An Analysis of Cigarette Prices and Affordability in Africa: Evidence from African Cigarette Prices (ACP) Data

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by

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Abstract

Cigarette affordability is defined as the amount of money or its time equivalent required to purchase cigarettes. It is one of the important determinants of tobacco consumption and is calculated from the interaction of consumer income and cigarette price. Governments of Low- and Middle-Income Countries have generally underutilized the most powerful tool in tobacco control, namely decreasing tobacco affordability by increasing tobacco taxes. I analyze price data collected from retail outlets and street vendors in seven countries: Botswana, Lesotho, Mauritius, Namibia, South Africa, Swaziland, and Zimbabwe. I use the African Cigarette Prices dataset [n=9285], which has data collected in June and July 2016. Affordability is expressed as Relative Income Price (RIP), i.e., as a percentage of per capita GDP for all countries. For South Africa, affordability is also estimated separately using household per capita income by sub-national region. The results of the study show that cigarettes are more affordable in countries and provinces where incomes are high. I compare the differences in prices between cigarette brands, packaging, and outlet type across countries, and, in South Africa's case, across provinces. The study is relevant as it indicates that, when setting excise taxes, policy makers should also take cigarette prices and incomes into account.

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List of Abbreviations

Abbreviation	Explanation
ACP	African Cigarette Prices
CPDIR	Percentage of daily income
CPI	Consumer Price Index
EIU	Economist Intelligence Unit
FCTC	Framework Convention for Tobacco Control
GDP	Gross Domestic Product
LMICs	Low-Middle Income Countries
NIDS	National Income Dynamic Study
PPP	Purchasing Power Parity
RIP	Relative Income Price
SALDRU	Southern Africa Labour and Development Research Unit
UCT	University of Cape Town
WHO	World Health Organisation

1. Introduction

1.1 Background

Tobacco smoking is responsible for many premature deaths. The number of deaths attributable to tobacco smoking is projected to increase from about 6 million deaths per year to around 8 million annually by 2030, with more than 80% of these deaths occurring in Lower-Middle Income Countries (WHO, 2016.) The price of tobacco products has been recognized as a key determinant of tobacco use behavior (Blecher and Van Walbeek, 2004). Although Chaloupka (1999) examined the effectiveness of tobacco control interventions and concluded that both price (taxes) and non-price measures (advertising bans, information campaigns, smoking restrictions, etc.) could reduce the demand for cigarettes, the IARC (2011) suggests that increasing the price of tobacco products remains the most effective way of reducing the number of smokers. WHO (2003) Article 6 of the WHO Framework Convention on Tobacco Control (2003) also indicate that price and tax measures are effective ways of reducing tobacco consumption. They are especially influential on whether young people take up smoking. Reducing the number of smokers, in turn, mitigates smoking-induced health damage, such as lung cancer and respiratory diseases (Yach & Townshend, 1988). Van Walbeek (2005), following results from the Economics of Tobacco Control in South Africa (ETCSA) Project in South Africa, showed that an increase in the real price of tobacco would be the most effective tool for reducing cigarette consumption, resulting in significant decreases in smoking prevalence. As well, the poor are more sensitive to price changes than the rich, that is, income plays a significant role in determining the effectiveness of tobacco taxes on the consumption of cigarettes.

The current study aims to evaluate the affordability of cigarettes against a background of understanding the underlying price data. Affordability is defined as the ability to purchase a product, influenced by the price of the product and the income of the individual (Blecher and Van Walbeek, 2004). Cigarette affordability is an important determinant of cigarette consumption. Cigarette prices are the key to determining the level of affordability, because if all else is held constant, higher prices and higher taxes will reduce smoking (Pampel, 2007). In general, an increase in the price of cigarettes will ultimately reduce affordability and in turn reduce cigarette consumption. There is therefore a need to increase taxes so that prices increase, reducing the affordability of cigarettes, particularly in African countries where smoking prevalence is

increasing rapidly. This rapid increase is cause for real concern. According to "Tobacco Atlas; 2018", the increase in smoking prevalence is a result of an increase in economic growth and cigarette affordability in African countries, combined with a lack of strong tobacco control policies.

1.2 Motivation

Aloui (2003) in a report on tobacco control in Morocco shows that an increase in tobacco tax rates generates revenue for the government, at the same time reducing consumption. The mechanisms for this remain poorly understood in many Low- and Middle-Income Countries (LMICs), particularly in Africa, when it comes to tobacco control. Developing a better understanding of affordability in LMICs is essential for the development of appropriate policies for tobacco control, particularly taxation policies. In recent decades, there has been a growing interest in determining cigarette affordability. The release of a new African Cigarette Prices dataset provides a useful benchmark for understanding the pricing and affordability of cigarettes across several African countries. Through continuous rounds of data collection, this dataset is continuously being expanded. The release of the data has allowed researchers to study possible measures to control smoking through affordability.

Salloum et al. (2015) used the concept of brand loyalty to determine smoking patterns in Zambia. Using established methods of calculating affordability, they noted Chelwa (2012) finding that cigarettes in Zambia had become relatively more affordable in 2015 than in 2005.

Economic liberalization has been accompanied by greater cigarette affordability for some countries. However, only excise taxes and income influence cigarette prices within the region. Tobacco control proponents have primarily engaged with three aspects of trade liberalization as it pertains to tobacco: trade agreements and policy space, tobacco company influence, and tobacco affordability (Appau, Drope, Labonte, Stoklosa, & Lencucha, 2017).

This paper will analyze prices and cigarette affordability in seven African countries, namely Botswana, Lesotho, Mauritius, Namibia, South Africa, Swaziland, and Zimbabwe. Affordability

is also measured by province in South Africa. The study looks at differences in prices according to cigarette brands, packaging, and outlet type across provinces. The price data used for this study is a new dataset, the African Cigarette Prices 2016. The data for this was collected in the respective countries by the Economics of Tobacco Control Project based at the University of Cape Town. Affordability is measured using the Relative Income Price Approach. Gross Domestic Product (GDP) per capita is used as a measure of income across all countries. In South Africa, household per capita income data from the National Income Dynamics Study (NIDS) (2014-2015) is used to calculate a Relative Income Price per province. The household income per capita approach has advantages over the GDP per capita approach, so I present both estimates for South Africa, since household income data is available only for this country. This provides improved estimates of affordability for province/region in South Africa.

1.3 Structure of the thesis

The paper is made up of six chapters. Chapter 2 provides a literature review which is centered on different measures of affordability. Chapter 3 focuses on the data sources and methodology used in the study. Chapter 4 looks at the results of the study on price data, and Chapter 5 looks at the estimates of Relative Income Price. Chapter 6 provides a discussion of results and conclusions to be drawn from them.

2. Literature Review

There are four broadly used measures of affordability in tobacco research to be considered. Affordability can be determined using the Minutes of Labour approach, by the Big Mac Index of cigarette affordability, as a percentage of daily income, or by Relative Income Price. I will also outline some key findings from studies that have specifically focused on each measure. This section also provides a critical analysis of these measures of affordability as well as providing a detailed opinion on the most appropriate measure adopted in this study given the price data at hand. This forms the basis of and justification for the method of calculating the Relative Income Price measure of cigarette affordability that this paper will adopt. The section aims to fill the gap that exists in the literature regarding affordability of cigarettes, specifically within the context of there being differences in affordability within countries. It is also important to consider the existing tobacco tax structure in these countries.

