Dispersion of Inflation Expectations – preliminary*

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Abstract

We construct cross-sectional measures of dispersion in inflation expectations, based on the extent of disagreement in survey data (a rough proxy for inflation uncertainty); and document how these measures evolve over time. The good news is that dispersion of inflation expectations has reduced substantially since 2000. The bad news is that expectations are converging on the upper bound of the official target range. The inter-quartile range of expectations is systematically entirely above the mid-point of the official target range since at least 2008.

Keywords: forecast disagreement; inflation uncertainty; behavioral macroeconomics.

"(...) people are insufficiently sensitive to distributional data even when such data are available. Indeed, (...) people rely primarily on singular information, even when it is scanty and unreliable, and give insufficient weight to distributional information." (Kahneman and Tversky (1977).)

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1 Introduction

Not everyone has the same expectations, about inflation or any other macroeconomic variable. This self-evident observation is largely overlooked in standard macroeconomic models where, for analytic convenience, it is normally assumed that all economic agents share the same information set, and process this information equally. Such an assumption is of course incompatible with observed differences in beliefs and forecasts.

Survey data show considerable disagreement about inflation ahead. The degree of dispersion in beliefs about future inflation is a non-trivial indicator for monetary policy.[1] First, it may indicate how firmly expectations are anchored.[2] Wide disagreement about inflation ahead means no convergence in the vicinity of the average forecast. If the inflation targeting policy is credible, not only should the central tendency of medium and long-term inflation expectations match the official target; but these expectations should also tend to converge on the target. Second, dispersion in inflation expectations is a rough proxy for uncertainty about future inflation. Inflation uncertainty affects the term premium in bond markets, which forces a wedge between short and long-term interest rates, beyond the effect of interest rate expectations. Third, high dispersion means that the expectations of a large number of economic agents will (necessarily) be proven substantially incorrect, once the level of realized inflation becomes known – irrespective of what that level is. The consequent updating and revisions to plans may impact aggregate fluctuations.[3]

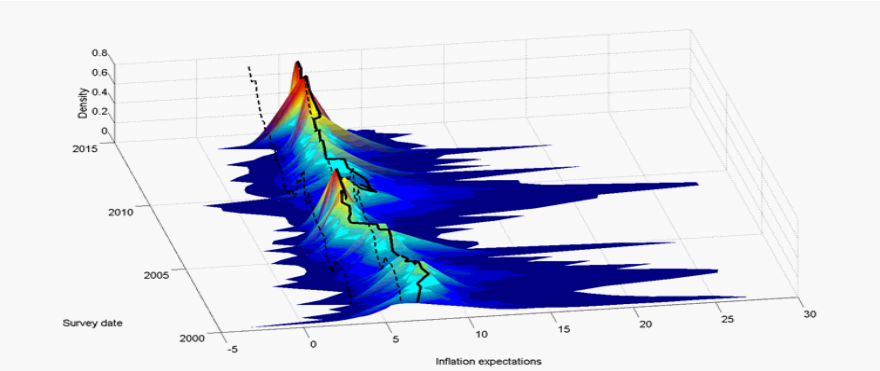
This paper documents the extent of disagreement about expected inflation

[1] Inflation expectations play a crucial role in an inflation targeting regime – they affect realised inflation, as well as the output cost of controlling inflation, and therefore monetary policy effectiveness. This is well understood, and reasonably studied in South Africa. The subject of this note is the extent of disagreement, or the dispersion, about these expectations. Interesting recent work recognizes heterogeneity in expectations, but is concerned with the evolution of group averages, rather than their dispersion. (Reid (2012), Walter, Johnson and Johnston (2013), Kabundi, Schaling and Some (2014).)

[2] Inflation expectations are "well anchored" if long-term expectations are relatively impervious to temporary shocks. See Orphanides and Williams (2005) and Bernanke (2007) for generally accepted definitions.

[3] Mankiw, Reis and Wolfers (2004, p. 210, 242) go as far as suggesting that "disagreement may be a key to macroeconomic dynamics." See Mankiw and Reis (2002), Khan and Zhu (2002), and subsequent literature on sticky information. On disagreement as a proxy for uncertainty, see for example Giordani and Söderlind (2003), Bachmann, Elstner and Sims (2013).

Figure 1: Evolution of probability densities of two-year ahead inflation expectations in SA



in South Africa, using simple and intuitive measures of dispersion. We show that the level of dispersion, within each group of respondents and overall, can be very high, with an average distance between the maximum and minimum expectation (the range) of 13 percentage points for the complete sample; that it varies significantly over time, with a maximum range of 24 percentage points (in early 2000), and a minimum of 5 percentage points (end of 2014); and that it is currently (latest available data) at its lowest level since the surveys began – for each group of respondents. The inter-quartile range, which represents the most likely spread of beliefs, is of course narrower, and quite stable in recent years. The cross-sectional standard deviation of inflation expectations is at a record low by the end of 2014. Figure 1 provides a compact preview.

In sum, dispersion has reduced, and substantially; observations are increasingly concentrated in the vicinity of the average (or median) forecast. The problem is that the likely (inter-quartile) range of expectations is *entirely* above the mid-point of the official target range (of three to six percent) since at least 2008; that of price setters (business and trade unions) expectations, since 2007. If we exclude an implausible forecast of inflation near zero (made in three quarters between 2013 and 2014), then for all but one of the past six quarters, the full range of expectations is above the mid-point of the target range – i.e., statistically speaking, nobody expects inflation to hit the mid-point from above at the two year horizon.[4] Consequently, and as docu-

[4]Note that 2014 saw an extreme reduction in the price of crude oil; this could have an effect on the distribution of forecasts reported in early 2015, but mainly for short-term

mented elsewhere, the average (and median) expectations, which have been relatively stable, exceed the mid-point of the official target band by about 150 basis points. Disagreement has fallen and expectations are converging, but on the upper bound of the target range. This is true for all groups of respondents.

