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# Some revisions to the sectoral factor model of core inflation

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## NON-TECHNICAL SUMMARY

Core inflation is a concept of price inflation that excludes one-off or highly volatile price movements. Central banks use core inflation measures to assess what is happening to "underlying" inflation. This is useful because idiosyncratic price movements, such as specific large changes in individual product prices, alter headline CPI inflation but do not necessarily reflect fundamental or persistent sources of inflation pressures.

There are many ways to measure core inflation. Statistics New Zealand publishes a range of measures that involve removing volatile price movements before inflation is calculated, or excluding certain groups of items from the calculation. As well, the Reserve Bank of New Zealand has a set of models that produce core inflation estimates. Every model is different, and the Reserve Bank uses the full suite of measures when forming an assessment of what is going on with inflation.

The sectoral factor model of core inflation approaches the issue by separating components of the CPI into tradables (products that are imported, or that compete with imports) and non-tradables (products that are not exposed to international factors). By distinguishing between these two sectors, the prices of which are widely regarded as being influenced by different things, the model allows an interpretation of what is driving core inflation.

We have recently made some improvements to the sectoral factor model. These are part of our ongoing work to improve our suite of models. The revised model gives an estimate of core inflation that is less volatile than previously, and has slightly less marked cycles – lower peaks and higher troughs. The broad cyclical behaviour of the new estimate is much the same as the previously published estimate. However, there are some episodes in history where the qualitative picture of core inflation, on this measure, is a little different after the revisions.

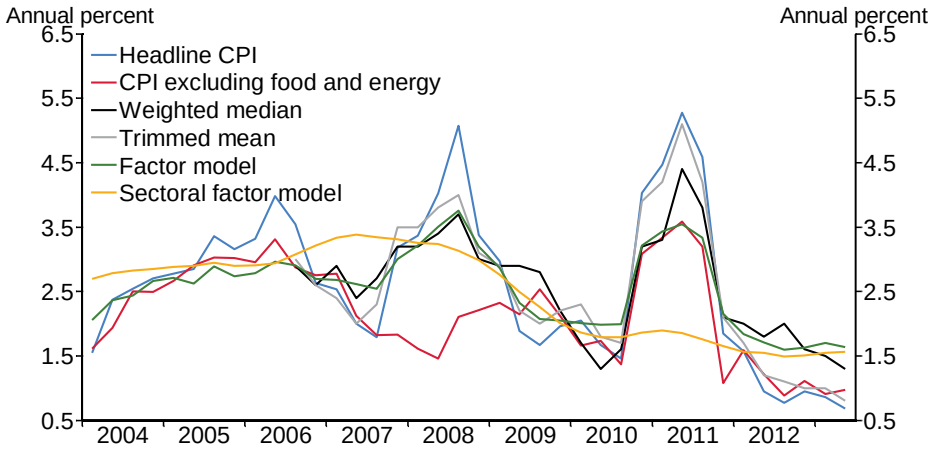
The revised data are now available in Table M1 (Prices) on the Reserve Bank's website. Future updates will be published as usual, at 3pm on the day of CPI releases.

## 1. INTRODUCTION[1]

Central banks often use the concept of core inflation to examine true or underlying price inflation, abstracting from short-term volatility. Measures of core inflation are designed to get at the underlying trends in inflation, allowing a central bank to assess whether current headline inflation movements are likely to dissipate quickly or to prove somewhat more persistent. The distinction is important for setting monetary policy: the Reserve Bank of New Zealand's Policy Targets Agreement (PTA) specifies the policy target in terms of "future CPI [Consumers Price Index] inflation outcomes… on average over the medium term", and encourages us to "look through" the numerous factors that mean headline CPI inflation can vary around "the medium-term trend of inflation, which is the focus of the policy target".

