The impact of the steel industry on the labour force – the case of Emfuleni municipal area.

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DECLARATION

I, Monyadiwe Ramatlotlo, hereby declare that the contents of this dissertation is my own work and that all the resources that were utilized were recognized and referenced. I further declare that this work or any part of it has never been submitted at any university or institution for any qualification.

SIGNATURE

DATE

ACKNOWLEDGEMENTS

All glory and praise be to God for carrying me through this journey. It was a tough ride full of many obstacles and challenges. There were times when I had no strength, there times when the road ahead seemed dark and there were times when I had lost hope but the Lord gave me strength to persevere and the will to finish this journey.

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I dedicate this dissertation to my late grandfather Tsie Israel Ramatlotlo. I am what I am today because of you and I will forever be grateful to you for raising me. May your soul rest in peace.

ABSTRACT

Steel is an important part of our everyday life almost visible in everything around us. If steel is not part of the product that we use, then steel was used in making the product or at least in transporting the product. Steel is a key ingredient in critical sectors of the economy such as construction, automotive and mining. The use of steel in any country is closely linked to its economy and serves as a barometer for economic development. The steel industry contributes significantly - both directly and indirectly to a country's economic development and industrialisation. The steel industry is also positioned as a major contributor to the country's Gross Domestic Product, an earner of foreign exchange, a vital supplier and a creator of employment.

The steel industry in South Africa rates among the largest in the world, with South Africa producing approximately 60 percent of Africa's total steel. The major steel producing company in South Africa is found in Vanderbijlpark and Vereeniging in the Gauteng province within the Emfuleni region. The aim of this study was to investigate the impact of the steel industry on the labour force at the Emfuleni municipal area. Literature and theories of the steel industry, manufacturing, economic growth and employment were used to conduct the literature review. The study also applied a number of various econometric models and approaches such as OLS, cointegration, error correction and vector error correction approaches to examine the impact of the steel industry on labour force in the Emfuleni municipality. Additionally, other approaches such as the error correction model (ECM) and the Toda-Yamamoto Granger causality were also used in the study. The study then ends with a summary, conclusion and recommendations.

KEYWORDS

Steel industry, employment, Emfuleni municipal area

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LIST OF ABBREVIATIONS AND ACRONYMS

AMSA: ArcelorMittal South Africa

ARDL: Autoregressive Distributed Lag

ADF: Augmented Dickey Fuller

BRICS: Brazil, Russia, India, China and South Africa

DF: Dickey-Fuller

ECM: Error Correction Model

ELM: Emfuleni Local Municipality

GDP: Gross Domestic Product

IMS: Integrated Manufacturing Strategy

IPAP: Industrial Policy Action Plan

KPSS: Kwiatkowski-Phillips-Schmidt-Shin

NGP: National Growth Path

PP: Phillips-Perron

PPP: Purchasing Power Parity

CHAPTER 1: INTRODUCTION AND BACKGROUND OF THE STUDY

1.1 INTRODUCTION

The steel industry is one of the most fundamental sectors of any national and regional economy of a country, a significant indicator of the economic power and comprehensive strength of a country or region (Changfu, 2012:1). Van Vuren, Grobler and Pelupessy (2008:15) state that steel production is crucial to the South African economy based on the cross linkages that exist between the steel industry and other primary and secondary industries that use steel. Media Club South Africa (2015) and ITAC (2016:1) states that the steel industry makes a significant contribution to the South African economy and employment. Ede, Bamigboye, Ogundeji and Azuh, (2015:148) attest that high level of unemployment and continually increasing rate of poverty can be alleviated by the well-functioning steel industry.

Major steel producing companies in South Africa are ArcelorMittal South Africa (AMSA), Highveld Steel, Scaw metal, Cape Gate and Cisco Thulare (2015:38). AMSA is the dominant steel producer in South Africa and is located at Vanderbijlpark which falls under the Emfuleni region. AMSA accounts for 79 % of domestic steel production and dominates the production capacity of Emfuleni region (Van Vuren, Grobler and Pelupessy, 2008:1).

Emfuleni's development is relatively linked to the steel industry and the area plays a vital role in the steel value chain. Production of steel is the main economic activity in Emfuleni (Villjoen, 2011:107). Majority of the steel consumed in South Africa is produced in Emfuleni (SACN, 2014:6). The local steel industry is beneficial to the domestic economy because it provides direct and indirect jobs and tax revenue (SAISI, 2014:4). The steel industry is the dominant sector in Emfuleni responsible for approximately 80 % of all manufacturing activities in the area (Van Vuren, Grobler and Pelupessy, 2008:13). The steel industry provided a quarter of all jobs in Emfuleni making it the largest employer in the area. Steel industry was responsible for 66 % of employment in Emfuleni (Slabbert,2004:145), (Van Vuren, Grobler and Pelupessy, 2008:6) and (Viljoen, 2011:12). SACN (2014:28) asserts that Emfuleni depends extremely on the steel industry.

1.2 PROBLEM STATEMENT

Jobs are a foundation of any economy because employment is the cornerstone of economic and social development. The most important benefit of employment is improved standard of living (Meyer, 2014:1-2). Employment grants a person the ability to provide for their family's basic needs (Van der Westhuizen, 2015:736). Inversely, the effect of unemployment on the community can be shattering and can result in poverty, crime and inequality (Meyer, 2014:1-2). Msimanga (2013:15) and Van der Westhuizen (2015:737) lists the following as the consequences of unemployment: loss of freedom and social exclusion, skills loss and long run damage, psychological harm, loss of human relation and family life and hopelessness. McCamel (2018:13) states that employment increases Gross Domestic Product (GDP) of the regional and national economy while providing social balance such as reduction of inequality and poverty.

South Africa's labour market has increasingly high levels of unemployment. To remedy this situation, the government in the National Development Policy has stated its aim to increase employment from 13 million in 2010 to 24 million in 2030. The government has identified the labour intensive sector (steel industry) as a gate way to achieving its employment goals and this was also emphasized in other government policies: National Growth Plan (NGP) and Industrial Policy Action Plan (IPAP) (Bhorat and Rooney, 2017:2). For a country like South Africa with high unemployment rate, the growth of the labour intensive steel industry is crucial because the industry has the capacity to offer jobs to different skilled people. (Bhorat and Rooney, 2017:8).

The economy of a region is important as it can affect employment, influence migration patterns and enable improvements in living conditions (SDM, 2013:27). Any change in the economy of a region will have an effect on its population in terms of employment opportunities, income generation, expenditure patterns, the level of poverty and social services (Van Vuren, Grobler and Pelupessy, 2008:4) and (SAMSA, 2013:13).

The steel industry is one of the major contributors to employment in South Africa. At regional level, the steel industry is the score employer in Emfuleni. Two thirds of households in Emfuleni are dependent on the local steel industry for their living (Verster, 2018). Almost 66

% of the labour force in Emfuleni would be unemployment if the steel company in Emfuleni were to be closed (Kilion, 2017). In recent years the steel industry has encountered thousands of job losses. Others steel companies have downsized and retrenched workers while others have closed down completely and left thousands of people unemployed. The following steel companies have closed down: Evraz Highveld steel, Cape Town Iron and Steel Works and Evraz Highveld steel. The following companies have retrenched workers: Scaw metals, Cape Gate, Macsteel and Aveng steel (Kilion, 2017). Meyer (2014:7) states that the contribution of the manufacturing sector (the steel industry) toward jobs has decreased when compared to the service sector. The service sector has been providing more jobs while the manufacturing sector has laid off more workers. Bhorat and Rooney (2017:2) attest that the contribution of the steel industry to employment and economic growth has been declining. Part of the reasons for this is attributed to rising wages while productivity is stagnant, rocketing electricity prices and competition from other developing countries.

1.3 OBJECTIVES OF THE STUDY

The following are the objectives formulated for the study:

1.3.1 Primary objective

The aim of this study was to determine the impact of the steel industry on the labour force in Emfuleni municipal area.

1.3.2 Theoretical objectives

Aiming to achieve the primary objectives, the following theoretical objectives were also formulated:

- To explain the theoretical aspects of the manufacturing sector and its link to the steel industry,
- To discuss the link between the steel industry and employment,
- To review studies about the impact of the steel industry on the economy of other countries.

1.3.3 Empirical objectives

- To determine the effect of exports by the steel industry on labour force (employment) in Emfuleni;
- To investigate impact of steel industry on labour remuneration in Emfuleni municipality;
- To analyse the impact of steel industry GDP share on employment in Emfuleni municipality;
- To determine the causal relationship between employment in the Emfuleni municipality and selected variables from steel industry (exports, GDP share and labour remuneration).

1.4 RESEARCH METHODOLOGY

1.4.1 Literature review

In conducting this study various secondary sources were employed to acquire reliable information. Among others: books, theses and dissertations, internet engine, academic journals, international and national publications were used as the source of literature. The literature included also empirical literature that assisted to elucidate the interconnectivity between employment, labour remuneration, GDP and exports.

1.4.2 Empirical study

1.4.2.1 Data collection

Analysis of the impact of steel industry on labour force focussing on employment, requires the presence of employment data in the Emfuleni municipality and some other data from steel industry such as exports, share of GDP and labour remuneration. The study employed the annual data starting from 1996 to 2017. Therefore, the study analysis focused on 21 observations. The data for the study was acquired from Global Insight Regional Explorer MacGregor data base. The sample size was limited to the presence and availability of data.

1.4.2.2 Data analysis

To achieve the empirical objectives, various econometric models and approaches were employed. These models and approaches assisted in determining the long run and short run relationships between the dependent variables (employment) and independent variables (exports, GDP and labour remuneration(wages)). The graphical descriptive and correlation analysis were the preliminary analysis used to determine the relationship between variables. Since the sample size was small and variables were a mixture of I (0) and I (1), the Autoregressive Distributed Lag (ARDL) model was employed to analyse the long run relationship among variable. The error correction model (ECM) was used determine the short run relationships while the Toda Yamamoto was used to assess the causal relationship.

1.5 ETHICAL CONSIDERATIONS

The research used secondary data that is available to the public and ethical clearance was not needed. However, the North West University ethical considerations were followed when conducting this research.

1.6 IMPORTANCE OF THE STUDY

The steel industry is Emfuleni has been the dominant economic activity in the area for numerous years and the main source of employment. About two thirds of households in Emfuleni depend on the steel industry for their sustainability. The steel industry has been faced with a number of challenges in recent years which has affected productivity and employment. The poor performance of the steel industry and job losses in the steel industry will have a major blow to the Emfuleni residents and economy. This study will help to highlight the impact of the steel industry on the employment in Emfuleni and outline the importance of the industry in the area by showing the relationship between employment by the steel industry and other economic variables. The findings of this study will assist the relevant authorities to realise the importance of the steel industry in Emfuleni and South Africa as a whole and encourage them to find suitable ways to ensure that this industry performs well due to the economic benefits aligned to it. The study will also enlighten policy makers about the much needed support that the industry needs to enable it to provide the economic benefits that it is capable of providing.

1.7 LIMITATIONS OF THE STUDY

Not much empirical research has been done about the steel industry in Emfuleni thereby making the information relating to the topic limited. Limitation of data was another issue. Most of the data that is available is for national level and the focus of this study was at regional level. Data needed for this study was available but the observations start from 1996 to 2017. The choice of using data from 1996 is that it is the origin of the data set and there was no prior data for the years preceding 1996.

1.8 CHAPTER CLASSIFICATIONS

Chapter 1: Introduction and background of the study: this chapter provides an overview of what the study is about, the objectives of the study and the scope of the study.

Chapter 2: Demographic and economic profile of Emfuleni municipal area: This chapter provides information about Emfuleni municipal area and its economic activities. The chapter also provides information about the steel industry in Emfuleni and its contribution to employment in the area.

Chapter 3: Theoretical and empirical literature review: This chapter reviews the theoretical and empirical aspects of the manufacturing sector and its relation to the steel industry and employment. The chapter also covers economic growth models and employment and unemployment theories.

Chapter 4: Research design and methodology: This chapter explains the models used to achieve the empirical objectives of the study, data variables description, data collection method and the sample period.

Chapter 5: Results and discussion of results: This chapter presents the results and findings of the empirical analysis.

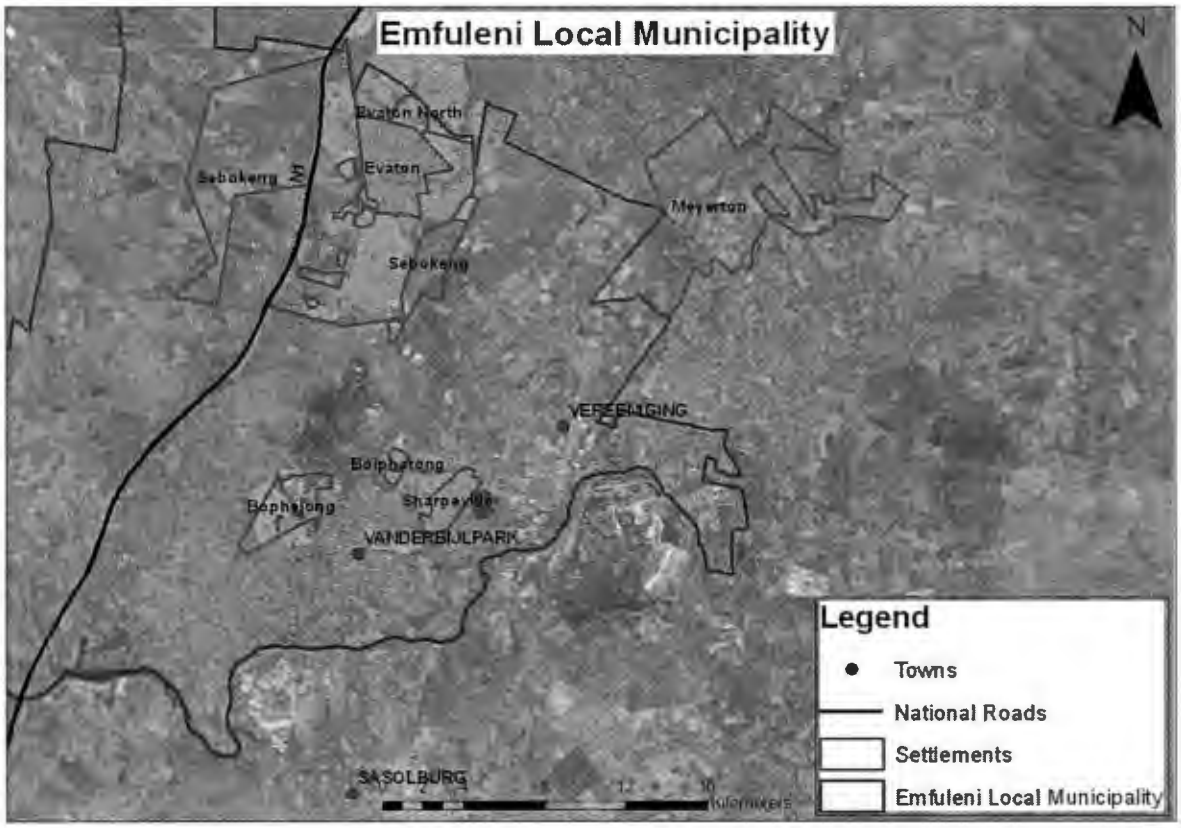
Chapter 6: Summary and conclusion: This chapter entails the summary of the study, the conclusion and recommendations.

