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Likely near-term macroeconomic impact of the implementation of the two-pot retirement saving system

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Abstract

This economic note seeks to explore the possible macroeconomic impacts of the recently-introduced two-pot pension system. Using the core model, we find that a moderate two-pot system scenario will add 0.1 and 0.3 percentage points (pp) respectively to GDP growth in 2024 and 2025, whilst reducing the government debt to GDP ratio by 0.5 pp in 2024/25 and by 1.0 pp and by in 2025/26. Under a high withdrawal scenario, we find that GDP growth will increase by 0.3 and 0.7 pp respectively in 2024 and 2025. The Government debt to GDP ratio will improve by 1.1 pp in 2024/25 and by 2.3 in 2025/26. The negative side is that the higher the withdrawal rates the less funds will be available at retirement age. The above impacts are relatively small when compared with pension reforms elsewhere. For instance, in Chile, rule changes allowed much larger withdrawals and pension assets declined by 14% of GDP.

1. Introduction

This economic note assesses the impact of the introduced pension reforms on household consumption, real fixed investment, inflation, government debt, and GDP growth. We postulate that over the short term the partial, pre-retirement withdrawal will boost consumption and growth somewhat, whilst over the long(er) term, the reforms are expected to raise the pool of retirement savings as employees will be unable to withdraw all their pension fund savings on resignation.

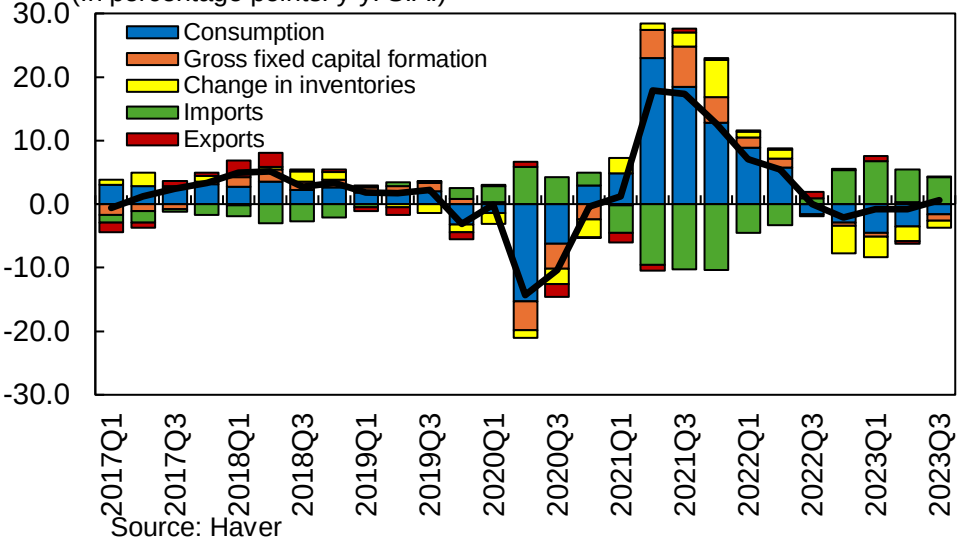
The note is structured as follows: In 2) we provide international experience with regards to pension reforms; 3) the need for pension reforms in SA; 4) the two-pot pension system characteristics and potential flows; 5) Pension fund reform scenarios; and finally concluding remarks.

2. International experience with regard to pension reforms

Globally, there have been different models of pension reforms. The reforms include the conditions under which access to funds pre-retirement is allowed, whether the funds need to be repaid or not, and the share of pension savings that an individual will have access to. Examples are listed as: (a) Allowing permanent withdrawal without repayment obligation. (b) Permission to take a loan from pension fund, with repayments required. (c) Hybrid pension savings models.

The impacts of these different models have varied considerably. But in general, when governments responded to financial stress facing households by allowing (multiple) withdrawals from pension funds, it resulted in increased consumption. This boosted demand and output, while governments benefited from increased tax revenues. However, total assets within pension funds were significantly reduced.

Figure 1: Contributions to Chile's real GDP growth
(In percentage points. y-y. S.A.)



Source: Haver

For example, in the case of Chile, the International Monetary Fund estimated that withdrawals accounted for 14% of GDP, following three pension withdrawal episodes between 2020Q3 and 2021Q1. These withdrawals halted growth in pension assets. Initially net tax revenues increased sharply, rising by 40% and 22% in 2021 and 2022, as spending increased with the opening of the economy from Covid-19 related lockdowns (Figures 1 to 3).

Real GDP growth was 11.7% in 2021, at least partly boosted by pension withdrawals. However, pension funds' assets declined significantly. Hence, government stopped further pension withdrawals. As a result, consumption growth slowed significantly.

Figure 2: Contributions to real consumption in Chile

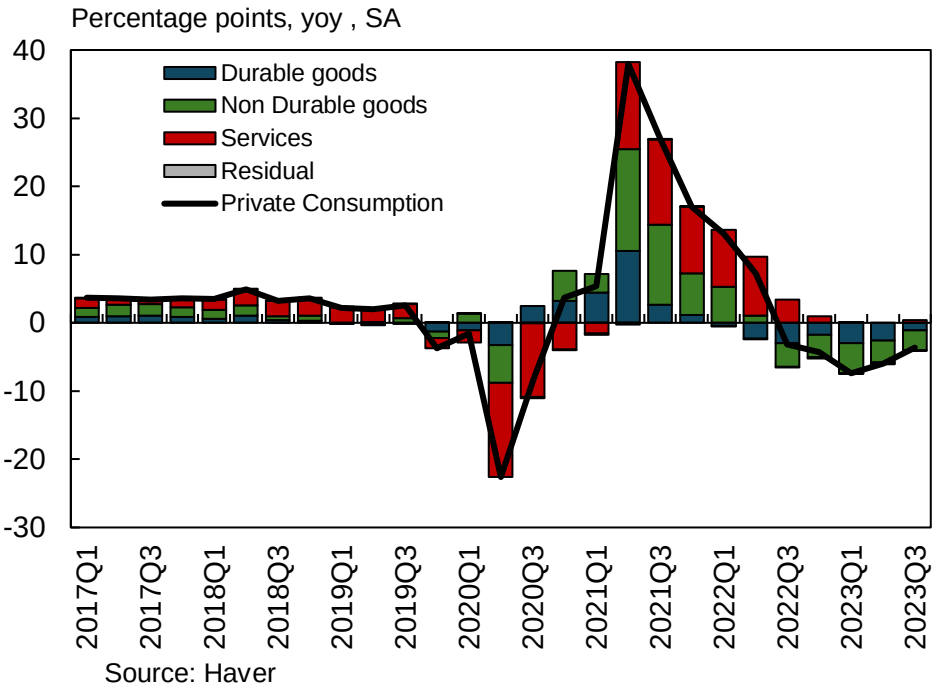
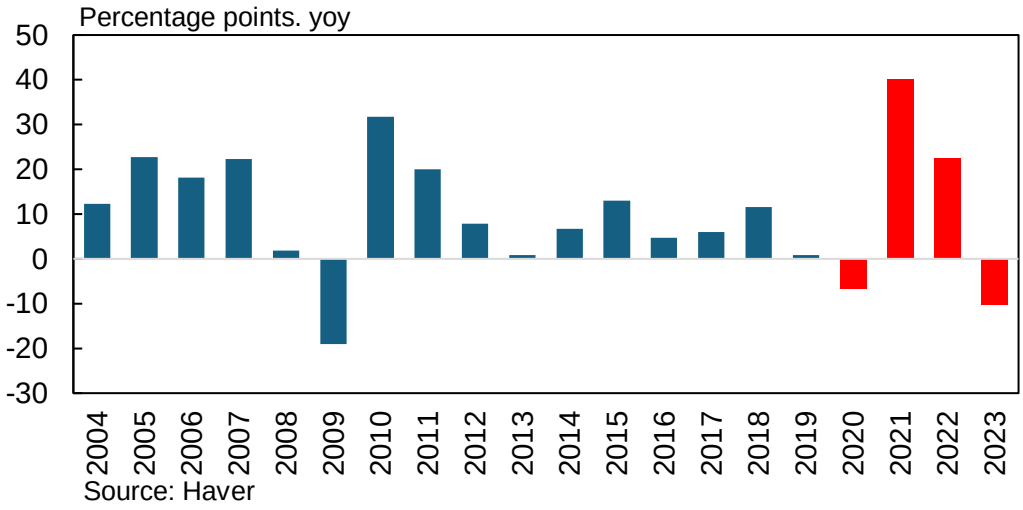


Figure 3: Net tax revenue growth in Chile



3. The need for pension reform in SA

South Africa's savings rate is very low when compared to Chile. In essence, according to ASISA,[1] only 6% of South Africans that are economically active can retire comfortably.[2]

[1] ASISA is the Association for Savings and Investments in South Africa.

[2] The 6% statistic illustrates the urgency of the retirement crisis in the country and the need to reform (see www.fanews.co.za). Factors contributing to financial stress among the middle-aged population include: a) inadequate savings on account of low incomes, informal labour market, limited access to formal pension schemes, b) high levels of debt including credit cards and personal loans, c) lack of financial literacy and

SARS data illustrates that for each of the three years (2016-2018), over 700 000 individuals opted to take out the withdrawal lump sum in cash before retirement (National Treasury, 2021). Around R78 billion on average between 2016 and 2018 per annum was taken out of the retirement system through withdrawals made before retirement compared to R246 billion annual pension contribution. On average, taxation on early withdrawals is over R12 billion each year. Higher tax rates are levied as a disincentive to deplete assets before retirement. However, given the large number of withdrawals, the severe tax implications do not appear to be a sufficient consideration in minimising this behaviour.

This large leakage reduces funds available for employees in retirement, contributing to low replacement ratios.[3]

4. The two-pot pension system characteristics and potential flows

It follows from the above that reforms to the South African pension system were urgently needed to allow some access to retirement funds, without having to resign, while simultaneously preserve funds for retirement.

This is addressed in the new (two-pot) retirement system which will be implemented on 1 September 2024, after which all retirement fund contributions made by an individual would be split between three components (or 'pots'):

a) **Vested component:**

- The vested component contains all accumulated retirement fund contributions made until 31 August 2024.
- A once-off seed capital transfer of 10% (capped at R30 000) of an individual's vested funds will be made to their savings 'pot' after the implementation date.
- Remaining funds stay invested, with access to these funds still only permitted after retirement or upon resignation, as per the current legislation.

b) **Savings component:**

- An individual's savings 'pot' will contain 1/3rd of all their net annual retirement contributions made after the implementation date, including the once-off seed capital transfer and future capital growth.
- Individuals will have full access to the available funds in their savings 'pots' before retirement, and without having to resign.

education on retirement planning leading to poor decision making around savings and investments, d) economic challenges of high unemployment and low economic growth. This depressing position is corroborated by the Schroders Global Investor Study 2018. The greatest disparity between current savings and savings perceived as necessary at a country level is seen in Chile and South Africa, (Appendix 2a) where people are saving, on average, 6% less for retirement than they would need to live comfortably. Also, South Africa, Sweden, and the US (Appendix 2b) fare the worst as locations where non-retired people are at risk of significantly misjudging the proportion of income required by the cost of living in retirement.

[3] Replacement ratio = Starting pension after retirement / Final salary before retirement. The ratio should ideally be around or above 75%.

- Restricted to one withdrawal per tax year and be taxed at an individual's marginal tax rate.

c) **Retirement component:**

- An individual's retirement 'pot' will contain the remaining 2/3rd of all their net annual retirement contributions made after the implementation date, including future capital growth.
- Prohibits access to these funds before retirement and requires an individual to buy a pension income after retirement.

The retirement industry is currently in a net outflow position, with annual withdrawals from pension funds exceeding annual contributions to those funds.[4] The reforms seek to minimise the net outflow over time, with the introduction of the two-pot pension system where the pension contributions will be allocated to the 1/3rd and 2/3rd savings/investment pots. Employees will have access to withdraw from the 1/3rd pot once annually, subject to a minimum withdrawal of R2 000.[5]

Gradually, the magnitude of annual net outflow is likely to dwindle and the industry to reach a new steady state. Coronation Fund Managers' view is that it would take roughly 10 years for the vested component to deplete, with the guiding principle being that once the vested component has been accessed (upon retirement/resignation), it cannot be accessed again.

This new steady state is estimated to result in an outflow of roughly R40-50 billion per year in less than 10 years, on the key assumption that there's no additional seeding after year one and that the availability of the savings pot might deter people to quit their jobs to access their vested rights. This is a reduction of around R50 billion compared to the current outflow levels. The withdrawals amount is therefore expected to bottom out, and either reach a flat or net positive cash flow position over time.

The initial drop in the assets of the pension funds due to the reforms will have positive shocks to consumption and GDP in the near-term. Based on the impact seen in other countries, as well as the transmission mechanisms and elasticities in the South African economy, the likely macroeconomic impact of the reforms is discussed in the next section.[6]

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4 Coronation Fund Managers: Interview on 20 February 2024. We sincerely thank Pieter Koekemoer, Alistair Barge and Rael Bloom for their time and invaluable insights into the reforms and the expected impacts. Under the current system, the withdrawals from the pension fund system are roughly about R360 billion per annum (of which between R100 billion to R120 billion per annum are due to resignations) with total annual contributions of R246 billion into the funds. Taking into consideration asset growth however, the total size of pension funds has remained almost unchanged over the last few years.

5 When the new system is implemented on 1 September 2024, our estimates suggest an additional R40 – 100 billion of withdrawals in the first year. This is due to the 10% of vested rights or R30 000 (10% of accumulated funds capped at R30k) in seeding capital being transferred to the savings/access pot becoming readily available to members for withdrawal within the 2024/25 tax year. The caveat is that the R80 – R100 billion "normal" outflow per annum is expected to continue but at a declining pace over a decade. This is due to the uncertain transition between the current and new system (assuming that the early resignation trend/behaviour is likely to persist for some time).

6 The elasticities here refer to the responsiveness of various economic variables from additional income available to households from pension withdrawals and to government's additional tax revenues.

5. Pension fund reform scenarios – possible impact on the economy

Implementation of the new "two-pot" pension fund reforms will lead to several possible economic and fiscal repercussions that are fundamentally linked to how people will react to this new source of income. Outcomes will vary depending on the rate of uptake of the available funds as well as the intended destination of the funds (consumption or debt reduction). Although the reforms will help employees to access funds in the 1/3rd pot for consumption once a year, the 2/3rd pot will boost retirement savings.[7]

Two scenarios are presented (Figures 4&5). First, is the high withdrawal scenario where the majority withdraw large portions (more than 90% of available funds) of all their available funds;[8] Second, the more moderate and more plausible scenario is where fund members realise the taxation penalties as well as the high cost of future compound growth, and only make emergency use of the option. We assume that those in higher income tax brackets, will be less likely to withdraw funds as they face higher tax penalties and should also have better access to other (crisis) funding options such as bank loans and credit cards.[9] The total accumulated vested component pot (R3 - R3.5 trillion) is an estimate based on SARS's different income groups and their historical pension fund contributions. To get an estimate of the withdrawable portion (seed capital) of the total vested pot (R122 billion), these contributions are then scaled by the number of payers per income group combined with the 10% or R30 000 rule.