2.1 Minutes of labour

The World Health Organization (WHO) proposes that affordability be assessed using the *minutes of labour approach* (WHO, 1998). This approach estimates how many minutes of labour are required to purchase the cheapest pack of cigarettes available. The more minutes required, the lower the affordability, and vice versa. Guindon, Tobin, and Yach (2002) examine trends in cigarette affordability by comparing data from 80 countries, using the minutes of labour approach. The main objective of the study was to compare cigarette price data from these countries, by examining trends in prices and affordability during the 1990s between developing and developed countries, using various methods to standardize prices. The data comes from the Economics Intelligence Unit for March 2001. The EIU collected price data every six months with a Cost of Living Survey in approximately 130 cities in almost 90 countries. The survey collected data on the price of Marlboro cigarettes or the nearest international brand in a pack of 20 cigarettes, and on the prices of local brands in packs of 20, as well as on the price of pipe tobacco.

The results of the study indicate that cigarette prices were higher in wealthier countries and in countries that have strong tobacco control programmes, such as the UK, Norway, Hong Kong, New Zealand, and Australia. Minutes of labour required to purchase cigarettes varied among countries, from 10 minutes in Japan and Switzerland to about 100 minutes in Kenya and India. It

has been shown that in developed countries, cigarettes are more expensive than bread (1kg), rice (1kg), and Big Mac burgers, relative to developing countries. The fact that one has to work longer to purchase a pack of cigarettes in Kenya or India makes cigarettes less affordable in these countries relative to Japan and Switzerland where fewer minutes of labour are required to purchase cigarettes.

The study highlights the time that a worker needs to work to be able to purchase a pack of cigarettes. The advantages of the price data used from the Economist Intelligence Unit is that it is more reliable and is expressed in the local currency and exchange rate at the time of survey. The data also considers the annual real percentage changes in prices between 1990 and 2000, this nominal adjustment of prices is of fundamental importance in considering the trends in affordability. However, according to the authors, considering changes between two periods does not necessarily indicate reduction in affordability. The study also warns of the weakness of these estimates as some of the changes in prices may be the result of domestic tobacco tax policy between the two periods. It also is strongly critical of the discrepancies that are likely to be caused by the data used on the price of cigarettes. It is difficult to compare the final estimates effectively since the change in prices varies because countries with strong tobacco control programmes experienced a decrease in the real price of cigarettes.

Bogdanovica, Murray, McNeill, and Britton (2012) also used the Minutes of Labour approach, using the European Union Most Popular Price Category (MPPC) cigarettes to estimate the number of minutes required to earn the amount necessary to purchase 20 cigarettes in European Union member states. They found that cigarettes were becoming less affordable. However, according to Bogdanovica et al. (2012), this finding does not take into account the adjustment of prices in relation to other consumer goods. Also, the effect of increases in wages on cigarette affordability has been less than the effect of changes in price because of tobacco taxes. E. Blecher, Ross, and Leon (2013) also studied EU member states, defining minutes of labour based on net earnings. Although the method is easier to interpret and also allows for the adjusting of income inequality by use of percentiles, they could not employ it as there was not sufficient data over a long enough range. Instead, the Relative Income price method was used. Bandi, Blecher, Cokkinides, Ross, and Jemal (2013), studying affordability in the United States, defined minutes of labour for a state hourly median wage, at the 50^{th} percentile (MoL50) based on Guindon et al. (2002) definition of

minutes of labour, and at the 25th percentile (MoL25) based on Kan (2007) definition of affordability as a percentage of daily income. This also helps to improve the original minutes of labour measure to allow for income inequality. According to a study in Bangladesh, minutes of labour is not as effective as other measures at showing price difference between races and across countries (Nargis et al., 2018).

The governments of countries involved in this study have failed to ensure that cigarette prices increase at the same pace as prices of other goods. This has made cigarettes appear comparatively more affordable. This suggests that there is an opportunity to increase cigarette taxes which in turn increases state revenues. Countries such as Australia, Egypt, Thailand and Iran have begun funding programmes to increase awareness of the dangers of smoking.

A challenge to increased tobacco taxes is the illicit trade in imported cigarettes. This is an important loophole where there is no uniform tax on tobacco products. A more harmonized tobacco tax structure across the continent would help discourage smuggling.

The need for robust measures of affordability in Africa means there is a need to convert the current price based data into minutes of labour measures. At the least there should be an African databank of cigarette price expressed in terms of a standardized measure of income. Such a data set would also need to consider differences in brand packaging and geographical location. This is where the African Cigarette Price data becomes very useful. The data for minutes of labour approach was collected from the Economist Intelligence Unit and constitute a bigger bundle of goods. The data currently at hand makes it difficult to apply the minutes of labour measure of affordability since it contains only prices and there is no data on incomes. More detail about the current dataset will be revealed in the methodology chapter.

2.2 Big Mac Index of cigarette affordability

In addition to the Minutes of Labour measure, the Big Mac Index has been widely used to define more accurately the affordability of cigarettes by using the purchasing power of different currencies relative to the US dollar. Lal and Scollo (2002) focus on the Big Mac index of cigarette affordability to determine affordability across many countries. The Big Mac Purchasing Power Parity (PPP) is defined, in their study, as an exchange rate such that a hamburger costs the same

in the USA as anywhere else in the world. Prices were converted to the standard currency (US dollar), and the authors proposed PPP as a better measure of affordability than minutes of labour.

Using data on both cigarette prices and cigarette taxes compiled by the Canadian Non-Smokers' Rights Association (NSRA), the Action on Smoking and Health (ASH) in the UK, and the exchange rate at 31 May 2002, the authors divide the local currency price of a Big Mac by the local currency price of a single cigarette. Results of the study show that a comparison of cigarette and Big Mac prices shows a small difference in affordability of cigarettes. Translating cigarette prices into US dollars, adding applicable taxes, and then comparing these to the Big Mac index of cigarette affordability, the authors claim that cigarettes are most affordable in Indonesia (with 86 cigarettes per Big Mac) and least affordable in Hong Kong, with seven cigarettes per Big Mac. This is due to higher tax rates in Hong Kong, and cigarettes are shown to be less affordable in countries with higher cigarette taxes.

The study makes use of the purchasing power parity (PPP) conversion factor which is the number of a country's currency required to purchase the same amount of goods in the domestic market. However, this conversion factor may not always be feasible. Although Big Mac is a good measure of PPP, since it is an accurate indicator of exchange rate in the long run, there is a problem of overvaluation of other currencies against the US dollar.

Pakko and Pollard (1996) suggest that the Big Mac often fails to meet the tests of the PPP, since the Big Mac hamburger is defined not by its ingredients but by the recipe. The ingredients used to make it are often tradeable goods from other countries, creating a deficiency if the law of one price does not hold. It is important to consider the method of production of these hamburgers, which also includes factors such as training, everyday changes in technology, and variations in working conditions across countries. There may also be imperfect competition since the Big Mac is produced by only one company. Cigarettes are produced by many companies, which makes it more difficult to compare them across different countries

It has also been established by Bogdanovica et al. (2012) that in the new EU Member States discussed above in the Minutes of Labour section, Big Mac prices tended to be set in relation to those of premium brand cigarettes, making it difficult for them to capture data on smokers' brand preference.