CHAPTER 2: DEMORGRAPHIC AND ECONOMIC PROFILE OF THE EMFULENI MUNICIPAL AREA

2.1 INTRODUCTION

The Emfuleni Local Municipality (ELM) is classified as a category B municipality as determined by the Demarcation Board in terms of section 4 of the Municipal Structure Act. It forms part of the three local municipalities (including Midvaal and Lesedi Local Municipalities) that constitute the Sedibeng District Municipality, which covers the entire southern portion of Gauteng (Van Vuren, 2003:121). According to Global Insight (2018), Emfuleni's total population in 2017 was 754 762. ELM (2006:12) classifies Emfuleni as the economic hub of Sedibeng due to the large concentration of industries in the area. Driel (2011:165) asserts that Vereeniging and Vanderbijlpark are two main economic areas in Emfuleni where significant employment occurs. Figure 2.1 is a regional map of Emfuleni local municipality and its surrounding areas.

Figure 2.1: Emfuleni regional map



Source: SACN (2014:15).

Manufacturing (the production of steel) is the main economic activity in Emfuleni and the main source of employment in the area (Slabbert, 2004:145), (Van Vuren, Grobler and Pelupessy, 2008:6), (Viljoen, 2011:12), (SACN, 2014:28) and (Meyer, Meyer & Molefe, 2016:125). The dominance of the manufacturing sector (steel industry) as a core economic activity in Emfuleni is validated by its location quotient index score of 2.61. Location quotient is a way of quantifying how concentrated a particular industry, cluster, occupation or demographic group is in a region when compared to the nation. It reveals what makes a region unique if compared to the national average. The location quotient is computed as an industry's share of regional total for some economic statistic (earnings, GDP by metropolitan area, employment, etc.). A location quotient score of more than one indicates high levels of specialisation and a competitive advantage. It also means that the region produces more than it could consume, which could open opportunities for the excess production to be exported (Meyer, 2015:28). Table 2.1 shows the location quotient index for the different sectors in Emfuleni from 2001-2013. The table shows that the Emfuleni area is highly specialised in the manufacturing sector (steel industry) with a score of more than two for all the different time frames. A constant increasing score by the manufacturing sector is visible since 2001.

Table 2.1: Economic Location Quotient Index: Emfuleni 2001 - 2013

Sector	2001	2011	2013
Manufacturing	2.48	2.58	2.61
Electricity production	1.16	1.49	1.60
Construction	0.81	0.93	0.94
Finance	0.75	1.00	1.01
Community services	0.94	0.96	1.07

Source: Meyer, (2015:8).

Emfuleni's steel industry is the key economic sector linked to income generation, employment creation and poverty alleviation in the area (SAMSA, 2013:49). Meyer (2015:31) states that the manufacturing sector in Emfuleni provides 19.9 percent (%) of all jobs categorised as

follows: steel 9.4 percent (%), petroleum 2.6 percent (%) and food and beverages 1.7 percent (%). According to SAMSA (2013:45), the highest average monthly wages in South Africa are paid by transport, electricity, gas, water and the manufacturing sector. The average monthly income per worker in these sectors is estimated at R7 032.

About two thirds of South Africa's steel is produced in Emfuleni municipal area (Marais,2016:75) and 40 percent (%) of Emfuleni's economy is related to steel manufacturing (Molefe, 2018:57). The Emfuleni local municipality relies heavily on ArcelorMittal South Africa (AMSA) for employment, taxes, local supplier procurement and corporate social investment (AMSA, 2016:60). ArcelorMittal South Africa (AMSA) is South Africa's largest steel producer which operates from Emfuleni area in Vanderbijlpark. It also has other plants in other provinces and abroad (South African Embassy, 2013). AMSA has a significant presence in all the local communities where its plants are located, acting as a driver for local economic development by providing local employment and spending on local supplies. Local communities are defined as those located close to ArcelorMittal's plants in Vanderbijlpark, Vereeniging, Newcastle, Saldanha and Pretoria, usually within a radius of 30km. These include communities such as Sebokeng, Evaton, Bophelong, Boipatong, Sharpeville and Vanderbijlpark. AMSA's Vanderbijlpark plant, in the Emfuleni region is one of the largest inland steel works in the world (O'Flaherty, 2015).

The steel industry has been the backbone of the Emfuleni economy for more than 60 years (SACN, 2014). ELM (2014:70) asserts that ArcelorMittal has a significant contribution to poverty alleviation and socio-economic well-being in Emfuleni. According to AMSA (2014:27-28) and Meyer (2015:24-25), nearly 9 000 people were directly employed by ArcelorMittal at Vanderbijlpark and Vereeniging plants in 2013. The majority of these jobs were permanent. With indirect employment included, total employment due to ArcelorMittal amounted to over 14 800. In 2015, a total of 6 560 permanent employees, hired labourers and service contracts were directly employed at AMSA Vanderbijlpark and Vereeniging plants (AMSA, 2016:60). AMSA (2014:21) cites that the employment impact of ArcelorMittal is not just limited to the direct jobs that it provides. AMSA estimates that 0.82 indirect jobs and 2.18 in induced employment result from every one million of steel demand. These jobs are found in the suppliers that support ArcelorMittal directly. This means that in total, ArcelorMittal is directly and indirectly the source of approximately 107 800 jobs in South Africa. stipulates that if it is assumed that each job can support a household of four people on average, then the total

population supported by ArcelorMittal can be estimated at around 431 200 in South Africa (AMSA, 2014:21). The Benchmarks Foundation (2013:14) affirms that the steel industry employs a significant portion of Emfuleni's labour market. Table 2.2 shows the number of people employed in the steel industry in Emfuleni from 2006 to 2017 against the total number of employed people in Emfuleni as a whole. It is visible from the table that the number of jobs offered by the steel industry has been going through and up and down scale each year. From 1996 to 2003 the number of jobs offered by the steel industry in Emfuleni decreased each year. From 2004 to 2007 the jobs offered increased. From 2008 to 2016 the number of jobs offered by the steel industry decreased again each year. The period of job losses in the steel industry is much more that the new job opportunities created.

Table 2.2: Formal sector employment in Emfuleni vs steel industry formal employment: 1996 - 2017 (R1000)

YEAR	TOTAL EMPLOYMENT IN EMFULENI	PERCENTAGE GROWTH RATE	STEEL INDUSTRY EMPLOYMENT	PERCENTAGE GROWTH RATE
1996	121 580		23 394	
1997	120 736	-0.69 %	22 165	-5.25 %
1998	123 816	2.55 %	21 440	-3.27 %
1999	129 444	4.55 %	21 011	-2.00 %
2000	133 273	2.96 %	20 230	-3.72 %
2001	132 683	-0.44 %	18 394	-9.08 %
2002	130 635	-1.54 %	17 837	-3.03 %
2003	130 466	-0.13 %	17 507	-1.85 %
2004	131 679	0.93 %	17 596	0.51 %
2005	134 884	2.43 %	18 672	6.12 %
2006	138 338	2.56 %	19 898	6.57 %
2007	148 786	7.55 %	20 524	3.15 %
2008	163 776	10.07 %	20 100	-2.07 %

2009	167 803	2.46 %	19 282	-4.07 %
2010	165 838	-1.17 %	18 154	-5.85 %
2011	167 138	0.78 %	17 619	-2.95 %
2012	159 454	-4.6 %	16 857	-4.32 %
2013	159 307	-0.09 %	16 645	-1.26 %
2014	159 988	0.43 %	16 221	-2.55 %
2015	156 380	-2.26 %	15 904	-1.95 %
2016	149 081	-4.67 %	14 993	-5.73 %
2017	149 627	0.37 %	15 448	3.03 %

Source: Global Insight (2018).

Except for being a major source of employment in Emfuleni, ArcelorMittal South Africa has also contributed to the establishment of other companies through strategic joint ventures in steel processing, trading and recycling. The first company formed as a result of these ventures is CWI (a South African producer of wire products located in Vanderbijlpark). CWI was established as a result of a joint venture between ArcelorMittal and Anglo American and has over 500 permanent employees. CWI produces high quality products such as mesh, wire fences and packaging material for domestic use and it also exports products to countries in Africa, Europe, Middle East, Australia and Canada. The second company is Toyota Tsusho South Africa (a joint venture between Toyota and ArcelorMittal located in KZN province). It processes primary steel into components for the automotive industry. The company provides an estimate of 100 jobs. The third company is Collect-a-Can Ltd (a non-profit joint venture between ArcelorMittal and Nampak located in Vanderbijlpark). The company was established to increase the recovery rate of metal cans, primarily beverage cans which can be 100 percent (%) recycled (AMSA, 2014:45).

2.2 THE STEEL INDUSTRY ON ECONOMIC VARIABLES

2.2.1 THE STEEL INDUSTRY AND GDP

Steel plays a vital role in the economy and growth of many countries (Thulare, 2015:12). The is a positive relationship between the steel production and Gross Domestic Product (GDP) (Davis, 2016). The South African economy has made a significant structural transformation from an economy that was initially agricultural based to one that was largely dependent on mining. These days, mining still remains important, but it is the secondary (manufacturing) and tertiary sectors that generate the largest share of GDP in South Africa. Mining accounts for 10 percent (%) of GDP, while manufacturing accounts for 20 percent (%). O'Flaherty (2015), states that the domestic steel industry is important for any local economy and it is crucial for the local economy to not rely on imports because there is a positive correlation between GDP and the steel industry for developing countries. A domestic steel industry lessens the risks of importing and offers protection against raw material market volatility.

South Africa's steel's industry represents 1.5 percent (%) of the country's GDP (O'Flaherty, 2015). The industry also supports strategic sectors of the economy of which the top five of them support 15 percent (%) of South Africa's total GDP. The steel industry adds more than R26 billion to the economic value of South Africa's iron ore and if this capacity was lost, it would cause a 1 percent (%) trade deficit to South Africa's GDP. The loss of domestic steel production capacity could constitute a great threat to the growth drivers set out in the country's growth strategies - the National Development Plan and the Industrial Policy Action Plan. (Davis, 2016). Okun's law states that a percentage increase in GDP leads to a 0.3 percent decrease in unemployment (Meyer, 2014:2).

2.2.2 STEEL INDUSTRY AND EXPORTS

South Africa is the largest steel producer in Africa (with almost 60 percent (%) of Africa's total production) and a net exporter, positioned 10th in the world, to more than 100 countries (Thulare, 2015:28). The steel industry has moderate multipliers and the potential to attract money from outside the region through an increase in exports (Slabbert, 2004:215). International trade has become a fundamental tool to fuel economic growth in most countries

including South Africa. This was argued by economists such as Adam Smith and David Ricardo who explicitly advocated that a country could benefit from specialising and exporting more of a commodity or service in which it possesses comparative advantage over its trading partners (KZN Provincial Government, 2015:8). The impact of exports on the economy is substantial and has played an increasingly important role in the South African economy. The contribution of exports to GDP has increased from 20.7 percent (%) in 1992 to 30.9 percent (%) in 2015. A bigger contribution of this percentage was from the manufacturing sector (IDC, 2016:7). IDC (2016:7) states that R140 billion was generated directly within the manufacturing sector in 2015 due to manufacturing exports alone. IDC (2013:3) postulates that manufacturing exports are highly concentrated. It states that the top 20 manufacturing sub-sectors, out of a total of 120, accounted for 77 percent (%) of South Africa's manufactured export basket in 2012. 60 percent (%) of that export basket included gold, iron ore, coal, iron and steel as well as non-ferrous metals Obinyeluaku and Sako (2014:26) and DTI (2014:14).

Policymakers and the South African government also stress the need for strong export orientation. This was highlighted in the New Growth Path (2011), the National Development Plan, the Industrial Policy Action Plan 2012/13 – 2014/15 and in the Monetary Policy Committee statements (2013). All these policies identified export growth as a priority for economic growth. Policymakers agree that reigniting the export engine is critical to strengthening growth and developing a more diversified export base to help reduce growth volatility. IDC (2016:8)

2.3 EMPERICAL FINDINGS ON OTHER COUNTRIES

Various researchers, Crompton (2000), Ghosh (2006) and Rebiasz (2006), conducted studies regarding the effect of the steel industry on the economy. The study by Ghosh (2006) indicated a significant economic growth in the study area as a result of the consumption of steel. The relationship between the consumption of steel and economic growth was tested through the Granger causality (a method to investigate causality between two variables in a time series). The results indicated causality from the consumption of steel towards the economy, whereas the reverse condition could not be identified. The study by Rebiasz (2006) proved a positive relationship between the consumption of steel and GDP. The study by Crompton (2000) proved that a decrease in the amount of steel consumption will lead to slower economic growth.

2.3.1 THE STEEL INDUSTRY IN CHINA

China is the second largest economy with a population of 1.4 billion and is increasingly playing an important and influential role in development of the global economy (World Bank, 2017). Prior to 1979, China's economy was centrally planned. A large share of the country's economic output was directed and controlled by the state, which set production goals, controlled prices, and allocated resources. A central goal of the Chinese government at that time was to make China's economy self-sufficient. Foreign trade was generally limited to obtaining those goods that could not be made or obtained in China (Morrison, 2015:2). In 1978, the Chinese government changed its Soviet-style economic policies by gradually reforming the economy according to free market principles and opening up trade and investment with the West, with anticipation that this would significantly increase economic growth and raise living standards (Zhu, 2012:110). At the beginning of 1979, China launched several economic reforms. The government established four special economic zones with the purpose of attracting foreign investment, boosting exports, and importing high technology products into China (Tang, 2010:2). Since initiating market reforms, China has shifted from being a centrally-planned economy to a market-based economy and has experienced rapid economic and social development. China's real GDP grew at an average annual rate of nearly 10 percent (%) a year and 679 million people were lifted out of extreme poverty (Morrison, 2015:1).

Changfu (2012:1-2) describes the history of China's steel industry as one that was weak and under-developed for a long time. It was the implementation of policy reform and opening up in the 1970's that resulted in the enormous economic development in China and a significant part of that development was due to the steel industry. Similarly, China's entry into the World Trade Organization at the beginning of the 21st century also contributed significantly to the development of the steel industry and witnessed China meeting the demands brought about by the rapid economic and social development. Changfu (2012:4) further explains that since China implemented the policy reform and opening up, it has recorded more than three decades of rapid economic development.

China has become one of the most significant steel manufacturing and consuming economy in the world, covering almost 50 percent (%) of the world's entire steel production and consumption (O'Hara, 2014). The development of China's steel industry has contributed greatly to its fast economic growth and improvement and is crucial to the long-term functioning

of its economy. China's steel is consumed greatly in its internal market and progressively in the external market as export. China's steel industry is monopolised by several important state-owned enterprises (SOEs), with many small and medium-sized enterprises (SMEs) covering a tiny share of the steel market (Popescu, Nica, Nicolaescu & Lazaroiu, 2016:123-124). In 2010, China's steel industry employed an annual average of 3.4563 million employees, making the sector the 11th biggest employer among all the industrial categories of the country (Changfu, 2012:3). In 2014, the overall steel industry employment increased to 4.7 million people (Bradsher, 2017). Steel consumption in China is correspondingly associated with GDP. Popescu *et al.* (2016:124) assert that an increase in steel consumption is associated with an increase in GDP per-capita. A study by Bradsher (2017) into China's GDP and its relation to steel consumption from 1991 to 2015 shows that China experienced a positive GDP growth rate in all those years.