5.1 The high withdrawal scenario.

In this scenario we assume that in 2024Q4 people will extract an additional R100 billion from the savings portion of their pension funds (this includes seed capital and their 1/3rd savings pot in 2024) due to the new legislation.[10] This will be on top of the historical resignation portion of R110 billion for the whole 2024 calendar year.

For 2025, it is assumed that the usage of the contributions to the one-third pot will drop to R40 billion, spread evenly over the four quarters (where 1/3rd of the total contributions for 2025 is R86.8 billion), leaving R46.8 billion in the savings pot. These withdrawals will increase by

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7 We do not model the long-term benefits of the 2/3rd pot in this economic note.

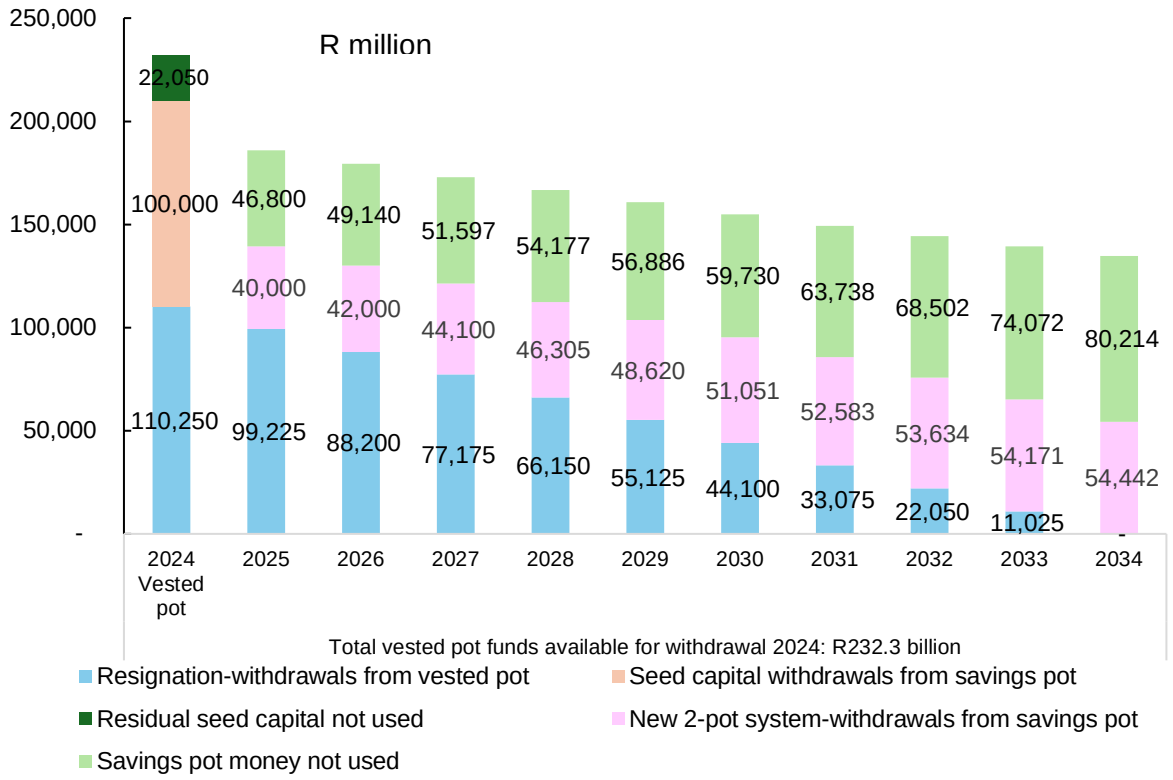
8 Note that this is a "high usage" scenario and not one that simulates the case where all eligible people use all of their available funds in 2024 as well as the following years.

9 Under the current system the withdrawals from the pension fund system are roughly R360 billion per annum, of which between R80 billion to R100 billion per annum are due to resignations. We assume that these annual outflows will continue over the next decade, albeit at a slower pace in each consecutive year, until the transitioning to the new two-pot system is completed. According to Financial Sector Conduct Authority (FSCA) data, there are 6.5 million people contributing to pension funds, of which about 700 000 people reset their pension funds annually, implying that within 9-10 years the system should reach a point where withdrawals will no longer be made from the historical vested pot when they resign and will then only have access to their 1/3rd savings pot.

10 This R100 billion is the upper estimate of the currently available funds within the pension fund system that will be taken by members from their vested pot and is derived from SARS income tax numbers as well as their tax deduction figures. According to SARS, on average, 85% of tax deductions are for retirement contributions.

5% to R42 billion in 2026 due to growth in the funds' underlying investments and as contributions are subject to annual wage increases.

Figure 4: High withdrawal scenario



After accounting for taxes, household disposable income is therefore only expected to be boosted by R79 billion in 2024Q4, by R31.5 billion in 2025 and by R33.1 billion in 2026.[11] Therefore, household consumption expenditure is expected to grow by an additional 0.8 pp in 2024, 1.8 pp in 2025 (as most of the 2024Q4 large withdrawals spill over into the following year) and to remain at an almost unchanged growth rate in 2026.

Initially, the withdrawals and higher interest rates (due to rising inflation related to rising output gap and weaker rand following increased imports) will curtail the positive effects that the higher GDP will have on fixed investment. As fund managers are forced to liquidate assets, thereby decreasing the pool of funds available for investments, growth in private sector fixed capital formation is expected to decline marginally by 0.2 pp in both 2024 and 2025, before increasing by 0.1 pp in 2026 as the benefits of the new system starts to positively affect this sector.

GDP is forecasted to grow by an additional 0.3 pp in 2024, 0.7 pp in 2025. Then GDP outlook returns to the pre- pension reforms growth rate in 2026. Inflation increases by 0.2 pp in 2025 and 0.3 pp in 2026, which along with a more positive output gap, necessitates repo to increase by 60bp in 2025 and by 90bp in 2026 relative to baseline.

[11] By applying a weighted structure to the marginal tax rates per income bracket from the SARS data numbers, all withdrawals from the pension fund will be subject to a proxied tax rate of 21% in the model.

Higher domestic demand results in increased real import volumes with the balance on the current account as percentage of GDP deteriorating by 0.2 pp in 2024, 0.5 pp in 2025 and 0.4 pp in 2026.

Personal income taxes (PIT) revenues increase by R41.0 billion in 2024/25, and by R32.4 billion in the year thereafter. These increases stem from both the pension fund withdrawals (as they contribute to taxable income) as well as the higher expected employment (consumption expenditure increases in direct proportion to the additional disposable income leading to higher GDP, with second round effects leading to increased employment and therefore more taxable income) and higher wage settlements (through inflation expectations). Corporate income taxes (CIT) grow by R2.0 billion in 2024/25 and by R5.3 billion in 2025/26.

Government expenditure is assumed to stay unchanged in this scenario leading to an improvement in both the primary balance to GDP ratios (0.4 pp in 2024/25 and by 0.7 pp in 2025/26) as well as the Government debt to GDP ratios (by 1.1 pp in 2024/25 and by 2.3 pp in 2025/26).

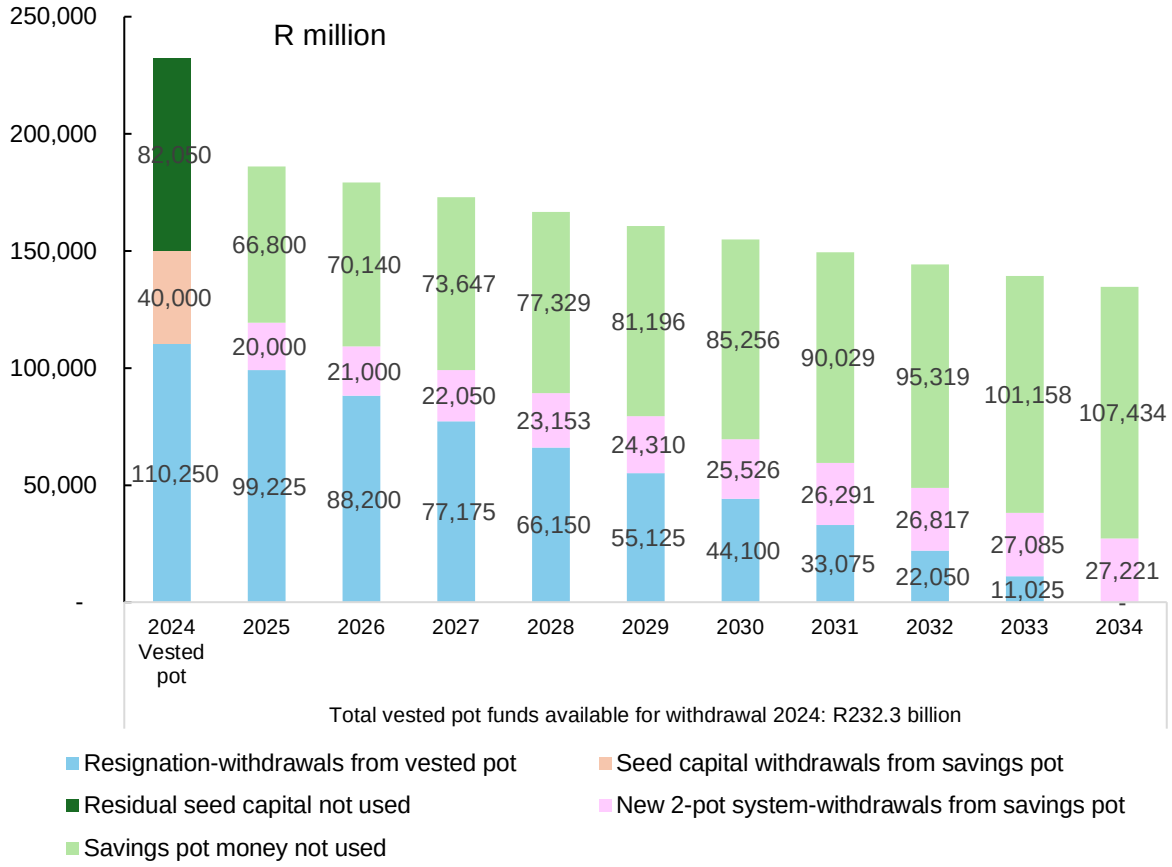
However, there is a likelihood that households will spend a portion of these withdrawals to reduce their existing debts. If this portion is approximately 50%, the effect would be to reduce the impact on consumption by half, so that in this scenario 2024 consumption expenditure by households would increase by 0.4 pp and 2025 0.9 pp. GDP would then increase by 0.2 pp in 2024 and by 0.4 pp in 2025.

5.2 The moderate withdrawal scenario.

This scenario assumes that people will be much more prudent and only extract an additional R40 billion from their pension funds in 2024Q4. For 2025, the usage of the contributions to the 1/3rd pot will drop even more than in the first scenario to only R20 billion, spread evenly over the four quarters. This amount will also then increase by 5% to R21 billion in 2026.

Tax-adjusted household disposable income is expected to be boosted by R31.5 billion in 2024Q4, by R15.8 billion in 2025 and by R16.6 billion in 2026. Household consumption expenditure to grow by an additional 0.3 pp in 2024, 0.7 pp in 2025 (as most of the 2024Q4 large withdrawals spill over into the following year) and to remain at relatively unchanged growth rate in 2026.

Figure 5: Moderate withdrawal scenario



This scenario leads to smaller increases in the growth of domestic demand, resulting in smaller increases in real import volumes, and consequently the balance on the current account as percentage of GDP deteriorates by only 0.1 pp in 2024 and by 0.2 pp in both 2025 and 2026. Growth in private sector fixed capital formation will decline marginally by 0.1 pp in 2024 and by 0.2 pp 2025, before remaining unchanged in 2026.

GDP should grow by an additional 0.1 pp in 2024, 0.3 pp in 2025, but growth should stay unchanged in 2026. Inflation increases by 0.1pp in both 2025 and 2026 resulting in an increase in interest rates of 20bp in 2025 and 40bp in 2026. If it is again assumed that the portion of withdrawals will be split in half between consumption and debt reduction, consumption will only increase by only 0.17 pp in 2024 and by 0.37 pp in 2024. GDP would then increase by only 0.06 pp in 2024 and by 0.15pp in 2025.

PIT will increase by R19.9 billion in 2024/25 and by R16.3 billion in 2025/26. CIT should grow by R0.8 billion in 2024/25 and R2.1 billion in 2025/26.

With government expenditures also assumed to stay unchanged in this scenario the additional revenues lead to an improvement in the primary balance to GDP ratios (0.2 pp in 2024/25 and by 0.4 pp in 2025/26) and the Government debt to GDP ratios (0.5 pp in 2024/25, by 1.0 pp in 2025/26).

6. Conclusion

The international experience indicates that pension fund reforms can result in a substantial boost to economic activity. However, if not well designed, their impacts could be short-lasting and result in a significant decline in pension assets over the long term.

According to our modelling, the two-pot pension funds system strikes a good balance by providing some short-term leeway to distressed consumers whilst over the long(er) term it will most likely result in improved retirement benefits as withdrawals will now be disallowed from the investment pot on resignation. This is also the main reason why government limits the initial withdrawal to the minimum of 10% or R30 000 rather than giving contributors access to the full portion in the vested pot. Whilst we do not model the longer-term benefits to the fund members, as it falls largely outside the forecast horizon, they will be severely impeded if all the available savings component funds are used over the short-term thus leaving members with considerably smaller than needed retirement funds.

More specifically, all current indications are that the net outflow in pension funds should peter out in about eight to ten years, and the pension fund assets would stabilise. Longer term, the economy at large would benefit from employees retiring with a larger pool of retirement savings stemming from the 2/3rd investment pot, which they will only be able to access on retirement.

Under a high withdrawal scenario consumption increases substantially in 2024 and 2025 before reverting to the baseline (pre-two-pot pension impact). However, a more likely scenario is for moderate pension withdrawals where households spending will add between 0.3 and 0.7 pp to real consumption in 2024 and 2025 respectively. Government tax revenue will benefit from these withdrawals, with tax revenues rising by 0.3 percent of GDP in 2025 and by 0.2 in 2026.[12]

[12] This includes tax revenues from CIT, PIT, VAT and Customs revenues.

