Testing an Interpretation of Core Inflation Measures in New Zealand

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NON-TECHNICAL SUMMARY

The Reserve Bank of New Zealand uses a range of core inflation measures in order to assess the underlying inflationary pressures. One definition of core inflation is that it represents the level of inflation to which headline inflation converges to in the future. This definition is similar to the idea of trend inflation. We build on this definition, by specifying an econometric test to evaluate which of the Reserve Bank’s core inflation measures are a good gauge of underlying inflation pressures and possess properties similar to trend inflation. According to the test, the sectoral factor model and CPI inflation excluding food and energy are, among the Bank’s current suite of measures, most consistent against this definition. We interpret our result as suggesting either of these measures as being reasonable approximation for where one might expect the level of headline inflation to converge to at a sufficiently long horizon.

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1 INTRODUCTION

A core mandate of the Reserve Bank of New Zealand is maintaining price stability. The Policy Targets Agreements states the Bank is responsible for keeping future CPI inflation outcomes between 1 per cent and 3 per cent on average over the medium-term. The focus on the medium-term reflects the view that central banks should not normally respond to one-off or transitory movements in inflation. This line of argument captures the heart of the idea of why the Bank monitors core inflation. Core inflation aims to assess underlying inflationary pressures by stripping out the transitory or idiosyncratic component of inflation. By monitoring core inflation, the Bank can form an assessment of the component of inflation that is expected to persist, and thus not respond to a component of inflation that is expected to dissipate over some medium-term horizon.

Figure 1: Core Inflation Measures, Annual %

In this Note, we assess the performance of a range of core inflation measures in gauging un-
derlying inflationary pressures. Figure 1 presents the current suite of core inflation measures monitored by the Bank. These measures can be broadly classified into model-based measures and exclusion/outlier based measures. Model-based measures includes the sectoral factor model (see Kirker, 2010; Price, 2013, for more details) and a factor model, as described by Giannone and Matheson (2007). Exclusion/outlier based measures include CPI inflation excluding food and energy, the weighted median and the trimmed mean.

As underlying inflationary pressures are ultimately unobserved, it is not straightforward to make an assessment of different core inflation measures. The objective of this Note is to econometrically compare how well different measures of core inflation by working off an interpretation of core inflation. The definition that we work off for our evaluation exercise is that core inflation is the level of inflation to which headline inflation will converge to in the future. This definition of core inflation is similar to the idea of trend inflation, and is used by, among others, Cogley (2002) and Stock and Watson (2016).

Before we proceed, we stress that we are working off one interpretation of core inflation because we are mindful that the literature is replete with different definitions (see, e.g. Bryan and Cecchetti, 1994; Clark, 2001). One should therefore be mindful that all one can conclude within the confines of our work is whether a measure of core inflation satisfies the very specific criterion and definition we are applying. Put differently, some core inflation measures may “fail" our test, but this does not necessarily invalidate them as core inflation measures, especially if one is applying a different criterion or had another metric in mind. We will return to this point.

2  THE TEST

Our evaluation exercise tests whether core inflation is the level of inflation to which headline inflation will converge to in the future and is similar to the one Cogley (2002) conducts for U.S. core inflation. Because core inflation is designed to strip out transitory factors, we are explicit about testing whether core inflation represents the permanent component of inflation. While the definition we apply may be narrow, our test is very precise in terms of what we are attempting to evaluate. As we stress in the Introduction, different working definitions may exist, and so our test may at best only form one part of a multi-faceted criteria if one is interested in
evaluating all the properties of core inflation measures.