2.3.2 THE STEEL INDUSTRY IN INDIA

India's economy is one of the fastest growing economies in the world. The economy of India is the seventh-largest in the world by nominal Gross Domestic Product (GDP) and the third largest by Purchasing Power Parity (PPP). India is classified as a newly industrialised country with an average growth rate of approximately 7 percent (%) over the last two decades and is also part of the G-20 major economies and a member of BRICS (Brazil, Russia, India, China and South Africa), a group of five emerging economies (Gayathri, 2016:1). The manufacturing sector holds a key position in the Indian economy. The sector accounts for a sizeable amount of the real GDP, and employs a large number of the country's labour force and creates three additional jobs in related sectors (Nandeesha, 2016:2). According to Gayathri (2016:1), India's GDP composition in 2014 was as follows: agriculture 17.9 percent (%), manufacturing 24.2 percent (%) and services 57.9 percent (%).

All major industrial economies are characterised by the existence of a strong steel industry and the growth of many of these economies has been largely shaped by the strength of their steel industries in their initial stages of development (Yadav, 2015:156). The initiation of the steel industry in India on a fully-fledged scale is accredited to the late Jamshedi Tata who opened the Tata Iron and Steel Company (TISCO) now known as Tata Steel Ltd in 1907 in India. From there, steel production increased rapidly following independence as India attempted to strategically invest in this core sector to bring about national industrial transformation (Yadav,

2015:157). Munna (2016:3) lists the core industries in India as: coal, crude oil, refinery products, fertilizers, steel, cement and electricity. These industries have played a significant role in the Indian economy.

India's economic growth is contingent upon the growth of the Indian steel industry. Steel is crucial to the development of any modern economy and is considered to be the backbone of human civilisation. The level of per capita consumption of steel is regarded as an important index of the level of socio economic development and living standards of the people in any country (Yadav, 2015:156). The steel industry in India employs six million people directly and provides more that 2.53 million of associated employment. Similarly, the steel industry in India initiates 6.8 percent (%) multiplier to GDP (Sundararajan, 2016). India was rated as the world's third largest steel producer in 2016 (IBEF, 2017). A study by Munna (2016:8) into the growth of the steel industry in India from 2009 to 2014 indicates that the country has experienced increased growth each year during that period, with the exception of 2012 where the growth declined but picked up gain in 2013 and continued to increase in 2014.

2.4 CONCLUSION

The aim of this chapter was to provide background information about Emfuleni as case study area and its economic activities. The chapter began by providing demographic and economic information about Emfuleni municipal area. The chapter then proceeded to unpack the main economic activities in Emfuleni. The manufacturing sector (steel industry) run by Arcelor Mittal is the main economic activity in Emfuleni and the main source of employment in the area. Employment statistics provided in the chapter showed that the steel industry has been the main source of employment in Emfuleni for years however the number of jobs offered by the steel industry in Emfuleni has been decreasing each year. The chapter also showed that the steel industry has a positive relationship with GDP and exports and this is an important link to bring growth and international revenue in the area.

The case studies of the performance of the steel industry in China and India indicate that both countries where able to achieve economic growth and high employment through the steel industry. The steel industry in both countries employs millions of people and contributes positively to economic growth, poverty alleviation and improved standards of living for the residents.

CHAPTER 3: THEORETICAL AND EMPIRICAL LITERATURE REVIEW

3.1 INTRODUCTION

The steel industry in South Africa represents an estimated 33 percent (%) of the country's manufacturing (Thulare, 2015:28). The manufacturing sector in South Africa is dominated by a few large sub-sectors specifically: chemicals, steel, machinery, as well as food processing (IDC, 2013:8). The steel industry is a significant contributor to the South African economy and employment, responsible for an estimate 25 percent (%) of total employment (Media Club South Africa, 2015). Adugna (2014:1-2) states that the economic transformation observed in most developed countries has been linked to the successful development of the manufacturing sector and similarly, the development of emerging countries has also been linked to the performance and structure of their manufacturing sector. The manufacturing sector plays a major role in the economic growth of developed and developing countries. Nel, Rogerson and Marais (2004:10) assert that the manufacturing sector is regarded as one of the key drivers of any regional or national economy. Black and Hasson (2012) state that with the right policies in place, the manufacturing sector can transform a stagnant economy into recovery. This is due to the multiplier effects that the manufacturing sector has if compared to other sectors of the economy. An increase in the share of the manufacturing sector in an economy leads to economic growth which is associated with significant shifts in sectoral output, employment and consumption structure. Rynn (2011) states that the manufacturing sector is central to the economy because it creates jobs, it is a source of economic growth and it is a path to development.

The importance of the manufacturing sector to economic growth is echoed in Kaldor's engine of growth hypothesis, which has been found to be true in the economies of the United States, China, Turkey and South Africa. Kaldor's hypothesis states that the manufacturing sector has the power to stimulate economic growth and growth of other sectors as well (Kupka, 2011:4). Gold (2014) posits that no sector does more to generate broad scale economic growth and high standards of living than the manufacturing sector. This growth enhancing power of the manufacturing sector is demonstrated in the sector's multiplier effects. The manufacturing sector has the highest economic and employment multipliers than any other sector (IDC, 2014:14 -15). A one million rand investment into the manufacturing sector can create 3.0 jobs,

compared to the finance sector which can create 1.0 jobs, mining 0.5 jobs and transport 0.1 jobs (Abedian, Kanda, Zanazo & Madindisa ,2011:15).

3.2 THEORIES OF MANUFACTURING AND ECONOMIC GROWTH

Economists and policymakers worry about swings in the manufacturing sector due to the role ascribed to the sector in the process of take-off and catch up of an economy (Felipe, Ledesma, Lanzafame & Estrada, 2007:7). There is a strong relationship between the growth of the manufacturing output and the growth of Gross Domestic Product (GDP) (Adugna, 2014:1). Tregenna (2007:3) asserts that the manufacturing sector has special growth enhancing characteristics that are not shared by the other sectors. Those special characteristics accord the manufacturing sector a central role in the economic growth process and also provide guidance that distinct focus should be placed on the manufacturing sector when policies are developed.

Nicholas Kaldor (one of the founders of the Post-Keynesianism), established the importance of the manufacturing sector for economic growth through three laws (Calderon & Sanchez, 2012:2). Kaldor hypothesised about facts and empirical regularities regarding the benefits of the manufacturing sector to the entire economy. Kaldor's three laws bring together the notion of "engine of growth", "economies of scale" and "sectoral benefits" of the manufacturing sector (Cantore, Clara & Soare, 2014:1). According to Knell (2004:72), Kaldor's empirical analysis focused on the role of the manufacturing sector as a tool to economic growth. Kaldor's analysis states that higher growth in manufacturing output leads to higher labour productivity growth both inside and outside the manufacturing sector.

Odior (2013:368-369) conducted a study covering data from 36 African countries to test Kaldor's hypotheses. The study examined the key determinants of manufacturing's share in aggregate output and its relationship with the real GDP growth and growth volatility. The study revealed that an increased share of manufacturing total output has the potential to raise GDP growth given the strong backward and forward linkages between the manufacturing sector and other sectors. The study further revealed that the design and implementation of effective industrial policies to promote manufacturing can act as a method to boost economic transformation and achieve economic and social development goals including employment and poverty reduction. Zalk (2014) attests that the manufacturing sector has positive correlation with GDP growth, while other primary and tertiary sectors do not. This affirms that the

manufacturing sector is the core driver of GDP growth and employment, while other sectors are likely to grow on the basis of the growing demand resulting from an increase in GDP and manufacturing.

3.2.1 KALDOR'S FIRST LAW

Kaldor's first law states that the manufacturing sector is the engine of economic growth. The law consists of three propositions. The first proposition states that the growth of GDP is positively related to the growth of the manufacturing sector (the faster the growth of the manufacturing sector in a country, the faster the growth rate of GDP). The second proposition states that manufacturing productivity growth rate is positively related to the manufacturing output growth rate. The third proposition states that manufacturing output leads to growth in the overall productivity in an economy, which is observed as a positive relationship between labour and productivity growth rate of all productive sectors and manufacturing output growth rate (Guo, Dall'erba & Le Gallo, 2012:6-7). Kaldor's first law furthermore elaborates that the growth of total output is determined by the growth of manufacturing. Kaldor believed that manufacturing drove economic growth and that the activities that a country or region specialised in, determined its economic success or failure. From the Kaldorian perspective, manufacturing is considered as the basis or central driver of an economy, because of its buying and selling links with other sectors (Calderon & Sanchez, 2012:2). Felipe *et al.* (2007:8-9) assert that the faster the growth rate of manufacturing output, the faster the growth rate of GDP, thus confirming the role of manufacturing as the engine of growth. This role is not only based on the engine of growth aspect, but also on the fact that capital accumulation and technical progress are strongest in the manufacturing sector, and have spillover effects on the rest of the economy. This implies that the higher the growth rate of manufacturing, the higher the growth rate of the rest of the economy.

3.2.2 KALDOR'S SECOND LAW

Kaldor's second law points out that there is a strong positive relationship between the growth of manufacturing production and the growth of manufacturing productivity. This law has been interpreted as evidence in support of the existence of increasing returns in the manufacturing sector. According to Kaldor's second law, the expansion of output leads to a process of macro dynamic increasing returns that results in productivity gains. The induced productivity growth

effect linked to increasing returns is specified as a regression of manufacturing employment growth on manufacturing output growth. Kaldor's hypothesis here is that output expansion induces a less than proportional employment expansion that leads to productivity gains. The elasticity of employment with regard to output is an indicator of the degree of increasing returns (Felipe *et al.*, 2007:9).

Kaldor's second law further states that the long-run elasticity of labour productivity with regard to output is constant and positive. This law has been used to explain persistent disparities in the growth rates among countries as well as causation patterns of economic growth. Kaldor's second law suggests that higher output growth tends to increase manufacturing productivity and exports, which in turn stimulate output. The law provides a link of the relationship between labour productivity and output to the division of labour. The reference to the division of labour explains the casual relationship running from output to labour productivity and productivity in the economy as a whole (Aspergis & Zikos, 2003:87-88). Feijo and Lamonica (2012:111) explain that an increase in output stimulated by an expansion of demand leads to productivity growth in sectors that have dynamic economies of scale.

3.2.3 KALDOR'S THIRD LAW

Kaldor's third law states that when manufacturing grows, the rest of the sectors (not subject to increasing returns) will transfer labour to manufacturing, thus raising the overall productivity of the economy. Dynamic sectors absorb workers from stagnant sectors where the level and growth of labour productivity is very low. This raises the overall productivity level of the economy and its growth rate (Felipe *et al.*, 2007:9). Kaldor's third law also points out that the higher the growth rate of exports, the greater the increase in GDP. According to Kaldor, in more advanced phases of economic development, GDP growth is fuelled by increasing export demand. This idea assumes that the expansion of industrial activity would raise productivity in the manufacturing sector, which would then enhance the competitiveness of exports and stimulate their growth. This in turn will lead to an increase in the economy's overall GDP (Feijo & Lamonica, 2012:111).

Kaldor also puts forward in the third law that growth in aggregate productivity is positively related to growth in manufacturing output and negatively related to growth in non-manufacturing employment. The logic in this relationship is that rapid growth in manufacturing

increases manufacturing productivity (hence aggregate productivity). With a surplus of labour in agriculture and the service sectors, rapid growth in manufacturing will raise productivity growth in these sectors because of the increases in the sectoral labour transfers from the rest of the economy to manufacturing. Labour then moves from agriculture where marginal work productivity is reduced, to manufacturing where work productivity is high. As a result of increasing returns in manufacturing and the rising productivity in non-manufacturing sectors, a rise in the growth rate of manufacturing productivity will lead to a raise in the productivity growth rate of the whole economy (Calderon & Sanchez, 2012:2).

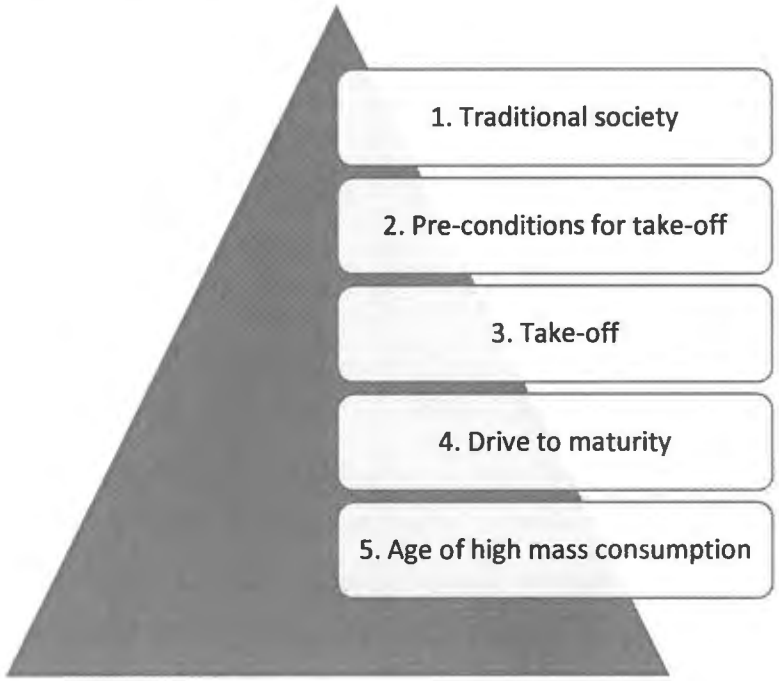
3.3 ECONOMIC GROWTH AND DEVELOPMENT MODELS

3.3.1 ROSTOWS'S STAGES OF GROWTH

Rostow's stages of growth model states that a country passes through a series of sequential stages before achieving development. The model explains that the transition from underdevelopment to development can be described by a sequence of five stages through which all countries must proceed. Stage one the traditional society, stage 2 the pre-conditions for take-off into self-sustaining growth, stage 3 the take-off, stage 4 the drive to maturity and stage 5 the age of high mass consumption (Torado & Smith, 2015:120). Stage one is the stage where the economy is dominated by subsistence activity and output is consumed by producers rather than traded. Stage two is where increased specialisation is witnessed as well as the development of transport infrastructure to support trade and entrepreneurs (Rostow, 2004:5). Stage three is characterised by industrialisation increase with workers switching from the agricultural sector to the manufacturing sector. At stage four, the economy starts to diversify into new areas through technological innovation. Technological innovation provides a diverse range of investment opportunities to produce a wide range of goods and services and imposes less reliance on imports. In the last stage, stage five, the economy is geared towards mass consumption, consumer durable industries flourish and the service sector becomes increasingly dominant (Yaraja, 2013). Rostow postulates that the advanced countries have all passed the stages of take-off into self-sustaining growth and the underdeveloped countries that were still in either the traditional society or the pre-conditions stage, have only a certain set of rules of development to follow to take-off and turn into self-sustaining economic growth. Rostow states that one of the principal strategies of development necessary for any take-off is the mobilisation

of domestic and foreign saving in order to generate sufficient investment to accelerate economic growth (Rostow, 2004:4-11).