2 Dispersion of two-year ahead beliefs

We use the entire cross-section of each quarterly Inflation Expectations Survey, organized by the Bureau for Economic Research, on respondents' inflation expectations, from the second quarter of 2000 to the fourth quarter of 2014. Respondents are drawn from business and trade union representatives, and professional economists in the financial sector. The average number of observations per quarter is 366, with high predominance from business sector responses (average of 337 observations per quarter, compared to 13 and 16 from labour and analysts, respectively).

The extent of disagreement and its evolution are summarized in the exhibits in Tables 1, 2 and 3. The measures of dispersion are the following: the range of the distribution, which is the difference between the highest and the lowest forecast; the inter-quartile range, which excludes forecasts in the highest and lowest quartiles; the standard deviation, which is arguably the most widely used measure of dispersion; and the coefficient of variation, which is the ratio of the standard deviation to the average forecast. These are all calculated for each quarter, using the survey data available for that quarter – i.e., they are cross-sectional measures, and not based on the past observations.

We only report here the results for beliefs about inflation two years ahead. The other horizons for which historical BER data are available (inflation in the current year and one year ahead) are too short for monetary policy to have an effect on inflation; well-anchored medium and long expectations do not preclude high oscillation in short-term (less than one year ahead) expectations.[5]

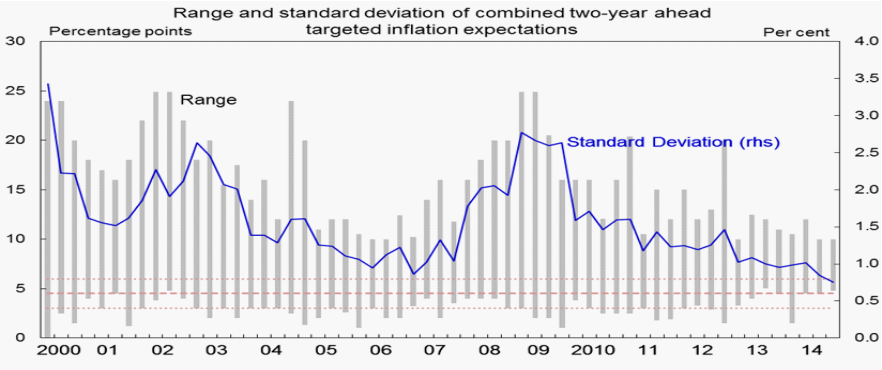
Table 1 shows the evolution of the different measures of dispersion using the full sample of respondents. Observe the gradual reduction in the standard

horizons.

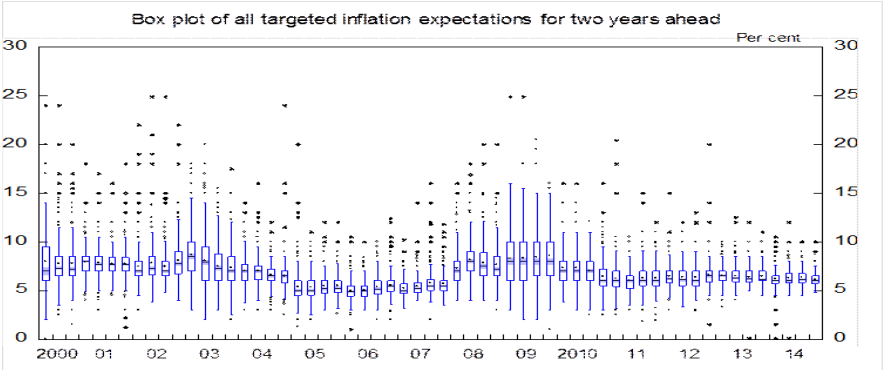
[5] BER survey data on expectations for inflation five years ahead are also available, but only from 2011.

Table 1: Range, standard deviation, and interquartile range for two-year ahead expected inflation, all respondents, from 2000 to 2014

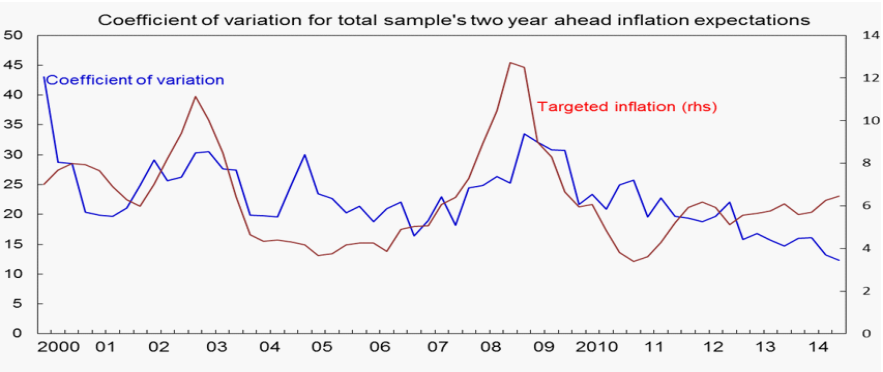
Full range and standard deviation



Inter-quartile range



Coefficient of variation and realised inflation



Source: authors' calculations; BER data

deviation, the narrowing and stability of the inter quartile range, and relative stability of the median (the line segments inside the rectangles), towards the end of the sample period.

2.1 Range and standard deviation

The figures in Table 2 show the quarterly evolution of the range (outliers included) and standard deviation of inflation forecasts, by business, trade union and analyst respondents.[6]

The standard deviation of expected inflation is at its lowest level since the introduction of inflation targeting. This applies to each group of respondents. The same peak in standard deviation of expected inflation, at or near the end of 2008 was observed in advanced economies, especially the US and UK.[7] It reflects variance in recent past inflation (oil and food price shocks); dispersion as a proxy for uncertainty; and of course, less than perfectly anchored expectations.[8]

The range oscillates, in central tendency, but remains wide. This is largely due to outliers (a few extreme expectations on the up and down sides) which distort the visual representation of the more likely range.

