Journal of Economics and Behavioral Studies (ISSN: 2220-6140)
Vol. 14, No. 1, pp. 6-22, March 2022

Business Cycles and Growth of South African Steel Manufacturing Industry

Andretta Tsebe
Department of Public Enterprises, Cranefield University, Pretoria, South Africa
tsebeandretta@gmail.com

Abstract: The paper studies the relationship between the South African business cycle and the performance of the steel industry. The analysis was conducted by first providing a brief bibliometric review of the definitions used for business cycles in literature. From this initial analysis, emerging themes were used to define the narrative literature review on the relationship between business cycles, economic growth, and supply-demand of the steel industry. Findings from the review, indicate a binary relationship between economic growth and steel industry output. It is recommended that future studies be done on quantitative analysis of the binary and ternary relationships between economic growth and other primary manufacturing industries in South Africa.

Keywords: *Steel, Economic Growth, Narrative Literature Review, South Africa.*

1. Introduction

The pivotal role played by primary industries in the creation of the industrialization infrastructure of any country is clearly understood. The steel industry has been just such a driver in all countries during and after the industrial revolutions in most western countries. South Africa is no exception to the basic economic growth theory, and it is unequivocal that the establishment of a viable domestic steel industry played a pivotal role in the development of a vibrant economy in the country from the 1900s onwards. Studies by Muchaonyerwa & Choga (2015), Pheng and Hou (2019), Maduku (2019) and Bonga & Kinfack (2020) link trade, industry activities and associated business cycle movements in African economies. These studies conducted found that trade and industry output performance was associated with business cycle movements. This paper aims to provide new insights into the relationship between economic growth, steel industry movements and business cycle trends in South Africa. The link between business cycles and economic growth has been central to many macroeconomic studies. Considering the existing literature, there is a need to go beyond the dichotomy and further explore the relationship between business cycles and economic industry outputs. The general objective of this paper is to identify the factors that enhanced or reduced the business cycle movements between the South African economy and its steel industry.

The paper investigates if business cycle movements were a result of decreasing level of steel manufacturing in South Africa or because of the overall decline in the manufacturing industry's contribution to the Gross Domestic Product (GDP). The objective was achieved by exploring the following:

- Defining the link between the economic activities and business cycle movements between 1960 and 2018 in South Africa.
- Analyzing the impact of steel demand and supply on the business cycles movements, and
- Examining the link between the steel price and steel demand divergence or convergence in South Africa.

The paper does not develop or apply econometric models to measure the business cycle and steel industry performance cycle between 1960 and 2018. The methodology used to analyze the paper's objectives is centered on the narrative literature review that Stanley (2001) and Brodeur et al. (2020) note that economics-related literature reviews do not contain explicit meta-analysis data and can present research that economists can use to inform academic and policy debates. Narrative literature reviews are called by Green et al. (2006) and Vicki et al. (2020) unsystematic literature reviews that synthesize previously published information. Findings from the review can be used to inform an analysis of the steel industry's economics-related gaps and areas that require further exploration by researchers.

2. Methodology

A narrative review of the business cycle movement and its relationship with the steel industry was conducted, informed using published empirical research. The first phase of the narrative literature was undertaken was a bibliometric analysis of the business cycle definitions in the literature. The bibliometric analysis was selected because literature is characterized by heterogeneity definitions of the business cycle. The different definitions are synthesized into themes that were used to develop linkages between business cycle movements and the South African steel industry. The second and last phase involved analysis of empirical literature including papers and steel industry publications that detail the movements in the South African economy and steel industry were imported into EndNote and data was extracted using tools developed in Microsoft Office. The approach taken is similar to that undertaken by Meagher (2013), Shiller (2017), Arruda et al. (2021) and Saz-Gil et al. (2021) by: defining the keywords that were used in the study, synthesis of emerging trends, analysis of findings from literature and making recommendations for further research.

Organization of the Paper: The paper is structured as follows: Section 2 summarizes the bibliometric analysis that was conducted for the study. Section 2 focuses on the theoretical literature on economic cycles and the South African steel industry. Section 3 discusses the impact of the steel manufacturing industry on economic growth from literature analysis. Section 4 focuses on the literature that describes the relationship between the elasticity of the steel sector and economic growth. Section 5 discusses the findings from the literature review on the steel industry equilibrium. Section 6 summarizes the paper, discusses implications, and suggests future research.

Definitions: To determine the synthesis of the review, as part of the bibliometric analysis. An overview of the most common definitions of business cycles used is articulated in Table 1, which shows the heterogeneity of definitions used in the literature.

Table 1: Terminology and Definition in the Literature

Terminology	Definition
Business Cycles	"Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle." (Burns & Mitchell, 1946) "Business cycles are defined as the fluctuations that occur in economic activities in countries where business organizations are mainly commercial or industrial." (Greenwald,1982) "A business cycle is defined as a circular process of the growth and decline of a nation's economy over a period." (Bookbinder & Einleger, 2001) "The business cycle is defined as a regular and oscillatory movement in economic output within a specified range of periodicities." (Cotis & Coppel, 2005) " Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration, business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own."(Skare & Stjepanovic, 2015)

An analysis of the conceptualization of the definitions of the business cycle in Table 1 discerned several recurring themes that reflect the two central elements. The first theme refers to the fluctuating or cyclic nature of the business cycles. The cyclical nature of fluctuations was explained by Cotis & Coppel (2005) in terms of expansions and contractions in the level of economic activity, typically measured by Gross Domestic Product (GDP), which are influenced by the dynamics of macroeconomic indicators (i.e., output, unemployment, consumption, investment, and prices (Zalgiryte and Giziene, 2014). The second theme refers

to the economic activity being the base of the business cycles. Gehringer & Mayer (2021) postulate that economic activity is a broad and abstract concept that looks at different industry outputs from a multidimensional perspective. In this regard, the paper focuses on economic activity related to steel production, the correlations between GDP movements over time with changes in demand and supply.

Business Cycles and The Steel Industry: In an attempt to properly understand the dynamics that contributed to the steel industry in South Africa over the last decade, it is important to explore the theoretical dynamics underpinning a viable and sustainable economy as a benchmark for comparison, as well as to scrutinize the changes in the operating environment in which the steel industry is required to function. This proposition is supported by both Chadha (1989), and Ra (2008), who found in their research that there is a direct causal relationship between steel consumption and economic growth in the countries they surveyed, primarily because steel is one of the basic components or building blocks of many, if not all, industries such as construction, industry, and manufacture of household machinery and equipment. In support of this proposition, Kapila and Kapila (2007), suggest that steel is one of the key sectors of the economy in terms of infrastructure development and that therefore any changes in economic performance, such as a recession, could result in volatile demand and supply of steel.

Researchers Meny, Wright and Rhodes (1987), identified a direct and positive correlation between the cyclic nature of the economies of several Western European countries in the 1970s and its impact on steel production volumes and steel prices. Similarly, Jones (2017), concludes that the steel industry is sensitive to trade-related disturbances, business cycle fluctuations and other market conditions that might result in excess capacity or deficiency. Business cycles are defined by Greenwald (1982), amongst others, as the fluctuations that occur in economic activities in countries where business organizations are mainly commercial or industrial. Bookbinder and Einleger (2001), define a business cycle as a circular process of the growth and decline of a nation's economy over a period. This description is supported by Scheiblecker (2008), who describes a business cycle as the type of fluctuation found in the aggregated economic activity of a country consisting of contractions and revivals which merge into the next economic cycle.

Arnold (2015), suggests that a business cycle consists of five phases:

- The contraction or recession phase can be described as the phase in which there is a decrease in the real gross domestic product for three consecutive quarters.
- The trough phase refers to the stage when the lowest point of a contraction phase is reached, and which lasts for a period of time before the economy turns around and grows.
- The recovery phase during which the real gross domestic product increases and becomes positive moving up from the trough and recession phases.
- The peak phase is the highest phase of the real gross domestic product, indicating a growth in the economy; and
- The expansion phase refers to the phase in which there is an increase in the real gross domestic product beyond the peak and recovery phases.

Based on these definitions of the different stages or phases of business cycles, the South African Reserve Bank identifies the different phases by means of three business cycle indicators:

- The leading indicator.
- The coincident indicator; and
- The lagging indicator.

