South African Reserve Bank Occasional Bulletin of Economic Notes

OBEN/24/01

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South African Reserve Bank

April 2024

SARB Occasional Bulletin of Economic Notes
April 2024

Table of Contents

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OBEN 2401* – June 2023

Change of the SARB's preferred inflation target in 2017: the conditional forecast story

Ekaterina Pirozhkova and Nicola Viegi

Abstract

This note analyses the effects of the South African Reserve Bank's Monetary Policy Committee communicating a change in its preferred inflation target in July 2017. Prior to 2017Q3, the MPC indicated its inflation targeting range to be 3–6%. From 2017Q3 onward, the MPC shifted to emphasising the midpoint of the range, 4.5%, as its preferred inflation target. We estimate the implications of this shift by means of a Bayesian vector autoregression-based counterfactual exercise. Our results show that this change in the preferred inflation target allowed a reduction in prices and inflation expectations without negative effects on real output and employment. This was achieved via the reduction in the South African–United States long-term interest rate spread (i.e. by a reduction in risk) and by a subsequent positive effect on asset prices.

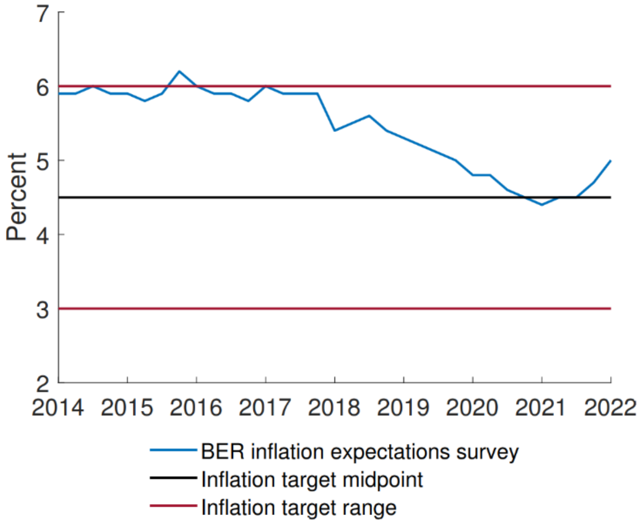
1. Introduction

In its Monetary Policy Committee (MPC) announcement of 20 July 2017, the South African Reserve Bank (SARB) communicated a change in its preferred inflation target. Prior to this announcement, SARB had indicated that it was targeting inflation in the range of 3–6%, whereas the July 2017 MPC statement postulated that the mid-point of the range, 4.5%, would be targeted going forward. We use this episode to study the effects of a change in the inflation target of the SARB.

The MPC's announcement in July 2017 coincided with the start of a downward trend in surveyed inflation expectations and in market-implied expectations derived from break-even rates. The latter emerged against the backdrop of reduced actual inflation in South Africa and globally, and de-anchoring of some inflation drivers from the upper band of the inflation target level domestically. As shown in Figure 1, the Bureau for Economic Research (BER) two-year ahead inflation expectations hovered around the upper bound of the 3–6% range until mid-2017 and gradually fell to the 4.5% midpoint after that.[1] This suggests that the 3–6% targeting range was effectively perceived by agents as the inflation target set near the range's upper band of 6%. One can therefore consider the change in the inflation target in July 2017 as a de facto reduction from 6% to 4.5%.

[1] The path of the break-even inflation rate as shown in Soobyah (2022) follows a similar pattern.

Figure 1: BER two-year ahead inflation expectations vs the inflation target



Source: SARB, BER.

It is typically understood that the transition towards a lower inflation target is costly. While the long-term benefits of this transition are very likely to be significant due to better predictability of returns on investment and savings and clearer relative price signals, its potential short-run costs make changing the inflation target a contentious issue.[2] This is particularly relevant in the context of South Africa with its low growth and dramatic level of unemployment. Evaluating the transition cost is therefore an important exercise for a policymaker considering a reduction in the inflation target.

This note contributes to existing literature that evaluates the implications of lowering the inflation target in South Africa. The recent work of Loewald et al. (2022) estimates the sacrifice ratio for South Africa as a measure of the costs of reducing the inflation target by employing trend analysis (Ball 1994) and a structural vector autoregression (VAR) (Cecchetti and Rich 2001). It finds a very low sacrifice ratio in a two-variable VAR at a four-quarter horizon, and shows a significant degree of uncertainty associated with estimates for longer horizons and in a three-variable VAR model. Gereziher and Nuru (2021) use a structural VAR model as well, estimate it over a different sample and show even lower sacrifice ratio estimates, while Kabundi, Schaling and Some (2016) find a higher value of the sacrifice ratio that decreased after the global financial crisis.

In this context, this note aims to refine the existing empirical evidence on the effects of changing the inflation target in South Africa by using an approach that is data-driven, i.e. relying on historical correlations as opposed to imposing a particular model structure, and employing the latest methodological tools suitable for this exercise (Giannone, Lenza and Reichlin 2010; Banbura, Giannone and Lenza 2015; Caruso, Reichlin and Ricco 2019). We focus on the 2017Q3 episode, when the SARB embarked on anchoring inflation expectations at the 4.5% midpoint of the inflation target range, and estimate the effects of this event by means of a Bayesian VAR-based counterfactual exercise. Specifically, we compare the realised macroeconomic dynamics in the period after 2017Q3 with the patterns of business cycle

[2] For the discussion and empirical findings on the transition to a lower inflation target, see, among others, De Gregorio (1992), Frenkel and Mehrez (2000), Mankiw (2000), Cecchetti and Rich (2001), and Belke and Boing (2014).

fluctuations formed during the period (2004Q1–2017Q2) in which the 3–6% inflation target range was adopted; we follow Caruso, Reichlin and Ricco (2019) in implementing this. To derive the counterfactual, we estimate a large VAR model on the 2004Q1–2017Q2 sample. The wide set of real, nominal and financial variables included in the model allows us to incorporate the effect of financial channels on business cycles. Importantly, we account for the expectations channel of monetary policy by introducing the survey-based inflation expectations variable in our framework.[3]

2. Conditional forecast view

Our approach to estimate the effects of the SARB's transition to anchoring inflation expectations at the 4.5% midpoint is to compare the actual macroeconomic dynamics after 2017Q3 with the counterfactual history. The counterfactual history is generated as a Bayesian VAR model forecast conditional on variables' historical correlations with the macroeconomy over 2004Q1–2017Q2 and on the realised path of monetary and fiscal policy variables. The period 2004Q1–2017Q2 is chosen as an estimation sample to capture the cross-correlations prevalent in macroeconomic and financial variables during the period in which the 3–6% range was adopted by SARB as the inflation target. We condition the forecast on the actual path of short-term interest rates and government expenditures, which are used as respective monetary and fiscal policy variables, to provide a role to realised macroeconomic policies in driving the economy.

Thereby, we focus on a once-off event of the central bank's preferred inflation target change in mid-2017, and by employing a large VAR model that includes a broad set of real, nominal and financial variables, we provide an overview of this event's effects on the economy accounting for interactions across business and financial cycles. Bayesian shrinkage is used to address the dimensionality problem of the VAR with a large number of predictors (De Mol, Giannone and Reichlin 2008; Banbura, Giannone and Reichlin 2010). Our quarterly frequency dataset consists of 27 aggregate time series, specifically: real output and its components, unemployment, monetary and fiscal policy variables, consumer prices, asset prices, and financial and credit variables for the period 2004Q1–2019Q4.[4] Table 1 in the Appendix provides details on the variables used in the model. With the exception of those measured in rates, variables are used in their log levels and are deflated with the GDP deflator. We follow Caruso, Reichlin and Ricco (2019) in addressing challenges associated with incorporating this broad set of variables in the VAR model. Minnesota and sum-of-coefficients priors are used in the empirical specification (Litterman 1979; Litterman 1986; Doan, Litterman and Sims 1983), with the priors' strength being set optimally according to Giannone, Lenza and Primiceri (2015).

We derive the conditional forecast for the South African economy in two steps. First, the Bayesian VAR model is estimated on the 2004Q1–2017Q2 sample. Second, the conditional expectations for all variables for the 2017Q3–2019Q4 period are obtained. The conditioning information we use is, first, the 2004Q1–2017Q2 model variables' data; second, the model's

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3 Botha, Kuhn and Steenkamp (2020) show that inflation expectations play a key role in explaining inflation in the case of South Africa.

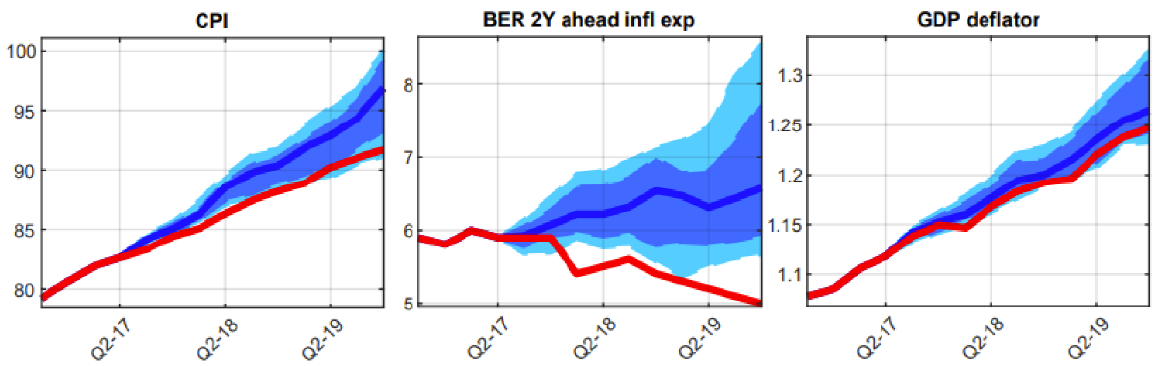
4 As a robustness check, unit labour costs (ULCs) were also included in the model. That did not change our results significantly, implying that the role that the ULCs played in putting downward pressure on inflation is implicitly accounted for by dynamics of other variables in the baseline Bayesian VAR specification. Notably, the actual path of ULCs after 2017 is significantly below the counterfactual in the robustness test, implying that producers' labour costs have also gone down following the change in SARB's preferred inflation target.

estimated parameters reflecting the variables' historical correlations; and third, the realised path of short-term interest rate and government expenditures in 2017Q3–2019Q4.

3. Results

In this section we discuss the results of the counterfactual exercise. We compare the realised path of macroeconomic and financial variables with their VAR model-based forecast that is conditional on the variables' historical correlation with the macroeconomy in 2004Q1–2017Q2 and on the path of monetary and fiscal policy variables after 2017Q3. Given that SARB anchored inflation to the 3–6% target range in the period 2004Q1–2017Q2, the conditional forecast indicates what would be expected if the central bank continued adopting the same inflation target range. A deviation of the actual path from the forecast shows the contribution of SARB's shift to anchor inflation to the 4.5% midpoint of the target range in 2017Q3.

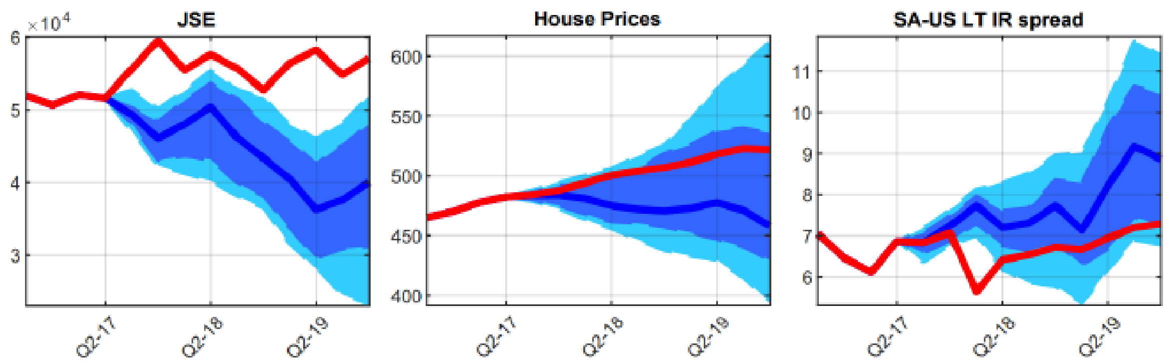
Figure 2: Conditional forecast – consumer prices



Note: The actual data (red) and the counterfactual path of the variables. The blue lines are the medians of the forecast conditional on the path of 3-month Johannesburg Interbank Average Rate (Jibar) and government expenditures, plotted with 68% (dark blue) and 90% (light blue) coverage intervals. The consumer price index (CPI) is an index; BER inflation expectations are in annual rates; GDP deflator is a ratio.

Figures 2, 3 and 4 show the actual path of model variables together with their conditional forecast, summarised as the median, the 68% and 90% coverage intervals. Several of our results are noteworthy.

Figure 3: Conditional forecast – asset prices



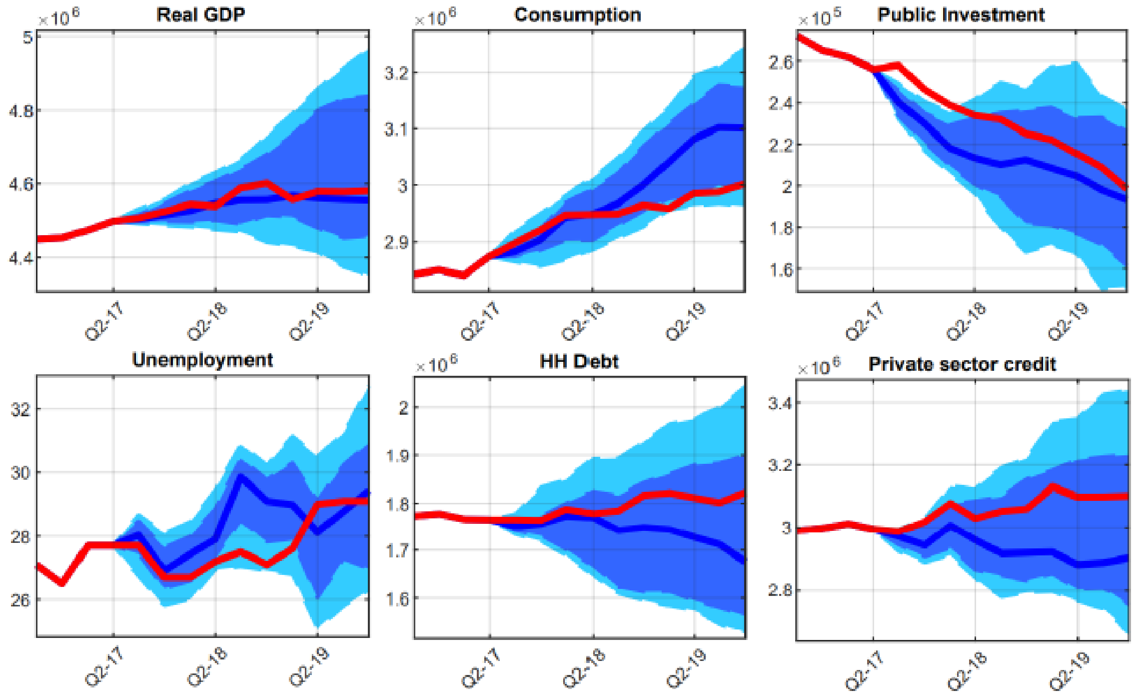
Note: The actual data (red) and the counterfactual path of the variables. The blue lines are the medians of the forecast conditional on the path of 3-month Jibar and government expenditures, plotted with 68% (dark blue) and 90% (light blue) coverage intervals. Johannesburg Stock Exchange and house prices are indices; South African-US long-term interest rate spread is in annual rates.

First, since 2017Q3 prices have dropped as a result of the inflation target shift by the central bank, as expected. The realised path of the CPI is below the lower bound of the 68% coverage interval implied by the model (see Figure 2, ‘CPI’ panel), meaning that the SARB’s change in the inflation target has contributed to reduced prices. Crucially, the survey-based inflation expectations have also dropped significantly post-2017Q3 (Figure 2, ‘BER 2Y ahead infl exp’ panel). The observed path of BER two-year ahead inflation expectations lies below the 90% model-implied coverage band, meaning that the realised levels of the inflation expectations measure were exceptionally low according to the model. This implies that given the actual path of monetary and fiscal policy variables, there has been an unprecedented reduction in prices and inflation expectations since 2017Q3. This evidence points to a strong expectations channel from central bank communication and the high credibility of SARB, consistent with previous findings (Botha, Kuhn and Steenkamp 2020).

Second, the change in the communication by SARB has contributed to increased asset prices. The stock market has recorded anomalous peaks post-2017Q3, in contrast with conditional expectations consistent with lower expected inflationary risk and reduced uncertainty (Figure 3, ‘JSE’ panel). Real house prices have gone up as a result of the inflation target shift – they have been close to the upper bound of 68% in model-implied coverage interval (Figure 3, ‘House Prices’ panel). The South Africa-US long-term interest rate spread has fallen compared to its forecasted level, reflecting reduced inflationary risk at the long horizon since 2017Q3 and indicating the expansionary effect of disinflation via a reduction in the country risk premium (Figure 3, ‘SA-US LT IR’ panel).

The big drop in the stock market in the counterfactual could be explained, first, by reduced foreign investors’ demand for domestic shares and bonds, reflecting their higher riskiness, and second, by tighter conditions in domestic financial markets – long rates are elevated, reflecting higher inflation risk going forward. Tighter financial conditions result in subdued private sector credit issuance in the counterfactual, which reduces financial resources for both companies and individuals to purchase equity. In addition, higher expected inflation in the counterfactual aggravates market expectations of further increases in short-term policy rates to contain inflation.

Figure 4: Conditional forecast – aggregate demand and its components



Note: The actual data (red) and the counterfactual path of the variables. The blue lines are the medians of the forecast conditional on the path of 3-month Jibar and government expenditures, plotted with 68% (dark blue) and 90% (light blue) coverage intervals. Unemployment is in percent, other variables are in millions of rand, with 2015 as the base year.

Third, there has been no negative effect on aggregate demand – the actual real GDP path is in line with or above the median of the conditional forecast following the transition to a 4.5% inflation target in 2017Q3 (Figure 4, 'Real GDP' panel). Unemployment has also not been affected by this transition negatively – if anything, unemployment has fallen since 2017Q3 and has returned to its conditionally expected levels (Figure 4, 'Unemployment' panel). Consumption has fallen post-2018Q3, possibly reflecting households' preference for increased borrowing – household debt and private sector credit have increased over this period in contrast to the median conditional forecast (Figure 4, 'Consumption', 'HH D' and 'Private sector credit' panels). This is consistent with lower expected inflation that reduces uncertainty about the cost of credit going forward. Public investment has been on the rise over 2017Q3–2018Q4 as compared with the forecast with possible crowding-out effects (Figure 4, 'Public Investment' panel).

4. Conclusion

This note used conditional forecasting techniques to evaluate the effect of the 2017 change in the SARB's communication about its monetary policy framework. That episode is the closest we have to an effective reduction in the inflation target from 6% to 4.5%. This note helps to illustrate the short-run macroeconomic effect of a change in the monetary policy framework. The results confirm that a credible reduction in the target has no negative real effects because the credible commitment to the new target is rapidly absorbed by private sector expectations, induces a reduction of the long-term risk premium and has a consequent positive effect on asset prices and credit to the private sector.

References

Ball, L. 1994. 'What determines the sacrifice ratio?' In Monetary Policy, edited by N G Mankiw (Chicago: University of Chicago Press): 155-193.

Banbura, M, Giannone, D and Lenza, M. 2015. 'Conditional forecasts and scenario analysis with vector autoregressions for large cross-sections'. International Journal of Forecasting 31(3): 739–756.

Banbura, M, Giannone, D and Reichlin, L. 2010. 'Large Bayesian vector auto regressions'. Journal of Applied Econometrics 25(1): 71–92.

Belke, A and Boing, T. 2014. 'Sacrifice ratios for euro area countries: new evidence on the costs of price stability'. Australian Economic Review 47(4): 455–471.

Botha, B, Kuhn, L and Steenkamp, D. 2020. 'Is the Phillips curve framework still useful for understanding inflation dynamics in South Africa?'. South African Reserve Bank Working Paper Series, WP/20/07.

Caruso, A, Reichlin, L and Ricco, G. 2019. 'Financial and fiscal interaction in the euro area crisis: this time was different'. European Economic Review 119(C): 333–355.

Cecchetti, S G and Rich, R W. 2001. 'Structural estimates of the U.S. sacrifice ratio'. Journal of Business & Economic Statistics 19(4): 416–427.

De Gregorio, J. 1992. 'The effects of inflation on economic growth: lessons from Latin America'. European Economic Review 36(2–3): 417–425.

De Mol, C, Giannone, D and Reichlin L. 'Forecasting using a large number of predictors: is Bayesian shrinkage a valid alternative to principal components?' Journal of Econometrics 146(2): 318–328.

Doan, T, Litterman, R B and Sims, C A. 1983. 'Forecasting and conditional projection using realistic prior distributions'. National Bureau of Economic Research (NBER) Working Paper 1202.

Frenkel, M and Mehrez, G. 2000. 'Inflation and the misallocation of resources'. Economic Inquiry 38(4): 616–628.

Gereziher, H Y and Nuru N Y. 2021. 'Structural estimates of the South African sacrifice ratio'. World Institute for Development Economics Research Working Paper 2021/12.

Giannone, D, Lenza, M and Primiceri G E. 2015. 'Prior selection for vector autoregressions'. The Review of Economics and Statistics 2(97): 436–451.

Giannone, D, Lenza, M and Reichlin, L. 2010. 'Business cycles in the euro area'. In Europe and the Euro, edited by A. Alesina and F. Giavazzi. National Bureau of Economic Research Conference Report (University of Chicago Press). Chapter 4. 141–167.

Kabundi, A, Schaling, E and Some, M. 2016. 'Estimating a time varying Phillips curve for South Africa'. South African Reserve Bank Working Paper Series, WP/16/05.

Litterman, R B. 1979. 'A Bayesian procedure for forecasting with vector autoregression'. Technical Report.

Litterman, R B. 1986. 'Forecasting with Bayesian vector autoregressions – five years of experience'. Journal of Business & Economic Statistics 4(1): 25–38.

Loewald, C, Makrelov, K and Pirozhkova E. 2022. 'The short-term costs of reducing trend inflation in South Africa'. South African Reserve Bank Working Paper Series, WP/22/08.

Mankiw, N G. 2000. 'The inexorable and mysterious trade-off between inflation and unemployment'. NBER Working Paper 7884.

Soobyah, L. 2022. 'Inflation expectations on the rise'. South African Reserve Bank Research Brief, RB/2022/05.

Appendix

Table 1: Variables included in the model

Variables' labels	Description	Source
Real GDP	Real GDP	SARB QB Database[7], KBP6006D
Consumption	Final consumption expenditure by households	SARB QB Database, KBP6007D
Private Investment	Fixed capital formation by private business enterprises	SARB QB Database, KBP6109D
Public investment	Fixed capital formation by general govt and public corporations	SARB QB Database, KBP6100D+KBP6106D
Unemployment	Unemployment Rate	SARB QB Database, KBP7019K
Gov Revenues	Total general govt revenues,[8] deflated by GDP deflator	Authors' calculations
Gov Expenditures	Total general govt expenditure excluding interest payments,[9], deflated by GDP deflator	Authors' calculations
Interest Payments	General govt interest payments,[10] deflated by GDP deflator	Authors' calculations
HH Savings	Household saving ratio to disposable income	SARB QB Database, KBP6287L
HH Debt	Household financial liabilities, deflated by GDP deflator	Authors' calculations
Private sector credit	Credit extended to private sector, deflated by GDP deflator	Authors' calculations
NFC Debt	Non-financial public corporations domestic marketable debt, deflated by GDP deflator	Authors' calculations
Banks Debt	Total liabilities of banks, deflated by GDP deflator	Authors' calculations
CA/GDP	Current account / GDP	SARB QB Database, KBP5380K
House Prices	House price index	FNB South Africa Average House Price Index
Long Term IR	Yield of govt bonds 10Y and over, end of quarter	SARB QB Database, KBP2003M
CPI	Consumer price index, end of quarter	SARB QB Database, KBP7170N
Spread 10Y-3M	Interest rate spread between 10Y govt bonds and 3M Tbill rate	Authors' calculations
SA-US LT IR spread	Spread South Africa-US 10Y bond yields	Authors' calculations
Real GDP/Employment	Real GDP / Employment[11]	Authors' calculations
GDP deflator	GDP deflator	Authors' calculations
3M T-bill rate	3M T-bill rate	FRED data[12], IR3TTS01ZAM156N
JSE	Johannesburg Stock Exchange index	SARB
USD ZAR	Rand/dollar exchange rate	SARB
BER 2Y ahead infl exp	Bureau for Economic Research 2-year ahead inflation expectations	SARB QB Database, KBP7125K
3M Jibar	3M interbank Jibar rate	SARB QB Database, KBP1450
EMBI+SA	JP Morgan EMBI+ South Africa index - country risk premium	SARB

[8]The South African Reserve Bank Quarterly Bulletin Database.
[9]Four quarters moving average is used for smoothing.
[10]Four quarters moving average is used for smoothing.
[11]Four quarters moving average is used for smoothing.
[12]Real GDP/Employment is used as a proxy of productivity measure in the absence of reliable data on hours.

OBEN 2401* – July 2023

Updating the SARB Index of Commodity Prices

Hannah de Nobrega, Johannes Coetsee, MG Ferreira, and Rowan Walter

Abstract

Elevated commodity prices cushioned the South African economy from structural challenges when the prices of key export commodities such as rhodium, palladium, thermal coal, and iron-ore surged. They helped lift the SARB Index of Commodity Prices (ICP) higher from mid-2020, keeping it elevated until late 2022. Accurately capturing the movements in these globally determined prices is integral to describing the extent to which commodity prices play this cushioning role. The SARB ICP is a valuable tool with which to track the impact of price changes on the South African economy. It is used as an assumption in the SARB's models and is often referred to in terms of trade, balance of payments and tax revenue discussions. As the Previous ICP calculation relied on SARS export values when weighting the commodity components, the price surges in rhodium and palladium alone would have raised the index beyond reasonable levels if it was merely updated and not methodologically revised. This is despite the forward-looking approach of anchoring future prices to a lower long-run average level. This previous calculation method - in combination with the internal structure of the weights - would bias the index upward. The above, as well as a general surveying of the previous basket composition (that considered data availability and overall contributions to exports), necessitated the following revisions to the ICP:

- **Calculation**: Updated to a **Laspeyres methodology** with index weights based on 2019, the most recent relatively normal year. This is to mitigate the exacerbating effect of using export values as weights.
- **Composition**: The Updated ICP now consists of 21 commodities with 21 underlying weights. Excluded commodities are **vanadium, titanium, ferromanganese,** and **coking coal** (either weight and or data-related exclusions). Newly included commodities are **iridium** and **ruthenium**.

1. Introduction[1]

South Africa, a major commodity exporter, benefits when the prices of its export commodities rise and remain elevated. The diversity of the South African commodity export basket - combined with sharp increases in many of its underlying prices - have helped cushion the economy from widespread structural problems. For instance, elevated commodity prices boost mining company profits and subsequent government revenue from these profits, thereby reducing the pressure on strained government finances.[2] Current account surpluses sustained their longest period of consecutive positive outcomes since 1994 and were largely driven by this surge in commodity prices.[3] The SARB Index of Commodity Prices (ICP) is an important tool with which to track these price movements. It is an input into the SARB's main models, affecting the output gap, all-share index, exchange rates, tax revenues, and the export drivers of the balance of payments. The ICP also adds additional granularity to the terms of trade.

The ICP basket should be updated periodically to reflect the true composition of export commodities and their prices more accurately. Similarly, its indexation methodology should be reviewed to ensure that the most suitable method is used to reflect these changes. In this note, these tasks are undertaken in the context of the recent surge in the price of thermal coal, iron ore, and Platinum Group Metal (PGM) commodities, rhodium and palladium. The influence of the surge in PGM prices on the Previous ICP can be seen in **Figure 1**. The Reserve Bank of Australia's (RBA) index also displays this surge, albeit to a lesser extent than that of the Previous SARB ICP. This is because of the relative importance of PGM exports for the South African case, which can be seen when excluding the PGM component in the Previous SARB ICP (the dotted line). [4]

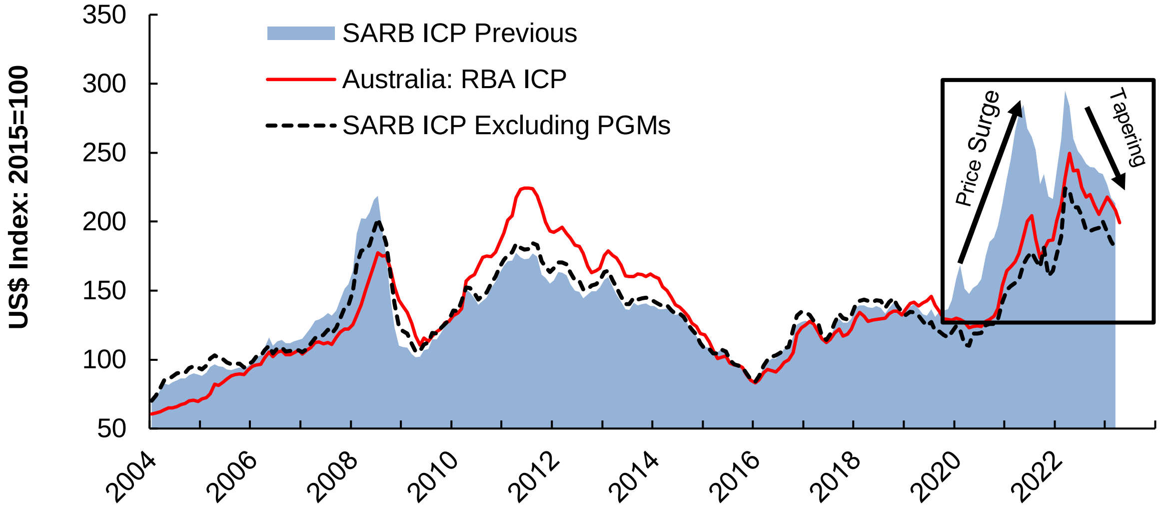
1 The authors would like to thank Iaan Venter, Patience Mathuloe and Theo Janse van Rensburg for valuable comments.

2 Loewald and Makrelov (2021) refer to large tax windfalls being realised from commodity booms. Meanwhile Allison et al (2022) estimate that 30% of the increase in gross revenue during fiscal years 2020/21 and 2021/22 is attributable to the growth in commodity prices. Looking ahead this windfall is likely to be temporary, as predicted, as commodity prices continue to correct.

3 Seven surplus quarters were recorded from 2020Q3 to 2022Q1 with the current account above 2% of GDP in all seven quarters, while it peaked above 5% in the first of these quarters.

4 The RBA and South African commodity markets share some similarities, which is what prompted this inclusion.

Figure 1: Previous SARB ICP & the PGM-Related Price Surge



Sources: RBA, Afriforesight & SARB - Calculations: Own

The previous SARB ICP was calculated using a modified Paasche indexation methodology.[5] The weights were export-value based and updated using a 24-month rolling moving average of these values.[6] The recent surge in commodity prices would have upwardly biased the index if the weights were updated as prescribed by this methodology. The bias occurs because the extreme price increase in especially rhodium and thermal coal (see **Figure 2**) also affects the weights used to calculate the index. Consequently, it was decided to delay updating the weights and to rethink the methodology. Section 2 below details this rationale.

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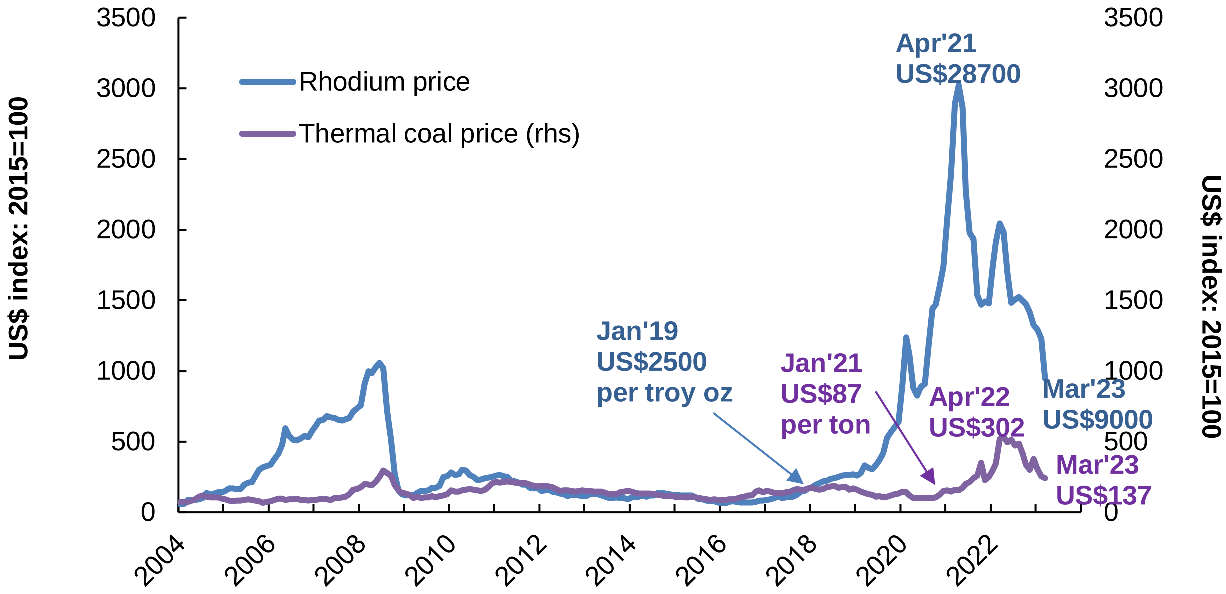
5 To avoid confusion, the following naming conventions will apply throughout:

- Previous SARB ICP – Modified Paasche Index with weights capped (data stops in August 2020). This version was in operation until March 2023.
- Previous SARB ICP (Uncapped) – the ICP had weights data not been capped. This is the same as 'Modified Paasche ICP new'.
- Updated SARB ICP – The new and updated index, based on a Laspeyres methodology.

6 A Paasche methodology where weights are continually updated using a 24-month rolling moving average (also called a 'modified' Paasche) of export values up to August 2020. Also imposed is an averaging of export values at this date over the forecast period to anchor the values closer to a medium-term equilibrium level. This anchoring was done to reduce the impact of price spikes in some commodities by including these future values in the calculation.

Figure 2: Rhodium & Thermal Coal Prices Surge



Sources: World Bank & Afriforesight

Further, we consider the impact of different indexing calculations on the ICP, most prominently the popular Laspeyres, Paasche, and Fisher methodologies.[7] We show how well each alternative tracks the Previous ICP; whether and by how much the overreaction to surging prices were muted; if it provided clear signalling for the SARB's leading indicator turning points; and finally, compared it to similar global indices.[8] A successful price index should thus: 1) not veer too sharply from the Previous ICP; 2) provide clear signals; and, 3) mute the artificial aspect of the price surge, thereby most accurately describing commodity price movements. As will be shown, the Laspeyres method was found to be the most appropriate in these tasks.

Last, the Updated ICP now comprises 21 sub-component export value weights (previously 24) with 21 underlying prices (previously 22).[9] Here, 14 of the 21 priced commodities now constitute 95% of the overall ICP. Traditionally, the ICP components have been updated every five years, with weights adjusted annually.

2. Rationale For Revision

There are two primary reasons for revising the index. The first relates to a 'standard' ICP revision, which is generally concerned with the following: which commodities to include and exclude, which year to choose as the indexation base year (i.e., rebasing year), and last, how the weights of the index should change to reflect the market most accurately.[10] The Previous

[7] Other than these three, alternative weighting schemes were also investigated to test the robustness of the previous iteration of the ICP. This is discussed in more detail in Appendix Section B.

[8] The global industry standard for commodity indices is the usage of a Laspeyres-type methodology.

[9] Less prices than weights in the previous index as the coking coal price was proxied with thermal coal, while other PGMs were proxied with the platinum price.

