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ASSESSMENT OF POLICY OPTIONS TO REDUCE THE IMPACT OF COMMODITY PRICE VOLATILITY ON THE NAMIBIAN ECONOMY

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A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Engineering

Johannesburg, 2022

DECLARATION

I declare that this research report is my own unaided work. It is being submitted to the Degree of Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University. I have read the University policy on plagiarism and hereby confirm that no plagiarism exists in this research report. I also confirm that there is no copying, nor is there any copyright infringement. I willingly submit to any investigation in this regard by the University of the Witwatersrand, and I undertake to abide by the decision of any such investigation.

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ABSTRACT

Namibia is considered a mineral-dependent country because the country's mineral commodities exports constitute about 50 percent of the country's total tangible exports. This makes the mining industry a significant contributor to the Namibian national revenue and gross domestic product. Unfortunately, the industry's contribution to the Namibian revenue has been inconsistent over the 19 past years (2000-2018). In 2007, the total tax paid to government by the industry was N$1.7 billion whilst the contribution in 2009 was only N$1 billion; a significant 41 percent drop. In 2013, the total tax paid to government was N$ 0.9 billion this increased to N$ 3.5 billion in 2018, a significant 74 percent increase (Chamber of Mines of Namibia, 2020).This inconsistent contribution is mainly attributed to the intrinsic volatility of mineral commodity prices, which makes the Namibian economy vulnerable due to the economy's dependency on minerals.

It was therefore the aim of this research to find suitable policy options which can lessen the impact of commodity price volatility on the Namibian economy. To achieve this, the research analysed five policy options which are commonly used to reduce the impact of commodity price volatility. The requirements, advantages, and disadvantages of each policy options were reviewed. Also, a strength, weakness, opportunities, and threats (SWOT) analysis of the Namibian economy was conducted. To evaluate the five policy options, a multi-criteria decision-making analysis approach was done using four criteria which are acceptability, cost, practicality, and effectiveness. The policy options' requirements, advantages, and disadvantages together with the Namibian economy's SWOT analysis were inputted into a matrix. Finally, the policy options were ranked according to the criteria.

The research found that revenue management and revenue insurance were the top two policy options suitable for the Namibian economy. The research recommends that the Namibian government implement these policy options. The research also recommends possible operational frameworks for the top two ranking policy options for four core Namibian minerals selected for

analysis. The frameworks require the Namibian government to use adequate reserves and SBI metrics to determine an economically viable year to set up a sovereign fund. The insurance scheme insures the core minerals identified using their contribution to mineral exports. The contribution to the sovereign fund and insurance scheme to be activated when the mining industry surpasses the budgeted revenue by 26 percent. The 26 percent is the average amount by which the actual revenue surpasses the budget revenue for the period that was under study (2000-2018). The withdrawal from the sovereign fund is to be activated when the actual revenue from the mining industry experiences a shortfall from the budgeted amount by 26 percent. The withdrawal condition for the insurance scheme was made specific to each mineral, where a withdrawal was activated when the current year's total export value for the minerals experience a shortfall lower than the average percentage change in the value of mineral exports when compared to the previous year's export value.

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- The University of the Witwatersrand School of Mining Engineering staff members and fellow postgraduate colleagues for their assistance and support during my studies; and
- My family and friends for their words of encouragement and support during my studies.

DEDICATION

This research report is dedicated to my son Andreas Nekwaya Halukeni Shitaatala, my parents Andreas Mutimili and Melania Mutimili and my siblings; Atanasius Mutimili, Adelinus Mutimili, Adelina Mutimili, Albinus Mutimili, Anna Mutimili and Apornia Mutimili.

LIST OF ACRONYMS

BoP	Balance of Payments
COVID-19	Coronavirus Disease of 2019.
CFF	Compensatory Finance Facility
CPVPO	Commodity Price Volatility Policy Options
CSR	Corporate Social Responsibility
FDI	Foreign Direct Investment
FLEX	Fluctuation in Export Earnings
GDP	Gross Domestic Product
GNP	Gross National Product
ICA	International Commodity Agreements
IFSWF	International Forum of Sovereign Wealth Funds
IMF	International Monetary Fund
MCI	Mining Contribution Index
MDFN	Mineral Development Fund of Namibia
MTEF	Medium-Term Expenditure Framework
NRF	National Revenue Funds
OPEC	Organization of the Petroleum Exporting Countries
SACU	Southern African Customs Union
SBI	Sustainable Budget Index
SWF	Sovereign Wealth Funds
SWOT	Strengths, Weaknesses, Opportunities, Threats
STABEX	Systéme de Stabilisation des Recettes d’Exportation

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1 INTRODUCTION

1.1 Research background

1.1.1 Contribution of the Namibian mining industry to GDP

Namibia is known to be richly endowed with mineral resources. Minerals mined in the country include diamonds, uranium, precious metals, base metals, gemstones, dimension stone and industrial minerals (Ministry of Mines and Energy, 2003). Namibia has the richest alluvial diamond deposits and is the fourth largest exporter of uranium in the world, providing 10 percent of the world's uranium mining output (Dzinomwa, *et al*., 2021).

In 2003, the Ministry of Mines and Energy labelled the mining of minerals as the bedrock of the country's economy. According to Nambinga & Mubita (2021), the mining industry remains the backbone of the Namibian economy based on its contributions to the country's gross domestic product (GDP); annual economic growth; employment creation and skills development; export earnings; and government revenue collection.

Over the years since Namibia gained independence in 1990, the mining industry has made significant contributions to GDP as compared to other sectors in the primary industry. During the period of 2017 and 2018, the contribution from other economic sectors dropped, but the mining industry maintained an above average contribution, contributing 14 percent of the country's GDP in 2018 (Nambinga & Mubita, 2021).The mining industry has an average contribution of 10 percent to GDP (Mwinga, *et al*., 2020). The mining industry's significant contribution to GDP can be observed in Figure 1 which depicts the historic percentage contributions to GDP by the different mineral commodities and the overall contribution from mining.

From 1990 to 2000 the mining industry was disaggregated into two sub-sectors: diamonds mining and other mining & quarrying. After 2000, the 'other mining & quarrying' subsector was divided into uranium, and metal ore subsectors.

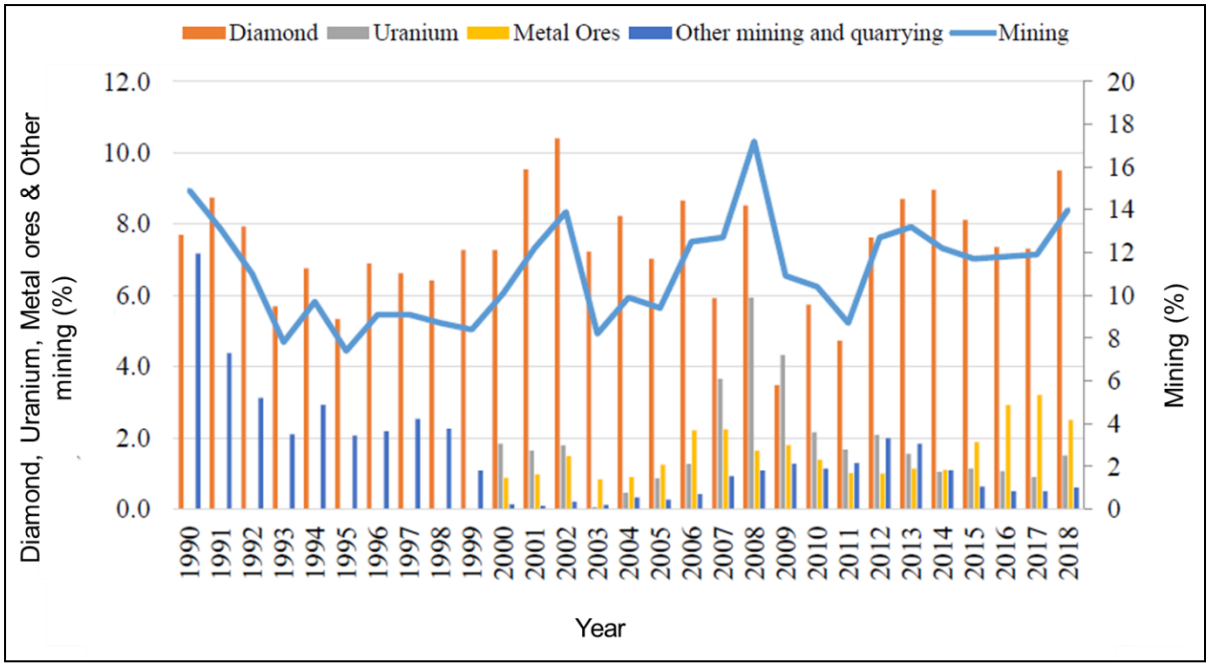


Figure 1: Contribution of the Namibian mining industry to GDP

(Nambinga & Mubita, 2021)

Figure 1 shows that diamonds contribute the highest percentage within the industry followed by uranium. Diamonds have always contributed more than 'other mining and quarrying' from 1990 to 2018. Figure 1 also shows that a large portion from the 'other mining & quarrying' subsector is contributed by uranium which became more visible as from 2000. The figure shows that that although the mining industry's contribution to GDP is significant it is not stable.

Nambinga & Mubita's (2021) mentioned that the mining industry's contributions are unstable and low despite the increase in total revenue generated from the industry in terms of GDP. These findings are not new as Simonis Storm (2019) came to the same conclusion and attributed the instability and low contribution to the fluctuation of mineral commodity prices.

1.1.2 Contribution of the Namibian mining industry to employment and skills

The mining industry is not the biggest employer in the Namibian economy, but it contributes significantly to the livelihood of Namibian citizens. Firstly, because it is one of the sectors with very good remuneration and secondly, because of the sector's industry multiplier factor (Nambinga & Mubita, 2021). Mines on average employ between 5000 to 10 000 permanent employees; the direct employment figures

increase to about just over 16 000 employees when temporary and contactors are added (Malango, 2017, 2018). According to Malango (2017, 2018), the mining industry's industry multiplier factor is 7. This means that over 112 000 people are directly and indirectly reliant on income from the mining industry. Figure 2 shows the permanent employment figures in the mining industry.

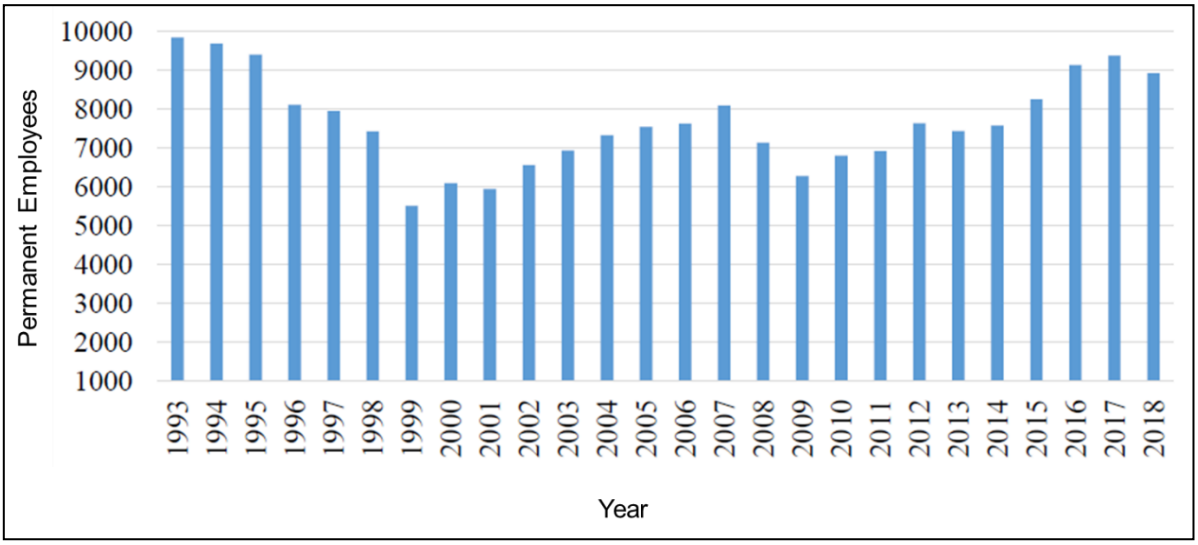


Figure 2: Mining industry permanent employment

(Nambinga & Mubita, 2021)

Figure 2 displays how the industry's contribution to employment has been changing over the years. After the drop in employment in 1999, there was a sharp increase from 2000 to 2007. However, a declined followed immediately from 2008 to 2009. Nambinga & Mubita (2021) mentioned that the cause of the drop in employment numbers from 2008 to 2009 was due to the closure of some mines or reduced operations during the wake of the global financial crisis that lead to reduced mineral commodity prices. The employment numbers however picked up again from 2010 to 2017 as new mines opened (Nambinga & Mubita, 2021).

Apart from job creation, the mining industry supports surrounding communities by investing in skills development. This has added tremendous value to the Namibian economy by increasing the number of local skilled labour. The mining industry spent over N$171 million on corporate social responsibility and skills development during the period 2016 to 2017 (Malango, 2017, 2018).

1.1.3 Contribution of the Namibian mining industry to tax revenue

The mining industry is a key source of government fiscal receipts through mining taxes (corporate tax and royalties) and export levies (Nambinga & Mubita, 2021). Mineral royalties are payments made for the minerals extracted from the land and sold on the markets to the holder of the mineral rights usually this is the government of the country (Cawood & Minnitt, 2001). The mining industry contributed about N$5.18 billion in 2018. Figure 3 shows the revenue generated by the mining industry and the revenue the mining industry paid the government of Namibia over the period 2012 to 2018.

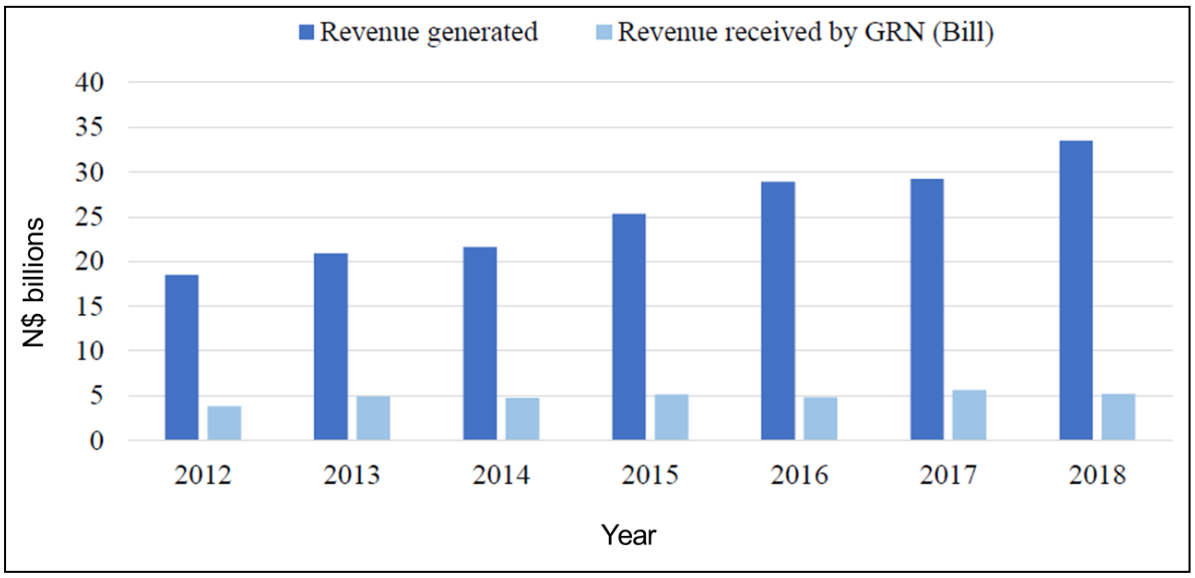


Figure 3: Contribution of mining to the Namibian government revenue

(Nambinga & Mubita, 2021)

Figure 3 shows that the revenue generated by the mining industry was increasing whilst the revenue the government received from the industry was almost constant. This shows that the total government revenue from the mining industry is not always proportional to the total revenue generated by the industry. This is because government receives payment from mining companies in the form of royalties, export levies and corporate taxes. Since royalties and export levies are paid based on the production of mines, this means that when production decreases so does the revenue mining pays to the government and vice versa. However, corporate tax is paid based on profits from mining companies after all their expenses have been deducted. Revenues are largely impacted by commodity price unlike corporate tax which is based on the profits of mining companies. If prices are volatile, the revenue generated by the industry and paid to government will also be unstable (United Nations

Development Programme, 2011). This is the reason total government revenue from the mining industry is not proportional to the total revenue generated from the mining industry (Nambinga & Mubita, 2021).

1.1.4 Contribution of the Namibian mining industry to exports

According to the Chamber of Mines of Namibia (2018), over 50 percent of Namibia's exports are minerals. The proceeds from exports of minerals are a major source of the Namibian government's revenue which confirms the significant role the mining industry plays in the Namibian economy (Chamber of Mines of Namibia, 2018). This introduces a reliance of the Namibian economy on mineral exports. According to Ribeiro *et al.* (2012), this situation is not unique to Namibia. Their work showed that some economies of mineral resource host countries are dependent on mineral exports. However, they indicated that this is not the case for all mineral host countries, which bring forth the question of how exactly a country's dependence on mineral exports is determined. According to Haglund (2011), a mineral export dependent country is defined as a country whose minerals contribute at least 25 percent to the country's tangible exports. Therefore, based on this definition, Namibia is a mineral-dependent country since the country's export share is at least 50 percent which exceeds the 25 percent benchmark. The Namibian mineral and non-mineral contributions to exports from 2002 to 2019 are depicted in Figure 4.

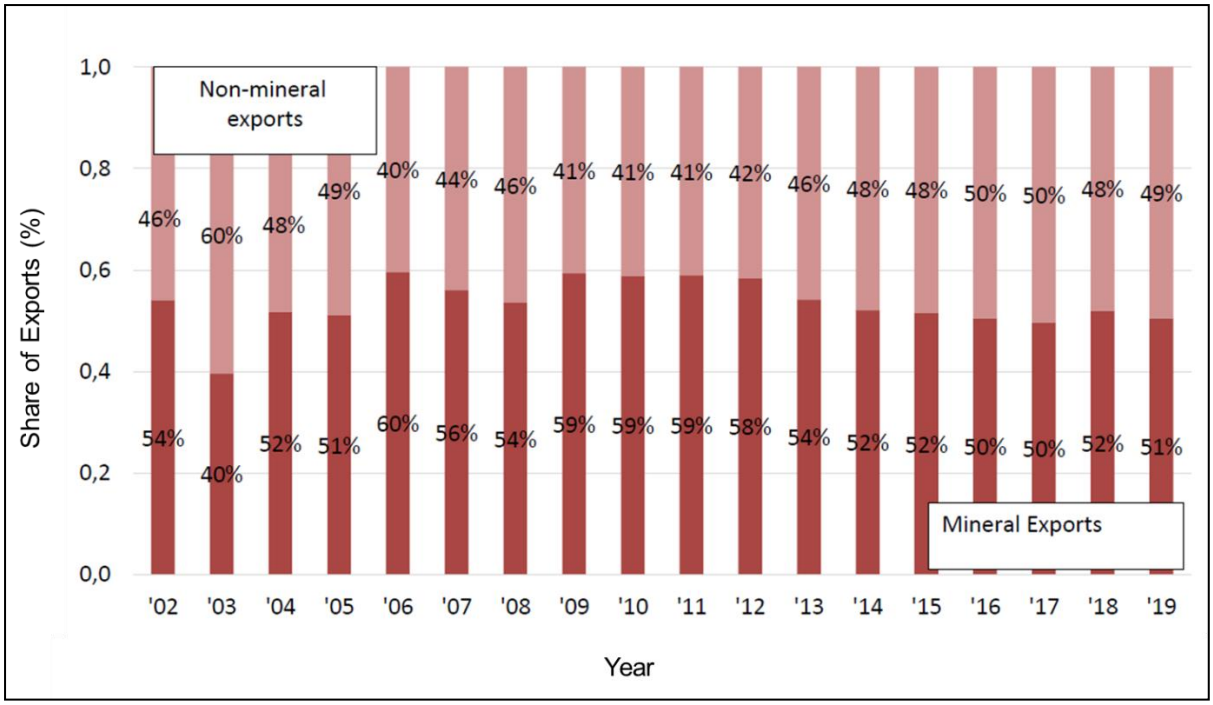


Figure 4: Namibia's mining share of exports

(Chamber of Mines of Namibia, 2020)

Figure 4 shows that over the period 2002 to 2019, minerals contributed between 40 to 60 percent to the total Namibian exports making Namibia a mineral-dependent country. The United Nations Development Programme (2011) found that high dependency on mineral commodities exports makes a country vulnerable to mineral commodity price shocks. Commodity price shocks happen when over a short span of time the prices for commodities radically decrease or increase. Varying commodity prices have a negative impact on both mining companies and mineral-dependent countries. For the mining company, a commodity price drop threatens the mining company's income (Page & Hewitt, 2001). Nambinga & Mubita (2021) found that this partly puts mining companies under pressure as their production costs remain constant but the price for selling the mineral commodity, they produce is low, at times the price is lower than the cost of producing the commodity. This can force the mining companies to implement cost reduction strategies to survive amidst the reduced commodity prices. One of the strategies is retrenchment of workers (Nambinga & Mubita, 2021 and Malango, 2017) which has a negative impact on the living standards of workers and increases unemployment rate in the country.

For a mineral-dependent country, mineral commodity price drops negatively affect the profit share taken by government. This is because low mineral commodity prices lead to the reduction of mining companies' incomes which translates into a reduction taxes the government receives from mining companies (Conradie, *et al*., 2016). This situation becomes worse when the mineral-dependent country's economy is not diversified because the volatility in mineral commodity prices leads to volatility in the country's revenue. Given that in such a country the mining industry contributes a substantial amount to the national revenue, the volatility of national revenues makes it difficult for governments to do fiscal planning, particularly planning for sustainable social and economic development programmes (Chen, 2010).

Variations in commodity prices cause the earnings generated from the Namibian mineral exports to be unstable (United Nations Development Programme, 2011). This has an impact on the growth of the mining industry in terms of the real value the industry adds to the national economy. Real value added is the value contributed by the mining industry towards the national economy. It is calculated by subtracting the value of intermediate consumption from the output (Douglas, 2006). The Chamber of Mines of Namibia (2017) mapped the relationship between mining industry growth and commodity price index and found that the growth of the mining industry is directly proportional to mineral commodity prices. The mining industry growth was calculated as the difference in the value added between the two years being evaluated. Commodity price index was calculated as the weighted average of the price of the mineral commodities mined in Namibia (diamonds, uranium, metal ores, mining and quarrying) relative to their prices for a chosen based year (Chamber of Mines of Namibia, 2017). The relationship between the real value added by the mining industry to commodity price index is depicted in Figure 5.

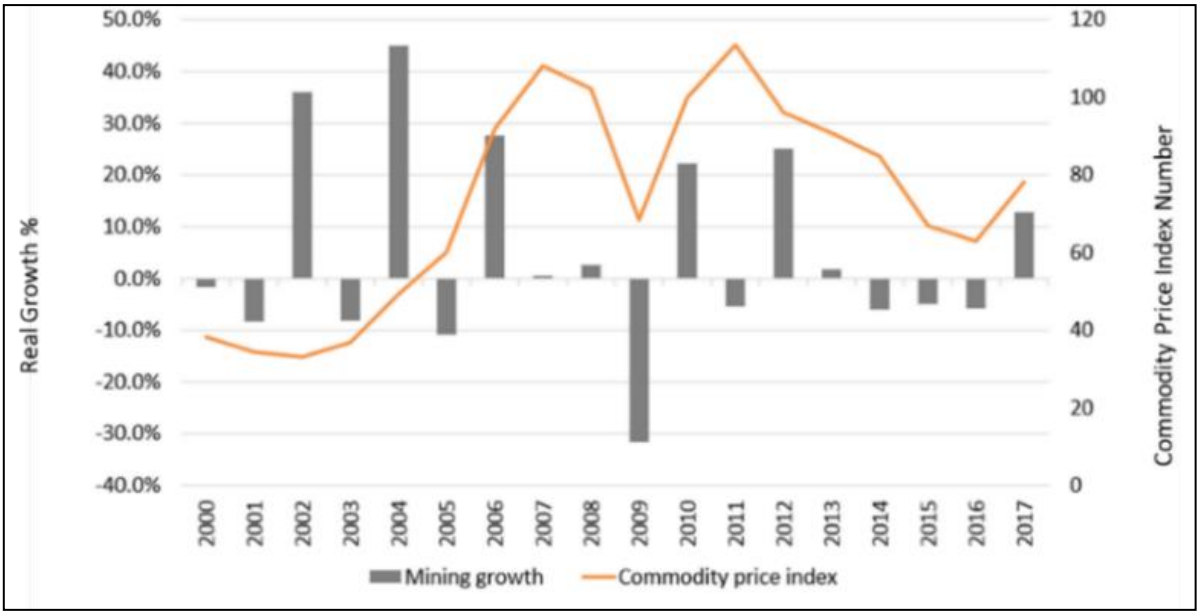


Figure 5: Namibian mining industry growth by real value added and commodity prices

(Chamber of Mines of Namibia, 2017)

Figure 5 shows that for the years, 2000 to 2003 commodity price index was low, but some growth was experienced in 2002 because the impacts of low commodity prices were cushioned by long-term contracts and investments in new mining projects. The new projects of Swakop Uranium and B2Gold mines caused an increase in production (Nambinga & Mubita, 2021). Increased production outputs yielded more revenues for mining companies shielding the economy against the impacts of falling commodity prices (Chamber of Mines of Namibia, 2017).

During the wake of the global financial crisis in 2009, prices for diamonds and uranium dropped significantly. The diamonds price index fell by about 12 percent from 124.1 in 2008 to 109.5 in 2009 (Golan, 2016). According to Duddy (2009), in the first quarter of 2009 earnings from diamonds exports were N$430 million compared to N$1.8 billion in the last quarter of 2008. In 2009, production of diamonds contracted by 58.2 percent while diamonds exports fell by as much as 30 percent when compared to 2008 (Bank of Namibia, 2010; Duddy, 2009). This shows the extent to which the global economic crisis affected diamonds mining and diamonds price. The drop in prices had significant negative impacts on the Namibian economy since diamonds and uranium are the top two minerals that contribute significantly to the country's economy as shown earlier in the report.

In the same year (2009), the price of uranium dropped by about 71 percent from a peak of USD140/lb in 2007 to USD40/lb. The plunge in uranium price and the reduced sales of diamonds due to the global economic crisis caused the total tax revenues paid to government from mining companies to drop from N$1.7 billion in 2007 to N$1 billion in 2009 (Chamber of Mines of Namibia, 2008, 2010). The total tax reveue paid to the Namibian government did increase over time as the uranium and diamond prices started to increase.In 2013 the total tax paid to government was only N$ 0.9 billion but this increased to N$ 3.5 billion in 2018 (Chamber of Mines of Namibia, 2020).The mining industry has been one of the largest contributors to GDP growth of Namibia over the years as indicated in Figure 6.

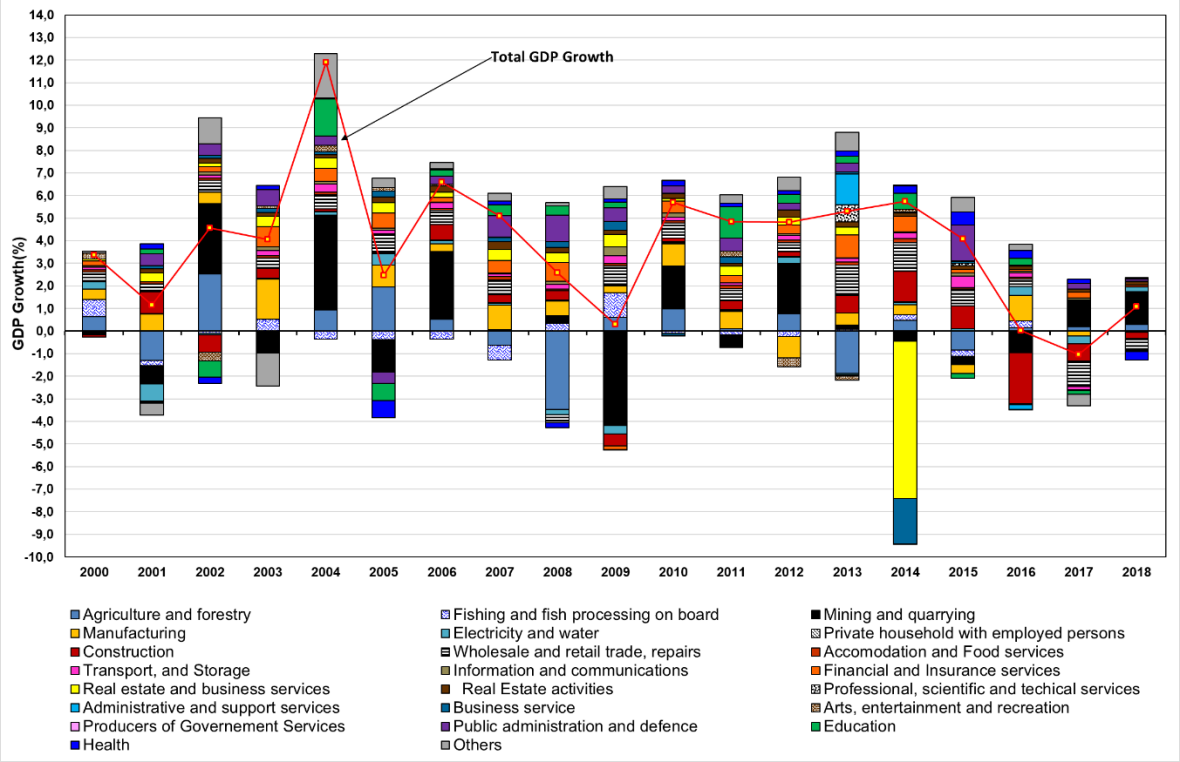


Figure 6: Contribution of each economic sector to real GDP growth (Percent)

(International Monetary Fund, 2016; Namibia Statistics Agency,2012; 2015; 2020)

Figure 6 shows that between 2004 and 2006, the mining industry contributed more to GDP compared to other years. The Chamber of Mines of Namibia (2008) attributed this to the uranium and diamond price boom which caused mines to ramp up production. Nakale (2016) found that increased prices for uranium and diamonds led to increased mining production. This in turn resulted in an increase in mining

companies' revenue enabling them to pay more taxes during the period of 2004 to 2006 as indicated in Figure 6.

The work done by Gijsberts *et al.* (2018) and International Monetary Fund (2016) found a directly proportion relationship between commodity prices and the real GDP growth of Namibia. Their work also showed that the mining industry's contributions to real GDP are unstable. Simonis Storm (2019) attributed this instability to the fluctuating commodity prices on international markets. All Namibian minerals are sold on international markets which are subject to commodity price volatility. As mentioned earlier in the report, the Namibian economy is dependent on export of mineral commodities. Therefore, given the impacts of commodity price volatility, mitigation strategies are needed to manage the commodity price volatility. This will ensure that the country's economy is cushioned from the volatility thereby maximising benefits from the export of the mineral commodities. There are various policy options that mineral-dependent countries can implement to mitigate commodity price volatility. These include financial instruments such as compensatory finance and insurance; market-based price risk management tools such as hedging; fiscal buffers such as national revenue management to absorb shortfalls commodity revenue and supply management.

1.2 Problem statement

As discussed in Section 1.1, Namibia's economy is dependent on the export of mineral commodities. This dependence makes the economy vulnerable as minerals are sold on international markets where commodity prices fluctuate. A decline in commodity prices translates into a decline in the mining industry's revenue, which also lead to reduced employment, and mining's contribution to the national revenue as discussed in Section 1.1. When commodity prices fell in 2009, the total mineral exports dropped by 5 percent, the mining industry's contribution to GDP dropped by 6 percent and the real value added by the mining industry dropped to -30 percent causing the national GDP growth to fall to -0.6 percent. While international markets determine commodity prices, it is essential to assess policy options that can be implemented to reduce the impact of commodity price volatility on the Namibian economy.

