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This report

Abstract

Impact of tobacco tax increases and industry pricing on smoking behaviours and inequalities: a mixed-methods study

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Background: Increasing tobacco prices through taxation is very effective for reducing smoking prevalence and inequalities. For optimum effect, understanding how the tobacco industry and smokers respond is essential. Tobacco taxation changes occurred in the UK over the study period, including annual increases, a shift in structure from ad valorem to specific taxation and relatively higher increases on roll-your-own tobacco than on factory-made cigarettes.

Objectives: Understanding tobacco industry pricing strategies in response to tax changes and the impact of tax on smokers' behaviour, including tax evasion and avoidance, as well as the effect on smoking inequalities. Synthesising findings to inform how taxation can be improved as a public health intervention.

Design: Qualitative analysis and evidence synthesis (commercial and Nielsen data) and longitudinal and aggregate cross-sectional analyses (International Tobacco Control Policy Evaluation Project data).

Setting: The UK, from 2002 to 2016.

Data sources and participants: Data were from the tobacco industry commercial literature and retail tobacco sales data (Nielsen, New York, NY, USA). Participants were a longitudinal cohort (with replenishment) of smokers and ex-smokers from 10 surveys of the International Tobacco Control Policy Evaluation Project (around 1500 participants per survey).

Main outcome measures: (1) Tobacco industry pricing strategies, (2) sales volumes and prices by segments over time and (3) smokers' behaviours, including products purchased, sources, brands, consumption, quit attempts, success and sociodemographic differences.

Review methods: Tobacco industry commercial literature was searched for mentions of tobacco products and price segments, with 517 articles extracted.

Results: The tobacco industry increased prices on top of tax increases (overshifting), particularly on premium products, and, recently, the tobacco industry overshifted more on cheap roll-your-own tobacco than on factory-made cigarettes. Increasingly, price rises were from industry revenue generation rather than tax. The tobacco industry raised prices gradually to soften impact; this was less possible with larger tax increases. Budget measures to reduce cheap product availability failed due to new cheap factory-made products, price marking and small packs. In 2014, smokers could buy factory-made (roll-your-own tobacco) cigarettes at real prices similar to 2002. Exclusive roll-your-own tobacco and mixed factory-made cigarettes

and roll-your-own tobacco use increased, whereas exclusive factory-made cigarette use decreased, alongside increased cheap product use, rather than quitting. Quitting behaviours were associated with higher taxes. Smokers consumed fewer factory-made cigarettes and reduced roll-your-own tobacco weight over time. Apparent illicit purchasing did not increase. Disadvantaged and dependent smokers struggled with tobacco affordability and were more likely to smoke cheaper products, but disadvantage did not affect quit success.

Limitations: Different for each data set; triangulation increased confidence.

Conclusions: The tobacco industry overshifted taxes and increased revenues, even when tax increases were high. Therefore, tobacco taxes can be further increased to reduce price differentials and recoup public health costs. Government strategies on illicit tobacco appear effective. Large, sudden tax increases would reduce the industry's ability to manipulate prices, decrease affordability and increase quitting behaviours. More disadvantaged, and dependent, smokers need more help with quitting.

Future work: Assessing the impact of tax changes made since 2014; changing how tax changes are introduced (e.g. sudden intermittent or smaller continuous); and tax changes on tobacco initiation.

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Supplementary material can be found on the NIHR Journals Library report page (https://doi.org/10.3310/phr08060).

Supplementary material has been provided by the authors to support the report and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.

Glossary

Big Mac® Index The number of cigarettes that can be purchased for the price of one McDonald's Big Mac hamburger (McDonald's Corporation, San Bernardino, CA, USA).

Cigar Roll of tobacco wrapped in a tobacco leaf.

Cigarette Roll of tobacco inserted into a cigarette paper tube.

Cigarillos Small cigars.

Combipacks Roll-your-own tobacco packs sold with papers and filters included.

Down-trading Shifting to a cheaper product.

Factory-made cigarette A mass-produced cigarette, inclusive of tobacco, filter and paper.

Illicit tobacco Tobacco products that are counterfeit and smuggled, commonly to evade tax.

Make your own Referring to machine-assembled cigarettes using smoker-owned machinery.

Net revenue The money the industry retains after sale (in this study, this refers only to the money retained after taxes, but before other costs, such as production, distribution and marketing, have been deducted).

Nielsen (New York, NY, USA) A global market research company that measures market share, sales volumes, distribution, pricing and promotion, with particular strengths in consumer packaged goods.

Nielsen Scantrack Nielsen's electronic point-of-sale database.

Overshifting Increasing the price of products by more than any tax increase.

Price marking Packs of cigarettes or tobacco with the price printed on them.

Roll-your-own cigarette A hand-assembled cigarette containing tobacco, filter and paper. Also known as hand-rolled tobacco.

Stock-keeping unit A retail product generally identifiable through a unique barcode.

Undershifting A strategy used by the tobacco industry to keep some tobacco prices low by absorbing the tax increases on some tobacco products, such that their price does not increase as intended and may even fall, while increasing prices of other products by more than the tobacco taxes ('overshifting'), hence maintaining profitability.

List of abbreviations

ASH	Action on Smoking and Health		OR	odds ratio
BAT	British American Tobacco		PMI	Philip Morris International
CAGE	Competitive Advantage in the Global Economy		PoS	point of sale
CI	confidence interval		PPACTE	Pricing Policies And Control of Tobacco in Europe
CPD	cigarettes per day		QIC	quasi-likelihood under the independence model criterion
CPI	Consumer Price Index		RIP	relative income price
EPOS	electronic point of sale		RPI	Retail Price Index
EU	European Union		RRP	recommended retail price
FM	factory made		RRR	relative risk ratio
FM-C	factory-made (cigarettes sold in) cartons		RYO	roll your own
FM-P	factory-made (cigarettes sold in) packs		SD	standard deviation
			SE	standard error
GDP	gross domestic product		SES	socioeconomic status
GEE	generalised estimating equation		SKU	stock-keeping unit
HMRC	Her Majesty's Revenue and Customs		STG	Scandinavian Tobacco Group
HSI	Heaviness of Smoking Index		TI	tobacco industry
ITC	International Tobacco Control Policy Evaluation Project		TPD	Tobacco Products Directive
			TTFC	time to first cigarette
JPS	John Player Special		UKCTAS	UK Centre for Tobacco and Alcohol Studies
JTI	Japan Tobacco International		ULP	ultra-low price
L&B	Lambert & Butler		VAT	value-added tax
MCT	minimum consumption tax		WAP	weighted average price
MET	minimum excise tax			
MPPC	most popular price category			

Plain English summary

Smoking causes more deaths in the UK than all other preventable causes. A very effective way to reduce smoking is to increase tobacco taxes. However, many factors affect how smokers respond to these, including how big the tax increases are and whether or not they apply to roll-your-own tobacco as well as factory-made cigarettes, and how the tobacco industry responds. We investigated these issues.

We examined three information sources: (1) tobacco industry and retailer reports and magazines (2008–14), (2) the amount of tobacco sold in shops and the prices smokers paid (2008–16) and (3) a survey of smokers (2002–14).

When tax changed, the tobacco industry raised prices slowly over a few months so that smokers would not notice. Overall, the industry dramatically increased prices of expensive packs while keeping cheapest packs about the same. It did this by cutting numbers of cigarettes in packs, introducing smaller roll-your-own packs and new, cheaper brands, often with the price printed on the pack, which shopkeepers had to change. Over time, the industry made larger price increases on top of the increases required for tax.

Smokers could buy tobacco in 2014 at the same price as in 2002. Some smokers attempted to stop and some succeeded, particularly when bigger tax increases were implemented. However, instead, more smokers switched to cheaper brands or roll your own, cut down, or used less tobacco when rolling cigarettes. Poorer smokers struggled most to afford tobacco, but smoked cheap products and were not more likely to quit. Buying smuggled or duty-free tobacco did not increase.

Sudden, large tax rises could stop the industry increasing prices slowly, and seeing a large price jump might encourage more smokers to quit. Preventing the industry from introducing new brands, having plain, standardised packaging and sizes, and providing support for smokers trying to quit would be likely to reduce smoking.

Scientific summary

Background

Since 2010, the UK government has introduced various tobacco tax changes. The aim of this study was to evaluate the effectiveness of these on tobacco use and inequalities in tobacco use, and the extent to which these were influenced by tobacco industry pricing strategies.

Objectives

- Provide up-to-date knowledge of tobacco industry pricing and the extent to which this modifies the impact of tobacco taxation on public health, by examining:

  - how the tobacco industry segments factory-made and roll-your-own cigarettes by price
  - the extent to which the tobacco industry undershifts, overshifts or fully shifts tobacco tax increases to consumers, whether or not this varies by product, price segment and over time, and what proportion of price increases by segment is explained by tobacco industry price increases versus tax increases.

- Explore the impact of tobacco tax increases, as moderated by tobacco industry pricing, on smokers' behaviour, by examining:

  - the impact of price changes and the price range (the difference in price between the most and least expensive products) on quitting, or switching between products/price segments
  - the impact of the price range and price changes on consumption
  - whether or not these behaviours differ by smokers' previous product/price choice.

- Increase understanding of trends in, and the nature of, tax avoidance and evasion, by examining:

  - trends in smokers' tobacco tax avoidance and evasion, their socioeconomic status and other characteristics, and where they acquire tobacco
  - whether or not tax/price increases, particularly larger increases, are linked to tax avoidance and/or evasion
  - products most frequently acquired via tax avoidance/evasion and from which sources.

- Explore the impact of tobacco tax increases, as moderated by tobacco industry pricing, on inequalities in smoking, by examining:

  - smokers' characteristics by product/price segment
  - whether or not behaviours (quitting, switching between segments and reducing consumption) differ by socioeconomic status
  - if the proportion of change in smoking inequalities over time is attributable to cheap tobacco use.

- Synthesise findings and develop recommendations to improve the effectiveness of tobacco taxation.

Methods

There were three main data sources.

Commercial literature (2008–14)

This comprised tobacco industry reports and presentations, analyst reports and trade magazines. A total of 517 articles were identified, providing 1892 extracts: 1700 concerned 347 brands/variants, used for segmentation. Qualitative analyses of 557 quotes explored how the tobacco industry maintains profitability, smokers' reactions and the wider context facing the tobacco industry.

Nielsen data (2008–16)

Nielsen provided tobacco sales data. Nielsen's Scantrak data are based on information obtained when tobacco products are sold (electronic point-of-sale system). Nielsen models the whole UK market using electronic point-of-sale data from 87% of the UK's supermarkets, 15% of its convenience stores and 17% of Northern Ireland stores with grocery sales. The data cover different factory-made and roll-your-own products: the number of units sold, price/unit, total value and volume.

International Tobacco Control Policy Evaluation Project data (2002–14)

This was a longitudinal cohort survey of UK smokers at recruitment, retained for as long as possible even if participants had quit, with replenishment, and administered via computer-aided telephone interviewing or online. Data were mostly from surveys 1–10 (2002–14). For roll-your-own tobacco weight calculations, a comparison was made with three other International Tobacco Control Policy Evaluation Project countries' surveys (2002–15). Stratified random sampling and weights are used to obtain broadly nationally representative samples. Validity checks were carried out and analyses examined prices paid, affordability, purchasing behaviours and consumption, and, when appropriate, examined differences by dependence and socioeconomic status.

Results

Objective 1

Segmentation

Our analysis of the commercial literature and Nielsen data analysis demonstrated four factory-made cigarette price segments (premium, mid-price, value and, from 2012, subvalue) and three roll-your-own tobacco price segments (premium, mid-price and value).

Tobacco industry pricing strategies and what smokers pay for their tobacco

The commercial literature reported smokers down-trading because of increased prices (due to tax/profit generation) and the recession. The tobacco industry implemented various strategies to maintain profitability, including innovation; launching more products in lower price segments, often of the same brand as higher priced products; and using a variety of techniques to promote cheaper products, such as price marking and smaller pack sizes.

The International Tobacco Control Policy Evaluation Project 2002–14 data (6169 participants, 15,812 responses) show that the real price paid for tobacco products purchased from licit sources (supermarkets and convenience stores) increased significantly over time. The median price per stick for factory-made (cigarettes sold in) packs increased by £0.10 (2002–14), factory-made (cigarettes sold in) cartons were typically £0.01–0.02 cheaper per stick and the median price per stick for roll-your-own tobacco increased by £0.05 (2006–14). Changing between product types saved money, with roll-your-own tobacco per stick being typically less than half the price of one factory-made pack cigarette. Changing within product types (to different brands) also saved money. The price range between the cheapest and most expensive products within each category [factory-made (cigarettes sold in) packs, factory-made (cigarettes sold in) cartons and roll-your-own tobacco] was consistently wide and, for some products, widening since 2010. Thus, smokers in 2014 could buy the same type of product at real prices similar to 2002 for factory-made cigarettes and 2006 for roll-your-own tobacco. There was a greater increase in prices since 2011, when duty was higher than in previous years, but this did not prevent the widening range between the cheapest and most expensive products.

Nielsen data corroborated these findings. From 2013 to 2015, real prices of premium factory-made and roll-your-own packs increased by £1.09 and £1.16, respectively (overshifting, i.e. raising prices above the need to meet taxes), whereas subvalue packs fell by £0.06 and roll-your-own tobacco packs only increased by £0.02 (undershifting). Prices of all three roll-your-own tobacco segments increased by the highest amount post the 2011 Budget, and the range between factory-made premium and value cigarette segments declined. However, subvalue products were then introduced, with falling real prices per pack subsequently leading to a widening of the range between premium and subvalue segments.

Smaller packs (17–19 sticks) were introduced to an increasing number of brands and market share of 20-stick packs declined over the study period. For roll-your-own tobacco, smaller (10-g) packs increased towards the end of the study period and the 50-g pack market share grew slightly. Price increases per stick were seen in every segment, suggesting that the fall in price of subvalue packs was due to the declining number of sticks per pack. Cheaper segments were more likely to be price marked and price marking appeared to increase gradually over time.

Nielsen data indicated that net real revenue was considerably greater for higher than for lower priced segments, with a more marked gap within factory-made than roll-your-own segments. At the 2011 Budget, a cyclical pattern emerged involving a drop in revenue immediately post Budget with increases thereafter, with different patterns across segments and progressively more differentiation in revenue between segments. A significant proportion of price rises was from industry revenue generation, rather than tax increases, with different patterns according to tax increases. Sudden, large tax increases appeared to compromise the tobacco industry's ability to manipulate prices.

Affordability

The commercial literature suggested that tobacco products were becoming less affordable. International Tobacco Control Policy Evaluation Project data (4062 current daily smokers, 8943 observations) indicated an average annual decrease in incomes over the study period. There was an average annual increase of 2.6% in the price of factory-made cigarettes and individualised affordability decreased annually by 0.24% (2002–14). There was an average annual increase of 4.5% in the price of roll-your-own cigarettes and individualised affordability decreased annually by 0.31% (2006–14). Roll-your-own tobacco was significantly more affordable than factory-made cigarettes.

Objective 2

Smokers' responses to taxation and tobacco industry pricing strategies

Nielsen data indicated that although the overall volume of factory-made cigarettes and roll-your-own tobacco sold declined markedly, this was made up of a 17% decline in factory-made cigarettes and a 46% increase in roll-your-own tobacco, although the latter stabilised post 2012. This was reflected in the International Tobacco Control Policy Evaluation Project data (2002–14; 6169 participants, 15,812 responses), which indicated that exclusive roll-your-own tobacco use increased and exclusive factory-made cigarette use decreased. Mixed factory-made cigarettes and roll-your-own tobacco did not show a statistical linear trend across 2002–14, but increased significantly in 2010–13, from 10.2% to 18.2%. Further evidence of down-trading was evident from Nielsen data, which showed that annual volumes of premium and mid-price factory-made products declined over the study period, whereas value factory-made products increased. Similarly, premium roll-your-own tobacco sales declined, whereas roll-your-own mid-price tobacco and value tobacco sales grew, although growth slowed around 2012–13.

International Tobacco Control Policy Evaluation Project data from 2008 to 2014 (2418 participants, 4339 observations) demonstrated that, overall, the use of cheap tobacco (mid-price factory made, value factory made and roll your own) increased modestly from 72.4% to 77.6%, with a corresponding drop in premium factory-made tobacco. Value factory-made cigarettes and/or roll-your-own cigarettes were more likely to be used than premium factory-made cigarettes when there was a higher tobacco tax increase rate.

In longitudinal analyses (1304 participants, 2202 observations), the most common outcome between the baseline and outcome surveys was trading up (5.5%) and no change (66.5%), 13.5% traded down to cheaper factory-made cigarettes, 6.2% switched from factory-made cigarettes to roll-your-own cigarettes and 8.3% stopped purchasing tobacco products for at least 6 months. A high tobacco tax increase at the outcome survey was the only significant predictor of all these behaviours. We also assessed quit attempts (1304 participants, 2202 observations) and 6 months' sustained quitting (1194 participants, 2017 observations). Just over one-third (39.4%) of smokers made a quit attempt: overall, baseline tobacco type was a predictor of attempting to quit, with those smoking mid-price factory-made cigarettes and value factory-made cigarettes significantly more likely to try quitting than those using roll-your-own cigarettes. Quit attempts at outcome survey were also more likely with a 2% tax increase rate above inflation than 1% (5% consistent with 2% but non-significant). Just under 1 in 10 smokers (9.7%) sustained quitting for at least 6 months and this outcome was significantly more likely among smokers of mid-price factory-made cigarettes, value factory-made cigarettes and roll-your-own cigarettes compared with premium factory-made cigarettes at baseline, and higher tax increase rate at the outcome survey.

In the International Tobacco Control Policy Evaluation Project affordability analysis (4062 current daily smokers, 8943 observations), factory-made cigarette smokers slightly, but significantly, reduced their cigarette consumption over time; there was no significant change for roll-your-own tobacco smokers. International Tobacco Control Policy Evaluation Project data (2006–15) assessed the weight of roll-your-own tobacco/cigarettes and changes over time, in the UK, the USA, Canada and Australia (1639 participants, 3176 observations). Just over one-quarter of UK participants (25.8%) smoked roll-your-own tobacco/cigarettes (compared with 3.5% in the USA, 6.0% in Canada and 13.8% in Australia). Mean roll-your-own tobacco/cigarettes weight was lowest in the UK [0.51 g (standard deviation 0.32 g)] and Australia [0.53 g (standard deviation 0.28 g)], compared with Canada [0.76 g (standard deviation 0.45 g)] and the USA [1.07 g (standard deviation 0.51 g)]. For the UK and Australia (1349 participants, 2705 observations) there was a significant decrease equivalent to a 2% per year decrease in average weight per cigarette. Thus, for both factory-made cigarette smokers and roll-your-own tobacco smokers in the UK, tobacco consumption was reducing over time, implying that the decrease in affordability was not attributable to increasing cigarette consumption.

Objective 3

Purchasing from possible tax evasion/tax avoidance sources

Purchasing from non-UK/non-store sources (6169 participants, 15,812 responses) constituted ≤ 20% of purchases and reduced significantly over time (2002–14). If missing data were assumed to be non-UK/non-store, then the decrease was no longer significant, but there was no evidence of an increase.

Among non-UK/non-store purchases, purchasing outside the UK was most common (≥ 40%), although this decreased significantly over time, as did purchasing from informal sellers (≤ 17%). Purchasing from duty-free outlets and friends/relatives significantly increased over time. Factory-made cigarettes in cartons were the most popular purchase from non-UK/non-store sources, followed by roll-your-own cigarettes, with very few factory-made cigarettes sold in packs. Median prices for factory-made cigarettes in cartons and roll-your-own cigarettes from non-UK/non-store sources significantly increased during the study. For all product types, median prices from non-UK/non-store sources were often lower than the lowest prices in UK store-based sources. Thus, factory-made cigarettes and roll-your-own cigarettes were significantly more affordable when purchased from non-UK/non-store sources than from UK stores [International Tobacco Control Policy Evaluation Project affordability analysis (4062 current daily smokers, 8943 observations)].

In longitudinal International Tobacco Control Policy Evaluation Project analyses (854 participants, 1397 observations), overall, 7.6% reported a high frequency of buying from sources likely to be illicit. Those reporting a high frequency of illicit purchases were significantly less likely to use mid-price or value factory-made cigarettes, and significantly more likely to use roll-your-own cigarettes than premium factory-made cigarettes, than those with a low frequency. There was no significant difference in trading down, switching to roll-your-own cigarettes or in quit attempts/success between high- and low-frequency illicit purchasers.

Objective 4

Socioeconomic status differences

In the International Tobacco Control Policy Evaluation Project individualised affordability analysis (4062 current daily smokers, 8943 observations), women, older smokers, more disadvantaged smokers (as measured by education and region) and more dependent smokers, found smoking less affordable. This was similar for factory-made cigarette and roll-your-own cigarette smokers, although roll-your-own cigarettes were uniformly cheap and there was less differentiation by socioeconomic factors and dependence compared with factory-made cigarette smokers.

In the International Tobacco Control Policy Evaluation Project data, overall, more disadvantaged smokers were more likely to smoke cheap products. In the longitudinal analyses, younger smokers, single smokers and smokers with low levels of education were more likely to trade down to cheaper factory-made products. Switching to roll-your-own cigarettes was significantly more common among younger and low-income smokers. More dependent, more disadvantaged and younger smokers were more likely to roll cigarettes with less tobacco. After controlling for price segment and product smoked, there was no clear relationship between socioeconomic status and quit attempts or quitting. Thus, low socioeconomic status smokers and other vulnerable groups may have been avoiding quitting by taking advantage of the availability of cheap tobacco products.

Conclusions

Overall, the tobacco industry continues to be able to overshift taxes, thereby increasing its revenues, even when tax increases are high. Recently, in the cheapest price segments, the tobacco industry has been overshifting to a greater extent and making more revenue on roll-your-own tobacco than cheap factory-made cigarettes. There is therefore scope to increase tobacco taxes further, particularly for roll-your-own cigarettes, to reduce price differentials and recoup the public health costs of smoking. We found no evidence of illicit increases, suggesting that the government's anti-illicit strategies have been successful and need maintaining. The tobacco industry smooths the impact of tax increases by cutting profits initially and then increasing profits thereafter, but large, sudden tax increases reduce the tobacco industry's ability to manipulate prices. The tobacco industry has a variety of strategies to keep some products cheap. Some of these (e.g. price marking, small pack sizes) are now outlawed by recent legislation, but the tobacco industry can still introduce much cheaper variants for its brands (unlike in Uruguay, for example).

High above-inflation tax rises decreased affordability and increased quitting behaviours. However, the growing availability of cheap tobacco products encourages trading down to cheap factory-made products and switching to roll-your-own cigarettes rather than quitting. Thus, despite more disadvantaged smokers struggling with affordability, they were not more likely to quit than other smokers. The ability of the tobacco industry to bring cheap products to the market therefore undermined the public health gains.

Research recommendations

1. Impact of changing how tax changes are introduced (e.g. sudden intermittent or smaller continuous) on smoking prevalence and illicit sales.
2. The effectiveness of minimum pack sizes, price-marking ban and a minimum excise tax in limiting cheap products.
3. Impact of tax on initiation.
4. Impact of novel nicotine products on prices.

Funding

Chapter 1 Introduction and aims

Background

Health and economic impacts of tobacco

Smoking remains the leading preventable cause of death, disease and health inequalities in the UK.[1] Over 100,000 people in the UK are killed by smoking every year.[2] Smokers lose an average of 10 years of life expectancy, and exposure to other people's smoke also causes death and disease among non-smokers. In England, the annual cost to the economy is estimated to exceed £11B a year, including cost to the NHS, employers and to the wider economy.[3] In 2017, 14.9% of the adult population in England were current smokers, but this figure masks large disparities in smoking across socioeconomic groups (e.g. 26% smoking prevalence among routine and manual vs. 10% among managerial and professional occupations).[4] Any public health intervention that reduces tobacco use or prevents uptake will lead to significant benefits by reducing premature mortality and morbidity and, consequently, lower NHS costs and increased economic output.

The importance of tobacco tax and price

Tobacco tax increases have been shown to be the most effective and cheapest way of reducing tobacco smoking prevalence,[5–13] consumption,[14,15] initiation[16,17] and inequalities in smoking.[18–21] Tobacco tax has been identified by the World Health Organization as a critically important tobacco control intervention[22] and the UK has real tobacco prices that are among the highest in the world.[23,24] The public health impact of tobacco taxation can, however, be reduced by the availability of cheap tobacco. The tobacco industry (TI) is aware of the importance of price and its internal documents show that pricing and price promotions are among its most important marketing tools[25–28] in order to reduce the effectiveness of tobacco tax increases.[29,30] Hence, research needs to assess the extent to which the effectiveness of tobacco tax increases is influenced by TI pricing strategies and the effect this has on smokers' behaviour and socioeconomic inequalities in smoking.

