An overlooked market: loose cigarettes, informal vendors and their implications for tobacco taxation

Max Gallien ![ORCID] ,[1] Giovanni Occhiali ![ORCID] ,[1] Hana Ross[2]

![Check for updates]

ABSTRACT
Objective To examine the features of markets for loose cigarettes in several low-income and middle-income countries and their effects on tobacco control policies, particularly taxation.
Design An analysis of survey data targeting people who smoke in two African, one Southeast Asian and two South Asian countries and retailers across 16 African countries to study loose cigarette markets and examine how prices in these markets move relative to the prices for cigarette packs.
Results Markets for loose cigarettes are large, and their consumer base tends to differ from the wider population of people who smoke. Loose cigarette prices are on average higher than those of cigarettes bought in packs, and they respond differently to tax increases, at least partially due to a denomination effect.
Conclusions The features of the loose cigarette markets present a challenge for tobacco control policy, especially tobacco tax policy. One way to overcome this challenge is to aim for large, rather than incremental, tax increases.

> **WHAT IS ALREADY KNOWN ON THIS TOPIC**
> ⇒ While there is sporadic evidence that markets for loose cigarettes are widespread, especially in low-income and medium-income countries (LMICs), very little is known about the response of these markets to tax policies.
> ⇒ Per-cigarette prices of loose cigarettes tend to be higher than those of cigarettes sold in packs.
>
> **WHAT THIS STUDY ADDS**
> ⇒ This study uses data on people who smoke cigarettes and cigarette vendors to show that loose cigarettes represent a large share of cigarette purchases across many LMICs, often catering disproportionately to lower-income groups.
> ⇒ It also demonstrates that prices of loose cigarettes move differently, primarily due to clustering of prices around small currency denominations, and postulates that this will impact tax pass through.
>
> **HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY**
> ⇒ Countries with large loose cigarette markets should opt for large rather than incremental tax increases in order to ensure their full effect and to achieve better public health.
> ⇒ We highlight the importance of further investigation and data collection on loose cigarette markets, outlining new areas of research.

INTRODUCTION

In the coming decades, the majority of tobacco-related deaths will occur in low-income and middle-income countries (LMICs).[1] Recent years have seen an expansion of research on tobacco impacts in these countries, expanding data availability and policy analysis that speak to their particular contexts.[2–5] However, these analyses have overlooked one crucial aspect of cigarette markets in these contexts. While most work on cigarette consumption and taxation assumes that cigarettes are being sold and bought in packs, this often does not capture the reality on the ground. Instead, many cigarettes are bought in the form of single, loose cigarettes, either from legal shops or from informal vendors.

For example, survey evidence from the International Tobacco Control (ITC) Policy Evaluation Project suggests that in India, Kenya and Zambia, more than two-thirds of respondents who smoke bought their last cigarette as a single stick and not as a pack (throughout this article, we use 'loose cigarettes' and 'sticks/single stick cigarettes' interchangeably). Similarly, Singh *et al*[6] estimate that 57% of people who smoke in India consume loose cigarettes, which according to Lal *et al*[7] account for 75% of sales in the country, although recent statewide bans might be changing this picture[8]; Stillman *et al*,[9] von Lampe *et al*[10] and Azagba *et al*[11] demonstrate that these markets are also prevalent in the USA, with Guillory *et al*[12] pointing out that loose consumption is more common among young people

and those who do not smoke every day. Studies on Mexico[13–15] point to the use of single cigarettes as a harm reduction strategy; one on Colombia notes differences in price movements[16]; and one in Indonesia argues that banning loose sales should be pursued to deter youth consumption.[17] However, to the best of our knowledge, there is no study that attempts a generalised account of these dynamics and of their effects on tobacco tax policies across as wide a set of countries as that covered here.

We argue that to understand cigarette consumption in LMICs, particularly in Africa, and to devise effective tobacco control policy, the features of this market demand explicit attention. We develop this argument by establishing four aspects of the market for loose cigarettes. First, it is sizeable and widespread. Second, it has a consumer base different from the overall population of people who smoke; people who smoke loose cigarettes tend to be poorer and younger. Third, price dynamics for single-stick cigarettes differ from those for packs,

as the price for the former is higher than the equivalent per-cigarette price of those in a pack. Furthermore, their prices also respond differently to external changes, partially due to a denomination effect. Finally, we show how the features of loose cigarette markets can affect the effectiveness of tobacco control policy and in particular of taxation. We highlight that small tax increases may have unexpected effects on demand or may not be passed on to the people who consume loose cigarettes at all. Consequently, the prevalence of single-stick markets provides an argument for large, rather than incremental, increases in tobacco taxation in many LMICs.

DATA AND METHODS
Data sources
This paper relies on two sources of data: the African Cigarettes Prices Project from the Economics of Excisable Products Research (REEP) unit and data from LMICs covered by the ITC Policy Evaluation Project, which include information on loose cigarette prices.

REEP collects prices of cigarettes sold by retail outlets and street vendors in a number of African countries since 2016. We use all publicly available data, which include cigarette prices differentiated between loose and packed and information about the brands and the type of store. While these data are not nationally representative, they contain a large number of price observations, which is useful for our purpose.

The ITC data consist of a set of multicountry nationally representative surveys of people who smoke. They include information on gender, age, income, level of education and tobacco use, such as where they last bought tobacco, in which form, of which brand and for which price. We used all data from LMICs, with the exclusion of Malaysia (as loose accounted for less than 5% of consumption) and Vietnam (as we were unable to access some of the relevant variables) and harmonised information on income and education as explained in online supplemental appendix A.

Analysis
More information on the data alongside summary statistics can be found in online supplemental appendix B. We rely primarily on the REEP data to analyse retail and price dynamics for cigarettes sold as sticks and as packs for 16 countries in Africa. We provide descriptive analyses of the relative distribution of loose cigarettes in different shops as well as the movement over time of the price for single cigarettes and packs for major brands. We rely on the ITC data to examine stick buyer demographics. Here, we analyse the demographics of people buying loose cigarettes in five countries using a random-effects logistic regression.

RESULTS
We structure our results around three themes: the proliferation of loose cigarette sales, consumer profiles and prices.

While there are little systematic data on the markets for loose cigarettes, what is available is sufficient to note that, in many LMICs, they are a large market, both with respect to consumption and to retail. In five of the LMICs covered by the ITC survey—Bangladesh, India, Kenya, Thailand and Zambia—at least one-third of consumers in the most recent wave reported that their last purchase was loose cigarettes. Notably, there is substantial variation: the proportion ranges from just under 34% in Thailand to 77% in India and over 80% in Zambia and Kenya. The REEP price data give an indication of how many stores sell loose cigarettes, with table 1 providing an overview by country and seller type. Even though stores are not randomly sampled and do not translate to proportional estimates of market shares, we get a clear sense that, across many African countries, the market for loose cigarettes is substantial, although with significant variation. Table 1 also shows at the proportion of brands sold as both sticks and packs in at least some stores in each country, presenting a partially overlapping and partly segmented market. Aside from Tanzania and Kenya, there are no countries where all brands sold in packs are also sold in single sticks. However, in all cases except Botswana, at least one-third of the brands sold

Table 1	Loose cigarettes supply structure across sub-Saharan Africa				
Country	Shops surveyed (n)	Percentage (%) of all shops selling loose cigarettes	Percentage (%) of formal shops selling loose cigarettes	Percentage (%) of informal street vendors selling loose cigarettes	Percentage (%) of brands sold both loose and in packs (brands, n)
Botswana	900	58.2	0.8	97.9	20.9 (41)
Chad	67	31.3	0.0	36.8	62.5 (8)
Ethiopia*	1120	98.4	0.0	98.9	47.6 (21)
Ghana*	103	59.2	17.7	23.5	50.0 (18)
Kenya*	78	92.3	0.0	100.0	100.0 (10)
Lesotho	6135	97.4	65.2	99.9	43.1 (58)
Madagascar	52	75.0	21.4	100.0	70.0 (9)
Malawi	322	6.8	3.9	4.1	38.5 (23)
Mozambique	104	87.5	0.0	98.8	78.6 (14)
Namibia	976	19.8	3.6	100.0	39.4 (31)
Nigeria*	59	54.2	0.0	36.4	38.4 (35)
South Africa	4051	82.0	26.5	97.8	63.9 (109)
Tanzania	185	81.6	41.5	98.3	100.0 (16)
Uganda*	38	71.1	0.0	100.0	42.9 (7)
Zambia	102	47.0	23.3	58.8	55.6 (17)
Zimbabwe	4189	71.2	31.5	79.5	73.5 (34)
Average		64.6	14.7	76.9	57.8 (28)

Source: Authors elaboration on Economics of Excisable Products Research data.
*Countries marked with an asterisk have passed some legislation that bans the sale of single-stick cigarettes reflected in lower proportions of formal stores selling them.