[10] In the case of a Laspeyres-type index, this would also include which year to base weights in. Although sounding similar, 'index base year' and 'base year weights' refer to distinct aspects of the indexation method. The 'index base year' refers to the period when the index, after being calculated, has base values of 100 (rebasing). 'Weights base year' refers to the period to which weights are tethered and is a specific

ICP composition was last updated in 2017 with weights updated in August 2020. Regular updates keep an index relevant and useful when analysing economic indicators, producing forecasts, and making decisions. For instance, it serves as a reference for market participants, economists, policymakers, and researchers to assess the level and trend of commodity prices in the South African context; and helps to improve forecasting accuracy by reflecting the most recent market prices, which can help to provide a more accurate picture of the future market.[11]

However, we also contend that a non-standard revision is required, one that considers the indexation method. This revision relates to the internal structure of the index methodology and the data it relies on. The previous index, a modified Paasche, utilises concurrent weights and prices in indexation and is therefore a *current-weighted* index. The SARS trade data used as weights are trade *value* data, where, for each commodity, the following is the case:

$$value = volume * price + other\ (tariffs, transport\ costs)$$

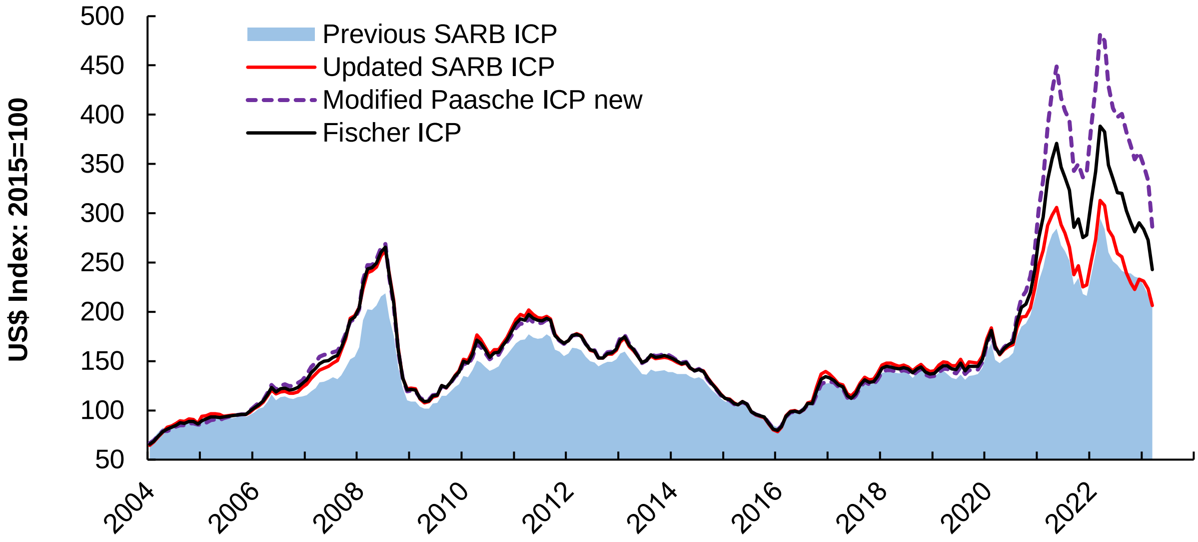
However, using values as weights is not ideal as price fluctuations are already internally present within the value data. One would prefer using ‘pure’ volumes (i.e., only export quantities) as weights, as this would be a more accurate representation of the quantities demanded. This - combined with the fact that weights are concurrent within a Paasche index – results in unusual price surges being exacerbated by the index itself.

In **Figure 3** below, the difference when including and excluding the value data from the price-surge era can be seen. This discernible difference between the Previous ICP and the ‘Modified Paasche ICP new’ (Uncapped) series showcases the exacerbation caused by the fact that the price surge is captured inside of the index. The object of the non-standard revision was to mitigate the internal exacerbation and thereby capture price movements more accurately. **Figure 3** also includes, for comparison, the Fisher and Updated SARB ICP methodologies, the latter being the chosen method which will be discussed in detail in **Section 3.2**.

step when aggregating the index. The former has no bearing on the calculation of the index itself; it is merely when the value of the index amounts to 100.

11 It also provides a better understanding of the risks associated with investing in a particular commodity which can help reduce the risk of losses due to unexpected price movements.

Figure 3: Previous ICP (Capping Weights in August 2020) vs Updated ICP



Calculations: Own

3. Comparing the Previous and Updated ICP

3.1. Describing the Previous SARB ICP

I. Methodology

The previous section gave the rationale behind altering the methodology that underpins the Previous ICP. Over the past decade, weights have been calculated using a 24-month moving average, where weights are the share that each commodity's export *value* contributes to the total export value of the basket of commodities across the annual average. While it was possible to let the weights change continually, they were only updated annually to accommodate the Leading Indicator. However, due to the surge in some commodity prices seen during the COVID-19 crisis, the weights were last updated in August 2020 to mute the Paasche method overreaction to this surge.

The previous index consisted of 24 commodities, with 22 underlying prices.[12] In terms of relative export values, commodities such as iron ore, coal, gold, chrome ore, and petroleum products were important. Some smaller commodities such as beef, wool, maize, and sugar were also included.[13] Since the previous revision, the commodity export market for South Africa has changed in (mostly subtle) ways related to the weights of individual commodities. These are discussed in more detail later.

Last, the previous (and the Updated ICP) index is 'dollar-based', i.e., US dollar prices are used to capture the commodity component prices rather than being rand denominated.[14] The overall

---

12 These are displayed in more detail in **Table 1** in **Appendix Section A**.

13 While these commodities are small relative to mining-related commodities, they add important variation to the index.

14 This choice is retained in the Updated ICP as it allows for global comparisons.

index is then obtained from the smoothed weighted contributions of the prices of the individual components.

II. Price Data

The dollar spot prices of the commodities are collected from multiple sources, such as Afriforesight, the World Bank, and the International Monetary Fund. Data availability remains a concern for some of the series.[15] In the effort to create a future-proof index, only prices with clear and consistent data reporting are considered.

III. Price Surges

Commodity prices are sensitive to external economic factors and prone to dramatic cyclical behaviour. For instance, during the period just before the Great Financial Crisis (GFC), commodity prices surged further, extending the boom. The price correction, when the crisis hit, was short lived and prices then rebounded as investors dumped volatile financial assets and instead chased value such as perceived to be offered by commodities. Prices remained relatively elevated as Quantitative Easing continued to ramp up providing price support. Around 2012, price support for PGMs can also be attributed to domestic labour supply shocks linked to a reduction in mining output.[16] Prices dramatically rallied again after COVID restrictions were implemented, reducing supply.

One goal of the ICP is to track the health of South Africa’s overall commodity sector. However, when there is a sharp increase in the prices of just a few commodities, there is a risk that these surges may over-state this health.[17]

IV. Weights Data and Evolution of Weights

Th values (weights) for the previous SARB ICP are provided by the South African Revenue Services (SARS) trade data and are captured as the aggregated final export values of the commodities. These values are collected as free-on-board values, thereby including the transaction value of the goods and the value of services performed to deliver goods to the border of the exporting country.[18]

Figures 4 and **5** below compare variations of the Previous SARB ICP and showcases ways in which analysts could emphasise different aspects of the Previous ICP.[19] This remains an important functional aspect of the SARB ICP.[20]

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15 For example, fruits and vegetables can be considered an important export category for South Africa; however, pricing data may be inconsistent or complicated to impute.

16 South Africa experienced an increase in miners’ strikes in the years leading up to 2012. The Marikana miners’ strike in 2012 was the pinnacle of these series of strikes.

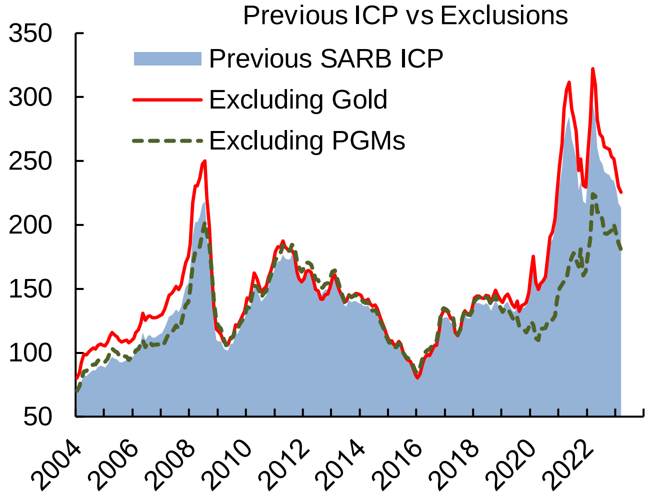
17 Such as the sharp increase in rhodium and palladium prices over the recent past.

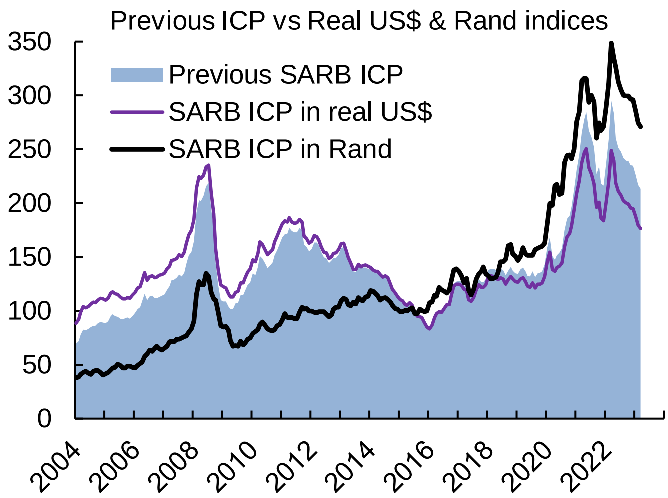
18 **Figures A** and **B** in **Appendix Section A** plot the evolution of these weights over time.

19 For instance, it is often useful for analysts to view more disaggregated indices (ones that exclude gold or PGMs), or to see the effect that currency depreciation has in supporting revenue.

20 For instance, if analysts require an index that emphasises the mining sector without PGM-related prices, the dotted line in **Figure 4** can be utilised. This is also the case for currency denominations in **Figure 5**.

Figures 4 and 5: Previous ICP – Variations





Calculations: Own. All indices 2015 = 100

3.2. The Updated Index

I. Methodology

The updated index uses a Laspeyres calculation methodology in aggregation. This method compares how much a basket of commodities in a base period would cost in the current period, thereby emphasising changes in prices rather than continually and automatically updating weights as with the previous index. Any commodity price index - as an input in SARB forecasting models – requires timely and accurate sign-changes in *prices*. As prices are included twice in the calculation process for the previous index, a method that mitigates the double counting of price changes in times where prices surge is required. The Laspeyres index accomplishes this by basing weights in a period where abnormal price surges are not present.[21] Importantly, this process does not remove the double counting of prices in the underlying data, something that is not viable due to the structure of the data. It does, however, base the index in a period where prices are not overstated above and beyond the natural double counting present in the data.

The choice of base year is reliant on discretion from the custodian of the index. As the base year can have a substantial impact on the index itself, this choice should be carefully considered once a year - in light of movements in export values - while keeping in mind that the weight data values have prices baked in.[22] In this sense, the choice of base period relies on three factors:

(1) Whether the period can be considered a 'normal' period, i.e., a period free of abnormal price surges.
(2) Whether it is the most recent such period.

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21 The Laspeyres index calculation and its related benefits and challenges are discussed in more detail in Appendix Section B.

22 Consider the Laspeyres equation in **Appendix Section B** to understand the role of the base year.

(3) Whether it tracks the historical index to a justifiable extent.

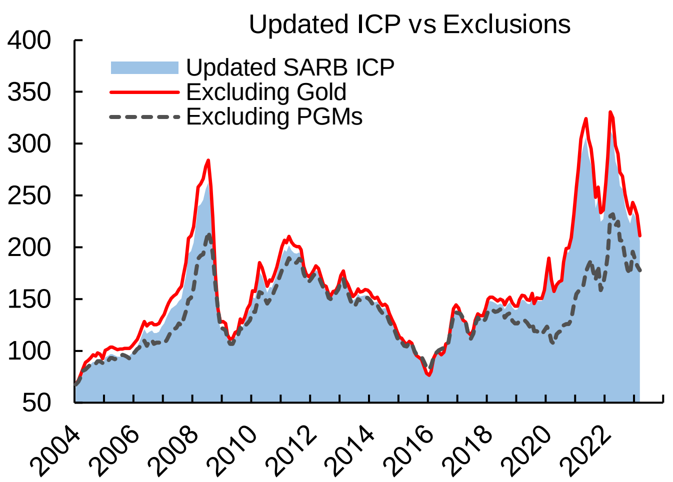
II. Composition

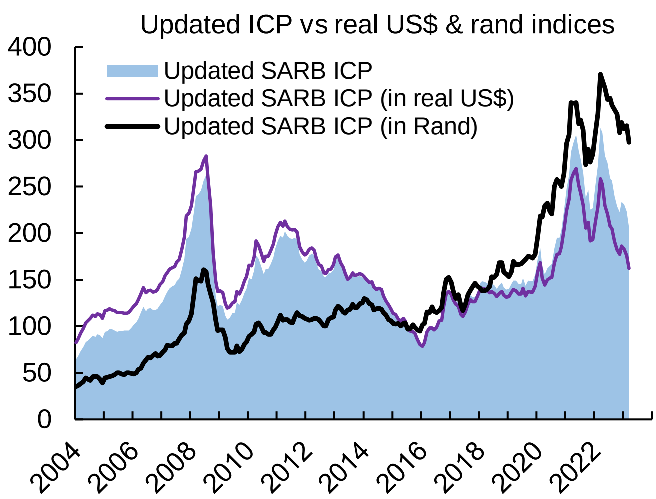
A total of 21 commodities are selected for the Updated ICP. Selection is primarily based on each commodity's respective total export value and data availability.[23] Some heavily weighted commodities in the index - coal, gold, and platinum - are weighted slightly less compared to the previous index. Given the unavailability of stable price data related to vanadium, titanium and ferromanganese, these commodities are excluded in the new iteration.[24] Last, the updated index now includes Ruthenium and Iridium as seperate inclusions given a stable price data source.[25]

III. Variations

Figures 6 and **7** display the Updated ICP and its variations. The Updated ICP can, like its predecessor, be disaggregated and augmented to some extent, depending on the use-case.[26]

Figures 6 and 7: Updated ICP – Variations





Calculations: Own. All indices 2015 = 100

3.3. The Updated vs the Previous Index

Figure 8 compares the Updated Laspeyres index with the Previous modified Paasche index (data capped). These two indices comove with correlations that are broadly unchanged over the entire sample period, fluctuating between 0.98 and 0.99. There are, however, level differences that occur most markedly during 2008 and 2011. **Table 1** in **Appendix Section A** summarises the changes between the previous and updated indices in terms of their respective commodity baskets and weights. It also discloses where the updated index price

23 We use 20 export values as iridium and ruthenium prices are a 50:50 weighting of "other PGMs" export value.

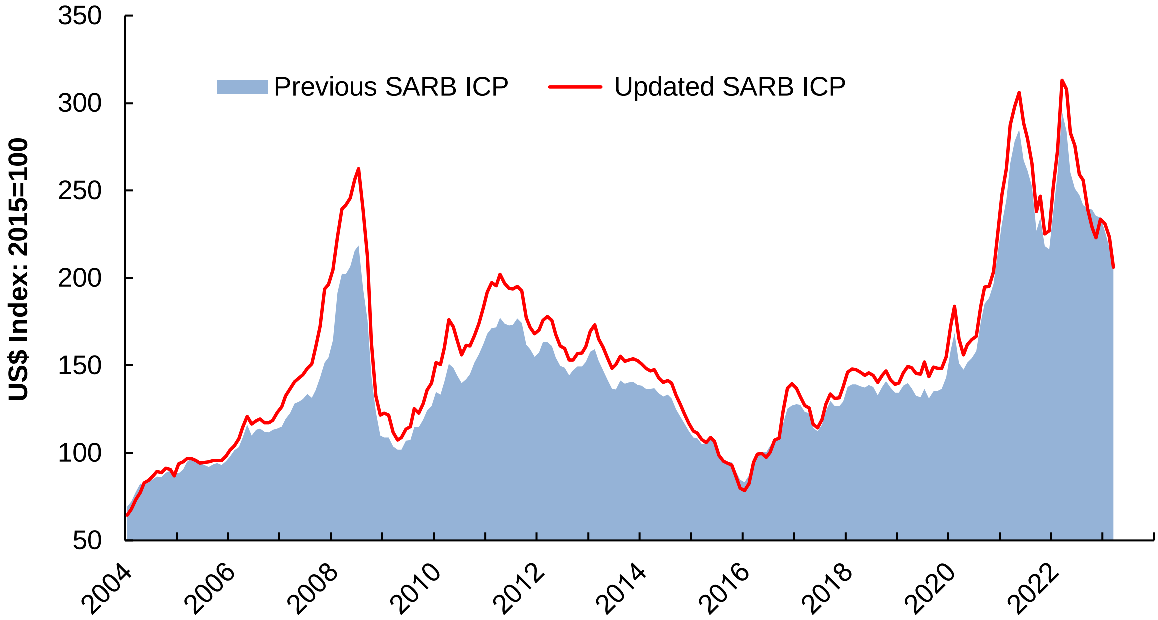
24 In the past, vanadium and titanium were linked due to data inconsistencies.

25 The commodities and its subgroups are listed in **Table 1** in **Appendix Section A**.

26 Note that the Updated SARB ICP (area in blue) is a nominal, dollar-denominated index, like its predecessor.

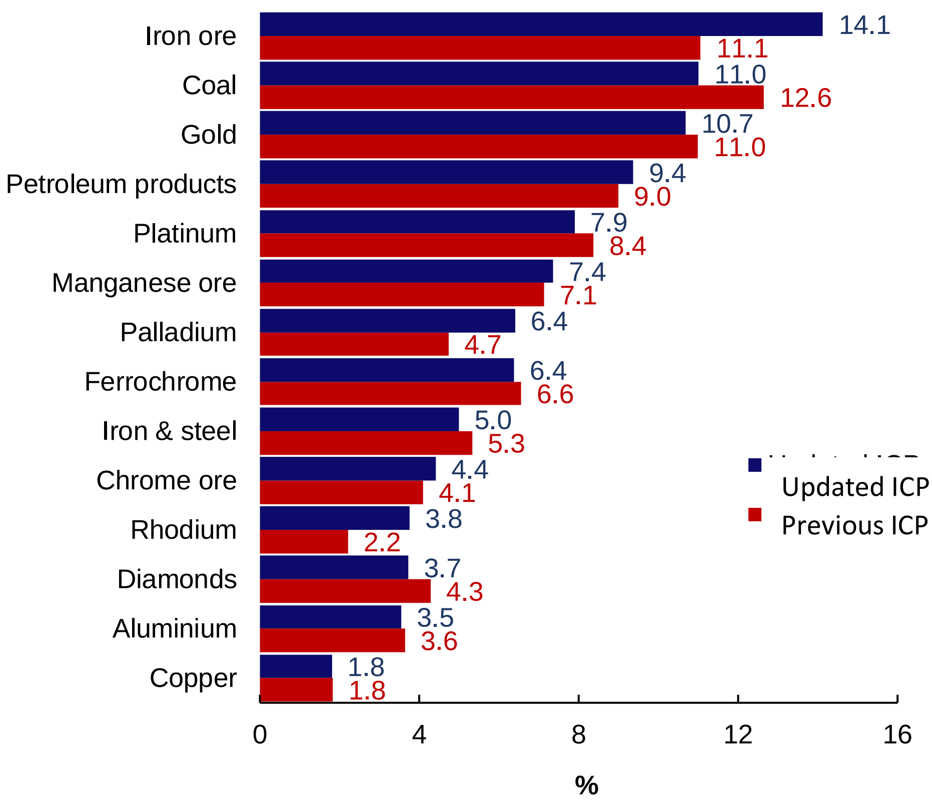
data is sourced for each commodity. **Figure 9** visualises these changes for the top 14 commodities, which comprise 95% (previously 92%) of the total of the index.

Figure 8: Updated vs Previous ICP



Calculations: Own

Figure 9: Change in ICP Weights



Calculations: Own

4. Conclusion

This note revised and updated the South African Reserve Bank's Index of Commodity Prices (ICP) by: (1) altering its methodology; (2) surveying the composition of its basket, and (3) updating the weights of underlying components. The latter two aspects relate to a 'standard' index revision, while the methodology revision follows the surge in PGM-related prices, which, in combination with the indexation method and weights data structure, would have led to a substantial increase in the overall index itself.

After comparing and testing a variety of indexing approaches and weighting schemes, the index methodology was updated from a Modified Paasche in the Previous Index to a Laspeyres index in the Updated Index. Weights are now fixed to a period (average of the year 2019) where prices are less volatile and a better true representation of the commodity export landscape.[27] The choice of Laspeyres index is considered best practice as it does not veer substantially from the Previous ICP, retaining its sensitivity to price changes, while also muting the effect of the price surge given the underlying weights data. Furthermore, it is used in similar indices like those employed by the World Bank, RBA, and the IMF.[28] The index basket and related weights were also updated. It is recommended that the basket, weights, and base year weight should be scrutinized and updated annually, to represent South African commodity market movements most accurately.

[27] 2019 being the most recent such period. In the next revision, this period should be reconsidered.
[28] This is discussed in detail in the **Appendix Section B**.

References

Allison, C, Nesengani, N and Spearman, N. South Africa's revenue performance during COVID and beyond: The impact of commodity prices. South African Reserve Bank Economic Note No. EN/2022/08, Pretoria: South African Reserve Bank, July 2022.

Bloxham, L., Brown, S., Cole, L., Cowley, A., Fujita, M., Girardot, N., Jiang, J., Raithatha, R., Ryan, M., Tang, B., and Wang, A. 2022. PGM market report. Johnson Matthey.

Diewert, E.W. and Fox, K. 2018. Substitution bias in multilateral methods for CPI construction using scanner data. UNSW business school research paper. 2018(13).

Fisher, I. 1921. The best form of index number. Quarterly Publications of the American Statistical Association. 17(133):533–551.

Janse Van Rensburg, T and Visser, E. 2021. Surging commodity prices explain a lot, South African Reserve Bank Economic Note No. EN/2021/16, Pretoria: South African Reserve Bank, August 2021.

Loewald, C and Makrelov, K. 2021. Commodity price windfalls and their implications for the fiscus. South African Reserve Bank Economic Note No. EN/2021/25, Pretoria: South African Reserve Bank, December 2021.

Hill, R. 2000. Measuring substitution bias in international comparisons based on additive purchasing power parity methods. European Economic Review. 44(1): 145-162.

Mano, K and Walter, R. 2018. Better commodity prices, but will it last? South African Reserve Bank Economic Note No. EN/2018/07, Pretoria: South African Reserve Bank, January 2018.

Laspeyres, E. 1981. IX. Die Berechnung einer mittleren Waarenpreissteigerung. Jahrbücher für Nationalökonomie und Statistik. 196(3):218–238.

Mphahlele, K. 2023. Commodity prices: have we come to the end of the current super-cycle? South African Reserve Bank Economic Note Series No. EN/2023/06, Pretoria: South African Reserve Bank, March 2023.

Paasche, H. 1874. Ueber die Preisentwicklung der letzten Jahre nach den Hamburger Börsennotirungen Jahrbücher für Nationalökonomie und Statistik, 23.

Robinson, T. and Wang, H. 2013. Changes to the RBA Index of Commodity Prices: 2013| Bulletin–March Quarter 2013. Bulletin, (March).

World Bank, 2023. Commodity Price Index "Pink Sheet" Data, Monthly prices, April 2023.

Appendix

Section A: ICP Evolution of Weights and Composition

Table 1: Changes in Composition and Weights

Commodity Price Weights (SARS Export Values)				
	Previous (2019)	**Updated (Base 2019)**	**Change (%)**	**Price Data Source[29]**
Base Metals and Metal Products	**18.08**	**17.46**	**-0.62**	
Ferro Chrome	6.55	6.38	-0.17	Afriforesight
Iron and Steel	5.33	5.00	-0.33	Afriforesight
Aluminium	3.64	3.55	-0.09	World Bank (Pink Sheet)
Copper	1.83	1.81	-0.03	World Bank (Pink Sheet)
Nickel	0.72	0.73	0.01	World Bank (Pink Sheet)
Precious Metals and PGMs	**29.87**	**29.64**	**-0.23**	
Gold	10.99	10.69	-0.31	World Bank (Pink Sheet)
Platinum	8.37	7.90	-0.47	World Bank (Pink Sheet)
Palladium	4.74	6.40	1.67	Afriforesight
Rhodium	2.21	3.76	1.55	Afriforesight
Ruthenium	0.00	0.44	0.44	Johnson Matthey
Iridium	0.00	0.44	0.44	Johnson Matthey
Vanadium	1.28	0.00	-1.28	-
Manganese (Ferro)	0.99	0.00	-0.99	-
Titanium	1.29	0.00	-1.29	-
Bulk Commodities	**23.70**	**25.14**	**1.44**	
Iron Ore	11.06	14.13	3.08	World Bank (Pink Sheet)
Coal	12.65	11.01	-1.64	World Bank (Pink Sheet)
Other	**28.35**	**27.76**	**-0.59**	
Petroleum Products	8.99	9.33[30]	0.33	World Bank (Pink Sheet)
Manganese Ore	7.14	7.37	0.23	Afriforesight
Chrome Ore	4.10	4.42	0.32	Afriforesight
Diamonds	4.28	3.73	-0.56	Afriforesight
Sugar	0.84	1.13	0.29	World Bank (Pink Sheet)
Wool	0.95	0.86	-0.09	IMF
Maize	0.88	0.65	-0.23	World Bank (Pink Sheet)
Beef	0.27	0.28	0.01	World Bank (Pink Sheet)
Other PGMs	0.81	0.00[31]	-0.81	-
Coal (Coking)	0.08	0.00	-0.08	-
Total	**100.00**	**100.00**	**0.00**	

Calculations: Own

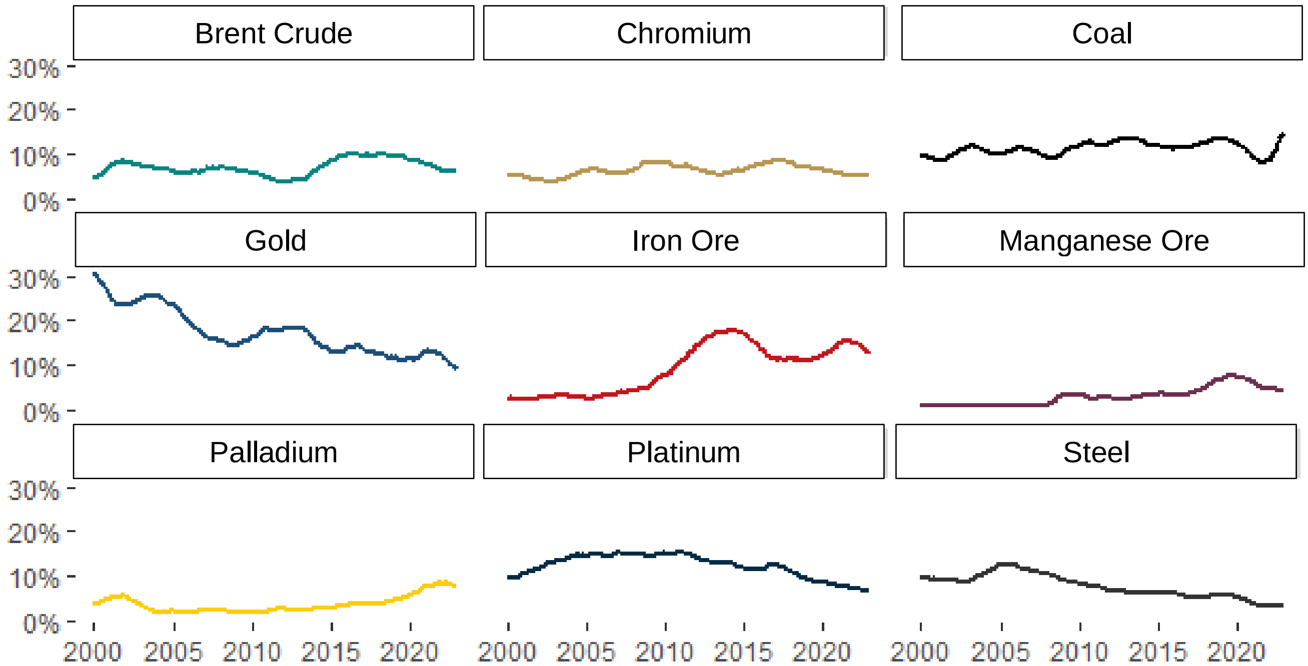
29 Data sources shown are for data since 2015. Prior to this year, data was also widely sourced from Reuters Datastream (later Refinitiv and now owned by the London Stock Exchange). Multiple data sources also exist for many of the price data series.

30 The Brent crude oil price is used as a proxy for petroleum product exports in terms of composition and for price data.

31 Other PGMs were linked to ruthenium and iridium prices in the Updated ICP, previously linked to the platinum price.

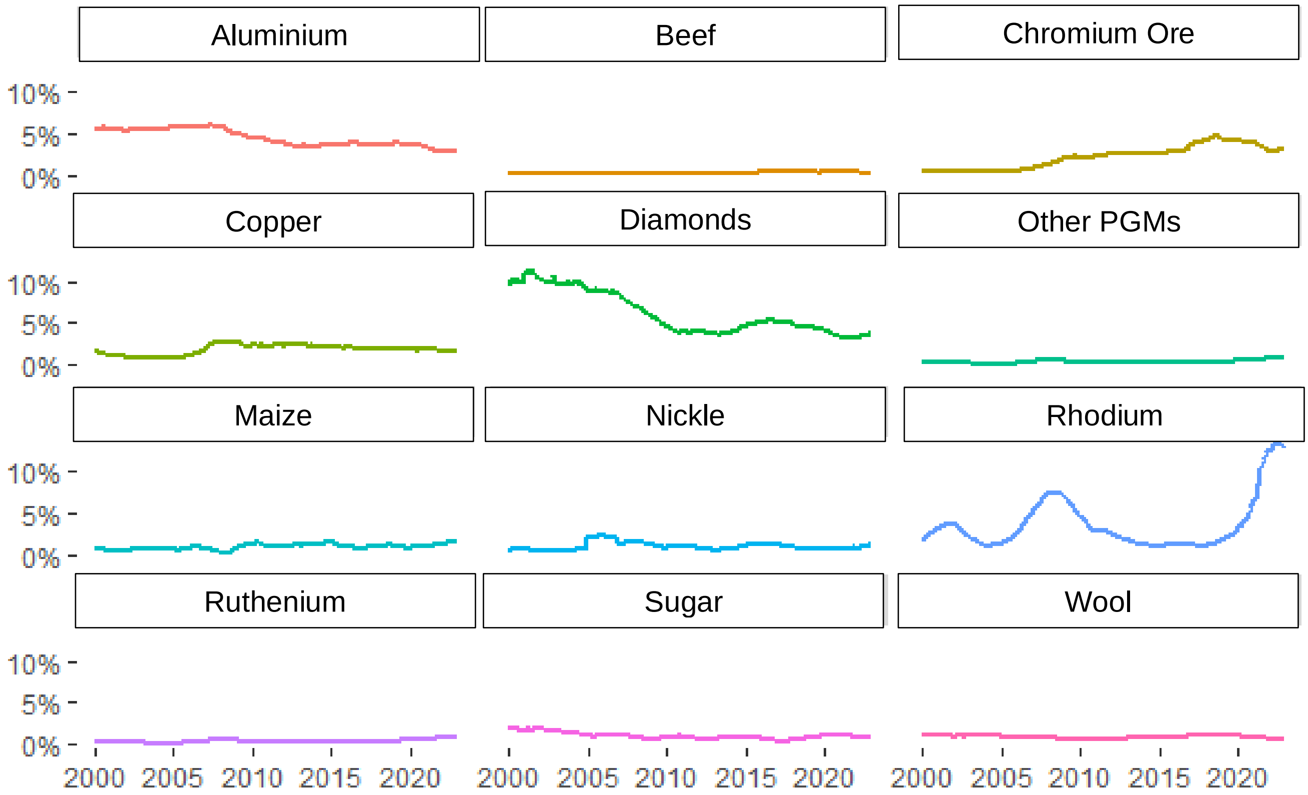
Figures A and **B** display the 24-month rolling smoothed evolution of weights as used in the Previous ICP basket. Specifically, **Figure A** displays the 9 larger commodities in the previous ICP, and how their weights evolved over time, while **Figure B** shows some of the smaller commodities. Overall, the decline of gold and diamonds over time is evident, while bulk commodities such as Iron Ore and Coal have increased over time. The most notable commodity remains Rhodium and its relative weight, which, in recent times, increased substantially in importance. Even though South Africa is integral in PGM supply globally, supplying 84% of the world's rhodium, 74% of platinum and 38% of palladium in 2021, the surge is not purely driven by trade volume weights, but by price-influenced values. In terms of other commodities, South Africa was also the largest producer of both chrome ore (38% in 2019) and manganese ore (34% in 2019) (Bloxham, et al., 2022).

Figure A: Larger Commodity Weights Evolution



Calculations: own. Data: SARS

Figure B: Smaller Commodity Weights Evolution



Calculations: own, Data: SARS

Section B: Indexation Methodology Comparison

Indices are used to simplify otherwise complex comparisons. It is particularly helpful when comparing commodities with a wide range of nominal values. When comparing intertemporal market movements, index numbers are used. All bilateral indices can be either period-on-period, chained, or fixed base. The comparison of periods contrasts two periods. Total change is calculated using chained indices by multiplying the period-on-period index by the change in each period. Each period is compared to the baseline by the fixed base index. Unlike a chained index, it does not use subsequent periods to gauge change since the base period. From period t-1 through period t, these are bilateral index number formulas.

Three primary index types were considered: first, the Laspeyres index, which uses only base-period weights; second, the Paasche index, which uses current-period weights; and third, the Fisher-type index, a geometric mean of the Laspeyres and Paasche indices. The availability of relevant data frequently influences the method of indexation chosen. For consumer pricing indices, for example, a base-period index, such as the Laspeyres index, is chosen because price data is accessible sooner than consumption or production data. Because weights are only determined in the base period, the data requirement is reduced. A Laspeyres-type index is also easier to read because it represents price fluctuations rather than export amounts from one period to the next. A Paasche index, on the other hand, measures changes in both prices and volumes. However, each has a bias, with Laspeyres having an upward bias in terms of price hikes and the Paasche having a downward tendency. The choice of indexation, in conjunction with data availability, is determined by the index's use-case. When commodity price changes are utilised to highlight market turning points, a Laspeyres index is preferable, however a Paasche index is preferable for a more comprehensive perspective of global commodity markets. If a more balanced approach is required and data availability is not an issue, the Fischer index is preferable since it moderates the upward and negative biases of the Laspeyres and Paasche indexes. However, the choice of index methodology is unambiguous theoretically, with the most suitable option often being a reflection of data availability and preferred process complexity.

Laspeyres (1981)

The Laspeyres index divides the current value of a commodity basket by itself in the base year, so it uses base-period quantity weightings. Also called a fixed-weight index. It compares how much a basket of goods in the base period would cost in the current period. Accuracy is highly related to the selection methodology of the set of goods. Calculated as:

$$Laspeyres = \frac{\sum Observation\ Price * Base\ Quantity}{\sum Base\ Price * Base\ Quantity} * 100$$

where the numerator is the sum of the price at the observation period times the base quantity/volume and the denominator is the sum of the price at the base period times the base quantity/volume. This index might be upward biased in terms of price increases.

Paasche (1874)

The Paasche Index is a current-weighted index, and measures price changes in a commodity compared to the base year. Quantity weights are thus calculated based on the current-period and is based on a changing consumer basket.

$$Paasche = \sum \frac{Observation\ Price * Observation\ Quantity}{Base\ Price * Observation\ Quantity} * 100$$

The numerator is total expenditures of all items at the observation period using the observation period price and quantities, with the denominator being total expenditures of all items using base period prices and observation period quantities. One advantage of the Paasche index is that it takes consumption patterns into consideration by using current quantities/weights.

Fisher (1921)

Geometric mean of the Laspeyres and Paasche Indices, thereby using both current year and base year quantities as weights.

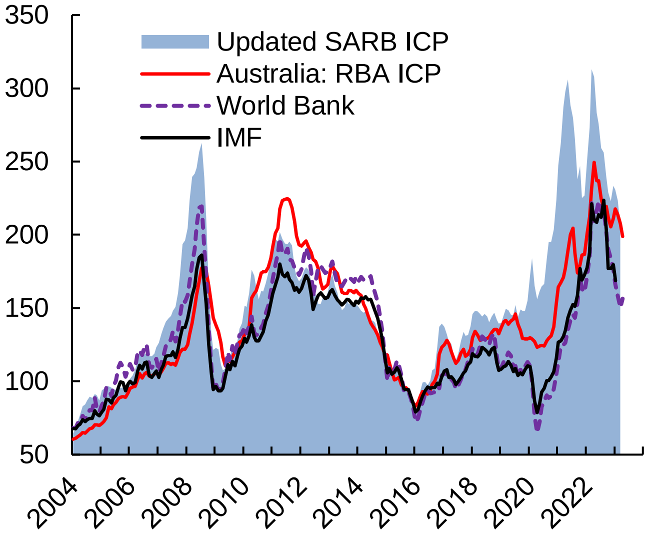
$$Fisher = \sqrt{Laspeyres * Paasche}$$

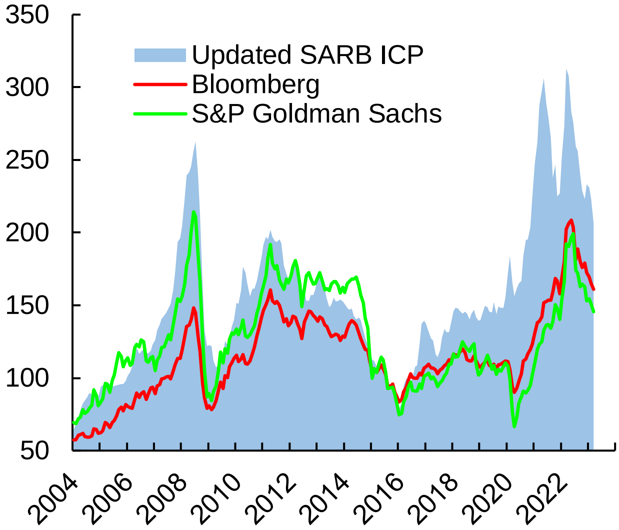
Structurally more complex but corrects for the upward bias of the Laspeyres Price Index and the downward bias of the Paasche Price Index. The Fisher price index requires more data than either the Paasche or Laspeyres indices and may often be impracticable because of this.

