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How firms and experts view the Phillips curve: evidence from individual and aggregate data from South Africa

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Abstract

A unique survey of firms and financial analysts in South Africa provides data about their inflation expectations as well expectations concerning other critical macroeconomic and financial variables. Surveys have been conducted since the introduction of inflation targeting in 2000. The data allow researchers to obtain indications whether respondents see links between key aggregates in the manner hypothesised by economic theory. Given the role and importance of the Phillips curve, and ongoing international interest in whether the underlying trade-off between the consumer price index (CPI) or wage inflation and real economic activity continues to operate, we estimate a wide range of Phillips curves for South Africa.

Surveys of both firms and financial analysts reveal a change in behaviour beginning after the global financial crisis (GFC). Thereafter, inflation expectations become less volatile and tend to remain at the top of the SARB's inflation targeting band, though there is some evidence of movement toward the midpoint of the target band beginning in 2018. There are significant differences in behaviour in how financial analysts see future economic activity relative to their counterparts in firms. There is also evidence of diversity in expectations across different industrial sectors. As in much of the advanced world, Phillips curves in South Africa have become flatter. While both forward- and backward-looking elements drive firms' and financial analysts' views of current inflation, backward-looking factors play a relatively larger role among firms surveyed. Wage-based Phillips curves are able to explain rising real wage growth in South Africa as an over-reaction to expected and past inflation and wage growth, at least since the GFC.

Keywords: Expectations survey, Bureau of Economic Research, Phillips curve, inflation targeting

JEL classification: E31, E32, E42, E24, E66

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1. Introduction[1]

There is perhaps no variable more central to macroeconomic theory and policy than expectations, especially ones that pertain to inflation. Inflation expectations lie at the core of theoretical treatments of monetary policy and the determination of interest rates and economic performance more generally. A range of developments, including Woodford's (2003) seminal treatment of macroeconomic theory and the experience of the global financial crisis (GFC) of 2008–09, have arguably increased the importance placed on the role of expectations. Indeed, the fallout from the GFC and, as this is written, the ongoing pandemic have conspired to convince central banks around the world to intervene at a scale that is unheard of, to put a floor on inflation and growth expectations.

Most of the widely used models in academia and central banks incorporating expectations remain of the New Keynesian variety. A recent stock-taking of these models (e.g. Galí 2018) highlights how, for example, monetary policy since the crisis, primarily in advanced economies, and heterogeneity of economic agents, notably among households, are now a regular part of the theoretical framework.

Nevertheless, one of the questions Bernanke (2007) pondered on the eve of the GFC remains relevant to this day. He pointed out that: "[T]heoretical treatments tend to neglect the fact that in practice many measures of inflation expectations exist." He also made special note of the fact that data about the "expectations of businesses" are particularly scarce. Almost a decade later, Yellen (2015), his successor as Chair of the FOMC, admitted that little information about firms' expectations continues to be available. As explained in the next section, there are, for example, comparatively few studies of the expectations of firms vis-à-vis the large literature on the expectations of experts. Indeed, there have been far greater developments in obtaining and analysing households' expectations (e.g. see Coibion et al. 2020) and this has no doubt contributed to some of the theoretical progress referred to above. A widely cited early study on the expectations of firms in New Zealand (Coibion and Gorodnichenko 2015) found their expectations more

[1] An earlier version of this paper was presented at a South African Reserve Bank (SARB) webinar where we received helpful comments. Both authors are grateful to the SARB for financial support as external Research Fellows and to an anonymous referee for valuable comments on a previous draft.

similar to ones of households than those of expert forecasters. Subsequent studies tend to disagree, as does ours, though, as we shall see, it is very difficult to draw any firm conclusions due to the diffuse nature of the existing studies that rely on firm-level (or household-level) data.

Beyond the emphasis on expectations, another preoccupation of the profession and policymakers worldwide has been about the behaviour of the Phillips curve. Titles of studies, especially when applied to U.S. data, asking what happened to the Phillips curve or hypothesising about whether the Phillips curve is alive and well abound (e.g. Gordon 2013; Blanchard 2016; Blinder 2018; Hooper et al. 2020). This is not surprising since central bankers have argued, both before and since the GFC, that the Phillips curve approach "has usefully informed monetary policy decision-making around the globe." (Yellen 2015: 16). The prevailing view nowadays is that the Phillips curve has become flatter (e.g. Galí and Gambetti 2019). Whether this phenomenon has been repeated, for example, in emerging market economies remains in doubt, although there is some evidence in favour of this view (Forbes et al. 2020). Or at least it requires some elaboration due to changes in economic structure over the past two decades, including a larger role for changes in monetary policy regimes and global factors (e.g. Kamber et al. 2020; Forbes 2019).[2]

Sometimes lost in the discussion is the fact that the original Phillips curve (Phillips 1958) was specified in terms of wage growth and not inflation. The latter is the result of a hypothesised stable relationship between wages and prices that led Samuelson and Solow (1960) to modify the original Phillips curve. Since inflation rates have declined worldwide and display less variation than in past decades, owing in part to the adoption of monetary policies designed to 'anchor' expectations, there has been greater interest in focusing on wage developments as the variable generating a stronger link with economic slack (e.g. see Galí 2011; Galí and Gambetti 2019; Cunningham et al. 2019). In addition, there is recognition that wage growth and inflation may reflect differences in the degree

[2] Demographic factors are also believed to play a role as Goodhart and Pradhan (2020, chapter 8) have pointed out. Other than some of the socio-economic controls this study relies on, we provide no additional controls for this possibility.

to which some sectors of the economy are more cyclically sensitive than others (e.g. see Stock and Watson 2019).

This paper makes two contributions. First, we introduce a firm-level dataset from South Africa that surveys respondents since the introduction of inflation targeting in 2000. Unlike almost all other firm-level surveys, the South African survey goes well beyond seeking information about inflation expectations in the current year. Two-year- and even five-year-ahead forecasts are obtained in addition to the routine one-year-ahead forecasts. Moreover, firms are surveyed about their interest rate, wage growth, GDP growth and exchange rate expectations. Finally, the dataset is greatly enriched with socio-economic information that allows researchers to ask what drives, for example, changes in inflation expectations. Given the span of time over which we have data, namely 19 years of quarterly data, together with the wide variety of information obtained from survey participants, the firm-level data used here are arguably the richest of their kind. South Africa has, of course, adopted all of the tools and strategies of inflation targeting that have been implemented in advanced economies, including introducing this kind of policy regime earlier than some advanced economies. Moreover, we complement the analysis of firm-level data with data at the individual level from experts, namely financial analysts, covering the same sample. We also provide some general comparisons with household-level data from South Africa (Reid et al., 2020). As a result, we are able evaluate how expectations differs across sectors of the economy and across time.

Our second contribution asks how firms, and financial analysts, view the trade-off between inflation and real economic performance. We are able to estimate a variety of inflation and wage growth Phillips curves as well as comment on related questions about the degree to which inflation expectations in South Africa are anchored.

We report that surveys of both firms' and financial analysts' views of expected inflation change beginning after the GFC. Thereafter, inflation expectations become less volatile and tend to remain at the top of the SARB's inflation-targeting band. There is, however, some evidence of movement in expectations toward the midpoint of the target band beginning in 2018. This suggests a response to communication by the SARB that they

were explicitly aiming to make this adjustment towards targeting the midpoint of the band.[3] These results are somewhat less apparent from the firms surveyed than among the financial analysts in the dataset. Significant differences exist in how financial analysts see future economic activity relative to their counterparts in firms. There is also evidence of diversity in expectations across different industrial sectors.

As in much of the advanced world, Phillips curves in South Africa have become flatter. Although this result holds based on both firms' and financial analysts' forecasts, the latter group places a larger weight on the forward-looking component of the Phillips curve while firms surveyed attach a larger weight to the past history of inflation. That said, there are considerable differences in the estimated slope of the Phillips curve between the two groups. Some of these differences can be traced to industry-level effects as well as to differences in the outlook of other variables survey respondents are asked to provide (e.g. the exchange rate and interest rates).

While both forward- and backward-looking elements drive firms' and financial analysts' views of current inflation, backward-looking factors play a relatively larger role among firms surveyed. Wage-based Phillips curve appear consistent with the possibility that rising real wage growth in South Africa represent an over-reaction to expected and past inflation and wage growth, at least since the GFC.

The rest of the paper is organised as follows. We review the literature on available firm-level evidence of inflation expectations in the next section. Section 3 provides a description of the data. Section 4 sets out the estimation methodology and the specifications to be tested econometrically. Section 5 first outlines the behaviour of expectations of inflation and the other variables surveyed, then presents evidence about the credibility and the degree of inflation expectations anchoring. These 'stylised facts' are followed by a discussion of various Phillips curve estimates. Section 6 concludes and draws some policy implications.

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[3] "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).

2. Literature review: firm expectations around the globe

Table 1 lists 25 recent studies from across the globe that examine the inflation expectations of firms. Only a small handful of studies consider data from emerging market economies. While we cannot be certain that the list contains all the relevant research, it does appear to come close to capturing the universe of studies whose focus is on the macroeconomic expectations of firms. Compared with studies that rely on time series or cross-sectional studies of Consensus or Survey of Professional Forecasts data, the number of studies using firm-level data is modest. Moreover, in recent years there has been a surge in studies that explore household expectations (e.g. see Coibion et al. 2020). However, as noted in the introduction, policymakers in major central banks have repeatedly hinted that surveys of firms' expectations represent the 'final frontier' for trying to understand the formation of inflation expectations of groups beyond the widely studied forecasts of professionals, households, and public agencies.

Coibion et al. (2020) have constructed a table that has some resemblance to Table 2.[4] However, whereas their aim is to provide a list of economies where such forecasts are available, and their source, our aim is to produce more insights about the content of these surveys and lessons that can be drawn from the existing empirical evidence.

Below, we highlight three broad observations about the extant literature to date. They are: (i) the heterogeneity and the absence of cross-country compatibility of the existing surveys of firms' inflation expectations; (ii) the principal foci of the various empirical examinations conducted to date; and (iii) potential lessons for policymakers. We briefly consider each element in turn.

There are other issues that are relevant, including the precise wording of questions, the number of questions in a survey (i.e. time to completion) and response rates. However,

[4] The coverage of countries in Table 1 is comparable to Coibion et al. (2020) with the exception of Iran, which is omitted here. The authors' characterisation of data from South Africa is not entirely correct. See the data section below. In the annexure we have also collected information about household inflation expectations data sources around the world and the questions posed in each survey.

space limitations prevent a fuller discussion. See, however, Reid and Siklos (2020), and Meyer et al. (2020).

At least 23 economies conduct some kind of survey of the expectations of firms.[5] However, it is notable that, with a few exceptions, most of the studies have been published only quite recently.[6] Unsurprisingly, all surveys construct a panel, but the coverage ranges from economy-wide surveys to surveys of particular industries (e.g. Boneva et al. 2016; Kukuvec and Oberhofer 2020). As a result, the number of observations also varies widely.[7] The vast majority of the data collected concerns short-term inflation expectations (i.e. usually one year ahead). A few surveys are interested in sales or growth expectations, and not directly inflation expectations (e.g. Botsis et al. 2020; Dovern et al. 2020), while a few others seek to extract the long-term inflation expectations of firms, with horizons that range from between two to 10 years (e.g. Hunziker et al. 2018; Kaihatsu and Shikari 2016). Not all studies are clear about the precise format of the question(s) posed. There appears to be some variety based on which kind of firms are surveyed, when they are surveyed, and the position of the individual(s) trusted with completing the survey. Indeed, one might have expected a little more discussion about survey design issues which are critical in establishing the validity and usefulness of any survey (e.g. see Bruine de Bruin et al. 2016). Generally, interest centres on expectations of price level changes or inflation in consumer prices, although there is some survey evidence that considers expectations of input prices (e.g. see Bryan et al. 2015). Other studies are concerned with the link between input costs and/or wage costs and inflation expectations (e.g. Conflitti and Zizza 2018; Flodén 2012).