2.2 Box plots and inter-quartile range

The figures in Table 3 show the evolution of box plots for the same forecasts. The length of the central rectangle gives a visual representation of the location of the inter-quartile range, an indication of the more likely range of variation in expectations, excluding extreme observations.[9] The outliers are shown outside the boxes, above and below the end of the vertical lines. The number of large outliers (among business respondents) calls for caution

[6] The survey data includes a decimal expectation from a business respondent in three recent quarters (expectations of 0.1, 0.07 and 0.1 percent in Q3-2013, Q1 and Q2-2014, respectively). We ignored these when illustrating the complete range, and replaced them by the next lowest forecasts. We preserve all observations as reported in the box plots however.

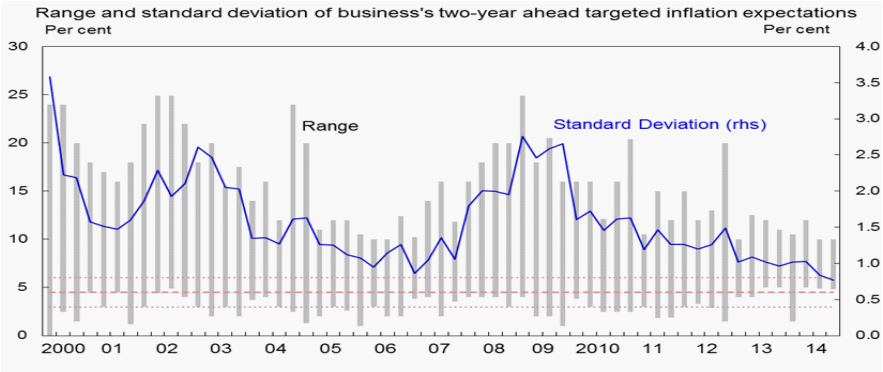
[7] See Gerlach, Hördahl and Moessner (2011).

[8] We also document the evolution of the coefficient of variation, a measure of dispersion which controls for the effect of changing mean levels – see the appendix.

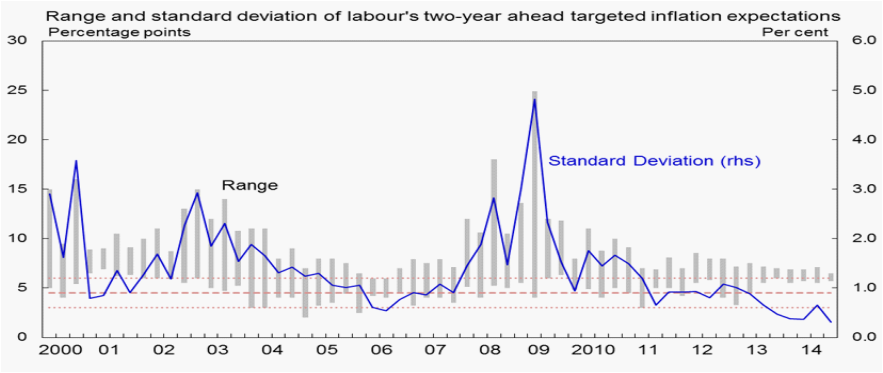
[9] The central boxes represent, at each point in time, the range containing the fifty percent of observations which span the first to the third quartiles of the distribution of forecasts. (See the appendix for detail.)

Table 2: Range and standard deviation of two-year ahead expected inflation, by business, labour, and financial analysts, from 2000 to 2014

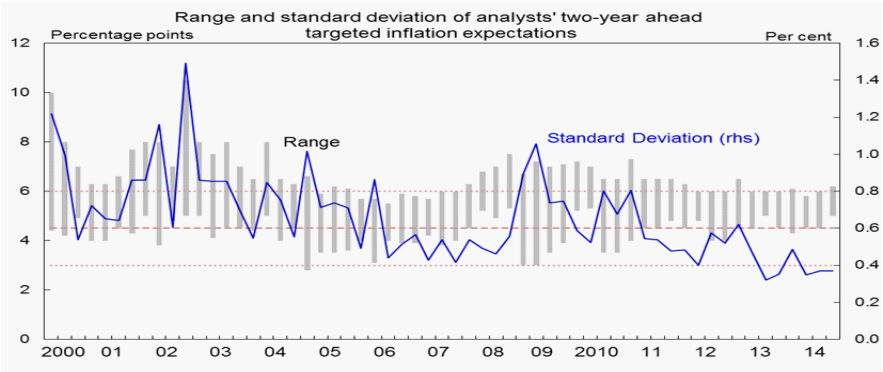
Dispersion of business expectations



Dispersion of trade union expectations



Dispersion of financial analysts' expectations



Source: authors' calculations; BER data

when reporting mean forecasts, as these can be weak indicators of central tendency. The number of extreme observations has reduced markedly.

Note how the inter-quartile range reduced (indicating increased convergence of expectations), and stabilized. This is a tentative sign of some degree of recent anchoring of expectations, given the observed evolution of inflation – that is, we show declining dispersion and an increasingly stable range of expectations, despite some variability in observed inflation, and high variability in crucial drivers of inflation, especially the exchange rate and commodities prices.

