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§ Results not presented are available on request and in a separate appendix. The raw data are confidential and cannot be circulated but a precise source is provided and can be requested. Monique Reid, Stan Du Plessis, and Pierre Siklos gratefully acknowledge financial support for this project from the National Research Foundation (Grant number: 93520). An earlier version was presented at the 11th Behavioral Finance Working Group Conference, Queen Mary University, London. Results not presented in the paper are in an appendix available on request. Comments by Michael Ehrmann, George Kershoff, and James Yetman on earlier drafts are gratefully acknowledged.

ABSTRACT

This paper examines the demographic determinants of inflation expectations in South Africa. Five surveys covering the period 2006-2016, and consisting of over 12000 observations were empirically examined using time series, cross-sectional, censored and quantile regressions. We assess whether factors such as gender, income, education, race and age, impact one year ahead inflation expectations. In doing so we uncover clear behavioural biases in how respondents view the inflation outlook. For example, education and income tend to be inversely related to inflation expectations. This is consistent with the literature although we observe significant changes over time that many other surveys are unable to uncover. In addition, it seems that inflation expectations respond to recently observed inflation. Unlike other studies, younger individuals have lower inflation expectations and we conjecture that the adoption of inflation targeting in South Africa played a role. Finally, we find that demographic characteristics interact with communication by the South African Reserve Bank, as well whether inflation is rising or falling. These are two additional novel features of the analysis.

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1. Introduction

Almost ten years after the Great Recession of 2008-09 former Fed chair Yellen (2016) expressed the view that policy makers still do not properly understand what drives inflation expectations. Other central bankers have also taken a similar stand. The role of the expectations channel in the monetary transmission mechanism, well established even before the financial crisis of 2007/2009, was further elevated in the aftermath of that event. In several economies, including many emerging market economies (EME), communicating the stance of monetary policy is supported by an explicit inflation target that aims to anchor inflation expectations. The South African Reserve Bank (SARB) is one such monetary authority that has been at the vanguard among EME by adopting inflation targeting (IT) in 2000. However, for at least a part of the inflation targeting period in South Africa, there has been less adherence to targeting the mid-point of the target band that is the hallmark of the IT strategy in several advanced economies where this approach was pioneered (e.g., see Taylor 2014, and references therein,).

Inflation expectations provide insights into the future unfolding of macroeconomic conditions. Given that monetary policy has long been thought to be forward looking (e.g., Friedman, 1968, Woodford 2003) it is reasonable for policy makers to devote considerable attention to inflation forecasts. All the more reason then for many central banks to more closely monitor broad developments in inflation expectations.

Generally, macroeconomic models treat inflation expectations as though they are adequately captured by a single point estimate. However, the recent literature makes a convincing case, both empirically and theoretically, that disagreement among individuals' inflation outlooks are linked to macroeconomic conditions more generally (e.g., see Siklos 2013, Brito et. al. 2018). Ignoring the heterogeneity of expectations is tantamount to omitting a potential role for critical determinants of expectations whose origins may, as we shall see below, lie in the

socio-economic sphere. As a growing body of empirical and theoretical research is making clear, the root causes of forecast disagreement remain unclear (e.g., see Siklos 2019, and references therein). Nevertheless, there are growing indications that various behavioural biases, which themselves interact with indicators of socio-economic status, represent significant determinants of macroeconomic expectations. Perhaps more importantly, studies of inflation expectations have tended to rely on the forecasts of professionals not only because they are more readily available but because the data could easily be incorporated into time series models. However, the extent to which macroeconomic outcomes are driven by such forecasts, as opposed to the inflation expectations of the general public, is unclear.

Inflation expectations are proxied in one of at least three ways. First, expectations of financial market participants can be estimated from asset price developments.[1] Second, models employed by central banks, government agencies, and others also provide some information about disagreement in the economic outlook or about the future as a function of model specification or the judgment of central bankers.[2] Finally, another approach to measuring inflation expectations consists of data from surveys of households and firms.

Some surveys consist of expectations of professional forecasters (e.g., Survey of Professional Forecasters (SPF) in the U.S. and the Eurozone, Consensus Economics forecasts globally); others are surveys at the individual, household or firm levels. The latter type is the focus of the present study. These data are often less accessible in part because they can be limited in their frequency, coverage, and availability, among other considerations to be outlined below. There are, of course, exceptions such as the Michigan Survey conducted in the U.S.

[1] Often break-even inflation rates (the difference between the yields on nominal and inflation-linked bonds) are used, as reported in the Monetary Policy Reports of several central banks. If a series of these bonds are used to estimate yield curves, then forward inflation compensation rates can be derived to provide more accurate measures of inflation expectations at various horizons along the yield curve (which was done for South Africa by Reid, 2009). Advantages of the market-based measures include the high frequency and accuracy of these measures (Svensson 1997).

[2] A good example of judgmental forecasts are the so-called 'dot plots' published in the U.S. Federal Reserve's Monetary Policy Reports. See https://www.federalreserve.gov/monetarypolicy/mpr_default.htm. These provide an indication of the anticipated future policy rates according to the views of members of the Fed's policy making committee (the FOMC or Federal Open Market Committee).

Critically, these data enable researchers to measure the expectations of groups in society other than financial market participants. Individuals in the latter group are likely to be better informed about finance and are a sub-set of the group with the highest levels of education and income. In contrast, household level surveys permit researchers to obtain some idea of individual expectations as opposed to ones determined by markets as a whole. However, survey data have the disadvantage that they are conducted infrequently and the results can be highly sensitive to the manner in which expectations information is obtained.

In any case, it is precisely from the data in such surveys that disagreement is likely to be rife and, as a consequence, to potentially have macroeconomic consequences. Central banks are also keenly aware that such surveys may contain important information about whether the central bank is credible and trustworthy, as well as the degree to which inflation expectations are anchored. The anchoring of inflation expectations is of particular interest when there is an explicit inflation target.[3]

Blinder et. al. (2008) called on researchers to investigate more deeply the inflation expectations of the non-financial markets segments of the general public because they give central banks 'the democratic legitimacy, and hence their independence' (Blinder, 2008:58). More recent research adds that differences that exist between the inflation expectations of households and financial market participants have economic implications that are non-negligible (Das, Kuhnen and Nagel 2017, Malmendier and Nagel 2015, Coibion and Gorodnichenko 2015). Many central banks concede that communication needs to be tailored specifically to this non-specialist audience (e.g., Binder (2018), Haldane 2017). Indeed, an early lesson from the nascent literature that relies on microeconomic survey data is that socio-economic status, largely captured through education and income, is a critical ingredient in

[3] An implication of relying too heavily on 'professional' forecasts is that these are more likely to be unbiased (e.g, see Croushore (1998), Carroll (2003), and Mankiw, Reis and Wolfers (2003) for U.S. evidence). This property is desirable in models but for central banks concerned with the credibility and effectiveness of their policies and, therefore, public support for their stance, this can provide a misleading impression about the effectiveness of their policy strategy.

explaining the evolution of expectations over time, and macroeconomic conditions more generally. Moreover, socio-economic status is also likely to be correlated with various cognitive biases (e.g., optimism, pessimism, age cohort specific views about the stance of policies).

In this paper we examine survey data of the inflation expectations of South African households, as collected by AC Nielsen on behalf of the South African Reserve Bank (SARB) and the Bureau for Economic Research (BER). Unlike some recent contributions (e.g, Kumar et. al. 2015, and Coibion et. al. 2018) that draw strong conclusions about the behaviour of inflation expectations based on surveys taken at one or a couple of points in time, our data cover a ten year period that contains expectations data from over 12000 different individuals in South Africa chosen on the basis of a carefully constructed cross-section of the population. As will be explained below, the survey is unique not only because it offers households' view about the short-run prospects for inflation but also because a considerable amount of socio-economic information is collected alongside data about inflation expectations.

From a policy perspective, the results suggesting the economic relevance of studying the inflation expectations of households separately raise a number of questions about the household survey. They include: (1) Do inflation expectations within South African households differ markedly across demographic groups? (2) Are inflation expectations of some groups better anchored than others? and, (3) Why do they differ? Moreover, to provide some perspective on the experience of an emerging market, where the central bank is accountable for controlling inflation in an explicit numerical target range, we also provide some comparisons with the Michigan Survey conducted in the U.S.

The remainder of the paper is organized as follows. The next section provides a brief overview of the relevant research that focuses on what is gained by examining surveys of household inflation expectations. A description of the data follows and some stylized facts are

discussed before presenting some econometric evidence about the socio-economic determinants of inflation expectations. The paper concludes with a summary and areas where additional research is needed.

Briefly, we find that expectations are determined by the available socio-economic strata. In particular, as several other cross-country studies have reported, female respondents tend to believe one year ahead inflation will be higher than their male counterparts. Moreover, censoring the distribution of inflation expectations has an impact on our interpretation of the role of socio-economic determinants of the inflation outlook. In line with international research, education and income tend to be inversely related to inflation expectations. However, the relationship between these determinants and expectations undergoes considerable changes over time. Educated respondents are found to react significantly to pessimistic language communicated by the SARB. In essence, the extent to which inflation expectations may be anchored appears to differ across groups with different demographic characteristics, as well as to be sensitive according to whether inflation is rising or falling. Finally, based on quantile regressions, the strength and significance of the socio-economic determinants of inflation expectations changes significantly depending on where the responses are located in the overall distribution of expectations.

2. Household Surveys, Socio-Economic Factors, and the Anchoring of Expectations

Central banks communicate with households for at least two reasons – to maintain democratic accountability and to anchor their inflation expectations. Surveys such as the survey of South African households' inflation expectations[4], launched in 2000 shortly after the adoption of inflation targeting, are typically employed to monitor inflation expectations to achieve the second objective.

[4] See Kershoff, Laubscher and Schoombee (1999) for a summary of the international usage of these surveys.