Global Comparison

Like every country, the South African commodity export market is unique. No index would be representable by any other. That said, it is useful to compare global indices to gauge the health of global commodity markets and how specific countries relate to one another. Moreover, it is important to compare index calculation methods to similar export markets, as much can be learned from other institutions that compile their own indices. **Figures C and D** compare the Updated SARB ICP to that of the Reserve Bank of Australia (RBA), and the commodity price indices of the World Bank (WB), the International Monetary Fund (IMF), Bloomberg and S&P Goldman Sachs.[32] Both the Previous and Updated SARB ICPs are generally higher than their global counterparts during surge periods. Specifically, consider periods such as those prior to the GFC and again over the past three years. Our contestation is that these surges impacted South Africa to a greater extent because of the country's role as large PGM exporter. The closest global counterpart - not in terms of PGM exports - but in commodity price index level terms, is the RBA.

Figures C and D: Updated ICP – Global Comparisons





Calculations: Own. All indices 2015 = 100

The RBA's ICP is also a Laspeyres index based on export values. However, their base-period weights are averaged over two years, updated annually.[33] The RBA examines the index's price measure and composition once a year, around April. To smooth ICP changes in export values, the index selects weights based on two years of data (Robinson and Wang, 2013). The most recent RBA ICP (April 2022) has been reweighted in terms of average export values between 2018/19 and 2020/21, with the average for 2020/21 now being 100 (previously 2019/20).[34]

32 See https://www.worldbank.org/en/research/commodity-markets.

33 The RBA previously used a modified Paasche index similar to the Previous SARB ICP. In Australia, the Paasche index was used because it corresponded to the National Accounts export price deflator.

34 See https://www.rba.gov.au/statistics/frequency/commodity-prices/2022/weights-icp-20220401.html for the most recent RBA weights.

Naturally, the World Bank's ICP plays a slightly different role. It emphasises the disaggregated sub-sectors to a greater degree than the SARB and excludes commodities relevant to South Africa such as PGMs (other than platinum), chrome and manganese ores. This is because the World Bank is more concerned with capturing global market movements in specific submarkets. Their indexation method is therefore more broad-based, however, also makes use of a Laspeyres method, with 2010 as the base year and weights based on export values from 2002 to 2004. It is a nominal US dollar index with 40 underlying price series in the energy and non-energy sectors.[35]

Section C: Smoothing

This section summarises the research on smoothing volatile weights. **Figure E** displays the results. It compares four smoothing methods: 24-month rolling moving average (MA), exponential weighted moving average smoothing (EWMA), chained weight smoothing, and smoothing based on a Kalman Filter. Smoothing volatile weights is important in the long run because an updated weight may differ significantly from the previous one. This should not be a problem in most cases. However, it may occasionally produce an oscillatory impact in the way requests are load balanced. To address this issue, weights are smoothed prior to index creation. A greater smoothing index will result in fewer abrupt changes in server weights. With a lower index, the server weights will shift more dramatically.

Rolling Moving Average

The first method applied to smoothing the weights in by applying a rolling moving average. The rolling moving average differs to the moving average approach as it updates weights monthly with an average of the 24-month lag, whereas the moving average updates weights only once every year. Rolling moving averages are aligned to the right to account for and mitigate the ragged edge problem[36].

Exponential Smoothing (EWMA)

Exponential smoothing is the second way to make the weights more even. It is part of a group of statistical techniques and procedures that are often used for discrete time series data. This method works with time series data that includes seasonal information and systematic trends that can be used to make predictions based on what has been seen before.

Chain-Weighted Smoothing

35 The non-energy sector comprises agriculture; metals and minerals; fertilisers; and precious metals sub-sectors. Meanwhile, the IMF's 'All Commodity US$ Price Index includes non-fuel commodity and petroleum market prices, actual market prices for non-fuel commodities and petroleum, and average weekly prices for non-fuel commodities and petroleum. The most important markets for a given commodity determine the benchmark prices that are representative of the global market. Annual, quarterly, and monthly data are available, dating back to 1992.

36 Note that in 'Changes to the RBA Index of Commodity Prices: 2013' the ICP is weighted according to an average of export values in 2010/11 and 2011/12 and indexed so that the 2011/12 average is 100.

Chained weights are the third approach for smoothing the weights. The benefit of utilizing chained weights is that it is a fixed-base-year technique that uses prices from a period to calculate real growth for that period.

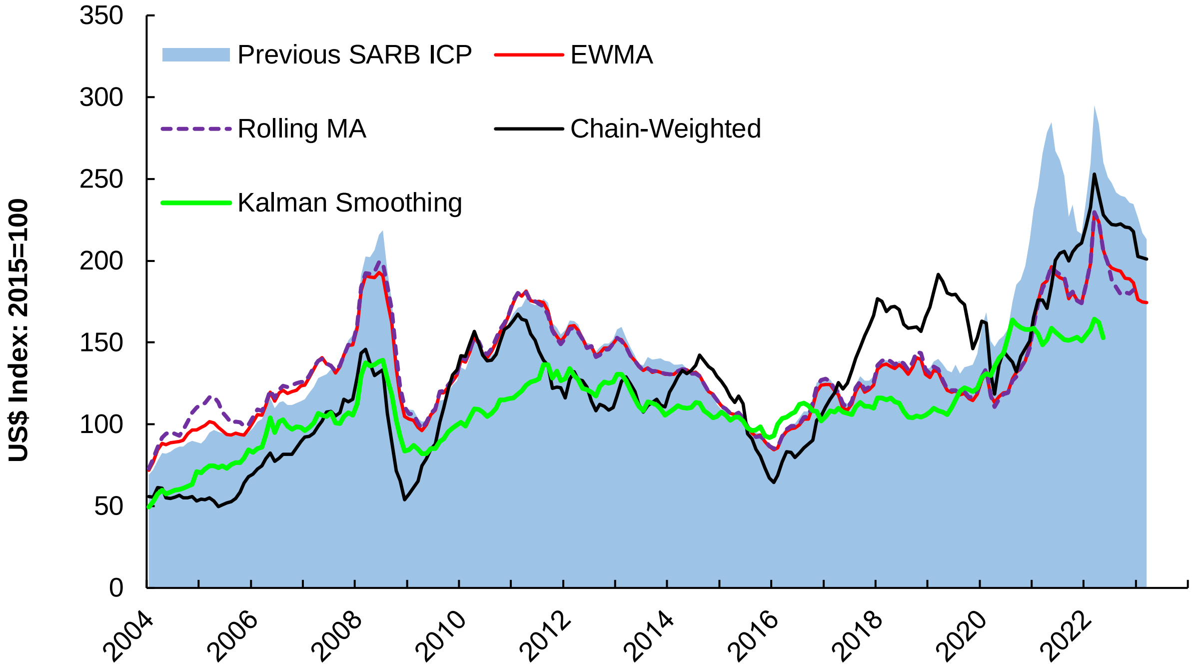
One issue with chain-linked indices is the possibility of chain drift. Consider the case when prices rise in one period and then go back to their previous level in the next. When prices rise, an index suffering from chain-drift rises, but does not revert to its former level when prices fall. In the preceding examples, it was observed that the Laspeyres index has a significant positive bias, and the Paasche index has a significant negative bias. Chain drift is at blame for some of this.

One strategy of avoiding chain drift is to select linking periods that are 'similar' in some way. Diewert and Fox (2018) mention this approach of linking, while Hill (Hill 2001) extends the concept by selecting the connection period based on a minimum cost spanning tree.

Kalman-Based Smoothing

The final approach used for smoothing weights is based on the Kalman filter. This approach incorporates a penalty that adjusts the weights of more volatile components downwards in the same way the Kalman filter does. **Figure E** shows the result. It is clear that a substantial amount of the volatility has been removed. However, this affects the index's sensitivity to turning points in price movements, one of the important characteristics needed for the SARB ICP.

Figure E: Alternative Indexing Schemes



Calculations: own. Data seasonally adjusted.

OBEN 2401* – September 2023

Carbon taxation in South Africa and the risks of carbon border adjustment mechanisms

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Abstract

South Africa has a high carbon intensity and a very low effective carbon price. This exposes the country to adverse economic shocks from carbon border adjustment mechanisms (CBAM) and changing consumer sentiments. Current impact assessments of the European Union's CBAM suggest small initial impacts, but these are likely to increase as (1) more goods and services become subject to the adjustment, (2) more countries implement such mechanisms, and (3) consumer choices shift away from carbon- intensive products. South Africa needs a higher, more predictable, and effective carbon price to drive the green transition and avoid revenue leakage. The additional government revenues can promote clean investment and reduce some of the negative impacts associated with carbon taxation. Economic and financial frictions to transitioning should be reduced by using a combination of price and non-price instruments. The focus of policy should be on how to position South Africa as a green production destination relative to other countries and consequently, reduce the exposure to CBAM's and changing consumer sentiments.

1. Overview

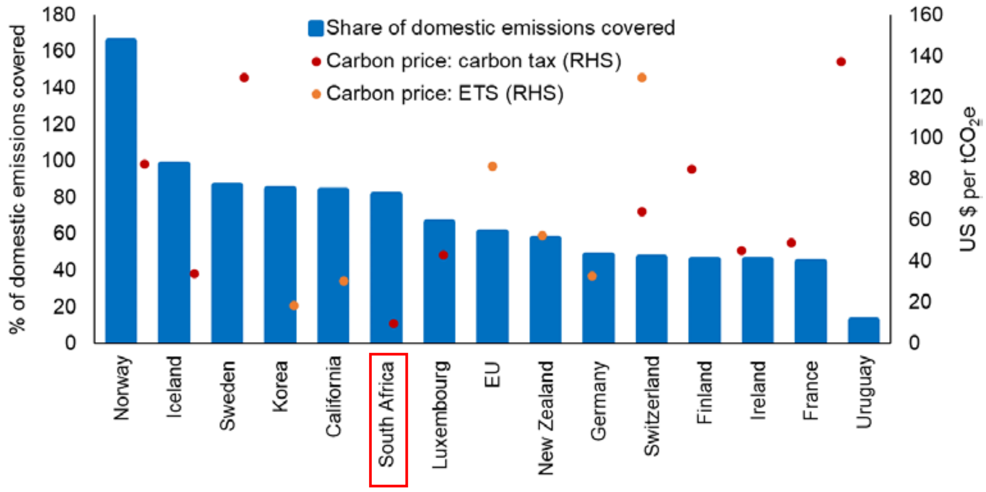
South Africa's carbon intensity remains high, but its domestic carbon price is low compared to its major trading partners in advanced economies. This exposes the country's exports to climate-related trade restrictions such as the European Union's carbon border adjustment mechanism (EU CBAM). Other countries such as the US, Canada and Japan are also considering the implementation of carbon border adjustment measures (Merven et al, 2023).

In this note, we discuss the implications for South Africa's exports from the introduction of the EU CBAM – South Africa's largest trading partner bloc. The results suggest small impacts initially, but these are likely to increase as the coverage of the adjustment mechanism increases. The impacts can be offset if South Africa reduces the carbon intensity of production more rapidly or introduces a higher carbon tax to reduce the revenue leakage associated with low domestic carbon prices and border adjustment mechanisms. Effective use of this additional tax revenue can accelerate the green transition and position South Africa as a green producer.

2. South Africa's carbon problem

South Africa's 1% share of global greenhouse gas (GHG) emissions is the lowest among the top fifteen emitters[1] (World Resource Institute, 2023). Carbon intensity of output, however, is one of the highest in the world, making South Africa a net exporter of carbon (Deidda and Harris, 2022). At the same time, the effective carbon tax[2] is one of the lowest (Figure 1 below).

Figure 1: Carbon pricing in selected economies



Source: IMF (2023), and authors calculations.

South Africa's carbon tax was introduced in June 2019 in a phased approach to ease the transition to net zero. The official tax was set at a rate of R120 (or about US$7) per tonne of CO_2e in phase one and increased to R134 (or about US$8) by the end of 2022 (National Treasury, 2018 and Qu et al, 2023). However, the tax-free allowances to cushion the potential adverse impacts on energy intensive sectors such as mining, and iron and steel (see annexure A for the full list of allowances), the coverage of only direct emissions[3] and the exemption of Eskom[4] implied an initial effective carbon tax rate range as low as R6 to R48 (or about US$0.30 to US$2.60) per tonne of CO_2e. This compares with a global average of US$6 by the end of 2022 (Parry et al., 2022).

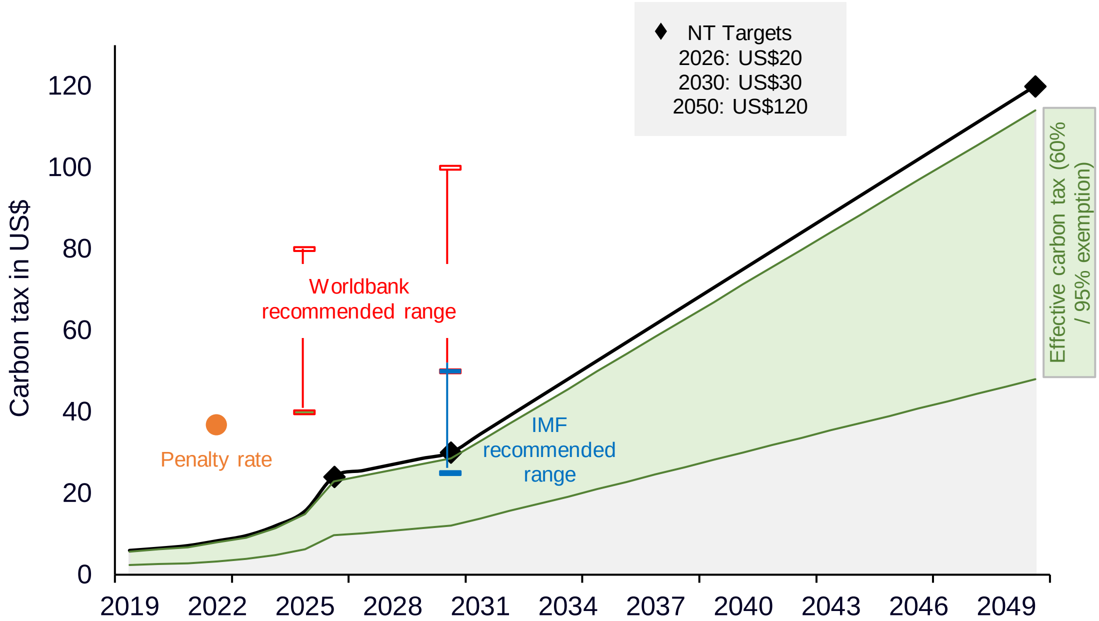
1 Climate Watch (World Resource Institute climate data platform) as of March 2023.

2 The price of carbon remains low even if we consider the impact of non-price instruments, see for example, Mavundla and Makrelov (2023).

3 The technical term is *scope 1* emissions. They result directly from fuel combustion and gasification, and from non-energy industrial processes. This includes include carbon dioxide, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons and sulphur hexafluoride.

4 Eskom is South Africa's primary electricity provider and largest carbon emitter (80% of total emissions). It's exclusion from phase one of the carbon tax is mainly driven by financial limitations and debilitating debt (National Assembly, 2021).

Figure 2: South Africa's carbon tax



Source: IMF (2023), World Bank (2023) and the National Treasury (2022).

The National Treasury is targeting an increase to US$30 by 2030 as shown in Figure 2 above. However, the extension of South Africa's phase one carbon tax from the end of 2022 to the end of 2025, together with an uncertain future trajectory and lack of clarity on future exemptions and the use of carbon budgets points to an effective carbon tax rate that is likely to remain well below the IMF's recommended US$50 by 2030 for emerging markets (Parry et al., 2022), and far below the implied carbon price of above €90 per tonne CO_2e (or US$100) currently traded on the EU ETS carbon market (Ember Carbon Price Tracker, 2023).

3. A brief overview of the EU CBAM

The European Parliament in April 2023 approved the design and implementation of a phased-in CBAM to replace the free allocation of allowances under the current emission trading system (ETS)[5] for the most trade-exposed emitting sectors: iron and steel, cement, fertiliser, aluminium, hydrogen, and electricity (see Annexure B for the complete list of goods covered under the EU CBAM).

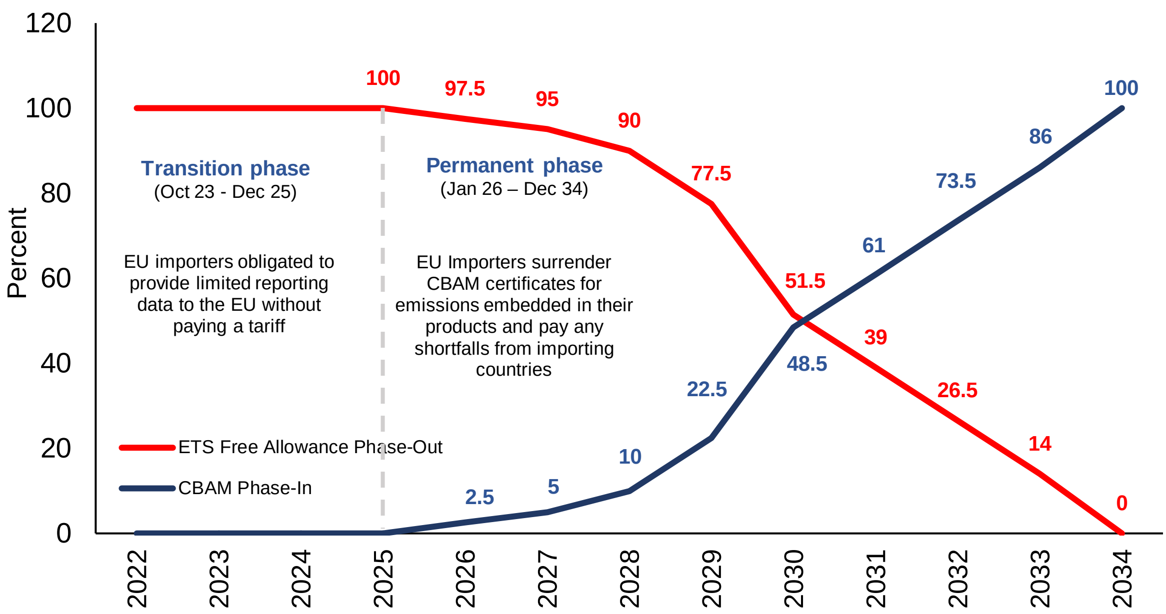
The CBAM aims to preserve the competitiveness of EU exports and prevent carbon leakage[6] by equalising the price of carbon between domestic products and imports in selected sectors. It will therefore function as a carbon price levied on the embedded carbon content of imports to the EU for which the embodied carbon emissions price is below the EU price. It is also intended to increase global climate action by encouraging countries that are subject to the EU

5 The EU ETS was established in 2005. It is a cap-and-trade system that sets an annual cap on the level of permissible emissions, with prices emerging indirectly from the auction of available allowances in the EU carbon market. As a result, the ETS price changes daily, both increasing and decreasing depending on supply and demand.

6 The European Commission (2023a) defines carbon leakage as a situation that may occur if, for reasons of costs related to climate policies, businesses were to transfer production to other countries with laxer emission constraints. This could lead to an increase in their total emissions.

CBAM to raise their emissions targets and increase their own carbon price to allow them to both eliminate their export liability and benefit from the higher tax revenue for use in their own countries.

Figure 3: EU CBAM implementation timeline



Source: PWC (2022) and the European Commission (2022).

Over the transitional 2023-2025 period, traders will only have to report on the emissions embedded in their imports subject to the mechanism without paying any financial adjustment. This will give time for businesses to prepare as well as provide the necessary information to fine-tune the definitive methodology. From 2026 onwards, traders will need to disclose and pay for the emissions embedded in their imports using CBAM certificates. Payments will increase gradually as ETS free allowances are phased out, a process that will finish in 2034 at which point importers will become responsible for paying for 100 per cent of the carbon embedded in imported products (European Commission, 2023b).

4. Potential Impacts of EU CBAM on South Africa

The introduction of the EU CBAM will increase the cost of South African exports to European markets. This will reduce their competitiveness and hence the value of future exports to the EU. There are several studies that try to assess the impacts. This section combines the results of these studies to show the potential impact of CBAM for South Africa under three scenarios:

1. What happens to South African exports under the current EU CBAM proposal?
2. What happens to South African exports if the EU CBAM is extended to cover all goods and services and all direct and indirect emissions from upstream value chains?
3. What happens to South African Exports if all countries impose a CBAM?

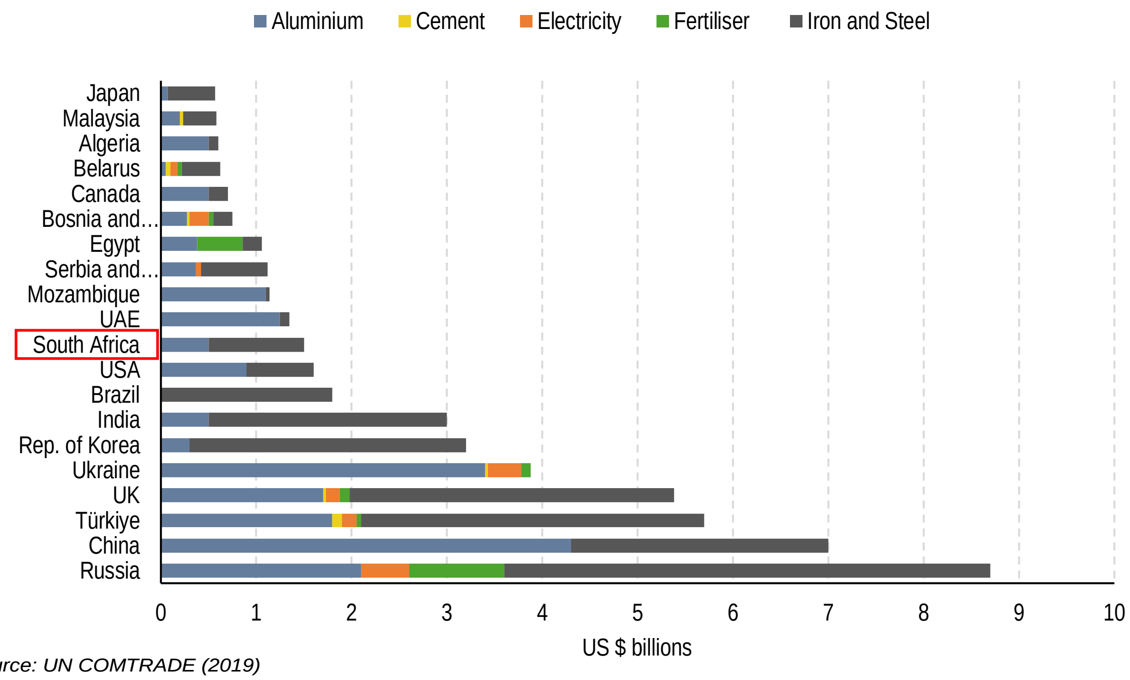
Our focus in answering these questions is on two studies that generate quantitative results for South Africa: Xiaobei et al., (2022) in a joint study by the IMF and The Task Force on Climate Development (TCD) and Merven et al. (2023) in a forthcoming working paper by the Transforming Social Inequalities through Inclusive Climate Action (TSITICA) project.

4.1 A brief overview of the literature

The European Commission conducted an impact assessment study that accompanied the EU CBAM proposal to assess the potential global spillover effects. So too the Banque de France (Bellora and Fontagné, 2022), however, their modelling analysis does not provide specific results for South Africa. The AFD (Magacho et al., 2022), UNCTAD, and Eicke et al. (2021) close this gap by identifying the most exposed EU trade partners and the export sectors at risk under the current agreement. The Presidential Climate Commission (PCC, 2023) and TIPS (Monaisa and Maimele 2023) do the same for South Africa, but there's no modelling work to quantify the impacts. Only two studies do this: Xiaobei et al., (2022) and Merven et al., (2023).

The results show that the current version of the EU CBAM will lead to a decline in trade flows to the EU by 2030 relative to a baseline with no CBAM. The most exposed countries are fellow BRICS nations Russia, China, and India as well as the Republic of Korea, Ukraine, and Türkiye (Eicke et al., 2021; UNCTAD, 2021; and Magacho et al., 2022). The impacts are set to be primarily channelled through the iron and steel, and aluminium sectors due to their high reliance of coal-powered electricity (PCC, 2023; Xiaobei et al., 2023; and Monaisa and Maimele, 2023) (Figure 4).

Figure 4: Exports to the EU in selected CBAM sectors, 2019 (excl hydrogen)



Source: UN COMTRADE (2019)

4.2 South African exports are at risk

The EU is South Africa's largest trading partner. In 2019, the share of total exports to the region was 19%, and the total value of exports subject to the EU CBAM was roughly US$1.5 billion or 1.6% of total exports (Monaisa and Maimele, 2023: 3 and Deidda and Harris, 2022). This has earned South Africa a spot in the list of top-20 countries most exposed to the EU CBAM (UNCTAD, 2021 and Magacho et al., 2022). However, the net impact on trade will depend on the ease of substitution of exports with less carbon-intensive options.[7] It will also depend on the ability to shift exports to other destinations with less stringent climate-related trade restrictions.

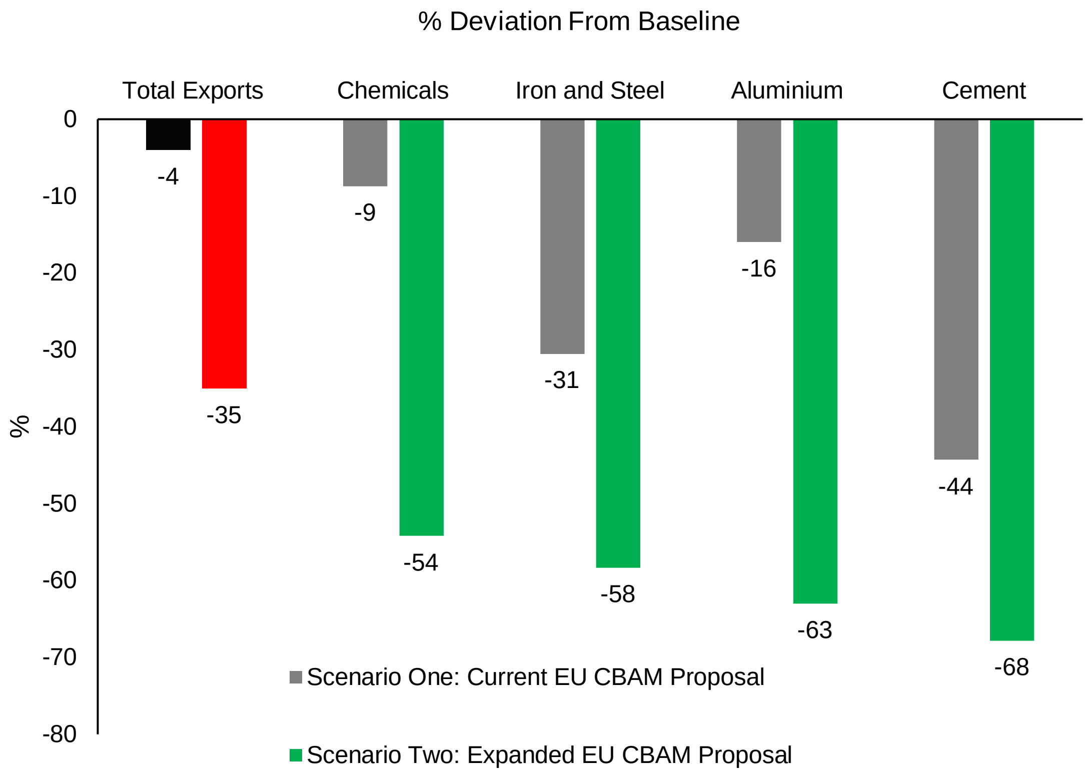
4.3 What happens to South African exports under the current EU CBAM proposal?

This scenario simulates the effect of the current EU CBAM proposal relative to a baseline with no CBAM in 2030 and the results are taken from Xiaobei et al. (2022). Their model builds on the dynamic CGE models by Van der Mensbrugghe (2019) and Zhai (2018) and is calibrated to the Global Trade Analysis Project (GTAP) database 10.0. Their simulation assumes an EU carbon price of €67 (or US$75) that is imposed from 2026 on the embedded carbon content of only direct emissions in line with the current EU proposal. The carbon price and emissions data for South Africa are taken directly from the World Bank Carbon Pricing Dashboard.

The results show that the current version of the EU CBAM could lead to a reduction in total exports to the EU of 4% in 2030 (or 0.02% reduction in GDP) relative to a baseline with no CBAM. The decline is mostly driven by the cement and iron and steel sectors that both see declines of more than 30% (Figure 5). Still, the overall results suggest small impacts initially, but these are likely to increase as the coverage of the adjustment mechanism increases.

[7] Two countries may have the same exposure to a CBAM, but the country with a high degree of carbon lock-in will be more vulnerable than one that is on a clean pathway (Eicke et al., 2021).

Figure 5: Impact of CBAM Proposal on South African Exports to the EU in 2030



Source: Xiaobei et al. (2022) in a joint study by the IMF and TCD.

4.4 What happens to South African Exports if all sectors are covered by EU CBAM?

This scenario simulates a more extreme case by assuming that the current EU CBAM proposal expands to cover all imported goods and services, and all indirect emissions from upstream value chains when calculating embedded carbon contents. The results are again taken from Xiaobei et al., (2022). The carbon price remains at US$75 and sectoral level carbon emission data for South Africa are taken directly from the World Bank Carbon Pricing dashboard.

The decline in total exports to the EU rises to 35% (or 0.3% reduction in GDP) in 2030 in this scenario relative to a baseline with no CBAM. The decline is led by the cement and aluminium sectors, and all CBAM export categories see a more than 50% decline (see Figure 5 on previous page). That is, exports of the affected categories more than half, and total exports to the EU decline by more than a third.

4.5 What happens to South African Exports if more countries impose a CBAM?

Countries like the US, Canada and Japan are also considering the implementation of carbon border adjustment measures, thereby exposing South Africa to more transition risk (Merven et al., 2023 and European Commission, 2023). We turn now to the study by Merven et al. (2023) that uses a linked energy-economic model for South Africa and an accounting-based microsimulation module to assess the distributional impact of CBAM on all economic sectors.

They consider in principle the same two scenarios as Xiaobei et al., (2022) above, but there are important differences in the design of the scenarios and the assumptions underpinning them. First, their carbon price is phased in over four years from 2026 and is set at €85[8] per tonne of CO_2e (or US$95). This is slightly higher than the average €67 (or US$75) used by Xiaobei et al. (2022). Second, they assume that all countries (not just the EU) impose a CBAM that looks like the EU's in design and implementation. Lastly, they account for South Africa's emissions and mitigation targets as outlined in the updated NDC[9] through the implementation of a least-cost energy plan that replaces ageing coal plants with cheaper renewables. This allows them to account for the expected structural changes as the economy transitions to a lower carbon path. The results are summarised in Table 1 below.

Table 1: Estimated Economic Impacts of CBAM

	Scenario One (All countries impose a carbon border tax like EUs CBAM in design and implementation)		**Scenario Two** (All countries extend coverage of their carbon border tax to all exports and direct emissions)	
	2030	**2050**	**2030**	**2050**
% difference in level from baseline scenario				
Total GDP	**-0.3**	**-0.9**	**-1.8**	**-9.3**
Agriculture	0.9	-0.6	0.4	-3.3
Mining	0.8	2.9	-1.4	-17.3
Manufacturing	0.3	-1.4	0.7	-4.8
Electricity	-1.7	-1.5	-3.8	-8.7
Services	-0.4	-1.2	-2.1	-9.5
level difference from baseline scenario (thousands)				
Total Employment	**-61**	**-351**	**-581**	**-3999**
Agriculture	23	-8	7	-81
Mining	15	55	-12	-213
Manufacturing	6	-56	9	-260
Electricity	-43	-63	-232	-811
Services	-61	-280	-353	-2635
% difference from baseline scenario				
Total Exports	**0.0**	**0.1**	**0.6**	**-10.1**
Agriculture	3.6	-0.4	-0.9	-1.7
Mining	2.7	6.6	-0.5	-22.1
Manufacturing	-3.8	-6.1	6.0	4.7
Electricity	-55.6	-16.8	-55.0	-16.2
Services	2.0	-1.3	-1.6	-10.0

Source: Merven et al., (2023).

Once again, the initial impact on total exports appears small relative to a baseline[10] with no CBAM, but this masks significant variation at the sector level. Some sectors like agriculture and mining and services see an increase in their exports in 2030 (and therefore employment and GDP) due to a reallocation of resources away from fossil-fuel dependent sectors like

8 The €85 per tonne CO_2e is based on the spot ETS price on the 5th of May 2023. The IMF study was published in March 2022 with an assumed average carbon price of €67/US$75 between 2022 and 2030. This is a conservative assumption by their own admission given recent developments and historical breach of the €100 mark (see EEX)

9 South Africa has committed to the global ambition to reduce emissions. In its Updated Nationally Determined Contribution, South Africa agreed to reduce emissions to between 398-510 Mt CO_2e (-4% and -25% relative to 2017) and 350-420 Mt CO_2e (-21% and -34%) by 2025 and 2030, respectively.

10 The baseline assumes a business-as-usual case where South Africa's Updated NDC emissions targets are met in a least-cost energy plan. A moderate growth rate of 2.7% is assumed from 2020 to 2050 in line with the growth projection of the NDC, but short-term forecasts have been updated to reflect recent downgrades to the outlook.

manufacturing and electricity. But the net reduction in GDP is larger at 0.3% by 2030. This mostly reflects the knock to both exports and GDP in the hard to abate electricity sector as more countries consider similar mechanisms.

This is because South Africa has no reported trade in electricity with the EU, but electricity exports are severely affected if other countries in the SADC[11] region adopt a CBAM. This is illustrated in the second scenario where the impacts are more negative, especially in the long-term. All export sectors experience declines as coverage of the CBAM extends to all sectors of the economy and all direct and indirect emissions from upstream value chains. Total exports fall by 10.1% in 2050 and GDP declines by 9.3% relative to the baseline.

The employment effects too are large: 350 000 jobs are lost by 2050 if more countries adopt a CBAM. This number rises to 2.6 million if all exports are subject to a CBAM (Merven et al., 2023). Poverty and inequality also rise, with negative consequences for household welfare. The results show that under different assumptions the results are different. However, the costs will be large and negative in the absence of any mitigating action.

4.6 Changing Consumer Preferences

South Africa's exports also face another threat from changing consumer sentiments. A variety of non-price instruments such as labelling requirements aim to increase consumer awareness and shift demand away from more carbon-intensive products. A survey[12] by Deloitte (2022) on consumer sentiments shows that climate consideration is becoming more important. Thøgersen (2021) reviews the literature and identifies climate communication with strong emotional content and carbon footprint labelling as effective instruments to drive substitution. If South Africa does not reduce its carbon intensity of production, foreign consumers can reduce demand for its products as consumption patterns shift.

5. Conclusion and policy implications

South Africa has a high carbon intensity and low effective carbon tax. This combination exposes the country to import carbon adjustment mechanisms that can significantly reduce demand for South African exports. Even if South Africa manages to negotiate exemptions from the EU, changing consumer sentiments pose an additional risk to the country's exports. Other countries transitioning faster in response to the CBAM or having higher carbon prices may also put South Africa at a disadvantage in the medium term as they position themselves as green production destinations. Mitigating against this risk requires a higher and more predictable carbon tax that will also generate significant financial resources to help the economy transition and possibly offset any negative impacts from having a higher carbon price.[13] Economic and financial frictions to transitioning should be reduced by using a combination of price and non-price instruments. These include for example the removal of

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11 The main destination of electricity exports from South Africa are: Mozambique, Namibia, Eswatini, Zimbabwe, and Botswana. Mozambique is the most exposed country (with more than 6% of output at risk on account of the importance of its aluminium and iron and steel exports to the EU (Xioabei et al, 2023 and PCC 2023).

12 Online survey with a nationally representative sample of more than 2,000 UK adults aged 18+ between 1 to 2 June 2022.

13 See for example Alton et al. (2014).

regulatory and trade barriers that can hinder electricity generation from renewable sources or the use of electric vehicles. The focus of policy should be on how to position South Africa as a green production destination relative to other countries and consequently, reduce the exposure to CBAM and changing consumer sentiments.