Turning to the questions that can be addressed with firm-level survey data, one can roughly identify three that are raised in most studies. First, the extent to which firms' expectations, and the resulting forecast errors, reflect 'rational inattention' in the formation of inflation expectations, stickiness in absorbing and using new information to revise

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5 The effective number of countries is actually larger since some surveys (e.g. Kukuvec and Oberhofer 2020) examine data for individual countries in the European Union.

6 Indeed, as this is written, most are in working paper form.

7 Not all studies are always precise about the number of firms surveyed.

expectations (e.g. Kaihatsu and Shiraki 2016; Frache and Lluberas 2019a, 2019b), and noisy information.[8] Depending on the country surveyed, findings range from expectations consistent with near rationality to a preference for a hybrid model that combines rational inattention with sticky information.

Second, how firms' expectations compare with professional forecasters' outlook or the efficiency and unbiasedness of firms' expectations has also been of interest to researchers (e.g. Bryan et al. 2015; Sousa and Yetman 2016; Rochard and Verstraete 2016; Borraz and Zacheo 2018; Ehlers and Steinbach, 2007). While results vary, the balance of the evidence suggests that firms' forecasts out-perform households' forecasts but lag behind the expectations of professional forecasters.

Third, a few studies explore whether the inflation expectations of firms are anchored, for example, by an inflation objective of the central bank (e.g. Martin 2020; Bartiloro et al. 2017; Kumar et al. 2015). The difficulty here is that the profession is far from agreed on how to define the concept of anchoring except to state that, if expectations match observed inflation for a time, then this outcome is viewed as consistent with anchored expectations.

Given the heterogeneity, content and variety of economies covered by the surveys listed in Table 1, it is difficult to come up with policy implications. While households' concerns are influenced by socio-economic factors, as well as commodity prices (viz. oil and energy), firms' expectations are likely influenced by a potentially wider set of factors, including whether they operate in export versus non-export industries (i.e. whether the exchange rate matters; see Moiseiva 2018), input costs, including wages and commodity prices, as well competitive considerations which can dictate not only costs but also sales and revenues more generally. Stated differently, firms' expectations are governed by

[8] Prices are seen as adjusting to the arrival, or not, of new information as opposed to sticky prices (e.g. price rigidity). Mankiw and Reis (2002) make the case for sticky information as a way of understanding the impact of monetary policy on prices. Rational inattention (e.g. see Sims 2010) has its origins in an old idea (bounded rationality; e.g. see Simon 1978), namely that individuals (or firms) face limits in their ability to interpret and digest information. Finally, when individuals cannot fully observe the current state of the world but know the structure of the economy and revise their estimates with the arrival of new information, expectational errors arise because the information received is "noisy" and it is not always possible to estimate the signal precisely. See, for example, Lucas (1972).

demand and supply factors simultaneously. Identifying changes in these expectations in response to each one of these factors is likely to be challenging and require data at an even higher level of disaggregation and detail than is currently available.

Table 1: Studies of firms' expectations: a survey of international evidence

Author(s)	Year	Sample	Geography	Variable of interest	Data structure	Key findings – remarks
Coibion et al.[2]	2018	2017–18	NZL	Inflation+1	Panel	Pro noisy information theory.
Kumar et al.[2]	2015	2013–15	NZL	Inflation+10	Panel	Inflation expectations of firms not well anchored and are similar to household expectations, not professional forecasters.
Coibion et al.[2]	2020	Varies	INTL	Inflation+1	Panel	Household and firm expectations deviate systematically from professional forecasts. Firm surveys are deficient.
Frache-Lluberas[9]	2019a,b	2010–17	URY	Inflation+1	Panel	Suggest a hybrid between the sticky price and rational inattention hypotheses works best. Confirm 2019a result of few revisions in expectations.
Borraz-Zacheo[18]	2018	2009–17	URY	Inflation+2	Panel	Favourable to the rational inattention hypothesis. Observed inflation moves expected inflation and "mood" also impacts expectations.
Conflitti-Zizza[15]	2018	2009–17	ITA	Inflation+1, 18 m, 2	Panel	Wages, contract timing, raw materials prices drive expectations
Bartirolo et al.[1]	2017	2012–17	ITA	Inflation+1,2,3,5	Panel	Inflation expectations increasingly de-anchored. Firm heterogeneity not dominant. Expectations updating is done by half the firms. Forecast disagreement linked to the ECB's price stability objective.
Dovern et al.[3]	2020	2018–19	DEU	Growth+1	Panel	Supports rational inattention view. Local information matters greatly. Expectations are frequently revised.
D'Acunto et al.	2020	2000–16	DEU, GBR, SWE	Inflation, consumption	Panel	Unconventional fiscal policy (i.e. surprise consumption tax change) has greater impact than forward guidance. Only 'experts' react to FG.
Vellekoop-Wiederholt	2017	1993–2016	NED	Inflation & assets	Panel (longitudinal)	Expectations are AR1 like with higher inflation expectations consistent with lower wealth and income.
Kukuvec-Oberhofer[4]	2020	2005–15	EU	Inflation+1	Panel*	Spillovers across firms, within country, across sectors, and countries. Supply chains matter in forecasts.
Botsis et al.[8]	2020	1998–2015	GRC	Sales	Panel*	Persistence in forecast errors due mainly to tail-like behaviour in expectations.

Bryan et al.[7]	2015	2011–14	USA	Inflation+1	Panel*	Firms' expectations driven by unit costs, behave similarly to professional forecasts but forecast concept is critical.
Richard-Verstraete[6]	2016	2001–15	CAN	Inflation+2	Panel*	Expectations behave somewhere between rational expectations and adaptive expectations. Oil prices and wage costs drive expectations, but they remain mostly in the 1-3% target range
Kaihatsu-Shiraki[5]	2016	2004–16	JPN	Inflation+5	Panel	Results are consistent with sticky information or rational inattention. UMP (i.e. QQE) raised inflation expectations.
Boneva et al.[10]	2016	2008–14	GBR	Inflation+1	Panel*	UMP raised inflation expectations by 0.2pct. Forecast errors are centred around zero but there is wide dispersion.
Flodén[11]	2012	1997–2012	SWE	Inflation+1	Panel	Forecasts match outturns quite well. Forecasts are useful for forecasting wage growth expectations.
Martin[16]	2020	2011–18	SRB, POL, CZE, HUN	Inflation+2	Panel*	Inflation expectations appear well anchored.
Sousa-Yetman[19]	2016	1999–2015	INTL	Inflation+1	Time Series*	In many countries (CZE, HUN, ISR) forecasts are biased and/or inefficient.
Golstein-Zilberfarb[12]	2018	1980–2009	ISR	Inflation+1	Panel	Information rigidities are state-dependent (i.e. recession versus expansion). Rare case where inflation expectations are volatile in the sample.
Moiseiva[13]	2018	2011–16	UKR	Inflation+1	Panel	Expectations are not rational; exchange rates help drive expectations.
Hunziker et al.[14]	2018	2014–17	CHE	Inflation+5	Panel*	Emphasis on longer-term inflation expectations. Short- and long-term expectations are related to each other. Large shocks (e.g. exchange rates) help move expectations.
Ozer-Mutluer[17]	2005	1999–2005	TUR	Inflation+1	Panel	Focus on the distributional properties of inflation expectations. Expectations are skewed and display excess kurtosis. Expectations of exporting firms less than ones of non-exporting firms.
Meyer et al.	2020	2011–19	USA	Unit costs+1	Panel	Firms' expectations differ substantively from households' expectations of the same variable. Question wording is critical. Firms' expectations covary with professional forecasts. Framing is not a significant issue.
Reid-Siklos[20]	2020	2000–18	ZAR	Inflation+1,2,5	Panel	See Empirical Results section.

Notes: * Not a continuous sample of data (e.g. interruptions over time in the survey). Country codes are as follows: NZL (New Zealand), INTL (international dataset), URY (Uruguay), ITA (Italy), DEU (Germany), EU (European Union), GBR (United Kingdom), GRC (Greece), USA (United States), CAN (Canada), JPN (Japan), GBR (Great Britain), SWE (Sweden), SRB (Serbia), CZE (Czech Republic), HUN (Hungary), ISR (Israel), UKR (Ukraine), CHE (Switzerland), TUR (Turkey), ZAR (South Africa).

1. Sample is 1 000 manufacturing and service sectors. "What do you think consumer price inflation, measured by the 12-month change in the harmonized index of consumer prices, will be [in six months], [1 year], [2 years], [on average between 3–5 years]?".
2. Response rate of 20% to a survey of about 15 000 firms. About 3 553 firms responded. Number of firms in the sample declines sharply with every wave (five of them). Weights used to adjust for size and industrial composition. "During the next 12 months, by how much do you think overall prices in the economy will change?"
3. Sample is roughly 5 500 firms in manufacturing, trade and services (excludes construction). "According to your assessment, by how much will the real gross domestic product in Germany change in the year 2018 relative to the previous year?"
4. Sample of 135 000 firms. "How do you expect the prices you would charge to change over the next 12 months?"
5. "How much higher or lower the average purchase price for manufacturing and selling the main product or service of your company …will be one year from now?" Ranges are given (20%+, 10–20%, 5–10%, 0–5%, 0%, 0 to -5%, -5 to -10%, -10 to -20%, -20% or more. 2 972 medium-sized SMEs are surveyed.
6. About 100 firms. "Over the next two years, what do you expect the annual rate of inflation to be, based on the consumer price index?"
7. "Projecting ahead, to the best of your ability, please assign a percentage likelihood to the following changes to unit costs over the next 12 months." (6 potential outcomes; probabilistic means is used). Survey of the 6th district, 300 panellists.
8. Sample of 799 manufacturing firms. "During the next three months, do you expect your aggregate sales to increase/remain the same/decrease?"
9. Around 500 firms sampled, 50+ employees. "What do you believe is going to be the change in the CPI?"
10. Manufacturing sector only. Sample consists of 400 firms that are considered homogeneous. "What has been the percentage change over the past 12 months in the general level of output prices in UK markets …, and what is expected to occur over the next 12 months?"
11. Sample consists 7 000 firms with 100+ employees. Data weighted by firm size. "How much do you think that prices will go up/down in the next 12 months?"
12. Eleven sectors of the economy sampled. Forecasts are for CPI inflation.
13. One thousand firms sampled from "different sectors and of different sizes". What is "expected changes in the prices in Ukraine in the next 12 months?" (decrease, 0–5%, 5–10%, 10–15%, 15–20%, 20–25%, 25–30%, above 30%). The main sectors surveyed include manufacturing, mining, utilities, construction, wholesale, retail and transportation.
14. Up to 240 companies across the economy, except the public sector and agriculture. "Where do you expect inflation – as measured by the CPI – to be in the next six to 12 months [3–5 years]?"
15. "What do you think consumer price in Italy, measured by the 12-month change in the harmonized index of consumer prices, will be in 6, 12 and 24 months?"
16. POLAND: "In … [month, for which the latest data is available] of the current year, the CPI (inflation) was equal to x% in annual terms. In the enterprise's opinion, during the next 12 months prices: (1) will rise faster than by x%; (2) will rise at the rate of x%; (3) will rise more slowly than by x%; (4) will remain unchanged; (5) will fall; (6) don't know". CZECH R.: "What year-on-year consumer price change in per cent do you expect in the next 12 months? What year-on-year consumer price change in per cent do you expect in the period of 36 months?" HUNGARY: "How do you expect consumer prices will develop in the next 12 months? Will they decrease, increase or remain the same? In your opinion, by what percentage will prices increase/decrease? In respect of long-term expectations, the survey uses the following question: What annual rate of inflation do you expect five years from now?" SERBIA: "…expectations for the y-o-y price growth one year ahead and also in the medium-term, i.e. two-years ahead".
17. Categorical question for up to two months ahead. Numerical expectation (%), expected inflation by the end of the year and over the next 12 months.
18. Precise question not provided but is likely the same as Frache and Lluberas (2019).
19. A large number of different surveys.
20. See data description section and Reid and Siklos (2020b).