Other than in the U.S. where extensive data are available (e.g., see Bryan and Venkatu 2001, Souleles 2004, Branch 2004 and 2007, Pfajfar and Santoro 2008, Malmedier and Nagel 2015, Das, Kuhnen and Nagel 2017, and references therein) only a handful of advanced economies conduct surveys and these are sometimes a one-time snapshot of households' macroeconomic outlook. Surveys that are broadly comparable with the ones used in our study have been conducted, for example, in Germany (Menz and Poppitz 2013), the U.K. (Blanchflower and MacCoille 2009), Austria (Fritzer and Rumler 2015), the Netherlands (van der Cruijsen et. al. 2015), Sweden (Jonung 1981), and Japan (Nishigushi, Nakajima, and Imabuko 2014, and Hori and Kawagoe 2011).

Econometric studies that rely on survey data confront the researcher with several challenges. Many of the surveys are episodic (i.e., one time only) and do not permit an assessment of the evolution of expectations over time (e.g., Kumar et. al. 2015). On the other hand, individual or household surveys are unique in their ability to determine the influence on inflation expectations of income and education. Several studies for the U.S. and select European countries confirm that that both of these variables represent valid proxies for the degree of financial sophistication or literacy of respondents (e.g., Ehrmann and Ziegelmeyer 2017, Calvet Campbell, and Sodini 2009a, 2009b). As a result, less financially sophisticated individuals are more likely to exhibit higher inflation expectations than the rest of the population.[5] Bruine de Bruin et. al. (2010), in particular, underscore the important role played by economic and financial literacy in the formation of inflation expectations. However, education may also be informative about anticipated income growth that can also provide an incentive to be more aware of future inflation trends.

[5] The same interpretation applies to survey respondents whose expectations are difficult to justify in relation to observed inflation rates. Interestingly, it is not uncommon to find that approximately 15% to 25% of survey respondents provide what some researchers deem to be 'non-rational' inflation expectations. See, for example, Holt and Laury 2002, and Blanchflower and Macoille 2009).

Of course, education, income, or other socio-economic characteristics may also be noisy conveyers of information. Keane and Runkle (1990) were among the first to argue that household inflation expectations surveys could incorporate a form of 'cheap talk' that render some responses uninformative (also see Manski 2004, Pesaran and Weale 2006, and Armantier et. al. 2015).

Another socio-economic characteristic that has attracted the attention of researchers is the link between gender and expectations. Jonung (1981) was the first to note, using Swedish data, that food prices exert a positive influence on inflation expectations among females relative to their male counterparts. Since then, other studies for other countries have reported that inflation expectations among females are relatively higher than for males (e.g., Bryan and Vekatu 2001a, 2001b, and Blanchflower and Macoille 2009). In addition to the impact that food prices exert on inflation expectations it is not uncommon for studies of this kind to report that households' inflation expectations are also highly sensitive to energy prices (viz., gasoline; see, inter alia, Clark and Davig 2008, and Coibion and Gorodnichenko 2015). A significant challenge in interpreting household inflation surveys, let alone cross-country comparisons, is that the questions posed are not always comparable. Some questions are phrased in terms of anticipated price level changes, others are phrased as asking about levels in the inflation rate. For example, van der Cruijsen et. al. (2015) use data from a survey of Dutch households and ask: "What do you think is the most likely price increase (increase in consumer prices) over the next twelve months" Other surveys (e.g., the Michigan Survey in the U.S.) sort respondents' inflation expectations bins or intervals that range from 1 to 2% up to 14% with some open ended intervals that exceed 15% or whether respondents expect any deflation (i.e., negative inflation).

Bruine de Bruin et. al. (2016) also use a one time survey of Dutch households to highlight not only that the manner in which questions posed can significantly impact responses but also the

type of media used to generate the data (viz., face to face versus web based surveys). Detemeister, Lebow, and Peneva (2016) reach similar conclusions also based on a one time U,S. survey.[6] Survey respondents' age has also, from time to time, been shown to significantly influence inflation expectations though the link does not appear to be as robust as the other socio-economic determinants mentioned above. Blanchflower and Macoille (2009), for example, find that younger members in their U.K. survey have relatively higher inflation expectations, as do Menz and Poppits (2013) in a German survey, but other surveys find a less reliably significant relationship (e.g., van der Cruijsen et. al. (2015) for Dutch households, and Detmeister, Lebow, and Peneva (2016) for U.S. households).

Coibion et. al. (2018) arguably represents the closest we have to a broad cross-country survey of the drivers of inflation expectations with a focus on households' and firms' expectations. Much of what has been mentioned above is confirmed in their overview of the evidence though they also complain about the "…abysmal track record of the typical communication strategies of central banks in affecting households' and firms' inflation expectations" (op.cit., pg 4). We return later to the role of central bank communication used by the SARB.

Arguably, the most widely used data set to study inflation expectations is the Michigan Survey. This survey has been used to demonstrate, for example, that while the dispersion of inflation expectations can be large, individuals around the centre of the distribution have fairly rational expectations (e.g., see Pfajfar and Santoro 2008).

Although a range of proxies are employed in empirical studies to capture the extent to which inflation expectations are anchored, this concept is also often not clearly defined. Kumar et al (2015) provide a systematic way of defining anchored expectations. The authors identify five different definitions of anchored expectations in the literature. A closer look at these

[6] An interesting twist in their study is the distinction made between perceptions of past inflation and expectations of future inflation (also see Fritzer and Rumler 2015. The former, for example, is strongly influenced by the prices of frequently purchased items.

definitions also suggests that inflation expectations will be influenced by the amount of information individuals have at their disposal and their capacity to process information. The data in this study permits us to broadly determine how well expectations are anchored in South Africa or, rather, which social groups within South Africa are more likely to put pressure on the inflation target.

Coibion and Gorodnichenko (2015), and Binder (2015), use household inflation expectations to re-estimate the Phillips curve for the USA. One of their conclusions is that the inflation expectations of high-income, college-educated, male, in the working age population play a larger role in inflation dynamics than do the expectations of other groups of consumers or of professional forecasters. This is simply just another way of stating that socio-economic factors play a critical role in expectations formation. Malmendier and Nagel (2015) find evidence that individuals' inflationary experience influences their views about the inflation outlook. Equally important, different age cohorts have different inflation expectations because their exposure to the past history of inflation plays a critical factor in expectations formation. Experience also appears to potentially transcend the role of education since experts' (e.g., central bankers) own opinions about the outlook impacts their views about the appropriate monetary policy stance (Malmendier, Nagel, and Yan 2017). The BER data generated for South Africa also allow us to evaluate how age, income and education affect inflation expectations over a 10 year period. As a result, we can evaluate how sensitive expectations from surveys are to recent inflation history unlike several other studies that rely on survey evidence of the kind cited above. We now turn to the data and empirical evidence.

3. Data and Stylized Facts

South African household survey data are collected on behalf of the BER and the SARB by the marketing research firm A.C. Nielsen. To maintain reliability, A.C. Nielsen need to ensure that data 'remain constant throughout variations in the measuring process' (Kaplan and

Goldsen, 1965). They do so, for example, by using a range of well-trained interviewers and interviewing a large, demographically representative sample (Nielsen, 2017). While reliability increases the chance of validity, it of course does not guarantee it.

A.C. Nielsen conduct face-to-face interviews with approximately 2500 individuals every quarter. For this paper, we were able to obtain the disaggregated data for 5 quarters, spread over the period 2006 – 2016.[7] These surveys cover a wide range of macroeconomic conditions. Each respondent is asked to answer the following question: "*Over the past five years prices increased by on average XX per cent per year. During YEAR prices increased by XX per cent. By about how much do you expect prices in general to increase during the next 12 months?*" The values for XX will depend, of course, on the date (i.e., month and YEAR) the survey is taken. Note also that the survey question is framed in a manner that provides some context as well as to reduce the possibility that answers are given at random.[8] Note that the respondents are not told that the central bank targets inflation nor what the target range is (3-6% since inception). The respondents, with few exceptions, are not sampled again in each subsequent survey. Hence, in each survey stratified sampling is used to draw a sample from the population of respondents.[9]

A stratified sample attempts to ensure that enough respondents from each sub-group of the population is interviewed to enable a reliable representation of South Africa's population. Representativeness is evaluated along four dimensions. They are: the fraction of the population that is black, white, coloured and Indian); the fraction of the population that live in the different provinces; according to the distribution of the population that lives in large as opposed to smaller urban or rural areas; and, finally, the fraction of males and females in

[7] The question dealing with inflation expectations respondents are asked to answer is for the calendar year in the first two surveys. Thereafter, the question pertains to the one year ahead horizon. We explore the sensitivity of our results by omitting the first two surveys. See below.

[8] Whether respondents understand the manner in which the question is framed is another matter as they are not asked how well they understand the question.

[9] Each respondent is assigned an id. Hence, we are able to check the number of respondents who answered the survey question more than once. With over 12000 observations the number of respondents who appeared more than once ranged from 0 (December 2008 survey) to 112 (October 2016 survey).

South Africa's population. Adults surveyed are 16 years and older and Nielsen also constructs an estimate (with a 95% confidence interval) of the population that each respondent to the inflation expectations question cited above is thought to represent.[10] Nielsen refers to these as 'weights'.

There is a long history in survey techniques that debates the significance of these weights. An important contribution is Deaton (1997) who refers to some survey techniques used in South Africa. Although some researchers have a clear preference for weighted as opposed to unweighted estimates Deaton is clear that there is no clear answer. Korn and Graubard (1995) agree and they examine in some detail the pros and cons of using weighted versus unweighted observations. They demonstrate that a trade-off exists between the bias induced by using unweighted observations, due to the loss of representativeness vis-à-vis the population, while weighted estimators are more variable since multiplying each respondent's inflation expectations by a weight creates much greater variation. One factor that tips the balance in favour of using weighed estimates is whether a potentially significant covariate is omitted from the estimated model. Since there is a distinct possibility that this might happen we present below estimates using weighted observations.