In the study by Guindon et al. (2002), the Big Mac approach rests mainly on currency behavior, and is not a good predictor of currency crisis. There is a range of different prices for countries where the Big Mac is sold. The dependence on currency behaviour, and the variation in prices, has led to Big Mac being cited as an example of why the PPP has failed. Earlier on, Click (1996) had pointed out that the relationship between Big Mac prices and income is parallel to that for measures of income that are more inclusive of the overall price level. The conclusion is drawn that the Big Mac costs more where incomes are higher.

Overall, given that the Big Mac measure of affordability rests on the stability and comparability of prices across different areas, and currencies need to be standardized, there is high risk of bias since the exchange rate fluctuates, and PPP fails to predict these changes. This makes this approach less useful given the price data currently available.

2.3 Percentage of daily income

Building on the results of the above-mentioned studies, Kan (2007) introduced another measure of cigarette affordability. The study defines cigarette affordability as the ratio of the price of one pack of cigarettes to daily income, what she terms a Cigarette Price Daily Income Ratio (CPDIR). Affordability is measured by the size of this ratio. That is, the higher the CPDIR, the lower the affordability and vice versa. For cigarette prices, Kan used the price of the Marlboro brand in 2006, as it was the international brand available in all 60 cities for which there was data in the World Cost of Living Survey published by the Economist Intelligence Unit. The results of her study were that affordability levels range from 0.03 to 0.3, and people in most cities manage to purchase cigarettes. Cigarettes are shown to be relatively more affordable in cities whose populations have high incomes, such as those in Western Europe and North America, than in cities with low incomes, such as Johannesburg and Nairobi. The main argument of the study was that different income groups respond differently to changes in price. The study adds that the price control measure of cigarettes is more effective in low-income groups than in higher-income groups. The main advantage of this measure is that it considers the income for lower-paying jobs, which is useful in measuring cigarette affordability for the poor. However, Blecher and Walbeek (2008) interpreted this measure as a reciprocal of Guindon's minutes of labour.

The CPDIR method does not investigate the distribution and variation of prices and affordability in generally low-income African countries, although it does compare groups with different levels of income. Nevertheless, it is also necessary to look at what happens in countries of the same region. This forms the basis of a modified and more recent method of calculating the affordability of cigarettes, the relative income price, which is discussed below.

2.4 Relative Income Price of cigarettes

Blecher and Van Walbeek (2004) introduced a comprehensive way of measuring affordability. In their study, cigarette affordability is defined as the percentage of per capita Gross Domestic Product (GDP) required to buy 100 packs of cigarettes (Blecher and Van Walbeek, 2004). The measure is termed Relative Income Price (RIP), with GDP per capita as the measure of income. The higher the Relative Income Price, the less affordable are cigarettes, and vice versa. Using data for 77 developing and developed countries, they measure the Relative Income Price of cigarettes. They use price data from the Economist Intelligence Unit's World Cost of Living Survey, which considers prices of Marlboro cigarettes, or the nearest international equivalent brand, and a popular local brand in each of 90 countries from which they collect data. The income data used was drawn from the Union Bank of Switzerland's (UBS) survey of earnings. The RIP was calculated for each country in which data was available for the period 1990 to 2001.

Blecher and Walbeek (2008) found that even though cigarettes are more expensive in high-income countries than in LMICs, they are more affordable to the average citizen in these countries than in the LMICs. Looking at the RIP across these countries, cigarettes are twice as affordable in high-income countries than in developing countries. For example, cigarettes are shown to be 68 times more affordable in Luxembourg than in Nigeria. Furthermore, between 1990 and 2006, affordability decreased in half of the countries in the sample. With log of consumption of cigarettes regressed on log of RIP, and using the ordinary least squares approach, the coefficient indicates that with a 10% increase in the affordability of cigarettes between countries, cigarette consumption is likely to increase by 5.3%.

This is the measure of affordability which the current paper uses. The countries in the study were grouped according to their stages of development and the authors emphasized the fact that the choice of income measure is very important. The key points made in this study is that differences

in the price of cigarettes is not a useful indicator of affordability in all situations unless income is also considered. The RIP measure of affordability is used because the data for it is the best available. There is cause for concern as African countries whose economies are growing may also experience increased affordability of cigarettes. However, there is a need to compare African countries at a more localized version of income. It was possible only to do this across provinces in South Africa, rather than across the region, but for the South African provinces the question of how the distribution of prices affects affordability was examined. Although tobacco control policies are prioritized in most of the countries, there is still a need to consider affordability instead of simply the ordinary price or the tax level.

A recent study by Nargis et al. (2018) uses the modified RIP measure of cigarette affordability even though they find it contains the same weaknesses as other measures. In this paper, I use data on GDP per capita as a measure of income since it is generally agreed, despite some criticism, to be the broadest measure of economic activity Blecher and Walbeek (2008). While per capita GDP has certain limitations as a measure of national income (it does not reflect the wealth distribution within countries), it remains the most standardized representation of income in a cross-country setting (Kostova et al., 2014). The disadvantage of using GDP is that it does not consider the urban rural wage differential, and unemployment is high in much of Africa. A more detailed explanation will be given in the following chapter.

3. Data and Methodology

This chapter will explain the sources of the price and income data used, and how this data was collected, and will then describe the methodology used to calculate Relative Income Price at the national, provincial or regional level. Lastly, the limitations of the data will be highlighted, and suggestions made concerning more detailed data.

3.1 Price Data

The price data used in the study comes from the African Cigarette Prices (ACP) Survey conducted between June and July 2016 in Botswana, Lesotho, Mauritius, Namibia, South Africa, Swaziland, and Zimbabwe. The data is available online from DataFirst, a research data center based at the University of Cape Town (UCT). The price collection project was launched in 2015 to gather data on the prices, brands, outlet types, and packaging of cigarettes sold in African countries. The project uses registered international UCT students as fieldworkers to collect data from cigarette retailers in their home countries, by photographing cigarette packs using cellphones. The selection of countries and provinces is based on the availability of students from those areas registered at UCT. The data consists of 9285 observations. The advantage of this data is that it gives a large sample of different prices and brands across countries where price data is not readily available. The aim is to create a retail cigarette price database to enable researchers to make estimations about price differences in these countries, between brands, in urban and rural settlements, and over time. Different datasets used to calculate other measures have not previously done this. Earlier datasets did not specifically target cigarette pricing, whereas the ACP price data specifically identifies brand, packaging, and geographically-based cigarette preferences. This plays a critical role in understanding cigarette affordability by providing information on how smokers respond to price differences across many types of cigarettes.

3.2 Income data

To establish levels of affordability, indicators of income in a country are required. This study uses GDP per capita data from the World Bank's Development Indicators, available online, as a measure of income. The data is available for all the countries and is used as an estimate of income for the country, and for provinces/regions within the country.