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Appendix

Table A1: Examples of pension fund models

Types	Criteria and conditions	Countries
Allowing permanent withdrawal without repayment obligation	There are strict conditions where individual pension holders can withdraw funds to address serious financial needs. Rules "allow controlled access in clearly defined cases of disability or terminal illness, [and] severe financial hardship". In these cases, it would typically apply to a small number of employees facing the need to, for example, upgrade their houses or vehicles to suit their disability conditions[13].	Canada Australia
Permission to take a loan from pension fund, with repayments required	Regulations allow for loans from pension funds to finance housing. The loan repayment terms (interest rates and period) would differ amongst pension funds. In the case of Switzerland, the two options of withdrawal and pledging from pension funds are permitted to purchase owner occupied residential property, with repayment. The pledging option allows the funds to remain in the pension fund and used as collateral. Pledging requires less equity, but is subject to higher mortgage interest rates, keeping retirement benefits intact. The Home Equity Access Scheme in Australia allows members of pensionable age to get a non-taxable loan up to 150% of the value of their home. The loan repayment is subject to the inclusion of interest and legal costs.	Switzerland Australia
Hybrid pension savings models	Permitted access to a portion of savings under conditions that are less stringent. Such systems are made possible by allowing for savings vehicles that have both liquid and illiquid components. In these systems part of the pension savings is purposefully placed where it could be easily accessed when the needs arise. But this should be done without disadvantaging the long-term retirement savings that are mostly placed in bigger, illiquid component. There should be a determined limit to the account that can be accessed pre-retirement[14].	United States New Zealand United Kingdom

[13] The Australian Super retirement fund allows early withdrawal on compassionate grounds, terminal medical condition, severe financial hardship, temporary incapacity, or permanent incapacity, see https://accessmysuper.com.au/access-my-super-guides/.

[14] The World Bank Group (2019:7) noted that: "Under this arrangement, contributions paid into the combined account structure would at first be distributed between liquid and illiquid accounts. When the balance in

Table A2: Income Tax brackets

2025 tax year (1 March 2024-28 February 2025) no changes from last year

Taxable income (Rand)	Rate of tax
1-27 500	0% of taxable income
27 501-726 000	18% of taxable income above 27 500
726 001-1 089 000	125 730 + 27% of taxable income above 726 000
1 089 001 and above	223 740 + 36% of taxable income above 1 089 000

2024 tax year (1 March 2023-29 February 2024) changes from last year

Taxable income (Rand)	Rate of tax
1-27 500	0% of taxable income
27 501-726 000	18% of taxable income above 27 500
726 001-1 089 000	125 730 + 27% of taxable income above 726 000
1 089 001 and above	223 740 + 36% of taxable income above 1 089 000

2023 tax year (1 March 2022-28 February 2023) no changes from last year

Taxable income (Rand)	Rate of tax
1-25 000	0% of taxable income
25 001-660 000	18% of taxable income above 25 000
660 001- 990 000	114 300 + 27% of taxable income above 660 000
990 001 and above	203 400 + 36% of taxable income above 990 000

Source: South African Revenue Service 2024.

the liquid account reaches a predetermined threshold level, known as the ‘savings cap’ all contributions thereafter go entirely into the illiquid retirement account.”

Appendix 3a)

Retirement savings deficit

Country	Current income being saved specifically for retirement	Annual income savings needed to live comfortably in retirement	Difference
Chile	13%	19%	6%
South Africa	**13%**	**19%**	**6%**
Hong Kong	11%	15%	4%
Poland	11%	15%	4%
Thailand	14%	18%	4%
Russia	9%	13%	4%
Taiwan	13%	16%	3%
Portugal	11%	14%	3%
Singapore	15%	18%	3%
Brazil	14%	17%	3%
Spain	10%	13%	3%
Italy	10%	13%	3%
UAE	14%	16%	2%
Australia	12%	15%	3%
France	10%	12%	2%

Source: Schroders Global Investor Study 2018.

Appendix 3b)

Proportion of income cost of living

Country	Non-retired: Expected (%)	Retired: Actual (%)	Difference
South Africa	**34**	**59**	**25**
Sweden	34	57	23
US	32	54	22
Australia	39	58	19
South Korea* (n=22)	27	44	17
Portugal	28	45	17
Canada	42	59	17
Belgium	34	50	16
Italy	37	53	16
Spain	35	51	16
France	30	46	16
Singapore	35	50	15
Chile* (n=20)	28	43	15
UK	38	53	15
Netherlands	38	52	14

Source: Schroders Global Investor Study 2018
*Limited Sample

Figure A1: Real household consumption expenditure

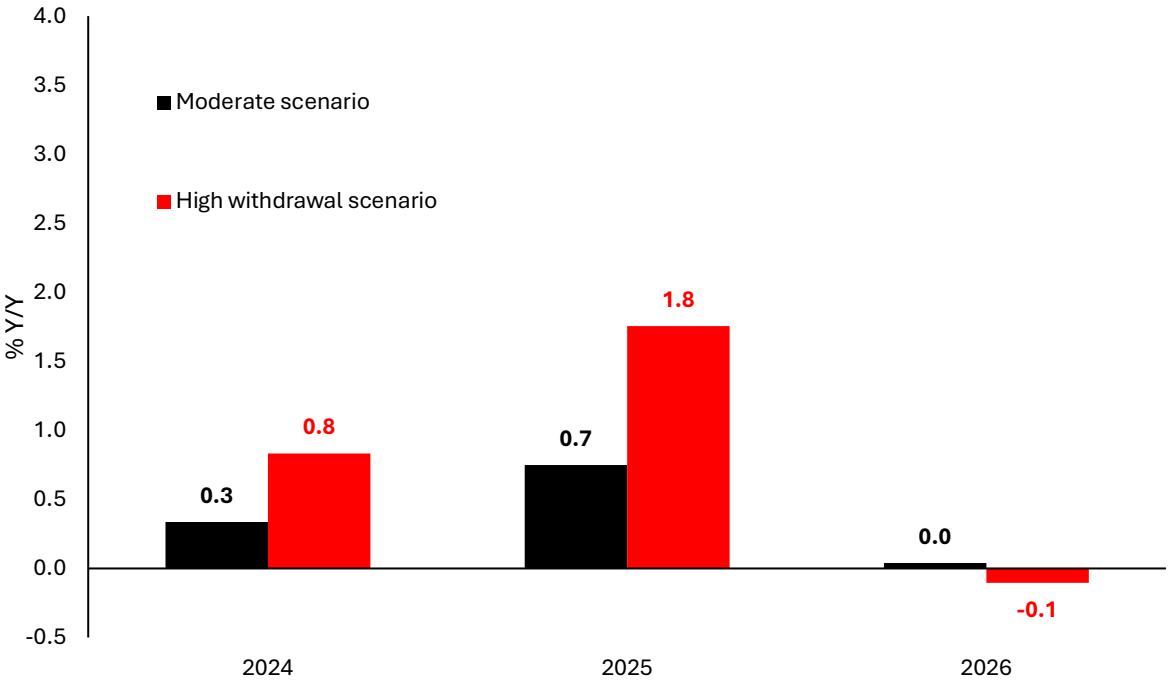


Figure A2: Real private sector investments

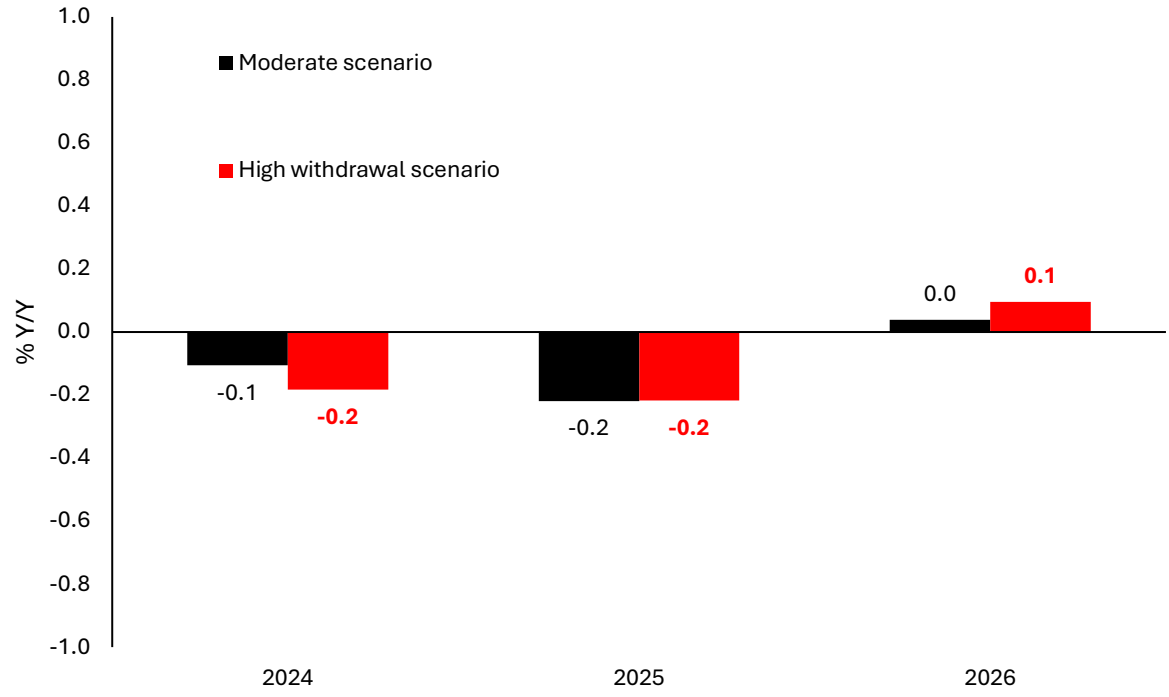


Table1: Impacts of pension fund reforms

Annual % change from baseline			2024	2025	2026
Real HH consumption expenditure		High	0.8	1.8	-0.1
		Moderate	0.3	0.7	0.0
Real Private sector investment		High	-0.2	-0.2	0.1
		Moderate	-0.1	-0.2	0.0
Inflation		High	0.0	0.2	0.3
		Moderate	0.0	0.08	0.1
Repo		High	0.1	0.6	0.9
		Moderate	0.0	0.2	0.4
R/$ exchange rate		High	-0.15	-0.54	-0.73
		Moderate	-0.06	-0.24	-0.32
GDP		High	0.3	0.7	0.0
		Moderate	0.1	0.3	0.0
CA/GDP ratio		High	-0.2	-0.5	-0.4
		Moderate	-0.1	-0.2	-0.2
Personal income tax R billion	(2024/25 & 2025/26)	High	41.0	32.4	--
		Moderate	19.9	16.3	--
Corporation income tax R billion	(2024/25 & 2025/26)	High	2.0	5.3	--
		Moderate	0.8	2.1	--
Primary balance % of GDP	(2024/25 & 2025/26)	High	0.4	0.7	---
		Moderate	0.2	0.4	---
Government debt % of GDP	(2024/25 & 2025/26)	High	-1.1	-2.3	--
		Moderate	-0.5	-1.0	--