Figures 1 and 2 provide some background about the evolution of headline inflation and the policy rate settings of the SARB. In 2006 both inflation and the SARB's policy rate (PR) are rising. In 2008 both indicators begin to fall from their peak around the time the global financial crisis (GFC) erupts in the last two quarters of 2008. In 2014 inflation is stable but falling and remains inside the inflation target range. In the meantime the SARB's policy rate reaches its lowest levels since IT was introduced in 2000; in 2015 the policy rate is increasing again while inflation also rises to the top end of the band. Finally, in 2016, the policy rate

[10] All the estimates discussed below are generated for both weighted and unweighted cases. The manner in which the weights are constructed turns out to have a negligible impact on the main stylized facts discussed below. In the econometric estimates there are some differences for reasons previously discussed. It is common for studies of this kind to weight observations. See, for example, Ehrmann and Ziegelmeyer (2017), and Failla (2010). The unweighted results are available on request.

ceases to rise while inflation continues to rise and just breaches the top of the IT range. Survey dates are identified by the vertical bars or shaded areas in both Figure1 and 2. For 2 of the 5 data points we have at our disposal, inflation is outside of the target range. Interestingly (see below), U.S. inflation rises and falls in the same direction when the same quarters are examined. Overall, the data at our disposal capture a variety of phases in the inflation and policy rate setting process.

To provide some perspective with other inflation expectations data for South Africa, Figure 3 compares an average of the inflation expectations of households and plots these for the five surveys in the data set alongside the SARB's own inflation forecasts as well as the inflation forecasts from Consensus Economics. Only one of the mean inflation forecasts by all households is within the IT range since 2006 but this is also the case for Consensus forecasts. Even the SARB's own forecasts tend to hover around the top edge of the IT range. Nevertheless, with the exception of the December 2008 survey, the differences between professional and household forecasts does not appear to be large. As we shall see, however, this level of aggregation hides considerable diversity in inflation expectations within the household sector.

Household inflation expectations data include both the disaggregated inflation forecasts of the participants as well as a range of socio-economic characteristics about each respondent. Table 1 provides some summary statistics about the distribution of inflation expectations. Further breakdowns by age, race, income, gender, community size, and education (the latter only for 2014, 2015 and 2016), are shown in Table 3.

Part A of table 1 provides some general information about the number of respondents and some indication of how much disagreement there is among South Africans.[11] The number of

[11] The potential for tail values, elsewhere often referred to as outliers, is common in surveys of this kind. See, for example, Detmeister, Lebow, and Peneva (2016), and references therein. Individuals' personal experience with changing prices, and hence socio-economic indicators, then become relevant. In any case, it can also be

respondents or observations is fairly stable over time. Although the proportion of respondents who gave no answers, or who simply do not know what their inflation expectations are, has declined it does remain well over 10% of the sample. However, as noted in the previous section, the incidence of those who are unaware what the inflation rate will be over the coming year, or believe it is expected to be zero, is well within the range reported in other studies for a variety of countries. This is also the case for the Michigan Survey conducted over the same period as the one in South Africa (see appendix). It is also worth noting that none of the respondents believe that inflation is expected to be negative. In contrast, there is a relatively small fraction of households who believe that inflation is expected to exceed 35%. The fraction of tail forecasts[12] declined substantially over time, at least until the October 2016 survey when it registered an increase. Otherwise, the number of such forecasts is quite modest.

The previous section mentions that other studies refer to seemingly very high inflation expectations as non-rational or unrealistic.[13] Moreover, one of the most consistent results found in the literature on household inflation expectations is that these can be very sensitive to food and energy prices. Figure 4 plots a variety of inflation rates for South Africa including coal and oil prices. Both are frequently discussed by the SARB. Clearly, very high inflation rates are not unusual even if they are only temporary. Hence, it is conceivable, as Detmeister, Lebow and Peneva (2016) report for the U.S., that frequently purchased or important items, such as energy, drive inflation expectations of some households. As a result, we prefer to refer to these forecasts as tail forecasts.

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challenging to perform a mental calculation about aggregate price changes when individuals are faced with several individual prices that can move quite differently from each and over time.

[12] There is no formal definition of a tail forecast. However, many would consider values greater than two or three standard deviations from the mean to be an appropriate benchmark. See, for example, Balke and Fomby (1994). We also considered thresholds of 15% and 25% with no impact on our conclusions.

[13] Presumably, the benchmark is overall observed inflation. However, it is likely that some households, even when informed about recent inflation history, as is true of the South African survey, may be thinking about the inflation rate they believe they face which, as explained below, can be driven by a few items in their consumption basket. There is also the possibility that some respondents will simply be inattentive to externally provided information.

Part B of Table 1 shows the mean and standard deviations of expectations as a function of whether we exclude outliers or not. As expected, households' inflation expectations tend to be higher than either the professional forecasts (mean inflation one year ahead forecast from Consensus Economics) or ones from the SARB (average SARB inflation expectations from the SARB Quarterly Bulletin). Once tail forecasts are omitted the gap between household and professional forecasts shrinks considerably.

Next, part C of Table 1 provides a breakdown of households' inflation expectations in relation to the SARB's IT mandate of keeping inflation within a 3 to 6% range. The SARB has also indicated, in the Quarterly Bulletin, that the target might be breached. Hence, the proportion of repondents' inflation expectations that lie in the top end of the range (i.e., 4 to 6% or 5 to 6%), as well those expectations that lie +1% over the top of the IT band (i.e., greater than 6% and up to 9%), is also provided. It is noteworthy that a sizeable fraction of respondents, ranging from a low of 8.5% to a high of almost 40%, expect that the SARB's target to be breached in the year ahead. There are also sharp variations in the number of households who expect inflation one year ahead will be inside the IT target band of 3 to 6%. Interestingly, when observed inflation is close to expectations a slight majority of respondents expects inflation to be within the target range. Otherwise, the fraction of the population that expect inflation to be within the band drops substantially. For example, we find a roughly negative correlation between the level of observed inflation and the fraction of the sample who believe the 3% – 6%inflation target will be met (last column of Table 1C), A visual confirmation is shown in Figure 3.

Table 1C also provides the mean and standard deviation of inflation rates for the target ranges shown. For the most part, mean inflation rates are quite close to the mid-point of the chosen

bands. In general, it is also found that standard deviations rise when inflation is rising and vice-versa (also see Figure 1).[14]

Figure 5 plots the densities for (unweighted) inflation expectations in each of the five surveys. Other than the October 2006 and October 2016 surveys the mass of the inflation expectations is clearly to the right of the IT range. The distribution of the inflation expectations is skewed to the right and experience sizeable shifts over time. This skewed distribution of expectations is however pronounced in the December 2008 survey (arguably, at the height of the global financial crisis) and a little above the target range in the October 2015 survey. It is important to highlight at this point that this skewed distribution is partly the outcome of an informal institutional feature of inflation targeting in South Africa during this period noted earlier. It is only recently that the SARB has communicated very explicitly that it has begun targeting the middle of the band (4.5%) rather than the top of the target range: "monetary policymakers have taken the strategic decision to anchor inflation expectations close to the 4.5% midpoint of the 3-6% target range, and not to treat the upper bound of that range as the de facto target" (SARB, 2018: 40).In summary, there is at least stylized evidence, that inflation expectations shift quite a lot over time, seemingly in line with changes in observed inflation, and this clearly has implications for the degree to which expectations are anchored to the IT.

Note that the sensitivity of inflation expectations to the most recently observed inflation rates is also a feature noted in U.S. data though such sensitivity is thought to be lower than in advanced economies with an IT (e.g., see Levin, Natalucci, and Piger 2004). What is especially notable in the present case is that the question is framed so that respondents are explicitly told not only what last year's inflation rate is but also inflation over the past five years. Moreover, the IT regime the SARB operates under is not mentioned.

[14] Table 1C shows the unweighted estimates. Weighted estimates were virtually the same in part because of the narrowness of the specified ranges. For example, the weighted estimate for mean inflation in the October 2006 survey is 4.36% instead of 4.46% for the weighted estimate.

Table 2 summarizes the available socio-economic information at our disposal about the South African population. Race, income, age, gender, community size, and education are the available stratifications. As discussed in the previous section, all of these variables, except race, are also used in other studies of the kind reported below.[15]

Further observations about the data are shown in Table 3 which presents summary statistics for each survey according to various available socio-economic strata.[16] First, inflation expectations appear to respond more quickly to last year's inflation rate than to inflation over the past five years. This is a feature of the data previously noted (see Figure 5). In contrast, the mean inflation rate over the previous five years (2nd line, under observed inflation) changes more slowly but does indicate a tendency to rise over the 5 survey periods. Second, with very few exceptions, respondents of all types tended to under-estimate the observed annual inflation rate. Inflation expectations are higher than the previous year's inflation rate in headline CPI, except in the case of low income earners in the October 2014 survey. The differentials are especially noticeable in the October 2015 survey.

There continues to be persistence in overestimating future inflation in the sense that households consistently believe that future inflation will be higher than past inflation. Put differently, the accumulated errors in forecasting next year's inflation rate are far from negligible.

It is apparent from the summary statistics that differences in inflation expectations are most pronounced depending on their education, followed by race, age, and income. In the case of older cohorts respondents expect higher inflation than the rest of the population in all of the

[15] We also have at our disposal an indicator of wealth (called Living Standards by A.C. Nielsen) as well as the state of residence. The former did not appear to have any meaningful impact on our conclusions. The later is excluded since the SARB is responsible for inflation control on a national scale. We assume that fixed effects, where appropriate, will capture some of these factors and, in any case, it is unclear what economic interpretation we should attach to these additional variables.

[16] As note above, we report unweighted results as differences were negligible when weighted data are aggregated.

surveys. This result tends to go against similar surveys in other countries.[17] Turning to income, until the October 2014 survey, respondents with the highest income (5000 Rand per month and above) had higher inflation expectations. This changes with the last two surveys in our data set where respondents with the lowest incomes (i.e., less than 2000 Rand per month) expected higher inflation over the next twelve months. This is broadly consistent with studies conducted in other countries.

The most educated are also seen to have relatively lower inflation expectations and this is especially true in the most recent survey (October 2016). Differences, however, are almost non-existent in the October 2015 survey. There are also difference according to race with black and coloured respondents consistently expecting lower inflation in the year ahead than their Indian and white counterparts.[18] Race is typically excluded from these kinds of surveys with the exception of the Detmeister, Lebow, and Peneva (2016) survey for the U.S. Fairly sizeable differences in inflation expectations are observed when inflation expectations are sub-divided according to gender. In every survey female respondents expected higher inflation than males but the gap has tended to fall over time, at least until the 2016 survey. This result is also compatible with the vast majority of such surveys.