Perhaps as a consequence of the foregoing factors, the wording used across the surveys listed in Table 1 varies considerably. Not only must the researcher contend with varieties of forecast horizon but there is also the difficult question of whether one queries respondents about changes in the level of process versus asking about expected rates of change.[9]

What is also noticeable, with very few exceptions (e.g. Flodén 2012; Goldstein and Zilberfarb 2018; Özer and Mutluer 2005), is the relatively short sample periods covered by surveys of firms' expectations. In addition, even when surveys are conducted over time, the available data are sampled only occasionally or are available at irregular intervals (e.g. see notes to Table 1). Another limitation is the inability to compare pre- and post-GFC periods to determine how this event may also have influenced inflation expectations (however, see Kaihatsu and Shiraki 2016).[10] Finally, most surveys are fairly narrow, that is, they survey inflation expectations but little else. Hence, it is not possible to consider, for example, whether expectations of various economic and financial variables may or may not be consistent with economic theories that relate expectations of inflation to aggregate economic slack, exchange rate or interest rate changes. Flodén (2012) and Boneva et al. (2016) are exceptions. As we shall see below, the BER's survey for South Africa appears to be the most comprehensive of any of the surveys listed in Table 1 and is among the longest-running in existence. That said, like any survey, it also has some potential limitations even if it combines several of the strengths of the more comprehensive surveys in existence elsewhere.

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9 Where possible or explicitly indicated by authors, the notes to Table 1 provides the details of the questions posed.

10 Post GFC many central banks, at least in advanced economies, became more concerned about inflation undershooting their targets. Central banks in most emerging markets did not share these concerns. Nevertheless, the rising importance of global factors in domestic inflation rates around the world may have impacted expectations even un emerging market economies. See, for example, Forbes (2019).

3. Data

3.1 The Bureau of Economic Research Business and Financial Analysts Survey

Since inflation targeting was introduced in South Africa in 2000, the Bureau of Economic Research (BER) at the University of Stellenbosch has surveyed households, trade unions,[11] businesses and financial analysts on a quarterly basis. Reid et al. (2020a) consider household inflation expectations in South Africa at five different periods across a span of more than a decade. The surveys of businesses and financial analysts, like the household survey, have almost always been conducted by A C Nielsen. However, unlike the household survey that aims to be representative of South Africa's entire population, the aim of the business and financial analysts survey is to ensure good representation of a cross-section of firms or analysts. Whether the respondents accurately reflect the changing composition of South Africa's economy is unclear, though data from input-output tables might provide some insights (see also below).[12] Nevertheless, we relegate to the annexure a table showing, on an annual basis, the distribution of respondents by SIC code.[13] For example, the data reveal that the share of respondents from the manufacturing and mining sectors has risen over time while representation from other sectors (e.g. water supply; sewage, waste management and remediation activities; financial activities) has remained approximately stable. One sector that has seen a decline is the arts, entertainment and

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11 The BER also collects data about the inflation expectations of trade unions which could potentially be useful information about wage expectations. The sample size is however far smaller than that of the business sector survey (the completed number of surveys by trade unions per quarter is usually about 15). This cannot be used in regressions with the same degree of confidence and it certainly will not enable us to differentiate between the responses across different sectors. Furthermore, the correlation between the inflation expectations of the business sector and trade unions at the aggregate level is surprisingly high (over 90%). Therefore, our position is that the inflation expectations of the trade unions is very similar to that of the business sector, and we are not convinced that the trade union survey would provide data about wage pressures that are superior to that of the business sector itself.

12 Tax data may not be helpful in this regard since only a small percentage of firms in South Africa pay business taxes. Hence, taxation data may not permit the creation of a representative sample of firms.

13 See, for example, the South African Revenue Service: https://www.sars.gov.za/TaxTypes/PAYE/ETI/Pages/SIC-Codes.aspx. The annexure reproduces the basic list of SIC codes. The survey's classification by business sector uses a classification system that can differ from the SIC code system. The BER kindly provided us the data in a form that is compatible with the standard SIC classification. For example, the BER survey classification of wholesale and retail trade, as well as manufacturing, is compatible with standard SIC codes but transport and other public utilities differs from the transport and storage SIC classifications.

recreation sector. We cannot say whether such changes impact the representativeness of the data, but it is not unreasonable to expect changes as the economy evolves over time.

Other surveys, as discussed in the previous section (also, see Table 1), may elicit a larger number of respondents but the BER survey stands out from the rest thanks to the breadth of its coverage. Beyond the usual questions about inflation and real GDP growth expectations, the survey asks for forecasts for the prime interest rate, wage growth and the rate of change in the rand/US dollar exchange rate. Surveys of financial analysts add questions that elicit expectations about growth rates in the M3 money stock and capacity utilisation.

Table 2 provides a summary of the contents of the two surveys.[14] Respondents are asked about their inflationary expectations for the current calendar year, as well as the next two calendar years. Since the second quarter of 2011, the survey was expanded to include a question about expectations five years ahead. The precise wording for the inflation question is: "What do you expect average headline inflation rate (as measured by the percentage change in the CPI) to be during the year."[15] Respondents are then asked to fill in boxes for the current calendar year and the next two.

There is some "priming" since respondents are also provided with average expected inflation rates for the previous calendar year as well the mean inflation rate for the last five years. For the longer-term inflation expectations question, respondents are asked "What do you expect the average CPI inflation rate to be over the next five years?" While there is no "priming" as such, respondents who are attentive ought to be aware of mean inflation over the previous five years. It remains a matter of debate how important priming is, but it is likely that the issue is of greater significance for households than for businesses or financial analysts who are, presumably, better informed.[16] Moreover, it is unclear how attentive respondents are to the advance data

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14 A scanned copy of the actual survey is in the annexure.

15 Between 2000 and 2008 both the CPIX and the CPI were surveyed. Thereafter, only the CPI data are collected. CPIX includes the cost of shelter but not the investment portion of housing investment. Instead, a measure of the imputed rent is included. In the empirical portion of this study, only CPI data are considered.

16 Reid et al. (2020b) investigate the question for South African households and conclude that Tversky and Kahneman's (1974) anchoring effect is valid. As a consequence, households treat the inflation data provided as a short-cut to the formation of their inflation expectations. Whether respondents are employed or not seems to be a significant factor in influencing whether a short-

provided or whether they deem these to be useful in the formation of their expectations. Finally, surveys are unable to determine whether respondents discount the data provided because they feel it is either inaccurate (i.e. not credible) or does not describe their inflationary experience. Hence, it is far from clear that priming has a negative impact or biases survey results.

Table 2: Contents of the BER Business and Financial Analysts Survey

Businesses	**Financial analysts**
Inflation: CY, YA, 2YA, 5YA*	**Inflation: CY, YA, 2YA, 5YA**
GDP: CY, YA	**GDP: CY, YA**
Interest rate (prime): CY, YA	**Interest rate (prime): CY, YA**
Wages: CY, YA	**Wages: CY, YA**
Rand/USD exchange rate: CY, YA	**Rand/USD exchange rate: CY, YA**
	Capacity utilisation: CY, YA
	M3 growth: CY, YA
	Long-term govt bond yield: CY, YA

Notes: CY is current year; YA is year ahead; 5YA is five years ahead. All variables, except Rand/USD and capacity utilization are in percent. * Since 2011Q2 only. All respondents receive information about the previous year's and average over the previous 5 years outturns.

The questions are phrased in the same manner for the real GDP growth, wages, M3 growth and utilisation of productive capacity. In the case of the prime overdraft interest rate, the long-term interest rate and the rand/US dollar exchange rate appreciation or depreciation, the relevant questions concern the value of these indicators at the end of each calendar year. Moreover, unlike inflation, respondents are asked about expectations for the current year and the year ahead only.

The business survey also elicits information about certain socio-economic characteristics. These include the sector to which the respondents' firms belong, the position of the respondent in the firm in question, and the number of full-time employees in the firm.[17] Since not all respondents reply in time, the BER has also

cut is taken by respondents. However, the compression in the distribution of responses does stand out.

[17] The survey also asks financial analysts whether they work in banks, at life insurers or financial brokers, advisors and investment managers. The business survey also seeks answers about the

recorded late respondents although these are small in numbers (see annexure). Anywhere from approximately 40% to slightly over 60% of firms surveyed are large, defined as firms with more than 200 employees. In the vast majority of cases the CEO is listed as the survey respondent. The other choices are firm accountant or a sales representative.

Between 2000 and 2003, the quarterly surveys were conducted in February, May, August and October. Since that time, the February and October surveys were shifted to March and November. The timing of the remaining two surveys is unchanged.

Respondents are identified by an ID.[18] They are anonymous to researchers. Equally important, there are an extremely small number of respondents who are sampled more than once over the years. The annexure provides the details. Therefore, we are unable to determine the evolution of expectations through time for the same firm. On the other hand, the re-sampling may provide a truer assessment of expectations more generally since, as pointed out above, we are unable to observe the time and effort devoted to completing the survey or the impact of a change in the individual in each firm who fills out the survey.

Timing issues might be a factor since some questions ask for expectations for a calendar year instead of some horizon (e.g. one-year-ahead expectations) or at a moment in time (e.g. end of year value for interest rates). The issue of survey design is also one that has been the subject of considerable discussion as highlighted in the literature survey above. And yet, since the survey requires an estimate of a future *average* value for a variable in a calendar year, it is not immediately clear how large the differences are between the fixed event type survey the BER conducts[19] and the

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kind of labour or employer organisations the "main business" of the firms are (i.e. trade union or employer organisation representation). However, in private discussions, the BER is skeptical about the accuracy of the data and did not recommend their use as covariates. For example, the data suggest that almost all respondents' firms are represented by a trade union.

18 As noted above, the ID refers to the respondent in a firm or trade union. It is usually the same person. The person may change between surveys if a colleague responds when the contact person is temporarily unavailable, has retired or has been replaced (such as when a new analyst starts at company X). In the case of trade unions, the contact person is not always the general secretary, but could be another knowledgeable person in the support staff. It is also not trade union representatives at firm level that are intimately involved in, for instance, wage negations, such as shop stewards.

19 Incidentally, most surveys of, say, inflation (e.g. Consensus) are fixed event surveys. The annexure contains a list of international surveys of firms and households and the questions posed in such surveys. A plot comparing current and one-year-ahead fixed event versus fixed horizon inflation expectations can also be found in the annexure.

fixed horizon type of concept that forms the basis of economic models. As will be shown in the following section, the differences do not appear large, relying on an admittedly somewhat ad hoc method that is widely used to convert fixed event to fixed horizon forecasts. See, for example, Siklos (2013, 2019).

We have also tried to explore other datasets that can be used to investigate which factors influence the inflation expectations of different groups. International Standard Industrial Classification codes would be used to link the other potential datasets to the primary data. The BER dataset includes ISIC codes at a two-digit level.[20]

3.2 Labour data

When considering macroeconomic controls from sources outside the BER surveys, the cost of labour is naturally one of the first to consider given that compensation of employees is usually one of the largest financial commitment firms face. In South Africa, there is substantial focus on the public sector wage bill that increased notably in the wake of the 2007/2008 financial crisis due to its impact on public debt, which is at concerning levels. These increases were predominantly in unskilled job creation, which are highly unionised and inflexible (Bhorat, Naidoo and Pillay 2019). In contrast, Altbeker, Boraine and Engela (2019) argue that the civil service was a beneficiary of wage rises during this period and this also helped inflate the wage bill.