According to Muchaonyerwa and Choga (2015), the leading business cycle indicator is identified by:

- Combining prices of all shares.
- Determining the real money supply.
- Calculating the labor productivity in the manufacturing sector.
- Examining the job vacancy advertisements in newspapers.
- Taking account of the commodity prices in US dollars for a basket of South Africa's export commodities; &
- Conducting an opinion survey of business confidence.

Moolman (2003), explains that the leading business cycle indicator provides insight and predicts the future prospects of the economy whereas the coincident indicator measures the current economic activity with the latest data. Moolman (2003), postulates that the components of the coincident indicator are:

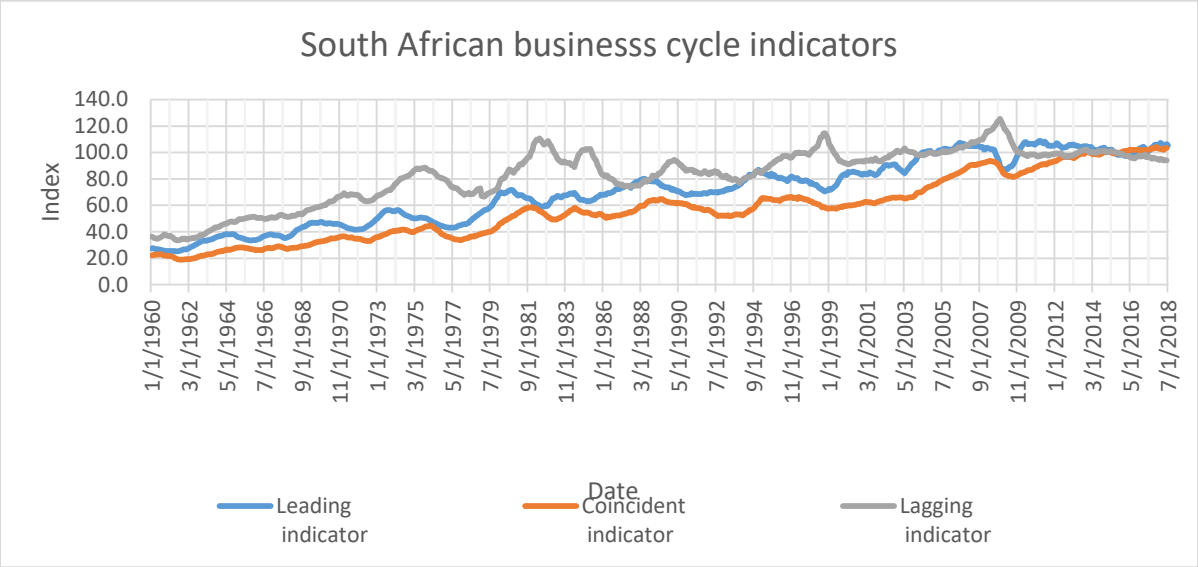
- Reported new vehicle sales.
- Reported retail sales figures.
- Reported wholesale sales figures.
- Manufacturing volume output; and
- The employment rate of the population.

The lagging business cycle indicator is a measure of the historical performance of the economy, according to Muchaonyerwa and Choga (2015), and comprises:

- The inflation rates.
- The ratio between the inventories and inventories to sales,
- The unit labor costs.
- Both short- and long-term interest rates.
- The extent and cost of commercial and industrial loans; and
- The installments on consumer installment credit.

Another economist, Venter (2005), states that the volume of manufacturing output excludes that of agriculture, fishing, and forestry. The calculation of production capacity in the manufacturing sector includes the output of both the mining and manufacturing sectors plus the amount of electricity generated and the weighted average output of each sector that contributes to the gross domestic product. Against this background, Boshoff (2020), explains that business cycle indicators can be used to analyze the historical, current and expected economic trends, while Mohr (2005), states that if the leading indicators are improving, an increase in business performance can be expected. Likewise, if the coincident indicators are declining, it can be concluded that the economic conditions are deteriorating.

Figure 1: South African Business Cycle Indicators



Source: (Reserve Bank, September 2018).

As indicated in Figure 1, there has been a steady increase in the length and duration of the leading and coincidental business cycle over the years from 1960 to 2018. The South African economy demonstrated substantial peaks and troughs with specific lengths and durations in months during the same period, but more so during the shorter periods between 1980 and 1982, and again between 1997 and 2002. During peak cycles, the economy normally grows in terms of, amongst other factors, an improved employment rate, increased industrial productivity and a reduction in the number of business insolvencies and liquidations.

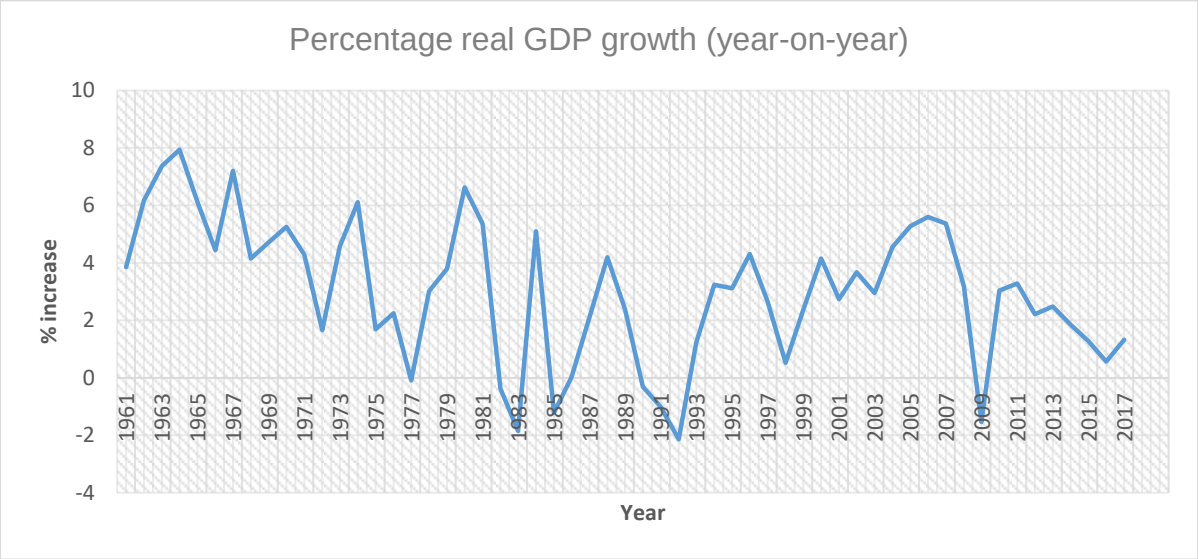
The real gross domestic product growth peak between 1960 and 1962 does not correlate with the peaks of the business cycle indices. This can be attributed to the manner in which the different indices were calculated during that period and the economic assumptions that were used in the calculation of the indices. Gidlow (1995) states that during the early 1960s the political disturbances of 1960 and 1961 required the South African Reserve Bank to implement fiscal and monetary measures to stimulate economic growth which resulted in the business cycle peaks from 1962 to 1964. The application of monetary policies to stimulate economic growth is an example of endogenous business cycle theories that were applied in the South African economy.

Boshoff (2020) states that business cycle theories can be exogenous or endogenous in nature, depending on whether the business cycle peaks and troughs are driven by internal or endogenous factors, such as a change in monetary policy, or exogenous factors such as floods and droughts. The monetary business cycle theory was developed by Friedman in the 1960s and is explained by Glasner (1997), as reliant on exogenous changes in money supply by the banks to the economy. Friedman theorized that the recovery phase of the gross domestic product starts when the cost of borrowing money falls and there is an increase in the money supply. As a result, the surplus money creates demand for goods, often leading to increases in investment and manufacturing of goods. According to Glasner (1997), and Johnson (1971), credit expansion can induce over-investment activity for a certain period of time which can come to an abrupt end and is referred to as an economic bubble. The impact of the 1960s monetary business cycle theory is evident in the growth of the manufacturing value-added index and gross domestic product that peaked at 9.9% and 6.3% respectively between 1960 and 1965, with annual growth rates of 8.6% and 5.7% respectively (Bell & Madula, 2001). The expansion of the Iscor operations in Pretoria and Newcastle in the early 1970s was an outcome of the monetary policy interventions that were applied during the 1960s business cycle.

