

**EXPLORING THE RELATIONSHIP BETWEEN PRODUCER PRICE INDEX AND
CONSUMER PRICE INDEX IN SOUTH AFRICA**

By

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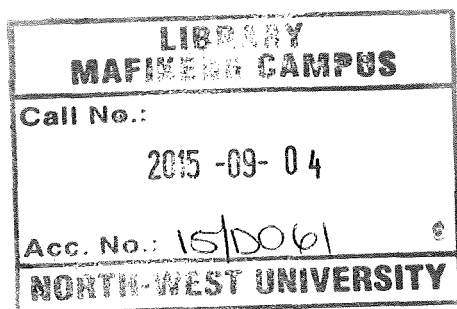
**A DISSERTATION IN FULFILMENT OF THE REQUIREMENT FOR MASTERS
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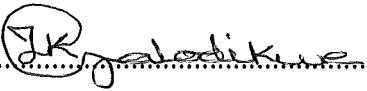
ABSTRACT

This paper investigates the relationship between consumer price index and producer price index in South Africa using correlation analysis, regression analysis and scatter plot using the data for the period 1970-2012. A number of studies have been conducted in different countries that have adopted inflation targeting as a monetary policy framework. The analysis of the scatter plot showed visually with the straight line that there is a linear relationship between Producer Price Index (PPI) and Consumer Price Index (CPI), and the correlation coefficient attested that there is a strong positive linear relationship between PPI and CPI. This implied that when there is a (positive or negative) change in the producer price there will also be a positive change in the consumer price index which doesn't automatically mean change in consumer prices will change producer prices. The model was also significant with p (price) value less than 0.05 which concluded that the model fits the data very well. In other words the PPI explains a significant amount of variability of the CPI. Regression analysis was also performed to assess the significance of the PPI in explaining the variability or behaviour of CPI. From the data used it showed that an increase of one unit for PPI amounts to a 0.46 increase in CPI.

Key words: Inflation, Consumer Price Index, Producer Price Index, Economic Growth

DECLARATION

I, undersigned, hereby acknowledge that the contents of this thesis is my own work, except where otherwise specified, and has not been submitted, in part or full, to any other university for the purpose of obtaining a degree.

Signature.. .....

Date..24-NOV-2014.....

IVAN KEAORATA GALODIKWE

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ABBREVIATIONS

ANOVA	Analysis of Variance
BLS	Bureau Labour Statistics
COLI	Cost-of-living index
CPI	Consumer Price Index
CPIX	CPI excluding interest rates on mortgage bonds
EPI	Export Price Index
FIFO	First-in, first-out
GDP	Gross Domestic Products
IPI	Import Price Index
IT	Inflation Targeting
LIFO	Last-in, first-out
P	Price
PPI	Producer Price Index
StatsSA	Statistics South Africa
SARB	South African Reserve Bank
SAS	Statistical Analysis Software
SMEs	Small to Medium Enterprises
WPI	Wholesale Price Index

GLOSSARY OF TERMS

Basket A specified set of goods and services. In a CPI context, the set may comprise the actual quantities of consumption goods or services acquired or used by households in some period, or may be made up of hypothetical quantities

Cost-of-living index An index that measures the change between two periods in the minimum expenditures that would be incurred by a utility-maximising consumer, whose preferences or tastes remain unchanged, in order to maintain a given level of utility (or standard of living or welfare).

Consumer Price Index A monthly or quarterly price index compiled and published by an official statistical agency that measures changes in the prices of consumption goods and services acquired or used by households. Its exact definition may vary from country to country.

CPI excluding interest rates on mortgage bonds. The *CPI* excluding interest rates on mortgage bonds (*CPIX*) is derived by excluding the interest rates on mortgage bonds from the basket of goods and services, which is used to compile the Consumer Price Index.

Deflator A price index that is used to divide the value of some aggregate in order to revalue its quantities at the prices of the price reference period.

Gross Domestic Products	The total value of goods and services produced within the geographic boundaries of a country for a specified period of time
Index Number	An index number is an economic data figure reflecting price or quantity compared with a standard or base value.
Inflation	The persistent change in the general level of prices.
Inflation Rate	The annual percentage change in the CPI for all items of the relevant month of the current year compared with the CPI for all items of the same month in the previous year expressed as a percentage.
Inflation Target	In setting monetary policy, the Treasury determines a range or target in the chosen inflation measure (e.g. CPI) as part of an approach to reduce inflation. This is done by adjusting chosen financial instruments (e.g. interest rates) in order to contain inflation within the target
Headline CPI (South Africa)	This monthly price index is compiled and published measuring changes in the prices of consumption goods and services for all urban areas.
Laspeyres Price Index	A price index defined as a fixed weight, or fixed basket, index which uses the basket of goods and services of the base period. The base period serves as both the weight reference period and the price reference period. It is identical with a weighted

arithmetic average of the current to base period price relatives using the value shares of the base period as weights. Also called a “base weighted index

Paasche Price Index

A price index defined as a fixed weight, or fixed basket, index which uses the basket of goods and services of the current period. The current period serves as the weight reference period and the base period as the price reference period. It is identical with a weighted harmonic average of the current to base period price relatives using the value shares of the current period as weights. Also called a “current weighted index”

Price Index

A price index is a normalised average (typically a weighted average) of prices for a given class of goods or services in a given region, during a given interval of time. It is a statistic designed to help to compare how these prices, taken as a whole, differ between time periods or geographical locations.

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CHAPTER 1

1.1 Introduction

There has been a series of formal meetings since the 1920s trying to find out certain forms of price stability as the main objective of the Federal Reserve System's monetary policy. Currently there is a broad global accord among the public, policymakers and economists that inflation is costly and that stable price is preferred, demonstrating that there is an agreement the central objective of the European Central Bank is stable price. Most of the countries such as Australia, Canada, the United Kingdom and others have an official inflation targeting framework as policy utilised to achieve price stability (Saxton 2004).

According to Uwilingiye (2010), during the 1970s and 1980s after most industrialized countries experienced high rates of inflation, price stability became popular as the main objective of monetary policy. A rising number of central banks have since adopted the inflation targeting framework. The objective of stabilising price is based on the suggestion that long-run economic growth is affected by high inflation. As such, inflation forecasting is imperative in order to make informed decisions. Economists have argued that the PPI can be a useful indicator of future consumer inflation, as changes in prices paid by producers (changes in costs) often pave the way to changes in prices paid by consumers. It is therefore important to look at the correlation or causality between the two indices.

Inflation can impose costs on real economic output and makes it difficult to use the price mechanism as a tool for efficient allocation of resources. The cost may be higher for the markets that are still growing than in the advanced economies as inflation is still higher than estimated in many of those markets and in general, those who are in lower income brackets may find it challenging to evade the cost of price increase and inflation including other alterations such as misaligned nominal exchange rates. The most important way through which inflation may have an effect on the economy needs to be clarified to policy makers in order to reduce the negative economic effects and welfare costs of rising inflation rate (Chowdhury 2014). Also, it should be emphasized that inflation can reduce economic growth through its effect on relative prices and uncertainty, and can increase growth through increasing price flexibility and allowing the real interest rate to become negative. Inflation

can also affect government revenues. Inflation can affect government revenue through one off windfall gains or through more sustainable channels (Abedian and Biggs, 1998).

As such, inflation targeting is used by many central banks to direct the performance of monetary policy. The first country to implement this strategy was New Zealand in 1990 and followed by numerous emerging-market and other industrialised economies, including Australia, Brazil, Canada, Chile, Mexico, Sweden and the United Kingdom (Merwe 2004).

1.2 Background of the study

In 1990, the South African Reserve Bank (SARB) pursued informal inflation targeting when monetary policy put considerable importance on stable price to reduce inflation rates. However, the South Africa inflation targeting was adopted as an official framework for the monetary policy in February 2000. The target range of 3-6% was set by the SARB. The majority of economists consider inflation targeting as an important tool for achieving less and stable inflation. This helps the SARB to be accountable and enforce the SARB's mandate (Klein 2012).

Hill (2004) indicates that monetary policy should mainly be concerned with pursuing stable price. Though, differences exist in terms of how to achieve this objective in an effective way. Much debate on the level on which the inflation rate should be targeted has taken place and on the forecasting methods for the Central Bank to predict future inflation patterns in order to align itself to the target. The general forces of inflation will naturally cause producer and consumer prices, as well as other types of prices such as wages, to move together over time

The CPI is used as a yardstick for private and public sector wage adjustment rather than monetary policy base. Also Hill further points that other researchers argue- that the CPI as an inflation target leaves out prices of investment goods, public-sector goods and services, exports, and assets such as land and equities, and is therefore considered to be too contracted(Hill 2004).

Clark (1995) shows that the production chain only weakly links consumer prices to producer prices, that this means that the PPI changes sometimes help predict the CPI changes but fail

to do so systematically. However, Sidaoui et al. (2009) in the case of Mexico suggest that the PPI may have a significant predictive content for the subsequent development of the CPI inflation. It would be normal to anticipate that changes in producer prices as they transfer over during the production processes, should ultimately affect consumer prices. Closer scrutiny on the relationship between the two indices is imperative. In this case, it would also be natural, from a statistical point of view, for producer prices to “cause” consumer prices. The CPI which measures the average price that consumers spend on goods and services in a market based ‘basket’ of goods and services and the PPI which is an index that tracks the rate of change in the prices charged by producers of goods are the two primary measures of inflation for South Africa.

There has been some discussion in economic literature about leads and lags relating to prices at stages of production. According to different researchers:

- Silver and Wallace (1980) conclude that the relationship between consumer and producer prices is often characterized as one-sided with changes in producer prices leading to changes in consumer prices.
- Colclough and Lange (1982) oppose this by emphasizing- the demand side. According to them, changes in the demand for final consumer goods affect the input prices-cost of production. This is supported by the empirical evidence of Clark (1995) which suggests there is a weak linkage from consumer price to producer price during the production chain. The PPI changes sometimes help predict the CPI changes but fail to do so systematically.
- According to a study by Ghazali et al. (2008) in Malaysia, the results show long-run association between the CPI and PPI. Evidence of a uni-directional causality running from the PPI to CPI was also found. According to this study it means that the CPI and PPI move together in the long-run. This evidence also found a uni-directional link from the PPI to the CPI without significant feedback.
- Evidence from Mexico suggests that the PPI may have significant predictive content for the subsequent development of CPI inflation (Sidaoui et al. 2009).

- Akcay (2011) indicated that there is a uni-directional causality between the PPI and the CPI. This runs from the PPI to the CPI in Finland and France; is bi-directional in Germany; and no significant causality is detected in the Netherlands and Sweden,
- Shahbaz et al. (2012) in the Pakistani case also found a uni-directional causal relationship running from the CPI to the PPI which varies across frequencies i.e. the CPI Granger causes the PPI at lower, medium as well as higher levels of frequency reflecting long, medium and short-run cycles. This implies that the CPI should be a leading indicator for important policy decisions pertaining to monetary or fiscal policies in Pakistan.
- In the Colombian case Wilmer et al. (2013) found that the PPI leads the CPI and depending on the group being analyzed, this leadership might anticipate evolution of the CPI by one month or even longer.
- In some cases e.g Spain, the CPI leads to the PPI, while there is bidirectional causality between the CPI and the PPI for other countries (Woo et al. 2013)
- In the case study for Turkey, Ulke and Ergune (2014) emphasize that in spite having an impact in the long-run, the change in the CPI does not have an effect on the PPI in the short-run. Excess demand may increase prices, this is known as demand pull inflation; this translates into a uni-directional long run causality from the CPI to the PPI.

1.3 Problem Statement

Fourie (1999) views inflation as an important macroeconomic problem. Others do not attribute much importance to inflation, but rather to collective economic challenges. This issue is still the focus of macroeconomic policy debate. The SARB is confident that the country would not have long term economic growth that is sustainable if does not device a mechanism to control inflation.

The SARB has an inflation target framework that is used as a tool to achieve and maintain price stability in the interest of balanced and sustainable economic growth. The central bank currently has a target inflation rate of between 3% and 6%, but this is set by the South African government. However, since the introduction of the inflation targeting framework, the central bank has constantly missed its target.

According to Merwe (2004), in 2002, during the first year for which an inflation target was specified on the basis of an average annual rate of increase of between 3 and 6 per cent, the rate of increase in CPIX averaged 10 per cent. The actual inflation rate was therefore 4 percentage points above the upper limit of the target range. According to StatsSA, in July 2009, inflation was above the set target range of (3% - 6%) by 0,8%; and again for the period April and May 2014 it continued to increase unrelenting, breaching the target band since August 2013. Headline CPI annual inflation rate for April 2014 was at 6.1 per cent, it was 6.1% in April and 6.6% in May 2014 (Stats SA 2014). It is evident from the above trends that exploring the relationship between inflation indices is important for inflation targeting by the SARB. Primary measures of inflation in South Africa are the CPI and the PPI as such there is need for a clear understanding of the causality between the two indices.

At the beginning of 2014, the performance of the Rand against the currencies of South Africa's trade partners and the increase in the price of petrol had a negative effect on the economy. The rapidly rising trends suggest the significant input cost pressure on the South African market and producers, and this raises the concern that increases in the prices of petrol and intermediate goods may be passed -on to consumers, resulting in a higher rate of inflation in consumer prices (SARB 2014). This research seeks to examine whether price increases at the early stages of production should be expected to move through the production chain, leading to increases in consumer prices or vice versa.

It would be normal to anticipate that changes in the producer prices, as they transfer over during the production processes, should ultimately affect the consumer prices. Closer scrutiny of the relationship between the two indices is imperative. In this case, it would also be natural, from a statistical point of view, for producer prices to "cause" consumer prices or for consumer price to "cause" producer price.

1.4 Aim of the study

To examine the causal relationship between the PPI and the CPI

- Whether the PPI causes the CPI; or
- whether the CPI causes the PPI.

1.4.1 Objectives of the study

The purpose of this study is to examine relationships between the PPI and the CPI in South Africa.

1.5 Hypothesis to be tested

Null hypothesis

H_0 = Changes in producer prices precede change in consumer prices

Alternative hypothesis

H_1 = Changes in producer prices do not precede change in consumer prices

1.6 Significance of the study

The research findings will ensure better consumer inflation forecasting models and help the monetary authority in terms of decision making processes with regards to the causality (causal relationship) between the CPI and the PPI. Understanding the relationship between the two inflation indices is important to decision makers in the sense that change in one of them will help predict the reaction of the other. It would be normal to anticipate that changes to producer prices, as they transfer over through the production chain should eventually have an effect on consumer prices.

Therefore, from statistical point of view, it is significant to test the causality between the two inflation indices i.e. producer prices should Granger cause consumer prices or consumer prices should Granger cause producer prices. The information could be useful for the SARB

in discovering cost-push shocks and predicting future inflation by using the PPI. Also, it can help policy makers to depend more on the relation between the two indices.

The evidence of causality is useful for policy makers. If producer prices cause consumer prices, information on producer prices should offer valuable predictive power about consumer prices and then the authorities can identify cost-push shocks that help improve the forecasts of consumer prices inflation. Similarly, if consumer prices cause producer prices, information on consumer prices should offer valuable predictive power about consumer prices and then the authorities can identify demand-pull shocks that are used to help improve the forecasts of producer price inflation (Tiwari 2012).

1.7 Study limitations and delimitation

The limitation of the study is that it is based on the data for the chosen variables, with time series data from 1970 to 2012. There are four important price indices in the structure of economic statistics namely: the PPI, the CPI, the Export Price Index (EPI) and the Import Price Index (IPI). These indices are well known and closely monitored indicators of macroeconomic performance. They are direct indicators of the purchasing authority of money in different types of transactions and other flows involving goods and services. This research will focus on the PPI and the CPI. Both are used to deflate nominal measures of goods and services produced and consumed. It is worth noting that the "PPI for domestic output of South African industry group" was discontinued in December 2012 and was replaced by "PPI for final manufactured goods", hence the data from 1970 to 2012. Using the data from 1970 to 2014 will not be a true reflection because the two are not comparable.

1.8 Structure and organization of the study

The entire study comprises five chapters.

Chapter 1 reviews the literature and presents a brief introduction about the study in terms of emerging issues of the PPI and the CPI. In this respect the study discusses some concepts and issues regarding inflation targeting and tries to find out research gaps in the existing literature and then tries to fill these gaps by setting up clearly defined objectives.

Chapter 2 presents the theoretical and empirical literature review on the PPI and the CPI according to various schools of thought. It studies the causal relationship that may exist between the two.

Chapter 3 describes the methodological and conceptual aspects of the CPI and the PPI

Chapter 4 focuses on the results and interpretation of the data. It also presents the empirical results from the regressions depicted and interpretation of the regression results. It will be interpreted in detail in order for good conclusions and recommendations to be made

Chapter 5 present the summary, conclusion and recommendation of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This section covers the review of different literature on the theoretical and empirical literature. The chapter begins with an overview explaining inflation indices. The literature review will also look at the practical and conceptual issues related to the definition and measurement of inflation.

The study investigates the relationship between PPI and CPI in case of South African. It attempts to understand the nature and causes of these two inflation indices. The rest of the literature is organized as follows: overview and measurement of inflation, followed by types of inflation indices, discussion on various schools of thoughts on the causes of inflation and it further investigates theories on the casual relationship between the PPI and the CPI, whether producer prices leads consumer prices or consumer price leads producer prices? In addition the study investigates the direction of causality between the PPI and the CPI.

2.2 THEORETICAL LITERATURE

The theoretical literature looks at various schools of thoughts on the causes of inflation indices. It further examines the theories on the relationship between the PPI and the CPI.

2.2.1 OVERVIEW OF INFLATION

Inflation is mainly caused by an increase in the supply of money and credit. Generally, inflation is the increase in the supply of money and credit (Hazlitt 1965). According to Chernyshov et al. (2012), the word “inflation” refers to a general rise in prices measured against a standard level of purchasing power. Inflation is measured by comparing two sets of goods at two points in time. There are, therefore, many measures of inflation depending on the specific circumstances. The most well known are the CPI which measures consumer prices, and the

gross domestic products (GDP) deflator, which measures inflation in the whole of the domestic economy.

Gerdesmeier (2009) defines inflation as a general or broadly-based, increase in the prices of goods and services over an extended period which consequently leads to a decline in the value of money and thus its purchasing power.

Inflation is an increase in the average price of goods and services in terms of money. Inflation sometimes reaches extraordinarily high levels. The most extreme cases are hyperinflations, which are traditionally defined as periods when inflation exceeds 50 percent per month.

Inflation is costly and those costs vary with inflation. Inflation is also variable and difficult to predict. Firstly, in many models, steady inflation just adds an equal amount to the growth rate of all prices and wages and to the nominal interest rate on all assets. Secondly, readily identifiable cost of inflation is that nominal prices and wages must be changed more often, or indexing schemes must be adopted. The last cost of inflation that can be easily identified is that it distorts the tax system (Romer 2006).

These are the primary reasons for the policy of many central banks stating that inflation must be kept 'low and stable'. To this end, many central banks have adopted an inflation target (Andolfatto 2005).

A situation in which the rate of inflation is very high and/or rises constantly and eventually becomes out of control is called "hyperinflation". Socially, hyperinflation is a very destructive phenomenon which has far-reaching consequences for individuals and society as a whole. Although there is no generally accepted definition of hyperinflation, most economists would agree that a situation where the monthly inflation rate exceeds 50 % can be described as hyperinflation (Gerdesmeier 2009).

2.2.2 THE IMPORTANCE OF INFLATION TARGETING AS MONETARY POLICY FRAMEWORK

There is a common agreement that low and stable inflation should be the main objective of monetary policy, especially since price stability is considered by main stream economists as a major precondition for faster and sustainable growth. A stable and conducive environment is important for long-term financing of government and private sector debt, including labour intensive industries such as construction and small to medium enterprises (SMEs). Nevertheless, for long term planning to succeed, it requires a thorough scrutiny on variables that influence inflation so that stable inflation can be realised (Kaseeram 2012).

The economic objectives can be best obtained, amongst other things, in a stable financial environment, and these can only be achieved if inflation is under control. The objectives of macro-economic policy include: the promotion of sustainable high economic growth, the creation of employment opportunities, the containment of inflation, improvement of the living conditions of all the residents of a country, and the elimination of income inequality amongst the population. Inflation targeting is becoming more popular as a policy goal among central banks for guiding their monetary policies.

Inflation is not good for the economy because it can distort prices, discourages savings and investment, stimulates capital flight (into foreign assets, precious metals, or unproductive real estate), inhibits growth, makes economic planning terrible, and, in its extreme form, induces social and political unrest. As a result, governments view inflation as a challenge and try to address it by adopting conservative and sustainable fiscal and monetary policies (Debelle 1998).

According to Merwe (2004), economists generally agree that monetary policy should be primarily concerned with the pursuit of price stability. However, they still differ on how this objective can be achieved most effectively. This debate remains unresolved, but a growing number of countries have adopted inflation targeting as their monetary policy framework. In 1990 New Zealand was the first country to implement this strategy. It was soon followed by a number of other industrialised and emerging-market economies, including Australia, Brazil, Canada, Chile, Mexico, Sweden, the United Kingdom and South Africa. Further, Merwe

explains that success was achieved with informal inflation targeting in bringing the inflation rate down to lower levels. After inflation in the CPI had generally fluctuated around a level of about 15 per cent in the late 1980s and the beginning of the 1990s, it moved below double digits in December 1992 and declined to an average annual rate of 5,2 per cent in 1999.

Uwilingiye (2010) mentions that many central banks have adopted formal inflation targets to guide the conduct of monetary policy. The inflation targeting (IT) monetary policy framework is considered by many main stream economists as the ideal vehicle for achieving the low and stable inflation objective. It is believed that this is due to the width of the inflation targeting band. In line with the inflation targeting literature on focal points, it is suggested that a narrower and possibly lower target band could be very helpful in improving the central bank's credibility and causing inflation expectations to converge to a focal point, and hence, bring down the mean and variance of the inflation rate.

2.2.3 TYPES OF INFLATION

Chernyshov et al. (2012) outline three major types of inflation, namely:

- **Demands pull inflation:** inflation from high demand for goods and low unemployment.
- **Cost push inflation:** presently termed "supply shock inflation," from an event such as a sudden decrease in the supply of oil, which would increase oil prices. Producers for whom oil is a part of their costs could then pass this on to consumers in the form of increased prices.
- **Built-in inflation:** induced by adaptive expectations, often linked to the "price/wage spiral" because it involves workers trying to keep their wages up with prices and then employers passing higher costs on to consumers as higher prices as part of a "vicious cycle. Built-in inflation reflects events in the past, and so might be seen as hangover inflation.

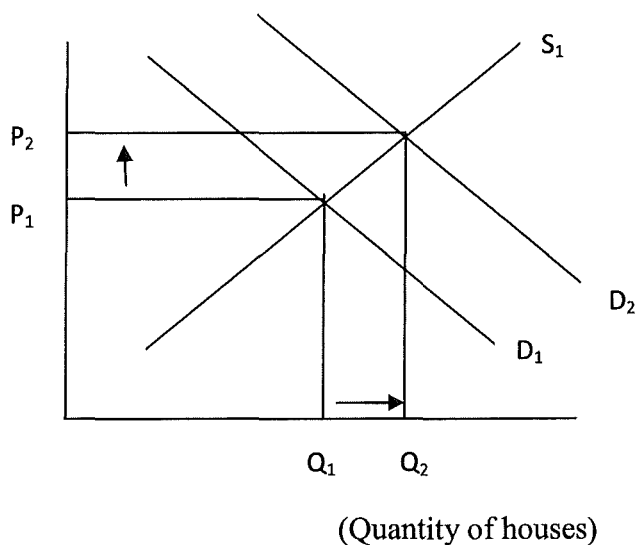
According to Fourie and Burger (2009) the term inflation is defined as sustained increase in the average price level, however, once-off or intermittent increases in the average price level do not constitute inflation. Though, one can make mention of inflationary movements in any single price or group of prices, there are four main types of inflation with various causes.

The first most important inflation is called demand-pull or excess demand inflation. It occurs when the total demand for goods and services in an economy exceeds the available supply, so the prices for these goods and services rise in a market economy.

This is the most common type and at times the most serious since consumers demand goods and services for survival and therefore if the supply is less than the demand this gives the suppliers an opportunity to increase the price in order to discourage demand. For example, rapid increase in the demand for houses produces this type of inflation because this puts pressure on property developers or suppliers of houses. Therefore, this results to an increase in house prices in order to ease the demand. The graph below depicts how the demand of houses increases the price. When quantity demand for houses increases from q_1 to q_2 , it causes the movement of prices of houses from p_1 to p_2 .

Figure 2.1: Demand Pull Inflation

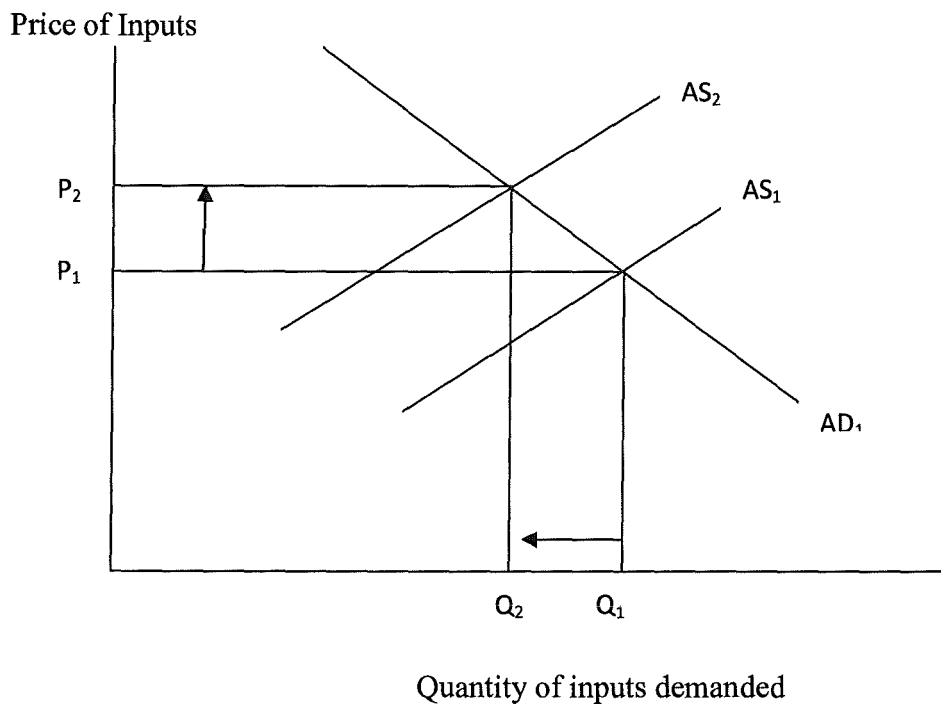
Price of houses



Other types of inflation occur more readily in conjunction with demand-pull inflation. The second common type of inflation is known as cost-push inflation. According to Fourie and Burger (2009), the name suggests that when the cost of production input increases, the producer is bound to increase the price in order to make a profit. An increase of salaries in excess of any gains in labour productivity, results to an increase of costs of production to the company. Therefore, the unit cost of production inputs pushes up the prices. This type of

inflation is less common than demand-pull, but can occur separately independently as well as in conjunction with it.

Figure 2.2: Cost Push Inflation



The third type of inflation is known as administered price inflation or pricing power inflation. This takes place in the event that businesses come to a decision to increase their prices to enhance their profit margins. Administered price inflation happens when the economy is performing well and sales are strong but not during recession. Also this type of inflation might be regarded oligopolistic inflation, because it has the characteristics of oligopolies that have the power to set their own prices and raise them when they decide it is the right time to do so.

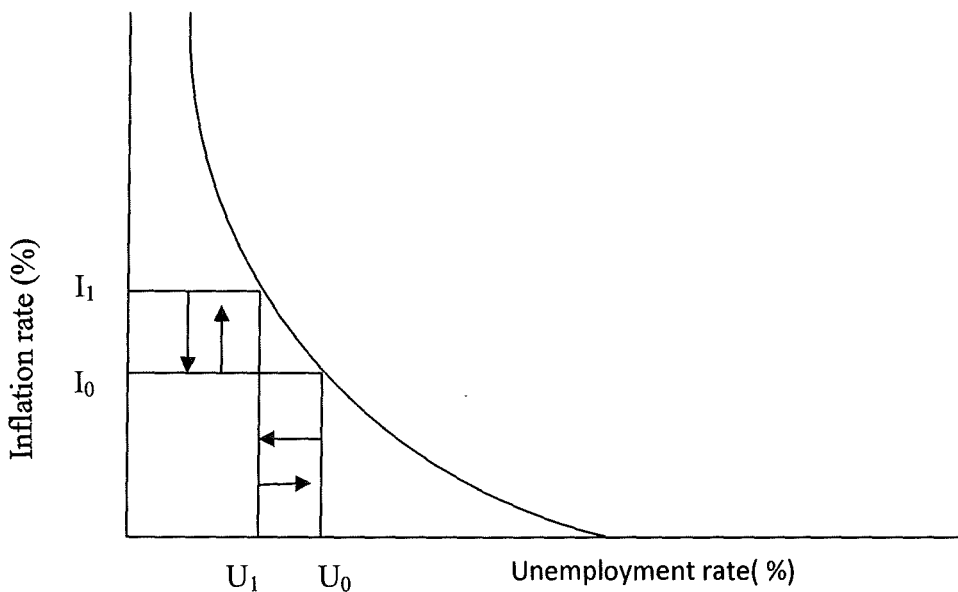
The fourth type is called sectoral inflation because it is determined by the value chain or the linkage among different suppliers of inputs material. If the industry affected by inflation a major supplier to many other industries e.g. steel and oil, this raises costs for industries using these products and forces up prices there also. So inflation becomes more widespread throughout the economy, although it originated in one basic sector.

2.2.4 CAUSES OF INFLATION

Inflation can reduce economic growth through its effect on relative prices and uncertainty, and can increase growth through increasing price flexibility and allowing the real interest rate to become negative. It can also affect government revenue through one off windfall gains or through more sustainable channels (Abedian and Biggs 1998).

The first modern hyperinflations took place as a result of the First and Second World Wars. According to Fourie (1999), in order to understand what causes high inflation, there is need to first understand what causes high money growth.

Figure 2.3. The Phillips curve



Phillips curve provides an interesting view of the historical course of the policy debate between the Keynesians and the Monetarists. The foundation of the Phillips curve is a negative correlation between the rate of unemployment and the rate of wages increases. In its popular form it refers to an inverse correlation between the rate of unemployment and the inflation rate. The diagram above shows that increase in I_0 to I_1 leads to a decrease from U_0 to U_1 and a decrease from I_1 to I_0 leads to an increase in U_1 to U_0 . I denote interest rates while U represents employment.

There are different schools of thought as to what causes inflation. Most can be divided into two broad areas: quality theories and quantity theories of inflation

The prevailing view in mainstream economics is that inflation is caused by the interaction of the supply of money with output and interest rates. Mainstream economists views can be broadly divided into two camps: the "monetarists" who believe that monetary effects dominate all others in setting the rate of inflation, and the "Keynesians" who believe that the interaction of money, interest and output dominate over other effects. Other theories, such as those of the Austrian school of economics, believe that an inflation of overall prices is a result from an increase in the supply of money by central banking authorities (Chernyshov et al. 2012).

2.2.5 DIFFERENT SCHOOLS OF THOUGHTS

2.2.5.1 Monetarism

According to Chernyshov et al. (2012), Quantity theory of money depends on one of the most schools of economic school of thoughts called monetarism. The empirical study of Monetarists shows that "inflation is always and everywhere a monetary phenomenon".

The Quantity Theory of Money confirms that the total amount of economic spending is mostly determined by the total amount of money available. From this theory the following formula was created:

$$P = \frac{DC}{SC}$$

Where P the general price level of consumer goods is, DC is the aggregate demand for consumers' goods and SC is the aggregate supply of consumers' goods. This formula explains that there is a negative relationship between the general price level of consumers' goods and the aggregate supply of consumers' goods, or if the aggregate demand increases relative to the aggregate supply of consumers' goods. As such economists who support the idea of Quantity Theory of Money also agree that the only cause for increase in the prices level in a growing economy is an increase of the total quantity of money in existence. (Chernyshov et al. 2012).

Fourie and Burger (1999) explain the view of the monetarist in terms of $MV = PY$ (price determination and changes in the price level). In terms of this, V assumed to be stable, and Y assumed to be stable at a full employment level. This formula means that only the long-run effect of money is on the average price level. Also, the money supply is the primary determinant of the average price level: $\Delta M \rightarrow \Delta P$ and without an increase in the money supply, the price level cannot increase. An analysis of the causes of inflation from the above theory explains that, firstly, without growth in the money supply, a sustained increase in the average price level cannot occur and secondly, too much money creation is the key explanation and cause of a sustained increase in the average price level. Any monetary expansion in excess of what is needed to facilitate the growing volume of transactions in a growing economy will only be reflected in increasing prices.

According to this theory of inflation the growth in the money stock must be fixed according to a monetary rule to allow the money stock to grow at a specified rate equal to the long-run growth rate in real GDP, and if the above formula is followed, the end results should be the absence of any inflation (Fourie & Burger 1999).

2.2.5.2 Keynesian

Furthermore, Fourie and Burger (1999) continue to distinguish the Monetarist theory from the Keynesian view. According to Fourie and Burger, the fundamental nature of the Keynesian approach is the difference between demand inflation and cost inflation or demand-pull and cost-push inflation. As such, a rise in total demand causes, through the interaction with total supply, upward pressure on the average price level accompanied by a rise in income. The basic idea of demand-pull is that extreme total demand or expenditure leads to price increases.

A reduction in aggregate supply causes an interaction with aggregate demand and the average price level to increase together with a concurrent decline in income. As a result, supply or cost pressure can be a cause of price increase (Fourie & Burger 1999).

2.2.5.3 Rational Expectations

This theory, which is sometimes referred to as “ratex” or “rashex”, is a view which emphasizes the need for economic actors to look rationally into the future and try to increase their general sense of future states of well-being, and not to simply respond to the immediate opportunity cost and pressures of the present.

In this view, future expectations and strategies are important for inflation and this means that central banks must establish their credibility in fighting inflation, or have economic actors make bets that the economy will expand (Chernyshov et al. 2012)

2.2.5.4 Austrian School

Chernyshov et al. (2012) continue to provide a different view by looking at this School which falls within the quantity theory of money. This school of thought does not support the idea that production will simply increase to meet the new demand as a result of more money in circulation, therefore prices will increase and the new purchasing power will disappear. According to Chernyshov et al., this view leads to the support for a commodity standard where all notes are convertible on demand to some commodity or basket of commodities.

2.2.5.5 Marxist Theory

In Marxist theory, the focus is on the labour required to produce a given commodity informed by the demand for that commodity by those with purchasing power. The price volatility in money terms are inconsequential compared to the rise and fall of the labor cost of a commodity. Marxist economics also supports the "classical" economic theories that argue that monetary inflation is caused solely by printing notes in excess of the basic quantity of gold (Chernyshov et al. 2012).

2.2.5.6 Supply-side Economics

Supply-side economics gives emphasis to the fact that inflation is always caused by either a rise in the supply of money or a decline in the demand for balances of money. The value of money is seen as being purely subject to these two factors. As such Supply-side economics

states that the money supply can grow without causing inflation as long as the demand for balances of money also grows (Chernyshov et al 2012)

2.2.5.7 Structuralist and Conflict Views of Inflation

The structuralist and conflict view identifies important factors which cause inflation in the economy. These factors are non-economic and they comprise of social, political and historical dimensions. According to this approach, inflation is easily initiated, propagated and entrenched. It is similar to the Keynesian approach in that demand-pull and cost-push elements are recognized. The conflict approach is more focused on the demands of various interest groups and the aggregate production capacity of the economy. It points to the conflict between labour and capital; race groups; the haves and the have nots; and those with political power and those without it as the fundamental cause of high inflation (Fourie 1999).

2.2.6 INFLATION MEASUREMENT

The focus in the measurement of inflation has increased significantly as many central banks have adopted inflation targets.

The average price level (inflation) is measured by different price indices, with the consumer price index being the most important. Most countries have a common approach to measuring inflation using the CPI. Purchasing patterns of consumers are analysed to determine the goods and services which consumers typically buy and which can therefore be considered as somehow representative of the average consumer in an economy.

In South Africa, the CPI and PPI are the two primary measures of inflation and both indices are published on a monthly basis. The CPI tracks the rate of change in the prices of goods and services purchased by consumers. The headline CPI is used as the inflation target measure which guides the SARB on the setting of interest rates. The PPI measures the average prices for a basket of inputs commonly purchased by producers. The PPI has two main functions i.e. to provide price indices for use in the deflation of gross domestic product data, and to provide a general measure of inflation (Fourie & Burger 2009).

2.2.7 CONSUMER PRICE INDEX

2.2.7.1 Definition and Measurement

The CPI is the most widely watched inflation measure. It has been the benchmark measure of the United States of America's inflation since World War I (Steindel 1997).

In South Africa, focus on the CPI started in 1917, covering large urban areas only. In 1997 smaller urban areas were included and the CPI excluding interest rates on mortgage bonds (CPIX) was introduced. It was discontinued in 2009 and the CPI for all urban areas was introduced as the main measure of inflation and as an inflation target measure. From January 2006, the CPI has been compiled using the prices of goods using the direct collection methodology in the metropolitan (primary) areas and in the other urban (secondary) areas, respectively (Stat SA, 2013).

The CPI is defined as a measure of the average change in prices of goods and service customarily purchased by families of wage earners and clerical workers living in cities of the United States (The Bureau of Labor Statistics (BLS), 2014).

The CPI is a price index of a particular basket called the CPI basket. The CPI basket contains basically all the goods and services consumed in a country. The composition of the basket and how the CPI is calculated are somewhat difficult and differ among countries. The composition of the basket is determined by the value of what is consumed in the country the larger the value of total consumption of a good or services, the larger the weight in the basket (Jochumzen, 2010).

According to Stat SA (2013), the CPI is a current social and economic indicator that is constructed to measure changes over time in the general level of prices of consumer goods and services that households acquire, use, or pay for. The index aims to measure the change in consumer prices over time. This is done by measuring the cost of purchasing a fixed basket of consumer goods and services of constant quality and similar characteristics, with the products in the basket being selected to be representative of households' expenditure during a year or other specified period. Such an index is called a fixed basket price index. Also, the

index aims to measure the effects of price changes on the cost of achieving a constant standard of living (i.e. level of utility or welfare). This concept is called a cost-of-living index (COLI). This definition is also echoed by Fourie and Burger (2009).

In South Africa, the CPI is used to measure inflation in the economy so that macroeconomic policy is based on comprehensive and up-to-date price information and to provide a deflator of consumer expenditure in the expenditure national accounts. In addition, it measures changes in the cost of living of households to ensure equity in the measures taken to adjust wages, grants, service agreements and contracts (Stat SA 2013).

The official CPI is based on a Laspeyres-type index in which the weights are based in a historical period. The CPI measures the cost of a pre-determined basket of consumer goods. The composition of the basket corresponds with the average consumption patterns of consumers, especially in urban areas. This cost is measured monthly and the amount then expressed as an index with a base year value of 100. The cost of the basket in other periods is then expressed relative to this base value. The CPI is calculated by Statistics South Africa (StatsSA) on the basis of monthly surveys of prices.

2.2.8 PRODUCER PRICE INDEX

2.2.8.1 Definition and Measurement

The PPI is widely used by businesses as a contract escalator and as a general indicator of inflationary pressures in the economy. This index is used for many purposes by government, business, labour, universities and members of the public. In addition to using the data for general economic analysis or as a deflator of some other quantity, private firms use the PPI data to assist their operations in a variety of ways. The PPIs are frequently cited for price escalation purposes in long-term sales or purchase contracts as a means of protecting both the buyer and the seller from unanticipated surges or drops in prices. Companies also use the PPI data to compare changes in material costs they incur against changes in the PPI for the material in question.

According to the BLS (2014), the finished goods index has been one of the most closely watched indicators of economic health since 1978. The PPI measures average changes in prices received by domestic producers for their output. Most of the information used in calculating producer price -indices is obtained through the systematic sampling of industries. The PPIs are frequently used in last-in, first-out (LIFO) inventory accounting systems by firms wishing to avoid the kind of phantom profits that might appear -in their books with a first-in, first-out (FIFO) inventory counting system.

In South Africa, the Producer Price Index tracks the rate of change in the prices charged by producers of goods (Stats SA, 2014).

The PPI which was commonly known as the Wholesale Price Index (WPI) is one of the oldest data published by the BLS. It has been compiled since 1902 by the federal government and the name was changed from the WPI to the PPI with the intention to re-emphasize the fact that the PPI was based on price received by producers of goods and services from whoever made the purchase (Bureau of Labor Statistics, 2014).

The Producer Price Index is calculated according to Laspeyres formula:

$$I_t = (\sum Q_a P_t / \sum Q_a P_0) \times 100,$$

Where

I_t is the price index in the current period;

Q_a represents the quantity shipped during the base period;

P_t is the current price of the commodity; and

P_0 is the price of a commodity in the comparison period

(BLS, 2014)

2.3 EMPIRICAL LITERATURE

Analyzing the relationship between the CPI and the PPI has been a target of many studies.

There have been several studies in international literature that tried to analyze the nature of the long-term relationship between the PPI and the CPI. Different results have been found, ranging from the PPI as a leading indicator of the CPI to a coincident relationship between them, or even the CPI anticipating the PPI.

Several studies for other countries have found a matching relationship between the two price indices. The evidence of causality is useful for policy makers. If producer prices cause consumer prices, information on producer prices should offer valuable predictive power about consumer prices, and then the authorities can identify cost-push shocks that help improve the forecasts of consumer prices inflation. Similarly, if consumer prices cause producer prices, information on consumer prices should offer valuable predictive power about consumer prices, and then the authorities can identify demand-pull shocks that are used to help improve the forecasts of producer price inflation (Tiwari, 2012).

2.3.1 CAUSAL RELATIONSHIN BETWEEN THE PPI AND THE CPI

There are two basic approaches about the PPI and the CPI causality relationship; these are the supply side and demand side. According to supply side approach, the PPI and the CPI are connected by the production chain. Advocates of the supply side approach claim that crude materials serve as inputs to the production of intermediate goods; these in turn serve as inputs to the production of final goods. Changes in prices of crude materials should pass on to prices of intermediate and final goods and ultimately to consumer prices (Clark, 1995).

The production chain view for the supply side argues that it is the changes in the PPI that cause the CPI because price changes in the raw materials should pass on to prices of intermediate goods as well as final goods sold to the consumer (Rogers, 1998). The opposite view is the demand side which according to Colclough and Lange (1982) states that changes in the demand for final consumer goods affect the input prices-cost of production.

According to the demand side approach, 'demand for final goods and services determines the demand for inputs between competing uses'. Thus, the cost of production reflects the opportunity cost of resources and intermediate goods, which in turn reflects demand for the final goods and services (Caporale et al, 2002).

Cushing and McGarvey (1990) assume that demand for primary goods depends on expected future prices of consumer goods. This assumption implies that current demand and past expectations of current demand determine consumer price, and expected future demand determines producer price. Changes in the demand for final goods have an impact on input prices, therefore the CPI leads to the PPI.

Empirical evidence of Clark (1995) shows the production chain only weakly links consumer prices to producer prices. The PPI changes sometimes help predict the CPI changes but sometimes fail to do so systematically. For the case of Greece, the paper concludes that long-term relationships exist between consumer prices and money supply and between wholesale prices and money supply (Pallis and Katsouli 2003).

According to a study by Ghazali et al (2008) in Malaysia, the results show long-run association between the CPI and the PPI. Evidence of a uni-directional causality running from the PPI to the CPI was also found. This means that the CPI and the PPI move together in the long-run. A uni-directional link from the PPI to the CPI was also found without significant feedback. Evidence from Mexico suggests that the PPI may have a significant predictive content for the subsequent development of the CPI inflation (Sidaoui et al, 2009).

According to studies by Akcay (2011) and Tiwari, (2012), there are four different possible relationships that exist between the CPI and the PPI. Firstly, there is no relationship, secondly, there is a bidirectional relationship, thirdly there is a unidirectional relationship from the PPI to the CPI, and lastly there is a unidirectional relationship from the CPI to the PPI.

According to Akçay (2011), the results indicate that there is a uni-directional causality between the PPI and the CPI , running from the PPI to the CPI in Finland and France, and bi-

2.4 Conclusion

This chapter explains the relationship between the producer price index and consumer price index. It also covers the theoretical and empirical literature on different schools of thought and the evolution of consumer price index and producer price index and its effect on inflation. It is, however, very difficult to measure and compare the effectiveness of the two indices on inflation without understanding which one amongst those two indices causes inflation. The chapter continues to explain causes of inflation and causality between PPI and CPI as found out by different researchers in different countries. Also, revealed in this chapter is the importance of inflation targeting as monetary policy framework. Emphasis should be made, for long term for long term planning to succeed it requires thorough scrutiny on variables that affect inflation since it will assist when making decisions on monetary policy issues.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter explains the analytical techniques that were be used to analyze the data. It starts with the model and definition of variables. It is followed by -an explanation of the various techniques that were be used to analyze data.

3.2 Data sources

This study used annual data for the period 1970 to 2012. Yearly data which was primarily collected by Statistics South Africa from 1970 to 2012 was used. Two economic variables the PPI and the CPI were used in the study. SAS was used to generate results.

3.3 Model specification

Regression analysis was used to analyse the data. The primary aim was to analyse the effect of, or relationship between the dependent and the independent variable (s). Correlation analysis was used to quantify the linear relationship between the PPI and the CPI, and then simple linear regression was used to define the linear relationship between the response variable (CPI) and the predictor variable (PPI). It was observed that the PPI had high correlation (0.9979); consequently, it is imperative to explore the relationship further using simple linear regression.

Null Hypothesis:

The simple linear regression model does not fit the data

$$\beta_1 = 0,$$

Alternative Hypothesis:

The simple linear regression model fits the data

$$\beta_1 \neq 0$$

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

If the estimated simple linear regression model does not fit the data by failing to reject the null hypothesis, thus there is not enough evidence to state the slope of regression line in the population is not zero and that the PPI explains a significant amount of variability in the CPI.

If the estimated simple linear regression model fits the data by rejecting the null hypothesis thus, there is evidence that the slope of the regression line in the population is not zero and that PPI explains a significant amount of variability in the CPI.

Pearson's correlation analysis was performed to examine and describe the relationship between these two variables. However, before correlation analysis was used, it was imperative to view the relationship between the PPI and the CPI using a scatter plot. Scatter plots are useful to explore the relationship between two variables, locate outlying or unusual values, identify possible trends and communicate data analysis results visually.

Values of correlation statistics are between -1 and 1, close to either extreme if there is a high degree of linear relationship, close to 0 if there is no linear relationship, close to 1 if there is a positive linear relationship, and close to -1 if there is negative linear relationship between the two indices (Wegner 1998).

Although there are common errors that can be made when interpreting the correlation coefficient between variables such as, *inter alia*, concluding a cause and effect relationship. A strong correlation between (the) two variables does not mean change in one variable causes the other variable to change, or vice versa. To assess the significance of the predictor variable in explaining the variability or behaviour of the response variable, regression analysis was performed.

Analysis of Variance (ANOVA) is similar to regression in that it is used to investigate and model the relationship between a response variable and one or more independent variables. However, analysis of variance differs from regression in two ways: the independent variables are qualitative (categorical), and no assumption is made about the nature of the relationship i.e., the model does not include coefficients for variables (Faraway 2002).

3.4 Research techniques

3.4.1 Scatter Plot

Tukey (1977) describes a scatter plot as a graphical plot of the values of the independent and dependent variables where the x values are recorded along the horizontal axis and the y values along the vertical axis. Pairs of x and y observations are plotted in space. A virtual inspection of the likely relationship between the two variables x and y, provides insight and understanding into the likely regression and correlation analysis results. Use of scatter plot helps to examine theories about cause-and-effect relationships of two variables under observation.

According to Turkey, a scatter plot is a very useful summary of a set of bivariate data (two variables), usually drawn before working out a linear correlation coefficient or fitting a regression line. It provides a clear picture of the relationship between the two variables, and helps the interpretation of the correlation coefficient or regression model. Each unit contributes one point to the scatter plot, on which points are plotted but not joined. The resulting pattern indicates the type and strength of the relationship between the two variables.

According to Cleveland (1979), a scatter plot is often employed to identify potential associations between two variables, where one may be considered to be an explanatory variable and another may be considered a response variable. Scatter plot diagrams will generally show one of six possible correlations between the variable (Turkey1977).:

- Strong Positive Correlation: The value of Y clearly increases as the value of X increases;
- Strong Negative Correlation: The value of Y clearly decreases as the value of X increases;
- Weak Positive Correlation: The value of Y increases slightly as the value of X increases;
- Weak Negative Correlation: The value of Y decreases slightly as the value of X increases;



- **Complex Correlation:** The value of Y seems to be related to the value of X, but the relationship is not easily determined; an
- **No Correlation:** there is any demonstrated connection between the two variables.

3.4.2 Descriptive Statistics

According to Gujarati and Porter (2009), descriptive statistics condenses large volumes of data into a few summary measures using measures of central tendency and measures of variability. They organise, summarise and extract essential information contained within data under observation

Wegner (1998) describes descriptive statistics as one of an important technique to summarize a collection of data in a clear and understandable way. According to Wegner descriptive statistics uses two basic methods to summarise data i.e numerical and graphical. In terms of the numerical approach, you can compute statistics such as the mean and standard deviation.

3.4.3 Correlation Analysis

According to Wegner (1998), Regression and Correlation analyses are two statistical methods which seek to identify a possible relationship between two variables. An understanding of the structural relationships between variables helps predict the unknown values of certain variables from known values of related variables. Correlation analysis looks into the strength of identified association between variables.

Andren (2008) describes correlation analysis as a statistical tool which examines the relationship between two variables. According to Andren, with correlation analysis, different methods and techniques are used to examine and measure the extent of the relationship between the two variables. There are two important types of correlation, namely: (1) positive and negative correlation and (2) linear and non-linear correlation. If the values of the two variables deviate in the same direction i.e. if an increase (or decrease) in the values of one variable results, on an average, in a corresponding increase (or decrease) in the values of the other variable the correlation is said to be positive. Correlation between two variables is said to be negative or inverse if the variables move in opposite direction.

According to Dallal (2000), if the points are very close to each other, an amount of correlation can be expected between the two variables. On the other hand, if they are widely scattered, a poor correlation can be expected between the two. If the points are scattered and they reveal no upward or downward trend, then the variables are uncorrelated. If there is an upward trend rising from the lower left hand corner and going upward to the upper right hand corner, the correlation obtained from the graph is said to be positive. Also, if there is a downward trend from the upper left hand corner the correlation obtained is said to be negative.

Correlation coefficients (denoted r) are statistics that quantify the relation between X and Y in unit-free terms. When all points of a scatter plot fall directly on a line with an upward incline, $r = +1$. When all points fall directly on a downward incline, $r = -1$. Strong correlations are associated with scatter clouds that adhere closely to the imaginary trend line. Weak correlations are associated with scatter clouds that adhere marginally to the trend line. The closer r is to +1, the stronger the positive correlation. The closer r is to -1, the stronger the negative correlation (Dallal, 2000).

3.4.4 Regression Analysis

Regression analysis is concerned with quantifying the underlying structural relationship between variables (Wegner, 1998).

The multiple linear regression model is used to study the relationship between a dependent variable and one or more independent variables. The generic form of the linear regression model is:

$$Y = f(x_1, x_2, \dots, x_k) + \epsilon$$

$$= x_1\beta_1 + x_2\beta_2 + \dots + x_k\beta_k + \epsilon$$

where y is the dependent or explained variable and $x_1, \dots, x_k$ are the independent or explanatory variables. The term ϵ is a random disturbance, so named because it disturbs an otherwise stable relationship (Greene, 2008).

According to Faraway (2002), regression analysis is a mathematical measure of the average relationship between two or more variables in terms of the original units of the data. It means the estimation or prediction of the unknown value of one variable from the known value of the other variable. It is specially used in business and economics to study the relationship between two or more variables that are related causally and for the estimation of demand and supply graphs, cost functions, production and consumption functions

Dallal, (2000) explains the **regression model** as follows:

$$Y = a + bx \dots\dots\dots(i)$$

y represent the **predicted value of Y**,

a represent the **intercept** of the best fitting line, and

b represent the **slope** of the line.

The least squares regression equation

$$\hat{y} = b_0 + b_1 x \dots\dots\dots(ii)$$

is an estimate of the population regression equation

$$E(Y|X=x) = \beta_0 + \beta_1 x \dots\dots\dots(iii)$$

The response variable, Y , is described by the model

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \dots\dots\dots(iv)$$

where ϵ_i is a random error.

3.4.5 Coefficient determination

The coefficient of determination is the square of the correlation coefficient (r^2). This statistic quantifies the proportion of the variance of one variable “explained” (in a statistical sense, not a causal sense) by the other. It can be used for describing the linear strength of a regression model. But its size is dependent on the degrees of freedom. The coefficient

determination tries to decompose the average deviation from the mean into an explained part and unexplained part (Andren 2008).

3.5 Conclusion

The chapter presented the procedures involved when performing regression and correlation analysis as outlined by Wegner (1998). Regression analysis was chosen because it assists to determine the nature of the relationship between the response and the explanatory. To perform this analysis involves choosing and fitting an appropriate model, done by the method of least squares, with a view to exploiting the relationship between the targeted variables to help estimate the expected response for a given value of the independent variable. Using correlation analyses was to test hypothesis about the cause and effect relationship and also to identify the association between variables and also estimating the value of one variable corresponding to a particular value of the other variable.

CHAPTER 4

EMPIRICAL ANALYSIS

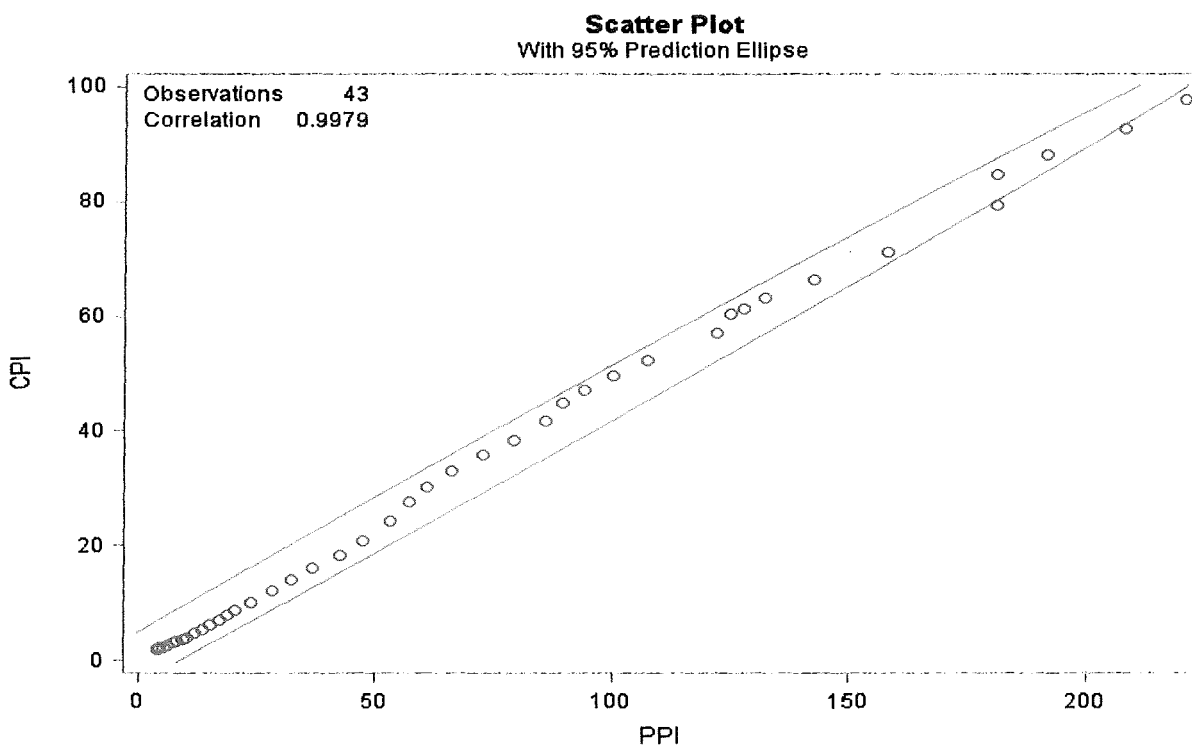
4.1 Introduction

This chapter analyses the results from various tests conducted to answer the question raised in chapter one. It analyses the results of the scatter plot, descriptive statistics, correlation analysis, regression analysis, analysis of variance and coefficient determination. The chapter uses techniques discussed earlier to empirically estimate and analyse the relationship between two variables.

4.2 Scatter Plot: CPI vs PPI

The scatter plot was used to visually look at the relationship between the PPI and the CPI.

Figure 4.1: Scatter Plot: CPI vs. PPI



The scatter plot shows a positive linear relationship between the CPI and the PPI. As the PPI increases, the CPI appears to increase as well. The correlation coefficient shows a positive linear correlation of 0.9979. The plot also shows that there are no outliers in the data set used.

4.3 Descriptive Statistics

Table 4.1 : Descriptive Statistics

Simple Statistics							
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum	Label
CPI	43	32.69767	29.58358	1406	1.90000	97.80000	CPI
PPI	43	70.30698	64.05280	3023	4.20000	220.50000	PPI

The table above shows the descriptive statistics for both sets of data only 43 observations were used. It also shows the mean, standard deviation, and minimum and maximum values of both variables.

4.4 Correlation Analysis

The scatter above shows that there is a linear positive relationship between the PPI and the CPI. A Pearson correlation coefficient measure the degree of linear relationship between these two variables was derived in the table below.

Table 4.2 : Correlation

Pearson Correlation Coefficients, N = 43 Prob > r under H0: Rho=0	
	PPI
CPI	0.99793
CPI	<.0001

The null hypothesis $H_0: \rho = 0$ (Population correlation coefficient is equal to zero). The correlation coefficient between the PPI and the CPI is 0.99793. The p value is small, which indicates that the population correlation coefficient (ρ) is significantly different from 0. The correlation analysis indicates that the PPI can be a good predictor of the CPI.

4.5 Regression Analysis

Correlation analysis was used to quantify the linear relationship between the PPI and the CPI, and then simple linear regression was used to define the linear relationship between the response variable (CPI) and the predictor variable (PPI), to assess the significance of the PPI in explaining the variability or behaviour of the CPI. The result of the analysis shows that PPI has high correlation (0.9979),

4.6 Analysis of variance

Table 4.3: Analysis of Variance

Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	36606	36606	9886.31	<.0001
Error	41	151.81100	3.70271		
Corrected Total	42	36758			

The F value tests whether the slope of the PPI is equal to zero. The p value (<0.0001) is very small (less than 0.05), meaning that there is enough evidence to reject the null hypothesis at 0.05 significance level. Thus, concluding that the simple linear regression model fits the data. In other words the PPI explains a significant amount of variability of the CPI.

4.7 Coefficient Determination

Table 4.4: Coefficient of Determination

Root MSE	1.92424	R-Square	0.9959
Dependent Mean	32.69767	Adj R-Sq	0.9958
Coeff Var	5.88495		

The coefficient of determination, R-square (R^2) is 0.9959, which means that the regression line explains 99% of total variation in the CPI values.

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

Table 4.5: Parameters

Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Variance Inflation
Intercept	Intercept	1	0.29265	0.43855	0.67	0.5083	0
PPI	PPI	1	0.46091	0.00464	99.43	<.0001	1.00000

Since the estimate of $\beta_0 = 0.29$ and $\beta_1 = 0.46$, the estimated regression equation is given by predicted $CPI = 0.29 + 0.46 PPI$. The model indicates that an increase of one unit for the PPI amounts to a 0.46 increase in the CPI. Substituting any value of the PPI in the formula above will yield new values for the CPI over the years.

4.8 Conclusion

The objective of the study was to explore the relationship between producer price index and consumer price index with the aim to examine whether PPI causes CPI or visa-versa. Correlation analysis showed that the PPI can be a good predictor of the CPI. This finding is echoed by Rogers (1998) who argued that, it is the change in PPI that causes CPI because the change in cost of inputs pass on to prices of intermediate goods as well as final goods sold to the consumer and also according to the Malaysian study, Ghazali et al (2008) found a unidirectional causality running from the PPI to the CPI. It is found out that analysis of variance also indicated that PPI explains a significant amount of variability of the CPI. Also this finding is supported by Clark (1995) explaining that it is evident that the production chain only weakly links consumer price to producer price, but PPI changes sometimes help predict the CPI changes. The coefficient determination results from the analysis found out that an increase of one unit for the PPI amount to a 0.46 increase in the CPI; therefore, this implies that substituting any value of the PPI will yield new values for the CPI over the years. Matinez et al (2013) also suggest that changes in PPI leads to CPI changes.

CHAPTER 5

SUMMARY, CONCLUSION, POLICY RECOMMENDATION AND LIMITATIONS OF STUDY

5.1 Introduction

This chapter presents a summary of the findings from the study, conclusion and recommendations for further research. The scope of the study covers investigation into the relationship between the Producer and Consumer Price Indices in South Africa from 1970 to 2012. The study provides findings, conclusions, and limitations encountered during the study. Also, some policy recommendations have been made on how the monetary authority can be assisted in terms of decision making processes and be informed in terms understanding causality between the CPI and the PPI. This study was quantitative in nature, the analysis and examination was conducted through a review of the relevant literature and models. The study aimed to answer the following research questions: Whether the PPI causes CPI or vice versa.

In 1999, the Governor of the SARB mentioned that the motive for the adoption of inflation targeting varies from country to country. For instance, Sweden and the United States adopted inflation targeting as a result of depreciation in their exchange rates in order to assure the public that monetary policy would remain disciplined. Other countries, such as Canada, introduced inflation targeting because of problems experienced with the targeting of monetary aggregates. The Governor further mentioned that whatever the motives of these countries were, the adoption of an inflation targeting strategy in all cases reduced the role of formal intermediate targets or guidelines, such as the exchange rate or the growth rate in money supply. Commitment to an intermediate target would be inconsistent with inflation targeting except if it is the only determining factor of inflation. Obviously this is unlikely. Although growth in money supply is a precondition for a general rise in prices, it is not the only factor that causes inflation (Mboweni, 1999).

According to Nell (2000), South Africa experienced high and accelerating inflation during the 1970s and 1980s, with inflation reaching a historically high level of 18 per cent in 1986. The SARB implemented a strict deflationary policy to bring inflation down to lower levels. Single-digit rates were again reached after 1993, and during the period 1994 to 1999, overall

consumer price inflation averaged around 7.8 per cent. Inflation rates of 6.8 per cent and 5 per cent in 1998 and 1999, respectively, were the lowest levels in thirty years.

South Africa introduced an official inflation target in 2000 for overall consumer price inflation (excluding interest rates on mortgage bonds) of 3-6 percent for the year 2002. Based on these targets, it was clear that the South African Reserve Bank's conservative approach towards inflation did not change, irrespective of the return to single-digit inflation rates since the mid-1990s (Mboweni, 2001).

More money in circulation increases demand for goods and services and inflation occurs as a result. High inflation is not good for the economy. Besides distorting prices, it discourages savings and investment, stimulates capital flight (into foreign assets, precious metals, or unproductive real estate), inhibits growth, makes economic planning terrible, and, in its extreme form, induces social and political unrest (Debelle et al. 1998).

5.2 Summary and Conclusion of Findings

In conclusion, the scatter plot showed visually with the straight line that there is a linear relationship between the PPI and the CPI, and the correlation coefficient attested that there is a strong positive linear relationship between the two. This implies that a change in the producer leads to a positive change in the CPI; this does not automatically mean change in consumer prices will change producer prices. The model was also significant with p value less than 0.05 which concluded that the model fits the data very well. Regression analysis was also performed to assess the significance of the PPI in explaining the variability or behaviour of the CPI. From the data used it showed that an increase of one unit for the PPI amounts to a 0.46 increase in the CPI.

The observation from this analysis is supported by Hill (2004), indicating that the debate regarding what rate of inflation a central bank should be targeting, and on methods for forecasting the rate of inflation so that a central bank can anticipate future trends and better meet its target. The CPI in most countries was designed as a benchmark for adjusting public and private sector wages rather than as a monetary policy benchmark. Some researchers have argued that in an inflation-targeting context, the focus of the CPI is too narrow since it

ignores prices of a range of items, such as investment goods, public sector goods and services, exports, and assets such as land and equities (Hill, 2004).

It can be concluded that there is a positive linear relationship between producer and consumer prices, i.e. a positive change in the PPI will also positively change the CPI. Therefore, the alternative hypothesis (H_1 = Changes in producer prices do not precede change in consumer prices) is rejected, and the null hypothesis (H_0 = Changes in producer prices precede change in consumer prices) is accepted. This link is important since it allows policy makers to predict future inflation using the PPI. Through the analysis provided in this study, policy makers maybe better prepared to avoid, or at least ease the negative cost of inflation.

5.3 Policy Recommendations

- Given the target of between 3-6 per cent for overall consumer price inflation, it is imperative that inflation causality should be monitored closely in order to achieve the intended objective. From this analysis it is clear that inflation is the result of the two indices (the PPI and the CPI), therefore understanding causality between the two is important for policy makers to achieve the objective of targeting inflation;
- This finding can help policy makers to rely more on the link between the PPI and the CPI, and to use changes in the PPI to predict changes in the CPI;

5.4 Limitations of the study

This research work was carried out effectively and efficiently, using the knowledge and skills acquired over the years. The following limitations were encountered:

- the literature on this topic was inadequate in South African perspective;
- there were inadequate books on this topic; and
- the time frames were limited as work and research were carried out simultaneously.

5.5 Areas for further research

On the basis of the findings of this study, several areas of potential for further research are indicated as follows:

- Further studies need to be conducted on variables that affect the PPI as they also affect the CPI indirectly.
- Determine long run and short run effect between the CPI and PPI
- Determine the extent to which PPI influence inflation

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APPENDICES

Appendix 1: Annual data of PPI and CPI from 1970 to 2012

YEAR	PPI	CPI
1970	4.2	1.9
1971	4.3	2
1972	4.7	2.2
1973	5.4	2.4
1974	6.3	2.7
1975	7.2	3
1976	8.3	3.4
1977	9.4	3.7
1978	10.3	4.1
1979	11.8	4.7
1980	13.5	5.4
1981	15.3	6.2
1982	17.2	7.1
1983	19	8
1984	20.6	8.9
1985	23.8	10.3
1986	28.3	12.3

YEAR	PPI	CPI
1987	32.3	14.2
1988	36.8	16.1
1989	42.5	18.4
1990	47.6	21
1991	53	24.3
1992	57	27.7
1993	60.7	30.3
1994	66	33
1995	72.9	35.9
1996	79.1	38.5
1997	85.6	41.9
1998	89.3	44.8
1999	93.8	47.1
2000	100	49.6
2001	107.6	52.4
2002	122.1	57.2
2003	124.8	60.5
2004	127.7	61.4
2005	132.4	63.4
2006	142.6	66.4

YEAR	PPI	CPI
2007	158.2	71.1
2008	180.9	79.3
2009	180.8	84.6
2010	191.7	88.2
2011	207.7	92.6
2012	220.5	97.8

Source: StatsSA, data downloaded from SARB website in 2014

Appendix 2: Changing weights of the headline PPI

PPI for final manufactured goods	2014	2013	2012
Food products, beverages and tobacco products	36.80%	33.47%	31.77%
Textiles, clothing and footwear	4.08%	4.30	5.02%
Wood and paper products	8.76%	8.23%	8.27%
Coke, petroleum, chemical, rubber and plastic products	16.84%	17.22%	19.73%
Non-metallic mineral products	3.87%	4.09%	4.83%
Metals, machinery, equipment and computing equipment	14.75%	15.65%	14.59%
Electrical machinery and apparatus, and subcomponents	3.04%	4.62%	4.44%
Transport equipment	9.51%	10.55%	9.26%
Furniture and other manufacturing	2.35%	1.87%	2.09%

Source: StatsSA 2014

Appendix3: Changes to the PPI Basket

Products now included	Products now excluded
Final manufactured goods	
Dog and cat food	Processed chicken products
Sweet biscuits	Corned meat
Instant coffee	Frozen fish
Spices and condiments	Canned tomato purée and paste
Nutritional, dietary and formulated food supplements	Oil cake
Magazines	Maize corn starch
Vitamins, hormones and antibiotics	Sparkling wines
Antiviral and retroviral drugs	Blankets
Motor vehicle parts and components of plastic	Tracksuits
Industrial mouldings of plastic	Bath soap
Stationery goods of plastic	Self-adhesive plastic products
Gold jewellery	Plastic tableware and kitchenware
Number plates and signs	Non-structural ceramic ware
Containers of iron, steel or aluminium	Ceramic tableware
Locks, padlocks and parts thereof of base metal	Ceiling boards
Ventilation, ducting, booths, hoods of base metal	Tombstones
Heating and cooling systems	Caps and lids
Refrigerating and freezing equipment	Co-axial cables
Filtering or purifying machinery and apparatus	Electronic components and subassemblies
Geysers	Tanker bodies
Stoves and ovens	Beds
Electric motors	Cotton yarn
Suspension, brakes, clutch, mountings and parts	Twine, cord, rope and cables

Seats for motor vehicles	Carbon black
Intermediate manufactured goods	Tanning extracts
Ferro-chromium alloy	Wood preservatives
Semi - finished products and ingots of iron and steel	Copper tubes and pipes
Angles, shapes, sections and similar products of iron or steel	
Unwrought or semi-manufactured gold	
Manganese metal	
Mining	
Palladium	
Agriculture	
Lemons and limes	
Grapes	

Source: StatsSA 2014

Appendix 4: Changes to the weights of the CPI

Category	New weights		Current weights	
	Value Rm	%	Value Rm	%
Food and non-alcoholic beverages	216 747	17.5	143 401	18.3
Alcohol and tobacco	66 690	5.4	43 597	5.6
Clothing	56 169	4.5	34 638	4.4
Housing	281 560	22.8	165 002	21.0
Household contents	63 944	5.2	48 181	6.1
Health	17 794	1.4	11 620	1.5
Transport	190 054	15.4	139 509	17.8
Communication	35 288	2.9	24 533	3.1

Recreation	55 756	4.5	30 821	3.9
Education	33 355	2.7	16 894	2.2
Restaurants and hotels	41 773	3.4	21 834	2.8
Miscellaneous goods and services	177 498	14.4	104 315	13.3
Total	1 236 632	100	784 350	100

Source: StatsSA 2012

Appendix 5: Changes to the CPI basket of goods and services

New products	Products now excluded
Bread rolls	Savoury Biscuits
Feta cheese	Porridge
Amageu	Samp
Seasonal fruit	Whole Chicken - Frozen
Mixed vegetables - tinned	Beef Meat Patties
Corn chips	Meat Meat Pies (Excl. Chicken Pies) - Frozen
Spreads (Marmite and Bovril)	Chicken Pies - Frozen
Ground coffee and coffee beans	Fish Portions In Crumbs - Frozen
Drinking chocolate	Fish Portions In Batter - Frozen
Mineral water/spring water (aerated and still)	Fish Paste
Other drinks (excluding fizzy and fruit drinks)	Evaporated Milk
Vodka	Lemons – Fresh
Spirit coolers and ciders	Dried Fruit
Bricks	Raisins
Cement	Nuts (Excl Peanuts)
Doors and doorframes	Peanuts
Electricians	Peas – Frozen
Plumbers	Green Mealies - Fresh
Washing Machines	Carrots – Frozen
Gas stoves	Peas – Dried
Fans	Lentils – Dried

Hotplates	Butter Beans - Tinned
Crockery	Mustard
Glassware	Dairy Mixtures
Graters	Sherry
Power drills	Port
Garden water sprinkler	Tile Adhesive
Toilet care – Disinfectant bleaches eg. Domestos	Paint Thinner
Eye drops	Paint Brush
Public General practitioners	Filler
Public Specialists	Varnish
Public - Theatre fees	Refuse Collection
Public - Ward fees	Sewerage Collection
Clutch kit	Firewood
Batteries	Candles
Courier services	Fitted Carpets
Aerials and satellite dishes	Floor Tiles
Cameras	Loose Carpets
Tablets	Electrical Frying Pan
Blank DVDs	Toaster
Musical instruments: Pianos	Casserole Dish
Sports boots	Dinner Set
Swimming pool cleaning equipment – brush or net	Cups And Saucers
Textbooks	Coffee Mug
Files	Saucepan
Package holidays	Plastic Bowl
Hair relaxers	Garden Hose
Hair colour	Ladder
Hair pieces	Bleach
Bubble bath	Air Freshener (Aerosol Or Pump Action)
Powder (including baby powder	Sinus Medication

Power driven garden tools – lawnmower	Fungal Medication (Foot And Hand)
Garden hand tools –spade, fork	Muscle Pain Relief Gel
	Consumables
	Engine Cylinder Head Gasket
	Clutch Friction Plate
	Fan Belt
	Car Wash
	Licence Issue And Application Fees
	Parking Fees
	Portable Radio And CD Combination
	Music Centre Or Hi-Fi
	Printer
	Calculator
	Action Figures
	Inorganic Fertilizers
	Organic Fertilizers
	Swimming Pool Entrance Fees
	Pencil
	Roll-On Deodorant
	Clock
	Car-Seats For Babies

Source: StatsSA 2012

NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.