Table 2 Stick buyer demographics

	Bangladesh	India	Kenya	Thailand	Zambia
Gender	−0.17 (0.23)	0.84 (0.69)	0.04 (0.37)	0.68‡ (0.21)	−0.18 (0.69)
Medium income	−0.17* (0.10)	−0.01 (0.14)	−0.60‡ (0.22)	−0.54‡ (0.14)	0.60 (0.46)
High income	−0.22† (0.10)	−0.92‡ (0.17)	−1.27‡ (0.28)	−0.74‡ (0.14)	0.34 (0.33)
Primary/lower secondary education	−0.07 (0.07)	−0.50† (0.23)	−0.03 (0.44)	−0.04 (0.19)	1.18 (0.84)
Higher secondary/tertiary education	0.06 (0.09)	−1.09‡ (0.23)	−0.30 (0.44)	−0.92‡ (0.25)	1.10 (0.87)
Age at recruitment	−0.01‡ (0.00)	−0.02‡ (0.01)	−0.00(0.01)	−0.02‡ (0.00)	−0.04† (0.01)
N (obs)	7731	2961	1389	5331	718
N (individuals)	3929	1828	1195	2292	651
Waves	4	3	2	6	2

Source: Random-effects logistic regressions based on International Tobacco Control data. The dependent variable is a dummy variable equal to 1 if a respondent last bought loose cigarettes and 0 if they bought a pack; income is an ordered categorical variable ranging from 1 (low) to 3 (high), with low income used as a benchmark for the coefficients; education is a categorical variable ranging from 1 (illiterate) to 3 (secondary or tertiary education), with illiterate used as a benchmark for the coefficients; gender is a dummy equal to 1 if the respondent is female. Age is indicated at the point of recruitment to the survey.
*Indicates significance at 10%.
†Indicates significance at 5%.
‡Indicates significance at 1%.

as packs are also sold as single sticks. Countries marked with an asterisk have passed some legislation that bans the sale of single-stick cigarettes, reflected in lower proportions of formal stores selling them.

The data also suggest that street vendors are much more likely to have loose cigarettes on offer than formal retail stores. This is not surprising, as street vendors typically operate informally and therefore are less likely to follow regulation on the sale of cigarettes. Similarly, they might have a poorer consumer base or provide the sale of loose cigarettes as an additional service for customers.

With respect to consumers, there are reasons to expect that buyers of loose cigarettes will on average have lower incomes. We know that people on lower incomes typically make routine purchases in smaller quantities despite higher unit costs because of irregular cash flows.[18] [19] Furthermore, they may already purchase other products from the informal vendors who are most likely to sell loose cigarettes.

We can test the relationship between income and loose cigarette consumption in countries for which the relevant ITC data are available. Table 2 summarises the results of a random effects logistic regression on the characteristics of people who smoke, where the dependent variable is a dummy indicating the choice to buy sticks rather than a pack, which show that in all countries except Zambia, a lower income is significantly correlated with this choice. Notably, we also find that in four out of the five countries, a younger age at recruitment is also significantly correlated with this decision, as is a lower level of education, though this is only significant in India and Thailand.

While data availability constricts our ability to add further controls, what is available provides strong support for the hypothesis that the consumer profile of loose cigarettes is substantially different from that of packs, and that in most cases correlates with a lower income and a younger age. While we assume here that each respondent is someone who smokes either packs or sticks, they might have a mixed pattern of consumption. However, the current structure of tobacco use surveys does not allow for any empirical quantification of this phenomenon.

The markets for loose cigarettes and the market for cigarettes sold in packs also differ in their prices. First, unit prices of cigarettes sold as sticks and packs have a different level—the former tend to be more expensive. Second, they tend to move differently over time. Third, stick prices are shaped by a currency denomination effect—they tend to cluster around steps in the denomination more than per-cigarette prices of cigarettes sold in packs.

In order to conduct this analysis, we have traced the average unit prices for cigarettes sold both as sticks and packs for the most common brands for each country in the REEP dataset with a sample size of over 2000 observations. We present this full analysis in online supplemental appendix C and draw on an illustrative example here.

First, the average unit price of cigarettes bought as sticks, both for all popular brands and for the most popular one, is higher than the average unit price of cigarettes bought in packs, the only exception being Tanzania in 2018. There is, at least on the average, a positive—and often substantial—price mark-up for loose cigarettes; although highly variable across countries, we have found average mark-ups ranging from 5.1% in Tanzania to 54.3% in Namibia. Figure 1 illustrates these dynamics for South Africa, where the unit price of the most popular brand, Peter Stuyvesant, is on average almost 50% higher for single sticks. Online supplemental appendix C replicates all brand-specific graphs using the median rather than the average, which yields almost identical results.

Where possible, we calculated average mark-ups by aggregating the differences in prices between cigarettes of the same brand sold as both sticks and packs in the same store. We find that while they are positive in virtually all stores (95.4% of the sample for which the analysis was conducted), there are a few cases where mark-ups can be negative, highlighting the need for further research into mark-ups and market structure. We present further analysis in online supplemental appendix C.

Second, the example of South Africa also illustrates another point visible across all countries: the per-cigarette prices of sticks and packs quite never move in parallel, with the gap between them widening and narrowing over time. While this analysis is primarily descriptive, it does provide some indications of more substantial differences in the internal dynamics of these two markets.

Third, the data provide a strong indication for one of the drivers of these different price movements, what we call the 'denomination effect'. Looking at frequency distributions for specific price points of per-cigarette prices for major brands, we find those for loose cigarettes to be more concentrated around round values of the currency denomination than per-cigarette
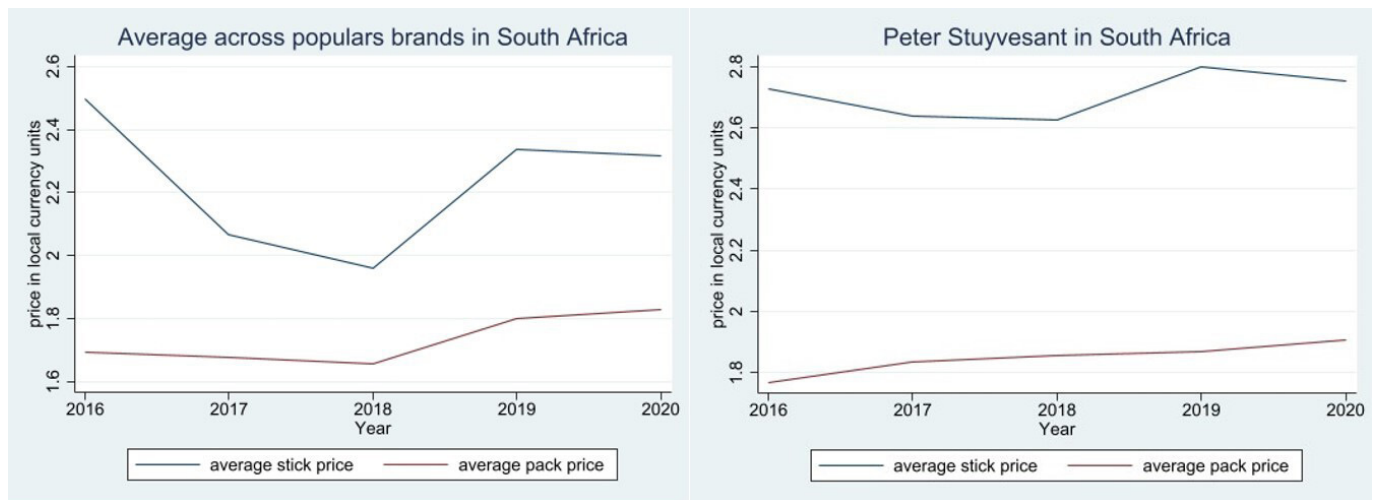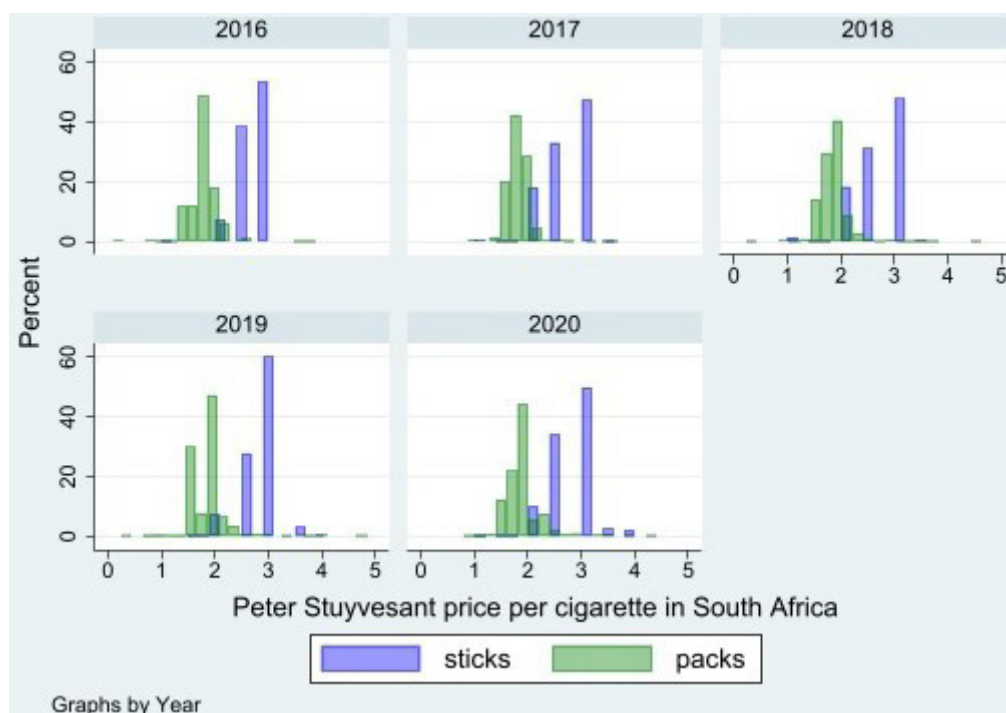
Figure 1 Nominal per-cigarette price of cigarettes sold as sticks and in packs in South Africa, 2016–2020. Source: Authors' elaboration from Economics of Excisable Products Research data, prices in nominal local currency units. 'Average pack price' refers not to a pack but to the average price of a single cigarette sold in a pack. See online supplemental appendix C for further details.

prices for packs. This is intuitive—any increase in pack prices is smoothed over all cigarettes in the pack, leading to a more continuous distribution. Conversely, the price for loose cigarettes is constrained by the availability of small currency denominations; prices can only increase to the next round value.