Figure 3.1: Rostow's stages of growth



Source: Torado and Smith (2015:120).

3.3.2 THE LEWIS THEORY OF ECONOMIC DEVELOPMENT

The Lewis theory focuses on the mechanism by which underdeveloped economies transform their domestic economic structures from a heavy emphasis on traditional subsistence agriculture to a more modern, urbanised and industrially diverse manufacturing and service economy. This involves a process of transforming the economy in such a way that the contribution of the manufacturing sector to the national income eventually surpasses the contribution of the agricultural sector (Hirota, 2002:50-51). According to the Lewis theory, the underdeveloped economy consists of two sectors: a traditional, overpopulated, rural subsistence sector characterised by zero marginal labour productivity and a high productivity modern and urban industrial sector into which labour from the subsistence sector is gradually transferred (Goulet, Streeten & Wolfensohn, 2003:117). The primary focus of the Lewis theory is on the process of labour transfer, the growth of output and employment in the industrial sector. Both labour transfer and industrial sector employment growth are brought by output expansion in the sector. The rate at which this expansion occurs is determined by the rate of

industrial investment and capital accumulation in the industrial sector (Torado & Smith, 2015:124).

The Lewis theory also states that due to zero marginal productivity of labour, it is possible to relocate unlimited number of workers from the traditional sector without causing a decline in its output. The theory regards the traditional sector as a sector with surplus labour which could be effectively absorbed into other productive sectors of the economy to spearhead economic development. In the industrial sector (characterised by high level of productivity), economic development involves the gradual transfer of labour from the traditional subsistence sector to the modern urban sector leading to more output and employment. This process leads to structural transformation of an economy from the one dominated by traditional subsistence, to the one which is predominantly more modern and industrialised (Kumo, 2011).

3.4 MANUFACTURING POLICIES

The development and strengthening of the manufacturing sector in South Africa has been one of the main business undertakings by the South African government. Since assuming its reigns of governance in 1994, the government has committed itself to accelerating the growth of the manufacturing sector in the country (Bailey, 2005:117). South Africa has undergone significant changes in terms of its manufacturing policies. The key shift has been from being a state controlled, Keynesian-based and intervention driven economy, to one in which the state in alignment with monetarist/neo-liberal principles, is seeking to facilitate a market led growth path which allows for global integration and open trade (Nel *et al.*,2004:17). According to SEDA (2012:17), a key policy objective of the South African government is to strengthen the manufacturing sector, facilitate the diversification of the country's manufacturing base and ultimately develop the country's capabilities in both labour absorbing and higher value adding manufacturing activities. Several policies and strategies have been formulated to achieve this goal and they include: The Industrial Action Plan (IPAP), the New Growth Path (NGP), the Manufacturing Competitiveness rescue package and the Integrated Manufacturing Strategy (IMS) (Department of Science and Technology, 2005:5) and Abedian, Kanda, Zanazo & Madindisa, 2011:8).

3.4.1 THE INTEGRATED MANUFACTURING STRATEGY (IMS)

The Integrated Manufacturing Strategy (IMS) was formulated by the Department of Trade and Industry in 2002 with a focus of improving competitiveness (Machaka & Roberts, 2003:1-19). The integrated manufacturing strategy identified five sectors that have considerable potential to increase output, exports and create employment. The identified sectors are: agriculture (including food production), tourism, manufacturing (including minerals, steel, chemicals) clothing and textiles and automotive. In each of these sectors, special focus is on employment creation, value addition (where technological innovation is critical), production for the domestic market, as well as export growth (Bailey, 2005:117). Roberts (2003:3) states that for the integrated manufacturing strategy to be a success, the following are required: a greater diversity of enterprise type and size, an integrated manufacturing economy capable of high degrees of value-added, a geographical spread of social and productive investment, an extensive information and communication technology and a logistics system capable of speed and flexibility.

3.4.2 THE INDUSTRIAL POLICY ACTION PLAN (IPAP)

The principal objective of IPAP is to achieve structural change by encouraging the development, growth and increased competitiveness of the South African manufacturing sector (DTI, 2014). The rationale for the manufacturing sector to be associated with the IPAP is that the manufacturing sector has greater employment creation potential for unskilled and semi-skilled individuals compared to other sectors. Also, the manufacturing sector is a critical driver of innovation and productivity growth. The manufacturing sector draws in and stimulates demand for a huge range of upstream inputs and services. It also stimulates additional downstream activity in services and it is central to the development of a strong export strategy. Nyakabawo (2014:1) states that the South African government through the IPAP is determined to grow competitiveness and labour absorbing capacity of the manufacturing sector, particularly in the traditional and non-traditional tradable and value adding sectors of the economy.

3.4.3 THE NEW GROWTH PATH (NGP)

According to Makhubo (2015:2) and SEDA (2012:17), the main aim of the New Growth Path is to bring down South Africa's unemployment rate from 25 percent (%) to 15 percent (%) and create five million jobs over a period of ten years from the year 2010. To achieve this, the NGP prioritises labour absorbing sectors such as agriculture, manufacturing and service as key drivers for job creation. The NGP further identified the manufacturing sector as one of the six core pillars of growth to drive the South African economy. The policy predicts that as many as 80 000 jobs can be created in South Africa's manufacturing sector by 2020. Fourie (2013:5) states that a key objective of the NGP is to identify areas where employment creation can take place on a large scale. The NGP specifies a growth path that identifies "job drivers" (where jobs can be created) and key "policy drivers" (policy tools available to support employment growth across the economy).

3.5 DEFINING UNEMPLOYMENT AND TYPES OF UNEMPLOYMENT

Availability of jobs is a feature supported by both idealistic and practical considerations. In an era where people are expected to provide for their own and family's economic livelihood, availability of employment opportunities is very critical for survival and human welfare. Unemployment can have various social costs for a society such as crime, regional deterioration, health issues, family breakdown, school dropouts, poverty and economic instability (Natarajan, 2014:43). Unemployment is a position where a person who is actively looking for a job cannot obtain one. Similarly, the availability of jobs is one of the indicators of economic performance. (Pineda, 2018). Unemployment and lack of employment opportunities is one of the factors that lead to poverty. Employment on the other hand grants a person the capability to afford basic needs for their family. Unemployment can be classified in different ways: structural unemployment, frictional unemployment and hidden unemployment. Structural unemployment is an incompatibility between the demand and supply of the labour force. Frictional unemployment is loss of employment due to economic reasons like recession. Hidden unemployment occurs when prospective employees are denied employment opportunities because of preference of a specific group, thus excluding another group (Van der Westhuizen and Swart, 2015:737).

3.6 UNEMPLOYMENT THEORIES

3.6.1 Classical unemployment theory

Classical unemployment theory states that part of unemployment in a country or economy can be attributed to government regulations and intervention through things such as the minimum wage. During economic recession, wages are kept too high. The theory explains that raising the minimum wage increases the cost of labour for a company more than the economic value of the actual labour. Company's then respond to such minimum labour laws by employing less people in order to reduce their labour costs and optimize their operations (Pineda, 2018). The classical unemployment theory also features the flexibility of prices and wages to bring full employment. The theory states that unemployment can be reduced by cutting down wages which would in turn increase the demand for labour and simultaneously increase activity. If wages are allowed to move freely, unemployment will be reduced and full employment can take place. Employment opportunities are mostly created by the private sector provided that government sets an enabling environment. The government policy should be based on three pillars: acceptable labour regulations, human capital development and macro-economic stability and development. Unrealistic labour regulations will prevent economic growth and job opportunities (Meyer, 2014:2).

3.6.2 Implicit contract theory

The implicit contract theory focuses on labour laws and contracts. The theory was developed to explain why job losses occur during downturns such as recessions. The implicit contract theory states that labour laws makes it difficult for companies to cut off employees' salaries when experiencing economic down turns. Therefore, during economic downturns, companies resort to reducing the number of their employees as a way to save costs and optimize their operation (Pineda, 2018).

3.6.3 Efficiency wage theory

Efficiency wage theory argues that employers should pay their employees differently according to their efficiency. More efficient workers should earn more than less efficient workers. The theory states that companies can operate more profitably and produce more if they paid their employees' salaries that are above the equilibrium level. The theory argues that high wages could encourage better performance from employees, attract competent employees and promote the wellbeing of employees. The downside to this practice is that high salaries will

attract more workers. Other employers might also follow suit by paying their employees higher wages to keep up with the competition in the labour market. This process makes the cost of labour to be very high and consequently the employers cannot expand their labor force due to existing high labour cost (Hadroj, 2016:566)

3.6.4 Keynesian theory of employment

Keynes theory of employment states that the factors of production remain unchanged while determining employment. Therefore, the level of employment is dependent on national income and output. Keynes theory held that an increase in national income will result in an increase in employment. Keynes also points out that the level of unemployment in the short run is dependent on aggregate effective demand of products and services. The theory explains that an increase in aggregate demand will increase employment and vice versa. That is total employment of a country can be determined with the help of total demand of the country. A decline in total effective demand would lead to unemployment. Thus effective demand affects a country's employment levels, national income and national output (Natarajan, 2014:43). The Keynesian theory of unemployment furthermore links unemployment with the business cycle. As the economy undergoes boom or bust cycle, so does employment. The bust phase of the economy results in low demand and more unemployment. Employment will increase when the economy enters the boom phase (Pineda, 2018).

3.7 CONCLUSION

The aim of this chapter was to review theories that concern the study. The chapter began by explaining the link between the steel industry is South Africa and the manufacturing sector. The steel industry in South Africa is classified as a manufacturing sector and the steel industry constitute 33 percent of South Africa's total manufacturing. The chapter then proceeded to review theories about the manufacturing sector and its link to employment. The chapter also presented employment and unemployment theories to explain the causes and reasons for the occurrence of unemployment in a country or region. Theories showed that unemployment occurs due to various reasons such as high wages costs, change in demand and strict laws by labour unions and government that prevent flexibility and effective negotiations between the employer and employee.

Literature in the chapter showed that the manufacturing sector including the steel industry is regarded as one of the key drivers of any regional or national economy. The importance of the manufacturing sector is based on that it creates jobs, it is a source of economic growth and it is

a path to development. Similarly, the sector has the power to stimulate economic growth and growth of other sectors as well. Literature pointed out there is a strong relationship between the growth of the manufacturing output and the growth of GDP.

The manufacturing policies presented the importance of the manufacturing sector as an engine of growth, economies of scale and sectoral benefits. Manufacturing drives economic growth and that the activities that a country or region specialises in, determines its economic success or failure. The chapter presented that there is a link between manufacturing exports and GDP.

The South African manufacturing policies discussed in this chapter highlighted the main aim of the government is to strengthen the country's manufacturing sector and facilitate the diversification of the country's manufacturing base. The rationale for the manufacturing sector to be associated with policies is based on the sectors ability to create employment for unskilled and semi-skilled individuals compared to other sectors. This chapter has evidenced that the manufacturing sector (steel industry included) is a source of employment, it generates economic growth and it is a source of international revenue through exports.

CHAPTER 4: METHODOLOGY AND RESEARCH DESIGN

4.1 INTRODUCTION

The previous chapter made an important attempt to review theoretical aspects and empirical studies that the author considers to be significant to the current study. The reviewed empirical studies applied a number of various econometric models and approaches such as OLS, cointegration, error correction and vector error correction approaches. Chapter 4 of this study, the current one, discusses the theoretical methods and procedures utilised in this study. This chapter is divided into three parts serving three purposes. Firstly, the chapter presents the theoretical approaches relied upon in the study. In this section the dataset and the sample period are also discussed. Secondly, the chapter addresses the issues concerning model building and model specification. Thirdly, it presents and provides the justification for the choice of the research techniques used in this study. To be specific, the current chapter provides the methodology followed, as well as the econometric techniques applied to examine the impact of the steel industry on labour force in the Emfuleni municipality. The researcher discusses the ARDL methodology in detail. This discussion includes the justifications for using this technique in analysing the impact of the steel industry on labour force in the Emfuleni municipality, the advantages and disadvantages of the model. Additionally, other approaches or model such as the error correction model (ECM) and the Toda-Yamamoto Granger causality are also discussed. The chapter closes with a conclusion.

4.2 DATA SELECTION, SAMPLE PERIOD AND VARIABLES DESCRIPTION

4.2.1 Data selection and sample period

The current study is based on the quantitative research and it uses annual time series data. The dataset comprises of employment (EMP_t) in the Emfuleni municipality as the dependent variable; and the share of steel industry on economic growth GDP_t), the steel industry total expenditure ($TEXP_t$) and labour wages ($WAGE_t$) as the independent variables. The dataset for all employed variables is sourced from the Global Insight Regional Explorer MacGregor. The Global Insight Regional Explorer MacGregor provides the regional and national data and it was the suitable source for the current research data. Nonetheless, the Regional Explorer MacGregor provides only the annual data. Consequently, the employed data time period starts from 1994 and ends in 2017. This time period was selected based on the availability of data. The study analysis covers 22 years, that is, 22 observations are subjected to the study analysis.

4.2.2 Variables description

Employment (the dependent or explained variable) is taken as a part of labour force of the Emfuleni municipality and it measured in thousands of people employed in this municipality. The GDP in the South African economy is measured using two approaches: the first approach measures GDP using the aggregate expenditure while the second considers the aggregate of the goods and services value added on production. GDP is measured in billions of rand. The second independent variables which is exports counts the total of the steel industry sold outside of South Africa, it is measure in millions of rand. Lastly, labour remuneration is the total amount of money paid for all employees working for the steel industry. The labour remuneration is measured in millions of rand. In further sections, wages and labour remuneration concepts will be used interchangeably.

4.3 ECONOMETRIC FRAMEWORK AND MODEL SPECIFICATION

Econometrics and time series studies are progressively relying upon the use of robust and more sophisticated techniques in their investigation inquiries as opposed to the direct use of the OLS model (Mina, 2011:202-218). This is essentially because of spurious results often obtained when using the OLS regression. Additionally, the use of these high-powered econometric time series techniques would lead to the simultaneous identification of various econometric issues such as multicollinearity, heteroscedasticity, autocorrelation, and non-stationarity of data (Arodoye & Iyoha, 2014:127-129). This study made use of the Pesaran, Shin and Smith (2001) ARDL approach, which is sometimes referred to, in the literature, as bound test for cointegration approaches. This model is considered as a useful approach in evaluating the presence of long-run and short-run relationships in time series analysis. In comparison to other cointegration models, the ARDL model is recommended for its various advantages and ability to conduct simultaneous estimations for long-run and short-run effects by means of the bounds testing technique permitting the Error Correction Model (ECM) to be estimated (Dritsakis, 2011; Sezgin & Yildirim, 2003). This is possible because the Error Correction Model (ECM) in the ARDL model integrates estimations for short-run adjustments towards reaching the long-run equilibrium without dropping the long-run results (Pesaran & Shin,1999).

The emphasis of this study is, therefore, to address both the relative importance and the dynamic effects of the various shocks on the macroeconomic variables with the assistance of the above-mentioned techniques. In assessing the impact of the steel industry on labour force

in the Emfuleni municipality, several specific empirical models have been constructed based on economic theory and empirical literature.