The growth in the manufacturing value-added index slowed down between 1970 and 1981 which, according to Bell and Madula (2001), was due to the gold commodity boom in South Africa. The lower manufacturing value-added index did not impact the three business cycle indicators shown in Figure 1. The international demand for gold in the 1970s created an increase in credit borrowings and domestic investment expenditure. Gidlow (1995), states that the increase in the export of gold during the 1970s showed that South Africa could experience longer business cycle peaks before the increase in the supply of money in the economy resulted in inflation. The trade cycle experienced in the 1970s was inherent to the monetary over-investment business cycle theory. Solomou (1990), and Dwivedi (2009), state that an increase in monetary investment in the economy can result in endogenous cycle waves that are referred to as being 'Kondratieff' in nature. Solomou (1990), further elaborates that a Kondratieff business cycle can be caused by high gold and agriculture production as a result of abundant and cheap capital. As shown in Figure 1, South Africa experienced a long upswing business cycle between 1970 and 2009 over a period of 39 years.

Which is close to the 45-year duration of the Kondratieff business cycle that Glasner (1997), noted. The longer peaks that were experienced in the early 1980s, as shown in Figure 1, were mainly attributed to the economic growth that was experienced as a result of the gold commodity boom. Bell and Madula (2001), state that exports of manufactured goods fell during the gold commodity boom but increased from 9.1% in 1983 to 12.7% in 1990. The sectors that contributed to the growth in manufacturing exports were other manufacturing sectors such as electrical machinery and transport equipment, and not necessarily the steel manufacturing sector. The variables that contributed to this growth were endogenous in nature. This is supported by the view of Gidlow (1995), that the South African monetary policies were Keynesian in nature. Botha, Greyling and Marais (2006), state that the Keynesian business cycle of the 1980s and early 1990s was endogenous and that the cycle fluctuations were caused by multiplier and accelerator relationships between the different economic variables. The Keynesian business cycle theory indicates that government must intervene in the economy by applying monetary and fiscal policies that will positively impact the gross domestic product.

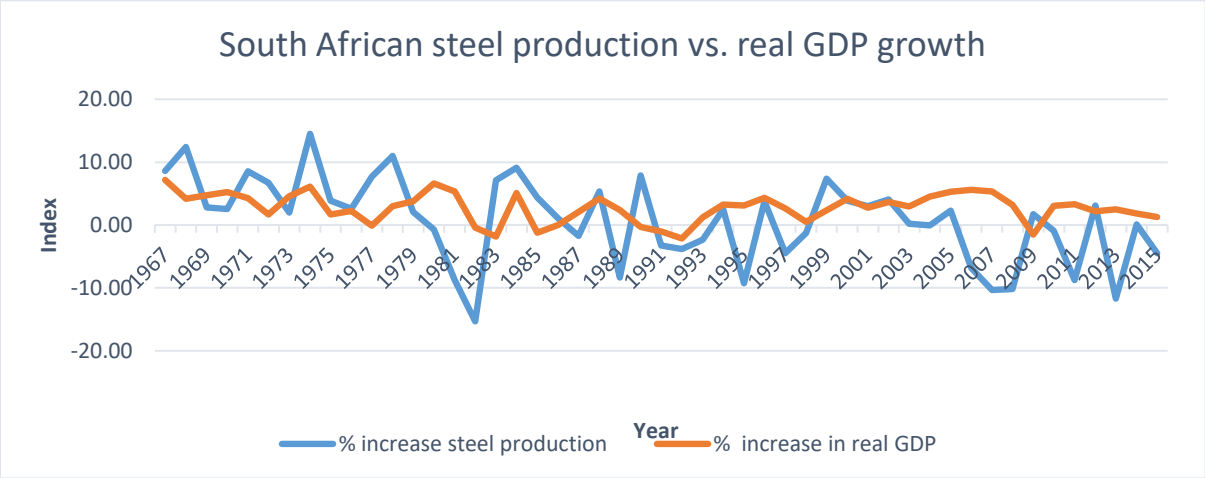
Figure 2: Annual Percentage Increase of Real Gross Domestic Product from 1961–2017



Source: (Statistics South Africa).

The economic researchers Fulop and Gyomai (2012), suggest that in some countries there is a direct, linear relationship between the economic business cycle indicators such as the gross domestic product and the manufacturing value-add production index. They are also of the opinion that industrial development in these countries plays a pivotal role in promoting the economic development of that country. This proposition is strongly supported by Wan and Thorbecke (1999), Szirman (2011), and Schwarzer (2013), who all agree that industrial development plays a central role in the economic development of countries as stated by Fulop and Gyomai (2012), especially in sectors that are the base of infrastructure development in the country, such as the steel sector. A comparison of the steel production volume output versus the real gross domestic product growth over five decades between 1960 and 2014, as shown in Figure 3, clearly supports the theory of the Kondratieff and Keynesian business cycles that were discussed.

Figure 3: Comparison of the Rate of South African Steel Production versus Gross Domestic Product Growth



Source: (World Steel Yearbook 1967–2016 and Statistics South Africa).

Figure 3 represents the operational performance of the steel industry and shows substantially greater fluctuation trends than the gross domestic product, which is of some concern as steel production and productivity are unequivocally key drivers of the sustainability of economic growth. In support of this

proposition Yu (2015) states that steel is a key feature in economic growth and Hogan (1999), is of the view that its role can be seen in public and private infrastructure investment, including in the average disposable incomes of households. The critically important role of the steel production industry is clearly demonstrated by the patterns of the per capita public and private infrastructural investment during the past five decades, compared with the economic growth data shown in Table 1 below, which shows a direct relationship between these two variables. The years between 1961 and 1978 also show a positive correlation between gross domestic product growth and infrastructure investment. This corresponds with the percentage increase per annum of domestic steel production during the same period, as shown in Table 1.

Table 1: South African Real Gross Domestic Product and Public Sector Economic Infrastructure Investment Per Capita

Period	GDP per Capita, % Increase per Annum	Economic Infrastructure Investment per Capita, % Increase per Annum	Domestic Steel Production, % Increase per Annum
1961 – 1976	2.2	6.0	6.5
1977 – 1978	-1.0	-15.7	9.3
1979 – 1982	1.5	4.0	-5.7
1983 – 1993	-1.4	-8.1	1.4
1994 – 2002	0.9	0.3	1.1
2003 – 2008	3.2	19.3	-4.1
2009	-2.7	19.5	1.8

Source: (Perkins, 2011).

The decline in economic growth between 1977 and 1978 had an immense impact on economic infrastructure investment which declined by 15.7% during the period. The impact of this negative economic growth and public infrastructure investment on steel production had a delayed effect as the impact was not immediately visible. The data shown in Table 1 indicates that during the subsequent periods and decades, the steel production had a delayed reaction to the government public sector infrastructure investments. A study conducted by Accenture (2017), and research conducted by Huh (2011), found that international steel consumption measured as a per capita index is generally found to increase in a direct, linear relationship with overall economic growth. More specifically, these studies found that economic growth is related directly to the demand for steel and steel-based products, amongst others, because it is a basic or raw material for sectors such as construction and other industries that are the cornerstone of economic growth. Hogan (1999), supports this argument by stating that economies that have a high demand for steel as an input to the key sectors contributing to economic growth, such as construction and public infrastructure development, tend to increase their steel usage.

