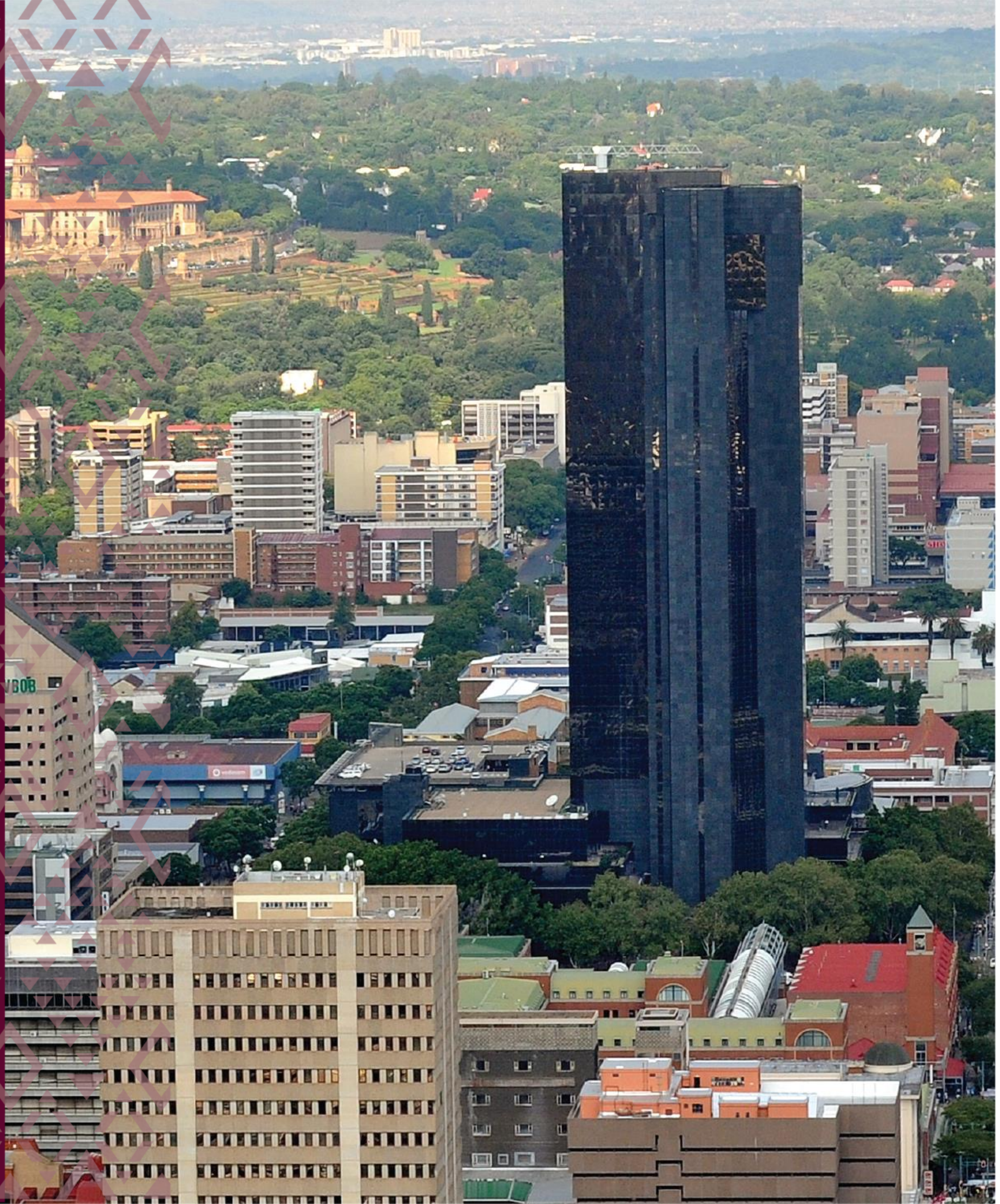

Whose Inflation Expectations Forecast Best?