Enders (2004:294-352) supports the idea that for the traditional econometric approach of transforming the data to stationary regressors prior to estimation, irrespective whether the point of focus is long-run or short-run relationships. Notwithstanding, this study follows the procedure of the ARDL analysis of using both level variables or the first differences, depending on the stability of the ARDL system. Further, in order to examine a reinforcing mechanism between the steel industry and labour force in the Emfuleni municipality within an ARDL framework, the analysis is carried out in the following different econometrics approaches.

4.3.1 Stationarity/unit root test

The unit root test for stationarity is a critical component in time-series analysis for it discloses whether the series is either stationary or non-stationary (Perron, 1989). Therefore, the stationarity test is an essential requirement in estimating long run relationships between variables that use the cointegration techniques (Gujarati & Porter, 2008:762). Nevertheless, it is frequently contended that traditional unit root tests such as the Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) tests, tend to lead to poor results when applied on a small data sample (Brooks, 2008:330-331). Wisz *et al.* (2008:763) asserts that a sample size is considered as small sample size when it consists of less than 30 observations. Consequently, use of the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) technique serves as an alternative test for stationarity dealing with the drawbacks of the ADF and PP unit root tests.

The unit root test (non-stationarity) or the univariate characteristics of time series is the first step when doing regression analysis to determine integration order of variables. This test is also performed in order to select appropriate estimation methodology. The literature provides various ways of testing unit roots. Some of these techniques are the Dickey-Fuller (DF) test, Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, Kahn and Ogaki test, Leyborne-McCabetest test, the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests as well as the cointegration regression Durbin-Watson (CRDW) test. The most popular unit root tests applied in empirical works are DF, ADF, PP and KPSS. Among these tests, both the DF and ADF tests are the most employed in in empirical studies (Ogbokor, 2015). These two approaches (DF and ADF) are preferred due to their general nature and simplicity (Johansen, 1988:231–254). Additionally, despite a minimal difference that exists between the ADF and PP test regarding the residuals, these two tests often, in terms of unit root test, provide similar

conclusion. Consequently, instead of using both ADF and PP tests, this study uses the ADF test and adds the KPSS test to insure the accurate results. The ADF test was preferred over the DF test because of its technical superiority over the DF test. More precisely, the ADF corrects the weaknesses of the DF test by assuming that Y (the dependent variable) follows an $AR(p)$ instead of an $A(1)$ process. The estimation of the ADF test involves estimating the following equation:

$$\Delta y_t = \rho* \ y_{t-1} + \rho_1 \Delta y_{t-1} + \rho_2 \Delta y_{t-2} + \ldots + \rho_{p-1} \Delta y_{p+1} + u_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

Where $\rho* = (\rho_1 + \rho_2 + \ldots \rho_p) - 1$

If $\rho* = 0$, then y contains a unit root. Therefore, null hypothesis suggesting the presence of a unit root within the variable is not rejected. In other words, the ADF t-statistic is greater than the ADF critical value.

4.3.2 Lag selection

It is important to note that the appropriate lag length should be used in implementing the ADF test. This is because the use of too few lags may result in rejecting the null hypothesis, when in fact, it was not supposed to be rejected. On the other hand, too many lags might reduce the power of the test. Therefore, it is important to determine the optimum number of lag prior to the model estimation (Brooks, 2014). There exist a number of approaches to determine the optimal lag to be included into the model. Although Brooks (2014) argues that none of these criteria is superior to another, the most popular and used are the Akaike Information criteria (Akaike 1974) symbolised as AIC and the Schwarz-Bayesian information criteria (Schwarz *et al.* 1978) known as SIC.

The SIC is the most preferred for its strictness and rigours features (Neath & Cavanaugh, 1997:559) especially when the ARDL model is used for estimation of long run relationship among variables. While Brooks (2014) argues that a maximum of 12 lags should be applied on monthly data, Narayan and Smyth (2009) and Pesaran (1997) assert that when using ARDL model, a maximum of four lags should be applied on quarterly data whilst a maximum of two lags is better for annually data. Since the current study analysed annual data, the maximum of two lags is considered.

4.4 AUTOREGRESSIVE DISTRIBUTED LAGS

This study employed the Autoregressive Distributed Lags (ARDL) to assess the long run and short run relationship between the steel industry and employment level in the Emfuleni municipality. The ARDL model was introduced in the econometrics literature by Pesaran & Shin (1999). This model was refined in 2001 (Pesaran, Shin & Smith, 2001). In recent econometrics analysis, the ARDL model has been widely utilized due to its several advantages over traditional statistical approaches for assessment of short/long-run relationships and cointegration among economic and financial variables.

4.4.1 Advantages and drawback of ARDL model

The first advantage of the ARDL model is that, contrary to the traditional methods such as Granger/Enger causality test (Engle & Granger 1987), Johansen's tests (Johansen 1991) and the Vector Autoregression (VAR), does not require variables under consideration to have one integaration order. In other words, the ARDL model can be applied whether variables are I(0) or I(1) or a mixture of the two [I(0) and I(1)] (Adom *et al.,* 2012; Duasa, 2007). Nonetheless, this model is not suitable for variables that are I (2). Additionally, the ARDL model provides long run and short run results simultaneously (Habanabakize, 2016). The ARDL model, unlike traditional cointegration tests, it more flexible. It allows for each variable in the model to have its distinct number of lags (Pesaran *et al.* 2001). Most importantly, the ARDL model is the best model to generate robust and consistent results when the study consists of the small sample size (Adom *et al.* 2012; Pesaran & Shin 1999; Pesaran *et al.,* 2001). Based on the abovementioned advantages of this model, the ARDL model is suitable for the current study; since the study sample size is between 1996 and 2017.

4.5 MODEL SPECIFICATION

When assessing the possible relationship between two or more variables the researcher frequently postulates a model specification. Equation 3.2 is an example of the assessment that analyses the relationship between two variables which can also be extended to multiples variables. In this equation Y represents the dependent variable while X is a vector of independent variable. The letter *f* symbolises the function.

$$Y = f(X) \quad \text{..... (3.2)}$$

Considering equation 3.2, the ARDL model is used to capture the relationship in the $f(X)$. In this regard, the ARDL is described in the simple format using one variable and is represented

as ARDL (q, p) model. This is the model applied on the selected variables of the current study. Following Pesaran and Shin (1999) and the revised Pesaran *et al.* (2001), the model represented in equation 3.2 can be elucidated by equation 3.3 where y_t is the dependent variable in time t and x_t is the independent variable in the same period t. q and p are the optimal lags for both variables Y and X respectively.

$$\Delta y_t = \beta_0 + \sum_{i=1}^{q} \tau_i \, \Delta y_{t-i} + \sum_{j=1}^{p} \omega_j \, \Delta x_{t-j} + \gamma_1 y_{t-1} + \gamma_2 x_{t-1} + e_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.3)$$

The coefficient β_0 is the drift coefficient, while the e_t represents the white noise error. The τ_j and ω_j are the short run coefficients for all j whilst the $\gamma, j = 1, 2$ corresponds to the coefficient of long run relationship. As the model intents to capture the cointegration or long run relationship among variables, the long run relationship was defined relative to the ARDL model. In this context, the long run relationship among variables suggests that variables under consideration converge to the long-term values and are no longer fluctuating dramatically (Brooks 2014). Consequently, in the long run equilibrium, the model or system is stable and remains constant over time. This implies the absence of dependency for fluctuation. That is, for instance:

$y_t = y_{t-1} = y$; $x_t = x_{t-1} = x$. This means if variables presented in the equation 3.3 are first differenced, the presence of the long run equilibrium, will be zero. More precisely, the first differenced variables are zero when the model converge to the equilibrium i.e $\Delta y_{t-1} = \Delta y_{t-j} = 0 \; \forall \, i, j$ in the long run (Brooks 2014). This assumption is mostly and firmly applied in macroeconomics. An example can be derived from the dynamism between price and quantity within a supply and demand equation. At the equilibrium level, the quantity demanded is equal to the quantity supplied. There is no movement, everything is constant. Applying this assumption to equation 3.3, the outcome is:

$$\gamma_1 y_{t-1} + \gamma_2 x_{t-1} + e_t + \beta_0 + C_0 t = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.4)$$

Consequently, the long run final coefficient the variable x is $-\frac{\gamma_2}{\gamma_1}$.

The ARDL model procedure can follow three steps. The first step is to determine the long run equation as described in the equation 3.3. The second step is to perform the bound test. If the bound test suggests the presence of long run relationship among variables, the next step which is Error Correction Modelling (ECM) is performed. Therefore, the third step is performed depending on the results obtained from the second step. If the long run relationship exists

among variables then the ECM is estimated to determine the short run dynamics (Adamu, 2014:23).

4.5.1 Bounds Test for cointegration and the Error Correction Modelling

Following the presentation in equation 3.3, it is now possible to determine whether a cointegration or long run relationship exists among variables. The existence of the long run relationship between variables is established through bound test or wald test. In computing equation 3.3, the test will reveal the presence of absence of the long run relationship among variables. The test for cointegration or long run relationship follows these hypotheses:

$H_0 = \gamma_1 = \gamma_2 = 0$: the absence of long run relationship between the variables

$H_1 = \gamma_1 \neq \gamma_2 \neq 0$: the absence of long run relationship between the variables

The hypothesis tests, in Wald test, differs from the regular hypothesis test because it involves both lower and upper bounds of the critical values. Consequently, the outcome from the test can lead to three types of conclusion. These decisions are made based on the comparison between the computed F-value and the critical value tabulated in Pesaran *et al.* (2001). If the value of the computed F-statistics is smaller than the tabulated values, the researcher fails to reject the null hypothesis and conclude that there is no long run relationship among variables. However, if the value of computed F-statistics is greater that the upper bound value from Pesaran *et al.* (2001), the null hypothesis is rejected in favour of the alternative. With this results, the researcher concludes that a long run relationship exists between variables under consideration. Further, if the value of the computed F-statistics falls between the lower and the upper bound values, unless further or additional information, no conclusion can be made (Pesaran et al. 2001). Hence:

Fail to Reject H_0 < Inconclusive < Reject H_0

In case the results from F-test leads to an in conclusion decision, the probable remedy is to estimate the error correction term following the method proposed by Banerjee et al. (1998) and Kremers *et al.* (1992). In a similar way, Pahlavani *et al.* (2005) and Bahmani-Oskooee and Nasir (2004) applied a negative and significant ECM-term to motivate the long run or cointegration under the inconclusive case. A T-test can also be performed as an equivalent or a complementary test if the F-test is inconclusive.

Since the F-bound test yields adequate results, it is possible to determine the cointegration or long run equilibrium without fear of spurious regression as the linear combination of the non-stationary variables are stationary in a simple OLS framework:

$$y_t = \beta_0 + \beta_1 x_t + e_t \quad \text{..... (3.5)}$$

Applying the ARDL model, the third step after the computation of the F-statistics, is the estimation of the error correction model (ECM). The error correction term (ECT) is defined in order to capture the model convergence towards the equilibrium. The error correction term is defined as:

$$ECM_{t-1} = y_{t-1} - \hat{\beta}_0 - \hat{\beta}_0 x_{t-1} \quad \text{..... (3.6)}$$

Where $\hat{\beta}$s are estimated from equation 3.5. It is important to note that ECM_{t-1} represents the residual in the Equation 3.5. Additionally, if the model tends towards the long run equilibrium, the difference between the dependent and independent variables (ECM_{t-1}) does not increase otherwise it would impose the divergence. Henceforth, the difference between the two (dependent and independent variables) has to decline. Furthermore, as all x_t, y_t and β_j are provided from regression in equation 3.5, the ECM_{t-1} becomes a new series. Consequently, the short run dynamic is estimated using the equation 3.3 replacing the lagged variables x_t, y_t with the error correction term (ECT_{t-1}). The error correction model is estimated as follow:

$$\Delta y_t = \beta_0 + C_0 t + \sum_{i=1}^{q} \tau_i \Delta y_{t-i} + \sum_{j=1}^{p} \omega_j \Delta x_{t-j} + \varphi ECM_{t-1} + e_t \quad \text{..... (3.7)}$$

The model converges to long run equilibrium if the ECM coefficient or the error term, in equation 3.7, is simultaneously negative and significant. Additionally, this coefficient determines the speed of adjustment. In other words, it provides the magnitude of the adjustment and time taken by the system to recover from the experienced shocks overtime. The ECM plays a significant role as it can assist policymakers to predict how quick their policies will affect the economy.

4.6 APPLICATION OF THE ARDL MODEL

The focus of the previous section was to describe the ARDL model in general. In this section the elucidated model (ARDL) is applied to the data and variables of the current study. Although the ARDL model uses different optimum lags on variables, it is important to perform a lag selection which is also useful when conducting the causality test. The study intends to analyse the impact of the steel industry on employment in the Emfuleni municipality. In order to keep

uniformity among variables and facilitate the results interpretation; variables under the study were transformed into natural logarithm.

Table 4.1: Variables representation

Variable	Abbreviation	Transformed variable
Employment	EMP	LnEPM
GDP share	GPD	LnGDP
Industry Total expenditure	TEXP	LnTEXP
Labour productivity	PROD	LnPROD
Labour wages	WAGE	LnWAGES

Source: Author's compilation

Following the representation of the equation 3.2 and equation 3.3, the ARDL model is applied on the current study to generate equation 3.8 and equation 3.9:

$$EMP_t = \mathrm{f}\,(GPD_t + TEXP_t + PROD_t + WAGE) \quad \text{..... (3.8)}$$

Applying the ARDL model to equation 3.8, the following equation is estimated:

$$\Delta LnEMP_t = \beta_0 + \sum_{i=1}^{p} \tau_i \Delta LnEMP_{t-i} + \sum_{j=1}^{p} \delta_j \Delta LnGDP_{t-j} \sum_{j=1}^{p} \omega_j \Delta LnTEXP_{t-j} + \sum_{j=1}^{p} \vartheta_j \Delta LnPROD_{t-j} + \sum_{j=1}^{p} \varphi_j \Delta LnWAGE_{t-j} + \gamma_1 LnEMP_{t-1} + \gamma_2 \Delta LnGDP_{t-j} + \gamma_3 LnTEXPO_{t-1} + \gamma_4 LnPROD_{t-1} + \gamma_5 LnWAGE_{t-1} + e_t \quad \text{..... (3.9)}$$

Applying the ARDL model to the current study to analyse the impact of the steel industry on labour force in Emfuleni the following equation is estimated; β_0 is the intercept. While the short run coefficients are represented by τ_i, δ_j, ω_j, ϑ_j and φ_j the long run coefficients are presented by γ_1, γ_2, γ_3, γ_4, *and* γ_5. The error correction is represented by e_t. In order to determine the presence or absence of long run relationship, the following hypotheses were formulated:

H_0: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$: no long run among variables

H_1: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0$: long run relationship exists among variables

As previously indicated the presence of long run relationship or cointegtration, is analysed using the bound test and comparing the computed F-statistics to the critical values in the Pesaran *et al.* (2001) tables. If the cointegtration exists, then the error correction model is estimated in the following equation 3.10

$$\Delta LnEMP_t = \beta_0 + \sum_{i=1}^{p} \tau_i \Delta LnEMP_{t-i} + \sum_{j=1}^{p} \delta_j \Delta LnGDP_{t-j} \quad \sum_{j=1}^{p} \omega_j \Delta LnTEXP_{t-j} +$$
$$\sum_{j=1}^{p} \vartheta_j \Delta LnPROD_{t-j} + \sum_{j=1}^{p} \varphi_j \Delta LnWAGE_{t-j} + ECT_{t-1} + e_t \quad \text{..... (3.10)}$$

Where ECT stands for the error correction term used to determine the speed of adjustment to the long run equilibrium. Once the short run and long run relationship is determined, the next step is to estimate the causal relationship among variables. Instead of using the traditional Granger causality test, this study uses the Toda an-Yamamoto Causality testing.