However, there is substantial evidence that centralised bargaining has also raised wages and thereby affected firms' employment choices in the private sector in South Africa (Klein (2012), Flowerday (2020), Magruder (2012), von Fintel (2016)). Von Fintel (2016) finds evidence that high concentrations of unionised workers, and employment in large firms that typically rely more on collective bargaining, contribute importantly to preventing unemployment from being even higher than recorded in South Africa. The findings of this literature have been supported by many years' worth of IMF article IV agreements (including 2006–2020). In summary, there is reason to believe that the impact of these rising and inflexible wage costs differ based on firm and industry characteristics, including firm size, degree of unionisation in the industry, the level of

[20] We sincerely appreciate the effort of George Kershoff of the BER for updating the dataset to include the two-digit level ISIC code for our use.

skills required by the industry, and the mix of public/private enterprises that constitute the industry.

We considered a number of labour datasets as a source of information about price of labour. The Quarterly Labour Force Survey (QLFS) and the Post-Apartheid Labour Force Survey (PALMS) collect data from respondents at the individual level (they are household-based) and are widely used by labour economists. This data is most appropriate for many of the labour research questions and therefore has the advantage that it has been extensively examined by academics. The Quarterly Employment Survey (QES) and Supply-Use Tables (Quantec, 2020) are firm-based measures, where data is collected from VAT-registered firms. While the omission of large parts of the working age population from these datasets is a limitation for many labour questions, in this study we are focusing only on the inflation expectations of the business sector and financial analysts. In addition, some of the weaknesses of the household-level datasets will be less of a concern when the data is collected at the firm level.

The QLFS is the official labour force data collected by Statistics South Africa (Stats SA) at a quarterly frequency. It has been collected in its current form since 2008 and the earnings question was only added in 2010 (it is currently available for the period 2010 – 2017). However, the data is imputed when respondents give 0 or bracket responses (Stats SA 2019), and there are concerns among researchers that there is evidence that this is distorting the data (Wittenberg (2016), Kerr and Wittenberg (2019) and references therein)). The PALMS dataset, published by UCT's Datafirst, uses the raw data from Stats SA and offers two ways to make adjustments for the 0 and bracket responses that aim to reduce distortion created by the inclusion of these responses (Kerr and Wittenberg, 2019).[21] The need for these adjustments means that even the PALMS data are complex to use responsibly, and it would still need to be aggregated back up to the industry level to match the BER's inflation expectations survey so this level of microdata may not be necessary.

[21] The 'bracket weight' adjustment involves dropping the bracket answers and re-weighting using the correct form of answers. This adjustment could be problematic at more disaggregated levels, and it is not immediately clear how much of a problem this would be at the two-digit SIC level. The second adjustment option presented is 'multiple imputations', whereby a distribution of earnings is generated for all bracket reporters/non-reporters/0-reporters, based on other characteristics.

In contrast, the QES being collected from VAT-registered firms faces fewer problems with accurate reporting. This survey collects data about employees from the formal non-agricultural sector (Stats SA 2020). If an individual is employed in more than one job, that person is counted multiple times as this survey counts the number of jobs rather than the number of employed people (as in the QLFS). Since our focus is on the experience of the firm, this representation is adequate. The limitation of this data is that it is only available since the third quarter of 2009.

Finally, Quantec publishes a version of the supply-use tables for South Africa that contains a measure of employee compensation, which is available for the entire sample period we are studying, but is only published annually. Given the limitations, the choice was made to use the QES data for this study, but others could be used with varying benefits.

4. Methodology and specifications

The workhorse model used to relate inflationary pressure to real economic activity is the New Keynesian Phillips curve (NKPC). Although its formulation can, with suitable restrictions, be traced to earlier versions of the Phillips curve, current versions often emphasise the forward-looking nature of monetary policy. That said, since many believe there is history dependence, a backward-looking element is also often introduced. A single equation version can be written as follows:

$$\pi_t = \alpha E_t \pi_{t+1} + \beta_i \sum_{i=1}^{k} \pi_{t-i} + \theta_{\tilde{y}} \tilde{y}_t + \boldsymbol{\mu} \mathbf{X}_t + \varepsilon_t \qquad (1)$$

where $\pi_t, E_t\pi_{t+1}, \tilde{y}_t$ are, respectively, observed inflation at time *t*, inflation expected at time *t+1* conditional on available information at time *t*, and a measure of tightness or slack in the economy.[22] Lagged inflation terms (π_{t-i}) enter via the summation sign while $\mathbf{X_t}$ represents a vector of other variables (e.g. oil prices, dummy variables for key events and other forecasts). Typically, *i=1,2* in most empirical studies of the Phillips curve in recognition that persistence in inflation helps explain current inflation. The residual, ε_t, is sometimes referred to as a mark-up shock. An extension of (1) in

[22] Some authors prefer to use a measure of labour market tightness based, for example, on the unemployment rate. Others prefer to substitute real marginal costs (mc) for $\tilde{y}_t$ and this is often modelled as a function of output (y) and the difference between a nominal interest rate (R) and expected inflation. The resulting function might be written $mc_t = \gamma_y y + \gamma_r (R_t - E_t \pi_{t+1})$.

structural form would model $\tilde{y}_t$ as a function of output and a real interest rate (i.e. an IS curve) and a policy rule (e.g. a Taylor rule).[23] The extant literature tends to suggest that structural versions of (1) do not, at least empirically, produce coefficient estimates that are vastly different from the single equation version. Hence, estimates presented in the next section are based on the reduced form equation (1).

Although the dependent variable in (1) is inflation, which is appropriate given that central banks have for a few decades now been expected to emphasise inflation control, it is straightforward to recast the NKPC in terms of wages by replacing observed and expected inflation with wage growth ($\dot{w}_t$) and wage expectations ($E_t\dot{w}_t$). Its relevance, as noted earlier, is explained by the fact that labour costs typically represent the largest component of a firm's total costs and a long-held prior that wage and price inflation move together. A purely forward-looking NKPC would find that $\alpha \neq 0, \beta_i = 0$, though, as noted above, most studies find it necessary to make allowances for history dependence when forecasting inflation or wage growth.

Many variants of (1) are estimated to account for shifts in parameters due to one or more structural breaks or a policy regime shift, not to mention non-linearities in the behaviour of inflation and inflation expectations. Often, expectations are proxied, if not generated from an assumption that inflation has a random walk-like property, by the mean or median of professional forecasters (e.g. Consensus). More recently, however, there has been a greater tendency to estimate some version of (1) using an aggregate measure of household expectations (e.g. see Binder 2015), because there is reason to believe that the expectations of professional forecasters and those of the broader public differ, and that these differences are of economic significance. As discussed in section 2 (see Table 1), estimates that use firm-level data are rare and so household data have usually been used to capture the expectations of 'price setters'.

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[23] The IS curve is often written as $y_t = \delta_y E_t y_{t+1} + \delta_r (R_t - E_t \pi_{t+1}) + \xi_t$ so has a forward-looking element which is available in the survey, as are expectations for the nominal interest rate. ξ_t is sometimes defined as a preference shock. The Taylor rule is well known and sets *i* as a function of slack and inflation, both defined earlier though there have been many variants on the standard Taylor rule proposed in the literature.

Survey data, if available at a disaggregated level, also permit estimation of a version of (1) at the individual level. In equation (2) below, the individual or firm is indexed by *j*.

$$\pi_{jt} = \alpha_j E_t \pi_{j,t+1} + \beta_{j,i} \sum_{i=1}^{k} \pi_{j,t-i} + \theta_{j,\tilde{y}} \tilde{y}_t + \boldsymbol{\mu}_j \mathbf{X}_{j,t} + \varepsilon_{jt} \qquad (2)$$

where all terms were previously defined. The vector $\mathbf{X_{j,t}}$ is now expanded to include socio-economic or geographic variables that identify characteristics associated with each individual. Section 3 above describes the available characteristics for data from the BER that surveys firms and financial analysts at the individual level.

Even if our focus is on the Phillips curve as seen by firms and financial analysts, it is useful to augment our estimates with some facts especially about the behaviour of inflation forecasts. Although detailed results are relegated to the annexure some highlights are discussed in the following section where we report on the amount of forecast disagreement,[24] information stickiness[25] and selected metrics of forecast performance for firms and financial analysts. These include how forecasts are revised, how inattentive forecasters are and the extent to which inflation expectations are anchored.[26] Clearly, separately as well as jointly, these performance metrics can impact how firms and financial analysts see the Phillips curve trade-off.

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[24] There is no consensus definition of forecast disagreement. However, many empirical studies use a version of the following kind (e.g. see Siklos 2013, 2019): $d_{t,t+\tau} = \frac{1}{N_t + 1} + \sum_{j=1}^{N_t} (E_t \pi_{j,t+\tau} - E_t \bar{\pi}_{j,t+\tau})^2$ where d is the indicator of forecast disagreement, Nt is the number of forecasts (viz. number of individuals) and $\bar{\pi}$ is a cross-sectional average of forecasts although other proxies (e.g. central bank forecast, professional forecast) can also be used. Although the equation is specified in terms of inflation, clearly the same definition extends to any other forecasted variable.

[25] Estimates are obtained from a regression of the form: $fe_t^\tau = \lambda_0 fe_{t-1}^\tau + \boldsymbol{\lambda}_\mathbf{i}^\tau \boldsymbol{\Theta}_\mathbf{t}^\tau + \varepsilon_t$ where *fe* is the forecast error (actual less expectation) at each horizon τ; $\boldsymbol{\Theta}$ are the forecast errors for the other variables in the survey. If the assimilation of information is slow, the definition of stickiness (Mankiw and Reis 2002) then forecast errors will be persistent and stem from a variety of sources.

[26] Forecast revisions are examined via the regression: $fe_t^\tau = \alpha_0 + \alpha_1 rev_t^\tau + \omega_t$ or $fe_t^\tau = \beta_0 + \boldsymbol{\beta}_\mathbf{1} \mathbf{X}_t + \zeta_t$ where X is defined earlier in the main text. The test asks whether revisions to forecasts (rev) can explain forecast errors. If forecasts are infrequently revised then this increases the scope for forecast errrors. One test of the anchoring of expectations asks: given a particular inflation target (IT) can a succession of deviations of short-run expectations explain the differential between a long-run forecast and the inflation objective? A regression of the form: $(\pi_t^{5Y} - IT) = \delta_0 + \delta_1 (\pi_t^{CPIT0} - IT) + \delta_1 (\pi_t^{CPIT1} - IT) + \delta (\pi_t^{CPIT2} - IT) + \varsigma_t$ is estimated. 5Y is the long-run expectation (five years into the future), while CPIT0, CPIT1, and CPIT2 are a succession of short-run expectations corresponding to current, one-year-ahead, and two-year-ahead forecasts.

Finally, given the rising popularity of household forecasts in exercises of the kind reported here, it is worth briefly contrasting at a general level, household expectations versus the ones considered in the present study. Table 3 provides some broad comparisons for South Africa. Data from individual-level household surveys at five moments in time are compared to the expectations of businesses and financial analysts. Reid et al. (2020a) provide more details about the household survey, while Miyajima and Yetman (2019) examine a time series of data at an aggregate level. Three stylised facts stand out. First, although there is a persistent positive gap between household and others' one-year-ahead expectations, the divide has declined over time. However, the standard deviation around mean forecasts remains considerably higher for household expectations than for the other groups shown in the table. Finally, household expectations are notable for the substantial proportion of respondents who believe inflation is zero percent or simply don't know.[27] While there are no comparable data for firms and analysts, the same phenomenon does not appear to hold for the other groups represented. That said, firms' participation in the surveys has declined over time (see annexure).

[27] It is unclear whether those who respond with an expectation of 0% simply do not know what inflation is. Accordingly, the categories are combined.