References

Alton, T., Arndt, C., Davies, R., Hartley, F., Makrelov, K., Thurlow, J., and Ubogu, D. (2014). Introducing carbon taxes in South Africa. *Journal of Applied Energy, 116: 344-354*. Available at: https://doi.org/10.1016/j.apenergy.2013.11.034.

Bellora, C and Fontagné, L. (2022). EU in Search of a WTO-Compatible Carbon Border Adjustment Mechanism. *SSRN working paper.* Available at: https://ssrn.com/abstract=4168049.

Deidda, L and Harris, L. (2023). The implications of national and international carbon pricing policies for the South African Reserve Bank. *SARB working paper 22/13.* Available at: https://www.resbank.co.za/content/dam/sarb/publications/working-papers/2022/WP%202213.pdf.

Deloitte UK. (2022). Key findings on survey of consumer attitudes and behaviours around sustainability. Available at: https://www2.deloitte.com/uk/en/pages/consumer-business/articles/sustainable-consumer.html.

Ember Climate. (2023). Ember Carbon Price Tracker. Available at: https://ember-climate.org/data/data-tools/carbon-price-viewer/.

Eicke, L., Weko, S., Apergi, M and Marian, A. (2021). Pulling up the carbon ladder? Decarbonization, dependence, and third-country risks from the European carbon border adjustment mechanism. Energy Research & Social Science, 80: 1-11. Available at: https://www.sciencedirect.com/science/article/pii/S2214629621003339.

European Commission. (2021). Establishing a carbon border adjustment mechanism. Proposal for a regulation of the European Parliament and of the council. Available at: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52021PC0564.

European Commission. (2023a). Carbon Leakage. Available at: https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en.

European Commission. (2023b). Commission consults on CBAM reporting obligations in its transitional phase as of 1 October. *Office of the Directorate-General for Taxation and Customs Union.* Available at: https://taxation-customs.ec.europa.eu/news/commission-consults-cbam-reporting-obligations-its-transitional-phase-1-october-2023-06-13_en.

IMF. (2023). World Economic Outlook: Inflation Peaking amid Low Growth. *January 2023.* Available at: https://www.imf.org/en/publications/weo.

Klots, S and Halliger, O. (2019). EU deal reached on the CBAM: What you need to know. *PWC insights, 19 December 2019*. Available at: [EU deal reached on the CBAM: what you need to know | PwC Switzerland]().

Magacho, G., Godin A., and Espagne, E. (2022). Impacts of CBAM on EU trade partners: consequences for developing countries. Research paper no.238. Available at: https://www.afd.fr/en/ressources/impacts-cbam-eu-trade-partners-consequences-developing-countries.

Mavundla, KA and Makrelov, K. (2023). Price and non-price tools for climate change. *SARB forthcoming economic note.*

Merven, B., Hartley, F., Hughes, A., Marquard, A and Ranchhod, V. (2023). Estimating the economy-wide and redistributive impacts of mitigation in South Africa. *Forthcoming working paper*. Transforming Social Inequalities through Inclusive Climate Action. Available on request.

Monaisa, L and Maimele, S. (2023). The European Union's Carbon Border Adjustment Mechanism and implications for South African exports. TIPS policy brief. Available at: https://www.tips.org.za/policy-briefs/item/4500-the-european-union-s-carbon-border-adjustment-mechanism-and-implications-for-south-african-exports.

National Assembly Committee. (2021). National Treasury on cost of 'Just Transition'. *Environment, Forestry and Fisheries committee meeting summary.* Available at: https://pmg.org.za/committee-meeting/33400/.

National Treasury. (2018). Explanatory memorandum on the carbon tax bill. Available at: https://www.treasury.gov.za/public%20comments/CarbonTaxBill2019/Explanatory%20Memorandum%20to%20the%202018%20Carbon%20Tax%20Bill%20-%2020%20Nov%202018.pdf.

National Treasury. (2019). 2019 Budget Review. Available at https://www.treasury.gov.za/documents/national%20budget/2019/review/FullBR.pdf.

National Treasury. (2020). 2020 Budget Review. Available at https://www.treasury.gov.za/documents/national%20budget/2020/review/FullBR.pdf.

National Treasury. (2021). 2021 Budget Review. Available at https://www.treasury.gov.za/documents/national%20budget/2021/review/FullBR.pdf.

National Treasury. (2022). 2022 Budget Review. Available at http://www.treasury.gov.za/documents/national%20budget/2022/review/FullBR.pdf.

National Treasury. (2022). Final Response Document on the 2022 Draft Rates and Monetary Amounts and Amendment of Revenue Laws Bill, 2022 Draft Taxation Laws Amendment Bill and 2022 Draft Tax Administration Laws Amendment Bill. *Based on hearings by the Standing Committee on Finance in Parliament, 16 January 2022.* Available at:

https://www.treasury.gov.za/comm_media/press/2023/2022TaxActs/2022%20Final%20Response%20Document%20on%20the%202022%20Tax%20Bills.pdf.

National Treasury. (2023). 2023 Budget Review. Available at https://www.treasury.gov.za/documents/national%20budget/2023/review/FullBR.pdf.

Parry, I. W. H., Black, S and Zhunussova, K. (2022). Carbon Taxes or Emissions Trading Systems? Instrument Choice and Design. *IMF staff climate note 2022/006*. Available at: https://www.imf.org/en/Publications/staff-climate-notes/Issues/2022/07/14/Carbon-Taxes-or-Emissions-Trading-Systems-Instrument-Choice-and-Design-519101.

Qu, H., Suphachol., Sneha, T and Sébastien, W. (2023). South Africa Carbon Pricing and Climate Mitigation Policy. *IMF Selected Issues Paper (SIP/2023/040).* Available at: https://www.imf.org/en/Publications/selected-issues-papers/Issues/2023/06/26/South-Africa-Carbon-Pricing-and-Climate-Mitigation-Policy-South-Africa-535220.

Thøgersen, J. (2021). Consumer behaviour and climate change: consumers need considerable assistance. *Journal of current opinion in behavioural sciences, Vol 42, pg 9 – 14.* Available at: https://www.sciencedirect.com/science/article/pii/S2352154621000309.

Presidential Climate Commission. (2023). Carbon border adjustment mechanisms and implications for South Africa. A Presidential Climate Commission Working Paper. Available at: https://pccommissionflow.imgix.net/uploads/images/PCC-Working-Paper-CBAM.pdf.

South African Government. (2019). Carbon Tax Act 15 of 2019. Available at: https://www.gov.za/sites/default/files/gcis_document/201905/4248323-5act15of2019carbontaxact.pdf.

UN COMTRADE database. (2019). International Merchandise Trade Statistics. *United Nations Statistics Division.* Available at http://comtrade.un.org/.

UNCTAD. (2021). A European Union Carbon Border Adjustment Mechanism: Implications for developing countries. Available at: https://unctad.org/system/files/official-document/osginf2021d2_en.pdf.

Van der Mensbrugghe, D. (2019). The Environmental Impact and Sustainability Applied General Equilibrium (ENVISAGE) Model.

World Resource Institute. (2023). Global Historical Emissions*. Climate Watch.* Available at: https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters.

Worldbank. (2023). Carbon Pricing Dashboard. Available at: https://carbonpricingdashboard.worldbank.org/.

Xiaobei, H., Fan, Z and Jun, M. The Global Impact of a Carbon Border Adjustment Mechanism: A quantitative assessment. *Task Force on Climate Development and IMF working paper, March 2022.* Available at: TF-WP-001-FIN.pdf (bu.edu) .

Zhai, F. (2018). China’s belt and road initiative: A preliminary quantitative assessment. *Journal of Asian Economics, 55: 84–92.*

Annexure A – South African Carbon Tax timeline

Phase 1 (Scope 1 emitters)					Phase 2	Phase 3
2019	*2020*	*2021*	*2022*	*2023*	*2025*	*Unconfirmed*
• R120 /tCO2e • 60 – 95 per cent tax free emission allowances • Revenue recycling measures • Carbon tax on fuel 7c/l (petrol) and 8c/l (diesel)	• R127 /tCO2e • 60 – 95 per cent tax free emission allowances • Revenue recycling measures • Carbon tax on fuel 7c/l (petrol) and 8c/l (diesel)	• R134 /tCO2e • 60 – 95 per cent tax free emission allowances • Revenue recycling measures • Carbon tax on fuel 8c/l (petrol) and 9c/l (diesel)	• R144 /tCO2e • 60 – 95 per cent tax free emission allowances • Revenue recycling measures • Carbon tax on fuel 9c/l (petrol) and 10c/l (diesel)	• R159 /tCO2e • 60 – 95 per cent tax free emission allowances • Revenue recycling measures • Carbon tax on fuel 10c/l (petrol) and 11c/l (diesel)	Details on the scope of Phase 2 and 3 yet to be announced	

Allowances:
- Basic Tax-free allowance (Section 7 of the Act)
- Allowance for industrial emissions (Section 8 of the Act)
- Allowance in respect of fugitive emissions (Section 9 of the Act)
- Trade exposure allowance (Section 10 of the Act)
- Performance allowance (Section 11 of the Act)
- Carbon budget allowance (Section 12 of the Act)
- Offset allowance (Section 13 of the Act)

Source: Carbon Tax Act (2019) and the Budget Review (2019 – 2023).

Annexure B – List of goods and corresponding GHG under the CBAM (excl hydrogen)

CN CODE	GREENHOUSE GAS
Cement	
2523 10 00 – Cement clinkers	Carbon dioxide
2523 21 00 – White Portland cement, whether artificially coloured	Carbon dioxide
2523 29 00 – Other Portland cement	Carbon dioxide
2523 90 00 – Other hydraulic cements	Carbon dioxide
Electricity	
2716 00 00 – Electrical energy	Carbon dioxide
Fertilisers	
2808 00 00 – Nitric acid; sulphonitric acids	Carbon dioxide and nitrous oxide
2814 – Ammonia, anhydrous or in aqueous solution	Carbon dioxide
2834 21 00 - Nitrates of potassium	Carbon dioxide and nitrous oxide
3102 – Mineral or chemical fertilisers, nitrogenous	Carbon dioxide and nitrous oxide
3105 – Mineral or chemical fertilisers containing two or three of the fertilising elements nitrogen, phosphorus and potassium; other fertilisers; goods of this chapter in tablets or similar forms or in packages of a gross weight not exceeding 10 kg **Except** 3105 60 00 – Mineral or chemical fertilisers containing the two fertilising elements phosphorus and potassium	Carbon dioxide and nitrous oxide
Iron and Steel	
72 – Iron and steel **Except** 7202 – Ferroalloys and 7204 – Ferrous waste and scrap; remelting scrap ingots and steel	Carbon dioxide
7301- Sheet piling of iron or steel, whether drilled, punched or made from assembled elements; welded angles, shapes and sections, of iron or steel	Carbon dioxide
7302 – Railway or tramway track construction material of iron or steel, the following: rails, checkrails and rack rails, switch blades, crossing frogs, point rods and other crossing pieces, sleepers (crossties), fish- plates, chairs, chair wedges, sole plates (base plates), rail clips, bedplates, ties, and other material specialised for jointing or fixing rails	Carbon dioxide
7303 00 – Tubes, pipes, and hollow profiles, of cast iron	Carbon dioxide
7304 – Tubes, pipes, and hollow profiles, seamless, of iron (other than cast iron) or steel	Carbon dioxide
7305 – Other tubes and pipes (for example, welded, riveted or similarly closed), having circular cross-sections, the external diameter of which exceeds 406,4 mm of iron or steel	Carbon dioxide
7306 – Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel	Carbon dioxide
7307 – Tube or pipe fittings (for example, couplings, elbows, sleeves), of iron or steel	Carbon dioxide
7308 – Structures (excluding prefabricated buildings of heading 9406) and parts of structures (for example, bridges and bridge-sections, lock- gates, towers, lattice masts, roofs, roofing frameworks, doors and windows and their frames and thresholds for doors, shutters, balustrades, pillars and columns), of iron or steel; plates, rods, angles, shapes, sections, tubes and the like, prepared for use in structures, of iron or steel	Carbon dioxide
7309 – Reservoirs, tanks, vats, and similar containers for any material (other than compressed or liquefied gas), of iron or steel, of a capacity exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment	Carbon dioxide
7310 – Tanks, casks, drums, cans, boxes, and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment	Carbon dioxide
7311 – Containers for compressed or liquefied gas, of iron or steel	Carbon dioxide
Aluminium	
7601 – Unwrought aluminium	Carbon dioxide and perfluorocarbons
7603 – Aluminium powders and flakes	Carbon dioxide and perfluorocarbons
7604 – Aluminium bars, rods, and profiles	Carbon dioxide and perfluorocarbons
7605 – Aluminium wire	Carbon dioxide and perfluorocarbons
7606 – Aluminium plates, sheets, and strip, of a thickness exceeding 0,2 mm	Carbon dioxide and perfluorocarbons
7607 – Aluminium foil (whether printed or backed with paper, paperboard, plastics or similar backing materials) of a thickness (excluding any backing) not exceeding 0,2 mm	Carbon dioxide and perfluorocarbons
7608 – Aluminium tubes and pipes	Carbon dioxide and perfluorocarbons
7609 00 00 – Aluminium tube or pipe fittings (for example, couplings, elbows, sleeves)	Carbon dioxide and perfluorocarbons

Source: Explanatory memorandum for a Regulation of the European Parliament and of the Council establishing a Carbon Border Adjustment Mechanism (2021).

OBEN 2401* – November 2023

Looking to the price setters: what can we learn from firm-level inflation expectations data?

Ayrton Amaral, Marique Kruger and Monique Reid

Abstract

This note gives an overview of the Bureau for Economic Research's business sector inflation expectations data in South Africa, including additional firm-level dimensions and characteristics, and provides motivation for prioritising the analysis of this data. We show how the disaggregated data can provide valuable insights for policymakers about how well "anchored" inflation expectations are and the extent to which inflationary pressures filter through the economy and become more generalised. Our illustrative analysis of the disaggregated firm-level data in recent post-COVID years (2021-2023) suggests that second-round effects may have arisen, with evidence that inflation expectations may have become moderately unanchored along with underlying inflationary pressures that have broadened.

1. Introduction

Central bank credibility and the management of inflation expectations are central to an inflation-targeting regime, so, unsurprisingly, central banks monitor inflation expectations closely. Researchers initially tended to rely relatively heavily on inflation expectations extracted from asset price data. The benefits of asset price measures of inflation expectations are that the data is of high quality and available at a high frequency, even enabling intra-day studies of the responses of the financial markets to new information. Asset prices also reflect actual behaviour rather than opinions (as captured by survey data).

The widespread adoption of greater transparency by central banks globally since the 1990s, labelled the 'Quiet Revolution' by Alan Blinder,[1] has seen an increased focus on central bank communication with the public rather than financial markets. This 'second wave' of the Quiet Revolution[2] was motivated by findings that there are notable differences between the inflation expectations of different groups in society and that these differences are of economic significance.[3] The expectations of groups other than financial market participants are collected via surveys, raising interest in survey data.

1 AS Blinder, (2004).
2 A Haldane, A Macaulay and M McMahon, (2020).
3 O Coibion, and Y Gorodnichenko, (2015).
C Binder, (2017).

With the adoption of inflation targeting in South Africa in 2000, the South African Reserve Bank (SARB) commissioned the Bureau for Economic Research (BER) to conduct inflation expectations surveys for four groups in society – financial analysts, the business sector, trade unions and households. While many countries have been collecting survey data about inflation expectations for an extended period, there has been a lack of consistency across countries regarding how these surveys are designed and targeted.

Globally, the groups most typically surveyed are financial professionals and households.[4] More recently, there has been increasing recognition that the inflation expectations of businesses may be more relevant due to their disproportional influence on prices, but surveys of this group remain rare internationally. We are therefore privileged to have, in South Africa, a rich survey of business sector inflation expectations for a period of over two decades.[5] The value of this data has yet to be fully exploited. The data is often still used in aggregate form, where the forecasts of the financial analysts and trade unions are presented together with those of the business sector. Little to no attention is paid to the heterogeneity within the data, which could provide insight into the price-setting behaviour contributing to inflation.

The aim of this note is threefold. Firstly, we explain the relevance of business sector inflation expectations and why they may warrant particular attention. We then describe the data, including the additional dimensions of firm classification collected in the survey (most notably the sector of each respondent firm). Finally, we use the disaggregated data to illustrate how it can provide insights into underlying inflationary dynamics in the South African economy beyond what simply looking at a sample average can provide. Specifically, we first look at the dispersion of the individual survey response data to determine whether expectations are anchored or whether there are signs that they are drifting. We then exploit the sectoral categorisation to shed light on the extent to which inflationary shocks are permeating through the system (becoming more ‘broad-based’ or ‘generalised’).

This detail is not just a matter of academic interest – the idea that inflationary pressure had become ‘broad-based’ was one of the central justifications that the Federal Reserve Bank used in March 2022 to justify its decision to start its aggressive rate hiking cycle. In a world where a central bank experiences numerous economic shocks, the distinction between ‘temporary pressures’ and ‘broad-based’[6] (or ‘embedded’) inflation is vital to determining appropriate monetary policy actions.

2. Honing in on the price setters: Why focus on the business sector inflation expectations?

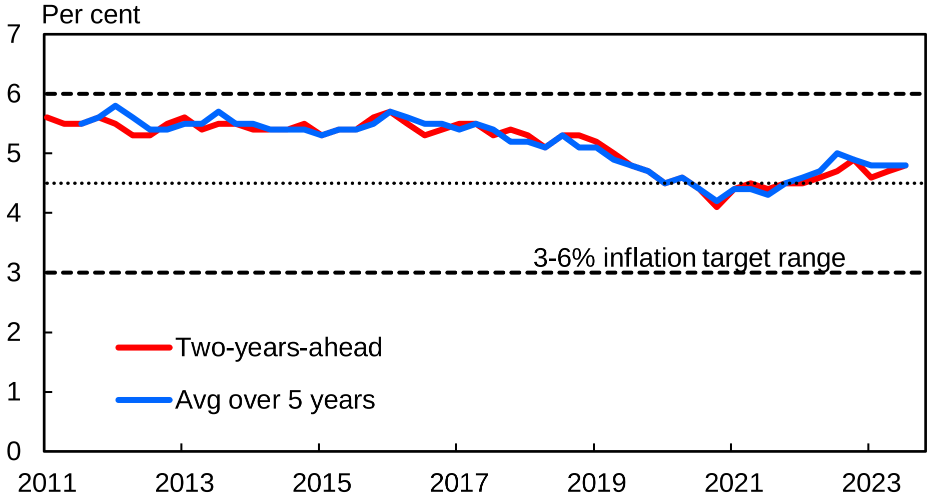
The results of the business inflation expectations survey are reported by the BER alongside the outcomes of the financial analyst and union representative surveys. The surveys of each group have slightly different characteristics that researchers should be mindful of when analysing the data.

4 M Weber, F D’ Acunto, Y Gorodnichenko and O Coibion, (2022).
5 M Reid and P Siklos, (2021).
6 J Cox, (2022).

The size of the financial analyst and trade union samples tends to be small. Across the four quarters of 2022, the BER collected 68 unique responses for analysts and 48 for unions, contrasting with the more than 600 received for businesses. Regarding the trade union survey, there is also concern that the person answering that survey may not always be in a crucial decision-making position, which might mean that the opinions of this set of price setters are not as precisely measured.[7]

There are also economic reasons for honing in on the price setters. Figure 1 shows that analysts' medium-term inflation expectations tend to be stable and anchored around the SARB's preferred midpoint of the inflation target range. This feature is likely attributable to their forecasting models having the midpoint as a built-in anchor point and their proximity to and familiarity with the central bank's monetary policy stance – both of which standard businesses may be less likely to possess.

Figure 1: Medium-term analyst inflation expectations



Source: BER

Local and international evidence shows that differences in the forecasts of the groups surveyed (analysts, firms and unions) can be notable[8,9]. As such, increasingly, academics have been recognising that the expectations of financial professionals (whether analysts or professional forecasters) may not adequately capture price-setting behaviour in an economy.

These differences across the survey groups may have a material impact on how we model and reason about concepts such as the Phillips curve (i.e., this distinction may be economically important).[10] The distinction affects how we think about inflation dynamics and how central banks should design their communication efforts. This does not mean that any of the survey groups should be disregarded. However, it supports the view that considering more

[7] M Reid and P Siklos, (2021).
[8] N Crowther-Ehlers, (2019).
[9] Understanding the behaviour that underlies these differences in inflation forecasts across groups is the subject of extensive ongoing research internationally. While information asymmetries across groups is usually put forward as a catch-all explanation for these differences, this simplicity belies our lack of certainty about the mechanisms driving these asymmetries. Theories proposed to explain differences include differences in specialised knowledge (or ability), lags in access to the true information (sticky information) and reliance on different information sets (subjective expectations).
[10] O Coibion and Y Gorodnichenko, (2015).

carefully how we apply and interpret the components of the aggregate inflation expectations survey number could provide valuable insights. In this note, we focus on the value of the business sector component of the survey.

Accordingly, given their role as price-setters and, consequently, their disproportionate role in driving inflation dynamics, there has been a shift internationally towards seeking more detailed information on firm-level inflation expectations. Such data remains, however, surprisingly limited. In 2007, Bernanke stated, 'Information on the price expectations of businesses--who are, after all, the price setters in the first instance--as well as information on nominal wage expectations is particularly scarce'.[11] There has been notable effort to fill this gap recently, but it will take time.

In South Africa, we are fortunate to have such a firm-level survey over 20 years old. There has been some South African research exploiting the firm-level data[12], but far more is warranted.

3. All about the business: Unpacking the richness of the BER business sector inflation expectations data

The BER has been collecting quarterly inflation expectations survey data from businesses across South Africa since the SARB first commissioned it in the third quarter of 2000. Besides the notable length of the time series, the dataset is rich. In addition to respondents' inflation expectations at various horizons,[13] the BER also collects data on respondents' expectations of economic growth, the prime rate, the rand/dollar exchange rate and wage growth. Furthermore, a range of respondent and firm-level characteristics are also recorded (Figure 2), allowing researchers to consider how forecasts might differ across respondent characteristics.

Figure 2: Business sector inflation expectations data characteristics

Sector	Firm size	Number of full-time employees	Respondent postion
• Agri. & Forestry • Construction • Manufacturing • Mining • Motor Trade • Other • Retail Trade • Services • T & OPU* • W/sale Trade	• Micro • Small • Medium • Large	• Min: <21 • Max: 1001+	• CEO/ Manager or Owner • Financial manager or accountant • Senior sales or production manager • Other

* Transport and Other Public Utilities.
Source: BER.

11 BS Bernanke, (2007).
12 We do not provide detail of this literature here due to space constraints.
13 Current year, one-year-ahead, two-years-ahead and, since the third quarter of 2011, expected inflation over the next five years; these are calendar year horizons, rather than fixed-year horizons.

One characteristic of the survey that could be improved upon is the extent to which the sample is representative of the structure of the South African economy. The BER has used convenience sampling and aimed to ensure adequate representation of the various sectors (Table 1) in the business survey. [14, 15] This technique results in a relatively broad sample, where a reasonable amount of information is collected from each sector, but it does not necessarily ensure that the sample structure represents that of the population.[16] Efforts are currently underway within the SARB to offer a way to re-weight the survey in a way that is broadly representative of the South African economy.

Table 1: Sample proportion by sector with Gross Value Added (GVA) sectoral weights
Per cent

% of GVA	BER categorisation	2000	2005	2010	2015	2020	2021	2022	2023*
Agri. (3.0%)	***Agri. & Forestry***	6.1	7.0	7.5	9.2	10.8	10.5	8.6	9.0
Construction (3.0%)	***Construction***	2.2	2.4	6.0	6.2	6.8	6.8	6.5	4.0
Manufacturing (13.1%)	***Manufacturing***	40.3	42.1	33.8	30.5	31.7	30.0	30.5	35.3
Mining (5.2%)	***Mining***	0.9	2.1	1.9	2.5	1.9	2.7	2.7	0.7
Trade (13.2%)	***Retail Trade***	0.0	0.0	0.0	0.0	13.4	10.3	9.5	7.6
	Wholesale Trade	30.1	27.7	28.7	23.7	7.0	10.1	16.8	17.3
	Motor Trade	0.9	1.2	2.4	2.5	2.1	2.9	2.3	3.3
Community and social services (includes personal services; 26.2%)	***Services***	17.7	15.3	14.1	21.5	22.8	17.0	16.2	16.4
Transport and electricity (11.4%)	***T & OPU****	1.7	0.9	2.3	1.8	1.6	1.6	2.1	3.1
	Other	0.1	1.3	3.2	2.2	1.9	8.0	4.5	3.3
	Unclassified	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
	Total	100	100	100	100	100	100	100	100

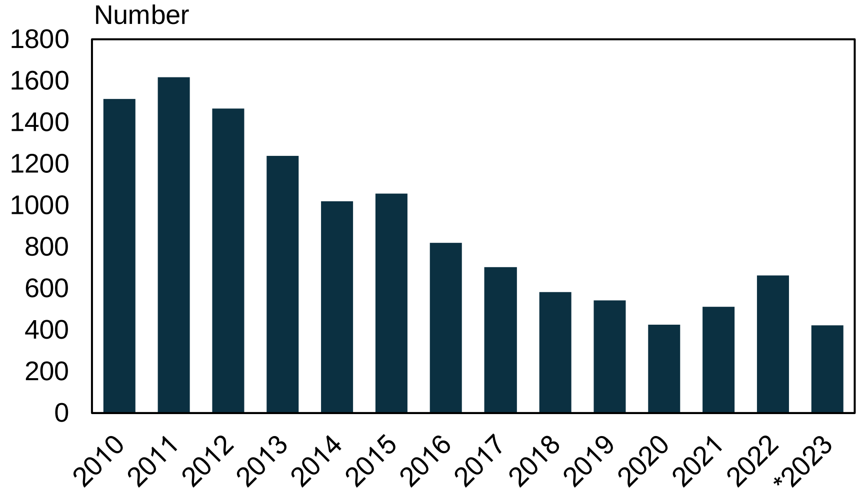
* 2023 up to Q3.
** Transport and Other Public Utilities.
Source: BER and Stats SA.

Another challenge is that overall survey response rates have been declining for some time, as shown in Figure 3, a problem exacerbated by the COVID-19 pandemic[17] and not unique to

14 A sampling technique in which survey respondents are selected based on accessibility and availability to the surveyor.
15 See Table A1 for a similar break-down according to firm size.
16 For a more detailed discussion of the strengths and weaknesses of the survey design, please see Reid & Siklos, (2021).
17 Despite the decline in recent years, the sample size of the business sector survey remains the larger than those of the financial analysts or trade unions.

South Africa. In 2022, the BER took steps to increase the sample size, recruiting new participants to replace those who had not responded in three years.[18] [19]

Figure 3: Business survey sample sizes across time



* 2023 up to Q3
Source: BER

Despite these survey-related challenges, the richness of the South African business sector dataset enables us to use the disaggregated data to gain deeper insight into the opinions of the business sector and potentially the price-setting behaviour that will flow from this.

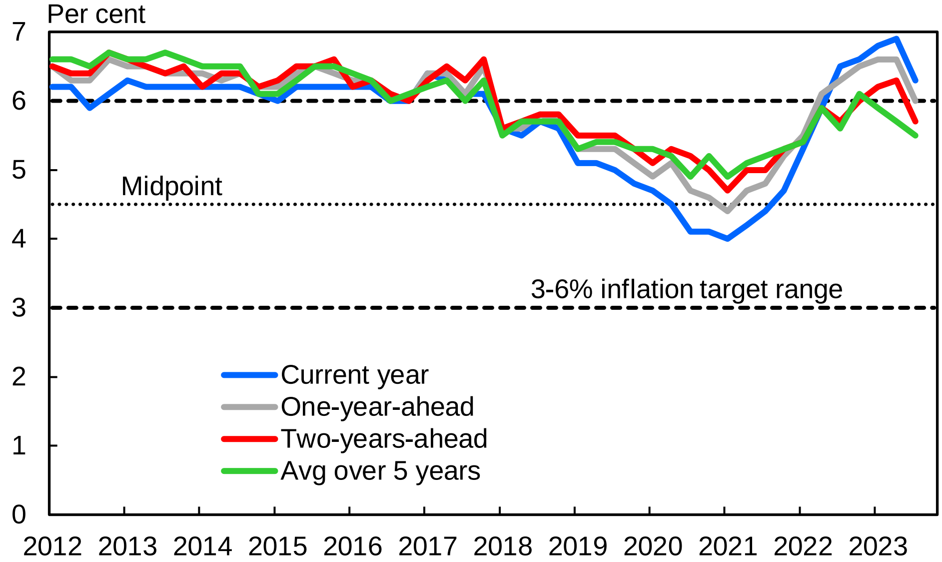
4. Degree of anchoring: an illustration of what the disaggregated business sector data can show us

In this section, we illustrate how this firm-level dataset can be used to gauge the extent to which inflation expectations are anchored and give potential insights into the prevalence of second-round effects.

South Africa was not spared the post-COVID inflation surge in 2022, causing both short- and long-term expectations to climb and resulted in average business two-years-ahead expectations breaching the upper bound of the SARB’s 3-6% inflation target range in the first quarter of 2023 (Figure 4). Naturally, this sharp rise has sparked debate around the anchoring of expectations.

18 BER (2022).
19 The decreasing response rate also supports the need to offer sample weights to ensure the sample is representative of the structure of the South African economy.

Figure 4: Business inflation expectations



Source: BER

The notion that inflation expectations are "anchored" is a concept that is broadly understood to mean that expectations are close to what the central bank wishes them to be – typically some official target. However, this apparent clarity is swiftly lost when we consider how to measure the extent to which expectations are anchored. A range of different measures have been used to capture the concept. Kumar et al. (2015) review the range of measures used to capture various features of well-anchored expectations. For example, they label expectations 'ideally anchored' if inflation beliefs are close to the central bank target on average and 'strongly anchored' if the dispersion of survey responses is low around a point of central tendency.[20,21]

The distribution of inflation expectations shows the dispersion and skewness of survey responses. It sheds light on the stability of the inflation expectations anchor, with greater dispersion indicating that a subset of the survey respondents is less anchored than others (sometimes interpreted as reflecting a degree of uncertainty within the group). If this level of dispersion were to increase over time, this would also perhaps be evidence of decreasing certainty, trust, and, ultimately, anchoring. The literature shows that increased dispersion and changes in the skewness of the distributions often precede sustained deviations from such a central tendency point.[22] Thus, analysing the shape of the distributions can give early indications on whether the expectations anchor may be drifting or becoming less stable.

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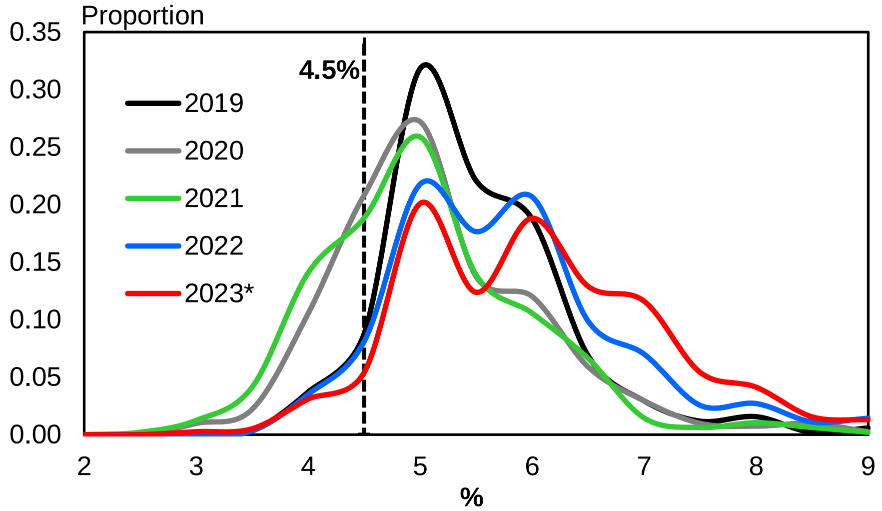
20 S Kumar, H Afrouzi, O Coibion and Y Gorodnichenko, (2015).

21 *Ideally* this central point would be the central bank target, but not necessarily, and could correspond to a long-term mean or median.

22 R Reis, (2022).

Figure 5: Distribution of two-years-ahead business inflation expectations



* 2023 up to Q3
Sources: BER and SARB

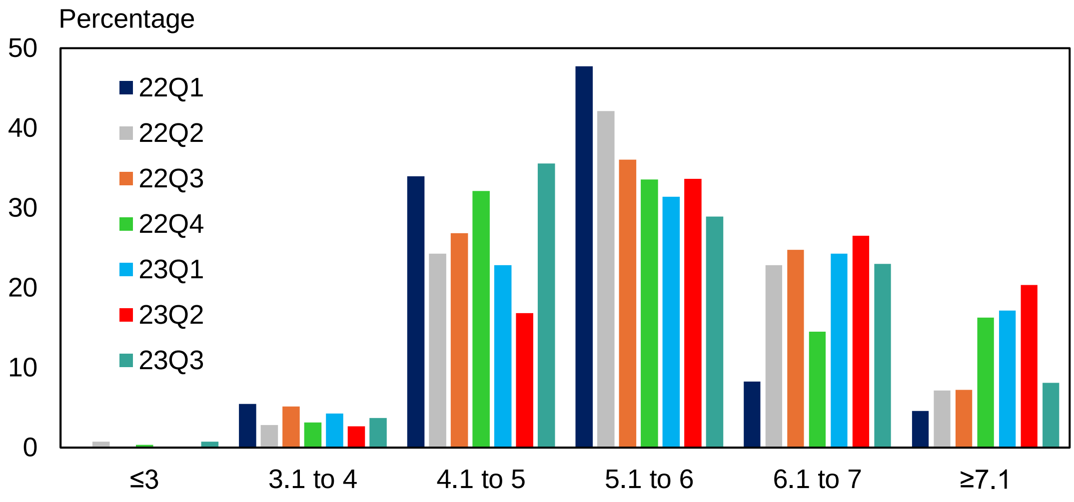
The BER data (Figure 5) reveals that, in addition to the fact that the means of the distributions have shifted in line with actual inflation outcomes, the dispersion of the two-years-ahead inflation expectations distribution has increased since 2019.[23,24] In addition, the 2022 distribution is bimodal, with a fatter right tail indicating that a larger share of business respondents expected inflation above 6%.[25] Concerningly, 2023 shows a similar picture. Looking more closely at 2022 and 2023, Figure 6 reveals that respondents revised their expectations higher as 2022 progressed, with an increasing share of them anticipating inflation to remain above the upper target limit over the medium term. This analysis suggests that the expectations of parts of the business population may have become moderately unanchored, showing some signs of drifting.

23 Mean (median) expectations for 2019, 2020, 2021, 2022 and 2023 respectively: 5.4 (5.2), 5.1 (5.0), 5.0 (5.0), 5.8 (5.5) and 6.0 (6.0).

24 The standard deviation of each distribution is a measure of the spread (the higher the number, the higher the spread): 2yr ahead: 0.97, 1.17, 1.10, 1.56 and 1.33 for 2019, 2020, 2021, 2022 and 2023 respectively.

25 Distribution sample sizes for 2019, 2020, 2021, 2022 and 2023 (23Q1 to 23Q3), respectively 512, 408, 483, 629 and 388. Note: the samples used to construct the distributions may differ slightly from the total sample sizes in Figure 2 as some respondents did not record responses for two-years-ahead inflation expectations.

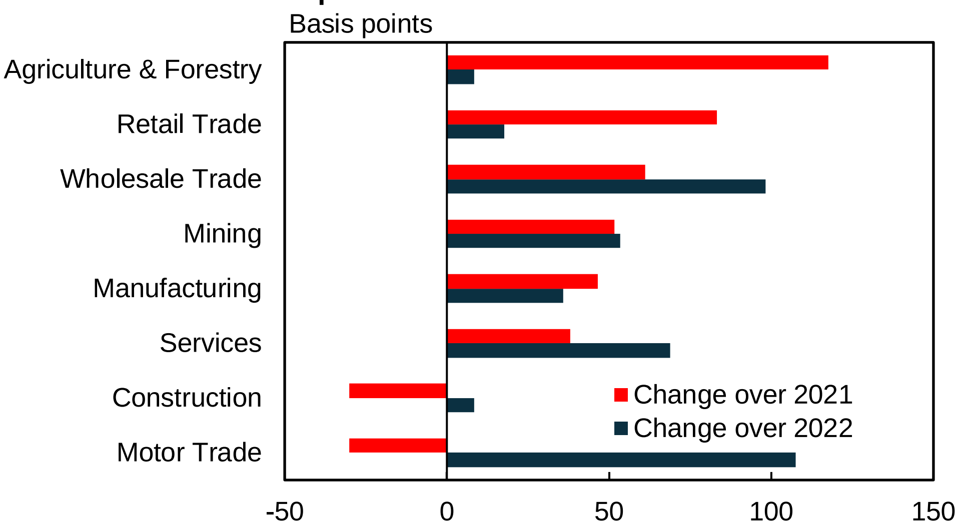
Figure 6: Business survey: distribution of 2yr-ahead inflation expectations throughout 2022 & 2023



Sources: BER and SARB

The availability of sectoral information about the survey respondents also allows us to ask questions about underlying inflation. The data can show how inflationary pressures filter through the broader economic system and whether they ultimately become more generalised – so-called "second-round effects". Intuitively, sectors experiencing a direct inflationary shock are more likely to revise their inflation expectations upwards immediately following the shock than sectors not directly exposed to the shock. If sectors seemingly isolated from the initial shock subsequently raise their expectations, it points to broadening inflationary pressures and possible second-round effects.