4.7 TODA YAMAMOTO (T-Y) APPROACH TO GRANGER-CAUSALITY TEST

The study employed the Toda-Yamamoto (T-Y) approach to discover the causal relationship between the steel industry on labour force in the Emfuleni municipality. The Toda-Yamamoto technique was introduced by Toda and Yamamoto (1995) as an approach to Granger non-causality investigating the augmented vector autoregressive (VARs) in levels. Contrary to the standard Granger (1969), the Y-T approach included an additional lags led by probable order of integration using the Block Exogeneity Wald test in an augmented VAR model (Hacker & Hatemi, 2006), (Lach, 2010:171) and (Mehrara, 2014:5). Additionally, the T-Y approach debilitates problems related with inaccurate i asymptotic critical values alongside the process for causality tests within cointegrated or non-stationary series (Ahmed, 2015:41).

The Y-T test estimates a VAR with the lag order of ($k + dmax$) using the maximal potential order of integration indicated by *d* and ignore the true lag order represented by k *(*Zachariadis, 2006:12-13). Thereafter, the Granger causality test is performed using the hypothesis tests within the VAR overlooking the extra lags *k+1, ..., k+d.* The Y-T test requires firstly the determination of lag length (*k*) and the order of integration (*d*) (Awokuse, 2003:130). Based on its significance, the additional lag is added to the unrestricted d variable to make it d_{max} (Lach, 2010:171) and (Oladipo, 2010:8). Similar to the ARDL model, the Y-T approaches evades the pre-tests underlying low-power unit roots and cointegration tests (Zachariadis, 2006:12-13). The current study in line with Anguibi (2015), Jebli and Youssef (2015), and Vaona (2012), used the Toda and Yamamoto (1995) augmented Granger non-causality built on a VAR model. Equation 3.11 expresses the Y-T model for this study:

$$\Delta LnEMP_t = \alpha_0 + \sum_{i=1}^{k} \beta_i \, \Delta LnEMP_{t-i} + \sum_{J=K+1}^{k+d_{max}} \beta_i \, \Delta LnEMP_{t-i} + \sum_{i=1}^{k} \delta_i \, \Delta LnGDP_{t-i} +$$
$$\sum_{J=K+1}^{k+d_{max}} \delta_i \, \Delta LnGDP_{t-i} + \sum_{i=i}^{k} \sigma_i \Delta LnTEXP_{1-i} + \sum_{J=K+1}^{k+d_{max}} \sigma_i \Delta LnTEXP_{1-i} +$$

$$\sum_{i=1}^{k} \gamma_i \, \Delta LnPROD_{t-i} + \sum_{J=K+1}^{k+d_{max}} \gamma_i \, \Delta LnPROD_{t-i} + \sum_{i=1}^{k} \beta_i \, \Delta LnWAGE_{t-i} +$$

$$\sum_{J=K+1}^{k+d_{max}} \beta_i \, \Delta LnWAGE_{t-i} + e_t \quad \text{..... (3.11)}$$

Where $LnEMP$ is the natural logarithm of employment, representing changes in the labour force in Emfuleni. The parameters to be estimated in equation 3.11 are denoted by α_0, β_i, δ_i, σ_i and γ_i. While d_{max} represents the maximum number of lags for the model; k denotes the optimal lag order and the e_t is the white noise error term. The null hypothesis for the causality test was that no causal relationship from the dependent variable ($LnEMP$) to interdependent variables ($LnGDP$, $LnTEXP$, $LnPROD$ *and* $LnWAGE$) and from each of the independent variables towards others.

Since it is indispensable to ensure the accuracy of the outcome from all the above mentioned test; the diagnostic tests are applied to this study. The diagnostic tests comprise of serial correlation, heteroscedasticity and normality test. These test are complemented by parameter stability tests with function form and recursive estimates (Takaendesa, 2006:100). The aim of these tests is to assess whether the system or model's stochastic properties are met to avoid the econometric analysis issues that may lead to spurious results. Subsequently, the diagnostic tests are employed to validate the regressions results (Habanabakize, 2016). The normal distribution of residuals is obtained using the Jarque Bera (JB) test, whilst the Breusch-Godfrey's Lagranges Multiplier (LM) test is used to determine the presence or absence of serial correlation. Additionally, the Breusch Pagan Godfrey is employed to test if the used variables are homoscedastic. Lastly, to analyse the recursive estimates of residuals, the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares residuals (CUSUMSQ) are employed to establish whether the models used in the study are stable.

4.8 CHAPTER SYNOPSIS

This chapter aimed at providing and establishing elucidation on data selection procedures, statistical and econometrics approaches employed. The discussion on the methodology highlighted different steps undertaken in establishing approaches and models used to determine the long run and short run relationships between the steel industry labour force fluctuations in the Emfuleni municipality. Additionally, the methods employed to establish the causal relationship among variables (employment, GDP share, industry total expenditure, labour productivity and labour wages) were discussed about. Data employed in the study was acquired

from Global Insight Regional Explorer MacGregor. The sample period covering the study was selected based on the data availability.

This chapter also justified the employed models, statistical approaches and the sample period. The chapter provided a detailed discussion of various tests conducted in the study; those tests includes stationarity and unit root test, the ARDL bound for cointegration, the error correction model (ECM), the Toda-Yamamoto Granger non-causality test, together with different diagnostic tests. The ARDL model was selected based on its flexibility and ability to provide accurate results even when applied on a small sample size. The next chapter focuses on estimation of empirical tests, results and discussion.

CHAPTER 5: RESEARCH DATA ANALYSIS AND DISCUSSION OF FINDINGS

5.1 INTRODUCTION

This chapter represents the regression analysis and the discussion of results obtained from the ARDL model. Under the empirical analysis, this chapter firstly provides graphical and descriptive representations of the trends within the analysed dependent and independent variables across the sampled period that starts from 1996 and ends in 2017. In this manner, the chapter offers a graphical representation, descriptive statistics and correlation analysis in order to establish a brief estimation of the series (variables) influences as well as the path or direction in which the observed series tend to oscillate. Therefore, variables are tested to determine their integration order and stationarity based on the two different tests. The Augmented Dickey-Fuller (ADF) for unit root test and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) for stationarity tests. These two tests are crucial for they proceed the cointegration analysis and assist in determining the appropriate model to establish the long run and short run relationship between variables.

Using the ARDL model and the bound test for cointegration, this chapter provides and discusses the results from presence of long run and short run relationships between employment in the Emfuleni municipality and the selected variables from the steel industry. With the aid of the Toda–Yamamoto granger Causality approach, the study analyses and presents the causal relationship among variables. Lastly, various diagnostic tests are conducted to assess and establish the validity of the model used in the current study.

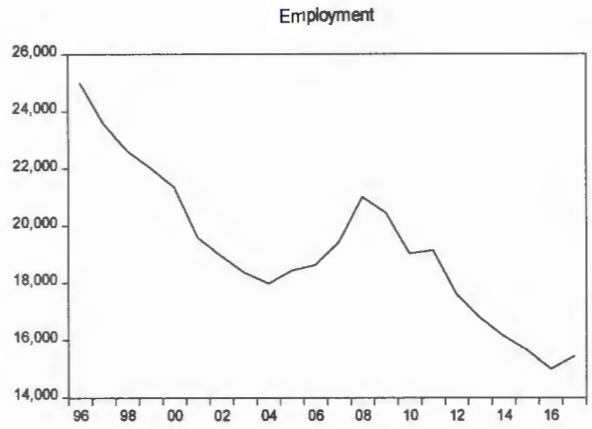
5.2 GRAPHICAL REPRESENTATIONS

In econometric analysis, graphical series or residual plotting is a key to elucidate the time series movements. This analysis is important because deficiencies may be observed in the form of structural breaks, outliers or inhomogeneous variances (Lütkepohl & Krätzig, 2004:40). If these deficiencies within a series are not addressed in the early stage of analysis, they can impact on the model results and, thus, influence the accuracy of findings. Consequently, identifying potential distortions in each variable is critical to econometric modelling and analysis. Therefore, the study established graphical representations, displayed by figure 5.1 and figure 5.2, to illustrate the descriptive picture of series to diagnose any possible deficiencies.

The series representing the total employment by the steel industry within the Emfuleni municipality is plotted on the figure 5.1. The graph represents employment starting from 1996

up to 2017. As it can be seen on the graph, between 1996 and 2003 employment by the steel industry in Emfuleni municipality experienced a declining trend. From 2004 to 2007 employment grew significantly. Nonetheless, in 2008 probably due to the financial crisis, employment by the steel industry in Emfuleni municipality was decreasing up to 2016 where it started rebounding.

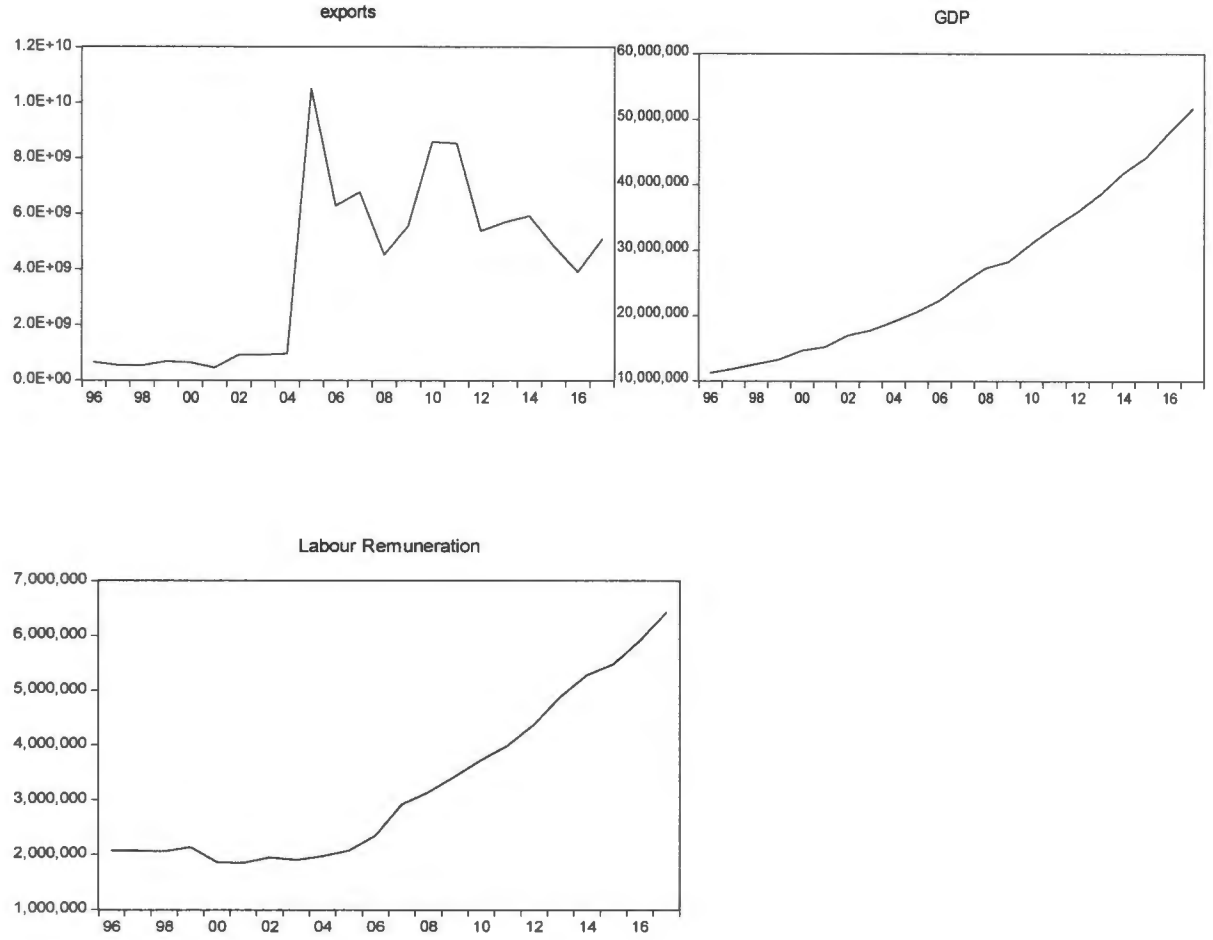
Figure 5.1: Graphical representation for the dependent variable (Employment)



Source: Compiled by author

Contrary to the decline in employment since 1996, the total exports within steel industry experience a moderate and consistent growth between 1996 and 2004. Between 2004 and 2005, the total exports in steel industry reached its highest growth. However, this growth did not last for a long period as between 2005 and 2007 the exports in the steel industry was declining. It rebounded in 2007 but since then it has experienced downwards and upwards movement up to 2017. Unlike the two variables, employment and exports, that experienced both downwards and upwards movements, GDP and labour remuneration experienced upwards trend between 1996 and 2017.

Figure 5.2: Graphical representation for the independent variables (Exports, GDP & remuneration)



Source: Compiled by author

5.3 DESCRIPTIVE AND CORRELATION ANALYSIS

5.3.1 Descriptive analysis

Data employed in this study was transformed into natural logarithm in order to analyse the responsiveness or elasticity of steel industry employment in the Emfuleni municipality to the fluctuation of exports, GDP share and labour remuneration in steel industry. The previous section focussed on the graphical representation and its interpretation. In order to better understand the general relationship among variables, it also necessary to continue with the descriptive and correlation analysis. The descriptive statistics for the selected series of the steel industry and employment within Emfuleni municipality are displayed in Table 5.1. The descriptive statistics, in Table 5.1, indicates that the natural log of exports and GDP have high standard deviation compared to other variables (employment and labour remuneration). This

result suggests that, during the period between 1996 and 2017, exports and GDP experienced a high volatility. In other words, these two variables (LnEXP and LnGDP) did significantly deviate from their means while LnEMP and LnWAGE are relatively less volatile. These results confirm the outcome from the graphical analysis in figure 5.1 and 5.2. With regard to the skewness, three variables LNEMP, LNGDP and LNWAGE are positively skewed while the LNEXP is negatively skewed. While the positive skewness indicates that variables are skewed to the right the negative skewness suggests that the exports are skewed to the left. The skewness values of LNEMP, LNEXP and LNGDP are close to zero suggesting that these are more likely to asymmetric. Under the Jarque-Bera values in table 5.1, the null hypothesis suggesting the presence of normal distribution among variables cannot be rejected (the P-value > 0.05). This implies that variables under the study are normally distributed.

Table 5.1: Descriptive statistics (in logs)

	LNEMP	LNEXP	LNGDP	LNWAGE
Mean	9.853550	21.62564	16.98114	14.90468
Median	9.851982	22.26705	16.98142	14.77782
Maximum	10.12697	23.07505	17.76072	15.67554
Minimum	9.615347	19.91062	16.23391	14.42969
Std. Dev.	0.137097	1.137233	0.484842	0.436399
Skewness	0.088599	-0.329000	0.028197	0.436635
Kurtosis	2.393151	1.348628	1.721118	1.649729
Jarque-Bera	0.366359	2.896660	1.502160	2.370344
Probability	0.832618	0.234962	0.471857	0.305694
Sum	216.7781	475.7641	373.5850	327.9029
Sum Sq. Dev.	0.394706	27.15930	4.936500	3.999327
Observations	22	22	22	22

Source: Compiled by author

5.3.2 Pearson correlations

The next step following the descriptive statistics is to assess the correlations between variables. The matrix of correlation is depicted in Table 5.2 below. As shown in table 5.2, all variables are statistically significant at 5 percent level. The total exports and the share of GDP from the steel industry possess a positive correlation with employment in the Emfuleni municipality

with the correlation coefficient of 0.574339 and 0.855489 for total exports and GDP respectively. Among these three variables, the strong and positive correlation exists between GPD and employment in the Emfuleni municipality. Additionally, there is a strong negative correlation between wages or labour remuneration and employment. The correlation coefficient between these variables is 0.724269. The total exports and wages are positively correlated to the steel exports with the correlation coefficients of 0.806602 for GDP and 0.695532 for wages respectively. Similarly, a strong and positive correlation exists between labour wages and GDP. The correlation between these two variables is 0.741563.

Table 5.2: Results of correlation coefficients

	LNEMP	LNEXP	LNGDP	LNWAGE
LNEMP	1.000000	----------	----------	----------
P-value	----------	----------	----------	----------
LNEXP	0.574339	1.000000	----------	----------
P-value	0.0052	----------	----------	----------
LNGDP	0.855489	0.806602	1.000000	----------
P-value	0.0000	0.0000	----------	----------
LNWAGE	-0.724269	0.695532	0.741563	1.000000
p-value	0.0001	0.0003	0.0000	----------

Source: Compiled by author

5.4 UNIT ROOT AND STATIONARITY TESTS

The Augmented Dickey-Fuller (ADF) and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests were employed to establish the order of integration that is suitable for the ARDL modelling approach. As highlighted in the methodology chapter, the use of these two tests (ADF for unit root test and KPSS for the stability test) is to ensure robustness of the test results. While the null hypothesis for the ADF test suggests the presence of a unit root within the

variable under consideration, the null hypothesis for the KPSS test suggests that the variable is stationary (the absence of unit root). Consequently, if the test fails to reject the null hypothesis (in KPSS test), the conclusion is that the series or variable is stationary.

5.4.1 The Augmented Dickey-Fuller (ADF) test

The table 5.3 displays the results of the ADF in both levels and first difference. The results suggest that the independent variable (TEMP) is stationary at levels while independent variables become stationary after the first difference. In other words, the ADF results suggest a mixture of I (0) and I (1).

Table 5.3: Results of ADF unit root test

Variable	Model specification	ADF: P-values		Integration order
		Levels	1st difference	
TEMP	Intercept	0.3168	0.0514	I(0)
	Intercept and trend	0.5064	0.1662	
	None	0.0069**	0.0069**	
GDP	Intercept	1.0000	0.8714	I(1)
	Intercept and trend	0.9991	0.0082**	
	None	--------	----------	
WAGE	Intercept	1.0000	0.3679	I(1)
	Intercept and trend	0.9191	0.0375*	
	None	--------	----------	
EXP	Intercept	0.2381	0.0001	I(1)
	Intercept and trend	0.2871	0.0007	
	None	--------	----------	

Notes: (a) * means the rejection of the null hypothesis at the 5 percent level of significance

(b) ** means the rejection of the null hypothesis at the 1 percent level of significance

Source: Compiled by author

5.4.2. KPSS stationarity test

The KPSS is another test employed to determine the variables order of integration. It was used as confirmatory test to the ADF unit root test. The results presented in table 5.4 also suggest

that some of the variables under consideration are stationary at levels (GDP and EXP) whilst others (TEMP and WAGE) are stationary at the first difference. Therefore, a mixture of variables. These results justify why the ARDL model is the appropriate mode to analyse the impact of steel industry on employment in the Emfuleni municipality.

Table 5.4: Results of the KPSS stationarity test

Variable	Model specification	Levels	1st difference	Order of integration
TEMP	Intercept	1.554693*	0.164315	I(1)
	Intercept and trend	0.088019	0.118269	
GDP	Intercept	0.647878*	0.632146*	I(0)
	Intercept and trend	0.183853	0.500000*	
EXP	Intercept	0.439439	0.160764*	I(0)
	Intercept and trend	0.142727	0.155723*	
WAGE	Intercept	0.595561*	0.557676*	I(1)
	Intercept and trend	0.176668	0.085705	

Notes: (a) critical value 0.463 with intercept without trend. With intercept and trend 0.1460

(b) * rejection of null hypothesis at 5% level of significance

Source: Compiled by author

5. 5 ESTIMATION OF THE AUTOREGRESSION DISTRIBUTIVE LAG MODEL

Various empirical studies argued that the results from the F-test are highly sensitive to the lag selection identified on first difference series (Bahmani-Oskooee & Ardani, 2006; Bahmani-Oskooee & Brooks, 2003). Therefore, information criteria are considered to provide necessary information that may lead to an equilibrium amongst the parsimonious specification and measurement of goodness of fit the used approach or model. Therefore, the selected model should be one that yields a minimised information criterion. In this regard, a model with larger number of lags may be selected only if the minimised log probability value offsets the penalty term value (Javed & Mantalos, 2013:1921). Additionally, Pesaran *et al.* (2001) argue that the process for the optimal lag selection requires a researcher to ensure that the designated model adjusts for biases likelihood, such as serial correlation and heteroscedasticity.

Nonetheless, the conventionally used Akaike Information Criterion (AIC) perceived to yield biased results for it is biased to selecting larger order models and consequently unreliable when

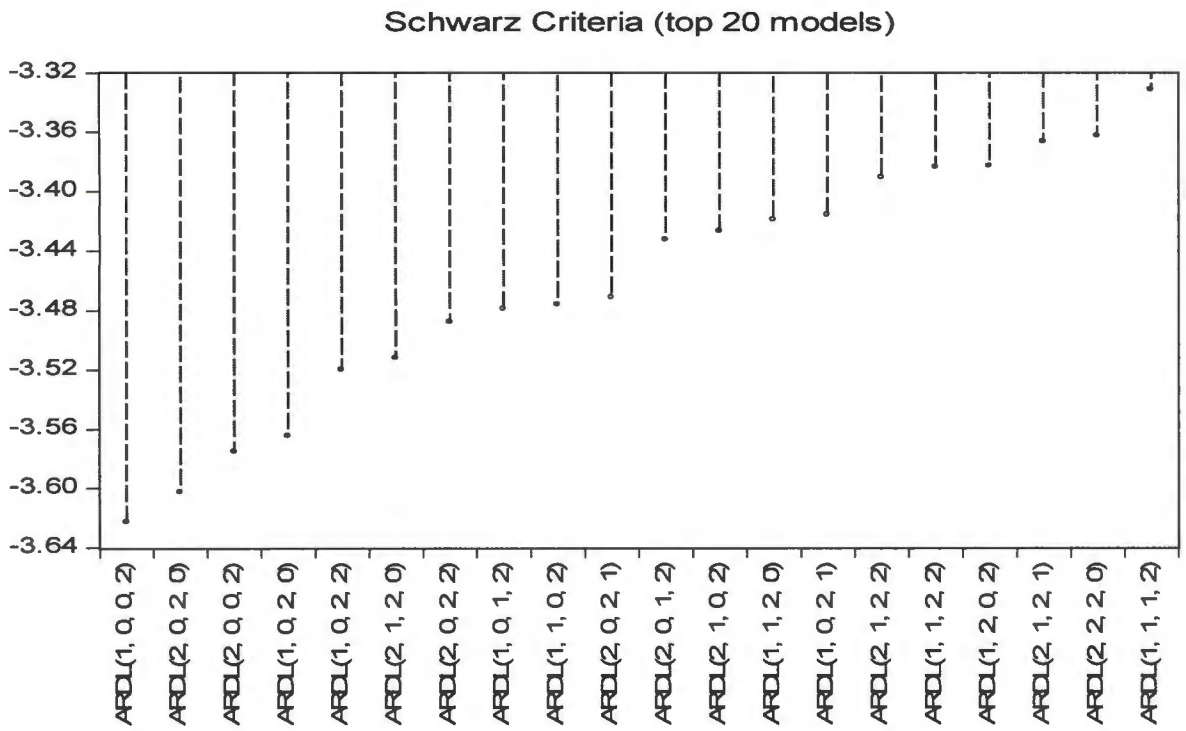
applied to a small sample size (Javed & Mantalos, 2013:1925). In contrast, diverse empirical studies have recognized the Schwarz Information criterion (SIC) to be the best criterion when conducting a study with a small sample size for it has more power and high consistency (Asghar & Abid, 2007) (Javed & Mantalos, 2013:1925) and (Ismail *et al.*, 2015:208).

In consideration to what is elucidated above with regards to the optimal lag selection, this study employed the Schwarz Information criterion (SIC) to test the cointegration among variables. The (SIC) is also applied to this study due to the small sample size used in this study. Additionally, the ARDL model was selected for the study based on the results obtained from the unit root and stationarity tests suggesting a mixture of I (0) and I (1) variables. The choice of the optimal lags using an appropriate information criteria (SIC) played an important role in applying ARDL model free of heteroscedasticity and serial correlation. Thus, the estimated long run and short run relationships among variables are reliable.

5.5.1 Lag length selection

Narayan (2004), Pesaran and Pesaran (1997) state that the maximum number of lags appropriate to the ARDL modelling in annually data is two lags, and four lags for annual data. As the current analysis employs annual data, a maximum of two lags were identified for both the explained and explanatory variables in estimating ARDL (p, q, r, s), with the assessed total number of regressions represented as (N+1)k, where "N" denotes the optimal number of lags and "k" represents the number of variables included in the equation. As displayed on figure 5.3, among the top 20 model that can be estimated for the study, the best model is ARDL (1, 0, 0, 2). In other words, one lag is used for the dependent variable (employment by the steel industry in the Emfuleni municipality), zero lag is used for total export and GDP, while two lags are used for labour remuneration (wages).

Figure 5.3: Best model selection



Source: Compiled by author

5.5.2 Long run relationship: Bound test for cointegration

To determine the existence of long run relationship the bound test for cointegration was performed based on the hypotheses formulated in the methodology chapter.

H_0: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = 0$: no long run among variables

H_1: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq 0$: long run relationship exists among variables

The results from the bound test are displayed in table 5.5. In this table, the value of the F-statistics together with lower and upper bound critical values are presented. The value of the F-statistics is 5.343586 exceeding the all upper bound critical values be it at 10 %, 5% and 1% level of significance. Since the computed F-statistics is greater than the upper bound critical values, the null hypothesis suggesting the absence of cointegration or long run relationship among variables is rejected in favour of the alternative hypothesis. The fact that the null hypothesis is rejected implies that variables selected from steel industry (Exports, GDP and Wages) have as significant impact on employment level in the Emfuleni municipality.

Table 5.5: Results of bound test for cointegration

F- Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.343586	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Compiled by author

Furthermore, the estimated s for cointegration providing the magnitude effect of the explanatory variables on the explained variables was estimated. Table 5.6 exhibits the long run coefficients of independent variables. The total exports and the share of GDP from the steel industry have a positive impact on employment growth in the Emfuleni municipality. As shown in Table 5.6, if the total exports increases by 10 percent, employment in Emfuleni municipality will increase by almost 0.6 percent. Additionally, if the share of GDP from steel industry increases by 10 percent, employment will approximately increase by 0.5 percent. Nonetheless, the labour remuneration of wages has a negative impact on the long run state of employment in the Emfuleni municipality. A 10 percent increase in wages causes employment to decline by almost 0.8 percent. This inverse relationship between wages and employment growth is justified by various theories and empirical studies (Habanabakize, 2018; Halko, 2005; Phillips,1958; Seputiene, 2011).

Table 5.6: The long run coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNEXP	0.057134	0.019411	2.943431	0.0107
LNGDP	0.053779	1.166919	3.473916	0.0037
LNWAGE	-0.075075	0.130016	-0.577429	0.5728
C	14.56026	0.829986	17.54278	0.0000

Source: Compiled by author

The presence of cointegration among variables requests the estimation of the error correction model (ECM). Using the ARDL model, the error correction model (ECM) was estimated. The validity of the model was assessed in terms of the goodness of fit. Additionally, several

diagnostic tests were also used. These tests comprise of LM test for serial correlation, the Jacque-Bera test for normality, the Ramsey RESET specification test, and the White test to assess if variables in the model are homoscedastic. All these tests ascertained that the model (ARDL) employed to the study met all the desired econometric properties. That is to say that, the model's residuals are normally distributed, free of serial correlation and heteroscedasticity; and the model possesses a correct functional form. Consequently, the reported results are technically valid and reliable. In relation to the ECM, the long run equation representing the elasticity or responsiveness of employment towards changes within the explanatory variables is represented as follow:

$$\ln EMP = 14.56026 + 0.057134*\ln EXP + 0.053779*\ln GDP - 0.075075*\ln WAGE \quad (4.1)$$

5.5.3 Short run coefficients and the Error Correction Model

The coefficients exhibiting the dynamic short run relationship between the dependent and independent variables and the error correction are displayed in Table 5.7. The role of the error correction model is to provide the variables short run fluctuations while adjusting towards long run equilibrium. In this model, all the explanatory variables, namely exports, GDP and wages are statistically significant and have a positive effect on jobs or employment by the steel industry in the Emfuleni municipality. These variables being significant means that they play an important role in elucidating employment changes. Besides, the model's error correction term is negative and significant. This suggests that the model short run shocks tend to the adjustment in the long run. The error term absolute value of 35 indicates that approximately 35 percent of shocks or disequilibrium in employment is offset by short run adjustment each year.

Table 5.7: Short run coefficients and the Error Correction Model

ECM Regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LNEMP(-1))	0.328134	0.143514	2.286418	0.0412
D(LNGDP)	0.812679	0.210914	3.853128	0.0023
D(LNGDP(-1))	1.019202	0.260565	3.911511	0.0021
CointEq(-1)*	-0.351246	0.058849	-5.968576	0.0001
R-squared	0.711620			
Adjusted R-squared				
Sum squared resid				
F-statistic				
Durbin-Watson stat			2.328509	

Source: Compiled by author

5.5.4 Toda Yamamoto Granger Causality Test

The application of the Autoregressive Distributed lag model (ARDL) in the study is significant to estimate the presence or absence of cointegration or long run relationship between the explained and explanatory variables. However, this approach does not provide the direction of the relationship. The study therefore, employed the Toda-Yamamoto causality test to examine the causal relationship between employment and the considered variables from the steel industry namely exports, GDP share and labour remunerations. The results portrayed in table 5.8 provide the estimated Toda-Yamamoto non-causality test outcome.