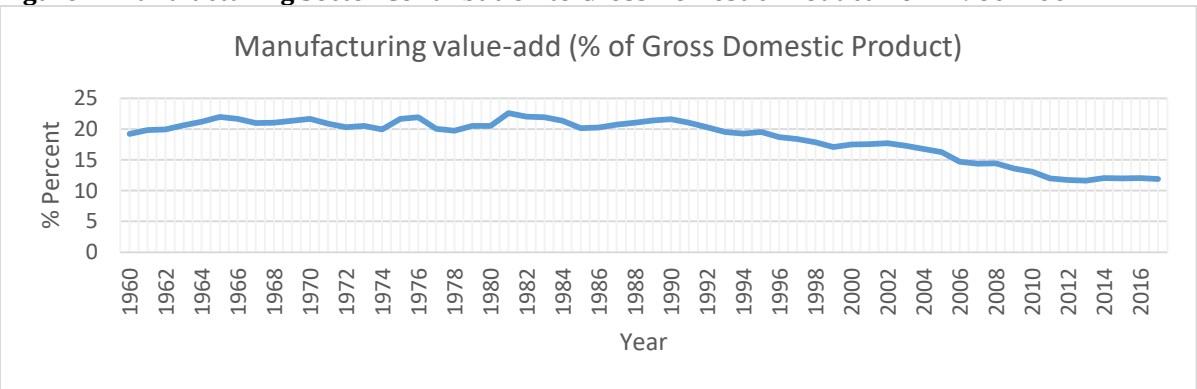
This supposition is expanded upon by Perkins (2011), who points out that in most countries the state or government is the largest investor in infrastructure development and that the government should have a vested interest in securing the sustainability and the viability of the steel production sector. This perspective of Perkins (2011) is confirmed by Aron, Kahn and Kingdon (2009) who state that it was mainly the South African government that, at the time, built, owned and operated steel-intensive sectors such as electricity, road and rail transport, ports, water systems entities, and other social infrastructure that were, and still are, largely operated as state-owned companies. South African state-owned companies such as Transnet, the various water boards and Sanral contributed largely to the companies in the steel sector. However, it would be presumptuous to conclude that public infrastructure investment is the only cause of fluctuation in domestic steel production. The direct relationship between steel sector productivity and economic business cycles has been well documented in the publications of the South African Reserve Bank and the South African Department of Trade and Industry. Public infrastructure spending has clearly been a critically important driver of the economic growth and sustainability of the steel industry over the past five decades.

3. Steel Manufacturing Against Economic Growth

Whereas it is abundantly clear from the discussion in the previous section of this paper that economic theorists agree that steel is accepted to be a critical driver and differentiator of economic viability,

sustainability, and growth, it is also accepted that there is a delicate reciprocal and interdependent relationship between the various other differentiators as well as between the various sectors of the economy. It is consequently also accepted that steel is not the only driver or differentiator of economic sustainability or growth. This supposition is demonstrated by the knowledge that even though steel production declined between 1979 and 1983, the contribution to the gross domestic product and the manufacturing sector during the same period, remained in excess of 20%, during this period. Data shown in Figure 4 indicates that the manufacturing sector contributed between 20% and 25% of the gross domestic product between 1960 and 1980. The generally held view and that of Bell and Madula (2001), is that other manufacturing sectors such as the mineral beneficiation and related industries sustained the economy during that period.

Figure 4: Manufacturing Sector Contribution to Gross Domestic Product from 1960–2007



Source: (World Bank data, 2018).

The importance of steel in assuring economic sustainability and growth is borne out by the fact that the marginal growth of an average of 1% per annum of steel production between 1983 and 2003, correlates closely with the decline, expressed as a percentage of the overall economy, of the manufacturing sector during that period. The information provided in Table 1 also indicates that public infrastructure investment during the same period declined by 8% due to high government debt arising from foreign loans. In the context of this information, Bond (2019), explains that the majority of capital-intensive projects in the 1960s, 1970s and the early 1980s, were financed by means of foreign loans. Between 1976 and 1983, the International Monetary Fund approved loans for South Africa of nearly $2 billion. Similarly, Camdessus (2000) records that between 1976 and 1983 the International Monetary Fund provided South Africa with continuous, so-called 'standby' funding agreements and loan drawdowns which allowed the government to access funds with ease. Other private international banks, including the World Bank, provided South Africa with similar funding agreements resulting in the national debt crisis of 1985. According to Bradlow (2017), South Africa's debt was $16.9 billion in 1980, which was 20% of gross domestic product, and increased to $24.3 billion in 1984, which was nearly 46% of the gross domestic product.

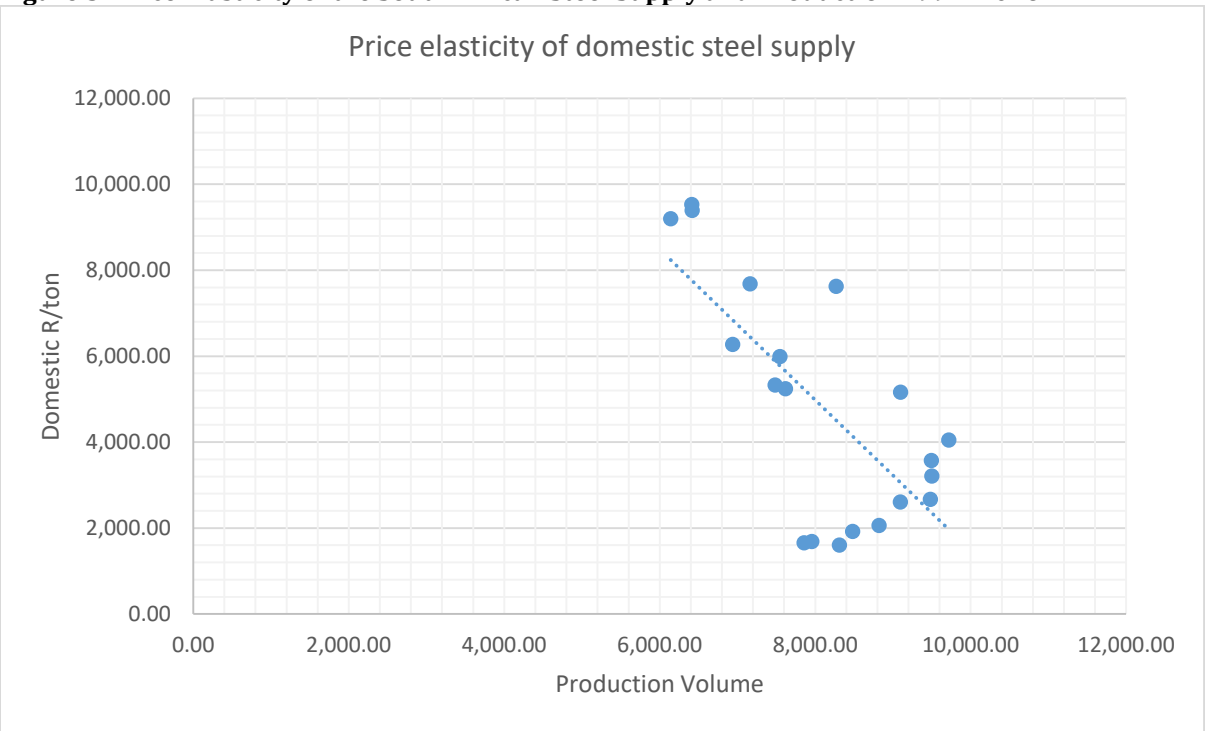
Adding to this bleak picture of economic decline, Hirsh (1989), records that South Africa's foreign debt was $18 889 million and its short-term foreign debt was $10 573 million in 1981. By 1986 the long-term foreign debt had increased to $ 22 593 million and its short-term foreign debt to $35 816 million. The short-term foreign debt was therefore 72% of the total foreign debt by 1985, with the total national debt reaching 50% of gross domestic product. Although public infrastructure investment declined substantially during the 1980s due, among other reasons, to the escalation of the public debt, economic sanctions and political turmoil, the liberalization of trade in the early 1990s resulted in a boom in the mining industry as well as in in the general economy between 2000 and 2008. The increased mining activity, specifically the mining of iron ore, had a positive impact on economic growth and public infrastructure investment, as shown in Table 1. This growth is generally attributed to the export of mineral ores such as coal, iron and manganese. Despite this positive impact, the steel production and manufacturing sectors did not reflect an equal or even similar growth. While it is clear from the previous discussion that steel manufacturing is in an interdependent, reciprocal relationship with most other sectors of the economy, its output, however, stimulates more economic activity

related to infrastructure development than any other sector, hence the use of the uncommon term, the 'elasticity' of steel production & implications in the context of economic growth.