Remark 1 *By all measures of dispersion, and for each group of respondents, we observe a significant reduction in disagreement about inflation two years ahead.*

This is very clear for all groups of respondents. However, the convergence is, for each group, at or very near the upper bound of the inflation target range. Indeed, observe that:

Remark 2 *The entire inter-quartile range (of expected inflation two years ahead) is systematically above the mid-point of the official inflation target range, since at least 2008, for each group of respondents; and since 2007 for price setters.*

That is, *to the extent that* median and mean long-term forecasts are relatively insensitive to the data and news flow, expectations are increasingly firmly anchored (there is less disagreement); but the emerging focal point is too high for a target range of three to six percent.[10] This finding corroborates and strengthens those in previous reports based only on the mean of each group's forecasts, regarding the the Bank's implicit target (e.g., Walter, Johnson and Johnston (2013), Kabundi, Schaling and Some (2014)).

3 Determinants of dispersion

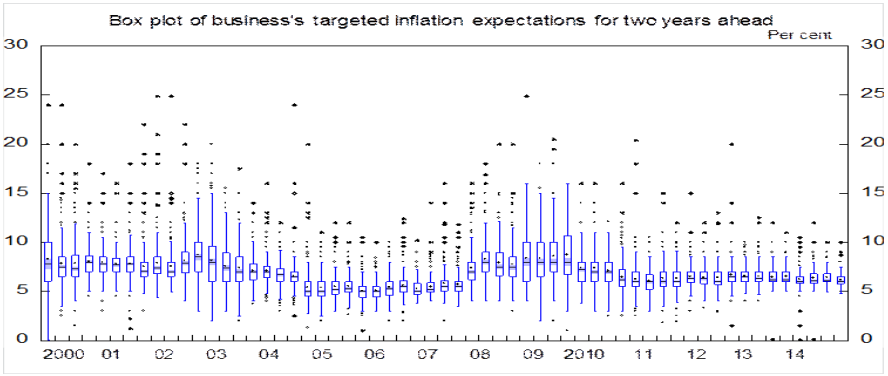
3.1 Past inflation and disagreement about inflation ahead

The figures in Table 4 suggest that past inflation (level and variability) affects current dispersion of expectations about inflation ahead. Intuitively, the

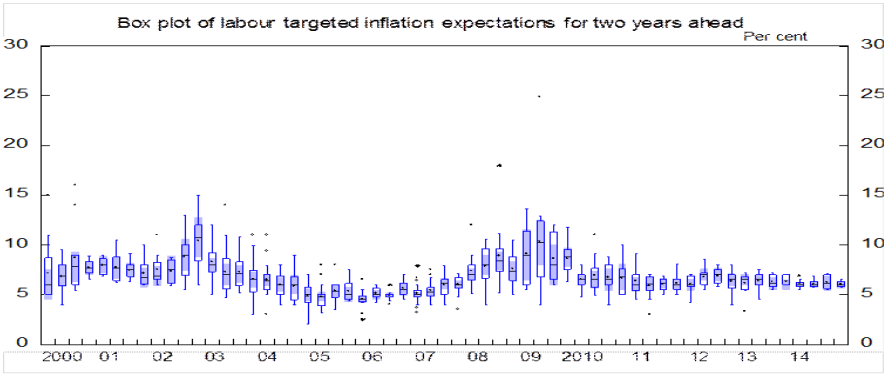
[10] It is not clear that expectations of price setters are well anchored. Realized inflation has been comparatively stable.

Table 3: Box plots for two-year ahead expected inflation, by business, labour, and financial analysts, from 2000 to 2014

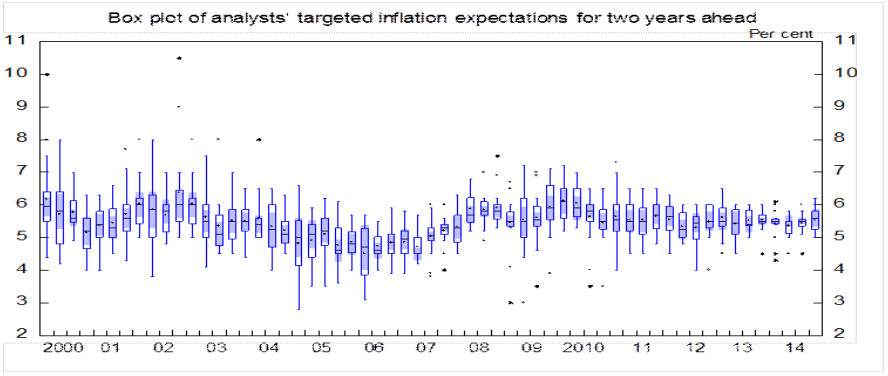
Dispersion of business expectations



Dispersion of trade union expectations



Dispersion of financial analysts' expectations



Source: authors' calculations; BER data

higher and/or the more volatile the observed rate of inflation, the harder it is to anticipate future inflation. Hence the sharp increases in dispersion around 2002 and 2008. Set A (top four figures) shows scatter plots of quarterly dispersion against the average absolute change in inflation over the previous quarter. Set B (bottom four graphs) shows scatter plots of dispersion against realized inflation over the preceding year.

There is a clear difference between the effect of past inflation on dispersion among analysts, and on dispersion among price setters (business and labour). Dispersion among analysts is not affected by the past level of realized inflation, in sharp contrast to price setters. (Contrast the first and third quadrants against the second quadrant in set B of Table 4.) Dispersion among analysts is however partly responsive to variability of past inflation.

The relationships in Table 4 (see the fourth and eighth quadrants in particular) need further probing, but they are indicative, and consistent with: a) a degree of adaptiveness in domestic expectations formation, especially by labour and business; b) theoretic predictions on the determinants of disagreement; and c) available international evidence, based on United States data.[11]

Realized inflation is publicly observable, so it is an element of the common information set. Different beliefs about inflation ahead must therefore reflect differences in how respondents process this information, plus the effects of other determinants of inflation expectations. Clearer understanding of the determinants of dispersion or disagreement about inflation (and other macro variables) requires further work.