Figure A3: Real gross domestic product

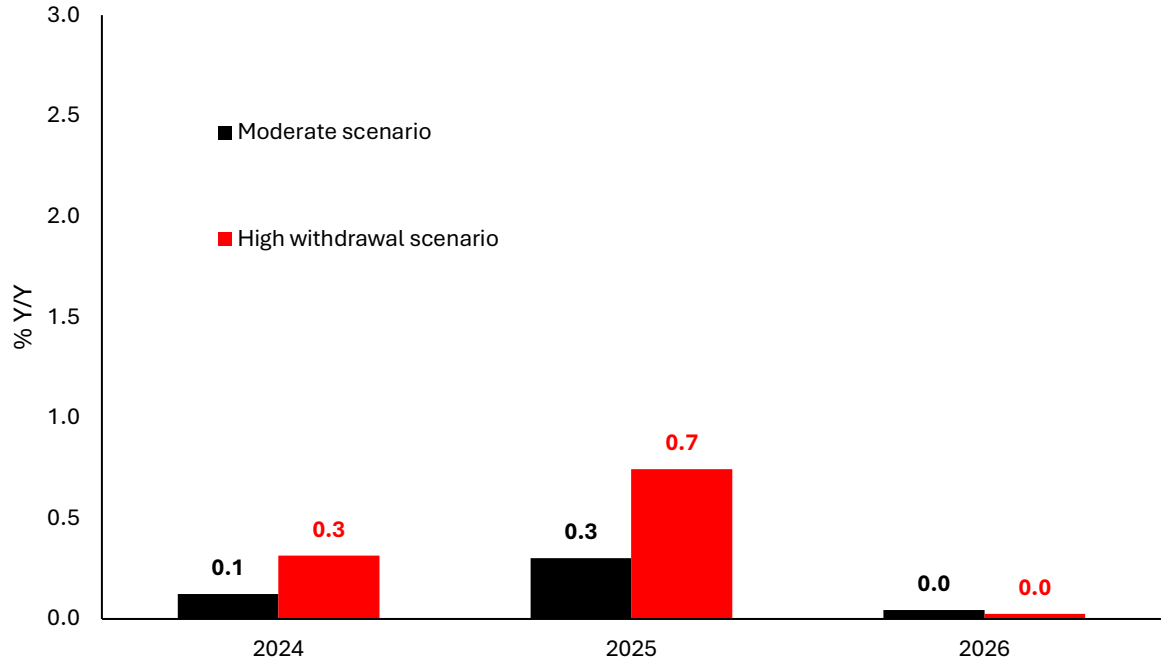


Figure A4: Inflation

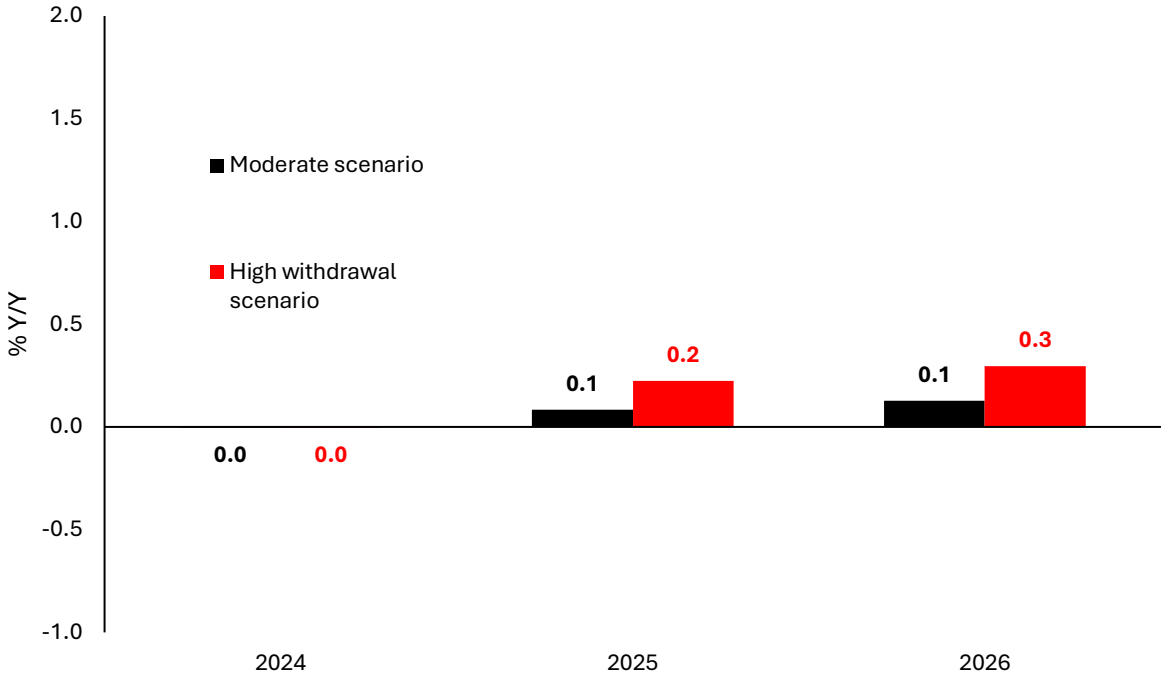


Figure A5: Repurchase rate

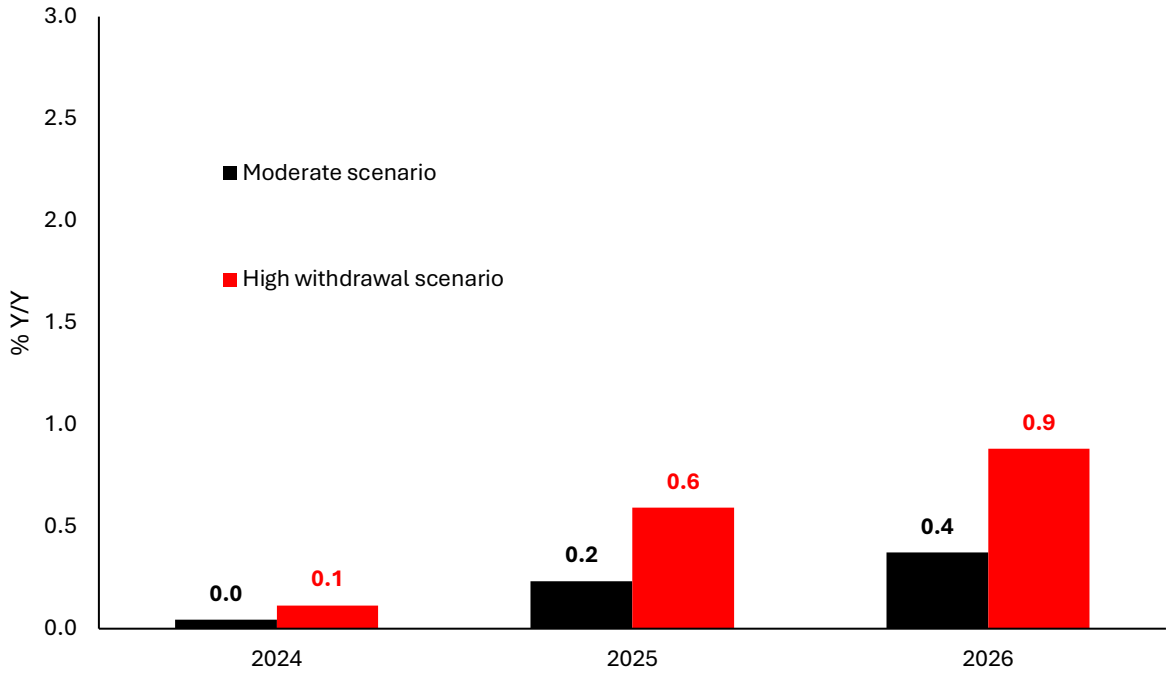


Figure A6: Primary balance

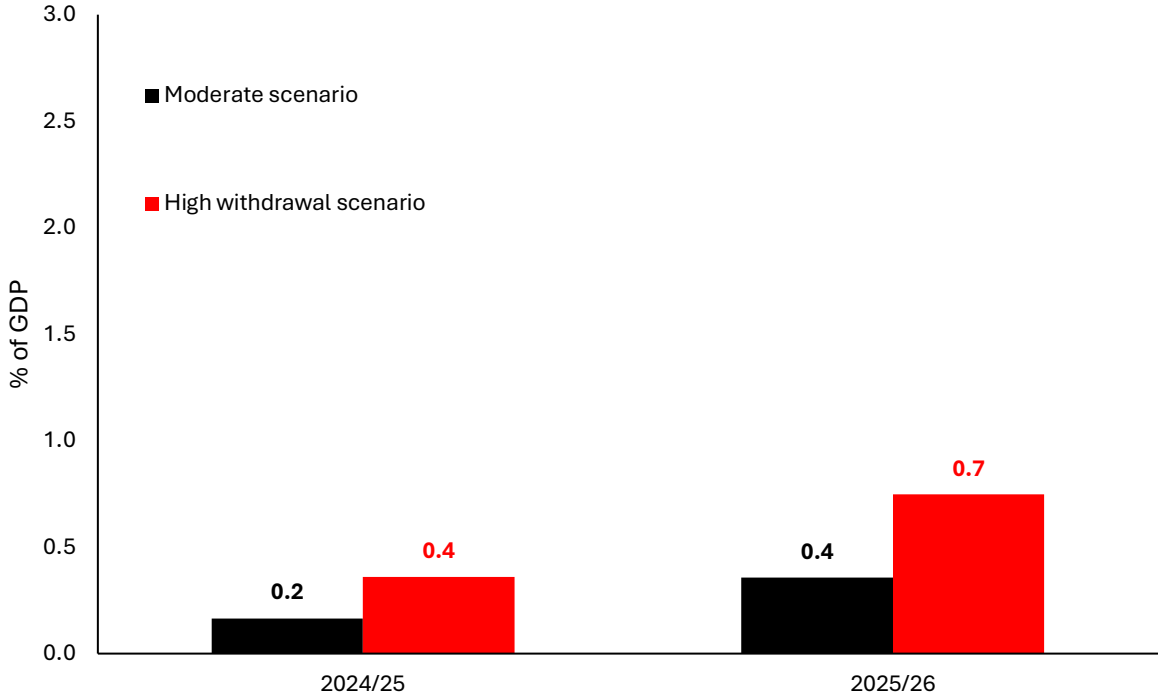


Figure A7: Personal income tax (PIT)

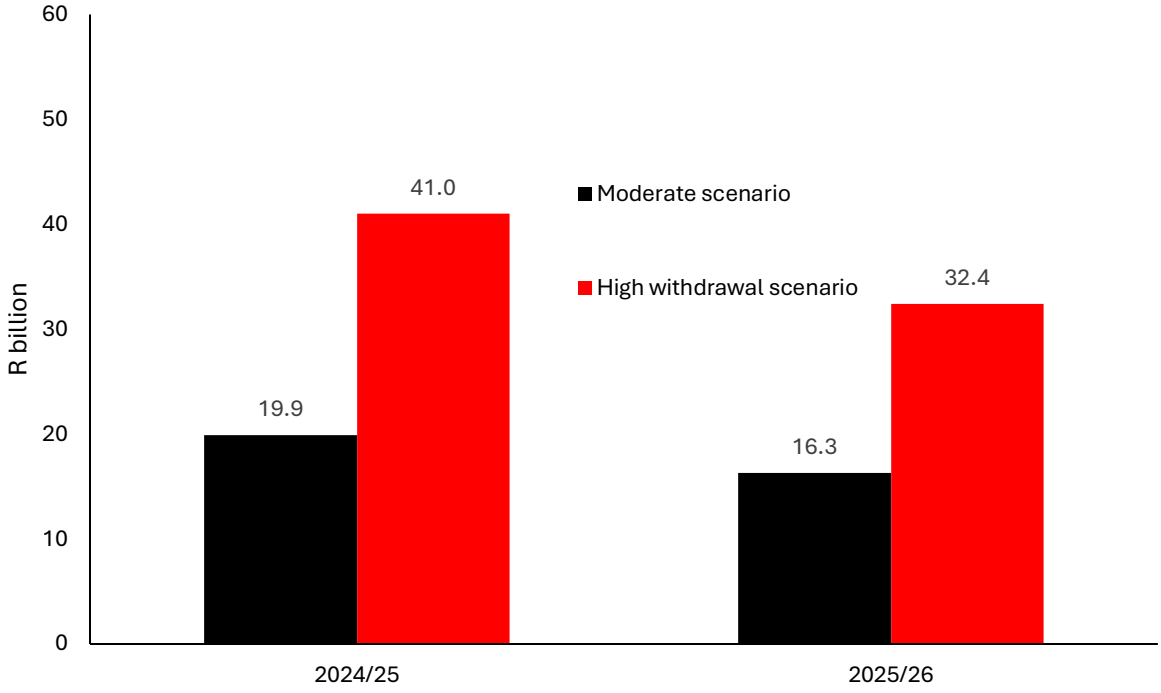


Figure A8: Corporate income tax (CIT)

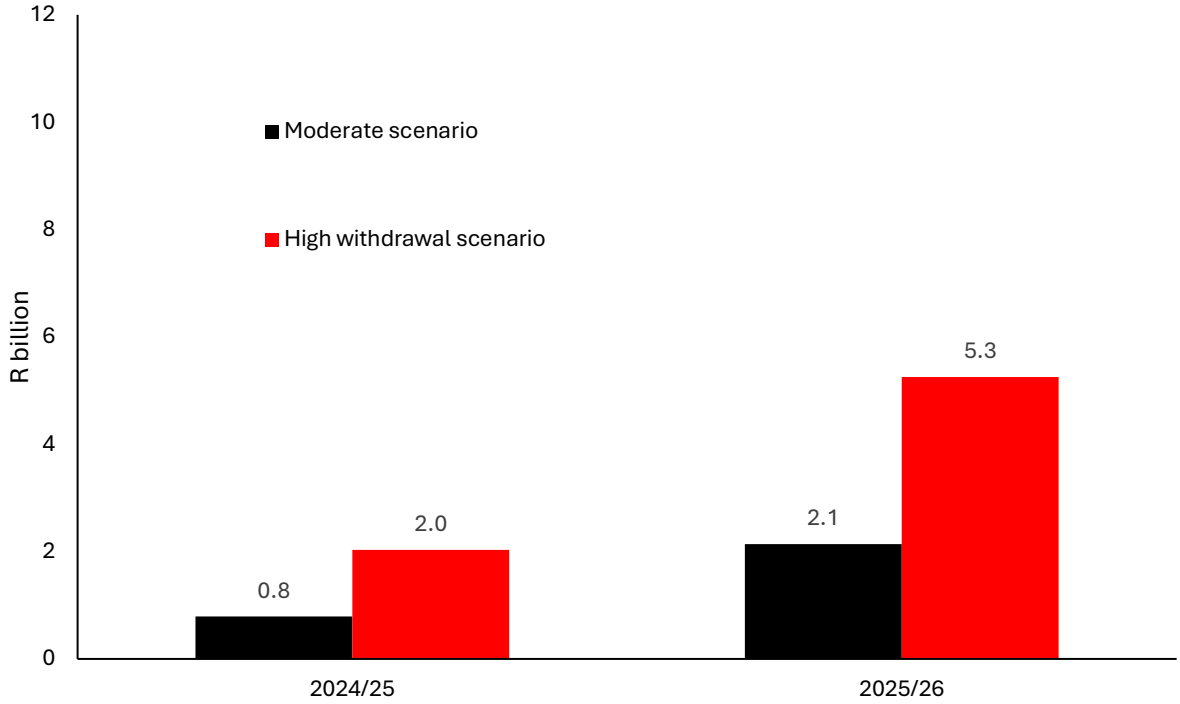
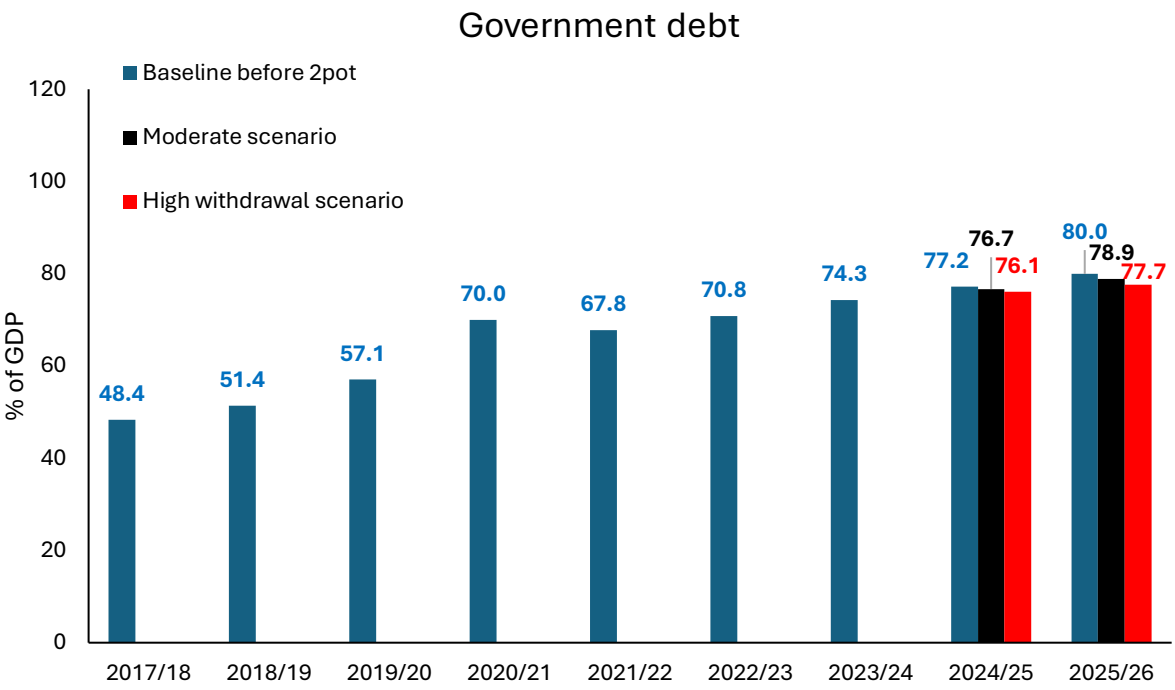


Figure A9: Government debt



Special OBEN 2402* – June 2024

PCCI of SA's CPI: Estimating the persistent and common component of inflation for South Africa

Ayrton Amaral, Marique Kruger, Dineo Lekgeu and Witness Simbanegavi

Abstract

This Note presents a new, additional measure of underlying inflation for South Africa, termed the persistent and common component of inflation (PCCI). The PCCI indicates that inflation pressures in the domestic economy are elevated, with outcomes remaining closer to the upper limit of the target band over the past year. The information content of the PCCI is similar to that of the other measures of underlying inflation, such as core and trimmed mean inflation. In particular, all three measures presently indicate that the persistence of headline inflation above the 4.5% midpoint partly reflects elevated underlying inflation. Reliability assessments show that the PCCI has high predictive power on headline inflation, is stable and is less volatile than headline inflation. Future work will consider estimating the PCCI with other methods as part of further testing the measure's validity (i.e. whether it measures underlying inflation accurately) and reliability (i.e. if it does so consistently).