Figure 7: Changes* in two-years-ahead inflation expectations



*Q4 mean minus Q1 mean
Sources: BER and SARB

As shown in Figure 7, sectors that raised their expectations considerably in 2021, such as agriculture and retail, were likely those most directly affected by initial post-COVID supply shocks. Such supply shocks included increasing fertiliser prices amid rising geopolitical tensions and supply chain constraints affecting retailers. These sectors either reduced the pace of upward revisions or kept the pace relatively constant the following year (2022). Sectors less likely to have been directly impacted by the supply shocks, like the services sector, saw smaller changes to expectations in 2021 but much larger adjustments in 2022. This finding provides further suggestive evidence that there has been reason to be concerned about spillovers and second-round effects.[26]

5. Conclusion

Inflation expectations contain important information for inflation-targeting central banks. After nearly 25 years, the BER continues to run the expectations survey of financial analysts, trade unions and the business sector. The business sector survey, in particular, is a precious resource, given its potential to capture price pressures from key economic decision-makers. The data gives more profound insights into underlying inflation dynamics by showing whether relatively temporary responses to supply-side inflationary shocks may be evolving into more entrenched responses that risk spreading to a broader portion of economic decision-makers. These insights are crucial in helping to determine the appropriate response of monetary policy to such shocks.

26 W Simbanegavi and A Palazzi, (2022).

References

Bernanke, B. S. (2007) '*Inflation expectations and inflation forecasting*' [online], Accessed: 18 July 2023, Available: https://www.bis.org/review/r070712a.pdf.

Binder, C. (2017) *'Fed speak on main street: Central bank communication and household expectations'*, Journal of Macroeconomics, 52: 238–251.

Blinder, A. S. (2004) *The quiet revolution: Central banking goes modern'*, Arthur Okun Memorial Lecture Series.

Bureau for Economic Research (BER), (2022) '*Survey of inflation expectations: 4th Quarter 2022*' [online], Accessed: 23 June 2023, Available: https://www.ber.ac.za/knowledge/pkviewdocument.aspx?docid=17017.

Coibion, O. and Gorodnichenko, Y. (2015) '*Is the Phillips Curve Alive and Well after All? Inflation Expectations and the Missing Disinflation'*, American Economic Journal: Macroeconomics, 7(1), pp. 197–232.

Cox, J. (2022) *'Federal Reserve approves first interest rate hike in more than three years, sees six more ahead'* CNBC [online], Accessed: 13 July 2023, Available: https://www.cnbc.com/2022/03/16/federal-reserve-meeting.html.

Crowther-Ehlers, N. (2019) '*Inflation Expectations in South Africa: Non-rational, intertemporal and idiosyncratic heterogeneity represented by a term structure approach'* [online], Accessed 19 July 2023, Available: https://scholar.sun.ac.za/server/api/core/bitstreams/f1564009-3283-402c-8f3d-b1669433b77e/content.

Haldane, A., Macaulay, A and McMahon, M. (2020) *'The 3E's of Central Bank communication with the public*', Bank of England Working Papers No 847.

Kumar, S., Afrouzi, H., Coibion, O and Gorodnichenko, Y. (2015) *'Inflation targeting does not anchor inflation expectations: Evidence from firms in New Zealand',* Brookings Papers on Economic Activity.

Reid, M. and Siklos, P. (2021) *'How firms and experts view the Philips curve: evidence from individual and aggregate data from South Africa',* South African Reserve Bank Working Paper Series WP/21/03.

Reid, M. and Siklos, P. (2021) '*Inflation expectations surveys: a review of some survey design choices and their implications*,' Studies in Economics and Econometrics, Taylor & Francis Journals, vol. 45(4), pages 283-303, October.

Reis, R. (2021) 'Losing the inflation anchor', Brookings Papers on Economic Activity, [online], Accessed: 29 June 2023, Available:

https://www.brookings.edu/wp-content/uploads/2021/09/Losing-the-Inflation-Anchor_Conf-Draft.pdf.

Reis, R. (2022) 'The burst of high inflation in 2021 - 22: How and why did we get here?', Bank for International Settlements Working Papers No 1060.

Simbanegavi, W and Palazzi, A. (2022) *'Mind second-round effects! The effects of food and energy inflation on core inflation in South Africa'*, SARB Economic Note No. EN/2022/09, October 2022.

Weber, M., D' Acunto, F., Gorodnichenko, Y. and Coibion, O*. (2022) 'The subjective inflation expectations of households and firms: measurement, determinants and implications'*, Becker Friedman Institute Working Paper 2022-64.

Appendix

Table A1: Sample proportion by firm size
Per cent

	2000	2005	2010	2015	2016	2017	2018	2019	2020	2021	2022	2023*
Large	22.9	26.7	22.1	17.9	18.8	15.9	18.0	18.6	19.0	22.8	20.8	19.9
Medium	32.1	29.2	25.9	23.0	23.4	22.0	20.9	20.6	23.0	30.0	32.3	29.9
Micro	26.1	25.4	30.6	34.4	35.2	39.8	38.7	38.9	38.0	29.0	29.2	23.1
Small	18.7	18.4	21.1	24.7	22.2	21.9	22.3	21.5	20.0	18.1	17.2	19.3
Unclassified	0.2	0.2	0.3	0.1	0.4	0.3	0.2	0.4	0.0	0.0	0.5	7.8
Total	100	100	100	100	100	100	100	100	100	100	100	100

* 2023 up to Q3.
Source: BER.

OBEN 2401* – November 2023

Recent GDP growth outcomes exceed expectations despite record power outages

Arnold Khoza, Mokgabiso Tshenkeng, Sumaiya Sidat and Kgotso Morema

Abstract

Despite ongoing weakness, GDP growth has been unexpectedly higher during the first half of 2023 as the mining, manufacturing and finance sectors outperformed expectations. Meanwhile, on the demand side, better than expected growth from government expenditure and private sector gross fixed capital formation was realised. Better-than-expected growth outcomes can be ascribed to firms adapting to load-shedding; Eskom reducing its planned maintenance to improve generation capacity and relying more on its Open Cycle Gas Turbines; and increases in self-generating rooftop solar power and wind energy. This occurred amidst trading partner growth resilience. Looking ahead into 2024, GDP growth outlook remains weak, but risks to the outlook are still balanced.

1. Introduction[1]

Against the backdrop of a sluggish economic landscape exacerbated by heightened instances of load-shedding in the latter part of 2022, ongoing logistical constraints and a GDP contraction worse than anticipated of 1.1% q/q in 2022Q4, prospects for domestic growth in the current year were subdued, especially during the initial six months of 2023. This lack of optimism was primarily fuelled by a continued surge in load-shedding, which has now peaked at a record-breaking 21 715 gigawatt-hours (GWh) in 2023, surpassing the previous high of 11 724 GWh recorded in 2022.

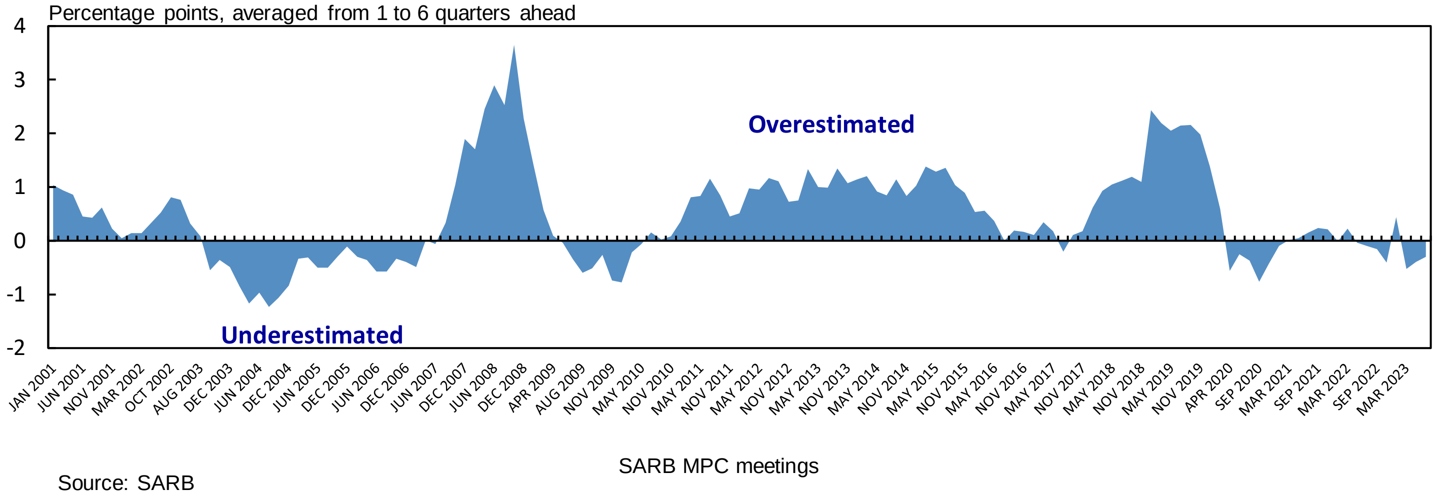
In 2023H1 alone, the country encountered a staggering loss of 15 349 GWH in electricity production, exceeding the total experienced throughout 2022. Nevertheless, in the face of these elevated power rationing levels, GDP growth surpassed initial expectations, thereby altering the narrative that prevailed at the start of the year. GDP growth is now expected to be closer to 1.0% this year, relative to earlier forecasts that were nearer to 0.0%. There are several reasons for this, and the purpose of this economic note is to explain the errors made in the forecast predictions as well as to provide some anecdotal evidence for these upside surprises.

[1] The authors would like to thank Rowan Walter for the valuable comments/suggestions.

2. Domestic growth has exceeded expectations in 2023H1

The SARB generally overestimated GDP leading up to the Great Financial Crisis (GFC) of 2008/09 and again from 2011 to 2019. Thereafter, small underestimations have essentially prevailed (see Figure 1).

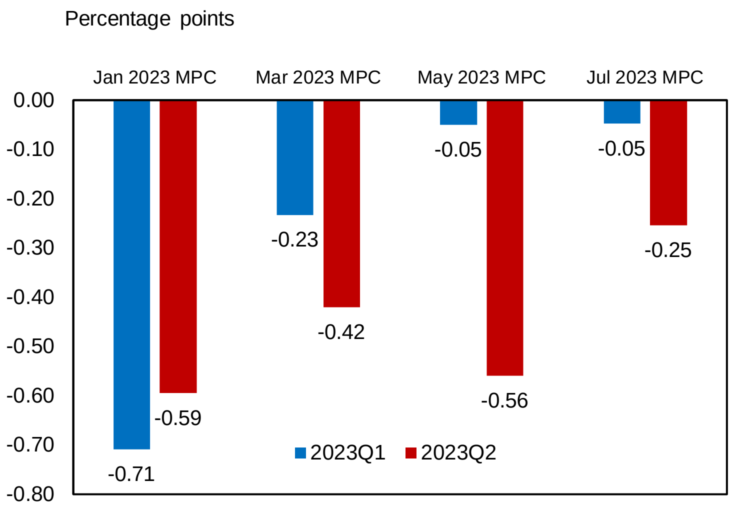
Figure 1: GDP errors



Source: SARB

Lately, GDP growth has exceeded expectations, surprising both the SARB and other forecasters. This has occurred despite worsening supply challenges, such as load-shedding and logistics issues (see Figure 2).[2] During the first half of 2023 these above expected GDP outcomes have primarily originated in mining and to a greater extent in the manufacturing sector. Being energy-intensive sectors, this might suggest that firms in these sectors have demonstrated more effective adaptation to operate amid load-shedding.

Figure 2: SARB GDP forecast errors in 2023H1



Source: SARB

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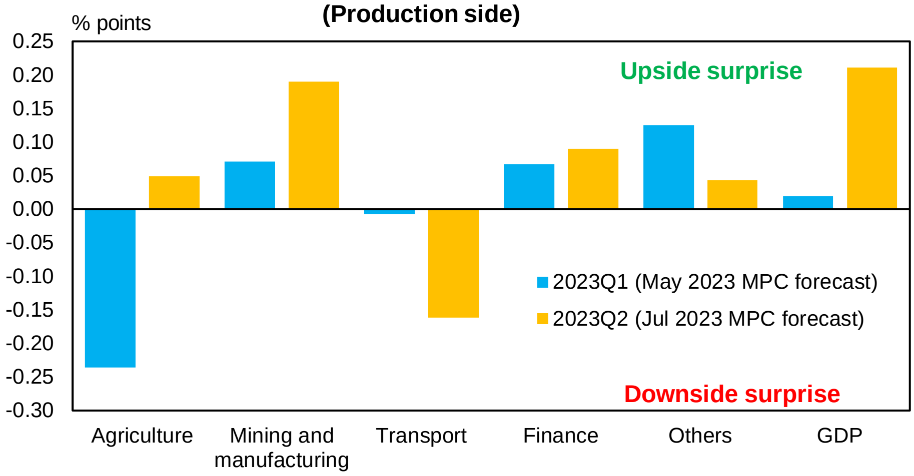
2 Recent GDP surprises, when compared to historical upside surprises, have been minimal.

The finance sector also contributed to the better-than-expected GDP growth outcomes. This is likely due to our limited access to high frequency data in advance of growth outcomes in this sector. Finance firms have also adapted to operating during load shedding, especially since they are not substantial electricity users. Unlike the intense power (especially base power) users such as the mining and manufacturing sectors, finance sector firms do not require significant installation of power to continue with operations during outages. This explanation could also apply to other sectors such as government and personal services (see 'other' category in Figure 3) which also contributed to the upside surprises in 2023H1 GDP growth. On the contrary, the agricultural sector GDP growth outcome was lower than expected in 2023Q1, while the transport sector outcome was much lower than anticipated in 2023Q2. Had it not been for the two negative outcomes from these sectors, GDP growth in the first half of 2023 would have probably been even higher than expected.[3]

Figure 3: Contribution to 2023H1 GDP growth forecast errors (Production side)

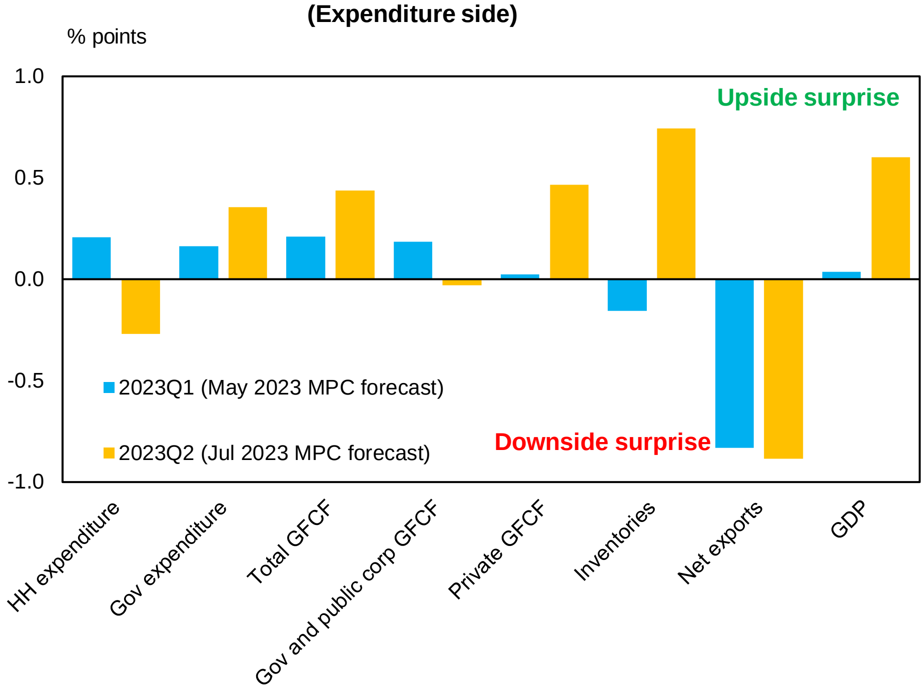


Source: SARB

There were even more significant positive surprises in growth that originated from government and total gross fixed capital formation (particularly the private sector) as measured by the demand side of the economy in 2023H1 - see Figure 4. Higher than anticipated private investment spending was mainly associated with load-shedding mitigation measures such as alternative self-generation. These energy projects also exhibit a high import content, which explains the significant and unexpected outcome in imports relative to our forecast. Meanwhile, exports came out higher than expected in 2023Q1, mirroring resilient trading partner growth. However, the reverse was true in 2023Q2, likely linked to the further sharp slowdown in commodity prices that began in early 2022.

3 There are a few elements that explain this sharp 2023Q1 contraction in the agricultural sector. These include the adverse impact of loadshedding on poultry production, delayed plantings due to field crops being affected by heavy rains, as well as foot and mouth disease which affected the cattle industry. In 2023Q2, the transport sector was impacted by a decline in rail freight and road passenger transport.

Figure 4: Contribution to 2023H1 GDP growth forecast errors (Expenditure side)



Source: SARB

3. Detail on the drivers of recent better-than-expected GDP outcomes

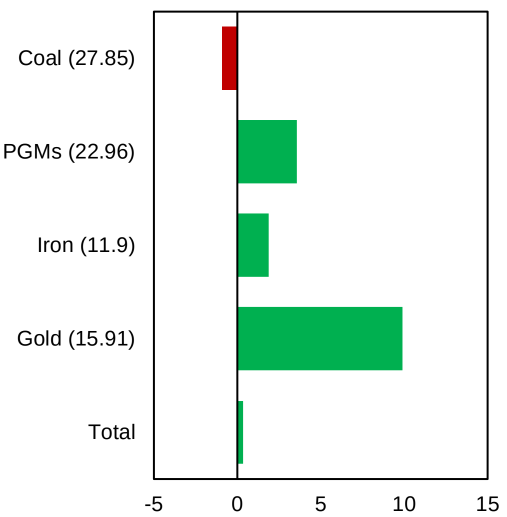
There are several reasons that could explain why domestic growth has surpassed expectations in the first half of 2023 (as discussed in Section 2).

3.1 Adaptation in energy intensive sectors

Recent near-term growth forecast errors were relatively small for the mining and manufacturing sectors given the benefit of high frequency data releases, which track these quarterly growth outcomes quite closely. However, it would be remiss to deliver a research output on how the economy has been fairing during record-high power rationing without unpacking the outcomes in the energy intensive sectors.

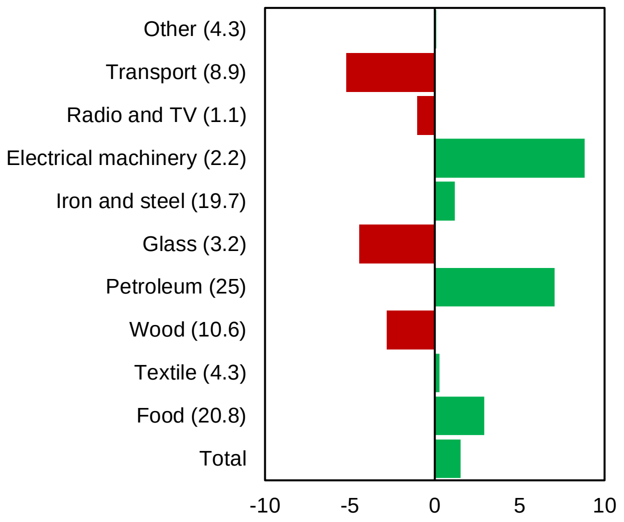
Notwithstanding the intensity of load-shedding, the mining, and manufacturing sectors have contributed positively to growth during the first half of this year in comparison with the last six months of 2022. In the mining sector (Figure 5), gold production has been a significant driver of total output (+9.9%). There was also a marked increase of 3.6% in the production of PGMs in the first half of 2023, which has the second highest weight in total production, after coal. In the manufacturing sector (Figure 6), large-weight items such as food and petroleum (supported by the reopening of a Cape Town refinery) advanced by 2.9% and 7.0% respectively in the first six months of the year, continuing their post-pandemic recovery.

Figure 5: Mining sector



Source: Stats SA

Figure 6: Manufacturing sector



Source: Stats SA

The growth observed in the mining and manufacturing sectors indicates a certain degree of resilience against the impacts of load-shedding. One potential avenue of adaptation is load curtailment, which involves instructing key industrial customers (>100GWh/annum) to reduce their demand for energy.[4] Predominantly, the industrial (40%) and mining (50%) sectors, encompass most of these curtailment customers.

As of 31 August, the cumulative implementation of load curtailment has amounted to 424 hours, as indicated in Table 1. This figure is significantly lower than the approximately 5000 hours of load shedding over the same period. Furthermore, load curtailment this year has been dominated by lower stages, particularly, stage two. Large industrial companies in these sectors may have benefited from some reprieve, as load curtailment customers are exempt from inclusion in load-shedding schedules.[5]

4 Load curtailment is load reduction obtained from customers who can reduce demand on instruction. Load curtailment is implemented on instruction from the System Operator. Customers who are a) able to respond, b) fall within the classification of being a key industrial customer (>100Gwh/annum), c) able to be measured and monitored and d) capable of being isolated on the network, may apply to be on load curtailment.

5 However, loadshedding remains a constraint for smaller operations in the production chain that won’t have the benefit of load curtailment.

Table 1: Load curtailment		
Load curtailment*	**Number of events**	**Number of hours**
Stage 2	30	232
Stage 3	1	8
Stage 4	20	184
Total	**51**	**424**
* Data obtained until 31 Aug 2023 Source: Eskom		

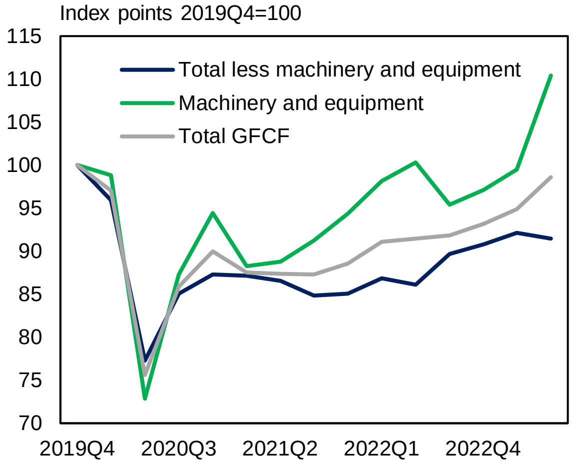
Another possible reason for the adaptation to load-shedding is the investment in self-generation within these sectors. Total gross fixed capital formation increased by 6.0% year-on-year, largely driven by investment in machinery and equipment (Figure 7), partly due to the ongoing renewable energy drive and related load-shedding mitigation measures. When analysing sectoral contributions to fixed investment, the manufacturing sector dominated during the first half of this year, contributing 2.7% points to growth (Figure 8). This partly reflects an increase in investment (possibly in self-generation) in the manufacturing sector.

Conversely, the mining sector has been diminishing fixed investment growth since the start of 2022 (apart from 2022Q3). This implies that adaptation within the mining sector may be attributed more to measures such as load curtailment, and less so to investment in renewable energy.

Despite the welcomed adaptation, mining and manufacturing production volumes are still underperforming (Figure 9). The overall trend in total production levels has remained broadly flat, with growth in the sectors constrained by a range of domestic challenges. These include criminal activities, logistical inefficiencies, high operating costs, navigating electricity load-shedding and a fragile global economic environment.

Figure 7: Machinery and equipment

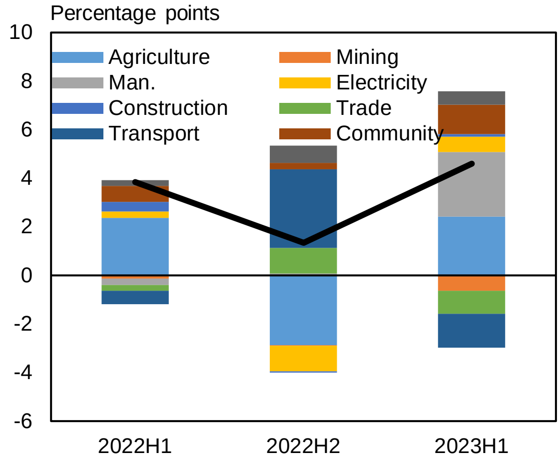
Index points 2019Q4=100



Source: Stats SA

Figure 8: GFCF contributions

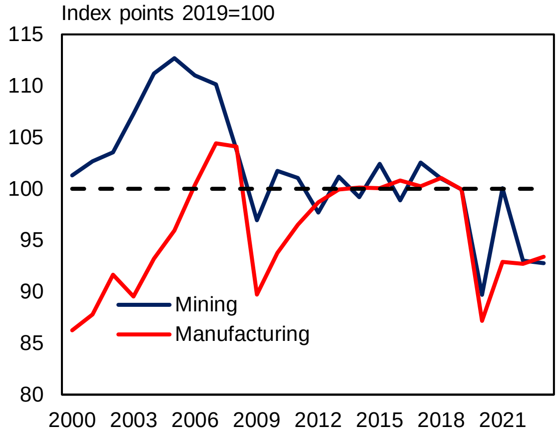
Percentage points



Source: Stats SA

Figure 9: Mining and manufacturing production volumes

Index points 2019=100



Source: Stats SA

3.2 Load-shedding assumed to worsen, but intensity improves

Evolution of the load-shedding assumption

The escalation in load-shedding at the tail-end of 2022 and the first half of 2023 is the result of a combination of factors. These include the breakdown of several generation units (resulting in unplanned maintenance) and delays in returning previously damaged generation units at various power stations back onto the grid. These developments resulted in revising the 2023 load-shedding assumption higher at both the January MPC from 100 days to 250, and the May MPC from 250 to 280 days. Further revisions were made at the September MPC, as there was an under allocation of load-shed days (lower stages). Therefore, an additional 30 days were added to the assumption taking the total expected load-shedding days to 310 for 2023 (see Table 2).

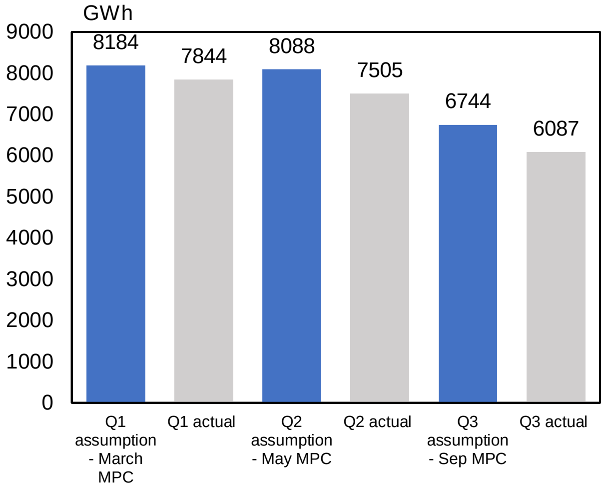
Table 2: Load-shedding		
	Load-shed days (2023)	GWh shed
Nov 2022 MPC	100	11724
Jan 2023 MPC	250	25416
Mar 2023 MPC	250	24840
May 2023 MPC	280	27000
Jul 2023 MPC	280	25872
Sep 2023 MPC	310	27792
Source: SARB		

Load-shedding intensity better than expected

Estimating load-shedding intensity in GWh shed has proven especially challenging with outcomes repeatedly lower than our forecasts – see Figure 10.

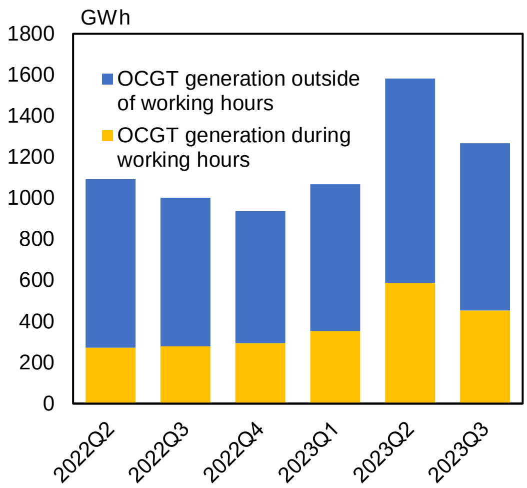
Several reasons explain the downside surprises. During the winter months, from June to August 2023, load-shedding was less intense when compared to the start of the year as Eskom introduced measures to counter the seasonal increase in demand. These included higher electricity tariffs for high-energy users to deter extensive energy consumption. Eskom also reduced its planned maintenance to improve generation capacity. Moreover, the increase in self-generating rooftop solar power and wind energy generation increased. Finally, Eskom was also more reliant on Open Cycle Gas Turbines (OCGTs) – see Figure 11, especially during peak time, which aided efforts to close the supply-demand gap.

Figure 10: GWh shed



Source: SARB

Figure 11: OCGT generation



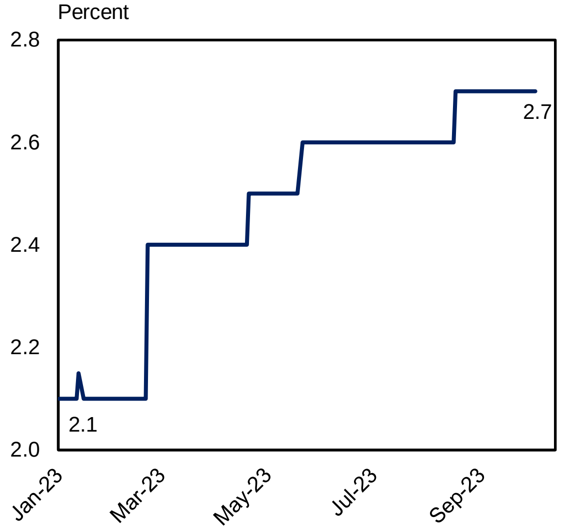
Source: Stats SA

These factors contributed to a more structured load-shedding schedule, favouring less load-shedding during working hours relative to the previous year's schedule. Figures 1 and 2 (in the appendix), which disaggregates load-shedding occurrences per hour while differentiating between the different stages, depicts this. That is, despite load-shedding intensity and frequency worsening over time, it has been relatively moderate during working hours (08:00-16:00). All these factors benefitted the entire economy, resulting in growth coming out higher than expectations.

3.3 SA trading partner growth proves resilient

The upside surprise in domestic growth could also be explained by better-than-expected global growth outcomes, particularly SA's trading partners as they proved to be quite resilient despite fears that tighter credit conditions would derail growth. This is reflected in the evolution of SA's trading partners' growth projections that have been revised continually upward over the course of the year for 2023, from 2.1% at the January 2023 MPC meeting to 2.7% at the September meeting (see Figure 12). These upward revisions are broad-based, but most pronounced in the US and Japan. This is also confirmed by Citigroup's global economic surprise index which has been positive for most of this year[6]. In our view, this has contributed to the recent upside surprises in domestic GDP, as export growth, as shown in Figure 3 came out higher than expected.

Figure 12: Evolution of 2023 global GDP growth forecasts



Source: Bloomberg

3.4 GDP growth volatility

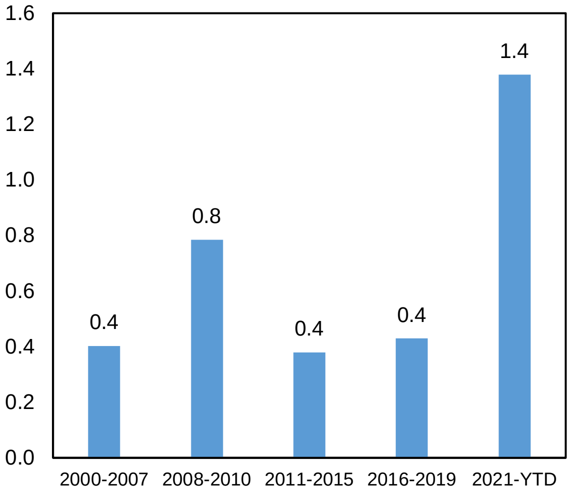
Domestic supply shocks have also contributed to the highly volatile economic activity levels (see Figure 13), making it harder for forecasters to project growth. There is a wide uncertainty band around our prediction for the estimated impact of these shocks (including that of load-shedding) as well as the recovery from these shocks. This could also explain some of the

6 https://en.macromicro.me/charts/45866/global-citi-surprise-index.

SARB's GDP growth forecast errors, especially recently as the country is still recovering from Covid-19 and the KZN floods. Also important is that the primary sector has been the most volatile in quarter-on-quarter terms post the GFC. This increases the likelihood of incorrectly projecting the primary sector (particularly the agricultural sector) compared to the secondary and tertiary sectors (see Figure 14).

Figure 13: SA's GDP volatility

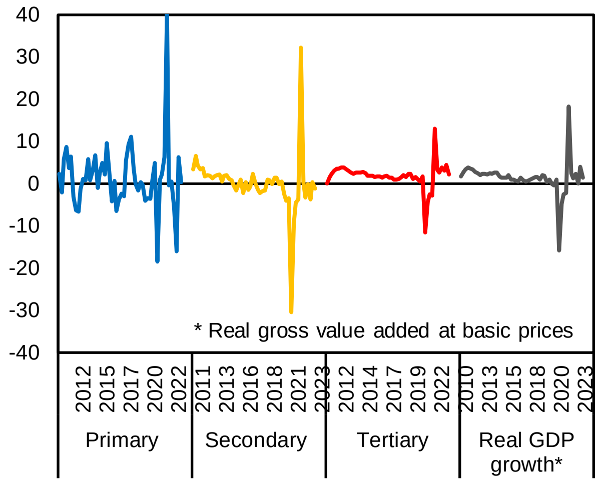
Standard deviation of q/q%



Source: SARB

Figure 14: Economic growth by sector

Percentage change from quarter to quarter



Seasonally adjusted

Source: Stats SA

4. Could GDP growth continue to exceed expectations?

Over the near term, growth is likely to remain weak, particularly in 2023Q3, given the slowdown in commodity prices, N3 truck torchings, the taxi strike in the Western Cape and floods in some parts of the country. Monthly data from Statistics South Africa has substantiated this expectation with risks to GDP growth in 2023Q3 skewed to the downside.

Meanwhile, in 2023Q4 risks could be to the upside as the intensity of load-shedding could be lower than expected. This is because Eskom has fast-tracked the return of three Kusile units (1, 3 and 4) which were expected to return online by December 2023. These units are currently fully operational adding an additional 2400MW to the grid. This is expected to provide just above two stages of load-shedding reprieve. The return of these units a month earlier than anticipated bodes well for the economy. Unit 2 and Unit 5 are expected to return online by early November and late December respectively each adding 800MW. With that said, Eskom officials have warned that even post-operational, Unit 5 would constantly undergo testing and would be regularly taken offline. Overall, excluding Unit 5, current developments surrounding Kusile are expected to generate 3200MW of electricity if they remain online sustainably.

5. Conclusion

South Africa has been hit by a series of shocks, such as intensified load-shedding, disruptions to rail and port, weather events, etc. The dramatic escalation in the intensity and frequency of load shedding, especially since 2022H2, has been the primary risk to economic activity. In 2023H1, around 15 300 GWh was lost due to load shedding – making 2023 the worst loadshed year since the first incident of load shedding in 2007. However, despite the magnitude of load-shedding in 2023H1, growth has shown some resilience, surprising both the SARB and other forecasters to the upside. These upside surprises can be explained by several factors such as businesses adapting to operating during load-shedding; upside surprises in load-shedding during working hours; load curtailment; better-than-expected trading partner growth and finally, GDP volatility. Looking ahead into 2024, we are uncertain whether these upside surprises in GDP growth will persist, as risks appear somewhat balanced.

References

Amaral et al. (2023). *'Eskom: This year and next',* South African Reserve Bank economic notes.

Bureau for Economic Research. (2018). '*Gauging GDP volatility and revisions in South Africa'*, [online], Accessed: 23 October 2023, Available: https://www.ber.ac.za/knowledge/pkviewdocument.aspx?docid=9366.

Creamer, T. (2023). '*Weather and winter tariff on large users helping to moderate electricity demand',* [online], Accessed: 1 November 2023, Available: https://www.engineeringnews.co.za/article/weather-and-winter-tariff-on-large-users-helping-to-moderate-electricity-demand-2023-06-26.

Ehlers et al. (2019). '*Assessing the accuracy of the SARB's growth forecasts'*, South African Reserve Bank economic notes.

Eskom. (2023). '*Eskom Data Portal'*, [online], Accessed: 23 October 2023, Available: https://www.eskom.co.za/dataportal/.