There is a range of ways to define core inflation, and an even greater range of ways to measure it (Wynne 2008). The Reserve Bank uses a set of core inflation models, which includes exclusion measures, smoothed measures, and measures calculated from disaggregate price data (Ranchhod 2013). As each different approach provides a different picture of underlying inflation, it is common to consider a range of measures (figure 1).

Figure 1: Headline inflation and measures of core inflation[2]




This note deals with a particular measure used by the Reserve Bank: the "sectoral factor model" of core inflation (Kirker 2010). The sectoral factor model provides a measure of core inflation that distinguishes between price movements in the two major sectors of the economy, and hence helps to identify where inflationary pressures are coming from. This appealing feature means that the sectoral factor

[1] All data used in charts in this note are sourced from Statistics New Zealand, unless otherwise stated. Model estimates of core inflation are produced by the Reserve Bank of New Zealand.

[2] The sectoral factor model estimate has been adjusted to remove the effect of the change to the rate of GST in 2010, while the other measures have not.

model is often used in Reserve Bank publications, and is sometimes called simply the "factor model" (see, for example, Kergozou and Ranchhod 2013).

The next section describes how the sectoral factor model works and highlights its useful features. Section 3 outlines some recent improvements to the model which have led to revisions to the model's estimate of core inflation throughout history. Section 4 concludes.

## 2. THE SECTORAL FACTOR MODEL[3]

The sectoral factor model estimates a measure of core inflation based on co-movements – the extent to which individual price series move together. It takes a sectoral approach[4], estimating core inflation based on two sets of prices: prices of tradable items, which are those either imported or exposed to international competition, and prices of non-tradable items, which are those produced domestically and not facing competition from imports (table 1).

Table 1: Examples of price series used by the sectoral factor model

| | |
|---|---|
| Tradable | Small tools and accessories for the house and garden<br>Fish and other seafood<br>Purchase of bicycles<br>Major tools and equipment for the house and garden<br>Small electrical household appliances |
| Non-tradable | Veterinary services<br>Repair and hire of household appliances<br>Dental services<br>Property maintenance services<br>Vehicle servicing and repairs |

It is useful to distinguish between these two types of products, as their prices are generally accepted as being influenced by different variables. Tradable prices are likely to be influenced by international prices and the exchange rate, whereas non-tradable prices are likely to be insulated from these drivers and instead more sensitive to conditions in the domestic economy. (Some CPI component series are an aggregation of prices for both tradable and non-tradable items, and hence appear in both panels of data.)