1. Introduction

A central challenge for inflation-targeting central banks is to decode from monthly inflation data the component of inflation that is durable (persistent) and the component that is transitory. It is the durable component that provides the signal of where inflation is headed and thus matters for monetary policy. The fleeting component washes off in a shorter time horizon than it would normally take for policy to transmit.[1] Techniques/approaches have been devised in the literature for extracting the signal from noisy high-frequency inflation data, and these have generated various indicators of underlying inflation pressures.[2]

The SARB tracks two 'official' measures published by Statistics South Africa (Stats SA), namely, core inflation and trimmed mean inflation, to gauge underlying inflation pressures and, thus, the likely trajectory for headline inflation. Core inflation, measured as headline inflation excluding food and non-alcoholic beverages (NAB), fuel and electricity, is the most widely used

1 Blinder, (1997).

2 Popular measures of underlying inflation include core inflation, trimmed mean inflation and weighted median inflation.

indicator, with applications in the SARB's Quarterly Projection Model (QPM). The trimmed mean inflation is also an exclusion-based measure, but it determines which components to exclude in a more systematic way. It drops different items each month by assigning a weight of zero to those components with the highest and lowest changes on a month-on-month basis ("trimming" 5% on either side).

While these exclusion-based measures are intuitive and easier to communicate, they have two major weaknesses. First, such measures could still carry substantial 'noise' as they may retain elements of transitory shocks in the included components.[3] Second, by throwing away certain data, potentially durable information in monthly data relevant for policy may be lost. This is especially likely in the context of persistent shocks to the excluded components that contribute to second-round effects in included components, as we have seen over the past four years.[4]

In this Note, we estimate a new measure of underlying inflation, hereafter referred to as the Persistent and Common Component of Inflation (PCCI), for South Africa, using factor modelling. The PCCI is a non-exclusion-based measure and thus does not suffer from the drawbacks highlighted above. The addition of this measure enriches the set of indicators to be considered by the SARB when assessing inflationary pressures in the domestic economy.

2. A factor model for underlying inflation

Factor modelling is a statistical technique that works off the premise that common dynamics of a large number of time series can be explained by a few unobserved factors.[5] While applying factor modelling to macroeconomic data is not new, the ever-increasing production of new data series published at a high frequency has made these models a popular data dimensionality reduction technique. Factor models have seen considerable uptake as a tool for analysing the vast information contained in consumer price subindices, especially since the method underpinning these models is data-driven (i.e. no structural economic assumptions are needed). Applications have included the derivation of underlying inflation measures such as the PCCI.

In factor modelling, inflation for a particular subseries i of the CPI can be thought of as being driven by two sources of variation: a persistent trend element that shares a common source of variation across the series in the system and a series-specific idiosyncratic disturbance denoted $\varepsilon_{i,t}$. The common variation can be thought of as encapsulating underlying price pressures stemming from drivers such as the output gap and second-round effects originating from supply shocks.[6, 7] In effect:

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3 For example, transport services inflation (included in core inflation) can see significant volatility stemming from fuel price shocks.

4 As Rangasamy (2011) shows, for example, food inflation in South Africa can be persistent and result in second-round price effects and he argues that, by excluding such a component from measures of core inflation, one could run the risk of failing to accurately capture underlying price pressures in the economy.

5 See Stock and Watson, (2016).

6 Since this modelling framework imposes no structural economic assumptions, it is not possible to pinpoint exact sources of underlying inflation pressures such as demand pressures or second-round effects. They are, however, implied given the described decomposition.

7 Non-exclusion-based measures derived from factor models have their own drawbacks. For one, their computation is more complicated and opaque than with exclusion-based measures. For example, and as

$$\pi_{i,t} = \Lambda_i F_t + \varepsilon_{i,t} \quad (1)$$

where F_t is the common factor driving inflation. Each subindex, i, is related to this common factor via a so-called factor loading, Λ_i. The term $\Lambda_i F_t$ therefore gives the persistent component of inflation of the i^{th} subindex.

From a monetary policy perspective, this decomposition is helpful since it breaks down inflation into a part over which policy can exert influence (i.e. the persistent or long-lasting component) and a part that policy should "look through" (i.e. the idiosyncratic component).

Factor models can be estimated parametrically by specifying a model for the factors or non-parametrically.[8] The non-parametric approach has the advantage that estimation tends to be computationally less taxing to implement when both the number of observations, N, and the time periods, T, are large, as is often the case with consumer price subindices. Examples of non-parametric studies of underlying inflation include Cristadoro et al. (2005) for the Euro Area, Giannone and Matheson (2006) for New Zealand, Khan et al. (2013) for Canada and Abenoja et al. (2017) for the Philippines. The present study follows this literature.

Along with Khan et al. (2013) and Abenoja et al. (2017), we consider a (static) factor model of the form:

$$\boldsymbol{\pi_t} = \mathbf{\Lambda F_t} + \boldsymbol{\varepsilon_t} \quad (2)$$

where $\boldsymbol{\pi_t}$ is a matrix of the inflation rates of the various series in the system, $\mathbf{\Lambda}$ is the matrix of factor loadings that relate the unobservable factors $\mathbf{F_t}$ with the different series in $\boldsymbol{\pi_t}$.[9] The matrix $\boldsymbol{\pi_t}$ has dimension $N \times T$, $\mathbf{\Lambda}$ is an $N \times r$ matrix (where r is the number of unobserved factors; the exact number to include is an empirical question which we address in Section 3), $\mathbf{F_t}$ is an $r \times T$ matrix and $\boldsymbol{\varepsilon_t}$ is of dimension $N \times T$.

Finally, each series' persistent component is then given by:

$$\widetilde{\boldsymbol{\pi}}_{\boldsymbol{t}} = \mathbf{\Lambda F_t} \quad (3)$$

3. Data and estimation

We estimate the PCCI for South Africa using consumer price subindices based on a COICOP four-digit level of aggregation, which equates to a total of 83 unique time series.[10] We calculate

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we outline in Sections 2 and 3, the estimated factors of the PCCI are not necessarily observable, possibly making its interpretation and communication to the public more complex.

8 See Stock and Watson (2016) and Doz and Fuleky (2019) for a more detailed exposition of factor models and the different estimation techniques.

9 The model in the dynamic form can be written as:

$$\boldsymbol{\pi_t} = \mathbf{\Lambda}(\mathrm{L})\boldsymbol{f_t} + \boldsymbol{\varepsilon_t}$$

where the other components are defined as above and $(\mathrm{L})\boldsymbol{f_t}$ represents the common factor matrix and its lags.

10 The four-digit COICOP is the most disaggregated level of CPI subindices stored consistently on the SARB's internal databases; a detailed list of the various series is given in Table A1.

the inflation rates of these 83 series as the year-on-year percentage changes. Four of these series were, however, dropped from the analysis because they either have too few data points since they only begin after 2012 (musical instruments, services for the maintenance and repair of dwelling and package holidays) or because there is insufficient variation in the series (games of chance).[11] The remaining 79 series were then reweighted.

The model in (2) is estimated non-parametrically with the aid of principal component analysis (PCA) to obtain estimates for the underlying factors as outlined in the methodology proposed by Stock and Watson (2002a; 2002b).

PCA is, however, sensitive to the scale of the time series; thus, it is common in the literature to standardise the series contained in $\boldsymbol{\pi_t}$ prior to performing the PCA.[12] There are various standardisation techniques in the literature. Here, we follow Leung et al. (2009) and Abenoja et al. (2017) and define the transformed variable as:

$$x_{i,t} = \frac{\pi_{i,t} - \bar{\pi}_i}{\sigma_{\Delta_i}} \tag{4}$$

where $\pi_{i,t}$ is the year-on-year inflation rate of the i^{th} subindex of CPI, $\bar{\pi}_i$ is the corresponding series' sample mean and σ_{Δ_i} is the standard error of the first difference of the series and $x_{i,t}$ is the standardised i^{th} series. The specification in (4) is deemed more appropriate when the time series data are non-stationary.[13] Let $\boldsymbol{X_t}$ be a matrix of all the standardised $x_{i,t}$ series.

We can derive an estimate for the loadings matrix in (2), $\widehat{\boldsymbol{\Lambda}}$, with PCA to obtain the loadings that correspond to the r^{th} principal component of the correlation matrix of $\boldsymbol{X_t}$ (recall that r is the number of factors to be included in the model). While statistical methods, such as information criteria, provide a systematic way of determining r,[14] in the PCCI literature, the focus is generally on obtaining a single underlying factor that drives variation across multiple inflation time series. Accordingly, r is typically set equal to one, implying that $\widehat{\boldsymbol{\Lambda}}$ is the vector of factor loadings corresponding to the first principal component from the PCA. $\widehat{\mathbf{F}}_\mathbf{t}$ is then given by:

$$\widehat{\mathbf{F}}_\mathbf{t} = \frac{\widehat{\boldsymbol{\Lambda}}' \boldsymbol{X_t}}{N} \tag{5}$$

Evaluating $\widehat{\boldsymbol{\Lambda}}\widehat{\mathbf{F}}_\mathbf{t}$ gives the standardised common component of each series, which needs to be rescaled to be comparable with the respective series' inflation rate.[15] Multiplying each rescaled series by its weight in CPI and taking the sum yields the overall PCCI measure. The results are presented in Figure 1. While headline inflation and the PCCI generally correlate well, there

11 The dropped series comprise of 2.36% of the total weight in CPI.

12 See, for instance, Khan et al. (2013) and Abenoja et al. (2017).

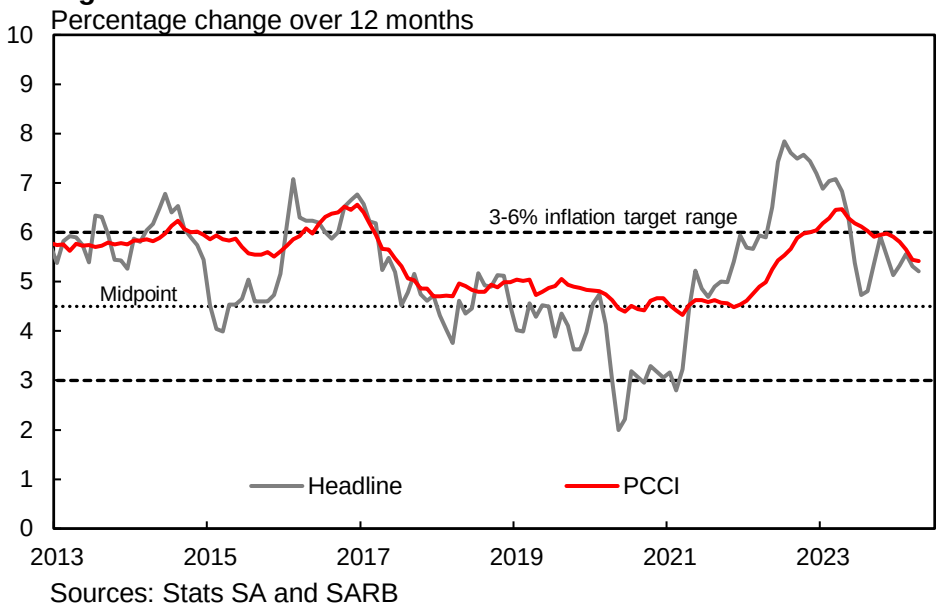
13 See Marques, Neves and da Silva (2001) for details.

14 See Bai and Ng, (2002).

15 The series can be rescaled by multiplying the standardised PCCI by the standard deviation of the first difference of headline inflation and then adding back the mean (See for example Khan et al. (2013) and Abenoja et al. (2017)) or by regressing the original ith series on its standardised common component and a constant (see for example Marques, Neves and da Silva (2001)). We use the latter.

also are periods of sharp divergence. These periods of marked divergence largely reflect supply-side shocks, such as sharp swings in fuel or food price inflation.[16]

Figure 1: PCCI and other inflation measures



Sources: Stats SA and SARB

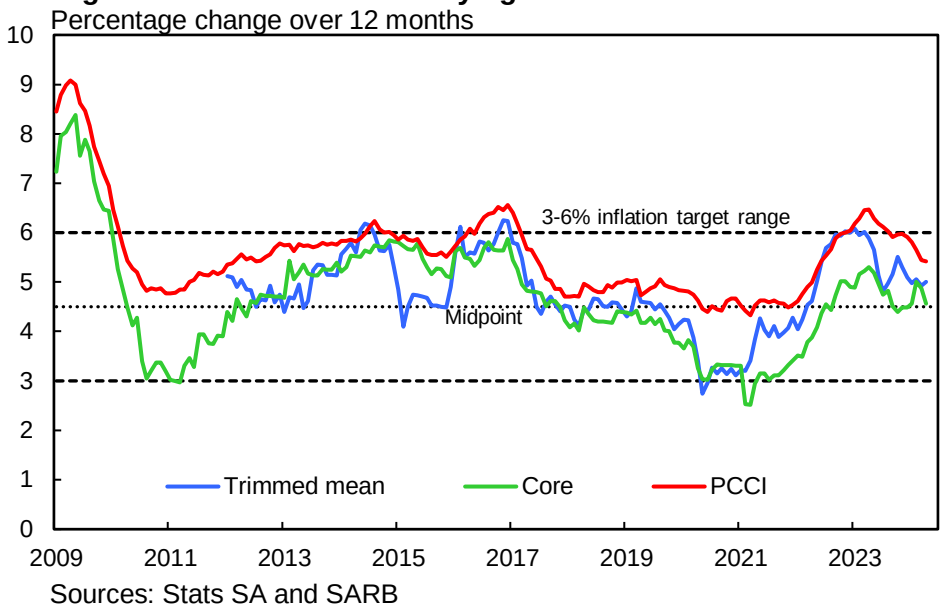
Figure 2 shows the extracted PCCI along with the exclusion-based measures of underlying inflation, namely core and the trimmed mean inflation. Visually, the PCCI is the smoothest of the measures. The lower volatility of the PCCI accords with expectations and intuition, given that it is constructed by isolating common, underlying drivers of inflation, which tend to be stable and slow-evolving since the PCCI excludes transitory/sectoral shocks. Another feature immediately obvious from Figure 2 is the PCCI's ability to smooth over periods of considerable shocks, such as during lockdowns in 2020-2021 and the subsequent post-COVID supply chain disruptions and the Russia-Ukraine war.[17] The PCCI correlates strongly with both core and the trimmed mean inflation, which suggests these measures capture a significant part of *true* underlying inflation.[18]

16 For example, the sharp drops in headline inflation around 2015 and then at the onset of the COVID-19 pandemic in 2020 resulted predominantly from fuel deflation (annual fuel inflation in 2015 and 2020 was -10.7% and -6.9% respectively). The model identified these events as idiosyncratic fuel inflation shocks, allowing the PCCI to smooth over these periods. Likewise, during the food- and fuel-driven surge in inflation in 2021 and 2022, the model also smoothed this shock, resulting in the PCCI measure coming out lower than the headline outcome.

