04

Development of a Commodity Basket

4. Development of a commodity basket

4.1 Introduction

A commodity basket, for the purposes of this report, is a collection of individual mineral commodities, contributed by different participating countries on the continent, in varying proportions, that together exhibit more stability in value, along with lower volatility than the local currencies of the participating countries. A commodity basket can be compared to a diversified equity index such as the S&P 500 in the US.

The initial analysis aims to test the hypothesis that there is a stable commodity basket that, if well-regulated and transparent, could be used as a mechanism to mitigate local currency mismatch risks related to financing in Hard currencies.

- If the empirical findings substantiate the hypothesis, participating African countries with significant commodity reserves, such as Zambia or DRC, would be able to borrow Hard currency to finance projects that generate local currency revenues without the need for a government guarantee to mitigate currency exchange rate and convertibility risk.
- This mechanism may accelerate economic development through greater access to project financing while benefiting from the potential upside offered by the rise of global commodity prices over time. This enables borrower countries to avoid the convertibility risk associated with repayment of loans in Hard currency, while project revenues are earned in local currency.

This section outlines the methodology of the report, presents the results from the data analysis, and provides interpretations of the currency and commodity behaviour. These insights will ultimately aid in devising effective strategies for constructing a commodity basket that would offset currency mismatch risk for project participants.

We define two quantitative measures to assess commodity and currency behaviour over time, namely appreciation/depreciation and volatility.

Figure 7: Quantitative definitions

Appreciation/depreciation refers to an increase/decrease in the value of an asset over time. If the price of a commodity rises, the commodity is said to have appreciated.

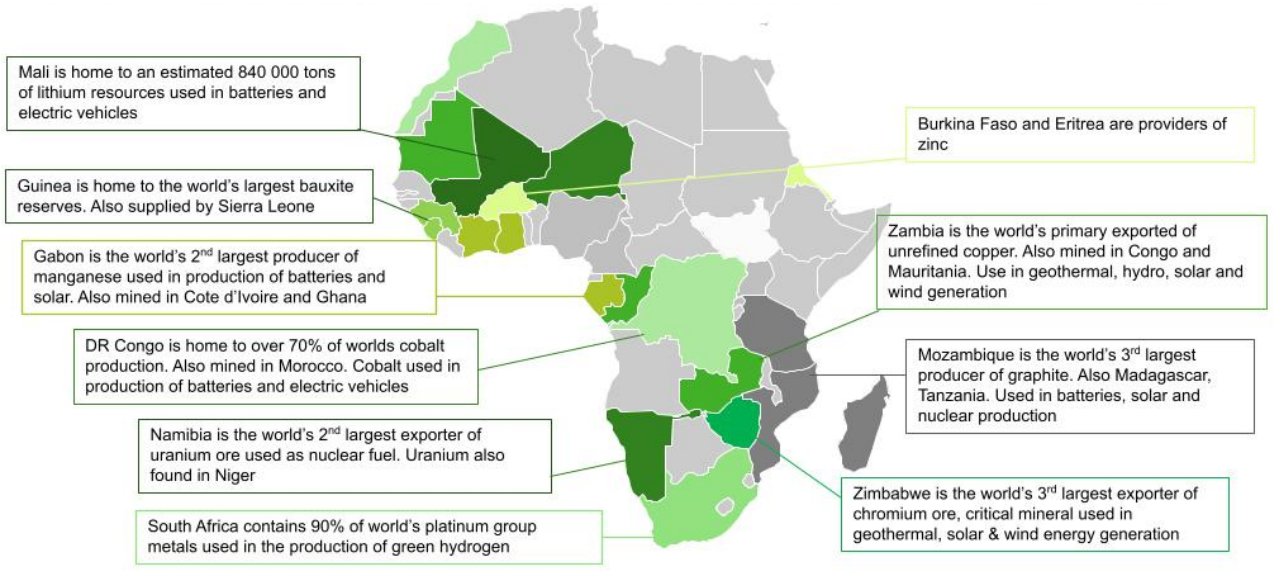
Volatility, as measured by annualised standard deviation, refers to the degree of variation or fluctuation in the price of a financial instrument over a certain period.

All calculations within this section are denominated in a particular country currency, or in the case of commodities, in US Dollars.

4.2 Africa commodity resource analysis

Endowed with vast natural resources, the continent presents an intriguing opportunity for commodity analysis. Africa is estimated to hold around 30% of the world's mineral reserves[15] many of which are critical to the renewable energy generation, transmission and storage, as well as to other low carbon technologies.

Figure 8: African suppliers of low carbon minerals



Africa holds c. 30% of the world's mineral reserves. Many of its minerals are critical to renewable or low-carbon technologies including solar, electric vehicles, battery storage, green hydrogen and geothermal.

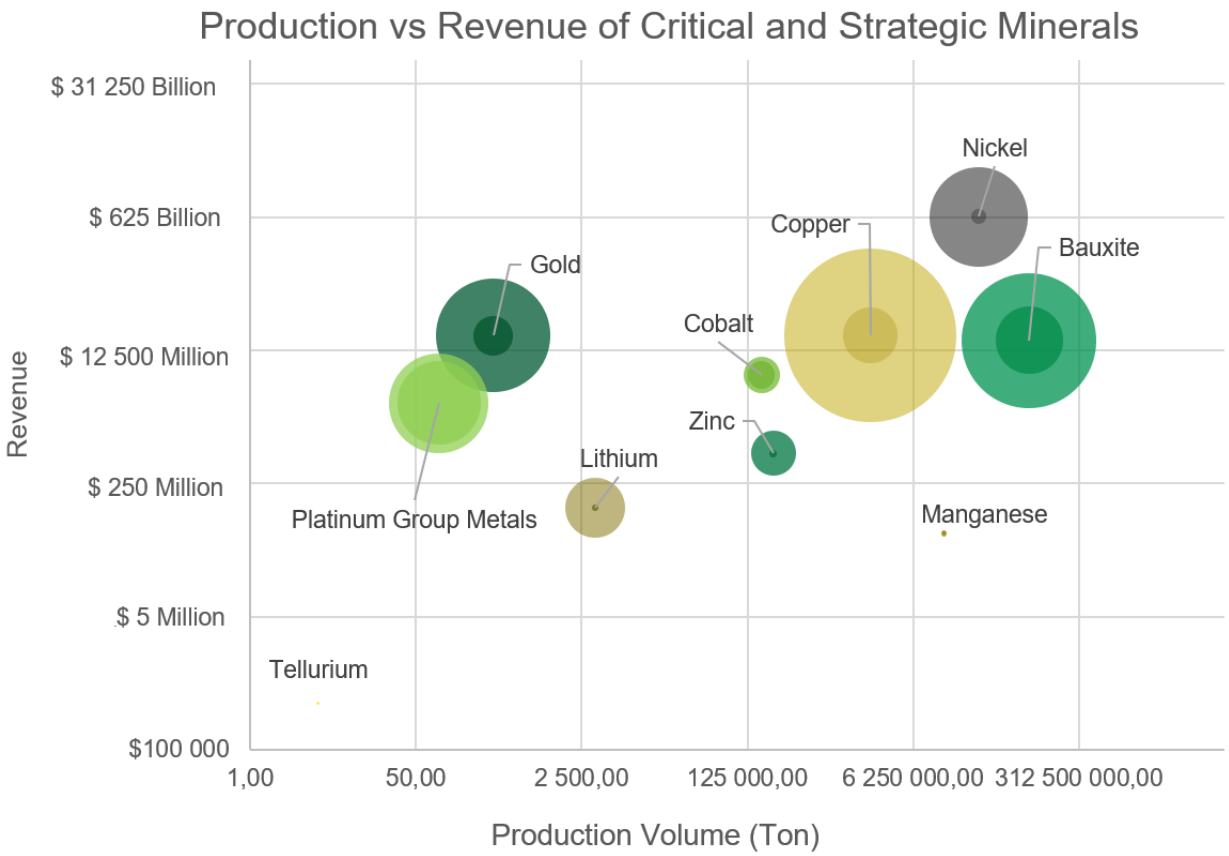
Source: Mo Ibrahim Foundation

The Mo Ibrahim Foundation reports that, to meet the rising demand for such critical minerals, it is expected that the supply of certain metals and minerals, including lithium, graphite, and cobalt, will need to increase by approximately 500% by 2050.

This presents a unique opportunity for African economies, but only if their natural resource wealth can be leveraged in line with their development requirements. As a significant supplier to global commodity markets, understanding the dynamics of Africa's commodities is essential and developmentally strategic, offering a potential competitive edge in future investment and trade decisions.

[15] Africa's critical minerals: Africa at the heart of a low-carbon future. Mo Ibrahim Foundation. 2023

Figure 9: Production versus revenue of critical and strategic minerals



Source: statista.com, pubs.usgs.gov, iisd.org and tradingeconomics.com

The graph above depicts a collection of critical and strategic minerals. Each mineral is represented by two coloured bubbles, comparing African reserves with global reserves. The lighter bubble represents the value of the world reserves, whereas the darker bubble represents the value of African reserves[16]. The graph also shows production volume for each mineral against the revenue for Africa in 2023.

The composition of a basket of Africa's critical and strategic minerals to function as a currency unit or a hedging tool hinges on a few critical resources:

- Cobalt is indispensable due to Africa's dominance in global supply, making it a strategic asset for the basket.
- Nickel plays a role as a substitute for cobalt in battery production, adding flexibility and resilience to the basket, especially when cobalt supply faces risks.
- Copper is crucial for renewable energy infrastructure; given Africa's copper reserves. The metal adds weight and stability to the basket due to its broad use in energy transmission and electrification.
- Bauxite is a strategic addition to an African focused mineral basket, especially given its importance in aluminium production, which is crucial for renewable energy infrastructure like solar panels and lightweight components for electric vehicles. Africa has substantial bauxite reserves: with a market value comparable to other minerals like cobalt or gold, bauxite's utility in clean energy technologies makes it relevant to the green economy.

[16] As estimated in 2023

Lithium and Manganese present some challenges:

- While Lithium is pivotal to the green economy, Africa currently has a low estimated reserve. The complementary relationship between Lithium and Cobalt in battery technology, however, underscores the importance of the role both of these could play in a commodity basket.
- Manganese has large production and reserve volumes but is relatively cheap, limiting its diversification benefit.

In summary, a strong commodity basket for Africa should consider Cobalt, Nickel, Copper as core components. These minerals provide a mix of market leverage, flexibility and stability. Lithium can be included but may not play a dominant role, owing to its scarcity in Africa, while Manganese would have a limited role in balancing risks.