How does the South African survey compare with the Michigan Survey conducted in the U.S.? We relegate to the appendix detailed tables that attempt to mimic the SARB survey but provide some general comparisons in Table 4. It is worth noting that the manner in which expectations data are obtained differs between the two series, including the precise phrasing of the twelve month ahead inflation rate question as well the fact that the Michigan survey places respondent's answers in bins while the South African survey solicits a numerical value

[17] Perhaps this outcome reflects two forces at play. The memory of higher inflation may well linger with older respondents. Simultaneously, younger respondents may be more aware about the current IT regime and, if it is credible, this may temper their expectations. Unfortunately, we have no way of identifying the relative importance of these effects. However, see Malmendier and Nagel (2015) for an illustration of how memory of earlier episodes of higher inflation can influence current expectations.

[18] Why this might be the case is unclear as race may well mask the impact of a variety of unobserved characteristics. The explanation could be as simple as one group is less attentive to the current inflation environment or is more influenced by the manner in which the survey question is posed.

for the same variable. Moreover, the age and education classifications are not identical across the two surveys although the differences do not appear to be wide.

Inflation expectations in the U.S. range from a low of 2.4% in 2016Q4 to 3% in 2006Q4. In contrast observed inflation over the same five quarters as when the South African survey is taken is as low as 0.4% in 2015Q4 and only approaches the 2% goal the Fed adopted in January 2012 by the time the last survey in 2016Q4, is examined.[19] In comparing the two surveys, we examine a range of 1-4% in the Michigan survey as this appears to be the rough equivalent of the SARB's 3-6% inflation target. Adopting this metric the proportion of the respondents who expect inflation to lie within the range in both countries is higher in the Michigan survey (also see Table 1C and 4 below).[20] The only exception is for the 2015Q4 survey. Interestingly, tail forecasts are far less prevalent in the South African survey than in the U.S. taken at roughly the same times and this is the case even if we are relatively generous about the threshold where a forecast is deemed to become a tail forecast.[21]

Table 4 also provides some general comparisons between the two surveys across key socio-economic characteristics. Although gender differences are comparable the proportion of respondents wo believe inflation will be inside some target range is considerably smaller in South Africa than in the U.S., for approximately the same target range. These kinds of differences also extend to the income variable. While the two surveys share the common result that low income respondents are less likely to expect inflation to be close to the observed inflation rate or, in the present case, inside a reasonably wide inflation range, the proportion of respondents who believe inflation will be in the chosen range is considerably smaller in the South African case. Of course, it is worth reminding readers that U.S. inflation

[19] The Fed's statement on the 2% medium-term inflation objective was announced on 25 January 2012. See https://www.federalreserve.gov/newsevents/pressreleases/monetary20120125c.htm.

[20] 41% of Michigan survey respondents expect U.S. inflation to be in the 1 to 4% range in 2006Q4, 18% in 2008Q4, 46% in 2014Q4, and 44% in both 2015Q4 and 2016Q4.

[21] For example, if tail forecasts begin at 35% for South Africa and 10-14% for the U.S., the Michigan survey returns proportions of 16% (2006Q4), 17% in 2008Q4, 8% in 2014Q4, 10% in 2015Q4, and 8% in 2016Q4. The same proportions in the South African case (also see Table 1) are 5%, 4.7%, 3.2%, 2% and 4%, respectively.

history by the time the first survey in our sample is taken was more stable and likely to be in the 1 to 4% range than is the case for South Africa in the years preceding 2006Q4 (see the appendix). A similar story emerges for differences across age cohorts. The single area where the two surveys yield broadly similar outcomes is when comparisons are made between respondents with low education in both countries. Interestingly, the fraction of respondents with high levels of education who believe inflation will be inside the ranges considered is much higher in the U.S. survey than in the South African ones.

The stylized facts for South Africa suggest that there is some evidence suggestive of socio-economic differences and disagreement in inflation expectations that may also have been influenced by the general economic environment when the surveys were conducted. Nevertheless, there are also indications that the inflation target may exert some influence on one year ahead mean inflation expectations as these tend not to deviate too far, at least from the upper bound of the range, with the only exception observed for the December 2008 survey which was taken at the height of the global financial crisis. We now turn to an examination of some econometric evidence.

4. Econometric Evidence

To investigate the determinants of households' inflation expectations we rely on variants of the following cross- sectional econometric specification written as

$$\pi^{e}_{it} = \alpha_{0t} + \beta_{0i}\mathbf{\Omega}_{it} + \beta_{1i}\mathbf{\Omega}_{it} \circ \mathbf{\Psi}_{jt} + \varepsilon_{it} \qquad (1)$$

where π^{e} represents the one year ahead inflation expectations of individuals *i* surveyed at time t, where t=OCT 2006, DEC 2008, OCT 2014, OCT 2015, OCT 2016. Other than the fixed (individual survey) effects the determinants considered consist of a vector of socio-economic determinants Ω listed in Table 2, and age squared, following the relevant literature

which views the impact of age as having an accelerating or decelerating impact as it rises or falls (e.g., Ehrmann and Ziegelmeyeer (2017) and references therein). Also included is a vector of interactions terms that proxy other potential sources of information that might influence individuals' inflation expectations when interacted with certain socio-economic determinants (see below). For reasons explained earlier, all observations are weighted so as to reproduce a representative profile of the South African population.[22]

Education, a potentially critical variable in related studies as discussed above, is only available for the last three surveys. As discussed above, there are reasons to question whether inflation expectations in the tail end of the distribution should be treated on an equal footing with the other responses. However, we also consider the potential impact of including all of the responses. In other words, some of the results are based on censored estimates while others are considered uncensored. Given that inflation and economic performance more generally has varied considerably over time we present estimates of equation (1) for each survey as well as a panel of all five surveys. One advantage, of course, of a panel is that it allows us to add interaction effects.

A distinguishing characteristic of IT policy regimes is communication about the economic outlook, notably expected inflation and the likelihood of meeting the central bank's inflation objective. Accordingly, as the *Quarterly Bulletin* is published around the time each one of surveys was taken, we also attempt to measure the degree to which the SARB's quarterly statement of the Monetary Policy Committee[23] expresses pessimism about the future. To evaluate pessimism we rely on the DICTION 7.0 algorithm (see Hart, Childers and Lind 2013). Essentially, the objective is to collect words that convey pessimism and assess the

[22] The appendix to the paper contains fuller details of the breakdown of the South African population according to the various stratifications discussed above.

[23] In the period investigated the statement can be found near the end of the Quarterly Bulletin. The statement tends to be considerably more detailed than comparable policy statement published by central banks in advanced economies. The statement is issued by the Governor of the central bank.

intensity with which a document can capture the content via the frequency with which these words appear in the document being examined.[24]

The content of central bank communication is occasionally assessed by coding documents according to readers' interpretations (e.g., tightening or loosening of policy).[25] Alternatively, content is quantified by estimating the frequency with which certain 'bags of words' appear in documents (e.g., Steckler and Symington 2016; Meade, Burk and Josselyn 2015). The use of a dictionary technique to capture the content or 'sentiment' of central bank texts, which is also used in the present study, is becoming more prominent in the relevant literature (e.g., Hubert and Labondance 2017).[26]

We then interact this pessimism indicator with individuals that earn lower incomes as well as race. This is motivated by the argument that it is plausible to assume that there are differences among these groups in the likelihood that they consume this kind of information published by the SARB. Since income and education are positively correlated, we retain the results where income interacts with the pessimism indicator, and drop the education and pessimism interaction term, as this version produced the most robust results across various estimated specifications (results not shown).

Finally, as noted above (also see Figure 1) inflation behaves differently around the time of each survey. It is rising in three of five surveys and falling in the remaining two. If income and age contain an element that directly impacts expectations about the future, combined with the extant literature's finding that recent inflation has a critical effect on short-term inflation

[24] Since effectively only 5 observations were collected it is difficult to draw definitive conclusions about how well DICTION captures the sentiment of pessimism. However, in the SARB's case, DICTION's definition of optimism is negatively correlated with pessimism and the latter negatively correlated with average inflation expectations by individuals in the various surveys considered.

[25] See the appendix for more details and Lombardi et. al. (2019) for additional details about the DICTION algorithm.

[26] Despite central banks' efforts to improve the clarity of signals provided in official communications, interpreting the content of central bank announcements remains less straightforward than the signal from regular macroeconomic releases that are numerical in nature. Still, incorporating qualitative elements of monetary policy into our analytical toolkit is found to add considerable value to our understanding of the effectiveness of monetary policy and best practice in central banking (e.g., Sturm and De Haan 2011; Hansen, McMahon and Prat 2014; Neuenkirch 2012).

expectations, then it is conceivable that expectation will be affected according to the stage of the inflation cycle. Defining a dummy variable set equal to +1 when inflation is rising, and -1 when it is falling, we further interact this dummy with age and income.

At least two more sets of issues are relevant in the estimation phase. First, the matter of what to do about respondents who rely 'don't know' when asked to provide a one year ahead expectation of inflation. Second, conventional regressions provide an estimate of the mean response to the various demographic characteristics considered. However, it is likely that the relationship specified in equation (1) will be sensitive according to the location of the responses in the distribution of all responses. One option is to censor the estimates, for example, by excluding the tail responses as argued above. Alternatively, we can retain as much information as possible and instead estimate a version of (1) for a series of quantiles. This allows for a much richer examination of the statistical relationship between the covariates in the model as well as possibly pinpointing differences in the impact of demographic factors according to where in the distribution of respondents households are located. In other words, we estimate a quantile regression (e.g., see Koenker 2005, 2017) version of (1) written as

$$Q_{\pi_{it}^{e}}(\tau|, \mathbf{\Omega} \circ \mathbf{\Psi}) = \alpha_{0t} + \beta_{0i}\mathbf{\Omega}_{it} + \beta_{1i}\mathbf{\Omega}_{it} \circ \mathbf{\Psi}_{jt} + F_{\varepsilon_{it}}^{-1}(\tau) \qquad (2)$$

where *F* denotes the common distribution of the errors, τ are the quantiles, and all other terms have been previously defined.