Alternatives Based on Survey and Financial Data

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Motivation for this Paper

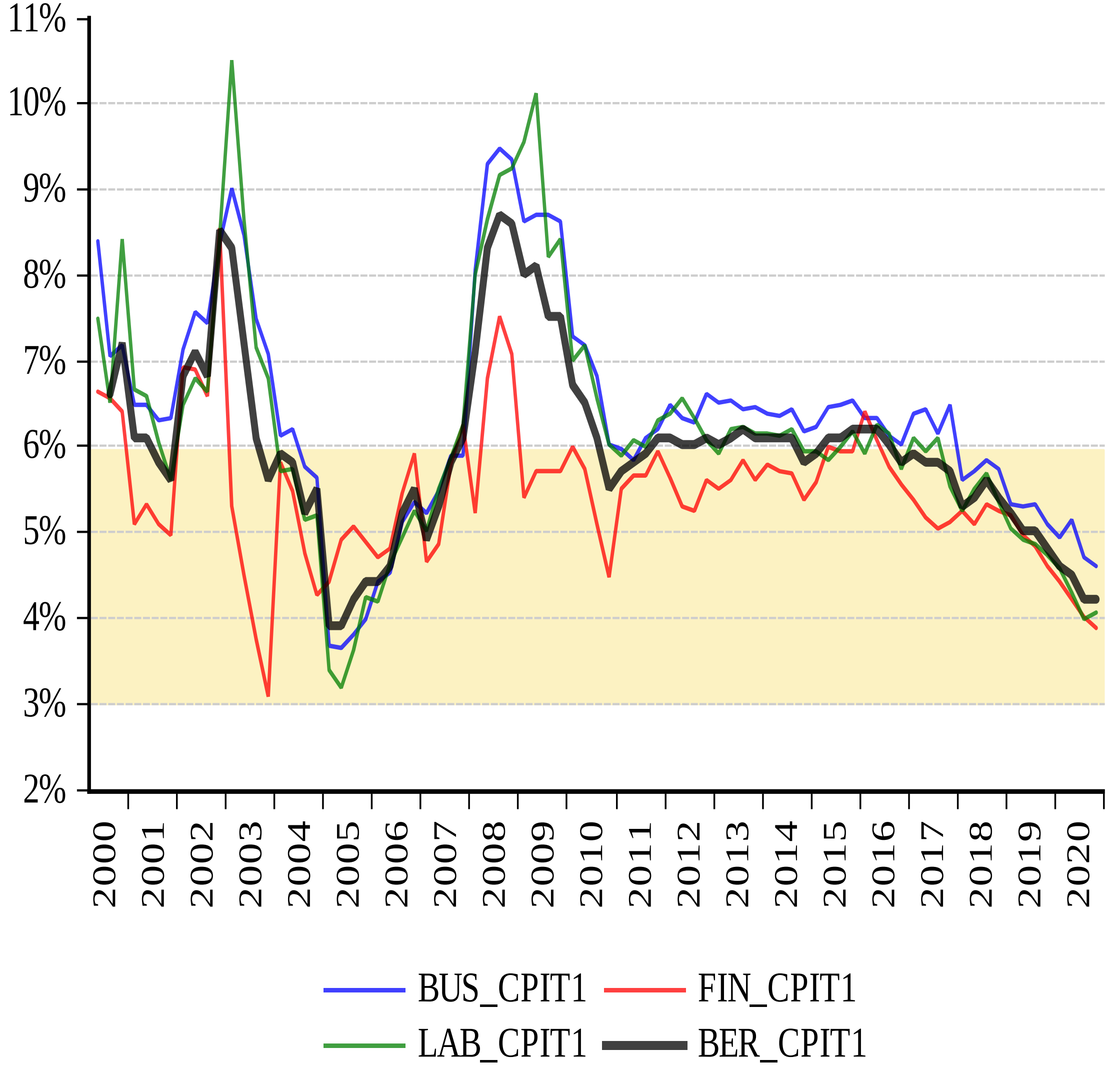
- Increasing attention on using microdata to answer macro questions
  - Main focus of the literature: (1) Expectations formation using micro data, and (2) Modelling the behaviour (typically models incorporating heterogeneity)
  - Our Question: What does this mean for models that require a single measure of expected inflation, such the Quarterly Projection Model of the SARB?
- Principles of inflation forecasting (Faust and Wright, 2013)
  1. Subjective forecasts do best;
  2. Good forecasts must account for a slowly varying local mean;
  3. Good forecasts begin with high quality nowcasts; and
  4. Heavy shrinkage in the use of information improves inflation forecasts

