.42 percentage points. Most of this difference occurs in 2009.

Figure 1. Sticky-price inflation measure most like CPI less food and energy

Percentage change over twelve months

Headline CPI excluding food and energy Sticky price inflation (threshold = 15%)

Sticky-price inflation at a threshold of 15% covers 16.4 percentage points of the inflation basket and includes the following categories: Education, Restaurant and Hotels, Clothing, Footwear, Miscellaneous goods and services, Alcoholic beverages, and Recreational and cultural services. The weight of these categories is significantly less

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4 Micro-price data is only available for this period.
5 Micro-price data from Statistics South Africa is used to determine the frequency of price change at the individual product level and then aggregated up to create the sticky-price measure. The frequency of price change is determined over the entire sample.
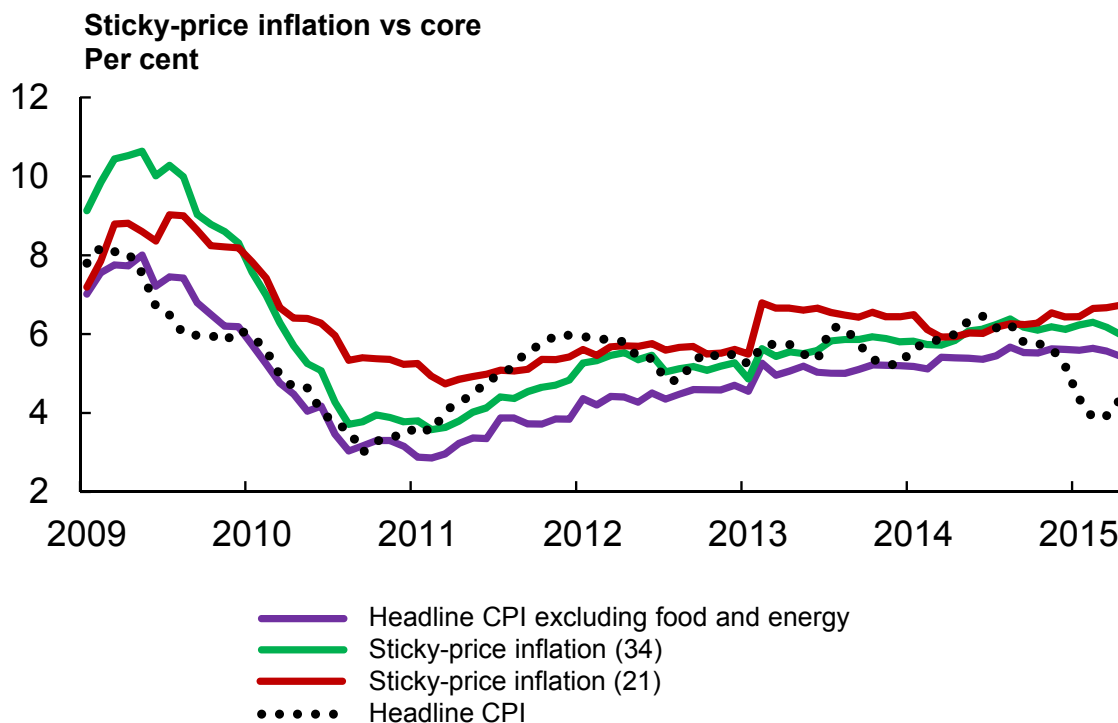
than the 75 percentage points core inflation includes, yet the inflation signals are almost identical. Sticky-price inflation includes 180 products – less than half the products included in CPI less food and energy. The products in order of largest individual weight that enter this measure are University fees, Imported beer, Lotto tickets, Primary school fees, Secondary school fees, Funeral policies, Telephone fees, Take-away foods, creche fees, General medical practitioners, Shoes, and Toll fees. These products make up almost 65% of the sticky-price inflation measure.

4   Other possible sticky-price options

There are two other approaches that could be used to determine an appropriate place to censor prices. First, a simple method is to find the median frequency of price change by product and use this. The median frequency price change is 21%. Second, a more scientific approach to determining an appropriate threshold would be to minimise a signal-to-noise ratio relative to headline inflation.[6] In order to calculate this we look at all sticky-price measures with frequencies of price changes between 4% – prices changing once every 25 months –and 60% – prices changing every 1.6 months, and calculate the signal-to-noise ratio. The signal-to-noise ratio is minimised at a frequency of 34%.

Figure 2 plots the two alternative sticky-price inflation measures. Both measures are above core inflation from Jan 2009 to April 2015. The median measure (labelled 'Sticky-price inflation (21)') is on average 1.4 percentage points above core inflation but tracks its movements well with a correlation of 0.9.[7] It contains 34.2 percentage points of the CPI basket weight and adds products from Miscellaneous goods and services (8 percentage points), Water supply and other housing services (2 percentage points), Alcoholic beverages (2 percentage points), and Telephonic equipment (2 percentage points). Products with the largest weight now included are health insurance, cellphone fees, and cigarettes.

Figure 2. Other sticky-price inflation measures

Sticky-price inflation vs core
Per cent

Legend:
— Headline CPI excluding food and energy
— Sticky-price inflation (34)
— Sticky-price inflation (21)
• • • • • Headline CPI

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[6] Examples using the signal-to-noise ratio (SNR) in the literature on core inflation include Mankikar and Paisley (2004), Walsh (2011) and Bullard (2011).

[7] The structural break in the sticky-price series is caused by health insurance.

The measure that minimises the signal-to-noise (labelled 'Sticky-price inflation (34)') is also generally above core inflation. It includes 58 percentage points of the CPI basket and 395 products. The biggest additional product categories included in this measure are Food (5.9 percentage points), and Miscellaneous goods and services. Not all food is created equal. Some food products including biltong, dried fruits, boerewors, baking powder, prepared salads, milk formula (baby food), peanuts, and vinegar, are not as flexible as traditionally thought and excluded from our current core inflation measure. Biltong, for example, is less flexible than 329 other goods and services (of a total 491) with its price changing on average every 7.3 months.

5   Conclusion

It is important to be skeptical about which core inflation measure is used for policy deliberation. This measure should represent that part of inflation that a central bank can actually control; that part of inflation that leads to the biggest welfare loss requiring a monetary policy response; and that part of inflation that best predicts future headline inflation. Choosing headline CPI excluding food and energy as the best and most appropriate core measure should not occur without a fight. For a policymaker who wants to know how good CPI less food and energy is, luckily the answer is pretty good compared with a more theoretically appropriate measure. This doesn't tell us anything about its optimality though.

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Appendices

A   The micro-price data

Determining whether a product's price is considered sticky or flexible requires the direct observations of prices and not just the aggregate indices. This is because aggregate data suffers from a bias which masks the true flexibility of products. This information became available in the mid-2000s when Statistics South Africa allowed researchers to analyse the micro-price data underlying the consumer price index. With this information we can

distinguish between the degree of price flexibility of products. We have this micro-price data for goods but not services. To construct these frequencies for services we exploit the fact that the bias in aggregate is likely to be significantly smaller due to the nature of collection. Many of these prices do not change often, and recognising this Stats SA does not collect them on a monthly basis.

The bias created by analysing how often prices change at the aggregate vs. at the micro-price level is plotted in figure 3. If the two were the same then all observations would be on the 45° line. However, on average the aggregate calculation of the frequency of price changes is 72 percentage points higher than the micro-price data outcomes.

Figure 3. Bias in calculating frequency of price change at aggregate index level