Table 3: Comparing inflation expectations of households, firms and financial analysts

Dates	All Households	Fraction of forecasts 25% & "don't know" or 0%	All Businesses	All Financial Analysts
October 2006	9.01% (15.63)	5% 20%	4.97% [3.5,10] (0.88)	5.91% [4.8,8] (0.88)
December 2008	11.80% (12.18)	4.7% 18.60%	10.33% [3.9,18] (2.25)	7.06% [4.8,9] (0.99)
October 2014	8.28% (9.98)	3.2% 16.74%	6.11 [5,8.4] (0.44)	5.37% [4.8,5.7] (0.32)
October 2015	7.89% (40.50)	2% 14.21%	6.17 [0.5,15] (0.91)	5.92% [5.6,6.5] (0.28)
October 2016	7.45% (30.36)	4% 12.16%	5.96 [3.2,10] (0.74)	5.50% [5.2,5.9] (0.23)

Notes: Household data drawn from Reid et al. (2020a). Standard deviations in parenthesis. Figures in brackets show range of values (minimum and maximum, respectively).

5. Firm-level expectations: stylised facts and Phillips curve estimates

There is no shortage of estimates of Phillips curves for South Africa. Recent contributions include Kabundi et al.'s (2019) time-varying estimates and Botha et al. (2020) who compare different specifications comparable to or extensions of ones used in the SARB's Quarterly Projection Model (QPM; see Botha et al. 2017). Generally, studies conclude that the Phillips curve remains a useful representation, though, as found in advanced economies, the trade-off has become flatter thanks to a successful monetary policy since the introduction of inflation targeting in 2000. Nevertheless, estimates can be sensitive to the measure of aggregate economic slack and the precise set of controls included (**X** in equation (2)). Perhaps equally important is that estimates of the slope of the Phillips curve (i.e. θ in equation (2)) in South Africa are broadly comparable with ones estimated for advanced economies in spite of differences between these economies.[28]

[28] For example, successive economic surveys of the OECD and Article IV consultations from the IMF highlight the persistently high unemployment rates in South Africa, the growing exposure of the central government to state-owned enterprises, and the relative importance of food, fuel and electricity prices. However, these same sources also point out the resilience of the South African economy to external shocks, albeit declining over time, and the strength of its institutions. Both the OECD and the IMF have regularly complimented the SARB for the effectiveness of the inflation-targeting regime while pointing out, of course, potential threats to inflation. Although we use headline inflation in the results shown below, we did examine prices of key sub-groups (e.g.

5.1 Stylised facts

Figure 1 plots observed headline inflation in South Africa since the beginning of the inflation-targeting era against inflation expectations of firms (top portion) or financial analysts (bottom portion) on a calendar year basis for the current year, next year, two-year-ahead and five-year-ahead horizons. The solid horizontal line represents the midpoint of the SARB's inflation target while the shaded area around the target highlights the target range (3 to 6%).[29]

Three features stand out in the figure. First, until the GFC ends around 2009, inflation rates, together with inflation expectations at all horizons, fluctuate considerably and spend little time inside the SARB's target range in the case of firms' inflation outlook while financial analysts often expect inflation to end up inside the 3 to 6% target band. Second, after 2009, inflation expectations for both groups surveyed are far more stable but tend to remain at the top edge of the band. This is less true for financial analysts who gradually expect inflation to decline toward the midpoint of the band.[30] Overall, forecast errors can persist (see below) but, other than for the middle part of the sample (i.e. 2003–09), can be positive or negative. Finally, there is on the whole less variation in inflation expectations than in observed inflation. This suggests, as noted in the introduction, that expectations do not respond to every wiggle in the data. The disagreement is, of course, about the precise source of this sluggishness.

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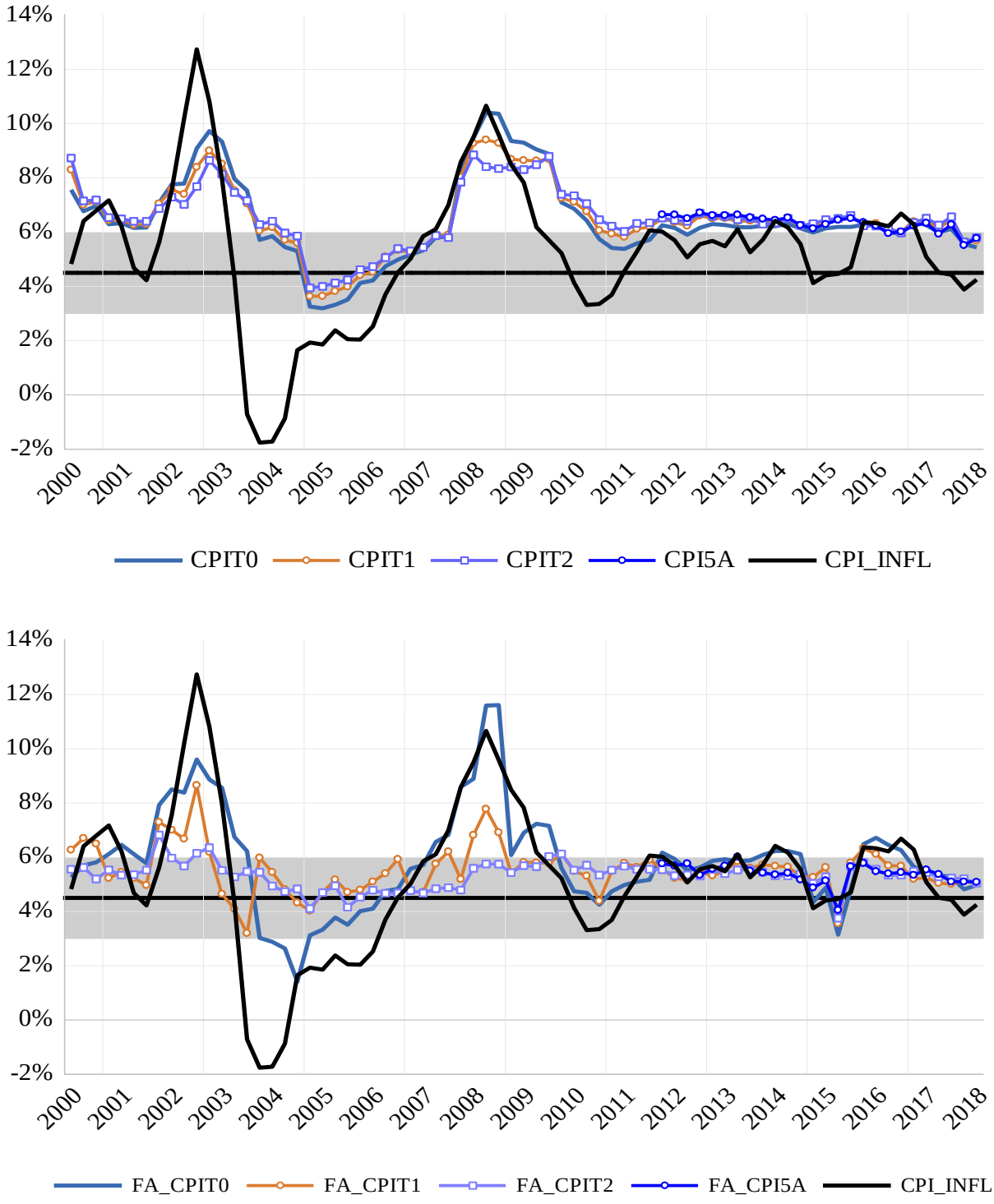
electricity and food) to construct an alternative measure of inflation. Broadly speaking, inflation developments were found to be similar. See the annexure.

29 To provide some perspective, we relegate to the annexure a plot that compares headline inflation in South Africa to the United States and the Eurozone. Post-GFC movements across all three economies are quite similar, though, of course, inflation rates average around 2% higher in South Africa than in the US or the Eurozone. Pre-GFC, the volatility of headline inflation in South Africa relative to the other two economies is what stands out.

30 There is a case to be made that the SARB was content to allow inflation to hover around the top edge of the band. This began to change after the sample of our study ends. See, for example, Reid et al. (2020c).

Figure 1: Inflation, inflation expectations and the SARB's inflation target



Notes: CPI is the Consumer Price Index. T0, T1, T2, 5A refer to current calendar year, next calendar year, 2 calendar years in the future, and five years into the future expectations of businesses. FA refers to the expectations of financial analysts. The shaded area is the SARB's inflation target. The dashed line is the midpoint of the inflation target (4.5%).

There are at least two ways to discern the import of sluggishness in inflation expectations. For example, if individuals are inattentive then observed economic fundamentals should not be related to forecast errors (e.g. see Kohlhas and Walter

2018). We relegate to the annexure regressions that show that, if fundamentals consist of inflation, real GDP growth and M3 growth, these statistically influence current, next year and two-year-ahead inflation expectations at both the firm and financial analyst levels with one exception, namely current year inflation forecasts of financial analysts.

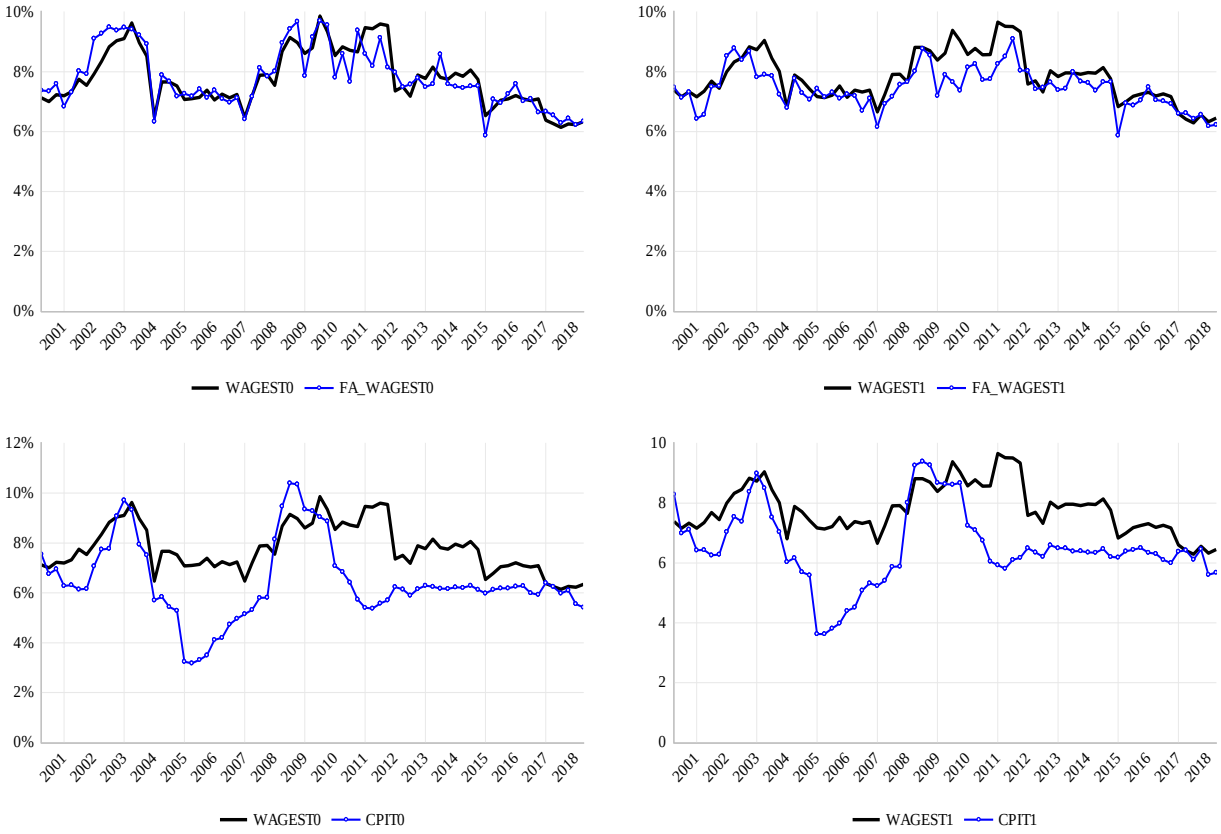
Alternatively, inflation expectations may be sluggish because they are well anchored, and this is thought to be one of the ingredients of a successful monetary policy regime. As noted above, there is no universally agreed to definition of anchoring. However, if we assume that the effective inflation target of the SARB over the period considered is 5% and we ask whether deviations in five-year-ahead inflation expectations from the target are statistically related to deviations in current, then one-year-ahead and two-year-ahead inflation expectations are on target.[31] Regression results can also be found in the annexure but these suggest that gaps between longer-run inflation expectations from the 6% target are influenced by similar gaps for shorter-run inflation expectations for both firms and financial analysts surveyed. Interestingly, however, there is an asymmetry among financial analysts surveyed since they are found not to respond to positive deviations from the target, only to negative deviations. A similar level of asymmetry is not found for the firms surveyed.