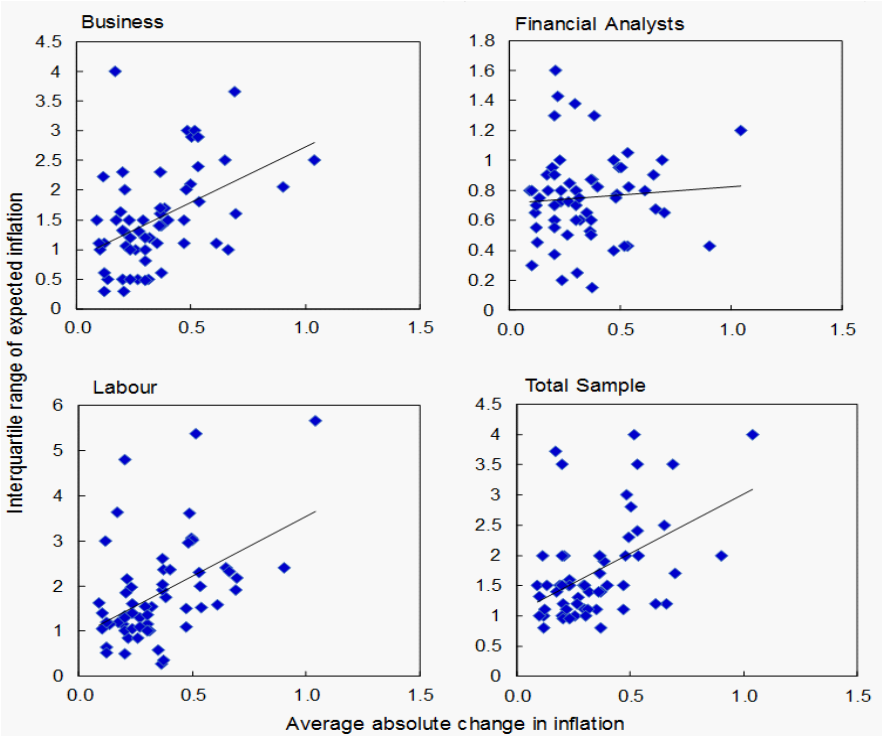
3.2 Regression tests

What drives the evolution of disagreement is not a perfectly settled issue. Recent academic research puts forward a number of theoretic explanations: Mankiw, Reis and Wolfers (2002) suggest that dispersion in inflation expectations can be explained by sticky-information updating behaviour, and Capitstran and Timmerman (2009) posit that people have asymmetric loss functions with respect to their inflation expectations. In the MRW model, people update the information which leads to their inflation expectations only periodically. This model is similar to the Calvo pricing model in that

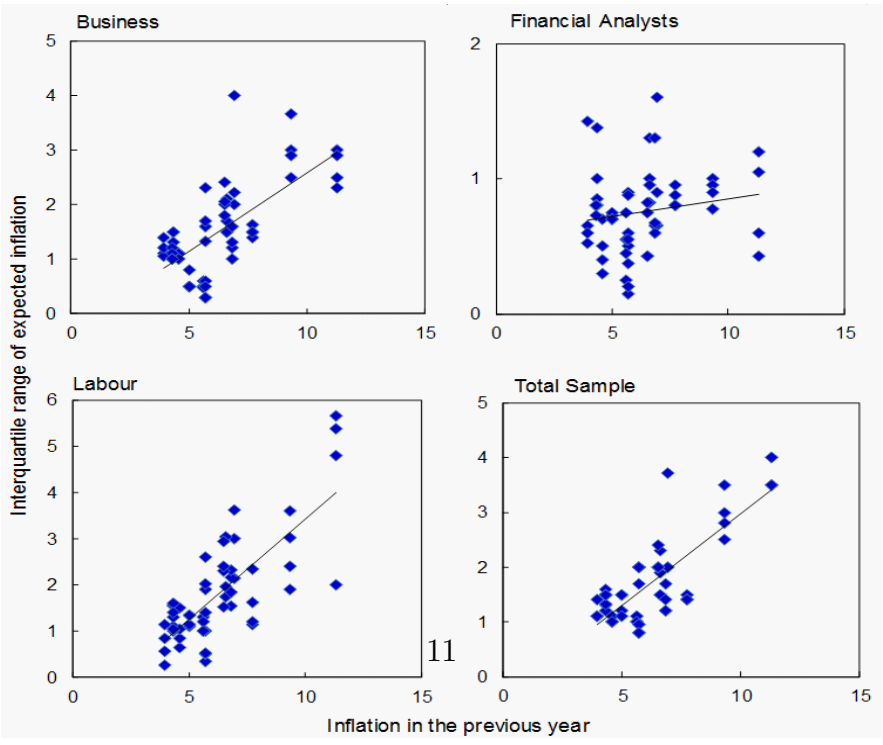
[11] See Ehlers and Steinbach (2007) on expectations formation in South Africa; and King (2004), Mankiw, Reis and Wolfers (2004), Williams (2004) and Cápistran and Timmermann (2009), on theoretic predictions and US evidence.

Table 4: Drivers of disagreement

A: inter-quartile range and past inflation variability



B: inter-quartile range and past inflation level



Source: authors' calculations; BER & SARB data

only a fraction of the population updates their expectations (through updated information) in each period. It differs in that it is concerned with the expectations formed in a previous period for inflation in the current period. MRW establish some stylised facts for the behaviour of the interquartile range of inflation expectations for three surveys - the Michigan survey (general public), the Livingstone survey (broad cross section of economists) and Survey of Professional Forecasters (market economists). They then simulate the evolution of the interquartile range of inflation expectations in a sticky-information scenario. They compare the results from the simulation with the stylised facts and conclude that there is some significant support for their theory that the dispersion in inflation expectations are driven by periodic updating of information.