Figure 2 illustrates the dynamic for Peter Stuyvesant in South Africa—examples across other countries are presented in online supplemental appendix C. While the per-cigarette price in packs shows a relatively smooth distribution across the average price, the price for the cigarettes is tightly clustered to different round denominations—2.0, 2.5 and 3.0 rands—multiples of extremely commonly used coins in South Africa.

This denomination effect can provide some explanation as to why the size of the mark-up that we observe changes over time, as loose cigarette prices remain 'sticky' around certain denominational values, while per-cigarette prices in packs more smoothly adjust to overall price levels. While we can speculate that, due to underlying inflation denomination effects may weaken over time and even potentially become cyclical, if and when this might happen is highly dependent on the context and inflation levels.

Figure 2 Distributions of nominal prices of loose and packed Peter Stuyvesant cigarettes in South Africa, 2016–2020. Source: Authors' elaboration on Economics of Excisable Products Research data, all prices expressed in nominal local currency unit.
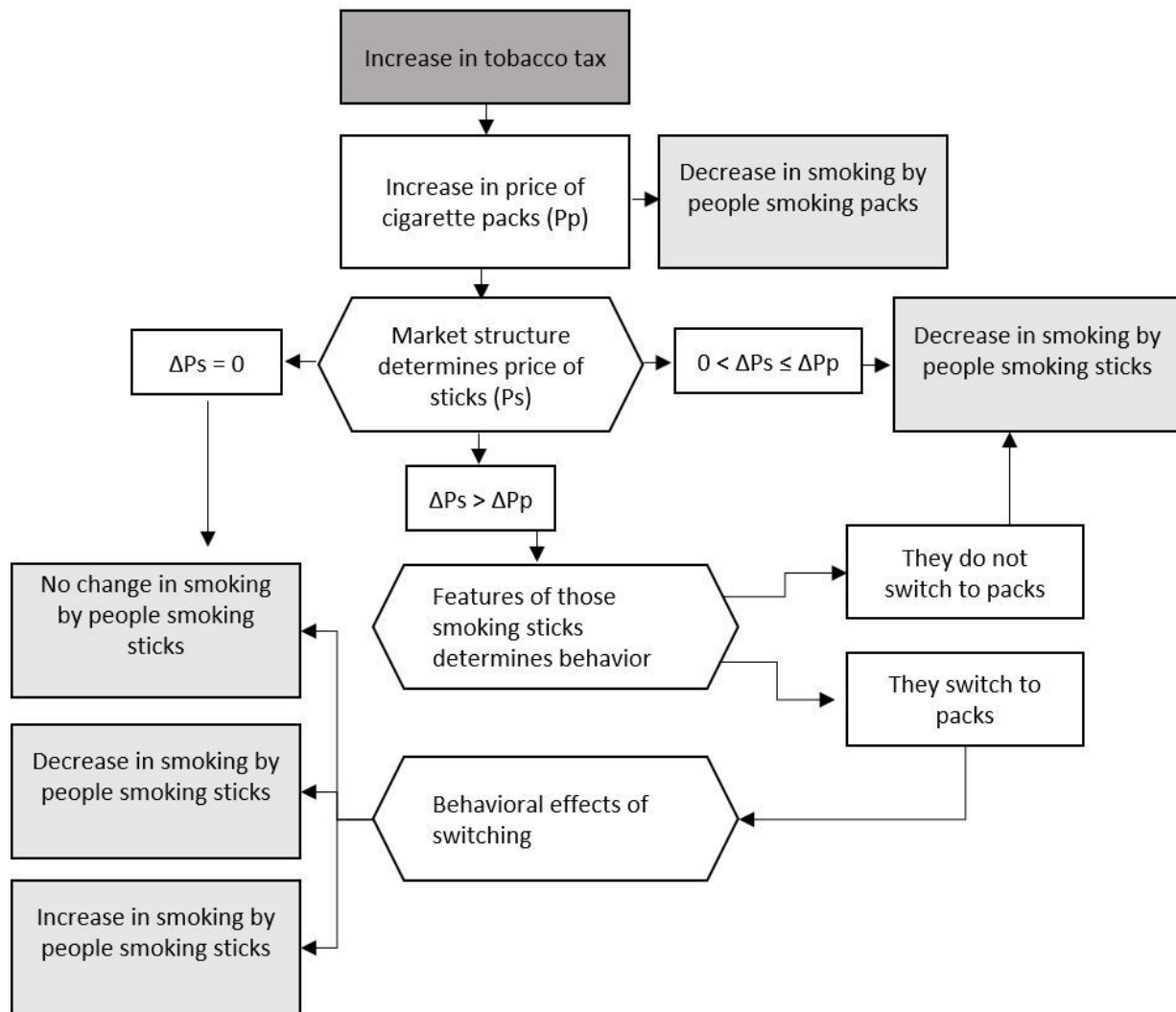
Figure 3 Potential impact of tobacco tax changes on overall cigarette consumption as mediated by the existence of loose cigarettes markets. Source: Authors elaboration.

DISCUSSION

The argument for tobacco taxation relies on the idea that increasing taxes lead to higher prices, which in turn decrease the overall smoking prevalence by leading to cessation, lowering smoking uptake and smoking intensities.[20 21] There is substantial evidence for these relationships, and it is unlikely that our considerations around the market for loose cigarettes will negate them. However, we argue that markets for loose cigarettes can have a direct effect on the outcomes and effectiveness of tobacco tax increases.

Figure 3 summarises the effects of a tax increase in a simple model, assuming the existence of a single brand and a negative price elasticity of demand for both people who smoke sticks and people who smoke packs. First, an increase in tobacco taxation affects the price of cigarette packs, which we assume will lead to some reduction in consumption among those who smoke packs. However, the effect on the price of loose cigarettes is less certain. As we have outlined, loose cigarettes tend to be sold at a mark-up, which varies across time and space according to unobserved market features. The unit price for loose cigarettes could increase more or less relative to the unit price for packed cigarettes following tax increases, depending on how much the mark-up can shrink. Crucially, the 'stickiness' in loose prices

connected with the denomination effect implies that a small increase in tobacco taxation, and a subsequent small increase in packs' prices, may not be passed on loose cigarettes at all, with consequences on their consumption.

If the increase in the price of cigarette packs is not passed on to loose cigarettes, it is reasonable to suggest that there will also be no decrease in consumption among people who smoke sticks. If the goal of tobacco taxation is a direct and immediate effect across actual and potential cigarette consumption of different population segments, then the existence of loose cigarette markets provides a direct argument for larger tobacco tax increases in LMIC contexts.

However, if the price of loose cigarettes increases relatively more than the per-cigarette price of packed cigarettes, another complication emerges. Depending on the behaviour of people who smoke loose cigarettes, we could see a large reduction in aggregate consumption or, instead, a large proportion of consumers switching to buying packs due to their comparatively lower per-cigarette price. We do have some evidence of consumers switching from loose cigarettes to pack, although limited by data availability (see online supplemental appendix D). The effect on total consumption among former buyers of loose cigarettes then becomes difficult to estimate. Here, the key

5

question is whether buying cigarettes in a now larger quantity affects smoking behaviour. We could imagine that high up-front costs at every pack's purchase could motivate people to quit smoking. However, we can also imagine that the large number of cigarettes in a pack could lead people who had previously only smoked occasionally to increase smoking intensity. This is particularly relevant as some literature notes that the consumption of loose cigarettes is intended by many as a harm reduction or cessation strategy.[6 13–15] However, much of this literature is based on high-income countries rather than on LMICs, in which users' demographics, presented in table 2, seem to indicate that lower unitary cost might be the main driver. Depending on the nature of these behavioural effects of switching to packs, the total consumption among people who were originally consuming loose cigarettes can decrease, stay the same, or even increase compared with before the tax rise.

We include this admittedly simplified model in order to illustrate two points. First, to show that the large markets for loose cigarettes that this paper discusses are not merely of academic relevance but can substantially dampen the effect of tobacco control policies such as taxation, shaping its distributional outcomes. One consequence of this discussion is that small and incremental changes in tobacco taxation are less likely to be passed on to loose cigarettes. As noted previously, inflation may over time lead to a passing on of tax increases to stick buyers despite the denomination effect; however, this may only be in the medium to long run and may also depend on the actual structure of tobacco excises, that is, ad valorem or specific.

Second, this model provides a more precise sense of the dynamics that we need to understand in order to estimate the effects of tobacco taxation on actual cigarette markets prevailing in most LMICs. Here, the model suggests focusing on three areas of which we currently only have a very limited understanding and consequently provides a roadmap for a research agenda on this issue. First, how do market structures shape the size of the price mark-up between loose cigarettes and packs, and how does it change in reaction to price shocks such as high inflation or taxation? We could imagine a wide variety of features of these markets that could play a role: the relative size of the consumer base for loose cigarettes, government policy towards their sale, the prevalence of street vendors, the level of diversification and competition, and the nature of the denomination effect, to name just a few. However, we currently do not have sufficient data to examine these relationships in detail or predict market reactions based on pre-existing factors.

Third, we have limited information on the likelihood of people who consume loose cigarettes switching to buying packs and its determinants. Again, features of the market such as competition and the availability of alternative brands, as well as consumer demographics, could play a role here. As summarised in online supplemental appendix D, we find some indication that switching does happen and is connected to price dynamics. However, the available data does not allow us to explore this any further. Fourth, we have no information on the effects of switching towards packs on consumption intensity among former buyers of loose cigarettes, nor on the existence of consumers indifferent between acquiring sticks or packs.

What these areas have in common is a dire need for more large-scale and systematic data collection. To the best of our knowledge, the surveys used in this paper are the only sources of data on tobacco consumption or pricing which also systematically cover loose cigarettes. The country coverage in this paper is notably a substantial but still limited and not representative subset of LMIC cases. While we argue that they are sufficient

for the main arguments in this paper, exploring critical questions in more detail and drawing more attention to this issue will require the mainstreaming of this issue in data collection on cigarettes. First, there is the need for more data on the price of loose cigarettes, alongside features of the respective sellers, such as whether they also sell packs, whether they are stores or informal vendors, and where they are located. Aside from the data collected by REEP and used in this article, we are not aware of any price data for prices of loose cigarettes with a sufficiently high number of observations in order to allow sophisticated analysis. Second, the inclusion of data on smoking loose cigarettes in long-term panels on the behaviour of people who smoke would allow more research on switching between sticks and packs and on its effects on smoking intensity without requiring a dedicated survey. Third, both of these data should be complemented with qualitative evidence to help us better understand the social and cultural aspects associated with loose cigarette consumption in LMICs.

Twitter Max Gallien @MaxGallien

ORCID iDs
Max Gallien http://orcid.org/0000-0002-9620-8433
Giovanni Occhiali http://orcid.org/0000-0002-3541-5420

REFERENCES

1 Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLOS Med* 2006;3:e442.
2 Chisha Z, Janneh ML, Ross H. Consumption of legal and illegal cigarettes in the Gambia. *Tob Control* 2020;29:s254–9.
3 Ross H. Tracking and tracing tobacco products in Kenya. *Prev Med* 2017;105S:S15–8.
4 Vellios N, van Walbeek C, Ross H. Illicit cigarette trade in South Africa: 2002-2017. *Tob Control* 2020;29:s234–42.
5 Gallien M, Occhiali G. No smoking gun: tobacco taxation and smuggling in Sierra Leone. *Tob Control* 2022:tobaccocontrol-2021-057163.
6 Singh M, Dogra V, Kumar R, *et al*. 'Loose' cigarettes association with intensity of smoking: a secondary data analysis from global adult tobacco survey, India, 2009-10. *J Sci Soc* 2017;44:26.

7 Lal P, Kumar R, Ray S, *et al*. The single cigarette economy in India--a back of the envelope survey to estimate its magnitude. *Asian Pac J Cancer Prev* 2015;16:5579–82.

8 Kapoor S, Mehra R, Yadav A, *et al*. Banning loose cigarettes and other tobacco products in India: a policy analysis. *Asian Pac J Cancer Prev* 2021;22:51–7.

9 Stillman FA, Bone LR, Milam AJ, *et al*. Out of view but in plain sight: the illegal sale of single cigarettes. *J Urban Health* 2014;91:355–65.

10 von Lampe K, Kurti M, Johnson J. I'm gonna get me a Loosie" understanding single cigarette purchases by adult smokers in a disadvantaged section of New York City. *Prev Med Rep* 2018;12:182–5.

11 Azagba S, Shan L, Manzione LC, *et al*. Single cigarette purchasers among adult U.S. smokers. *Prev Med Rep* 2020;17:101055.

12 Guillory J, Johns M, Farley SM, *et al*. Loose cigarette purchasing and Nondaily smoking among young adult bar patrons in New York city. *Am J Public Health* 2015;105:e140–7.

13 Thrasher JF, Villalobos V, Dorantes-Alonso A, *et al*. Does the availability of single cigarettes promote or inhibit cigarette consumption? Perceptions, prevalence and correlates of single cigarette use among adult Mexican Smokers. *Tob Control* 2009;18:431–7.

14 Thrasher JF, Villalobos V, Barnoya J, *et al*. Consumption of single cigarettes and quitting behavior: a longitudinal analysis of Mexican Smokers. *BMC Public Health* 2011;11:134.

15 Hall MG, Fleischer NL, Reynales-Shigematsu LM, *et al*. Increasing availability and consumption of single cigarettes: trends and implications for smoking cessation from the ITC Mexico survey. *Tob Control* 2015;24 Suppl 3:iii64–70.

16 Maldonado N, Llorente B, Escobar D, *et al*. Smoke signals: monitoring illicit cigarettes and smoking behaviour in Colombia to support tobacco taxes. *Tob Control* 2020;29:s243–8.

17 Hartono RK, Meirawan RF, Nurhasana R, *et al*. Retailer's density and single stick cigarette's accessibility among school-age children in Indonesia. *Asian Pac J Cancer Prev* 2023;24:675–82.

18 Singh R, Ang RP, Sy-Changco JA. Buying less, more often: an evaluation of Sachet marketing strategy in an emerging market. *Mark Rev* 2009;9:3–17.

19 Karnani AG. Fortune at the bottom of the pyramid: a mirage. 2006. Available: https://papers.ssrn.com/abstract=914518 [Accessed 19 Oct 2022].

20 Chaloupka FJ, Straif K, Leon ME. Effectiveness of tax and price policies in tobacco control. *Tobacco Control* 2011;20:235–8.

21 Blecher E, Ross H. Tobacco use in Africa: tobacco control through prevention. American Cancer Society; 2013. Available: https://www.cancer.org/content/dam/cancer-org/cancer-control/en/reports/tobacco-use-in-africa-tobacco-control-through=prevention.pdf [Accessed 23 Mar 2020].

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

Tob Control

Appendix: An overlooked market: loose cigarettes, informal vendors, and their implications for tobacco taxation

Appendix A: Data and Method

This paper relies on two main sources of data: the African Cigarettes Prices Project from the Economics of Excisable Products Research Unit (REEP) and data from all low- and middle-income countries covered by the International Tobacco Control (ITC) Policy Evaluation Project which included information on loose cigarette prices. The only middle-income country which was not included from those for which ITC had data is Vietnam, as we could not verify the availability of data on loose cigarettes. To the best of our knowledge, these are the only two sources of data on tobacco consumption or pricing which also cover loose cigarettes and that include a time component. That is, some information on loose cigarette consumption and pricing is also available through the Global Adult Tobacco Surveys managed by the Centres for Disease Control and Prevention (CDC), but in the vast majority of cases this survey was only implemented once in each country. On the other hand, both of the data sources we use ensure coverage of each country in at least 2 years.

The Data on Aliments, Tobacco and Alcohol in Africa Project based at REEP at the University of Cape Town has been collecting prices of cigarettes sold at retail outlets and from street vendors in a number of African countries between 2016 and 2022, with data available through the DataFrist of the University of Cape Town at https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/927 . This survey represents the most extensive source of data on cigarette prices in the African continent, but, importantly, it is not nationally representative. The data is collected by students of REEP after rigorous training, but the sampling is purposive in nature, as it is up to the students to determine from which shops information is collected. While efforts are made to avoid duplicate in data collection where more students are working in the same area, there might be some geographic bias in coverage (e.g. less focus on poorer areas in which data collection might be more complex), and the way in which geographic coverage is determined is not well documented. Consequently, while certain shops are covered in more than one round of the survey, the data remains cross-sectional in nature rather than representing a true panel. While 10 rounds of the survey exist, we draw on the publicly available data here, which includes 2020 (for a full breakdown of the number of rounds used by country see Appendix B). Critically, its information about cigarette prices differentiates between cigarettes sold as loose cigarettes and cigarettes sold as packs. It also includes information about the brands as well as about features of the store, such as whether they are street vendors, kiosks, or retail outlets. The data is best described as a repeated cross-section rather than a panel, and does not present a nationally representative sample of retail outlets as selection was purposive rather than based on an underlying sampling frame. As its authors note, this may have caused some geographic bias, for example against poorer areas that are more difficult for enumerators to access. Nonetheless, the data is notable and useful for our purposes not merely for its specific treatment of loose cigarettes, but also because of its large number of price observations (for example, it includes 50,219 price observations over 5 years in South Africa).