17 PCCI moved by 1.8 percentage points from trough to peak while core inflation rose by 2.7 percentage points and trimmed mean by 3.3 percentage points.

18 The correlation coefficients between the PCCI and trimmed mean and core inflation are 0.86 and 0.89 respectively.

Figure 2: Measures of underlying inflation

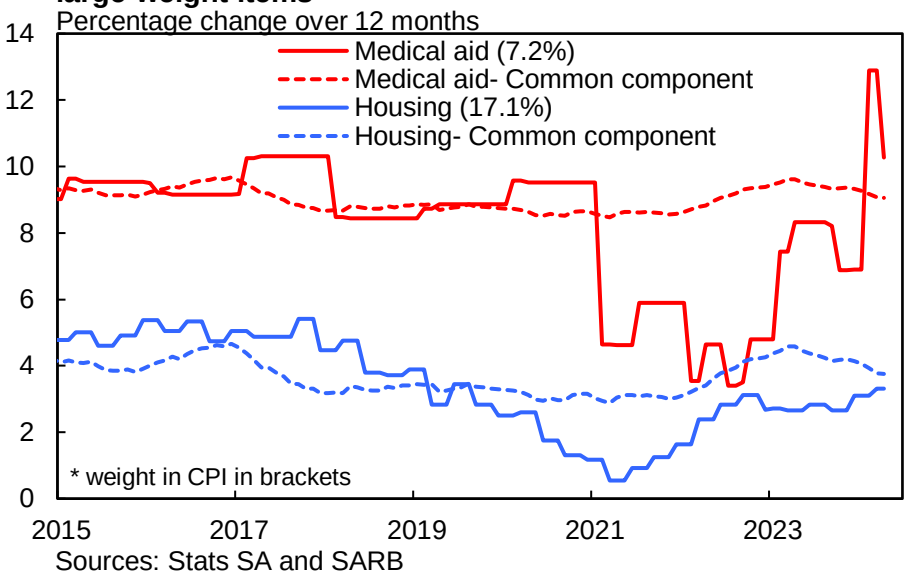


Sources: Stats SA and SARB

Figure 2 also shows a sustained divergence between the PCCI and core inflation since the COVID-19 pandemic in 2020. In addition, the PCCI measure indicates that underlying inflationary pressures are stronger than suggested by core inflation. These observations are related in that the main reason for both stems from the sizeable downside idiosyncratic shocks among large-weight components of the core CPI basket. In particular, actual inflation outcomes for medical insurance inflation and housing have been below their long-term trends since around 2020-2021 (Figure 3). This has slowed the rise in core inflation over this period. However, as inflation for these items returns to levels more aligned with long-term averages, core inflation will shift closer to the PCCI, as we have observed in recent months.[19]

[19] More generally, PCCI has tended to be consistently above core inflation, to varying degrees, over the sample period in question. One of the primary reasons for this gap is the inclusion of traditionally 'non-core' elements, specifically food and non-alcoholic beverages (FNAB), in the PCCI's construction. FNAB inflation is higher, on average, than core inflation (6.6% vs 4.7%; from Jan 2009 to Jan 2024). Our model identifies a non-negligible persistent/common component among the series that together constitute the FNAB basket and that ultimately contributes to the aforementioned gap. The presence of a persistent component for FNAB is in line with findings by Rangasamy (2011) which suggests that food inflation may be an important contributor to underlying inflation dynamics in South Africa.

Figure 3: Inflation and common components for selected large-weight items*



Sources: Stats SA and SARB

4. Is the PCCI a valid and reliable measure of underlying inflation?

To be useful and informative for monetary policy, a measure of underlying inflation must have predictive power for headline inflation, be stable with respect to historical revisions as new inflation data is introduced to the model and be less volatile than headline inflation.[20] In this section, we evaluate the PCCI against these criteria.

We first evaluate the predictive ability of the PCCI. To evaluate this, we follow Giannone and Matheson (2006) and run a regression of the form:

$$\pi_{t+4} - \pi_t = \alpha + \beta(\pi_t^u - \pi_t) + \varepsilon_{t+4} \quad (6)$$

where π_t^u denotes a measure of underlying inflation such as the PCCI (we carry out similar regressions using trimmed mean and core inflation for comparative purposes).

Table 1 includes descriptive statistics and estimates from a regression testing the predictive power of the various underlying measures.[21] By these metrics, the PCCI is a valid and reliable indicator of inflationary pressure and has predictive power regarding the future direction of headline inflation.

[20] See, for example, Khan et al. (2013), Einarsson, (2014) and Abenoja et al. (2017).

[21] The regression is to test whether the current gap between underlying inflation measure and headline inflation predicts future changes in headline inflation. Predictive power is indicated by $\beta > 0$ and α should also be equal to 0. R^2 shows the goodness of fit and thus gives an indication of the predictive power of the variable in question (see Giannone and Matheson (2006)).

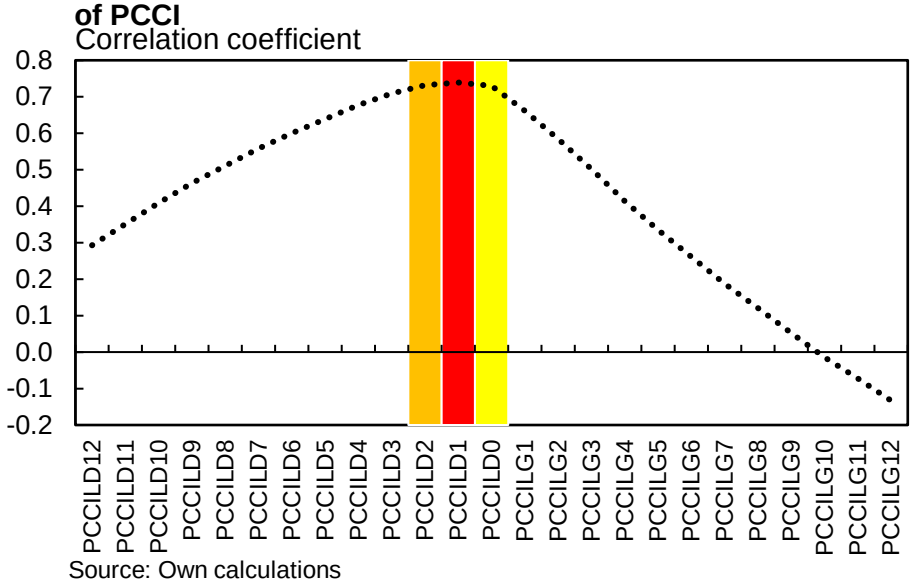
Table 1: Descriptive statistics and predictive ability of underlying inflation measures

	Mean	Standard deviation	Correlation	$\pi_{t+4} - \pi_t = \alpha + \beta(\pi_t^{core} - \pi_t) + \varepsilon_{t+4}$		
				α	β	R^2
Headline CPI	5.68	1.96				
Core inflation	4.67	1.12	0.68	-0.015	0.083	0.36
Trimmed mean	4.81	0.79	0.88	0.09	0.263	0.41
PCCI	5.57	0.93	0.73	-0.013	0.216	0.38

When comparing the three measures of underlying inflation, the trimmed mean performs the best, followed by the PCCI.[22] Figures A1 to A3 in the appendix show in-sample forecasts of headline inflation with the various measures as the primary explanatory variable and show similar conclusions regarding each measure's predictive ability as the analysis in Table 1.

We also analyse correlations of headline inflation to leads and lags of the PCCI, and the results suggest that the latter contains information that could help in identifying turning points in headline inflation (Figure 4).[23]

Figure 4: Correlation of headline inflation to leads and lags of PCCI



Source: Own calculations

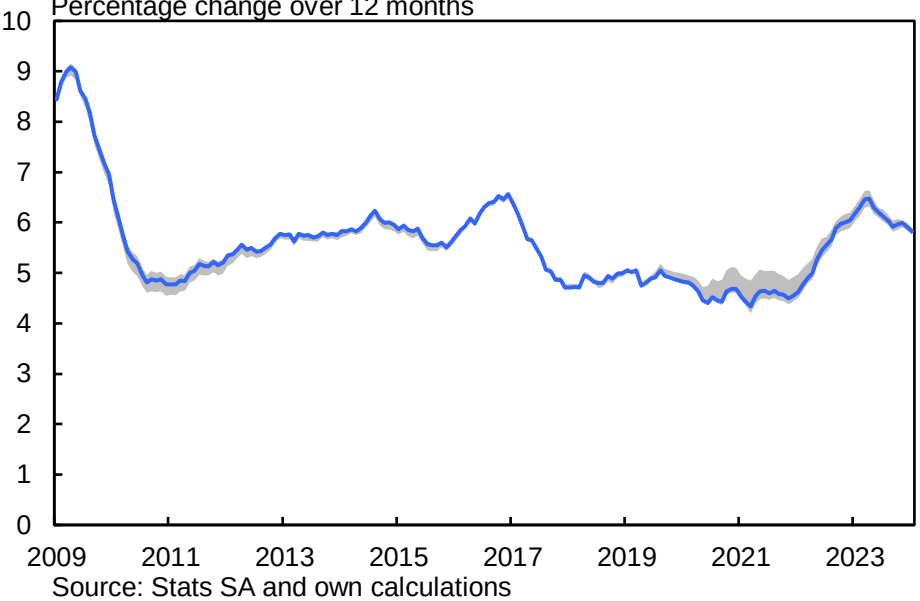
22 The superior performance of trimmed mean is unsurprising given that it tracks 90% of the CPI basket and that it incorporates some transitory shocks (except for the excluded 10%).

23 See Ehrmann et al. (2018) as well as Bańbura and Bobeica, (2020).

The stability of the PCCI is assessed through the evaluation of the sensitivity of the PCCI to historical revisions each time new inflation data is added to the model.[24] Large and significant revisions to the PCCI would cast doubt as to the measure's real-time accuracy and, thus, usefulness for policy purposes. To test the sensitivity of the PCCI to data revisions, we run the PCA over ten years. We then expand the PCA window by one month at a time and get a new PCCI series each time. We iterate this process until the whole sample is covered in the PCA. Figure 5 shows that, except for the COVID period, the PCCI measure is remarkably stable.[25]

Figure 5: PCCI revisions

Percentage change over 12 months



Source: Stats SA and own calculations

One of the essential characteristics of underlying inflation measures is that, by construction, they should reduce or eliminate volatility arising from transitory or sectoral disturbances (i.e. extract the signal from noise in inflation data). Accordingly, at the very minimum, it should be smoother than the headline inflation measure. Figure 6 (see also Table 1) shows that the various measures of underlying inflation exhibit lower volatility compared to headline, with the PCCI performing relatively well in this regard.[26] Also worth highlighting in Table 1 is that the PCCI seems to provide the most accurate estimate for the mean of actual inflation.[27]

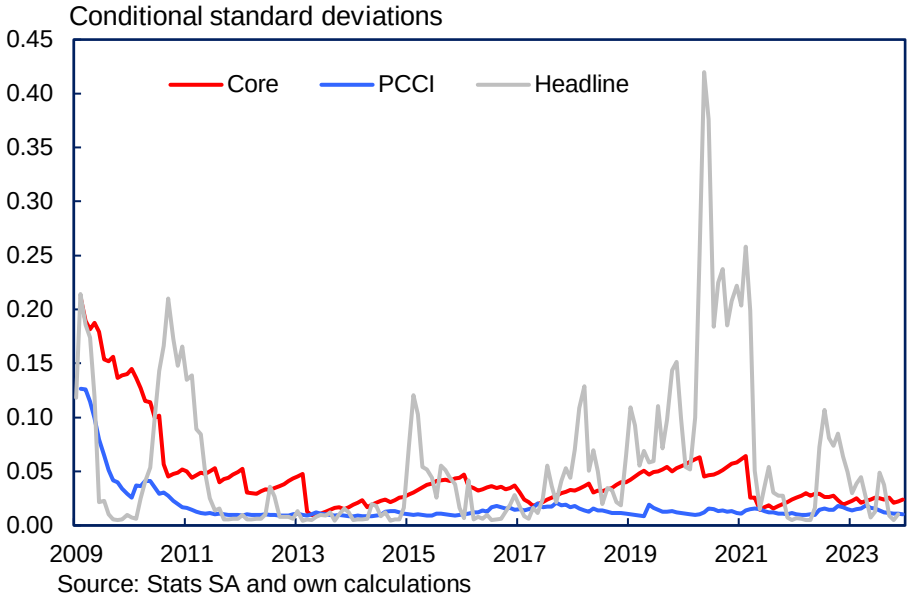
[24] CPI data itself is not subject to historical revisions, however, since the PCCI is estimated each time new CPI data is released, PCCI estimates may be subject to historical revisions.

[25] For our full sample, revisions averaged around 0.06pp in absolute terms. During 2020/2021, as the real-time sensitivity to new data picked up, this value increased, averaging 0.12pp in absolute terms. Since 2022, the number has fallen again, averaging 0.07pp.

[26] In Figure 6, volatility is determined using the generalized autoregressive conditional heteroscedasticity methodology.

[27] As highlighted by du Plessis, du Rand and Kotzé (2015), such in-sample statistics serve as additional ways of evaluating the usefulness of core inflation measures more generally.

Figure 6: Volatility of Core, Headline and PCCI



Source: Stats SA and own calculations

In all, the above analyses confirm that the PCCI is a reliable and informative alternative measure of underlying inflation. This provides confidence for its use as an alternative measure of underlying inflationary pressures in the domestic economy.

5. Conclusion

In this research, we estimated the PCCI for South Africa. It serves as an additional gauge of underlying inflation that complements existing measures by seeking to counter shortcomings of core and trimmed mean inflation. This new measure shows more elevated underlying inflationary pressures than suggested by core inflation, but direction of travel is similar. PCCI as well as core inflation and trimmed mean inflation all point to elevated underlying inflation, with outcomes above the target midpoint over the past year.