The UK tobacco industry

The main tobacco companies involved in the UK market are Imperial Tobacco (now Imperial Brands) and Japan Tobacco International (JTI).[31] In 2008, JTI became a major player in the UK market through purchasing Gallaher. British American Tobacco (BAT) and Philip Morris, also known as Philip Morris International (PMI), have smaller shares.[31] PMI's main contribution to the UK market is its iconic brand Marlboro (Philip Morris, New York, NY, USA). Scandinavian Tobacco Group (STG) (Copenhagen, Denmark) was previously involved in the UK through its distribution of Natural American Spirit [chiefly roll your own (RYO)], and currently via sales of cigars and cigarillos. The annual profits generated by the UK TI have been estimated to be £1.5B in 2012 and 2013, with profit margins estimated at approximately 50%.[31]

Tobacco industry segmentation and pricing strategies

The TI offers a variety of different tobacco products, including factory-made (FM) or manufactured cigarettes, RYO tobacco, cigars, cigarillos and waterpipes. FM cigarettes and RYO tobacco are by far the most popular tobacco products, particularly in the UK. For each tobacco product, the industry offers a number of different brands and it also segments the market into different price categories. Our previous work reviewed the industry literature and sales data on FM segments and identified four price segments: premium, mid-price, economy and ultra-low-price (ULP) brands.[32]

When tax increases are announced in the Budget each year, tobacco companies can do one of three things: (1) increase prices on top of tax increases, so that both the price and tax increase are passed on to consumers (known as overshifting), (2) absorb the tax increase so it is not passed on to consumers (undershifting) or (3) pass the tax increase on to consumers in full (fully shifting).[33] The extent of

'tax pass-through' to consumers will reflect economic conditions, competition in the market and the extent to which manufacturers are willing to adjust their profits in order to absorb some of the tax increases.

We previously revealed that, between 2000 and 2009 in the UK, the TI undershifted taxes and cut prices on cigarettes in the cheapest segments to keep them cheap, while overshifting taxes on more expensive cigarettes to maximise profits.[32,34,35] Approximately, only half of the price increases were needed to meet tobacco taxation increases, consistent with evidence from Ireland between 2000 and 2010.[36] The range between the cheapest and most expensive cigarettes (the 'price gap') therefore increased. Similar TI pricing strategies have now been confirmed in other jurisdictions,[37–39] where tobacco companies have also been introducing increasing numbers of lower priced products.[37–39] Smokers are therefore incentivised to down-trade from expensive to cheap cigarettes, rather than quitting smoking.

UK smokers' behavioural responses to price increases

When faced with a tobacco tax and price increase, smokers may do nothing, quit, reduce consumption or engage in price-minimising behaviours by switching to one of a number of cheaper sources of tobacco. This might include:

- cheaper legal products (e.g. cheaper manufactured/FM and/or RYO cigarettes[12,40–44])
- tax avoidance – travellers returning from other European Union (EU) countries (which typically have lower tobacco duties) can legally purchase tobacco for personal use in line with guidelines for reasonable personal use,[45] or smokers can purchase tobacco in duty-free shops[46]
- tax evasion – changing to illicit sources,[47] including purchases of a genuine TI product that has entered the illicit market or of counterfeit or 'illicit whites'
- purchasing larger quantities which afford economies by buying in bulk (e.g. by the carton, rather than the pack).[40,41]

The growing availability of legal cheap cigarettes in the UK is therefore a major public health concern, as it provides options to smokers other than changing their smoking behaviour. If this differentially affected smokers in lower socioeconomic groups, it would drive smoking inequalities further.[32,34,35] The use of cheaper tobacco products has indeed increased, particularly by the poorest.[10,12,42–44,48] The same concerns apply to tobacco tax evasion, also used more frequently by lower socioeconomic groups.[49–52] By contrast, tax avoidance is more common among higher socioeconomic groups consistent with their greater propensity to travel.[46] However, self-reported tax avoidance and evasion by UK smokers declined from 2002 to 2011,[53] in contrast to TI arguments that they would increase in response to higher tobacco taxes (see *Illicit tobacco: tobacco industry complicity and UK government strategies*).

It is, however, unclear whether the decline in use of expensive FM cigarettes is due to a decline in uptake, users quitting or trading down to cheaper products.[12] Evidence indicates that the availability of cheap tobacco reduces motivation to quit and quit success.[54–59] Our work, to date, had used repeat cross-sectional data to examine cheap cigarette use in the UK and could therefore not directly determine the impact that tax and industry price changes had on smokers' behaviour. Two US studies[40,60] found mixed results: one[60] found smokers using cheaper FM cigarettes were less likely than those using premium brands to quit or reduce smoking between 1988 and 1993, and the second, more recent, study[40] found no direct association between use of cheap FM brands or RYO tobacco in 2009 and quitting outcomes in 2010. Evidence from the International Tobacco Control Policy Evaluation Project (ITC), using data prior to 2008, across four countries (Canada, Australia, the USA and the UK), found a lower likelihood of successful quitting among smokers of cheaper compared with more expensive FM cigarettes.[56] However, in comparison with these other countries, the use of cheap tobacco has been found to be significantly higher in the UK.[57]

Factors that might influence smokers' inclinations to switch to cheaper products rather than quitting also remain largely unexplored. For instance, smokers who are brand-loyal,[61,62] or loyal to a specific product type (FM cigarettes or RYO tobacco, rather than smoking both[63]) might be less likely to switch to a cheaper product. To the best of our knowledge, existing research has provided only limited insights into the purchasing patterns among UK smokers of tobacco on which UK tobacco duties have not been paid,[46] and no studies have examined trends in tax evasion separately from tax avoidance, or how these purchasing patterns might change in response to tobacco tax increases.

Affordability

The impact of price rises is also modified by changes in incomes and inflation rates, and, hence, it is important to measure affordability (i.e. smokers' purchasing power for tobacco in relation to their real incomes). There are many different types of 'aggregate' tobacco affordability measures: the 'Big Mac® index' representing the number of cigarettes purchased for the price of one McDonald's Big Mac hamburger (McDonald's Corporation, San Bernardino, CA, USA);[64] the 'minutes of labour' needed to purchase a pack of 20 Marlboro cigarettes or an equivalent local brand;[65] the 'relative income price' (RIP), representing the percentage of per capita gross domestic product (GDP) required to purchase 100 packs of cigarettes (Marlboro or local brand);[66] and the cigarette price–daily income ratio, which divides the price of one pack of cigarettes (Marlboro or local brand) by daily income.[67] These measures have different strengths and weaknesses and their merits, particularly when compared across high-, middle- and low-income countries, have been discussed elsewhere.[68]

Studies using these methods indicate that cigarettes in the UK have became less affordable since the 1990s, although the rate of decline in affordability appears to be slowing. Between 1991 and 2002 the annual decrease in tobacco affordability was around 5.5%,[65] but only around 2–3% between 2003 and 2009.[69] Similarly, estimates using the RIP indicate an annual decrease in affordability of around 2.5–3% between 1990 and 2001,[66] but only 1–2% between 2004 and 2010.[70] No studies have examined tobacco affordability in the UK since 2010.

A major limitation of aggregate affordability measures is that they rely on average cigarette prices, usually derived from a small number of brands, and on average national income estimates. However, there are wide income inequalities observed within many countries, including the UK, and, as shown in *Tobacco industry segmentation and pricing strategies*, a large range of prices between and within different tobacco products. In addition, aggregate measures do not capture the strategies that smokers use to minimise costs, such as buying from cheaper sources or buying in bulk.

Illicit tobacco: tobacco industry complicity and UK government strategies

There is overwhelming evidence of the TI's historical involvement in the global illicit tobacco trade.[47,71–73] In the UK in the 1990s, tobacco companies were accused of facilitating smuggling by deliberately oversupplying their brands to countries with no demand for them.[74] Although the nature of the illicit tobacco market has since changed substantially and the TI now claims that it has addressed the problem, evidence suggests that the TI has continued to be involved in illicit trade and failed to control their supply chain,[73,75,76] despite signing legal agreements to address both these issues.[47] In the UK, Her Majesty's Revenue and Customs (HMRC) estimated that in 2011 the aggregate supply of certain brands of RYO tobacco to some countries exceeded legitimate demand by 240%.[77] Similarly, massive TI overproduction of cigarettes in the Ukraine has been shown to fuel the illicit market in Europe,[78] a finding supported by our pan-European survey, which showed that illicit tobacco use was greatest for those living in countries that shared a land or sea border with the Ukraine, Russia, Moldova or Belarus.[52] Furthermore, PMI's own data suggest that in 2010 around one-quarter of illicit cigarettes in Europe were genuine PMI brands.[79]

Despite this, the TI continues to use the threat of increases in illicit tobacco use to argue against key tobacco control policies, including tax increases.[33,79–81] Although these arguments are intuitive and price is one driver of illicit tobacco use, it is not the main driver; supply-side issues (such as levels of corruption and TI complicity) are more important and are key to controlling illicit trade.[82] Nevertheless, the industry has

used these arguments extensively in the UK, despite evidence that much of the price increases is directly attributable to industry price increases rather than tax increases, no observed association between tobacco prices and illicit tobacco use across countries in Europe,[52] and an observed overall decline in levels of illicit tobacco in the UK despite continued tax increases.[83]

The UK government implemented a number of strategies to reduce illicit tobacco use during the study period. In 2000, the UK launched its first illicit tobacco strategy, including £201M of additional funding, new customs staff, freight scanners, stronger penalties for tobacco smuggling and new 'UK duty paid' markings on tobacco packs. Government co-operated with tobacco companies to reduce illicit tobacco and implemented a publicity campaign to raise awareness of illicit tobacco use dangers.[84] In 2006, 2011 and 2015, the strategy was updated and refreshed. A regional programme in the north of England, launched in 2009, also aimed to reduce demand for illicit tobacco.[85]

UK government tobacco taxation

In the UK, three types of tax are applied to tobacco: (1) specific tax (a fixed amount per 1000 cigarettes or 1000 grams of RYO tobacco); (2) ad valorem tax (set as a percentage of the retail price and only applied to FM cigarettes); and (3) value-added tax (VAT) (another ad valorem tax applied to most goods and services and applied to both FM cigarettes and RYO tobacco). Compared with ad valorem taxes, specific taxes tend to narrow the price range between expensive and cheaper brands, maximise the impact of tobacco taxes[24,86,87] and raise more revenue.[88]

Since our previous work, UK tobacco taxes have increased annually, their structure has changed somewhat and the rate of VAT has varied [*Table 1*, and for further details see the fact sheet published by Action on Smoking and Health (ASH) England[89] and UK Budget documents[90–98]]. Two significant changes occurred in March 2011. For FM cigarettes, there was a shift away from ad valorem taxes,[99,100] which were reduced from 24% to 16.5% of the retail price. Instead, specific taxes on FM cigarettes were increased from £119 to £155 per 1000 sticks. Ad valorem taxes generally increase the price range between cheap and expensive products and this move was intended to narrow the price range between different FM brands. For RYO tobacco, there was a sudden increase of 10% above the Retail Price Index (RPI) in tax from £130 to £152 per kilogram. This was intended to narrow the price range between RYO and FM products. A third significant change occurred in March 2012, when the tax escalator (which was otherwise set between 0% and 2% above RPI throughout the study period) increased to 5% above RPI for 1 year. It should be noted that, although the RPI (a measure of private household spending from survey data) is still employed in relation to tobacco taxation changes,[101] it was de-designated as a national statistic in March 2013 and replaced with the Consumer Price Index (CPI), which meets international standards and is comparable with other European countries.[90] The RPI, unlike the CPI, includes housing costs, is more volatile than the CPI and rises more quickly.[102] We used the CPI to adjust our FM and RYO prices for inflation (see *Chapter 2*).

European Union tax changes

Since the 1970s, tobacco product regulations have been introduced in European countries.[103] Two pieces of legislation were introduced in the last decade that are relevant to this study: EU Council Directives 2008/118/EC and 2011/64/EU, which define categories for tobacco and tax structures, including minimum tobacco tax rates. Of relevance here are cigarettes (Article 3), cigars and cigarillos (Article 4) and RYO tobacco (Article 5). The regulations require countries to apply a specific excise tax and an ad valorem tax on cigarettes, as well as a minimum excise duty. Countries have more flexibility for other tobacco product categories and can apply specific and/or ad valorem tax. Mandatory minimum tax rates are set out.[104] The European Commission also changed the price benchmark from the most popular price category (MPPC) to a weighted average price (WAP) in each member state in January 2011.

TABLE 1 Tobacco duty rates for FM cigarettes and RYO tobacco: UK 2001–15

Time point	Specific duty[a]		Ad valorem[b] (%) (FM only)	VAT[c] (%)	Tax escalator (%)	Inflation[d]	
	£/1000 FM cigarettes	£/kg of RYO tobacco				CPI	RPI
March 2001	92.25	96.81	22.0	17.5	0		
April 2002	94.24	98.66	22.0	17.5	0		
April 2003	96.88	101.42	22.0	17.5	0		
March 2004	99.80	104.47	22.0	17.5	0		
April 2005	102.39	107.18	22.0	17.5	0		
March 2006	105.10	110.02	22.0	17.5	0		
March 2007	108.65	113.74	22.0	17.5	0	2.8	4.6
March 2008	112.07	117.32	22.0	17.5	0	2.5	3.8
November/ December[e] 2008	112.07	122.01	24.0	15.0	0	4.5	4.2
April 2009	114.31	124.45	24.0	15.0	0	2.3	−1.2
January 2010				17.5			
March 2010	119.03	129.59	24.0	17.5	1	3.4	4.4
January 2011				20.0			
March[f] 2011	154.95 (25% > RPI)	151.90 (12% > RPI)	16.5[f]	20.0	2	4.0	5.3
March 2012	167.41	164.11	16.5	20.0	5	3.5	3.6
March 2013	176.22	172.74	16.5	20.0	2	2.8	3.3
March 2014	184.10	180.46	16.5	20.0	2	1.6	2.5
March 2015	189.49	185.74	16.5	20.0	2	0.0	0.9

a Specific duty is set in fixed cash terms as an amount per 1000 FM cigarettes or per kilogram of RYO tobacco.
b Ad valorem duty is set as a percentage of the retail price and is applied only to FM cigarettes.
c VAT is set as a percentage of the retail price and is applied to all consumer goods (so both FM and RYO).
d The rates quoted are the 12-month inflation rates in the month prior to the Budget month.
e In November 2008, tobacco duties (specific for RYO and ad valorem) were increased to ensure that the overall level of taxation remained broadly unchanged following the temporary VAT reduction on 1 December 2008.
f In March 2011 there was an overall 2% increase above inflation, but a major restructure of FM taxation meant that ad valorem duty on cigarettes decreased to 16.5% and specific duty increased by 25% above inflation. Duty on RYO tobacco increased by 12% above inflation (i.e. an extra 10% on the 2% above inflation).

Rationale for current study

The increased use of cheap legal tobacco products coinciding with the widening price range between expensive and cheap manufactured cigarettes in the UK, and the relatively high (although declining) use of illicit tobacco, raised concerns that tax increases in the UK were perhaps not as effective as assumed, particularly for smokers with low socioeconomic status (SES). An additional concern was that the government's willingness to increase tobacco taxes was constrained by fear that tax and price rises would fuel the illicit tobacco trade. There was a clear need, therefore, for greater understanding of the effectiveness of tobacco tax increases, the extent to which their public health impact is undermined by TI pricing and whether or not the threat of the illicit trade is a genuine concern that needs to be considered when setting tobacco duties. There were three inter-related issues that we identified as evidence gaps.

Roll-your-own pricing strategies

To the best of our knowledge, no studies had examined TI pricing of RYO tobacco in the UK, despite its growing market share. Furthermore, the work on FM cigarette pricing dated only to 2009. Up-to-date data on RYO tobacco and cigarette pricing were essential, because TI pricing strategies could evolve over time to reflect market, economic and policy developments, and should be considered when setting tobacco duties.

Tobacco industry pricing strategies and socioeconomic inequalities

There was limited evidence on the impact of TI pricing on levels of cheap tobacco use in the UK. Evidence was also limited on differences in smoking outcomes (including quit attempts and success) among those using expensive compared with cheap cigarettes and the extent to which this explains inequalities in smoking. Further research was therefore needed to examine how UK smokers respond to TI pricing strategies, including the extent to which they engage in price-minimising behaviours, reduce consumption or quit, and whether or not these responses vary by SES.

The prevalence of illicit tobacco use

Although the argument that the TI most frequently uses to prevent tobacco tax increases is the claim that they will lead to an increase in the illicit tobacco trade,[105] to the best of our knowledge no study had directly examined links between tax increases and trends in tax evasion or avoidance by smokers in the UK. Furthermore, as the TI uses the illicit trade to argue against tobacco tax increases and other tobacco control measures using its own data,[47,81,105] it is important that assessments of the level and nature of illicit use in the UK are conducted independently of the TI. The only recent, independent studies estimating illicit use in the UK covered only England, or regions therein, and did not provide a measure of uncertainty with the estimate.[49,50,52] Some also did not break the data down by FM and RYO.[49] Further independent studies were therefore essential.

Research objectives

The main intended public health impacts of tobacco taxation are, first, to reduce tobacco smoking and, second, to raise revenue to deal with the public health costs attributable to smoking. Central to this is the intent that taxation-based interventions are socially equitable, that is, they do not widen (and ideally help to reduce) the sociodemographic disparities associated with smoking. This study aimed to evaluate the effectiveness of tobacco tax increases in reducing tobacco use and minimising inequalities in tobacco use in the UK, and the extent to which this was influenced (undermined or enhanced) by TI pricing strategies.

Objectives

- Provide up-to-date knowledge of TI pricing and the extent to which this modifies the impact of tobacco taxation on public health, by examining:

    - how the TI segments manufactured cigarettes and RYO tobacco on price
    - the extent to which the TI undershifts, overshifts or fully shifts tobacco tax increases on to consumers, whether or not this varies by product, price segment and over time, and what proportion of price increases by segment is explained by TI price increases versus tax increases.

- To explore the impact of tobacco tax increases, as moderated by TI pricing strategies, on smokers' behaviour, by examining:

    - the impact of the price range (the difference in price between the most and least expensive products) and price changes (annual tax increases modified via TI pricing) on quitting or switching between products or price segments
    - the impact of the price range and price changes on tobacco consumption
    - whether these behaviours differ by smokers' previous product or price choices.

- To explore the impact of tobacco tax increases, as moderated by TI pricing strategies, on inequalities in smoking, by examining:

  - the characteristics (socioeconomic, geographic, etc.) of smokers using each product/price segment
  - whether or not behavioural choices (quitting, switching between price segments and reducing consumption) differ by smokers' SES
  - the proportion of change in smoking inequalities over time attributable to cheap (legal) tobacco use.

- To explore whether or not cheap (legal) products are a means of market entry for the young, by examining:

  - the age of smokers using each product or price segment
  - trends in youth usage of cheap products
  - whether or not young people initiate smoking via cheap products, later upgrading to more expensive products.

- To increase understanding of trends in and the nature of tax avoidance and evasion, by examining:

  - trends in the proportion of smokers engaging in tax avoidance and evasion and their socioeconomic and other characteristics (where they acquire their tobacco and trends therein)
  - whether or not tax/price increases, particularly larger tax increases, are linked to tax avoidance and/or evasion
  - which products are most frequently acquired via tax avoidance and evasion, and from which sources.

- To synthesise findings and develop recommendations to improve the effectiveness of tobacco taxation as a public health intervention.

Once the project was under way, we realised that it was not possible to address the fourth objective [to explore whether or not cheap (legal) products are a means of market entry for the young], as insufficient numbers of young people were enrolled in the ITC. Instead, the ITC data were useful for supplementary analyses on tobacco affordability and weight of RYO cigarettes, which enhanced our understanding of the public health effectiveness of tobacco tax increases.

Patient and public involvement

We did not initially plan patient and public involvement, as the research focused on secondary data analysis. However, we did set up a Stakeholder Group for the project (see *Acknowledgements*), consisting of stakeholders, including Her Majesty's Treasury, Public Health England and ASH, which met annually during the project, and we also invited two lay members to join the group. The lay members were two representatives from the then current UK Centre for Tobacco and Alcohol Studies (UKCTAS) Smokers' Panel: Matthew Alford and Dan Griffin. The UKCTAS Smokers' Panel is a group of both active smokers and those trying to quit, or recent quitters, who provide lay input into the work of the UKCTAS. At the time our project started, the Panel was recruited from the Bath area. The Stakeholder Group reviewed and commented on preliminary findings and directed the focus of ongoing work so that it was relevant to policy and smokers' lives. Our two lay members provided critically important and useful input, which helped us to interpret our research findings. In particular, they helped us to assess affordability issues, alerted us to new tobacco packs being marketed and also stimulated us to address the weight of RYO tobacco used. We were enormously grateful for their input.

Chapter 2 General methodology

Introduction

This chapter describes the three main data sources used for our programme of research: (1) tobacco sector commercial literature (hereafter 'commercial literature'), (2) Nielsen tobacco sales data (hereafter 'Nielsen data') and (3) the ITC data. Nielsen is a retail measurement service providing sales data on a range of consumer goods. The ITC conducts longitudinal cohort surveys in 29 countries (including the UK), aimed at systematic evaluation of key tobacco control policies, including assessing the impact of tobacco prices [see URL: www.itcproject.org (accessed 25 August 2019)].

Commercial literature

The commercial literature was used to give a comprehensive overview on the TI pricing strategy for tobacco products and to describe how the industry segmented FM and RYO markets (also identifying brand names in each identified segment).

Sources
The commercial literature included TI documents, industry monitoring reports and trade magazines, from the years 2008 to 2014, with a few articles from early 2015 included when they were reviews of 2014. TI documents included annual reports from BAT, Imperial Tobacco, JTI and PMI, and presentations from BAT, Imperial Tobacco and PMI (JTI does not make presentations available). Industry monitoring reports were from Euromonitor International Ltd (London, UK), Mintel (London, UK) and Keynote (Google Inc., Mountain View, CA, USA), and for 2014 only from Bank of America (Charlotte, NC, USA)/Merrill Lynch (New York, NY, USA) (Imperial Tobacco bought some American brands from Reynolds American at this time). Trade magazines included *Retail News* (online as *Talkingretail.com*), *The Grocer*, *Wholesale News* and *Tobacco Journal International* (including the supplement *Tobacco Profiles*). Online and/or paper copies of trade magazines were searched, depending on availability. Additional trade magazines (2014 editions of *Forecourt Trader*, *Convenience Store* and *Asian Trader*), available from a related literature review for a previous project, were also searched. One article on Imperial Tobacco price segmentation from the *Scottish Grocer*, found via a post hoc Google (Google Inc., Mountain View, CA, USA) search for segment names, was also included.

Analyses
From articles mentioning tobacco products, we collated the following information in a database: segment name, tobacco company, brand name, pack size, price, price type [recommended retail price (RRP) or price marked], date referred to, date of article, source of article, title of article, reporter, geography and relevant quotations. The number of articles/reports extracted was 517. Each article was searched for mentions of brands and brand variants, alongside segment information and any text relevant to understanding segmentation. An article could mention one or several brands and brand variants and/or could provide one or more quotations regarding segmentation. This resulted in 1892 entries in the final main database, of which 1700 concerned 347 brand and brand variants. The remainder of the entries were articles that discussed price segmentation generally without referring to specific brands.

We also conducted a qualitative analysis to explore how the industry maintained profitability through brand segmentation, in the context of other price-limiting strategies, between 2008 and 2014. For this, 557 quotations about brand segments and tobacco pricing were collected from the commercial literature and analysed. The quotations were imported into NVivo 10 (QSR International, Warrington, UK) and coded at various nodes. There were two super-nodes: 'market conditions that the TI was experiencing' and 'TI actions and responses to these market conditions'. Within each super-node, subnodes were developed iteratively during data collection. Queries for each subnode by year were used to assess patterns over time.

Limitations and strengths

Strengths of the commercial literature are that it can provide unique insights into industry attempts to maintain and enhance profitability. This was also the only data source available which included cigars and cigarillos. However, this literature may also obscure the TI's real intentions (e.g. to promote sales) and fears (e.g. of declining premium sales and profits), and it will tend to report industry rather than public health viewpoints. The flip side of this is that as this literature is aimed at current and potential investors, rather than government and regulatory bodies that seek to regulate its promotional activities, it often contains illuminating examples of TI efforts to promote sales, sales figures and profitability.

Studies using the commercial literature

The commercial literature was often used as a background to inform our investigations, but three specific studies were also conducted.

1. Study 1 (see *Chapter 3*): what were the TI actions to maintain profitability?
2. Study 2 (see *Chapter 3*): how does the TI segment products on price?
3. Study 3 (see *Chapter 6*): was there any evidence of smokers down-trading to cheaper brands in the commercial literature?

Nielsen data

These sales data were primarily used to finalise the allocation of FM and RYO brands to price segments [a process that was begun in the commercial literature study 2, building on our earlier Pricing Policies and Control of Tobacco in Europe (PPACTE) project[32]], and then to identify trends in the price, sales volumes and TI revenue of FM cigarettes and RYO tobacco by price segment. We were also interested in the extent to which the TI was overshifting or undershifting tax increases by segment.