Aside from this, we also draw on data from ITC that is based on a set of multi-country surveys which can allow researchers to compare the success of different tobacco control policies promoted by the WHO. Multiple waves of nationally representative surveys have been implemented in each of the 28 countries covered by the projects – most of which are high-income countries – targeting both people

1

who do and do not smoke and people who use other tobacco products such as chewing tobacco. The survey includes different types of information on both the respondents – such as gender, age, income and level of education – and, if any, their tobacco use – such as where did they last buy tobacco, in which form, of which brand and for which price. Furthermore, the data is collected in a panel format, although not all respondents could be tracked for each wave, so that it is possible to track changes in tobacco consumption over time – such as a switch between consuming loose and packed cigarettes. Due to attrition, most of our analysis uses this data as a repeated cross-section rather than a panel. As mentioned in the opening paragraph of the section, we initially targeted all ITC data from low and middle-income countries in which we could find evidence of loose cigarette consumption – these were Bangladesh, India, Kenya, Malaysia, Thailand and Zambia. While Vietnam could have also qualified, we did not pursue that data as the survey instrument is only available in Vietnamese on ITC website, so that we could not determine whether information about loose cigarettes consumption and pricing was available. Furthermore, after an initial examination of the data, we decided to exclude Malaysia from the analysis, as loose cigarettes accounted for less than 5% of consumption in five of the six survey waves. Summary statistics for both datasets are provided below.

There are two consequences of the limited availability of data on the sale and consumption of loose cigarettes. The first is that, although we believe that the phenomena we are trying to illustrate occur in a number of different low- and middle-income countries across the globe, the vast majority of those covered in the remainder of the paper are located in Sub-Saharan Africa, as those are covered in the REEP data.

A further consequence is that we mostly limit our analysis to exploratory statistics, such as testing for correlation or significant differences amongst variables, although we also perform a couple of multivariate regressions in cases in which enough data is available, which is mainly the case for the characteristics associated with smoking sticks (Table 2 in the paper). We decided to run these regressions separately for two main reasons. The first is that not enough information is generally available on this topic to assume that the characteristics associated with the decision to buy loose cigarettes will be the same across the 5 countries for which we have data, nor that they will have the same impact (i.e. in certain countries women who smoke might be more likely to buy singles, in others less). The second reason is that some of the data contained in the survey – education and income – might be categorised differently across each country survey, and hence require thorough harmonisation if we were to pool all countries together. Nonetheless, we have attempted some harmonisation of both of these variables to allows for some comparability, which we now describe. With regard to education, each country survey contained detailed information of what was the highest educational attainment of the respondents. While this included many categories, the diverse structure of schools' progression across different countries led us to decide to create three categories for which we could construct with relative certainty in each country case: "illiterate" (which we use as baseline for regression), "primary or lower secondary" and "higher secondary or tertiary". While this categorisation necessarily leads to some loss of information, this was necessary to ensure some comparability. With regard to income, each country survey contained an income variable with three categories which were however not labelled, nor corresponding to a clear variable in the survey instrument. In this case, we determined whether this variable was increasing from "low" to "high" income or decreasing from "high" to "low" income through the relative distribution of occupations. Using Thailand as an example, we determined that the category 1 was associated with "low income" and 3 with "high income" as professionals made up 0.06% and 3.59% of the two group respectively; those employed in the service sector 7.17% and 21.99% respectively; those employed in agriculture 50.81% and 20.69% respectively, etc. As the paper demonstrates, this level of analysis is sufficient to make our general case, but it also highlights the importance of further data collection in this area.

Appendix B: Summary Statistics

Table C.1 – Summary statistic of REEP data

Country	Observation	Rounds	Years	Main brand	Shop Type		
					Retail	Spaza/Kiosk	Street Vendor
Botswana	9,934	8	2016-2020	Peter Stuyvesant	83.93%	2.18%	13.88%
Chad	250	1	2019-2020	Fine	4.40%	9.20%	86.40%
Eswatini	723	3	2016-2020	Dunhill	96.82%	1.38%	1.80%
Ethiopia	5,989	3	2018-2020	Nyala	-	4.51%	95.49%
Ghana	485	1	2017-2018	Pall Mall	16.29%	61.65%	22.06%
Kenya	349	1	2018-2019	Sportsman	12.89%	64.18%	22.92%
Lesotho	25,653	9	2016-2020	Dunhill	9.69%	15.52%	74.78%
Madagascar	367	2	2019-2020	Good Look	24.52%	38.15%	37.33%
Malawi	2,334	4	2017-2020	Pall Mall	27.08%	18.34%	54.58%
Mauritius	232	1	2016	Dunhill	100.00%	-	-
Mozambique	850	2	2019-2020	Pall Mall	19.18%	4.47%	76.35%
Namibia	25,919	9	2016-2020	Camel	96.83%	1.32%	1.85%
Nigeria	740	2	2018-2020	Benson & Hedges	11.22%	73.51%	15.27%
South Africa	45,410	8	2016-2020	Peter Stuyvesant	54.34%	16.28%	29.38%
Tanzania	2,137	3	2017-2020	Embassy	28.69%	9.45%	61.86%
Uganda	128	2	2016-2019	Dunhill	29.69%	57.03%	13.28%
Zambia	556	5	2017-2019	Peter Stuyvesant	49.10%	43.17%	7.73%
Zimbabwe	22,046	8	2016-2020	Pacific	27.24%	15.40%	57.36%

Table C.2 – ITC Summary statistics

Country	Observation	Waves	Years	Consumption	
				Packed	Loose
Bangladesh	8,243	4	2009-2015	33.01%	66.99%
India	3,052	3	2007-2013	23.97%	76.03%
Kenya	1,776	2	2012-2018	12.70%	87.30%
Thailand	8,146	6	2005-2014	63.12%	36.88%
Zambia	813	2	2012-2014	17.90%	82.10%

Table C.3 – Tests of differences across individual variables and for multicollinearity, Bangladesh

Bangladesh					
	Number	Gender	Income	Education	Age
People who smoke packs	2,646	0.02	2.35*	1.97**	38.88***
People who smoke loose cigarettes	5,777	0.02	2.33*	2.01**	36.37***

3

	VIF	SQRT VIF	Tolerance	R-Squared
sex	1.00	1.00	1.00	0.00
income	1.08	1.04	0.92	0.08
education	1.11	1.05	0.90	0.10
age_at_recruitment	1.02	1.01	0.98	0.02

Table C.4 – Tests of differences across individual variables and for multicollinearity, India

India					
	Number	Gender	Income	Education	Age
People who smoke packs	727	0.01	2.02***	2.60***	40.65***
People who smoke loose cigarettes	2,325	0.01	1.84***	2.38***	37.82***
	VIF	SQRT VIF	Tolerance	R-Squared	
sex	1.00	1.00	1.00	0.00	
income	1.04	1.02	0.97	0.04	
education	1.04	1.02	0.96	0.04	
age_at_recruitment	1.01	1.01	0.99	0.01	

Table C.5 – Tests of differences across individual variables and for multicollinearity, Kenya

Kenya					
	Number	Gender	Income	Education	Age
People who smoke packs	219	0.07	1.73***	2.45*	40.42
People who smoke loose cigarettes	1,557	0.08	1.42***	2.38*	40.82
	VIF	SQRT VIF	Tolerance	R-Squared	
sex	1.02	1.01	0.98	0.02	
income	1.03	1.01	0.97	0.03	
education	1.08	1.04	0.92	0.08	
age_at_recruitment	1.06	1.03	0.94	0.06	

Table C.6 – Tests of differences across individual variables and for multicollinearity, Thailand

Thailand					
	Number	Gender	Income	Education	Age
People who smoke packs	3,957	0.08***	2.36***	2.08***	41.07***
People who smoke loose cigarettes	1,534	0.13***	2.21***	2.01***	38.7***
	VIF	SQRT VIF	Tolerance	R-Squared	

4

sex	1.01	1.01	0.99	0.01
income	1.07	1.03	0.94	0.07
education	1.09	1.04	0.92	0.08
age_at_recruitment	1.09	1.04	0.92	0.08

Table C.7 – Tests of differences across individual variables and for multicollinearity, Zambia

Zambia				
	Number	Gender	Income	Education	Age
People who smoke packs	144	0.04	2.07	2.48	36.49***
People who smoke loose cigarettes	669	0.04	2.17	2.55	32.7***
	VIF	SQRT VIF	Tolerance	R-Squared	
sex	1.01	1.00	0.99	0.01	
income	1.12	1.06	0.89	0.11	
education	1.13	1.06	0.88	0.12	
age_at_recruitment	1.01	1.01	0.99	0.01	

Appendix C: Price Data for all countries in the REEP dataset

This appendix illustrates, for each country in the REEP dataset for which a sample size of over 2,000 observations is available (excluding Malawi, for which stick prices represent less than 10% of the observations for the main brand):

1) The trends in nominal prices (per cigarette) of cigarettes sold as sticks and packs, averaged over the price of every brand that makes up at least 2% of the total prices recorded.
2) the trends in prices (per cigarette) of cigarettes sold as sticks and packs of the dominant brand in the country that is sold as both stick and packs (dominant brand defined as the brand that has the highest peak market share at any year for which data is available), both averaged across all price points and using only the median price.
3) the distribution/histogram of the prices (per cigarette) of cigarettes sold as sticks and packs of the dominant brand over time.
4) The average mark-up applied to loose cigarettes, expressed as share of the price of a packed one, as well as its standard deviation and the share of brand-store pairs for which the mark-up is negative (i.e., selling sticks at a lower price than packed cigarettes).
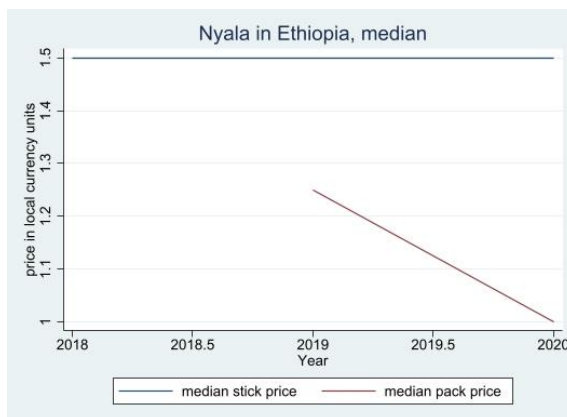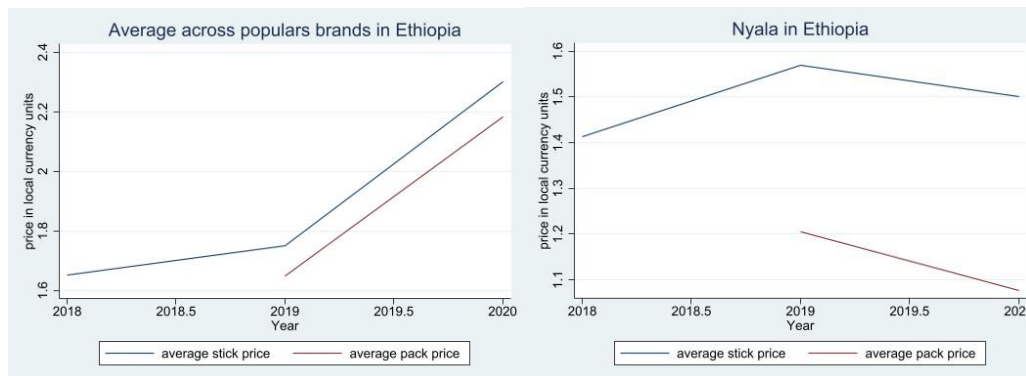
Botswana
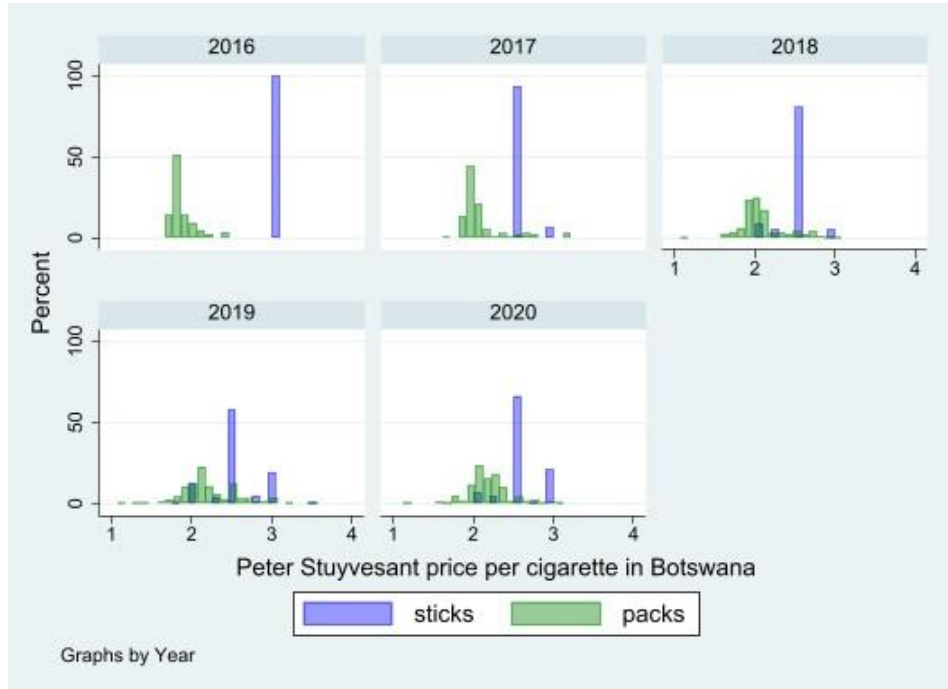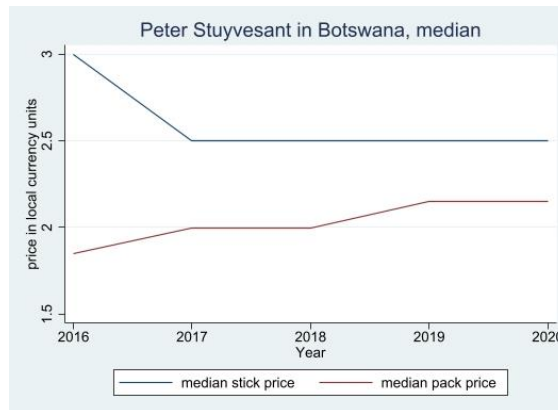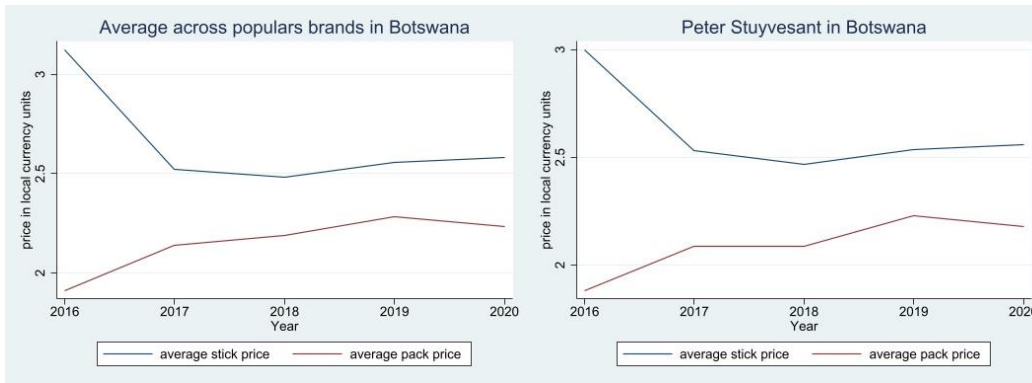
5

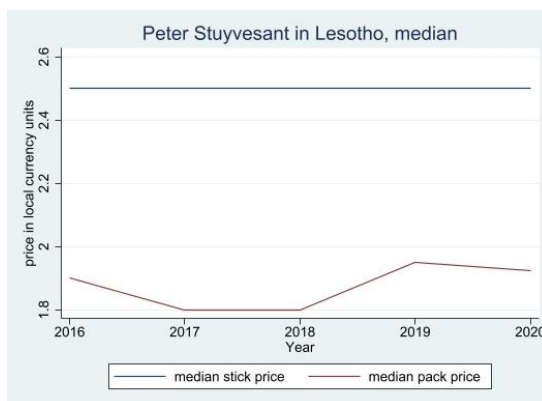| Mark up on loose as a share of packed cigarette price	Average	Standard Deviation	Negative Share
	6.5%	14.2%	0.0%

6

Ethiopia

7

Mark up on loose as a share of packed cigarette price	Average	Standard Deviation	Negative Share
	18.3%	36.6%	10.8%

Lesotho
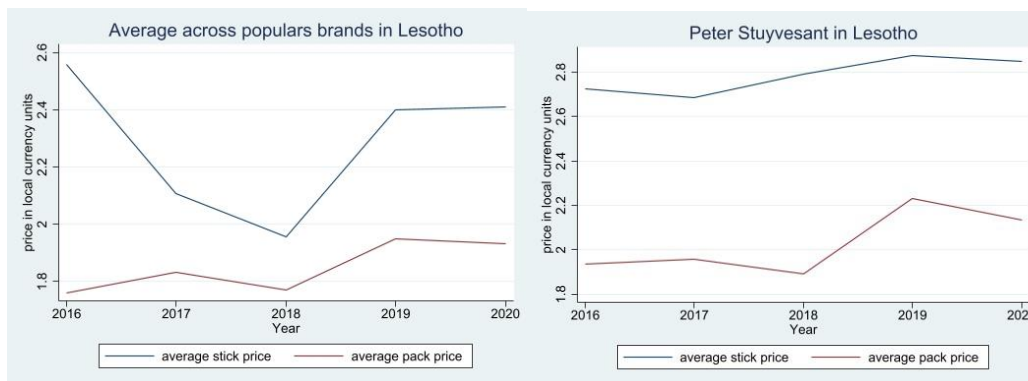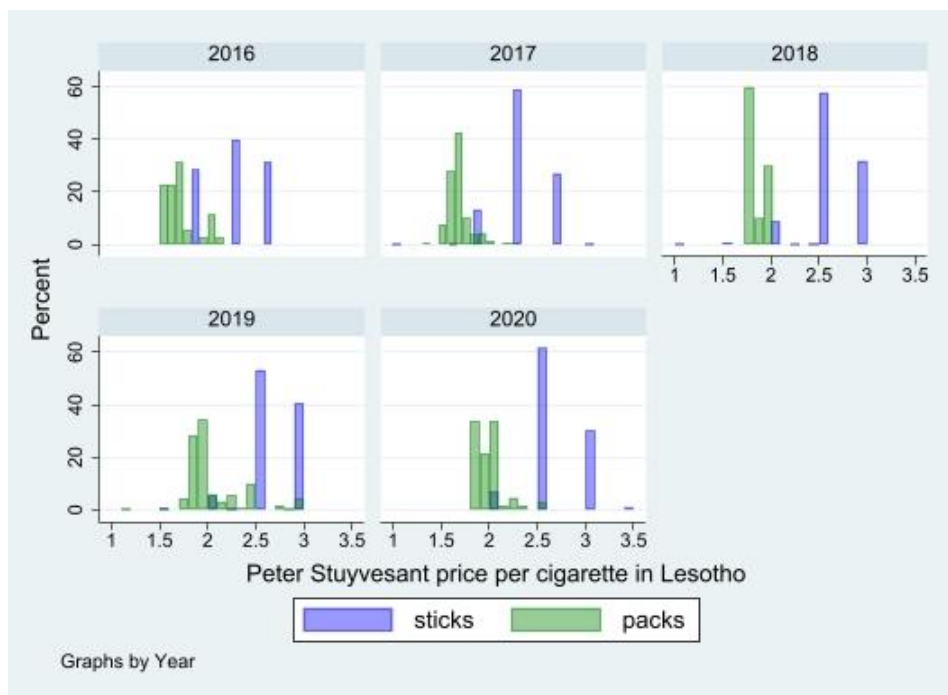
Average across populars brands in Lesotho

Peter Stuyvesant in Lesotho

Peter Stuyvesant in Lesotho, median

8

Graphs by Year

Mark up on loose as a share of packed cigarette price	Average	Standard Deviation	Negative Share
	27.4%	22.7%	1.0%

Namibia
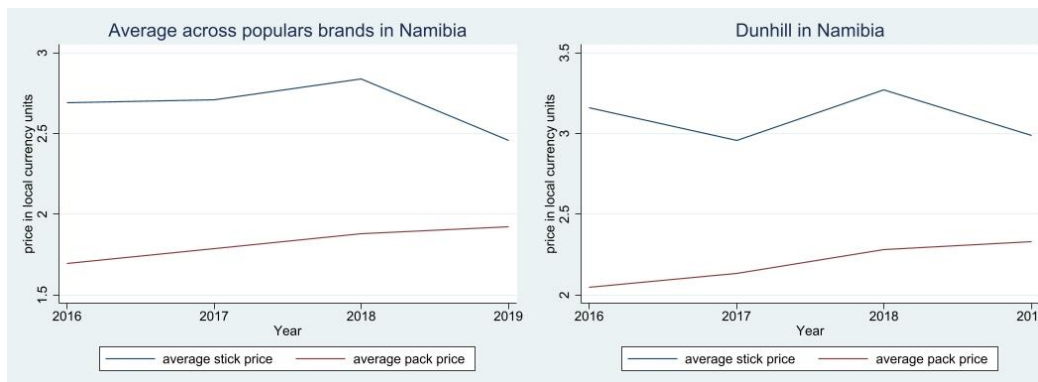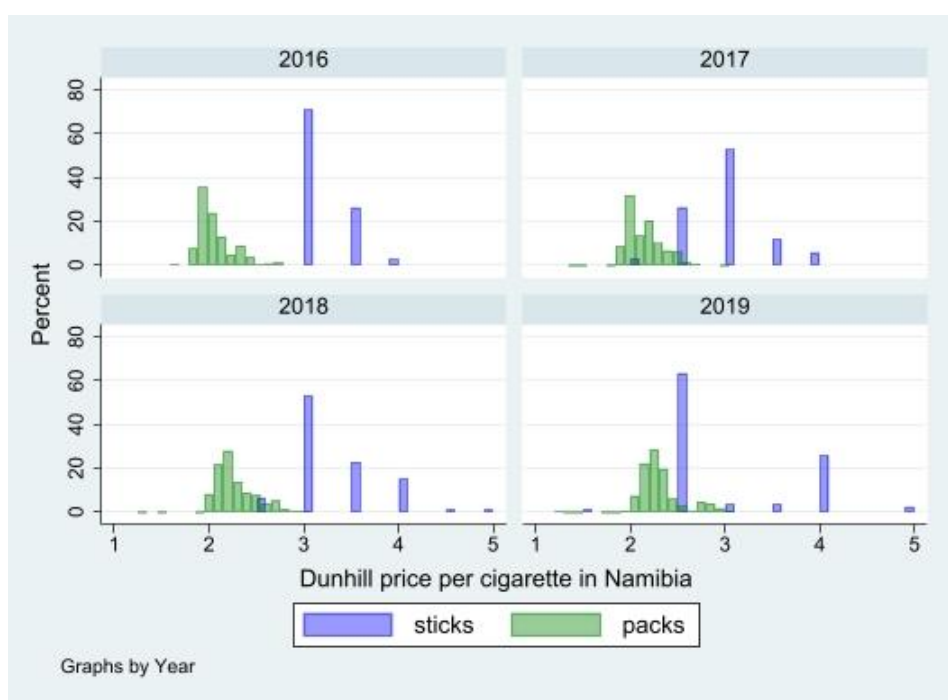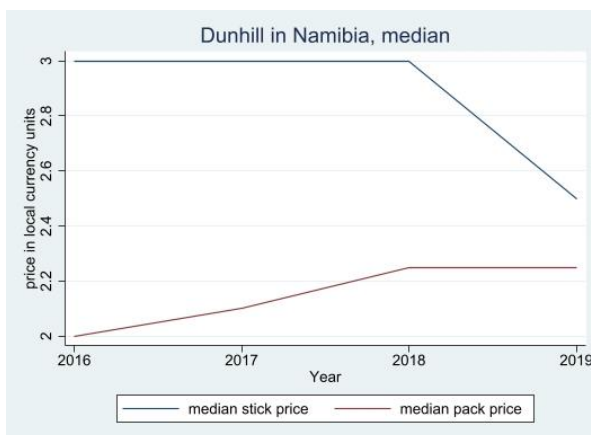
9

Dunhill in Namibia, median

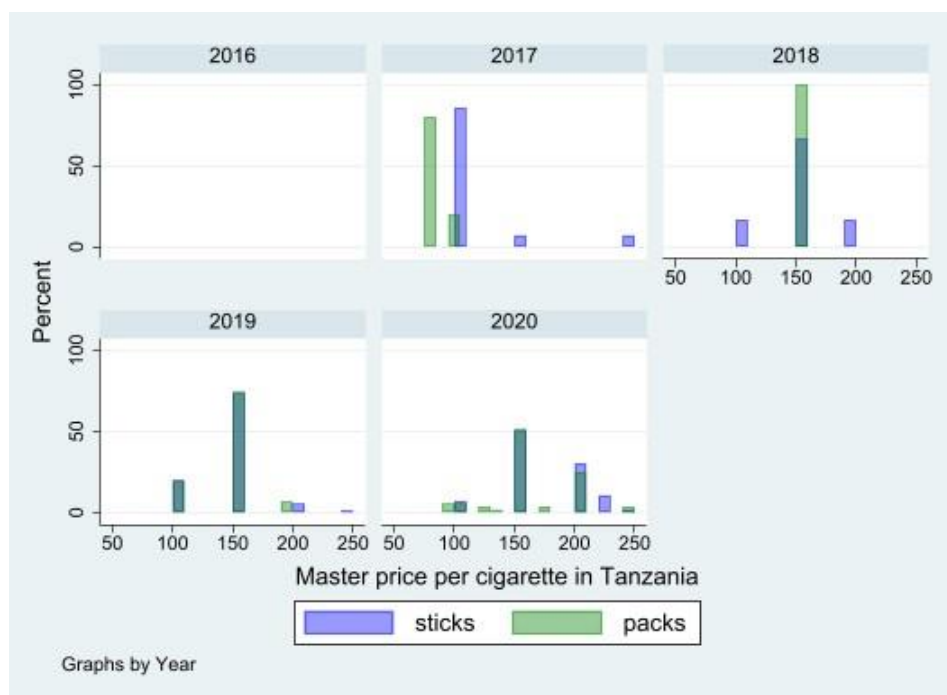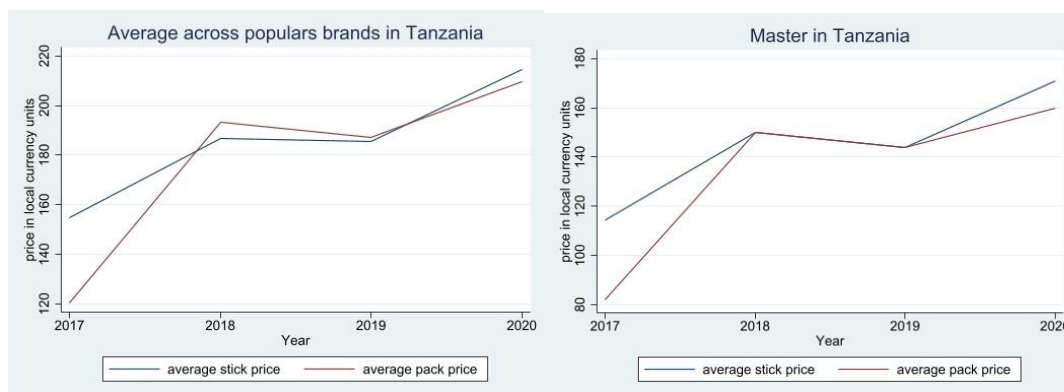| Mark up on loose as a share of packed cigarette price	Average	Standard Deviation	Negative Share
	54.3%	46.9%	0.0%

South Africa
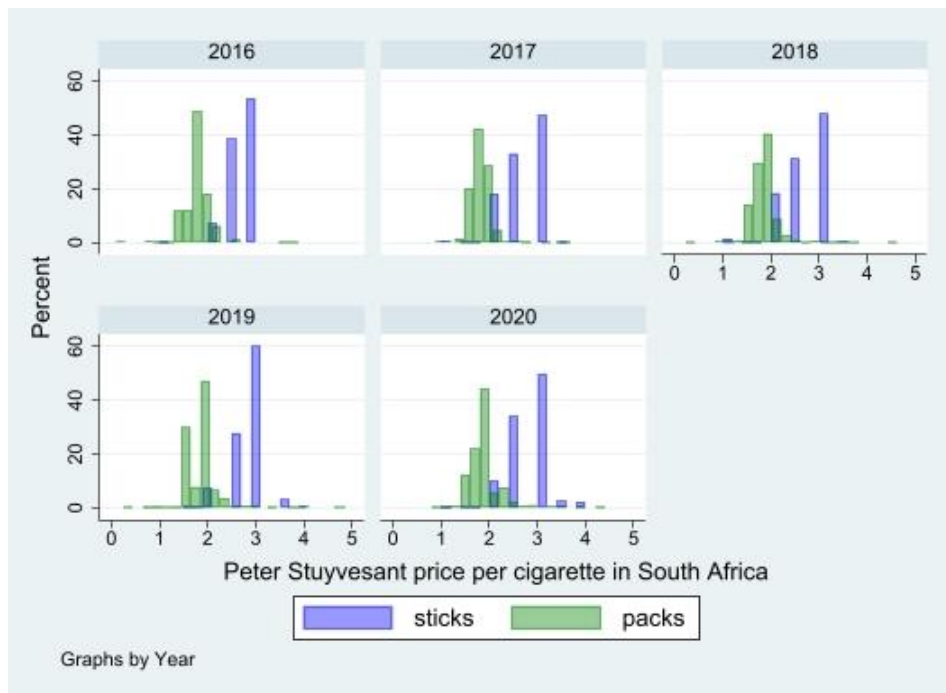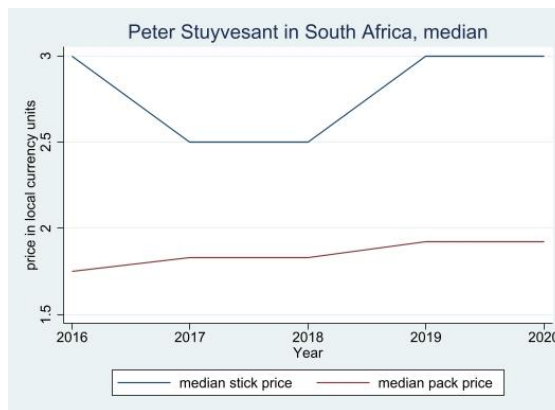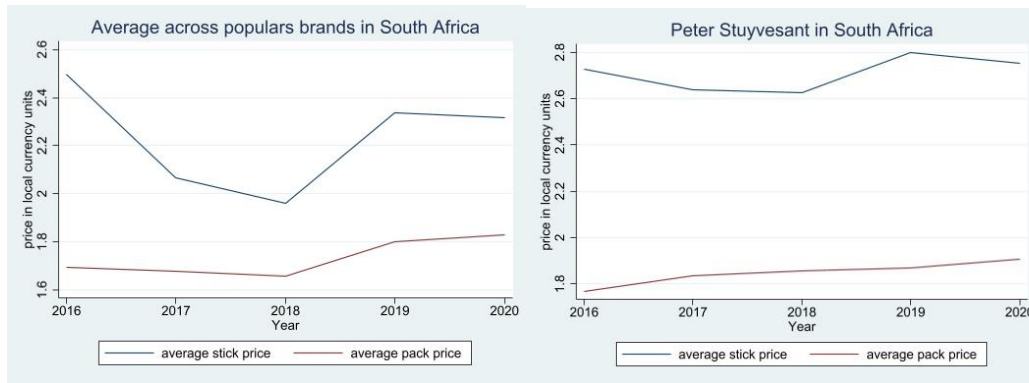
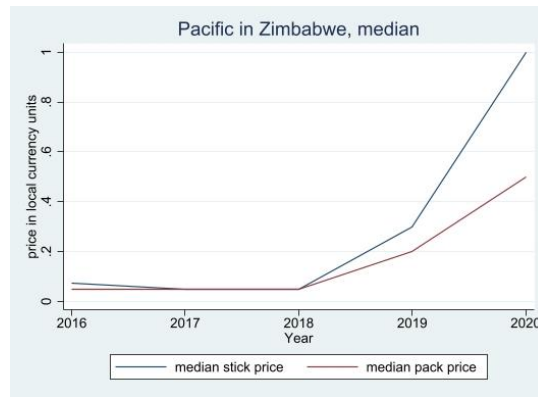| Mark up on loose as a share of packed cigarette price	Average	Standard Deviation	Negative Share
	28.6%	27.0%	3.0%

Supplemental material

BMJ Publishing Group Limited (BMJ) disclaims all liability and responsibility arising from any reliance placed on this supplemental material which has been supplied by the author(s)

Tob Control

Tanzania

12

Mark up on loose as a share of packed cigarette price	Average	Standard Deviation	Negative Share
	5.1%	20.9%	5.6%

Zimbabwe
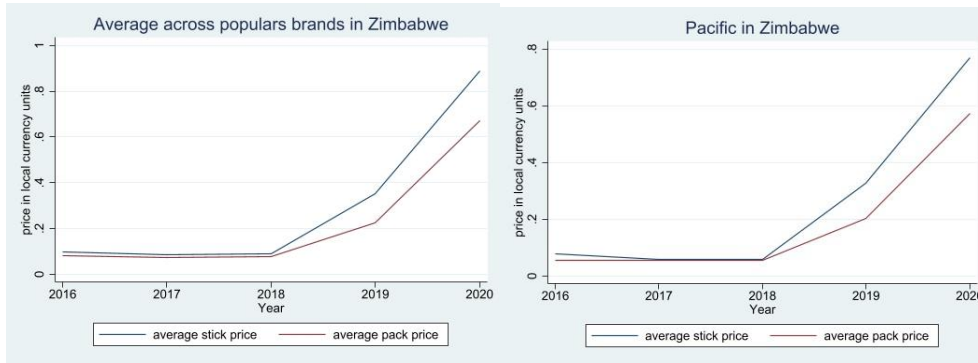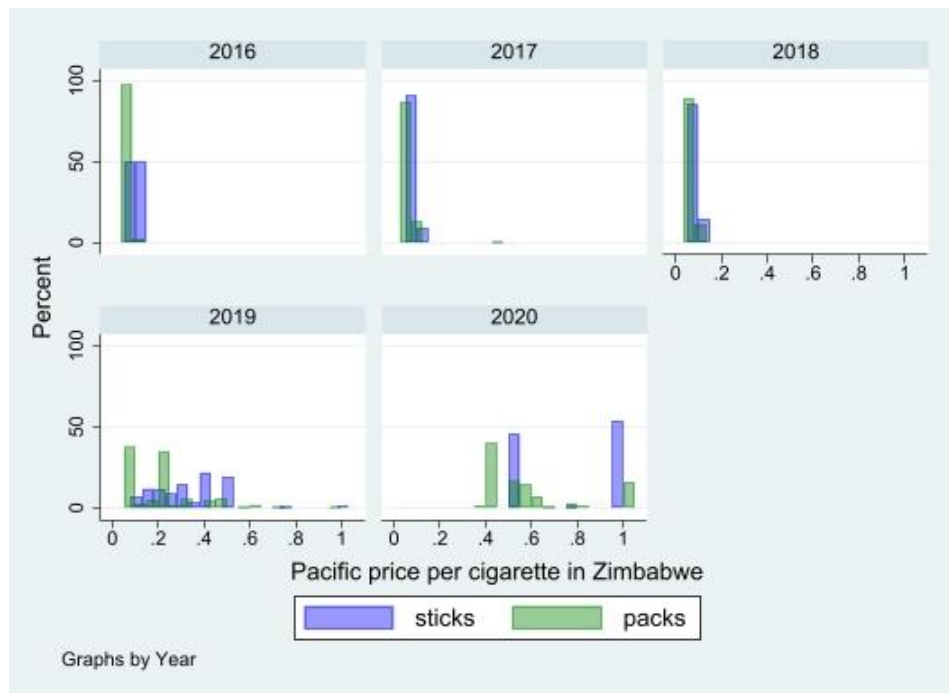
Average across populars brands in Zimbabwe

Pacific in Zimbabwe

Pacific in Zimbabwe, median

Mark up on loose as a share of packed cigarette price	Average	Standard Deviation	Negative Share
	17.4%	29.8%	6.2%

Appendix D: Summary statistics on switchers

Table D1: Frequency and share of people who smoke and have switched between loose and packed cigarettes, by country.

	Packs to Loose		Loose to Packs	
	Frequency	Share	Frequency	Share
Bangladesh	447	5.3%	729	8.7%
India	132	4.3%	155	5.1%
Kenya	16	0.9%	49	2.8%
Thailand	602	7.4%	27	0.3%
Zambia	7	0.9%	15	1.9%

Source: Authors' elaboration on ITC data, switching is defined as a difference in the type of tobacco last acquire by a respondent in 2 consecutive waves.

14