In addition to GDP per capita, household per capita income data is available by province in South Africa, and this was used as a second estimator for income for that country alone. This data was obtained from the National Income Dynamics Study (NIDS), a panel data set that consists of four waves-Wave 1 (2008) to Wave 4 (2014/2015). NIDS is a nationally representative household dataset, collected in South Africa. It is an initiative by the Department of Planning, Monitoring, and Evaluation (DPME), and the survey is implemented by the Southern Africa Labour and Development Research Unit (SALDRU) at UCT (Leibbrandt, Woolard, & de Villiers, 2009). I chose Wave 4 because it is closest to the time of price data collection.

3.3 Cleaning and auditing

Data cleaning was undertaken on the cigarette price data by the UCT Economics of Tobacco Control Project (ETCP) team, to check the consistency and reliability of the data. Photographs taken by the fieldworkers were verified to see if price labels corresponded to the recorded price per observation. This was done for both retail and street vendor outlets. Data on pack quantities was included, and this was recoded to show singles, packs of 2, 5, 10, 12, 13, 20, 30, and cartons of 200 and 400 cigarettes.

3.4 Methodology

For my analysis, the data was recoded and analyzed using Stata 14. The prices for all countries were converted to US dollar prices, using the prevailing exchange rate at the time of the survey. This was done to enable comparability across countries. All collected prices were converted to a price per pack with the following formula:

$$P_{20} = \frac{P_i}{i} * 20$$

Where P_{20} is the average price per standardized pack of 20 cigarettes in US dollars, and *i* is the quantity of cigarettes.

To measure affordability, this study adopts the Relative Income Price method, as described by (Blecher & Walbeek, 2008). RIP is calculated as follows:

$$RIP_{jX} = \frac{\bar{P}_{jX}}{GDPPC_X} * 100$$

Where RIP_j is the relative income price for province *j* in country *X*, $\overline{P_j}$, is the average price per 100 packs of 20-cigarettes in province *j* for country *X*, and $GDPPC_X$ is the Gross Domestic Product per capita for country *X*. This is a given as a percentage.

For South Africa, the Relative Income Price was also calculated using the formula below:

$$RIP_{SA} = \frac{\bar{P}_Y}{\overline{Hhpcinc_Y}} * 100$$

Where $\bar{P}_Y$ is the average price per 100 packs of 20 cigarettes in province *Y*, *Hhpcinc* is the annual average household per capita income per province. The household per capita income is calculated using the formula:

$$\overline{HHpcinc_Y} = \frac{\overline{hhinc_Y} * 12}{\overline{hhsize_Y}}$$

Where $\overline{hhinc}$ is the average household monthly income, and $\overline{hhsize_Y}$ is the average household size, both in province *Y*. This gives the income that each smoker gets per year. The data for monthly household income has been converted to annual income and then divided by household size to come up with per capita household income. This income is converted to the equivalent US dollar amount using the prevailing exchange rate at that date.

3.5 Data Limitations

The limitation of the ACP dataset is that it does not cover the whole distribution of prices in a country since the data was collected only in specific towns and cities in a country. This means that the findings from this study will not be nationally representative.

GDP per capita data is used in this study as a proxy for income. A limitation of this data is that GDP per capita is a broad measure of income that hides local income inequalities. For example, in very unequal countries where 1% are very rich, and the rest are poor, the wealth of the few raises the GDP per capita figures. However, GDP per capita was the only estimate of income available for most countries in the study. Attempts to find more localized income data were thwarted by time and budget constraints. Income estimates at the regional level were available only for South Africa's sub-regions. It is recommended that more detailed income data be made available in the public domain at both national and provincial/regional levels.

3.6 Market share

It is useful to discover how the market share compares to external data. This was only possible in South Africa where the data has been compared to Euromonitor. Euromonitor is a global market intelligence publisher which provides market research on cigarette prices in South Africa. It has categorized the South African cigarette prices per packs of 20 into Premium prices (above R38 per pack), Mid-Priced (between R28 and R38), and Economy (below R28) (Euromonitor 2017). Table 1 below shows the market share (in percentages) of retail price categories between Euromonitor and African Cigarette Prices. Euromonitor did not provide street vendor prices so that no comparison is possible for these prices. The ACP data has a higher market share of expensive cigarettes than Euromonitor does. In both, the most popular cigarettes were mid-priced cigarettes.

Table 1: Retail market share by percentage.

	ACP (%)	Euromonitor (%)
Premium	29.1	20.9
Mid-Priced	42.9	56.8
Economy	28.1	22.3

Source: Euromonitor, 2016; African Cigarette Prices, 2016

4. Prices by packs, outlet type and brand

In the previous section, I describe the data sources and methods used to calculate the Relative Income Price. In this chapter, I illustrate the results of the study. These include summary statistics, and also descriptive statistics on price by outlet type, brand, and packaging. I compare the Relative Income Price per province with the average price by country. The same comparison is also done for package size, between single sticks and packs of 20.

4.1 Sample Statistics of prices

Table 2 below shows sample statistics for countries and provinces.

Table 2: Sample Statistics

Country	N	%	Province/Region/District	n	%
Botswana	262	2.8	Central	262	100
Lesotho	216	2.3	Mokhotlong	216	100
Mauritius	249	2.8	Plaines Wilhems	137	55.0
			Rivière Noire	112	45.0
Namibia	2435	26.2	Khomas	1701	69.9
			Oshana	187	7.7
			Oshikoto	112	4.6
			Otjozondjupa	435	17.9
South Africa	3634	39.1	Eastern Cape	455	12.5
			Gauteng	929	25.6
			KwaZulu-Natal	113	3.1
			Limpopo	1056	29.1
			North West	1011	27.8
			Western Cape	70	1.93
Swaziland	655	7.0	Hhohho	298	45.5
			Manzini	357	54.5
Zimbabwe	1834	19.8	Harare	1408	76.7
			Mashonaland West	43	2.3
			Matebeleland North	265	14.4
			Midlands	118	6.4
Total	9285	100		9285	100

Source: African Cigarette Prices 2016

Table 1 shows data for seven countries, in which most of the observations were from Namibia, South Africa, and Zimbabwe. These countries have a wide dispersion of observations over

different regions. Botswana and Lesotho had the lowest number of observations, and these were collected from only one region in each country.

4.2 Price by Outlet Type

For retail outlets, the price is highest in Mauritius (US$4.06 per pack) and lowest in Zimbabwe (US$1.67). For street vendors, the price is highest in Botswana, at US$5.73, and lowest in Zimbabwe, at US$1.61. These prices are for the single sticks expressed in a per-pack price. There were no street vendor prices provided for Mauritius. Since the sample was not randomly selected, the determination of prices per province (in countries where two or more provinces were sampled) is broadly accepted as a picture of how the prices differ per outlet across regions, given that the data is not representative of the whole country.

Overall, as can be seen in Table 3 and 4, cigarettes from retailers cost more than those from street vendors, except in the case of cigarettes sold singly, which are cheaper from retailers than from street vendors. Most street vendors are likely to buy cigarettes from retailers and sell them outside in single sticks at a premium. Packs of 20 sold in Botswana, Namibia, South Africa and Swaziland are also cheaper from retailers. In the Appendix Table 4 is replicated but shown in local currencies.

Table 3: Pricing by outlet type

		Retail Outlet		Street Vendor	
			Average price per pack in USD (Std. Dev.)		Average price per pack in USD (Std. Dev.)
Country	Province	N	2.36 (0.7)	N	2.27 (1.1)
Botswana		258	3.45 (0.7)	4	5.73 (0.5)
	Central	258	3.45 (0.7)	4	5.73 (0.5)
Lesotho		189	3.09 (0.8)	27	3.96 (0.2)
	Mokhotlong	189	3.09 (0.8)	27	3.96 (0.2)
Mauritius		249	4.06 (0.6)		
	Plaines Wilhems	137	4.06 (0.5)		
	Rivière Noire	112	4.06 (0.6)		
Namibia		2366	2.28 (0.5)	69	3.16 (1.1)
	Khomas	1681	2.24 (0.5)	20	3.17 (1.2)
	Oshana	187	2.30 (0.5)		
	Oshikoto	63	2.35 (0.8)	49	3.16 (0.1)
	Otjozondjupa	435	2.41 (0.6)		
South Africa		2795	2.28 (0.5)	839	2.89 (1.2)
	Eastern Cape	226	2.33 (0.5)	229	3.11 (1.1)
	Gauteng	819	2.30 (0.5)	110	1.95 (1.3)
	KwaZulu Natal	113	2.25 (0.5)		
	Limpopo	882	2.28 (0.5)	174	3.34 (1.0)
	North West	755	2.25 (0.5)	256	2.69 (1.2)
	Western Cape			70	3.21 (0.9)
Swaziland		636	2.51 (0.6)	19	3.17 (1.1)
	Hhohho	298	2.33 (0.4)		
	Manzini	338	2.67 (0.6)	19	3.17 (1.1)
Zimbabwe		835	1.70 (0.5)	999	1.61 (0.4)
	Harare	432	1.62 (0.4)	976	1.60 (0.4)
	Mashonaland West	40	1.87 (0.4)	3	1.33 (0.3)
	Matebeleland North	252	1.90 (0.7)	13	1.77 (0.3)
	Midlands	111	1.53 (0.4)	7	2.00 (0)

Source: African Cigarette Prices; 2016

Table 4: Prices; Outlet type by pack size

Average retail prices by country

Country	Outlet type	n	Single stick (Std. dev)	n	Pack of 10 (Std. dev.)	n	Pack of 20 (Std. dev.)
Botswana	Retail			27	3.49 (0.5)	225	3.45 (0.8)
	Street Vendor	4	5.73 (0.5)				
Lesotho	Retail	115	3.48 (0.6)			70	2.50 (0.5)
	Street Vendor	27	3.96 (0.2)				
Mauritius	Retail					249	4.06 (0.6)
	Street Vendor						
Namibia	Retail	8	3.72 (0.6)	3	2.48 (0.2)	2234	2.28 (0.5)
	Street Vendor	61	3.30 (1.1)			8	2.07 (0.5)
South Africa	Retail	88	2.97 (0.9)	253	2.45 (0.43)	2354	2.23 (0.5)
	Street Vendor	703	3.11 (1.1)	6	2.15 (0.8)	120	1.63 (0.9)
Swaziland	Retail	65	3.62 (0.6)	64	2.57 (0.2)	496	2.36 (0.4)
	Street Vendor	19	3.17 (1.1)				
Zimbabwe	Retail	63	1.93 (0.2)	39	1.65 (0.3)	695	1.69 (0.6)
	Street Vendor	7	2.00 (0)	1	1.50 (-)	989	1.60 (0.4)

Source: African Cigarette Prices, 2016

Table 4 above shows breakdown by retail environment and street vendor outlets. The distribution shows that buying in singles sticks is more expensive than in packs of 10 or 20. Furthermore, packs of 20 are less expensive than packs of 10 across all outlet types.

4.3 Pricing by pack size

Table 5: Packaging by single sticks, packs of 10 and packs of 20

		Priced in Single sticks		Priced in Packs of 10		Priced in Packs of 20	
Country	Province	N	Price per standardised pack of 20 (Std. dev)	N	Price per standardised pack of 20 (Std. dev.)	N	Price per standardised pack of 20 (Std. dev.)
Botswana	Central	4	5.73 (0.5)	27	3.49 (0.5)	225	3.45 (0.8)
Lesotho	Mokhotlong	142	3.57 (0.6)			70	2.50 (0.5)
Mauritius	Plaines Wilhems					137	4.06 (0.5)
	Rivière Noire					112	4.06 (0.6)
Namibia	Khomas	17	3.38 (1.1)	3	2.48 (0.2)	1564	2.25 (0.5)
	Oshana					184	2.30 (0.5)
	Oshikoto	50	3.34 (1.0)			61	2.19 (0.6)
	Otjozondjupa	2	3.38 (1.0)			433	2.41 (0.6)
South Africa	Eastern Cape	240	3.13 (1.1)	23	2.32 (0.4)	182	2.26 (0.5)
	Gauteng	59	2.79 (1.3)	61	2.53 (0.3)	787	2.20 (0.6)
	KwaZulu Natal			7	2.44 (0.4)	102	2.22 (0.5)
	Limpopo	197	3.40 (0.9)	106	2.42 (0.5)	697	2.20 (0.5)
	North West	227	2.89 (1.2)	62	2.48 (0.5)	704	2.20 (0.6)
	Western Cape	68	3.26 (0.9)			2	1.50 (1.1)
Swaziland	Hhohho	2	2.71 (1.0)	34	2.56 (0.2)	256	2.30 (0.4)
	Manzini	82	3.54 (3.5)	30	2.58 (0.3)	240	2.42 (0.4)
Zimbabwe	Harare	2	2.00 (0.0)	14	1.69 (0.3)	1380	1.61 (0.4)
	Mashonaland West			1	2.00 (-)	40	1.83 (0.5)
	Matebeleland North	63	1.94 (0.2)	9	1.88 (0.3)	169	1.94 (0.8)
	Midlands	5	2.00 (0)	16	1.46 (0.3)	92	1.55 (0.4)

Source: African Cigarette Prices 2016

Note: Odd/Bulk pack sizes were excluded from this table, for example, packs of 2, 5, 12, 13, 30, 200 and 400.

The relative affordability of single sticks, packs of 10 and packs of 20 is shown in Table 5, with packs of 20 being the most affordable. Prices were collected for packs of 20 in Botswana, Namibia, South Africa, Swaziland and Zimbabwe. In Lesotho cigarettes are mostly sold in single sticks. There are fewer prices available for packs of 10, with most of the data coming from South Africa, Swaziland and Zimbabwe.

4.4 Brand prices by a pack.

Table 6 shows the major brands (top four) in each country and their respective average prices. Dunhill was generally the most popular brand, except in Namibia and Zimbabwe where the most popular brands were Camel and Everest respectively. The price of Dunhill cigarettes was highest in Botswana and Mauritius.

Table 6: Brand Prices per pack

Country	Top 4 Brands	N	Price per pack (20) in USD	Std. Dev.
Botswana	Dunhill	64	3.95	(0.3)
	Peter Stuyvesant	24	3.60	(0.4)
	Kent	25	3.88	(0.4)
	Marlboro	17	3.75	(0.3)
	Chesterfield	16	2.97	(0.3)
Lesotho	Dunhill	18	2.75	(0.4)
	Peter Stuyvesant	17	2.65	(0.3)
	Rothmans	13	2.64	(0.3)
	Craven A	10	2.66	(0.2)
	Sun	6	1.60	(0.2)
Mauritius	Dunhill	52	4.66	(0.0)
	Pall Mall	51	3.67	(0.0)
	Matinee	35	4.02	(0.1)
	Benson & Hedges	18	4.66	(0.0)
	Embassy	17	4.23	(0.0)
Namibia	Camel	292	2.47	(0.5)
	Dunhill	251	2.78	(0.2)
	Peter Stuyvesant	228	2.55	(0.2)
	Marlboro	215	2.61	(0.3)
	Chesterfield	211	2.08	(0.3)
South Africa	Dunhill	427	2.69	(0.2)
	Peter Stuyvesant	296	2.35	(0.3)
	Camel	238	2.38	(0.4)
	Marlboro	150	2.45	(0.3)
	Pall Mall	149	1.62	(0.1)
Swaziland	Dunhill	144	2.66	(0.1)
	Peter Stuyvesant	54	2.51	(0.2)
	Marlboro	46	2.27	(0.3)
	Chesterfield	43	1.95	(0.3)
	Kent	35	2.61	(0.1)
Zimbabwe	Everest	417	1.78	(0.3)
	Madison	417	1.86	(0.3)
	Pacific	380	1.09	(0.2)
	Dunhill	152	2.18	(0.5)
	Newbury	94	1.97	(0.4)

Source: African Cigarette Prices 2016

5. Relative Income Price

5.1 Relative Income Price by country

Figure 1 shows the Relative Income Price by country. This reveals that cigarettes are less affordable in Lesotho than in Mauritius, primarily because incomes in Mauritius are almost ten times those of Lesotho as seen can be seen in Table 7 below. In Swaziland and Zimbabwe, cigarettes are less affordable than in Botswana, Namibia, and South Africa, which all have similar affordability levels. The table below shows the GDP per capita used to calculate the RIP.

5.2 GDP Per capita

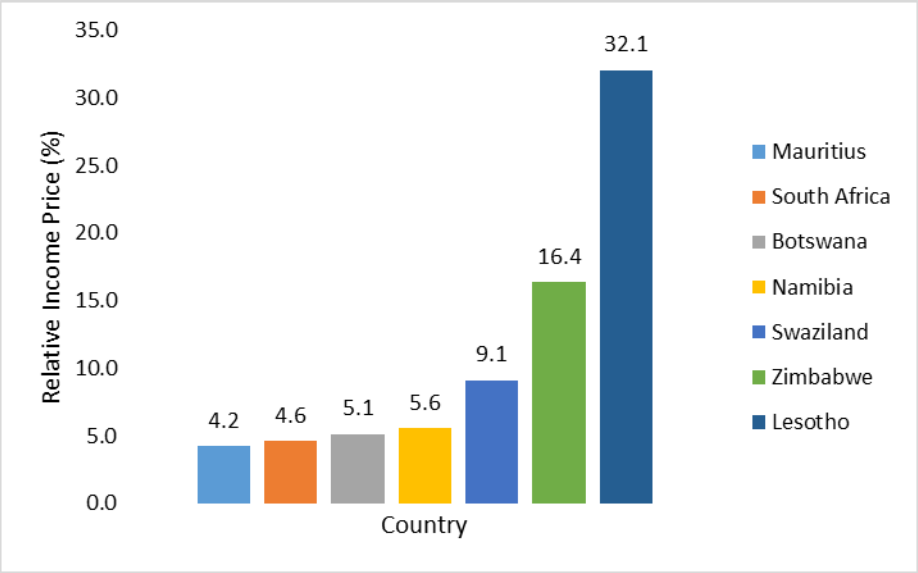
Table 7 shows the distribution of income across countries in June 2016.

Table 7: GDP per capita income (USD)

Country	GDP per capita
Botswana	6788
Lesotho	998
Mauritius	9628
Namibia	4140
South Africa	5274
Swaziland	2776
Zimbabwe	1009

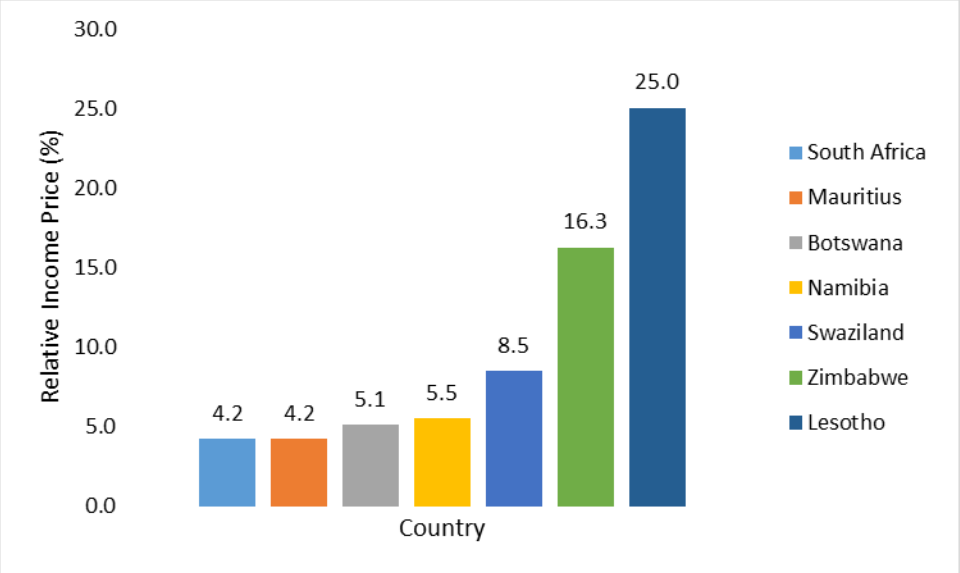
Source: World Bank Development Indicators, 2016

Figure 1: Relative Income Price of cigarettes per pack per country



Source: World Bank Development Indicators, 2016

Figure 2: Relative Income Price of single sticks of cigarettes



Source: World Bank Development Indicators, 2016

Figure 2 shows the Relative Income Price of cigarettes when they are sold as single sticks. Broadly similar levels of affordability were observed in all countries except Lesotho and to a lesser extent Zimbabwe where they are significantly less affordable than in the other five countries. Cigarettes

are cheaper when sold in single sticks in Lesotho than when sold in packs of 20, as can be seen by comparing Figures 1 and 2. Only packs of 20 and single sticks are used in this section as there was not a large enough sample of other pack sizes.

Table 8: Affordability trend between 2010 and 2016

Country	RIP % (2010)	RIP % (2016)	% Change
Mauritius	3,21	4,20	30,84
South Africa	4,87	4,50	-7,60
Botswana	3,48	5,10	46,55
Namibia	6,51	5,60	-13,98
Swaziland	11,90	9,10	-23,53
Zimbabwe	6,73	16,40	143,68
Lesotho	45,65	32,10	-29,68

Source: Tobacco Atlas 2010, World Tables. African Cigarette Prices 2016

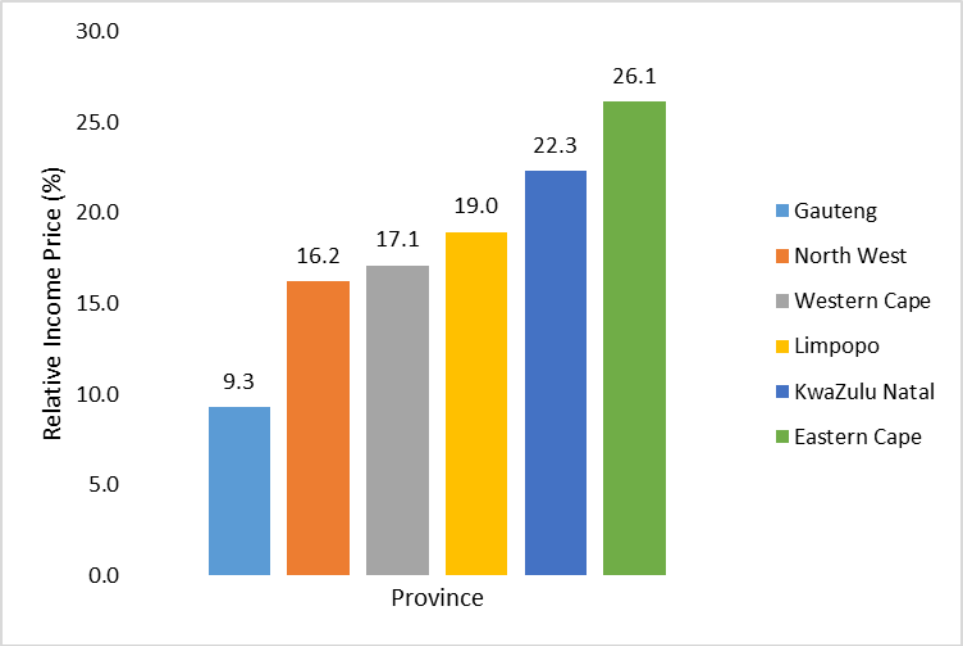
The table above shows the trend in affordability between 2010 and 2016. The 2010 data was from the Tobacco Atlas while the 2016 data is from the analysis in this thesis. There was an increase of more than 100 percentage points in the RIP in Zimbabwe, making cigarettes much less affordable than in 2010. Lesotho experienced a substantial decrease, meaning that cigarettes have become more affordable since 2010.

5.3 Relative Income Price in South Africa using income from NIDS

Affordability was calculated for South Africa using household per capita income from NIDS data as a measure of income. This is the only country for which household per capita income data was available. Household per capita income has some advantages over GDP per capita as a proxy for earnings. Firstly, household per capita income accounts for regional differences in income in a country. This gives better estimates of affordability than those calculated using GDP per capita. Secondly, household per capita income considers private disposable income, the earnings that remain after tax. GDP per capita does not take into account taxes paid by the individual, and therefore either overestimates or underestimates affordability. Thirdly, household per capita income is measured per smoker, as a change in individual specific income. GDP per capita, which is a measure of income for everyone in the country, does not capture this individual change. However, household per capita income also has limitations as a measure. Household per capita income is obtained from self-reported data, and individuals may not be comfortable disclosing full information about their earnings, for fear of increased taxation. If lower incomes are reported, the

affordability measure will be subject to bias. Figure 5 gives estimates of affordability in South Africa's provinces.

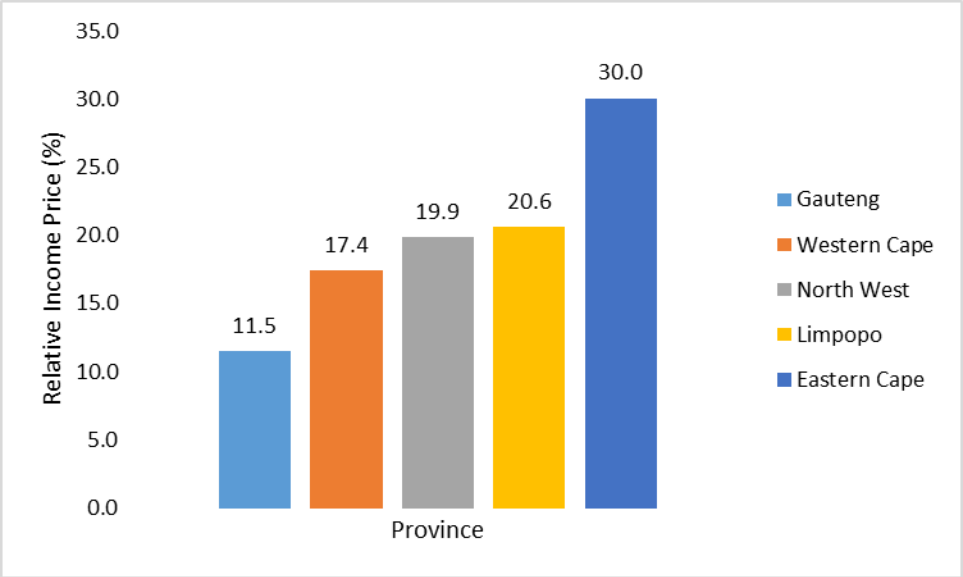
Figure 3: Relative Income Price of cigarettes per pack in South Africa



Source: African Cigarette Prices 2016, National Income Dynamic Study, Wave 4: 2014/15

Figure 3 shows that cigarettes were most affordable in the Gauteng province of South Africa, as evidenced by this province's RIP percentage of 9.3. Cigarettes were least affordable in Eastern Cape, with a relative income price of 26.1%. This was followed by KZN residents whose cigarettes require twice as much share of income than those in Gauteng province. Limpopo, North West, and Western Cape provinces had an average RIP of 16%.

Figure 4: Relative Income Price per single sticks of cigarettes in South Africa



Source: African Cigarette Prices 2016, National Income Dynamic Study, Wave 4: 2014/15

In Figure 4, cigarettes are seen to be less affordable when sold in single sticks, as Relative Income Prices are higher than those in Figure 5. This supports the argument that a better measure brings better estimates and, when these estimates are compared to those done using per capita GDP, it is evident that the latter understates affordability. Kwa-Zulu Natal is not included in this figure as no prices for single sticks were collected for this province.

5.4 Causes of variation

In the context of South Africa, the variation found in the graphs above can be explained by differences in income across provinces. The household per capita income data shows that incomes were lowest in the Eastern Cape and highest in Gauteng. Cigarette prices were in the same range across all provinces, thus income variation has led to variation in affordability. Gauteng, which had the highest income, apparently had the lowest price per pack of 20, priced in single sticks. Table 9 shows average household income per province in South Africa and the corresponding price per single sticks and packs of 20.

Table 9: Distribution of income, prices and affordability by province

	Average Price per singles stick (Std. dev.)	Average price per pack of 20 (Std. dev.)	Average Income (US$)	RIP per pack (%)
South Africa	0,15 (0,1)	2,42 (0,8)	1458,85	16,6
Eastern Cape	0,16 (0,1)	2.72 (0,9)	1041,50	26,1
Gauteng	0,14 (0,1)	2,26 (0,7)	2425,70	9,3
KwaZulu-Natal		2,26 (0,5)	1007,18	22,4
Limpopo	0,17 (0)	2,5 (0,7)	1319,20	18.95
North West	0,14 (0,1)	2,36 (0,8)	1452,47	16,2
Western Cape	0,16 (0)	3,21 (0,9)	1873,81	17,1

Source: African Cigarette Prices 2016, National Income Dynamic Study, Wave 4: 2014/15

6. Discussion and Conclusion

Blecher and Walbeek (2008) compare affordability across countries of different income levels, finding that cigarettes are less affordable in LMICs than in high-income countries. The current study adopts their Relative Income Price measure of affordability with the aim of comparing affordability at both country and regional level. Affordability has been measured using different methods, such as Minutes of Labour, Relative Income Price, Big Mac Index, and as a percentage of daily income. Findings from this study can be compared to those of Guindon et al. (2002), who found that cigarettes are more affordable in developed countries than in developing countries, even though prices may appear to be high in countries with high incomes. It is important to note that higher prices are not in themselves a measure of affordability. It must also be borne in mind that the comparison of prices through standardization of the currency does not necessarily reflect the purchasing power of these currencies.

The results of this study are relevant to the results of other studies, despite differences in income measures and geographical units. The results demonstrate that the use of per capita GDP in place of per capita household income may give misleading estimates of affordability (Nargis et al., 2018). For South Africa, affordability is measured using a more localized version of income, household per capita income, and this gives lower rates of affordability than those measured using GDP per capita. GDP per capita clearly understates affordability, and should be used with caution, as household per capita income as a measure of income gives more reliable estimates. The results of the study confirm previous studies, in that it shows that there is greater affordability in regions with a higher average income. However, it is important to remember that the data collection was not randomized and the disparities between the street vendor and retail prices may be the result of sample bias.

The study found that Dunhill was the most popular brand and its price was highest in Botswana and Mauritius. This is consistent with evidence from previous studies that there is greater price variation in countries with ad valorem taxes (Liber, Ross, Ratanachena, Dorotheo, & Foong, 2014). In these instances, low-priced products are made more attractive by increasing the difference between low-priced and high-priced brands. Salloum et al. (2015) found that there is no significant association between pack design and brand choice since most smokers purchase cigarettes in single

sticks rather than packs. However, the importance of design must be considered if restrictions are placed on the sale of single cigarettes. The WHO recommends specific tobacco excise taxes, as these reduce the gap between premium and low-priced alternatives, and limit opportunities for smokers to switch to cheaper alternatives in response to tax increases. Ultimately, when policy makers make tax excise policies, they should consider tobacco prices and income levels. As bulk packs are cheaper, it is advisable to encourage outlets to sell in small packs to increase the Relative Income Price of cigarettes. Action needs to be taken with respect to the illicit trade in cigarettes, and this leads to lower prices, which in turn can increase the prevalence of smoking. As only one wave of the dataset was used in this study, no cross-sectional study of the effectiveness of tobacco control policy was possible in this study (Salloum et al., 2015).

It is important to consider the living standards in each area, including incomes and levels of health. Differences in affordability can also be attributable to differences in living standards across countries. The purpose of reducing cigarette affordability is to counter deteriorating health in the population as a result of smoking-related diseases such as lung cancer. Blecher and Walbeek (2008) recommend that governments increase excise taxes to reduce cigarette affordability and eventually create an environment in which smoking is no longer viewed as socially desirable.

One of the key issues to consider is that an increase in the price of tobacco products if accompanied by a significantly larger increase in income results in better affordability (Appau et al., 2017). It is also important to note that it is difficult to compare affordability between countries with different cultures, economies, educational opportunities, and costs of living since spending patterns vary (Bogdanovica et al., 2012). The findings of this study should also support a tobacco control policy which establishes a cigarette tax policy benchmark in the countries studied. It should be noted, however, that the prices collected from the African Cigarette Prices dataset do not include the Roll Your Own (RYO) cigarettes which are much cheaper than ready-made cigarettes. This should be included since it captures cigarette affordability for more disadvantaged groups and across all socio-economic groups. The purchase of cigarettes from duty free, cross-border or illicit sources can also have an influence in affordability (Guindon et al., 2002).

Cigarette consumption should be reduced through making cigarettes less affordable. Cigarette smoking exposes smokers to diseases. F. J. Chaloupka, Yurekli, and Fong (2012) argue that it is

critical for governments in the African Region to protect the youth by increasing the price and taxation of tobacco products and banning the sale of single cigarettes. Affordability is a factor in smokers' choosing to reduce the amount they smoke. Policymakers should take this into account when attempting to reduce smoking in the populace. LMICs can also benefit from revenue generated by increased taxation.

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Appendix

Prices in local currencies per standardized pack of 20 as priced in single sticks, pack of 10 and pack of 20.

Average Prices in local Currency if priced per single, 10 and 20 sticks

Country (Currency)	Outlet type	N	Single stick (Std. dev)	N	Pack of 10 (Std. dev.)	N	Pack of 20 (Std. dev.)
Botswana	Overall	4	62.50 (5.0)	27	38.03 (5.4)	225	37.61 (8.3)
(P)	Retail			27	38.03 (5.4)	225	37.61 (8.3)
	Street Vendor	4	62.5 (5.0)				
Lesotho	Overall	142	52.82 (8.9)			70	36.94 (7.5)
(LSL)	Retail	115	51.48 (9.3)			70	36.94 (7.5)
	Street Vendor	27	58.52 (3.6)				
Mauritius	Overall					249	143.96 (19.6)
(MUR)	Retail					249	143.96 (19.6)
	Street Vendor						
Namibia	Overall	69	49.57 (15.1)	3	36.65 (2.3)	2242	33.72 (7.8)
(NAD)	Retail	8	55 (9.3)	3	36.65 (2.3)	2234	33.73 (7.8)
	Street Vendor	61	48.85 (15.6)			8	30.69 (7.1)
South Africa	Overall	791	45.79 (16.2)	259	36.15 (6.5)	2474	32.55 (8.0)
(ZAR)	Retail	88	43.86 (12.7)	253	36.25 (6.4)	2354	32.99 (7.4)
	Street Vendor	703	46.03 (16.5)	6	31.83 (11.3)	120	24.10 (12.7)
Swaziland	Overall	84	52.02 (10.8)	64	37.94 (3.6)	496	34.84 (6.2)
(SZL)	Retail	65	53.54 (8.4)	64	37.94 (3.6)	496	34.84 (6.2)
	Street Vendor	19	46.84 (16.0)				
Zimbabwe	Overall	70	1.94 (0.2)	40	1.65 (0.3)	1684	1.64 (0.5)
(USD)	Retail	63	1.94 (0.2)	39	1.65 (0.3)	695	1.69 (0.6)
	Street Vendor	7	2.00 (0.0)	1	1.50 (-)	989	1.60 (0.4)

[1]*Source: African Cigarette Prices; 2016*

[1] The figures in this table show the prices per single stick, pack of 10, and pack of 20 in the given countries' respective local currencies i.e. Botswana-Botswana pula; Lesotho-Lesotho loti; Mauritius-Mauritian rupee; Namibia-Namibian dollar, South Africa-rand; Swaziland-Swazi lilangeni; Zimbabwe-USD. The prices were originally collected in these currencies.