Source

Nielsen's Scantrak data were based on electronic point-of-sale (EPOS) system data (i.e. information obtained when tobacco products are scanned at the till in sales outlets).[106] Data are collated by Nielsen on grocery sales, which include sales in supermarkets and convenience stores. Nielsen collates 100% of sales data from four supermarkets [Tesco (Welwyn Garden City, UK), Sainsbury's (London, UK), Morrisons (Bradford, UK) and Asda (Leeds, UK)] and conducts stratified random sampling with replacement from other outlets [e.g. Co-op (Manchester, UK)].[107] For remaining retail outlets, sales could only be modelled. As an example, in November 2015, Nielsen collected EPOS data from 87% of the UK's supermarkets, 15% of its convenience stores (including 83% supermarket-owned convenience stores, 59% petrol station shops, 6% convenience store chains and 4% independents) and 17% of Northern Ireland stores with grocery sales (Northern Ireland represents 2.8% of the UK population).[107] The outlets that provide Nielsen data vary over time and changes to the cigarettes being sold by the outlets may also mean that databases need adjusting. Nielsen updates its market coverage and thus its estimation of prices and volumes twice a year. In the UK, Nielsen collates EPOS data on grocery sales from 15,000 shops across all food and drink trade channels, and the total grocery market measured was £145B in 2015.[108] Other estimates of the total UK grocery market vary from £99.2B[109] to £179.1B;[110] thus, Nielsen's estimate is consistent with these.

Nielsen data consists of a list of stock-keeping units (SKUs). A SKU is identified through an individual electronic barcode. Each SKU comprises seven different descriptors:

1. product type (e.g. RYO tobacco vs. FM cigarettes)
2. trading company (e.g. BAT)
3. house (e.g. Pall Mall)
4. brand (e.g. Pall Mall Blue king size)
5. pack size (e.g. the number of FM sticks or grams of RYO per pack)
6. sales unit contents – the number of packs sold together (e.g. in a carton)
7. packaging type – whether or not price promoted (i.e. sold in a price-marked pack).

Stock-keeping units are thus the lowest level element within a hierarchical classification system. We compared this Nielsen hierarchical brand typology with other alternatives,[111,112] producing one to be used for our study (*Table 2*). Nielsen provides monthly sales data and for this study we used data from November 2008 to February 2016.

Analyses

Nielsen provided six overlapping data sets of monthly data: 1 (November 2008–October 2011), 2 (January 2009–December 2011), 3 (August 2011–July 2013), 4 (July 2012–December 2014), 5 (January 2013–November 2015) and 6 (March 2013–February 2016). Nielsen updates its estimates (market coverage and thus sales volumes and prices) twice yearly. Hence, the most recent data sets are likely to reflect the market most accurately, so when data for a month were available from multiple data sets, we used the most recent (e.g. we took data for November 2008–December 2008 from data set 1, January 2009–July 2011 from data set 2). We thus created a data set with the most recently provided monthly data, spanning from November 2008 to February 2016.

Up to five types of sales information were provided by Nielsen for each SKU every month:

1. number of units (usually packs) sold
2. price of each unit
3. total value of SKUs sold
4. total volume sold (sticks of FM or kilograms of RYO)
5. percentage of sampled stores to which each SKU was distributed.

TABLE 2 Comparison of hierarchical brand classification typologies

Level	Generic brand hierarchy[a]	Nielsen (UK data)	PMI	Australia[b]	Our study
1	Family brand (e.g. Buick)		Parent anchoring brand (e.g. Marlboro)	Brand family (e.g. JPS)	Brand [e.g. (1) Marlboro and (2) Benson & Hedges]
2	Individual brand (e.g. Buick Regal)	House[c] (e.g. Marlboro Bright Leaf)	Brand family (e.g. Marlboro Fresh)	Brand/brand extension (e.g. JPS Duo)	Brand family [e.g. (1) Marlboro Bright Leaf and (2) Benson & Hedges Blue]
3	Modifier (e.g. Buick Regal GS)	Brand (e.g. Marlboro Bright Leaf Platinum)	Brand variant (e.g. Marlboro Fresh Ice Blast or Marlboro Fresh Kretek Mint)	Products (e.g. JPS Duo Gold)	Brand variant [e.g. (1) Marlboro Bright Leaf Platinum and (2) Benson & Hedges Sky Blue Superkings]
4	Product description (e.g. mid-size luxury sport sedan automobile)	SKU (e.g. Marlboro Bright Leaf Platinum 10s carton, not price marked)		SKU (e.g. JPS Duo Gold 20s)	SKU [e.g. (1) Marlboro Bright Leaf Platinum 10s carton not price marked and (2) Benson & Hedges Sky Blue Superkings 19-stick price-marked single pack]

JPS, John Player Special.
a   Some analysts also discuss 'brand extensions' defined as when a brand is extended to a new type of product. In terms of tobacco, an example of this would be when a FM brand is extended to RYO (e.g. Marlboro's RYO extension: Marlboro Gold Fine Cut Hand Rolling Tobacco).
b   Obtained from an anonymous reviewer of our published paper on this work.
c   Unlike other classifications, for FM, Nielsen develops a new house only when there is a brand variant at a different price point. Thus, although PMI differentiates Marlboro into three brand families (Red, Gold and Fresh), Nielsen in the UK does not differentiate between these three as they were introduced at the same price point. Only Marlboro Touch and Bright Leaf, for which SKUs have lower prices, were listed as being in different houses by Nielsen. RYO was not always differentiated in this way by Nielsen.

Sometimes tobacco companies change the names of brands. We used this sales information, together with the commercial literature and Google searches, to check whether an apparent new brand, family or variant in a data set previously existed under a different name. Thus, SKU behaviour over the entire analysis period was identifiable.

It should be noted that not all five types of sales information were provided for all the data sets. Volumes were not provided for data sets 1 and 2 (used for our estimates between November 2008 and July 2011), so we imputed volume based on number of units sold. When provided, the volume variable showed evidence of modelling by Nielsen, so there may be some discrepancy between earlier and later data sets here. Distribution data were provided only for data sets 5 and 6 (used for our estimates between January 2013 and February 2016).

Data validity and exclusions

Nielsen state that data are valid only when a SKU is distributed to ≥ 10% of retailers in its sample. However, given that distribution data were not available for the earlier data sets, this could not be used as our exclusion criterion. Thus, we instead attempted to model 10% distribution using market share (dividing volume of sticks or 0.5-g RYO stick equivalents sold for each SKU by total volume) for conducting our FM segmentation (see *Chapter 3*). We did this using a selection of months for which we had distribution information available, namely January 2013, February 2013, March 2013, January 2016 and February 2016 (January 2013 and February 2016 were the first and last months, respectively, for which we had distribution information). For our modelling we explored market shares for FM SKUs between 0.02% and 0.06%, and compared these to Nielsen's ≥ 10% distribution criteria (*Table 3*). We wanted to identify the market share value that minimised the number of SKUs misclassified (see *Table 3*, 'F' rows) and provided a number of valid SKUs as close as possible to that using Nielsen's ≥ 10% distribution criterion (see *Table 3*, comparison of 'A' and 'E' rows). The resulting optimal outcome was a market share of > 0.05%, which we therefore applied uniformly over our entire data set as the criterion for identifying valid SKUs for brand segmentation each month (we ended our modelling with 0.06 because the number of misclassified SKUs was rising). Given that the 10% distribution criterion was also suggested by Nielsen for RYO products, we used the same criterion of > 0.05% market share for conducting our RYO segmentation.

For the segmentation development, the FM and RYO data sets were kept separate, but for the price analyses, these data sets were merged so that we could compare market share changes of RYO tobacco and FM cigarettes. On merging these data sets, the exclusion criterion of 0.05% market share was no longer applicable because the total number of SKUs was larger. We found that changing the criterion to 0.008% market share allowed all SKUs that were valid in the separate FM and RYO data sets to be also valid in the combined data set. However, other SKUs now reached sufficient market share to be included that had not done so for the segmentation process. To prevent random fluctuations from being influential, new SKUs were included only if they reached sufficient market share for 3 months. To avoid incorrectly excluding SKUs that were present for < 3 months because they were arriving on or leaving the market at the beginning or end of the data series, respectively (rather than due to random fluctuations), the price analyses using the merged data sets were restricted to January 2009–December 2015. The allocation of these extra SKUs to segments is described in *Chapter 3*.

To identify consistent pricing patterns, some atypically priced and/or rare SKUs were excluded. Retailer and wholesaler brands and cartons (sometimes known as 'multipacks') were excluded from all analyses because they rarely reached valid distribution during the time period that distribution data were available. We also excluded make your own (when smokers purchase empty cigarette tubes and a small machine that fills these tubes with tobacco) and combi-packs (packs of RYO tobacco sold together with rolling papers and/or filters) from all analyses, as they were consistently priced higher than other SKUs in their brand family. From the segmentation analyses only, we excluded price-marked packs and FM packs containing < 17 or > 20 sticks, due to their rarity (e.g. 14 stick packs) or consistently different pricing than other SKUs in their segment (e.g. 10 sticks packs were priced higher), and RYO packs of uncommon sizes (we included only 10-g, 12.5-g, 25-g and 50-g packs). From the pricing analyses only, we excluded Berkeley and Swan brands

TABLE 3 Nielsen data: comparison of number of valid FM cigarette SKUs using Nielsen's suggested distribution criteria (distributed to ≥ 10% of stores) vs. our estimations using varying minimum market shares based on volume of sticks sold (> 0.02% to > 0.06%)

	Time point				
Market shares for FM SKUs	**January 2013**	**February 2013**	**March 2013**	**January 2016**	**February 2016**
Total number of SKUs available	221	221	218	387	387
A. Valid SKUs based on distribution (B + D) (Nielsen criterion: distributed to ≥ 10% of stores)	87	88	88	102	98
1. Market share > 0.02%					
B. Only distribution valid	0	0	0	0	0
C. Only market share valid	28	29	29	39	43
D. Distribution and market share valid	87	88	88	102	98
E. Any market share valid (C + D)	115	117	117	141	141
F. Total misclassified (B + C)	28	29	29	39	43
2. Market share > 0.03%					
B. Only distribution valid	1	1	2	3	0
C. Only market share valid	14	15	18	26	29
D. Distribution and market share valid	86	87	86	99	98
E. Any market share valid (C + D)	100	102	104	125	127
F. Total misclassified (B + C)	15	16	20	29	29
3. Market share > 0.04%					
B. Only distribution valid	3	4	3	4	0
C. Only market share valid	12	12	12	18	24
D. Distribution and market share valid	84	84	85	98	98
E. Any market share valid (C + D)	96	96	97	116	122
F. Total misclassified (B + C)	15	16	15	22	24
4. Market share > 0.05%					
B. Only distribution valid	6	6	7	7	4
C. Only market share valid	7	6	7	13	15
D. Distribution and market share valid	81	82	81	95	94
E. Any market share valid (C + D)	88	88	88	108	109
F. Total misclassified (B + C)	13	12	14	20	19
5. Market share > 0.06%					
B. Only distribution valid	9	13	12	10	8
C. Only market share valid	6	6	6	10	14
D. Distribution and market share valid	78	75	76	92	90
E. Any market share valid (C + D)	84	81	82	102	104
F. Total misclassified	15	19	18	20	22

Notes
Data from this table were used to determine the approximate equivalent volume market share that was comparable to Nielsen's validity criterion of distribution to ≥ 10% of stores. We wanted to maximise the similarity between the number valid via distribution vs. market share (rows B and E) and to minimise the total misclassified (row F). This led us to select > 0.05% market share as the best estimate of Nielsen's distribution to ≥ 10% of stores validity criterion, to be applied consistently to all data sets.

due to idiosyncratic pricing. Unless otherwise noted (e.g. for revenue analyses; see *Chapter 4*) and unlike the segmentation analyses, price-marked packs, 10-stick FM packs and RYO packs of all sizes were included in the pricing analyses.

Prices per stick and roll-your-own 'stick equivalents'

After literature review and analysis of consumption patterns in the ITC data (see *Chapter 7*), we defined one RYO cigarette ('stick equivalent') as containing 0.5 g of tobacco. Price per stick (one FM cigarette or 0.5-g RYO stick equivalent) was calculated by dividing the price per unit (pack) by the number of sticks or stick equivalents per pack. It is worth reiterating here that, in the UK, specific duty on FM cigarettes is calculated per 1000 cigarettes, whereas on RYO tobacco it is calculated per 1000 g of tobacco, and these rates are comparable (e.g. in 2015, specific duty was £189.49 for 1000 FM sticks and £185.74 for 1000 g of RYO tobacco, see *Table 1*). Implicit in this, is the notion that one FM cigarette is comparable to 1 g of RYO tobacco; however, our data indicate that 1 g of RYO tobacco is more comparable to two FM cigarettes, which means that specific duty on RYO tobacco is effectively half that on FM cigarettes.

Limitations and strengths

Nielsen tobacco data are increasingly being used for academic, as well as commercial, research.[14,113–116] They have also been validated for policy evaluation.[117] Only legal grocery store sales are included, but such sales (including supermarkets and convenience stores) represent up to 80% of the total market [see *Chapter 6, ITC data study 3: smokers' tobacco purchasing behaviours by product and store type (licit purchases)*] and, as we shall see, illicit and non-grocery store sales are declining (see *Chapter 8*).[81,118] In this project, we did not differentiate Nielsen sales data in terms of the percentage of tobacco sales that came from supermarkets compared with convenience stores; thus, although Nielsen samples overall grocery sales from around 87% of UK supermarkets and 15% of its convenience stores, we do not have the data to determine what percentage of the tobacco sales came from those supermarkets compared with convenience stores. However, in more recent work (covering the period from May 2015 to April 2018), we have found that about 80% of tobacco sales were from convenience stores (data not shown). This was higher than in this study using the ITC data (41% of legal tobacco sales were from convenience stores; see *Chapter 6*). Thus, assuming that convenience stores have higher tobacco prices, it might be the case that our Nielsen analyses would provide slightly higher estimates of tobacco prices than our ITC data; however, given that we can triangulate the findings from these two sources, we are confident that we will obtain an accurate estimate of tobacco prices in this project.

Only RYO tobacco prices are included, not papers or filters (which currently cost between £0.002 and £0.006 and between £0.002 and £0.008 each, respectively),[119,120] which would add between £0.004 and £0.014 per cigarette.

Wider changes in the competitive landscape may also have contributed to price changes, but this seems unlikely: the e-cigarette market in 2015 was only a twentieth of the size of the tobacco market in the UK[121] and four transnational tobacco companies collectively accounted for > 90% of the market, with only relatively small changes in their respective market shares.[122]

Studies using the Nielsen data set

- Study 1 (see *Chapter 3*): allocation of SKUs to segments.
- Study 2 (see *Chapter 4*): TI pricing strategies.
- Study 3 (see *Chapter 4*): what proportion of price increases by segment are explained by TI price increases versus tax increases?
- Study 4 (see *Chapter 6*): what are sales volumes overall and by tobacco type over time?
- Study 5 (see *Chapter 6*): what are sales volumes by differently priced segments over time?

ITC data

The ITC was used to explore the impact of tobacco taxation and TI pricing strategies on smokers' behaviour. This included the extent to which smokers were switching between different products (FM and RYO) or FM brand families (e.g. trading up or trading down), purchasing from different sources (e.g. licit/illicit), or changing their consumption patterns (e.g. reducing cigarettes smoked or quitting smoking). We were also able to explore differences by smoking dependence and sociodemographics.

Data source and sampling characteristics

This research predominantly used the UK data from the ITC. This includes Canada, the USA, the UK and Australia. It is a longitudinal cohort study of adult smokers (aged ≥ 18 years) who are initially recruited as smokers (at least 100 cigarettes smoked in their lifetime and smoking at least monthly at the time of the survey). They are subsequently retained in the study for as long as possible, even if they quit smoking. At each survey, a new 'replenishment' sample of smokers are also recruited to compensate for those lost to follow-up (ranging for the UK between 22% and 34%), maintaining sample sizes at around 1500 for each country at each survey. This research mostly used the first 10 surveys or 'waves' of the UK ITC, conducted approximately annually between 2002 and 2014 (*Table 4*) (for some analyses, a subset of these surveys was used). More recent data were excluded because the methodology, sampling and questionnaires changed.

The ITC surveys were administered via computer-aided telephone interviewing or online (the online version was piloted at survey 7 in 2008 and then introduced gradually from survey 8 in 2010 onwards). Stratified random sampling was used to obtain samples broadly representative of national distributions of age, sex and geographical region for each of the four countries at the time of each survey. At each survey, cross-sectional sampling weights were also calculated to be representative of these characteristics, as well as longitudinal weights that were adjusted for attrition. Detailed methodological information about the ITC has been published elsewhere.[123,124]

TABLE 4 UK survey dates and sample sizes for the ITC data

Survey	Start date	End date	Sample (*n*) Recontact	Replenishment	Total
1	21 October 2002	9 December 2002		2401	2401
2	17 May 2003	5 August 2003	1865	255	2120
3	12 June 2004	21 December 2004	1494	586	2080
4	11 October 2005	30 January 2006	1540	503	2043
5	19 October 2006	17 February 2007	1406	613	2019
6	27 September 2007	13 February 2008	1484	523	2007
7	30 October 2008	29 March 2009	1453	370	1823
8	13 July 2010	13 January 2011	1325		1325
9	7 February 2013	9 September 2013	870	533	1403
10	28 August 2014	14 December 2014	1018	452	1470

Notes
Surveys = ITC 'waves'.
No replenishment sample was collected for the UK at survey 8 owing to lack of funds.

Measures

Not all studies used all measures and details will be provided in subsequent chapters when appropriate.

Sample design control variables

A variable was included to differentiate between the recontact sample (those who had been recruited in a previous ITC survey) and the replenishment sample (those who were completing their first ITC survey). A variable to indicate the survey mode (telephone or online) was also included.

Demographics

Demographic data were stratified to contain logical subgroups that were also large enough for analysis.

Sex

Sex was dichotomised as male or female.

Age

All participants were asked their age, in years, at the time of their recruitment survey. Their age at each subsequent survey was estimated by adding the number of days that had elapsed between their recruitment survey and the survey in question (based on survey dates) to their age at recruitment. Implicit in this methodology was the assumption that all participants were surveyed on their birthdays. This was not considered to be problematic as it was consistently applied to all participants and the margins of error were < 1 year. As age was usually stratified for analysis, the impact of this assumption on our findings was considered to be negligible. Unless otherwise noted, age was stratified into three groups: 18–39 years, 40–54 years and ≥ 55 years.

Geographical region of residence

UK analyses: London, Northern (Yorkshire and The Humber, North East and North West), Midlands and Eastern (East Midlands, West Midlands and Eastern), Southern (South East and South West) and outside England (Wales, Scotland and Northern Ireland). Four-country analyses: Australia, Canada, the UK and the USA.

Ethnicity

Ethnicity was dichotomised as white or not white.

Relationship status

Relationship status was dichotomised as single (separated, divorced, widowed or single) or partnered (married or de facto).

Education

Participants' highest level of education was coded as low (secondary school/vocational level 3 or less), moderate (some college or university, but no degree) or high (completed university or post graduate degree).

Income

The ITC asks about income and household composition. Gross annual household income is assessed in ranges (£0–6499, £6500–15,000, £15,001–30,000, £30,001–40,000, £40,001–50,000, £50,001–65,000, £65,001–95,000 and ≥ £95,001). For the affordability calculation (ITC study 2), the mid-point of each range was used and £95,001 for the highest value. Participants also reported their household composition, which was used to derive 'equivalised' annual income (adjusted for household composition) using the modified Organisation for Economic Co-operation and Development (mOECD) scale.[125] Equivalisation weights were modified slightly because children's ages in the ITC questionnaire were stratified somewhat differently to the mOECD strata. Income was converted to 2014 values for all ITC studies, using CPI data from the Office for National Statistics.[126] For some analyses, income was stratified to low, moderate, high or not disclosed. Further details on income equivalisation are available in *Report Supplementary Material 1*.

Nicotine dependence measures

Time to first cigarette after waking
This was stratified to within 5 minutes (most dependent), 6–30 minutes, 31–60 minutes and after 60 minutes (least dependent).

Cigarettes per day
This ranged between 1 and 100 [mean around 16 cigarettes per day (CPD) and standard deviation (SD) around 8.5 CPD] for the daily smokers in our UK sample.

Heaviness of Smoking Index
This was a combination of time to first cigarette (TTFC) and CPD.[127] This was slightly modified to minimise exclusions due to missing data. For participants who had valid data on both CPD and TTFC (constituting 95.7% of observations), the Heaviness of Smoking Index (HSI) was computed as normal and then stratified to low (0–2), moderate (3–4) and high (5–6). Participants with valid data on CPD only (3.8%) were classified as low (0–20), moderate (21–30) and high ($\geq$ 31), and participants with valid data on TTFC only (0.5%) were classified as low ($\geq$ 31 minutes), moderate (6–30 minutes) and high (within 5 minutes).

Tobacco use and purchase measures

Usual tobacco product type (product loyalty)
This was measured by asking 'Do you now smoke . . . (packet/FM cigarettes only, RYO cigarettes only, or both)?'. For the measure of product loyalty, those who responded 'both' were classified as non-product-loyal 'mixed' users; and those who responded as 'FM cigarettes only' or 'RYO tobacco only' were classified as product-loyal 'non-mixed' users.

Last tobacco purchase type
This was coded as factory-made (cigarettes sold in) packs (FM-P); factory-made (cigarettes sold in) cartons (FM-C) or RYO (*Figure 1*). For participants who reported having a usual brand of tobacco, they were asked if this was the same as their last purchase. Those purchasing other products may be less brand-loyal and potentially more influenced by price promotions or discounts.

Brand loyalty
Participants were asked 'Do you have a regular brand and variety of cigarettes (yes/no)?'.

Purchase source (differentiating full duties paid, tax avoidance and tax evasion)
In the ITC, we use a number of different measures to assess tax evasion and avoidance in relation to tobacco purchases, depending on what aspect of this we are interested in. When we are interested in the price smokers pay for their tobacco products, we need to determine tax evasion/avoidance using the source of the last tobacco product they purchased, as ITC ascertains only prices paid for the last product purchased. The ITC also asks about the frequency of tobacco purchases likely to be illicit, and when we are not interested in assessing the price of products from different sources, we are able to use this more direct measure as an indicator of likely illicit use instead.

Purchase sources (UK store based vs. non-UK/non-store)
We devised a novel way of assessing potentially illicit tobacco purchases, via categorising the purchase sources of participants' most recent tobacco purchase into two categories. Purchases from convenience stores, supermarkets and tobacconists were classified as 'UK store-based sources' (deemed likely to be licit tobacco with full UK duties paid), and purchases from overseas or duty free (deemed likely to be tax avoidance), friends/relatives or informal sellers (deemed likely to be tax evasion, although see further discussion in *Chapter 8*) and the internet were classified as 'non-UK/non-store' sources. Remaining sources that we were unable to code into one of these two categories (e.g. 'do not know' or 'from work'), were classified as 'other' (see *Figure 1*).
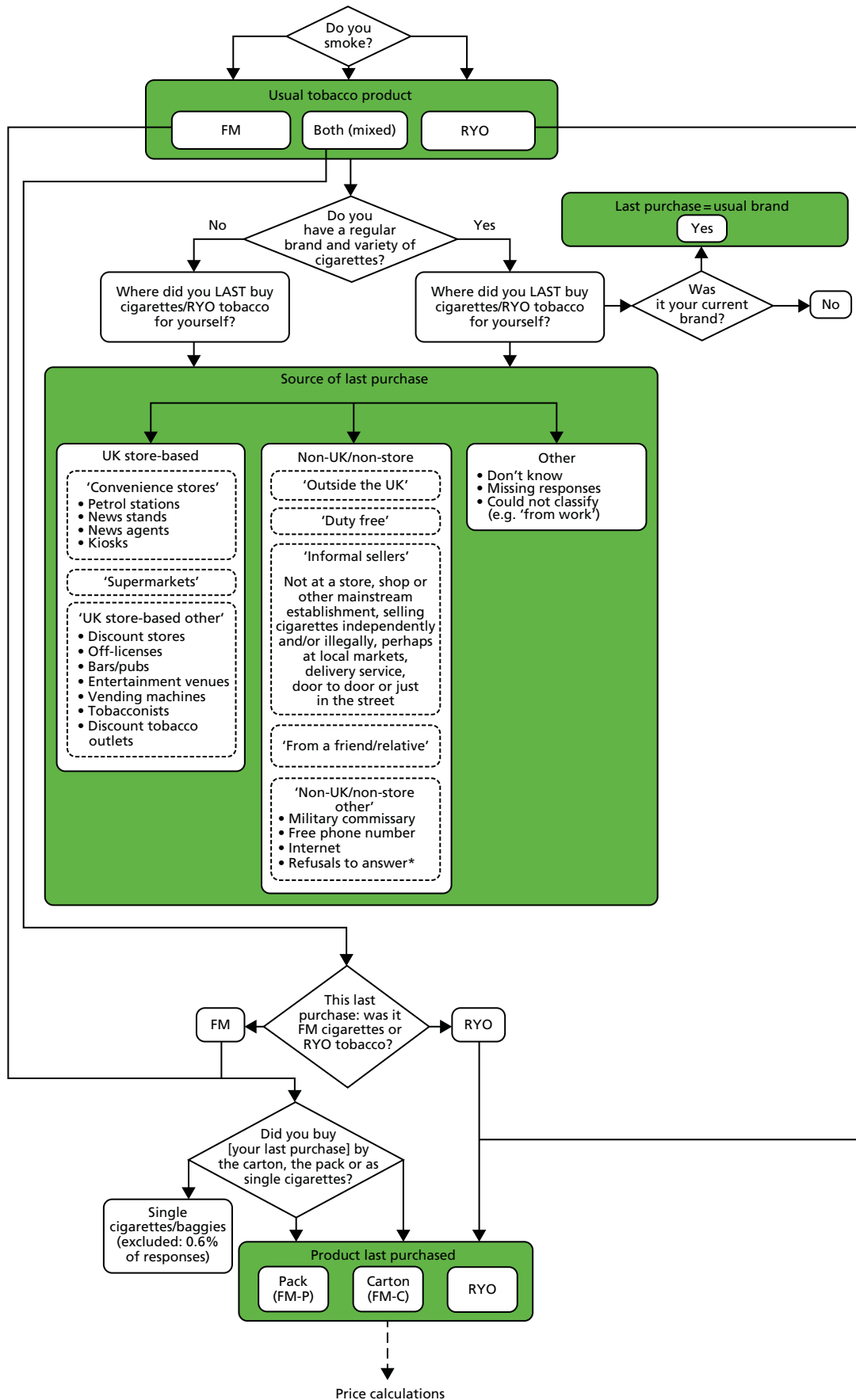
FIGURE 1 International Tobacco Control Policy Evaluation Project survey questions and response categorisation for tobacco product purchases.

