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Authorised for publication by:

Chris Loewald

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

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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.

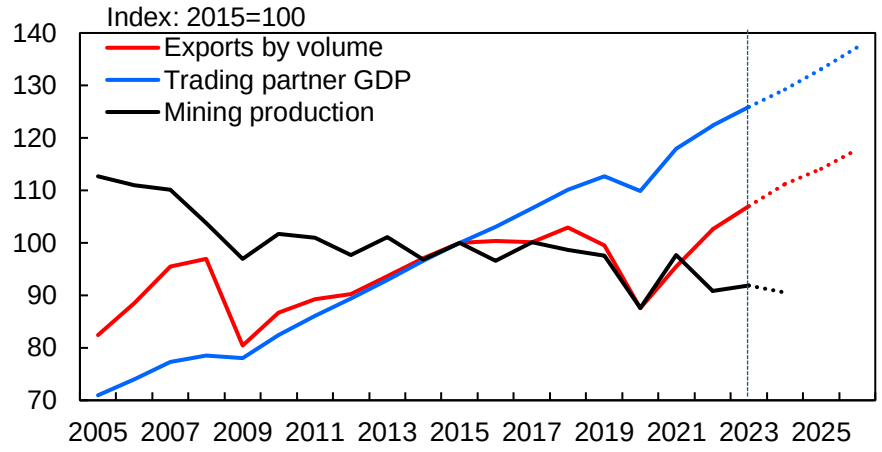
1. Introduction

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.

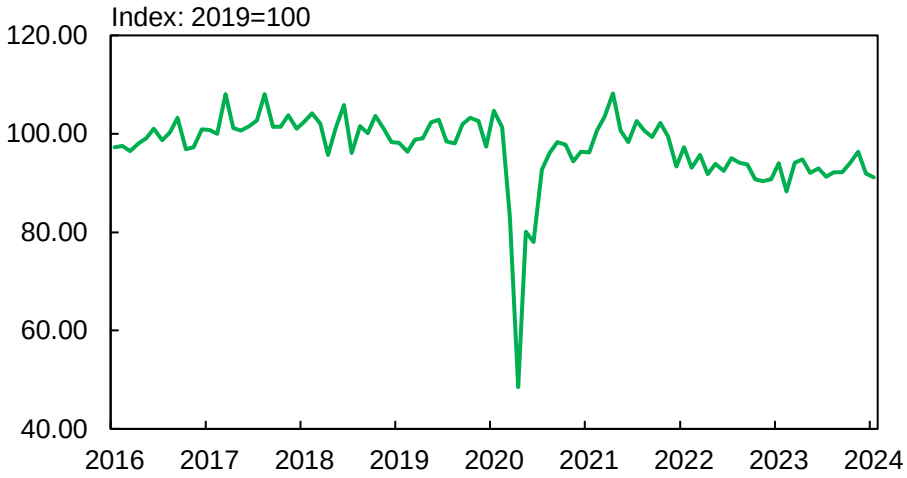
[2] Manufacturing production co-moves with mining production over the sample period. Its correlation with export volumes also evolves similarly. In this Note, however, we focus solely on mining production as it makes up the bulk of total exports.

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

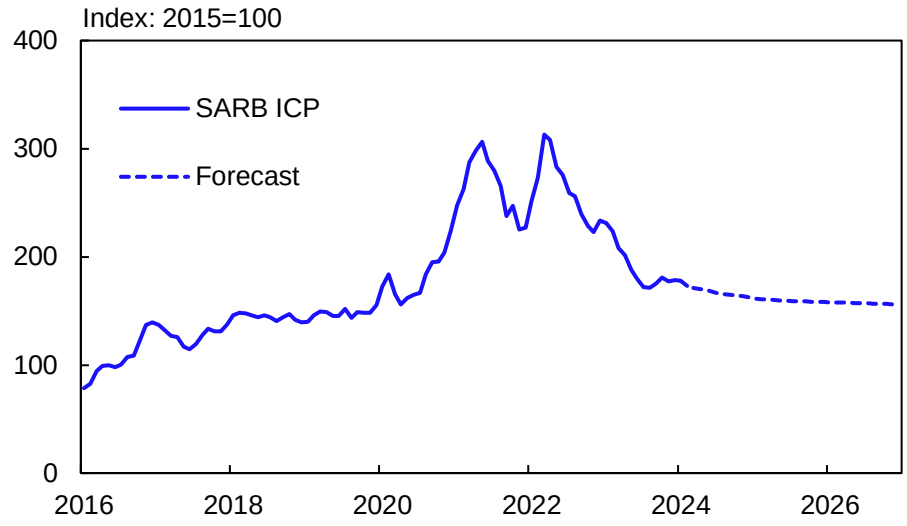
The mining sector continues to be constrained by a myriad of challenges including regulatory uncertainty (amidst changes) as well as operational constraints that include inefficient transport logistics, loadshedding, and strike actions. Mining production decreased by 3.3% y-o-y in January 2024, after 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

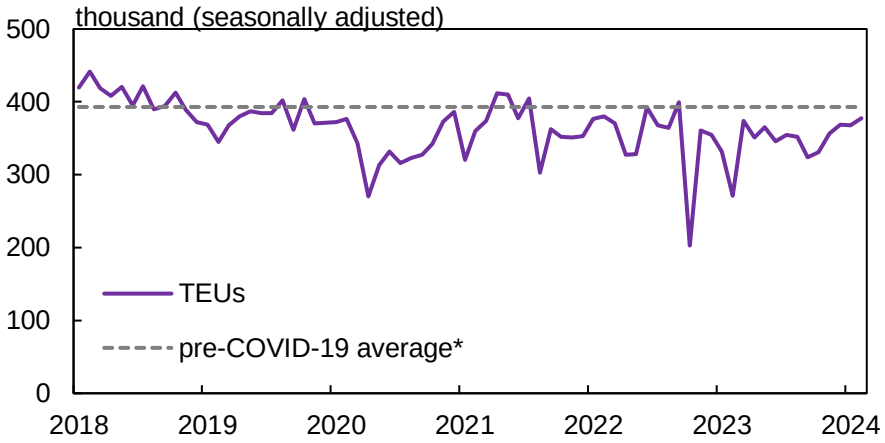


Source: SARB

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.

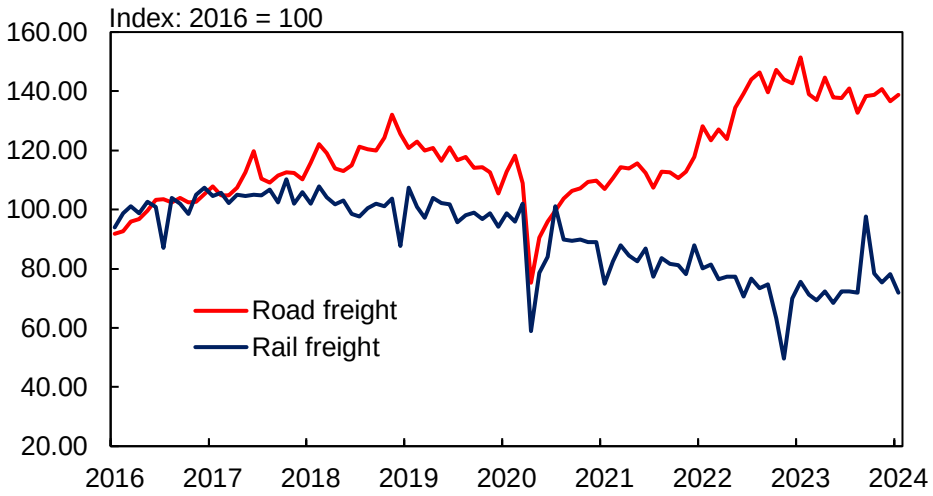
Figure 4: Transnet TEU containers landed and shipped



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

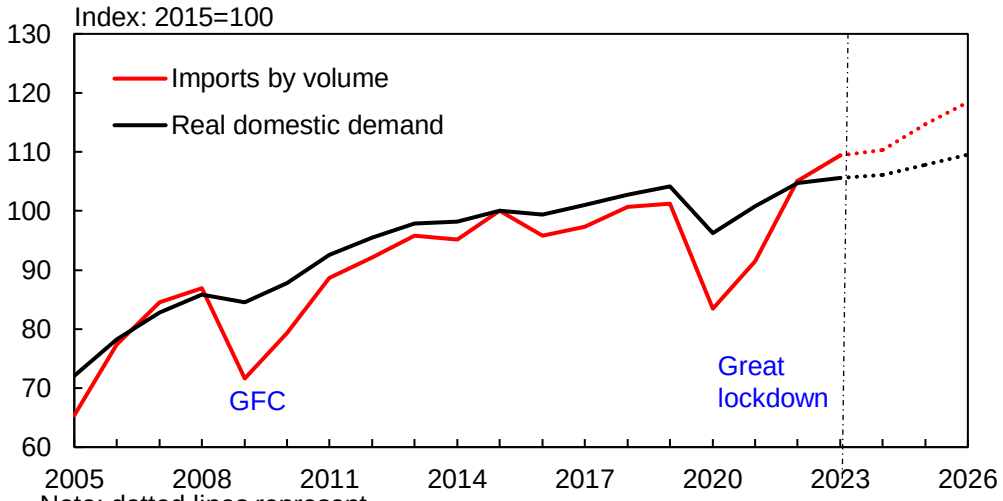
Given the devasting impact of the rail inefficiencies on the domestic economy, a few measures have been taken to remedy the situation. Transnet has partnered with the Philippines' International Container Terminal Services Inc in a 25-year venture to develop and upgrade the Durban Container Terminal Pier 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/.

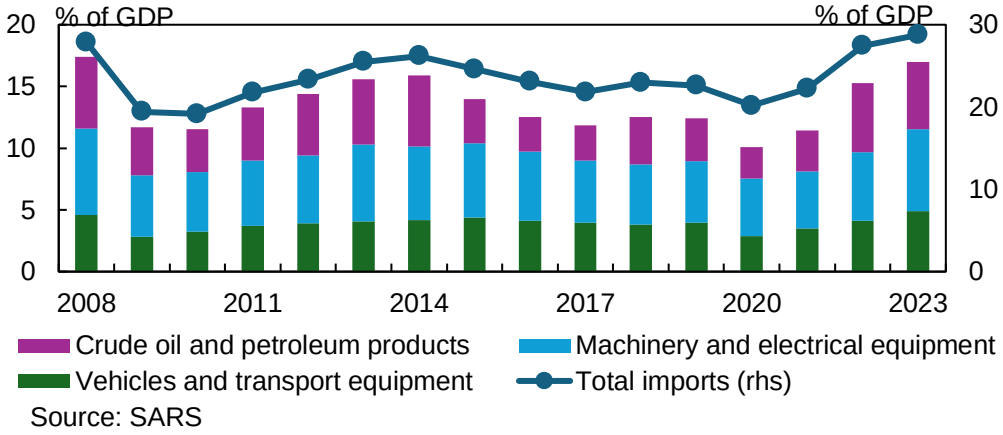
Figure 6: Imports and domestic demand



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.

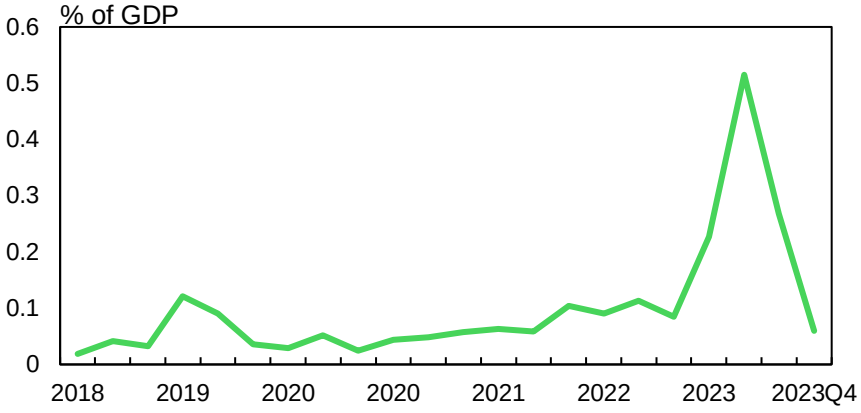
Import growth is expected to outpace domestic demand growth at least in the short term. This is bolstered by the 4.1% increase in import volumes in 2023, outpacing that of domestic demand (0.8%). This decoupling however should be temporary, and the two variables should move together over the long term.

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.

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

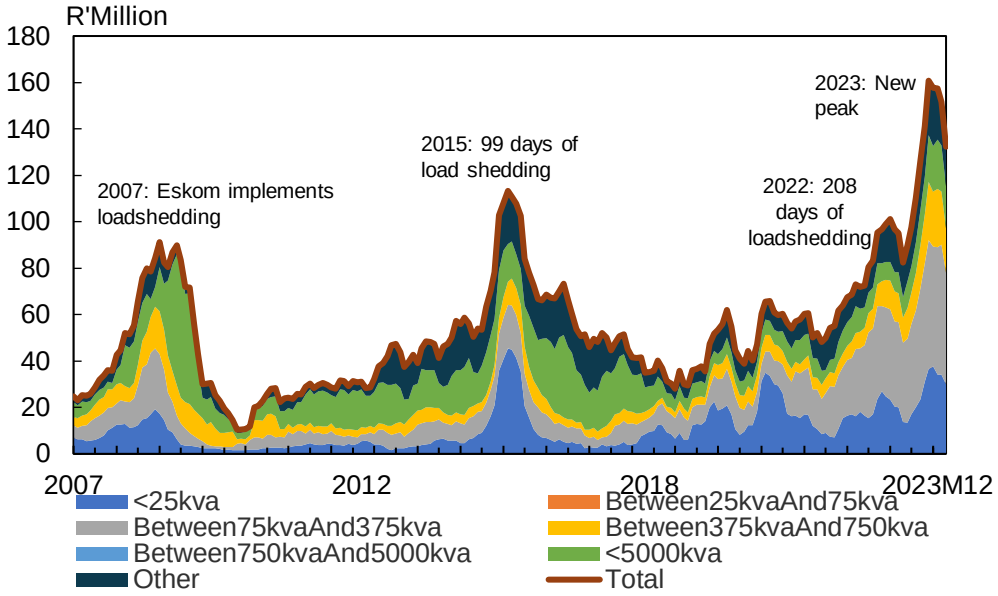
6 South Africa has a limited number of domestic manufacturers of low carbon energy solutions. As of writing, there were only two manufacturers of solar panels, namely ART Solar and Seraphim Solar. Therefore, to meet rising demand, alternative energy equipment imports will likely increase. See article: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



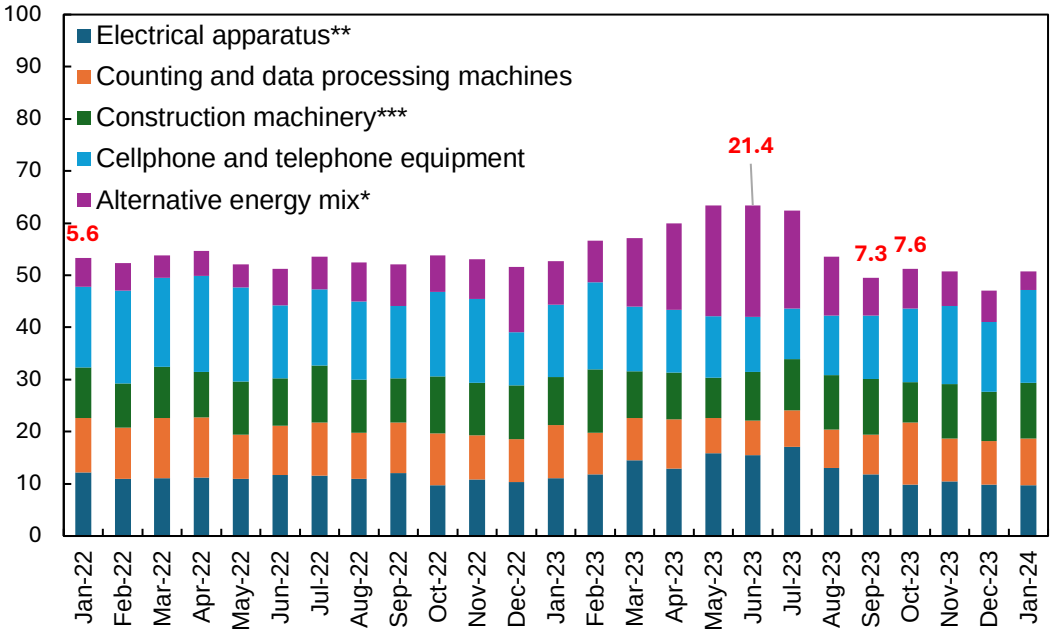
Source: SARS. Note: Applied 6 month moving average.

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

% Total machinery and electrical equipment 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***	-0.83***	-0.73***	-0.32***
	(0.07)	(0.19)	(0.15)	(0.13)
Long run determinants				
Mining production	1.42***	-0.17	0.38*	1.32***
	(0.41)	(0.30)	(0.22)	(0.42)
Trading partner GDP	0.67***	1.43***	0.45***	0.55***
	(0.10)	(0.10)	(0.07)	(0.16)
Real effective exchange rate	-0.18	-0.04	-0.23***	-0.17
	(0.21)	(0.11)	(0.60)	(0.21)
Short run determinants				
Mining production	0.54***	-0.10	0.17	0.54***
	(0.12)	(0.27)	(0.12)	(0.13)
Trading partner GDP	1.80***	0.39	1.78	1.99***
	(0.58)	(1.34)	(1.38)	(0.68)
Real effective exchange rate	-0.10	0.09	-0.22***	-0.15
	(0.09)	(0.12)	(0.08)	(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**	-0.71***	-0.52***	-0.30***
	(0.07)	(0.16)	(0.14)	(0.11)
Long run determinants				
Real domestic demand	1.65***	1.91***	2.1***	2.11***
	(0.27)	(0.06)	(0.16)	(0.41)
Import deflator	-0.15	-0.21***	-0.25**	-0.14
	(0.14)	(0.11)	(0.10)	(0.10)
Short run determinants				
Real domestic demand	1.46***	1.14***	1.93***	1.48***
	(0.15)	(0.34)	(0.27)	(0.16)
Import deflator	-0.16	0.01	0.03	0.04
	(0.10)	(0.12)	(0.10)	(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.

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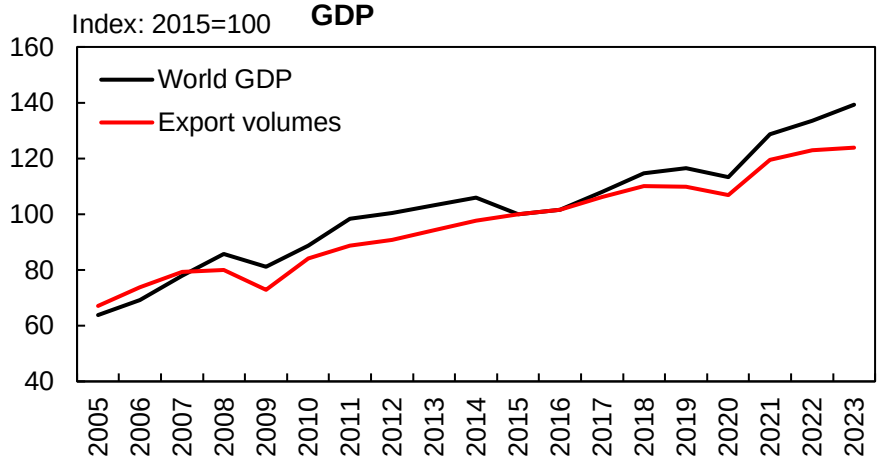
Appendix

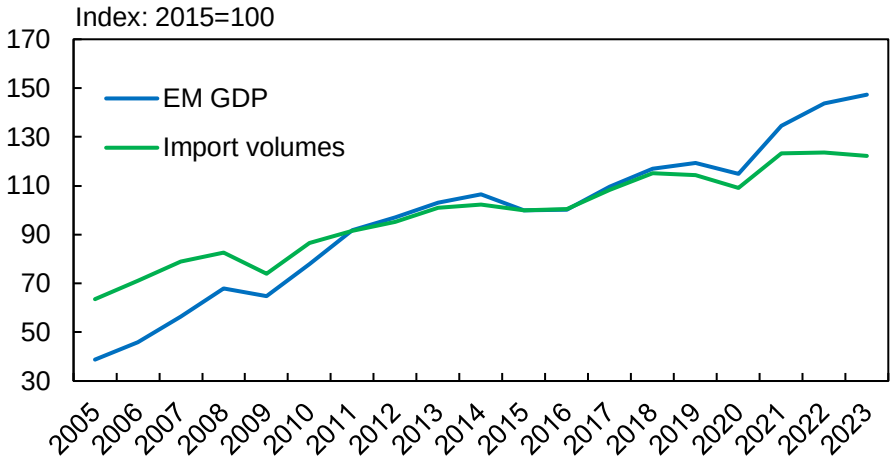
A. Emerging Market Charts

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:

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

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***	0.55	1.92***	1.41***
	(0.29)	(0.77)	(0.41)	(0.31)
Import price deflator relative to domestic prices	-0.36**	-0.22	0.23	0.01
	(0.16)	(0.27)	(0.24)	(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.