The principal econometric results are shown in Tables 4 and 5 and Figure 6. Table 4 presents estimates for each survey separately. Two versions of equation (1) are shown. The column labelled "all" includes all the data except for the zero and 'don't know' responses. Adding the very small number of zero responses (see Table 1A) has no impact on the results. The next column omits inflation expectations of 35% and above. It is unclear how to tackle the 'don't

know' responses. However, we have separately estimated a relationship such as (1) where respondents who provided a numerical value are set to 1 while the 'don't know' responses are set to zero. We then estimate logit models to determine whether the likelihood of obtaining a numerical responses is a function of the socio-economic characteristics considered in the paper. The results (see the appendix) indicate that the same demographic factors that significantly influence expectations (see below) are also the ones that explain the probability of obtaining a numerical response. Moreover, there seems to be no noticeable effect on this likelihood across income levels. We do, however, find that whites are more likely to provide a numerical inflation expectation while females, low income respondents, as well as the relatively less educated are less likely to provide a precise response. Overall, to the extent that the results discussed below are biased, these seem to be in the expected direction so that the interpretation of the regression results ought to be representative of the actual link between demographic characteristics and inflation expectations.

Examining the survey by survey results we find that younger cohorts exhibit relatively lower inflation expectations although the statistical significance of the link with expectations changes over time.[27] It appears to be strongest when observed inflation is inside the target band (see Figure 1). A similar inconsistency emerges when the link between race and residence in a large urban area are considered. While Indians and Whites display relatively higher inflation expectations the gap begins to become smaller or disappear, in statistical terms, following the financial crisis. Urban residents have relatively higher inflation expectations but only for the first and last surveys examined.

The results are most consistent for the three remaining determinants, namely income, gender, and education. These are the same variables that the extant literature has emphasized as having a significant impact on inflation expectations. Low income individuals have relatively

[27] Wald tests (not shown) confirm that the coefficients are statistically different from each other except between the October 2006 and 2014 surveys.

higher inflation expectations but the difference with their higher income counterparts varies. It is especially large in the first two surveys, that is, prior to and including the financial crisis. Similarly, inflation expectations among females is consistently higher than for their male counterparts and reaches a peak in the survey conducted at the height of the global financial crisis (December 2008). Consistent with evidence reported in other countries, respondents with relatively low education report higher inflation expectations. However, the same result is obtained when the more educated respondents are considered.[28] In addition, the size of the impact of education on inflation expectations dwarfs that of the other demographic factors considered. It must also be noted that the education variable is only available for the last three surveys, that is, when inflation was broadly within the SARB's IT. Whether this feature plays a role in our findings is unclear.

In Table 5 we turn our attention to the cross-sectional estimates which allow us to add interactions effects. In the cases shown in Table 5, representative of the large number of regressions that were estimated, all five cross-sections are included. When incorporating the education variable we are left with only three cross-sections. Although coefficient signs are unchanged when the data set omits tail response their size, in the case of race, income and all the interaction terms, is considerably and significantly smaller for the case where inflation expectations of 35% and above are excluded. Otherwise, in the case of age, gender, and urban dwellers, inflation expectations are more sensitive to these factors when large responses are omitted. Just as importantly, pessimism, our proxy for SARB communication, combines with income and race, to further raise inflation expectations. Furthermore, reversals in the direction of observed inflation combines with income and age also to influence expectations. In the case of income it has a moderating influence on the gap in expectations with respondents who have relatively high incomes; in the case of age, pessimism combined with age has the net

[28] The respondents left out are those who refused to provide an answer, and respondents with some to completing primary schooling. The results do not change when each educational category is separately included in the regression (not shown).

effect of reducing inflation expectations among the younger cohorts.[29] This result holds in both cross-sectional results shown in Table 5. More generally, the results suggest that SARB communication influences expectations. It is tempting to conclude that some of these findings are the direct result of the adoption of an inflation target. Unfortunately, this interpretation must remain speculative at this stage.

Finally, Figure 6 plots the coefficients, by quantile, on selected variables from the estimation of equation (2) together with their confidence intervals. Estimates use all available information and tail forecasts are not excluded. The quantile regression results make clear that the earlier findings, while unchanged, are highly sensitive to the portion of the distribution of inflation expectations examined. For example, while Table 5 reports that Indian and White respondents have relatively lower inflation expectations this is an especially strong feature at the high end of the distribution of responses. Even more notable is the finding that the relatively lower expectations among low income respondents is almost exclusively a feature of those who report relatively high inflation expectations.

Estimates by quantile can also reveal sign reversals. Thus, in the case of the relatively younger cohorts, those who are at the low end of the inflation expectations scale actually have higher inflation expectations which is the finding most often reported in the extant literature. It is only the younger cohort who provide relatively high inflation expectations who tend to forecast lower future inflation rates. By far the most robust result is the positive link between gender and inflation expectations. There seems to be little difference among females whether they are at the higher or lower tails of the distribution of inflation expectations. Pessimism and race interact in such a way that individuals with relatively high expectations also believe that future inflation will be higher than the rest of the remaining members of the population. Finally, it appears that a changing direction in observed inflation combined with age yields

[29] That is, summing the age and age interacted with pessimism variables is negative and statistically different from zero.

statistically different expectations only at the low and higher quantiles with a sign reversal. Hence, this interaction effect raises inflation expectations among younger respondents whose forecasts are at the lower end of the distribution of expectations. However, the same relationship becomes negative among respondents who have expectations in the right tail of the distribution.

5. Conclusions

If expectations are largely driven by local economic conditions, as other studies conducted in several countries have reported, then the results of this paper demonstrate that this is also true for South Africa. Moreover, our econometric estimates provide evidence that gender, age, race and education also impact the formation of expectations over time. While the relationship between demographic characteristics and inflation in South Africa is similar to results reported in other such studies there are also differences which, we conjecture, may be due to the adoption of an inflation target in South Africa. For example, younger cohorts, when we allow their age to be influenced by whether inflation is rising or falling, have lower inflation expectations than was found for older members of the population. The latter cohort may continue to be influenced by higher inflation rates that preceded the change in monetary policy regime.

Another novel feature of the analysis is the inclusion of a variable measuring the impact of central bank communication. Pessimistic language in the SARB's policy statement is also found to interact with income and race to impact inflation expectations.

Overall, our results provide some challenges for the SARB's attempts to anchor expectations especially when socio-economic characteristics are believed to influence that households think the short-term inflation outlook is likely to be. The data are rich in both cross-sectional and time series senses although we effectively have only five observations over time even if these cover an eventful ten year period. Nevertheless, our data is potentially more informative

than other comparable survey-based data sets mentioned which often provide a one-time only snapshot of links between demographic characteristics and inflation expectations.

While the South African survey question is framed via the provision of some historical inflation data, it is unclear to what extent whether individuals surveyed are aware of the existence of an inflation target nor their level of understanding about the size of changes in the cost of living since since portions of the distribution of inflation expectations are well outside the SARB's 3-6% inflation target. If demographic determinants improve our understanding of how inflation expectations are formed it is unclear to what extent these factors spill over to create broader macroeconomic effects. Finally, it may be fruitful to examine the expectations data alongside other surveys, notably ones that are informative about the inflation expectations of firms. These implications are the subject of our ongoing research.

Table 1 BER Survey: Stylized Facts

A. Samples

Survey date	Number of Observations (in the sample)	Population size (as per Nieslen weights)	Fraction (%) & [Number] Who Answer "don't know" or 0%	Tail Forecasts‡		
				≤ 0%	≥ 25%	≥ 35%
Oct 2006	2465	17065904	20.00%# [493: 42, 451]‡	0	124	102
Dec 2008	2479	17065902	18.60% [461: 436, 25]	0	116	79
Oct 2014	2628	23752000	16.74% [312: 252, 60]	0	84	65
Oct 2015	2512	23757000	14.21% [330: 278, 52]	0	51	40
Oct 2016	2532	24585247	12.16% [259: 259, 21]	0	101	76

‡ Numbers in brackets are total number of inflation expectations in each category.
# Percent of total number of observations.

B. **Means and Standard Deviations of Inflation Expectations (samples and population estimates)**[1]

Survey	Observed Inflation	Consensus	SARB	BER household inflation expectations			
				All observations (unweighted)‡‡	All observations (weighted)	Excludes ≥35% (unweighted)¶	Excludes ≥35%¶ (weighted)
Oct 2006	5.75%	4.98% (0.32)	6.33% (0.67)	8.62% (15.63)	9.01% (15.63)	5.28% (3.81)	5.23% (3.81)
Dec 2008	9.62%	7.43% (0.67)	5.78% (0.63)	11.63% (12.17)	11.80% (12.18)	9.48% (4.39)	9.38% (4.39)
Oct 2014	5.83%	6.21% (0.12)	5.86% (0.27)	8.30% (9.98)	8.28% (9.98)	6.78% (3.39)	6.66% (3.39)
Oct 2015	5.03%	6.35% (0.18)	5.73% (0.57)	8.01% (7.02)	7.89% (40.50)	7.13% (3.32)	7.13% (3.32)
Oct 2016	5.43%	6.92% (0.73)	6.60% (0.00)	7.92% (9.86)	7.45% (30.36)	6.29% (3.70)	6.15% (3.70)

Note: Sample estimates are obtained by multiplying the inflation expectations by the survey weights (i.e. the number of persons that each response represents)

1. After 2008, headline CPI; before 2008 CPIX (excludes mortgage); ‡‡ Excludes "don't know" and 0%. ¶ Excludes 0% inflation expectations. Consensus forecasts are for the month in question with the standard deviation over the calendar year. SARB forecasts are quarterly so the Quarter 3 (September) or Quarter 4 (December) forecasts for the calendar years shown were used. The standard deviation is for the available published forecasts for the calendar years shown.

C. **Distribution of Inflation Expectations (sample)¶**

Survey	$3 \le \pi^e_{t+12} \le 6$	$4 \le \pi^e_{t+12} \le 6$	$5 \le \pi^e_{t+12} \le 6$	$6 \le \pi^e_{t+12} \le 7$	$7 \le \pi^e_{t+12} \le 9$
OCT2006	51.60 [1272]	40.49 [998]	25.60 [631]	14.00 [345]	7.91 [195]
DEC2008	13.19 [327]	11.01 [273]	8.43 [209]	8.47 [210]	27.51 [682]
OCT2014	44.03 [1157]	40.60 [1067]	36.53 [960]	39.84 [1047]	23.67 [692]
OCT2015	28.50 [716]	24.80 [623]	20.02 [503]	32.25 [810]	41.52 [1043]
OCT2016	53.16 [1346]	46.56 [1179]	39.26 [994]	29.03 [735]	18.96 [480]

Column 2: Headline inflation is for the 4 quarters prior to the survey (eg. 2005Q4 to 2006Q3 for the October 2006 survey)

¶ Columns 3 – 7: Percent of complete sample [Number of observations].Data excludes outliers defined as expectations of inflation 35% and higher.