The Toda-Yamamoto Granger non-causality approach examines the null hypothesis of non-causal relationship against the alternative hypothesis of the presence of causality between variables. In this regard, three outcomes can be abstained from the test. It is either one-way causal relationship, two-ways causal relationship or no causality between variables at all. The results suggest only a single causal relationship between the dependent and independent variables. That is, the unidirectional causality between wages and employment. This implies that other explanatory variables such as exports and GDP have no short run causality on steel employment in the Emfuleni municipality. Wages causes fluctuations not only in employment

but also in GDP. A unidirectional causal relationship exists between wages and GDP. Additionally, changes in GDP can also be caused by employment level.

Table 5.8: Toda –Yamamoto Causality (modified WALD) Test Results

Null hypothesis	Chi-sq	Prob.	Granger Causality
LNEXP does not granger cause LNEMP	0.015162	0.9020	No causality
LNEMP does not granger cause LNEXP	0.054086	0.8161	
LNGDP does not granger cause LNEMP	0.114786	0.7348	Unidirectional
LNEMP does not granger cause LNGDP	6.600886	0.0102*	Causality LNEMP → LNGDP
LNWAGE does not granger cause LNEMP	8.032492	0.0046*	Unidirectional
LNEMP does not granger cause LNWAGE	1.351912	0.2449	Causality LNWAGE → LNEMP
LNEXP does not granger cause LNGDP	1.846967	0.1741	No causality
LNGDP does not granger cause LNEXP	0.121866	0.7270	
LNEXP does not granger cause LNWAGE	1.600334	0.2059	No causality
LNWAGE does not granger cause LNEXP	0.299371	0.5843	
LNGDP does not granger cause LNWAGE	0.833470	0.3613	Unidirectional
LNWAGE does not granger cause LNGDP	4.596571	0.0320*	Causality LNWAGE → LNGDP

Source: Own elaboration

5.5.5 Residual diagnostic tests

To avoid the conventional econometric problems which overlook the violation of some of classical linear model assumptions, the residual diagnostic tests were applied to the study to assess whether the ARDL model used in the study meets the stochastic properties. These stochastic properties consist of, *inter alia*, normality, parameter stability, autocorrelation and heteroscedasticity (Takaendesa, 2006:100). Based on the results in table 5.9, it obvious that the underlying model passed all the diagnostic tests, namely normality, serial correlation and heteroscedasticity as indicated by the probability value which exceeds 5 percent level of significance. All the null hypothesises suggesting that residuals are normally distributed, homoscedastic and serially uncorrelated were not rejected.

Table 5.9: Results of diagnostic tests

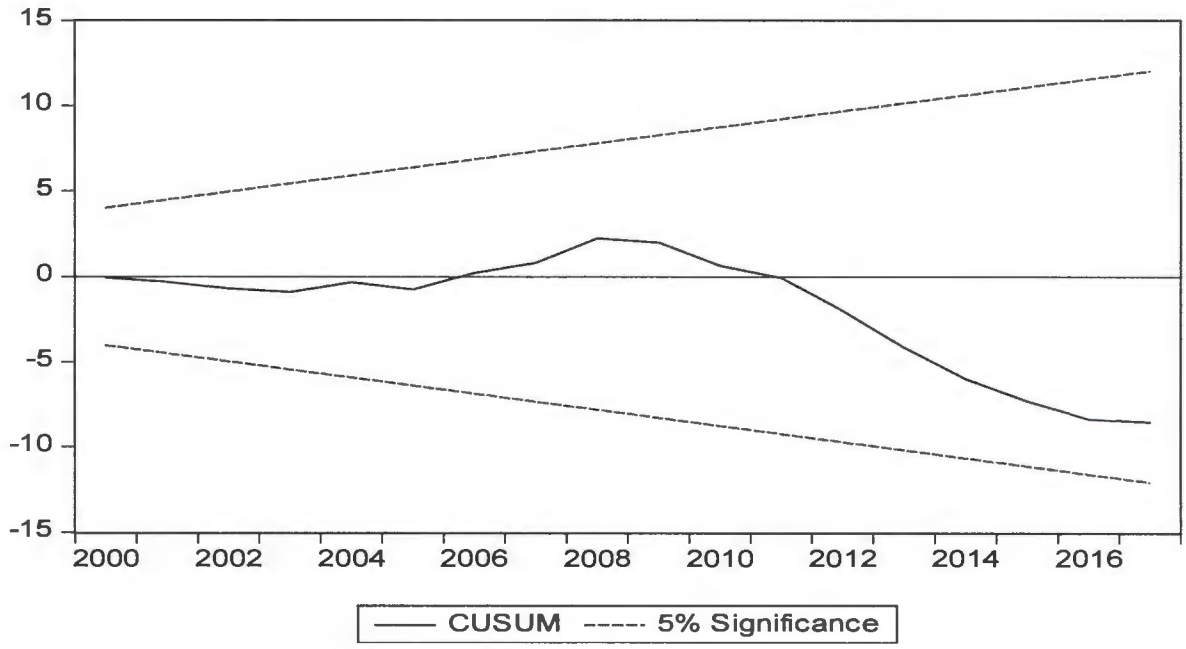
Test	H0	P-value	Decision	Conclusion
Jarque-Bera	Residuals are normally distributed	0.71744	reject H0	Residuals are not normally distributed.
L M Test	No Serial correlation	0.9851	Fail to reject H0	No serial correlation in the model.
White (CT)	No Heteroscedasticity	0.2570	Fail to reject H0	No Heteroscedasticity in the model.

Note: * failure to reject null hypothesis at 5% level of significance.

Source: Compiled by author

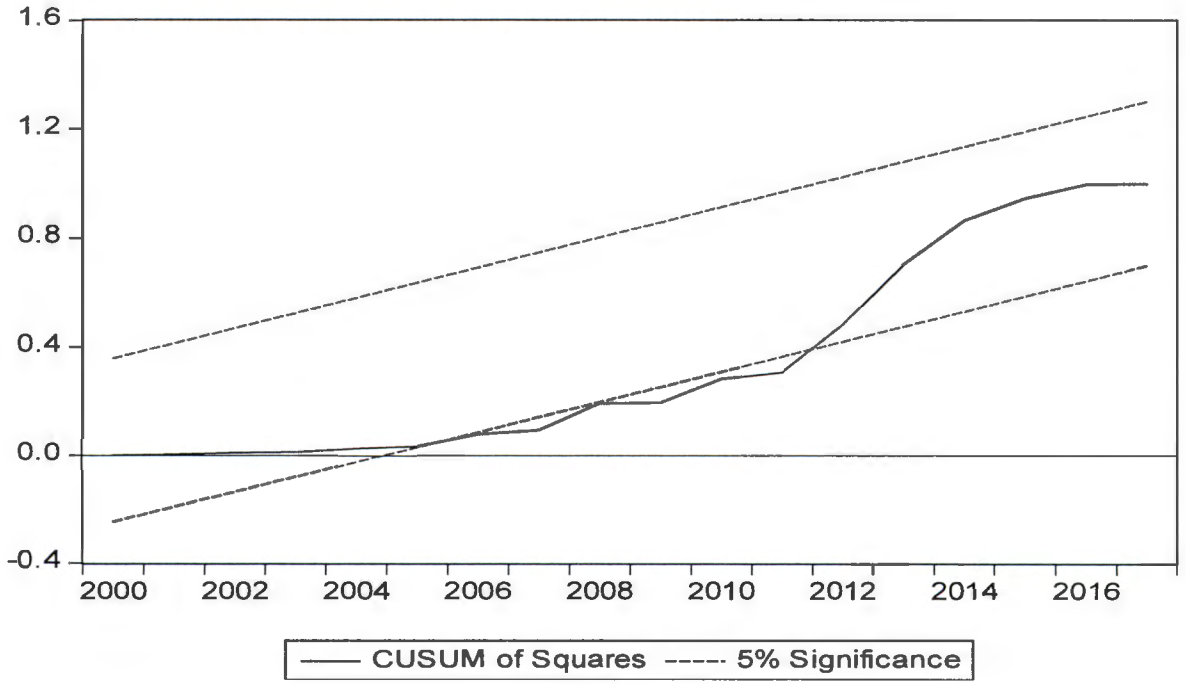
In support to the diagnostic test represented in table 5.9, the research found a necessity to conduct the stability tests. The stability tests assist in evading the model misspecifications that results from time series volatility (Pesaran & Pesaran, 1997; Zanini *et al.,* 2000). Accordingly, this study applied the Cumulative Sum of Recursive Residuals (CUSUM) to assess the model and parameters' stability as recommended by Lee and Strazicich (2004:132). The CUSUM of squares test was employed to assess the random movements. The random movements are those that are not necessarily generated by structural change in coefficients (Brown *et al.,*1975). As displayed in figure 5.4 and figure 5.5, the graphical reorientation of CUSUM test and CUSUM of squares test indicates that the model employed in the study is stable for the blue line lies between the red lines. In other words, the plots for both tests remain within the critical bounds at 5 percent level of significance. Therefore, the model parameters are also stable. These results together with the results in table 5.9 confirm validity and robustness of the model employed to estimate the long run and short run relationships among variables.

Figure 5.4: CUSUM test results



Source: Compiled by author

Figure 5.5: CUSUM of Squares test results



Source: Compiled by author

5.6 CHAPTER SYNOPSIS

The aim of this chapter was to empirically establish the long run and short run relationship between employment by the steel industry in the Emfuleni municipality and other variables namely exports, GDP and labour remuneration. The chapter started the analysis with the graphical representation, descriptive statistics and correlation analysis. The stability and units root tests conducted in the chapter revealed that the dataset used for analysis contains a mixture of variables. In other words, the order of integration for the dataset was found to be a mixture of I (0) and I (1). Having identified the order of integration of integration for variables under the study, the ARDL model was the appropriate model to estimate the relationships among variables. Using the abovementioned model, the finding confirmed the presence of long run relationship or cointegration among variables. The existence of cointegration among variables implied the estimation of short run relationship based on the error correction model (ECM). Besides the long run relationships among variables the ECM analysis identified that the significance of independent variables in the short run. Thus, exports, GDP and labour remuneration from steel industry possess a short run impact on employment level in the Emfuleni municipality.

Furthermore, the chapter analysed the causal relationship among variables. The results from Toda-Yamamoto tests revealed that among three independent variables, only labour remuneration (wages) can cause short run changes in employment. Additionally, wages and employment can cause changes to GDP. To ensure the validly of the model used in the study and accuracy of the obtained variables, various diagnostic tests were conducted. The results from diagnostic tests confirmed the validity and robustness of the model. The findings of the study are therefore accurate and reliable.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Lack of employment and employment opportunities can have dire effects on a community and its economy. Similarly, unemployment contributes to poverty and reduced standard of living. It has been proven undoubtedly that the manufacturing sector is a source of sustainable economic growth and jobs for any economy. The ability of the manufacturing sector to be a source of economic growth and jobs is linked to its multiplier effects which generates growth and creates jobs in the primary and service sectors as well. The theories and policies about the manufacturing sector assert this important role played by the manufacturing sector as a source of employment and economic growth. Inversely, some of the South African policies advocate for the development of the manufacturing sector due to the benefits that the sector has on the economy particularly in creating jobs. Countries such as China and India were able to move from being stagnant undeveloped economies to developed economies and correspondingly experienced increased employment rate, thus elevating economic growth and sinking poverty rates as a result of promoting the full functioning of the manufacturing sector, particularly the steel industry.

The manufacturing sector, particularly the steel industry, has been the dominant economic activity in the Emfuleni municipal area and a main source of employment for a number of years but its dominance has been declining each year. The steel industry in Emfuleni has been providing less jobs due to various factors associated with economic downturns and cheap imports from China. The decline in the number of jobs offered by the steel industry in Emfuleni raises a serious concern as two thirds of households in Emfuleni are depended on the steel industry for sustainability. This indicates that the continued decline in the number of jobs offered by the steel industry will have negative consequences on the Emfuleni economy and community.

The econometric analysis done in the study revealed the existence of a positive correlation between employment by the steel industry in Emfuleni municipality and exports and GDP respectively. This sites that the steel industry has the influence to generate growth in the Emfuleni economy as exports bring in valuable foreign earnings and GDP is a sign of growth

of the economy. Similarly, the total exports and the share of GDP from the steel industry has a positive impact on employment growth by the steel industry in Emfuleni municipality

6.2 RECOMMENDATIONS

The steel industry has been a great source of employment and economic growth for countries such as China and India as covered in this study. These countries achieved this millstone through the good performance of their steel industry. Prior to them having an active steel industry, these countries were undeveloped, had low growth rates and high unemployment rates. Econometric analysis done in this study asserts this statement and proved that employment by the steel industry in Emfuleni has an effect on GDP, exports, and remuneration in the area.

The steel industry was the main economic activity in Emfuleni local municipality for a number of years, but its employment ability has been diminishing each year. This calls for intervention given the important role that the steel industry has played for other economies and the fact that two thirds of households in Emfuleni rely on the steel industry for survival.

The study thus recommends that greater investment be made into the steel industry. From a policy perspective, the government must create an enabling environment for the steel industry by providing the required infrastructure. Financial investment or subsidies by the government into the steel industry must be made as this gesture can enhance production capabilities that will sustain the steel industry and inversely grow the sector as well. Part of the production problems experienced by the steel industry in Emfuleni is the use of old and outdated machines that hamper production and sometimes gets broken. Support from government or funding towards new machinery will enable improved production outcome by the steel industry, reduced production cost and at the same times the steel industry will be able to retain and hire more workers.

Sustained and stimulated steel production activities in Emfuleni could result in increased employment for local residents and high employment rates results in economic growth as well. Employment of people as done by the steel industry in Emfuleni as opposed to them being unemployed preserves developed skills which can be positive for the current and future

productivity of the economy. Unlike coal which can be substituted with renewable energy, steel has no substitute and remains a critical ingredient for the county's development needs. This indicates that there is always potential for the growth of the steel industry in Emfuleni and South Africa. If the country experiences positive growth rates, increased activity is expected in roads, housing, transport networks and construction which are all dependent on steel. Because the steel industry has multiplier effects and is the largest economic activity in Emfuleni, a small percentage increase in the demand for steel will have a considerable effect on the economy of Emfuleni. This will automatically stimulate other sectors of the economy as well, particularly the service, trade and finance sectors. Thus, the well-functioning steel industry is an important and essential ingredient for the Emfuleni economy. A continued loss of employment opportunities or shedding of jobs by the steel industry will be very detrimental to the Emfuleni economy as the economy is greatly supported by this sector.

Importantly that study has discovered that wages has a negative impact on the long run state of employment by the steel industry the Emfuleni municipality. A 10 percent increase in wages causes employment to decline by almost 0.8 percent. From a labour perspective, government and authorities could find suitable ways to balance the ratio between wages and production so that the steel industry does not pay more for wages whereas production is stagnant. A balanced ration of wages and production implies that the steel industry will be operating at sustained level and will be able to create more jobs with an increase in production

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TO WHOM IT MAY CONCERN

CERTIFICATE OF EDITING A DISSERTATION

This serves to confirm that I have read and edited Ms Monyadiwe Ramatlotlo's dissertation titled: **The impact of the steel industry on the labour force – the case of Emfuleni municipal area (1996-2017).** The candidate corrected the language errors identified. The document is of an acceptable linguistic standard.

Thank you

Yours Faithfully

J.J.R Moletsane

.....

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