Figure 2 plots wage growth expectations of businesses and financial analysts first against each other (top portion) and then businesses' wage growth expectations against curent and one-year-ahead inflation expectations (bottom portion). Other than around the GFC, current and year-ahead wage growth expectations for both groups are quite comparable. The bottom portion of Figure 2 permits one to determine the evolution in the growth of expected real wages. Overall, real wage growth is positive, though the few years before the GFC and between 2010 and 2014 stand out with substantial increases in real growth expectations. Note, however, that real wage growth begins to converge toward zero toward the end of the sample. In general, it appears that real wage growth takes place when economic growth is strong but then,

[31] Five years ahead is assumed to proxy longer-term inflation expectations. In advanced economies, the 10-year horizon is typically considered to represent the long run. Arguably, given the inflation record of most emerging market economies, five years ahead is a reasonable proxy for long-run expectations. See Reid (2009) for some indication of how the extent of anchoring of South African expectations compared with that of other countries over the early part of the inflation-targeting period (2000–2008).

as economic conditions became more difficult in recent years, real wage growth expectations diminish considerably.

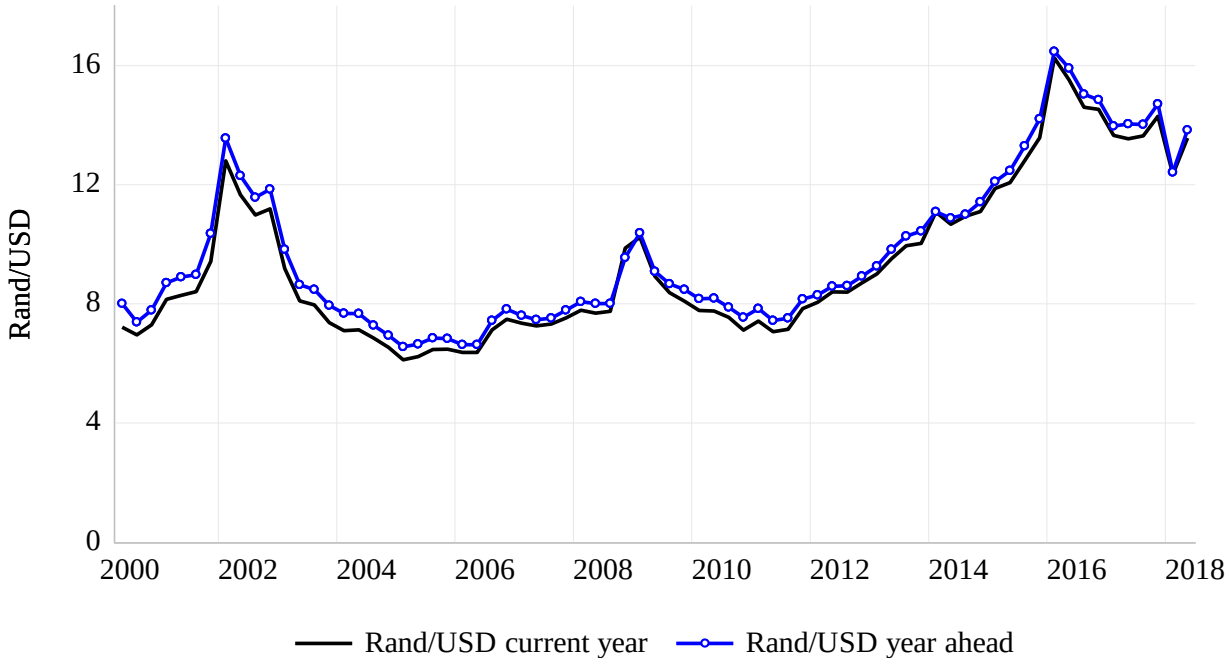
Figure 2: Wage growth expectations



Notes: T0 and T1 refer to current calendar year and one calendar year ahead. WAGES are wage growth expectations of businesses. FA are the same expectations of financial analysts. CPIT0 and CPIT1 are from Figure 1.

Figure 3, which plots expectations of the rand/USD nominal exchange rate level, displays a general trend toward rand depreciation over time, though there are three brief interruptions: the first between 2001–04, then again in the aftermath of the GFC (2008–09), and finally in 2016–18. We leave it for future research to detemine the extent to which firms' expectations for the rand are driven by changes in internal versus external economic conditions. We include these expectations due to the potential pass-thorugh effects from exchange rate changes to domestic inflation.

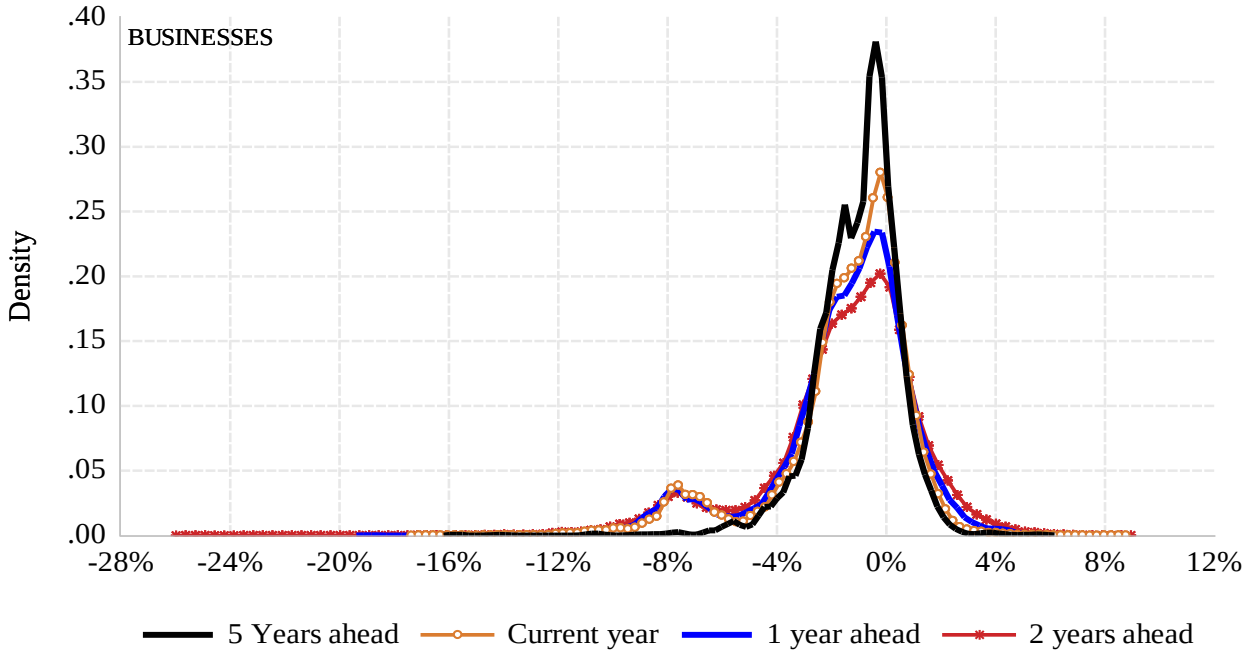
Figure 3: Rand/USD nominal exchange rate

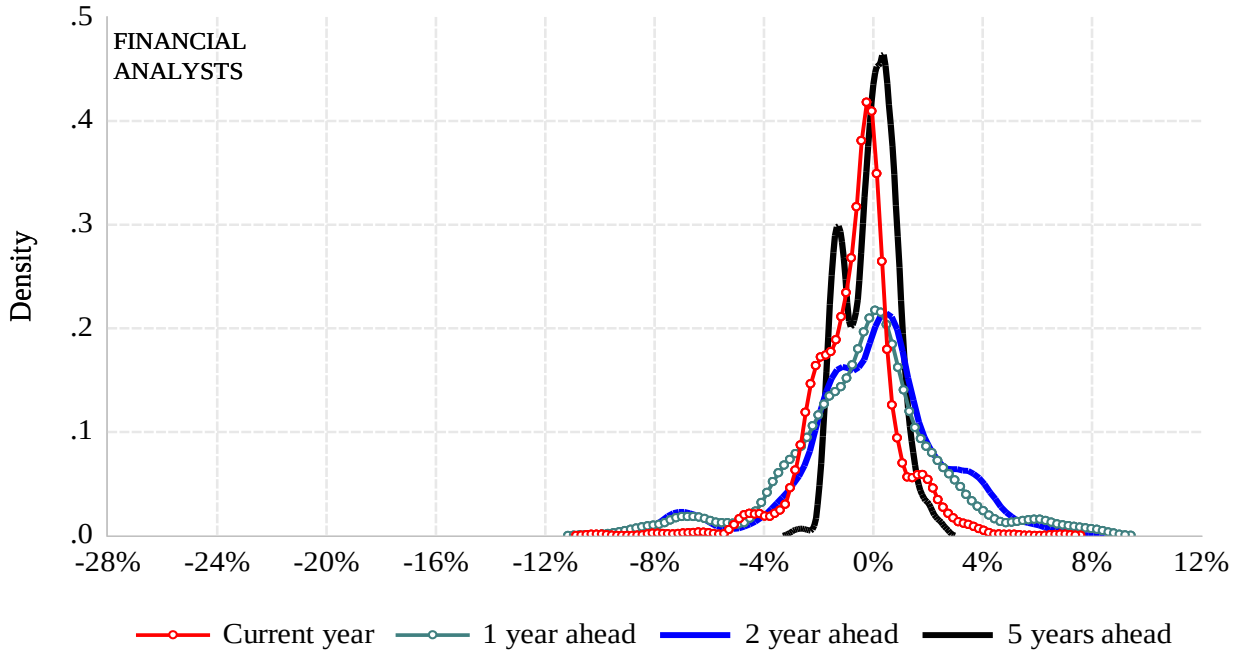


Notes: RANDT0, RANDT1 are the mnemonics used. Calendar year expectations are surveyed, and the plots shown are for businesses.

Figure 4 examines the distribution of inflation forecast errors, that is, the difference between observed and expected inflation at different horizons (see Figure 1). It is notable that whereas the peak of the disribution of these errors is around the 0% mark, for the most part this is truer the longer the forecast horizon considered. More interesting perhaps is that the distribution of these errors is skewed to the left both for firm and financial analyst forecasts, which suggests a tendency to over-estimate inflation over time. Over-estimation is somewhat more evident among the firms surveyed than for financial analysts. Nevertheless, broadly speaking, both distributions are comparable. It is also noticeable that the distribution of errors is wider the shorter the forecast horizon. This suggests that there is less disagreement about longer-run forecasts than short-run ones. Stated differently, the factors that drive long-run and short-run forecasts are likely to differ. This is also consistent with the literature on the anchoring of inflation expectations cited earlier which also highlights the need to distinguish between short- and long-run inflation forecasts.

Figure 4: Densities for forecast errors of inflation at different horizons: individual data





Notes: The Epanechnikov kernel is applied to data from 2000Q2–2018Q2 for inflation expectations at the horizons indicated. The mnemonics are defined in Figure 1. Forecast errors are observed inflation of individual businesses or financial analysts less expected CPI inflation at the appropriate horizon. For the 5-year horizon mean, CPI inflation is used.