D. Inflation Rates and Inflation Ranges

Survey	Headline CPI	$3 \le \pi^e_{t+12} \le 6$	$4 \le \pi^e_{t+12} \le 6$	$5 \le \pi^e_{t+12} \le 6$	$6 \le \pi^e_{t+12} \le 7$	$7 \le \pi^e_{t+12} \le 9$
OCT2006	5.75%	4.46% (1.02)	4.86% (0.76)	5.36% (0.48)	6.34% (0.48)	7.54% (0.74)
DEC2008	9.62%	4.78% (1.05)	5.13% (0.76)	5.47% (0.50)	6.53% (0.50)	8.27% (0.72)
OCT2014	5.83%	5.31% (0.93)	5.51% (0.67)	5.67% (0.50)	6.38% (0.49)	7.53% (0.69)
OCT2015	5.03%	4.95% (1.03)	5.24% (0.75)	5.54% (0.50)	6.67% (0.47)	7.60% (0.68)
OCT2016	5.43%	4.98% (1.00)	5.26% (0.71)	5.49% (0.50)	6.34% (0.47)	7.62% (0.71)

Note: Columns (3) through (7) are based on unweighted data. Data are mean values of respondents whose one year ahead inflation expectations are within the ranges shown.

Table 2 Inflation Expectations and Their Socio-Economic Determinants: Variable Definitions in the BER Survey

Socio-Economic	Coding	
Inflation expectations: *"Over the past five years prices increased by on average **xx.x** per cent per year. During YEAR **xxxx** prices increased by **xx.x** per cent. By about how much do you expect prices in general to increase during the next 12 months?"* A fixed horizon forecast.	Inflation expectations	= 888 means 0%; = 999 means "don't know" re: inflation expectations
Race	Black Coloured Indian White	1 2 3 4
Household Income (monthly)	R10000plus R5000_R9999 R2000_R4999 R1_R1999	1 2 3 4
Age	a16_24 a25_34 a35_49 a50plus	1 2 3 4
Gender	Male Female	1 2
Community Size – see Stats SA	Metro Other Urban Rural	1 2 3
Level of education. Levels B, and C aggregated to create PRIMARY; levels D, E, and H aggregated to form EDUC_2; levels F and G aggregated to form EDUC_3. *Not available for October 2006 & December 2008*	A. No school B. Some primary school C. Primary school completed D. Some high school E. High school completed F. Some university G. University completed H. Other post matric qualifications I. Refused	1 2 3 4 5 6 7 8 9

Note: Bureau of Economic Research (BER).

Table 3 Inflation Expectations By Socio-economic Strata (for the samples)

Socio-Economic Variable	Item	Survey Dates				
		OCT2006	DEC2008	OCT2014	OCT2015	OCT2016
Observed	Headline CPI[1]	5.75% (0.73)	9.62% (2.10)	5.83% (0.43)	5.03% (0.91)	5.43% (0.86)
	Previous 5 years	4.71% (3.33)	4.92% (3.38)	5.23% (0.88)	5.20% (0.81)	5.50% (0.62)
AGE	Under 50 years	5.15% (3.97)	9.35% (9.81)	6.62% (3.41)	6.96% (3.15)	6.17% (3.58)
	Over 50 years	5.63% (3.30)	9.81% (4.27)	7.07% (2.95)	8.00% (3.70)	6.68% (4.05)
RACE	Black & Coloured	5.50% (3.38)	9.14% (4.33)	6.67% (3.59)	7.02% (3.23)	6.12% (3.38)
	Indian & White	5.61% (3.67)	10.00% (4.45)	7.01% (2.95)	7.34% (3.48)	6.63% (4.25)
INCOME	R1 to R1999	5.05% (4.08)	9.29% (4.15)	6.33% (4.15)	7.30% (3.39)	6.44% (3.44)
	R2000 to R4999	5.32% (4.12)	9.41% (4.18)	6.95% (3.32)	7.12% (3.52)	6.71% (4.28)
	R5000 to R9999	5.36% (3.68)	9.56% (4.74)	6.66% (3.49)	7.09% (3.36)	6.07% (3.30)
	R10000 & above	5.20% (3.50)	9.58% (4.37)	6.85% (3.22)	7.12% (3.18)	6.23% (3.72)
GENDER	Male	5.23% (3.73)	9.40% (4.52)	6.68% (3.56)	7.15% (3.53)	6.32% (3.81)
	Female	5.33% (3.88)	9.40% (4.52)	6.88% (3.56)	7.11% (3.09)	6.26% (3.59)
COMMUNITY SIZE	Metro	5.31% (3.89)	9.37% (4.31)	6.75% (3.46)	7.13% (3.60)	6.41% (3.59)
	Other Urban	5.23% (3.67)	9.76% (4.58)	6.83% (3.29)	7.12% (2.76)	6.09% (3.87)
EDUCATION	No school	NA	NA	9.67% (7.92)	7.29% (1.71)	6.73% (6.38)
	Some primary to High School	NA	NA	6.76% (3.28)	7.07% (3.33)	6.38% (3.89)
	Some Uni & Uni	NA	NA	6.66% (3.14)	7.27% (3.43)	6.11% (3.22)

Note: These figures are the mean and standard deviation (in parentheses) for each socio-economic characteristic of the data. Headline inflation is for the 4 quarters prior to the survey (e.g., 2005Q4 to 2006Q3 for the October 2006 survey). Data exclude responses that equal or exceed 35%.

Table 4 Comparing the South African and Michigan Surveys Along Socio-Economic Characteristics

Survey	BER		Michigan		BER		Michigan		BER		Michigan		BER		Michigan	
	3-6		1-4		3-6		1-4		3-6		1-4		3-6		1-4	
	M	F	M	F	Low Income	High Income	Low Income	High Income	≤ 34 YRS	50 ≥ YRS	≤ 34 YRS	55 ≥ YRS	≤ High School	> High School	≤ High School	> High School
Oct2006	26	26	54	41	2	18	31	59	27	13	49	45	NA	NA	35	55
Dec2008	7	6	22	18	2	4	15	19	7	3	22	20	NA	NA	18	21
Oct2014	22	22	55	46	3	19	40	65	18	14	38	51	33	9	36	55
Oct2015	14	14	55	44	3	13	37	58	14	7	45	56	21	6	37	54
Oct2016	27	27	57	45	4	27	48	62	27	12	54	49	36	15	41	56

Note: For definitions of BER survey see Table 2 and the text. In South Africa, Low income is R9999 or less. In the U.S. low income is defined as the bottom 25% of the income distribution; High income is the top 25% of the same distribution. In the U.S., > High School means some college, a college degree and some graduate study. M= male; F= female. The variable definitions are not always comparable across the two surveys. Data for the U.S. is from the Surveys of Consumers, University of Michigan, http://www.sca.isr.umich.edu/. Tables were extracted from quarterly expected changes in inflation rates for the same quarters as in the South African survey.

Table 4 Determinants of Inflation Expectations: Survey By Survey Estimates

	Dependent variable: Responses (Weighted)									
Independent Variables	OCT 2006		DEC 2008		OCT 2014		OCT 2015		OCT 2016	
	All	<35%	All	<35%	All	<35%	All	<35%	All	<35%
Constant	0.001*	0.001*	0.002*	0.002*	0.000*	0.005*	0.001*	0.001	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age 50 and less	-0.122	-0.069	-0.785**	-0.726**	-0.276**	-0.294**	-2.069*	-2.053*	-0.428‡	-0.361‡
	(0.162)	(0.159)	(0.337)	(0.331)	(0.142)	(0.140)	(0.292)	(0.292)	(0.227)	(0.219)
Indian & White	0.841*	0.855*	0.853*	0.921*	-0.158	-0.127	-0.394‡	-0.379‡	0.089	0.091
	(0.143)	(0.134)	(0.337)	(0.331)	(0.126)	(0.124)	(0.208)	(0.208)	(0.152)	(0.146)
Higher Income	-0.141	-0.126	0.206	0.190	-0.078	-0.078	0.140	0.138	-0.406*	-0.344*
	(0.120)	(0.116)	(0.256)	(0.189)	(0.076)	(0.077)	(0.114)	(0.113)	(0.092)	(0.083)
Female	0.576*	0.565*	1.404*	1.392*	0.230*	0.220*	0.300*	0.294*	0.243*	0.199*
	(0.083)	(0.082)	(0.142)	(0.140)	(0.072)	(0.071)	(0.087)	(0.086)	(0.076)	(0.073)
Metro	0.555*	0.505*	-0.029	-0.025	0.037	0.014	-0.076	-0.079	0.485*	0.401*
	(0.085)	(0.085)	(0.151)	(0.149)	(0.072)	(0.071)	(0.092)	(0.092)	(0.080)	(0.077)
Lower Education	NA	NA	NA	NA	4.476*	4.872*	5.106*	5.138*	4.582*	4.802*
					(0.151)	(0.151)	(0.165)	(0.164)	(0.121)	(0.117)
Higher Education	NA	NA	NA	NA	4.616*	4.730*	4.956*	4.990*	4.620*	4.844*
					(0.176)	(0.176)	(0.208)	(0.207)	(0.157)	(0.152)
Summary Statistics										
R^2 (weighted)	0.51	0.54	0.60	0.62	0.77	0.79	0.67	0.68	0.69	0.72
p-value for F-equivalent	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Observations	1972	1870	2018	1939	2316	2251	2182	2142	2273	2197