1.3 Research aim and objectives

The aim of the research was to assess policy options that can be implemented to mitigate the impacts of commodity prices volatility on the Namibian economy. The objectives of this research were to:

- Provide an overview of policy options as well as their enablers from literature;
- Identify Namibian's critical minerals and determine their price volatility;
- Analyse the current legislative instruments in Namibia and explore whether they cater for policy options;
- Analyse the impact of the Namibian mining industry on the country's economy and perform a strength, weaknesses, opportunities, and threats (SWOT) analysis of the Namibian economy; and
- Assess and suggest suitable policy options to reduce impact of commodity price volatility on the country's economy.

1.4 Research motivation

As mentioned in previous sections of this report, the mining industry is a significant contributor to the economy of Namibia in terms of export earnings, tax revenue, employment, and GDP. However, despite this significant contribution, the monetary value contributions to the economy have been volatile over the years due to fluctuating prices on international markets (Wakeford, 2017; Workman, 2020). The volatility has two major impacts on the government in terms of governance, national revenue, and economy.

The first major impact is that it obstructs the long-term planning of the national revenue as well as planning for sustainable social and economic development programmes. Secondly, it drives continued commodity dependency which leaves the Namibian economy vulnerable (United Nations Trade and Development Commission, 2019; Crawford *et al*., 2018). Therefore, an understanding of how the mining industry and the national economy are impacted by commodity price volatility is crucial as it can enable the government to select policy options that can reduce the impact. The policy options will not only help government stabilize the revenue from mining but will also assist in reducing the number of mines that would have normally close due to mineral commodity price drops. The policy options can secure the employment of the

Namibian citizens whilst safeguarding mineral rents to be used for development by the government.

1.5 Research scope and description

Literature has grouped the various instruments available to manage and mitigate commodity price volatility into five policy options, namely supply management, national revenue management, market-based price risk management tools, compensatory finance, and revenue insurance. This research focused on all the five policy options. The options were summarised into strength and weakness that were used as inputs in the Commodity Price Volatility Policy Options (CPVPO) matrix. The matrix score ranking was used to determine which of the five policies are best suited and applicable to Namibia. A framework was developed for the two policy options found to be suitable for Namibia. The research also assessed whether the current legislative instruments in Namibia make provision for policy options.

1.6 Report structure

The report is structured into six chapters. Chapter 1 provided the background about the importance of mining to the Namibian economy. It highlighted how mining impacts GDP, employment, national revenue, and exports. The chapter also provided the problem statement, research aim and objectives, research motivation and outlined the report structure. Chapter 2 defines mineral dependency, discusses the relationship between price volatility and risk, causes of mineral commodity price volatility, and mineral commodity price trends. The chapter also reviews literature on different policy options that are used to manage commodity price volatility.

Chapter 3 describes the research methodology used. The data, sources of data and minerals selected for this research are presented in this chapter. The chapter also presents the matrix that is used to evaluate the policy options through consolidating the multi-criteria analysis of risk management tools for policy options by Breen *et al.* (2013) and the evaluation guidelines from the Organization for Economic Co-operation and Development (2019). Chapter 4 discusses in detail the Namibian mining industry and its contribution to the national revenue, GDP, employment, fixed investment, exports, and corporate social responsibility. Chapter 5 evaluates the policy options. Conclusions and recommendations are provided in Chapter 6.

2 MANAGING COMMODITY PRICE VOLATILITY

2.1 Chapter overview

This chapter defines mineral dependency, outlines how a country is classified as being mineral dependent and looks at mining's relative importance to a mineral dependent country's economy by using the mining contribution index. It will also cover the drawbacks of mineral dependency. Commodity price volatility is discussed pertaining to how it leads to commodity price risk. The chapter further discusses the commodity price volatility causes. Commodity price trends and the need to manage commodity price volatility are also discussed in the chapter. Literature on available policy options is reviewed in the chapter. Each policy option is summarized in terms of the requirements, advantages, disadvantages, and existing practical applications. The different tools such as financial instruments, market-based price risk management tools and fiscal buffers available for use under each policy options will be studied in this chapter. Lastly, the chapter reviews existing legislative instruments available in Namibia to analyse whether they make provisions for possible implementation of the policy options.

2.2 Commodity dependent country

A commodity is a tangible item produced for commerce and it may be bought or sold. Commodities are divided into four groups which are fuels, minerals ores and metals, all food, and agriculture raw materials. This was done to enable the United Nations Trade and Development Commission to track the performance of commodities in terms of commodity prices and the dependency of economies to the commodities (United Nations Trade and Development Commission, 2019). The need to track the performances of the different commodities was brought about by the volatility of commodity prices that creates uncertainty about future revenues from commodity sales and exports which strains governments of commodity-dependent countries (United Nations Trade and Development Commission, 2018).

There have been various attempts to find the bases that should be used to classify a country as being commodity dependent. According to South Centre (2005), there are three indicators used to classify a country as being commodity dependent. These indicators are:

- The share of a commodity's exports earnings in relation to the country's total mechanize exports. Based on this indicator, a country is classified as commodity dependent if its exports of that commodity accounts for more than 60 percent of total mechanize exports by value (United Nations Conference on Trade and Development, 2019).
- The percentage of people involved in producing a commodity. This indicator measures whether a certain commodity industry is either a major employer, major customer of the local procurement sector and/or provide the most commodities needed in other sectors such as manufacturing or mining (Renner & Wellmer, 2019).
- The percentage contribution of a commodity to GDP. When a country's revenue from a certain commodity account for more than 20 percent of the country's total GDP then that country is classified as being commodity dependent (South Centre, 2005).

If a country meets any of the three above requirements for a certain commodity from the four groups of commodities, it is classified as being commodity dependent. However, this research only focused on mineral-commodity dependency which includes the minerals ores and metals group of commodities to establish if Namibia is a mineral- dependent country. This research excluded the fuels, all food, and agriculture raw materials groups of commodities, Mineral commodity dependent country.

2.2.1 Mineral commodity dependent country

The definition of a mineral-commodity-dependent country is the same the general definition of a commodity-dependent country. However, the thresholds in terms of export share and contribution to GDP are slightly different as discussed below. For a country to be classified as being mineral-commodity dependent:

- Exports earnings from mineral commodities must be at least 25 percent of the country's total mechanize exports (Haglund, 2011).

- The mining industry should either be a major employer, major customer of the local procurement sector and/or provide the most commodities needed in other sectors such as manufacturing (Renner & Wellmer, 2019).
- Mineral commodities must contribute more than 20 percent of the country's total revenue and/or mineral rents must contribute more than 10 percent of GDP of that country (McKinsey Global Institute, 2013).

Renner & Wellmer (2019) acknowledged that all the three indictors above give a correct indication of whether a country is mineral-commodity-dependent or not but they did not use the last two indicators in their research. This is because the last two indicators could not be practically implemented as the data on a country's mineral production and financial accounts was not readily available. Renner & Wellmer (2019) used the first indicator to determine an economy's dependence on minerals as the data was readily available from the Nations Conference on Trade and Development (UNCTAD) statistics database.

Research done by Haglund (2011), choose a similar approach of not using the last two indicators because data on production and tax receipts by industries in different countries were not readily available in a standardized format. However, Haglund (2011) noted that even if the data on tax receipts was available, the lag between commencement of production and payment of taxes was so significant that using this data would distort the evaluation resulting in an incorrect conclusion on mineral dependency. It is for these reasons that the classification for a country's mineral dependency in this research was also defined by the share of exports earnings to total merchandise exports only (the first indicator). The higher the share of exports earnings from minerals to the country's total mechanize exports, the higher the mineral- commodity dependency (McKinsey Global Institute, 2013). Using that indicator, about 87 countries meet the requirement of being mineral-commodity dependent with Namibia being ranking 16th as shown in Table 1.

Table 1: Mineral commodity dependent countries

(Bauer, 2020)

No	Country	Mineral exports as a percentage of total exports_2017 or most recent (%)	No	Country	Mineral exports as a percentage of total exports_2017 or most recent (%)
1	Eritrea	97	14	Mali	63
2	Botswana	91	15	Australia	62
3	Mongolia	91	16	Namibia	61
4	Congo, DR of	90	17	South Africa	60
5	Burkina Faso	85	18	Niger	60
6	Zambia	84	19	Kyrgyzstan	57
7	Guinea	81	20	Chile	56
8	Suriname	80	21	Ghana	53
9	Tajikistan	78	22	Mauritania	53
10	Nauru	74	23	Guyana	51
11	Mozambique	69	24	Bolivia	49
12	Sierra Leone	67	25	Papua New Guinea	45
13	Peru	63	26	Tanzania	43

Table 1 shows that countries with the highest mineral-commodity dependency are found in Africa. The table shows that of the top 20 mineral-commodity dependent countries, 60 percent are African, 15 percent are South American, 15 percent are Asian, 5 percent are Oceania countries and 5 percent is Australia. The table also indicate that mineral exports dominate the total mechanized exports of these 20 countries as all the top 20 countries' share of mineral commodity exports are above 50 percent. This exceeds the threshold of 25 percent required for a country to be classified as a mineral-commodity-dependent country.

2.2.2 Mining contribution index (MCI)

The relative importance of a country's mining industry to its economy can be measured using a metric called mining contribution index (MCI) developed by the International Council on Mining& Metals (2020). The metric was based on four indicators:

- The contribution of mineral exports;
- The increase/decrease of mineral export as compared to total exports;
- The value of mineral production expressed as a percentage of GDP; and
- Mineral rents as a percentage of GDP.

A score is assigned to a country. The score is an indication of the scale of mining in relation to other productive activities in the country. The score also indicates:

- Whether mining as an economic activity is growing or falling over time;

- The value addition mining brings to the national economy; and
- Tax and economic rent contributions from mining.

According to International Council on Mining& Metals (2020), the highest and lowest possible MCI scores are 100 and 0, respectively. Even though the highest possible score is 100, according to International Council on Mining& Metals (2020), any score between 80 and 100 means that the scale of mining is considered relatively high when compared to other productive activities in the economy. This means that the mining industry would be growing over time and the mining value addition to the national economy is significant. On the other hand, a score of 0 to 50 means that the scale of mining is relatively lower compared to other productive activities in the economy. This means that the mining industry is contracting over time and the mining value addition to the national economy is reducing (International Council on Mining& Metals , 2020).

In 2018, Namibia's MCI score was 87.6 placing it 11th on the MCI rank table (International Council on Mining& Metals, 2018). This score meant that the scale of mining in the country was relatively more when compared to other productive activities in the economy and that the mining industry was growing over time. It also meant that value addition to the Namibian economy from mining varied depending on mineral commodity prices, a clear indication of how the economy is greatly affected by mining.

2.2.3 Drawbacks of mineral dependency

Having minerals constituting a large portion of a country's exports has some draw backs. Haglund (2011) found that a negative correlation exists between mineral- commodity dependence and GDP per capita of a country. This means that countries with a high dependence on mineral commodities are more likely to have lower economic developments than other countries. These countries are also characterised to have poor institutional governance which put them at risk of a resource curse. A resource curse is defined as the inability of a mineral-dependent country to fully benefit from its minerals (natural resource wealth) (Haglund, 2011).

Mineral-dependent countries are impacted by both low and high commodity prices. When commodity prices are low, there are concerns about the possible loss of national

revenue, affecting the country's national budget (United Nations Trade and Development Commission, 2018). This is because low commodity prices mean

possible reduction in mining activities, reduction in mineral export volumes and earning value. Additionally, Page & Hewitt (2001) found that when commodity prices are low, export earnings by mining companies in mineral-dependent countries would not keep pace with their costs of production. On the other hand, when commodity prices are high, there is a concern that government will overspend on consumption and unsustainable programs as the mineral export volumes and earning value increase. This translates into increased national revenue and real income (Roe & Dodd, 2018).

These two extremes are a challenge faced by commodity-dependent countries. To minimise the impacts of these challenges, commodity-dependent countries must find strategies to shift from specialization on one mineral commodity. An example of such strategies includes diversification into other mineral commodities or other commodity types. However, one of the challenges with diversification is that it takes time to fully implement. Another option is for commodity-dependent to implement policies that can sustainably insulate their economies from macroeconomic problems associated with volatile mineral commodity markets.

2.3 Commodity price volatility and risk

2.3.1 Commodity price volatility

Most mineral economies sell their commodities on international markets which are subject to commodity risk. Barned (2012) defined commodity risk as the risk that the financial position or performance of a business entity is exposed to, due to commodity price fluctuations. Commodity price fluctuations also called price volatility is defined by United Nations Trade and Development Commission (2019) as the degree of variation in commodity prices. Commodity price volatility is inherent in commodity markets because both supply and demand are unresponsive in the short term (Page & Hewitt, 2001). There are four types of commodity risk which are quantity, cost, political and price risk (Barned, 2012).

Quantity risk arises when there are changes in the availability of commodities. Cost risk is the adverse movement in the price of commodities that impact a company's

cost (Barned, 2012). Barned (2012) mentioned that political risk normally arises from set of rules and regulations companies have to abide by that affects the price and/or supply of commodities. Lastly, price risk is defined as the probability that an actor (commodity producer, trader and/or government) in the commodity sector will suffer a financial loss due to price volatility caused by uncertain external market forces which are beyond the control of the actors (Metal and Energy Trade with Trust, 2018; United Nations Trade and Development Commission, 2019).

The most prevalent risk among commodities is price risk. United Nations Trade and Development Commission (2018, 2019) conducted two studies to determine the levels of price volatility of the four commodities groups (mentioned in first paragraph of Section 2.2) between 1960 and 2016 in 58 countries. Two measures were used; the quartile coefficient of dispersion and the coefficient of variation. The quartile coefficient of dispersion is a measure of the spread within and/or between data sets, while the coefficient of variation is defined as the ratio of standard deviation to the mean (United Nations Trade and Development Commission, 2018). Both studies found that although price volatility was common across all the four commodity groups, prices of the minerals and metal commodity group had the highest volatility amongst the four groups followed by the fuels group.

The two studies made additional findings in terms of the impact of commodity price volatility on commodity-dependent countries. The United Nations Trade and Development Commission (2018) found that fluctuating mineral commodity prices causes uncertainty in future mineral commodity prices. This translates into uncertainty about future revenues from mineral commodity sales or exports for the mineral commodity dependent country (United Nations Trade and Development Commission, 2018; 2019). Uncertainty regarding future revenue from mineral commodity sales increases the possibility of financial losses for the commodity producer, trader and/or government whose revenues depend on the sales of the commodities (United Nations Conference on Trade and Development, 2019). The United Nations Trade and Development Commission (2019) found that revenue from mineral commodity sales which is used for the sustainability and continuity of public development is not constant due to commodity price volatility.

The above findings revealed the dual problem faced by mineral-commodity-dependent countries, which is the impact of commodity price volatility on their mineral revenue streams and the associated impacts on economic planning and macroeconomic stability (Brown *et al*, 2008; United Nations Trade and Development Commission, 2019). The impact of mineral commodity price volatility is worse for mineral- commodity- dependent countries because mineral commodity price volatility impacts their balance of payments (BoP) which is a key determinant of both the budget (revenue) and debt payment (expenditure) (United Nations Trade and Development Commission, 2019; Renner & Wellme,2019). This highlights the importance of managing mineral commodity price volatility for mineral-commodity dependent countries. Since Namibia is a mineral-dependent country, and because minerals are the commodity group with the highest price volatility, it was crucial to analyse the causes of commodity price volatility. This is important to identify ways to reduce the impact of price volatility on the Namibian economy.

2.3.2 Causes of mineral commodity price volatility

Thouraya & Youssef (2011) classified causes of mineral price volatility into four categories which are economic cycles, price speculation, supply shock and shift to just-in-time inventory. Mineral commodities are sold on international markets that are controlled by major economies. The performance of these major economies drives the mineral commodity price fluctuations which cause mineral commodity price volatility (Brown, *et al*., 2008). According to Thouraya & Youssef (2011), the performance of these major economies is largely dependent on the phase in the economic cycle the economy would be experiencing. An economic cycle is defined as the different phases an economy goes through, which has four stages; expansion, peak, contraction and trough. During these four stages of the economy, there will be fluctuations in the prices of commodities making the mineral commodity prices volatile.

Thouraya & Youssef (2011) defined price speculation as the use of commodity derivatives by investors and funds which causes shifts in supply and demand. The derivatives can be in the form of futures and options contracts. The shifts in supply and demand means investors would be manipulating the supply and demand a situation which is beyond the control of market forces. This is because these

derivatives are used to accelerate or amplify the number and degree of commodity prices swings causing price volatility which leads to price risk (Brown *et al*, 2008).

A supply shock is an event that causes a sudden increase or decrease in the supply of a mineral commodity. Supply shocks impact the production levels of a mineral commodity which then create sharp spikes in commodity prices (Thouraya & Youssef, 2011). According to Brown *et al*. (2008), a supply shock can be as a result of political unrest or environmental disaster in the mineral commodity producing country or a world pandemic such as the Coronavirus that emerged in 2019.

Just-in-time inventory management is an approach in which mineral commodities are only produced (mined and processed) after a buyer has placed an order. In so doing, inventories of mineral commodities are kept low. With this approach, a company would only have the exact amount of the mineral commodity goods required only when they are needed. Keeping inventories low is a method of controlling the market. This method results in an increase in the demand for the commodity. In so doing the variations in commodity price are driven by demand rather than the true availability of the mineral commodities (Thouraya & Youssef, 2011).

2.3.3 Mineral commodity price trend

Prices of mineral commodities also fluctuate like prices of the other three commodity groups. The prices constantly change upward and downward as can be seen in Figure 7. The figure shows monthly commodity price indices from 1998 to 2017.

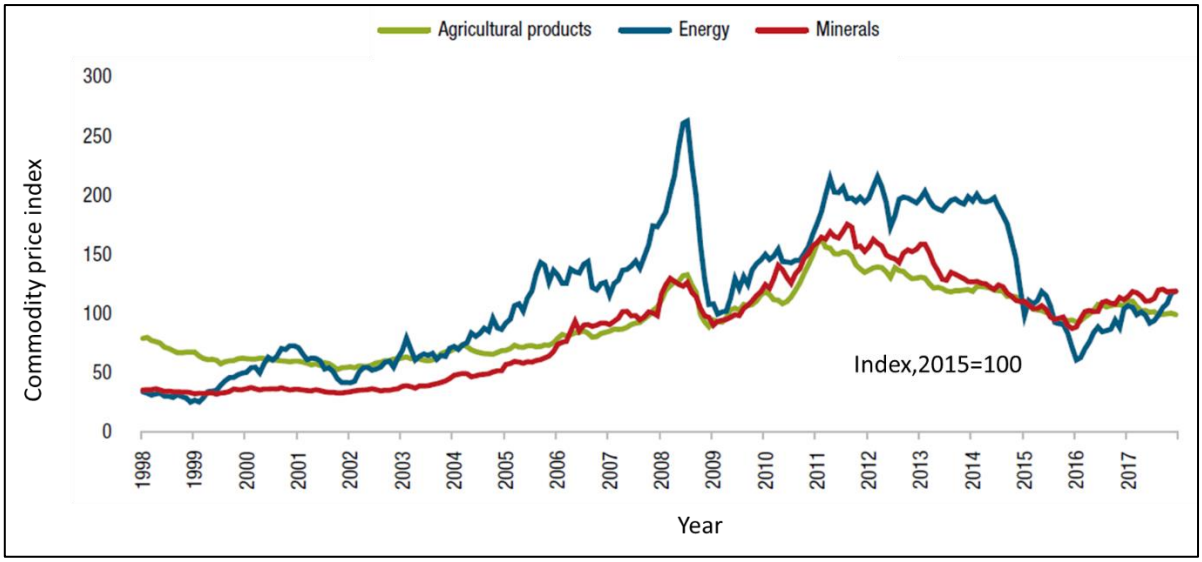


Figure 7: Monthly commodity price indices for the period from 1998 to 2017

(United Nations Conference on Trade and Development, 2019)

Agricultural, energy and minerals commodities all trended upwards from 1998 to 2008. Although the prices then dropped in 2009 due the global financial crisis, they recovered from 2010 to 2012. However, from 2013 to 2016 the prices were on a downward trend again but slightly recovered from 2016 as depicted in Figure 7. The energy price index experienced excessive fluctuations in the long run than that of minerals and agriculture. The mineral price fluctuations were more gradual as compared to energy. The agricultural sector has the least fluctuations over the period of 1998 to 2017. This is in accordance with the findings of the South Centre (2005), that mineral commodity prices in the short term, fluctuate excessively but in the long term they show a secular decline. To determine if mineral commodities prices are fluctuating excessively, their price instability is measured. Price instability is based on measuring the price changes against a set target by central banks. Price instability measures the behaviour of prices of individual commodities by looking at the price level of the commodity using a price index metric (United Nations Development Programme, 2011). There are two price indices matric used the consumer price index or the harmonized index of consumer prices. The price index basically indicates whether there are major fluctuations in the prices of a consumer good outside what is considered a normal range. Using the price index, the monthly mineral price instability was determined as depicted in Table 2.

Table 2: Average monthly instabilities of different commodity groups

(Adapted from United Nations Development Programme, 2011)

	Commodity monthly price instability (%)	
Commodity categories	1990-1999	2000-2009
All primary commodities	9	26
All food	9	25
Minerals, ores and metals	17	40
Crude Petroleum	31	28

Table 2 shows that all commodity prices change over time making them all instable. During the period of 1990-1999 the p[rice instability of crude petroleum was the highest among the community groups with a 31 percent price instability higher than the average for all commodities. Minerals, ores and metals had the second highest price instability at 17 percent and all food has the lowest price instability at 9 percent. The following decade the Minerals, ores and metals top as the commodity group with the highest price instability with an instability of 40 percent, the instability of crude petroleum dropped to 28 percent making it the second most instability commodity the all food was still the commodity group the lowest price instability however the price instability of the all food also raised from 9 percent to 25 percent. This shows that in the period of 1990-2009 the mineral commodities prices are more volatile as their fluctuation yielded a higher monthly instability compared to the other commodity types. The monthly price instability of 'mineral, ores and metals commodities' increased to 40 percent from 17 percent during a period of 20 years; the biggest change amongst all the commodity categories. Figure 7 which shows periods of price increases and declines correlates to the increases and decreases of the monthly price instability shown in Table 2. Figure 7 and Table 2 confirm that commodity prices are volatile. Figure 7 and Table 2 focused on mineral commodities as a group, but since this research is focused on the minerals found in Namibia Figures 8 and 9 were used to better understand the fluctuation of price for mineral commodities mined in Namibia.

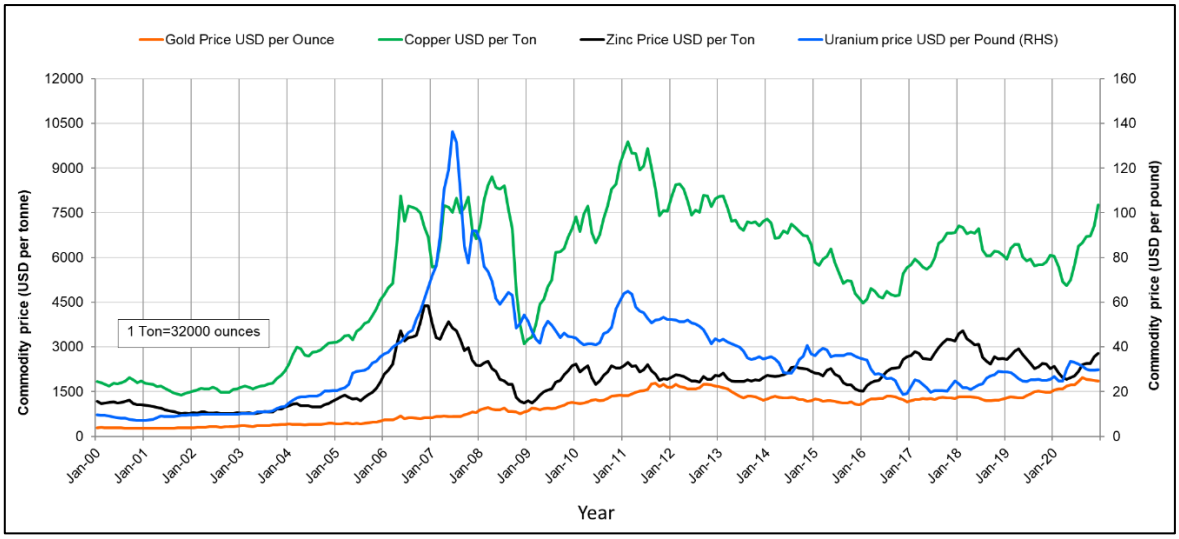


Figure 8: Historical prices of mineral commodities

(Index Mundi, 2020)

Figure 8 shows a declining trend from 2000 to 2003. The United Nations Trade and Development Commission (2011) and van Zyl *et al.* (2020) reported a gradual decline for prices of mineral commodities such as copper, gold, aluminium, iron ore, tin, nickel, zinc, and uranium during that period. From 2003 to 2008, there was a gradual to sharp increase in the prices. The United Nations Trade and Development Commission (2011) reported that during this period the highest price increase was observed in May 2006, an increase of 17 percent compared to the average increase of 3.9 percent in other months. The increase in mineral commodity prices were attributed to the global commodity boom that was experienced between 2005 to mid-2008 (Mwinga, *et al*., 2020).

In August 2008, the prices of the mineral commodities drastically dropped by 19.7 percent. The price dropped a further 9 percent in 2009 due to the global financial crisis that happed in 2008 to 2010. The prices recovered in the last quarter of 2010 up to mid-2011 (United Nations Development Programme, 2011). Figure 8 shows a gradual decline in prices shortly after January 2011. The United Nations Trade and Development Commission (2018) mentioned that although prices were high from mid-2011 to 2016 when compared to the 2000 to 2003 period, the prices were declining to a lowest price in 2016 (United Nations Trade and Development Commission, 2018). Since diamonds prices are based on contracts, they were analysed separately as shown in Figure 9.

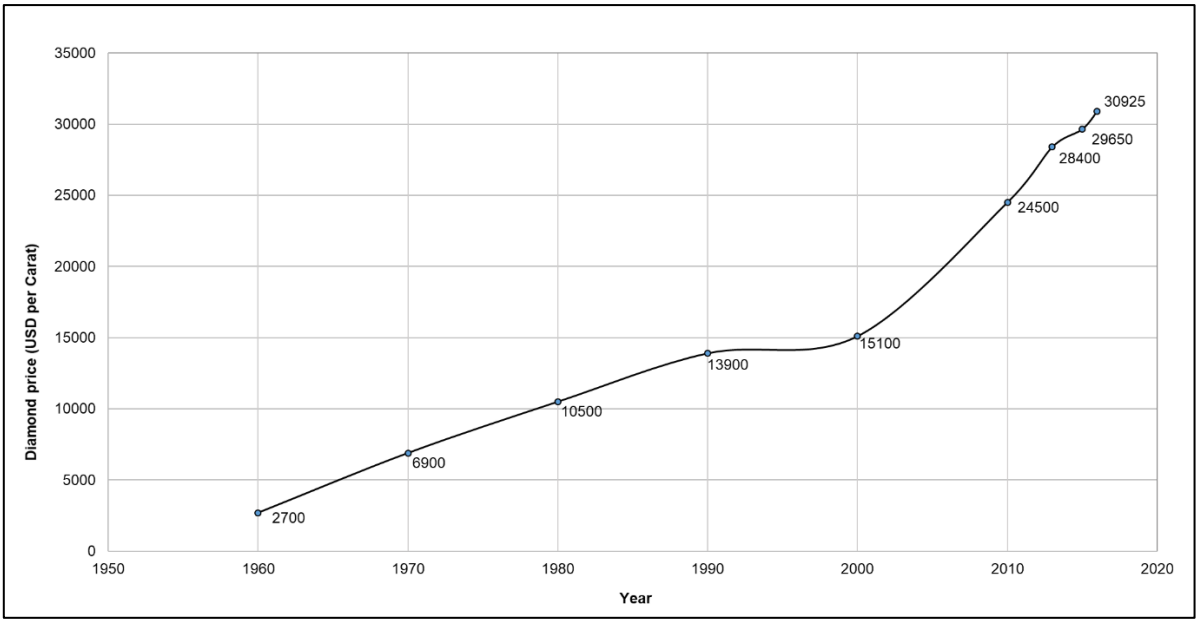


Figure 9: Average historical diamond price

(Index Mundi, 2020)

Figure 9 shows an increasing trend in the price of diamonds from 2000 to 2020. However, van Zyl *et al. (*2017) and van Zyl *et al.* (2020) analysed the diamonds price and showed that the price was affected by the global financial crisis, causing a price drop in 2009. In 2015 the diamond price dropped again as companies were unable to sell their diamonds profitably since the global economy was still recovering from the global finacial crisis.

As shown in Figure 8 and Table 2 that mineral commodity prices are volatile, it is important that mineral-commodity-dependent countries understand commodity price trends. This will assist them to protect their economies from the impacts of price volatility. Mineral-commodity-dependent countries should understand that during periods of low commodity prices, the cost of imported production goods and services becomes significantly higher than the revenue from the mineral commodity exports. According to Page & Hewitt (2001), during these periods producers will be faced with higher risks at lower returns. Both developed and developing mineral-dependent countries are faced with this problem. However, developing mineral-dependent countries are most affected due to the extent of their dependence on minerals (United Nations Trade and Development Commission, 2019).

Most mineral-dependent countries are characterised by two things that make their economies more vulnerable to market forces (Brown, *et al*., 2008). Firstly, they specialise in one or few mineral commodities (Page & Hewitt, 2001). Secondly, they have little to no say in commodity pricing decisions. It is thus important for such countries to prepare for the periods of low mineral commodity prices during the periods where mineral commodity prices are high. Lack of proper management of mineral commodity price volatility by commodity-dependent countries could lead to failure of their mineral economic development programs (Page & Hewitt, 2001). It is against this background that Brown *et al.* (2008) recommended that mineral economies should investigate different policy options suitable for their respective economies to minimise the impact of commodity price risk on their revenues from mining.

2.4 Policy options for managing commodity price volatility

According to United Nations Conference on Trade and Development, (2019) there are five policy options used to manage commodity price volatility namely, supply management, national revenue management, market-based price risk management tools, compensatory finance, and revenue insurance. These are discussed in the next subsections.

2.4.1 Supply management policy option

Supply management is a policy option that seeks to achieve a desirable commodity price by controlling supply of the commodity in relation to demand of the commodity. The policy's prime objective includes both the level and stability of commodity prices (Brown *et al*., 2008; South Centre, 2005). Brown *et al*. (2008) discussed the working mechanism of the supply management policy option mentioning that it is largely dependent on a controlling agent responsible for implementing the policy. The agent should have the ability to influence the supply of a specific commodity. The agent can be a company, cooperation, government ministries or an international body acting on behalf of several producer or consumer countries.

The policy option uses four systems, which are the buffer stock system, minimum purchase price system, import quotas and export quotas (Brown *et al*., 2008; South Centre, 2005). The buffer stock system works by forming a central body which buys a specific product in bulk during periods of low commodity prices and waits for the prices

to increase to release stocks of that specific product. The minimum purchase price system is typically used by government of the producer's host country to define the minimum purchase price of a commodity. If the commodity is not bought, the government acts as the last resort buyer for the commodity (Brown, *et al*., 2008).

Import quotas aim to directly limit supply of imports as well as to ensure that imported commodities do not undercut the minimum price level. This is the commonly used system within the supply management policy category. The system involves the formation of an international body like a cooperation by a group of producer countries that seeks to achieve a desired world commodity prices by limiting supply through controlled exports. There are two common examples of export quotas. The first example is the International Commodity Agreements (ICAs). ICAs were mostly used from the 1970s to 1980s and their objective was stabilization of revenue by controlling commodity prices (South Centre, 2005). To achieve this, the agent (ICA) applies clauses in the agreements that allowed authorities to intervene in the market as required.

The second example of an export quota is the Organization of the Petroleum Exporting Countries (OPEC) which was formed in the 1970s by major oil producing countries. OPEC's objective was to stabilize international oil prices while satisfying interests of producing nations by ensuring steady incomes for the producing countries (Brown *et al*., 2008; South Centre, 2005). To achieve this objective, OPEC used national export quotas that were periodically adjusted to market conditions. They managed to stabilize world oil prices and increase the ability of predicting the levels of export earnings. However, later OPEC was faced with challenges of quotas enforcement and free riding.