5.2 Inflation and wage growth Phillips curves

A large number of Phillips curves were estimated. Three proxies for expectations are considered: firms, financial analysts and Consensus forecasts.[32] Next, Phillips curves were estimated for individual-level data (equation (2)), using panel Ordinary Least Squares, while data aggregated from individual-level data were used to estimate using Ordinary Least Squares and Generalised Method of Moments, and were supplemented with estimates from Markov-switching and restricted models. In the case of restricted models, we constrained forward- and backward-looking components to sum to one.[33] We also estimated versions of equations (1) and (2) by averaging current, one-year and two-year forecasts for inflation (or other forecasts) and by using the first principal component of all forecasts as a proxy for expectations. Measures of slack include forecasts of GDP growth, observed GDP growth or the observed unemployment rate.

When comparing Phillips curves for firms and financial analysts, we also estimate versions that either included or excluded forecasts of M3 growth, capacity utilisation and the long-term interest rate. Recall that the latter variables do not appear in the surveys of firms' expectations. In addition, we estimate separate Phillips curves with or without commodity prices. The latter were proxied either by oil prices (Brent prices) or the mean of price changes for South Africa's main commodity exports, namely, coal, iron ore, gold and platinum. Finally, estimates for the full available sample (i.e. 2000Q2–2018Q2), as well as pre-crisis (i.e. up to 2008Q3) and post-crisis (beginning 2008Q4) samples, are also estimated. In the case of individual-level data, we were also able to estimate Phillips curves for the crisis sample, defined as 2009Q1–2009Q3 based on the chronology of Hashimoto et al. (2012).

Given the large number of estimates that were generated, we report in Figure 5 box plots that report the range of estimates obtained for the slope of the Phillips curve (i.e. λ) as well as the forward- and backward-looking inflation variables (i.e. α, β,

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32 We considered using the forecasts published along with MPC meetings of the SARB but the data are available only since 2015Q3, which give us only 12 observations. A plot in the annexure reveals that, other than for 2015Q3, while inflation and real GDP growth forecasts across all three groups are broadly comparable, there is a persistent gap between SARB, financial analyst forecasts and ones from firms surveyed. In addition, SARB inflation forecasts tend to be lower than those of the other two groups.

33 This is consistent with the homogeneity postulate linking expectations to observed inflation.

repectively).[34] By way of illustration, Table 4 reports selected estimates based on both individual-level and aggregated data that are fairly representative of many Phillips curve estimates obtained.

Median estimates of the slope of the Phillips are higher for firms than for financial analysts. However, while median and mean estimates for financial analysts are approximately the same, mean estimates are lower for firm data than median estimates. It is also notable that the 95% confidence interval for estimates from firm-level data are considerably wider than for financial analysts. No outlier estimates were obtained though there is a wide gap between the first and third inter-quartile ranges for firm level vis-à-vis financial analysts data. Hence, higher growth rates or less economic slack is significantly related to inflation. Moreover, as shown in Table 4, the slope of the Phillips curve has become flatter since the GFC. This is true whether individual-level data are used (shown) or time series estimates are used (not shown). It is worth adding that the post-crisis sample consists of fewer than 40 observations in the aggregated time series version of the Phillips curve. Nevertheless, median estimates are close to ones obtained by Forbes et al. (2020), who estimate Phillips curves for a cross-section of 31 advanced and emerging market economies (South Africa is not included).

[34] A memorandum table gives the mean estimates shown in Figure 5 and selected estimates from South African and international Phillips curve studies. Overall, estimates are broadly comparable. Note that data, samples, specifications, measures of slack and, in the case of international evidence, countries differ from ones used in the present study.

Table 4: Selected Phillips curve coefficient estimates

(a) Individual-level data

	Firms				
Variables	Full	Pre-GFC	Crisis (GFC)	Post-GFC	2011Q3–2018Q2
GDP – mean	0.002	0.57	0.04	0.02	0.14
	(0.01)	(0.03)*	(0.01)*	(0.01)**	(0.01)*
π_{t-1}	0.25	0.04	INS	0.18	-0.07
	(0.01)*	(0.01)*		(0.01)*	(0.01)*
CPIT0	0.41	0.16	0.004	0.24	0.14
	(0.01)*	(0.02)*	(0.01)	(0.01)*	(0.01)*
	Financial Analysts				
GDP – mean	0.02	0.28	0.001	-0.23	-0.23
	(0.07)	(0.18)	(0.03)	(0.04)*	(0.06)*
π_{t-1}	0.30	0.57	INS	0.21	0.57
	(0.04)*	(0.08)*		(0.02)*	(0.10)*
CPIT0	1.15	0.87	0.12	1.02	1.04
	(0.04)*	(0.08)*	(0.07)	(0.04)*	(0.05)*

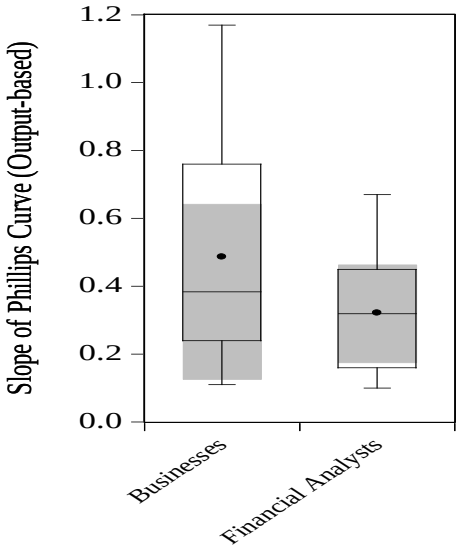
(b) Aggregated data

Variables	Firms	Financial analysts
GDP growth	0.22	0.22
	(0.09)**	(0.06)*
π_{t-1}	0.78	0.81
	(0.13)*	(0.13)*
CPIT - mean	0.33	0.57
	(0.18)***	(0.33)*

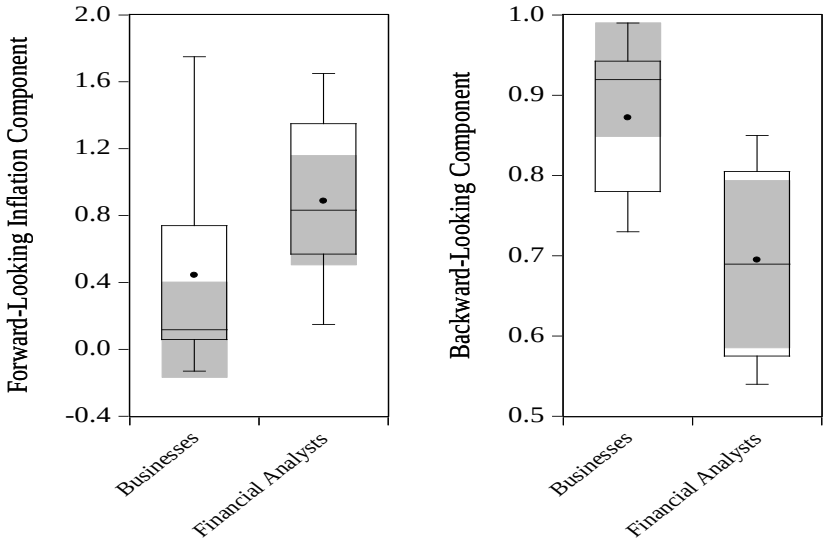
Notes: Estimates of versions of equations (1) and (2). Only selected coefficient estimates are shown. GDP growth is observed current GDP growth. π_{t-1} is lagged observed inflation. CPIT0 is expected inflation in the current period. CPIT - mean is the arithmetic mean of current, one- and two-year-ahead expected inflation. The full sample is 2000Q2–2018Q2; Pre-GFC is 2000Q2–2008Q3; Post-GFC is 2008Q4–2018Q2; crisis (GFC) is 2009Q1–2009Q3. INS means insufficient or the data are unavailable. Estimates in part (a) estimated via OLS; GMM used in part (b) estimates. * means statistically significant at the 1% (** 5%; *** 10%) level of significance.

Figure 5: Box plots of the slope of the Phillips curve, backward- and forward-looking inflation components

(a) Slope of Phillips curve



(b) Forward- and backward-looking components



Notes: Part (a) reports estimates of λ for the variety of specifications described in the text. Similarly, for α, β, respectively, reported in part (b) of the table. The specifications sampled exclude commodity prices (see text). The point represents the mean, the shaded area the 95% confidence interval, and the box is defined by the median (flat line), the 1st and 3rd quartiles, with estimates three times the interquartile range shown as the whiskers. All box plots are based on full sample estimates (2000Q2–2018Q2, before lags or transformations).

Memo to Figure 5: Selected estimates

	South Africa			International		
SLOPE	This study (means)	Botha et al.	Kabundi et al.	Forbes et al.	Cunningham et al.	Binder
Business Financial Analysts	.49 .32	[.07,.54] output [.08,.78] wage	[-.15,.-.27] unemployment	[-.15, -.35] "slack"	[-.36,. -.55] unemployment	[-.15, -.23] unemployment
Backward-Looking						
Businesses Financial Analysts	.87 .70	[.58,.83]	[.65,.83]	[.56,.61]	[.11,.14]	.33
Forward-Looking						
Businesses Financial Analysts	.44 .89	[.31,.56]	NA	[.70,.84]	NA	.67

Notes: Range of statistically significant point estimates shown for selected studies. Botha et al. (2020) from Tables 2 and 3; Kabundi et al. (2019) based on estimates in Figure 5; Cunningham et al. (2019) based on Table A-1 cols (2) and (10); Forbes et al. (2020) based on Table 1. NA means no estimate or variable used.

We now turn to estimates of the forward- and backward-looking components of the Phillips curve. While the mean estimate of the forward-looking component is around 0.4 for firms, it is considerably higher at around 0.8 among financial analysts. Mean estimates are close to zero for firms surveyed. Indeed, based on the 95% confidence intervals shown, there is no evidence of forward-looking behaviour influencing current period inflation. Figure 5 also indicates firms view inflation as being far more persistent than do financial analysts. Whereas the median estimate of β is around 0.7 for financial analysts, and this is virtually identical to mean estimates of coefficients obtained, the median estimate for firms is around 0.9 with the mean estimate just above 0.85. Confidence intervals of 95% are narrower for firms surveyed and we can easily conclude that estimates are statistically significantly higher than for financial analysts.[35]

[35] Additional sensitivity tests were conducted for both the individual-level and aggregated datasets. For example, we added oil price inflation lagged one quarter (Brent price) and the average of four commodity prices (coal, iron ore, gold and platinum) as proxies for external import and domestic export factors that might affect domestic inflation. For the most part, these additional variables were statistically insignificant although, for a few specifications relying on data for financial analysts, commodity prices did affect inflation though the estimated coefficients suggest they are economically small.