Following Cogley (2002), the idea of the test is that if headline inflation is above (below) current core inflation, headline inflation should fall (increase) to converge back to core inflation. Let $\pi_t$ and $\pi^c_t$ be headline inflation and core inflation at time $t$, respectively. A more compact way of describing the idea of headline converging back to core at some future horizon is

$$E\pi_{t+h} = \pi^c_t,$$  \hspace{1cm} (1)

Equation (1) states that at time $t$, given headline inflation is expected to converge to core inflation in the future, the expectation of inflation $h$ periods ahead is core inflation at time $t$. If we subtract the current level of inflation from the left and right hand side,

$$E\pi_{t+h} - \pi_t = -(\pi_t - \pi^c_t), \hspace{1cm} (2)$$

$$\pi_{t+h} - \pi_t = \alpha + \beta(\pi_t - \pi^c_t) + \epsilon_t. \hspace{1cm} (3)$$

Equation (2) follows from equation (1), and describes that if the original definition from equation (1) holds, the differences between $h$ periods ahead headline inflation from today is just the negative of today’s gap between headline inflation and core inflation. In other words, at some horizon $h$ the effects of temporary factors dissipate out and all we are left with is core inflation.

Equation (3) provides a relationship that can be used to test the definition embodied in (1). If the definition we started out in equation (1) holds, then a measure of core inflation consistent with our definition would produce estimates of $\alpha = 0$ and $\beta = -1$ if we estimate equation (3).

If $\alpha$ is different from zero, it suggests that the measure of core inflation is biased. If $\beta$ is smaller than -1, then the core inflation measure is potentially stripping out too little. In other words, some of the transitory factors are not stripped out at a particular horizon $h$ and the measure of core inflation is contaminated by the transitory factors. Conversely, if $\beta$ is greater than -1, the core inflation measure is potentially stripping out too much. In other words, part of the permanent component of inflation is being stripped out.
It is important to note that the econometric tests we conduct are not informative about the current level of core inflation. We essentially test whether, on average over the sample, the various core inflation measures deliver the particular joint restrictions on the parameters $\alpha$ and $\beta$. Therefore our test should not be seen as a forecasting exercise. It is possible that some of the core measures rejected by our procedure might do better at forecasting headline inflation. A forecast-based evaluation may be a useful alternative criteria but the interpretation and the ranking of core inflation measures under that metric is not encompassed within the boundaries we consider.

It is not obvious to determine a priori the appropriate horizon over which headline inflation should converge back to core inflation. We report the estimated values of parameters $\alpha$ and $\beta$ for horizons up to 12 quarters, but focus on horizons 8 to 12 given the relevant horizon for our monetary policy mandate is over the medium-term.

It is worth keeping in mind that the definition we are working off in equation (1) does not make a distinction between trend inflation, future expected inflation, the permanent component of inflation, or core inflation. This is relatively similar to what one would encounter in the wider empirical literature (e.g. Cogley, 2002; Chan, Koop, and Potter, 2013; Stock and Watson, 2016). In essence, our working definition regards trend inflation and core inflation as the expected level of inflation at a far enough future horizon, and therefore one of the same. Put differently, it is equally valid to view our evaluation procedure test as which core inflation measures are good proxies for trend inflation. While we recognise that such views may be equivocal, we view this as a desirable property of trend inflation, similar to the cited references.

In our set of core inflation measures, we consider two model-based measures (from the sectoral factor model and the factor model) and three exclusion based measures (CPI inflation excluding food and energy, the weighted median and the trimmed mean). We also consider a measure based on an exponential smoothing of CPI inflation as this has been used in previous Bank’s publications to be a reasonable and simple approximation of underlying inflation pressures (see, e.g. Giannone and Matheson, 2007; Ranchhod, 2013). The sample is 1993Q3 to 2015Q4.¹

¹The GST spike in 2010 is a one off event and we have verified whether accounting for it or not does not affect our analysis.
Figure 2: Estimates of $\alpha$, $\pi_{t+h} - \pi_t = \alpha + \beta(\pi_t - \pi_t^c) + \epsilon_t$

Notes: For each measure of core inflation, the graphs present the estimates of parameter $\alpha$ for horizon $h$. Solid line represents the point estimate. The dotted lines represent bounds of the 90% confidence interval calculated using heteroskedasticity and autocorrelation consistent standard errors.