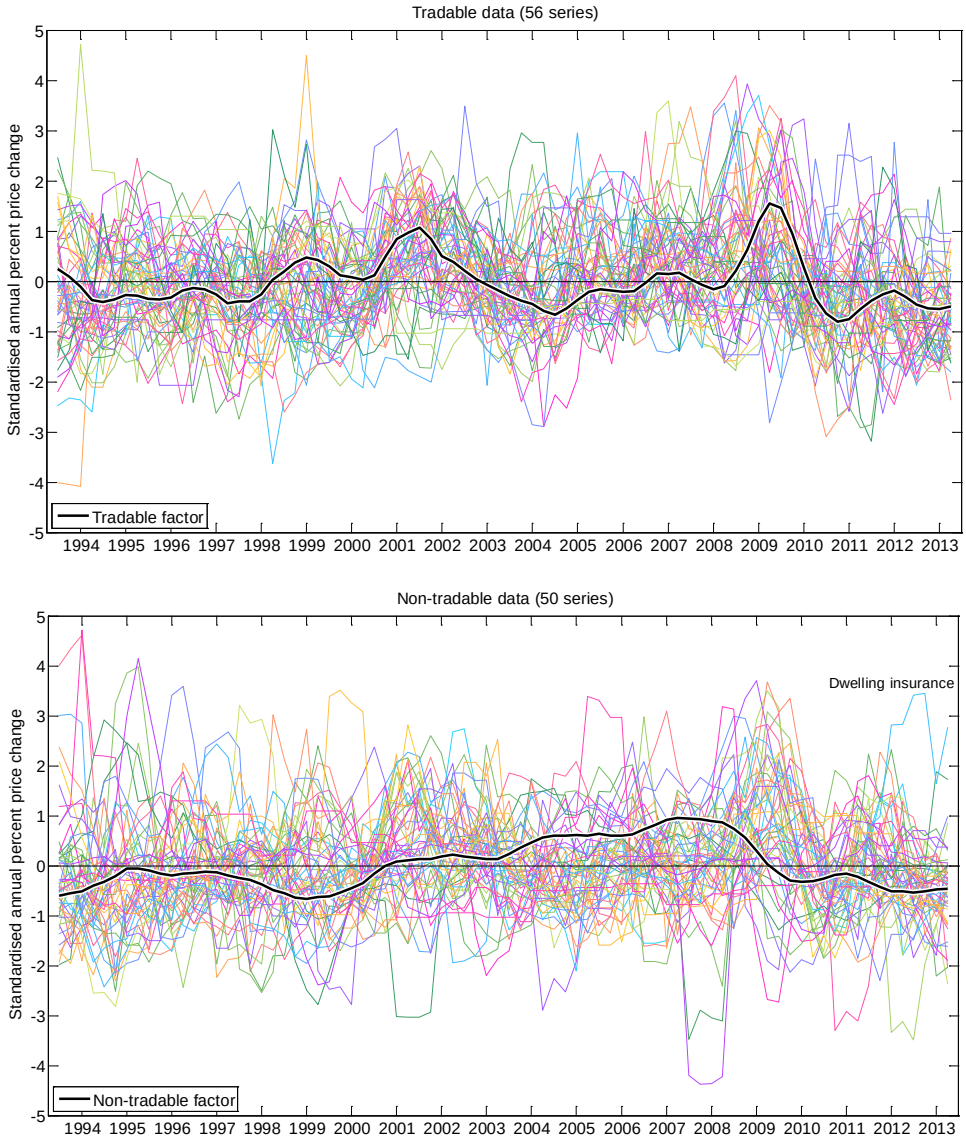
[3] For a full technical description of the sectoral factor model, see Kirker (2010).

[4] The sectoral core inflation model is similar to another model used by the Reserve Bank, shown in figure 1 as the "factor model" (Matheson and Giannone 2006). This model estimates co-movements among all CPI components without the tradable/non-tradable distinction.

The model is estimated using 96 component series of the CPI. It separately estimates co-movements (factors) in tradable and non-tradable components, and then jointly uses those factors to estimate core CPI inflation. In this framework, core inflation is the portion of headline CPI inflation that can be explained using the two factors in a regression. Intuitively, the model's estimate of core inflation at a particular time is a weighted average of the the common change among all tradable prices and the common change among all non-tradable prices in that period. If any individual price series moves differently from the majority of series, it is treated as "idiosyncratic" for that period, and does not contribute to the estimate of core inflation.

The two factors – tradable and non-tradable – each summarise the common movements among the CPI component series in their part of the panel, and ignore idiosyncratic movements in those series (figure 2).

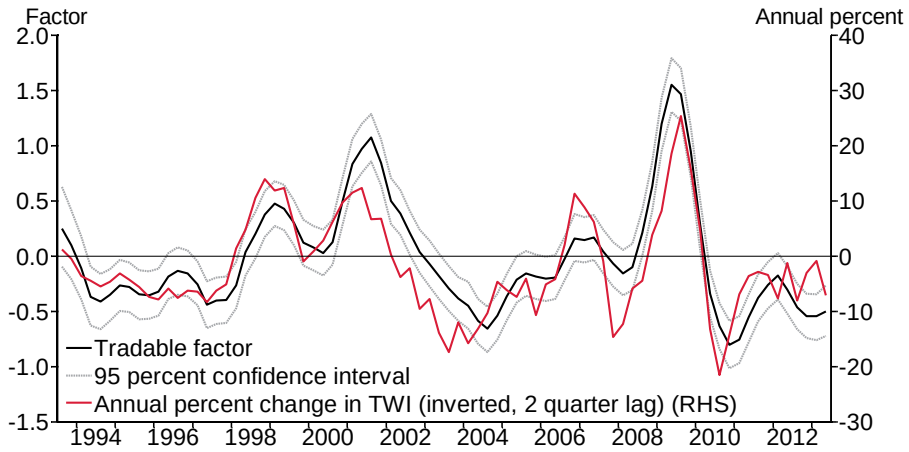
Figure 2: Tradable and non-tradable inflation data and factors