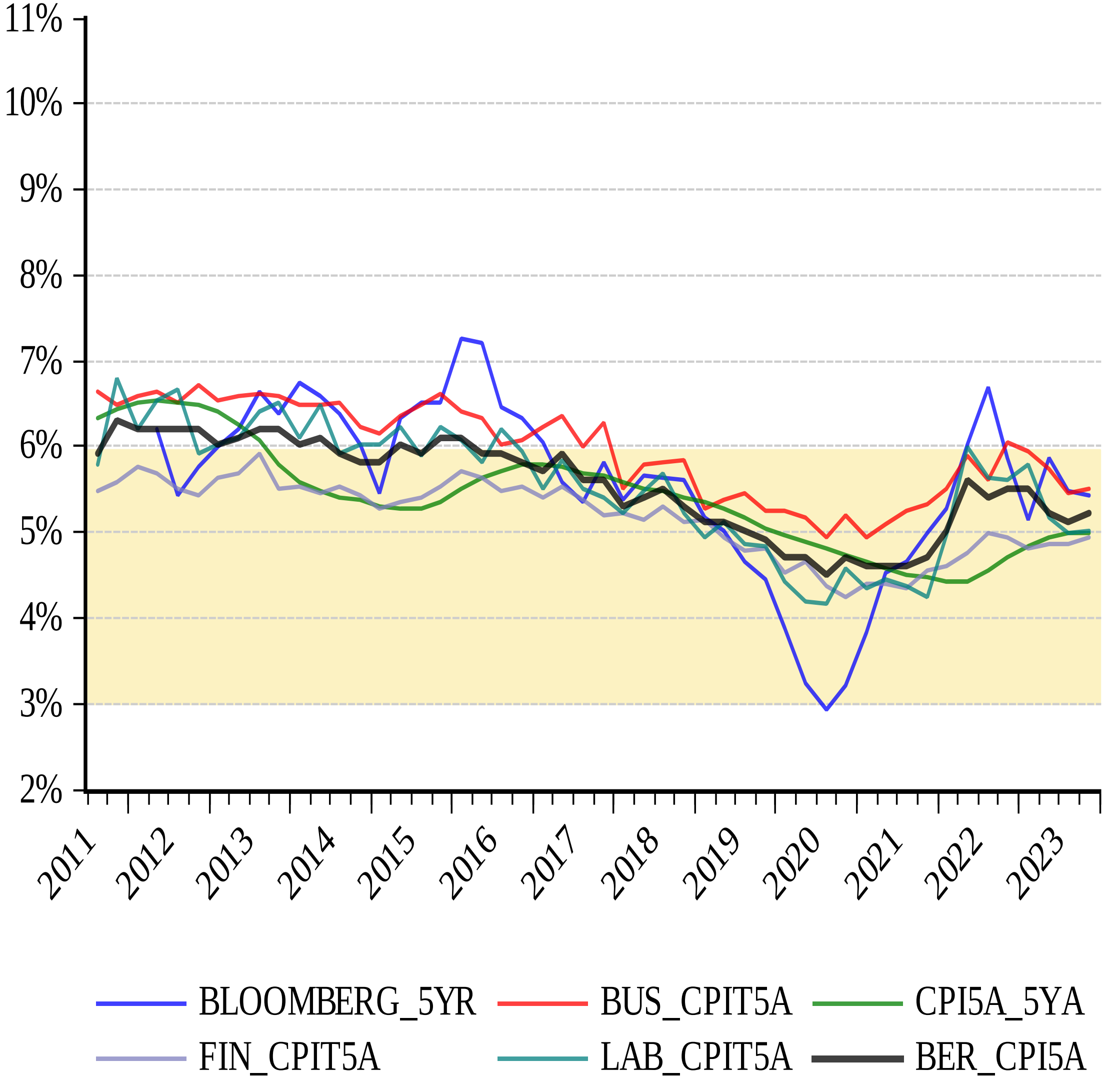
Our choices

- Aggregation across groups:
  - ‘BER aggregate’ – arithmetic mean
- Aggregation at the group level:
  - BER Financial analysts (FA)
  - BER Businesses (BUS)
  - BER Trade Unions (TU)
- Asset price data (Bloomberg)
- Some other form of aggregation
  - Factor models

Q: Whose Inflation Forecast performs best?