A battery of tests indicates that this measure is a reliable and informative measure of underlying inflation and is thus potentially useful for monetary policy. Future research on the PCCI will consider different estimation strategies and alternative model specifications.

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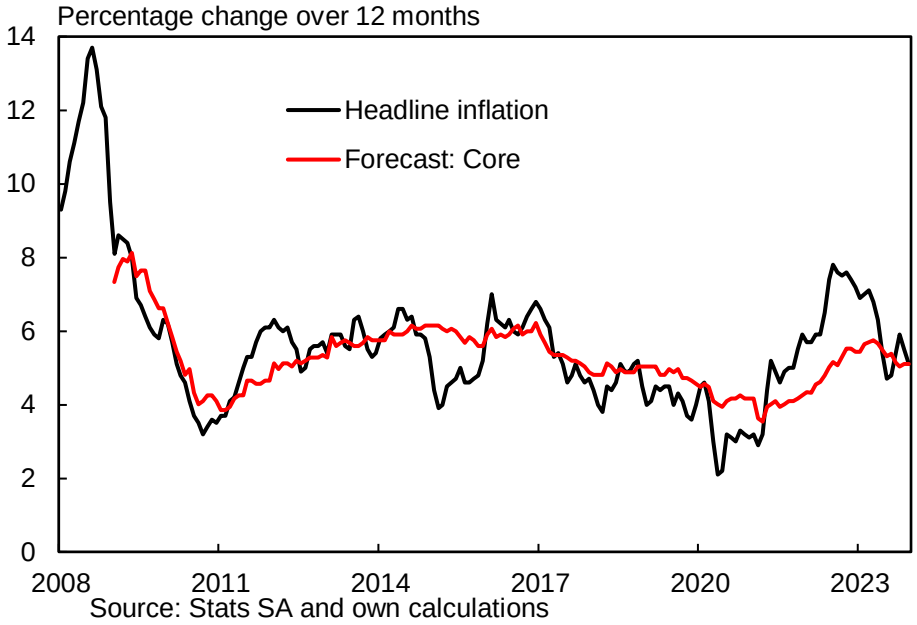
Appendix

Table A1: Relationship between PCCI and individual components of CPI

CPI Components	Weight	Correlation
Goods: Hot beverages	0.67	0.873
Goods: Personal care	1.38	0.868
Goods: Large appliances	0.36	0.844
Services: Restaurants	2.30	0.838
Goods: Other foods	1.16	0.823
Goods: Games, toys and hobbies	0.08	0.794
Goods: Fish	0.40	0.729
Goods: Spirits and liqueurs	0.94	0.714
Goods: Pharmaceutical products	0.57	0.705
Goods: Tools and equipment for house and garden	0.02	0.694
Goods: Clothing	2.64	0.691
Services: Health Medical services	0.97	0.684
Goods: Small appliances	0.08	0.678
Services: Accommodation services	1.14	0.676
Services: Financial services N.E.C	1.63	0.662
Goods: Milk, cheese and eggs	2.53	0.658
Goods: Footwear	1.01	0.653
Goods: Small tools & equipment	0.07	0.622
Goods: Garden products	0.08	0.616
Services: Actual rentals for housing: Houses	2.16	0.607
Goods: Maintenance and repair	0.51	0.581
Services: Owners' equivalent rent: Houses	11.43	0.577
Goods: Vegetables	1.27	0.570
Goods: spare parts and accessories	0.43	0.566
Goods: Cigarettes	1.85	0.559
Goods: Personal effects: Travel goods and other carriers	0.17	0.559
Goods: Cleaning & maintenance products	0.35	0.553
Services: Other services	1.39	0.549
Goods: Photographic and cinematographic equipment	0.28	0.530
Goods: Glassware, tableware and household utensils	0.13	0.529
Goods: Sugar, sweets and desserts	0.58	0.522
Goods: Stationery and drawing materials	0.13	0.521
Goods: Electricity	3.63	0.519
Goods: Personal effects: Other	0.05	0.513
Goods: Newspapers and periodicals	0.33	0.510
Services: Owners' equivalent rent: Townhouses	1.31	0.510
Goods: Cold beverages	1.17	0.505
Goods: Information processing equipment	0.32	0.502
Goods: Equipment for recording & reproduction of sound & pictures	0.22	0.497
Other recreational items: Pet products	0.27	0.491
Services: Insurance connected with the dwelling	1.25	0.480
Goods: Outdoor recreation items	0.23	0.473
Goods: Bread and cereals	3.16	0.466
Services: Domestic services	2.63	0.464
Goods: Jewellery, clocks and watches	0.12	0.453
Services: Actual rentals for housing: Townhouses	0.55	0.450
Goods: Fruit	0.33	0.431
Services: Pre-primary and primary education	0.88	0.430
Services: Personal care services: All	0.48	0.430
Goods: Household textiles	0.45	0.421
Services: Secondary education	0.89	0.421
Services: Owners' equivalent rent: Flats	0.55	0.400
Services: TV licence & subscription	1.12	0.394
Services: Postal services	0.12	0.379
Services: Actual rentals for housing: Flats	1.09	0.373
Goods: Other tobacco	0.12	0.365

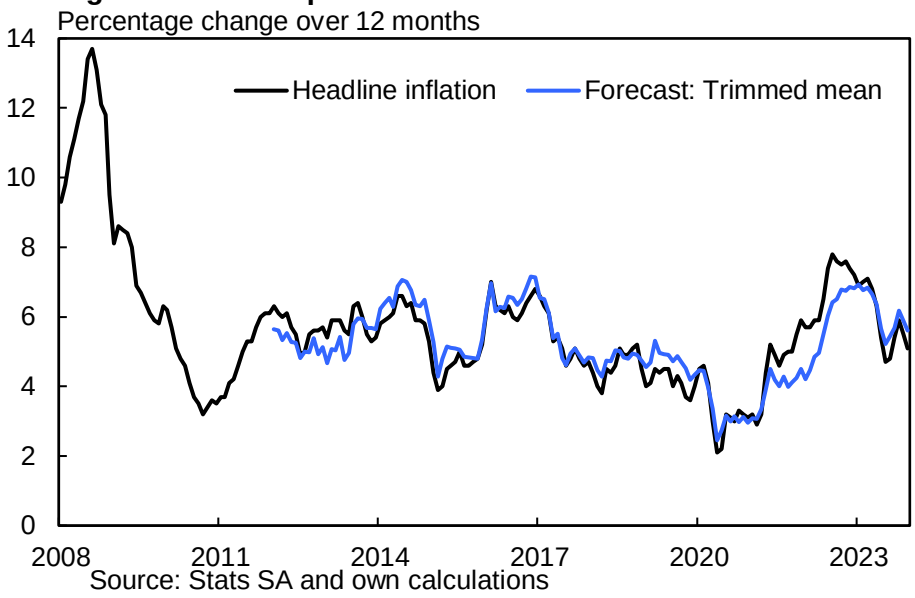
Services: Public transport: Air	0.40	0.317
Goods: Recording media for pictures and sound	0.03	0.263
Services: Telephone services	2.31	0.255
Goods: Beer	2.21	0.236
Services: Insurance connected with health	7.21	0.234
Goods: Furniture & furnishings	0.37	0.216
Goods: Purchase of vehicles	5.91	0.205
Goods: Telephone equipment	0.19	0.195
Services: Public transport: Road	2.14	0.164
Services: Insurance connected with transport	0.74	0.162
Services: Cinemas, theatres & concerts	0.20	0.144
Services: Tertiary education	1.15	0.104
Goods: Books	0.15	0.071
Goods: Meat	5.42	0.064
Goods: Photographic and cinematographic equipment	0.03	0.057
Services: Assessment rates	2.33	0.018
Goods: Wine	1.14	-0.021
Goods: Liquid fuels	0.07	-0.076
Services: Public transport: Railway	0.19	-0.126
Goods: Oils and fat	0.45	-0.175
Services: Other	1.09	-0.180
Services: Water supply	1.33	-0.356
Goods: Fuel	4.82	-0.415

Figure A1: In-sample forecasts with Core inflation



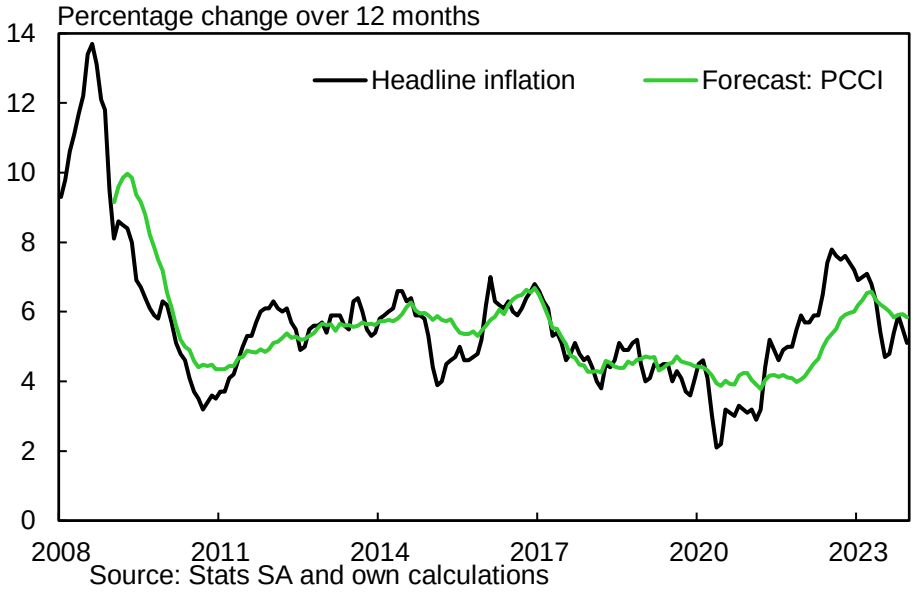
Source: Stats SA and own calculations

Figure A2: In-sample forecasts with trimmed mean



Source: Stats SA and own calculations

Figure A3: In-sample forecasts with PCCI



Source: Stats SA and own calculations

Special OBEN 2402* – June 2024

A supercore inflation measure for South Africa

Samantha de Kock, MG Ferreira, Mpho Rapapali, Witness Simbanegavi and Mokgabiso Tshenkeng

Abstract

We construct a new inflation measure to monitor underlying price developments in South Africa, termed supercore inflation. Supercore inflation is made up of the components of core inflation that are responsive to general economic conditions, as measured by the output gap. Our findings reveal that demand-driven inflationary pressures, as measured by supercore inflation, are presently balanced, with inflation outcomes hovering around the target midpoint over the past year. The finding of 'balanced' demand-driven inflationary pressures is consistent with a virtually closed output gap over the past year, as indicated by the South African Reserve Bank's Quarterly Projection Model.

1. Introduction[1]

Although the South African Reserve Bank (SARB), like most other central banks, targets headline inflation as its anchor for price stability, it pays significant attention to underlying inflation to gauge the direction of headline inflation and thus the appropriate monetary policy posture. This is because headline inflation is susceptible to transitory shocks and thus can be quite volatile, with a high noise-to-signal ratio. Underlying inflation measures attempt to filter out short-run price fluctuations and depict the persistent or trend component of inflation.

The standard measure for underlying inflation commonly applied by central banks is core inflation, which eliminates seasonal fluctuations and volatile items such as food and energy prices (Johnson 1999). Various other measures of underlying inflation have been developed in the literature and include trimmed mean inflation,[2] weighted median inflation,[3] persistent and common component of inflation (PCCI)[4] and supercore inflation. Relying on multiple measures of inflation provides robustness to monetary policy setting against the uncertainty from trend

1 We would like to extend our gratitude to Susan Knox for her assistance with the data and valuable contributions to the economic note.

2 The trimmed mean considers the average inflation rate after symmetrically or asymmetrically trimming a certain percentage of the inflation distribution at both ends (Brischetto and Richards 2007).

3 The weighted median includes trimming 50% of the entire distribution on each side, and the core inflation reading would be the inflation rate of the component in the middle (Ball, et al. 2023).

4 The persistent and common component of inflation captures the underlying trend common for all goods and services in the CPI basket (Bańbura and Bobeica 2020).

inflation unobservability (Morana 2023). Presently, the SARB tracks two measures of underlying inflation – core and trimmed mean inflation – published by Statistics South Africa (Stats SA), with core inflation playing a more central role in policy discussions.

The objective of this note is to construct a new measure of underlying inflation for South Africa, namely, supercore inflation, to broaden the suite of indicators of trend inflation tracked by the SARB's Monetary Policy Committee. Supercore inflation is designed to track the price pressures that are driven primarily by economic slack, as measured by the output gap. It is that subset of core inflation whose components show high sensitivity to the business cycle. In this regard, it provides valuable insights for monetary policy, especially in distinguishing between inflationary pressures that are likely to be transient and those signalling more persistent trends.[5] To the extent that the output gap proxies the balance between aggregate demand and aggregate supply (potential output) well, inflation pressures are stronger when output is above its potential and muted otherwise.[6] Because of this ability to isolate demand-driven inflation pressures, a supercore inflation measure is directly relevant and supportive of monetary policy decision making.

To construct the supercore measure, we follow the methodology proposed by the European Central Bank (ECB) (2018) but with notable variations. The approach uses reduced-form Phillips curve specifications to test the responsiveness of the sub- components of core inflation to the output gap.

2. Data and methodology

The analysis uses the core consumer price index (CPI) data from Stats SA, disaggregated at the COICOP 3 level. The disaggregated data contains 43 indices. However, three of these, namely, other major durables for recreation and culture, services for the maintenance and repair of dwellings and package holiday services were dropped from the analysis as these indices have too few observations, leaving a total of 40 quarterly indices. These CPI indices are not seasonally adjusted, and we log- transform them to account for any exponential trend typically present in price indices. Other key data include the output gap series as estimated by the SARB's Quarterly Projection Model. The sample period is from the first quarter of 2002 to the first quarter of 2024 and is chosen to both capture the inflation targeting period and to have enough observations to apply our methodology.[7]

We construct a supercore index by selecting only those components of the core CPI basket that are sensitive to general economic conditions as proxied by the output gap. In this sense, the measure filters out components of core inflation that, as described below, are assessed to be unresponsive to business cycle fluctuations. We follow the approach by the ECB (2018), but with some departures. The methodology is implemented in three steps. First, for each of the 40 core CPI components, we estimate three Phillips curve specifications which respectively

5 See BBVA (2018).

6 Concerns regarding real-time output gap estimates for South Africa include the fact that they undergo significant revisions overtime, which may affect reliability. This is, in part, attributable to revisions in the national accounts data, including GDP (Kemp 2014).