Table 2: Select critical and strategic mineral production values[17]

Metal/ Mineral	Production country	Africa Production (tons)	Global Production (tons)	% of Global
Cobalt	DRC, Madagascar, Morocco	174 000	230 000	75.7%
Manganese	Gabon, Ghana, South Africa	13 030 000	20 000 000	65.2%
PGMs	South Africa, Zimbabwe	86	210	41,0%
Bauxite	Guinea	97 000 000	400 000 000	24.3%
Gold	Burkina Faso, Ghana, Mali, South Africa, Tanzania	310	3000	10.3%
Copper	DRC, Zambia	2 280 000	27 000 000	8.4%
Lithium	Zimbabwe	3 400	180 000	1.9%
Zinc	South Africa	230 000	12 000 000	1.9%
Nickel	South Africa	29 500	3 600 000	0.8%
Tellurium	South Africa	5	640	0.8%

Source: USGS Mineral Commodities Summaries, 2024

Table 3: Select critical and strategic mineral resource revenues[18]

Metal/ Mineral	Average Price per ton (US Dollar)	Africa Reserves (1000 tons)	Global Reserves (1000 tons)	Value of Africa Reserves (million USD)	Value of World Reserves (million USD)	% of Global
PGMs	30 973 000	64	71	1 988 467	2 199 083	90.4%
Cobalt	34 700	6 100	11 000	211 670	381 700	55.5%
Manganese	4	674 000	1 900 000	2 999	8 455	35.5%
Bauxite	173	7 400 000	30 000 000	1 280 200	5 190 000	24.7%
Zinc	2 650	12	74	16 430	583 000	16.6%
Gold	62 372 400	7	59	450 329	3 679 972	12.2%
Copper	8 500	101 000	1 000 000	858 500	8 500 000	10.1%
Nickel	21 500	2 900	130 000	62 350	2 795 000	2.2%
Tellurium	80 200	0.8	36	64	2 887	2.2%
Lithium	35 650	310	28 000	11 362	1 026 200	1.1%

Source: .GS Mineral Commodities Summaries, 2024

This analysis seeks to explore the diverse selection of African commodities, including metals, critical and green minerals, and fossil fuels, to identify a potential combination or basket of commodities that would result in a diversified grouping, with a combination of a more stable or appreciating valuation and lower volatility than any individual commodity.

[17] Data for this table were sourced from statista.com, pubs.usgs.gov, iisd.org and tradingeconomics.com

[18] Data for this table were sourced from statista.com, pubs.usgs.gov, iisd.org and tradingeconomics.com

4.2.1 Methodology applied to select commodities

The selection of commodities for this analysis was guided by an intentional approach anchored in the broader context of the African markets and global economic indicators. Given Africa's vast natural resource endowments, we have focused our study on several metals and minerals, subdivided into four main categories: critical minerals, precious metals, industrial metals, and fossil fuels.

The following list of natural resources was the focus of our analysis: Platinum, Copper, Cobalt, Manganese, Nickel, Uranium, Zinc, Tin, Lead, Palladium, Gold, Silver, Crude Oil, Natural Gas, and Coal.

Several factors influenced our decision in selecting these commodities.

- **Exclusivity and rarity:** The presence and production of certain minerals, including Platinum and Palladium, are largely concentrated in Africa.
- **Global demand:** Commodities, including Copper, Nickel, and Manganese, remain at the centre of growing industrial usage, especially with the rapid rise of technological advancement and the demand for smart devices.
- **Economic contribution*:*** Precious metals, including Gold and Silver, contribute significantly to the revenues of many African economies.
- **Critical and low carbon minerals:** Recognising the pivotal commodity market effect of the transition from fossil fuels towards sustainable energy. These include Lithium, Cobalt, and Uranium.
- **Market liquidity:** The accessibility and liquidity of the market for each of these commodities were also considered, ensuring that selected commodities had active markets with good trading volumes for analysis.

While basket construction may have logistical and legal constraints, this construction sufficiently reflects Africa's diverse commodity landscape.

4.2.2 Analysis of commodities

With Africa being a major contributor to the global commodities market, an in-depth historical review of commodities' appreciation/depreciation and volatility provides a foundation for the research.

Recognising that appreciation/depreciation indicates the profitability of an investment over a given period, and volatility reflects the price fluctuations, together they capture the risk and value growth associated with each commodity.

This analysis will review the market performance of a set of minerals and metals, classified into three categories:

Table 4: Commodity basket categories

Basket #	Basket name	Composition of basket
1	Critical and low carbon minerals	Platinum, Copper, Cobalt, Manganese, Nickel, Uranium, and Zinc.
2	Industrial metals	Tin, Lead, and Palladium.
3	Other minerals and fossil fuels	Gold, Silver, Crude Oil, Natural Gas, and Coal.

By analysing each of these commodities in terms of appreciation/depreciation and volatility, this study aims to understand their individual and collective behaviours, and their potential investment value, in a grouping or basket of commodities.

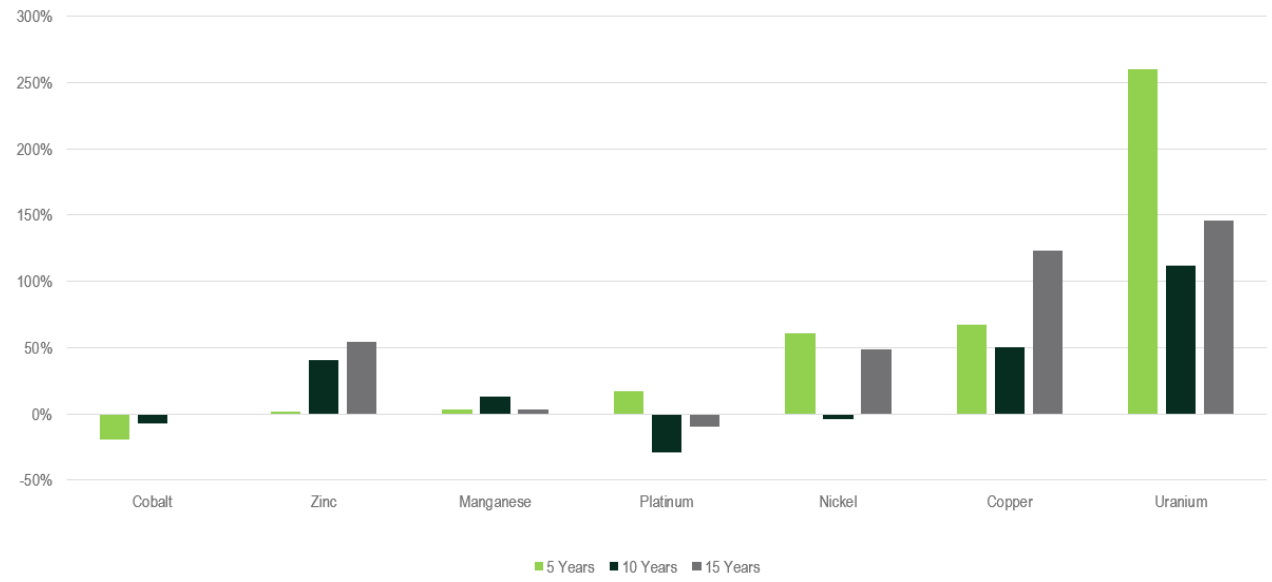
Appreciation/depreciation[19] and volatility observed historically are driven by global supply and demand for the given commodities.

[19] The formula for appreciation and depreciation is:

Appreciation|Depreciation= -End ValueStart Value-1

Positive values correspond to appreciation and negative values correspond to depreciation.

Figure 10: Historic value growth on critical and low carbon minerals

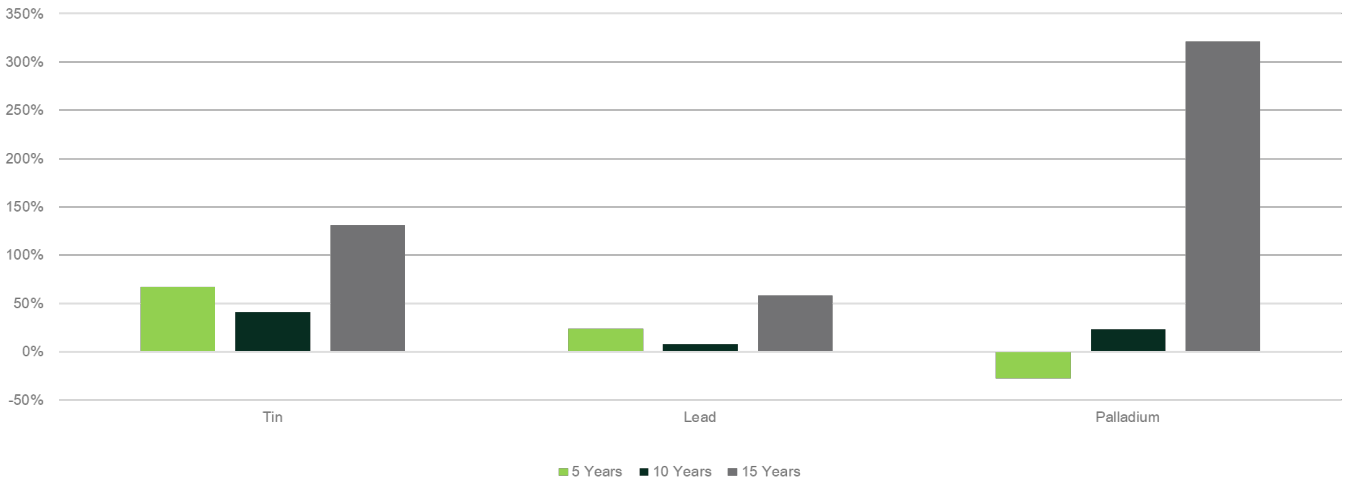


Source: EquityRT, KPMG analysis

The data provided shows the varied performances of the defined critical and low carbon minerals grouping over a 5-[20], 10-[21] and 15-year[22] timeframe.

The critical and low carbon minerals show a wide range of appreciation/depreciation over the different time horizons, not indicating a specific appreciation/depreciation pattern. While there is no clear growth pattern, four out of the seven critical and low carbon minerals show significant appreciation over the 15-year period suggesting that if this trend continues, they could be used as part of a long-term currency risk mitigation commodity basket and that they tend to keep their value over long horizons.

Figure 11: Historic value growth on industrial minerals



Source: EquityRT, KPMG analysis

The graph displays the appreciation/depreciation of industrial minerals: Tin, Lead, and Palladium.