We establish some basic facts about the behaviour of inflation expectations for the individual groups surveyed by the BER. Table 5 shows the results of a number of regressions of inflation disagreement on a number of macroeconomic aggregates.

Panel A establishes the bivariate relationship of the inflation disagreement for each survey group against each variable, Panel B is similar, except inflation has been used as a control variable. Panels C and D show the results for multivariate regressions using the same macroeconomic aggregates. We find that disagreement in inflation expectations by price setters is influenced by actual inflation, and the output gap for both business and labour, and inflation variability and changes in the exchange rate in the case of business only. Financial analysts tend to be responsive to the relative price variability and changes in the exchange rate. The results are a bit counterintuitive in that the output gap relationship is negative, which suggests that disagreement increases with subdued economic output, however this might also reflect that prices (and perhaps expectations) are sticky downward. Similarly the relationship between the change in the exchange rate and disagreement is positive, which shows that disagreement increases when the rand gets stronger against its trading partners, although this might again indicate that, at least part of, the population expect prices to be sticky downward.

3.3 Sticky-information inflation expectations

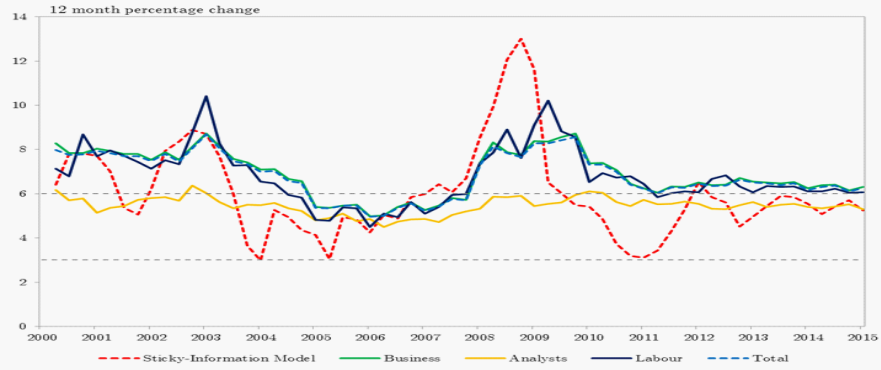
MRW implement the sticky information model by assuming that 10 per cent of the population update information and hence expectations at any point in time. Following this, we produce a sticky-information inflation expectations

Table 5: Drivers of disagreement: regression tests

	Business		Financial		Labour		Total	
Panel A: bivariate regressions								
Inflation rate	0.0929	***	0.0097		0.1897	***	0.0913	***
	(0.0327)		(0.0296)		(0.0459)		(0.0296)	
Δinflation-squared	0.1733	***	0.0199		0.2271	**	0.1591	***
	(0.0354)		(0.0381)		(0.0893)		(0.0349)	
Output gap	-0.2538	*	-0.0016		-0.187		-0.2346	*
	(0.1324)		(0.0343)		(0.2001)		(0.1398)	
RPV	2.9628	*	1.7026	*	5.7706	***	3.192	*
	(1.7056)		(1.0100)		(1.7966)		(1.6612)	
ΔNEER	0.0216	***	0.0078	*	0.0092		0.0181	**
	(0.0083)		(0.0044)		(0.0093)		(0.0071)	
Panel B: controlling for the inflation rate								
Δinflation-squared	0.1571	***	0.0186		0.1667	**	0.1407	***
	(0.0452)		(0.0392)		(0.0741)		(0.0432)	
Output gap	-0.4613	***	-0.015		-0.5014	***	-0.4337	***
	(0.1178)		(0.0451)		(0.1912)		(0.1203)	
RPV	0.6347		5.3517	***	0.2297		1.6867	
	(4.2469)		(1.5249)		(3.3952)		(4.1754)	
ΔNEER	0.0365	***	0.0109	**	0.0302	***	0.0318	***
	(0.0065)		(0.0048)		(0.0060)		(0.0056)	
Panel C: multivariate regressions								
Inflation rate	0.1987	***	0.03		0.2834	***	0.1884	***
	(0.0532)		(0.0360)		(0.0562)		(0.0539)	
Δinflation-squared	0.0914	**	0.0039		0.1084		0.082	**
	(0.0384)		(0.0280)		(0.0720)		(0.0375)	
Output gap	-0.3169	***	0.0488		-0.4007	*	-0.3137	**
	(0.1174)		(0.0478)		(0.2227)		(0.1299)	
ΔNEER	0.0225	***	0.0124	**	0.0127		0.0183	***
	(0.0047)		(0.0057)		(0.0132)		(0.0060)	
Panel D: multivariate regressions with RPV								
Inflation rate	0.1665	***	-0.0849	**	0.2448	***	0.1254	***
	(0.0479)		(0.0423)		(0.0745)		(0.0440)	
Δinflation-squared	0.085	*	-0.0189		0.1007		0.0695	*
	(0.0437)		(0.0250)		(0.0719)		(0.0415)	
Output gap	-0.3351	***	-0.016		-0.4225	*	-0.3492	**
	(0.1240)		(0.0465)		(0.2424)		(0.1472)	
RPV	1.5252		5.4278	***	1.8217		2.9782	
	(1.9522)		(1.3947)		(3.1271)		(2.2624)	
ΔNEER	0.0218	***	0.01	**	0.0119		0.017	**
	(0.0049)		(0.0042)		(0.0145)		(0.0070)	

Note: Data from the second quarter of 2000 until the first quarter of 2015. Standard errors are in parenthesis. *, **, *** indicate significance at the 10 per cent, 5 per cent and 1 per cent levels respectively. RPV is relative price variability, calculated as the interquartile range of the weighted inflation rate for 29 commodities of the consumer price index. Δinflation-squared is the squared change in the 12 month inflation rate. ΔNEER is the 12 month percentage change in the nominal effective exchange rate.