7 The first quarter of 2024 includes the average of two months (January and February). The inflation outcome for March was not published yet at the time this model was run.

include the output gap lagged by one quarter; the output gap lagged by two quarters and the output gap lagged by one and two quarters. This is estimated using a seasonal autoregressive integrated moving average (ARIMA) model, specified under the framework ARIMA (1, 1, 1)×(1, 1, 1)$_4$. The seasonal component is added to capture any seasonality and survey effects that may be present in the data. We also estimate a benchmark ARIMA model for each of the core CPI components. ECB (2018), on the other hand, use an autoregressive process of order 1 (AR (1)) instead as their benchmark model. The four estimated equations are written as:

$$\Delta\Delta_4 y_{it} = ARIMA\ terms + \alpha_{1i} \cdot outputgap_{t-1} + \varepsilon_{it}^1 \quad (1)$$

$$\Delta\Delta_4 y_{it} = ARIMA\ terms + \beta_{1i} \cdot outputgap_{t-2} + \varepsilon_{it}^2 \quad (2)$$

$$\Delta\Delta_4 y_{it} = ARIMA\ terms + \delta_{1i} \cdot outputgap_{t-1} + \delta_{2i} \cdot outputgap_{t-2} + \varepsilon_{it}^3 \quad (3)$$

$$\Delta\Delta_4 y_{it} = ARIMA\ terms + \varepsilon_{it}^4 \quad (4)$$

where Δ and Δ_4 represent the first order non-seasonal and seasonal differencing, respectively; y_{it} is the log-transformed index level of component *i* in the core CPI basket at time *t*, and ε_{it}^j is the error term of the *j*th equation. Equation (4) serves as a benchmark to compare against equations (1), (2) and (3). The ARIMA terms are omitted for brevity.

In the second step, we perform forecasts for each of the 40 components for horizons of one to four quarters ahead. The forecasts are estimated conditional on the path of the output gap over the forecast period. Lastly, we calculate the average root mean square forecast error (ARMSFE) for each of the components of the core basket. This is done for each of the three Phillips curve equations as well as for the ARIMA benchmark model. We compare the ARMSFEs of the Phillips curve equations with the benchmark and if any one of the Phillips curve equations performs better than the benchmark, then that component is deemed sensitive to slack and is included in the supercore index.[8]

3. Estimation results and discussion

3.1. Preliminaries

Based on the above analysis, a total of 11 components in the core inflation basket make it into the supercore basket, accounting for 22.4% of the core CPI basket.[9] This means that about a quarter of the core inflation dynamics can be explained mainly by demand fluctuations. This differs somewhat from Radebe (2019) who finds that 37% of the core inflation basket is

[8] In other words, the inclusion of the output gap enhances the predictive accuracy of inflation for each item, compared to the baseline.

[9] Table A1 in Appendix A outlines the excluded components from the supercore index.

sensitive to the business cycle.[10] Table 1 gives the items included in the supercore index, and their respective weights.

The three largest components in our supercore measure are rentals, water and other services, and household content services, with weights of 21.0%, 20.8% and 15.2%, respectively (see Table 1). That water and other services (this includes assessment rates, refuse collection, and sewerage) and tertiary education are included in supercore is rather surprising as these are administered prices.[11] Equally, there are items such as clothing, footwear, purchase of vehicles, household content goods, and hotels that, intuitively, one would expect to show sensitivity to the business cycle that, nevertheless, are excluded from supercore. Radebe (2019) also found these items to be unresponsive to economic slack (i.e. acyclical).[12] The statistically insignificant results may reflect a relatively low elasticity of demand, or factors related to market structures (ECB 2014).

Table 1: Supercore components and weights

Component	Weight in headline	Weight in core	Weight in supercore
Goods			
Other recreational items	0.66	0.89	4.0
Recreational equipment	0.6	0.81	3.6
Spare parts and accessories	0.43	0.58	2.6
Telephone equipment	0.19	0.26	1.1
Services			
Actual rentals for housing	3.5	4.70	21.0
Water & other services	3.46	4.65	20.8
Household content services	2.53	3.40	15.2
Catering services	2.2	2.96	13.2
Other miscellaneous services	1.29	1.73	7.7
Tertiary education	1.05	1.41	6.3
Personal vehicle operation	0.76	1.02	4.6
Total	**16.67**	**22.4**	**100**

Source: Stats SA and authors' own calculations.

10 Radebe (2019) used CPI data disaggregated at the COICIOP 2 level, the level of disaggregation could explain the difference in the authors findings compared to ours. When we ran the model using the COICOP 2 level of disaggregation, the supercore basket accounted for 40.0% of the core basket which is more in line with Radebe (2019). Her Phillips curve specification differs greatly from our own. She includes inflation expectations and only the first lag of the output gap. The model follows AR(1) process whereas we use an ARIMA model. Moreover, a component from the core CPI basket is considered procyclical if the coefficient is positive and statistically significant. We employ a three-step process that includes calculating the ARMSFEs to determine which components to include in the supercore index.

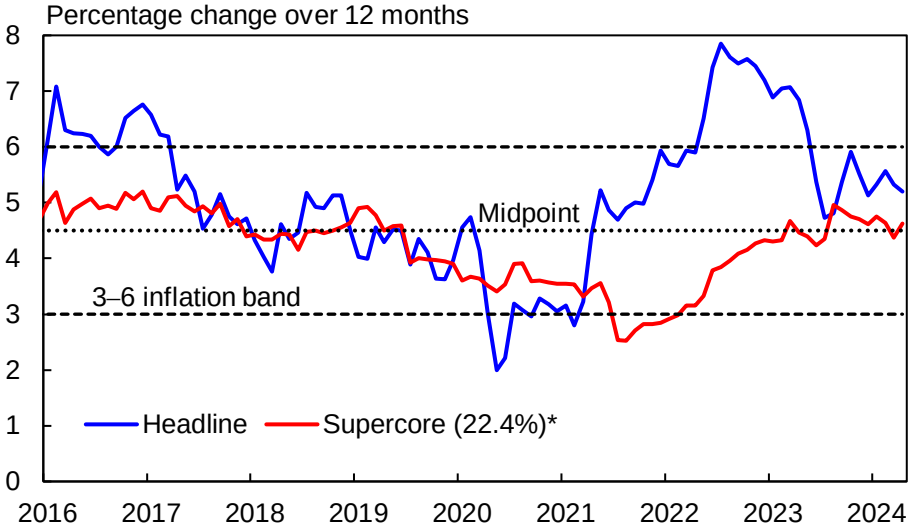
11 We ran the model considering only the pre-COVID-19 sample period (from the first quarter of 2002 to the fourth quarter of 2019). We find that administered prices are excluded from the supercore index. This suggests that the COVID-19 pandemic may have resulted in a correlation between the business cycle and some administered prices.

12 As suggested by the reviewer, the non-sensitivity of some of these components could be because they only respond to slack with a lag of more than two quarters. Our model only considers the first and second lags.

3.2. The supercore measure

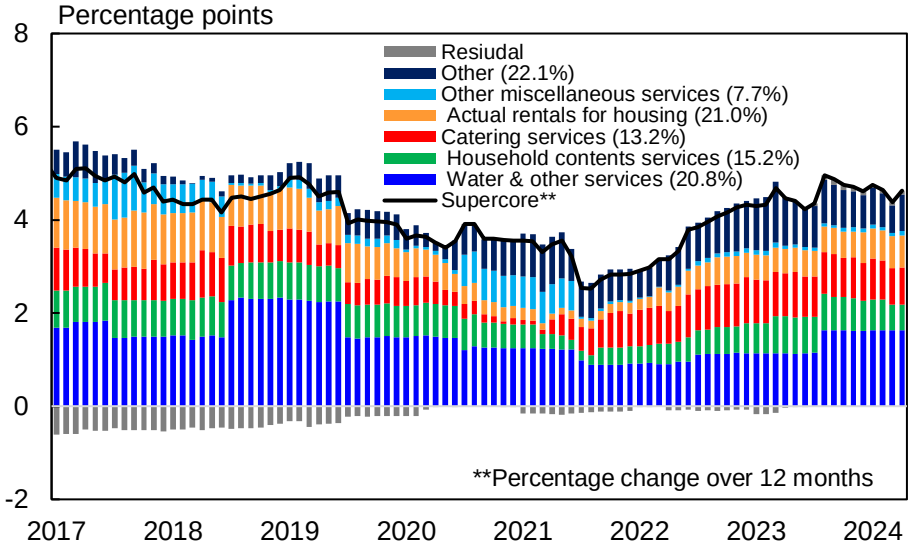
Figure 1 depicts supercore inflation along with headline inflation. As one would expect, supercore inflation is less volatile than headline inflation. Supercore inflation remained close to the midpoint of the target band between 2016 and 2019, but trended lower from 2019, briefly falling below the lower threshold of the target band before gradually rising from 2021. The rise in supercore inflation since 2021 has been broad- based, with actual rentals, catering services and household content services adding materially to the upwards momentum (Figure 2). Over the past year, supercore inflation has hovered around the midpoint of the target band.

Figure 1: Supercore inflation



* Weight in core basket in brackets
Sources: Stats SA and SARB

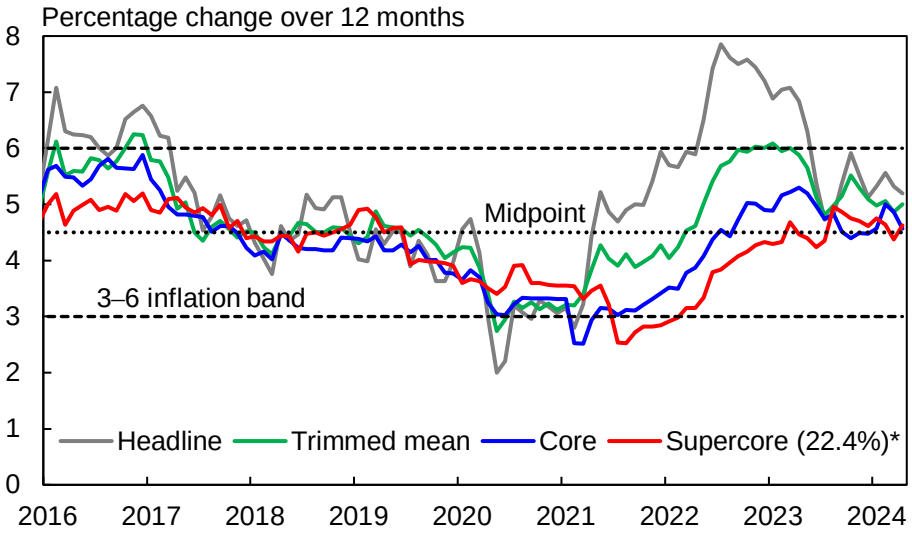
Figure 2: Contributions to supercore inflation*



* Weight in supercore basket in brackets
Sources: Stats SA and SARB

Between 2017 and 2020 headline inflation and the three measures of underlying inflation (core, trimmed mean and supercore inflation) tracked each other closely and hovered around the midpoint of the inflation target band. The convergence to the 4.5% midpoint over this period coincided with the shift in the SARB's communication to emphasise the midpoint of the 3-6% target band. The COVID-19 shock in early 2020 resulted in a sharp deceleration in inflation across all measures, but with some delay in supercore, which only troughed in July 2021.[13] As the economy re-opened following the COVID-19 lockdowns and economic activity gained momentum, inflation picked up across all measures but the gap between them widened, with headline and trimmed mean inflation quick off the blocks while supercore rose only gradually.

Figure 3: Measures of underlying inflation



* Weight in core basket in brackets
Sources: Stats SA and SARB

The sluggish rise in supercore inflation in the post-pandemic period suggests that inflationary pressures over this period were less about demand-pull and more about cost-push factors or relative price movements. Indeed, early in the recovery inflationary pressures largely emanated from the surge in global food and oil prices on account of recovering global demand amid the COVID-19-induced supply bottlenecks. These effects were later exacerbated by the Russia/Ukraine conflict in 2022, which impacted on agricultural commodities, agricultural input costs and crude oil prices. Further supply-side pressures emanated from a depreciated rand, along with other idiosyncratic factors such as load-shedding and the outbreak of animal diseases.

The trajectory of supercore inflation since the pandemic is best understood by reference to the dynamics of the output gap during this period. The output gap widened to -3.5% in 2020 and remained elevated at -1.9% in 2021, implying demand weakness and thus substantial disinflationary pressures. Supercore inflation rose as the output gap closed (demand strengthened) through the recovery, in part benefitting from the record low interest rates during

[13] Headline and trimmed mean inflation troughed in May 2020, while core inflation bottomed nearly a year later in February 2021.

this period. Supercore inflation now hovers around the target midpoint, indicating neither inflationary nor deflationary demand pressures.

4. Conclusion

In this economic note we construct a new measure of trend inflation for South Africa, named supercore inflation, to broaden the suite of indicators used by the SARB to monitor underlying price developments. The supercore basket is made up of components that are responsive to general economic conditions as measured by the output gap. Broadening the suite of measures for assessing underlying price pressures enhances robustness and confidence of correctly pinning down the persistent inflationary dynamics given the uncertainty around any single such measure, which is crucial for the formulation and calibration of monetary policy by the SARB. Our findings reveal that demand-driven inflationary pressures are presently more balanced, with supercore inflation hovering around the target midpoint in recent months.

'Official' measures – core inflation and trimmed mean inflation – show slightly more elevated inflation pressures. The divergence between core and trimmed mean inflation on the one hand and supercore inflation on the other reflects supply-side price pressures such as cost-push factors and shifts in relative prices. Indeed, the 'balanced' inflationary pressures finding for supercore inflation is consistent with the SARB's view of the output gap – which is estimated to be neutral/closed since the past year.

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Appendix

A Included and excluded components in supercore

Table A1: Core CPI

Core CPI component	Included or excluded in the supercore measure
Goods	
Alcoholic beverages	No
Tobacco	No
Clothing	No
Footwear	No
Telephone equipment	Yes
Medical products	No
Furnishings	No
Textiles	No
Glassware, tableware, and household utensils	No
Household appliances	No
Tools and equipment for house and garden	No
Liquid fuels	No
Maintenance and repair	No
Personal care products	No
Personal effects	No
Newspapers, books, and stationery	No
Other recreational items	Yes
Recreational equipment	Yes
Vehicle spare parts and accessories	Yes
Purchase of vehicles	No
Services	
Postal services	No
Telephone services	No
Primary education	No
Secondary education	No
Tertiary education	Yes
Hospital	No
Outpatient	No
Household content services	Yes
Actual rentals	Yes
Owners' equivalent rent	No
Water and other services	Yes
Financial services	No
Insurance	No
Other miscellaneous services	Yes
Personal care services	No
Cultural services	No
Accommodation services	No
Catering services	Yes
Personal vehicle operation	Yes
Public transport	No

Sources: Stats SA and SARB.