The model treats as idiosyncratic any unusual or extreme movements, and these are not incorporated into the factors. Recent large increases in dwelling insurance premiums, for example, have not caused the non-tradable factor to increase, as they were not common with movements in other price series (see the lower panel of figure 2).

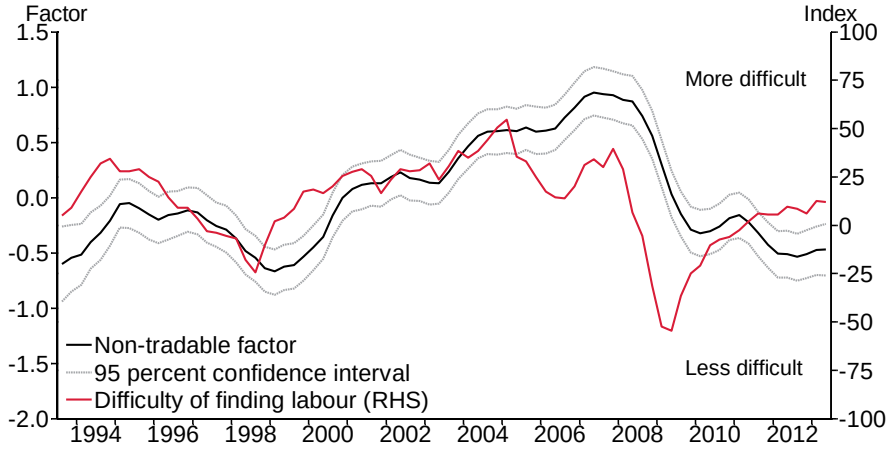
Each of the two panels of data has co-movement that, we believe, originates from a particular place. The co-movement in tradable series is likely to come from a combination of exchange rate movements and international price changes. Indeed, movements in the exchange rate are quite highly correlated with the estimated tradable factor (figure 3). Non-tradable co-movement is likely to be driven by fundamental domestic factors, such as the degree of spare capacity, in the labour market (figure 4) or in the economy as a whole. Domestic inflation expectations probably also affect non-tradable co-movements.

Figure 3: Tradable factor and New Zealand dollar TWI exchange rate




Source: RBNZ.

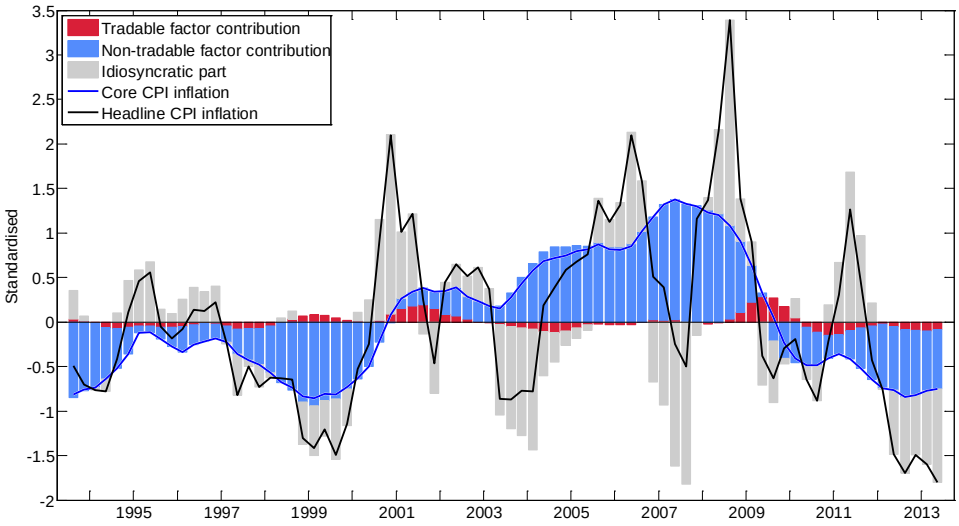
Figure 4: Non-tradable factor and labour market capacity pressures