4. Economic Growth and The Elasticity of The Steel Sector

As discussed previously, there is clear evidence of a reciprocal and interdependent relationship between the domestic steel production industry, public sector investment, the manufacturing sector, and the overall performance of the economy. This reciprocal and interdependent relationship is impacted by what is referred to as the elasticity and fluctuations in the production of steel. The construct of elasticity, according to Colander (1998), and Guo and N'Diaye (2009), is based on the understanding that the effectiveness and efficiency of the steel industry and other sectors are influenced by various factors, including the price of raw materials such as iron ore, the quality of the steel produced, and changes in the volume of demand for steel and steel products in the global markets. Another description of elasticity, according to Mostert, Oosthuizen, Smit and Van der Vyver (2002), and Weaver (2010), amongst other authors, is that it refers to the measure of the reaction of consumers and producers to the changing economic dynamics that each commodity is exposed to. Mostert et al. (2002) suggest that the elasticity of the steel production industry is best explained in terms of the change in the price of the final product to the changes in demand in volumes of the same products and the ability of the industry to ensure that the supply or availability of the products satisfies the demand. Lipsey and Harbury (1992), describe the elasticity of the supply of steel as the relative change in quantities of the products supplied to the change in their price.

Figure 5: Price Elasticity of the South African Steel Supply and Production 1997–2016



Source: (World Bank data, 2018).

Figure 5 shows the relationship between price versus demand which describes the elasticity of the supply of domestic steel between 1997 and 2016. From the data, it is clear that the domestic production of steel is elastic in terms of price and therefore the supply of steel and steel-related products is also elastic. According to Siddiqui (2011), the price elasticity of a product will depend on the marginal cost of production and the volume of production. This is related to what is referred to as the contingency costs of production which are the costs that are not directly involved in the production of the commodity, but those indirectly incurred prior to production in the preparation for production. The following example from the building industry

illustrates this in practical terms. The cost of bricks, mortar, wood for roof trusses, labor-related costs, and various other related costs are included in the normal building costs. The cost of bringing heavy earth moving equipment to prepare the ground before the start of the actual building activity as well as the cost of leasing this equipment is considered to be the indirect or contingency costs of the building. From this proposition, Fuerstenau and Han (2003), conclude that if the marginal or contingency costs of steel production increase, the producers are likely to decrease production, even if the overall steel price increases.

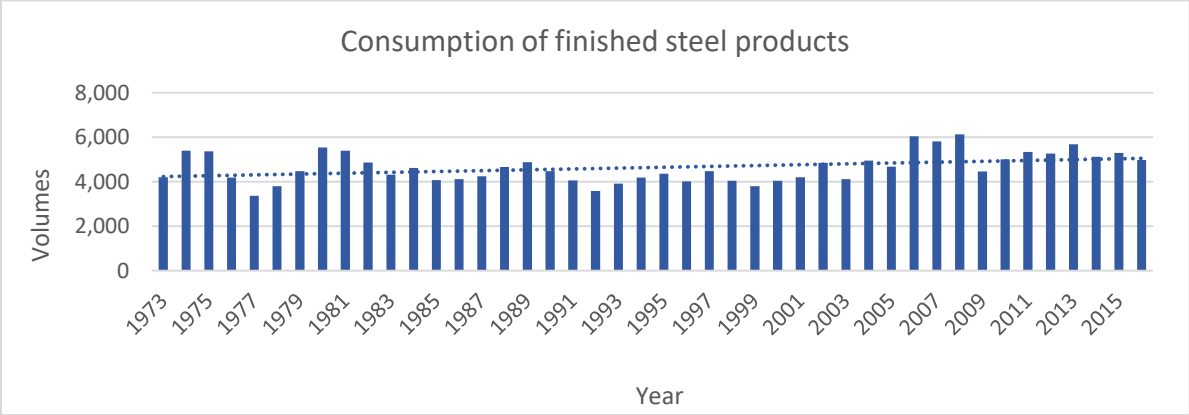
In support of this statement, Mostert et al. (2002), state that the factors that influence steel supply elasticity are:

- The number of raw materials available enables steel producers to increase production when needed. These raw materials include iron ore, scrap steel, electricity, and coking coal.
- The capacity of steel producers to increase production if and when the steel price increases. The question of whether a steel mill's utilization capacity in terms of efficiency and effectiveness is important as is whether the steel production plant is flexible enough to increase production for the market. The high utilization capacity of a steel mill means that the production of steel is assured, regardless of changes in price or market demand.
- The availability of appropriately qualified and experienced skilled labor as well as the availability of the necessary production equipment will enable steel mills to increase production without delay. A situation in which there is a need to procure new or additional equipment or to train additional labor will cause a delay in the production of products; and
- In a capital- and raw material-intensive industry such as steel production, the availability of commodities such as raw materials or capital is a critical determinant of the capacity to increase production without delays.

According to Adams (2006), when steel producers experience a price increase, they are faced with the problem of deciding whether the price increase represents a change that will increase the company's revenue or is the increased price inflation-related. Considering the determinants stated by Mostert et al. (2002), of optimizing steel production while assuring the continued viability, sustainability and competitiveness of the steel industry in a changing business environment, the steel industry is responsible for the decision of when the price of steel should increase. The issue of whether the steel price increase represents a real opportunity to increase the company's revenue or assure its viability and sustainability should be disregarded from a practical business management perspective. Monetary policy adjustments by the South African Reserve Bank usually result in short-term changes in the economy in terms of the duration of the effect of a change in the price of general products. Mohr and Fourie (2002), describe monetary policy adjustment as the measures taken by the monetary authorities to influence the quantity of money available in the economy or the rate of interest, referred to as the 'repo rate'. This impacts the rate of repayment of loans from banks and other sources of financing.

To achieve stable prices, improve the employment rate, and promote economic growth. The Reserve Bank's monetary policy committee meets on a quarterly basis to consider any possible adjustments to the repo rate, which is the interest rate at which the Reserve Bank lends money to commercial banks. Amongst other measures, the South African Reserve Bank uses the repo rate as an instrument to control inflation rate fluctuations within defined limits. A change in commodity prices, whether negative or positive, in relation to steel production, can also contribute to the changes in the demand for steel emanating from the downstream and value-adding steel-consuming sectors such as the construction or automotive sector. Research has shown that the consumption of steel is not sensitive to price but is sensitive to consumer demand and the ability of steel companies to meet the consumer volumes. The volume of consumption of finished steel products, as shown in Figure 6, is not limited to basic steel, but includes different carbon steel products such as hot-rolled coil sheets, structural bars and railway track material. Over the past decades, the consumption of finished steel products has clearly shown a regular cyclical pattern, as is depicted in Figure 6.

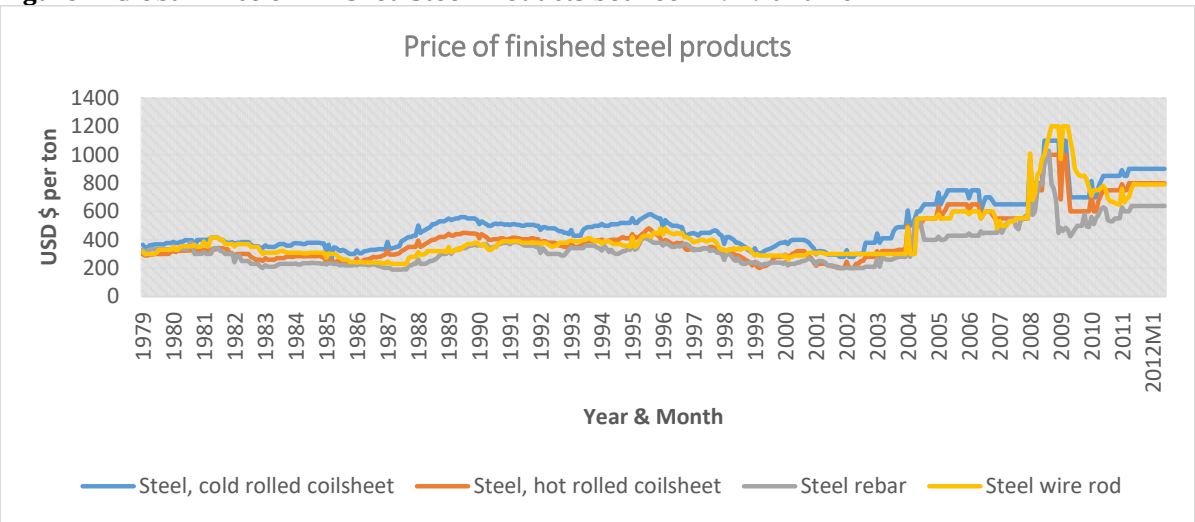
Figure 6: South Africa Consumption of Finished Steel between 1973 and 2015



Source: (World Steel Organisation data, 2018).