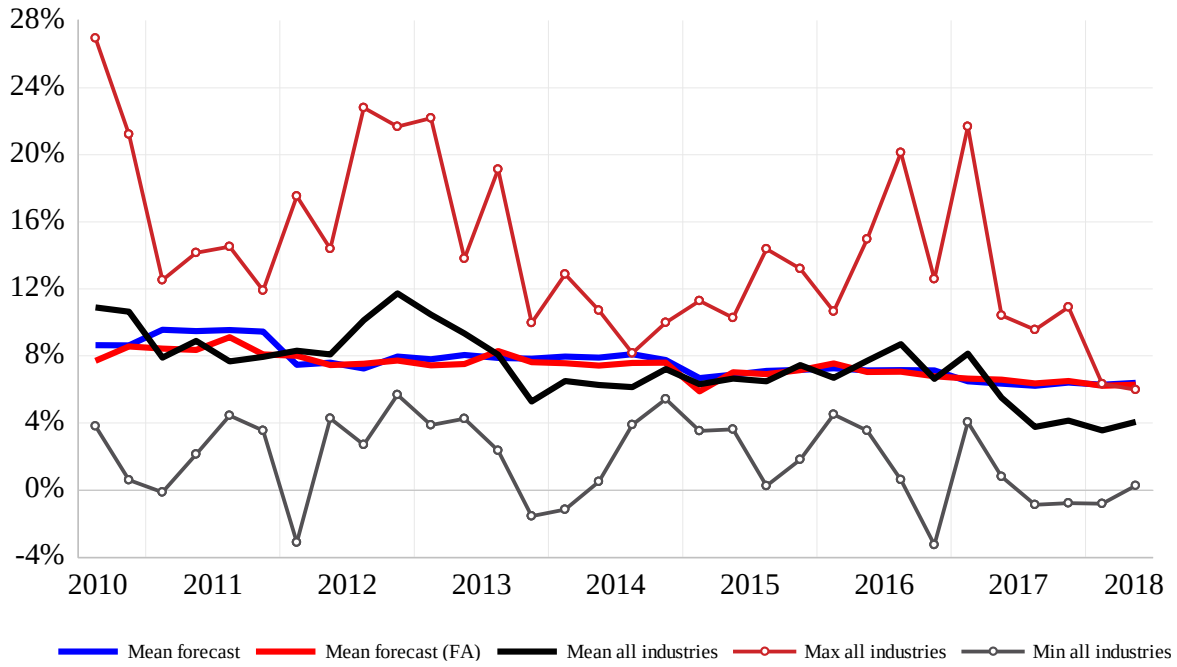
Next, we turn to estimate wage growth-based Phillips curves. The challenges with the available data were noted earlier. However, it is worth reminding readers of two additional limitations of the estimates discussed below. First, data from input-output tables or Quantec data are annual. Moreover, SIC classification used by Quantec data differ somewhat from ones generated from the BER survey (details are in the annexure). In the case of data constructed from Stats SA's QES, data are available only since 2009. Hence, we are not able to perform pre- versus post-GFC comparisons to ascertain whether this form of the Phillips curve has become flatter. Accordingly, we report below results using QES data only.[36]

Figure 6 plots a summary of growth rates from the QES data alongside wage growth forecasts from the survey of firms and fianncial analysts. The top and bottom lines give a sense of the range of growth rates experienced across the 11 industries for which we have data.[37] The range of observed wage and salary growth rates is quite large. However, when mean observed growth rates are compared to survey forecasts differences they are, for the most part, small, though it is also clear that forecasts are noticeably less volatile than outturns. Indeed, a plot of mean observed and expected wages over the available two-year horizon (see the annexure) reveals that both series track each other over time. Nevertheless, it is also the case that actual wage growth typically exceeds expectations.

[36] We relegate to the annexure a comparison of wage growth rates for QES versus annual data from Quantec. At this frequency the two data sources are comparable even if some estimates can be more volatile than others.

[37] The industries covered by the QES data that are compatible with the BER survey are: Manufacturing, Electricity, Water, Construction, Finance, Information and Communication, Public Administration, Education, Arts, Professional services, and Health.

Figure 6: Growth rates in wages in South Africa: QES Survey



Notes: Year to year rate of change in wages and salaries using data drawn from Stats SA's QES. Mean forecasts for businesses and mean forecasts (FA) are for financial analysts are for the one-year-ahead horizon (see Figure 1).

Table 5 presents some estimates of wage growth-based Phillips curves. Once again, a large number of variants of equation (2), replacing inflation with wage growth as the dependent variable, were considered. Coefficient estimates shown in Table 5 are largely unaffected by specification changes (not shown). Moreover, as revealed by the test for redundant fixed effects, coefficient estimates do not change much even if no fixed effects are included. Nevertheless, the results shown include fixed effects.[38] The first variant considered (column 2) uses lagged observed values for some of the control variables. Moreover, in case wage growth is affected by the kinds of series subject to survey among financial analysts, that is, long-term interest rates, M3 growth, and capacity utlisation, we included these as well. The estimates in column 4 then use financial analysts' forecasts of these same control variables. Note also that the specifications shown include both forward- and backward-looking inflation and wage growth variables, the rate of change in oil prices (Bent),[39] as well as rand/USD

[38] The fixed effects reveal something about the range of wage and salary growth estimates displayed in Figure 6 since electricity and public administration sectors experience relatively higher wage growth while the health sector does relatively poorly, compared to all other sectors. This seems consistent with comments from successive IMF Article IV and OECD annual reports mentioned earlier.

[39] One variant replaces oil prices with the mean rate of change of critically important commodity prices (see note 28 above). The conclusions shown in Table 5 are unchanged.

depreciation or rand forecasts. The latter may be thought of as proxying the possible pass-through effects from exchange rate changes.

Table 5: Selected wage Phillips curve estimates

Variable	Wage growth	Variables	Wage growth
Mean: CPIT0&CPIT1	2.36 (1.22)**	Mean: CPIT0&CPIT1	1.46 (1.07)
π_{t-1}	-0.23 (0.34)	Mean: CPIT0&CPIT1	0.47 (0.29)
Mean: WAGEST&WAGEST1	0.47 (0.32)	Mean: WAGEST&WAGEST1	1.01 (0.37)*
$w_{t-1}^{\cdot}$	0.36 (0.05)*	$w_{t-1}^{\cdot}$	0.35 (0.05)*
Mean: GDPT0&GDPT1	1.54 (0.62)*	Mean: GDPT0&GDPT1	2.50 (0.76)*
Brent$_{t-1}$	0.006 (0.03)	Brent$_{t-1}$	-0.07 (0.02)*
Rand$_{t-1}$	0.07 (0.03)	Mean: RANDT0&RANDT1	-0.03 (0.79)
Prime$_{t-1}$	2.39 (1.34)†	Mean: PRIMET0&PRIMET1	0.43 (0.80)
Long-term interest rate$_{t-1}$	-1.12 (0.69)†	Mean: R153T0&R153T1	-1.34 (0.57)**
M3 Growth$_{t-1}$	-0.20 (0.26)	Mean: M3T0&M3T1	-0.42 (0.37)
Capacity utilisation$_{t-1}$	0.003 (0.19)	Mean: CAPACITYT0&CAPACITYT1	0.04 (0.03)
Summary statistics		***Summary statistics***	
Cross-section Fixed effects	1.62 (0.10)	Cross-section Fixed effects	1.67 (0.09)
No. of cross-sections	11	No. of cross-sections	11
No. of observations (per cross-section/total)	31/341	No. of observations (per cross-section/total)	31/341
Adj. R^2	0.32	Adj. R^2	0.33
F-stat.	8.80 (0.00)	F-stat.	8.99 (0.00)

Notes: For coefficient estimates, standard errors are shown in parenthesis. * means statistically significant at the 1% (** 5% level; † 10% level). For summary statistics, p-values are given in parenthesis. Least squares estimation used. In the first column, variables in *italics* observed values for the series shown, lagged one quarter, are used. Constant and fixed effects not shown to conserve space.

The choice of using observed versus expected values for the control variables influences the statistical significance of some of the variables even if, broadly speaking, past wage growth as well as past growth performance always have a positive impact on current wage growth while past inflation does influence wage growth.[40] Hence, a 1% rise in expected inflation raises wages proportionately more in one case but becomes insignificant when additional forward-looking variables are added (column 4).

[40] Omitting the control variables produces results somewhat closer to column 2.

Indeed, based on the estimates given in column 2, a 1% rise in expected inflation generates a rise in real wage growth which is consistent with the stylized facts shown in Figure 2 discussed earlier. Even though oil prices and rand depreciation are significant in one of the two specifications shown, the coefficients suggest that these variables are not economically significant. Finally, there is some evidence that long-term interest rates negatively impact wage growth in an economically significant manner. To the extent expected, increases in long-term government bond yields reflect higher future expected interest rates, but are not reflected in expected changes in the prime rate. The results suggest that borrowing costs impact wage growth.

6. Conclusions

This study has two principal aims. First, to introduce and analyse an important and, at the international level, novel survey of firms' and financial analysts' expectations not only of inflation but of several critical macroeconomic and financial variables. Second, the survey results are used to estimate a variety of Phillips curves, both of the inflation- and wage growth-based kind.

A few salient conclusions can be drawn. The behaviour of inflation expectations, in particular, change around the time of the GFC. Moreover, expectations begin to settle around the top of the inflation target band and show some signs of declining toward the midpoint of the band at the end of our sample, though the decline is more visible among the financial analysts surveyed than among the firms in our dataset. Generally speaking, inflation forecasts of firms are comparable to ones provided by financial analysts. Nevertheless, important differences between the two groups remain. For example, forecast errors are relatively more persistent among firms surveyed. Forecasts of other variables, such as real GDP, the prime interest rate, wage growth and the rand/USD exchange rate, display similar differences.

As reported recently for several advanced economies, the slope of the Phillips curve in South Africa became flatter after the end of the GFC. Although this result holds based on both firms' and financial analysts' forecasts, the latter group places a larger weight on the forward-looking component of the Phillips curve while firms surveyed attach a larger weight to the past history of inflation. That said, there are considerable differences in the estimated slope of the Phillips curve between the two groups. Some of these differences can be traced to industry-level effects as well as to differences in

the outlook of other variables survey respondents are asked to provide (e.g. the exchange rate and interest rates).

Finally, we estimated a few wage-based Phillips curves, though data limitations inhibit direct comparisons with traditional Phillips curve estimates. Nevertheless, it appears that expectations of higher real wage growth might be traced to an overreaction of observed wage growth to a rise in either inflation or wage growth, either expected or past. The question of whether this suggests support for the 'wages affected by inflation' hypothesis versus the 'strategic attempts to claim a larger part of the pie' hypothesis is left to future research.

Beyond attempting to improve our ability in estimating wage-based Phillips curves, there are other potential extensions to this paper. One important step would be to explore inter-industry differences and potential drivers of these. This would involve at least two steps. Firstly, analysing the composition of the survey sample over time to explore whether this has any impact on our ability to analyse data about the individual industries. As we noted, it is possible that our estimates are affected by changes in the response rate among firms surveyed over time, and there are indications in the data of a potential source of bias, the importance of which is unclear at this stage. Once we better understand the sample composition, a second step could be to explore other characteristics of specific industries, such as exposure to the exchange rate or import and export activity, to provide more detail about the drivers of differences in the expecations across industries.

After describing differences across industries, a natural next step could be to condition our Phillips curve slope estimates to consider the impact of central bank communication. One way of addressing this issue is to estimate Phillips curves during quarters when the SARB publishes a Quarterly Bulletin or the Monetary Policy Review (and when accompanying Monetary Policy Forums take place) and compare these to periods without these publications. The dataset used in this study would, in addition, allow us to determine which industries respond to such signals. Alternatively, we could measure the tone of SARB policy rate statements and ask whether this impacts inflation expectations during quarters when these are published or indirectly perhaps affect the Phillips curve. An important omission in surveys of the kind used to examine the behaviour of expectations is that we are unable to determine where firms and financial analysts obtain information used to construct their expectations. We suspect,

but cannot empirically demonstrate, that firms' expectations are likely driven by input costs while financial analysts might consider broader macroeconomic information and global factors. That said, we cannot observe where information is obtained. We can only speculate on whether some form of inattention, rational or otherwise, is at play. Indeed, if forecasts are partly based on information obtained from media outlets, then, as far as the SARB is concerned, biases may well stem from how the press reports and interprets inflation and economic developments, as discussed in Reid et al. (2020c). Clearly, this will have implications for how the central bank communicates with the public.

Finally, growing interest in the role of uncertainty suggests a role for inflation uncertainty and whether this is related to uncertainty in the behaviour of the other macroeconomic and financial variables that survey respondents are asked to forecast.

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