Frequency of purchasing from cheap (probably illicit) sources

In a series of questions, participants were asked directly whether or not, in the past 6 months, they had purchased cigarettes from (1) the internet, (2) phone order, (3) mail order or (4) people selling independently (e.g. door to door, in the street or at local markets) and, if yes, how often (only once, a few times, many times or all of the time). In addition, in surveys 9 and 10 only, participants were also asked if and how often in the last 6 months they had purchased tobacco that had been (5) smuggled, lacked proper health warnings or did not have all government taxes paid (no, once or twice a year, every few months, a couple of times a month or at least once a week). Anyone who responded 'no/never', 'only once/once or twice a year' or 'a few times/ every few months' to all of the above sources was classified as having a low frequency of cheap purchases, whereas anyone who responded 'many times/a couple of times a month' or 'all of the time/at least once a week' to any of the above five sources was classified as having a high frequency of cheap purchases.

Weight of tobacco in roll-your-own cigarettes

We used participants' last reported tobacco purchase (because the relevant data were available only for last rather than usual purchase) to derive the average weight of tobacco per RYO cigarette for each participant. We felt that this was justified as 95.4% of our sample of RYO users indicated that their last purchase was the same as their usual purchase. Using the reported weight of the pouch of RYO tobacco they had last purchased, the reported days it usually took them to smoke this amount and how many cigarettes, on average, they smoked per day (CPD), we then calculated their average weight per RYO cigarette, in grams, by dividing the total pouch weight by the days taken to smoke it and by their CPD. The average grams of tobacco per RYO cigarette over the survey period for which these data were available (from survey 5 in 2005 to survey 10 in 2014) ranged between 0.45 g and 0.55 g (data not shown). We therefore chose the mid-point (0.50 g) for use throughout this project as the RYO 'stick equivalent' to one FM cigarette.

Tobacco price

The price per stick (for both FM and RYO) was also calculated using last purchase data. The price of FM cigarettes was available for all ITC surveys, the price of RYO was available only from survey 5 (2006) onwards. A series of questions was asked, depending on the tobacco product type (e.g. how many cartons purchased, packs per carton, cigarettes per pack, or RYO weight and number of packs). Participants could give the price they paid for a single carton, pack or pouch, or the total they paid. Prices were converted into 2014 values using CPI[126] data (see *Equation 1*).

$$\text{Real Price}_{2014} = \text{Price}_{\text{YearX}} \times \text{CPI}_{2014} \div \text{CPI}_{\text{YearX}}. \tag{1}$$

The CPI values we used in *Equation 1* for each ITC survey year were 95.4 (2002), 96.7 (2003), 98 (2004), 100.0 (2005), 102.3 (2006), 104.7 (2007), 108.5 (2008), 114.5 (2010), 126.1 (2013), and 128 (2014) (see also *Report Supplementary Material 1* for more information relating to the calculation of real prices). We then calculated the median reported price for each product type last purchased within each source and, for UK store-based sources only, the 'price range' for each product type was also calculated. Some exclusions were agreed on a priori to remove improbable responses from the data and this was done prior to converting to 2014 values, these were any prices per FM stick or 1.0 g of RYO tobacco obtained from any source > £0.50 (before survey 6) or > £0.80 (survey 6 onwards); prices per FM stick or 1.0 g of RYO obtained from UK store-based sources only < £0.07 (before survey 6) or < £0.10 (survey 6 onwards); and any FM packs containing > 50 cigarettes obtained from UK store-based sources only. We also truncated the price range from UK store-based sources to lie between the 2.5th and 97.5th percentiles, in order to have a more representative range by capturing 95% of all prices (thus excluding the extreme, low-frequency cases).

Annual tobacco spend

Annual tobacco spend for all participants was calculated by multiplying the price per stick (0.5-g RYO stick equivalent) by CPD and by 365. As before, we felt it reasonable to extrapolate annual expenditure from participants' most recent purchase, as the large majority of our sample (92.2% of FM users and 95.4% of RYO users) indicated that their most recent purchase was their usual brand.

Time (tobacco tax year)

The ITC survey collection periods occurred at differing times of year and spanned varying numbers of months for each survey (see *Table 4*), whereas UK tobacco tax changes were usually enacted during the annual Budget update, typically in March (sometimes April) of each year (see *Table 1*). For certain analyses, we therefore assigned participants to the appropriate 'tobacco tax year', corresponding to the timing of their survey responses relative to when the tobacco tax changes were implemented. No ITC survey data were collected in the 2009 or 2011 tobacco tax years.

Tobacco taxation increase rates

For some analyses involving surveys 7–10 of the ITC data (see *Table 4*), we were interested in the impact of different tobacco taxation increase rates. Using a similar strategy as for tobacco tax year [see *Time (tobacco tax year)*], tobacco taxation increase rates based on tax changes outlined in annual Budget statements (see *Chapter 1* and *Table 1*) were allocated to these ITC surveys as follows: 0% (equivalent to inflation) for all data from survey 7 (October 2008–March 2009); 1% above inflation for all data from survey 8 (July 2010–January 2011); 2% above inflation for the majority of data from survey 9 (February 2013–September 2013) and all data from survey 10 (August 20 –December 2014); and 5% above inflation for the remainder of the data from survey 9 (February 2013). Tobacco taxation increase rates for longitudinal analyses were those applicable at the follow-up (not baseline) surveys.

Affordability

We developed a new individualised affordability measure: the percentage of a smoker's annual gross income remaining after subtracting their annual tobacco spend (see *Equation 2*), with higher values representing more affordable tobacco. Values theoretically ranged between 0% and 100%, but after excluding outliers (the top and bottom percentile of the data), affordability ranged between 35.3% and 99.9%.

$$\text{Individualised Affordability} = \frac{(\text{Income} - \text{Annual Tobacco Spend})}{\text{Income}} \times 100\%. \tag{2}$$

For comparison, an aggregate version of this affordability measure was also calculated (see *Equation 3*), based on average tobacco prices and national estimates of income, but this was possible only for FM cigarettes. An existing methodology was adapted, the RIP,[66] which is the percentage of per-capita GDP required to purchase 100 packs of 20 FM cigarettes (2000 cigarettes). We made two adjustments to make comparable with our individualised method, in magnitude and direction: (1) we tripled the number of cigarettes (to 6000 cigarettes or 300 packs of 20), which corresponded more closely to the average annual cigarette consumption of our sample (mean 6074 cigarettes, SD 2913 cigarettes); and (2) we inverted the equation so that higher values would indicate more affordable cigarettes (as in the individualised measure). It should be noted that our new methodology for calculating affordability (both the individualised and aggregate versions) also differed from traditional measures, such as the RIP, in that we incorporated consumption into our measure, whereas traditional measures usually assess only the ratio of price to income (see *Chapter 7* for a more detailed discussion of this issue). UK FM cigarette prices for our aggregate version of affordability were based on the MPPC from 2002 to 2010 or the WAP from 2011 to 2014, as these were the European Commission published data[128] on which UK tobacco taxes were based. Cigarette prices and yearly GDP figures were adjusted for inflation to 2014 values using the CPI. GDP and CPI data were obtained from the Office for National Statistics.[126,129] For income, we took the mid-point of each range and £95,001 for the highest value. Owing to the complexities and slight deviations from the published methodologies involved in equivalising income (see *Report Supplementary Material 1*), sensitivity analyses were carried out using a version of income that was not equivalised for household composition. The results of these analyses did not deviate substantially from the results presented using equivalised income and did not alter the conclusions drawn from the data (data not shown).

$$\text{Aggregate Affordability} = \frac{(\text{GDP} - \text{Tobacco Spend}_{6000 \text{ cigarettes}})}{\text{GDP}} \times 100\%. \tag{3}$$

Analyses

The ITC data analyses were conducted using the Stata® software package, Stata SE version 12.1 (StataCorp LP, College Station, TX, USA), unless otherwise indicated. When relevant, more detailed analytical plans are discussed for each study in the relevant chapters. In general, for analyses in which we were interested in simple overall population trends (e.g. in prices paid for different products over time, or changes in the proportions of participants purchasing tobacco from different sources), we used generalised estimating equations (GEEs) with population-weighted data. However, the estimates provided by GEE analyses are not well suited for predictive modelling (e.g. for simulating or predicting responses of individuals or different groups of individuals),[130] so for analyses in which we were interested in examining the role of other factors (e.g. nicotine dependence, sociodemographics or taxation rates) on our outcomes from our particular sample, we instead used random-effects regression analyses with unweighted data.

The ITC data are hierarchical, in that the same individual can provide multiple responses by participating in more than one survey, so the data are responses clustered within individuals, with a large number of small clusters (an average of around two responses per individual) and even some 'clusters' of size 1. GEEs require that the nature of the correlation between responses in the same cluster (in the ITC data that is the correlation between responses made by the same individual in different surveys) be specified. Stata allows for seven different types of correlation structure (independent, exchangeable, unstructured, autoregressive, stationary, non-stationary and fixed). From the outset, the autoregressive, stationary and non-stationary options were ruled out for our data, as these rely on equally spaced timing of observations with no gaps, which was not the case for our data. For the remaining options, we made our selection using a theory-driven, rather than a data-driven, approach. The fixed option allows for the user to specify a correlation matrix; however, we had no theoretical basis for producing such a matrix, so this option was also ruled out. The independent option assumes that responses provided by the same individual at different time points are independent (uncorrelated). We felt that this was highly unlikely and thus ruled out the independent correlation structure also. The likeliest scenario for our data, we felt, was that participants' responses at different time points would be related in such a way that responses made closer together would be more closely related than those made further apart. The exchangeable correlation structure imposes the same relationship at all time points and does not allow for this scenario. This left only the unstructured correlation option, in which correlations are estimated for each time point from the data themselves. We thought that, theoretically, this was the best option to fit our data and therefore used this as the default option (the exchangeable structure was the next best option and, thus, we used this when the unstructured method failed to converge). In addition, the standard errors (SEs) provided by GEE are quite robust to mis-specification of the correlation structure if robust SEs are specified, which we did routinely. However, we did also use a data-driven method to compare model fit of the unstructured compared with exchangeable options, using the quasi-likelihood under the independence criterion (QIC), and the results of this are presented in *Table S1* in *Report Supplementary Material 2*. The QIC statistic indicated an equivalent or better fit using the unstructured correlation matrix in all cases, with one exception, and the implications of this are discussed in *Chapter 8*.

Our reasons for choosing random- (and not fixed-) effects regression were both practical and theoretical. Our objective was to make inferences at the group level, controlling for the correlation of responses provided by the same individual (e.g. exploring the effect of time or age on tobacco affordability). Fixed-effects regression focuses on cluster-level analysis, in which the clusters themselves are of interest (e.g. in data in which pupils are clustered in schools, looking at the effect of different schools on academic outcomes), and clusters of large sizes are desirable. Random-effects regression is more focused on the group-level effects and can handle large numbers of small clusters and clusters of 1 (as in our data). Fixed-effects regression therefore also requires a higher degree of within-cluster variability than was present in our data. Furthermore, we were also often interested in the effects of time-invariant variables (e.g. sex, ethnicity), and fixed-effects regression does not allow for this.[130]

We note also that we have not, in any of our analyses, adjusted our alpha levels for multiple comparisons, as we agree with others that this is not a meaningful or useful strategy.[131] We have, however, provided *p*-values throughout the report, enabling interested readers to make their own adjustments if so desired.

Limitations

The ITC data are based on self-reported details of smoking behaviour, so the results are dependent on the accuracy of that reporting. In general, several steps are taken to minimise bias and maximise response rates (e.g. through using different times of the day and days of the week for recruitment calls). Multiple contact information is collected to minimise attrition, with up to 25 attempts at follow-up, using different methods. Demographic profiles of the unweighted samples are compared with benchmark surveys and weights calculated, so that weighted data are consistent with corresponding national benchmarks. Full details of methods and weighting are given elsewhere.[123,124] Data from single countries can be used to examine how smoking behaviour changes over time in response to specific policies. Given the commonality of methods, study design and questionnaires across different countries, comparisons across countries can also be made using other countries as controls. The ITC conceptual model[123] focuses on how single policies affect behaviour, rather than how combinations of policies and other factors interact to influence behaviour.

Similarly to the limitations discussed with the Nielsen data, the ITC survey did not ascertain whether or not RYO pouches were purchased as part of a bundle, including filters and/or rolling papers. However, the impact of this on our price estimates is likely to be minimal, with papers and filters contributing only between £0.004 to £0.014 to the prices per RYO cigarette, and any resulting biases would be consistently applicable over the study period, thus not affecting time-related trends.

A particular strength of the ITC is that it has been subject to consideration by ethics committees in multiple organisations and the hundreds of outputs from ITC data have been subjected to extensive peer review. As an international collaboration, all the processes and practices are subject to ongoing quality improvement. Specific limitations pertaining to particular analyses and subsamples are described in the relevant chapters.

Studies using ITC data

- Study 1 (see *Chapters 4* and *8*): prices paid for tobacco by smokers over time from both licit and tax avoidance/tax evasion sources.
- Study 2 (see *Chapters 5–9*): changes in tobacco affordability over time among smokers.
- Study 3 (see *Chapters 6* and *8*): smokers' tobacco purchasing behaviours by product and store type, for both licit and tax avoidance/evasion sources.
- Study 4 (see *Chapters 6*, *8* and *9*): impact of tobacco pricing changes on smokers' purchasing patterns and product choices (analysis 4a) and smoking behaviour (analysis 4b).
- Study 5 (see *Chapters 7–9*): impact of tobacco pricing changes and product choices on smokers' quit attempts (analysis 5a) and sustained abstinence (analysis 5b).
- Study 6 (see *Chapter 7*): weight of RYO tobacco cigarettes, analysis over time and international comparison.

Structure of report

The chapters that follow discuss the research in relation to the objectives set out in the *Introduction* and the studies set out above. *Chapter 3* assesses TI pricing strategies and how the industry segments its tobacco market for FM and RYO cigarettes using commercial literature and Nielsen data. *Chapter 4* uses ITC data for an analysis of how much smokers pay for their tobacco and have paid between 2002 and 2014, and how prices paid differed by the type of product purchased. Nielsen data are also used to assess the price of products by price segment and then to analyse what proportion of price increases by segment are explained by TI price increases compared with tax increases. *Chapter 5* uses the commercial literature and ITC data to assess changes in tobacco affordability over time among smokers, using a new individualised measure of affordability. *Chapter 6* examines the impact of tobacco tax increases, as moderated by TI pricing, on

smokers' legal purchasing patterns. Commercial and Nielsen data are used to examine patterns of product use and sales volumes over time. We then use ITC data to examine purchasing behaviours by product and store type. Then, using Nielsen data, we assess sales volumes of differently priced segments over time. Utilising ITC data, we then examine the impact of tobacco pricing changes (taxation) on product choices and purchasing patterns. In *Chapter 7*, we analyse the impact of tobacco tax increases, as moderated by TI pricing, on smokers' quitting and reducing behaviours. We examine quit attempts and 6-month abstinence using ITC data and then the impact of tobacco pricing changes on cigarette consumption over time. As smokers of RYO cigarettes can reduce either the number of cigarettes or the amount of tobacco in their cigarettes, we also examine the weight of RYO tobacco cigarettes over time and in comparison with other countries that have different RYO taxation strategies. *Chapter 8* examines tax avoidance and evasion using smokers' sources for their cigarettes. We look at the proportion of tobacco purchases that are from non-UK/non-store sources and the prices paid from different sources. The impact of tax and price on sociodemographic inequalities is assessed in *Chapter 9*. Finally, we synthesise all the results with implications for practice in *Chapter 10*.

Chapter 3 Tobacco industry pricing strategies and price segmentation of the UK tobacco market

Introduction

Our previous work[34] demonstrated that tobacco companies produced low-priced products to provide an alternative to cessation for price-conscious smokers. This was possible because they could offset lower profits on these cheaper products by overshifting taxes on their more expensive products, such that the gap between cheap and expensive products was widening. We had, however, previously examined only FM cigarette data up until 2009. RYO pricing had not been studied, nor what other pricing approaches the TI had utilised since. Our other research[12] also suggested that TI pricing strategies might play a key role in driving inequalities in smoking and compromising declines in population smoking prevalence. In this chapter, we build on this work using a qualitative approach (commercial literature study 1) to assess if the TI was able to continue producing low-priced FM products in the period between 2008 and 2014 and, if so, how this was achieved. We also extend this work by assessing the pricing of RYO tobacco during this time.

A key objective of our research was to understand how the TI segmented its FM and RYO tobacco products and how the price of these segments changed over time. In the second part of this chapter (commercial literature study 2), we describe the methods used to categorise the TI's brands into segments. We did not use statistical techniques to understand segmentation, in case this led to oversimplification and/or obfuscated deliberate TI pricing strategies. Moreover, TI pricing strategies are linked to brand marketing. Thus, consumer perceptions, rather than statistical groupings, influence consumer choices. Instead, our segmentation was based on an approach used successfully in the PPACTE study.[35] We reviewed the commercial literature to understand the industry's approach to segmentation and combined this with an analysis of relative price positions of SKUs in the Nielsen data to categorise brands into segments.

Commercial literature study 1: what were the tobacco industry actions to maintain profitability?

Background: UK market conditions reported to be facing tobacco companies in the commercial literature

The TI strategies undertaken to maintain profitability during the review period (2008–14) were reported within the context of two main price-impacting tax changes that were also reported in the commercial literature. These were (1) the EU-wide plans to increase taxes and (2) to begin to equalise tobacco taxes (and thus prices) between different tobacco products to reduce the price differential between cigarettes and other forms of tobacco.[132] These changes were often discussed in emotive terms:

> *The government is mounting an assault on the downtrading trend in tobacco sales . . .*
>
> *Hayward[133]*

The commercial literature reported detailed implications of proposed changes, such as the removal of certain loopholes:

> *The proposal would also remove loopholes which allow some cigarettes made from fine cut tobacco to be sold as cigars, cigarillos or pipe tobacco and therefore to benefit from a lower tax rate.*
>
> *Euromonitor International Ltd[132]*

The banning of small pack sizes as a result of the revised EU Tobacco Products Directive (TPD) in 2016 was also reported.[134] Additionally, analysts noted that EU tax policy aimed to reduce the range in prices between different EU countries, although its ability to do this was limited:

> . . . the mainly ad valorem (i.e. as tax as a percentage of price) mechanism of setting tax levels in the tobacco market means that equalising taxes and duties would not, by any means, make for equal prices, though the cross-border gaps would be narrowed.
>
> *Euromonitor International Ltd[132]*

The commercial literature therefore revealed that tobacco analysts and vendors were expecting tax increases in this period and that tax structure changes were intended to reduce the price range between different products.

Findings: tobacco industry actions undertaken to maintain profitability

Price rises

Increasing taxes on tobacco raises its price, which has the effect of reducing volumes of tobacco sold. Euromonitor International Ltd suggested that reduced volumes did not reduce TI profits because 'volumes fall by less than the rise in retail prices'.[132] However, Euromonitor International Ltd also predicted that 'there will come a point at which prices are perceived as so high by the consumer that the elastic in the elasticity snaps', which they predicted would be in the 2020s.[132] Thus, during the review period, the TI was able to make profits from tax rises because (overall) they increased their prices above what was required to meet government taxes, sufficiently to compensate for loss of sales.

Price segments

It was noted that higher priced and more profitable premium products were crucial for industry profitability:

> The investment bank [Citigroup] says the tobacco industry is profitable only because smokers are willing to pay a significant premium for some brands and as a consequence mix [relative distribution of price segments sold in a market] is at least as important as volumes.
>
> *Tobacco Journal International[135]*

Thus, price segments were a vital tool for tobacco companies in their quest to make profits. In 2008, price segmentation of cigarette brands was already a global phenomenon:

> Most cigarette markets broadly consist of a premium band, a mid-price band and a value/budget/economy band. Though these bands are not directly comparable between countries because of -often extreme- differences in mean prices, they are similar in that at premium level [the same brands will appear].
>
> *Tobacco Journal International[136]*

In 2009, it was noted that there was also price segmentation within RYO tobacco:

> The RYO market can now be split into two distinct segments – premium RYO (41% share) and value RYO (59% share) (JTI EPOS Estimates November 2009).
>
> *Talking Retail[137]*

In 2011, three RYO segments were noted:

> JTI's Blackburn says . . . RYO brands can now be categorised as premium, sub premium and value.
>
> *Wood[138]*

Tobacco manufacturers discussed the importance of having products available in every segment, 'creating a proposition to suit every pocket',[139] and sometimes adapted their price segmentation. For example, by the end of the period it appeared that Imperial Tobacco had stopped using (or at least referring to) the mid-price segment. Andrew Miller, head of independent retail at Imperial Tobacco, was quoted in *The Scottish Grocer* as saying:

> *. . . the firm segments the factory-made cigarette [FMC] market into five price sectors: premium, sub-premium, value, economy and sub-economy.*
>
> *The Scottish Grocer[140]*

New products were also created when there was a gap in the price segments.[141]

Strengthening the image of economy brands for smokers and investors

Tobacco company spokespersons noted that smokers want 'quality brands that offer value for money' (Christopher Street, Head of Grocery Channel at Imperial Tobacco, quoted in *The Grocer*).[142] To this end, some cheap brands were given premium style packaging or makeovers:

> *Economy brand Windsor Blue is changing its packaging to a more vibrant blue style with silver lettering to give the brand a premium feel.*
>
> *Talking Retail[143]*

The John Player Special (JPS) brand in the economy sector and the linked Player's brand in the subeconomy sector were targeted towards those with an interest in higher priced brands:

> *The Player's brand name holds a lot of heritage in the tobacco category and using this as a launch pad for new formats Player's smooth king size and Superkings 19s is Imperial Tobacco's way of providing a product that fits into the subeconomy market while maintaining its heritage of quality.*
>
> *Gockelen-Kozlowski[144]*

In a presentation to financial analysts, Imperial Tobacco referred to JPS as 'premium on everything except the price' [Imperial Tobacco presentation to the CAGE (Competitive advantage in the Global Economy) conference 2011].[145] Investors were reminded of JPS's association with Formula One racing, despite the passage of time since sports sponsorship was banned:

> *. . . a unique value brand asset . . . anchored in style and sophistication due to its F1 [Formula One] heritage, its understated packing style plus its overall premium image.*
>
> *Wouda Kuipers[146]*

In tobacco company presentations to investors it appears there was increasing ambiguity around the price segment a brand was in. For example, Imperial Tobacco had a confusing explanation of 'value':

> *[One of] two key areas of growth [is] in value – and this isn't shorthand for cheap – this may be a good price but its about more than price.*
>
> *Cooper et al.[145]*

Moreover, although at the beginning of the review period Imperial Tobacco presented results by price segment,[147] by the end its annual reports classified brands as either 'growth' or 'specialist'. Growth brands included (premium) Davidoff, (mid-price) Lambert & Butler (L&B) and (economy) JPS – all described as 'high-quality brands with strong consumer appeal'[148] and specialist brands 'which appeal to specific consumer groups',[148] such as RYO brands and cigars.