3 RESULTS

Figure 2 presents the estimated constant, $\alpha$ and Figure 3 presents the coefficient estimate for $\beta$ for a sequence of regressions indexed by horizon $h$. The dotted lines represent 90% confidence intervals associated with each point estimate. From Figure 2, we can conclude that there is no evidence that any of the evaluated core inflation measures is biased as none of the estimates of $\alpha$ is significantly different from zero. It is worth highlighting though that the weighted median and the trimmed mean have point estimates that are further from zero than the rest, suggesting the possibility of upward bias in both those measures.

Figure 3 presents the coefficient estimates of $\beta$. We focus mostly at the longer end of those horizons (i.e. $h$ at 8-12 quarters ahead) given the medium-term focus for our monetary policy
Figure 3: Estimates of \( \beta, \pi_{t+h} - \pi_t = \alpha + \beta(\pi_t - \pi_t^c) + \epsilon_t \)

Notes: For each measure of core inflation, the graphs present the estimates of parameter \( \beta \) for horizon \( h \). Solid line represents the point estimate. The dotted lines represent bounds of the 90% confidence interval calculated using heteroskedasticity and autocorrelation consistent standard errors.

mandate. We first observe that the trimmed mean is statistically less than -1 at some of the medium-term horizons, and it's point estimate of \( \beta \) is around 2 (though not necessarily always statistically significant), suggesting that as a core inflation measure, the trimmed mean is potentially contaminated by transitory influences. The factor model also has a \( \beta \) estimate than is (barely) statistically different from -1 at some of the medium-term horizons, suggesting that it may at times be stripping out too little of the transitory influences.

The sectoral factor model and the CPI inflation excluding food and energy do relatively well based on our evaluation metric, given that both are not significantly different from -1, and the point estimate for \( \beta \) at 12 quarters ahead is almost exactly -1.

For the weighted median, the estimated values of \( \beta \) at 8-12 quarters horizon is not statistically different from -1. We should, however, note that their point estimate is much further from -1.
than both the sectoral factor model and the CPI inflation excluding food and energy, and may also be slightly biased based on testing $\alpha$.

The exponential smoothing measure of core inflation has an estimated values of $\beta$ which is larger than -1, suggesting it may be stripping out part of the permanent component. At the 8-12 quarters horizon, the estimated values of $\beta$ is sometimes barely not statistically different from -1, but sometimes statistically different from -1.

Based on the tests, we conclude that the sectoral factor model and CPI inflation excluding food and energy are most consistent with possessing trend inflation properties.

4 Concluding Remarks

As we had mentioned in the onset, the lack of a precise working definition of core inflation means that there could be criteria that others may view as being desirable properties that core inflation measure should possess. For example, one might desire core inflation to display “cyclical” properties, perhaps embedding a Phillips Curve within them. Such properties are not explicitly tested within our procedure. If one was interested in these alternate properties, it is important to design an appropriate evaluation exercise to fit these properties accordingly. Our evaluation procedure views core inflation much closer to how one thinks about as trend inflation, analogous to Cogley (2002) and Stock and Watson (2016).

We also emphasise that our procedure does not tell us the level of core inflation, though it does inform us which measures have, over history, more promise if one invoked the definition that core inflation is the level that inflation is expected to converge to in the future. One particular issue is that even if one subscribed to our definition of core inflation, two or more measures may satisfy this definition but imply very different core inflation estimates. Our procedure does not distinguish which measure pins down the level of core inflation, apart from informing us that the two or more measures should be taken into account. In addition, it is known that model-based measures such as the sectoral factor model do experience revisions over time. Revisions further complicate the task of inferring the level of core inflation as the real time assessment of core inflation can potentially be noisy, and possibly inaccurate.
We therefore emphasise that our testing procedure identifies core inflation measures which possess trend inflation like properties. Based on an econometric test to evaluate different measures of core inflation, we conclude that the sectoral factor and CPI inflation excluding food and energy are most consistent relative to this definition of core inflation.

REFERENCES