Source: NZIER, RBNZ estimates.

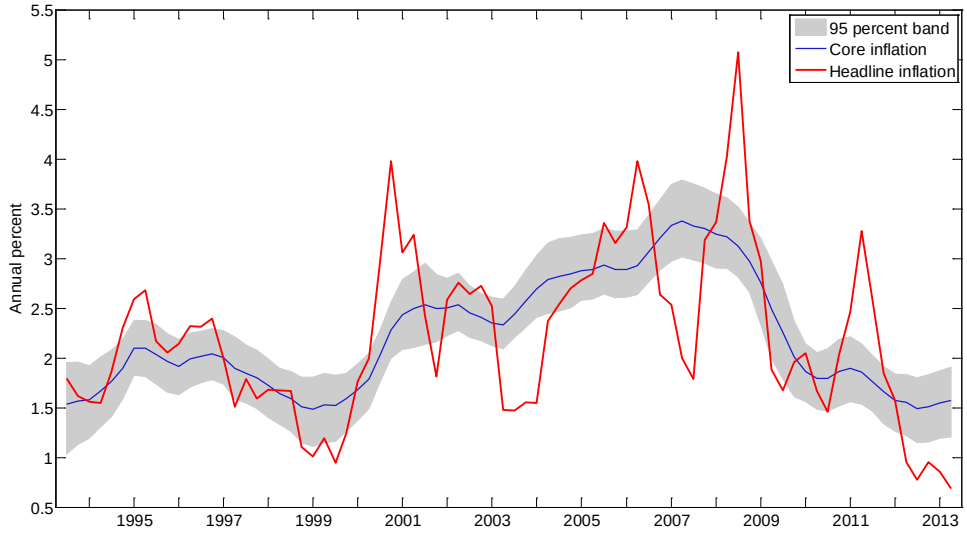
After the factors are estimated in the model, they are used to create an overall estimate of core CPI inflation. This is done essentially by regressing headline CPI inflation on the factors. By using the two factors separately, the model is able to assign different weights to tradable and non-tradable co-movements, in whatever way explains as much of the movement in headline CPI as possible. It turns out that this is achieved by placing most of the weight on the non-tradable factor, and only a little on tradables (figure 5).

Figure 5: Contribution of the factors to the estimate of core inflation




Like all model-based estimates, the sectoral factor model's estimate of core inflation is subject to uncertainty. A two-standard-deviation band, which contains 95 percent of the possible outcomes for core inflation (given the model's estimation), puts the current core inflation estimate between 1.3 percent and 1.9 percent, with a median of 1.6 percent (figure 6).