Selected Aggregated Forecasts: 1 & 5 YR Horizons





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Alternative (possibly better) forms of aggregation

Demeaned inflation Forecast – could also be standardized

$$\tilde{\pi}^{e}_{t,h} = \pi^{e}_{t,h} - \bar{\pi}^{e}_{t,h} = \sum_{i=1}^{m} \lambda_{i,h} f_{i,h} + \varepsilon_{i,h}$$

Expected inflation (forecast) @ time *t* for horizon *h*

Average inflation forecast
NOTE: aggregate used BUT other benchmarks are possible

Loadings: <u>unequal</u> unlike arithmetic averaging

Factors: <u>limited to 1</u> – often supported by the data …but extensions are possible

Testing Forecasts: Which metrics?

- **RMSE**

$$RMSE_{t,h} = \sqrt{\sum_{j=1}^{k}(\pi_{t,h} - \pi^{e}_{t,h})^2}$$

Problems: (1) Scale-dependent. Arguably heterogeneity of forecasts across BUS, FIN, and LAB imply different distribution shapes not controlled for in RMSE; (2) sensitive to 'outliers'; (3) If FE = 0 then RMSE is undefined (or infinite) – a real problem only if this occurs frequently; (4) can be artificially skewed

- **MASE**

$$FE_{t,h} = \pi_{t,h} - \pi^{e}_{t,h}$$

$$q_{t,h} = \frac{FE_{t,h}}{{}^{1}/_{k-1}\sum_{j=2}^{k}\left|\Delta\pi_{t,h}\right|}$$

$$MASE_{t,h} = mean(\left|q_{t,h}\right|)$$

Hyndman & Koehler (2006) propose a scale invariant measure that is also easier to interpret. For example, an MASE $<$ 1 means that it outperforms than a naïve one-step ahead forecast. If MASE $>$ 1 then a naïve forecast is superior.

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Reminder: Superiority Relative to naïve forecast
(if MASE = 1 the two forecasts are equally accurate)

MASE Results

Type	CPI T0	CPI T1	CPI T2	CPI 5a
BER	0.515	**0.402** ^{3}	**0.333** ^{3}	0.451
BUS	0.618	0.633	0.583	0.990
FIN	**0.324** ^{2}	**0.026** ^{2}	**0.076** ^{2}	0.743
LAB	**0.494** ^{3}	0.512	0.491	**0.339** ^{3}
Factor Model	**0.003/0.088*** ^{1}	**0.003/0.070*** ^{1}	**0.016** ^{1}**/0.057***	**0.423/0.290*** ^{2}
Bloomberg	NA	NA	NA	**0.315** ^{1}

“Calm” sub-sample

Type	CPI T0	CPI T1	CPI T2	CPI 5a
BER	0.847	**0.796** ^{3}	**0.763** ^{3}	**0.287** ^{2}
BUS	0.847	0.918	0.916	0.984
FIN	**0.533** ^{2}	**0.432** ^{2}	**0.314** ^{2}	0.872
LAB	**0.760** ^{3}	0.832	0.826	**0.364** ^{3}
Factor Model	**0.072** ^{1}	**0.164** ^{1}	**0.246** ^{1}	**0.154** ^{1}
Bloomberg	NA	NA	NA	0.491

Volatile sub-sample

Type	CPIT0	CPIT1	CPIT2	CPI5a
BER	0.411	**0.248** ^{3}	**0.161** ^{2}	0.732
BUS	0.525	0.505	0.437	1
FIN	**0.258** ^{2}	**0.059** ^{2}	**0.176** ^{3}	**0.330** ^{3}
LAB	**0.394** ^{3}	0.384	0.350	**0.299** ^{2}
Factor Model	**0.026** ^{1}	**0.055** ^{1}	**0.060** ^{1}	0.749
Bloomberg	NA	NA	NA	**0.100** ^{1}

Summary

- Simple arithmetic averaging of BUS, FIN, and LAB inflation expectations (i.e., the BER forecast) rarely yields the best forecast
- A simple factor model seems to consistently perform quite (confirming principles 1 and 4 from Faust and Wright)
- Which forecasts do best in volatile periods (‘non-normal times, when models too are performing poorly)?
    - We are less confident about these results
    - MASE suggests factor models, BER average and FAs do best in both calm and volatile periods, with TUs also offering good insight for T0 and T5
    - RMSE suggests financial analysts do best in ‘normal times’ and labour in volatile times (business not too far behind)