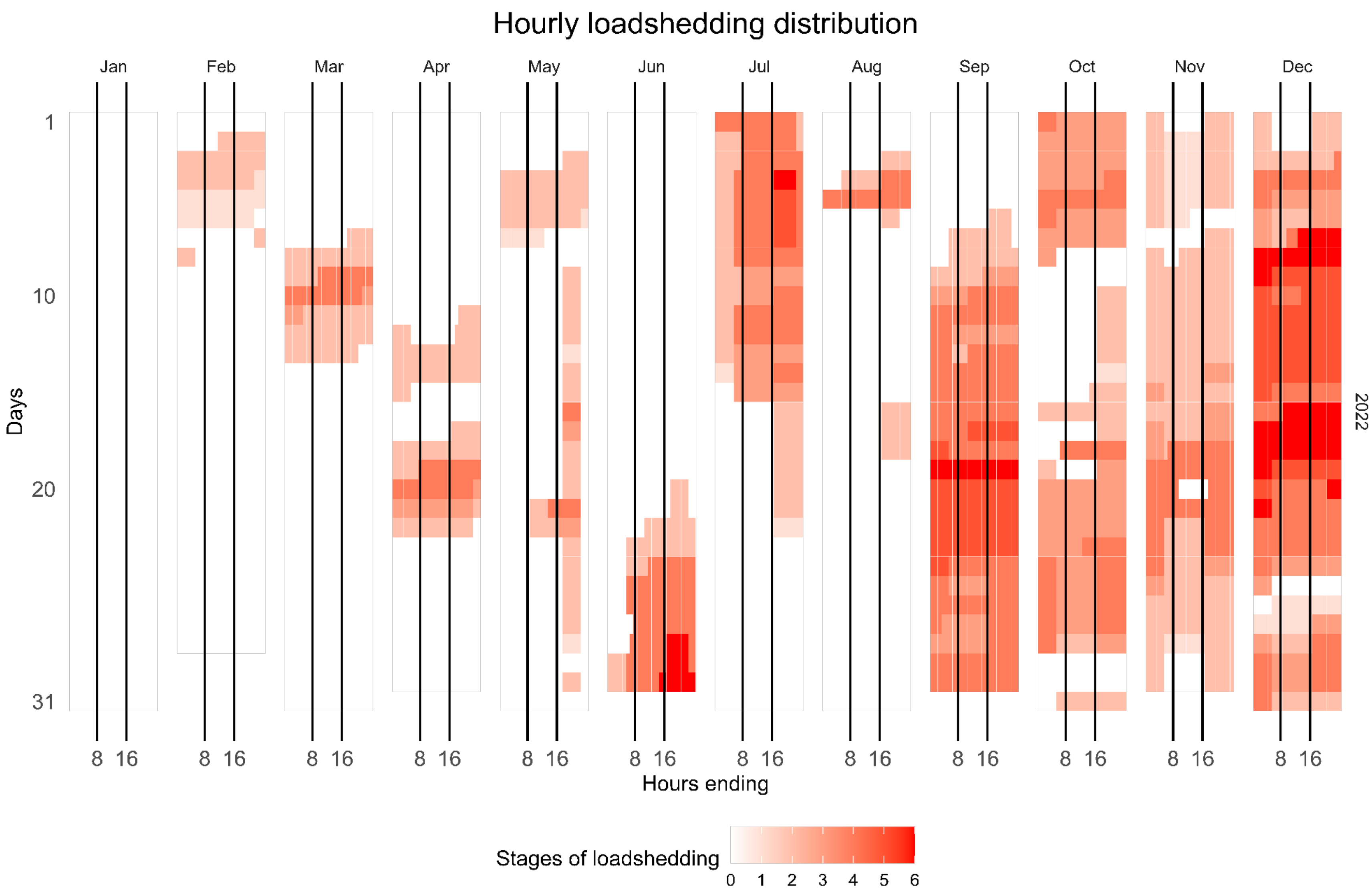
Eskom. (2023). '*Winter Outlook Briefing',* [online], Accessed: 1 November 2023, Available: https://www.eskom.co.za/wp-content/uploads/2023/05/State-of-the-system-presentation-Winter-Plan-Outlook-18-May-2023.pdf.

MacroMicro. (2023). *'World- Citi Surprise Index'*, [online], Accessed: 23 October 2023, Available: https://en.macromicro.me/charts/45866/global-citi-surprise-index.

South African Reserve Bank. (2023). '*Box 6: Unpacking the SARB's 2022 GDP forecast errors'*, [online], Accessed: 23 October 2023, Available: https://www.resbank.co.za/content/dam/sarb/publications/monetary-policy-review/2023/Monetary%20Policy%20Review%20April%202023.

Statistics South Africa. (2023). '*Manufacturing: Production and sales'*, [online], Accessed: 23 October 2023, Available: https://www.statssa.gov.za/publications/P30412/P30412June2023.

Statistics South Africa. (2023). *'Mining: Production and sales'*, [online], Accessed: 23 October 2023, Available: https://www.statssa.gov.za/publications/P2041/P2041June2023.


Hourly loadshedding distribution
Jan
Feb
Mar
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May
Jun
Jul
Aug
Sep
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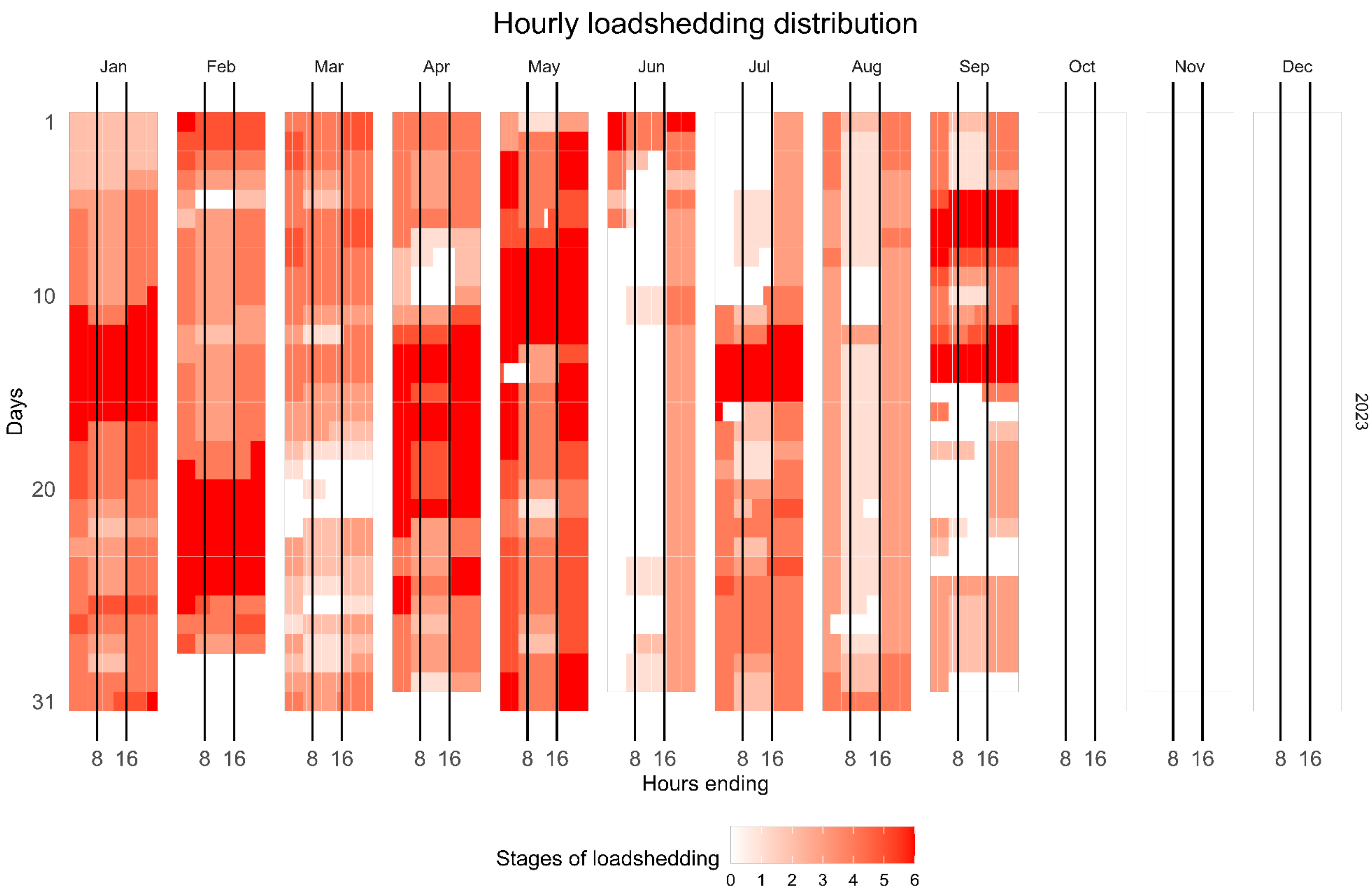
Days
1
10
20
31
8 16
Hours ending
2022
Stages of loadshedding
0 1 2 3 4 5 6

Figure 1


Hourly loadshedding distribution
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Hours ending
2023
Stages of loadshedding
0
1
2
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Figure 2

OBEN 2401* – February 2024

The importance of geopolitics

Josina Solomons, Pamela Mjandana and Jean-Francois Mercier

Abstract

In the past few decades, political factors have had a short-lived impact on the world economy and policy. The rise in geopolitical tensions in recent years, however, suggest that this trend could be changing. In the years following the 2008-09 Global Financial Crisis (GFC), investors seemed less concerned with political dynamics and more focussed on economic performance, such that global policy mostly reflected economic conditions rather than political risk at the time. Recently, geopolitics has become a complex mix of events, exogenous factors, and thematic risks. This complexity poses a heightened risk to the global economy, potentially leading to more frequent geopolitical surprises in the coming decade. Geopolitical tensions, including the ongoing Russia-Ukraine war, the Israel-Hamas conflict, and the impact of climate change on food prices, are likely to remain on the radar for South Africa over the medium term, while general elections later this year also pose a threat to political stability.

1. Introduction

Geopolitical risk typically arises from tensions that disrupt the normal course of international relations and tends to increase when peaceful conditions shift due to war, the threat of war, sanctions, or diplomatic conflicts. Geopolitics studies the interactions of geography, politics, and economics. These relationships often shape economic growth, foster good business operating environments as well as efficient market conditions. However, geopolitical risk often occurs alongside other global macroeconomic events, making it difficult to assess its impact on the world economy.

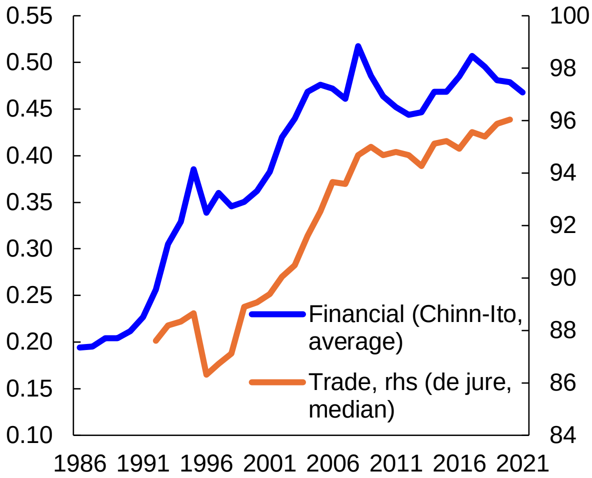
In the past few decades, political factors seemed to have had a short-lived impact on the world economy. In this economic note, we investigate whether the economic impact of geopolitics is changing. We assess whether such factors significantly affect global supply/demand balances, as well as capital flows and financial risk premia.

2. A brief history of geopolitics

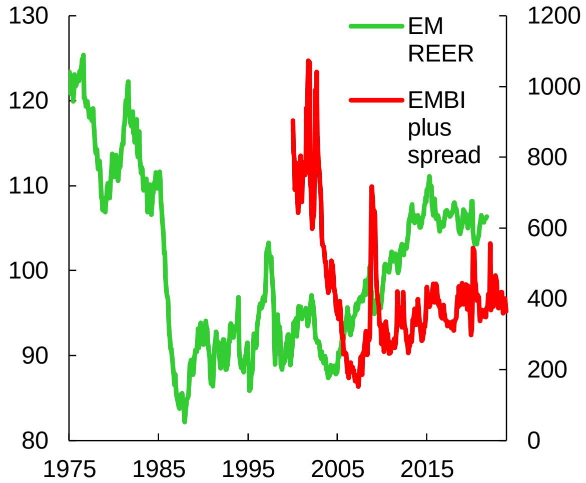
The term *geopolitics* gained popularity at the time of World War I (WW1) and World War II (WWII). Although geopolitical theory has experienced a decline in usage after the two world wars, geopolitics continued to influence international politics and was instrumental in the US Cold War strategy. The end of the Cold War, however, ushered in a "new world order" that was dominated by the West (and primarily the US) and where the free-market, rules-based approach to domestic policy and international economic relations became the norm. Francis Fukuyama asked in 1989 if this situation marked the "end of history"[1].

In advanced economies, this often meant a political space dominated by centre-left and centre-right parties.[2] Investors generally came to see electoral changes and other political dynamics as having limited impact on the economic outlook. Meanwhile, in emerging markets, most governments strove to be part of the new economic order and get a slice of global capital flows. To that extent, most emerging market economies ended up endorsing stability-oriented, investor-friendly policies[3]. Simultaneously, trade and financial openness increased across emerging market economies (Figure 1). Again, this meant investors got less concerned about political risk and more about economic performance[4]. Consequently, emerging market volatility abated, and real exchange rates improved (Figure 2).

Figures 1 and 2: Measures of trade and financial openness (left) and average EM real effective exchange rate vs EMBI+ sovereign spread (right)



Source: World Bank and Chinn-Ito



Source: JP Morgan

1 "The End of History?", Francis Fukuyama, The National Interest, No. 16, Summer 1989

2 In practice these parties differed little on key economic issues and generally endorsed independent central banks, free trade, lesser regulation, multilateralism, and regional integration. An example was the UK, where "New Labour" under Prime Minister Tony Blair became a softer version of *Thatcherism*, with no significant reversal of liberalization policies undertaken by previous Conservative governments.

3 In the 1990s, South Africa's ruling party, the African National Congress (ANC), went within a few years from "command economy" plans to the pro-market GEAR (Growth, Employment and Redistribution) strategy. This was not an isolated case in the emerging world.

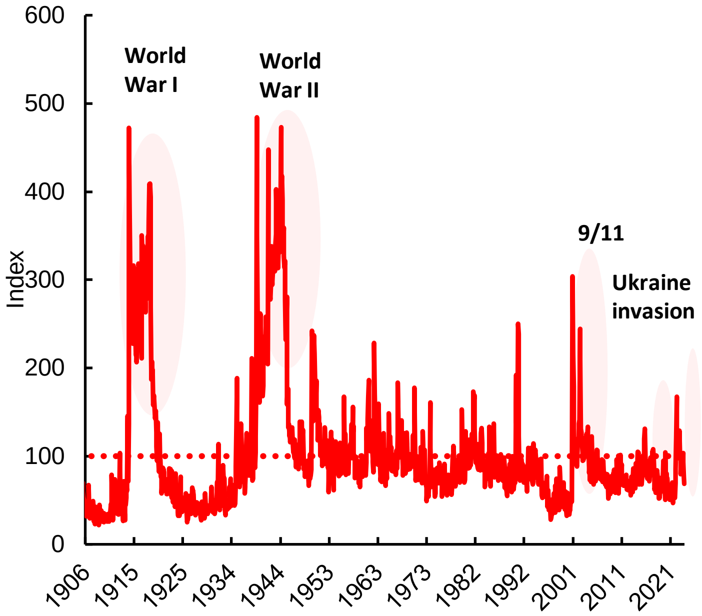
4 A trend emerged where rating agencies focused more on government's ability rather than their willingness to pay its debt.

The model's ability to engineer stronger growth and convergence towards living standards of high-income countries, however, faltered following the 2008-09 Global Financial Crisis (GFC).[5] Moreover, emerging powers that integrated into the global market such as China, India and Russia began to be perceived as threats rather than merely fast-growing markets for western multinationals.[6] In a slowing global economy, and at a time when governments failed to deliver on growth, populism gained ground, creating a situation where policy changes relevant to economic performance and structure became more prevalent.[7]

3. Types of geopolitical risk

Geopolitical risk[8] has been fluctuating over the last few centuries, spiking around the two world wars, and again at the start of the Korean War in the early-1950's, the Cuban Missile Crisis in the 1960's, and after the 9/11 terrorist attacks. Each successive spike in the geopolitical risk index however, failed to reach the levels seen at the time of the two world wars (Figure 3). While Russia's invasion of Ukraine in 2022 pushed the index higher, it still fell short of previous spikes seen after 9/11 and has recently fallen to levels below the long-run average.

Figure 3: Geopolitical risk index



Source: US Federal Reserve

5 This era also faced growing opposition amid the uneven spread of growth benefits both across countries and income groups within countries.

6 COVID-19, cybercrime as well as climate change illustrated the emergence of new threats.

7 For example, trade restrictions which the Trump administration placed on Chinese exports between 2017 and 2021 were largely kept in place by the Biden administration.

8 Illustrated by the Geopolitical Risk Index was calculated by Caldara, Dario, and Matteo Iacoviello (2021), "Measuring Geopolitical Risk," working paper, Board of Governors of the Federal Reserve Board, November 2021.

In this note, we characterize geopolitical risk as event risk, exogenous risk, or thematic risk. Event risk evolves around an expected political event such as an election outcome e.g., Brexit in 2016, that could have negative implications for prevailing conditions and potentially result in changes to a country's cooperative stance. Exogenous risk, conversely, is a sudden or unanticipated risk and include events such as natural disasters, political unrest, pandemics, and other unexpected events. Thematic risks are generally anticipated events that evolve and expand over time, which include issues such as climate change, cyber threats, the regulation of artificial intelligence as well as the ongoing threat of terrorism. Meanwhile, the issues of energy security as well as the potential re-organisation of global supply chains can also be grouped under thematic risks. In recent years, geopolitics have been characterised by a complex mix of event, exogenous as well as thematic risks, posing increasing risks to open market economies.

4. How does geopolitical risk affect the global economy?

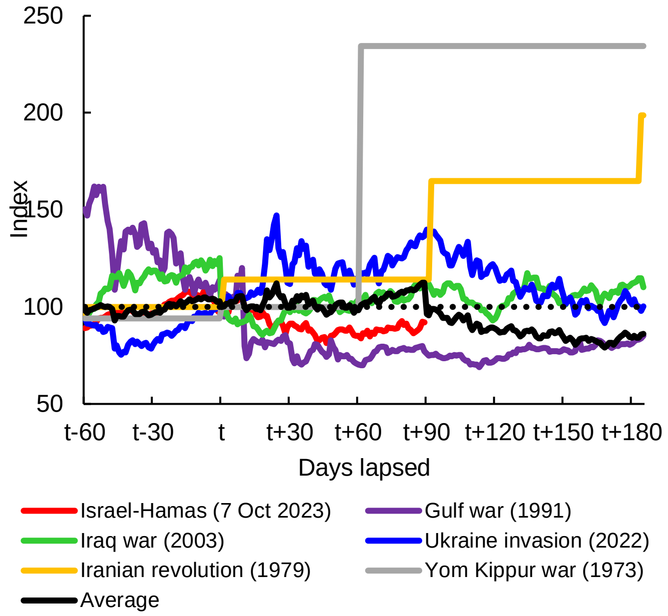
4.1 Short term impact on the world economy

Geopolitical risks mostly materialise as a surprise, making it difficult to monitor, forecast as well as assess their impact on the global economy. There are various transmission channels of geopolitical risk on the economy, some of which we will consider in this section. We first analyse the impact of geopolitics on global financial markets, as this is usually the quickest transmission channel.

Contrary to what one would expect, the oil price does not always rise in response to increased geopolitical risk[9]. The Middle East should continue to be a geopolitical "hotspot" but should have less of an impact on the oil price today compared to say in the 1970s and 1990s, when the region controlled a larger share of the global oil market.

[9] In our analysis, the oil price is indexed to 100 at time *t*, which coincides with the start of the geopolitical crisis. In 1973 and 1979, there was not yet a developed free market for oil where prices were determined daily, so price indices adjusted based on OPEC decisions – hence explaining the lagged response to the start of the geopolitical event.

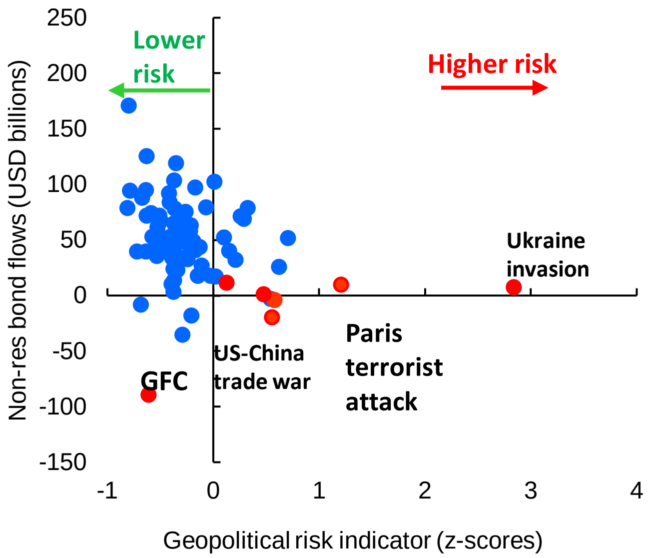
Figure 4: Oil price around major geopolitical crises



Source: OECD, Bloomberg

Rising geopolitical tensions tend to heighten risk aversion, impacting capital flows and global equities. During times of elevated geopolitical risk, emerging market economies generally experience mild bond and equity outflows. However, a period of unusually elevated risk – the Ukrainian invasion – did not result in major outflows, possibly because markets differentiated across flow recipients with respect to the vulnerability to the event shock.

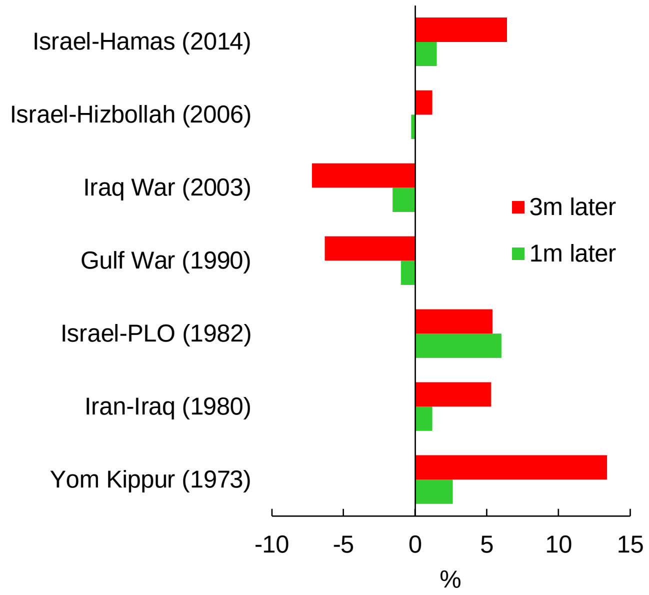
Figure 5: Emerging market bond and equity flows



Sources: IIF, SARB

When analysing the performance of the US dollar one and three months after the start of key geopolitical events in the Middle East, it is evident that the US dollar typically appreciates, except for two instances[10]. Other factors like the global economic climate and the state of the US monetary policy cycle also influence currency markets during geopolitical events.

Figure 6: Change in US dollar index after start of Middle East conflicts



Source: Bloomberg

4.2 Long-term impact on the world economy

Geopolitics typically influences the world economy through sentiment, generating uncertainty that directly impacts trade and investment decisions. It can also distort the allocation of resources: for example, higher geopolitical risk of the military type can force an increase in defense expenditure, which can easily crowd-out other, more productive investments. We consider two major channels by which we think geopolitics can impact the world economy – trade and foreign direct investment (FDI).

4.2.1 Impact on global trade

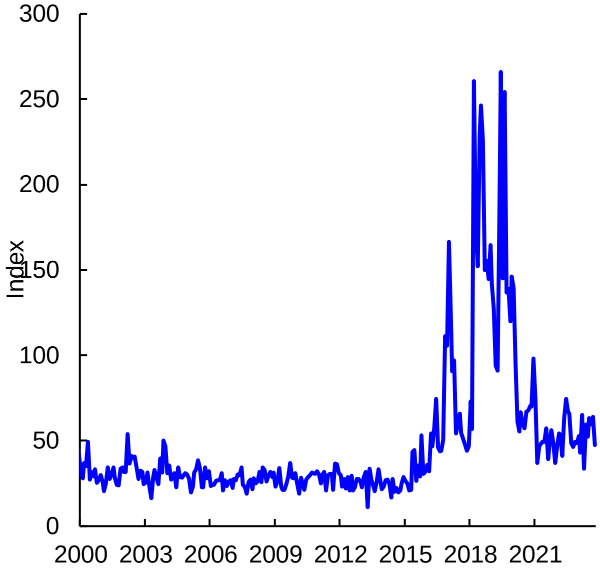
Recent geopolitical events[11] have likely triggered a geopolitical rift in the global economy. Concerns are rising that the world is leaning towards a more fragmented trading environment, where major economies are becoming more inward-looking. Trade uncertainty has also risen amid persistent geopolitical conflicts, partly contributing to weaker global trading conditions (Figures 7 and 8).

---

10 In the early-1990s, after the start of the Gulf War, and at the time of the 2003 Iraq War the US dollar depreciated against emerging market currencies.

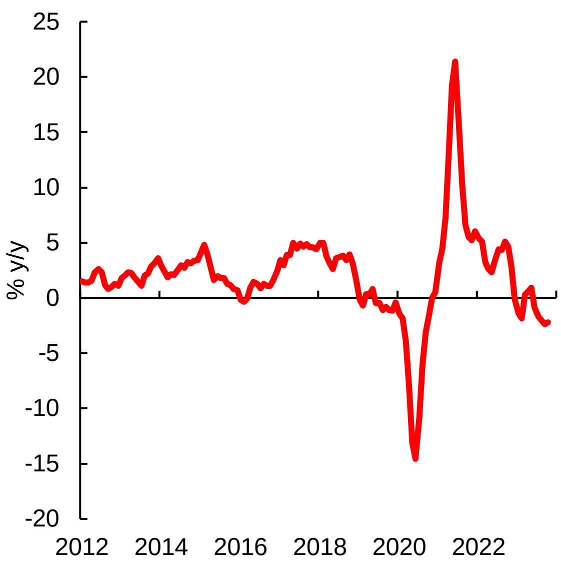
11 The US-China trade war that started in 2016, followed by the COVID-19 pandemic and then the war in Ukraine in 2022.

Figure 7: Trade policy uncertainty



Source: OECD

Figure 8: Global trade

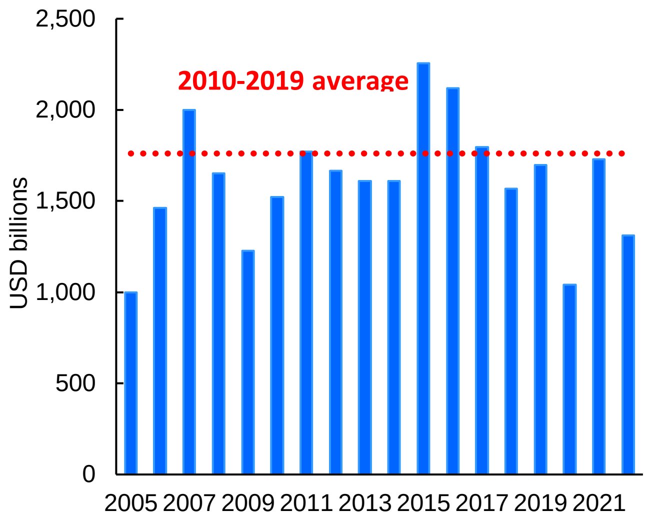


Source: Haver

4.2.2 Impact of geopolitics on investment

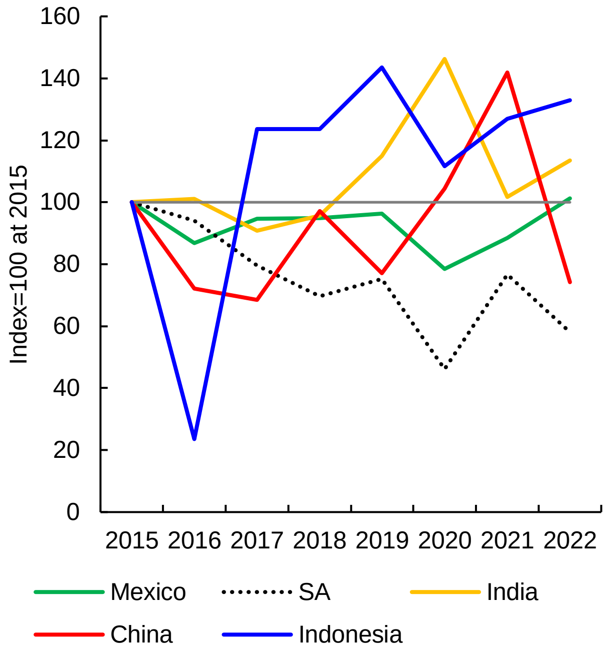
The size and direction of capital investment is likely to change in a world where countries are more geopolitically aligned. Global foreign direct investment has also fallen steadily in recent years (Figure 9). There are also emerging signs of investment reorientation along geopolitical lines. Notably, FDI inflows to China have continued to decline following the start of US-China trade tensions, while inflows into countries such as India, Mexico, Indonesia appears to have benefitted (Figure 10). More and more it would appear that FDI flows are increasingly concentrated among geopolitically aligned countries.

Figure 9: World FDI flows



Source: OECD

Figure 10: China net FDI inflows



Source: OECD

5. Outlook for geopolitics

Geopolitical risks are likely to remain elevated, and potentially increase, in the next decade or so. Among the top ten risks for 2024 mentioned by investors in a Deutsche Bank survey, three were of a geopolitical nature: the US 2024 election, an escalation of the Israel-Hamas conflict, and Taiwan becoming a global flashpoint[12]. With many countries also expected to hold elections this year, political dynamics could generate regulatory and policy uncertainty, further raising the likelihood of geopolitical surprises over the short term. [13]

Over the medium term, the lack of quick convergence of emerging market economies towards high-income countries could continue to intensify migratory flows in advanced economies, which are already struggling to manage an influx of immigrants, causing political backlash against open-border policies.[14] Meanwhile, in poorer economies, demographic pressures and the climate crisis could increase competition for basic resources, such as land or water. Such risks are likely to result in a greater probability of growth-unfriendly geopolitical dynamics, be it conflicts, internal military instability or the election of “illiberal” governments, not to mention climate events. It may be no surprise that conflict frequency has already been rising in recent years, both between and within countries (Figure 11).

Politically weakened governments may also struggle to enforce world order, while multilateral organisations like the United Nations see their authority undermined amid growing global

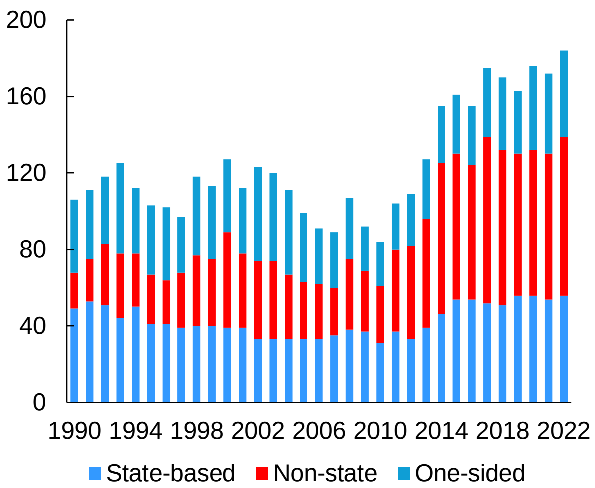
12 See December 2023 Global Markets Survey, Deutsche Bank Research, 11 December 2023.

13 This year, voters will go to the polls in countries that account for about 54% of the global population and nearly 60% of global GDP.

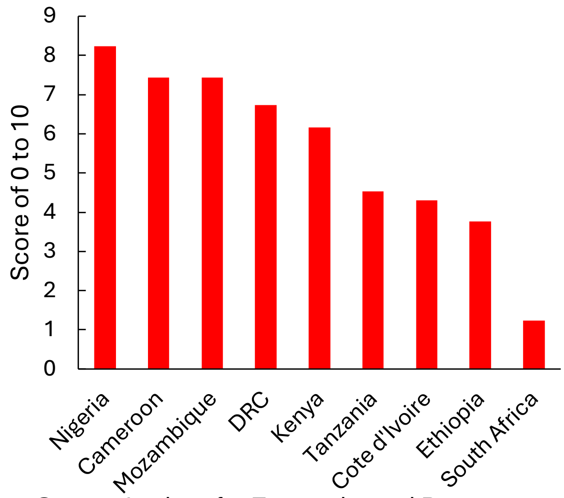
14 This contributes to politics in major democracies becoming more polarized, while lower voter participation can potentially reduce government legitimacy.

geopolitical divisions. Meanwhile, countries that are not part of formal military alliances or economic unions (NATO, the EU), or which do not have strong enough institutions to effectively allocate resources, combat the risk of terrorism or prepare against potential climate events, appear more at risk. Low-income countries, particularly in Sub-Sahara Africa (SSA), with strong population growth and urbanisation, may be more affected and have faced a growing terrorism risk over the years (Figure 12). These nations also stand to lose more from geo-economic fragmentation into rival blocs.[15]

Figures 11 and 12: Number of conflicts in the world (left) and degree of terrorism threat in major African economies (right)



Source: Uppsala Conflict Data Programme



Source: Institute for Economics and Peace

5.1 Implications for South Africa

Geopolitical tensions, including the ongoing Russia-Ukraine war, the Israel-Hamas conflict, and the impact of climate change on food prices, are likely to remain on the radar for South Africa. General elections this year also pose a threat to political stability if the ruling African National Congress fails to secure a majority.

Moreover, South Africa remains vulnerable to spillovers from global thematic risks. For instance, if perceived as aligning with one geopolitical bloc over another, South Africa may experience reduced access to certain markets or foreign direct investment (FDI). The country's neutral stance on Russia and the war in Ukraine could potentially reshape its future diplomatic relations with the US. This could, for instance, result in the potential exclusion from the African Growth and Opportunities Act (AGOA) programme[16], which poses a risk to local financial institutions' participation in the global system. There is also the increased likelihood of

[15] "Geoeconomic Fragmentation: Sub-Saharan Africa Caught between the Fault Lines," Regional Economic Outlook Analytical Note, International Monetary Fund, April 2023.

[16] The African Growth and Opportunity Act (AGOA) provides duty-free treatment to products from designated sub-Saharan African countries. According to a Brookings article, following the AGOA forum in August 2023, the U.S congress. released a draft bill to renew the programme for 16 years but would require an immediate "out-of-cycle" review of South Africa's eligibility for AGOA. Such a review could lead to an expulsion from the programme.

secondary sanctions, with long-term implication of further isolation from US-aligned trading partners.

Following the Israel-Hamas conflict, oil prices seem to have to have reacted mildly thus far, primarily due to concerns about global growth. However, if the conflict were to escalate and disrupt oil supplies, risks of higher energy prices and volatility could increase. More recently the Suez Canal developments have raised concerns about shipping costs[17]. Should the attacks on container ships escalate, supply chain disruptions similar to what was seen during the COVID-19 lockdowns could reappear. South Africa's sea ports are inefficient even without the disruptions in the global shipping industry. Hence, risks of running out of critical supplies, including liquid fuels, would be high.

Additionally, South Africa is increasingly becoming more vulnerable to adverse weather conditions. The more frequent bouts of extreme weather conditions in different parts of the country – particularly, floods in KZN and the Western Cape - and the ongoing El Nino event[18] remain key risks to the agricultural sector. This may impact food prices with implications for the future stance of monetary policy.

Within the region though, South Africa maintains its prominence, enjoying positive relations with neighbouring countries and currently facing no direct terrorism exposure and little to no internal strife. However, this stability may be challenged, particularly if issues like poverty and criminality escalate, potentially testing the effectiveness of South Africa's institutions and the rule of law in specific areas, thus altering the geopolitical landscape. An additional risk could be increased migration from the rest of the continent were violent conflict in African "hotspots" to intensify, at a time when unemployment in SA is high and peri-urban infrastructure would struggle to cope with significant new population inflows.

6. Conclusion

In recent decades, geopolitics has had a diminished impact on the global economy. However, the recent escalation in political tensions, coupled with a heightened awareness of geopolitical factors, indicates a potential shift in these dynamics. Geopolitics have also been characterised by various types of risk in recent years, making it even more difficult to predict and raising the likelihood of more frequent geopolitical surprises in the short to medium term. As tensions continue to escalate, investors are likely to adjust their business models, strategies, and supply chains to become more resilient to geopolitical disruptions. Meanwhile, South Africa, is no exception and remains vulnerable to a volatile and unstable geopolitical backdrop.

[17] Shipping is core to the global economy, accounting for 90% of the world trade carriage.

[18] Though the probability of a severe drought has been declining, concerns about the extreme heat conditions in certain parts of the country, i.e. Limpopo and Mpumalanga remain a risk.

OBEN 2401* – March 2024

Are shifts in AE labour markets structural?

Mukovhe Takalani, Jean-Francois Mercier, Blessings Nkuna and Kagiso Mphahlele

Abstract

This note evaluates aspects of labour market tightness in AEs, examines whether they are resolving, and explores how they could potentially impede normalization of inflation. Recent years have seen a noticeable shift in the Beveridge curve within AEs, indicating a change in labour supply dynamics. The post-pandemic recovery in labour force participation has been slow and uneven among AEs. Persistent tightness in labour markets is evident through high job vacancies and recruitment challenges. Firms appear to engage in labour hoarding, which contributes to high wage growth. Encouragingly, labour market normalisation (mostly through improved supply) seems underway. Nonetheless, some shifts take longer to resolve, sustaining the risk of durable changes to wage-unemployment dynamics.

1. Introduction

In a stable macroeconomic environment, characterized by flexible and deregulated labour markets where demand and supply are in equilibrium, labour cost increases tend to correspond with productivity of labour inputs and expected inflation. This stability in inflation typically revolves around the central bank's inflation target. Such alignment prevents the emergence of wage-price spirals and limits the risk of inflation pressures, even when temporary shocks occur. However, there is a broad consensus among central banks and economists that this equilibrium does not apply right now. Real wages fell in 2021-22 in major economies as inflation surged, and central banks now accept that there will be some "catch-up" in the next year or two. However, this catch-up needs to be moderate and gradual, and accompanied by a compression in firms' profit margins, to remain consistent with a return of inflation to target.

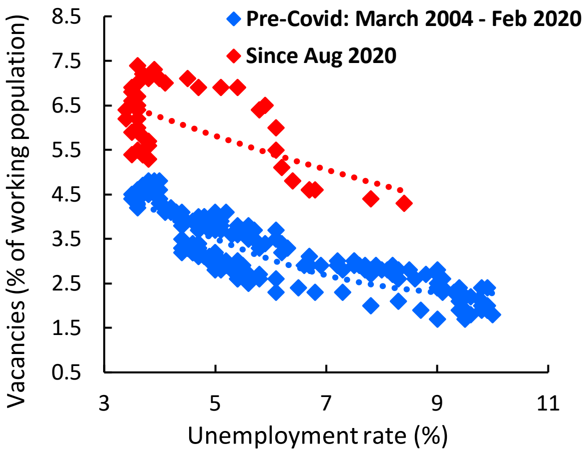
The recent state of advanced economy (AE) labour markets poses risks to that benign scenario. After the pandemic, there were signs of structural shifts in many AEs that affected labour supply and reduced the sensitivity of labour demand to tighter policy. This situation has the potential to fuel higher nominal (and in turn, real) wage growth. Presently, numerous factors have resulted in tight labour markets in AEs. This Note investigates what these factors are, whether they are in the process of resolving themselves, and how they might challenge the continued normalisation of inflation.

2. Back to the Beveridge curve

Over recent years, several countries have displayed a shift in the Beveridge curve (that links vacancies to unemployment), which signals a change in the supply of labour. This was particularly obvious in the US, potentially suggesting a major structural shift. Under normal circumstances, the equilibrium of unemployment (u) versus vacancies (v) shifts along the curve, as demand for labour fluctuates: Thus, in a recession, u rises as v falls. However, since the pandemic, the whole curve has shifted to the right. This means that for given levels of u, v has been higher – firms find it harder to fill positions even if demand for labour is unchanged.

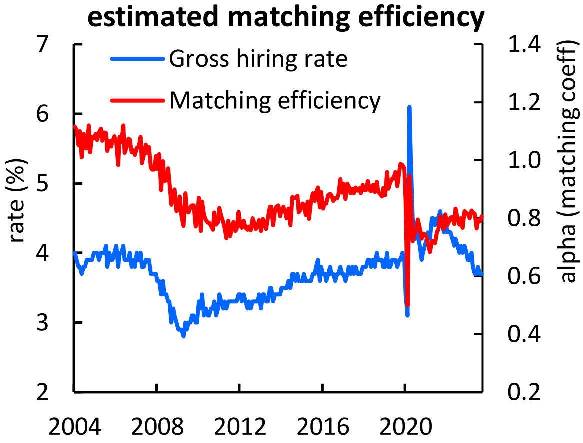
In the last few quarters, the US labour market has seen a decrease in job vacancies occurring without a substantial rise in unemployment, which could be a sign that the Beveridge curve is moving back to its pre-pandemic position (Figure 1). However, the initial shift in the curve has not yet fully reversed, and the normalisation seemed to stall in December/January.[1] Furthermore, there is still evidence of a decline in the matching efficiency within the US labour market. Using a formula[2] employed by Blanchard, Domash, and Summers (2022), which estimates efficiency by relating the number of hires to unemployment and vacancies, it is evident that matching efficiency experienced a significant decline during the pandemic. Despite some subsequent improvement in the matching process, the pandemic decline has not been fully reversed.

Figure 1: US beveridge curve



Source: Bureau of Labour Statistics

Figure 2: US gross hiring rate and estimated matching efficiency



Source: JOLTS

In contrast to the United States, the Eurozone Beveridge curve has not shown any notable inward or outward shifts since 2020, although it appears to have steepened. The apparent steepening of the curve may therefore be a sign of its non-linearity, made evident by the fact that unemployment fell to unusually low levels (Figure 3). Still, the pandemic has led to a

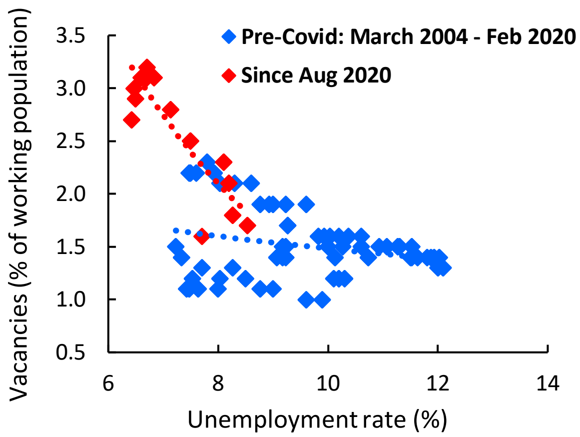
1 Job creation re-accelerated in the last two months, while vacancies rose in December.

2 The matching formula used: $h = a * (u^{\alpha}) * v^{(1-\alpha)}$, where h is gross hires, and a is a parameter of the efficiency of matching. u and v indicate the unemployment rate and vacancy rate, respectively, and have a convex relationship, the so-called Beveridge curve. Hence, if matching efficiency is high (a high level of a), hires can be elevated even with low unemployment and vacancy levels. The estimates for α in the literature range between 0.3 and 0.5. As in the Policy Brief by Bernanke et al. (2022), we use a value of 0.4, which has similar results for values in the range.

significant shift in the v versus u equilibrium, with an excess of job openings alongside low unemployment rates – implying a tight labour market.

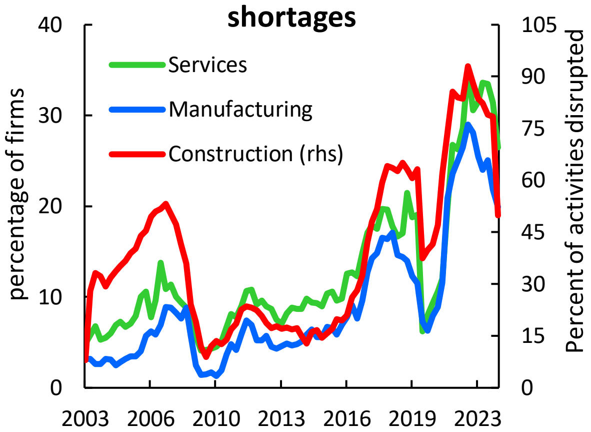
Further corroborating the existence of a tight labour market within the Eurozone bloc is the substantial prevalence of firms – in all major sectors – reporting labour shortages inhibiting production. A research brief authored by Colliac (2023) also highlights that over 15% of companies in the manufacturing and services sectors in the Eurozone face labour shortages, constraining their production activities. By comparison, since 2021, more than 25% of construction activities in this economic bloc have been disrupted due to labour shortages[3] (Figure 4).

Figure 3: Eurozone beveridge curve



Sources: Eurostat

Figure 4: EZ firms reporting labour shortages



Sources: European Commission and DG ECFIN

The Beveridge curve in the UK displays similar traits to that of the Eurozone, featuring a steeper incline post-pandemic (Figure 5). However, it lies somewhere between the US and Eurozone curves. Notably, job vacancies in the UK surged in 2021-22 and the vacancies-to-unemployment ratio was unusually high. In addition, unlike in the Eurozone, participation rates in the UK have been relatively slow in recovering to pre-pandemic levels. Although furlough schemes have ended in the UK, a persistent challenge lies in the substantial number of individuals remaining economically inactive due to long-term sickness. Additionally, net migration of EU citizens has been depressed since the pandemic and under more restrictive post-Brexit immigration rules[4].

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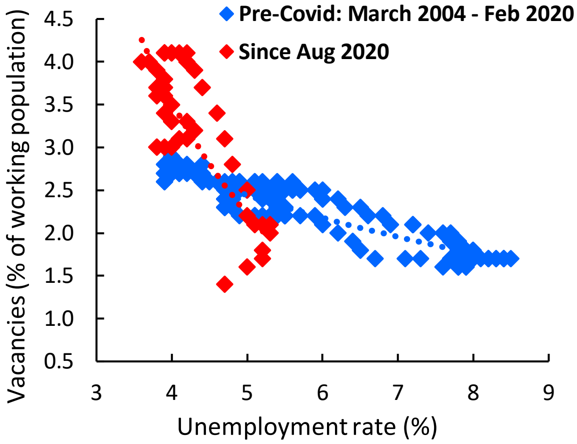
[3] Monthly values are available for the construction industry, and aggregated to quarterly data, while quarterly values are available for services and manufacturing labour. For manufacturing and services industry, these are firms reporting labour shortages that are limiting their production, while for the construction industry, the percentage of building activities disrupted by labour shortages is illustrated in Figure 4.

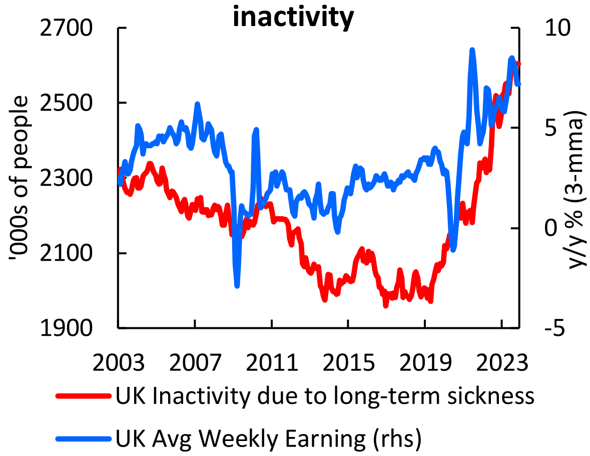
[4] See: Cuibus, M., 2023. *EU migration to and from the UK.* London: The Migration Observatory at the University of Oxford. The author investigates immigration into the UK, and they find that between 2016 and 2022, immigration into the UK has fallen by almost 70%, affecting the supply of foreign labour in the country.

Figure 5: UK Beveridge curve



Sources: Office for National Statistics

Figure 6: UK wages and economic inactivity



Source: Office for National Statistics

While job vacancies have now eased back to near pre-pandemic levels, unemployment remains lower than before Covid-19. The number of economically inactive individuals has been steadily increasing since 2019, exacerbated by the pandemic. This upswing in inactivity poses considerable challenges for the UK, contributing to a higher inflationary environment compared to other developed economies, limiting output growth, and reducing tax receipts, thereby posing a risk to public finances. Furthermore, it is leading employers to offer higher pay to attract workers to fill open vacancies, which is contributing to the overall upward trend in wages (Figure 6).

Filling job needs has therefore faced significant challenges in many AEs[5] post-pandemic, and lingering policies impeding a full return to work (as well as evolving work preferences and choices in the post-pandemic landscape) contribute to continued disparities between labour supply and demand. A surge in retirements remains a challenge for the US, while prolonged sickness among the older population in the UK also continues to suppress labour supply.

3. Slow and uneven recovery in participation

A recovery in workforce participation rates post pandemic is key to ironing out supply-demand mismatches in labour markets. However, not all countries are experiencing a similar rebound. In the US, the participation rate (LFPR) plummeted from 63.3% in February to 60.1% in April 2020, and despite a subsequent recovery, remained 0.8 percentage points below its February 2020 level as of February 2024 (Figure 7). This disparity is primarily attributable to a lasting reduction in the LFPR among individuals aged 55 and older, which fell from 40.3% in February 2020 to 38.5% in May 2020 and has stagnated since[6]. The LFPR for workers under 54, on the other hand, has surpassed the pre-pandemic (2010 – 2019) average of 81.5%, recently at 83.5% in February 2024.

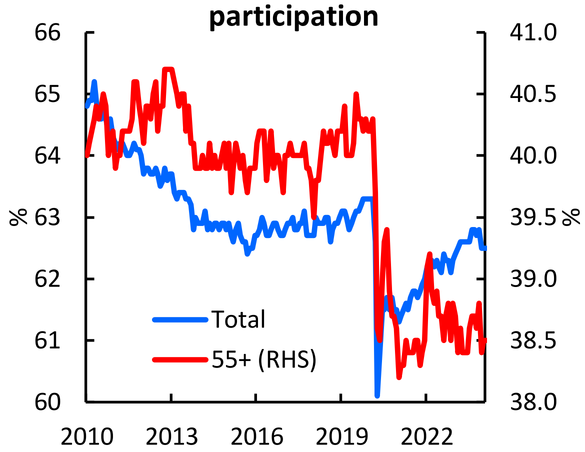
[5] Some other AEs not covered in this note also experienced a surge in vacancies, especially relative to unemployment, since 2020-21. In Canada, however, this surge has by now largely unwound, whereas vacancies remain unusually high in Australia or Sweden.

[6] Extrapolating the pre-pandemic peak LFPR to the civilian noninstitutional population aged 16 and above as of December 2022 implies the existence of approximately 3.73 million "missing workers" in the U.S. economy.

Because of population ageing, and larger cohorts falling into older age groups with lower participation, the overall participation rate probably would not have continued its prior upward trend even in the absence of Covid (Hornstein et al., 2023). Still, a surge in retirements occurred post-pandemic. Faria e Castro and Jordan-Wood (2023) analyse its role in contributing to the decline in LFPR and its incomplete recovery. They compare the actual retirement rate to the expected numbers under normal circumstances in the last months of the COVID-19 emergency period, concluding in May 2023[7].

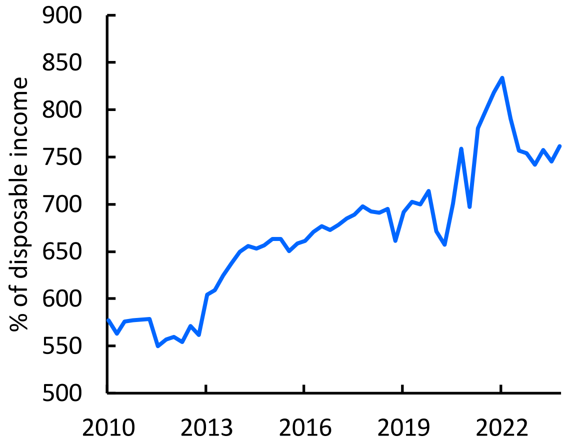
The retirement trend closely followed expectations until February 2020. During the initial months of the pandemic, the actual retirement rate sharply exceeded predictions, indicating an excess of just over one million retirees in May 2020. From 2023 onward, the model projects a stabilisation in anticipated retirements, levelling off after a consistent rise from around 16% in 2012 to slightly over 18.6% in early 2023[8].

Figure 7: US labour force participation



Source: US Bureau of Labor Statistics

Figure 8: US household net worth



Source: Federal Reserve

In a separate article, Faria e Castro and Jordan-Wood (2023) contend that wealth effects stemming from surging household asset returns in 2020-21 explain part of the decline in the LFPR during that period, particularly among older workers nearing retirement[9]. Furthermore, fears of falling ill with Covid-19 were higher for older individuals, amplifying incentives, particularly for those engaged in contact-intensive occupations or unable to transition easily

7 In this retirement model, retirement decisions for a particular demographic group, delineated by a combination of age, ethnicity, education, and gender, are presumed to be influenced by several factors. These factors include prevailing labour market conditions, the level of generosity associated with Social Security retirement benefits applicable to the specific age group, and temporal trends that encapsulate other enduring shifts in how various demographic groups navigate decisions related to the labour market.

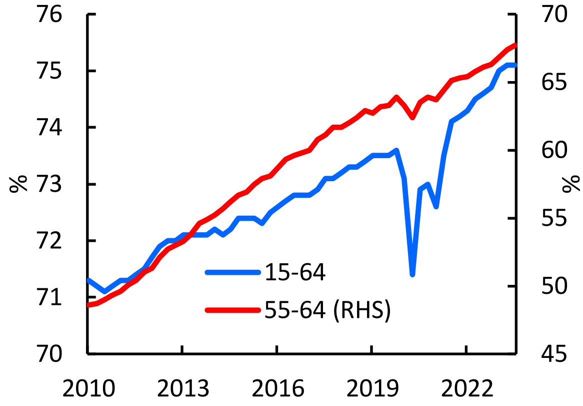
8 Concurrently, the actual share in 2023 has decreased from its peak of 19.8% in December 2022. By April 2023, estimates suggest there were approximately 2.4 million excess retirees in the U.S. The persistent elevation of excess retirements beyond the projected trend is likely a contributing factor to the sustained tightness in the labour market and the low unemployment rate since the rebound from the pandemic-induced recession.

9 In conjunction with the previously mentioned trends in the LFPR and retirement share, there were notable fluctuations in the valuations of major asset classes during the pandemic. These shifts in asset valuations likely had significant implications for households' overall net worth. Faria e Castro and Jordan-Wood estimate that changes in net worth account for 28.7% of the LFPR decrease in the 2019-21 period and 18.13% in the 2019-2022 period for individuals aged 55-70.

to remote work environments, to stop working (Famiglietti et al., 2020)[10]. With household net worth still high (see Figure 8), LFPR for individuals 55 and above may well remain near current levels unless net worth starts plummeting in coming years.

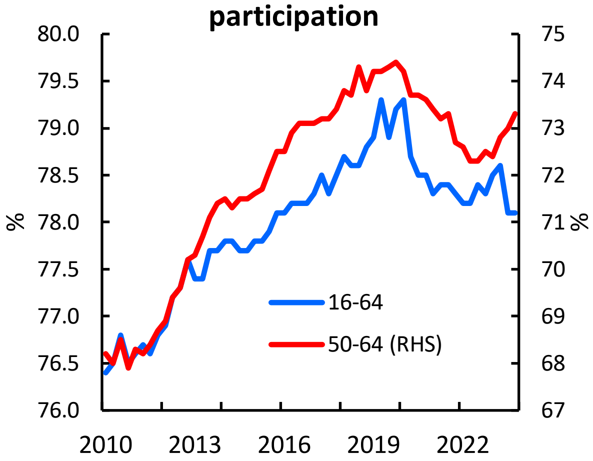
In contrast to the US, the COVID-19 pandemic did not have a long-lasting impact on participation rates in the Eurozone, even among older workers (Figure 10). Research identified a front-loading of retirement decisions for approximately 175 000 workers (Botelho & Weißler, 2022). This relatively modest number suggests that, unlike in the U.S, the pandemic did not have a pronounced impact on the retirement choices of older workers in the Eurozone. Nevertheless, health concerns appeared to influence the timing of their retirement.

Figure 9: Euro area workforce participation



Source: Eurostat

Figure 10: UK workforce participation



Source: UK Office for National Statistics

The Eurozone is the one AE region where labour supply appears to have normalized the quickest. With 75.1% of the population in the labour force as of the third quarter of 2023, this is the highest percentage ever for individuals between ages 15 and 64. The euro area's increased labour supply is bolstered by migration. In recent years, the proportion of foreign workers in the working population has increased considerably[11]. In the UK, by contrast, the LFPR Is not fully back up to its pre-pandemic peak despite picking up to 78.1% in the fourth quarter of 2023 (see Figure 10). The primary catalysts for subdued participation appear to be retirement and long-term sickness, particularly chronic health issues, which continue to distinguish the situation from that of other advanced economies.

Still, firms continue to experience recruitment difficulties, even in those AEs where labour force participation has recovered. This appears to have prompted instances of labour hoarding, as

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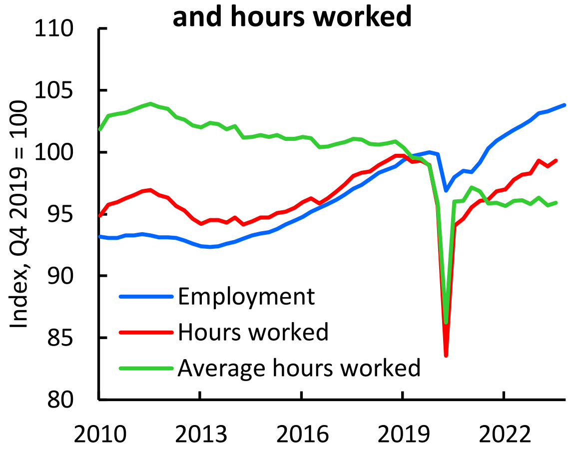
10 While the impact of COVID-related fears on labour supply has diminished over time, there is a growing discourse regarding the potential role of long COVID. Even after the initial recovery, a notable portion of individuals who contracted COVID-19 continued to grapple with debilitating symptoms, including difficulties in thinking or concentrating ("brain fog"), headaches, sleep disturbances, and mental health issues such as depression or anxiety. It would not be unexpected if some individuals dealing with long COVID, who might otherwise have remained in the workforce, chose to withdraw or reduce their working hours (Abraham & Rendell, 2023).

11 Increased participation rates are also supported by labour mobility inside the EU, whose nationals frequently relocate within the eurozone for employment purposes. In the second quarter of 2023, the LFPR for immigrants from within the EU jumped from 68.8% in 2005 to 74.7%. The majority of those responsible for the increase in the LFPR are older, female, highly educated and foreign workers.

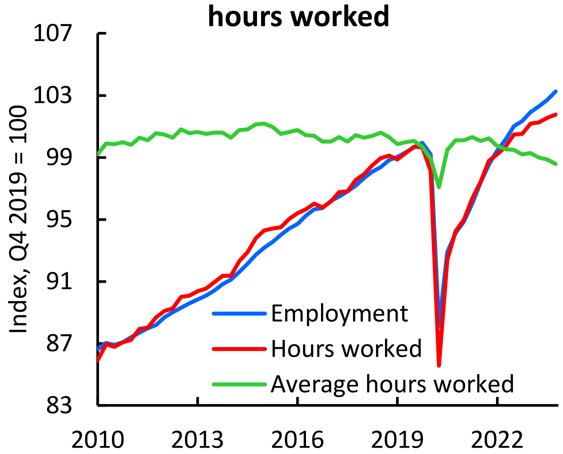
indicated by the quicker slowdown in hours worked relative to jobs. This is particularly evident in the Eurozone, where even three years after the initial pandemic shock, overall hours worked continue to lag employment, meaning that average hours worked per employee still fall short of pre-pandemic levels (Figure 11). In the US labour market, while initial adjustments during the pandemic occurred via layoffs rather than lower working hours, hours worked have also been rising less than employment since Q2 of 2022 – also suggesting some labour hoarding (Figure 11)[12]. Firms showed reluctance to release workers despite economic headwinds, especially retaining skilled employees deemed essential for future needs, as noted by Arce et al. (2023)[13].

Figure 11: Euro area employment and hours worked



Source: Eurostat

Figure 12: US employment and hours worked



Source: Bureau of Labour Statistics

Hence, despite (uneven) recoveries in participation rates, evidence of labour hoarding persists across major AEs, and may be contributing to wage pressures. While wage growth has eased recently as labour markets cooled, it remains stronger than pre-pandemic trends, and generally inconsistent with inflation targets.[14] Furthermore, economists and central banks are concerned that after the shock of recent years, linkages between labour market tightness and wage growth (the "wage Phillips curve) may have changed. We look at this in the latter section of this Note, studying the case of the US, where shifts to the curve appear at first glance more likely than in other jurisdictions.

4. The Phillips curve – shifting or non-linear?

In the US, despite a relatively long period of price stability, the slope and position of the Phillips curve has continued to change over time. A point density plot of the unemployment gap (actual joblessness minus the CBO's estimate of the natural rate of unemployment) and core PCE inflation (lagged 12 months) with a fitted line shows a non-constant intercept for the periods

12 When comparing the US and the euro area, both economies underwent similar adjustments in total hours at the onset of the pandemic, although a notable contrast lies in the average hours.

13 Although average hours worked increased between the second half of 2021 and 2022, the euro area witnessed unusually high levels of sick leave, with most cases being temporary sick leave, allowing employees to remain on the payroll of their employers.

14 In fact, in the US (where wage growth slowed earlier than other AEs), different measures suggest this slowdown has stalled in recent months.

2000Q1 – 2007Q4 (2.2), 2008Q1 – 2016Q4 (4.5), 2017Q1 – 2020Q1 (1.9) and 2020Q2-2023Q4 (3.8). This would imply that equilibrium wage growth – i.e. when the labour market is neither tight nor loose – has changed over time.

Moreover, examining the standard relationship between the unemployment rate and wage growth indicates a rightward shift in the Phillips curve since 2020 (Figure 13). If that were indeed the case, equilibrium wage growth would have increased. However, the unemployment rate may not be the most precise gauge of labour market slack at present, given the observed shift in the Beveridge curve. Following the analysis of Bernanke and Blanchard (2023), we substitute u with u/v as the measure of labour market slack in our Phillips curve analysis. The resulting plot suggests that the curve may not have shifted much, but rather may exhibit non-linear characteristics. Due to unusually low levels of unemployment, the US labour market found itself in the steep segment of the curve in 2022-23 (Figure 14).

This holds fundamental implications for inflation. If the curve is merely non-linear, it explains why inflation has been more responsive to shifts in the labour market in recent years, but equally, it suggests that provided u/v normalizes, the US should eventually return to a wage-slack relationship that resembles more what prevailed pre-2020. And with vacancies falling in recent quarters, the risk of a lasting deviation of u/v from norms – which could, over time, force an outright structural shift in the Phillips curve – is receding.

Were the Phillips-curve to have shifted to the right, this would be reflective of an increase in the natural rate of unemployment (formerly known as the Non-Accelerating Inflation Rate of Unemployment, or NAIRU). While the debate over whether the natural rate has increased or not remains open, it is noticeable that the Congressional Budget Office (CBO), which provides frequently updated estimates, has not projected a rise in the natural rate in coming years.

Figure 13: US wage Phillips curve

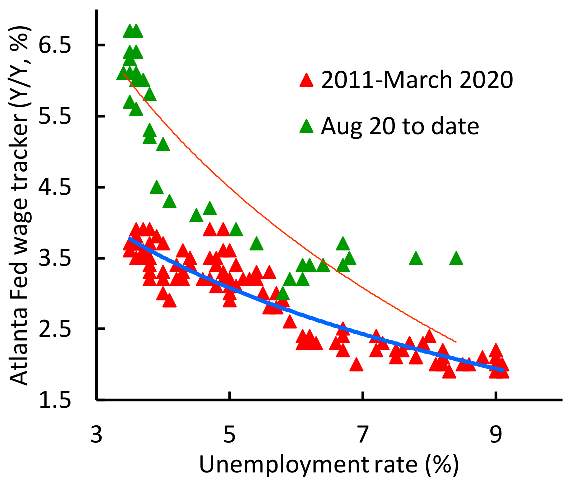
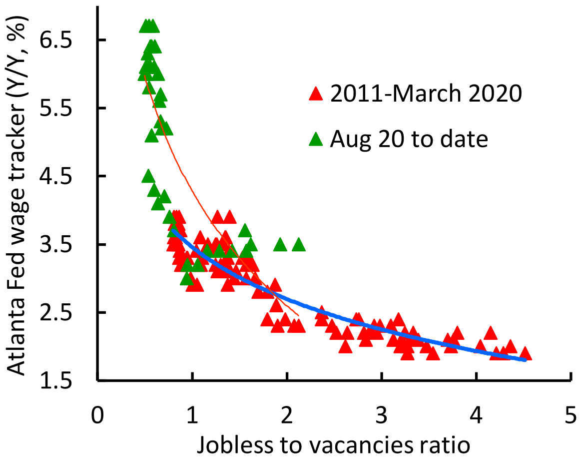


Figure 14: Alternative US Phillips curve approach



5. Conclusion

The Covid-19 pandemic, resulting lockdowns and policies put in place to mitigate the shocks had a durable impact on AE labour markets. Labour force participation fell significantly, and its recovery has been slow and uneven. High vacancies and recruitment challenges attest to ongoing tightness in labour markets, many firms have responded by hoarding labour, reducing average working hours and offering more attractive pay to retain workers. These measures probably contributed to the sustained high wage growth. That said, wage growth in the US has decelerated and there are signs of it peaking in the Eurozone and the UK. Additionally, declining vacancies are helping to mitigate supply-demand mismatches in labour markets even without a marked rise in unemployment. Assuming these trends persist, and the Phillips curve remains stable, they are expected to support continued disinflation throughout 2024-25. Nonetheless, persistent uncertainties about how long some of the impact of recent years' labour market shocks will last, are likely to keep central banks cautious about how quickly they can unwind recent policy tightening.

Bibliography

Abraham, K., & Rendell, L. (2023). Where Are the Missing Workers? *Brookings Papers on Economic Activity Conference Drafts*.

Arce, O., Consolo, A., Dias da Silva, A., & Mohr, M. (2023). More jobs but fewer working hours. *European Central Bank*.

Bernanke, B. & O. Blanchard, 2023. What caused the US pandemic-era inflation? Paper prepared for a conference at the Brookings Institution, May 23, 2023.

Botelho, V., & Weißler, M. (2022). COVID-19 and retirement decisions of older workers in the euro area. *ECB Economic Bulletin, Issue 6/2022*.

Colliac, S. (2023). Europe: Less Widespread but Still Meaningful Labour Shortages. *BNP Paribas Economic Research*.

Domash, A., Summers, L. H., & Blanchard, O. (2022). Bad news for the Fed from the Beveridge space. *Peterson Institute for International Economics*.

Faria e Castro, M., & Jordan-Wood, S. (2023, June 22). Excess Retirements Continue despite Ebbing COVID-19 Pandemic. *Federal Reserve Bank of St. Louis*. Retrieved from Federal Reserve Bank of St. Louis: https://www.stlouisfed.org/on-the-economy/2023/jun/excess-retirements-covid19-pandemic.

Faria e Castro, M., & Jordan-Wood, S. (2023). Pandemic Labor Force Participation and Net Worth Fluctuations. *Federal Reserve Bank of St. Louis Working Paper Series*, 2023-010A.

Hornstein, A., Kudlyak, M., Meisenbacher, B., & Ramachandran, D. A. (2023). How Far Is Labor Force Participation from Its Trend? *Federal Reserve Bank of San Fransisco*.

Leibovici, F., Santacreu, A. M., & Famiglietti, M. (2020). Social Distancing and Contact-Intensive Occupations. *Federal Reserve Bank of St. Louis*.

OBEN 2401* – March 2024

Big drivers of export and import volumes: How have these relationships shifted amidst large shocks?

Lesego Chanza, Koketso Mantsena and Mpho Rapapali

Abstract

In this economic note, we uncover changes to the big drivers of export and import volumes. We also use an error correction model to determine how the elasticities have changed over time. After co-moving with trading partner GDP, export volumes decoupled from this relationship in 2015 and tracked mining production. The economic recovery after COVID-19 saw export volumes rebound away from mining production towards global growth. However, export volumes are still constrained by domestic factors. The GFC and COVID-19 interrupted the positive relationship between import volumes and real domestic demand, albeit temporarily. The ECM results show that elasticities of export and import volumes declined after the GFC and COVID-19. The speed of adjustment to long-run equilibrium also decreased after both shocks.

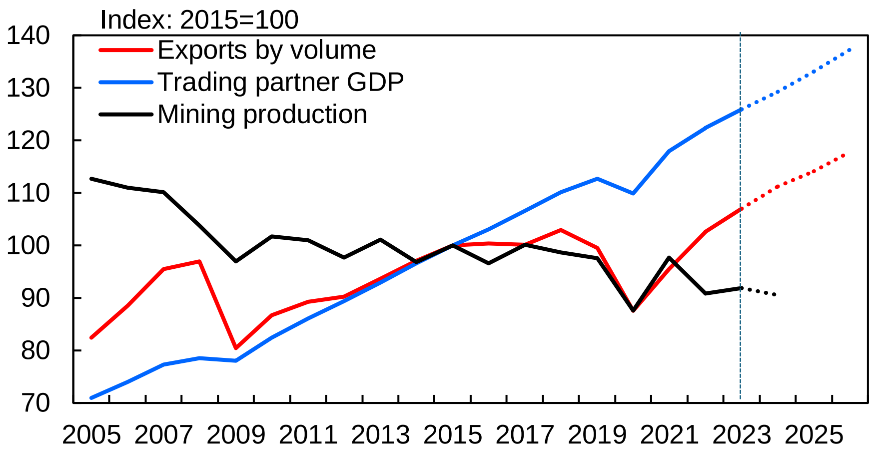
1. Introduction

Over the past decade and a half, South Africa's trade has been impacted by the lingering effects of the Global Financial Crisis (GFC) and more recently the COVID-19 restrictions, and geopolitical tensions. The 2021 commodity price boom turned to bust while loadshedding and logistical challenges at domestic rail networks and ports further worsened a domestic environment that has not been conducive to export volume growth. The positive relationship between import volumes and domestic demand weakened significantly again in 2020, albeit temporarily like it did in 2009. As strong price movements are both knowable and tend to distort trade statistics in value terms, we focus on trade volumes. Our analysis examines the big drivers of export and import volumes, to what extent they were impacted by past shocks, and how these drivers may evolve over the medium term. We also use the error correction model to determine how elasticities of export and import volumes have changed over time.

2. Export volumes and global demand

Export volumes have historically co-moved with trading partner GDP (Figure 1). However, the two series decoupled in 2015 as export volumes began to track mining production - which slowed due to growing operational costs, infrastructure challenges and labour protests (Mining industry of South Africa, 2016). The gap between foreign demand and export volumes continued to increase and reached its widest level in 2020 when the COVID-19 lockdown restrictions almost halted trade activity. Trading partner GDP decreased by 2.6% year-on-year (y-o-y) in 2020, while exports by volume declined by 12% and mining production by 10.2%. Correlation tests show that the correlation between export volumes and trading partner GDP decreased to 25.2% over the period 2015Q1-2023Q3, from 96.2% during 2009Q1 to 2014Q4. Meanwhile, the correlation between volumes and mining production increased to 49.2%, from 20% over the period 2009Q1 to 2014Q4. For emerging market (EM) economies, export volumes closely track world GDP (Figure 1A in Appendix A). However, after Covid-19 the relationship slightly diverges as global demand trends higher relative to export volumes.

Figure 1: Exports and trading partner GDP



Note: Dotted lines represent Mar MPC forecasts.
Source: SARB.

During the recovery phase that followed the COVID-19 pandemic restrictions, global economic growth bounced back (up 7.3% in 2021), boosted by easing restrictions and expansionary fiscal policy. However, the rebound lost momentum, and growth dropped back to 3.8% in 2022. Global growth slowed to 2.9% in 2023 and is expected to pick up marginally in the next two years.[1] The anaemic outlook reflects tighter monetary policy needed to bring down inflation, deteriorating financial conditions, and growing geo-economic fragmentation (IMF, 2023). Export volumes increased by 7.4% in 2022 while mining production decreased by 0.9%, resulting in the decoupling of these[2]. Growth in mining production is undermined by persistent power shortages, and inefficient rail and port operations. Exports increased modestly by 3.5 % in 2023 and are projected to increase by 3.4% in 2024, and 3.7% in 2025. While exports

1 SARB projects global growth to increase by 2.7% in 2024 and 3% in 2025.

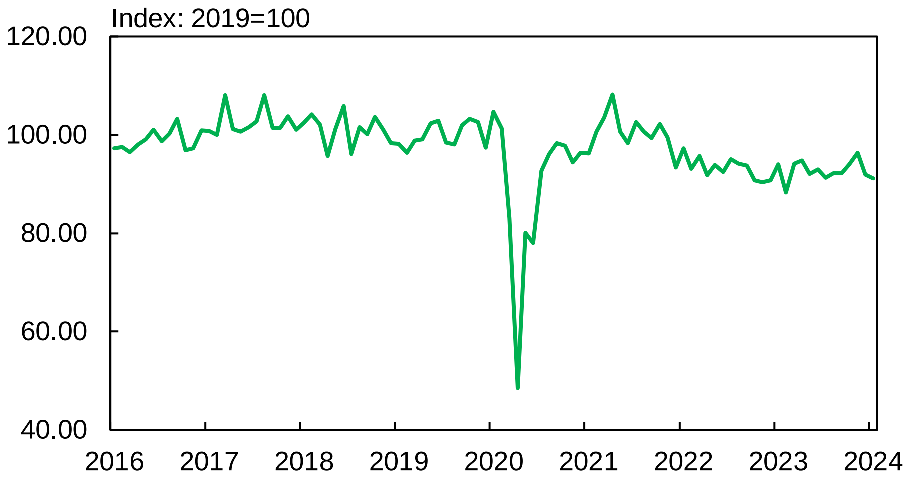
2 Manufacturing production co-moves with mining production over the sample period. Its correlation with export volumes also evolves similarly. In this Note, however, we focus solely on mining production as it makes up the bulk of total exports.

are expected to trend upward with global economic growth over the forecast period, the gap between the two is expected to remain relatively large.

3. Mining production

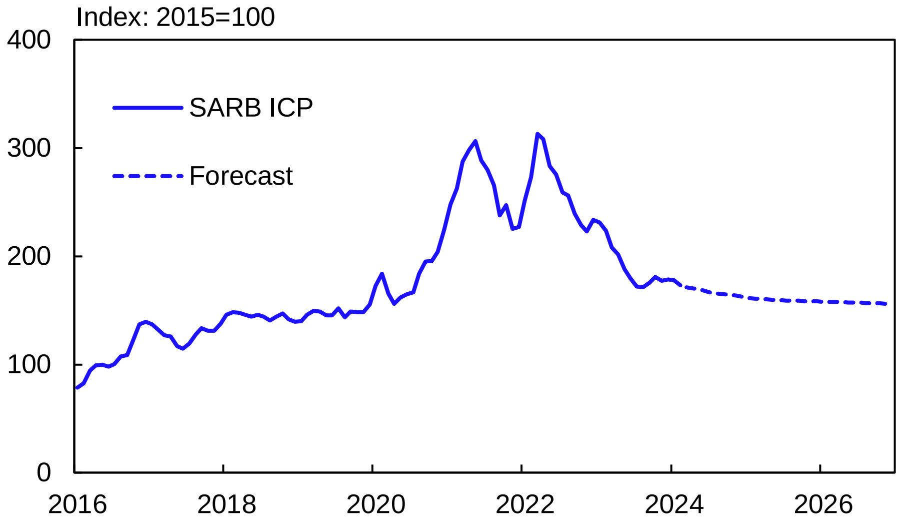
The mining sector continues to be constrained by a myriad of challenges including regulatory uncertainty (amidst changes) as well as operational constraints that include inefficient transport logistics, loadshedding, and strike actions. Mining production decreased by 3.3% y-o-y in January 2024, after improving by 0.6% y-o-y in the previous month (Figure 2). Loadshedding, underperforming global growth, and volatile commodity prices are all obstacles to future mining production growth. Figure 3 shows that the SARB Index of Commodity Prices (ICP) declined by 22.3% y-o-y in February 2024, largely due to base effects following high 2022 levels and subdued demand amid weak global economic growth. Commodity prices trend downwards during the forecast period but are still expected to remain above pre-pandemic levels.

Figure 2: Total mining production



Source: Stats SA

Figure 3: Commodity prices

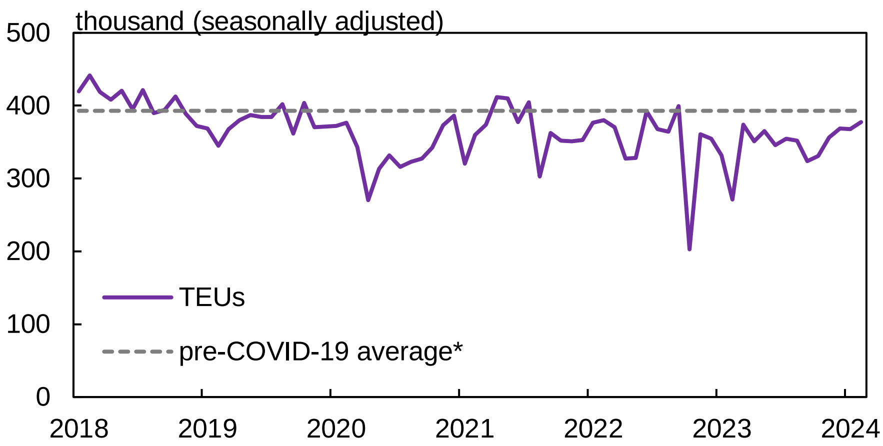


Source: SARB

4. Port and rail inefficiencies

Trade activity is highly dependent on the efficiency of ports and railways. Transnet, which manages the country's freight, ports, and pipelines, has been adversely impacted by cable theft, shortages of locomotive parts, and infrastructure challenges. Figure 4 shows that the total number of twenty-foot equivalent units (TEUs) handled at ports increased in February 2024 (377 326 units compared to 367 634 in January) as inefficiencies at Transnet improved. However, TEUs remain below the pre-COVID-19 average. Port terminals continue to recover from the flooding and industrial action in 2022 but logistical operations at Transnet remain under pressure.

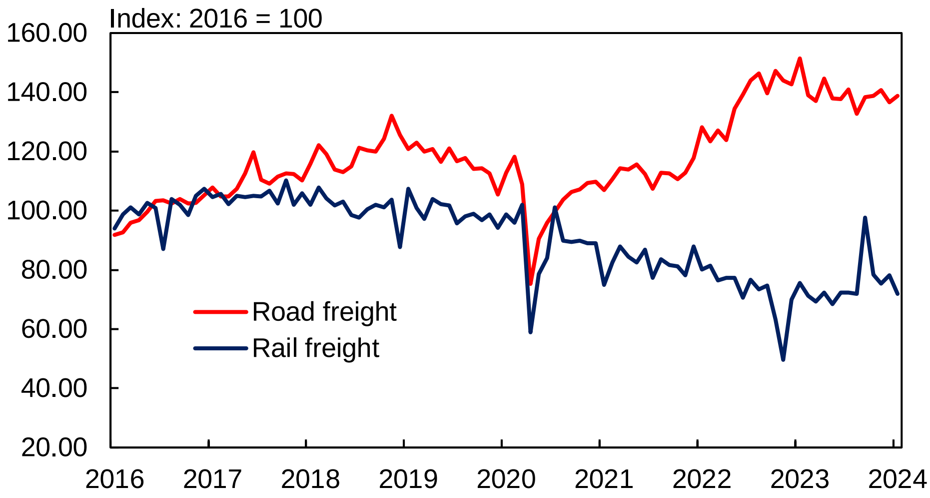
Figure 4: Transnet TEU containers landed and shipped



Note: *The pre-COVID-19 average is simply the average over the period 2018 and 2019. Source: Transnet

The World Bank Container Port Performance Index (CPPI) ranked Durban, Cape Town and Ngqura in the bottom 10 ports out of the 370 locations analysed globally in 2022. This is based on the average time spent by a ship in these locations, which, in turn, is reflective of factors like the availability and quality of infrastructure, layout of the harbour, and the expertise of the employees, amongst others (World Bank, 2023). Figure 5 shows that freight by rail has been declining since 2017 while freight by road has increased, suggesting that firms are opting to transport goods by road as rail networks continue to be constrained.

Figure 5: Volume of land freight transportation



Sources: Stats SA and SARB

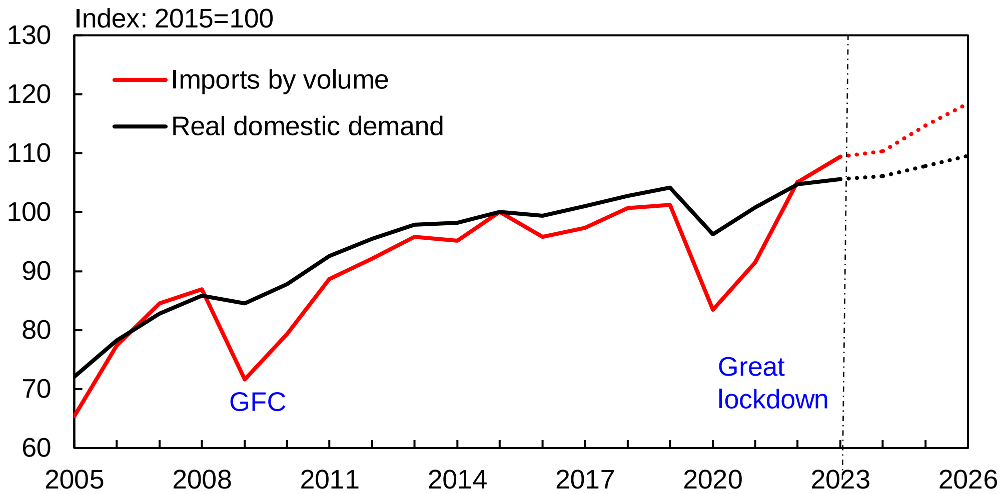
Given the devasting impact of the rail inefficiencies on the domestic economy, a few measures have been taken to remedy the situation. Transnet has partnered with the Philippines' International Container Terminal Services Inc in a 25-year venture to develop and upgrade the Durban Container Terminal Pier 2. This will improve efficiency at the port and potentially expand Terminal Pier 2's capacity from 2.2 million TEUs a year to 2.9 million. The state-owned entity is also in the process of replicating this private sector participation model at the Ngqura container terminal in the Eastern Cape and at the Richards Bay port in KwaZulu-Natal.[3] To improve rail inefficiencies, Transnet is working together with the private sector through the National Logistics Crisis Committee (NLCC). The NLCC will address several urgent problems with key corridors handling commodities such as coal and iron ore, as well as containers. There will also be an intervention to combat ongoing cable theft, as well as maintenance and spare backlogs across Transnet's port and rail systems.

5. Imports and domestic demand

Figure 6 shows how historically, import volumes and real domestic demand (measured by real Gross Domestic Expenditure (GDE)) display a strong positive relationship over the sample period (2005Q1-2023Q3), with the correlation between the two variables measuring 91%. The relationship only weakened during the GFC and the COVID-19 pandemic. Strict COVID-19 lockdown restrictions led to a large contraction in domestic demand, and thus a decline in imports. Import volumes decreased by 17.6% y-o-y in 2020, like the decline observed during the GFC (17.7%). However, the rebound was much quicker and steeper following the COVID-19 shock than the GFC shock. The post COVID-19 rebound for import volumes was also quicker for emerging markets. However, the gap between the two widened in 2021 as EM GDP growth outpaced growth in import volumes.

3 See: Philippine logistics firm to the rescue: Transnet embraces private sector as partner for delivery. Available at: https://www.dailymaverick.co.za/article/2023-07-23-philippine-logistics-firm-to-the-rescue-transnet-embraces-private-sector-as-partner-for-delivery/.

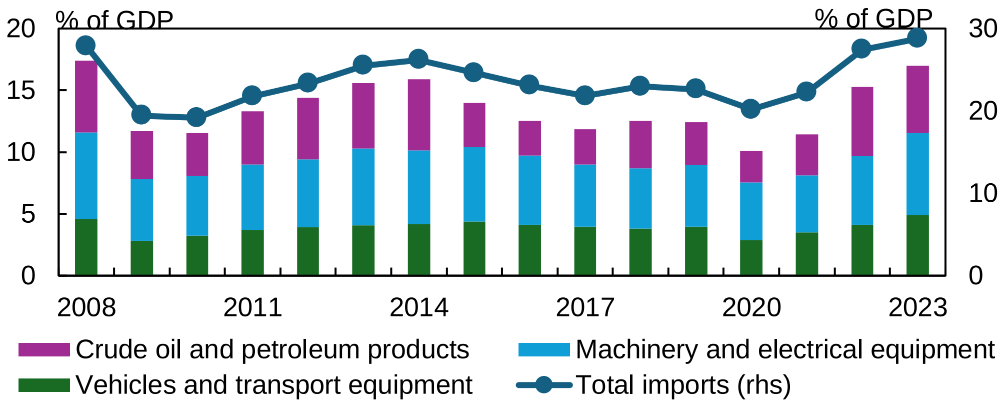
Figure 6: Imports and domestic demand



Note: dotted lines represent November MPC forecasts.
Source: SARB

The post-COVID-19 V-shaped recovery was mainly driven by a rise in demand for machinery and electrical equipment, motor vehicles and transport equipment, and crude oil and petroleum products in 2022 and 2023 (Figure 7).

Figure 7: Drivers of imports



Source: SARS

Import volumes increased by 14.9% y-o-y in 2022 and returned to track real domestic demand. However, this will likely be short-lived. While real GDE decreased by 3% quarter-on-quarter in 2023Q3 (down from 1.3% in 2023Q2), it rose by 1% in the final quarter of 2024. Persistent loadshedding in 2023 continued to weigh on confidence, disrupt operations, and drive-up production costs.[4] Because of this, real GDE grew by 0.9% in 2023, and is expected to increase by only 1.2% in 2024. Imports, on the other hand, are forecasted to continue to rise at a faster pace of 5.4% in 2023, and 3.7% in 2024 as they continue to correct after the great lockdowns.

4 2023 experienced six consecutive months of loadshedding (April-September), which among other factors such as the weaker exchange rate and geopolitical tensions, was one of the reasons for the fall in the RMB/BER business confidence index from an average of 41 in 2022 to 32 in 2023.

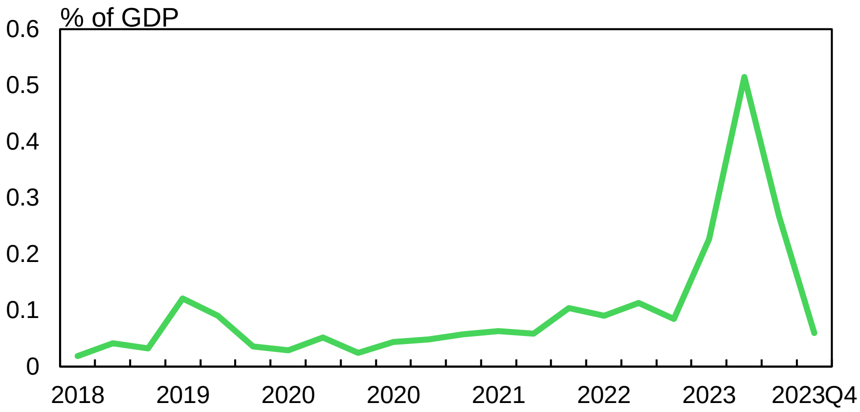
Import growth is expected to outpace domestic demand growth at least in the short term. This is bolstered by the 4.1% increase in import volumes in 2023, outpacing that of domestic demand (0.8%). This decoupling however should be temporary, and the two variables should move together over the long term.

6. Are energy-related imports a future driver?

South Africa experienced 335 days of loadshedding in 2023, surpassing the previous year by 130 days (63% increase).[5] As a result, households and firms invested in more sustainable means of self-power generation and low carbon emitting power solutions in the long run. This is expected to increase alternative energy equipment imports.[6]

Figure 8 shows that solar energy equipment imports as a percentage of GDP fell sharply in the second half of 2023, after reaching record highs in the first half of the year. [7] The decline in solar equipment imports may reflect the reduction in loadshedding intensity recorded in the second half of the year. [8] Nevertheless, this past year has recorded the three largest quarters of solar energy equipment imports ever recorded and suggests that individuals are seeking alternative energy sources amid persistent and intense loadshedding. Indeed, imports of AC generators are seen to increase rapidly during periods of heightened power cuts (Figure 9).[9] Real value AC generator imports amounted to R158 million in August, the greatest ever recorded, exceeding the peak witnessed in 2015 (R111 million). This upward trend is expected to continue if intense loadshedding persists.

Figure 8: Solar energy equipment imports



Source: SARS.

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5 The Outlier. 2024. Loadshed: powered by The Outlier. [online] Available at: [https://loadshed.theoutlier.co.za/.](https://loadshed.theoutlier.co.za/)

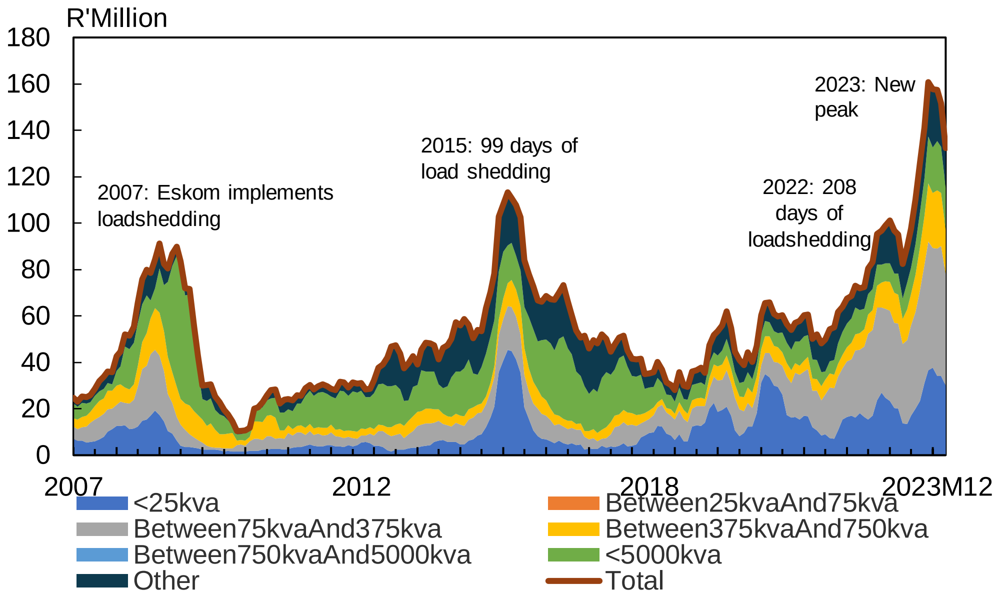
6 South Africa has a limited number of domestic manufacturers of low carbon energy solutions. As of writing, there were only two manufacturers of solar panels, namely ART Solar and Seraphim Solar. Therefore, to meet rising demand, alternative energy equipment imports will likely increase. See article: New solar record for South Africa.

7 Solar energy equipment imports are made up of all imports related to photosensitive semiconductor devices, including all photovoltaic (PV) cells, PV panel equipment (assembled, non-assembled, LED, and other), and all PV panels related to AC and DC generators.

8 According to Eskom data, 2023H1 had 135 days of stages 4 and above loadshedding. This is compared to 63 days of stages 4 and above power cuts in 2023H2.

9 This includes all imported AC generators that produce electricity between 25 Kilovolt-amps (KVA) and 5000 KVA.

Figure 9: Real AC generator imports

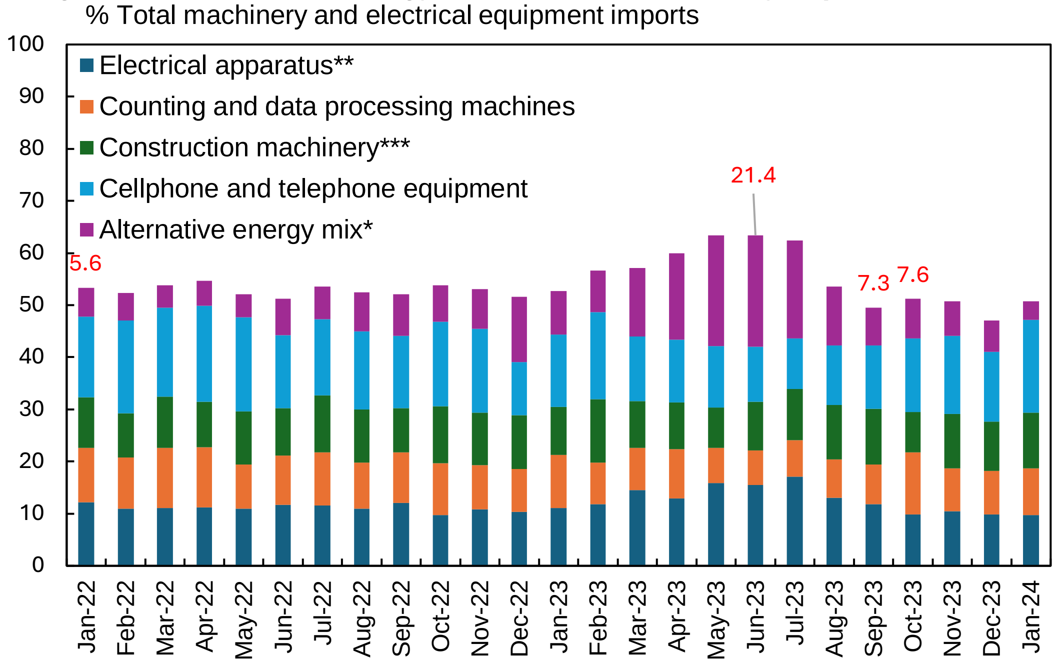


Source: SARS. Note: Applied 6 month moving average.

Despite the recent rapid rise of energy-related imports, they are relatively small and average a little under 1% of GDP in 2023.[10] As a share of total machinery imports, the alternative energy mix has averaged 12.2% compared to 6.7% in 2022 (Figure 10). This follows from firms and households increasing their investment in loadshedding mitigating energy sources. While, historically, machinery imports have been primarily driven by cell phone and telephone equipment, electrical apparatus, construction machinery, and computer/counting machine-related imports, alternative energy imports have in recent quarters become a large category which is expected to remain elevated should intense loadshedding persist.

[10] The figure comes from the creation of an alternative energy mix that include the aggregation of all finished and unfinished solar, hydro, wind, primary cells and batteries, ac generator and dc generator related energy equipment import values, nonseasonal adjusted.

Figure 10: Alternative energy as a driver of machinery imports



*Alternative energy mix includes all finished and unfinished solar, hydro, wind, primary cells and batteries, ac generator and dc generator related energy equipment imports.
**Electrical apparatus include (among other things) traffic control equipment, electric capacitors, cathodes and valves, and other related electrical parts of machinery
***Construction machiner include forklifts, rollers, loading/unloading machines and bulldozers
Source: SARS.

7. Have trade elasticities changed?

In this section, we use an error correction model (ECM) to investigate how the relationships between export volumes, trading partner GDP and mining production, and import volumes and domestic demand have changed over time. The full model specification can be found in Appendix B.

Table 1 gives the ECM results for export volumes. For long-run relationships, export volumes have become less responsive to changes in trading partner GDP since the GFC. However, the long-run elasticity increases slightly after COVID-19 likely reflecting the rebound in global demand due to easing lockdown restrictions and expansionary policies. Export volumes have become more responsive to changes in mining production, with the elasticity increasing significantly in both post-GFC and post-COVID-19 periods.[11] The error correction term decreases after the GFC and pandemic (at 0.7 and 0.3, respectively), and suggests that the shocks significantly reduce the speed of adjustment to long-run equilibrium.

11 We also control for possible structural breaks in mining production due to strike actions and regulatory changes. However, we find that these disruptions to be small and thus have no significant impact on the mining and export relationship.

Table 1: ECM results for export volumes

	Full sample (2000Q1-2023Q2)	Sample1 (2000Q1-2008Q4)	Sample2 (2010Q1-2019Q4)	Sample3 (2010Q1-2023Q2)
Error correction term	-0.24*** (0.07)	-0.83*** (0.19)	-0.73*** (0.15)	-0.32*** (0.13)
Long run determinants				
Mining production	1.42*** (0.41)	-0.17 (0.30)	0.38* (0.22)	1.32*** (0.42)
Trading partner GDP	0.67*** (0.10)	1.43*** (0.10)	0.45*** (0.07)	0.55*** (0.16)
Real effective exchange rate	-0.18 (0.21)	-0.04 (0.11)	-0.23*** (0.60)	-0.17 (0.21)
Short run determinants				
Mining production	0.54*** (0.12)	-0.10 (0.27)	0.17 (0.12)	0.54*** (0.13)
Trading partner GDP	1.80*** (0.58)	0.39 (1.34)	1.78 (1.38)	1.99*** (0.68)
Real effective exchange rate	-0.10 (0.09)	0.09 (0.12)	-0.22*** (0.08)	-0.15 (0.13)

*/**/*** signify levels of significance between 1% and 10%. Values in parentheses are standard errors.

We compare the export volume elasticities with those from the core model. The results are shown in Table C1 in Appendix C. In the core model, total exports are treated as an identity of manufacturing, commodity, and service exports.[12] Therefore, we compare our total export volume elasticities with that of commodity volume exports as they make up more than 60% on average of total exports over the full sample period.

In the core model, homogeneity is imposed between commodity exports and trading partner GDP in the long-run for all sample periods (1:1 relationship) and thus does not capture how export volumes respond to changes in trading partner GDP over time.[13] The core model also does not capture the long-run relationship between export volumes and mining production. We find this relationship to be statistically significant in both the post-GFC and post-pandemic periods and it possibly explains the divergence between export volumes and trading partner GDP observed post-GFC. Anund, Perrelli and Zhang (2016) find a long-run elasticity of around 0.4 after controlling for firm and sector specific characteristics during 2010-2014. Ndou (2022) finds much higher elasticities ranging from 1.8 to 2.3 over the period 2000-2019. In the short run, volumes become less responsive to changes in trading partner GDP after the GFC. However, the magnitude is much larger, and explosive compared to our model results. Similar results are observed by Ndou (2022). The error correction term is significantly lower across all sample periods compared to our model. However, in line with our results, the speed of adjustment decreases after the GFC.

12 The core model specification differs slightly from our ECM specification in that commodity prices are included as an explanatory variable while mining production is not, and time dummy variables are used to improve model fit. As a result, comparisons are done with caution.

13 The core model also restricts the long-run relationship between commodity exports and the real effective exchange rate at 0.1% for all sample periods.

Table 2 gives the ECM results for import volumes. In both the short run and long run, import volumes respond strongly to changes in real domestic demand. This does not change drastically over the different sample periods and suggests that the GFC and pandemic shocks do not significantly affect the relationship between volumes and domestic demand. The error correction term has been declining since the GFC, measuring 0.7 and 0.3 after the GFC and the pandemic. This suggests that it takes longer for import volumes to reach long-run equilibrium after each shock.

Table 2: ECM results for import volumes

	Full sample (2000Q1-2023Q2)	Sample1 (2000Q1-2008Q4)	Sample2 (2010Q1-2019Q4)	Sample3 (2010Q1-2023Q2)
Error correction term	-0.16** (0.07)	-0.71*** (0.16)	-0.52*** (0.14)	-0.30*** (0.11)
Long run determinants				
Real domestic demand	1.65*** (0.27)	1.91*** (0.06)	2.1*** (0.16)	2.11*** (0.41)
Import deflator	-0.15 (0.14)	-0.21*** (0.11)	-0.25** (0.10)	-0.14 (0.10)
Short run determinants				
Real domestic demand	1.46*** (0.15)	1.14*** (0.34)	1.93*** (0.27)	1.48*** (0.16)
Import deflator	-0.16 (0.10)	0.01 (0.12)	0.03 (0.10)	0.04 (0.14)

*/**/*** signify levels of significance between 1% and 10%. Values in parentheses are standard errors.

Looking at the core model elasticities (Table C2 in Appendix C), we find that import volumes do not respond strongly to changes in domestic demand during the GFC crisis in the short run. However, this relationship changes considerably after the crisis and the pandemic where we observe elasticities of 1.9 and 1.4, respectively. This is similar to our ECM results.[14] Changes in the long-run relationship over time are unobservable due to the imposition of homogeneity. The error correction term remains relatively low across the different sample periods and ticks up after the GFC before edging lower post-COVID-19.

8. Conclusion

In this note, we show that after moving broadly in tandem with trading partner GDP, total export volumes decoupled from this relationship in 2015 to track mining production. Meanwhile, the positive relationship between import volumes and real domestic demand was little changed by either the GFC or COVID-19 shocks. Domestic constraints continue to weigh on trade

[14] Unlike our ECM, the core model equation uses volumes of non-oil imports as the dependent variable, which makes up approximately 80% of total imports. The equation also includes an import price deflator relative to domestic prices as their cost variable. Manufacturing export volumes are used to account for a portion of imports earmarked for re-export, and time dummy variables are added to improve model fit. As a result, comparisons are done with caution.

activity and economic growth. Port and rail inefficiencies are expected to persist in 2024. While there are plans to include private partners in developing and upgrading Transnet container terminals, there are no stipulated timelines on when the partnership will commence or when the results can be expected in the proposed 25-year contract. Eskom is still tormented by unplanned outages, keeping loadshedding hours elevated. As things stand, the power utility is still producing below consumption, and this is expected to continue in 2024.

The ECM results corroborate our findings. Our results find that mining production becomes statistically significant in the long run in explaining total export volumes post-GFC. The results also show that the shocks significantly reduce the speed of adjustment to long-run equilibrium for both exports and import volumes.

References

Anand, R., Perrelli, M.R. and Zhang, B., 2016. South Africa's Exports Performance: Any Role for Structural Factors? International Monetary Fund Working Paper WP/16/14.

Banerjee, A., Dolado, J.J., Galbraith, J.W. and Hendry, D., 1993. *Co-integration, error correction, and the econometric analysis of non-stationary data*. Oxford university press.

De Boef, S., 2001. Modelling equilibrium relationships: Error correction models with strongly autoregressive data. *Political Analysis, 9(1),* pp.78-94.

Ndou, E., 2022. Exchange rate changes on export volumes in South Africa under the inflation targeting period*. SN Business & Economics, 2(6), p.59.*

IMF World Economic Outlook, April 2023: A Rocky Recovery. [online] Available at: https://www.imf.org/en/Publications/WEO/Issues/2023/04/11/world-economic-outlook-april-2023#:~:text=The%20baseline%20forecast%20is%20for,to%201.3%20percent%20in%202023 [Accessed 15 August 2023].

PwC., 2022. SA Mine 2022: Level up or reset. *October 2022 14th Edition*. [online] Available at: https://www.pwc.co.za/en/assets/pdf/sa-mine-2022.pdf [Accessed 17 August 2023].

The World Bank., 2023. The Container Port Performance Index 2022: A Comparable Assessment of Performance Based on Vessel Time in Port. [online] Available at: https://openknowledge.worldbank.org/handle/10986/39824 [Accessed 10 September 2023].

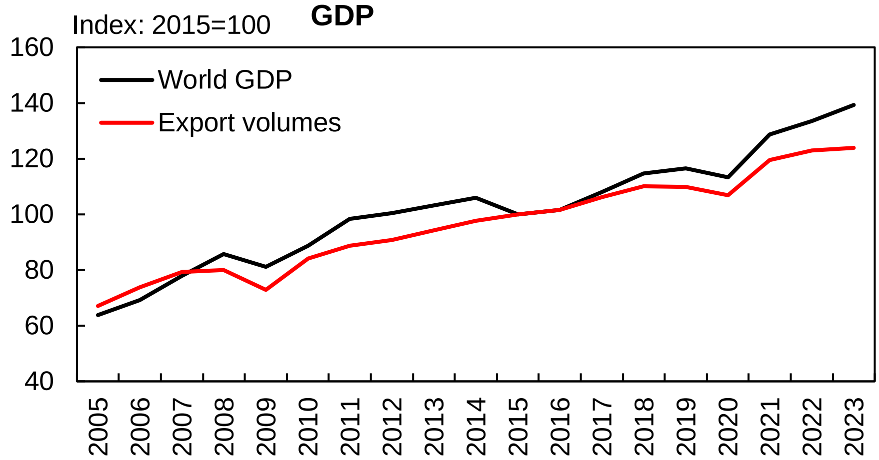
The World Bank., 2023. Commodity Markets Outlook, April 2023. [online] Available at: https://openknowledge.worldbank.org/server/api/core/bitstreams/6864d537-d407-4cab-8ef1-868dbf7e07e2/content [Accessed 11 July 2023].

Yager, T.R., 2016. The Mineral Industry of South Africa*. US Geological Survey, Minerals Yearbook 2016.* [online] Available at: https://www.usgs.gov/media/files/mineral-industry-south-africa-2016-pdf [Accessed 09 September 2023].

Appendix

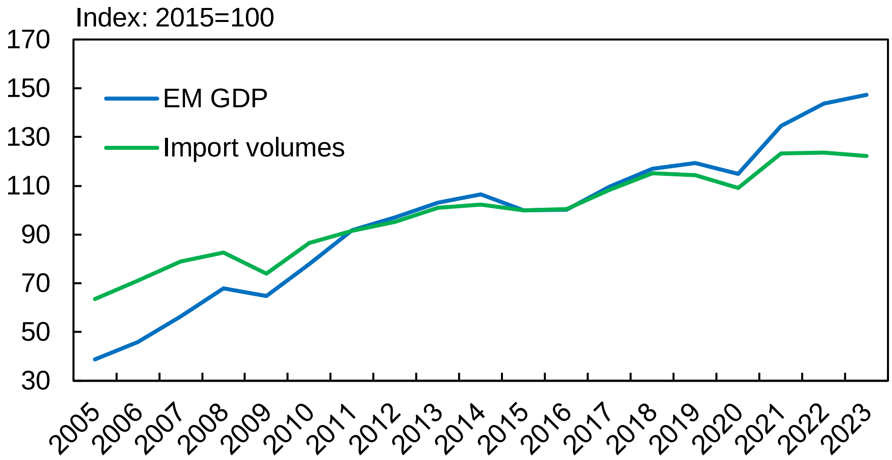
A. Emerging Market Charts

Figure A.1: Emerging market exports and world GDP



Source: IMF and Haver.

Figure A.2: Emerging market imports and GDP



Sources: IMF and Haver.

B. Error Correction Model

We use an error correction model (ECM) to determine how export and import volumes change over time. The ECM separates long-run and short-run relationships and makes it possible to deal with non-stationary data (De Boef, 2001).

We follow a one-step ECM process proposed by Banerjee et al. (1993), and it is specified as follows:

$$\Delta y_{i,t} = \gamma\left(y_{i,t-1} + \sum_i^n \beta_i \, x_{i,t-1}\right) + \lambda_1 + \sum_i^n \alpha_i \, \Delta x_{i,t-1} + \eta_t \qquad \text{(A1)}$$

where $y_{i,t}$ is export volumes or import volumes, $(x_{i,t-1})$ is a vector of the following explanatory variables; trading partner GDP, mining production and real effective exchange rate if export volumes are the dependent variable, and real domestic demand and import deflator if import volumes is the dependent variable.[15] The term in brackets represents the long run cointegrating relationship, β_i represents the long-run elasticity of the dependent variable to the explanatory variables, γ is the speed of adjustment towards equilibrium and should be negative (between 0 and -1) if there is a converge to the long-run relationship. Short-run elasticities are captured by α_i, the constant term is λ_1, and η_t is the error term.

The model is estimated using quarterly data over the period 2000Q1 to 2023Q3. The data is divided into different sample periods. Sample 1 is from 2000Q1-2008Q4 and represents the pre-GFC period, sample 2 (2010-2019) captures the post-GFC and pre-COVID-19 period, and sample 3 (2010-2023Q2) captures the impact of COVID-19.

C. Core Model Elasticities

Table C1: Core model results for volume of commodity exports

	Full sample (2000Q1-2023Q2)	Sample1 (2000Q1-2008Q4)	Sample2 (2010Q1-2019Q4)	Sample3 (2010Q1-2023Q2)
Error correction term	-0.15*** (0.06)	-0.43*** (0.12)	-0.11* (0.09)	-0.17* (0.09)
Short run determinants				
Trading Partner GDP	0.40* (0.57)	4.16* (2.12)	2.99* (2.85)	0.09 (0.61)
Commodity prices	0.10** (0.06)	0.27** (0.15)	0.10 (0.07)	0.11 (0.08)

*/**/*** signify levels of significance between 1% and 10%. Values in parentheses are standard errors. Trading partner GDP and the real effective exchange rate are restricted at 1% and 0.10%, respectively in the long run.

Table C2: Core model results for import volumes

	Full sample (2000Q1-2023Q2)	Sample1 (2000Q1-2008Q4)	Sample2 (2010Q1-2019Q4)	Sample3 (2010Q1-2023Q2)
Error correction term	-0.12** (0.05)	-0.18* (0.09)	-0.21*** (0.06)	-0.16** (0.07)
Long run determinants				
Import price deflator relative to domestic prices	-0.12* (0.06)	-0.24* (0.13)	-0.06 (0.09)	0.07 (0.11)

15 The use of most of the independent variables comes from a literature review of related exercises, see for example Edwards and Lawrence (2006) and Kabundi (2014). Other independent variable choices were based closely on those used in the core model. The use of mining production follows the empirical correlation analysis (mentioned in earlier sections) that finds a strong relationship between mining production and export volumes post GFC.

Short run determinants				
Real domestic demand	1.32*** (0.29)	0.55 (0.77)	1.92*** (0.41)	1.41*** (0.31)
Import price deflator relative to domestic prices	-0.36** (0.16)	-0.22 (0.27)	0.23 (0.24)	0.01 (0.27)

*/**/*** signify levels of significance between 1% and 10%. Values in parentheses are standard errors. Real domestic demand is restricted/homogenised at 1% in the long run and both the GDP deflator and non-oil import deflator are restricted at 0.8% in the long run.