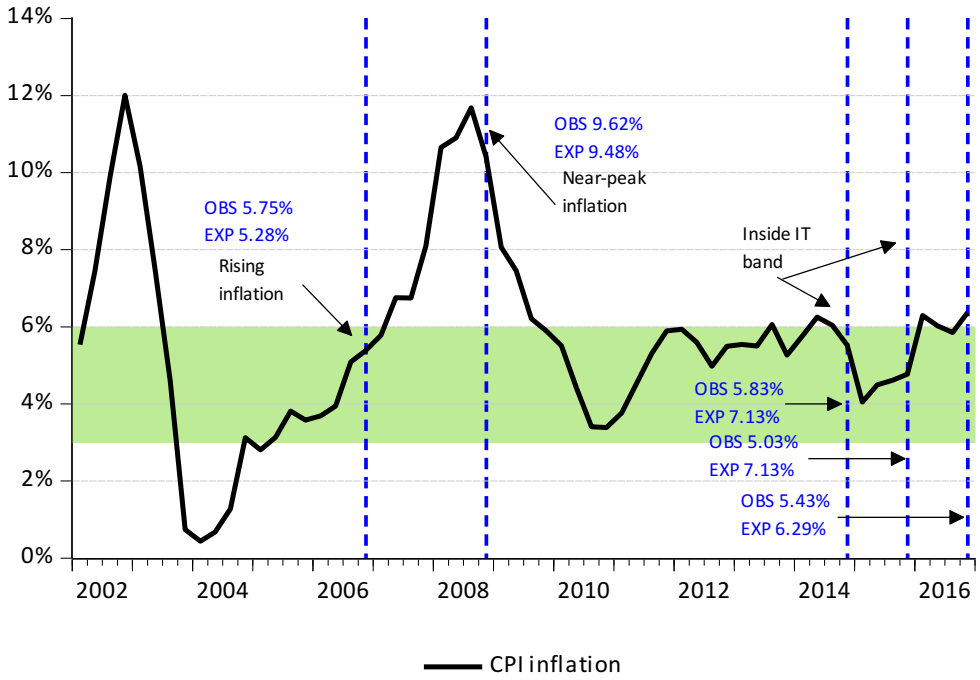
Note: Estimated via robust least squares. Huber standard errors. Results in columns (3), (5), (7), (9), and (11) omit inflation expectations higher than 35% (these were considered outliers) while ones in columns (2), (4), (6), (8), and (10) omit inflation rates equal to zero and 'don't know' respondents. The dependent variable are responses times the normalized (i.e., converted to percentages) weights as described in the main body of the paper. *, **, ‡ signifies statistically significant at the 1%, 5%, and 10% levels of significance. Low education are individuals with primary education up to, and including, high school. High education are individuals with some University to completing university education and other qualifications. Low income includes levels of up to R9000 per month; High income are levels R5000 and above. To conserve space the constant and age^2 variables are not shown.

Table 5 Determinants of Inflation Expectations: Cross-Section Estimates

Independent Variables	All	<35%
Constant	0.002* (0.000)	0.002* (0.001)
Indian & White	-9.344** (4.312)	-7.295* (0.870)
Higher Income	9.851* (6.004)	1.110 (0.697)
Age 50 and less	-0.700 (0.508)	-0.101 (0.169)
Female	0.558* (0.206)	0.977* (0.080)
Metro	0.771* (0.215)	0.951* (0.082)
Lower Education	3.758* (0.365)	NA
Higher Education	4.149* (0.460)	NA
Higher Income * Pessimism	-0.305‡ (0.176)	-0.028 (0.019)
Indian & White * Pessimism	0.222* (0.123)	0.161* (0.022)
Inflation Momentum * Higher Income	0.539 (0.587)	0.028* (0.111)
Inflation Momentum * Age 50 and less	-0.729* (0.206)	-0.772* (0.076)
Summary Statistics		
Adjusted R^2	0.102	0.325
F-statistic (p-value)	55.99 (0.00)	359.25 (0.00)
Observations	6771	10399
Redundant fixed effects (F-test)	2.59 (0.08)	171.10 (0.00)
No. of cross-sections	3	5

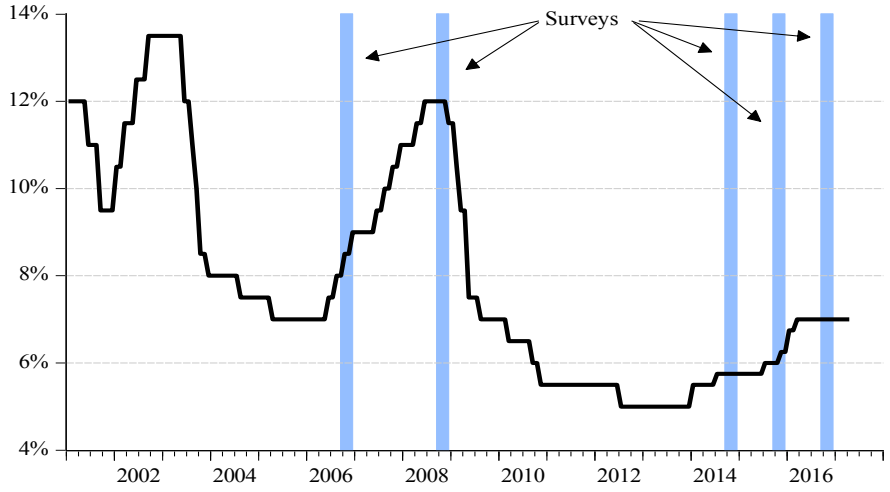
Note: see notes to Table 4. The last four variables are interaction terms. Inflation Momentum is a +1/-1 dummy depending on whether inflation was rising or falling at the time of each survey. Pessimism is a variable derived from SARB policy statements as explained in the text. Also not shown are fixed effects. The three cross-sections that include education variables are: October 2014, 2015,and 2016.

Figure 1 Headline Inflation in South Africa



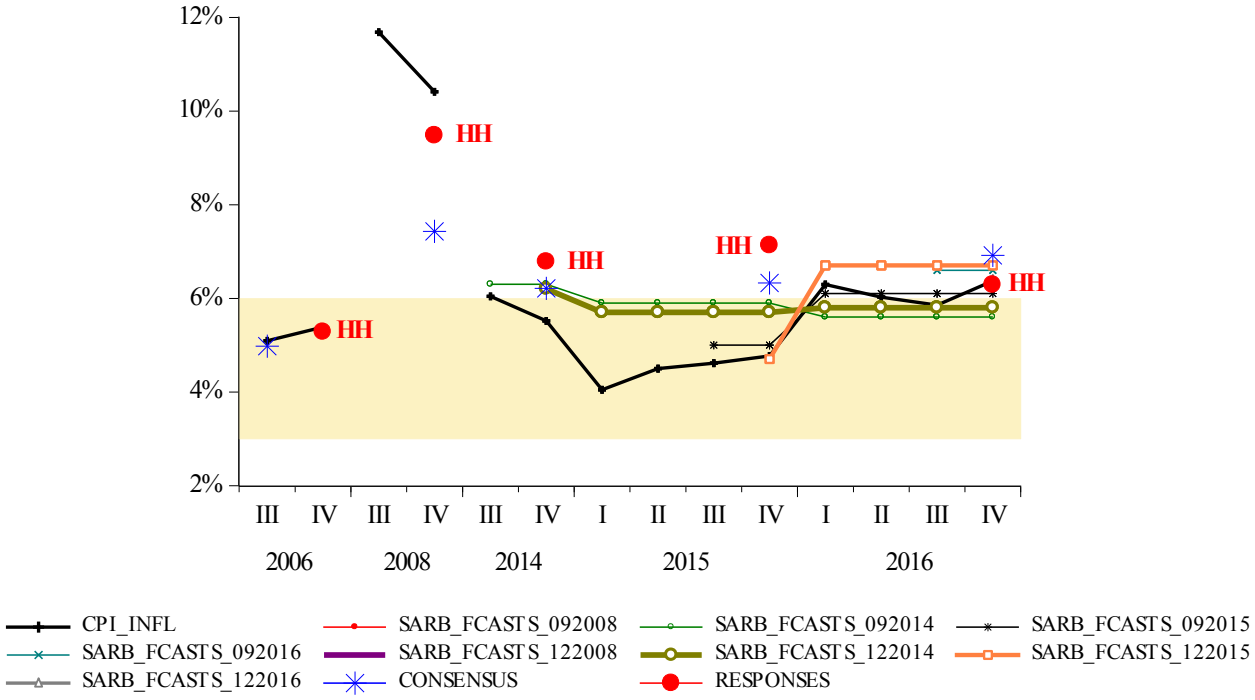
Source: SARB and authors' calculations. The vertical dashed lines indicate the survey dates (see Table 1A). The shaded area represents the SARB's inflation target. OBS means observed CPI inflation rate for the quarter when the survey is taken (see Table 1C). EXP is the mean inflation expectation from Table 1B where responses of 35% and higher are excluded.

Figure 2 The SARB's Policy Rate



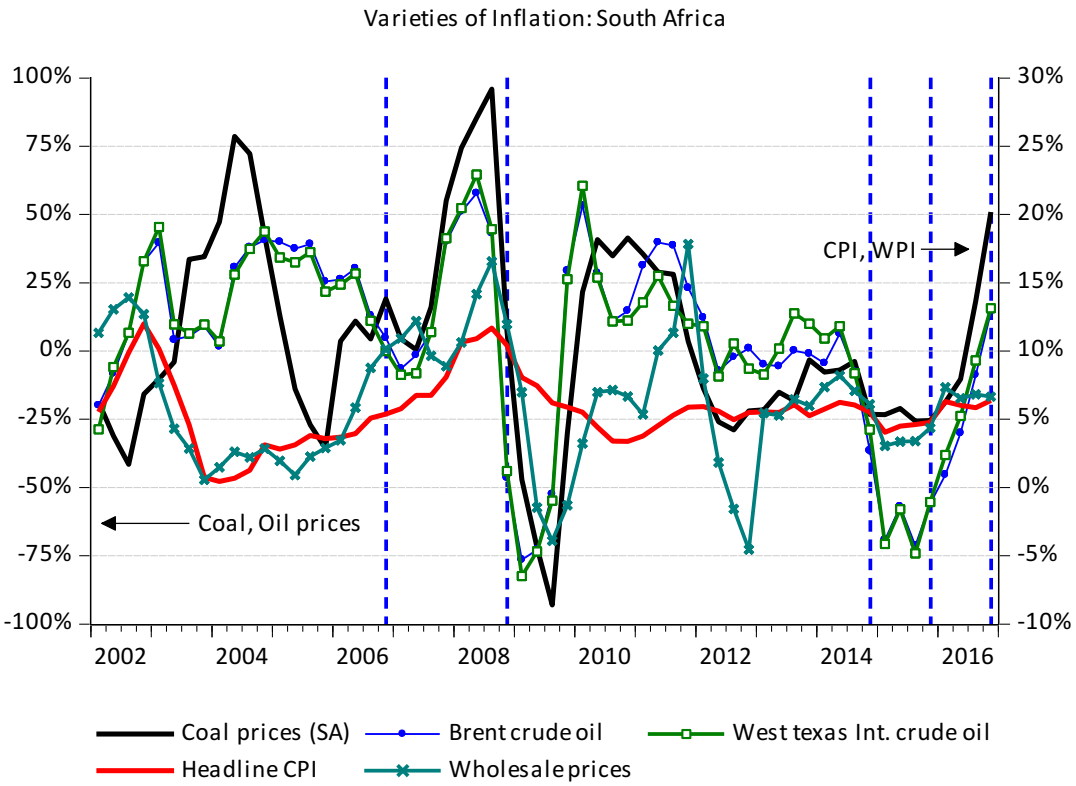
Source: See Figure 1. The vertical shaded areas represent the dates when the surveys were taken (see Table 1A).