Innovation and promoting premium brands

Premium brands provided the highest profit margins.[142] Hence, efforts were made to protect and promote the share of premium brands. Jeremy Blackburn, JTI head of communications, was quoted in *The Grocer* as saying:

> The premium brands have been affected but we are continuing to look to shore up this part of the sector and it still represents a big chunk.
>
> *The Grocer[149]*

This occurred through the use of innovations, although it was also suggested that the tobacco in premium brands was better quality[150] and also:

> Charcoal filters, flavour capsules etc have been means by which manufacturers have sought to increase the proportion of premium brands in the sales mix to enable value sales to rise even when volumes fall.
>
> *Hedley[151]*

> Innovations grow the top line. When used to reinforce 'premiumness' they lock consumers in the premium segment. If the consumer trades down, the consumer must sacrifice something. They also provide consumers with the incentive to trade up.
>
> *Stevens[152]*

Near the beginning of the review period, innovations (including capsules, flavours and taste, cigarette size and packaging) were aimed at the premium sector; later on, however, they became more ubiquitous:

> Innovation is now present in all price bands (premium, mid price and economy) and many of the innovation trends are common to each (pack colour coding, lower tar variants, super slims, carbon filters, pack size variants, cigarette length, limited editions, flavour capsules. Shifting sub-brands between price bands, presence across all price bands [and] launching sub brand extensions of international brands in different price bands, using pack type pack size cigarette length, tobacco blend etc.
>
> *Euromonitor International Ltd[153]*

Types of innovation

Capsules

Capsule technology utilises a liquid-filled ball placed in the cigarette filter that smokers have the option of crushing to obtain a menthol taste.[154,155] They were initially intended to promote premium brands:

> . . . capsules etc have been means by which manufacturers have sought to increase the proportion of premium brands in the sales mix to enable value sales to rise even when volumes fall.
>
> *Hedley[151]*

It was 2012 when 'capsule technology took off in the premium segment' (Melanie Mills, communications manager at JTI, quoted in *Retail Newsagent*[156]). However, in 2014 it was noted that there had been a 'proliferation [of capsule cigarettes within] many different price segments'.[157]

Flavours

Two types of flavours were mentioned, most notably in terms of target groups, particularly women. These were an added menthol flavour and a smooth (in contrast to original) tobacco flavour. Menthol cigarettes were said to appeal to women smokers due to 'perceptions that they are a transition between full strength

and lower tar cigarettes'.[158] Golden Virginia Yellow RYO was developed with a smooth flavour to appeal to smokers of cheap cigarette brands who might be finding manufactured cigarettes too expensive.[159] In 2014, 38% of variants in the subeconomy cigarette sector were smooth,[160] and Golden Virginia Smooth was aimed at women and younger people.[161]

Additive free
It was suggested that 'UK smokers [are] looking for a more natural flavour. Natural American Spirit (NAS) is the main brand to have capitalised on this trend'.[162] However, tobacco companies were usually unable to certify their products as organic because they could not find certification bodies that would work with them.[163] Natural American Spirit was promoted as a premium RYO product.[150]

Cigarette size
Cigarettes can be varied in their length and circumference. Slim cigarettes can be known as super slims or demi slims. These 'slimmer variants . . . target value-conscious smokers and women'.[164] However, in 2012, unisex packaging was introduced for these products.[165]

Longer, so-called 'super king-sized', cigarettes were often associated with lower priced segments:

> *Currently over 48% of cigarettes in the economy priced sectors sold by retailers are above king size. This reflects the increasing number of consumers who are seeking better value for money from their tobacco purchases. L&B Blue Superkings provides consumers with a longer cigarette at a great value price as well as capturing the increasing number of adult smokers who are down trading.*
>
> Asian Trader[166]

> *Our ongoing research shows consumers are increasingly seeking lower priced, quality products from big brands. Superking size cigarettes currently account for around 30% of the cigarette market. L&B Blue Superkings are designed to appeal to those long time value-seeking smokers who previously haven't been able to afford a product from the Lambert & Butler family.*
>
> Rebecca Ivey, brand manager for L&B, quoted in Forecourt Trader[167]

From the above, tobacco companies appeared to be innovating with cigarette size in order to prevent smokers down-trading to less profitable segments or even quitting, and women and low-income smokers were targeted.

Packaging updates
Many articles addressed packaging changes. These could be introduced to indicate a premium product[168] (whether or not it actually was) or to appeal to a particular demographic. For example, for women, 'The traditional packaging shorthand tends to be pink or pastel graphics on a white or pastel background with floral imagery',[165] or 'aimed at young adult smokers, the striking pack features the distinctive Rastafari livery of red, yellow and green and carries the on-pack description "chill tobacco"'.[169]

Packaging innovation aiming to imply membership of higher priced segments included 'a metallic finish to promote the premium quality of the product'[170] and 'round corner kingsize packs and more tactile packs [packs with embossed designs]' (Imperial Tobacco presentation to the 2012 CAGE conference). Lower priced segments were indicated through 'soft packs and big boxes' (Imperial Tobacco presentation 2012 to the CAGE conference) or 'urban designs . . . a modern alternative for those choosing to down trade out of premium' (Jeremy Blackburn, head of communications, JTI, quoted in *Wholesale News*[171]).

However, there were stated to be limits to the efficacy of packaging, *The Grocer*'s annual top products survey revealed that price – far more than bright shiny packaging – determines purchasing decisions.[172] Thus, the retailer literature suggested that packaging was useful but not sufficient for success.

Expanding brands across price segments

In the past, 'umbrella brands normally [sat] in a specific price band . . . across regions to retain brand integrity and image'.[153] However, more recently brand variants were created in different price segments for that brand. This could be either in a higher or in a lower priced segment. Analysts reported that it is possible to change the brand price segment through changing the 'pack type, pack size cigarette length, tobacco blend etc'.[153]

Brand was also important for launching new innovations, such as capsules:

> *The solid bedrock of a strong established brand is particularly helpful for the launching of new products in the tobacco category . . . a product can arrive in store and gain immediate familiarity and from that instant sales.*

> *Gockelen-Kozlowski[173]*

On some occasions a new variant could be launched in a higher priced segment: in 2008, Kent Nanotech was established 'at a premium relative to the Kent main range' (BAT 2008 Annual Report).[174] Additive-free brands were popular, so additive-free variants were launched for established RYO brands, such as Drum and Golden Virginia (Imperial Tobacco 2013 Annual General Meeting).

New value products

New, cheaper products were being launched over the study period, in response to specific policy developments within both manufactured cigarettes and RYO tobacco. In 2009, BAT noted a 'stronger mix of value-for-money offerings across Western Europe' (BAT Annual Report 2009). In 2010, with an impending point-of-sale (PoS) display ban, there were 'four major launches at the value end of the increasingly popular roll your own (RYO) category'.[175] As former FM smokers began to smoke RYO, new RYO products were devised that were more similar to cigarettes.[176] By 2012, the move to value products was obvious:

> *'The future of the tobacco market is not premium' so said British American Tobacco brand manager. . . The growing number of value for money brands shows the determination of tobacco firms to make this sector a success.*

> *Lambert[177]*

This trend continued to the end of the review period.[166] It was described as reassuring to smokers if a new low-priced product (whether FM or RYO) was a variant of another brand:

> *Having a cigarette brand on the label is very reassuring. Smokers see JPS tobacco as a natural progression if they move into roll your own from cigarettes.*

> *Retail Newsagent[178]*

For the industry, this approach would also serve 'to encourage smokers of their brands to remain loyal when trading down'.[179] Hence, expanding the brand into cheaper segments would retain customers who no longer wanted to, or were unable to, pay for higher priced products. Examples include Marlboro Bright Leaf, which was launched in 2009 in the mid-price range, whereas all other Marlboro variants were premium products. This was seen as a 'logical move in a market where none of the leading brands are in the premium band'.[180] PMI said they would 'maintain the quality of the brand, but at a lower price point'.[181]

New RYO variants of manufactured cigarette brands also appeared[182] and variants of existing RYO brands were placed in the RYO value segment:

> *Imperial Tobacco recently reacted to changing consumer preferences by launching Golden Virginia Yellow to reflect smokers' propensity towards high-quality, smoother, value for money tobacco*

brands. Building on the renowned heritage of Golden Virginia this brand extension has been
extremely successful.

Mike Laney from Imperial Tobacco, quoted in Wholesale News[159]

In the later years of the review period, more and more iconic brands were subject to variant launches at lower price ranges. Two examples include the super premium brand Davidoff where Davidoff iD was launched at a premium price band in the UK (Imperial Tobacco presentations 2013 Annual General Meeting)[183] and Marlboro Gold Touch 'a slightly thinner variant of the core brand [which could be launched at a] more affordable price point'.[156]

Innovation in cheap tobacco products
There was a plethora of ways that cheap tobacco products were made available during the review period.

Price marking
Price-marked packs reduce the opportunity for retailers to increase their margins by charging more than the RRP.[184] Price-marked packs were popular with tobacco companies because they 'give adult smokers confidence that they are getting a fair deal' (Andreas Nicolaou, Head of Trade at BAT, quoted in *Retail Newsagent*[185]) and were particularly used in convenience stores. Tobacco companies encouraged retailers to sell price-marked packs on the basis that it increased footfall, despite lower profit margins.[186] If true, it is possible that price marking increases industry profits by increasing sales volume.

Price marking grew over time, playing an increasingly important role in price reduction during the study period. At the beginning, price marking was used to signal a downgrading of brands between price sectors, such as Sterling in 2008 between economy and super value[187] and Berkeley in 2010 to the mid-price sector.[159] In 2011, the popularity of price-marked packs among convenience store RYO shoppers was noted:

> *. . . no fewer than six of the top 10 are price-marked packs, indicating a price sensitive market.*
>
> Retail Newsagent[188]

Similarly, among the top-selling cheap manufactured cigarettes 'eight [are] price-marked products all of which are mid-priced or economy brands'.[188] In 2012, Andreas Nicolaou, Head of Trade at BAT, noted that nearly half of tobacco sales (47.5%) in UK convenience stores were in price-marked packs.[185] The increase in popularity was due to '[t]he growing number of value seeking smokers' (Mike Lancey Head of Convenience at Imperial Tobacco quoted in *Retail Newsagent*[189]).

In 2013, it was noted that 'price marking dominates RYO sales with seven of the top 10 lines carrying flashes on packaging'.[190] By 2014, it was noted that 'most brands and nearly all new products (particularly those at the economy or 'value' end of the market) are now available to retailers in price-marked packs'.[191] The only exception was additive-free cigarettes:

> *NAS [Natural American Spirit] isn't price-marked as price tends not to matter to the adult smokers who buy it. These tend to be wealthy urbanites.*
>
> Alan Graham from Scandinavian Tobacco, quoted in Convenience Store[150]

Downgrades and price cuts
Products were sometimes downgraded to a lower priced segment by cutting their price in order to prevent smokers from switching to another company's product or quitting. This happened to Sterling in 2008, ostensibly to 'help retailers at a time of economic instability and when adult smokers will be looking for more value for their money'.[187] However, another reason for the move may have been a new brand from a rival company competing with Sterling.[192] The price cut was reported to be a success (in the three months following the price cut its share of the overall market climbed from 5.2% to 6.1%)[193] and the price segment downgrade was later confirmed as permanent.[194]

In 2010, Berkeley was downgraded to the mid-price sector in order to 'meet demand'[159] and Samson RYO tobacco was downgraded to the value segment for similar reasons.[195] In 2012, Berkeley was further downgraded to the value sector[196] and, in 2014, the price of Berkeley cigarettes was lowered,[197] as was that of Holborn RYO.[198]

Reduced margins

Pricing affected profit margins, which varied over time and by product for both tobacco companies and retailers. PMI launched Marlboro Bright Leaf in the mid-market price sector, which was viewed as an attempt 'to gain market share at the expense of margin'.[180] Although Imperial Tobacco claimed that 'profit per pack had steadily increased since 1989', figures seen by *The Grocer* suggested that retailer and wholesaler margins on Imperial Tobacco's best-selling brand variant had 'almost halved' in the same period (from 11% to 6% or from 71p to 40p).[199] Thus, declining margins appeared to lead to profit falls not for tobacco companies but for other elements in the supply chain.

Thus, government taxation, rather than tobacco company actions, was blamed in the commercial literature for falling retailer margins.

Added value

At the beginning of the review period, it was noted that RYO tobacco provided opportunities for retailers to sell accessories. In 2012 and 2013, tobacco companies were including papers with RYO tobacco. The price of these packs was cheaper for smokers, rather than buying each element separately.[200] RYO packs, which included papers, therefore 'added value' by providing smokers with less to pay for each cigarette smoked.

Make your own

Make your own was launched in the UK in 2011 and was claimed to reduce the pack price of JPS Silver by 20% (£3.80 compared with £5), after the initial outlay of a make-your-own cigarette maker at £3.09 and a £0.99 pack of 100 tubes.[201]

Segments consisting of very cheap products

The term ULP, which was used frequently during our previous review of the retail literature, is little used in this review and was either used by analysts or for cigarillos. However, such a segment was mentioned under different names, at the beginning and end of the review period. In 2008, it was noted that cheap tobacco was being made available through the creation of a new, very cheap segment:

> . . . the new lower priced cigarettes entering the market, Sterling and Windsor have added to the sector movements by creating a new pricepoint below the usual value for money level.
>
> *Lewis[202]*

Japan Tobacco International called the segment 'super value' in 2009.[194]

In 2011, a retailer noticed that 'some customers seem to be ditching traditional economy brands and switching to even cheaper ones'[203] and, in 2012, Imperial Tobacco announced the creation of a new segment:

> *Imperial Tobacco is launching Player's a new 'sub-value' priced cigarette brand. Sue Transter consumer marketing manager at Imperial Tobacco commented: 'Imperial Tobacco has chosen to position Player's just below the value priced sector, making it the first 'sub-value' priced cigarette brand available in the UK.*
>
> Wholesale News[204]

By the end of the period (2014), Imperial Tobacco referred to this segment as 'subeconomy',[140] and it was estimated that Imperial Tobacco's brands in this sector 'account[ed] for 7.67% of the entire cigarette market by the end of 2013'.[160] Imperial Tobacco stated that margins in the sector were increasing.[205]

Cigarillos

In 2010, it was noted that in the UK, unlike some other countries, cigarillos were more expensive than premium cigarettes, so they were not part of the creation of cheap tobacco options.[206] Nevertheless, in 2010, cigarillos were being designed to suit women and those with low incomes:

> . . . in order to appeal to this incoming consumer (also increasingly female) manufacturers have developed their products to appeal to squeezed wallets with smaller pack sizes. With lighter tastes, often with flavours/aromas and with a filter: the cigarette style cigarillo.
>
> *Euromonitor International Ltd[206]*

In 2011, Alistair Williams, STG's UK trade marketing manager, stated that 'a value for money segment has clearly developed in the cigar category in the past few months'; the sales from this were 'impressive [and] saw the variant soon outsell competitor brands in store' and this was thought to 'point to the value-for-money trend as being important in the cigar sector as elsewhere'.[207] In 2013, Alan Graham (also of STG) noticed that 'even the cigar market . . . is suffering from down trading . . . although not to the same extent as the rest of the category'.[142]

In 2014, a product (Break Little Cigars) was launched that could compete with cigarettes on price:

> [STG] launches an ultra low price product next month . . . a filter cigarillo product packed in a cigarette style box . . . aimed at price conscious smokers willing to alter taste and category preferences . . . 'This is the lowest out of pocket price for a ready-made smoke anywhere' said Alan Graham head of marketing at STG . . . ' because the EU sees this type of product as cigars and not cigarettes Break will be exempt from restrictions on flavour enhancements and minimum pack sizes.
>
> *Wholesale News[208]*

Cigars were therefore being moved into the lowest priced sector because they were not subject to some of the EU restrictions. From the retail literature, it appears that the cigar market was being subjected to the down-trading pressures found in manufactured cigarettes and RYO. Tobacco manufacturers were taking advantage of loopholes in legislation to launch low-priced cigars.

Pack size

Varying the numbers of cigarettes per pack

Cigarette packs were historically sold with 20 sticks or 10 sticks per pack. An innovation during the period was cutting the number of sticks in order to 'maintain reasonable price points'.[209]

For example, BAT created a Pall Mall 19-stick pack, which was 23p cheaper than the 20-stick pack, in order to stop smokers 'down[-trading from] the premium category [in a way that] didn't affect value for consumers or profitability for retailers' (Henry Lewis from BAT, quoted in *Retail News*).[210]

The small change in pack size could go unnoticed by smokers:

> Increasingly our customers are buying on price even to the point that sometimes they don't realise they are buying 19s – all they see is the price.
>
> *Wholesaler Paul Ford, quoted in* Wholesale News[211]

Changing pack size could therefore be a successful way of retaining smokers in brands with higher profit margins.

Roll-your-own tobacco pack sizes

Small pack sizes quoted tended to be 12.5 g and 10 g (or even, on occasion, 8 g), larger pack sizes tended to be 20 g (or sometimes 50 g). Large pack sizes could be advantageous to smokers with a lower price per gram, whereas smaller pack sizes gave a lower purchase price; thus, manufacturers launched both.[144]

Supporting retailers

Retailers are more likely to stock products and to make more effort to sell products if they receive support from manufacturers. This support could be in terms of profit margins or other practical support. Particularly when launching a new product, higher margins might be made available.[212] Other incentives to stock new variants included competitions for retailers to win a prize (e.g. a trip to New York)[213] and visits from tobacco company representatives for promoting special offers.[214]

In 2014, with preparations for the PoS display ban, stores were also getting more visits from manufacturers to help them.[205] Additionally, manufacturers provided advice in trade magazines as to how best to stock their gantry.[215] However, the PoS display ban was seen as perhaps changing the power distribution between manufacturer and retailer slightly:

> [One retailer] speaks for many retailers when he says manufacturers must work even harder to get new products on his two metre gantry.
>
> *Lambert[216]*

Commercial literature study 1 conclusions

During the review period (2008–14), the commercial literature reported that smokers were continuing to down-trade to lower priced tobacco options for two main reasons: (1) increased prices (generally blamed in the commercial literature on tax increases) and (2) the recession reducing smokers' disposable incomes (see *Chapter 5*).

The TI responded in a number of ways. First, innovations (capsules, flavours, etc.) were used to promote premium products and signal their greater attractiveness. However, as the trend to down-trade grew, tobacco companies appeared to blur the boundaries between price segments and innovations, in that both product and packaging were increasingly used in lower price segments. Growing numbers of products were launched in cheaper price segments, often within the same brand/brand family (e.g. cheaper variants or RYO tobacco versions of known FM cigarette brands). Additionally, a variety of techniques were used to promote cheaper products and help maintain their lower prices, most notably price marking and smaller pack sizes (e.g. packs with < 20 cigarettes or low-weight RYO packs).

The compensation mechanism of premium brands offsetting the lowered profit margins of cheaper products was forecast, by Euromonitor International Ltd, to stop working in the UK in the 2020s. Indeed, many of the promotional approaches noted during the review period are now restricted in the UK (see *Chapter 10*).

Commercial literature study 2: how does the tobacco industry segment its products on price?

This literature review was used to inform our segmentation of brands from the other data sources. Through preliminary analysis of the commercial literature, it became apparent that the same brand might be priced differently (and thus be in a different price segment) in different countries. Analysis of brand and segment links in the literature was therefore restricted to those mentioned in a UK context. We found that cigarettes, RYO tobacco and cigars/cigarillos were discussed in terms of price segmentation, but no references to pipe tobacco, waterpipes or smokeless tobacco being differentiated in this way were found. Segment names present in the commercial literature, sorted by approximate price group, are provided in *Table 5*. Segment names were fairly consistent across the three tobacco types (FM cigarettes, RYO tobacco and cigars/cigarillos), although there were more segment names applied to FM cigarettes, probably due to higher volumes of sales.

TABLE 5 Commercial literature study 2: segment names mentioned in the commercial literature, sorted by approximate price group

FM	RYO	Cigars/cigarillos
Super premium		
Above premium		
Luxury		
Luxury or prestige		
Luxury and premium		Luxury
Premium and super premium		Luxury and premium
Premium and above premium		Super premium
Super premium and premium		
Premium		
Higher price segments	Targeting higher end of the market	
Higher priced		
Subpremium		
Mid-price/premium		
Mid to high		
More affordable		
Mid-price		
Mainstream		
Mid-market		
Mid-priced		
Mid-range		
Mid-tier		
Mid-price/economy		
Mid/value		
Mid-price/economy		
Mid-price/value for money		
Economy/value		
Budget		
Discount		
Economy		
Economy/budget		
Low margin value brand		
Low price		
Low priced		
Lower priced		
Lower value		
Lowest price sectors		

TABLE 5 Commercial literature study 2: segment names mentioned in the commercial literature, sorted by approximate price group (*continued*)

FM	RYO	Cigars/cigarillos
More budget focused		
Value and economy		
Value for money or VFM		
Value line extensions		
Value price point		
Value – sub £6		
***Subvalue/subeconomy*[a]**		
Cheapest product on the market	Own label	
Even cheaper than economy		
Own label		
Own brand		
Subvalue		
Super value		
ULP		
		Super value for money
		ULP

a Analysts also used the terms 'ULP', 'ultra-discount' and 'deep discount' to refer to very low-priced FM products, particularly near the beginning of the data series. Such products were not lowest price during most of our data series.
Note
In addition to price segments, there were also mentions of a 'natural' segment and segments associated with sales to young people, older people, women, men and unisex/urban.

Very high-priced products were often termed 'luxury', but the most common segment name for high-priced products was 'premium'. The prefix 'mid' was often used as part of the segment name for products in the middle of the market (middle price range). There were many names for low-priced products with variations of 'economy' and 'value' being common. Particularly, low-priced FM and RYO products were sometimes referred to as being in a segment with the prefix 'sub'. Cigar products with this pricing were referred to as 'ULP'.

Explicit provision of names of the price segments used by tobacco companies were rare. During the analysis period, Imperial Tobacco stopped talking about price segments in its annual reports. In 2014, however, an article named the price segments used by Imperial Tobacco to be (from highest to lowest price range) premium, subpremium, value, economy and subeconomy.[140] Imperial Tobacco brands labelled as 'value' were actually mid-market brands, yet generally in the commercial literature 'value' was used interchangeably with 'economy'.

Nielsen data study 1: allocation of stock-keeping units to segments

Taking the findings from the commercial literature (study 2) as a starting point, this study undertook a detailed allocation of brands to segments. This analysis was restricted to non-price-marked packs containing 17–20 FM sticks or 10 g, 12.5 g, 25 g or 50 g of RYO tobacco (not combi-packs) per pack, and to SKUs with sufficient market share (see *Chapter 2*).

Segmentation of stock-keeping units for factory-made cigarettes

For the first month of data, using the list of SKUs for each price segment which was developed in our PPACTE study[32] (premium, mid-price, economy and ULP), we allocated FM SKUs to segments (except that the PPACTE economy segment was split into 'subpremium' and 'value' segments based on common segment naming of two subgroups of brands in this segment; see *Table 5*). All SKUs sold in the first month were listed in order of increasing price per stick, alongside their PPACTE segment. If there was no PPACTE segment, we allocated the SKU to the segment within which its price fell. There were a few brand families, generally that arose towards the end of the PPACTE data series, where the segment once the brand was established, as shown in the new data set, had moved. Segments for such brand families were revised. We then could calculate a price range for each segment and establish price boundaries for each segment that did not overlap.

For subsequent months, we again listed all SKUs sold by price per stick, alongside their segment from the previous month. New brand families were added to the segment within which their price fell. Problem SKUs, which appeared to cross segment boundaries, were flagged and addressed separately. These problem SKUs were not included in the boundary designation for that and subsequent months until their price had stabilised within the designated boundary. If a new SKU emerged or reached valid market share and its price was in between two segments, it was classified with the closest segment, unless in the future it was persistently in the other segment, and the commercial literature suggested that segment or the emergence of a new segment.

Our PPACTE work, the updated commercial literature review and an initial analysis of the data, showed that all SKUs within a FM brand family tended to be within the same price segment and that brand families tended to stay in the same price segment over time. Originally, we had believed that brand variants in the same brand family would be located at different price segments because the commercial literature (study 1) had suggested that brand variants were being introduced at different price points to their main brand family. When this occurred, however, Nielsen generally split the lower priced variants into a different brand family. For example, L&B Blue was presented as a different brand family to L&B. The final allocation of FM SKUs was thus always consistent with their brand family.

Seven FM segments were originally identified from the Nielsen data and literature: (1) premium; (2) vestigial mid-price (brands identified as being in the mid-price segment in the PPACTE study, which mostly either disappeared or were repriced during the data series); (3) subpremium; (4) value; (5) original ULP (brand families in this segment at, or near to, the beginning of the data series); (6) new ULP (brand families that appeared from 2011 onwards that were priced generally within the original ULP bracket); and (7) sub-ULP (brand families that appeared from 2012 onwards and were consistently priced below the ULP brand families). Two researchers analysed in detail all flagged SKUs, to ascertain why they were not in the expected segment. When possible, rules were then developed for allocating flagged SKUs. Reasons for SKUs not being in the expected segment (based both on data observations and on the literature review) included (1) delayed price increases (e.g. Dunhill); (2) high-priced SKUs within one segment overlapping with low-priced brand families within another segment (e.g. JPS Black, Sovereign Black and Vogue Perle were priced between main subpremium brand families and value brand families for long periods); (3) low introductory pricing (e.g. Marlboro Bright Leaf Platinum); (4) very low exit pricing, particularly in 2014 when the number of sticks per pack was changing from 20 sticks to 19 sticks (e.g. Richmond, Mayfair) and the old 20-stick packs were sold off very cheaply; (5) repricing a brand family into a different segment (e.g. Superkings moved from vestigial mid-price to premium, or Berkeley, where the segment declined several times); and (6) gimmicks (e.g. click on or menthol, which often led to higher priced SKUs).