Figure 2: Sticky information mean inflation expectations



median series, in which updated information inflation expectations are the result of a three variable VAR's iterated expectations. Figure 2 shows the mean expectations from the survey for each survey group as well as the mean expectations from the sticky information model. The movements in the mean sticky information expectations, and the mean expectations for business and labour, tend to move in the same direction – suggesting that the process of updating information to produce inflation expectations might be a reasonable approximation to business and labour expectation formation. This is important, because these groups' expectations are more problematic than those of analysts, which are flatter and better anchored (see Kabundi, Schaling and Some (2015)).

The Mankiw and Reis (2002) sticky-information model assumes that there are costs at acquiring and processing information to change inflation expectations. Hence, only a portion λ of agents optimise each period. We assume that rational agent's forecasts are proxied by a Vector Autoregression (VAR) model. Since South Africa is a small open economy we estimate a four variable Bayesian VAR including the real effective exchange rate, output gap, targeted consumer inflation, and the repurchase rate. We take annual changes in inflation and the exchange rate while keeping interest rates in levels. The output gap is based on work by Anvari, Ehlers and Steinbach (2014).

Briefly, we use a variation of the Minnesota prior from work by Doan et al. (1984) and Litterman (1986). The Minnesota prior assumes that the coefficients of longer lag lengths are likely to have a mean of zero with the first lag having a mean of unity. We set the mean to 0.9 assuming that the

data is persistent but not a random walk. This prior is used since it leads to simple posterior inference. Given the significant changes that occurred to the structure of the South African economy we only estimate the BVAR from 1990 on quarterly data, generating iterated two-year-ahead out-of-sample forecasts from 2000. The VAR is estimated with four lags.

Specifically, the Mankiw and Reis (2002) sticky-information model assumes that there are costs at acquiring and processing information to change inflation expectations. Hence, only a portion (λ) of agents optimise each period. We assume that rational agent's forecasts are proxied by a Bayesian Vector Autoregression (VAR) model. This is specified in matrix notation as:

$$y = (I_M \otimes X)\beta + \mu, \tag{1}$$

where $X = [x_1, x_2, ..., x_T]'$ is $T \times K$ matrix with $x_t = (1, y'_{t-1}, ..., y'_{t-p})$ and $K = Mp + 1$. $\beta = vec(\mathbf{B})$ is a $KM \times 1$ vector with $B = (cB_1...B_2)'$ and $\mu \sim N(0, \Sigma \otimes I_M)$.

We use a variation of the Minnesota prior from work by Doan et al. (1984) and Litterman (1986). This prior is used since it leads to simple posterior inference. The Minnesota prior assumes that the coefficients of longer lag lengths are likely to have a mean of zero with the first lag having a mean of unity. We set the prior as:

$$\beta \sim N(\underline{\beta}_{\min}, \underline{V}_{\min}), \tag{2}$$

with the elements of $\underline{\beta}_{\min}$ set to zero except for the first own lag which is set to 0.9 assuming that the data is fairly persistent but not a random walk. (This follows the work of Koop and Korobilis (2010)). The prior covariance matrix,$\underline{V}_{\min}$, is a diagonal matrix such that the diagonals elements $\underline{V}_{i,jj}$ for equation i is:

$$\underline{V}_{i,jj} = \begin{array}{ll} \frac{\underline{a}_1}{p^2}, & \text{for coefficients on own lags} \\ \frac{\underline{a}_2 \sigma_{ii}}{p^2 \sigma_{jj}}, & \text{for coefficients on lags of variables } i \neq j \\ \underline{a}_3 \sigma_{ii}, & \text{for all coefficients on exogenous variables} \end{array} \tag{3}$$

where $\underline{a}_1$,$\underline{a}_2$, and $\underline{a}_3$ are are hyperparameters set to 0.5, 0.5, and 10^2 respectively; p is the lag length, and $\sigma_{ii} = S_i^2$ are the OLS estimates of the variance from an AR(p) model. As the lag length increases the variance tends to zero.

Since South Africa is a small open economy we estimate a four variable Bayesian VAR including the real effective exchange rate, output gap, targeted

consumer inflation, and the repurchase rate. Table XX includes the variables included in the VAR, their transformations, and sources. The output gap is based on work by Anvari, Ehlers and Steinbach (2014).

Table 6: Variables used in VAR

Variable	Description	Transformation	Source
YGAP	Deviation of Real gross domestic product (Seasonally adjusted annualised rate) from potential	Log difference	SARB
CPI	Targeted consumer price index (Headline CPI since 2008, CPIX prior)	Percentage change over four quarters	STATSA
REPO	Repurchase rate	Level	SARB
REER	Real effective exchange rate – 20 trading partners based on trade in manufactured goods	Percentage change over four quarters	SARB

4 Remarks and caveats

4.1 Inflation uncertainty

There is a solid academic literature where forecast disagreement is used to quantify uncertainty – see for example Giordani and Söderlind (2003), Bachmann, Elstner and Sims (2013). This association is however primarily intuitive – one expects that the degree of dispersion in inflation forecasts will increase with uncertainty about future inflation. Theoretically, equating forecast dispersion with uncertainty may be questionable. If the number of survey respondents is one, dispersion is zero; but not uncertainy in the economy. This does not seem to be a signficant practical problem. Nevertheless, disagreement about inflation expectations is, strictly speaking, only a proxy for inflation uncertainty. [12]

[12] See Giordani and Söderlind (2003) on the performance of disagreement as a proxy for uncertainty.

4.2 Survey responses

As noted by King (2004), survey responses are "not market actions, just statements".