Figure 3 The SARB's Inflation Forecasts and CPI Inflation



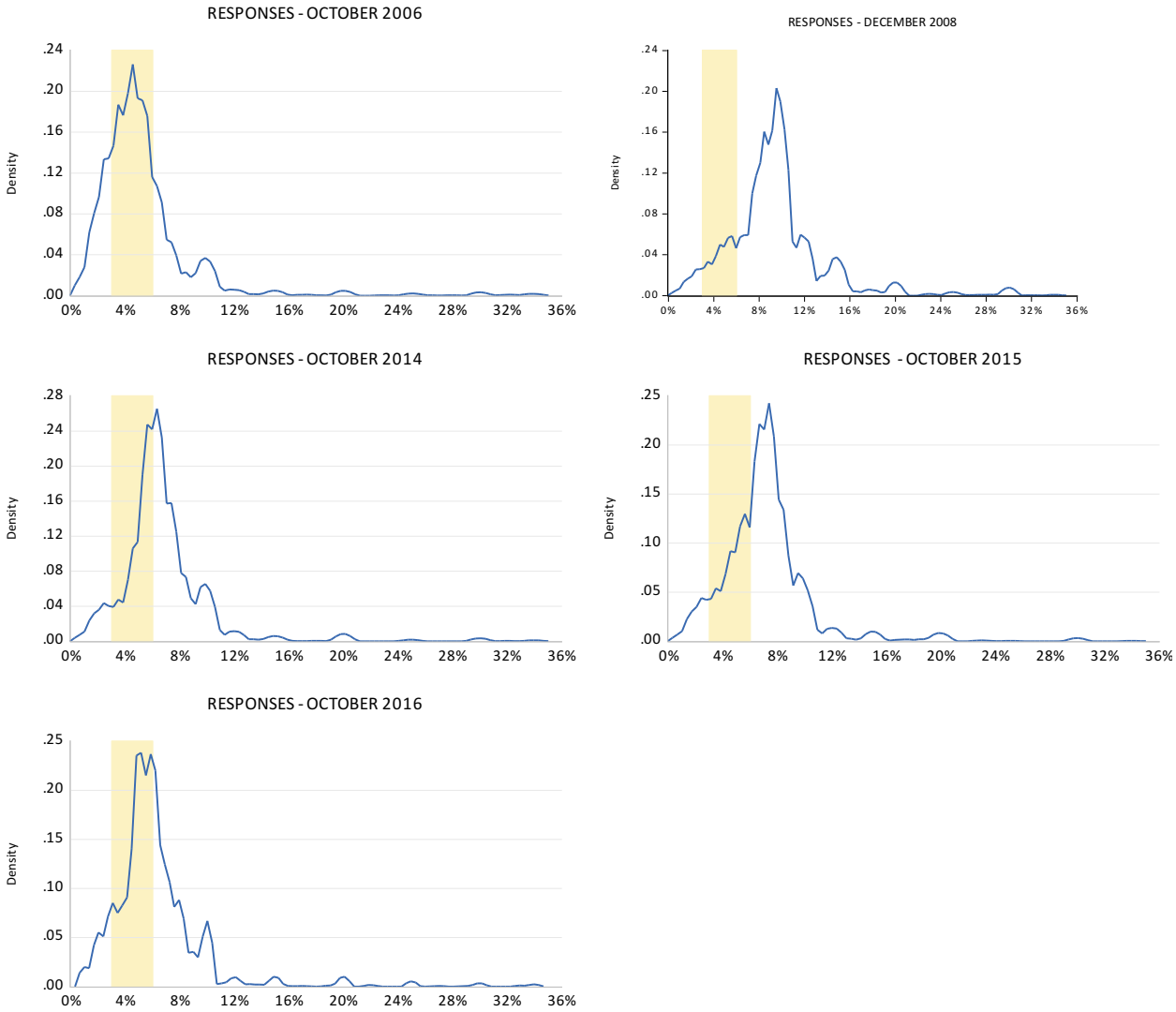
Note: SARB stands for inflation forecasts published in the QB dated mmyyyy. With the exceptions of the 2016 forecast issued in DEC 2014, and the 2016 forecast issued in DEC 2015 the other forecasts were adjusted downward. Data are from the SARB's Quarterly Bulletin (various issues). HH are the household forecasts (see Table 1B and Figure 1).

Figure 4 Energy Prices in South Africa: Coal and Oil



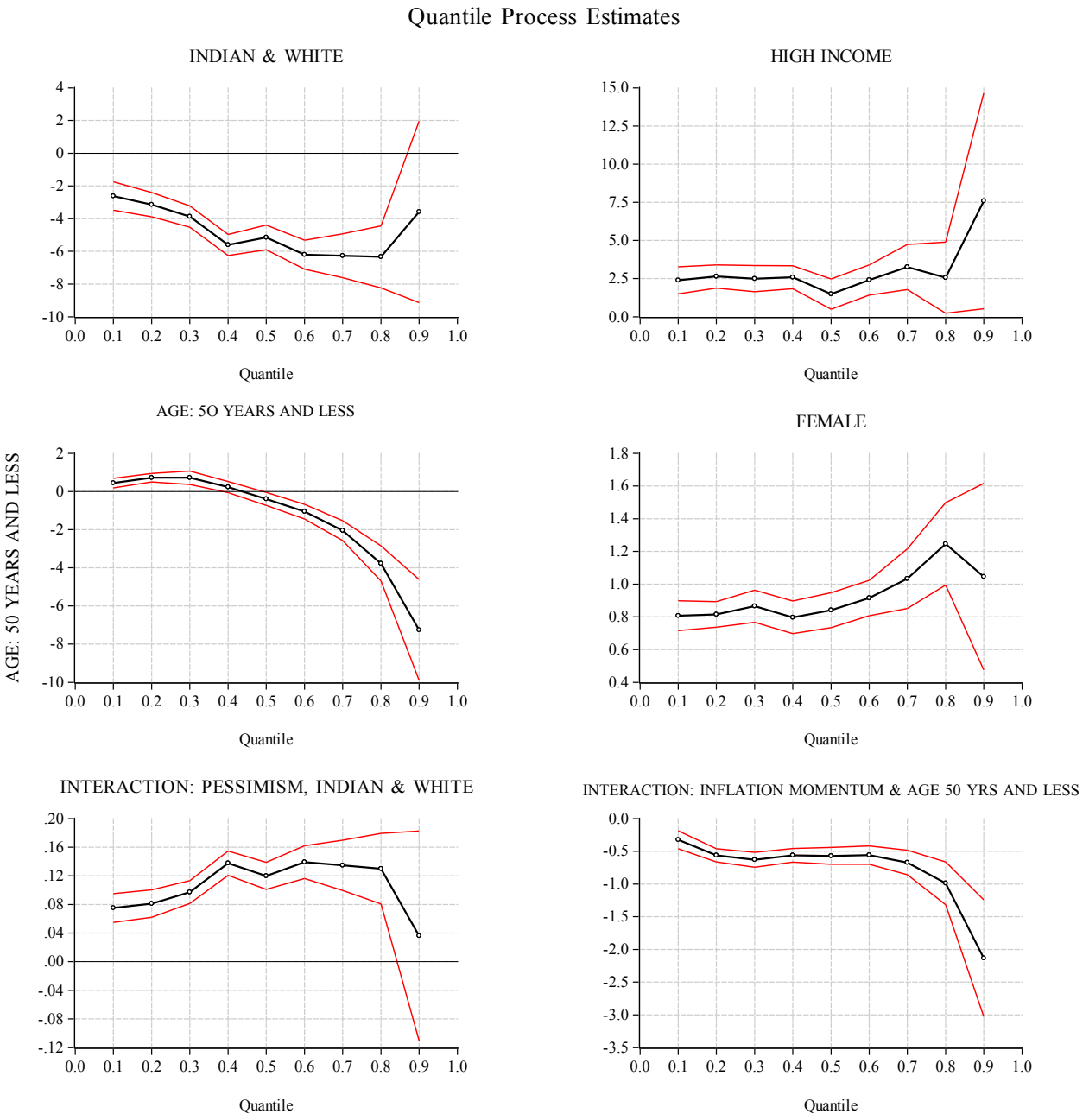
Sources: SARB, Statistics South Africa (http://www.statssa.gov.za/), and International Financial Statistics (International Monetary Fund), August 2017.

Figure 5 The Density of Inflation Expectations: Weighted Estimates



Note: The figures represent the kernel densities for survey inflation expectations (BER expectations or responses) excluding those who gave estimates that exceeded 35%. The horizontal axis reflects (unweighted) inflation expectations (responses).

Figure 6 Quantile Process Estimates: Selected Variables



Note: Based on the quantile regression estimates described in the paper. Detailed estimates for the .1, media, and .9 quantiles are in the appendix.

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