Figure 6: Uncertainty around sectoral core inflation estimate



## 3. REVISIONS TO THE SECTORAL FACTOR MODEL

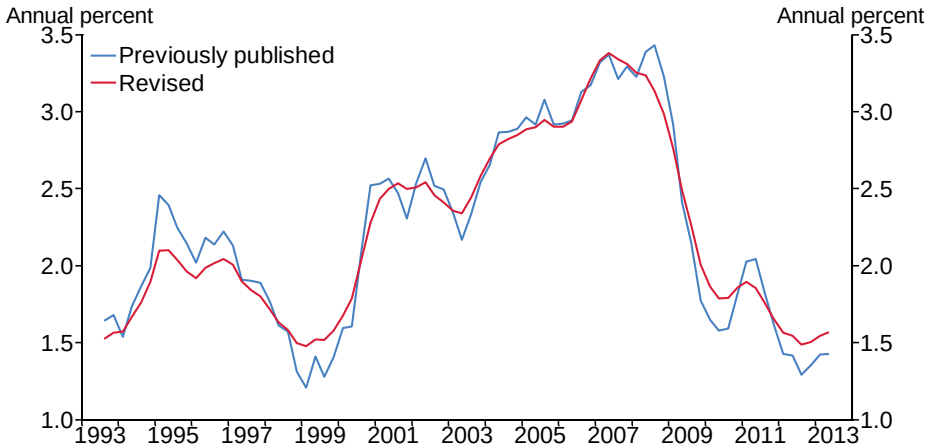
We have recently made some improvements to the sectoral factor model. These come as part of our ongoing work to ensure that our suite of models is robust and reliable.

The main change is adjusting the panel of data on which the model is estimated, so that it no longer includes headline tradable inflation, headline non-tradable inflation, or headline CPI inflation (which previously appeared in both the tradable and non-tradable panels). These three series are all aggregates of the other 96 series in the panel. Including the aggregates alongside the individual component series meant that we ran the risk of double counting co-movements, meaning that movements in core inflation might appear larger than they really were.

In the course of reviewing the model, we also identified a small number of technical errors, which have been corrected in this revised version.

The revised model produces an estimate of core inflation that has less short-term volatility, with slightly less marked peaks and troughs (figure 7). The cyclical behaviour of the estimate is broadly the same after the revisions. Both versions of the model estimate the current trough in core inflation to be about the same as that seen in 1999 (when the inflation target was lower than at present). Both show high and rising core inflation between 2004 and 2007. Both find a sharp fall in core inflation around the time of the recession in 2008, and estimate that core inflation declined in every quarter from then until 2010.

Figure 7: Revisions to the sectoral factor model estimate of core inflation




There are some points in history, however, where the qualitative picture of core inflation is a little different after the revisions. The somewhat lower peaks in the

mid-1990s are more consistent with our sense at the time that core inflation was fluctuating around 2 percent, which was then the top of the target range for inflation.[5] As well, the model previously showed core inflation peaking in late 2008; the revisions move the peak in core inflation forward by more than a year, to mid-2007, and provide a clearer signal due to the decreased volatility.

Over the past three years, the previous estimate of core inflation was quite variable. The revised measure appears less variable, and now suggests that core inflation remained broadly constant between 2010 and early 2012.

Of course, as noted earlier in this paper, the sectoral factor model is only one measure in our suite of inflation indicators, and these modifications to a single measure are unlikely to materially alter the overall assessment of inflation pressures at any particular period.

## 4. CONCLUSION

Central banks use measures of core inflation to get at a concept of "underlying" inflation, abstracting from one-off or highly volatile price movements. There is a wide range of concepts and measures of core inflation, and the Reserve Bank uses a suite of measures when forming a view on inflation.

The sectoral factor model offers one useful approach to core inflation, in that it looks separately at core price movements originating in the tradables and the non-tradables sectors of the economy. In this way the model measures the most widespread price movements, and ignores movements that occur in just a few prices. The main result from the model is that, on this measure, core inflation in recent decades has originated mostly in non-tradable prices, with only a small contribution from tradables.

We have recently made some improvements to the sectoral factor model of core inflation. This is part of our ongoing work to ensure that all the models we use are robust and reliable. The revised estimate of core inflation is less volatile than previously, and has slightly less marked peaks and troughs. The revised data on the sectoral factor model measure of core inflation are now available on the Reserve Bank website. Updates will be released, as usual, at 3pm on CPI release day.

[5] See the December 1996 *Monetary Policy Statement,* page 39.

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