5 Conclusion

Trehan and Zorrilla (2012, p.2) observe that disagreement about the inflation target is "as problematic" as uncertainty about the central bank's commitment to its target. We document decreasing disagreement; therefore less uncertainty about the Reserve Bank's commitment; but with increasing agreement on commitment to an implicit target in the vicinity of the six percent upper bound of the target range. Conclusion regarding tests: in progress.

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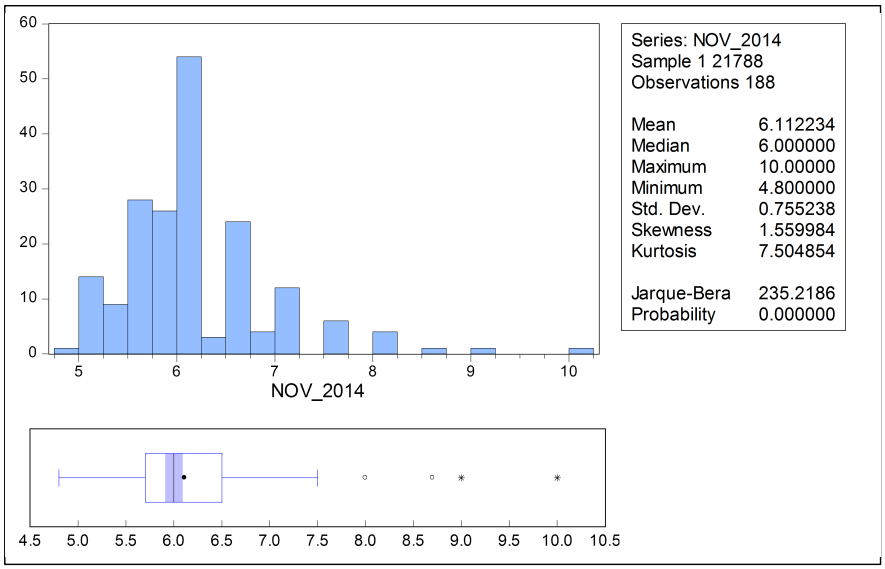
7 Appendix

7.1 A snapshot: the extent of disagreement in November 2014

The exhibit below illustrates the relationship between the box plot and the distribution of data. It shows a histogram and box plot (which has been rotated) for the same dataset. In this case, the dataset consists of expectations for two-year ahead CPI inflation in South Africa for all participants in the Bureau for Economic Research's inflation expectations survey, as reported in November 2014.



Distribution of data from the November 2014 survey of inflation expectations as shown as a histogram and box plot

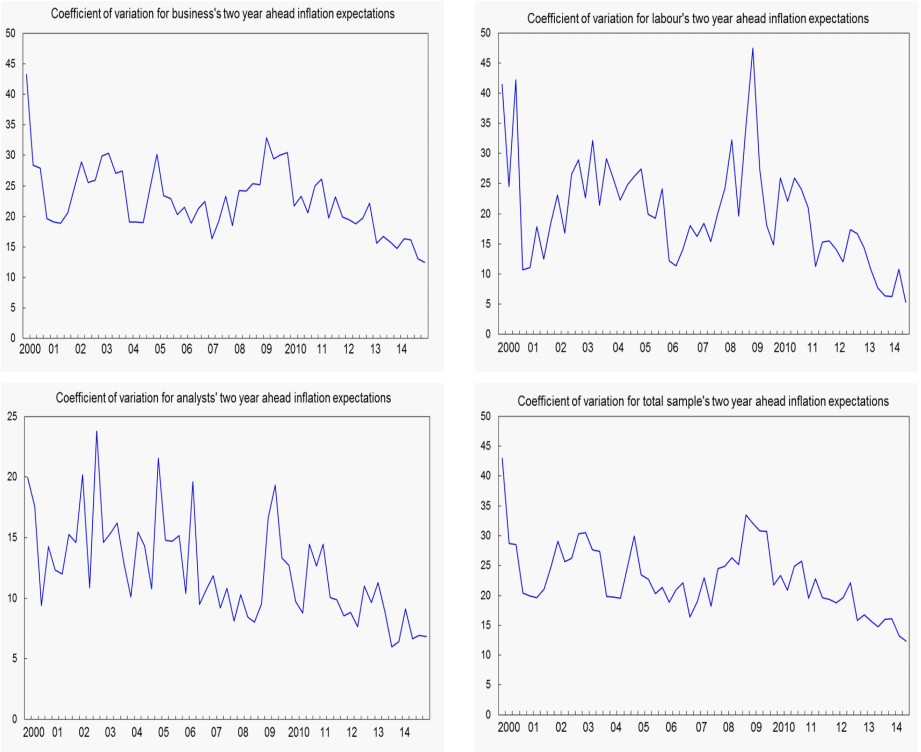
The existence of outliers only to the right of the distribution can be seen in both figures. The median is below the mean because the data are right-skewed, so the mean is upward biased. Observe that the majority of observations fall between 5.5 and 6.25 (in the case of the histogram, with over 100 observations between these points) and in the case of the box plot

between 5.7 and 6.5 (accounting for 94 observations). The box plot is slightly more accurate in this case as it pins down exactly where the data splits rather than the histogram which places observations within arbitrarily determined bins.

7.2 Coefficient of variation

This is the standard deviation of a series divided by its mean. In the case of the expectations data, the total sample exhibits a pattern that suggests that the dispersion of inflation expectations during recent surveys is significantly lower than when the survey began in 2000.

Table 7: Coefficient of variation for two year ahead inflation expectations



The reported coefficients of variation for the financial analyst and labour samples are adjusted for the bias induced by their small cross-sectional samples, by multiplying the coefficient by $(1 + (1/4n))$ where n is the number of

observations in that quarter.[13]

[13] See Sokal, R., and F. Rohlf, 2012, Biometry, New York: Freeman and Co.