The demand for and consumption of finished steel products declined in the late 1980s and early 1990s in line with the decline in the global price of steel products, such as steel rebar, during this period. It is clearly understood that the downstream demand for and consumption of manufactured steel is sensitive to consumer market sectors such as the car manufacturing and industrial equipment manufacturing industries. The global price of most steel products, as shown in Figure 7, increased rapidly from 2008 due to the construction sector globally and the measures taken by various countries to limit volumes of steel imports from China.

Figure 7: Global Price of Finished Steel Products between 1979 and 2012



Source: (World Bank Pink Sheet, 2018).

In their research Hazlitt (1971), Colander (1998), and Fernando (2006), found that the degree to which consumers of raw steel consumers respond to changes in the price of steel and steel-based products, is determined largely by the following factors:

- The perception of consumers of whether steel is regarded as a necessity or a luxury item. Steel is considered to be a basic material required by most manufacturing and construction industries globally, therefore, the demand and supply of steel products should not be price sensitive nor should it be considered a luxury item.
- Metal oxides such as ferroalloys, stainless steel, or other derivatives manufactured from base metals such as aluminium and silver, can be used as substitutes for steel in some areas of construction and manufacturing. The demand for certain grades of steel is elastic because consumers can easily switch

between different oxides, depending on the final product specifications and the demand of consumers in sectors such as petrochemical and food manufacturing.

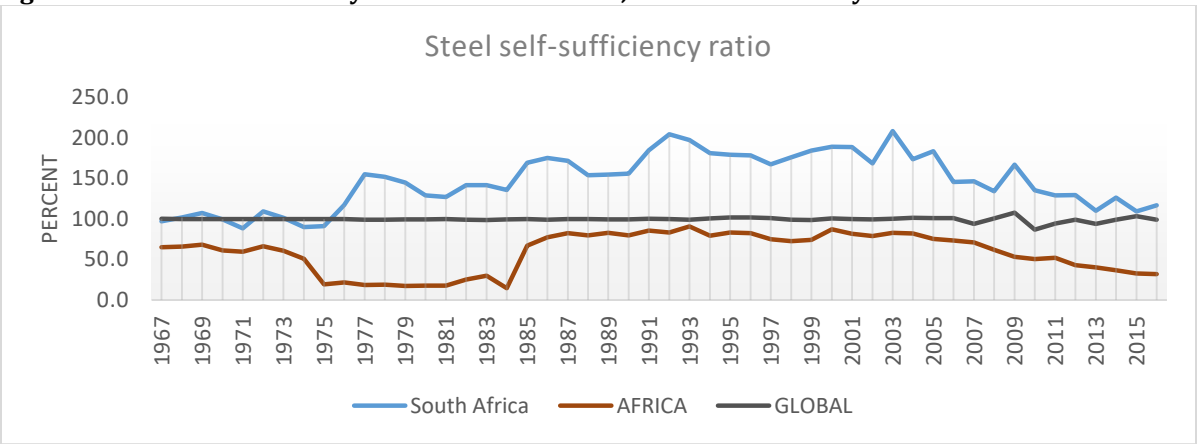
- Unlike other consumer goods such as alcohol and cigarettes, steel is not a habit-forming product. Therefore, it is elastic in the sense that it is sensitive to changes in price and consumers can live without steel products such as electricity towers or motor vehicles. This allows for the supposition that the consumption of steel for these purposes is understood not to be price sensitive.
- The cross elasticity of raw materials as inputs to the manufacture of certain products, such as iron ore, scrap metal, and coking coal, can change the demand for steel and its selling price. If the cross elasticity of iron ore and coking coal is negative, it can be explained that the increase in the price of one product leads to an increased demand for another product.

Rapid fluctuations in steel prices can often lead to pressure from consumers for the government to intervene in the reduction of inflation by means of intervention from the South African Reserve Bank. In South Africa, however, the price of steel is not only affected by normal price inflation on consumer products, but also by the changes in the global demand for and supply of steel products. Research has shown that the consumption of steel is not sensitive to price but is sensitive to consumer demand and the ability of steel companies to meet the consumer volumes.

The Steel Market Equilibrium: It is accepted amongst academics and economists that to determine the market equilibrium of steel and steel-based products, the total capacity of the steel market must be fully understood in context. According to Colander (1998), and Mostert et al. (2002), the definition of the construct of market equilibrium is dependent on the understanding of the concept of total market utility which includes the sum of the consumption of all related products and services within a given period of time. For the purposes of this paper, the total utility of the domestic steel industry was characterized as the self-sufficiency ratio. In this context, the self-sufficiency ratio (SSR) of the steel sector is defined by Omoweh (2005), as the measure of the country's total production capacity against the domestic demand for steel and steel-based products, and for which the following formula was proposed:

$$SSR = \frac{\text{domestic production}}{\text{Total steel demand (consumption)}}$$

Figure 8: Steel Self-Sufficiency Ratio in South Africa, Africa and Globally

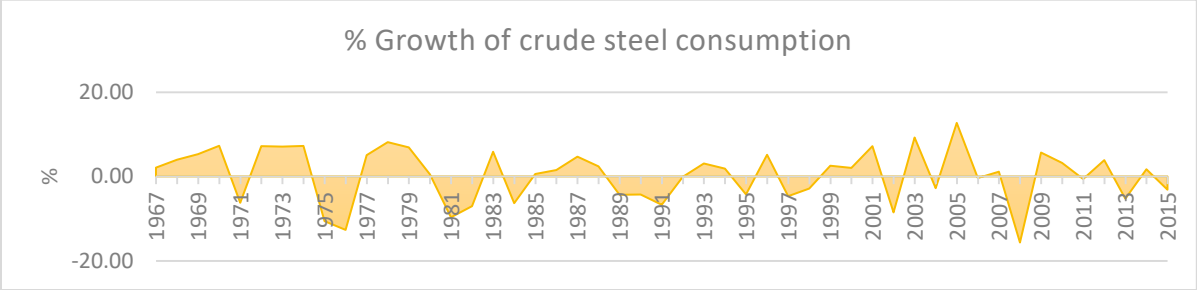


Source: (World Steel Organisation, 1967–2016).

From the graphs of the self-sufficiency ratio of the steel industry, as shown in Figure 8, it is clear that South Africa remained self-sufficient in terms of steel production and consumption from 1967 to 2015. A self-sufficiency ratio of 100 and above suggests a constant or optimum level of steel production measured against the consumption of steel. This is usually accepted as an indication of an optimum level of development in stable and sustainable steel industry. Between 1967 and 2015, South Africa had an average self-sufficiency ratio of 146, which means that the country was able to produce steel volumes sufficient to meet the domestic demand and to have a sufficient excess of produced steel for export. In contrast, the African continent as a whole showed an average self-sufficiency ratio of only 59, compared with the threshold of 100 mentioned

previously and South Africa's ratio of approximately 150, which indicates that most African countries were required to import crude steel from countries with export capacity because their domestic steel production was below their domestic consumption. The data provided by Statistics South Africa confirmed that South Africa was exporting excess crude steel to other African countries between 1975 and 2015, which supports the abovementioned supposition and also shows that South Africa dominated the African steel sector during that period. Although South Africa was exporting excess crude steel to other African countries, the consumption of crude steel in South Africa was erratic from 1967 to 2015, as shown in Figure 9 below. This erratic consumption was a result of economic business cycle fluctuations that impacted the usage of steel in the South African economy.

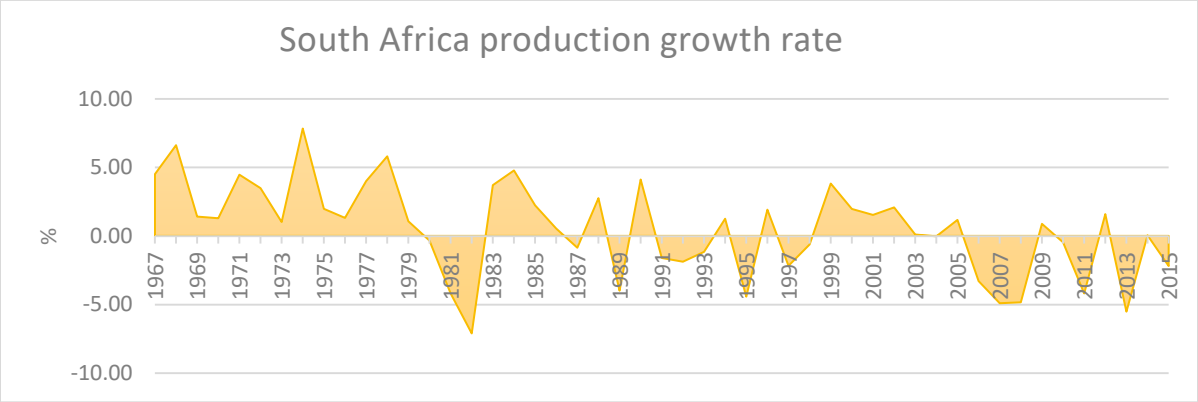
Figure 9: South African Steel Consumption Rate



Source: (World Steel Association reports, 1964–2016).