We produced graphs of SKUs within brand families and segments over time to understand the segmentation better. Two examples are provided to illustrate the utility to our allocation process of visualising the data. *Figure 2* shows the atypical brand Berkeley for which repricing changed the segment several times. The three Berkeley superking SKUs (SKUs 1–3; black lines in *Figure 2*) present at the beginning of the data series dropped from vestigial mid-price to value around May 2010 and from value pricing to original ULP pricing around
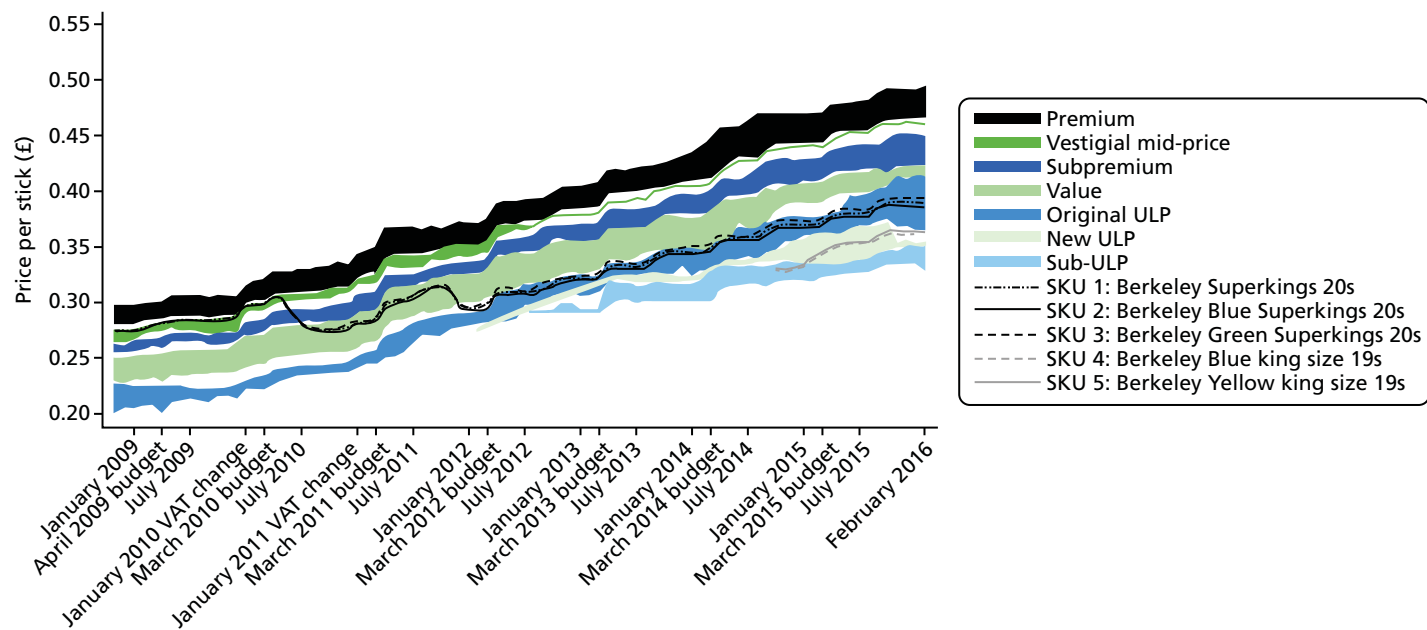
FIGURE 2 Nielsen data study 1: Berkeley FM cigarette SKUs alongside preliminary price segments, illustrating how anomalous SKUs were used to understand segmentation. All SKUs are single packs with no price marking. Prices are not weighted for volumes.

December 2011. Berkeley king size 19-stick packs (SKUs 4 and 5; grey lines in *Figure 2*) showed the opposite pattern and increased from subULP in late 2014 (when they arrived on the market) to original ULP pricing by the end of the data series.

Mayfair was a key brand in the value segment. However, there were some anomalous SKUs (*Figure 3*). Mayfair Menthol SKUs could sometimes be priced higher than expected and for many months the green SKU illustrated (SKU 5 in *Figure 3*) was priced in the subpremium segment. Dramatic falls in price of 20-stick Mayfair packs in 2014 when the 19-stick packs were introduced are also shown. Note, that one of the replacement 19-stick packs was actually priced higher than the 20-stick pack, at the border between value and subpremium pricing.

Our visual analysis of flagged brands showed that although some SKUs might temporarily be priced within a neighbouring segment, this generally occurred only for short periods and in the margins of the unexpected segment. As such, it was simple to allocate each SKU to the segment where it spent most time. There were two exceptions: (1) there was considerable overlap in price between the original ULP and new ULP segments (these were therefore merged, see *Figure 2*); and (2) it was impossible to allocate a clear segment to Berkeley brand families due to several marked price changes. Berkeley was therefore excluded (see *Generalisation and final segments*).

Segmentation of stock-keeping units for roll-your-own tobacco

Stock-keeping unit prices were listed and graphed separately by pack size, as these were priced differently, with heavier packs cheaper per gram. Initial graphical analysis of the RYO SKUs revealed only three main price segments and that these were priced consistently above, in line with or below one of the main traditional RYO brands (Amber Leaf) (*Figure 4*). RYO SKUs were therefore listed by price per gram together with their segment, based on their pricing relative to Amber Leaf. If SKUs appeared to move segments, flags were used in the same way as for the FM SKUs.

Generalisation and final segments

Nielsen did not always differentiate FM and RYO SKUs at the same point in the brand classification hierarchy (see *Chapter 2* and *Table 2*). For FM SKUs, Nielsen differentiated brand families (their 'houses') when they were introduced at different price points, for example Marlboro Red and Marlboro Gold were in the same brand family, whereas Marlboro Bright Leaf, which had lower prices, was differentiated. For RYO SKUs, this was not always the case. For example, Amber Leaf Signature Blend SKUs were in the same brand family as the other Amber Leaf SKUs, despite being more expensive. This difference may flow from there being fewer RYO SKUs (e.g. in 2015 there were 934 FM SKUs and 226 RYO SKUs). Thus, for FM, SKUs in different brand families were reliably likely to have different price points, so we allocated FM SKUs to price segments at the brand family level. As this was not clearly the case for RYO SKUs, these were allocated to price segments at the more specific brand variant level.

The segment allocations, which were initially determined using the restricted pack types and sizes described in *Segmentation of stock-keeping units for factory-made cigarettes* and *Segmentation of stock-keeping units for roll-your-own tobacco*, were then extended to all other relevant pack sizes, cartons and price-marked SKUs. For simplicity and for consistency between FM and RYO, the vestigial mid-price, subpremium and value segments were merged into a 'mid-price' segment, the original and new ULP segments were merged into a 'value' segment and the subULP became the 'subvalue segment'. Thus, for analysis, the segments for FM were premium, mid-price, value and subvalue; and the segments for RYO were premium, mid-price and value. The final list of FM brand families and RYO brand variants allocated to these prices segments is provided in *Table 6*.

To explore convergent validity, FM brand families and RYO brand variants were listed within their allocated price segments, together with associated price-related terms used in the commercial literature (see *Tables S2* and *S3* in *Report Supplementary Material 2*). In general, there was good consistency between segments and literature terms; this was especially true for FM families in the premium segment, which were clearly
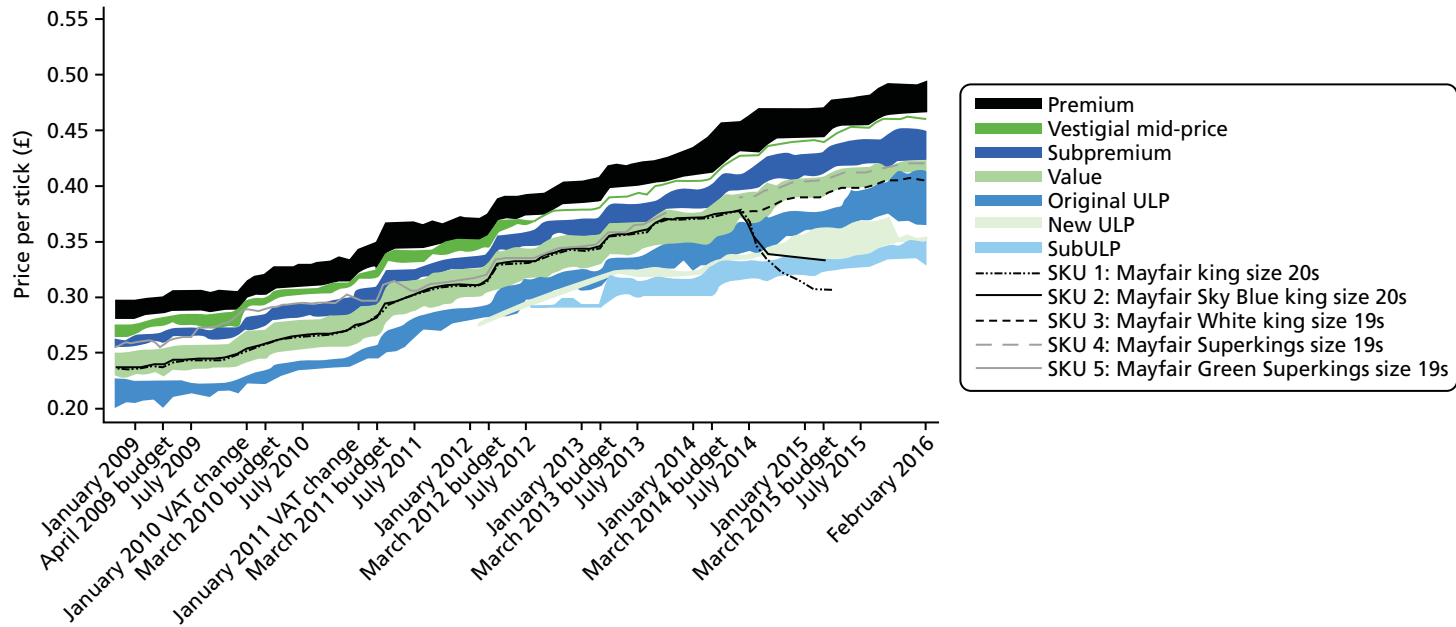
FIGURE 3 Nielsen data study 1: Mayfair FM cigarette SKUs alongside preliminary price segments, illustrating the dramatic discounting of some SKUs being phased out of production, as new SKUs were introduced. All SKUs are single packs with no price marking. Prices are not weighted for volumes.
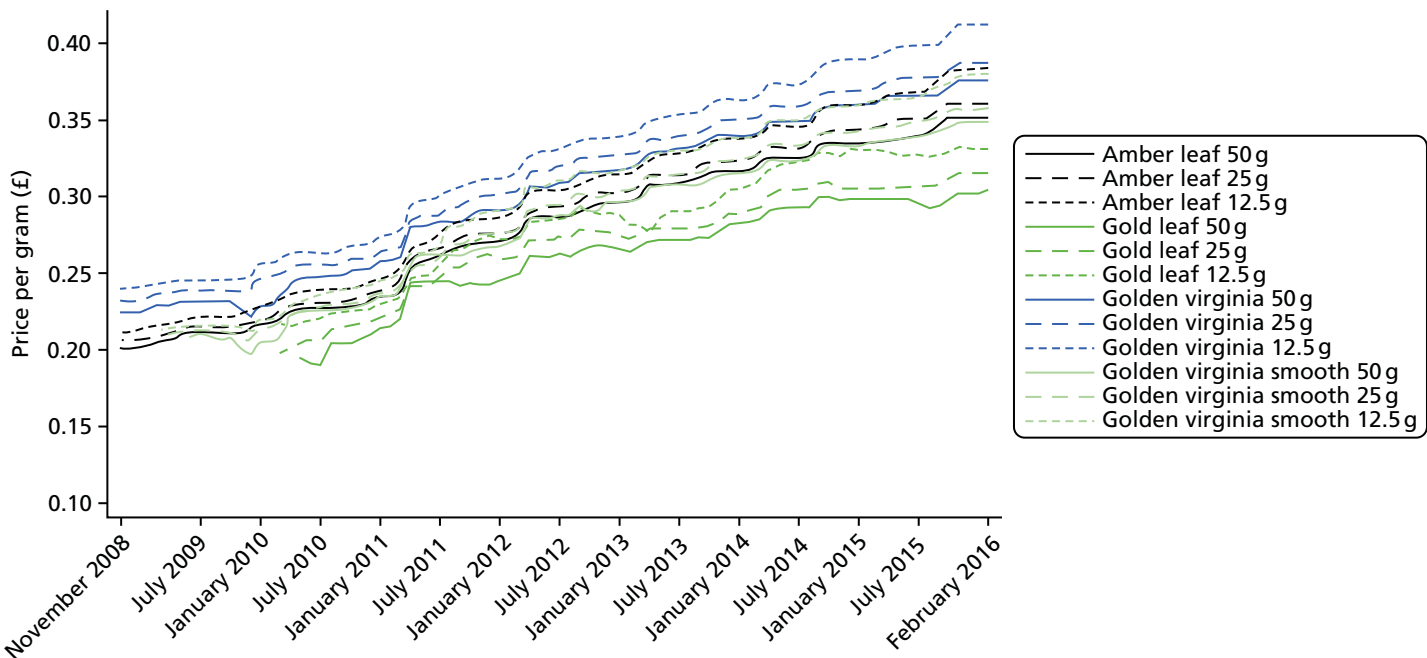
FIGURE 4 Nielsen data study 1: RYO SKUs compared with Amber Leaf SKUs, showing the pattern that was observed when other RYO SKUs were priced consistently above (e.g. Golden Virginia SKUs; blue lines), in-line with (e.g. Golden Virginia Smooth SKUs; light green lines) or below (e.g. Gold Leaf SKUs; dark green lines) the more traditional RYO brand Amber Leaf (black lines). Note, all SKUs displayed were single, non-price-marked packs.

TABLE 6 Nielsen data study 1: final allocation of FM cigarette brand families and RYO tobacco brand variants from the Nielsen data to price segments

Price segment	FM cigarette brand families	RYO tobacco brand variants
Premium	Dunhill, Rothmans, Vogue Superslims, Embassy, Regal, B&H Gold, Camel, Park Drive, Silk Cut, Marlboro, Superkings (originally John Player Superkings), Consulate, Rothmans, Solo, Superkings, More, Peter Stuyvesant, Players Navy Cut, Senior Service, St Moritz, Woodbine	Amber leaf signature, B&H Gold, Drum, Drum Additive Free, Drum Gold, Golden Virginia, Natural American Spirit, Old Holborn
Mid-price	Club, Raffles, Natural American Spirit, L&B, B&H Dual, B&H Silver, B&H White, B&H Black, Vogue Perle, Craven A, Royals, Richmond, Mayfair, Sovereign (Black), Marlboro Bright Leaf, JPS Black, JPS White, Dorchester	Amber leaf, Amber Leaf Blonde, B&H Silver, Cutters Choice, Cutters Choice Extra Smooth, Cutters Choice Gold, Cutters Choice Exquisite Blend, Cutters Choice A True Blend, Golden Virginia Smooth, Marlboro Gold, Old Holborn Yellow, Samson Virginia
Value	Pall Mall, All JPS (except Black and White), Windsor (Blue), Ronson, Sterling, Winston, Specials, Maxim, B&H Blue, Sovereign Blue, L&B Blue, Chesterfield, Marlboro Touch	Ashford Gold Bright Virginia, Carlton, Gold Leaf, Holborn Smooth Taste, JPS Silver, Pall Mall, Players Gold Leaf, Salsa (Virginia Blend), Sterling, Manitou Gold, Pueblo, Rol, The Turner, Urban, Players Volume Tobacco
Subvalue	Rothmans of London, Carlton, Players, Allure, Rothmans Blend 55	
Wholesaler or retailer brands	Balmoral, Beaumont, Goldmark, Kingsmen, Londis, No. 3, Park Road, Red Band, Select, Silver Strand, Sky	Private Label, Red Band

B&H, Benson & Hedges.

differentiated. For FM families in the mid-price segment, the literature terms used could depend on whether the family was positioned as desirable because of cheaper pricing (resulting in some overlap with terms used for brand families in the value and subvalue segments), or for being more sophisticated than cheaper brands (resulting in the use of the term 'premium' in the literature). The greatest variation in literature terms was seen for the FM brand families in the value and subvalue segments (although there was no overlap with terms used for the premium segment). For RYO tobacco, brand variants allocated to the premium and value price segments were clearly differentiated by price-related descriptors in the commercial literature. RYO variants in the mid-price segment, however, could be described by low- or high-price terms, or a mixture. This often occurred when they were being compared with a differently priced brand variant in the same brand family (e.g. Golden Virginia Smooth is 'low priced' compared with the original Golden Virginia brand variant). By contrast, Marlboro RYO was described with high-priced descriptors, perhaps as a reflection of the premium nature of the Marlboro brand overall.

Segmentation allocation of extra stock-keeping units based on industry pricing analyses

Some additional SKUs that did not meet the inclusion criteria for the original segmentation analysis (see *Table 3*), due to low market share, became valid when the Nielsen data sets were merged for the industry pricing analyses described in the following chapter (see also *Chapter 2*). These extra SKUs were allocated to either the same price segment as their brand family (FM) or their brand variant (RYO). If this was not possible, they were allocated to the segment that their price was closest to for the majority of the time that the SKU was valid (e.g. FM Lucky Strike and RYO Turner SKUs). One brand, Swan, was excluded due to extremely low pricing. It is possible that there was some confusion by retailers, given that some Swan RYO accessories are sold in packaging similar to cigarette packs; thus, Swan filter tips or rolling papers, for example, could have incorrectly been given a tobacco brand SKU (see *Figures S1–S3* in *Report Supplementary Material 3* for illustrations of this allocation process).

Allocation of factory-made cigarette brands in the ITC data to price segments

Analysis of the ITC data set included exploring how smokers moved between FM cigarette price segments (see *Chapter 6*). Thus, we needed to know the price segment of the brands that ITC respondents reported smoking. For ITC participants surveyed prior to November 2008 (see *Table 4*), when Nielsen data from this current study became available, we used PPACTE classifications to allocate brands to price segments. Some brands recorded by ITC respondents did not appear in the Nielsen data and were allocated to the segment in which their price fell (i.e. allocated by price not brand). Price boundaries for each segment had to be recalculated slightly for this purpose, because ITC does not differentiate between price-marked and non-price-marked packs. It was necessary to develop some new exclusion criteria to recalculate the price boundaries. In addition to the usual exclusions (SKUs with market share ≤ 0.05%, packs containing < 17 sticks or > 20 sticks, retailer and wholesaler brands, cartons and all Berkeley SKUs), we excluded all Chesterfield, Marlboro Touch and Mayfair Green superking 20-stick pack SKUs when recalculating the price boundaries. Some further SKUs were partially excluded in some months only, due to anomalous pricing in visual analysis of the boundaries (see *Table S4* in *Report Supplementary Material 2*). Unlike the original Nielsen segment analyses, we included price-marked packs. Wholesaler and retailer brands could not be included in the Nielsen analysis because they were distributed only to a small selection of stores. Such brands appeared in the ITC data, so tentative boundaries from the Nielsen data were also provided for these (they tended to be priced lower than other products). The final price segment boundaries used for ITC brand allocation are provided in *Figure 5*.
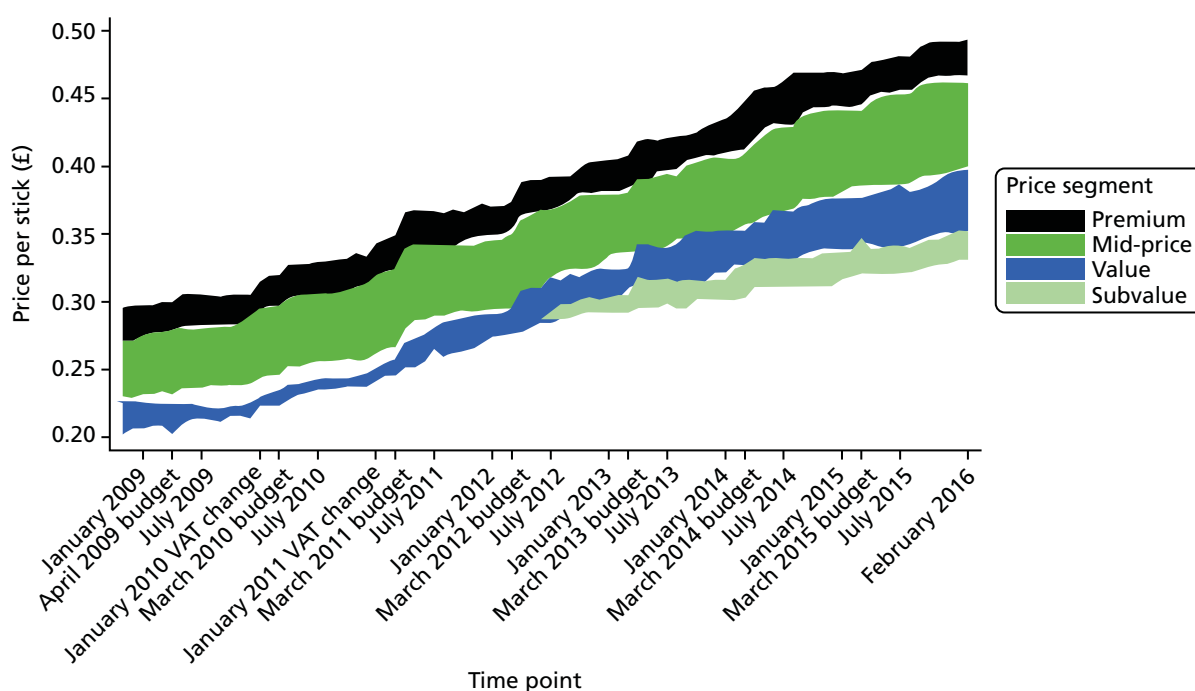
FIGURE 5 Nielsen price boundaries used for ITC brand allocation of FM cigarettes to price segments (used in ITC studies 3–5). Note, that for some ITC analyses the value and subvalue segments were combined.

Summary

To the best of our knowledge, this is the first study to provide a comprehensive overview of TI pricing strategies in both the FM and RYO markets. The commercial literature review indicated that low-priced FM and RYO tobacco products remained available throughout the study period via various pricing strategies, including launching new cheaper products; locking down the price of certain products through price marking; introducing smaller packs; and undershifting to ensure smaller price increases in the cheaper segments.

Our analysis of TI price segmentation indicated that, although the industry employed numerous price-related terms for its products, for practical purposes these could be summarised in four segments for FM cigarettes (namely, premium, mid-price, value and subvalue) and three segments for RYO tobacco (premium, mid-price and value). This information was used in our subsequent ITC studies to allocate smokers' FM cigarettes to price segments.

Chapter 4 What smokers pay for their tobacco

Introduction

In this chapter we examine patterns of use of cheap, legal tobacco products by smokers. Our analyses comprise an assessment of what smokers pay for their tobacco using ITC data (2002–14 for FM and 2005–14 for RYO) and an examination of Nielsen data (2009–15).

ITC data study 1: prices paid for tobacco by smokers over time

Introduction

Here we assess UK smokers' store-based tobacco purchase costs over time. As described in *Chapter 2* (see also *Chapter 6*), these are assumed to be legal, fully taxed purchases. During the study period, 2002–14, ITC data suggested that most (≥ 80%) tobacco purchases were from UK store-based sources. The most common source of tobacco purchases changed from convenience stores to supermarkets over the study period, which presumably conferred price savings. We compare purchase costs of FM-P, FM-C and RYO tobacco in order to understand possibilities for price savings, which could be undertaken as an alternative to quitting.

Methods

Data

We used the first 10 surveys of the ITC UK data (2002–14) for FM purchases and six surveys for RYO tobacco purchases (surveys 5–10, spanning 2005–14). At each survey, we included only responses from participants who were smoking at least monthly at the time. Participants were excluded if they had data missing on any variables relating to their last tobacco purchase (*Table 7*). This was generally minimal; however, a relatively large proportion of responses were excluded due to missing (2.3–5.2% per survey) or improbable (1.0–3.7% per survey, see *Chapter 2*) responses for price. Data were pooled over all surveys, so participants who had provided valid data on some surveys were excluded from other surveys if they had stopped smoking (8.0%), had missing data (0.6%) or were lost to follow-up (25.5%). This resulted in a final sample size of 6169 participants who provided 15,812 responses overall [each individual participated in, on average, 2.6 surveys (SD 2.0 surveys)].

Sample characteristics are shown in *Table 7*. A comparison of the included sample with the excluded sample indicated some differences. Those excluded were more likely to use cheap tobacco, suggesting that prices, particularly for the non-UK/non-store sources, may be overestimates.