According to South Centre (2005), both agents (ICA and OPEC) managed to shield producer countries from large temporary shocks in oil prices. Brown *et al*. (2008) indicated that supply management can influence both domestic and international markets. However, among the systems within the supply management policy option, only import quotas solely affect domestic markets.

Requirements for the application of the supply management policy option

All supply management systems are mostly based on same principles although they have different technical structures depending on factors such as type of mineral commodity, the implementing agent, and the market. To have a successful supply management system, the following guidelines were developed:

- All parties including the agent must agree to set goals to avoid commodity goods being produced in excess of the supply management agreement (Brown, *et al*., 2008)**.**
- According to Brown *et al.* (2008), the selected commodity's market should be well defined and must not have products that can easily be substituted. For example, natural rubber can be substituted by synthetic rubber; natural diamonds can be substituted by synthetic diamonds.
- The agent chosen to administer the supply management system must be credible and technically competent. They must be able to enforce the agreement, have financial resources to sustain operations and storage capacity to withhold supply for a period long enough to achieve the desired price (South Centre, 2005).
- The supply management system must have the flexibility to accommodate and respond to all market changes over a long term (Brown, *et al.*, 2008).

Advantages of the supply management policy option

Brown *et al*. (2008) and South Centre (2005) found that the supply management system has the following advantages in managing commodity price volatility:

- Companies of developed countries have a tight control over the market (supply and demand). Supply management can help weaken this control by controlling the supply of commodities using buffer stocks. This builds up the countervailing power and restores some balance of the producers and developing countries (Brown, *et al*., 2008).
- The ability to exploit new technological advancements (South Centre, 2005). The policy option makes use of improved geographic information system, developments in product tracing among other technologies to enforce production agreements.

- The advancement in markets such as the introduction of tradable quotas coupled with the use of financial assets such as virtual buffer stocks make it cheaper to implement the supply management system. This makes the option more attractive to consumer countries to buy (United Nations Trade and Development Commission, 2011; Brown *et al*., 2008).

Disadvantages of the supply management policy option

The supply management policy option has the following disadvantages in managing commodity price volatility:

- The South Centre (2005) found that policy option only focusses on the supply of mineral commodities through price management. This limits the policy option to only address supply issues caused by mineral commodities price management even though the supply of mineral commodities can be affected by other factors such as social and environmental factors.
- The policy option is commonly used by groups such as organizations or cooperates making it extremely difficult to sustain the required coherent action and agreement among stakeholders (Brown, *et al.*, 2008).
- According to Brown *et al.* (2008), the policy option works best through schemes. However, not all mineral producers join schemes. This is risky because important producers that remain out of schemes called free riders can undermine the supply management arrangements.
- Developed countries are unlikely to support supply management proposals as it is a threat to countervail the current market power which they have (Brown, *et al.*, 2008).
- Utilizing the supply management policy option is costly as stabilizing commodity price requires the agent or scheme to buy up a specific mineral product when prices are low and release stocks when prices are high (United Nations Development Programme, 2011). For example, OPEC needed to spend about US$100 million of oil per day to take large volumes of oil off the market to support prices during the global economic crisis as the oil prices fell below US$100 per barrel (World Bank Group, 2020). The cost of buying and storing (buying or renting a warehouse and keeping quality of product intact) the

mineral commodity also makes the policy option expensive (United Nations Development Programme, 2011).

- There are difficulties in the quota allocations and enforcements (South Centre, 2005). The decision on the method to use to allocated quotas requires the entity implementing the supply management policy to study available methods to choose which method will be best to allocate the quotas to producers or distributors, a tedious and costly process.

2.4.2 National revenue management policy option

According to United Nations Trade and Development Commission (2019), revenue management is done through Sovereign Wealth Funds (SWFs). SWFs are special purpose investments owned by state governments. They comprise of public finance, public partnerships, public domestic borrowing, tax and non-tax revenues. SWFs are shielded from liabilities because they do not depend on short-term liquidity, which expands their investment horizons (Alambo, 2020). SWFs originated from Kuwait in 1953. The Kuwait government established a SWF to invest surplus revenue from oil, which according to Alambo (2020) was done to reduce the country's dependence on oil. It took almost 20 years for the idea of SWF to gain traction such that it was only during the 1970s and early 2000s that many state governments started to form SWFs. These periods were characterized by high commodity prices. United Nations Trade and Development Commission (2019) and Alambo (2020) mentioned that the objectives of SWFs are to:

- Stabilize government's revenues and export earnings from oil or other commodities susceptible to commodity price volatility; and
- Accumulate a country's financial wealth and use it for intervention purposes and for BoP.

In 2008, the International Forum of Sovereign Wealth Funds (IFSWF) members endorsed what is now called The Santiago Principles. The principles were developed to promote prudent investment practices, good governance, accountability and most importantly transparency. The Santiago Principles consist of 24 principles and practices divided into the following three pillars (International Forum of Sovereign Wealth Funds, 2014):

1. Pillar 1- Legal framework, objectives, and coordination with macroeconomic policies;

2. Pillar 2- Institutional framework and governance structure; and

3. Pillar 3- Investment and risk management framework

The Santiago Principles pillars provide guidelines to member countries to form well-designed fiscal policy frameworks with clear cash inflow and outflow rules. According to Alambo (2020), there are five types of SWFs as classified in the Santiago principles:

1. Pension reserve funds

   Alambo (2020) described pension reserve funds as funds that normally hold a high share in equities. They are established to reduce the impact of identified future cash outflows from pension funds on government balance sheets. This is because the outflows are characterised by contingent-type liabilities.

2. Reserve funds

   Typically, reserve funds hold a high share in equities and alternative investments. Reserve funds usually take the form of reserve investment corporations which hold ample reserves that must earn significant returns. Holding reserves comes with cost called the carry cost, the fund must make sure this carry cost is reduced (Alambo, 2020).

3. Development funds

   According to Alambo (2020), development funds, are established with a goal to foster development by allocating funds to priority socioeconomic projects like infrastructure. In the 1990s, Namibia created the Mineral Development Fund of Namibia (MDFN) which was based on mining revenues. The fund's prime objective was to provide money for infrastructure projects across the country. However, in 1999 the annual report of the MDFN reported that money from the fund was used for projects that were neither technically nor financially viable. The fund still exists but there is little or no data of its current monetary value (Andrzej, *et al*., 2015). Based on the research done by Andrzej *et al*. (2015), the MDFN seems to have experienced mismanagement, which raises the question of whether the country will be able to implement and sustain other types of SWF successfully.

4. Stabilization funds

Stabilization funds are funds that aim to stabilize the national budget by preventing short-term volatility in revenue from commodities from turning into short-term volatility in government spending (South Centre, 2005; Brown *et al.,* 2008; United Nations Trade and Development Commission, 2019; Alambo, 2020). Stabilization funds work by reserving excess revenue when prices are high. This has been found to reduce excessive government spending during periods of commodity booms. If governments of mineral-dependent countries can effectively control their spending during times of commodity price booms and reserve money to for use during periods of commodity price bursts, these governments will be able to deliver continuous sustainability of public development programmes. United Nations Trade and Development Commission (2019) concluded that when stabilization funds are utilized well they can enhance economic resilience and stabilise public finances.

5. Savings fund

According to United Nations Trade and Development Commission (2019) and Alambo (2020), saving funds aim to accumulate wealth by transferring mineral wealth to financial wealth. This is achieved by transforming minerals which are non-renewable assets into other form of assets such as diversified financial assets. The savings are in the form of liquid assets. Saving funds focus on long-term returns and have been found to withstand volatility. Brown *et al.* (2008) and United Nations Trade and Development Commission (2019) indicated that the accumulation of assets by countries with saving funds helps the countries to reduce their net debts. A low debt level is an important indicator when a country's economy is being credit rated.

According to United Nations Trade and Development Commission (2019), globally minerals-dependent countries have had different experiences with SWFs. They found that the success of stabilisation funds is highly dependent on the legal framework applied by a country. Over the years' different countries have applied different legal frameworks based on what they deemed to suite their countries. Some have been successful, others have not. Examples of successful sovereign funds (According to United Nations Trade and Development Commission, 2011;2019) include the:

- Social Stabilization Fund of Chile, which is based on copper revenues;
- Pula Fund of Botswana which is based on diamond revenues;
- Petroleum Fund of Timor-Leste which is based on petroleum revenues;
- The Mineral Resources Stabilization fund of Papua New Guinea, this fund closed as the government withdrew the fund's whole balance to settle government debt; and
- Sovereign wealth fund of Nigeria which is based on oil.

The different guidelines used by different countries that resulted in successful SWFs were formalised and documented as The Santiago Principles in 2008 to act as guidelines to countries who already have or plan to establish their SWFs. One of the successful SWFs is the Pula Fund of Botswana which is an indication that African countries also have successful SWFs. However, there are much less African countries who have established SWFs when compared to the number of mineral-dependent African countries as indicated in Table 3 which shows SWFs in Africa.

Table 3: Sovereign Wealth Funds in Africa

(Adapted from Alambo,2020)

Country	Capitalisation (USD Billion)	Type	Hard Commodity
Algeria	7,24	Future Generations	Oil/Minerals
Angola	5,00	Development	Oil
Botswana	6,90	Future Generations	Minerals
Chad	0,03	Future Generations	Oil
DR Congo	1,39	Stabilization	Oil/Minerals
Equatorial Guinea	0,07	Stabilization	Oil/Minerals
Gabon	0,40	Future Generations	Oil
Ghana	0,49	Future Generations	Oil
Libya	60,00	Development	Oil
Mauritania	0,30	Stabilization	Minerals
Mauritius	0,50	Development	
Namibia	N/A	Development	Minerals
Nigeria	1,40	Stabilization	Oil
Rwanda	0,21	Development	Minerals
Sao Tome and Principe	0,01	Stabilization	
Senegal	1,00	Development	
Sudan	0,15	Stabilization	Oil
Uganda	0,05	Development	

Table 3 shows a mix of different SWFs ranging from reserve funds, pension funds, development funds, stabilization funds and saving funds. Data on the SWFs is not always available in terms of the monetary value of the funds. This can be seen in Table 3, where Namibia's Mineral Development fund has no data. Listed in Table 3 are countries classified as mineral dependent having set up funds and were able to grow the monetary value of their funds. Given that Namibia does not have a successful SWF, the country can learn from countries such as Nigeria which has a functional stabilization fund managed by an investment authority. Nigeria's fund has successfully disbursed money to the country's economy within 72 hours when the economy needed stabilization due to dropping oil prices (United Nations Trade and Development Commission, 2011). A country chooses a SWF based on its needs of development, protection from commodity price volatility and transferring wealth to future generations.

Among the five types of SWFs, the stabilization and savings funds are the mostly used and are broadly described as National Revenue Management policies. They are normally in the form of National Revenue Funds (NRF). With NRFs, the fiscal buffer savings are established using fiscal management laws and smoothing mechanisms which are used to stabilize the national budget and accumulate wealth by transferring mineral wealth to financial wealth (Brown *et al*., 2008; United Nations Trade and Development Commission, 2019). A country can focus on one or both the stabilization and saving funds depending on the goals of the country. As mentioned earlier in Chapter 1, the aim of this research is to reduce the impact of commodity price volatility on the Namibian economy. Since the purpose of the stabilization fund is to stabilize the national budget, this research only focussed on the stabilization fund to evaluate if it can be applied to the Namibian economy.

Requirements for the application of the National revenue management policy option

Brown *et al*. (2008) noted that for national revenue management policies to be successful, strong legislative restrictions are mandatory. The success of national revenue management policies is highly dependent on the adherence to set strong legislative restrictions. Countries that decide to implement NRFs must balance their expenditures to match their revenues left after reserving the agreed amount classified as excess revenue into a fund. This is especially important because no amount of

excess revenues from the fund will be enough to provide the stabilizing effect if the country continues to spend the revenue from the funds as collateral to finance new expenditures through debt (Brown, *et al*., 2008).

Advantages of national revenue management funds

The following are the advantages of national revenue management funds:

- A NRF is a good policy option to be used for fostering social development by channelling windfall profits into economic transition and diversification (Brown *et al.,* 2008). Brown *et al.* (2008) however, highlighted that this only happens when the NRF is kept transparent and when there is compliance to mandatory strong legislative restrictions.
- When NRFs are properly designed and executed, they can offer commodity-dependent countries an opportunity to sustainably insulate their economies from macroeconomic problems (United Nations Development Programme, 2011).
- The legal framework used to implement NFRs provides established rules against which governments' performance can be measured (Brown *et al.*, 2008; United Nations Development Programme, 2011).

Disadvantages of national revenue management funds

The following are the limitations of National revenue management funds:

- Brown *et al.* (2008) mentioned that, even with established legal NRF frameworks, there is no guarantee that countries will start to practice fiscal discipline.
- For successful implementation of a NRF, a country must have good institutional and political systems; things which lack in most developing countries (United Nations Development Programme, 2011).
- The United Nations Development Programme (2011) agrees with Brown *et al*. (2008)'s findings that some NRFs are not always established to provide revenue stability for a country. It has been found that at times countries establish NRFs to portray a good country's image to external institutions. This is a major drawback because NRFs have been proved to work for many countries such as Chile. When a NRF is established to impress only, it leads to

poor management of the fund, which translates to misuse of money (United Nations Development Programme, 2011). This defeats the purpose of establishing the NRF because when there is short-term volatility in revenue from mineral commodities price dropping and funds are needed to stabilize the national budget the funds will not be available. An example of poor management of a fund is Namibia's MDFN. Money from the fund was used for projects that were neither technically or financially viable (Alambo, 2020).

2.4.3 Market-based price risk management tools policy option

Market-based price risk management tools also known as hedging are strategies that help producers reduce the uncertainty associated with commodity prices. Examples of such financial products are futures, forward, options and swaps contracts (Brown *et al.,* 2008). Futures are contracts between two parties to buy or sell commodities at a specified future date at a locked price. Futures contacts were originally designed to protect producers. According to the United Nations Trade and Development Commission, (2019) all commodity futures contracts are standardized based on the characteristics and quantity of the commodity. This makes it easy to regulate them and enables the contracts to be traded on stock exchanges (United Nations Trade and Development Commission, 2019; Brown *et al*., 2008).

The United Nations Trade and Development Commission (2019) traced the first use of futures contracts to Japan in the eighteen century, where they were used in the agricultural sector. Over the years their application spread to other economic sectors including the minerals sector. Today many mineral commodity futures are traded on numerous stock exchanges globally including the Chicago Mercantile Exchange, London Metal Exchange, South African Futures Exchange and many more (United Nations Trade and Development Commission, 2019; Brown *et al*., 2008). As time passed the use of futures contracts was not only limited to producers and buyers. They are also now used by investors in several asset types. Brown *et al.* (2008) highlighted that the market for futures contract has drastically changed to now include financial futures contracts. Financial futures contracts are based on financial assets (foreign currencies, treasury bills and stocks) and indices (interest rates) rather than commodities. Currently, trade in commodity futures is relatively a small share of the entire futures market (United Nations Trade and Development Commission, 2019).

The second market-based price risk management tool is forward contracts. The United Nations Trade and Development Commission (2019) described forward contracts as contracts that work on the principle of locking prices for future sale of a commodity. Forward contracts are almost similar to future contracts but the two instruments have some differences. One of the differences between the future and forward contracts is that the forward contracts are not standardized (United Nations Trade and Development Commission, 2019).The United Nations Trade and Development Commission (2019) reported that this makes it harder to regulate forward contracts and thus they are traded over-the-counter rather than on stock exchanges like futures contracts. The other difference between future and forward contracts is that unlike future contracts, forward contracts are often used by physical commodity traders to hedge commodity price risk rather than by investors (United Nations Trade and Development Commission, 2019). According to the United Nations Trade and Development Commission, (2019) this is because forward contracts mostly result in physical delivery, making their transactions cost higher than that of future contracts

Forward contracts' terms and conditions are negotiated in a decentralized manner between the involved parties on over-the-counter markets as they are not standardised (United Nations Trade and Development Commission, 2019) . The United Nations Development Programme (2011) and United Nations Trade and Development Commission, (2019) found that forward contracts can be customized to the contract party's specific needs as it is not used on the stock exchange. For example, the parties can agree on a fixed price or a future reference price for the sake of a commodity as well as stipulate other individual contract characteristics (United Nations Trade and Development Commission, 2019). The United Nations Trade and Development Commission, (2019) however, cautioned that this comes with the risk of default by one of the contract parties. Markets for forward contacts include but not limited to agreements between producers and buyers of mineral commodities, agreements between farmers and traders of agricultural commodities or agreements between power generators and buyers (United Nations Trade and Development Commission, 2019).

Options is a market-based price risk tool that was created to benefit producers when price increases and protect them when price decreases. They achieve this by allowing

sellers to lock in a maximum price and the buyers to lock in a minimum price (Brown, *et al.,* 2008; United Nations Trade and Development Commission, 2019). Options works by allowing the buyer to pay a premium to the counterparty for the right to buy or sell the underlying commodity at a strike price which pre-specified on or before an expiration date (United Nations Trade and Development Commission, 2019). However, there is no actual obligation for the option holder to buy or sell the commodity. Therefore, if the holder does not buy or sell the commodity the premium is the only cost, they face. According to the United Nations Trade and Development Commission (2019), options were only traded on over-the-counter market where commodities were physically delivered. However, in the early 1980s exchange-traded options (no physical delivery of commodity) were introduced in stock exchanges based in the United States of America. There are two types of options; a 'call option' which gives rights to the holder to buy the underlying commodity. The second is a 'put option' which gives rights the holder to sell the underlying commodity (United Nations Conference on Trade and Development, 2019).

The fourth market-based price risk management tool is called commodity swaps. The United Nations Trade and Development Commission (2019) defined commodity swaps as a tool where the price of an underlying commodity is used as a base by contract parties to exchange money. This tool is used by both commodity consumers and producers. Brown *et al.* (2008) found that commodity swaps are used to lock commodity prices over the medium to long term. According to the United Nations Trade and Development Commission, (2019) commodity swaps works by guaranteeing that if the price of the underlying commodity increases beyond the strike price, the buyer will receive a payment equivalent to the price difference from the seller for the quantity stipulated in the contract. On the other hand, if the price decreases below the strike price, the buyer must pay the seller an amount equal to the difference in price. Commodity swaps use financial assets and indices but are only sold on over-the-counter markets (United Nations Trade and Development Commission, 2019).

The main function of market-based risk management tools in commodities markets is to transfer some of the risk faced by producers and governments to investors. These tools offer only revenue predictability; they cannot guarantee revenue stability. Revenue predictability enables producers and governments to make better and

informed decisions to obtain better credit terms (United Nations Trade and Development Commission, 2019). The tools are designed for short-term periods as they become too expensive beyond one or two years.

Requirements for the application of market-based price risk management tools

Brown *et al*. (2008) mentioned that the challenge of using market-based price risk management tools is the requirement for the user to have access to a market. According to Brown *et al.* (2008), it is extremely difficult for an individual producer to access organized futures and options markets. However, individual producers can instead access over-the-counter markets normally created by banks and trading companies.

Users of market-based price risk management tools are also required to have good financial knowledge to understand how to utilise the tools, choose from the full range available and know how markets operate (United Nations Trade and Development Commission, 2019). Brown *et al.* (2008) mentioned that most producers are in developing countries and they do not possess this financial knowledge, thus most producers will require training.

Advantages of market–based price risk management tools

The following are some of the advantages of market–based price risk management tools in managing commodity price volatility:

- The tools are widely used, and they shift the risk from producers to investors offering revenue predictability (Brown *et al.,* 2008).
- The four different types of market-based price risk management tools provide producers with an opportunity to choose the best method that will allow them to shift the commodity risk and meet their individual needs (United Nations Trade and Development Commission, 2019; Brown et al., 2008).
- If an individual producer cannot access stock exchange markets, they can choose the over-the-counter market that is provided by trading companies or banks (United Nations Trade and Development Commission, 2019).

Disadvantages of market–based price risk management tools

The following are some of the disadvantages of market–based price risk management tools in managing commodity price volatility:

- Brown *et al.* (2008) mentioned that despite the advantages of market-based price risk management tools, they have short-term maturities. This is because they are only suitable for about one to two years which might not always be sufficient for producers since the risk associated with commodity prices can last for longer.
- All commodities do not have organized stock exchanges. Therefore, market-based price risk management tools may not be applicable to all commodities. Additionally, the tools are most suitable for producer groups and cooperatives, leaving out individual producers (United Nations Trade and Development Commission, 2019; Brown *et al*., 2008).
- The accessibility to the infrastructure and financial training needed to make the market-based tools feasible on large scale has been highlighted by both the United Nations Trade and Development Commission (2019) and Brown *et al.* (2008) as drawback which limit the broad use of the tools.
- Some of the market-based price risk management tools such as futures contracts, require contingent cash requirement in order to use them. Producers in developing countries are considered riskier compared to producers in developed countries. This means that they must pay much higher risk premiums or asked for higher-value collaterals that they may not afford (United Nations Trade and Development Commission, 2019; Brown *et al*., 2008).

2.4.4 Compensatory finance policy option

The compensatory finance policy option as described by Brown *et al.* (2008), is a policy option where multilateral donors provide relief payments to developing countries during periods of commodity price bursts to help them stabilize revenue flows. The policy option is primarily focused on making payment to help sort the economic balance for the country's economy. The policy option can be in the form of grants or loans directed to governments (Advance Consulting, 2020). The grants or loans are expected to trickle down to producers in the form of diversification or development

programs set up by governments. For developing countries to benefit from compensatory finance, they must meet the eligibility criterion and the thresholds set up by the donors (South Centre, 2005). Organisations such as the International Monetary Fund and the European Union offer compensatory finance schemes.

The first compensatory finance scheme called the Compensatory Finance Facility (CFF) was developed in 1963 by the International Monetary fund. The scheme was created to provide short-term balance of payment support to countries that suffered temporary export shortfalls caused by exogenous shocks (South Centre, 2005). These payments were not donations but loans. Hewitt (2007) outlined the following three key requirements member states must satisfy for them to be eligible for loan funding from CFF, stating that a country should:

- Have experienced a short-term export earnings shortfall caused by circumstance largely beyond the country's control;
- Demonstrate using the BoP the need for financial support; and
- Be willing to cooperate with the CFF to find where the funds should be best used to solve the BoP problems.

The successful application of the CFF scheme failed. Brown *et al.* (2008) attributed the failure to the third requirement above. Member countries governments were compelled to agree and commit themselves to implementing the specific policies chosen by the CFF. CFF implied that the specific policies would help the countries solve their BoP problems (Hewitt, 2007). South Centre (2005) mentioned that member countries of the scheme had issues with the scheme's policies because the policy do not always tackle the sector that will boost the country's economy and they delayed the disbursement to the countries. With time member countries found the CFF eligibility requirements too strict, their finance terms too costly and their application procedures too onerous. Due to these reasons, since 2000 CFF has been largely unused (Brown *et al*., 2008; Hewitt, 2007; South Centre, 2005).

The second compensatory finance scheme called the Systéme de Stabilisation des Recettes d'Exportation (STABEX) was developed by the European Union in February 1975 as part of the Lomé agreement (Brown *et al.,* 2008). STABEX is an aid and trade agreement between 71 African, Pacific, Caribbean countries and the European Union

signed in Lomé, the capital city of Togo (Brown *et al.,* 2008). South Centre (2005) mentioned the main STABEX eligibility requirement to be any drop of at least 6.5 percent in export revenue when compared to a four-year average. South Centre (2005) found that such a drop would automatically trigger compensation payment to the affected government to use for diversification programs that will benefit producers in affected sectors. STABEX operated as a grant aid allocation scheme (Hewitt, 2007). Brown *et al*. (2008) further mentioned that STABEX was replaced by the Fluctuation in Export Earnings (FLEX) scheme in June 2000 with the signing of the Cotonou agreement. FLEX is an aid and trade agreement between 78 African, Pacific, Caribbean countries and the European Union signed in Cotonou, Benin. FLEX eligibility requirement is for member countries to demonstrate export earnings shortfalls or public deficits. Like STABEX, FLEX scheme operates as a grant.

South Centre (2005) found the compensatory finance policy option to be less beneficial in practice despite the potential benefit they claim to give developing countries. This was largely attributed to the following inherent weakness in how the schemes operate (South Centre, 2005):

- The schemes have onerous processes to verify export losses;
- The schemes require higher trigger thresholds to active fund disbursements; and
- The timing of the schemes' disbursement of funds is poor because funds are not disbursed when export revenue falls, they are disbursed when export revenue has reduced or fully recovered.

The grant part of compensatory finance may promote excess production of commodities covered by the schemes because the commodity exporters can think that their business operations are still profitable. This is because government offset the prices of inputs using funds from a compensatory scheme even when the commodities might have great market risk. The compensatory finance policy option introduces some trade distortion through its push for diversification as governments of benefiting countries are practically forced to use the money in favour of a sector which might not necessarily be best economic choice, which is a major drawback (van Dijk & Sideri, 2005).

Brown *et al*. (2008) mentioned that it is because of the lack of practical benefits from compensatory financing schemes that few governments have expressed interest in supporting the schemes. UNCTAD argued that with the right design and implementation, compensatory finance schemes can transform commodity-dependent countries to be self-sustainable.

Advantages of the compensatory finance policy option

The compensatory finance policy option is often attributed with the following advantages:

- Brown *et al.* (2008) reported that the policy option mechanisms centred on loans in theory can serve as self-financing that can reduce the likely hood of aid dependence among recipient countries.
- The United Nations Trade and Development Commission (2019) found that with the work done by UNCTAD, all the countries interested in compensatory finance policy option must do is to follow the recommendations for a self-sustaining compensatory finance mechanism.
- The compensatory finance policy option is one of the policy options that have been around for many decades giving policy makers the benefit of experience that they can again from other countries who have used the policy option (Hewitt, 2007).

Disadvantages of the compensatory finance policy option

Compensatory finance is often attributed with the following limitations:

- Brown *et al.* (2008) mentioned that compensatory finance can create aid dependency if not well designed.
- The option can be expensive since not all money given is in form of aid. Some of the financial assistance is in the form a loan that need to be repaid (Brown, *et al*., 2008). Overseas Development Institute (1979) reported that loans from CFF need to be paid back within five years and have an interest and service charge totalling 4.5 percent in the first year of repayment. This interest and service charge fees increase to about 6 percent in the fifth year. CFF can permit a maximum withdrawal of US$10 billion per annum for all the member countries (Overseas Development Institute, 1979)

- Hewitt (2007) found the compensatory finance policy option to be unreliable sometimes in terms of disbursement of funds. This is because the funds would arrive while the commodity prices have recovered. The late arrival of funds means that the funds would no longer be useful in stabilising government revenue. Instead, the funds would be spent on other unplanned projects leading to an upward spike in government revenue leading to over spending tendencies.
- Initially the compensatory finance entrusted the payment to governments believing that the benefit will trickle down to producers. However, this did not happen as government mismanaged the funds. Instead of the funds being received by producers as intended, government used the funds for consumptions and unstainable spending (Brown, *et al*., 2008; Hewitt, 2007).
- According to Brown *et al.* (2008) and Hewitt (2007), previously, applicants were required to prove that the shocks were not caused by domestic policies. This requirement alone made the policy option inaccessible to many deserving countries as it is always extremely difficult to prove that shocks are not caused by domestic policies.

2.4.5 Revenue insurance policy option

Insurance is a risk management instrument that shares the risk between the producers and the international market. It is commonly used in the agricultural sector to cover farmers against non-market related threats such as low harvests yield due to weather. Traditionally, agricultural insurance pay-outs were based on loss assessments of the actual harvest yield done by the insurer. This process was not only costly and time consuming, but also led to asymmetry of information. This is because there is no way the insurer would know more about the actual harvest yield and farm practices than the farmers. The farmers could influence the farm data and outputs which normally led to higher premium rates for the farmers.

To overcome these obstacles, in the early 2000s traditional agricultural insurance was replaced by a new insurance instrument called Index-Based Weather Insurance Scheme. The scheme was based on weather indices such as temperature and rainfall where specified patterns of the index would trigger the pay-outs if the threshold level

of the index was surpassed (United Nations Department of Economic and Social Affairs, 2007; United Nations Trade and Development Commission, 2019). The United Nations Trade and Development Commission (2019) is moderately open to the use of the new insurance schemes because it eliminates the costly verification and provide a measurable index that is closely related to agricultural loss. The United Nations Department of Economic and Social Affairs (2007) discouraged the use of index-based insurance schemes for price insurance. However, the research done by Kang & Mahajan (2006) found that index-based insurance schemes can be used for price insurance and revenue insurance.

According to Kang & Mahajan (2006), price insurance works by using objective price index of the crop to determine if a farmer suffered a loss due to price volatility. The price index used can be future prices or spot market price which cannot be influenced by the farmer.

The revenue insurance instrument works by compensating farmers when there is a sharp drop in expected revenue due to a drop in crop prices or harvest yields. The instrument originated from the private sector's need to fill the gap left by government. Governments are not always financially able to assist farmers when they suffer from price volatility or low harvest yields (Kang & Mahajan, 2006).

Furthermore, Thomas (2018) investigated the possibility of using the revenue insurance instrument in the mineral industry to stabilize revenue when faced with commodity price volatility. Thomas (2018) proposed that mineral-dependent countries should collaborate to form an insurance scheme where they will each contribute 0.25 percent of their annual GDP as a premium. The insurance scheme would be managed by a non-governmental committee made of technocrats from the member states to limit political interference. Once the premiums are collected, Thomas (2018) projected that they would be used to pay claims of any member state. According to Thomas (2018), each year a portion of the premiums remaining after the claims were paid out would be spent to address the biggest shortfalls faced by mineral-dependent countries. The portion to be spent would be based on a pro-rata of money contributed by member states. The identified shortfalls are diversification, education, research, and innovation projects. Countries would be eligible to claim when an insured commodity experience a drop of more than 10 percent when compared to the previous

year's average price. The scheme guaranteed that mineral-dependent countries would receive no revenue less than 90 percent of the preceding year's average price from a commodity.

Requirements for the application of the revenue insurance policy option

The first requirement of the revenue insurance policy option is that member countries must be resource dependent. The second requirement is that each member country should be willing to contribute a percentage set by the revenue insurance scheme from its annual GDP (United Nations Department of Economic and Social Affairs, 2007).

Advantages of the revenue insurance policy option

Advantages of the revenue insurance policy option are:

- The United Nations Department of Economic and Social Affairs (2007) considered the revenue insurance policy option to be a policy option that can reduce risk of default; this gives the mineral dependent country leverage to apply for credit.
- In theory the policy option guaranteed the member countries that they would not receive revenues below 90 percent of the previous year's average revenue (United Nations Department of Economic and Social Affairs, 2007; United Nations Trade and Development Commission, 2019).

Disadvantages of the revenue insurance policy option

Disadvantages of the revenue insurance policy option are:

- The United Nations Trade and Development Commission (2019) normally does not recommend insurance for revenue and commodity price because the policy option lacks information and does not have regulatory frameworks.
- Countries normally struggle to govern their existing policies which means that there is no guarantee that a group of countries could successfully unite to join a scheme (United Nations Department of Economic and Social Affairs, 2007; United Nations Development Programme, 2011).

All policy options discussed in Sections 2.4.1 to 2.4.5 address commodity price volatility. Supply management requires coherent action and agreement among

stakeholders which is difficult to sustain as noted by Brown *et al*. (2008). Countries normally struggle to agree on requirements of supply management contracts. NRF requires strong institutions in legal framework and education for their successful implementation. The market-based price risk management policies require certain infrastructure before they can be feasible on a large scale and they are costly. The policies are best applicable to private companies and not government organizations. Compensatory finance can lead to grant dependency and a cycle of being in debt. Mineral-dependent countries are already dependent on minerals therefore, adding grant dependency does not assist in the goal of making these countries self-sustainable. Revenue insurance requires discipline from a country to pay premiums and forego a certain percentage of GDP earned each year. It also requires strong legal frameworks to make sure the insurance is transparent and practically feasible.

It is necessary to do an evaluation on how to choose the best policy option among the five discussed in previous sections. The policy option to be chosen should be able to lessen the impact of commodity price volatility on the mineral dependent Namibian economy.

2.5 Tools to access and select policy options

The United Nations Development Programme (2011) and United Nations Trade and Development Commission (2019) have done numerous analyses on the five policy options available to mineral-dependent countries. They discussed in detail the requirements, experience, advantages and disadvantages of the policy options. However, there are no proper guidelines to assist countries to choose suitable options to implement among the five policy options. Therefore, the decision is left entirely on the mineral-dependent country. The method by which a policy option is chosen by a mineral-dependent country has not been included in the United Nations Development Programme (2011) or the United Nations Trade and Development Commission (2019) work.

Thomas (2018) identified insurance as a better policy option to insure mineral revenues against commodity price volatility. Thomas (2018) argued that the fact that insurance is already used in everyday life to insure cars and homes makes the policy options more acceptable. According to Thomas (2018), the proposed insurance

schemes money is invested in different financial vehicles securing the funds. This makes it a good policy option because there will always be money to pay out claims when the prices of mineral commodities drop. Secondly, Thomas (2018) motivated the choice of insurance as a good policy option because insurance companies are one of the biggest sources of investment. This gives a degree of guarantee that the insurance scheme will always have money to fund claims. One of the limitations of the research by Thomas (2018) is that it only focused on one policy option as an appropriate policy option for certain countries without analysing other policy options. Therefore, all five policy options must be reviewed to select the suitable policy.

Brown *et al.* (2008) evaluated the applications of the five policy options in detail. They then summarized and compared the policy options using a tick box method. The tick box method looked at whether the policy option addresses income risk, social risk, environmental risk, affects price levels, and can be easily scaled up. Using this tick box method, a mineral-dependent country would choose a policy option which best lessens the impact of mineral commodity price volatility. One of the limitations of Brown *et al.* (2008)'s work is that it did not analyse how policy options interact with a country's economy. This is a drawback as there is no guarantee that the policy option that would be chosen using this method will be coherent and successful to support the mineral-dependent country's economy during price drops.

This still leaves the question of, how mineral-dependent countries can know which policy option best suits their economies, given the strength, weakness, opportunities and threats of the mineral-dependent countries' economies. Breen *et al*. (2013) tried to answer this question when they analysed policy options available for agricultural- dependent countries that are vulnerable to price volatility of agricultural products. Breen *et al*. (2013) first analysed how price risk can be controlled. This was done by analysing how functional, effective, feasible and acceptable (political and budgetary) the policy options were in controlling commodity price risk. They coupled this with the cost and benefits of policy options and created a multi-criteria analysis approach. The approach was used to rank the policy options to determine which policy option scored better. The policy that had a higher score was considered the best policy option. Currently, there is no other literature that attempted to do similar work of finding

some criteria to rank the policy options for either agricultural dependant or mineral dependent countries.

Currently, Namibia does not have any of the five policy options in place except the MDFN that failed. Guidelines on selecting the best suitable policy option for Namibia among the five options are needed. This was achieved by extending the multi- criteria approach used by Breen et al. (2013) to the minerals sector. Therefore, in this research the study did not introduce a new method but rather adopted the multi- criteria by Breen et al. for agricultural dependant countries to be used for a mineral dependant country. The adopted multi-criteria approach was then customized for mineral dependant countries by incorporating the guidelines from the United Nations Development Programme (2011) and the United Nations Trade and Development Commission (2019) together with the principles of use for evaluation criteria from the Organization for Economic Co-operation and Development (2019) to form a new multi-criterion specifically for mineral dependent countries. This mineral dependent specific multi-criterion was then used in this research study to evaluate the different policies whilst considering the Namibian economy's SWOT to find a policy option that suited the country's economy.

2.6 Existing legal frameworks of Namibia

Namibia's mineral industry is regulated by the Mineral (Prospecting and Mining) Act 33 of 1992, Diamond Act 13 of 1999, Mineral Development Fund of Namibia Act 19 of 1996 and Mineral Policy created in 2003. The Mineral (Prospecting and Mining) Act 33 of 1992 explains the ownership of minerals in Namibia and give guidelines on the administration of the minerals industry (Republic of Namibia, 1992). The objectives of the Mineral Development Fund of Namibia Act (section 3) 19 of 1996 are to (Republic of Namibia, 1996):

- Safeguard the production and earning power of the country's mining industry;
- Broaden the production base of the industry into the national economy through diversification as well as horizontal and vertical integration;
- Support the mining industry by improving the national geological, geophysical, and mineral database; and

- Support the Namibian mining industry by investing in education through the expansion of national training facilities and programs.

The fund was managed by a board whose duties were outlined in section 4 of the Act (Republic of Namibia, 1996). This is crucial as most SWFs fail due to poor management and simply appointing a board does not guarantee that the fund will be managed well (Brown *et al*., 2008; South Centre, 2005; United Nations Trade and Development Commission, 2019).

The Diamond Act 13 of 1999 was developed to provide guidelines on the establishment of the Diamond Fund. The fund was also managed by a board called the Diamond Board of Namibia and the act defined the powers, functions, and duties of the board (Republic of Namibia, 1996). To ensure that both exploration and mining activities in the country comply with the environmental and economic regulatory framework, the Mineral Policy was drafted and signed in 2003 (Ministry of Mines and Energy, 2003).

The existing legal framework has made room for some policy options to lessen the impact of commodity price volatility on the Namibian economy. Among the four legal frameworks, only two had provisions to establish funds. One of the funds was a development fund and the other a savings funds and both fall under the national reserve management policy option for managing commodity price volatility.

All the four legislations discussed above support the policy options for managing commodity price volatility. This is because they make provisions for the mineral industry to comply with economic regulatory frameworks and establishing funds. For example, the use of the Medium-Term Expenditure Framework (MTEF) which is aimed at controlling government spending of mineral revenue. Currently, Namibia also opts to use the government spending smoothening option instead of using a stabilization fund to achieve fiscal discipline. Using the smoothening option, the government's fiscal goal is to limit public debt to 25 percent of GDP. Even though this does not necessarily mean that the government will increase savings during the periods of peak mineral revenue receipts, the option prevents the government from borrowing against future mineral receipts (International Monetary Fund, 2008). According to Koep & Partners (2019), Namibia also has an option of using an investment agreement for the

stabilization of government revenue. Therefore, it can be concluded that the current legal framework in Namibia does support policy options aimed at reducing the impact of commodity price volatility. As a mineral-dependent country finding a policy option that can reduce the impact of commodity price volatility on the government's revenue is essential to cushion the economy for when mineral commodity prices drop.

2.7 Chapter summary

This chapter discussed the requirements of a country to be classified as mineral dependent, outlined how a country is classified as being mineral dependent and looked at mining's relative importance to a mineral dependent country's economy by using the mining contribution index. This chapter summarised the drawbacks of mineral dependency. It defined price volatility and discussed the causes of price volatility, the price trends were also looked at. It summarised the five policy options used to management commodity price volatility by grouping each policy's requirements, advantages, and disadvantages. The different tools available for use under each policy options and their existing practical applications were studied in this chapter. The chapter concluded by looking at the Namibian legal framework and found that the framework makes provision for policy options to be used in Namibian to reduce the impact of mineral commodity price volatility on the county's economy.

3 RESEARCH METHODOLOGY

3.1 Chapter overview

This chapter describes the method used to conduct the research. It also outlines the input data used to populate the modified policy ranking matrix. It describes how the matrix was modified. Minerals which are crucial to the Namibian mining economy in terms of contribution to GDP and export earnings were also identified in the chapter.

3.2 Input data and their sources

Strengths and weaknesses of the five policy options discussed in Chapter 2 were summarized. The mineral commodity price obtained from the annual reports of the Chambers of Mines of Namibia was used to calculate coefficients of variation. Statistics on the contribution of mineral commodities to GDP, government revenue and export earnings were obtained from the annual reports of the Chamber of Mines of Namibia, Namibian Ministry of Finance, and the Bank of Namibia. These were used to simulate the possible conditions for Namibia to pay money into a SWF or an insurance scheme and to qualify for pay-outs from selected policy options.

The study was done for the period from 2000 to 2018. The period was selected as this is the time during which commodities experienced both the increase and decline in their prices, post and pre the global economic crisis in 2008. Data mentioned in the paragraph above was collected for that period except diamonds price which was for the period from 1960 to 2016. This is because diamonds are not sold at spot price; they are primarily sold through private contracts with negotiated prices that are not disclosed to the public (Antwerp World Diamond Centre private foundation (AWDC), 2012). Using different data sources on the diamond contracts, Index Mundi (2020) compiled a ten-year average price of diamonds. The contracts consider various factors such as the political landscape and legislation changes during these ten-year periods. Hence, Index Mundi (2020) used different resources and managed to average the diamond price every tenth year since 1960 until 2010. After 2010, the only prices available are for 2013, 2015 and 2016. Since diamonds prices are not available for each year, all the available diamonds price data was used in the research.

3.3 Case study: mineral commodities

Composition of mining, contribution to GDP and individual export share of total mining exports were the indicators used to choose the top minerals crucial to the mining industry of Namibia. The minerals that have the largest composition in mining are diamonds and uranium as shown in Figure 1. Diamonds normally have the largest composition of mining; there are periods where diamonds constituted more than 70 percent of the total mining. Uranium is the second highest contributor to mining. In 2018, uranium constituted approximately 26 percent of total mining (Chamber of Mines of Namibia, 2020). In 2008, uranium constituted approximately 37 percent of total mining surpassing diamonds that constituted approximately 35 percent of total mining (Chamber of Mines of Namibia, 2008).

The next group is ‘metal ores’ which is a combination of copper, manganese, zinc, other metal ores. Uranium’s economic performance was reported under ‘metal ores’ group until 2006. From 2007 it was reported individually. Since the composition of mining indicator only reported individual statistics for diamonds and uranium, the other economic indicator used was contribution to GDP. Table 4 shows the contribution of each mineral to GDP.

Table 4: Mining contribution to GDP

(Chamber of Mines of Namibia, 2017, 2018, 2020)

Year	Diamonds (%)	Uranium (%)	Metal ores (%)	Other mining and quarrying (%)	Mining-all minerals (%)
2000	7,3	1,8	0,9	0,1	10,1
2001	9,5	1,6	1,0	0,1	12,2
2002	10,4	1,8	1,5	0,2	13,9
2003	7,2	0,1	0,8	0,1	8,2
2004	8,2	0,5	0,9	0,3	9,9
2005	7,0	0,9	1,2	0,3	9,4
2006	8,7	1,3	2,2	0,4	12,5
2007	5,9	3,6	2,2	0,9	12,7
2008	8,5	5,9	1,6	1,1	17,2
2009	3,5	4,3	1,8	1,3	10,9
2010	5,7	2,2	1,4	1,1	10,4
2011	4,7	1,7	1,0	1,3	8,7
2012	7,6	2,1	1,0	2,0	12,7
2013	6,0	1,3	1,0	1,9	10,2
2014	6,3	0,9	1,2	1,2	9,6
2015	5,4	0,9	1,9	0,6	8,9
2016	4,6	0,9	3,3	0,6	9,5
2017	4,0	1,0	2,7	0,6	8,3
2018	4,4	1,2	2,6	0,7	9,0

Table 4 only distinguished the contribution to GDP of diamonds and uranium with other minerals reported under metal ores. The last indicator analysed was mineral export

share to total mining exports. The individual mineral's contribution to exports is shown in Table 5.

Table 5: Mining contribution to total exports

(Chamber of Mines of Namibia, 2017, 2018, 2020)

	Diamonds (%)	Uranium ore (%)	Copper (%)	Metal Ores (%)	Zinc Refined (%)	Other Minerals (%)	Mining contribution to total exports (%)
2000	42,7	0,0	0,6	12,9	0,0	0,6	56,9
2001	40,0	0,0	1,9	12,9	0,0	0,6	55,4
2002	38,6	0,0	1,9	12,7	0,0	0,8	54,1
2003	27,2	0,0	1,4	8,4	1,9	0,7	39,6
2004	35,3	0,0	1,5	9,1	5,0	0,8	51,7
2005	31,2	0,0	1,3	9,5	8,2	0,8	51,1
2006	32,4	0,0	1,5	12,6	12,0	1,1	59,6
2007	20,6	9,8	4,3	4,9	14,4	1,5	55,5
2008	18,5	21,4	4,4	4,0	7,5	1,6	57,3
2009	16,6	15,0	6,5	4,8	7,2	1,6	51,7
2010	20,2	15,5	5,4	4,9	7,6	1,7	55,3
2011	19,8	12,5	9,0	4,0	6,7	2,0	54,0
2012	21,3	13,7	7,8	3,7	5,5	1,9	54,1
2013	24,1	13,8	3,8	4,5	5,9	2,0	54,1
2014	27,9	9,7	2,3	4,8	7,0	1,8	53,4
2015	27,9	7,2	3,0	8,1	3,8	1,2	51,3
2016	23,2	5,7	4,5	8,5	4,0	1,0	47,0
2017	25,5	6,8	4,9	10,5	4,8	1,4	53,9
2018	18,2	14,2	5,2	8,9	4,2	1,3	51,9

In Table 5, two new individual minerals are identified which are copper and zinc. The individual export performance for uranium ore and refined zinc were reported starting from 2007 and 2003 onwards, respectively. In previous years, these two minerals were reported under 'metal ores'. In 2018, copper contributed approximately 10 percent of mining exports which was 5.2 percent of the total Namibian exports whilst zinc contributed approximately 8.1 percent of mining exports, which was approximately 4.2 percent of total Namibian exports (Chamber of Mines of Namibia, 2020).

Considering contribution to mining and GPD (Indicators 1 and 2), diamonds and uranium still contributed more. Diamonds contributed 18.2 percent to total Namibian exports which is 35.1 percent of mining exports whilst uranium contributed 14.2 percent to total exports which is 27.4 percent of mining exports. Therefore, in terms of mineral contribution to mining exports the highest contributing minerals are diamonds, uranium, copper, and zinc. The Chamber of Mines of Namibia (2017, 2018, 2020) noted that the contributions of other minerals are insignificant. Also, reliable data on these individual minerals' contributions to total mining exports do not exist hence, they are grouped and reported under mineral ores. Based on the three indicators, four minerals were identified as crucial to the Namibian mining industry. These are diamonds, uranium, copper and zinc in order of their contribution.

3.4 Commodity price volatility for the four selected minerals mined in Namibia

In Section 2.3.1, it was established that the best way to quantify the volatility of mineral commodity prices is to calculate the coefficient of variation (United Nations Trade and Development Commission, 2018). Therefore, to quantify the volatility of the four selected minerals mined in Namibia, the coefficient of variation was used over the analysis period mentioned and explained in Section 3.2. According to the Statistics How To (2020), a coefficient of variation can be calculated using Equation 3.1:

$$\mathrm{CV} = \frac{\sigma}{\bar{X}} \tag{3.1}$$

where; *CV is coefficient of variation,* σ *is standard deviation, X is the mean of the sample.* Standard deviation was calculated using Equation 3.2:

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{X})^2} \tag{3.2}$$

where; n is number of commodity price observations, *x is* commodity price. According to Kelemu (2021), when CV is:

- Less than 0.2, it means there is less price volatility.
- Between 0.2 to 0.3, it means there is moderate price volatility.
- Greater than 0.3, it means there is high price volatility.

3.5 Correlation of Namibian mining industry to the country's economy

To better understand the impact of mineral commodity prices on the Namibian economy, the correlation coefficient between mining growth and real GDP growth was calculated. Mining growth was used because mineral commodity prices have a major influence on how the mining industry grows. As explained in previous chapters, Namibia is a mineral-commodity- dependent country which means that the mining industry has a significant impact on the Namibian economy. To quantify this relationship, the correlation coefficient between the mining industry and real GDP growth was calculated. According to Statistics How To (2021), a correlation coefficient can be calculated using the Pearson's correlation coefficient formula shown by Equation 3.3:

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}} \quad (3.3)$$

where; *r is the* strength of correlation between x and y variables being evaluated, *n is the samples size.* Statistics How To (2021) explained how to interpret the correlation coefficient, saying that a correlation coefficient equal to:

- 1 indicates that the two variables have a direct proportional relationship. This means that when one variable experiences a negative decrease or positive increase the other variable experiences a corresponding equal negative decrease or positive increase.
- -1 indicates that the two variables have an inverse proportional relationship. This means that when one variable experiences a negative decrease the other variable experiences a corresponding equal positive increase and vice versa.
- 0 indicates that there is no relationship between the two variables. This means a positive or negative increase in one variable does not result in a positive increase or negative decrease in the other variable, respectively. In other words, it means that the two variables are not related.

3.6 Data analysis methods

To choose the best policy option, a matrix was developed to rank the policy options based on their strengths and weaknesses. As explained in Chapter 2, the multi-criteria analysis of risk management tools developed by Breen *et al.* (2013) for agricultural commodities price risk management was adapted for this research. To suit mineral- dependent countries, the matrix was modified using the evaluation criteria from the Organization for Economic Co-operation and Development (2019). The evaluation criteria were used to derive the criteria which were used to evaluate the policy options to manage commodity price volatility and select the best policy options applicable to Namibia. Breen *et al.* (2013)'s matrix and the evaluation criteria from the Organization for Economic Co-operation and Development (2019) were chosen because they consider the economy of the country under analysis unlike the works done by Brown *et al.* (2008) and Thomas (2018) as discussed in Section 2.5. After the two suitable policy options were chosen, a framework was then proposed per policy option. The proposed frameworks outline how the policy option would possibly work

to lessen the impact of commodity price volatility to the Namibian economy. The research followed the following steps:

- Step 1: summarized advantages and disadvantage of each policy option.
- Step 2: defined the criteria and evaluating the policy options.
- Step 3: outlined the scales to be used for criteria to rank the policy options.
- Step 4: created an evaluation matrix.
- Step 5: ranked the policy options and choose the best two.
- Step 6: from the two chosen policy options, a framework on how the policy would work to lessen the impact of commodity price volatility on the Namibian economy was proposed per policy.

3.6.1 Evaluating policy options

The policy options were evaluated and then ranked. Four focus evaluation points according to the multi-criteria analysis of risk management tools for policy options by Breen *et al.* (2013) were evaluated. These are cost of implementing the policy options, budgetary acceptance by the Ministry of Finance, the practicality of the policy options in terms of functionality and lastly the effectiveness of the policy options in controlling commodity price risk. The evaluation guidelines from the Organization for Economic Co-operation and Development (2019) has the following six criteria:

- Coherence- how the policy option will complement existing policies in the country.
- Sustainability- the ability of governement to sustain the policy option and the duration of the benefits derived from the policy option.
- Efficiency- how resources will be used.
- Relevance- the extend of the policy option to control commodity price volatlity.
- Impact made by the policy option.
- Effectiveness of the policy option in achieving the set objectives.

The above points are summarised in Table 6. The last column of the table shows the four criteria that were applied in the mineral CPVPO matrix for the Namibian case

study. The four were derived from Breen *et al.* (2013) and Organization for Economic Co-operation and Development (2019) as mentioned in previous sections of the report.

Table 6: Developing the commodity price volatility policy options matrix for mineral commodities

Multi-criteria analysis of risk management tools for policy options (Breen , et al., 2013)	**Better Criteria for Better Evaluation (Organization for Economic Co-operation and Development, 2019)**	**Commodity Price Volatility Policy Options Matrix**
Acceptability-The policy option should not cause trade distortion.	**Coherence-**How well will the policy option fit.	**Acceptability-**The policy option should not cause trade distortion, does the policy option complement existing methods implemented to reduce impact of commodity price volatility.
Cost-Price related to implementing and sustaining policy option.	**Sustainability-**Will the government be able to sustain the policy option and will the benefits from policy option last.	**Cost-**Cost related to implementing, cost efficiency and cost sustainability of policy option, Will the government be able to sustain the policy option and will the benefits from policy option last.
Operationally-Barriers of implementation, flexibility and adaptability.	**Efficiency-**How well will the resources be used.	**Practicality-**Barriers of implementation, flexibility, adaptability, resource utilization.
Effectiveness-Does the policy option manage the risk.	**Impact-**What difference will the policy option make? **Relevance-**Is the policy option controlling the commodity price volatility. **Effectiveness-**Is the policy option achieving its objectives.	**Effectiveness-**Achieve the objective by managing the risk and making a difference.

The first criterion in the new matrix is acceptability of the policy options. The criterion evaluated whether a policy option does not cause trade distortions according to Breen *et al.* (2013) and whether the policy option will complement existing policies in Namibia, for example MTEF. A policy option was acceptable only if it will complement existing policies according to Organization for Economic Co-operation and Development (2019).

The second criterion in the matrix is cost. Breen *et al*. (2013) and Organization for Economic Co-operation and Development (2019) each had only one condition under cost. The new matrix will consider both conditions by first analysing the cost involved in implementing the policy options and then analysing the cost of maintaining the policy after it is implemented as shown in column 3 of Table 6. The third criterion analysed is practicality which analyses barriers of implementation, flexibility, and adaptability of the policy options. The efficiency aspect analysed how resources will be utilized by the policy options.

The last criterion in the matrix is effectiveness of the policy option which analysed whether the policy option will manage commodity price risk. However, being able to manage risk is not enough to consider a policy option as being effective. Thus, this criterion also analysed whether the policy option will achieve the policy's set objectives.

3.6.2 Scales used for the four criteria

A policy option must pass the acceptability criterion before being further evaluated. To pass the acceptability criterion, the policy option must pass both sub-criteria of acceptability discussed in the previous subsection. Once a policy option passed the acceptability criterion it was further evaluated against the remaining three criteria after which the policy option was ranked using scores. Each criterion had three possible scores ranging from 1 to 3 as shown in Table 7. The cost criterion was represented using negative scores as any cost related to a policy option is considered a disadvantage by the government, since cost is a cash outflow.

Table 7: Scales used to evaluate policy options for ranking

(Adapted from Breen *et al*., 2013)

Criterion	**Acceptability**	**Cost, practicality and effectiveness.**	
Measure	Fail/Pass	Scale	Fulfilment
		1	Weak
		2	Moderate
		3	Complete

A score of 3 was the highest possible score indicating that the policy option had fulfilled the criterion and a score of 1 was the lowest possible score indicating that the policy option had not fulfilled the criterion. These scores obtained for each policy option under different criteria were then summed to give a total score for the policy option. For market-based price risk management tools policy option, further evaluation was done to assess the risk of the contracts used to activate the tools as shown in Table 8.

Table 8: Scale for additional criteria to rank market-based risk management tools

	Additional Criteria for Market-Base Price Risk Tools
Scale	Fulfilment
0	Risk not associated with tool
-1	Risk moderately associated with tool
-2	Risk highly associated with tool

The assessment in Table 8 lower the ranking of the market base tools if the risk being assessed is associated with the tool. As shown in Table 8, the additional evaluation analysed if a certain risk was associated with the market-based price risk management tools policy option. If there was no risk, then the score was 0. If there was a high risk associated with the tool, then a score of -2 was assigned. The scores were assigned negative scores since any risk associated with market-based price risk management tools policy option raises a concern of whether the policy option will be able to lessen the impact of mineral commodity price volatility on the Namibian economy.

3.6.3 Commodity price volatility policy options matrix

The commodity price volatility policy options matrix was developed to have four main criteria and eight sub-criteria as shown in Table 9.

Table 9: Four main criteria by which the policy options were evaluated

Criteria for Evaluation	**Acceptability**		**Cost**		**Practicality**		**Effectiveness**	
Sub Criteria	Trade Distortion	Compatibility	Cost of Implementation	Cost sustainability and efficiency	Ease of Implementation	Flexibility/ Adaptability	Managing Risk	Resolving Market Failure
Description of Criterion	Does policy option cause trade distortion	Does the policy option complement existing methods implemented to reduce impact of commodity price volatility	Cost for implementation (Lesser costs are more desirable). Cost must be equitable	Will the cost of the policy option be sustainable and will the benefits from policy option last	Barriers of implementation (example legal framework, Institutions) and resource utilization	Capacity of Policy option to adapt over time	Achieve the objective by managing the risk	Policy option's impact on market failure caused by ,market control or externalities
Rule	Pass/Fail	Pass/Fail	Scale 0-3	Scale 0-2	Scale 0-2	Scale 0-2	Scale 0-2	Pass/Fail
Scale								
1			High Cost	Difficult to sustain	Infeasible	Cannot adapt	Ineffective	
2			Medium cost	Moderately sustainable	Feasible	Weak	Limited	
3			Low cost	Sustainable	Highly feasible	Moderate	Effectiveness	

Table 9 depicts the four criteria of acceptability, cost, practicality, and effectiveness that were used to evaluate the five policy options. However, there is one policy option that needed additional evaluation to factor in the risk of the contracts. The additional evaluation for the market-based tools were developed to have four sub-criteria as shown in Table 10.

Table 10: Additional evaluation criteria for market-based price risk management tools

(Adapted from Breen *et al*., 2013)

Sub Criteria	Additional Criteria for Market-Base Price Risk Tools			
	Basis	Counter-party	Systemic	Compounded Production Risk
Description of Criterion	Risk that the spot price and the futures price do not converge	Risk of contract counterparty defaulting on delivery of cash product	Risk of collapse of entire market due to exposure across entire system	Risk that seller will have to satisfy contractual agreement and supply output despite a failure in production (where seller will have to buy in at inflated market prices)
Rule	Scale 0-2	Scale 0-2	Scale 0-2	Scale 0-2
Scale				
0	Risk not associated with tool	Risk not associated with tool	Risk not associated with tool	Risk not associated with tool
-1	Risk moderately associated with tool	Risk moderately associated with tool	Risk moderately associated with tool	Risk moderately associated with tool
-2	Risk highly associated with tool	Risk highly associated with tool	Risk highly associated with tool	Risk highly associated with tool

In Table 10, the first sub-criterion analysed whether there was a risk that the spot commodity price and future commodity price will not converge. The second sub-criterion analysed whether there was a risk that the contract counterparty would default on delivery of a cash product. The third sub-criterion analysed the risk of collapse of the entire market due to exposure across the system. The last sub-criterion analysed whether a seller would satisfy the contractual agreement.

3.7 Chapter summary

This chapter outlined the input data and their sources as well as the minerals used for the research. The methods to determine the commodity price volatility for the four main minerals mined in Namibia and correlation of the Namibian mining industry to economy were also outlined in this chapter. The chapter described two available matrix methods of evaluating the policy options, the Breen, et al (2013) and Organization for Economic Co-operation and Development (2019) matrix methods. This two matrix methods were

then adapted and few adjusments made to develop a modified matrix for commodity price volatility policy options having four criteria used to rank the policy options.

4 IMPACT OF MINING ON THE NAMIBIAN ECONOMY

4.1 Chapter overview

This chapter provides a detailed analysis of the Namibian economy and mining industry and how the two are linked by looking at the mining industry's contribution to GDP and the real GDP growth of the country. The chapter then describes how the performance of mining due to mineral commodity prices and production outputs impact the country's economic growth in terms of real GDP growth.

4.2 Namibian economy

The Namibian economy is dominated by the exploitation of key non-renewable minerals resources. Since independence, Namibia has been faced with the challenge of transforming its non-renewable mineral resources into overall national growth and prosperity whilst avoiding resource over-exploitation. Resource over-exploitation is an eminent risk to any mineral-dependent economy. The risk of over-exploitation increases if the mineral-dependent country does not have diversity in the non- renewable mineral resources it mines (Fernandes, 2014). The Namibian economy is a good example of such a mineral-dependent country as it is poorly diversified and heavily reliant on non-renewable mineral resources (Fernandes, 2014). Humavindu & Stage (2013) described the Namibian economy as a dual economy that mainly comprises of a modern market and subsistence farming. Majority of the country's population is in the northern part of the country and is highly dependent on subsistence agriculture.

Most of the country's wealth comes from the modern market which is made up of capital-intensive industries, mining and agriculture. Even though the mining industry is highly productive and contributes significantly to the country's real GDP growth, it does not create a lot of employment when compared to agriculture. Most of the Namibian work force (30 percent) is employed in the agricultural sector in commercial farms (International Monetary Fund, 2014). Based on the research by Humavindu & Stage (2013), raw materials have minimal value addition as they are exported either in unprocessed or semi-processed form.

4.2.1 Balance of payments

Mineral exports significantly affect a country's BoP (United Nations Trade and Development Commission, 2019; Renner & Wellmer, 2019). This is one of the reasons why mineral-dependent countries must implement policy options that lessen the impact of mineral commodity price volatility. BoP is the difference between net income (money in flow) and expenditure (money out flow) in a country for a particular period (quarter of a year, half of a year, full year). The net income and expenditure are managed in a current account. The change in ownership of natural resources assets is reflected in the capital account. The current account and capital account make up the main components of BoP. BoP is an important aspect of a country as it:

- Shows a country's economic and financial status;
- Affects a country's budget and debt payments;
- Is a determining factor in the type of trade and fiscal policies a government chooses; and
- Gives an overall picture of the economic dealings a country has with other countries.

Over the years, the Namibian current account has been having a positive balance which is normally offset by the deficit on the capital account, as depicted in Figure 10. The figure shows Namibia's current account balance from 2001 to 2018. This is a rare economic status for a developing country (Humavindu & Stage, 2013). According to Humavindu & Stage (2013), a positive current account shows that a country has excess domestic savings than investments in the economy. These are savings that the country can use for investment when investments opportunities arise such as identified policies that support development of key economic sectors. This means that should Namibia want to implement a policy option to lessen the impact of mineral commodity price volatility on its economy, funding might already be available.

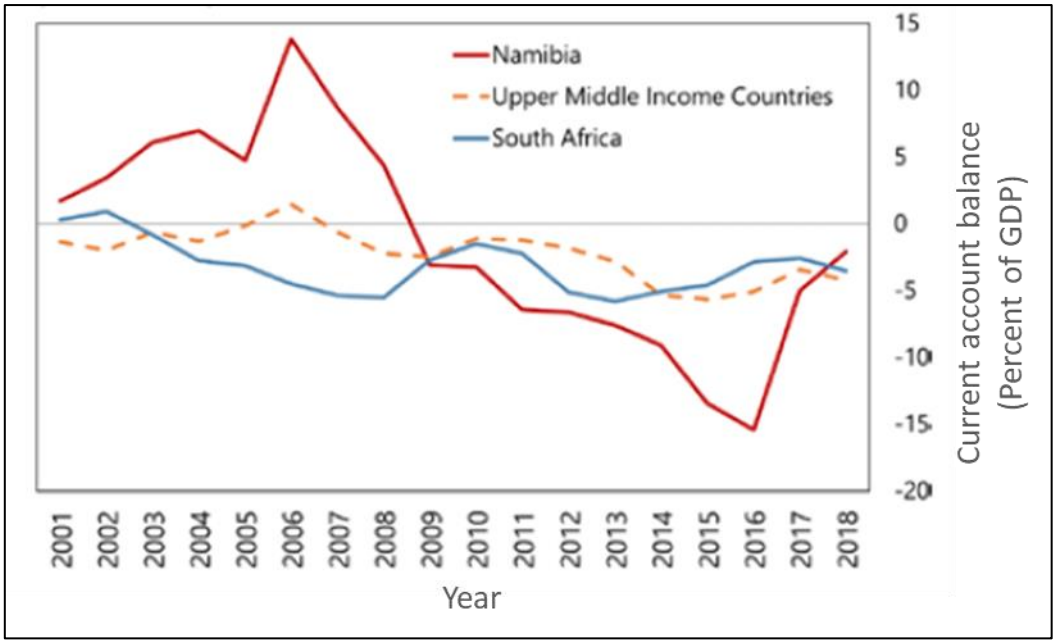


Figure 10: Namibia's current account balance (percent of GDP)

(International Monetary Fund, 2019)

Figure 10 shows that the Namibian current account was in surplus from 2001 to 2003. The International Monetary Fund (2003) reported a surplus of 2.1 percent of GDP in 2001. The Namibian current account also recorded a surplus in 2004. The International Monetary Fund (2006) attributed the 2004 surplus of more than 10 percent of GDP to the surge in diamonds exports (due to increase in diamond prices) and good receipts from Southern African Customs Union (SACU). However, Figure 10 shows a gradual decline in the Namibian current account balance between 2006-2016. The Namibian current account experienced the first deficit in 2009 due to the global economic crisis when exports and prices of mineral commodities dropped. The figure depicts the lowest drop in the Namibian current account balance to be in 2016. According to the International Monetary Fund (2019), this was attributed to the development of large mines in the country, a peak in imports and a drop in non-mineral exports. The following year in 2017, the current account balance started to rise as these large mines become operational.

The outflow in the Namibian capital account was high but still in surplus in 2004 as there were huge investments by banks, insurance companies and pension funds into the South African market. Since the Namibian Dollar is pegged parallel to the South

African Rand, investments benefits in South Africa spilled over to the Namibian economy.

This research focussed on the current account since the aim of the research was to lessen the impact of mineral commodity price volatility on the Namibian economy which is impacted more by the performance of mineral commodities than the capital account. The impact of mineral commodities price movements on the current account has been shown with the current account recording surpluses and deficits as mineral commodity prices increased and decreased, respectively as mentioned in the paragraph above.

4.2.2 Trade openness

The ratio of international trade to a country's GDP is called trade openness. Samundengu (2016) considered trade openness as a determinant of a country's economic growth. Economic growth is defined as the increase in consumption and production of goods and services over a year. Economic growth is measured by comparing the current year's Gross National Product (GNP) to the previous year's GNP. Samundengu (2016) defined GNP as the value of all goods and services produced within a country including all imported goods and services less the value of exported goods and services.

There are two measures of trade openness, which are activity-based and incentive-focused. The activity-based measure considers exports and imports in comparison to a country's GDP, whilst the incentive-focused measure considers free trade, which include things such as tariffs. Most scholars use the activity base approach, which can be calculated as a percentage of exports and imports to GDP (Samundengu, 2016). Humavindu & Stage (2013) used the activity-based approach and found that the sum of exports and imports in the Namibian economy equates to more than 90 percent of GDP. This indicates a very high degree of openness. The openness of the Namibian economy is an indication of the degree of involvement of the economy in international economic relations such as flow of services, goods, and input factors (Mwinga, *et al*., 2020).

Trade openness is calculated using the sum of exports and imports then dividing the sum by the GDP (Mwinga, et al., 2020). When the ratio is close to 1 or above 1 it

shows that the country's economy is vulnerable to global events. For example, economic indicators such as GDP, employment and price level will be impacted by any significant change in foreign economic variables. This is the case for Namibia which had an average score of 0.97 for the period of 2000 to 2018 and 1.02 for the period of 1990 to 2019 (Mwinga *et al*., 2020). Namibia's trade openness over the years is depicted in Table 11. When a country has a low degree of openness like South Africa which scored about 0.6, it means that the country's economy is self-sufficient as it has a large international market. Mwinga, et al (2010) however, cautioned that an extremely low degree of openness is not always an indication of self-sufficiency, at times it can be an indication of an economy being underdeveloped. For example, the trade openness for Zambia is about 0.53 which is lower than that of South Africa. South Africa's economy is bigger than that of Zambia making it unlikely that Zambia's economy is more self-sufficient than that of South Africa (Mwinga, et al., 2020).Therefore, in such cases more information is required, such as the country's competitiveness to world markets to establish if country's economy is indeed self-sufficient.

Table 11: Degree of openness of the Namibian economy

(Mwinga, *et al*., 2020)

Year	GDP N$ Million	Exports Earnings (X) N$ Million	Expenditure on Imports (M) N$ Million	Trade Openess (X+M)/GDP
2000	27125,00	10811,00	12119,00	0,85
2001	30535,00	12446,00	14226,00	0,87
2002	35430,00	16230,00	16966,00	0,94
2003	37304,00	17396,00	18617,00	0,97
2004	42679,00	16991,00	17959,00	0,82
2005	46177,00	18678,00	18615,00	0,81
2006	54028,00	24566,00	22454,00	0,87
2007	62303,00	31553,00	32310,00	1,03
2008	72904,00	40068,00	39446,00	1,09
2009	75214,00	38270,00	41387,00	1,06
2010	82596,00	45170,00	49243,00	1,14
2011	90104,00	42471,00	47462,00	1,00
2012	106862,00	44936,00	60040,00	0,98
2013	122792,00	54029,00	71916,00	1,03
2014	138758,00	64627,00	92135,00	1,13
2015	150080,00	58982,00	98739,00	1,05
2016	166007,00	70912,00	97946,00	1,02
2017	180601,00	57988,00	81210,00	0,77
2018	191121,00	92345,00	109637,00	1,06
Total Average				**0,97**

Benefits of trade openness include access to new technologies and innovations as well as efficient allocation of resources to yield effective productivity to foster sustainable economic growth (Samundengu, 2016). The extent to which a country's economy is exposed to exogenous economic shocks depends on the economic openness and the type of commodities exported by the country.

4.2.3 Key contributors to GDP

According to Mwinga *et al.* (2020), Namibia has three main sectors which contribute to its GDP, categorised into primary, secondary and tertiary. These sectors have different industries within them as shown in Table 12.

Table 12: Namibian economic sectors

(Mwinga, *et al*., 2020)

Namibian sectors	Namibian economic industries
Primary	Mining
	Agriculture
	Fishing
Secondary	Manufacturing
	Electricity and water
	Construction
Tertiary (Services)	Public Administration
	Trade
	Education
	Financial Intermediation
	Real Estate
	Other
	Transport and Communication
	Health
	Hotels
	Community Services

The service sector has about nine industries, whilst the primary and secondary sectors both have three industries each. The others under the service sector are clearly depicted in figure 6. The mining industry is a primary sector. Some industries contribute more to GDP than others. However, there are industries in sectors that are not the top contributors to GDP that individually contribute more to GDP compared to an individual sector as depicted in Figure 11.

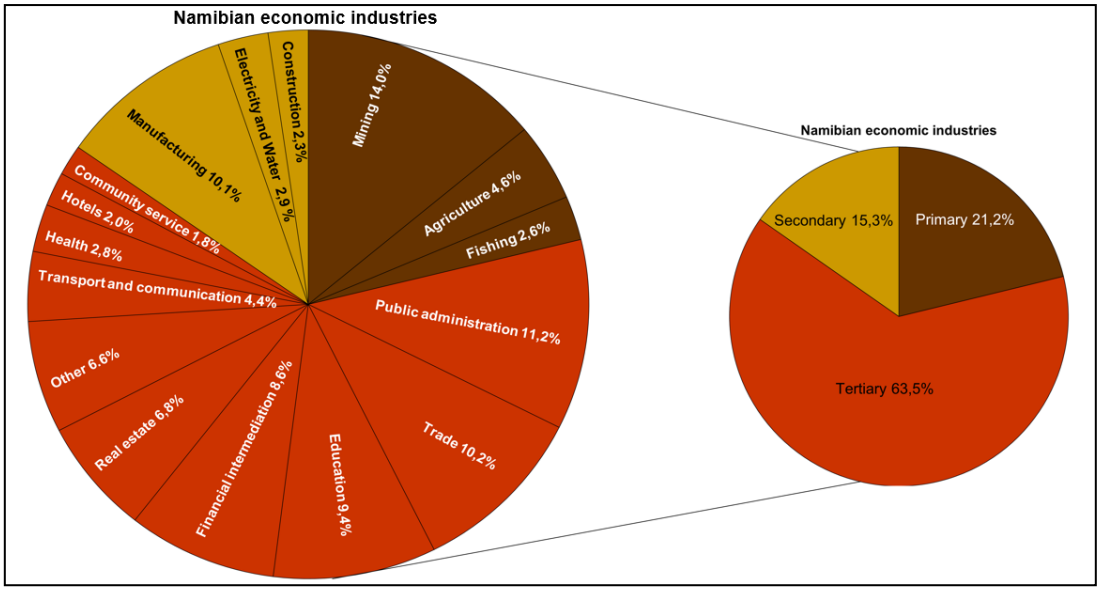


Figure 11: The performance of Namibian economic industries and sectors in 2018

(Institute for Public Policy Research, 2019)

Mining is a significant industry always within the top three industries that contribute to GDP. The mining industry contributed 14 percent in 2018 as shown in Figure 11. This indicates the significance of the industry to the Namibian economy. However, the contribution to GDP by the mining industry is not constant. It has been fluctuating over the years ranging from 13 percent in 1985 to 12.6 percent in 2017. The fluctuation is attributed to fluctuating mineral commodity prices. A directly proportion relationship exist between mineral commodity prices and contributions to GDP by the mining industry (Mwinga, *et al*., 2020). Figure 11 shows that the tertiary sector was the largest contributor to the Namibian economy in 2018, followed by the primary and secondary sectors, each contributing 63.5 percent, 21.2 percent, and 15.3 percent, respectively.

4.3 Namibian mining industry

Namibia is the fifth largest mining industry in Africa. The country is largely endowed with natural resources (minerals and metals) as seen in Figure 12. To date, the full extent of the Namibian mineral wealth is unknown (Ministry of Mines and Energy, 2003). It has been estimated that of the world's identified uranium reserves, 5 percent are found in Namibia (Van Wygaardt, 2017). Minerals extracted in Namibia include

uranium, diamonds, precious metals, base metals, gemstones, dimension stone and industrial minerals (Ministry of Mines and Energy, 2003).

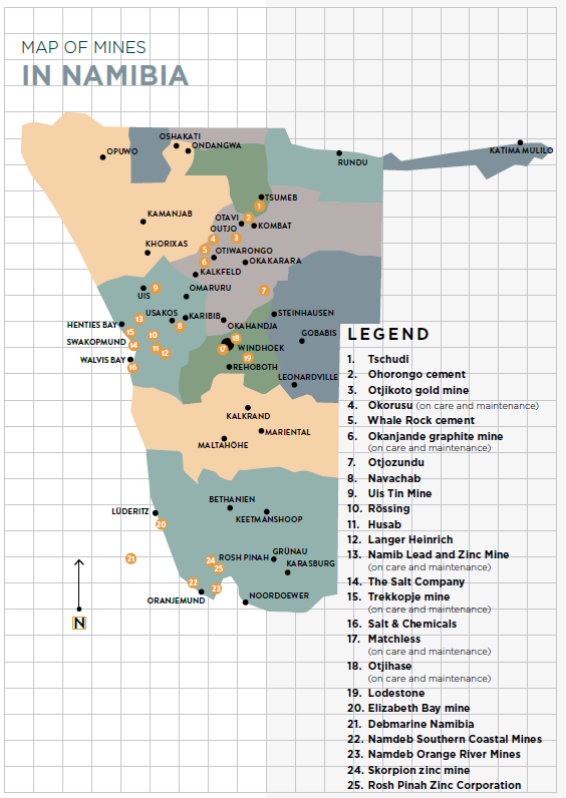


Figure 12: Active mines in Namibia
(Chamber of Mines of Namibia, 2020).

The country has over 20 active mines, which are primarily in the western, central, and southern regions of the country as shown in Figure 12. In Namibia all natural resources (inclusive of minerals, metals) within the continental shelf and territorial waters, that are above and/or below the surface of the land, and within the exclusive economic zone of Namibia belong to the state unless, they are otherwise lawfully owned as stipulated in Article 100 of the Constitution of the Republic of Namibia (Koep & Partners, 2019).

4.4 Namibia's mining industry and the Namibian economy

According to the Chamber of Mines of Namibia (2016), the mining industry's importance is evident based on how it contributes to the country's GDP, employment, fixed investment, exports and corporate social responsibility. The next subsections discuss such contributions.

4.4.1 Revenue distribution in the mining industry

The mining industry generates billions of Namibian dollars revenue each year (Chamber of Mines of Namibia , 2016). The breakdown of how the mining revenue is utilised is shown in Figure 13.

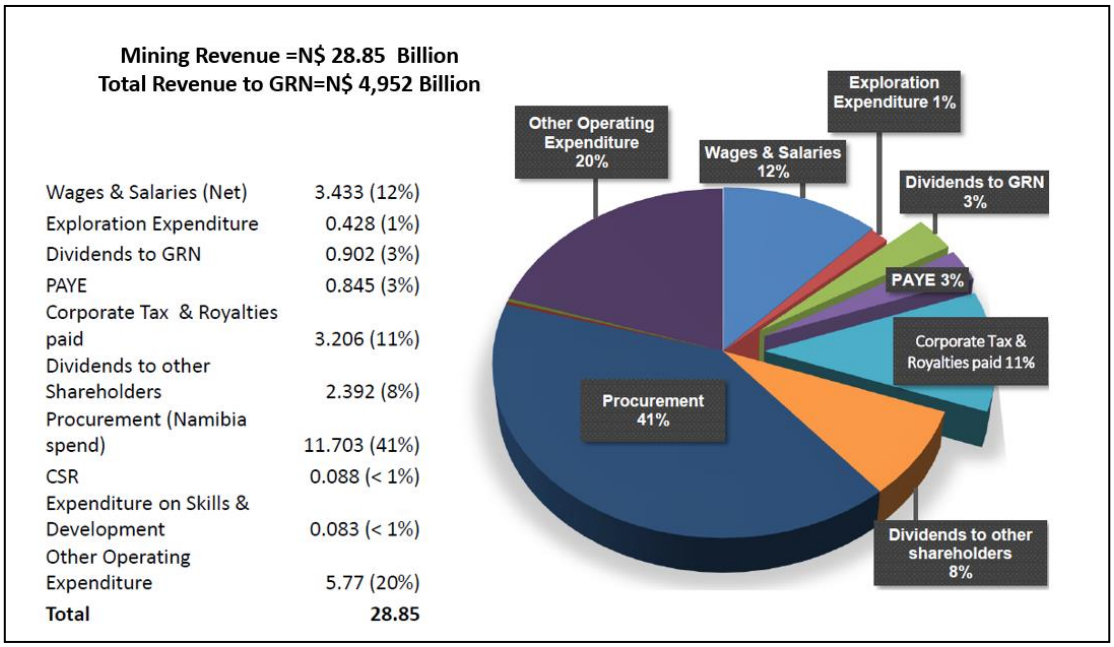


Figure 13: Mining industry cost breakdown- N$Billion

(Malango, 2017)

The mining industry contributed about N$4.9 billion and N$5.6 billion in 2016 and 2017 to the total revenue of the country, respectively (Malango, 2018). The level of contribution changes depending on the revenue the mining companies earn each financial year. Figure 13 also depicts the cost of the mining industry. The largest portion of the mining industry cost is incurred in procurement and other operating expenditures. These two cost items together consume 60 percent of the revenue from mining. Approximately 17 percent (N$4.9 billion) of the mining revenue goes to the government revenue as shown on Figure 13. In order mining industry to contribute N$ 4.9 billion to the government revenue it had to spend about N$ 21.3 billion (Malango, 2017).

4.4.2 Mining contribution to GDP

The mining industry contributes significantly to Namibia's GDP. The contributions vary year to year depending on factors such as commodity prices fluctuations, production

outputs of mines and foreign exchange rate fluctuations. The varying contributions of mining to Namibia's GDP are depicted in Figure 14. On the figure, the line and bars represent contributions to GDP in percentage and N$ terms, respectively.

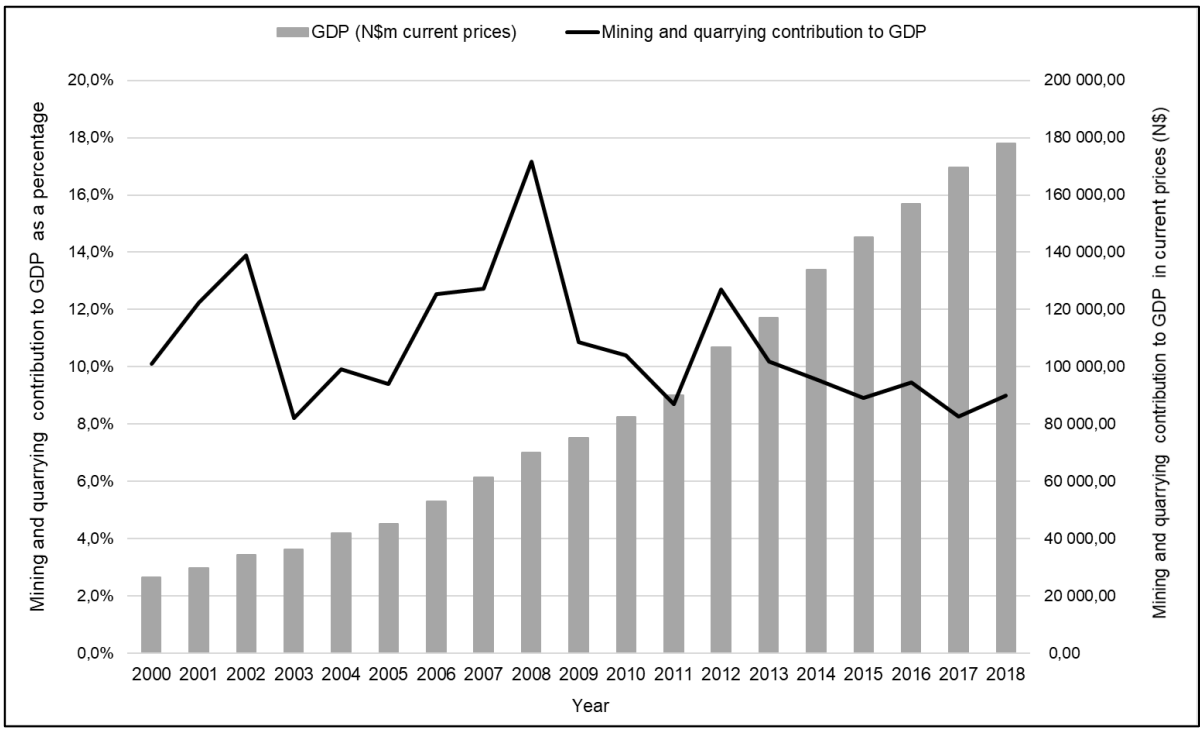


Figure 14: Contribution to GDP by the mining industry

(Chamber of Mines of Namibia, 2017, 2018, 2020)

Figure 14 shows a fluctuating contribution to GDP in percentage terms, with a significant increase from 2005 to a peak in 2008 due to the boom in commodity prices during that period as explained in previous chapters. The contribution significantly dropped in 2008 due to the global financial crisis. In monetary value terms, the contribution to GDP shows a growing trend, increasing from N$13.6 billion in 2012 to N$16.0 billion in 2018. Some minerals are considered the backbone of the Namibian mining industry based on their composition of the mining industry and their individual contribution to GDP. The contribution to GDP of the individual minerals is depicted in Figure 15.

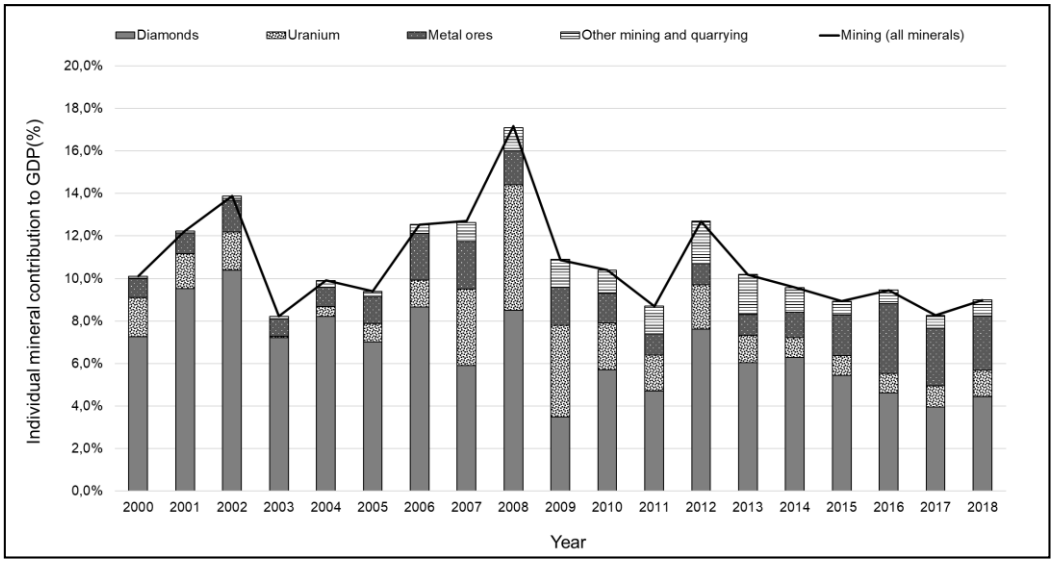


Figure 15: Contribution to GDP by individual minerals

(Chamber of Mines of Namibia, 2017, 2018, 2020).

Figure 15 shows that diamonds' contribution to GDP is more than the other minerals. This supports previous findings in the report.

4.4.3 Mining contribution to employment

The Namibian mining industry created jobs for a total of 18 992 people in 2015, 15 673 people in 2016 and 16 905 people in 2017. These employment numbers include directly employed contractors, permanent and temporary employees employed by the mining industry as reported by Chamber of Mines of Namibia (2016). At first glance these numbers look trivial but when considering the multiplier effect for each employee the contribution increases. The industry is estimated to have a multiplier effect of around 7 (Chamber of Mines of Namibia, 2015). This shows how the mining industry directly and indirectly sustained approximately 132 994, 109 711 and 118 335 people financially in 2015, 2016 and 2017, respectively (Chamber of Mines of Namibia, 2017). These figures are significant because when compared to the country's population of approximately 2.3 million during the period of 2015 to 2017, coupled with the country's high unemployment rates of 20.9 percent, 23.4 percent and 21.6 percent in 2015, 2016 and 2017, respectively, the industry's contribution to employment is significant. The permanent employment statistics for the mining industry is depicted in Table 13.

Table 13: Permanent employment statistics for the mining industry

(Chamber of Mines of Namibia, 2017, 2018, 2020)

	Permanent Employment	Multilpier effect (x7)	Unemployment Rate (%)
2000	6103,00	42721,00	20,30
2001	5948,00	41636,00	20,73
2002	6622,00	46354,00	21,28
2003	7047,00	49329,00	21,74
2004	7445,00	52115,00	22,09
2005	7644,00	53508,00	21,97
2006	8005,00	56035,00	21,70
2007	8215,00	57505,00	21,46
2008	7374,00	51618,00	21,38
2009	6226,00	43582,00	21,95
2010	6847,00	47929,00	22,10
2011	6929,00	48503,00	19,34
2012	8165,00	57155,00	16,77
2013	7582,00	53074,00	19,03
2014	7903,00	55321,00	18,52
2015	8853,00	61971,00	20,88
2016	9574,00	67018,00	23,35
2017	9643,00	67501,00	21,57
2018	9042,00	63294,00	19,88

Table 13 shows a drop in permanent employment after 2008. This was due to the global economic crisis when companies retrenched workers. The employment increased in 2012 and slightly decreased in 2013 and 2014, before increasing again in 2015 when new mines were opening as mentioned earlier in the report.

4.4.4 Mining contribution to fixed investments

The contribution of mining to the Namibian economy also reflects in the percentage of fixed investments the industry makes per year. The Chamber of Mines of Namibia (2016) reported that the mining industry spent more on fixed investments compared to other industries in the primary sectors or from other sectors of the Namibian economy. The fixed investments from mining are depicted in Table 14.

Table 14: Mining fixed investment

(Chamber of Mines of Namibia, 2017, 2018, 2020).

Year	Gross Fixed Capital Formation by Mining companies (includes exlporation)-N$ million	Fixed investment by Chamber Members (Operating and Development Companies)-N$ million
2011	6498,50	5200,79
2012	6489,90	3329,15
2013	16482,83	8538,73
2014	21465,19	17263,44
2015	17381,45	5477,57
2016	9259,92	3486,07
2017	5833,30	5610,76
2018	5376,29	3696,64
2019	5286,51	3372,12

The mining industry spent about N$5.2 billion on fixed investments in 2011 excluding investment in exploration. If investments in exploration are added the total amount increases to N$6.5 billion as shown in Table 14. In 2014, the amount increased to N$17.3 billion (N$21.5 including investment in exploration) because of three new mining projects that were being developed in the country. The amount of fixed investment dropped by 26 percent from N$5.6 billion in 2017 to N$4.1 billion in 2018. Fixed investments in mining are crucial to the Namibian economy as they can be used for industrial development. They also inject money into the Namibian economy which can be used for technology and training. The fixed investments also provide long-term profit opportunities into foreign markets (Chamber of Mines of Namibia, 2020). According to the Chamber of Mines of Namibia (2008), the mining industry spent more on fixed investment as compared to other sectors of the economy with exception of the Namibian government.

4.4.5 Mining contribution to total exports

Mining exports on average constitute about 50 percent of the total merchandise exports of Namibia, making the country mineral-commodity dependent (United Nations Development Programme, 2010). Over the years, the value of mining exports has been increasing significantly as shown in Figure 16 which shows the monetary value and percentage contribution of the country's mining exports.

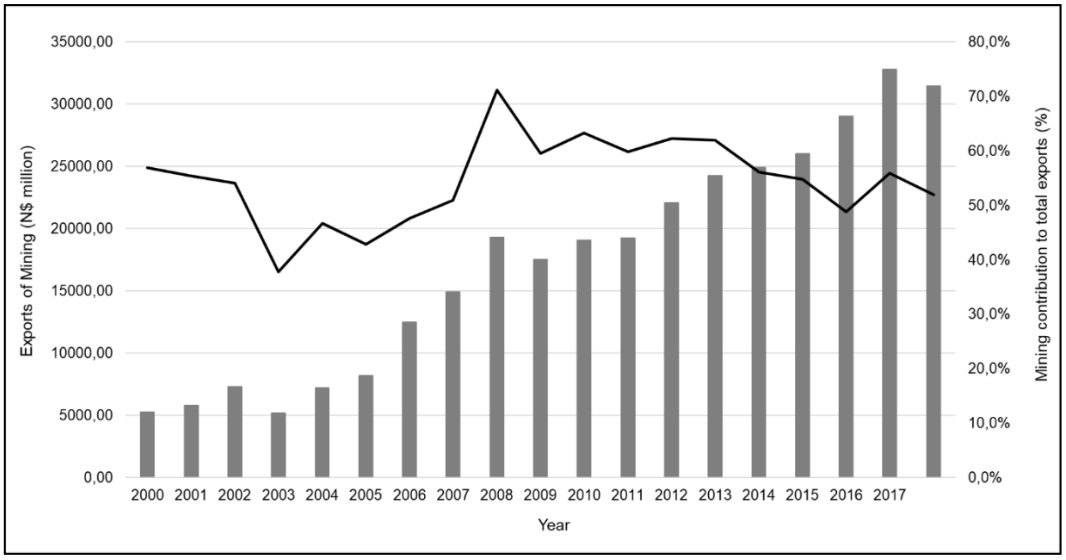


Figure 16: Monetary value of the Namibian mining exports and the percentage composition of mining to total exports

(Chamber of Mines of Namibia, 2017, 2018, 2020)

According to Mwinga *et al*. (2020), the total monetary value of mining exports was N$31 billion in 2018. The value has been increasing yearly with the only drop experienced in 2003 as shown in Figure 16. Having mining exports constituting at least 50 percent of the total Namibian exports indicates the degree to which mining is crucial to the Namibian economy. However, this exposes the country's economy to external shocks such as mineral commodity price volatility (International Monetary Fund, 2014).

4.4.6 Corporate social responsibility

Mining companies invest back into their surrounding communities through corporate social responsibility (CSR) and skills development. This is done by sponsoring community programs and local schools' various activities. Table 15 shows the monetary value contribution towards CSR by the mining industry.

Table 15: CSR expenditure by the mining industry

(Chamber of Mines of Namibia, 2017, 2018, 2020)

	(N$)m
2013	107,8
2014	123,9
2015	61,3
2016	92,1
2017	79,8
2018	73,1

A lot of money is spent by mining companies to try and elevate the living standards of neighbouring communities as indicated in Table 15. According to Chamber of Mines of Namibia (2016, 2017), the mining industry spent N$92.1 million and N$79.8 million in 2016 and 2017, respectively as shown on Table 15.

Over the years the Namibian mining industry has contributed to CSR through projects. In 2019, the Chamber of Mines of Namibia reported on two projects that the mining industry collectively funded. The first project involved the servicing of land in the Northern part of Namibia through the Namibian Chamber of Environment. The second project involved the electrification of households in the Zambezi region of the country. These two projects have been reported to have yielded economic benefits that went beyond expectation. Firstly, because the two areas that benefited are located very far from the sponsoring mines and secondly because the projects led to national socio-economic development.

4.4.7 Impact of the mining industry on the Namibian economy

Figure 17 summarises the impact of the mining industry on the Namibian economy in terms of mining industry growth, real GDP growth and mineral commodity price.

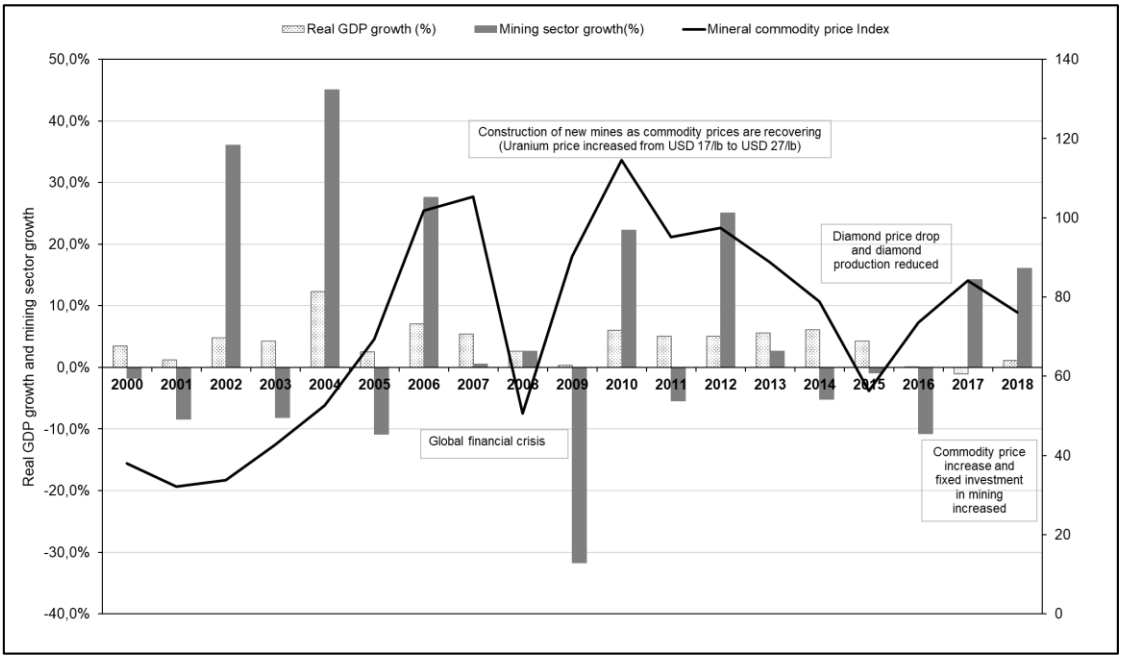


Figure 17: Impact of mining on the Namibian economy

(Chamber of Mines of Namibia, 2017, 2018, 2020; International Monetary Fund, 2009, 2019; Mwinga *et al.*, 2020).

Figure 17 shows a direct relationship between the mining industry's performance and the economic growth of Namibia in terms of real GDP growth. When mining growth increased due to increases in production output, the Namibian economy (in terms of real GDP growth) also grew. The same happened when mining exports increased due to increasing mineral commodity prices. This is seen on Figure 17 for the period of 2000 to 2007. Similarly, when the mining industry suffered (mining growth dropped due to decreasing commodity prices), the Namibian real GDP growth also dropped. This is seen on Figure 17 for the period of 2008 to 2009.

4.5 Strength, weaknesses, opportunities, and threats analysis for the Namibian economy

Characteristics of the Namibian economy were studied and categorised into strengths, weaknesses, opportunities, and threats (SWOT). The SWOT was used in the evaluation of the policy options to select the best two policy options suitable for the Namibian economy. The policy options should be able to lessen the impact of commodity price volatility on the economy. Using the economy's characteristics in the selection process will assist in selecting a policy option that can be implemented and succeed in the Namibian economy.

4.5.1 Weaknesses of the Namibian economy

The International Monetary Fund (2014) identified some characteristics of the Namibian economy that can be considered as weaknesses. They include low economic growth, trade openness, lack of skilled labour, high rate of poverty, high unemployment rate, and unequal distribution of wealth. The Namibian economy grew steadily post-independence in 1990. However, during the period of 2008 to 2009 the economy become stagnant after the global economic crisis. The following years were characterised by both economic growth and drops.

A weak economic growth was the forecast for Namibia during 2016 to 2018 as mineral commodity prices such as uranium were still suppressed (Mwinga, et al., 2020) . This led to external accounts deteriorating which declined the economic growth and caused debt ratios to rise. The Namibian current account was characterised by surplus but went into a deficit from 2016. This deficit kept widening as the saving rate declined dramatically in response to the mining industry's performance and the fact that

Namibia struggles to implement fiscal adjustment plans (Koep & Partners, 2019). When fiscal adjustment plans are not implemented, the fiscal deficit will continue to reduce the growth of GDP (International Monetary Fund 2016, 2019). This caused the Namibia's global competitiveness index position to drop to 92 out of 144 in 2013. This meant that the ability of Namibia to achieve sustained high growth rates of GDP per capita dropped.

Namibia's degree of trade openness is considered high which makes the economy vulnerable to external market factors. The International Monetary Fund (2019) mentioned that the pegging of the Namibian dollar to the South African Rand causes a dependence of the Namibian economy to the South African economy. This makes Namibia vulnerable and benefit from risks and benefits from the South African economy, respectively. For example, when the South African economy is flourishing, benefits are gained by the Namibian economy and vice versa when the South African economy is facing tough economic conditions such as recessions.

4.5.2 Strengths of the Namibian economy

The Namibian economy has some strengths such as the country's ratio of government debt to GDP. In 2017, the country's ratio of government debt to GDP was 40 percent which is above the government's target of 25 percent. This is still relatively low compared to its peers in Sub-Saharan Africa with debt to GDP ratios above 50 percent. Even though the Namibian government struggles to implement fiscal adjustments, there is an improvement since the international reserves have been improving (Mwinga, *et al*., 2020).

van Zyl *et al.* (2017) reported that Namibia is characterised by low inflation rates and economic growth. In 2017, the inflation rate was 7.3 percent. The country has managed to continuously attract foreign direct investment (FDI) inflow in the mining industry. This stimulates productivity growth enabling the country to foster sustainable economic growth and industrialization it needs to attract the same amount of FDI to other economic sectors of the economy (Nakale, 2016). According to Nakale (2016), there are plans in place in the country to foster development in the transport, technology, and energy infrastructure. Plans have been implemented with the country being known for a good transport infrastructure which is crucial for trade.

The country's mineral reserve base is still high with big new mines opening to extract uranium and gold. Namibia is considered politically stable and has a strong good governance and institution score for the following indicators: accountability, government effectiveness, rule of law, regulation, stability, and corruption (International Monetary Fund, 2019).

4.5.3 Opportunities in the Namibian Economy

Opportunities to strengthen, grow and improve the Namibian economy exist. According to the Ministry of Mines and Energy (2003), Ministry of Industrialization and Trade (2021) and Namibia House (2022) some of the opportunities that exist are: attracting direct foreign investment, regulatory environment, and beneficiation. The first opportunity of attracting direct foreign investment, is depended on two key indicators used by foreign investors to determine whether to invest in a country. These indicators are the corruption perception index and the investment attractive index. Corruption perception index is used by all industries while the investment attractive index is mining industry specific, both indicators use various inputs that result in a score out of 100 (Ministry of Mines and Energy, 2003; Ministry of Industrialization and Trade,2021).

The corruption perceptions index looks at transparency, bureaucracy, and corruption. According to the Political and Economic Risk Consultancy Limited (2022), the corruption perceptions index is a score out of 100, with 100 indicating a very clean country meaning no perception of corruption, 50 indicating median perception of corruption and 0 indicating high perception of corruption. Currently the corruption perceptions index ranks about 180 countries of the world (Political and Economic Risk Consultancy Limited, 2022). In 2018 Namibia scored 53 points out of 100 indicating median perception of corruption, which placed it on the 52nd position among the 180 countries being ranked. This score indicate that Namibia needs to improve its corruption perception index to attract more direct foreign investment (Political and Economic Risk Consultancy Limited, 2022).

The investment attractive index is an overall measure of a country's competitiveness (Chamber of Mines of Namibia , 2022). The index is constructed by combination 60

percent from the policy perception index, which measures the effects of government policies on attitudes towards exploration investment. The remaining 40 percent comes from the best practice mineral potential index, which rates regions based on their geological attractiveness (Chamber of Mines of Namibia, 2022; South African Institute of International Affairs,2022).The investment attractive index is a score out of 100, where 100 indicate the country has a jurisdiction with the most attractive policies, whilst a score of 0 indicate the country has a jurisdiction that pose the greatest barriers to investment (Yunis & Aliakbari, 2022). According to the Ministry of Industrialization and Trade (2021) and Yunis & Aliakbari, (2022) Namibia's investment attractive index score has been gradually dropping since 2014 averaging 69 from 2014 to 2018. In 2017, the score dropped from 61 to 57 in 2018 due to a significant decrease in the best practise mineral potential index (Chamber of Mines of Namibia , 2022). The drop in the investment attractive index score has caused Namibia to lose its position of competitiveness. In the 2018 World Bank Easy of Doing Business ranking of 190 economies, the country dropped to position 107th in 2018 from 106th in 2017 (Ministry of Industrialization and Trade, 2021).The opportunity to attract direct foreign investment is there but in order to fully benefit from it, Namibia as a country need to move up its position of competitiveness by improving the country's mineral potential.

The second opportunity for Namibian lies in the regulatory environment and how to use it to make sure the country can harness more from the mining industry to grow and strengthen its economy. The Ministry of Industrialization and Trade (2021) has reported that Namibia is politically stable because the country has an independent judiciary system and good governance. As discussed in section 2.6 the Namibian legal framework allows for policy options to be implemented.

The third opportunity is through beneficiation which is defined as the addition of value to mined raw minerals through metallurgical processes to attain refined mineral products (Dworzanowski, 2013; McGregor, et al., 2017). According to Africa Business (2013) the aim of beneficiation is to move the mineral dependant countries from only having the comparative advantage (having raw minerals) to adding and enhancing their competitive advantage (having the skills and infrastructure to produce refined minerals competitively at the right price). Namibia as a mineral dependant country also

looks to increase its competitive advantage through beneficiation, the country has established the Namibian Mineral Beneficiation Strategy. This beneficiation strategy can aid local industrialisation and economic development (McGregor, et al., 2017; Ministry of Industrialization and Trade, 2021). According to the Ministry of Industrialization and Trade (2021), Namibia has started some beneficiation of its mineral ores such as final refining of Copper and Zinc to 99.9 percent purity. Some of the country's diamonds are cut and polished locally. The Uranium oxide is semi processed in form of yellow cake. The benefit of mineral beneficiation is that it increases the value of some mineral commodities locally by at least a factor of ten (Ministry of Industrialization and Trade, 2021). The other benefit of beneficiation is that it will reduce the impact of commodity price volatility on the Namibian economy if the country export refined mineral products instead of exporting raw or semi-processed mineral products. This is because raw or semi-processed mineral products are exposed to market price fluctuations which do not usually affect or apply to refined mineral products (Ministry of Industrialization and Trade, 2021)

4.5.4 Threats to the Namibian Economy

The Namibian economy is facing several threats which can cause significant damage to the economy. These threats include commodity price volatility, exchange rate as well as shifts in supply and demand. The threat of commodity price volatility exists to the Namibian economy because the country has a high degree of openness making the country's economy vulnerable to global events (Mwinga, et al., 2020). As mineral dependent country the price of commodities is very crucial, a dropping commodity prices means less revenue from the mining industry to the government (Chamber of Mines of Namibia, 2020). Fluctuations in commodity prices also cause non-consistent contribution such as royalties and corporate taxes from mining to the Namibian economy.

Hanusch, et al., (2019) found that the mining industry in the Southern African region pose a threat to the development and competitiveness of other industries and sectors such as manufacturing in the economies of mineral dependent countries. This is because in most mineral dependant economies the government focus more on the

mining industry development. According to Hanusch, et al., (2019) when there is a boom in commodity prices or a new discovery of minerals there is a surge in the productivity which increase the mining exports. This in turn increases the price in the tertiary sector subsequently increasing the levels of the tertiary goods. This causes the exchange rate to increase and unless the non-mining exporters increase their productivity, their competitiveness will reduce and they will get crowded out (Hanusch, et al., 2019). This phenomenon is called the Dutch disease where rapid development in one industry/sector (like mining) causes a decline in development for other industries/sectors (like manufacturing) of the economy (Corporate Finance Institute, 2022).

The shifts in supply and demand are a threat to the Namibian economy as the country relies on exports. According to Poulton, et al., (2013) the shift in supply and demand which cause imbalance are driven by factors as such political unrest, environmental disaster, world pandemic and the mineral substitutes.

The first factor of political unrest refers to conflicts in producing countries that cause political instability that can disrupt mineral commodity supplies that normally impact supply routes and mineral commodity prices (Brown, *et al*., 2008) . The second factor is environmental disaster which according to Brown, et al., (2008) refers to extreme weather events such as heavy rainfalls in the mineral commodity producing countries that can cause operational delays and inefficiencies. The world pandemic refers to an outbreak of an infectious diseases such as COVID-19 across extended geographical areas (Morens, et al., 2009). The COVID-19 control measures such as social distancing, isolation and lock downs caused low production at the mines which reduce the supply to the global markets. The travel restrictions affected the ports, borders, and rail networks and subsequently the mining industry could not transport planned production volumes (Ministry of Industrialization and Trade, 2021; Brown *et al*. 2008).

Availability of mineral substitutes and/or secondary production such as synthetic diamonds and production of copper from urban mining cause shifts in the supply and demand. Demand for mineral substitutes may increase because they may be cheaper and more readily available compared to raw minerals. This may lead to primary commodities price drop (Page & Hewitt, 2001).

4.5.5 SWOT analysis

Using the strengths and weaknesses of the Namibian economy, a SWOT analysis was done for the Namibian economy as depicted in Table 16. The table was used in the evaluation of policy options in the next chapter.

Table 16: A SWOT analysis of the Namibian economy

Strength	**Weakness**
• Steady GDP growth upward trend until after the global economic crisis. • Stable low inflation rate. • Strong financial infrastructure and institution • Moderate ratio of government debt to GDP • (40 percent). • Attracts foreign direct investment. • High mineral reserve and strong mining industry (diamonds, uranium and mineral ores). • Good transport infrastructure. • Strong good governance and institution score. • Political Stability. • Namibian Dollar pegged to South African Rand.	• Stagnant and declining economic growth from 2008. • High rate of poverty. • High unemployment. • Extreme unequal distribution of wealth. • Increasing fiscal deficit (current account in deficit), deteriorating external accounts and raising public debt. • Low saving rate. • Dependence on the mining industry. • Struggle to implement fiscal adjustments. • High housing prices. • Shortage of skilled labour. • Low global competitiveness index. • Dependence on the South Africa Economy.
Opportunities	**Threats**
• Attract foreign direct investment to the manufacturing sector. • Develop backward and forward linkages in the mining industry. • Look into policy options to reduce impact of commodity price volatility to protect its mining revenue streams. • Diversification of the economy through benefication.	• High degree of openness (1,02) making economy vulnerable to external shocks. • Commodity price volatility and lack of policies to lessen the impact and protect the mining industry revenue streams. • Exposure to exchange rate volatility. • Shift in supply and demand • Global pandemic such as COVID-19 • Synthetic diamonds pose a risk to the performance of the diamond mining.

4.6 The Namibian economy and mineral commodity price volatility

Some countries whose economies are dependent on revenue from the mining industry have implemented policies to lessen the impact of mineral commodity price volatility. Most of the policies were established to stabilize government incomes where streams of revenue from the mining industry are contributed into SWFs. A reference export

price is determined and when the export price exceeds the reference price, the surplus money is transferred to a stabilization fund. On the other hand, when the export price is below the reference price, money in the stabilization fund is then used to cover the shortfall in expected revenue from the mining industry (International Monetary Fund, 2008). Although many scholars argue that stabilization funds do not work, some scholars found that even if they do not guarantee fiscal smoothening, they promote spending discipline for governments (International Monetary Fund, 2008). The spending discipline enable governments of these countries to reserve money when the mineral commodity prices boom and use the money when mineral commodity prices burst. This reduces the borrowing tendencies that government employs during mineral commodity prices bursts. In so doing, expenditures are insulated from fluctuations in revenue from the mining industry.

Namibia chose not to use a stabilization fund and instead attempted to achieve fiscal discipline and smoothen spending directly. They tried to achieve this by setting a goal of making sure that the ratio of government debt to GDP is always 25 percent or below. This worked for earlier years, post-independence but, since the global financial crisis in 2008, the ratio of government debt to GDP has been higher than the 25 percent target averaging approximately 40 percent (Chamber of Mines of Namibia, 2020). The country also sets its national budgets in a multi-year setting using the MTEF to avoid expenditures from reflecting unreasonable short-term revenues mainly from the mining industry (International Monetary Fund, 2008). This shows that the country still needs a policy option to lessen the impact of mineral commodity price volatility. This is because the country currently does not have any policy in place. The two policy alternatives that are being used worked for some time but, have not been properly managed since the global economic crisis of 2008.

An analysis was done to better understand the impact of commodity price volatility on the Namibian economy. Firstly, prices of the four selected minerals were used to calculate the coefficient of variation to determine the volatility of the prices. The volatility was then compared to the volatilities of the minerals, ores and metals group calculated by (United Nations Trade and Development Commission, 2019). After the volatilities of the four selected minerals were established, the commodity prices were compared to real GDP rates of Namibia to see the impact of commodity price on the

economy. To determine the relationship between the Namibian economy and mineral commodity price volatility, two indictors were used. For the Namibian economy, real GDP growth was used and for mineral commodity prices volatility, mining industry growth rates were used since mineral commodity prices impact growth of the mining industry. This was done using graphic representations and calculating the correlation coefficient between the mining industry and real GDP growth.

4.6.1 Commodity price volatility for the main minerals mined in Namibia

The volatilities of prices of the four selected mineral commodities were calculated using Equation 3.1. The coefficient of variation values are shown in Tables 17. The table was drawn using data in Appendices 8.1 to 8.4 for diamonds, uranium, copper and zinc, respectively.

Table 17: Coefficient of variation for the four minerals

(Adapted from Index Mundi, 2020)

Mineral commodity	Coefficient of variation
Diamonds	0.55
Uranium	0.54
Copper	0.43
Zinc	0.42

The coefficient of variation for diamond, uranium, copper, and zinc were found to be 0.55, 0.54, 0.43 and 0.42, respectively as shown in Table 17. Based on the interpretation of the coefficient of variation discussed in Section 3.4, prices of all the four mineral commodities are highly volatile, since their CVs are greater than 0.3.

The volatilities of the four mineral commodities were then compared with the volatilities of mineral, ores and metal commodities which were calculated by the United Nations Trade and Development Commission (2019). This was done to determine the degree of their price volatility as compared to the commodity group price volatility. The comparison results are shown in Figure 18.

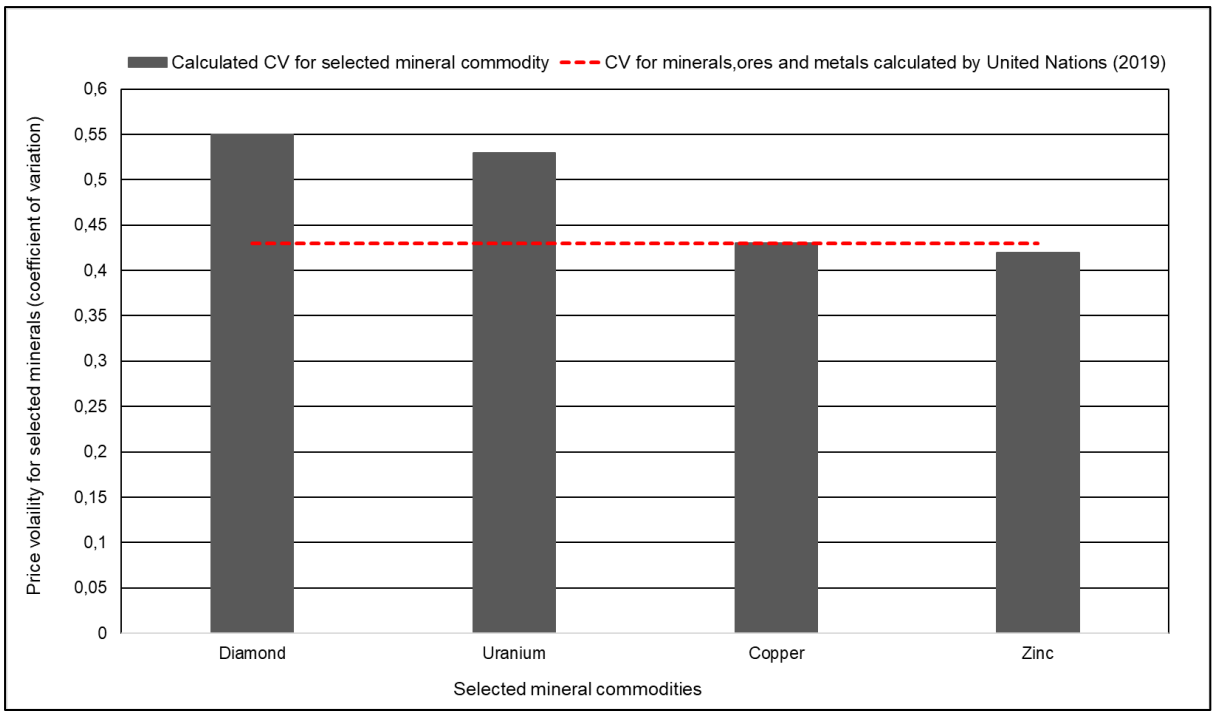


Figure 18: coefficient of variation for selected minerals compared to the minerals, ores and metals group volatility.

Figure 18 shows that only copper price's volatility is equal to the commodity group's volatility. Zinc price's volatility is slightly lower than the volatility for the commodity group. Commodity price volatility has been found to impact mining growth (Chamber of Mines of Namibia, 2017). To visualize this relationship, commodity price index was plotted against mining growth as shown in Figure 19.

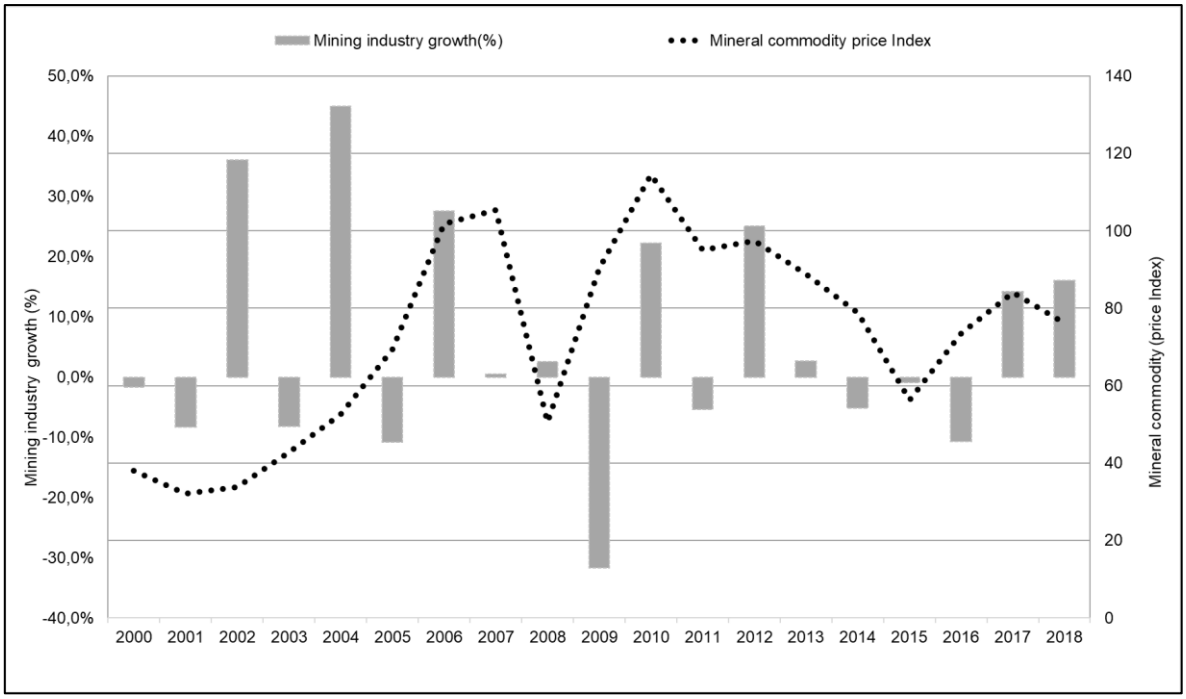


Figure 19: A comparison of mining industry growth and mineral commodity price index

(International Monetary Fund, 2003, 2015, 2019; Chamber of Mines of Namibia, 2001, 2015, 2020).

Figure 19 shows that although mineral commodity price influences mining growth there are periods when the mineral commodity price dropped but the mining growth experienced a rise. As discussed previously in the report, mining growth is affected by other factors.

4.6.2 Relationship between Namibian real GDP growth and mineral price volatility.

Real GDP growth is an indicator used to measure the performance of an economy. As discussed in Sub-section 2.3.1, mineral commodity price volatility increases uncertainty about future revenues from mineral commodity sales or exports. This uncertainty on future revenues impacts economies of mineral-commodity dependent countries. To visualize the impact, commodity price index was plotted against real GDP growth as shown in Figure 20.

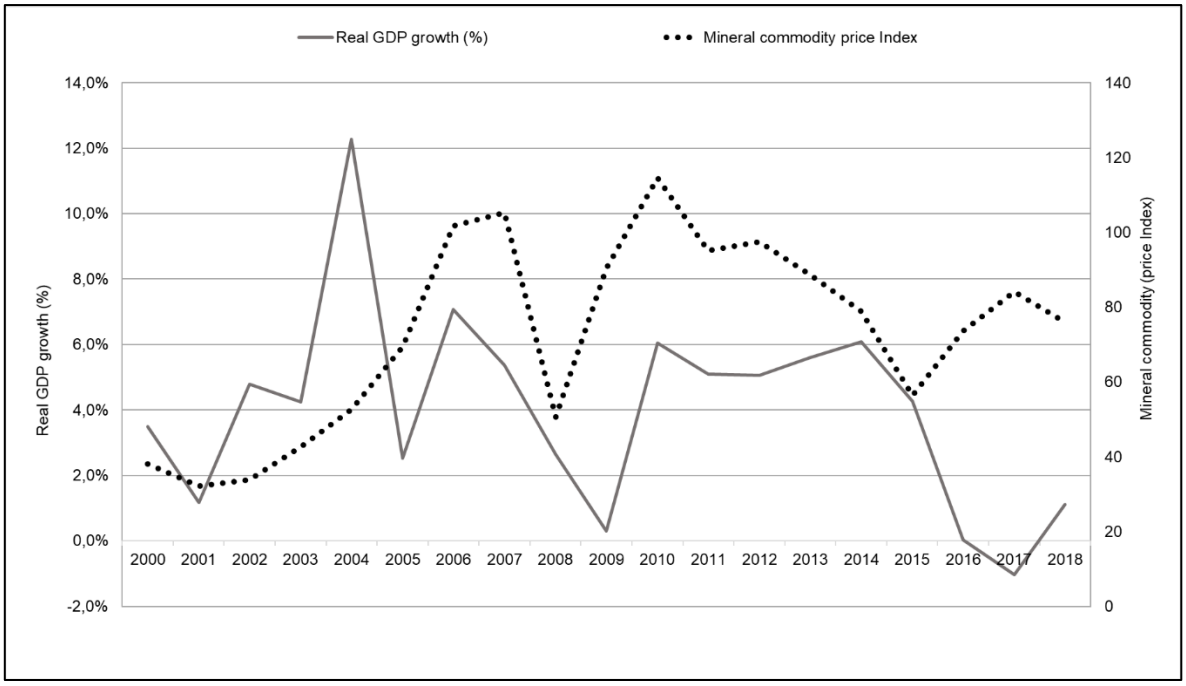


Figure 20: A comparison of Namibia's real GDP growth and mineral commodity price index

(International Monetary Fund, 2003,2015, 2019; Chamber of Mines of Namibia, 2001, 2015, 2020)

Figure 20 shows that Namibia experienced a moderate real GDP growth between the years 2000 and 2004. The real GDP growth dropped in 2005 and immediately picked up the following year. Figure 20 also shows gradual declines of both commodity price index and real GDP growth from 2006. In 2015, when commodity price index dropped, real GDP growth also dropped as depicted in Figure 20. Figure 20 shows that mineral commodity price impacts the real GDP growth of the country. This in turn means that the performance of the mining industry affects the performance of the Namibian economy. The mining industry growth was plotted against real GDP growth as depicted in Figure 21. The correlation coefficient of the two was calculated to establish their relationship.

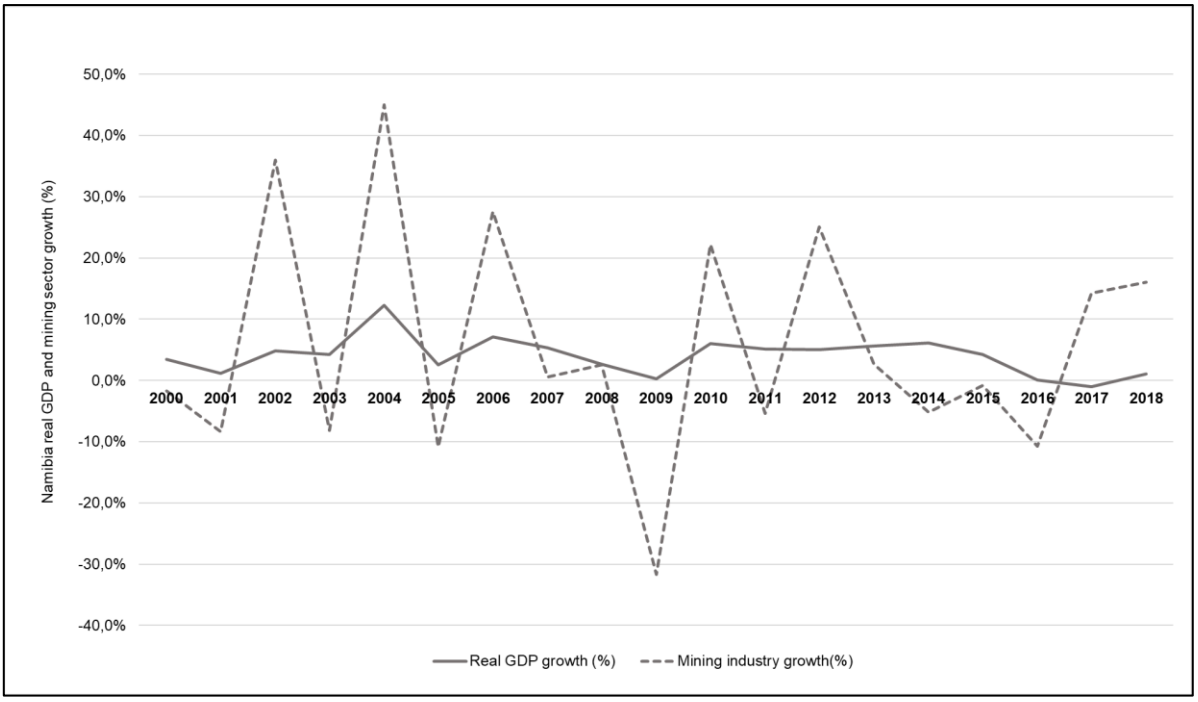


Figure 21: A comparison of Namibian real GDP growth and mining industry growth

(International Monetary Fund, 2003,2015,2019; Chamber of Mines of Namibia, 2001, 2015, 2020)

The mining industry has been recording growth, however, as shown in Figure 21, the growth was fluctuating. The performance of the mining industry is mainly controlled by the production and prices of diamonds, uranium, and copper (Mwinga, *et al*., 2020). Comparably, real GDP growth shows less fluctuations. The mining industry growth and real GDP growth have a positive correlation as shown in Figure 21 and Table 18. Table 18 shows the correlation coefficient between Namibia's mining industry growth and real GDP growth.

Table 18: Correlation coefficient between Namibia's mining industry growth and real GDP growth

(International Monetary Fund, 2003, 2015, 2019; Chamber of Mines of Namibia,2001, 2015, 2020)

Year	Real GDP growth (x)	Mining sector growth (y)	xy	x^2	y^2
2000	3,5%	-1,7%	-0,1%	0,1%	0,0%
2001	1,2%	-8,4%	-0,1%	0,0%	0,7%
2002	4,8%	36,0%	1,7%	0,2%	13,0%
2003	4,2%	-8,2%	-0,3%	0,2%	0,7%
2004	12,3%	45,0%	5,5%	1,5%	20,2%
2005	2,5%	-10,9%	-0,3%	0,1%	1,2%
2006	7,1%	27,6%	2,0%	0,5%	7,6%
2007	5,4%	0,5%	0,0%	0,3%	0,0%
2008	2,7%	2,6%	0,1%	0,1%	0,1%
2009	0,3%	-31,7%	-0,1%	0,0%	10,0%
2010	6,0%	22,2%	1,3%	0,4%	4,9%
2011	5,1%	-5,4%	-0,3%	0,3%	0,3%
2012	5,1%	25,1%	1,3%	0,3%	6,3%
2013	5,6%	2,6%	0,1%	0,3%	0,1%
2014	6,1%	-5,2%	-0,3%	0,4%	0,3%
2015	4,3%	-0,9%	0,0%	0,2%	0,0%
2016	0,0%	-10,7%	0,0%	0,0%	1,1%
2017	-1,0%	14,2%	-0,1%	0,0%	2,0%
2018	1,1%	16,1%	0,2%	0,0%	2,6%
Sum	76,2%	109,0%	10,6%	4,7%	71,1%

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

$$r = \frac{19(10{,}6) - (76{,}2)(109{,}0)}{\sqrt{[19(4{,}7) - 76{,}2^2][19(71{,}1) - (109{,}0^2]}}$$

$$r = \frac{1.180}{1.980}$$

$$r = 0.596$$

$$r = 0.6$$

The correlation coefficient was calculated and found to be 0.6, which indicates a strong positive correlation between the growth in the mining industry and real GDP. This means that for every increase in the mining industry, the real GDP of Namibia will grow by 0.6 (60 percent). This shows that the mining industry has a significant impact on the economy of Namibia and by extension, mineral commodity prices do impact the economic performance of the country. This means that if the mining industry contracts, Namibian economy is expected to also contract and vice versa. This again justifies the need to implement a policy option that will lessen the impact of mineral commodity prices on the country's economy.

4.7 Chapter summary

This chapter showed how the Namibian economy is dependent on the mining industry through mining's contribution to GDP which impact the country's real GDP growth. A SWOT analysis on the economy was done. The identified strengths, weaknesses, opportunities, and threats were used in the evaluation of the policy options in the next chapter. The chapter confirms that the performance of the mining industry has a significant impact on the Namibian economy.

5 ANALYSIS OF POLICY OPTIONS FOR NAMIBIA'S ECONOMY

5.1 Chapter overview

In this chapter, the requirements, advantages, and disadvantages of each policy option analysed were used as inputs in the CPVPO matrix. The matrix was used to evaluate and rank the policy options. The top two policy options were chosen and an operating framework was proposed for each chosen policy option.

5.2 Evaluation of policy options

The policy options were evaluated using the requirements, advantages, and disadvantages of each together with the results from the SWOT analysis of the economy. The requirements, advantages and disadvantages of each policy option were colour coded into four criteria as shown in Appendices 8.5 to 8.8 using the key shown in Table 19.

Table 19: Grouping characteristics of the policy options into different criteria

Key	
Acceptability	Trade distoration
	Compatibility
Cost	Cost implementation
	Cost sustainability and efficiency
Practicality	Ease of Implementation
	Flexibility/ Adaptability
Effectiveness	Managing Risk

Each criterion was assigned a score depending on whether the policy option's requirements, advantages or disadvantages support or are draw backs for the criterion. After a policy option passed the acceptability criterion as explained in Chapter 3, the policy option was further evaluated using the requirements, advantages, and disadvantages of the policy option. They were then sorted using colours into the other three criteria which are cost, practically and effectiveness.

5.2.1 Analysis of the acceptability criterion

The compensatory finance policy option failed the acceptability criterion. The option failed based on the finding of van Dijk & Sideri (2005) which found the policy option to cause some degree of trade distortion. This is because on a macroeconomic level, the

diversification promoted by some compensatory finance schemes is done by favouring one sector over others. This is done without first identifying what the beneficiary country really needs economically and how the commodities of that sector are performing on the market. This finding was supported by Brown *et al.* (2008), who found the STABEX compensatory finance scheme to introduce distortions into the market. The distortions came from the false signals given to the primary commodity procedures/exporters to ramp up production for commodities regardless of the price of the commodities since the scheme provides a buffer from any commodity price drop. This leads to mining companies producing commodities expecting to sell them at a profit but end up selling them at a lower price. This causes more distortion in the market instead of promoting some market adjustment for producers to start concentrating on other commodities (diversifying to other commodities that are performing better on the market). The compensatory finance option can complement other existing policies to lessen commodity price volatility but, has a risk of causing dependence. This is also shown in Appendix 8.8. Table 20 presents the acceptability criterion scores for the policy options.

Table 20: Acceptability criterion scores for the policy options

Criteria for Evaluation	**Acceptability**		
Sub Criteria	**Trade Distortion**	**Compatibility**	**Qualify or further evaluation**
National Revenue Management	Pass	Pass	Yes
Revenue Insurance	Pass	Pass	Yes
Supply Management	Pass	Pass	Yes
Market-Base Price Risk Management	Pass	Pass	Yes
Compensatory Finance	Fail	Pass	No

Table 20 shows that only the compensatory finance option failed the acceptability criterion. Therefore, the option was not further analysed. The other four policy options all passed the acceptability criterion as shown in Table 20, because they do not cause trade distortions and they complement existing policies to lessen the impact of commodity price volatility on the economy. The remaining four policy options that passed the accessibility criterion were scored as explained in Sub-section 3.6.3.

5.2.2 Analysis of the cost criterion

Cost of implementing the policy options

The supply management policy option was given a score of one (1) because of its relative high cost of implementation. According to Brown *et al.* (2008) and South Centre (2005), supply management policy instruments require a high amount of capital to stabilize commodity prices. For example, in 2007 OPEC needed to spend about US$100 million per day to take off large volumes of oil from the market to support oil prices during the global economic crisis as the oil prices fell below US$100 per barrel (World Bank Group, 2020). This high cost causes price speculation to be able to control the mineral commodity price. This means that the supply management policy instruments policy option requires the agent (government/organization) to have a huge amount of capital to:

- buy the product off the market;
- acquire facilities to keep commodity buffer stocks; and
- be able to survive financially during periods when the stock is being withheld for extended periods of time as it means no sales are being made.

However, the cost involved to implement the supply management policy option has been gradually reducing. This is due to advancement in market systems such as the introduction of tradable quotas and the use of financial assets such as virtual buffer stocks. Nonetheless, this does not offset the capital needed to buy the product off the market and maintain buffer stocks for a period until the market is favourable to release them.

The national revenue management policy option was given a score of two (2) because of its relatively medium cost requirements. This policy option should be implemented by government by allocating all revenue from the mining industry that exceeds the budget revenue from the industry to a SWF. The excess revenue could be due to commodity price surpassing the benchmark commodity price set by government. It can also be due to mining companies outperforming and pushing their production volumes above the established benchmark by the government in their annual budget. This usually happens during periods of commodity booms (Brown, *et al*., 2008).

The amount of excess revenue that would be allocated to a SWF by government is usually a significant amount as it makes substantial contribution to the country's GDP. In 2004, Nigeria created an excess crude account to allocate all revenues above the benchmark oil price that was established by the Nigerian government. By the end of 2004, the excess crude account had a balance of about US$5.1 billion (United Nations Trade and Development Commission, 2011). In 2008, Chile invested about US$34 billion into a SWF in line with their set standard of contributing a minimum of 0.2 percent of the previous year's GDP to the SWF (Ministry of Finance Chile, 2016).

The practise of saving money into a SWF promotes governments to be disciplined in terms of spending. This ultimately increases a country's wealth since money in the fund earns interest. Also, the saved money would be available for withdrawal when commodity prices experience a burst. However, it is extremely hard for governments to save excess revenues into SWFs. Governments would rather spend the excess revenue on projects that they believe to be crucial for economic development instead of investing it in a fund. The idea that government should save money they could have used for immediate development makes the national revenue management policy option costly. However, this high cost can be offset by two factors. Firstly, government does not lose the money as the money would always be available in future. Secondly, whilst the money is saved in the fund, it earns interest thereby increasing the country's wealth. For this reason, the cost of implementing the national revenue management policy option is medium, thus the policy option was given a score of two (2).

The market-based price risk management tools policy option was given a score of a one (1) because of its relatively high cost of implementation. Market-based price risk management tools are very costly to create (Brown, *et al*., 2008). Futures contracts require collateral to qualify for the contract. Options contracts are also expensive to create. For example, the Mexican government spent about US$1.3 billion on purchasing options to hedge oil exports in 2010. This money was used to buy 230 million barrels of oil off the market at a price of US$57 per barrel to protect the Mexican government against oil price fluctuations (United Nations Trade and Development Commission, 2011). If Namibia is to use this policy option, the Namibian government will have to spend a huge amount of money to keep a certain volume of their mineral commodities off the market. This will enable the country to reduce the impact of

mineral commodity prices fluctuations. The SWOT analysis of the Namibian economy done in Subsection 4.5.3, found that the country is currently operating on a deficit. Therefore, the country cannot afford to spend huge amounts of money required each time one of the four selected commodities prices experience a price burst.

The United Nations Trade and Development Commission (2011) found the cost of implementing market-based price risk management tools differs depending on a country's classification in terms of development. Developing countries are considered to be riskier compared to developed countries, thus they are required to pay much higher risk premiums (United Nations Trade and Development Commission, 2011). For example, if the Mexican government had decided to use a futures contact instead of an options contact, its risk premium would have been US$3 per barrel. This is because the futures contract would have been taken out in 2009 instead of 2010. In 2009 during the economic crisis, the oil price fell to as low as US$50 per barrel. In 2007, the market predicted a spot price of oil to be US$60 per barrel within a year. If the future price was US$57 for example, then the risk premium the Mexican government as a speculator would have expected to receive for balancing the market and managing the future spot oil price risk would be US$3 per barrel. That would be a risk premium of US$69 million to buy 230 million barrels of oil on a futures contract (United Nations Trade and Development Commission, 2011). This makes the cost of implementing market-based price risk management tools high, hence a score of one (1).

The revenue insurance policy option was given a score of two (2) because of the relatively medium cost of implementation. Like the national revenue management policy option, revenue insurance requires government to contribute money that is equal to a set percentage of GDP if a set revenue threshold is met. The idea of forgoing money available now to invest for later use can be a challenging thing to do for the Namibian government. This is because there are always several economic development projects that are awaiting funding. Previous experiences in the country when money was withdrawn from a development fund to fund unplanned projects causing the fund to fail (Andrzej, *et al*., 2015) is evidence of this challenge. The idea of investing money whilst there are projects awaiting funding and development, makes it difficult for governments to invest money for future use. The other challenge with the

revenue insurance policy option discussed by Thomas (2018) is that the option requires member states to collectively contribute premiums. This process involves cost to set-up SWFs at a regional level like Sub-Sahara Africa. The fact that the revenue insurance cost requires government to save an agreed percentage of their current year's revenue for later use makes the cost to set up the revenue insurance policy option relatively moderate hence a score of 2.

Cost sustainability and efficiency of the policy options

The supply management policy option was given a score of one (1) because it is difficult to sustain. The policy option is commonly used by organizations or co-operations. This makes it extremely difficult to sustain in terms of contributions as proposed cost structures may not be agreed upon at once, indicating difficulties in efficiency and sustainability. The policy option also requires government to acquire facilities to keep buffer commodity stocks. Sustaining these buffer stock facilities incurs additional cost and requires government to be able to keep the stocks for extended periods. This will not be possible for Namibia since it is a mineral-dependent and developing country. The country does not have much influence on mineral commodities international markets and will not be able to afford the high cost required to establish and maintain buffer stocks as an individual country. An organisation such as OPEC can afford since it is funded by different member states. The supply management policy option is best suitable for organisations and not individual countries. Thus, the policy option was given a score of one (1) for cost sustainability and efficiency as Namibia will find it difficult to sustain the policy option because of reasons given above.

The national revenue management policy was given a score of two (2) because it is relatively easy to sustain. The cost linked to the policy option is sustainable as there will be set targets that will activate the contribution to the fund as well as the withdrawal of funds from the Fund. The benefits from the funds as outlined by Brown *et al.* (2008) are long lasting. This is because the policy option can result in fiscal discipline by the government and lessening the impact of commodity price volatility by smoothening revenue.

The market-based price risk management tools policy option was given a score of one (1) because it is difficult to sustain. This is because the short-term contacts can last

for about two years. An example discussed in earlier in this section shows that if Mexico had taken a futures contract for oil in 2009 it would have paid US$69 million in risk premiums to maintain the contract for two years. This means Mexico would have paid about US$138 million in risk premiums in two years. This cost is very difficult to sustain for a country whose economy is already struggling like Namibia based on the SWOT analysis results discussed in Subsection 4.5.3. The high premiums and high collateral required to maintain futures or options contracts make the cost difficult to sustain hence a score of one (1).

The revenue insurance policy option was given a score of two (2) because it is moderately sustainable. With the policy option, the cost is standardized based on the set target that activate monetary contributions to the insurance scheme. The sustainability of the policy option can only be determined during periods of extremely low commodity prices. This makes the policy option attractive since it is sustainable based on its working principle.

Ideally, the revenue insurance policy option should be given a score of three (3). However, this is not possible because the policy has drawbacks in cost sustainability. The first drawback is that different countries will have different GDP growth rates; thus, some countries will contribute more than others. Since the policy option allows all member states to benefit equally, countries with higher GDPs are disadvantaged. This is the reason the option could not be given a score of 3 but 2 in terms of cost sustainability and efficiency. Thomas (2018) proposed that to correct this discrepancy, the scheme should use excess funds to invest into other developmental projects to balance out the difference in contributions and withdrawal of funds. This proposal may not be welcomed by all member states causing efficiency issues hence a score of 2.

Additional criteria for market-based price risk management tools

The market-based price risk management tool works by transferring risk between two parties (from the producer to the investor) and during this process other risks may arise. The first such risk is the risk that the spot price and the price agreed in the futures contract do not converge. When commodity price deviates from the price agreed in a contract, there is nothing a producer or investor can do to change the price. This results in either the producer or investor loosing substantial income. The risk that the spot price and the price in the futures contract do not converge is

commonly associated with market-based price risk management tools especially forward and swap contracts, hence a score of -2 was given.

The second risk is the risk of contract counterparty defaulting on delivery of a cash product. This risk emerges when production activities are affected by catastrophic events. The market-based price risk management tools policy option cannot protect parties from this risk. Hence a score of -1 was given since the risk is only moderately associated with the policy option. The third risk is the risk that the entire market collapses due to exposure across the entire system. The market-based price risk management tools policy option can also not protect parties from this risk since they cannot reverse the position of the market hence a score of -2 was given.

The last risk is the risk that the seller will have to satisfy the contractual agreement and supply the agreed output despite achieving a below target production output. In this case, the seller will have to buy in at inflated market prices to supplement the production shortfall. This is mostly experienced in only one of the market-based price risk management tools, the swap contracts. Due to this reason the policy option was given a score of -1.

5.2.3 Analysing the practicality criterion

Ease of implementing the policy options

Under this sub-criterion, the barriers needed for policy options to be implemented are considered. For the supply management policy option, a well-defined commodities market is required. This means the market must not constitute products that can be easily substituted. For example, natural rubber and natural diamonds as mentioned in Section 2.4.1. This makes the supply management policy option unfeasible as it difficult to implement and less likely to succeed. Therefore, it was given a score of 1.

According to Brown *et al.,* (2008), the national revenue management policy option requires strong mandatory legislative restrictions for the policy option to succeed. This is because the policy option is highly dependent on adherence to applicable legislative restrictions. This is a challenge for most governments including the Namibian government which is already faced with challenges of implementing fiscal adjustment plans. For example, the Namibian government is currently struggling to achieve its target of government debt to GDP ratio of 25 percent. In 2017, the country's ratio of

government debt to GDP was at 40 percent which is above the government target of 25 percent. The second example if failure by the Namibian government to comply to the MTEF fiscal plan which was established to smoothen revenue and control spending of revenue from mining. The implementation of this fiscal plan by the government is failing because the mining income surplus is currently being spent. This is because there is no policy in place for this money to be saved and used during periods of low mineral commodity prices. Thus, a score of 1 was assigned.

To use the market-based price risk management tools policy option, the commodity should be sold on an organized exchange market which is available for all commodities. Also, the policy option, requires infrastructure and financial training for its implementation to be feasible on a large scale. This is not readily accessible making the tools less broadly used. Thus, the option was given a score of 1.

The revenue insurance policy option requires a framework stipulating how the scheme will work. It also requires functional financial institutions. The insurance scheme should be managed by a non-governmental committee made of technocrats from the member states to limit political interference. The establishment of the committee is challenging for most developing governments that lack skilled labour. Thus, a score of 1 was assigned.

All the four policy options attained a moderate score of one (1) in the practically criterion because they are all not easy to implement as explained in above paragraphs. The capacity of the policy options to adapt over time is highly dependent on the Namibian government establishing and enforcing control mechanisms.

Flexibility of the policy options

Supply management policy option is designed to be flexible so that it can accommodate and respond to market changes over a long term (Brown, *et al*., 2008). Therefore, it was given a score of 2.

According to Brown *et al*. (2008), if national revenue management funds are properly designed and executed, they can adapt to any macroeconomic problem to insulate the economy. Therefore, they are flexible. Thus, the national revenue management policy option was given a score of 2.

Market-based price risk management tools are flexible in that there are four different options that agents (governments/producers) can choose from depending on their individual needs. The tools also give an option for agents to use over-the counter options or market exchanges. Therefore, the market-based price risk management tools policy option was given a score of 2 under the flexibility sub criterion.

The United Nations Trade and Development Commission (2019) normally does not recommend using revenue insurance and commodity price insurance schemes. This is because the schemes lack information and are not properly regulated. The work done by Thomas (2018) found that revenue insurance is a flexible policy option based on the agreement between member states. Therefore, the revenue insurance policy option was given a score of 1.

5.2.4 Analysing the effectiveness criterion

Management of risk by the policy options

Supply management policy option instruments are used to balance supply and demand forces in a market since companies of developed countries have tight control over the market. This policy option can help weaken this control by controlling the supply of commodities using buffer stocks. These builds countervailing power and restores some balance of producers and developing countries. However, the supply management policy option instruments only focus on commodity price risk management. It does not manage other risks that producers face such as social, economic, and environmental risks. This means that the policy option moderately manages risk. Therefore, the policy option was given a score of 1.

According to Brown *et al.* (2008), the national revenue management policy option can effectively manage commodity price volatility by providing revenue stability. The policy option also fosters social development by channelling windfall profits towards economic transition and diversification. Thus, the policy option was given a score of 2.

Market-based price risk management tools are highly effective in managing commodity price risk. This is because they shift the risk from producers to investors offering revenue predictability. The market-based tools also do not affect commodity price. Due to these reasons, the policy option was given a score of 2.

Revenue insurance moderately manages risk of commodity price volatility. It is the preferred option since it reduces the risk of default by governments during commodity price bursts. This then gives mineral-dependent countries an option of claiming money from the scheme instead of going into debt. Therefore, the revenue insurance policy option was given a score of 1.

Resolving market failure by the policy options

All the four policy options that passed the acceptability criterion also passed this criterion as none of them contributes to market failure. In fact, the supply management policy option attempts to balance supply and demand market forces which have been distorted by developed countries. Policy options such as the market-based price risk management tools do not impact commodity prices or supply/demand; they focus on transferring risk from producers to investors. Both the national revenue management and revenue insurance policy options focus on smoothening revenues. They do not deal with market forces but rather manage the utilization of revenue received from mineral commodity exports.

5.3 Ranking the five policy options

The analyses of the five policy options in previous sections of this chapter show that there is no single policy option that best lessens the impact of commodity price volatility on an economy. Instead, each policy option is unique in terms of managing commodity price volatility. Using the scores from the CPVPO matrix, the policy options were ranked as shown in Table 21. The top two ranking policy options are national revenue management (stabilization fund) and revenue insurance options. An operating framework was then proposed for the two policy options.

Table 21: Ranking of the five policy options

Criteria for Evaluation	**Acceptability**		**Cost**		**Practicality**		**Effectiveness**		**Additional Criteria for Market-Base Price Risk Tools**				**Score**
Sub Criteria	Trade Distortion	Compatibility	Cost of Implementation	Cost sustainability and efficiency	Ease of Implementation	Flexibility/ Adaptability	Managing Risk	Resolving Market Failure	Basis	Counter-party	Systemic	Compounded Production Risk	
National Revenue Management	Pass	Pass	2	2	1	2	2	Pass					9
Revenue Insurance	Pass	Pass	2	2	1	1	1	Pass					7
Supply Management	Pass	Pass	1	1	1	2	1	Pass					6
Market-Base Price Risk Management	Pass	Pass	1	1	1	2	2	Pass	-2	-1	-2	-1	1
Compensatory Finance	Fail	Pass	No further Evaluation										

5.4 Proposed framework for the national revenue management policy option

The national revenue management policy option is made up of two types of funds: stabilization and savings funds. Most developing countries prefer establishing stabilization funds as their immediate focus is to smoothen revenue streams. After revenues are stabilized, they then establish saving funds. On the contrary, most developed countries establish both funds at the same time (Brown, *et al*., 2008). The International Monetary Fund has drafted guidelines which countries can use in establishing their respective SWFs. The guidelines help countries determine if they are economically viable to establish a stabilization fund. Das *et al*. (2009) summarized considerations on how a country can determine its adequate reserves. These were applied to Namibia to analyse if the country is economically viable to establish a stabilization fund.

5.4.1 The readiness of Namibia to establish a stabilization fund

Several studies have been carried out on stabilization funds, they looked at how to set up a stabilization fund, how it operates and how it can be managed but very little work is done on when a country should actually set up a stabilization fund. Das *et al*. (2009), through the International Monetary Fund (IMF), specifically looked at when a stabilization fund should be set up. They found that two key aspects can be used to determine when a country is economically viable to set up a stabilization fund. Currently, viability is determined by considering the country's financial assets and liabilities. Assets include future tax revenues and the monetary value of all commodities in the ground.

The United Nations Trade and Development Commission (2019) found that most countries that were planning to establish stabilization funds were currently using experiences from other countries that had established stabilization funds. A common observation on countries that have established successful stabilization funds such as Chile and Botswana is that they established their SWFs during commodities price booms. This is because they used to achieve a BoP or fiscal surplus as an indication that their economies were ready to establish a SWF (United Nations Trade and Development Commission, 2019). This corresponds to the second key aspect given

by Das, et al. (2009) on the guide to when a country should set up a SWF. The two key aspects that can be used to guide a country as to whether the country is economically viable to establish a stabilization fund according to Das *et al*. (2009) are:

- The first point is the determination of an optimal financial reserve of the country and the length of time the reserve will last.
- The second point is establishing if mineral rent can be reinvested to maintain national wealth.

Financial reserves are defined as external assets of a country that are controlled by monetary authorities (like the central bank of the country) and are readily available to meet the country's BoP needs. They are used to intervene in exchange markets to affect the currency exchange rate or for maintaining confidence in the country's currency and the economy. They are also used as a basis for foreign borrowings (Independent Evaluation Office of the International Monetary Fund, 2012).

Optimal financial reserves

A county must first investigate its financial reserves to establish if they are adequate. This needs to be agreed upon by the government and the central bank. The country's central bank must assess the country's current and capital accounts to establish if balances in the accounts are sufficient to sustain the country's economy for a full year without requiring external capital inflow. If a country has a current account deficit and weak banking systems then its financial reserves should be increased (Das, *et al*., 2009). After establishing the adequate financial reserves, the next step is to find out the source of the adequate financial reserves. Possible sources may include fiscal budget surpluses (accumulation of foreign assets), surpluses of revenue from the mining industry (due to commodity price boom) and capital inflows from issuing government papers (bonds or notes) and issued central bank liabilities. It then needs to assess how long these reserves will last whether they are once off or can last longer.

The book by Das, et al. (2010) looked at investments approaches of SWF and cautioned that SWFs are not established to solve BoP crises as this will prevent the funds from meeting long-term investment goals. This can lead to SWFs holding fewer liquid assets. Some countries set up agreed trigger points that allow the SWF to be

withdrawn to provide liquidity support for the BoP in crises. However, this was strongly discouraged by the International Monetary fund (2015).

The International Monetary fund (2019) defined an adequate level of financial reserves a country should have. A country is regarded to have adequate or optimal financial reserves when the financial reserves constitute about 20 to 30 percent of GDP. The Namibian financial reserves are depicted in Figure 22.

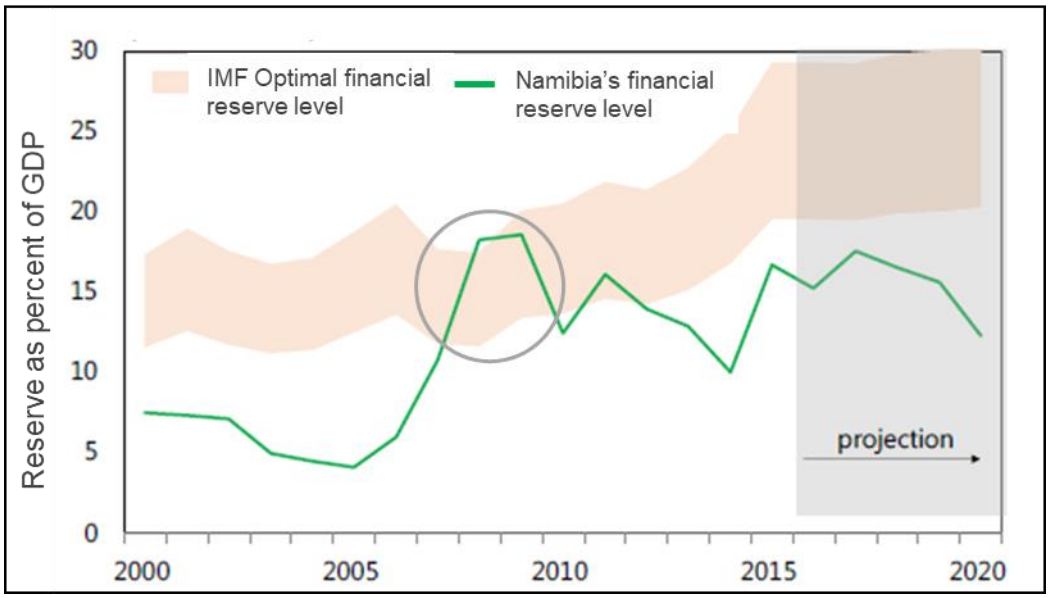


Figure 22: The adequacy of Namibian reserves

(International Monetary Fund 2019)

Figure 22 shows that Namibian financial reserves have been below the optimal financial reserve level set by the International Monetary fund (2019) for the period of 2000 to 2016. About 70 percent of the financial reserves did not meet the 20 to 30 GDP set target. The reserves were only adequate between 2008 and 2012 (the period circled in grey on Figure 22). This was because of an increase in mining revenues (due to commodity price increases and new mines starting production) and higher receipts from SACU. Based on Figure 22, the Namibian financial reserves were adequate for five years whilst the requirement is to set up a stabilization fund when a country's reserves are adequate for a full year.

Reinvestment of mineral rent to maintain national wealth

SWFs are primarily established to smoothen revenues. It is also expected that mineral rents will be reinvested to promote sustainable economic growth. According to Das, *et al*. (2009), there are guidelines on how mineral rent can be reinvested by a government. For example, the Hartwick-Solow Rule that specifies the amount of economic rent that a government is required to reinvest. Currently, Namibia does not have a policy/framework on how the country should be reinvesting mineral rents to promote sustainable economic growth. Economic growth can be achieved by investing the economic rents in human capital (health care and education), foreign financial assets and infrastructure. This raises a question of how Namibia's mineral wealth is transformed into other assets (Lange, 2003).

According to Lange (2003), Botswana is the only country in Sub-Saharan African that has a successful SWF. The Pula Fund of Botswana is funded using revenue from the country's diamonds mining operations. The country developed a formula which measures how mineral wealth is transformed into other assets that promote sustainable economic growth. The formula is called the Sustainable Budget Index (SBI). SBI quantifies rent reinvestments by showing what percentage of the public consumption is paid using non-mineral revenues. Equation 5.1 shows the SBI formula (Lange, 2003):

$$SBI = \frac{Government\ Spending(\ non\ investment)}{Governemnt\ Revenue\ (non{-}mineral)} \qquad (5.1)$$

When SBI < 1, it implies that all mineral rents are used for investment in infrastructure, human capital, or public sector. When SBI > 1, it implies that mineral wealth is used to fund public consumption rather than being invested a situation which is unsustainable in the long term. According to Lange (2003), the most favourable situation for a mineral-dependent country is for SBI < 1.

The Namibia Statistics Agency (2012, 2015, 2019) found that Namibia's SBI has been fluctuating over the years having periods with SBI above one and other periods with SBI below one as indicated in Table 22 which shows the SBI for Namibia for the period from 2000 to 2018.

Table 22: Sustainable Budget Index for Namibia for the period from 2000 to 2018

(Namibia Statistics Agency,2012; 2015; 2020)

Year	Public Consumption (N$m current prices)	Reveune Non-Mining (N$m current prices)	SBI
2000	6375	5973,90	1,07
2001	6970	7074,10	0,99
2002	7613	7295,30	1,04
2003	8283	7888,50	1,05
2004	8693	8584,30	1,01
2005	8905	10158,90	0,88
2006	10526	11763,30	0,89
2007	**12834**	**15175,60**	**0,85**
2008	**14851**	**17681,40**	**0,84**
2009	**17277**	**20596,00**	**0,84**
2010	**19714**	**21680,70**	**0,91**
2011	22469	19923,50	1,13
2012	23875	26296,90	0,91
2013	30383	34298,70	0,89
2014	33071	38243,60	0,86
2015	32201	44763,80	0,72
2016	33248	46605,00	0,71
2017	34686	48440,80	0,72
2018	36783	55202,90	0,67

Table 22 shows how the Namibian SBI changed over the years from a SBI of greater than one (1) during the period from 2000 to 2004 to a SBI of less than one (1) for the period from 2005 to 2018 except for in 2011. This indicates a change from being a country that uses mineral wealth (rents) to fund public consumption to a country that uses mineral wealth (rents) to promote sustainable economic growth by investing in the public sector, infrastructure, and human capital. Even after the global economic crisis the country continued to have a SBI of less than one (1) apart from the year 2011 which indicates that the country maintained reinvesting their mineral wealth, instead of spending it.

Using the two indicators of optimal financial reserve and mineral rent reinvestment, it was found that Namibia was economically viable to set up a stabilization fund as early as 2009, up until 2010. This is because the Namibian financial reserves were adequate from 2008 to 2012. Based on the requirement of a full year with optimal financial reserves, Namibia could only establish a fund between 2009 and 2012. In terms of mineral rents being reinvested, Namibia's SBI was less than one consecutively from 2005 to 2018. The only period when Namibia met both conditions was from 2009 to 2010. Thus, the best time for Namibia to have considered establishing a SWF was

during the period of 2008 to 2010 as the country's economic standpoint was favourable according to the two indicators of adequate reserves and SBI.

5.4.2 Proposed rules for funding and withdrawing for the Namibian SWF

Once a country has determined the level of adequate reserves and established the country's SBI, the country's government should then set operational rules for funding and withdrawals for the SWF. This process should be guided by the International Monetary Fund's Road map or the Santiago Principles. According to Lange (2003), for most mineral commodity stabilization funds the rule is to activate funding when the mineral commodity price rises above a set price for a defined period and withdraw once the mineral commodity price drops below the set price. This has successfully worked for mineral commodities whose prices are determined on international markets. However, it is challenging for countries whose main minerals are nonfungible such as diamonds. Nonfungible commodities such as diamonds are not readily available on any market because diamonds are not sold at a spot price. They are primarily sold through private contracts with negotiated prices that are not disclosed to the public (Antwerp World Diamond Centre private foundation (AWDC), 2012).

Due to the reason in the above paragraph, Namibia should use the difference in the predicted budget revenue from mining and the actual revenue from mining as the rule to determine when funds must be paid or withdrawn from the stabilization fund. The assumption is that the Namibian ministry of finance already considers mineral commodity price volatility when they estimate revenue from the mining industry. Thus, the contribution to the SWF will be done whenever there is a surplus, where the actual revenue from the mining industry surpasses the budgeted revenue.

The first condition is when the surplus is equal to 26 percent or less, in this case all the surplus money will be paid into the SWF. The 26 percent is the average amount by which the actual revenue surpasses the budget revenue per year for the period (2000-2018) under study. However, if the surplus is above 26 percent, only 80 percent of the surplus will be paid into the SWF. The 80 percent was based on the framework developed by Thomas (2018) which allows the remaining 20 percent of the surplus to be used for any development projects. This 20 percent for development projects will

aid in ensuring that no withdrawals from SWF is made other than when the need to stabilize earnings from mining arises.

The condition for withdrawing will be met when the actual revenue from the mining industry is less than the budgeted revenue from mining by at least 26 percent. When this happens, the SWF will pay out 90 percent of the difference. The remaining 10 percent will be reserved to ensure that the fund does not go into a deficit. Using the adequate reserves and SBI indicators, the SWF could have been established in 2008 and this would have been the funding and withdrawal movement of SWF moneys as shown in Table 23.

Table 23: Namibian SWF funding and withdrawal simulation

(Chamber of Mines of Namibia 2015, 2020)

Year	Revenue from Namibian mining (N$m current prices)			Change in revenue	Withdraw	Contribution to SWF (N$m current prices)	Comment
	Budget	Actual	Difference in revenue				
2000	525,00	623,80	98,80	19%			No Adequate Reserves
2001	490,00	716,30	226,30	46%			
2002	824,00	1156,70	332,70	40%			
2003	1285,00	1920,40	635,40	49%			
2004	1760,00	480,50	-1279,50	-73%			
2005	566,90	694,70	127,80	23%			
2006	296,90	604,70	307,80	104%			
2007	368,90	1192,60	823,70	223%			First year meeting adequate reserves
2008	1100,00	1643,80	543,80	49%		435,04	**Both adequate reserve and SBI met.** **Pay revenue first difference into SWF**
2009	1458,00	1172,70	-285,30	-20%			No withdrawal, No contribution
2010	939,80	1053,80	114,00	12%		13,68	Pay revenue difference into SWF
2011	1148,80	2216,00	1067,20	93%		853,76	Pay revenue difference up to threshold of 26 percent into SWF
2012	2160,70	1788,00	-372,70	-17%			No withdrawal, No contribution
2013	1989,60	1882,60	-107,00	-5%			No withdrawal, No contribution
2014	2044,50	956,00	-1088,50	-53%	Yes		Withdraw difference between budgeted and actual revenue from SWF to meet budget revenue
2015	3104,10	3318,50	214,40	7%		15,01	Pay revenue difference into SWF
2016	3154,30	3666,60	512,30	16%		81,97	
2017	3666,90	3071,20	-595,70	-16%			No withdrawal, No contribution
2018	3353,60	3456,00	102,40	3%		3,07	Pay revenue difference into SWF
Mining performance budget vs actual revenue				**26%**			
Mining revenue surplus not contributed to SWF						213,44	
Total contribution to SWF						1402,53	
Total withdrawal from SWF						-979,65	
End of 2018 SWF value (excluding interest earned)						422,88	

Key	
Withdrawal requirement meet	
No withdrawal, no contribution	
Contribution requirement meet	

According to Table 23, the first withdrawal would have been in 2014 when the actual revenue from the mining industry was in a shortfall by 53 percent to the budgeted revenue. The minimum requirement for a withdrawal is a shortfall of 26 percent. When that happens, the SWF must pay out 90 percent of the differential amount required to meet the budgeted revenue for the year 2014. The pay-out would have been about NS$980 million. A SWF can either be part of the central bank, ministry of finance or be a separate entity. To avoid mishandling of funds as reported in the case of the Development Fund of Namibia, the Namibian SWF should be a separate entity, independent from government.

5.5 The proposed framework for revenue insurance policy option

Thomas (2018) developed a framework for revenue insurance using five Sub-Saharan African countries. The countries were selected based on their mineral dependency on different mineral commodities. Each country under the framework is required to pay 0.25 percent of its previous year's GDP. The member states can then claim from the insurance scheme when the commodity price for their registered primary commodity drops by more than 10 percent (Thomas, 2018). After a claim, the scheme is expected to pay out a compensation equal to the difference between the actual commodity price and the new commodity price to make sure that the country does not get less than 90 percent of the previous year's revenue. This was the scheme's guarantee to each member state. At the end of each year, 20 percent will be withdrawn from the remaining balance in the insurance scheme and paid to an established agency. The money withdrawn will be used to fund diversification initiatives, infrastructure, education, and innovations developments for the member states.

5.5.1 Drawbacks of the current mining revenue insurance framework

The framework by Thomas (2018) promises to be successfully applied but, it is not readily accepted due to four major draw backs. The first drawback is based on the findings of Brown *et al*. (2008) and South Centre (2005) that policy options that rely on different countries to come together are likely to fail. This is because coherent action and agreement is required among stakeholders (member states). This is difficult to achieve and sustain because countries normally struggle to agree on policy option goal. However, it can be argued that Sub-Saharan African countries have already

collaborated before when the SACU was formed. SACU is considered a successful organisation.

The second drawback is based on the warning of the United Nations Trade and Development Commission (2019) against insurance schemes since the schemes lack information and regulatory frameworks. The concern by the United Nations Trade and Development Commission (2019) on the lack of regulatory frameworks for revenue insurance policy options was addressed by Thomas (2018). Thomas (2018) outlined how revenue insurance policy options should be regulated and operated stipulating conditions for pay outs, limit for pay outs and how excess funds will be utilised.

The third drawback is based on the proposal that each member state's contribution should be set at 0.25 percent of a country's GDP per year, regardless of how the mining industry performed. This is not sustainable because when the industry performs poorly, money will be taken from other sectors of the economy to raise the 0.25 percent contribution to the insurance scheme. To address this, this research proposes that for fairness, the contribution to the scheme should be based on the mining industry's performance and not contribution to GDP. This is because some Sub-Saharan African countries like Namibia are working hard to reduce the contribution of the mining industry to GDP by improving other sectors of the economy such as manufacturing and services (Mwinga, *et al*., 2020).

Fixing the contribution to 0.25 percent of GDP, regardless of mining performance will hinder the progress of countries that are making efforts to reduce their mineral-commodity dependency. This is because, at some point, money will be diverted from other sectors of the economy which will be performing well to meet the 0.25 percent contribution towards the mining scheme. For several years to date, the mining industry's contribution to Namibia's GDP has been low, from a peak of 17 percent to an average of 10 percent (Chamber of Mines of Namibia, 2010). This is a good sign of progress made towards reducing the Namibian economy's dependency on mineral commodities (Chamber of Mines of Namibia, 2020). In this case, it will be unfair to other economic sectors to take out the same 0.25 percent towards the mining revenue insurance scheme when clearly other sectors contributed more than the mining sector.

Due to reasons above, contributions to the insurance scheme should be based on mining performance where actual revenue from mining is compared to the budgeted revenue. A threshold of 26 percent established in Subsection 5.4.2 will be used to determine the amount of mining surplus that will be contributed towards the SWF. The same threshold will be used for the insurance scheme. Any surplus between 0 and the threshold must be paid into the scheme. If a particular year's surplus is above the threshold, 80 percent of the surplus will be saved in the scheme and government will decide how best to use the remaining 20 percent of the surplus revenue.

The fourth drawback regards the 20 percent that would be withdrawn from the fund for developmental activities. The challenge is making sure that member states will benefit equally from the scheme. To overcome this challenge, each year one-member state should be elected to benefit from the development initiative. The selected benefiting country should then present its top three development projects and the other member states assess and decide on which project will be funded by the insurance scheme. The other member states will also instruct the agency on how to fund the selected development project.

Revenue insurance is a good policy option when a regulatory framework is well implemented. This is the reason the policy option ranked second in the CPVPO matrix (Table 21). Suggestions by Thomas (2018) for an independent committee to be established and for an insurance scheme to be a separate entity are good. The insurance scheme by Thomas (2018) was based on different countries collaborating to cover each country's primarily mineral commodity. This research adjusted the insurance scheme to cover different minerals in one country, instead of focussing on one mineral. This is contrary to the stabilization fund by Thomas (2018) where a group of countries with different mineral commodities collaborate. For Namibia's mining insurance scheme, four minerals were selected based on their contribution to mining exports. These minerals will be insured under one scheme and their performance in export value will be used to determine how each mineral will be compensated.

5.5.2 Proposed rules for funding and withdrawing for the Namibian mining revenue insurance scheme.

The condition for contributing towards the mining insurance scheme will be similar to that proposed for the Namibian SWF. The actual revenue from the mining industry must surpass the budgeted revenue. On average, the mining revenue surpass the budget mining revenue by 26 percent as shown in Table 24. When the surplus is equal to 26 percent or less, all the surpluses will be paid into the insurance scheme. If the surplus is above the 26 percent threshold, then 80 percent of the total surplus will be paid into the insurance scheme. The remaining 20 percent will be used based on how best the government deems fit to benefit the mining industry and economy.

The condition for withdrawal were determined using the performance of the different minerals towards export value as shown in Table 24. The table shows the different withdrawal requirement thresholds.

Table 24: Namibian mining revenue insurance scheme withdrawal requirements for diamond, uranium, copper and zinc

(Chamber of Mines of Namibia, 2015, 2020).

Year	Diamond export value (N$m current prices)	Change in diamond export value (%)	Uranium export value (N$m current prices)	Change in uranium export value (%)	Copper export value (N$m current prices)	Change in copper export value (%)	Zinc export value (N$m current prices)	Change in zinc export value (%)
2000	3936,00				58,00			
2001	4161,00	6			201,00	247		
2002	5192,00	25			262,00	30		
2003	3546,00	-32			186,00	-29	242,00	
2004	4911,00	38			212,00	14	694,00	187
2005	5002,00	2			214,00	1	1318,00	90
2006	6787,00	36			314,00	47	2518,00	91
2007	5546,23	-18	2638,75		1156,69	268	3881,24	54
2008	6240,72	13	7195,10	173	1482,56	28	2521,00	-35
2009	5641,56	-10	5103,42	-29	2195,79	48	2427,07	-4
2010	6971,50	24	5348,32	5	1860,06	-15	2603,60	7
2011	7073,36	1	4460,64	-17	3207,65	72	2390,70	-8
2012	8708,06	23	5609,91	26	3192,28	0	2265,44	-5
2013	10805,47	24	6186,26	10	1720,97	-46	2657,93	17
2014	13034,53	21	4508,35	-27	1064,00	-38	3259,00	23
2015	14167,34	9	3670,14	-19	1507,35	42	1949,62	-40
2016	14328,14	1	3545,29	-3	2795,73	85	2460,27	26
2017	15528,00	8	4126,01	16	3000,82	7	2918,00	19
2018	11014,00	-29	8579,00	108	3131,00	4	2543,00	-13
Average Export Value Percentage Change (%)		8		22		43		27

Key	Withdrawal requirements meet

The proposal is for each mineral to have a condition suited to it under which a withdrawal is triggered. This is because the different minerals' contributions to total export value are different. Unlike with the SWF, the year in which a withdrawal is made does not exempt government from contributing to the mining revenue insurance scheme. This is because the contribution requirements are based on the actual amount of revenue from mining whilst withdrawals are based on the monetary value of mining exports. The withdrawal conditions per mineral will be as follows:

- Diamond withdrawals will be activated when the current year's total diamond exports value experiences a shortfall of 8 percent when compared to the previous year's export value. The 8 percent was derived from the average percentage change in the value of diamonds exports as shown in Table 24. The mining revenue insurance scheme will pay out the difference between the actual commodity price and the new commodity price. This will ensure that the Namibian government does not get less than 90 percent of the previous year's export value from diamonds. Based on Table 24, the withdrawal for diamond would have been in 2003, 2007, 2009 and 2018.
- Uranium withdrawals will be activated when the current year's total uranium exports value experiences a shortfall of 22 percent when compared to the previous year's export value. The 22 percent was derived from the average percentage change in the value of uranium exports as shown in Table 24. The mining revenue insurance scheme will pay out the difference between the actual commodity price and the new commodity price. This will ensure that the Namibian government does not get less than 90 percent of the previous year's export value from uranium. Table 24 shows that there would have been withdrawals from the scheme for uranium in 2009 and 2014.
- Copper withdrawals will be activated when the current year's total copper exports value experiences a shortfall of 43 percent when compared to the previous year's export value. The 43 percent was derived from the average percentage change in the value of copper exports as shown in Table 24. The mining revenue insurance scheme will pay out the difference between the actual commodity price and the new commodity price This will ensure that the Namibian government does not get less than 90 percent of the previous year's

export value from copper. Table 24 shows that scheme would have experienced only one withdrawal due to copper in 2013.

- Zinc withdrawal will be activated when the current year's total zinc exports value experiences a shortfall of 27 percent when compared to the previous year's export value. The 27 percent was derived from the average percentage change in the value of zinc exports as shown in Table 24. The mining revenue insurance scheme will pay out the difference between the actual commodity price and the new commodity price to ensure that the Namibian government does not get less than 90 percent of the previous year's export value from zinc. Table 24 shows that here would have been two withdrawals from the scheme for zinc in 2008 and 2015.

The assumption was that the insurance fund was implemented in 2000. The yearly premiums paid to the insurance scheme from 2000 to 2018 are shown in Table 25.

Table 25: Namibian mining revenue insurance funding simulation

(Chamber of mines of Namibia 2015, 2020)

	Revenue from Namibian mining (N$m current prices)			Percentage change	Contribution to insurance scheme (N$m current prices)
Year	Budget	Actual	Difference in revenue		
2000	525,00	623,80	98,80	19%	18,77
2001	490,00	716,30	226,30	46%	181,04
2002	824,00	1156,70	332,70	40%	266,16
2003	1285,00	1920,40	635,40	49%	508,32
2004	1760,00	480,50	-1279,50	-73%	
2005	566,90	694,70	127,80	23%	29,39
2006	296,90	604,70	307,80	104%	246,24
2007	368,90	1192,60	823,70	223%	658,96
2008	1100,00	1643,80	543,80	49%	435,04
2009	1458,00	1172,70	-285,30	-20%	
2010	939,80	1053,80	114,00	12%	13,68
2011	1148,80	2216,00	1067,20	93%	853,76
2012	2160,70	1788,00	-372,70	-17%	
2013	1989,60	1882,60	-107,00	-5%	
2014	2044,50	956,00	-1088,50	-53%	
2015	3104,10	3318,50	214,40	7%	15,01
2016	3154,30	3666,60	512,30	16%	81,97
2017	3666,90	3071,20	-595,70	-16%	
2018	3353,60	3456,00	102,40	3%	103,68
Mining performance budget vs actual revenue				**26%**	

Key	
Contribute requirement meet	

Table 25 shows that the mining revenue insurance scheme would have received yearly premiums expect in 2004, 2009, 2012, 2013, 2014 and 2017; years when there was a short fall of revenue compared to budgeted revenue.

5.6 Chapter summary

This chapter ranked the five policy options based on their requirements, advantages, and disadvantages which were inputs in the CPVPO matrix. Results from the matrix were used to rank the policy options. From the ranking, the top two policy options were then chosen, which are the national revenue management policy option (stabilization fund) and the revenue insurance policy option. The chapter proposed an operating framework for the two policy options. The proposed framework for the national revenue management policy option requires Namibia to use the adequate reserves and SBI indicators to determine an economically viable year to set up a SWF. The fund should be funded using the difference in the predicted budget revenue from mining and the actual revenue from mining. When this difference exceeds 26 percent then the surplus

must be paid to the SWF. The withdrawal condition is that when the actual revenue from the mining industry has a shortfall 26 percent from the budgeted amount, the fund will pay out 90 percent of the difference.

The proposed framework for the revenue insurance scheme will protect Namibia's four critical Namibian minerals against fluctuating commodity prices. The condition for contribution to the mining insurance will be similar as proposed for the SWF. The withdrawal condition will be specific to each mineral, where a withdrawal is activated when the current year's total export value for the minerals experience a shortfall lower than the average percentage change in the value of mineral exports when compared to the previous year's export value.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Chapter overview

This chapter summaries the findings of the research study. The findings were used to make conclusions and recommendations. This chapter also presents the limitations of the research.

6.2 Research summary

Five policy options aimed at lessening the commodity price volatility were discussed. Each policy option focused on a different aspect of the market or a country's economy to try and lessen the impact of mineral commodity price volatility. The supply management policy option tries to lessen the impact of commodity price volatility by controlling the supply of commodities by using various instruments. The instruments are used to try and bring back the equilibrium of supply and demand forces in the market since companies of developed countries have tight control over the market, they influence the supply and demand. The option has challenges of high cost and requires action and agreement among stakeholders which is difficult to sustain.

The national revenue management policy option requires the implementing government to put away excess revenues obtained from commodity exports. The principle is that during periods of commodity prices booms or when the revenue from mining exceeds the budgeted revenue from mining, government should save the surplus revenue into a SWF. To achieve this, the government must match its expenditures with revenues. The government must also have strong institutions, legal frameworks and education to successfully implement the NRF.

The market-based price risk management policy option aims to transfer risk from the producer (government of mineral commodity producing country) to investors using contracts (market-based price risk management tools). The policy option is costly and requires strong financial systems and education for it to be successfully implemented.

The compensatory finance policy option is based on schemes that fund developing countries in the form of grants or loans. Loans are more expensive and have strict conditions which make it difficult for countries to qualify. They also have set specifications on what the receiving country should use the funds from the loan for.

This leads to a cycle of developing countries being in debt. Grants also have the same features except the repayment and debt risk. They may introduce a new risk of grant dependency. Most mineral economies are already dependent on minerals such that adding grant dependency does not assist in the goal to make these economies self-sustainable. Some organisations such as the United Nations Trade and Development Commission (2019) argue that when properly managed and implemented, the compensatory finance policy option is a good option. However, due to its many requirements, most developing countries are moving away from using it.

The revenue insurance policy option requires discipline from a country to pay premiums and forego a certain percentage of its GDP earned each year. For the policy option to be successful, strong legal frameworks are required to ensure that the policy option is transparent and practically feasible.

The Namibian economy and mining industry were analysed. Mineral commodities that contribute significantly to the Namibian economy in terms of GDP, minerals exports, employment and tax revenue were identified. These are diamonds, uranium, zinc, and copper. The volatilities of these commodities' prices were calculated using the coefficient of variation. The volatilities were then compared to the United Nations' average volatility of 0.43 for the minerals, ores and metals commodity group. It was found that diamonds prices were more volatile followed by uranium with volatilities of 0.55 and 0.54, respectively. Volatilities of both diamonds and uranium were found to be higher than the commodity group's average volatility. Copper's volatility of 0.43 was equal to the volatility of commodity group's average whilst zinc's volatility of 0.42 is slightly lower than the commodity group's average volatility. This means that the prices of diamonds and uranium are the most volatile. The volatilities of these minerals make it important for Namibia to implement policies to lessen the impact of commodity price volatility on the country's economy.

The relationship between Namibia's economy (real GDP) and mining industry (growth in mining) was analysed. The two were found to have a positive correlation coefficient of 0.6. This means that for every increase in the mining industry the real GDP of Namibia will grow by 0.6 (60 percent). Thus, it can be concluded that the mining industry performance has an impact on the Namibian economy.

6.3 Conclusions

The mining industry is a significant contributor to the Namibian economy. This means that the performance of the industry has an impact on the Namibian economy. However, mineral commodity prices are volatile which also result in the contribution of the industry to the economy to be unstable. Therefore, it is important that Namibia implement strategies to manage the impact of commodity price volatility on the Namibian economy.

Five policy options that can be used to manage volatility on the Namibian economy were identified. The five options were analysed and ranked. While there is no single best policy to lessen the impact of commodity price volatility, two policy options were chosen as they passed the criteria of acceptability, cost, practicality and effectiveness. The top two policy options that will suit the Namibian economy are national revenue management (stabilization fund) and revenue insurance.

6.4 Recommendations

It is recommended that the Namibian government should consider implementing two policy options. These are the national revenue management policy option (stabilization fund) and revenue insurance policy option. This is because current methods of keeping ratio of government debt to GDP below 25 percent and setting the budget in a multi-year using MTEF are not working for the country. Two frameworks are proposed for each policy option.

6.4.1 Recommendations for the national revenue management policy option

This policy option will require Namibia to use adequate reserves and SBI metrics to determine an economically viable year to set up a sovereign fund. For the period of 2000 to 2018 analysed in this study, it was found that Namibia had met the conditions to establish a sovereign wealth fund as early as 2008 based on adequate reserves and SBI metrics. Namibia could have set up a SWF between 2008 and 2010. This research recommends that when Namibia decides to set up a stabilization fund, it should be funded using the difference in the predicted budget revenue from mining and the actual revenue from mining. When the actual revenue from the mining industry surpasses the budgeted revenue by 26 percent, the surplus must be paid into the fund.

Similarly, when the actual revenue from the mining industry is a shortfall from the budgeted amount by 26 percent, then the fund will pay out 90 percent of the difference. It is also recommended that the stabilization fund should not be linked to government to avoid influence from the government.

6.4.2 Recommendations for revenue insurance policy option

This policy option will require Namibia to create a revenue insurance scheme that covers the four identified minerals. The condition for contribution to the mining insurance will be same as that proposed for the Namibian SWF. The withdrawal condition will be specific to each mineral. Diamond withdrawal will be activated when the current year's total diamond exports value experiences a shortfall of 8 percent when compared to the previous year's export value. Uranium withdrawal will be activated when the current year's total uranium exports value experiences a shortfall of 22 percent when compared to the previous year's export value. The withdrawal for copper will be activated when the current year's total copper exports value experiences a shortfall of 43 percent when compared to the previous year's export value. With zinc the withdrawal will be activated when the current year's total zinc exports value experiences a shortfall of 27 percent when compared to the previous year's export value. The compensation for each mineral will be different as each commodity has a different price and the compensation will be the difference between the actual commodity price and the new commodity price of the mineral. This is to make sure the Namibian government does not get less than 90 percent of the previous year export value from the mineral.

6.5 Limitations of research findings

The following are the limitations of the research:

1. The research only analysed the period of 2000 to 2018. If the Namibian government decides to implement the frameworks recommended in this research, they will need to analyse a more recent period to determine the ideal time to set up the stabilization fund in the future.
2. The research analysed the monetary value of SWF and the insurance scheme. A more thorough cost-benefit analysis is needed for both the SWF and the insurance scheme.

3. Only four critical Namibian minerals were analysed in this study. Further work can be done by analysing all minerals extracted in Namibia to develop a framework applicable to all minerals.

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8 APPENDICES

8.1 Coefficient of variation for diamonds

(Index Mundi, 2020)

Diamond **Unit**: US Dollars per Carat

Year	Price (x)	Percentage Change	$(x_i - \bar{X})^2$
1960	2700,00		236049081,79
1970	6900,00	155,56%	124632415,12
1980	10500,00	52,17%	57212415,12
1990	13900,00	32,38%	17337970,68
2000	15100,00	8,63%	8784637,35
2010	24500,00	62,25%	41423526,23
2013	28400,00	15,92%	106835192,90
2015	29650,00	4,40%	134237970,68
2016	30925,00	4,30%	165408179,01
Mean $\bar{X}$	18063,89	$\sum_{i=1}^{n}(x_i - \bar{X})^2$	891921388,89

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{X})^2}$$

$$\sigma = \sqrt{\frac{1}{9} \times 891921388,89}$$

$$\sigma = 9955,017657$$

$$CV = \frac{\sigma}{\bar{X}}$$

$$CV = \frac{9955,02}{18063,9}$$

$$\boldsymbol{CV = 0,55}$$

8.2 Coefficient of variation for uranium

(Index Mundi, 2020)

Uranium **Unit**: US Dollars per Pound

Year	Price (x)	Percentage Change	$(x_i - \bar{X})^2$
2000	7,40		672,34
2001	9,47	27,97%	569,28
2002	9,84	3,91%	551,76
2003	12,37	25,71%	439,30
2004	20,08	62,33%	175,55
2005	32,75	63,10%	0,34
2006	56,06	71,18%	516,68
2007	77,50	38,24%	1951,03
2008	48,60	-37,29%	233,19
2009	46,11	-5,12%	163,34
2010	48,83	5,90%	240,27
2011	52,34	7,19%	361,40
2012	44,61	-14,77%	127,25
2013	34,85	-21,88%	2,31
2014	35,75	2,58%	5,86
2015	36,96	3,38%	13,18
2016	21,19	-42,67%	147,37
2017	19,68	-7,13%	186,31
2018	27,95	42,02%	28,94
2019	24,25	-13,24%	82,44
Mean $\bar{X}$	33,33	$\sum_{i=1}^{n}(x_i - \bar{X})^2$	6468,11

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{X})^2}$$

$$\sigma = \sqrt{\frac{1}{20} \times 6468{,}11}$$

$$\sigma = 17{,}983483$$

$$CV = \frac{\sigma}{\bar{X}}$$

$$CV = \frac{17{,}98}{33{,}33}$$

$$\boldsymbol{CV = 0{,}54}$$

8.3 Coefficient of variation for copper

(Index Mundi, 2020)

Copper

Unit: US Dollars per Pound

Year	Price (x)	Percentage Change	$(x_i - \bar{X})^2$
2000	1898,59		11876242,75
2001	1377,28	-27,46%	15741076,09
2002	1483,76	7,73%	14907494,75
2003	1920,54	29,44%	11725436,70
2004	3012,24	56,84%	5440754,51
2005	4059,76	34,78%	1651282,83
2006	7500,39	84,75%	4646643,69
2007	8008,44	6,77%	7095071,28
2008	4925,70	-38,49%	175630,14
2009	6287,98	27,66%	889621,52
2010	8292,41	31,88%	8688507,88
2011	7394,19	-10,83%	4200071,10
2012	8062,03	9,03%	7383433,98
2013	7203,02	-10,66%	3453046,61
2014	6737,48	-6,46%	1939606,33
2015	5216,09	-22,58%	16561,76
2016	4731,26	-9,29%	376409,86
2017	6807,60	43,89%	2139835,04
2018	6219,59	-8,64%	765288,16
2019	5757,30	-7,43%	170170,69
Mean $\bar{X}$	5344,78	$\sum_{i=1}^{n}(x_i - \bar{X})^2$	103282185,65

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{X})^2}$$

$$\sigma = \sqrt{\frac{1}{20} \times 103282185,65}$$

$$\sigma = 2272,468$$

$$CV = \frac{\sigma}{\bar{X}}$$

$$CV = \frac{2272,47}{5344,78}$$

$$\boldsymbol{CV = 0,43}$$

8.4 Coefficient of variation for zinc

(Index Mundi, 2020)

Zinc **Unit**: US Dollars per Metric Ton

Year	Price (x)	Percentage Change	$(x_i - \bar{X})^2$
2000	1095,90		726952,34
2001	761,50	-30,51%	1409004,61
2002	754,70	-0,89%	1425194,25
2003	897,96	18,98%	1103665,81
2004	1064,95	18,60%	780687,11
2005	1488,38	39,76%	211724,22
2006	3822,96	156,85%	3513544,06
2007	2975,33	-22,17%	1054349,04
2008	1302,11	-56,24%	417839,42
2009	2071,59	59,09%	15147,46
2010	2372,14	14,51%	179458,14
2011	1871,42	-21,11%	5943,64
2012	1903,96	1,74%	1985,15
2013	1884,84	-1,00%	4054,51
2014	2276,83	20,80%	107790,74
2015	1724,34	-24,27%	50254,43
2016	2311,50	34,05%	131758,11
2017	3264,60	41,23%	1732079,73
2018	2673,67	-18,10%	525849,77
2019	2451,62	-8,31%	253114,64
Mean $\bar{X}$	1948,52	$\sum_{i=1}^{n}(x_i - \bar{X})^2$	13650397,18

$$\sigma = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{X})^2}$$

$$\sigma = \sqrt{\frac{1}{20} \times 13650397,18}$$

$$\sigma = 826,1476$$

$$CV = \frac{\sigma}{\bar{X}}$$

$$CV = \frac{826,15}{1948,52}$$

$$\boldsymbol{CV = 0,42}$$

8.5 Supply management requirements, advantages and disadvantages sorted into evaluation criteria

Supply Management Application Requirements
All parties including the agent need to agree to the set goals to avoid commodity goods getting produced in excess of the supply management agreement.
The selected commodity's market should be well defined and must not have easily substitutable products for example natural rubber can be substitute for synthetic rubber or natural diamonds can also be substituted for synthetic diamonds.
The agent chosen to administer the supply management instrument is required to be technically competent and credible. This means they are required to have the ability to enforce the agreement, have financial resources to sustain operations and storage capacity to withhold supply for a period long enough to bring about desired price.
The supply management instrument is required to have the flexibility to accommodate and respond to all market change over a long term.
Advantages of Supply Management
Brown, et al., (2008) and South Centre (2005) discussed them as follows:
Corporates of developed countries have tight control over the market, they influence the supply and demand. Supply management can help weaken this control by controlling the supply of commodities using buffer stocks. This build up the countervailing power and restores some balance of the producers and developing countries
Supply management exploits the new technological advancements such as improved geographic information system, developments in product tracing among others to enforce production agreements.
The advancement in markets such as the introduction of tradable quotas coupled with the use of financial assets such as virtual buffer stocks makes its cheaper to implement the supply management instrument which make them more attractive to consumer countries to buy.
Disadvantages of Supply Management
Brown, et al., (2008) and South Centre (2005) discussed them as follows:
Supply management's focus is only on price management, it does not look at other risk that producers face such as social, economic and environmental risks.
Supply management is commonly used by groups such as organizations or cooperates. This makes it extremely difficult to sustain the required coherent action and agreement among stakeholders.
Important producers that remain out of the scheme called free riders can undermine the supply management arrangements.
Developed countries are unlikely to support supply management proposals as it is a threat to countervail the current market power they have.
There is high cost involved in price stabilization.
There are difficulties in the quota allocations and enforcements.

Key	
Acceptability	Trade distoration
	Compatibility
Cost	Cost implementation
	Cost sustainability and efficiency
Practicality	Ease of Implementation
	Flexibility/ Adaptability
Effectiveness	Managing Risk

8.6 National revenue management requirements, advantages and disadvantages sorted into evaluation criteria.

National Revenue Management Application Requirements
Brown, et al., (2008) noted that in order for national revenue management to work strong legislative restrictions are mandatory, success of national revenue management is highly dependent on the adherence to the set strong legislative restrictions.
For revenue management to work the country implementing it needs to balance their expenditures to match their revenues left after putting away the agreed amount classified as excess revenue into the fund. This is especially important because no amount of excess revenues from the fund will be enough to provide the stabilizing effect if the country still continues to over spend and use the revenue from the funds as collateral to finance new expenditures through debt Brown, et al., (2008).
Advantages of National Revenue Management
Brown, et al., (2008) listed the benefits of National Revenue Management as follows:
NRF can be used to foster social development by channelling windfall profits in to economic transition and diversification.
When NRF are properly designed and executed, they can offer commodity dependent countries opportunity to sustainability insulate the economy from macroeconomic problems.
The legal frame work used to implement NFR provide established rules against which governments' performance can be measured.
Disadvantages of National Revenue Management
Brown, et al., (2008) listed the drawbacks of National Revenue Management as follows:
Even with established legal framework of NRF, this does not guarantee that countries will start to practice fiscal discipline.
For NRF to be implemented the country need to have a good institutional and political strength, most developing countries do not possess this.
The reason for setting up NRF are not always to provide revenue stability, at times it has been found that this is done only to benefit the country's external image.

Key	
Acceptability	Trade distoration
	Compatibility
Cost	Cost implementation
	Cost sustainability and efficiency
Practicality	Ease of Implementation
	Flexibility/ Adaptability
Effectiveness	Managing Risk

8.7 Market-based price risk management tools requirements, advantages and disadvantages sorted into evaluation criteria.

Market-Based Price Risk Tools Application Requirements
Market-base price tools require, the user to have access to the market. According to Brown, et al., (2008) it is extremely difficult for an individual producer to access organized futures and options markets. However Individual producers can instead access over-the-counter markets normally create by banks and trading companies.
Users of market-base price tools are required to have good financial knowledge in order to understand how to utilise the tools, choose from the full range available and how the market operates. Brown, et al., (2008) discussed that most producers are in developing countries and they do not possess this financial knowledge, thus most producers will require training.
Advantages of Market–Based Price Risk Management
Brown, et al., (2008) and (United Nations, 2019) discussed the benefits as follows:
The market-based tools do not affect commodity price. They shift the risk from producers to investors offering revenue predictability.
There are four Market-based price tools this gives the producer a choice to choose the best methods that will allow them to shift the commodity risk and meet their individual needs.
If an individual cannot access the exchange markets they can choose the over-the-counter market that is provided by trading companies or banks.
Disadvantages of Market–Based Price Risk Management
Brown, et al., (2008) and (United Nations, 2019) discussed the drawbacks as follows:
The market-base price tools have short-term maturities, as they are only suitable for about one to two years, this might not always be sufficient for the producers as the price risk faced can last for more than two years. The tools manage short-term risks they do not mitigate the causes of the commodity price.
All commodities do not have organized exchanges meaning market-base price tools might not be available to use for all commodities and on top of that the tools actually work best for producer groups and cooperatives, leaving out individual producers.
The infrastructure and financial training needed to make the market-based tools feasible on large scale are not readily accessible making the use of the tools less broadly used.
Some of the market-base price tools like futures requires contingent cash requirement in order to use them. Producers in developing countries are classified as being riskier to producers in developed countries, this means they have to pay much higher risk premiums or asked for higher-value collaterals that they cannot afford.

Key	
Acceptability	Trade distoration
	Compatibility
Cost	Cost implementation
	Cost sustainability and efficiency
Practicality	Ease of Implementation
	Flexibility/ Adaptability
Effectiveness	Managing Risk

8.8 Compensatory finance requirements, advantages and disadvantages sorted into evaluation criteria.

Compensatory Finance Application Requirements
Countries should be able to demonstrate their loss from export revenue.
They have to agree to follow the policies identified by the scheme to be the best to provide the solutions to the balance of payments.
Advantages of Compensatory Finance
Brown, et al., (2008) and (United Nations, 2019) discussed the benefits as follows:
The compensatory finance mechanisms centred on loans in theory can serve as self-financing that can reduce the likely hood of aid dependence among recipient countries.
With the work done by UNCTAD all the countries interested in Compensatory Finance need to do is follow the recommendations for a self-sustaining compensatory finance mechanism.
Compensatory Finance is one of the policy options that have been around for many decades giving policy makers the benefit of experience that they can again from other countries who have used the compensatory Finance schemes.
Disadvantages of Compensatory Finance
Brown, et al., (2008) and (United Nations, 2019) discussed the drawbacks as follows:
Compensatory Finance can create aid dependency if not well designed.
They are expensive as they are loans that need to be repaid.
It can cause trade distortion.
In the past Compensatory Finance fund disbursement is not reliable, the funds would arrive while he commodity prices recovered and instead of stabilising the government revenue and spending in gives an upward spike in government revenue leading to over spending tendencies.
Initially the Compensatory Finance entrusted the payment to governments believing the benefit will trickle down to the producers, but as was discovered later the governments mismanaged the funds and instead of the funds reaching the producers as it was intended, the government used the funds for consumptions and unstainable spending.
Applicants were in the past required to show that the shocks were not caused by domestic policies. This requirement alone made the Compensatory Finance inaccessible to many deserving countries as it is extremely difficult to prove that shocks are not caused by domestic policies.

Key	
Acceptability	Trade distoration
	Compatibility
Cost	Cost implementation
	Cost sustainability and efficiency
Practicality	Ease of Implementation
	Flexibility/ Adaptability
Effectiveness	Managing Risk