The economic growth in the early 2000s had a positive impact on the demand for and consumption of steel in South Africa. Conversely, the rapid decline in the consumption of domestic steel in 2007 and thereafter can be attributed to various factors such as the new steel pricing structure that was adopted at the time and the increase in foreign steel imports. As can be seen in Figure 10, the domestic steel sector had a similar erratic growth rate in the consumption of steel in terms of production volumes between 1964 and 1980. Domestic steel production gradually declined after 1991, but showed a marginal growth between 1999 and 2003, ostensibly due to economic growth in South Africa. While the South African steel sector has seen challenging times in the past, it has continued to remain self-sufficient throughout the years.

Figure 10: South Africa Steel Production Rate



Source: (World Steel Association annual reports, 1964–2016).

The self-sufficiency ratio cannot be used in isolation to determine the overall level of development and performance of any industrial sector in any country. This also holds true for the South African steel sector. The per capita steel consumption can also be used as an indicator of the volume of steel consumed by the economy as a whole. According to Jenkins, Barton, Bartzokas, Hesselberg and Knutsen (2002), and Dohrn and Kratschell (2013), there are two factors that can be used for the calculation of per capita steel consumption. These are:

- The income of the population and its demand for steel-related products such as motor vehicles; and

- The structure of the steel sector in the economy in terms of where raw materials are procured, the technology type, and the location of the steel production plants.

Ezekiel and Wylie (1941), argue that the consumption of steel determines the volume of production which, in turn, determines the production costs of steel at the steel mills. In support of this argument, Moya (2016), states that the costs that steel mills incur in the production process will depend on a variety of production inputs and factors which can be either fixed or variable. Adding to the discussion of the assurance of a balanced operational system in the manufacture of steel, Mostert et al. (2002), promote the differentiation of fixed and variable costs in a commodity production business. It is necessary to identify the production costs that are flexible and those that are inherent to the production process. The financial implications of using specific factors of production such as machinery and equipment cannot be changed in the short term and in business, these are the fixed costs. Conversely, production costs that can be altered at relatively short notice, such as skilled labor that can be dismissed, can be described as variable costs.

In attempting to clarify this proposition, Svatos and Gargulak (1983) elaborate by explaining that the maximization of steel production output requires the optimal usage of production input factors such as labor, raw materials, and machinery, and these can either be fixed or variable costs, depending on production requirements. This differentiation between fixed and variable costs in the management of any business is well understood and has been an integral part of the financial management of business organizations from the earliest days of industrialization. The achievement of high levels of self-sufficiency in the South African steel sector can only be realized by the capacity of the industry to consistently contain its fixed and variable costs to affordable and manageable levels. Keeping costs down whilst operating in globally competitive sectors such as steel production requires the local steel sector to drive down production costs while increasing innovation in all departments of the business.

5. Conclusion and Recommendations

There is a rich profusion of research on linkages between business cycles, the steel industry and economic growth, with a range of theoretical analogies. The literature has been reviewed under three main categories: mapping linkages between business cycles – steel industry performance – GDP performance; steel elasticity against economic performance; and balancing between self-sustainability in steel in South Africa and supplying other African countries. The paper made a critical contribution to studies on African economies' business cycle relationship with the steel industry. During the investigation, it was found that there is a scarcity of literature investigating the binary relationship between steel industry performance and South African economic growth. There is a need for future binary and ternary relationship studies on economic growth, manufacturing industry performance and business cycle movements, especially from an African perspective. In South Africa, employment growth is elastic to growth in the manufacturing industry (Mkhize, 2019). With an unemployment rate of 34.9% in December 2021 (Statistics South Africa, Dec 2021), an increase in manufacturing industry output, specifically the steel industry can reduce levels of unemployment in South Africa. It was found in the literature that an increase in economic infrastructure investments correlated with an increase in steel production and GDP growth in South Africa between 1961 and 2009. Furthermore, there is a need for future modelling of the relationship between South African steel prices against monetary policy decisions, on the impact of the industry's short-and-long-term liquidity sustainability.

Such research should explore the relationships between industry sustainability practices and monetary policy with a special focus on the steel industry's leading rates. Studies by Gertley and Gilchrist (1994), Cooley and Quadrini (2004) and Yang et al. (2021) have analyzed the impact of monetary policy uncertainty and decision on decisions made by manufacturing companies in developed economies. These researchers concluded that short-term monetary policy uncertainty has a weakening effect on manufacturing industry investment levels. For manufacturing industries such as steel that are reliant on primary input commodities such as electricity and coal that are elastic to global political and economic changes, it is important to measure the net steel industry collateralization effect triggered by monetary policy decisions. In terms of steel production and exports, the study found that Africa lags far behind the rest of the world, and South Africa is the shining beacon on the continent. There is significant room for growth in African steel

manufacturing within the continent. Signe (2018) and Fofak and Mold (2021) note that Intra-African trade in manufactured goods has increased from 10% in 2000 to 16% in 2014. An increase in intra trade of manufactured steel goods between African countries will result in countries being able to control the quality and prices of steel goods which will ultimately result in more self-sufficient and globally competitive manufacturing sectors. Given the capabilities of the steel industry to support economic growth, policymakers and researchers should support the generation of industry data that promotes investment and strengthens the intracontinental trade of South African steel products.

References

Accenture (2017). Accenture presentation at the OECD. [Online] https://www.oecd.org/industry/ind/Item_4b_Accenture_Timothy_van_Audenaerde.pdf.

Adams, R. (2006). Reasons for Steel Price Increases and Impact on Agricultural Machinery Industry. London: Journal UK.

Arnold, R. (2015). Microeconomics. Boston: Cengage Learning.

Aron, J., Kahn, B. & Kingdon, G. (2009). South African Economic Policy Under Democracy. New York: Oxford University Press.

Arruda, E., Melatto, R. & Levy, W. (2021) Circular Economy: A Brief Literature Review 2015-2020. *Sustainability*, 2(1).

Bell, T. & Madula, N. (2001). Where Has All the Growth Gone? South African Manufacturing Industry 1970–2000. Pretoria. Department of Trade and Industries.

Bond, P. (2019). Debt and the Historical Geography of South Africa's Uneven and Combined Development, Durban: University of KwaZulu Natal.

Bonga, L. & Kinfack, E. (2020). Trade Linkages and Business Cycle Co-movement: Analysis of Trade between African Economies and Their Trade Partners. *Genoa Chamber of Commerce International Economics*, 73(2).

Bookbinder, S. & Einleger, L. (2001). The Dictionary of the Global Economy. Toronto: Franklin Watts.

Botha, I., Greyling, L. & Marais, D. (2006). Modelling the Business Cycle in South Africa: A Non-Linear Approach. *Econometrics Journal*, 30(2).

Boshoff, R. (2020). Business Cycles and Structural Change in South Africa. Stellenbosch: Springer.

Bradlow, D. (2017). Don't Waste a Serious Crisis: Lessons from South Africa's Debt Crisis, Pretoria: Research Gate.

Brodeur, A., Gray, D., Islam, A. & Bhuiyan, S. (2020). A Literature Review of the Economics of COVID-19. IZA Institute of Labor Economics, IZA Paper No. 13411.

Burns, A. & Mitchell, W. (1946). Measuring Business Cycles. National Bureau of Economic Resolution. Washington. D.C

Camdessus, M. (2000). Looking to the Future: The IMF in Africa, Washington D.C: International Monetary Fund.