Analyses

Generalised estimating equations were used to test for linear trends in the prices paid for each product type, via clustered linear regression analyses, using a Gaussian distribution with an identity link function and unstructured correlation matrix (or exchangeable if unstructured failed to converge). We pooled responses from all surveys and GEE controls for correlated responses resulting from the same individual providing data at multiple surveys. Data were weighted using ITC cross-sectional weights for representativeness of age, sex and geographical region, as the intention was to observe population trends rather than conduct predictive analyses. All prices were adjusted to 2014 values using CPI data.[126]

TABLE 7 International Tobacco Control Policy Evaluation Project data study 1: unweighted sample characteristics by survey wave

Participant characteristics	ITC UK survey number									
	1	2	3	4	5	6	7	8	9	10
Met selection criteria (*n*)	2367	1914	1831	1727	1690	1636	1474	960	1096	1117
Sex (%)										
Female	56.6	55.4	55.8	57.2	57.2	57.4	55.8	55.3	51.0	52.9
Male	43.4	44.6	44.2	42.9	42.8	42.6	44.2	44.7	49.0	47.1
Age group (years) (%)										
18–24	8.5	6.4	5.0	4.4	4.7	4.8	3.7	2.6	4.2	3.0
25–39	32.2	29.6	27.7	26.0	24.6	24.4	20.8	14.4	21.4	21.6
40–54	33.9	36.3	37.8	38.6	36.6	36.7	35.7	37.0	34.0	33.4
≥ 55	25.4	27.6	29.5	31.0	34.1	34.2	39.8	46.0	40.3	42.1
Geographical region (%)										
London	13.4	13.3	12.3	12.1	13.3	13.1	11.5	11.8	10.3	10.8
Yorkshire and The Humber	8.8	8.6	8.6	8.9	8.1	7.1	6.7	7.0	7.5	7.6
East Midlands	6.8	7.0	7.7	7.1	7.0	7.3	8.0	7.2	6.7	6.8
Eastern	8.5	8.3	8.8	8.9	7.9	8.2	7.6	8.9	9.6	9.8
North East	4.7	4.6	4.6	5.0	4.9	4.6	4.3	4.1	4.3	4.5
South East	13.7	14.0	13.9	13.1	13.3	13.2	13.1	14.3	13.1	13.5
South West	7.7	8.1	7.4	8.1	8.4	8.3	9.4	8.4	7.9	8.2
West Midlands	8.5	8.9	8.7	8.1	7.7	8.7	8.6	8.3	9.5	8.0
North West	10.6	10.6	10.9	10.9	10.1	9.7	9.4	9.2	11.0	11.5
Wales	5.0	4.7	4.6	5.3	5.9	5.9	6.7	6.5	5.8	5.9
Scotland	9.9	10.0	10.2	10.1	10.9	10.7	11.5	12.0	11.0	10.7
Northern Ireland	2.3	2.0	2.5	2.5	2.6	3.2	3.2	2.5	3.5	2.8
Missing data (%)										
Usually smokes FM or RYO	0.04	0.21	0.05	0.23	0.00	0.00	0.14	1.98	0.00	0.18
Carton purchases	2.15	2.09	0.82	0.69	0.47	3.73	0.95	4.48	2.55	2.24
Purchase source	0.46	0.78	0.16	0.17	0.53	0.79	0.61	0.21	1.55	1.52
Price missing/excluded	7.73	4.86	3.77	5.44	5.21	8.13	6.17	8.75	16.97	17.64
All valid (complete cases)	90.5	93.8	96.0	94.3	94.0	91.1	93.6	91.0	82.2	81.7

Note
Missing data + complete cases do not sum to 100% because it was possible for participants to have data missing on more than one variable.

Results

The real price (base year 2014) of all product types purchased increased significantly during the study period: prices remained relatively unchanged up until 2010, but increased thereafter (*Figure 6*). The real price per stick for both FM-P and FM-C increased by only £0.10 from 2002 to 2014. For FM-P, median prices per stick increased from £0.27 to £0.37. FM-C were typically £0.01 to £0.02 cheaper per stick. The median price per stick of RYO tobacco increased by only £0.05, from £0.12 in 2005 to £0.17 in 2014.
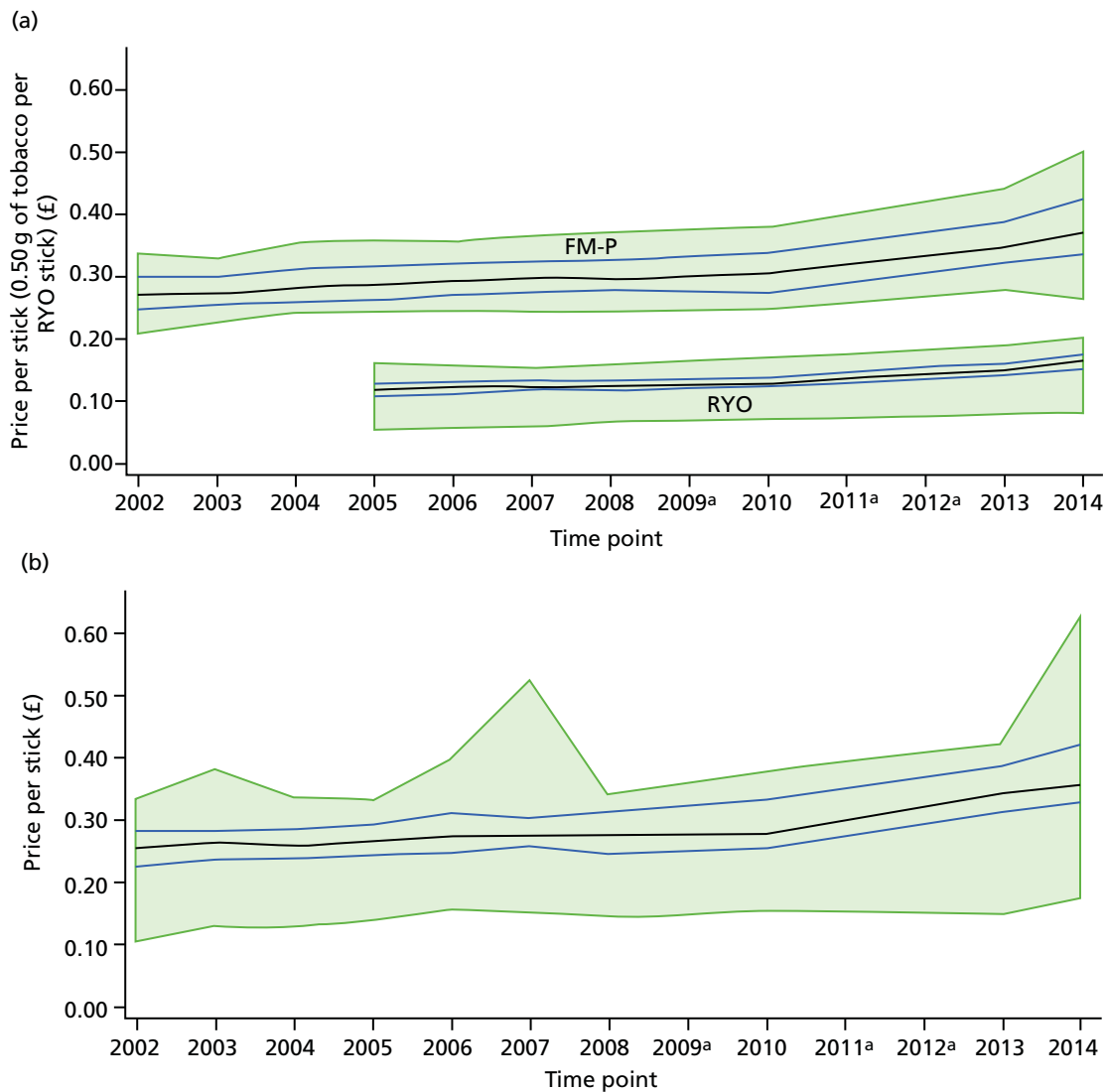
FIGURE 6 International Tobacco Control Policy Evaluation Project data study 1: weighted median prices (black lines) and 95% ranges (shaded areas: top and bottom 2.5% excluded) of (a) FM-P and RYO tobacco; and (b) FM-C purchased from UK store-based sources only. Blue lines indicate 25th and 75th percentiles. All prices are adjusted to 2014 values (base year = 2014) and based on the most recent reported tobacco purchase. a, No data collected for this year.

The range of prices differed by product type, but FM-P/FM-C and RYO smokers in 2014 were able to buy the same type of product at real prices similar to 2002 and 2005, respectively. The price range for FM-P was relatively narrow and changed little over time: £0.12 per stick in 2002 to £0.13 in 2010; then £0.16 in 2013 to £0.23 in 2014, when an increase in the highest price and a decrease in the lowest price was evident. The price range for FM-C was wider and more variable, despite median prices being similar to FM-P, ranging between £0.19 and £0.27 per stick in most years, but £0.37 in 2007 and £0.45 in 2014. The price range for RYO tobacco changed little over time, from £0.10 per stick in 2005 to £0.12 in 2014. FM-P prices were evenly distributed over the range, whereas RYO prices were negatively skewed, with greater variation at the cheaper (below median) end.

Limitations

No data were collected for most of 2011 and all of 2012. Hence, we are unable to comment on changes specific to this period and this might overestimate the linear nature of the trends observed over time. However, the large size of the data set does give some confidence in the observations reported. Some store-based purchases might be 'under the counter' and hence tax evasion, but we minimised this possibility by excluding very low prices paid from UK store-based sources. To be included in the study, participants had to be current smokers, so our procedure meant that quitters were progressively excluded

from the analysis. However, the missing data analysis also suggested that users of cheap tobacco (who other research has shown may be less likely to quit[54–56,59]) were more likely to be excluded. Thus, it is possible that these two effects balance each other to some extent. The ITC survey is replenished at each wave with a representative sample of current smokers, to minimise attrition effects. We therefore think it is unlikely that the observed trends are due to attrition.

Implications

Changing between product types would have saved money (e.g. purchasing FM-C rather than FM-P would typically confer a saving of £0.01–0.02 per stick on the median price). Switching to RYO conferred the largest savings, a 0.5-g stick being typically less than half the price (around £0.18 cheaper) of one FM-P cigarette. This means that a saving of about £750 per year could be made for the average UK smoker smoking around 11.4 CPD,[217] by switching from FM-P to RYO.

Changing within product types (to different brands) also saved money. The price range between the cheapest and most expensive FM-C products purchased was consistently wide and, from around 2010 onwards, the price range of FM-P products also widened markedly. These findings suggest that the TI strategy of overshifting prices on premium and undershifting prices on cheaper products was becoming more aggressive in the UK. In contrast, the observed price range for RYO tobacco was disproportionate, due to more variation in the cheap prices, suggesting that TI undershifting may be particularly relevant within the RYO tobacco market.

In relation to the influence of tobacco taxation, from 2011 onwards, when tobacco duty was higher than in previous years (at 2–5% above inflation; see *Table 1*), there was a greater increase in the prices of purchased tobacco products. However, even when assuming that this was a causal relationship, these tax increases did not substantially impact real prices, did not prevent a widening price range between cheapest and most expensive FM-P products, and made little impact on the lowest price paid for RYO tobacco. Hence, although there was a statistically significant increase in real price paid over the study period, this was not substantial.

Summary of ITC data on tobacco prices

The real price paid by smokers changed little over time, despite taxation changes. For some smokers, it was possible that the prices they were paying for their tobacco from licit sources in 2014 had not changed in real terms compared with 2002. Tobacco taxation had not prevented the success of the TI strategy of widening the price range between expensive and cheap products.

Although the ITC data were able to tell us about the range of available prices, there were too few cases to break down tobacco products into detailed price segments for both FM and RYO. In addition, insufficient detail was available on products purchased to understand fully how the wide variation in prices was achieved. Nielsen tobacco sales data were used for these purposes.

Nielsen data study 2: tobacco industry pricing strategies

The more detailed data from the Nielsen sales data set, compared with ITC, allowed both FM and RYO to be split into price segments. SKUs were allocated to price segments, and price segment labels were identified based on the commercial literature review and an analysis of their relative pricing each month, as outlined in *Chapter 3*. As stated in *Chapter 2*, cartons had to be excluded from the analysis, as they were not sufficiently widely sold for Nielsen to provide reliable estimates of pricing.

Analysis

Weighted average real prices

For theses analyses, monthly weighted average real prices (base year 2014) were calculated by weighting for volumes (FM sticks or 0.5-g stick equivalents of RYO tobacco) sold and adjusting for inflation using the CPI.[218] We used volumes of sticks, rather than packs, sold because pack sizes varied by SKUs and changed over time.

For every month, for each SKU that reached valid market share (see *Chapter 2*), we multiplied the real price per stick by the volume sold. We then summed these amounts [Σ(real prices × volumes)] for all SKUs within a segment and divided by the total volume of all SKU sold within that segment, to obtain a weighted average real price for that segment in that month. This basic procedure could be adapted, for example to create WAPs per pack instead of per segment, or to create prices for different pack sizes or compare price-marked SKUs with non-price-marked SKUs within each segment.

Pack size and price marking

To examine changes in pack size over time, we identified popular pack sizes and calculated the market share by pack size for each segment annually over the study period. We explored patterns in the use of price marking by calculating the percentage of price-marked packs by segment and pack size each month. We also calculated real WAPs (as above), and the percentage difference between the prices of price-marked and non-price-marked packs in each segment.

Impact of the 2011 Budget on roll-your-own tobacco pricing

To understand whether or not the 2011 Budget was successful in its objective of raising RYO tobacco prices (via an additional 10% increase in RYO tobacco taxation, as well as a shift towards greater specific taxation; see *Chapter 1*), we compared the median monthly price rise in each RYO segment immediately after the 2011 Budget enactment with median monthly price rises immediately following the other Budget enactments, and across the data series as a whole.

Results

Price per stick

When comparing prices per stick, RYO sticks were considerably cheaper than FM sticks (*Figure 7*, and see also *Table S5* in *Report Supplementary Material 2*). Over the study period, the price range between cheapest and most expensive price segments widened. For RYO sticks, from £0.02 to £0.03 per stick and for FM sticks from £0.07 to £0.10 per stick. This reflected smaller price increases in the cheaper segments. However, price increases were seen in every segment, suggesting that the fall in price of subvalue packs (see *Price per pack*) was attributable to the declining number of sticks per pack. Prices per stick also increased much faster among FM cigarettes than RYO tobacco, with the exception of the subvalue FM segment.

Price per pack

The prices per pack of FM and RYO products in the premium and mid-price segments were similar (see *Figure 7* and see also *Table S5* in *Report Supplementary Material 2*), whereas the price of the value RYO packs was considerably lower than that of value FM packs. Around the time of the 2011 RYO tobacco tax increase, the price per pack of the RYO premium and mid-priced segments began to follow the respective FM pack prices, rather than being cheaper. The gap between value FM and RYO packs also narrowed at this time, but had widened again by the end of the data series. Overall, the range between the pack prices in the highest (FM premium) and lowest (RYO value) priced segments grew over time (£1.74 in January 2009 to £2.48 in December 2015).

Across the data series as a whole, the range in prices per pack between the most and least expensive products within both FM cigarettes and RYO tobacco increased. This was particularly so since 2012/13 and was largely due to stagnation in the price of the cheapest products. From January 2013 to December 2015, the real prices of the FM subvalue products fell £0.07 and RYO value packs increased by only £0.02, whereas the prices of premium FM and RYO products increased by £1.09 and £1.16, respectively.

Impact of the 2011 Budget on roll-your-own tobacco pricing

After the 2011 Budget, the gap between the FM premium and FM value segments declined from a high of £0.08 per stick in January 2011 to £0.07 in February 2012. At this point, the subvalue segment brands began to be introduced. Moreover, prices per stick of all three RYO segments increased by their highest amount after the 2011 Budget: premium increased £0.72, mid-price increased £0.65 and value increased £0.42 in April 2011, compared with median monthly rises of £0.03, £0.04 and £0.03, respectively, overall, and median monthly post-Budget rises of £0.20, £0.19 and £0.07, respectively, in the rest of the data period.
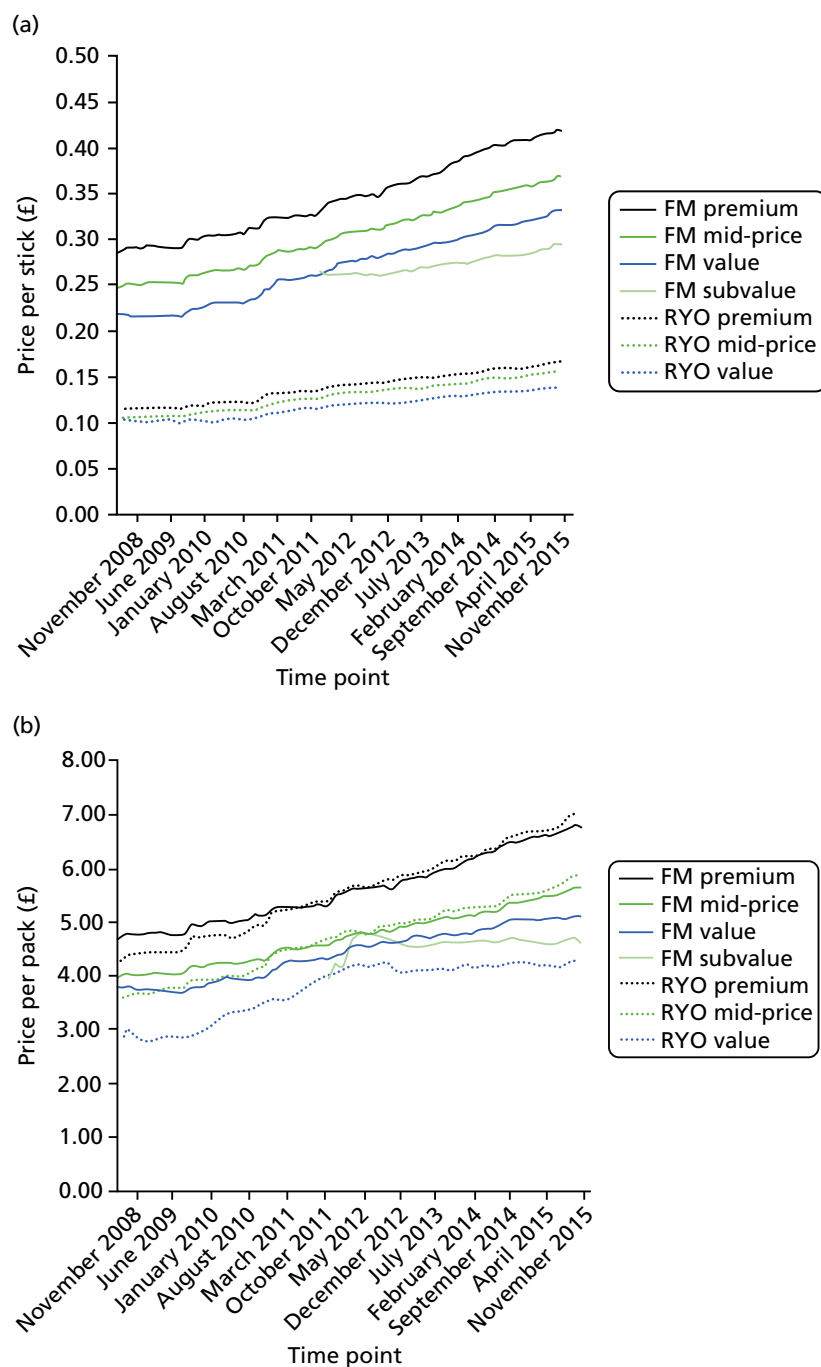
FIGURE 7 Nielsen data study 2: weighted average real prices (base year = 2014). (a) Per stick; and (b) per pack for FM cigarettes and RYO tobacco in different price segments, over time. Data are for all pack sizes combined (cartons excluded). Note, the price of FM subvalue packs appears unstable initially as different pack sizes were introduced.

Factory-made cigarette pack size

The variety of FM pack sizes increased over the study period, with the introduction of increasingly smaller pack sizes (17- to 19-stick packs) to an increasing number of brands (*Table 8* and see also *Figure S4* in *Report Supplementary Material 3*). Market share of traditional FM 20-stick packs declined in all segments, but most markedly in the value and subvalue segments, in which, by 2015, only 1% and 0% of volume, respectively, were 20-stick packs. By 2015, the pack size with the largest share was 18 sticks for the subvalue segment (46% FM share), 19 sticks for the value segment (45%) and 10 sticks for the mid-price segment (45%).

TABLE 8 Nielsen data study 2: annual volumes of pack sales (millions) and market share for FM cigarettes and RYO tobacco, by price segment and pack size

Price segment and pack size	Pack sales (millions)							Market share (%)[a]						
	2009	2010	2011	2012	2013	2014	2015	2009	2010	2011	2012	2013	2014	2015
FM cigarettes														
Premium														
10 sticks	215	187	171	154	140	130	108	36	35	37	38	38	39	39
20 sticks	386	341	291	254	225	201	171	64	65	63	62	62	61	61
Mid-price														
10 sticks	504	468	428	376	338	290	227	41	42	43	45	46	46	45
19 sticks						112	166	0	0	0	0	0	18	33
20 sticks	728	658	565	467	404	227	112	59	58	57	55	54	36	22
Value														
10 sticks	79	122	185	220	236	253	231	27	28	32	34	35	35	33
17 sticks							18	0	0	0	0	0	0	3
18 sticks	1					5	135	0	0	0	0	0	1	19
19 sticks	12	43	60	75	107	324	316	4	10	10	11	16	45	45
20 sticks	197	264	336	357	329	140	8	68	61	58	55	49	19	1
Subvalue														
10 sticks				3	17	39	67				20	24	23	25
18 sticks						14	122				0	0	8	46
19 sticks					18	106	77				0	26	64	29
20 sticks				13	35	7	< 1				80	49	4	0
RYO tobacco														
Premium														
10 g						< 1	1	0	0	0	0	0	1	1
12.5 g	79	73	67	58	51	44	37	62	60	60	60	59	57	54
25 g	39	37	33	29	26	24	23	30	31	30	30	30	32	34
50 g	10	11	10	9	9	8	7	8	9	9	10	10	11	11
Mid-price														
10 g	1	2	2	4	6	13	25	1	2	2	2	4	8	17
12.5 g	70	86	102	107	110	98	76	72	69	68	66	64	60	51
25 g	20	28	36	39	42	40	37	21	23	24	24	25	25	25
50 g	6	8	11	13	13	12	12	6	7	7	8	8	7	8
Value														
10 g					5	13	9	0	0	0	0	9	24	21
12.5 g	< 1	8	20	28	32	28	17	82	77	75	71	61	50	42
25 g	< 1	2	6	10	13	12	11	2	21	22	24	24	22	28
50 g	< 1	< 1	1	2	3	3	4	16	3	3	5	5	5	9

a Market share is calculated within each tobacco type (FM or RYO), not total tobacco market share.

Roll-your-own tobacco pack size

The most notable change in the RYO tobacco segment was the gradual advent of smaller, 10-g packs (see *Table 8* and see also *Figure S5* in *Report Supplementary Material 3*), particularly in the mid-price and value segments. For example, RYO mid-price 10-g packs increased from a 1% to a 17% RYO tobacco market share between 2009 and 2015. Throughout the study period, 12.5-g packs held the largest market share in all RYO tobacco segments, but over time this fell (e.g. RYO premium 12.5-g tobacco packs declined from 62% market share in 2009 to 54% in 2015). Generally, the market share of the largest pack size (50 g) grew slightly over the study period. For example, RYO premium 50-g tobacco packs increased from 8% RYO tobacco market share in 2009 to 11% in 2015.

Prices by pack size (*Table 9*) demonstrate higher increases in the higher price segments and that the growth in smaller packs enabled price-conscious smokers to choose to spend a smaller amount on tobacco rather than quit.

Price marking

Cheaper segments were more likely to be price marked than expensive segments (*Figure 8* and see also *Table S6* in *Report Supplementary Material 2*). For example, between 60% and 100% of subvalue FM products were price marked compared with a negligible proportion of premium FM products. Patterns for RYO products were similar, although a higher proportion of premium RYO products were price marked than premium FM products (36% in 2012 and about 25% thereafter). Half of RYO value products were price marked.

For RYO tobacco, but not FM cigarettes, smaller packs were also more likely to be price marked than larger packs (see *Figure 8* and see also *Table S7* in *Report Supplementary Material 2*). For most segments and pack sizes, price marking appeared to increase gradually over time. However, there were notable exceptions to this pattern. When the new subvalue FM brands were introduced in early 2012, 100% were price marked but this then fell rapidly to between 60% and 70%. There was substantial price marking of 10-g RYO packs prior to growth in the mid-price segment (2011) and when 10-g packs were introduced into the value segment (2013). In addition, price marking on premium brands in both FM and RYO segments fell.

Differences between the prices of price-marked and standard packs varied over time and between segments; however, price-marked packs were typically cheaper (see *Table S8* in *Report Supplementary Material 2*). Overall, the increasing availability of price-marked products enabled the TI to sell products at lower prices, albeit compromising convenience store profit margins.

Tobacco industry pricing conclusions

Tobacco sales and ITC data indicated that, although overall tobacco prices increased, the cheapest products did not increase in price in real terms. The data sets also revealed types of tobacco products with cheaper pricing: RYO tobacco (all data sets); cartons (ITC data); and mid-price, value and subvalue FM cigarettes, mid-price and value RYO tobacco, price-marked packs and small packs (Nielsen data). The availability of cheap tobacco products that did not increase in price in real terms helps explain why smokers could still purchase their tobacco at prices similar to those at the beginning of our study period in 2002 and also the role of RYO tobacco in keeping the cost of smoking low. In the following section, we explore how the TI uses its pricing strategies to respond to tobacco taxation changes.

Nielsen data study 3: what proportion of price increases by segment are explained by tobacco industry price increases compared with tax increases?

Methods

Calculation of net revenue

Net revenue per pack (the money the industry retains after tax) was calculated by deducting the sum of the tobacco taxes (specific plus, for FM only, ad valorem) and VAT applicable to each pack from the nominal pack price and then adjusting for inflation using the CPI (base year = 2014). We note that 'net'

TABLE 9 Nielsen data study 2: weighted average real prices (base year = 2014) per pack over time for FM cigarettes and RYO tobacco, by price segment and pack size

Price segment and pack size	Time point, price per pack (£)								Mean yearly per cent change[a]
	January 2009	January 2010	January 2011	January 2010	January 2013	January 2014	January 2015	December 2015	
FM cigarettes									
Premium									
10 sticks	3.02	3.12	3.25	3.41	3.63	3.86	4.23	4.39	5.80
17–20 sticks	5.75	5.95	6.18	6.47	6.89	7.33	7.93	8.18	5.52
Mid-price									
10 sticks	2.61	2.69	2.81	3.03	3.25	3.43	3.69	3.85	5.96
17–20 sticks	4.97	5.14	5.37	5.76	6.16	6.49	6.69	6.91	5.09
Value									
10 sticks	2.28	2.25	2.39	2.68	2.93	3.08	3.31	3.44	6.49
17–20 sticks	4.32	4.40	4.62	5.13	5.52	5.77	5.89	5.87	5.35
Subvalue									
10 sticks					2.71	2.80	2.87	2.89	2.91
17–20 sticks					5.24	5.23	5.26	5.33	0.19
RYO tobacco									
Premium									
10 g							3.21	3.33	
12.5 g	2.95	3.06	3.17	3.47	3.68	3.87	4.15	4.31	5.87
25 g	5.80	5.96	6.15	6.73	7.13	7.49	7.91	8.16	5.33
50 g	11.29	11.22	12.02	13.13	14.00	14.69	15.52	16.00	5.49
Mid-price									
10 g	2.23	2.37	2.30	2.60	2.71	2.91	3.08	3.26	5.64
12.5 g	2.70	2.79	2.89	3.24	3.44	3.61	3.84	3.98	6.09
25 g	5.25	5.40	5.60	6.25	6.66	6.99	7.38	7.60	5.88
50 g	10.21	10.54	10.97	12.21	13.04	13.71	14.51	14.96	6.06
Value									
10 g						2.57	2.70	2.77	5.06
12.5 g	2.69	2.56	2.70	2.99	3.14	3.24	3.46	3.54	4.39
25 g			5.21	5.79	6.05	6.24	6.58	6.69	6.05
50 g		7.49	9.43	10.55	11.63	12.18	12.83	13.02	11.62

a   For comparability across product types, price segments and pack sizes, mean yearly per cent changes were obtained by first calculating each year-on-year per cent change for the time-period when the product was available, and then dividing by the total number of changes (note, the January 2015 to December 2015 change was excluded because it did not encompass an entire year).

revenue in this study refers only to the revenue after taxes are paid, but other costs (e.g. production, distribution and marketing costs) have not been deducted.

The three taxes (value-added, specific and ad valorem) were calculated as follows. An example value-added tax calculation for each month is provided for months during which the value-added tax was 20%:

$$\text{Pack price} - (\text{pack price}/1.2). \tag{4}$$

(a)

(b)
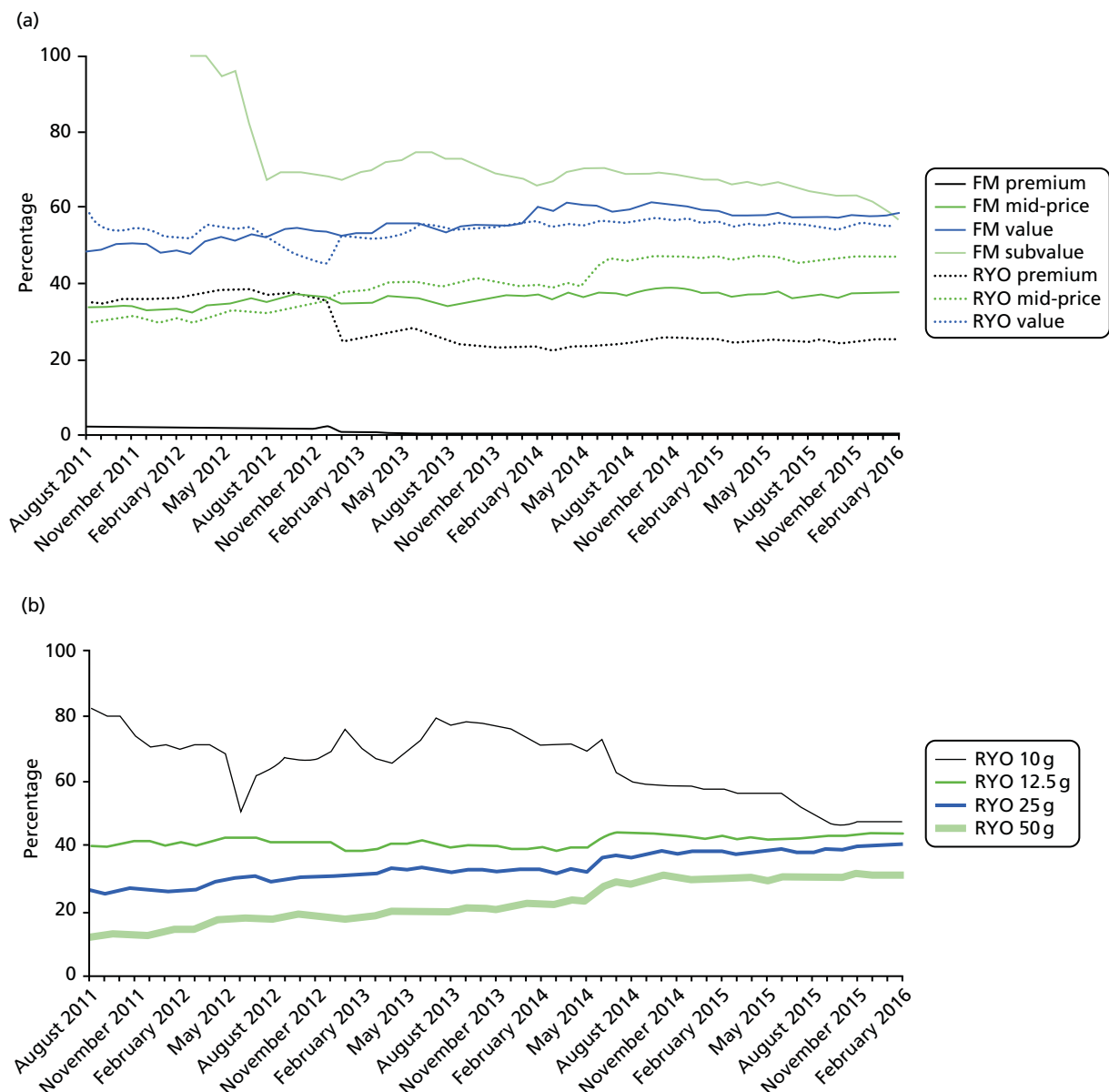
FIGURE 8 Nielsen data study 2: percentage of packs price marked by (a) segment for FM cigarettes and RYO tobacco; and (b) pack size for RYO tobacco. Nielsen data on price marking was only available from August 2011.

For the months during which the value-added tax was 17.5% or 15%, the pack price was divided by 1.175 or 1.15, respectively. Specific taxes were calculated as the applicable rate per FM stick or gram of RYO tobacco (reported rates divided by 1000; see *Table 1*) each month, multiplied by the pack size (FM sticks or RYO tobacco grams). The HMRC calculate one ad valorem rate for each FM brand,[111] which is calculated using the RRP of 20-stick packs and then applied proportionately to different pack sizes.[93] Price-marked packs do not attract a separate tax rate.[99] This raised some issues when using the Nielsen data, particularly from 2014 onwards. First, some 20-stick packs were being sold very cheaply (cheaper than 19-stick packs), implying that the sales price was well below the RRP. Second, 43 (12%) FM brands in the data set never had a recorded 20-stick variant and others lost their 20-stick variant (it was possible that a 20-stick variant might have existed but had been excluded due to insufficient market share). For our ad valorem calculation, we therefore restricted the analysis to the most common pack sizes (10 sticks and 17–20 sticks) and, hence, 20 sticks should have been the most expensive if they were sold at the RRP. We then identified which was the most expensive brand variant each month for each brand and pack size, and if this was the 20-stick pack then we used this price to calculate ad valorem. If not the 20-stick pack, but there was a 20-stick variant available within the

data, we imputed the pack price of an imaginary 20-stick variant using the price of the highest priced available variant and used this imputed price to calculate the ad valorem tax. Each brand's ad valorem tax was then calculated by the pack price multiplied by the applicable monthly ad valorem rate. For packs with < 20 sticks, ad valorem tax was calculated pro rata to the 20-stick equivalent.

Tax pass through by segment

Net revenue (in pence) for all pack sizes was plotted graphically by year and segment to examine patterns over time. Similar patterns were observed across the different pack sizes; hence, only changes in revenue for popular pack sizes (20 sticks for FM premium and mid-price FM cigarettes, 19 sticks for FM value and subvalue FM cigarettes, and 12.5 g for RYO tobacco) are discussed.

To assess the extent to which taxes were passed to consumers following each Budget and how this varied in relation to segment and size of tax increase, we estimated the change in net revenue. The net revenue per pack for the month immediately prior to the tax increase was subtracted from the net revenue for the subsequent months (up to the next Budget).

Calculating source of price rises

We calculated [by product type (RYO or FM) and price segment] the proportion of the pack price change attributable to tax increases compared with industry pricing for two 3-year time periods: 2010–12 and 2013–15. The former time period included unexpected large tax increases and a change in tax structure towards specific taxes, whereas in the latter time period there were regular but smaller tax increases that were set years in advance.

January 2013–December 2015

We calculated percentages of the total price change that were due to government tax rises and industry revenue for the popular pack types used in the analysis of tax undershifting and overshifting. We determined the increase in WAPs across the time period by subtracting the real weighted price in January 2013 from the price in December 2015. The difference between the change in price and the change in tax liability was the change in industry net revenue. We were then able to calculate the percentage of the total price increase that was from government tax and industry revenue.

For example, in January 2013 the overall WAP for a FM premium 20-stick pack was £6.89 and by December 2015 the price had increased to £8.18; thus, the price increased by £1.29. The associated tax liability increased by £0.71 during this period (from £5.96 in January 2013 to £5.24 in December 2015; small difference due to rounding), meaning that net revenue per pack increased by £0.58 (from £1.65 in January 2013 to £2.22 in December 2015; small difference due to rounding). Thus, 55% of the pack price increase was due to increases in tax and 45% was due to increases in industry revenue.

To calculate WAP for FM cigarettes we multiplied total price increases for each FM pack type by their percentage market share. We then summed these to create a total price change for FM. We repeated the procedure for the associates tax liabilities. The same approach was adopted for RYO tobacco pack types to create statistics for RYO tobacco.

January 2010–December 2012

Popular pack sizes were the same as for the latter period, with the exception that the subvalue segment was not established during this period so was not included, and substantial numbers of value packs contained 20 sticks so proportions were additionally calculated from 20-stick value packs. All other calculations were the same as for the latter time period.

Calculations for both periods were verified by following price and tax changes for one popular Marlboro SKU.

Results

Net real revenues were considerably greater for higher than for lower priced segments, although the gap was more marked for FM than RYO segments (*Figure 9*; see also *Table S9* in *Report Supplementary Material 2*). A cyclical pattern of a drop in revenue immediately post Budget, followed by an increase thereafter, emerged with the 2011 Budget and from this point there was progressively more differentiation in revenue between segments. Within the premium segment, revenue was greater on FM than RYO products, whereas in the value segment this pattern reversed and net revenues in the cheapest FM segment changed little throughout the whole period.

Declines in net revenue at times of tax (VAT or tobacco tax) increases can be seen more clearly using changes in net revenue post Budget (*Figure 10* and see also *Table S10* in *Report Supplementary Material 2*). Every year and in every segment, in the month after the Budget, net revenues fell. Thus, tobacco tax changes were not passed straight on to consumers, but were initially absorbed by tobacco companies (indicating slightly lower profits per pack). In general, the extent and duration of the undershifting was greatest in the lowest segments, whereas in higher priced segments the undershifting was less marked and often short-lived with profits recovering to and then exceeding pre-Budget levels (indicating overshifting) within 1–3 months each year. For example, in 2014, revenue on premium FM products recovered to pre-Budget levels by May and by the end of the Budget year was up by £0.23. By contrast, revenues on subvalue FM products fell in 2014 until August and, although they increased thereafter, never recovered to pre-Budget levels (see *Figure 10*).

Patterns varied somewhat by year, reflecting the different tax changes. Unlike for other tax years, in January 2010 and January 2011 there were VAT increases. The declines in revenue at both these points indicate these VAT increases were absorbed by tobacco companies. The years 2011 and 2012 saw the most marked tax changes (see *Table 1*). In line with this, after the 2011 tax system changes, a more marked pattern of initial undershifting and greater differentiation in revenue change by segment emerged, consistent with the widening revenue gap between segments.

Tax or industry revenue as reason for price increases

The proportion of total price increases attributable to government taxes compared with TI revenue is presented in *Table 10*. In 2010–12, price, tax and revenue increases did not differ substantially by price segment (although tax and price increases were greater for FM cigarettes than RYO tobacco). For both FM cigarettes and RYO tobacco, increases in industry revenue accounted for about one-fifth of the total price increase, with little variation (20–26%), and government revenues for the remainder (up to 80%).

In 2013–15, however, the patterns were quite different in a number of ways. First, government tax, industry revenue and total price increases varied more substantially by price segment, with greater increases seen in higher price segments for both FM cigarettes and RYO tobacco. The impact of the differential tax increases on price was exacerbated by industry pricing, with industry adding £0.58 to the price of FM premium brand cigarettes but cutting subvalue brands by £0.04; and in RYO tobacco, adding £0.36 to RYO premium tobacco, but only £0.16 to RYO value tobacco. Consequently, a twofold difference in tax (£0.41 for FM subvalue cigarettes to £0.71 for FM premium cigarettes) increase translates to a threefold difference in price increase (£0.37 to £1.29, respectively) between FM cigarette segments. The percentage increase in total price attributable to increases in industry revenue was higher in this period than in the previous period. On average, about one-third of the price increase for FM cigarettes was industry revenue (compared with 23% in the previous period) and about half of the increase for RYO tobacco was industry revenue (compared with less than one-third in the previous period).

This analysis indicates that a significant proportion of the price increase was from industry revenue generation, rather than tax increases. The TI was overshifting taxes for all segments (apart from the FM subvalue segment from 2013 to 2015), indicating that it was not sufficiently concerned about the alleged threat of illicit tobacco to limit the price increases. This implies that they themselves do not believe in their own argument that higher taxes encourage illicit tobacco purchasing. This is further supported by a higher
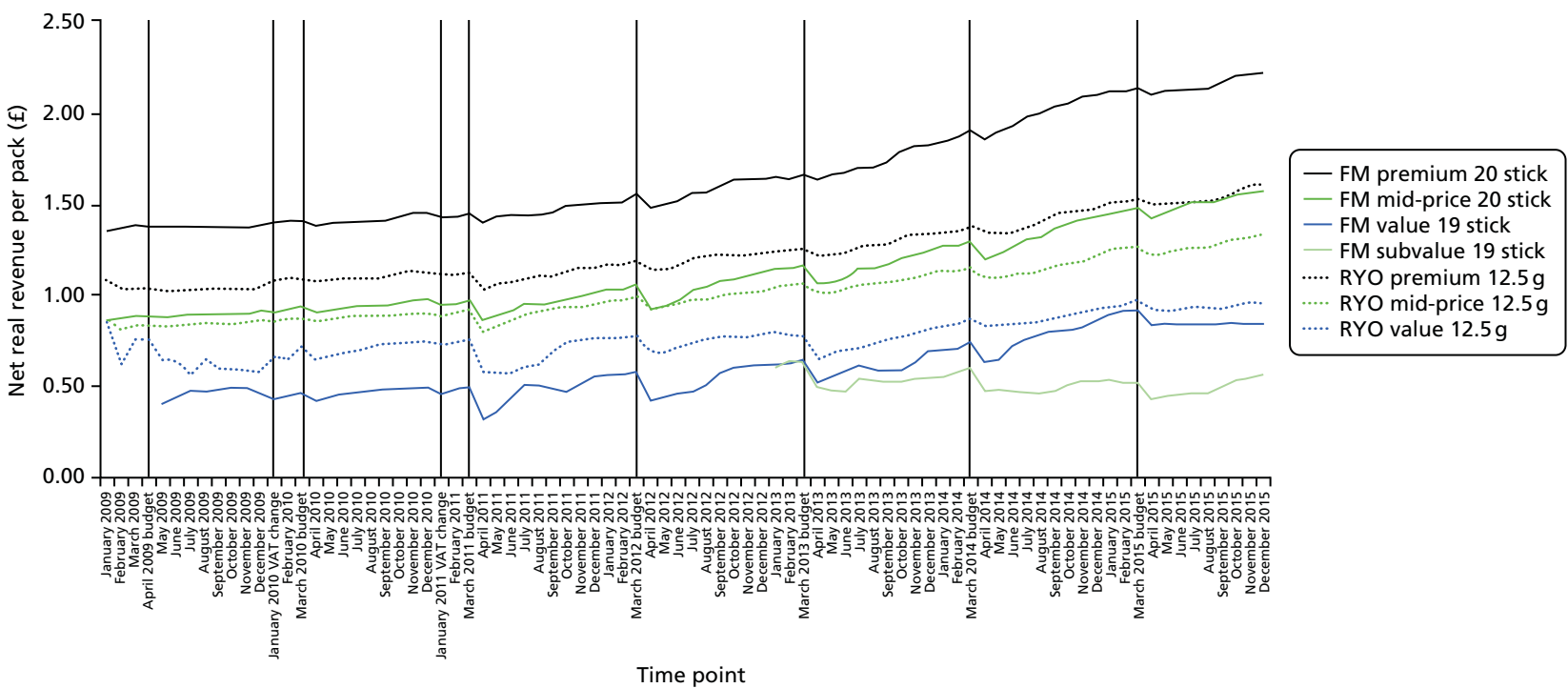
FIGURE 9 Nielsen data study 3: net real (base year = 2014) TI revenue per pack (most popular pack sizes) for FM cigarettes and RYO tobacco, by price segment. Vertical reference lines indicate tax changes. Net revenue refers to revenue after tax only (other costs, e.g. distribution, production, etc., have not been deducted).

(a)

(b)

FIGURE 10 Nielsen data study 3: change in net real (base year = 2014) revenue per pack (£) post Budget [difference in revenue per pack in each post-Budget month compared with Budget month (last month of previous tax year)] for popular pack sizes of FM cigarettes and RYO tobacco, by price segment: (a) 2009 tax year; (b) 2010 tax year; (c) 2011 tax year; (d) 2012 tax year; (e) 2013 tax year; (f) 2014 tax year; and (g) 2015 tax year. Budgets were held in April 2019 and March in subsequent years. A negative change indicates undershifting and a positive change indicates overshifting: when values cross the £0.00 reference line in any tax year, it indicates that revenue has reached the same level (in real terms) as in the last month of the previous tax year, just prior to when the Budget was enacted. Note that, in 2009, FM value packs are 20 sticks, not 19 sticks, as 19 stick packs were not available at this time. Note that the FM subvalue segment was introduced in 2012, so this is shown from 2013. Net revenue refers to revenue after tax only (other costs, e.g. distribution, production, etc., have not been deducted). (*continued*)

FIGURE 10 Nielsen data study 3: change in net real (base year = 2014) revenue per pack (£) post Budget [difference in revenue per pack in each post-Budget month compared with Budget month (last month of previous tax year)] for popular pack sizes of FM cigarettes and RYO tobacco, by price segment: (a) 2009 tax year; (b) 2010 tax year; (c) 2011 tax year; (d) 2012 tax year; (e) 2013 tax year; (f) 2014 tax year; and (g) 2015 tax year. Budgets were held in April 2019 and March in subsequent years. A negative change indicates undershifting and a positive change indicates overshifting: when values cross the £0.00 reference line in any tax year, it indicates that revenue has reached the same level (in real terms) as in the last month of the previous tax year, just prior to when the Budget was enacted. Note that, in 2009, FM value packs are 20 sticks, not 19 sticks, as 19 stick packs were not available at this time. Note that the FM subvalue segment was introduced in 2012, so this is shown from 2013. Net revenue refers to revenue after tax only (other costs, e.g. distribution, production, etc., have not been deducted). (*continued*)

FIGURE 10 Nielsen data study 3: change in net real (base year = 2014) revenue per pack (£) post Budget [difference in revenue per pack in each post-Budget month compared with Budget month (last month of previous tax year)] for popular pack sizes of FM cigarettes and RYO tobacco, by price segment: (a) 2009 tax year; (b) 2010 tax year; (c) 2011 tax year; (d) 2012 tax year; (e) 2013 tax year; (f) 2014 tax year; and (g) 2015 tax year. Budgets were held in April 2019 and March in subsequent years. A negative change indicates undershifting and a positive change indicates overshifting: when values cross the £0.00 reference line in any tax year, it indicates that revenue has reached the same level (in real terms) as in the last month of the previous tax year, just prior to when the Budget was enacted. Note that, in 2009, FM value packs are 20 sticks, not 19 sticks, as 19 stick packs were not available at this time. Note that the FM subvalue segment was introduced in 2012, so this is shown from 2013. Net revenue refers to revenue after tax only (other costs, e.g. distribution, production, etc., have not been deducted). (*continued*)

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TABLE 10 Nielsen data study 3: percentage weighted real (base year = 2014) price changes in pack industry net revenue and tax, for popular pack sizes, by price segment

Pack sizes and price segments	Increase (£)			% of price change that is	
	Total price	Government tax	TI revenue	Government tax	TI revenue
January 2010–December 2012					
FM premium cigarettes (20 sticks)	0.91	0.67	0.24	74	26
FM mid-price cigarettes (20 sticks)	0.96	0.74	0.22	77	23
FM value cigarettes (20 sticks)	1.12	0.87	0.25	78	22
FM value cigarettes (19 sticks)	0.95	0.87	0.19	80	20
Total FM cigarettes[a]				77	23
RYO premium tobacco (12.5 g)	0.58	0.43	0.14	75	25
RYO mid-price tobacco (12.5 g)	0.60	0.43	0.17	72	81
RYO value tobacco (12.5 g)	0.55	0.42	0.13	76	24
Total RYO tobacco[a]				73	71

TABLE 10 Nielsen data study 3: percentage weighted real (base year = 2014) price changes in pack industry net revenue and tax, for popular pack sizes, by price segment (*continued*)

Pack sizes and price segments	Increase (£)			% of price change that is	
	Total price	Government tax	TI revenue	Government tax	TI revenue
January 2013–December 2015					
FM premium cigarettes (20 sticks)	1.29	0.71	0.58	55	45
FM mid-price cigarettes (20 sticks)	1.08	0.66	0.42	61	39
FM value cigarettes (19 sticks)	0.83	0.60	0.23	73	27
FM subvalue cigarettes (19 sticks)	0.37	0.41	−0.04	112	−12
Total FM cigarettes[a]				64	36
RYO premium tobacco (12.5 g)	0.64	0.28	0.36	44	56
RYO mid-price tobacco (12.5 g)	0.55	0.26	0.28	48	52
RYO value tobacco (12.5 g)	0.39	0.24	0.16	61	39
Total RYO tobacco[a]				48	52

a Totals are weighted for volumes. Net revenue refers to revenue after tax only (other costs, e.g. distribution, production, etc., have not been deducted).

proportion of the total price increase being attributable to industry revenue increases for RYO tobacco (rather than FM cigarettes), despite illicit sales of RYO tobacco being substantially higher.

There was less overshifting in a period with sudden large tax increases (January 2010–December 2012) than with a period of planned steady, smaller tax increases (January 2013–December 2015). This implies that sudden large tax increases compromise the TI's ability to manipulate prices.

Summary

Both the ITC and Nielsen data indicate that although real prices per stick of tobacco have increased, real prices of the cheapest FM and RYO products remained static since 2012. Nielsen data indicated that real pack prices (and hence the price the consumer pays) have also remained static, largely due to the decline in pack sizes. Ten-gram packs accounted for a greater proportion of the cheapest RYO tobacco segments and were more likely to be price marked; hence, the combination of small packs and price marking appeared to be reinforcing. The price range between FM cigarettes and RYO tobacco was more complex: the range in pack price appears to have narrowed between 2009 and 2012, particularly in the lowest segment (i.e. between FM value cigarettes and RYO value tobacco), signalling some success in using the 2011 tax changes to close the price range. However, in terms of price per stick, the price range increased across the data set as a whole. Within RYO tobacco and FM cigarettes, the range between cheapest and most expensive products has increased, reflecting the differential shifting of taxes between segments. Hence, the opportunities for down-trading have continued to increase and volumes of the cheapest segments have grown in both FM cigarettes and RYO tobacco.

Tobacco industry pricing appears to be designed to deliberately undermine the public health impact of tax increases. