An Analysis of Cheap Cigarettes in South Africa[1]

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Abstract

Using wave 5 of the National Income Dynamics Study this paper investigates the market for very low-priced cigarettes, which in all probability are illicit. We find that approximately 30% of cigarettes consumed in South Africa are bought for R20 or less per 20-pack. Low-priced cigarettes are found across all nine provinces and these products are consumed in substantial quantities across all racial and socio-economic groups. At the margin, purchases of very cheap cigarettes in South Africa is more associated with lower socio-economic factors, such as having lower levels of income and educational attainment. Cheap cigarettes are also strongly associated with specific packaging types, specifically 20-packs and cartons of 200. As illicit cigarettes undermine both the fiscal and health agendas of tobacco taxation policy, we strongly urge the relevant authorities to implement measures to curb the illicit trade.

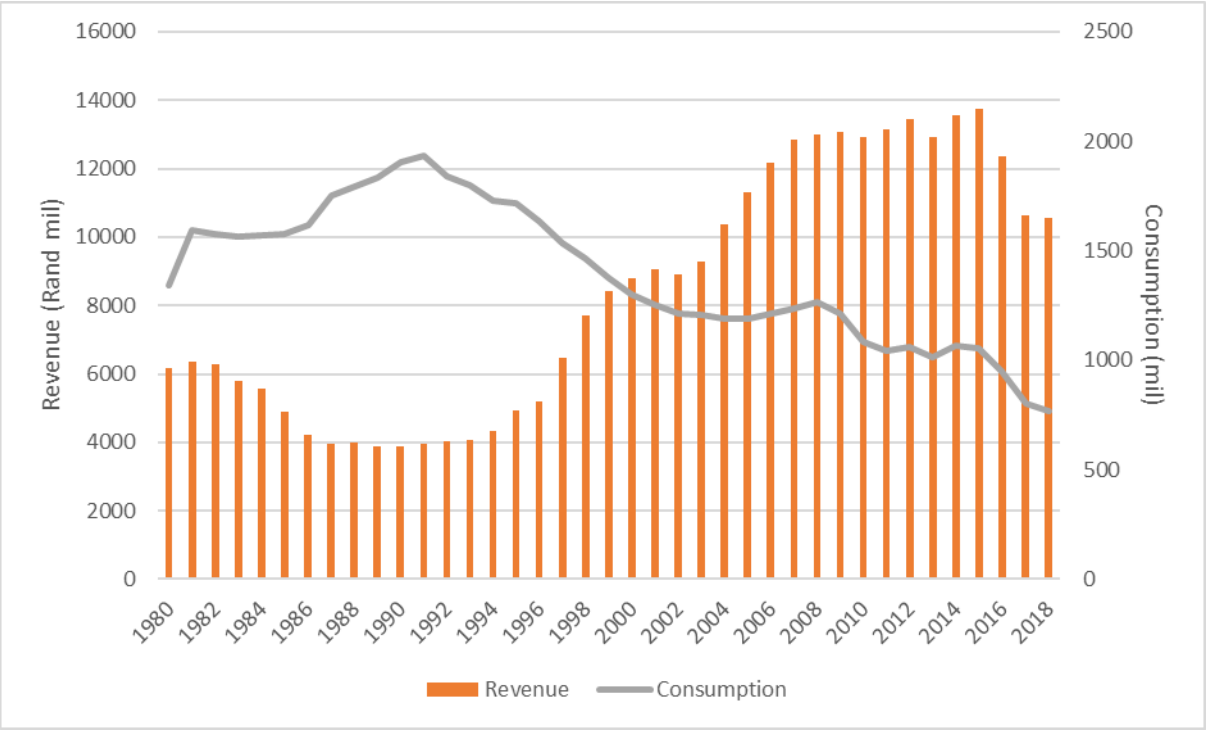
Introduction

Tobacco taxes reduce tobacco use and increase government tax revenue [(NCI; WHO, 2016) and (IARC, 2011)]. However, decreasing the affordability of cigarettes through taxes can create opportunities for an increase in the illicit cigarette market, since the higher taxes and prices increase the "rents" producers and consumers can gain by evading or avoiding taxes (Jha & Chaloupka, 1999). Therefore, if legislation around tobacco taxation is not strongly enforced, the trade in cigarettes for which the full tax has not been paid is likely to become more prevalent, driving down the price of cigarettes and undermining the health and fiscal objectives of tobacco taxation. This is likely to impact smokers at the lower socioeconomic levels most, as these smokers are most sensitive to price changes [(IARC, 2011), (Mukong & Tingum, 2018) and (Hyland, et al., 2006)]. In fact, smokers of untaxed cigarettes report lower smoking cessation rates than smokers of fully taxed cigarettes (Licht, et al., 2011).

After decades of neglect, in the early 1990s South Africa strengthened its tobacco control policy. This policy was anchored by large increases in excise taxes and retail prices. This resulted in a drastic reduction in consumption between 1990 and 2004. Despite the decrease in consumption, real (inflation–adjusted) excise tax revenue increased sharply. Between 2004 and 2015, tax-paid consumption of cigarettes stabilised, other than a sharp decrease in 2009 and 2010, which coincided with a deep recession (2009) and a spike in the illicit market (Van Walbeek, 2014). The sudden decrease in tax-paid consumption since 2015 suggests a corresponding increase in the size of the illicit market. Recent tobacco surveys in informal settlements (Liedeman & Mackay, 2015) and price surveys (Data on Alcohol and Tobacco in Africa, 2018) also indicate that the availability of very cheap cigarettes has increased in South Africa in recent years. The tobacco industry has argued for many

years that illicit trade in South Africa is growing and becoming increasingly problematic, and a recent report by the Tobacco Institute of Southern Africa (TISA) has resulted in a media campaign highlighting the seriousness of the problem (TISA, 2018). The issue of the illicit cigarette trade has also received much publicity by the revelations about the tobacco industry's own involvement in the illicit trade in books such as "Rogue" (Van Loggerenberg & Lackay, 2016), "The President's Keepers" (Pauw, 2017), and testimonies at the Nugent Commission on SARS.

Figure 1: Real Excise Revenue and Cigarette Consumption in South Africa, 1980 - 2018



Source: Derived from various issues of the National Treasury Budget Review (1980-2018). Author's own calculations. Real excise revenue is displayed in millions of Rands, with 2016 as the base year. Consumption is in millions of 20-packs.

This paper focuses on very cheap cigarettes in South Africa. While we cannot be sure that these are untaxed cigarettes, because the government does not impose a minimum retail price on cigarettes, the prices are so low that it seems highly improbable that the full taxes are being paid. The paper provides a nationally representative estimate of the share of these very low-priced cigarettes in South Africa. Using wave 5 of the National Income Dynamics Study (NIDS), we estimate the proportion of cigarettes that are purchased below various price points. We also describe the market for cheap cigarettes, to understand in what form (packaging type) and where these cheap cigarettes are most often bought, as well as a description of the buyers of these products, using regression analysis.

Data and Methodology

Dataset

NIDS is a nationally representative panel survey of South Africans. The first wave of the NIDS survey was conducted in 2008, with a sample of about 28 000 individuals in 7 300 households across South Africa, and most of these individuals have been re-interviewed roughly every two years since. In the fifth wave in 2017, the NIDS survey included new questions on the most recent purchase of cigarettes by smokers (individuals indicating that they smoked cigarettes at the time of the interview). Smokers were asked to describe the purchase, specifically the packaging in which the cigarettes were bought (singles, various pack sizes (typically 10, 20 and 30 cigarettes per pack) and cartons—typically 10-packs of 20 cigarettes each), the number of items/packs purchased, and the total amount that they had spent on the purchase. This paper uses these questions to estimate the proportion of cigarettes purchased at relatively low price points. Our analysis includes individuals aged 15 years and older, as the children's questionnaire does not have questions about tobacco.

Methodology

The focus of this study is the price of cigarettes. We construct our price variable using the NIDS questions about the most recent purchase of cigarettes, which were:

1) Q: When you last purchased cigarettes, what size was the packaging?
   A: Select single/Packet of 10/ Packet of 20/Packet of 30/Carton of 200/Other
2) Q: How many of these packs (or single sticks) did you buy when you bought your cigarettes?
   A: Number of packs/sticks
3) Q: How much did it cost you to buy these cigarettes?
   A: Cost

We use this information to calculate the amount paid per stick, and then we convert all per-stick prices into an equivalent price paid for 20 cigarettes, given that a pack of 20 is the most popular packaging type. Price is expressed in nominal terms. We account for individual consumption and for NIDs weighting (national representativeness) in the calculation of all estimates in the analysis (for example, the average and variance of price).

Reporting Errors

There were a number of respondents who gave unexpected and/or nonsensical answers to the questions regarding the most recent cigarette purchase. In these cases, we used our knowledge of the cigarette market, as well as information from the African Cigarette Prices (ACP) dataset (Data on Alcohol and Tobacco in Africa, 2018), to develop informed rules to correct obvious reporting errors. For example, if an individual reports spending a total of R0.50 for 5 single sticks (resulting in a per

stick price of R0.10); this is likely a data error, since there is no record of a single stick selling for less than R0.50 in South Africa, whereas there is much evidence of single cigarettes being sold for R0.50 by informal vendors. Thus, it is reasonable to assume that this individual incorrectly reported spending R0.50 in total, and actually spent R0.50 per stick.

More specifically, we discovered two common reporting errors:

1) For the total expenditure on the last cigarette purchase, the respondent incorrectly reported the price per item (single, 10-pack, 20-pack, 30-pack or cartons of 200), rather than for the whole transaction (specifically, where the person buys more than one unit),

2) Instead of reporting the total number of items purchased (singles, packs or cartons), the respondent reported the total number of sticks purchased (sticks per item).

The rules used to correct these errors are detailed in

Appendix A. Based on our knowledge of the South African cigarette market and the price data from the ACP dataset, we assume that a single stick cannot be sold for less than R0.50 or more than R4 per stick, a 10-pack cannot be sold for less than R5 or more than R35 a pack, a 20-pack cannot be sold for less than R8 or more than R60 a pack and a 30-pack cannot be sold for less than R12 or more than R90 a pack.

We made 505 corrections where the calculated/implied price per stick was less than R0.50. These were made up of 69 Singles (4.3% of all singles in the NIDS data), 103 10-packs (18.6%), 241 20-packs (14.7%), 16 30-packs (18.8%), and 76 cartons (52%). As is shown in Table 1 below, there were a further 45 prices which were below R0.50 per stick, which we dropped from the analysis because they did not meet the correction rules. Lastly, there were 293 prices above R4 per stick. These are very likely instances where the respondent reported the packaging type incorrectly (for example, they reported a single stick, when it was a 20-pack). In these cases, we dropped them from the analysis because there was no way that we could meaningfully correct them.

Table 1: Summary of Data Cleaning

	Total
Initial Data Collected	**4 224**
Data Removed During Cleaning	
No Packaging Reported	191
No Price Information Reported	94
No Consumption Reported	91
Consumption > 100 cigarettes per day	3
Removed Due to Price Reporting Errors	
Prices per Stick <R0.50 (could not be corrected)	45
Prices per Stick >R4.00	293
Remaining Sample Including Corrections	**3 507**

Notes: NIDS Wave 5 (2018). Data are weighted using the NIDS Wave 5 population weights.

Overall, of the almost 24 000 adults (aged 15+) interviewed in wave 5 of NIDS, 4 224 individuals indicated that they smoked cigarettes. They represent almost 6.7 million of 34.6 million South African adults (a smoking prevalence of 19.26 percent amongst adults). Since our analysis relies heavily on the three questions relating to the price for the most recent purchase of cigarettes, our sample was reduced as we cleaned these variables. Firstly, we removed any individuals who did not provide the packaging type, number of items purchased, or total expenditure variables. We also removed individuals who did not report their cigarette consumption and we limited consumption to a maximum of 100 cigarettes per day. This is summarised in Table 1 above. After all the data cleaning, we are left with a sample of 3 507 smokers, representing approximately 5.6 million smokers in South Africa, which is 84% of all smokers represented in NIDS wave 5.

Cartons

Cartons presented particular issues of data inconsistency. For example, there were a number of cases where the expenditure reported for carton purchases was too low to be believable (below R50 a carton), or unlikely numbers of cartons were reported to be purchased at the last purchase (for example 100, or 200). Because of this, we only make corrections for obvious reporting errors, and other unrealistic prices were discarded. However, since the range of prices for a carton is so vast (there is evidence that cartons are sold for as little as R50, and can go over R500 a carton) it is possible that even prices that fall within a reasonable per-stick price could be erroneous. For example, an individual reporting paying R200 for 2 cartons could have meant either R100 or R200 per carton. Our rules are not able to pick up on these mistakes. Thus, we report prices both including and excluding cartons in all analyses. Of our cleaned sample, 137 smokers reported purchasing cartons, which is approximately 4% of both the weighted and unweighted samples.

Defining Cheap Cigarettes

At the time of the survey (2017), the excise tax on a 20-pack of cigarettes was R14.30. This tax amount, together with the VAT rate of 14%, meant that for cigarettes the full tax amount was R16.30 and that any price below this could not have met the full tax amount. Depending on to whom one speaks, cigarettes can be manufactured from as little as R2.50 a pack (or, in some instances, even less). This cost, together with distribution costs and retail margins, suggests that it would be unlikely for any fully-tax-paid cigarette to be sold for less than R20 per pack (or pack-equivalent). To account for this uncertainty regarding what the minimum retail price for legal cigarettes should be, we define four thresholds for a 20-pack (or equivalent) of cheap cigarettes, which are: less than R16.30; less than R20; R20 or less; and less than R23.

Model specification

In the results section of the paper, we present a regression analysis that assesses the socio-economic correlates of smoking cheap cigarettes. Our specification, run as a logit model, is defined as:

$$\text{SmokerCheap}_{iP} = B_0 + \boldsymbol{B}_1 Ind + \boldsymbol{B}_2 HH + \boldsymbol{B}_3 Smoke + \varepsilon_i \quad (1)$$

Where $SmokerCheap_{iP}$ is an indicator variable for whether individual *i* is a smoker of cheap cigarettes at price threshold *P,* where *P*<R16.30, *P*<R20, *P*≤R20, or *P*<R23. *Ind* is a vector of individual characteristics including gender, race, age, education, employment status (employed, unemployed or not economically active), marital status, and the importance of religion. *HH* is a vector of household characteristics, including the natural logarithm of household income per capita, location type (urban, farm or traditional lands), and province. Lastly, *Smoke* is a vector of smoking

characteristics, namely the packaging type purchased and consumption per day in sticks. The regression is run as a logit regression to determine the probability of smoking cheap cigarettes at the various price thresholds, and we present the marginal effects.

Descriptive Statistics

The following section describes the price of purchased cigarettes in South Africa, as well as the proportion of cigarettes purchased below various price points. We also describe the demographics of smokers of the various cheap cigarettes.

Table 2: Cigarette Price Profile, Including and Excluding Cartons

	Including Cartons				Excluding Cartons			
	Mean	**Median**	**St. Dev**	**N**	**Mean**	**Median**	**St. Dev**	**N**
Overall Price	30.73	30.00	14.82	3507	31.59	30.00	14.80	3370
Pack Type								
Single	37.17	40.00	18.63	1253	37.17	40.00	18.63	1253
10-Pack	38.20	40.00	16.29	498	38.20	40.00	16.29	498
20-Pack	28.01	29.00	12.46	1541	28.01	29.00	12.46	1541
30-Pack	25.37	26.67	12.57	78	25.37	26.67	12.57	78
Carton	19.81	22.50	15.07	137	-	-	-	-
Geo Type								
Urban	30.24	30.00	14.74	2528	31.14	30.00	14.74	2411
Rural	33.06	35.00	15.15	979	33.57	35.00	15.04	959
Province								
Western Cape	29.09	30.00	12.97	788	29.31	30.00	13.03	769
Eastern Cape	31.04	29.00	15.41	343	32.74	29.00	15.50	322
Northern Cape	30.71	27.00	17.53	513	30.96	27.00	17.54	502
Free State	30.21	30.00	13.31	191	31.63	30.00	12.81	179
KwaZulu-Natal	34.75	30.00	17.64	561	36.08	30.00	17.46	546
North West	28.89	27.00	15.04	210	30.05	27.00	15.52	202
Gauteng	30.84	30.00	14.99	533	31.70	30.00	15.05	497
Mpumalanga	29.75	32.00	14.36	217	30.99	32.00	13.98	205
Limpopo	31.02	30.00	11.95	151	31.39	30.00	12.01	148

Notes: NIDS Wave 5 (2018). Data are weighted using the NIDS Wave 5 population weights. Prices are also weighted for consumption. All prices are expressed as a per 20-pack price.

Table 2 describes the price of cigarettes purchased in South Africa. When cartons are included, the average price is almost R31 per 20-pack. 10-packs are the most expensive packaging type at R38.20 per 20-pack equivalent, followed by single sticks at R37.20. These two packaging types also have the greatest variation in price. For all packaging types, the median price is above the mean, suggesting left-skewed distributions, with lower prices pulling down the average. Cartons are the cheapest at R19.80 per 20-pack equivalent. Cigarettes are more expensive in rural areas, where prices are roughly R3 higher than in urban areas.

The provincial disaggregation is included to assess the extent of spatial variation in prices. On average, cigarette prices are highest in KwaZulu-Natal at R34.80 per 20-pack, followed by the Eastern Cape and Limpopo, both at R31. The median cigarette price is highest in Mpumalanga at R32 per pack. KwaZulu-Natal and the Northern Cape have the largest variation in prices.

When cartons are excluded from the sample, the overall average price increases slightly to R31.60 per pack. This confirms that cartons are generally cheaper, and their prices push the overall average cigarette price down. This same pull-down effect occurs when disaggregating price by geographical area and province. Even though the quality of the data on cartons is less reliable than that of other packaging types, we include cartons in the analysis and do not distinguish between "including cartons" and "excluding cartons" in the remainder of the analysis.

Table 3: Proportion of Cheap Cigarettes at Various Price Cut-offs

	<16.3	<20	≤20	<23	N
Overall	19.6	20.9	30.7	32.8	3507
Pack Type					
Single	11.8	12.1	32.0	32.3	1253
10-Pack	3.4	3.4	13.0	13.4	498
20-Pack	23.0	24.1	31.4	33.9	1541
30-Pack	29.1	32.1	34.1	38.3	78
Carton	42.8	48.7	49.3	55.7	137
Geo Type					
Urban	20.4	21.7	30.9	33.1	2528
Rural	16.2	17.1	29.9	31.6	979
Province					
Western Cape	19.6	20.0	29.3	30.2	788
Eastern Cape	19.6	19.8	31.8	34.7	343
Northern Cape	19.3	21.5	37.3	40.0	513
Free State	18.7	18.8	26.7	32.1	191
KwaZulu-Natal	12.5	14.0	27.4	29.2	561
North West	24.7	25.7	35.7	46.4	210
Gauteng	21.2	22.7	31.8	33.1	533
Mpumalanga	24.5	26.1	31.5	33.3	217
Limpopo	13.6	16.4	26.7	27.3	151

Notes: NIDS Wave 5 (2018). Data are weighted using the NIDS Wave 5 population weights. Prices are also weighted for consumption.

Table 3 presents estimates of the size of the market for cheap cigarettes at various price thresholds. Overall, 19.6% of cigarettes are bought for less than R16.30, the tax amount at the time of the survey. When we allow for reasonable production costs and profit margins across the cigarette supply chain, and thus increase the definition of cheap cigarettes to R20 (inclusive), we see that as much as 30% of cigarettes are bought at prices that suggest that the taxes have been evaded.

For all price thresholds, cartons and 30-packs are most likely to be cheap. For example, 42.8% of cigarettes sold in cartons, and 29% of cigarettes sold in 30-cigarette packs are sold at less than R16.30 per 20-pack equivalent, compared to 23% for packs of 20, 12% for single sticks and 3% for packs of 10 cigarettes. The trend that cigarettes sold in cartons and 30-cigarette packs are more likely to be cheaper than the other packaging types holds for all price thresholds. About 20% of all single sticks are sold at R1 per stick (i.e. R20 per pack-equivalent), indicating that this is a very important and common price point.

Cheap cigarettes are more likely to be bought in urban areas than in rural areas. The North West, Mpumalanga, and Gauteng provinces tend to have the highest proportion of cheap cigarette sales.

Table 4: Characteristics of Cheap Cigarette Smokers

	<16.3	**<20**	**≤20**	**<23**	**N**
N	601	658	1115	1182	
Proportion of Smokers buying Cheap Cigarettes					
Male	15.0	16.1	25.6	27.4	2578
Female	20.5	21.8	32.6	35.1	926
Race					
African	13.5	14.6	24.3	25.8	1972
Coloured	19.6	20.6	33.9	35.4	1182
Indian/Asian	10.4	10.6	17.2	19.0	71
White	26.7	28.7	33.5	38.6	282
Education					
Primary School or Less	22.4	24.0	40.4	41.7	833
Incomplete HS	17.0	18.3	28.6	30.7	1808
Complete HS	11.3	11.8	17.7	19.4	514
Tertiary	10.5	11.8	16.0	18.2	336
Employment status					
Employed	15.2	16.8	24.5	26.9	526
Unemployed	16.5	16.8	28.9	29.4	1866
Geographic location					
Urban	16.9	18.2	27.2	29.0	2528
Rural	13.1	14.0	26.4	28.7	979
Characteristics for Smokers of Cheap Cigarettes (Average)					
Age	40	40	39	39	3507
Per Capita HH Inc.	2924	3020	2695	2911	3507
Cig. Cons. Per day	9.7	9.6	9.1	9.0	3507

Notes: NIDS Wave 5 (2018). Data are weighted using the NIDS Wave 5 population weights. Prices are also weighted for consumption. Income is reported in March 2017 Rands.

Table 4 describes some of the characteristics of smokers of cheap cigarettes, at the various price thresholds. Although there are some modest variations in the prevalence of purchases of cheap cigarettes, the major finding of the table is the widespread prevalence of cheap cigarette purchases

across all demographic and socio-economic groups. Compared to their comparator groups, a slightly higher proportion of smokers who are female, white or coloured, urban dwellers, individuals with incomplete education, or unemployed purchase cheap cigarettes.

Regression results

Table 5: Logit Regression, Marginal Effects

VARIABLES	<R16.3	<R20	<=R20	<R23
Packaging (Base = Single Sticks)				
10-Pack	-0.0742***	-0.0793***	-0.152***	-0.153***
	(0.0211)	(0.0213)	(0.0321)	(0.0325)
20-Pack	0.107***	0.117***	0.0119	0.0382
	(0.0279)	(0.0285)	(0.0330)	(0.0342)
30-Pack	0.146	0.157	0.00671	0.0405
	(0.144)	(0.137)	(0.139)	(0.135)
Carton 200	0.336***	0.389***	0.254***	0.275***
	(0.0724)	(0.0749)	(0.0786)	(0.0771)
Consumption (Sticks/day)	0.00139	0.00109	0.00430**	0.00372**
	(0.00132)	(0.00140)	(0.00182)	(0.00190)
Female	-0.00267	0.000991	-0.000305	0.00125
	(0.0224)	(0.0233)	(0.0286)	(0.0293)
Race (Base = African)				
Coloured	0.0771**	0.0757**	0.137***	0.136***
	(0.0317)	(0.0331)	(0.0433)	(0.0437)
Asian/Indian	0.0261	-0.00287	-0.00759	-0.00390
	(0.0491)	(0.0448)	(0.0660)	(0.0664)
White	0.140**	0.130**	0.145**	0.175***
	(0.0635)	(0.0627)	(0.0662)	(0.0654)
Age Category (Base = Age 15-29)				
30-44	0.0633***	0.0647***	0.0605**	0.0540*
	(0.0236)	(0.0244)	(0.0300)	(0.0311)
45-59	0.111***	0.0956**	0.117***	0.110**
	(0.0377)	(0.0377)	(0.0433)	(0.0440)
60-74	0.148***	0.149***	0.155***	0.152***
	(0.0526)	(0.0531)	(0.0566)	(0.0578)
Education (Base = None to Primary School Completed)				
Grades 8-11 (Incomplete High School)	-0.0271	-0.0370	-0.0819**	-0.0708**
	(0.0303)	(0.0312)	(0.0347)	(0.0351)
High School Completed	-0.105***	-0.127***	-0.196***	-0.196***
	(0.0368)	(0.0380)	(0.0457)	(0.0464)
Tertiary	-0.0920*	-0.107**	-0.194***	-0.197***
	(0.0472)	(0.0481)	(0.0536)	(0.0533)
Log of Household Per Capita Income	-0.0406***	-0.0403***	-0.0521***	-0.0493***
	(0.0112)	(0.0115)	(0.0140)	(0.0149)

Employment (Base = Not Economically Active)				
Unemployed	0.0218	0.0209	0.0185	0.0130
	(0.0294)	(0.0297)	(0.0367)	(0.0373)
Employed	-0.00624	0.00495	-0.0156	-0.00811
	(0.0230)	(0.0236)	(0.0301)	(0.0310)
Marital Status (Base = Married)				
Living with Partner	0.0702**	0.0463	0.0507	0.0405
	(0.0304)	(0.0326)	(0.0376)	(0.0399)
Widow/Widower	-0.0231	-0.0391	-0.0444	-0.0249
	(0.0294)	(0.0326)	(0.0428)	(0.0469)
Divorced or Seperated	0.00598	-0.0162	-0.0285	-0.0430
	(0.0314)	(0.0335)	(0.0435)	(0.0455)
Never married	0.0801***	0.0605*	0.0867**	0.0698*
	(0.0293)	(0.0324)	(0.0370)	(0.0391)
Importance of Religion (Base = Not Important)				
Important	-0.00616	-0.00888	0.0286	0.0334
	(0.0337)	(0.0337)	(0.0341)	(0.0347)
Geographical Type (Base = Traditional Lands)				
Urban	0.0396	0.0477*	0.0433	0.0282
	(0.0258)	(0.0259)	(0.0319)	(0.0352)
Farms	0.101*	0.0920*	0.157***	0.132**
	(0.0578)	(0.0557)	(0.0589)	(0.0599)
Pseudo R Squared	0.1525	0.1517	0.1092	0.1065
Observations	3,444	3,444	3,444	3,444

Notes: NIDS Wave 5 (2018). Data are weighted using the NIDS Wave 5 population weights. We control for province; however, these estimates are not presented. Robust standard errors are given in parentheses, with significance stars defined as *** p<0.01, ** p<0.05, * p<0.1.

The results in Table 5 present the marginal effects, at the average of the determinants, of whether a person has purchased cheap cigarettes, estimated using a logit regression. The dependent variable is dichotomous, taking a value of 1 if the person smokes cheap cigarettes (zero otherwise), using the R16.30, R20, R20 inclusive and R23 price thresholds.

Holding all else constant, 10-packs are less likely to be cheap, while 20-packs and cartons are more likely to be cheap than single sticks. For the R20 inclusive and R23 thresholds, smokers who smoke more cigarettes per day have a higher probability of smoking cheap cigarettes.

In terms of race, Coloureds and Whites are significantly more likely to purchase cheap cigarettes than Africans, at all thresholds. The probability of smoking cheap cigarettes increases monotonically with age, also for all price thresholds. Smokers who have never married are more likely to buy cheap cigarettes than married smokers, while those living with their partners are more likely to buy cigarettes for less than R16.30.

Holding all else constant, smokers with higher levels of education are less likely to buy cheap cigarettes than smokers with lower levels of education. Moreover, at all price thresholds, the probability of smoking cheap cigarettes decreases as per capita household income increases.

Farm dwellers are more likely to purchase cheap cigarettes than are smokers in traditional lands. The same applies for smokers who live in urban areas, but only at the R20 threshold.

Some factors did not significantly influence the probability of smoking cheap cigarettes, namely gender, employment status, and the importance of religion.

Overall, smoking cheap cigarettes in South Africa is associated with lower socio-economic factors, such as having lower levels of income and lower educational attainment. Cheap cigarettes are also strongly associated with specific packaging types, specifically 20-packs and cartons.

Caveats

A challenge with our data-correction approach for price reporting errors, discussed in the Methodology Section, is that we are imposing a minimum price per stick as part of how our rules are defined, assuming a minimum for each packaging type (R0.50 for a single, R5 for a 10-pack, R8 for a 20-pack, R12 for a 30-pack and R50 for a carton). Thus, if any prices below these amounts are in fact valid, that data will be lost. However, these are conservative assumptions and are supported by other surveys about the price of cigarettes in South Africa [(Data on Alcohol and Tobacco in Africa, 2018), (Liedeman & Mackay, 2015)].

Given that 338 individuals reported prices that could not be corrected with the price correction rules, and that some individuals were dropped from the analysis owing to incomplete data or outliers, our sample for analysis is a sub-set of the NIDS smokers. Our sample represents approximately 5.6 million smokers in South Africa (84% of all smokers). Table 6 below presents the distribution of prices by packaging type for the original and final samples of data. We observe that the ratio of the final data (used for analysis) to the original NIDS sample is consistently close to one. Therefore, we believe that the sample of data that was dropped is close to a random subset of the original data, and will not cause any significant biases to the results.

Table 6: Comparison of Original and Final Samples, by Packaging Type

	Original Sample		Final Sample		Ratio of Final to Original
	Freq.	Percent	Freq.	Percent	
Single	2,527,054	37.88	1,931,119	34.58	0.91
10 Pack	826,656	12.39	738,710	13.23	1.07
20 Pack	2,707,006	40.58	2,542,545	45.53	1.12
30 Pack	157,990	2.37	149,489	2.68	1.13
Carton 200	234,929	3.52	222,193	3.98	1.13

Pack Type not Reported	216,888	3.25	-	-	-
Total	6,670,524	100	5,584,056	100	1.00

Notes: NIDS Wave 5 (2018). Data are weighted using the NIDS Wave 5 population weights. The ratio represents the ratio of the final sample proportion to the original sample proportion.

Discussion and Conclusion

Illicit cigarette sales in South Africa have become a widespread problem in recent years. For many years the tobacco industry has argued that the illicit market is substantial and growing (Van Walbeek & Shai, 2014). The rationale for this strategy was to dissuade National Treasury from increasing the excise tax on cigarettes. The tobacco industry's narrative was countered by research from independent researchers that indicated that there was no evidence that the illicit market had grown to the levels suggested by the tobacco industry, and that the tobacco industry was restating historical estimates to suit their narrative [(Blecher, 2010); (Van Walbeek, 2014) and (Van Walbeek & Shai, 2014)].

Unfortunately, since 2015 the situation in South Africa has taken a significant turn for the worse. Between 2015 and 2018, the volume of tax-paid cigarettes, as recorded by National Treasury, has decreased by 23%. Although the economy was underperforming and per capita incomes dropped slightly during this period, these factors can explain only a very small part of the decrease in tax-paid cigarette consumption. A number of surveys, mostly localised and not representative of the country as a whole, have shown that the prevalence of illicit cigarettes is high. NIDS wave 5 is the first independent, nationally representative, survey that allows one to investigate the market for very low-priced cigarettes, which in all probability are illicit, in substantial detail.

The single most important conclusion for this study is the ubiquity of low-priced cigarettes in South Africa. Low-priced cigarettes are found across all nine provinces, with prevalence ranging from 26.7% in Limpopo to 37.3% in the Northern Cape for cigarettes priced at R20 per pack or less. They are consumed across all racial and socio-economic groups. Whereas there might have been a perception that the sale of illicit cigarettes was concentrated in the poorer townships, this paper found that the prevalence of low-priced cigarettes is highest among Whites, by far the richest population group in South Africa.

These results are deeply disturbing. The illicit cigarette market undermines both the fiscal and health agendas of tobacco taxation policy. It reduces the excise revenue that is collected by the tax authorities. Since 2014, when a new commissioner was appointed at the South African Revenue Services, a large number of senior personnel have left the institution, dedicated tax compliance units have been shut down, and there has been a general decrease in tax morality among the population. A number of politically well-connected companies have sprung up or have grown over this period,

flouting the tax revenue authorities. The Tobacco Institute of Southern Africa, representing the large multinationals, has recently launched a campaign, entitled #TakeBackTheTax, in which they claim that the fiscus loses R7 billion each year to illicit cigarettes. While there is much evidence that the smaller players are heavily involved in trading illicit cigarettes (van Loggerenberg, 2016 and 2018), there is also considerable evidence to suggest that the larger players are significantly involved.

Other than the obvious fiscal impact, illicit cigarettes are more affordable and more accessible, thus exposing more people to the harms of smoking, particularly the most vulnerable in society. Cheap illicit cigarettes will cause people, who otherwise might have quit smoking, or might never have started smoking, to continue with a habit that they are likely to regret (Pechacek, et al., 2017).

As independent economists with a strong public health focus, our views often clash with that of the tobacco industry. However, for once we agree with the tobacco industry, namely that, currently, the size and the recent growth in the illicit cigarette market is cause for concern. Decisive action needs to be taken, including the re-establishment of dedicated units in SARS and the policing authorities to curb the illicit trade in cigarettes, the ratification by South Africa of the Illicit Trade Protocol of the WHO Framework Convention on Tobacco Control, and the implementation of an effective, independent Track and Trace system for cigarettes in South Africa.

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Appendix A

Price Correction Rules

As we mentioned in the Methodology Section, we applied the following *price correction rules* where obvious reporting errors where identified:

Reported purchasing singles:

1) $Pr/_{Cig_i} = Tot\ Exp_i$

$if\ 1 \leq Tot\ Exp_i \leq 4\ \&$

$\& \frac{Tot\ Exp_i}{Sticks_j} < 0.5$

Reported purchasing 10-packs:

1) $Pr/_{Cig_i} = \frac{Tot\ Exp_i}{10}$

$if\ 5 \leq Tot\ Exp_i \leq 35$

$\& \frac{Tot\ Exp_i}{Sticks_j} < 0.5$

2) $Pr/_{Cig_i} = \frac{Tot\ Exp_i}{Num\ Items_i},$

$if\ 0.5 \leq \frac{Tot\ Exp_i}{Num\ Items_i} \leq 4$

$\& Tot\ Exp_i \geq 5$

Reported purchasing 20-packs:

1) $Pr/_{Cig_i} = \frac{Tot\ Exp_i}{20}$

$if\ 8 \leq Tot\ Exp_i \leq 60$

$\& \frac{Tot\ Exp_i}{Sticks_j} < 0.5$

2) $Pr/_{Cig_i} = \frac{Tot\ Exp_i}{Num\ Items_i}$

$if\ 0.5 \leq \frac{Tot\ Exp_i}{Num\ Items_i} \leq 4$

$\& Tot\ Exp_i \geq 8$

Reported purchasing 30-packs:

1) $Pr/_{Cig_i} = \frac{Tot\ Exp_i}{30}$

$$if\ 12 \leq Tot\ Exp_i \leq 90$$
$$\&\ \frac{Tot\ Exp_i}{Sticks_j} < 0.5$$

2) $$Pr/_{Cig_i} = \frac{Tot\ Exp_i}{Num\ Items_i}$$
$$if\ 0.5 \leq \frac{Tot\ Exp_i}{Num\ Items_i} \leq 4$$
$$\&\ Tot\ Exp_i \geq 12$$

Reported purchasing cartons (200 sticks):

1) $$Pr/_{Cig_i} = \frac{Tot\ Exp_i}{200}$$
$$if\ 50 \leq Tot\ Exp_i \leq 600$$
$$\&\ \frac{Tot\ Exp_i}{Sticks_j} < 0.5$$

Where Pr/Cig_i is the price per cigarette for smoker *i*, $Tot\ Exp_i$ is the total expenditure on all cigarettes for the most recent purchase reported, $Sticks_j$ is the number of sticks given the reported packaging type *j* where j=1, 10, 20, 30, 200 and $Num\ Items_i$ is the number of items (packs, cartons or singles) purchased.