Chadha, R. (1989). A Key Sector of Indian Economy: Systematic View. New Delhi: Concept Publishing

Colander, D. (1998). Describing Supply and Demand: In Microeconomics. Boston, Mc-Graw Hill.

Cooley, T. & Quadrini, V. (2004). Monetary Policy and Financial Decisions of Firms. *Economic Theory,* 27(1).

Cotis, J. & Coppel, J. (2005). Business Cycle Dynamics in OECD Countries: Evidence Causes and Policy Implications. Reserve Bank of Australia Economic Conference July 2005.

Dohrn, R. & Kratschell, K. (2013). Long Term Trends in Steel Consumptions [Online] Available at: www.rwi-essen.de

Dwivedi, D. (2009). Essentials of Business Economics. New Delhi: Vikas Publishing.

Ezekiel, M. & Wylie, K. (1941). Cost Functions for the Steel Industry, New York: American Statistical Association Journal.

Fernando, A. (2006). Corporate Governance Principles Policies and Practice. In: New Delhi: Pearson Education.

Fofak, H. & Mold, A. (2021). The AfCTA and African Trade: An Introduction to the Special Issue. *Journal of African Trade,* 8(2).

Fuerstenau, M. & Han, K. (2003). Principles of Mineral Processing. London: Society for Mining Metallurgy and Exploration.

Fulop, G. & Gyomai, G. (2012). Leading Business Indicators and Production Indexes. [Online] Available at: http://www.oecd.org/sdd/leading-indicators/49985449.pdf

Gehringer, A. & Mayer, T. (2021). Measuring the Business Cycle Chronology with a Novel Business Cycle Indicator for Germany. *Journal of Business Cycle Research*, 17(1).

Gertley, M. & Gilchrist, S. (1994) Monetary Policy Business Cycles and Behaviour of Small Manufacturing Firms. *The Quarterly Journal of Economics*, 109(2).

Gidlow, R. (1995). South African Reserve Bank Monetary Policies under Dr. T.W. De Jongh. Pretoria. South African Reserve Bank.

Glasner, D. (1997). Business Cycles and Depression: An Encyclopaedia. New York. Garland.

Green, B., Johnson, C. & Adams, A. (2006) Writing Narrative Literature Reviews for Peer-Reviewed Journals. *Journal of Chiropractic Medicine,* 5(3).

Greenwald, D. (1982). Business Cycles. In: Encyclopaedia of Economics. New York: Mc-Graw Hill.

Guo, K. & N'Diaye, N. (2009). Is China's Export-Oriented Growth Sustainable, New York: International Monetary Fund.

Hazlitt, H. (1971). Man, Versus Welfare State, Auburn: Ludwig von Mises Institute in Alabama.

Hogan, W. (1999). The Steel Industry of China: Its Present Status and Future Potential. New York: Lexington Books.

Hirsh, A. (1989). Origins and Implications of South Africa's Continuing Financial Crisis, Michigan State University: Michigan State University.

Huh, K. (2011). Steel Consumption and Economic Growth in Korea: Long-term and Short-term Evidence. *Research Policy Journal*, 36(2).

Jenkins, R., Barton, J., Bartzokas, A., Hesselberg, J. & Knutsen, H. (2002). Environmental Regulation in the New Global Economy: The Impact on Industry and Competitiveness. Northampton: Edward Elgar Publishing.

Johnson, H. (1971). The Keynesian Revolution and the Monetarist Counter-Revolution. *American Economic Review,* 61(2).

Jones, K. (2017). Politics vs Economics in World Steel Trade. In: New York: Routledge.

Kapila, R. & Kapila, U. (2007). Economic Developments in India. New Delhi: Academic Foundation.

Lipsey, R. & Harbury, C. (1992). First Principles of Economics. (2nd ed). London: Oxford University.

Maduku, H. (2019). On the Business Cycle and New Business Ventures: A Panel Analysis of Selected South African Development Countries. *Acta Commerci*, 19(1).

Meagher, K. (2013). Unlocking the Informal Economy: A Literature Review on Linkages Between Formal and Informal Economies in Developing Countries. WIEGO Working Paper No.27

Meny, Y., Wright, V. & Rhodes, M. (1987). The Politics of Steel: Western Europe and the Steel Industry in the Crisis Years 1974 -1984. Berlin: Walter de Gruyter.

Mkhize, N. (2019). The Sectoral Employment Intensity of Growth in South Africa. *South Africa Business Review,* 23(1).

Mohr, P. (2005). Economic Indicators. Pretoria: Unisa Press.

Mohr, P. & Fourie, L. (2002). Economics for South African Students. Pretoria: Van Schaik.

Moolman, E. (2003). Predicting Turning Points in the South African Economy. *SAJems,* 6(2).

Mostert, J, Oosthuizen, A, Smit, P. & Van der Vyver, T. (2002). Macroeconomics: A Southern African Perspective. Cape Town. Juta

Moya, J. (2016). Production Costs from Energy Intensive Industries in the EU and Third World Countries, London: JRC Science for Policy.

Muchaonyerwa, F. & Choga, I. (2015). Business Cycles and Stock Market Performance in South Africa.

Omoweh, D. (2005). Political Economy of Steel Development in Nigeria. African World Press.

Perkins, P. (2011). The role of economic infrastructure in economic growth.

Pheng, L. & Hou, L. (2019). The Economy and Construction Industry. *Construction & the Economy*, 21(54).

Ra, H. (2008). Does Steel Consumption and Production Cause Economic Growth: A Case of Six Southeast Asian Countries. *Journal of International Area Studies*, 10(1).

Saz-Gil, I., Bretos, I. & Diaz-Foncea, M. (2021). Cooperatives and Social Capital: A Literature Review and Directions for Future Research. *Sustainability*, 13(1).

Scheiblecker, M. (2008). The Austrian Business Cycle in the European Context. Frankfurt: Peter Lang Publishing.

Schwarzer, J. (2013). Industrial Policy for a Green Economy. *The International Institute for Sustainable Development*, 10(1).

Shiller, R. (2017). Narrative Economics. Cowles Foundation Discussion Paper No 2069. Yale University

Skare, M. & Stjepanovic, S. (2015). Measuring Business Cycles: A Review. *Contemporary Economics*, 10(1), 2016.

Siddiqui, K. (2011). Political Economy in Pakistan. Yorkshire. The University of Huddersfield.

Signe, L. (2018). The Potential of Manufacturing and Industrialization in Africa. Africa Growth Initiative at Brookings.

Solomou, S. (1990). Phases of Economic Growth 1820-1973. New York. Cambridge University Press.

Stanley, T. (2001). Wheat from Chaff: A Meta-Analysis vs Quantitative Literature Reviews. *Journal of Economic Perspectives,* 15(3).

Svatos, J. & Gargulak, Z. (1983). Set of Models for Planning Iron and Steel Production, New York: Research Institute for Iron and Steel Technology and Economics.

Szirman, A. (2011). Manufacturing and Economic Development.: United Nations University.

Venter, J. (2005). A Brief History of Business Cycle Analysis in South Africa.

Vicki, B., Huong, T., Miranda, B., Rachel, L. & Marj, M. (2020). A Narrative Review of Economic Constructs in Commonly Used Implementation and Scale-up Theories Frameworks and Models. *Health Research Policy and Systems*, 18(1).

Wan, H. & Thorbecke, E. (1999). Taiwan's Development Experience: Lessons on Roles of Government and the Market. New York: Springer Science.

Weaver, F. (2010). Economics Literacy: Basic Economics with an Attitude. (3rd ed). New York: Rowman and Littlefield Publishers.

World Steel Organisation. (2017). World Crude Steel Report in Figures.

World Steel Organisation. (2018). World Crude Steel Production Report.

Yang, J., Wang, L., Sun, Z., Zhu, F., Guo, Y. & Shen, Y. (2021). Impact of Monetary Policy Uncertainty on R&D Investment Smoothing Behaviour of Pharmaceutical Manufacturing Enterprises: Empirical Research Based on a Threshold Regression Model. *International Journal of Environmental Research and Public Health*, 18(2).

Yu, H. (2015). Chinese Regions in Change: Industrial Upgrading and Regional Development. New York: Routledge.

Zalgiryte, L. & Giziene, V. (2014). The Analysis of Trends in GDP and Cyclic Nature of GDP Changes. *Procedia Social and Behavioural Sciences,* 156(2014).