THANK YOU

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Selected Other Results

- Added to Appendix

RMSE Results

Full Sample

Type	CPIT0	CPIT1	CPIT2	CPI5a
BER	**1.766** [3]	**2.033** [2]	**2.214** [3]	**0.411** [1]
BUS	2.085	2.210	2.362	0.688
FIN	**1.449** [2]	2.162	2.426	**0.414** [2]
LAB	1.955	**2.063** [3]	**2.184** [2]	**0.541** [3]
Factor Model	**0.864** [1]	**1.085** [1]	**1.304** [1]	1.060
Bloomberg	NA	NA	NA	0.917

"Calm" Sub-Sample

Type	CPIT0	CPIT1	CPIT2	CPI5a
BER	**0.959** [3]	**1.117** [3]	**1.233** [3]	**0.827** [2]
BUS	1.291	1.447	1.562	1.112
FIN	**0.555** [1]	**0.854** [1]	**0.967** [1]	**0.720** [1]
LAB	1.162	1.269	1.355	0.868
Factor Model	**0.833** [2]	**0.966** [2]	**1.134** [2]	**0.851** [3]
Bloomberg	NA	NA	NA	0.893

"Volatile" Sub-Sample

Type	CPIT0	CPIT1	CPIT2	CPI5a
BER	**2.196** [3]	**2.253** [2]	**2.741** [3]	1.389
BUS	2.526	2.646	2.821	1.397
FIN	**1.860** [2]	2.769	3.106	1.614
LAB	2.387	**2.503** [3]	**2.645** [2]	**1.246** [2]
Factor Model	**0.934** [1]	**1.317** [1]	**1.626** [1]	**1.378** [3]
Bloomberg	NA	NA	NA	**0.890** [1]

BER data

Variable	Trimmed CPI Inflation Forecast (excludes +/-20% of the distribution) Mean (S.D.)			Not Trimmed Inflation Forecast Mean (S.D)		
Survey Source	Business	Fin. Analysts	Trade Union	Business	Fin. Analysts	Trade Union
Current Year: T0	6.18 (1.53)	5.60 (1.76)	5.96 (1.56)	6.19 (1.53)	5.96 (1.56)	5.96 (1.56)
One Year Ahead: T1	6.20 (1.21)	5.37 (0.82)	6.02 (1.44)	6.29 (1.25)	5.37 (0.82)	6.05 (1.42)
FH Two Years Ahead: T2	6.18 (1.06)	5.19 (0.47)	6.04 (1.33)	6.31 (1.09)	5.18 (0.48)	6.08 (1.32)
FE Average Over 5 Years Ahead: 5Y	5.88 (0.55)	5.18 (0.48)	5.49 (0.71)	5.95 (0.55)	5.15 (0.44)	5.54 (0.72)
Observed inflation	5.32 (2.56)					

SAMPLE: 2000Q2-2023Q4

Other Summary statistics

BUS: Up to 30000+ Observations
By firm SIZE
By Position of Respondent
By SIC

FIN: 1600+ Observations
By firm SIZE
By Position of Respondent
By Sector

LAB: 1400+ Observations
By firm SIZE

Probability	BUST0	BUST1	BUDT2	BUS5A
BUS T1	**0.94**	1.00		
	18.67	-----		
	0.00	-----		
BUS T2	**0.90**	**0.97**	1.00	
	13.96	28.08	-----	
	0.00	**0.00**	-----	
BUS 5A	**0.03**	**0.02**	**0.05**	1.00
	0.20	0.14	0.35	-----
	0.84	0.89	0.73	-----
FIN T0	**0.33**	**0.26**	**0.22**	**0.10**
	2.44	1.83	1.58	0.68
	0.02	**0.07**	0.12	0.50
FIN T1	**0.48**	**0.46**	**0.49**	**0.21**
	3.81	3.57	3.90	1.48
	0.00	**0.00**	**0.00**	0.15

Simple correlation between pairs of forecasts

Encompassing tests

- Evidence of 'superiority' in combining forecast data

Encompassing Tests: Full and Sub-samples 2009Q2-2023Q4

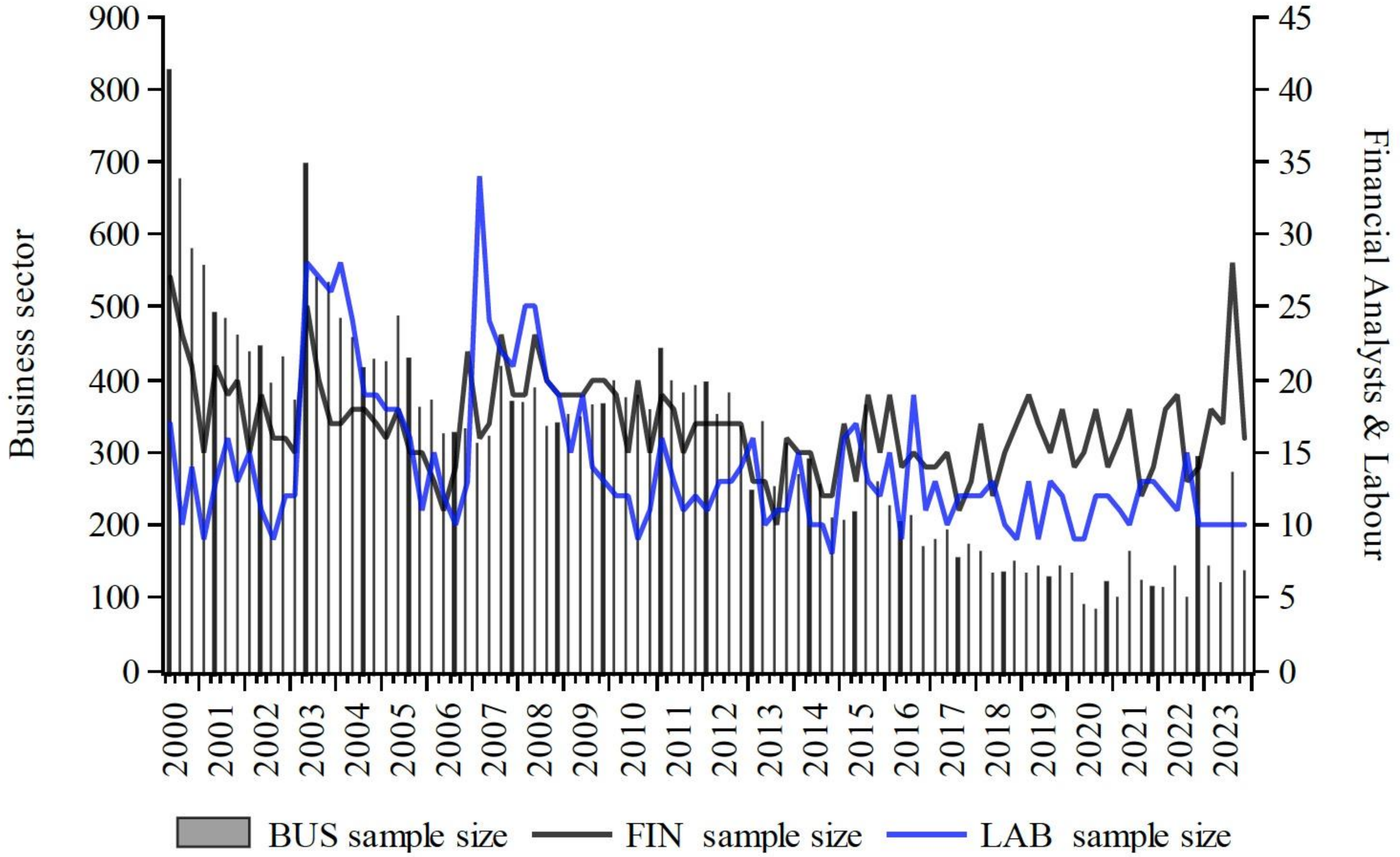
Forecast horizon	BER vs BUS		BER vs FIN		BER vs TU		BER vs SARB	
	Full	Sub	Full	Sub	Full	Sub	Full	Sub
T0	.00	.00	.00	.00	.00	.00	.00	.00
T1	.00	.00	.00	.01	.00	.00	.00	.00
T2	.00	.72	.00	.00	.03	.00	.00	.00
5a	.69	.69	.00	.00	.00	.00	.00	.00

Factor loadings

(b) Extended Model– Full Sample

Forecast horizon	Business	Financial Analysts	Trade unions	SARB
	Full	Full	Full	Full
T0	0.965	0.893	0.966	0.898
T1	0.934	0.683	0.927	0.595
T2	0.952	0.785	0.924	0.485
5a	0.959	0.928	0.953	0.856

BER Survey: No. Observations By Year/Quarter



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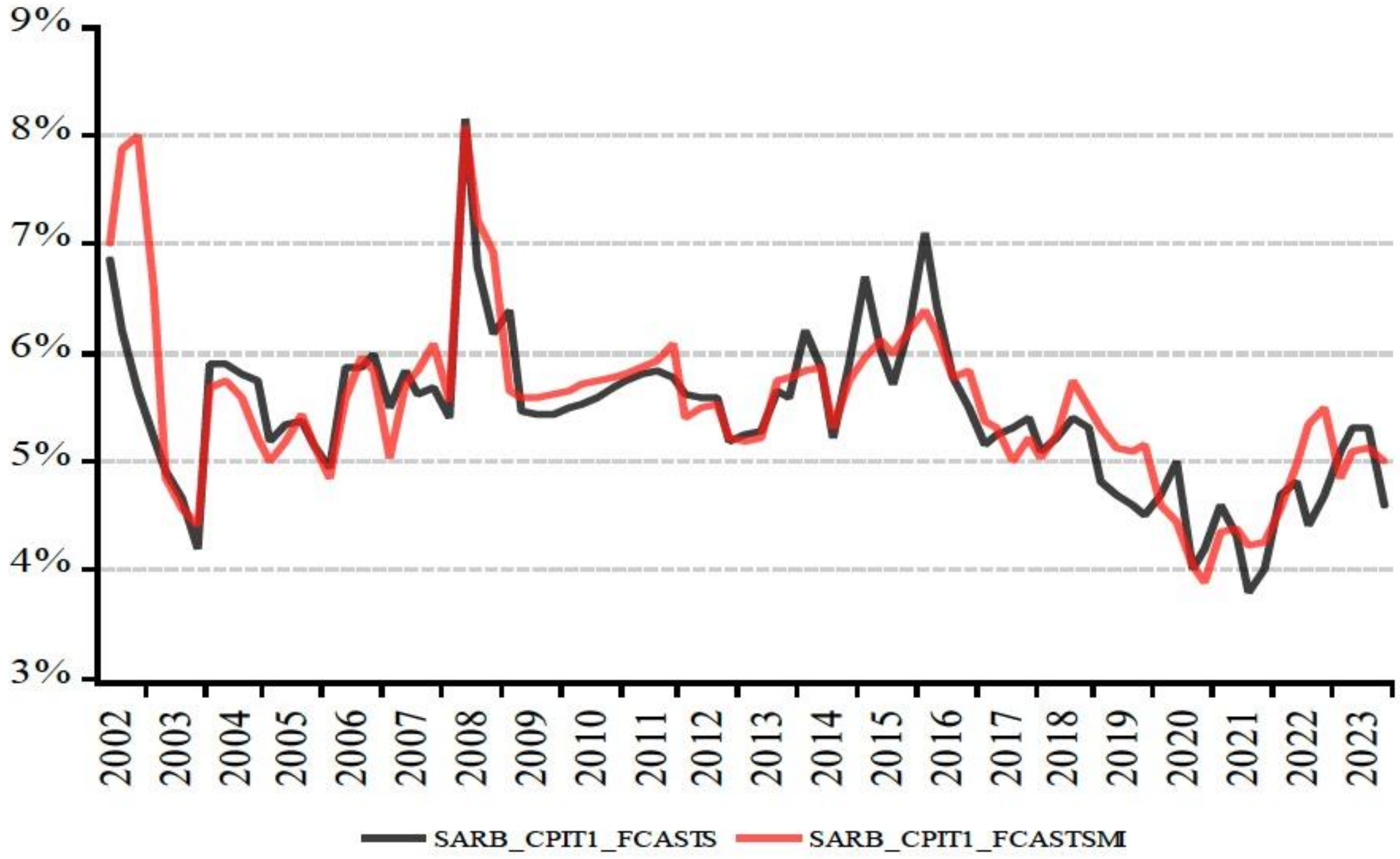
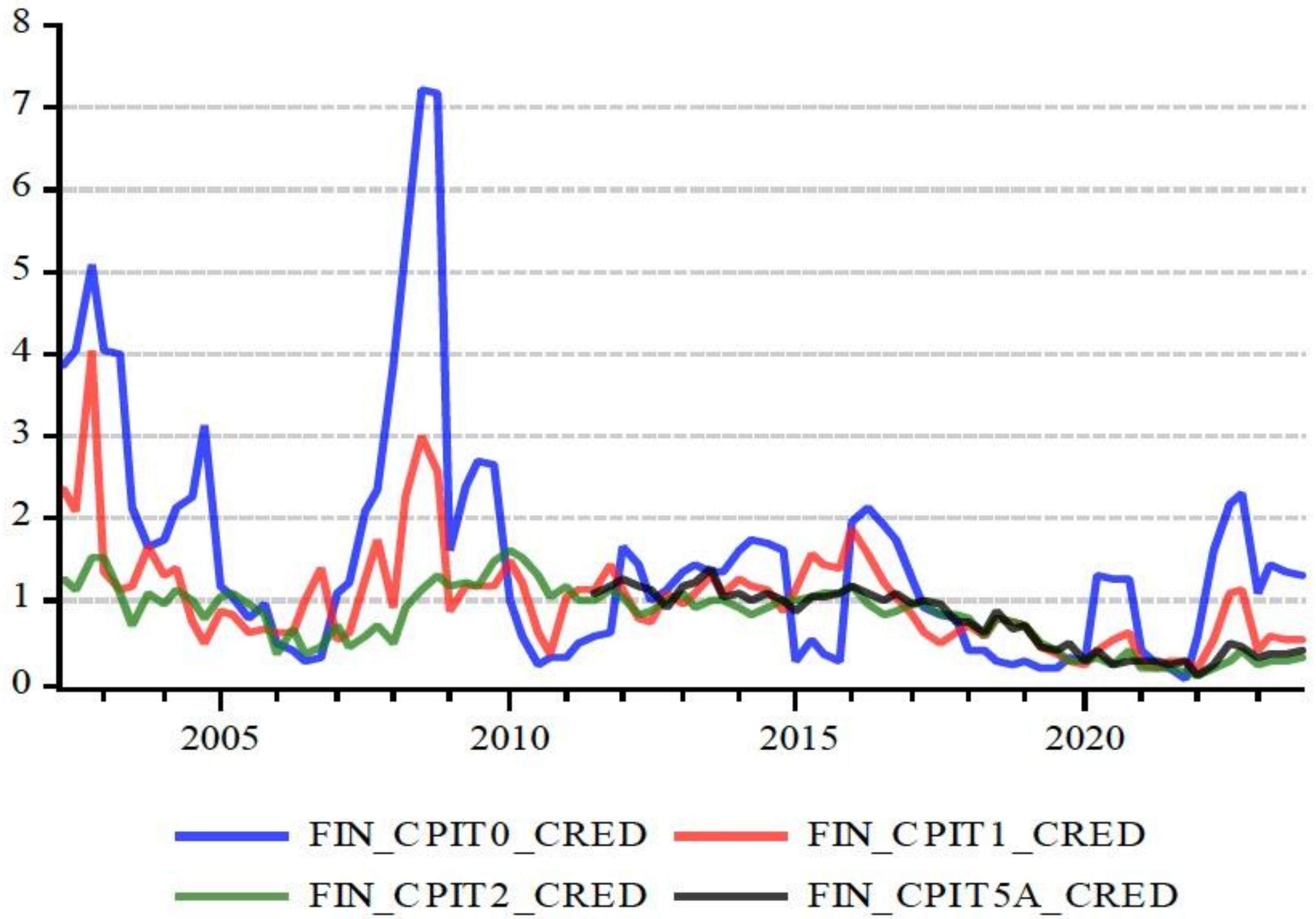
FE vs FH Forecasts: The Case of SARB Forecasts



SARB Credibility Over the Years: FIN Perspective



Outliers: The One Year Ahead Case from BUS