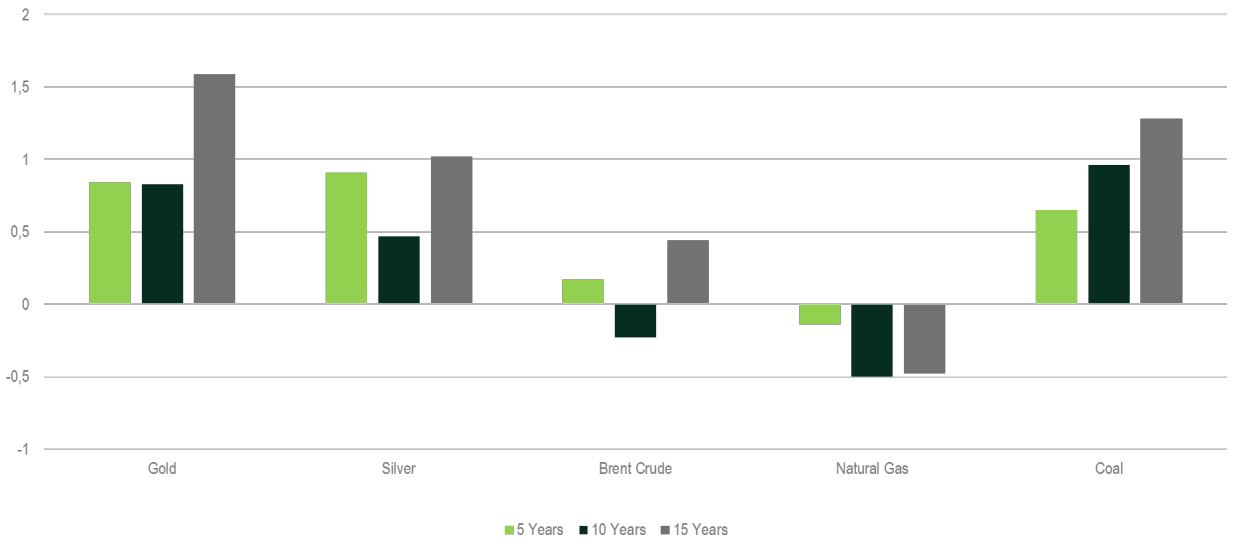
[20] The 5-year period is measured between 2019-05-11 and 2024-05-10.

[21] The 10-year period is measured between 2014-05-11 and 2024-05-10.

[22] The 15-year period is measured between 2009-05-11 and 2024-05-10.

- As with most of the critical and low carbon minerals, the industrial minerals also have higher price appreciation over the 15-year period.
- The relatively high long-term appreciation of the industrial minerals makes them attractive components for a commodity basket aimed towards preserving value over extended periods. These minerals have demonstrated resilience and growth, suggesting they can serve as a hedge against inflation, market volatility, and currency volatility.

Figure 12: Historic value growth on other minerals and fossil fuels



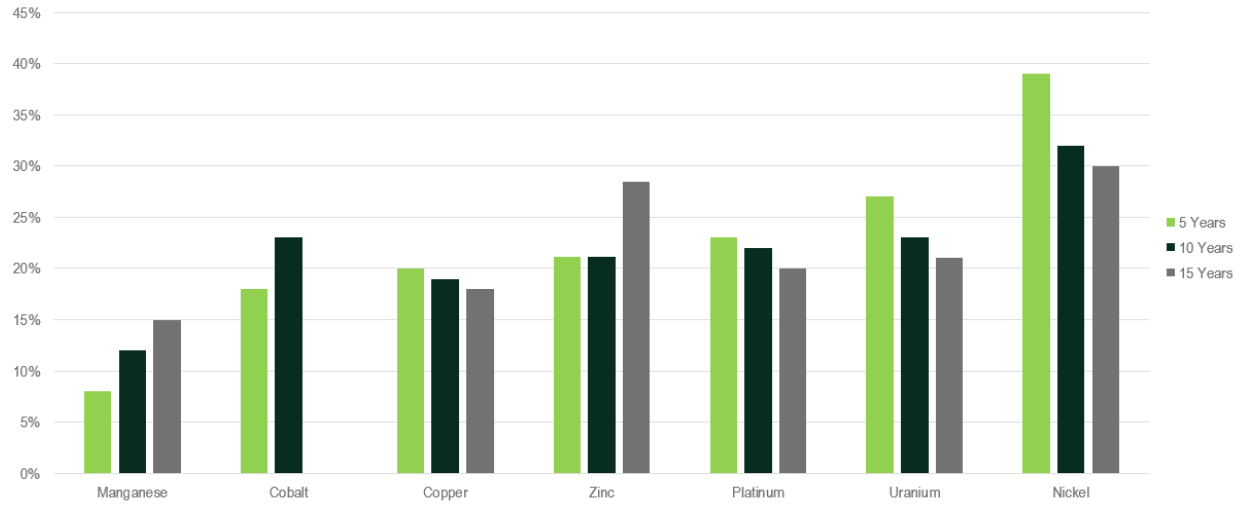
Source: EquityRT, KPMG analysis

The above graph offers insight into the appreciation/depreciation of the other minerals and fossil fuels category comprising Gold, Silver, Crude Oil, Natural Gas, and Coal, over 5, 10, and 15-year timeframes.

- The precious metals showcase relatively consistent high price appreciation over the various periods, while the energy minerals have a more sporadic growth pattern.
- The differences in the performances of these commodities underscore the diverse nature of commodities performance over time, and demonstrate the necessity of a nuanced approach when predicting future behaviours.
- The effects of various external factors, including global demand, geopolitical events, supply, potential substitute minerals, environmental circumstances, and economic price fluctuations, should be considered when analysing these value growths.

4.2.2.1 Volatility

Figure 13: Historic volatility of critical and low carbon minerals

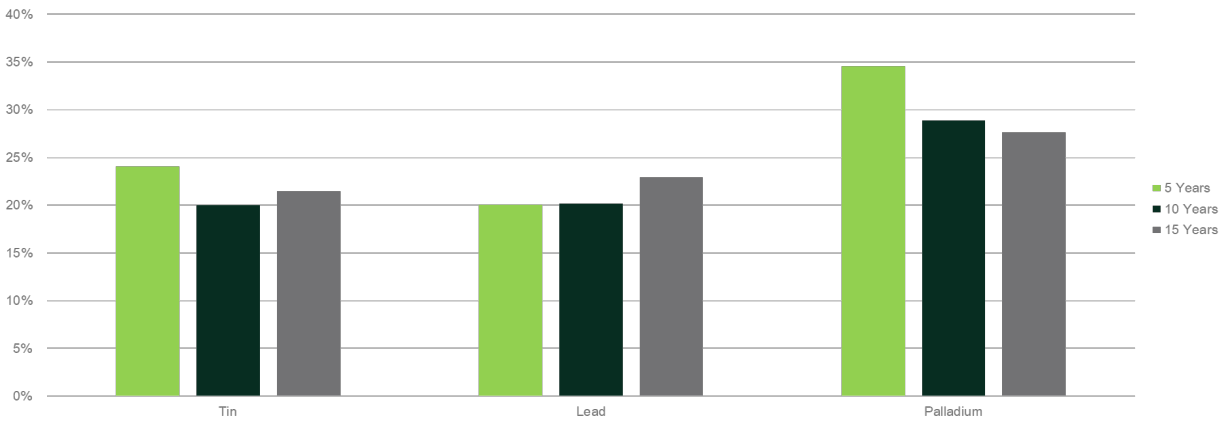


Source: EquityRT, KPMG analysis

The graph highlights the annual realised volatility of various critical and low carbon minerals, namely Manganese, Platinum, Copper, Uranium, Nickel, Zinc, and Cobalt, over 5-, 10- and 15-year time frames.

- The critical and low carbon minerals' volatility remains relatively constant over the three different time horizons. The minerals generally indicate a lower volatility over a longer time horizon, barring Manganese, Cobalt, and Zinc.

Figure 14: Historic volatility of industrial metals

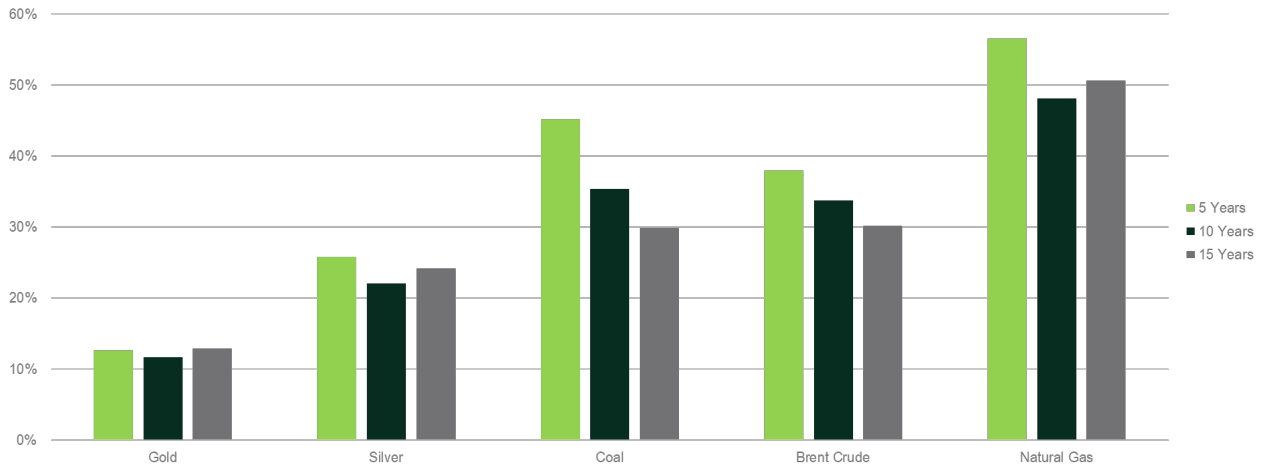


Source: EquityRT, KPMG analysis

The data presents the annual realised volatility over 5, 10, and 15 years for industrial metals including Tin, Lead, and Palladium.

- The industrial metals show a similar pattern in their volatility to that of the critical and low carbon minerals with a relatively constant volatility over three different time horizons.

Figure 15: Historic volatility of other metals and fossil fuels



Source: EquityRT, KPMG analysis

The graph outlines the annual realised volatility for Gold, Silver, Coal, Crude Oil, and Natural Gas, over 5-, 10- and 15-year timeframes.

- Gold displays the lowest volatility amongst the presented commodities. The energy commodities, however, indicate relatively high volatilities over all three time horizons, compared to all of the other commodities.

4.3 Forward-looking analysis

The underlying rationale for selecting the commodities that will make up the basket is based on the future expectation of the value of those commodities. For this reason, critical minerals appear to be a subsection of commodities that are expected to hold or increase their value into the future. This expectation is based on the demand for their uses as integral to the many technologies required for the implementation of the global green energy transition.

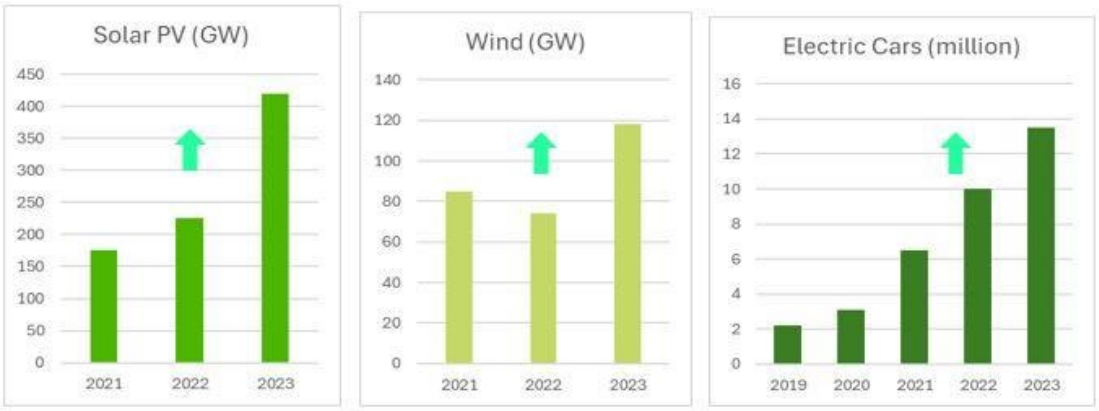
A recent study by the International Energy Agency[23] (IEA) highlights that the market for critical minerals and especially battery minerals (Cobalt, Nickel, and Lithium) has been turbulent over the past few years, with strong increases in prices experienced in 2021 and 2022, reversing into large declines in late 2023 and 2024.

Recent price declines can be explained by strong increases in supply[24] and ample inventories of certain critical minerals as well as the general slow economic growth globally in the post-pandemic period. This has been good for climate change technology roll-out, but has also meant that financing for more exploration for these minerals has also declined. This has created some uncertainty regarding the future movement of the prices of these commodities.

[23] International Energy Agency. *Global Critical Mineral Outlook 2024.*

[24] The increase in supply from Africa is projected to result in a 65% increase in the market value of its critical mineral sales by 2030.

Figure 16: Other minerals and fossil fuels



Source: IEA. Global Critical Mineral Outlook 2024. KPMG analysis

Underlying this volatility is the intention of most countries to move away from the use of fossil fuels as a source of energy, and towards sustainable energy sources as part of a larger awareness of the negative climate effects of fossil fuels. Most countries have set targets for achieving reductions in fossil fuel use and some have even mapped a path towards net-zero emissions at a future date.

What is clear is that demand for critical minerals remains robust, with solar and wind growing by an average of 75% in 2023, driven by the demand for network expansion and, by implication, for minerals such as Copper and Aluminium. Lithium saw a 30 percent increase in demand through 2023, while Nickel, Cobalt, and Graphite, experienced growth rates of between 8 and 15 %over the same period.

Going forward, the balance between the supply and demand for critical minerals presents a mixed picture with significant gaps between prospective supply and market demand for Copper and Lithium developing over time.

- The IEA[25] estimates that, if all projects currently announced to increase supply were to go ahead, they would only supply around 70% of Copper and 50% of Lithium demand.
- For Nickel and Cobalt, the relationship between projected supply and demand appears tighter, if confirmed project supply is considered.
- Finally, for Graphite and Rare Earths, there may not actually be a future supply constraint, however, the concentration of these minerals with over 90%of Graphite and 77% of Rare Earths originating in China, means that there is concentration risk that may result in severe supply constraints in future, depending on the geopolitical climate.

The IEA[26] further estimates that mining activity will need substantial investment to be able to access the mineral resources required to achieve either the currently announced country pledges, or to reach the net zero scenario. To achieve this, the IEA has estimated that mining investment of $590 billion will be required under the former target and up to $800 billion to achieve the latter. Other constraints on supply include a general need for improved logistics infrastructure, especially in Africa, to enable the prospective extraction industry to get those minerals to market.

The conclusion is that there is a good probability that given the dynamics listed above, over the period to 2040 and even 2050, the value of the critical minerals underpinning the mechanism would be expected to increase.

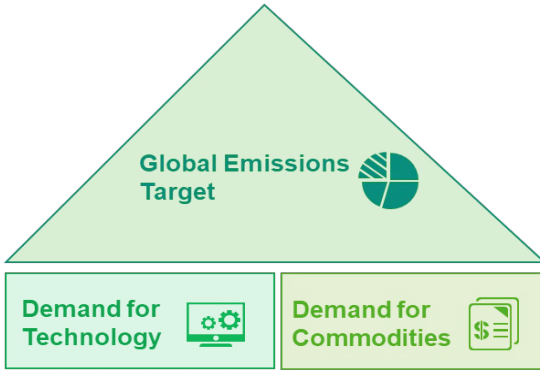
[25] International Energy Agency. *Global Critical Mineral Outlook 2024*. p8.

[26] International Energy Agency. *Global Critical Mineral Outlook 2024*. p9.

4.3.1 Scenario analysis of commodity markets

We included a scenario analysis of the commodity market and in particular the supply and demand dynamics for a select list of critical minerals to analyse the potential future trend of commodity performance.

Figure 17: Global emissions scenarios



The demand for critical minerals is both a derived demand for the technology used in the green-energy transition, which is dependent on the goals set by countries reflecting their ambitions with respect to climate change. The stronger the ambitions in terms of reductions in the use of fossil fuels, the greater the demand will be for green technology and therefore for critical minerals used in those technologies. The future scenarios are premised on analysis done by the International Energy Agency (EIA), which considers three future scenarios with respect to climate change ambitions.

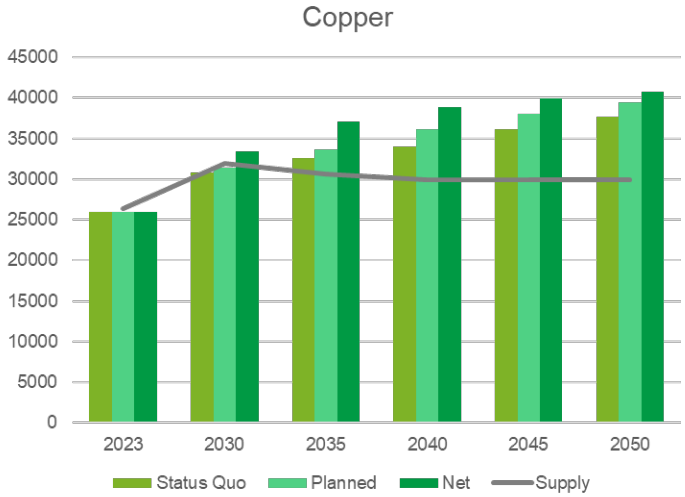
1) **Status quo** – In this scenario, emissions levels remain relatively stable and may even increase, as there is a lack of a binding commitment or effective regulation driving more substantial change.
2) **Planned projects** – Under this scenario, national policies aimed at decreasing Greenhouse emissions through various means such as transitioning to renewable energy, improving energy efficiency and regulatory measures.
3) **2050 Net Zero** – Any emissions produced are counterbalanced by efforts to remove an equivalent amount from the atmosphere, often through carbon capture technology and reforestation efforts.

4.3.2 Copper

Copper is used in a variety of green technologies, from solar panels and electric vehicles to wind turbines, and generally for the expansion of energy grids based on the growth of sustainable energy sources.

Demand for Copper is expected to grow substantially over the period to 2050, especially under the net zero emission scenario. At the same time, ESG projects are predicted to grow from 25%of current demand to around 47% of demand, thereby becoming a more important determinant of future Copper prices. The analysis of supply and demand factors for Copper appears to suggest an increasing future price trend.

Figure 18: Supply and demand for Copper

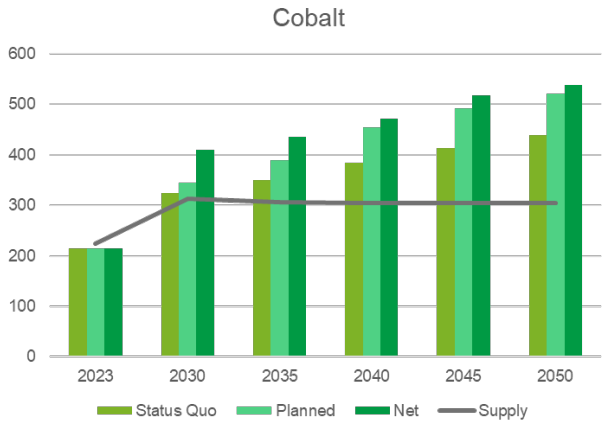


Source: International Energy Agency. Global Critical Mineral Outlook 2024. KPMG Analysis

4.3.3 Cobalt

As an important element used in cathodes in battery technology, the use of more battery storage for electric vehicles and grid storage will drive the demand for Cobalt. Although demand is expected to grow, as can be seen in the graphic below under all three emission scenarios, production is relatively concentrated with the Democratic Republic of Congo accounting for almost 70% of global production. This concentration introduces concentration risk and has encouraged research into finding alternative substitute products. Green technologies are expected to grow from accounting for 30%of demand for Cobalt to approximately 60% in future, making the demand for green projects a more important determinant of the price of Cobalt.

Figure 19: Supply and demand for Cobalt



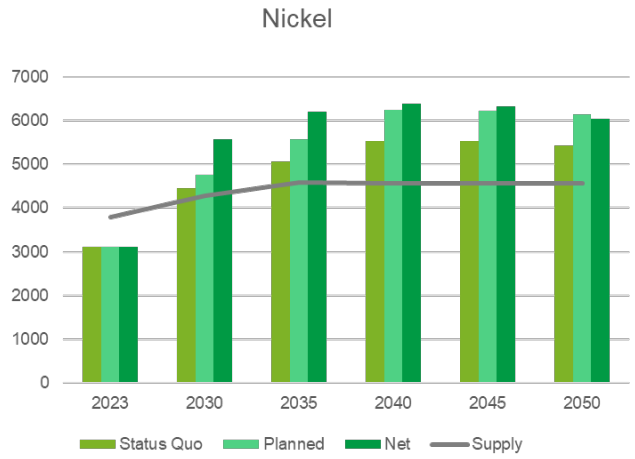
Source: International Energy Agency. Global Critical Mineral Outlook 2024. KPMG Analysis

Given the current supply and demand dynamics, the price for Cobalt is expected to trend upwards over the forecast period without a substitute element being found.

4.3.4 Nickel

Nickel is another mineral used for cathodes in battery technology. As the demand for battery storage and electric vehicles rise, so too will the demand for Nickel. Nickel is one of the few minerals that can serve as a substitute for Cobalt. Therefore, the demand for Nickel is also expected to increase over time. Currently, green energy applications account for approximately 15%of the demand for Nickel, but demand is expected to grow to around 51% over the forecast period as the green energy transition gathers momentum.

Figure 20: Supply and demand for Nickel



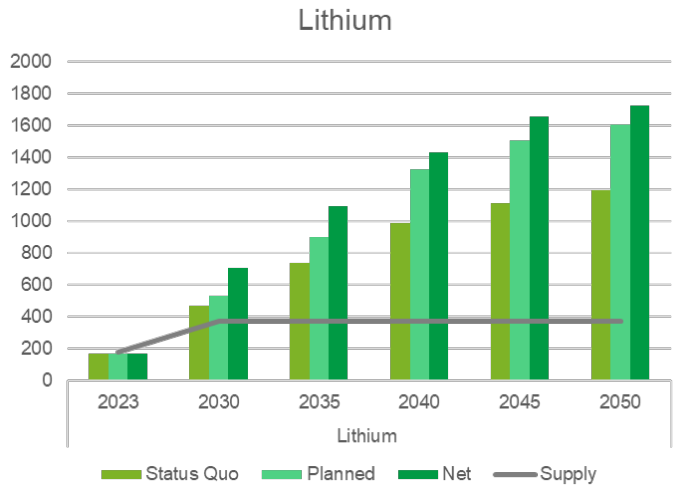
Source: International Energy Agency. Global Critical Mineral Outlook 2024. KPMG Analysis

Given the expected growth of demand for battery storage and the supply and demand dynamics presented, the trend for Nickel is expected to be upward sloping.

4.3.5 Lithium

Lithium is a third mineral used in battery storage and is therefore dependent on the demand for grid storage applications, and the growth of the electric vehicle sector. Other applications include the magnets used in wind turbines. As a result, the demand for alternative energy and batteries will drive the demand for Lithium in future. This may be countered by technology developments towards manufacturing batteries of a smaller size, and alternative, solid state battery technology. Currently, there are no substitutes for Lithium-Ion battery technologies. As a result, it is expected that the demand for Lithium will increase by 40 times under the net zero emission scenario.

Figure 21: Supply and demand for Lithium



Source: International Energy Agency. Global Critical Mineral Outlook 2024. KPMG Analysis

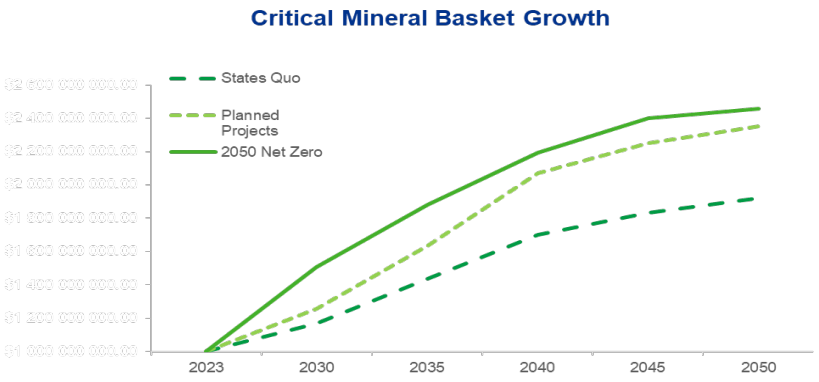
Given the potential future demand for battery storage applications and the levelling off in the supply of Lithium, our analysis finds that there will be an upward trend in the value of this mineral.

4.3.6 Critical mineral analysis and the future value of the commodity basket

The demand for critical minerals is expected to grow, as countries attempt to reduce their emissions of global Greenhouse gasses. In addition, the future growth in demand for many minerals is expected to exceed the supply of those minerals, putting upward pressure on the value of the critical minerals over the following decades, under all three of the EIA's emission scenarios.

As a result, the value of the commodity basket is expected to increase over time, although quantifying that future value is subject to much uncertainty and will require further scenario analysis before a reasonable range can be provided.

Figure 22: Expected trend of the value of the commodity basket



Source: International Energy Agency. Global Critical Mineral Outlook 2024. KPMG Analysis

4.4 Currencies analysis

The value and stability of currencies provides an indication of a country's economic strength. This section presents a quantitative analysis of a selection of African and other currencies. Currency performance forms a critical part of determining the feasibility of a commodity basket formed to mitigate local currency risk.

4.4.1 Methodology applied to select currencies

Two groups of countries were selected for analysis:

- African countries that would potentially participate in the currency convertibility mechanism as participating countries.
- A group of countries representing hard currencies, that potentially would act as lender countries into the mechanism and against which the performance of the African country currencies could be measured.

The selection of the African country currencies for this analysis was guided by two main dimensions:

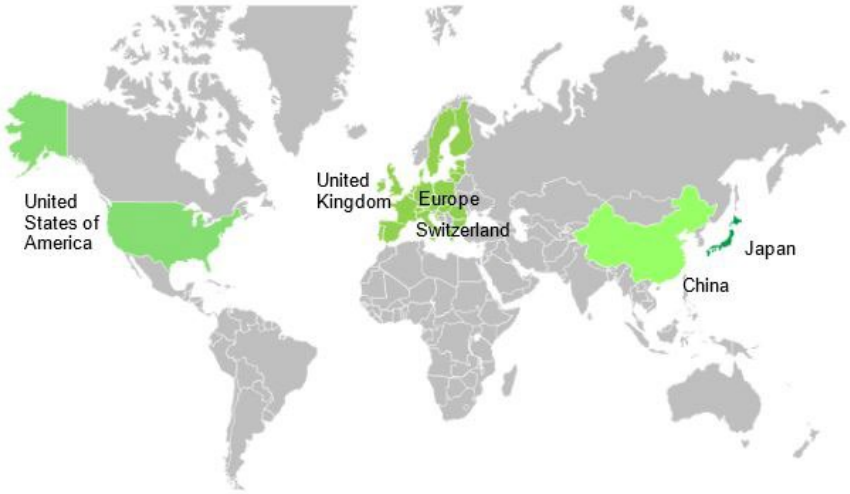
- The size of the individual economies as measured by GDP, with preference given to larger economies.
- The prominence of the resource extraction industry in those countries. In addition, data availability and data quality were also a consideration with longer, complete time series preferred to shorter, intermittent series.

Table 5: Currency groupings

Currency grouping	Component currencies
African currencies	Nigeria Naira, Ghanaian Cedi, Egyptian Pound, Ethiopian Birr, Congolese Franc, South African Rand, Botswana Pula, Guinean Franc, Kenyan Shilling, Moroccan Dirham.
Hard currencies	US Dollar, UK Pound Sterling, Euro, Japanese Yen, Chinese Yuan, Swiss Franc.

Figure 23: Map of African currency countries

Figure 24: Map of Hard currency countries



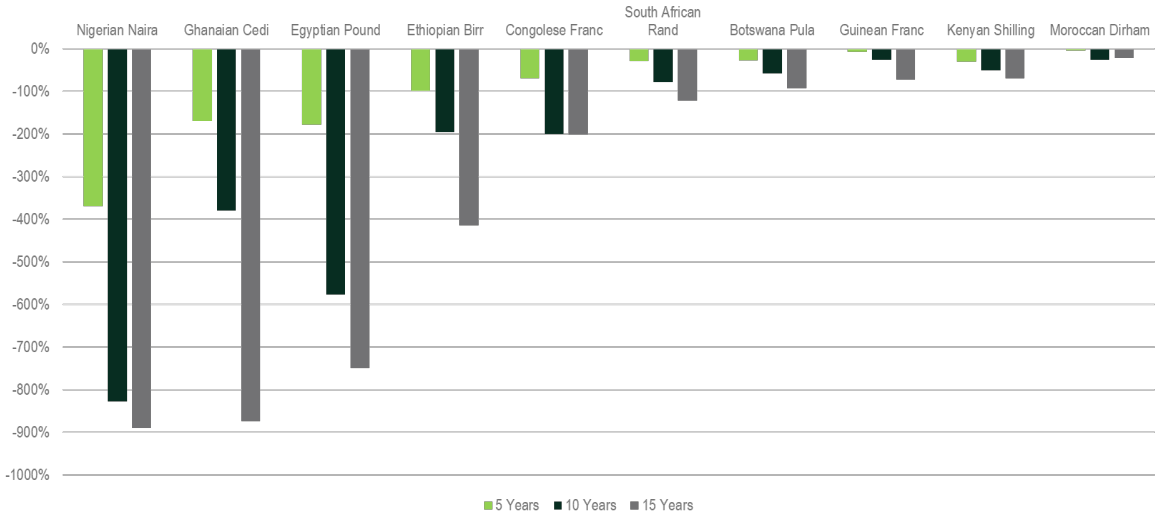
4.4.2 Quantitative analysis

The quantitative analysis serves as the backbone of our methodological approach. The aim is to understand the behaviour of the different currencies to gauge the potential scope and influence of the proposed currency convertibility mechanism.

4.4.2.1 Currency Appreciation/Depreciation

Exchange rate data of daily frequency was collected for the countries listed above for the time period 2009 to 2024.

Figure 25: African country currencies depreciation over the period 2009 to 2024



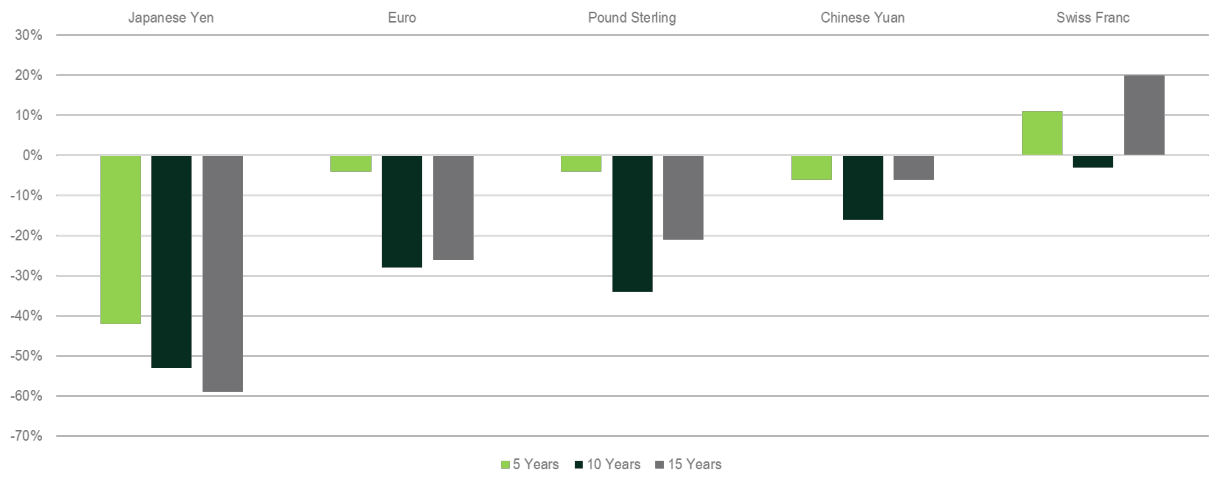
Source: EquityRT, KPMG analysis

The analysis shows the historical depreciation for a set of African currencies over three distinct time intervals of 5 years, 10 years, and 15 years.

- Six of the ten African currencies lost more than half of their value over the 15-year period. The remaining four countries also lost value against the US Dollar, but to a lesser extent. Nigeria, Ghana, and Egypt experienced the largest value loss.

- All African country currencies analysed experienced a depreciating trend against the US Dollar over the period under review, with the rate of depreciation varying substantially across those countries.

Figure 26: Major country/regional currencies appreciation/depreciation over the period 2009 to 2024

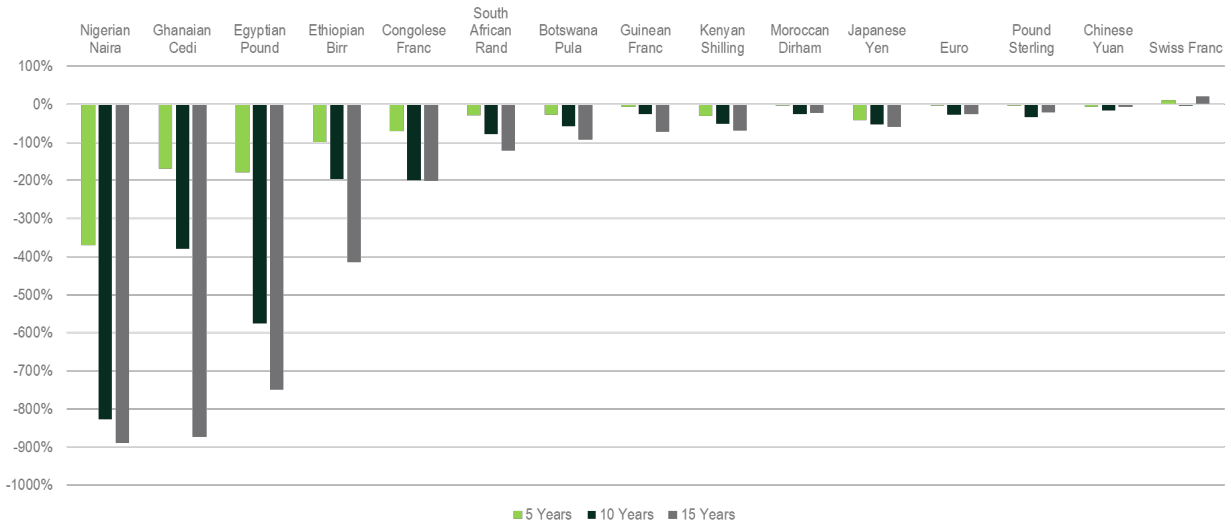


Source: EquityRT, KPMG analysis

The graph above indicates the appreciation/depreciation of five hard currencies to the US Dollar over 5, 10, and 15 years. These include the Japanese Yen, Euro, Pound Sterling, Chinese Yuan, and Swiss Franc.

- The hard currencies also generally depreciated against the US Dollar over the three time horizons. When compared to the African currencies, however, the extent of the depreciation is far lower.
- The Swiss Franc was the only currency included in the analysis that increased in value against the US Dollar over the 15 and 5-year periods.

Figure 27: Comparison of the extent of appreciation/depreciation of African country currencies to hard currencies



Source: EquityRT, KPMG analysis

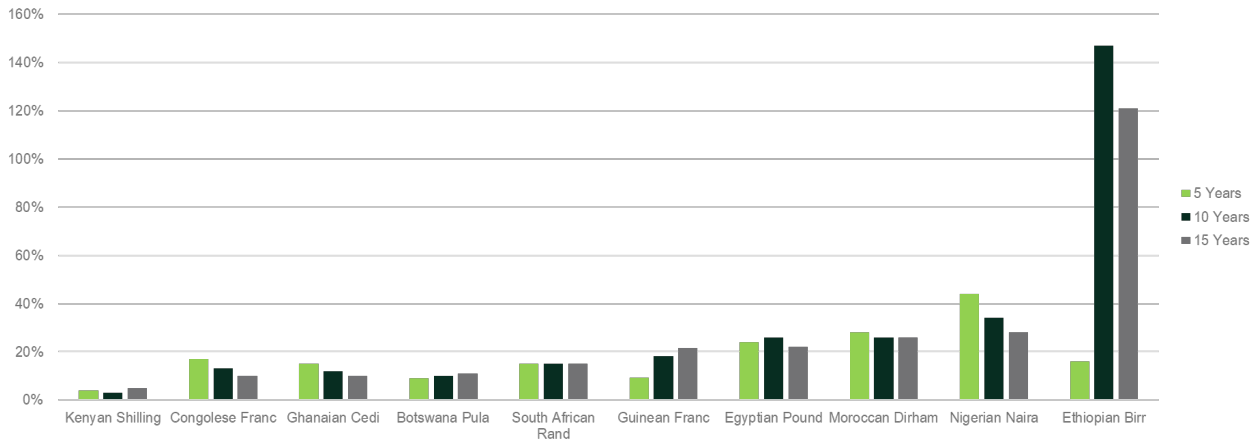
The African currencies experience significantly larger depreciation to the US Dollar, when compared to the hard currencies over the three periods analysed. The Naira and Cedi depreciated by more than 800%. In contrast, the hard currencies depreciated by less than 50% over the same period.

The analysis above highlights the problem many African economies have when attempting to service Hard currency loans using depreciating local currency payments. The value of the repayments in local currencies depreciates faster compared to the hard currencies of the lenders, therefore increasing the repayment burden, and reducing the ability of the borrower to service that loan.

4.4.2.2 Volatility

The currency volatility assessment serves as an essential measure for identifying investment risks over time due to the uncertainty associated with the value of that currency at any future period. Currencies with lower volatility offer more stability over time, while more volatile currencies present considerably more risk. Understanding currency volatility would be important to determine the currency risk that could be managed through a value-retaining basket of commodities.

Figure 28: African country currency volatility



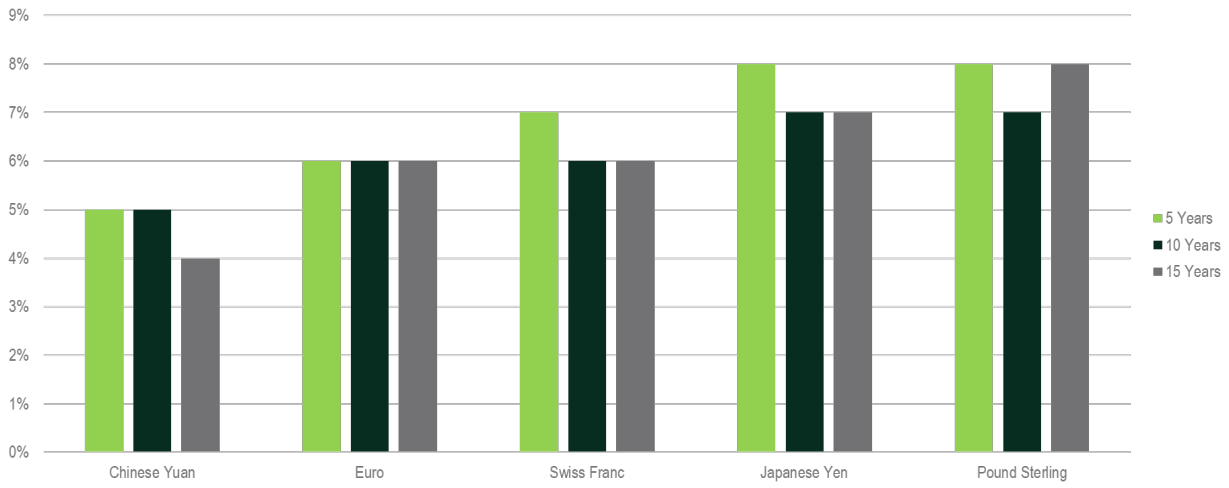
Source: EquityRT, KPMG analysis

Analysing the volatility of the African currencies over the periods of 5, 10, and 15 years, indicates a range of outcomes.

The volatility of African currencies tends to be stable over the three-time horizons, with the exception of the Ethiopian Birr.

- The measured volatility for the African currencies of around 20% indicates a relatively higher level than the 8% for the hard currencies over the three time horizons.

Figure 29: Hard currency volatility

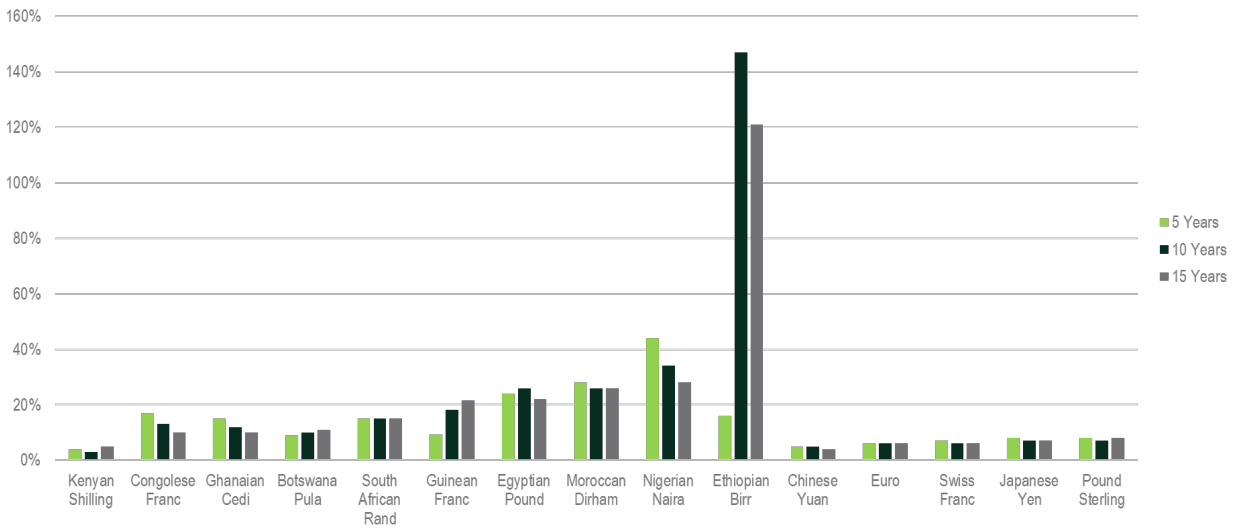


Source: EquityRT, KPMG analysis

The graph above presents the volatilities of the hard currencies over the periods of 5, 10, and 15 years.

- The hard currencies have stable volatilities of around 8%.

Figure 30: Comparison of African to Hard currency volatility



Source: EquityRT, KPMG analysis

The hard currencies display a considerably lower level of volatility, when compared to African currencies.

4.4.2.3 Summary

African currencies experience a larger rate of depreciation over time, along with higher volatility than the hard currencies. The Nigerian Naira experiences the highest rate of depreciation, whereas the Moroccan Dirham experienced the least. In terms of volatility, the Ethiopian Birr experienced significant fluctuation, while the Kenyan Shilling proved to be the least volatile.

The hard currencies generally experience a lower rate of depreciation and lower volatility than the African currencies over the three periods.

4.5 Commodity basket construction

The development of a diversified collection of commodities or commodity basket that retains, or even gains, value over time and has low volatility can play a pivotal role in providing a store of value that can be used to facilitate development financing.

Three distinct commodity baskets were constructed to assess different levels of diversification that can be achieved from combining alternate combinations of commodities. The three baskets are defined as follows:

Table 6: Commodity baskets

Basket #	Description of Commodity Basket
1	Critical minerals and low carbon minerals.
2	Critical minerals, low carbon minerals, and Industrial metals.
3	All commodities.

Each basket contains the same proportion of the component commodities at inception, ensuring balanced exposure and minimising the risk associated with any single commodity. The portfolio inception date was the 1st of January 2013.

4.5.1 Methodology applied to determine the basket composition

The selection of the above three portfolios reflects strategic choices, based on the essential role these commodities play in renewable and low carbon energy production and storage, along with the search for the most diversified and stable combination of commodities.

The data used for this analysis includes daily price data for all commodities considered, from 2013 to 2024.

4.5.2 Analysis of commodity baskets

4.5.2.1 Components of commodity baskets

The critical mineral and low carbon basket consists of the following commodities:

Figure 31: Basket options

Critical minerals + low carbon basket	
Platinum	Nickel
Copper	Uranium
Cobalt	Zinc
Manganese	

Critical minerals are essential for several high-tech industries and the transition to renewable energy sources. These minerals are crucial for manufacturing batteries, electronics, and green technologies such as electric vehicles and renewable energy infrastructure. The increasing demand for these applications makes critical minerals a strategic choice for a growth-oriented basket.

The critical mineral and low carbon and industrial metals basket includes all the critical and low carbon minerals plus:

Critical mineral + low carbon and industrial metals basket
Tin
Lead
Palladium

By adding industrial minerals like tin, lead and palladium, this portfolio aims to diversify further while still focusing on materials essential for green-energy transition, industrial and technological applications.

This basket includes all the critical and low carbon mineral plus industrial metals plus:

All commodities	
Gold	Natural gas
Silver	Coal
Crude oil	

This diversified portfolio encompasses a broad range of commodities, including precious metals, fossil fuels, critical minerals, and industrial metals. Gold and silver are traditional safe-haven investments and store of value. Crude oil, natural gas, and coal are fundamental traditional energy sources, critical for global energy markets and economic activity.

Basket	Value growth %	Volatility %
Critical and low carbon mineral	10.5	2.5
Critical and low carbon + industrial minerals	10.9	2.7
All commodities	10.3	3.3

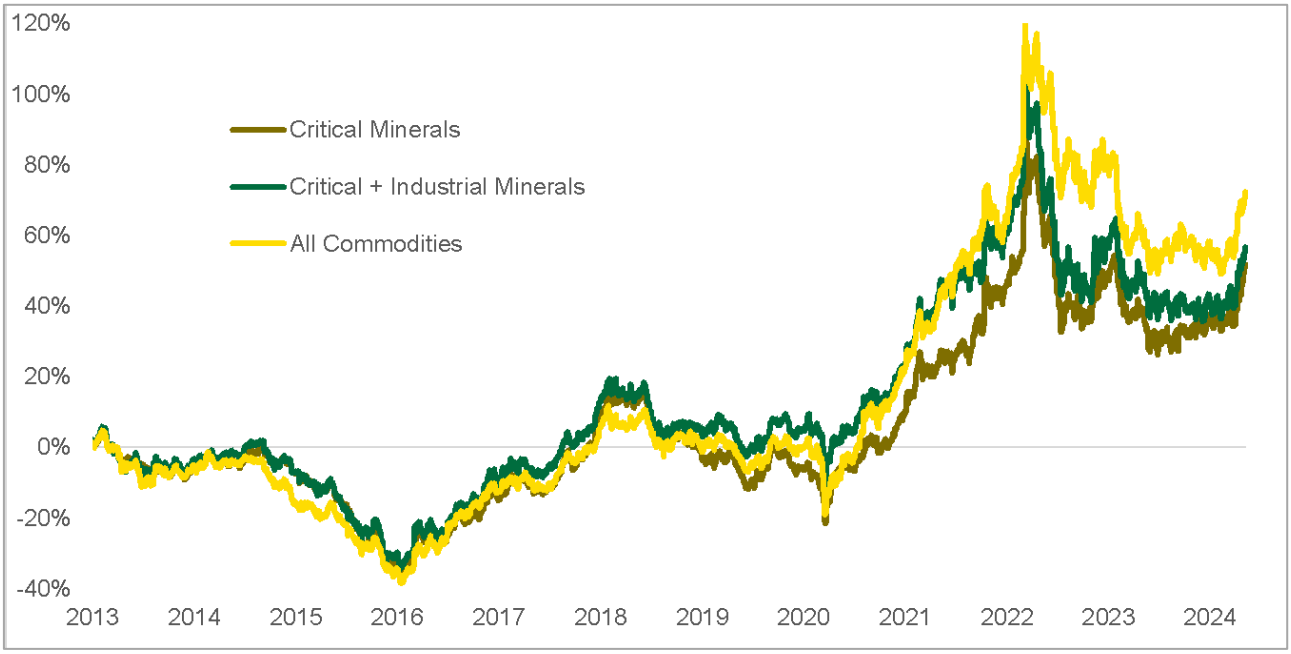
The critical and low carbon minerals basket focuses on stability and steady growth, with a relatively low volatility of 2.5% and an average growth in value of 10.5% per year. The low volatility indicates that the portfolio is less susceptible to market fluctuations.

Adding industrial minerals to the basket leads to a marginal increase in both volatility and value growth, compared to the critical mineral's portfolio. The volatility of 2.7% is still relatively low, indicating a stable investment. The average growth in value of 10.9% per year suggests that the inclusion of industrial minerals and palladium enhances growth potential without significantly increasing risk.

The addition of a broader range of commodities increases the basket's volatility further to 3.3%, reflecting greater exposure to market dynamics and fluctuations in commodity prices. The average growth in value decreases marginally to 10.3% per year. This indicates that, while the portfolio contains more components and is more diversified, the inclusion of precious and energy commodities does not add any additional portfolio benefits in terms of growth in value or reducing the volatility.

4.5.2.2 Commodity portfolios

Figure 32: Realised change in value of all three commodity baskets



Source: EquityRT, KPMG analysis

- All three baskets experienced significant volatility, particularly around the years 2015-2016 and 2020-2021.
- The critical and low carbon minerals, including industrial metals baskets, move in tandem, with the All commodities basket showing similar but more pronounced movements.

The increase in volatility and subsequent lower performance around 2020-2021 reflects the COVID-19 pandemic period, where commodities experienced significant price fluctuations based on changing global growth prospects.

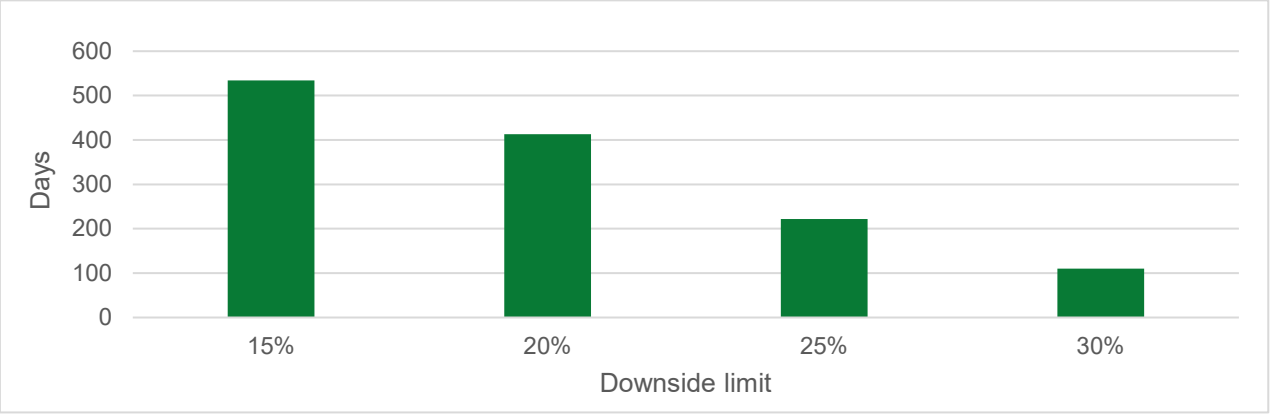
4.5.2.3 Downside analysis

The downside analysis aims to assess the absolute percentage loss of value of the basket, as well as the number of days that the basket remains below its initial or face value. The percentage loss limits were set in a range between

15% as the lowest limit and 30% as the upper limit, in anticipation of a potential haircut value set within the same range.

The analysis was performed using the three commodity baskets defined above, using data covering a ten-year period, from 2013 to 2024.

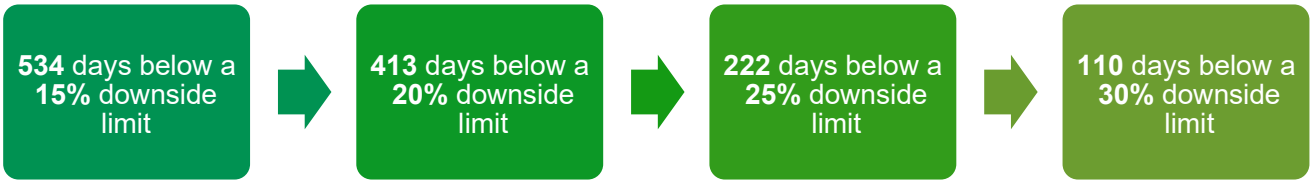
Figure 33: Bar chart of days below specified downside limit



Source: EquityRT, KPMG analysis

The figure above indicates that the basket had a period of around 530 days during which its value was 15% below its face or initial value. It also indicates that the same basket had a period of 110 days during which its value was 30% below its face or initial value.

The implication of the analysis is critical to estimate the potential duration of loans that could be set under the currency convertibility mechanism, and to set limits as well as haircut percentages[27] into the commodity management framework agreement.



With a 20% haircut, and assuming that the portfolio will not experience downside below 30% for more than four months, the maximum loss that could be experienced by counterparties will be the difference between the maximum downside loss of the portfolio and the haircut, in this case a maximum loss of 10%.

4.6 Commodity basket performance analysis

4.6.1 Analysis of results

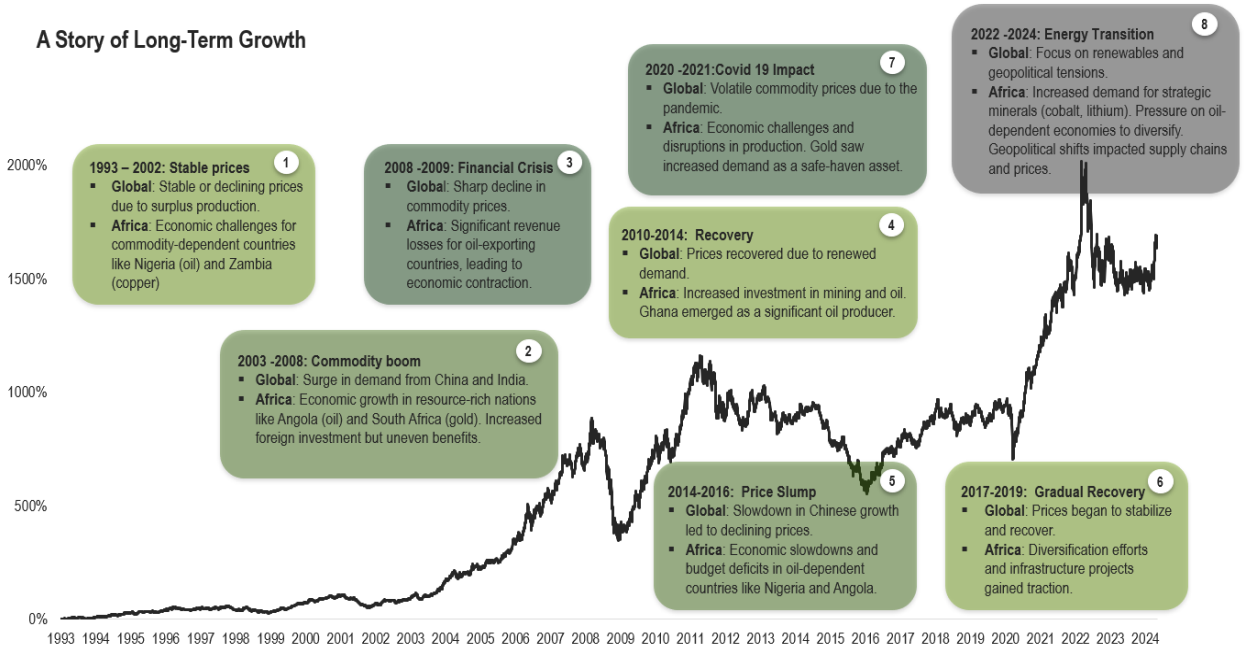
4.6.1.1 Long term growth of commodities

The history of commodity prices over the past few decades tells a compelling story of economic ebbs and flows shaped by global events, a global pandemic, and regional supply and demand dynamics. This period has seen significant shifts, from stable prices to dramatic booms and slumps, each leaving a lasting effect on economies worldwide, particularly in Africa.

The trajectory of these commodity prices reflects the changing demand and production capacities and underscores the intricate linkages between global market trends and the economic health of commodity-dependent nations. This overview outlines the key phases of commodity price movements from 1993 to 2024, illustrating how global developments and regional responses have intertwined to shape the economic landscape.

[27] The reduction in the stated value of an asset

Figure 34: Commodity basket long-term growth



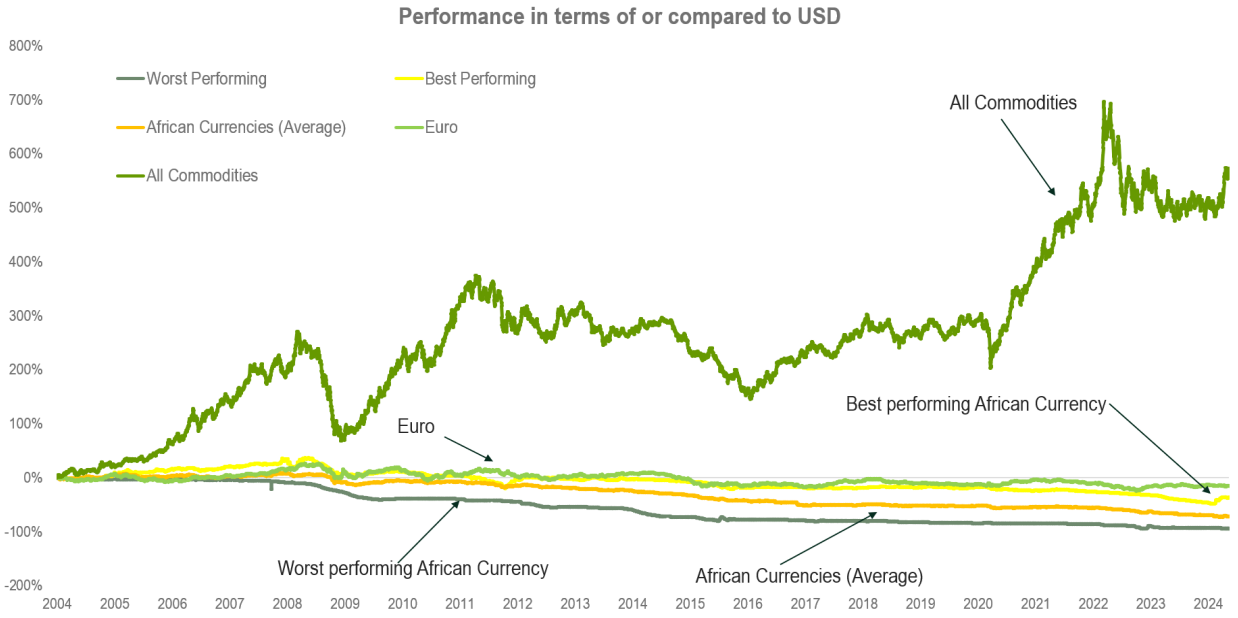
Source: EquityRT, KPMG analysis

- From pre-2003, commodity prices were either stable or declining, challenging African economies dependent on exports like Nigeria and Zambia.
- The 2003-2008 commodity price boom, driven by China's industrial growth, boosted prices and benefited resource-rich African nations.
- The 2008-2009 global financial crisis caused a sharp decline in commodity prices, significantly affecting commodity exporting economies. A recovery period (2010-2014) saw rising commodity prices and increased investment in the extraction industry.
- A 2014-2016 price slump, due to China's economic slowdown, strained fiscal positions in oil-exporting African countries. From 2017-2019, gradual price recovery and economic diversification efforts began stabilising African economies.
- The COVID-19 pandemic (2020-2021) caused commodity price volatility and fiscal strain due to the unforeseen additional health and social expenditures along with a reduction in tax revenues due to economic lockdowns in many sectors of the economy.

The 2022-2024 focus is on the growth and roll-out of renewable energy, driven by climate change, the desire for energy independence and geopolitical shifts like Russia's invasion of the Ukraine. This has led to increased demand for critical and low carbon minerals like Copper, Cobalt, Manganese, Bauxite, Uranium, and Lithium, etc.

4.6.2 Currency versus commodity basket performance

Figure 35: Performance of commodity basket vs currencies



Source: EquityRT, KPMG analysis

The commodity basket significantly outperformed both African and hard currencies over the period 2004 to 2024, peaking at around 700% above the baseline before stabilising at 500%-600% despite noticeable volatility with peaks in 2008, 2011, and 2022 and troughs in 2009, 2016 and 2020.

The Euro showed relative stability but limited growth, fluctuating close to the baseline with minor deviations and a 14% overall loss in value against the dollar over the period.

African currencies experienced substantial losses against both the commodity basket and the US Dollar, with the worst performing at -94%, the average at -71%, and the best at -35% over the period.

4.7 Conclusion

The assumption that a basket of commodities comprising critical minerals found on the African continent could hold value better than any African currency was confirmed, based on the analysis conducted using historical commodity and currency data contained in this section.

The historical analysis showed a better-than-expected result, with a commodity basket composed of critical minerals showing growth of more than 600% between 2004 and 2024, while a basket of African currencies experienced a depreciation of more than 50% over the same period.

The downside analysis, which is critical in setting haircut ratios and understanding the operational duration of the proposed mechanism, was performed on a set of commodity baskets over a period of ten years. The finding was that, with a 20% haircut, and assuming that the portfolio does not experience downside movements below 30% for more than just a couple of months, the maximum loss that could be experienced by counterparties will be the difference between the maximum downside loss of the portfolio and the haircut, which in this case is 10%.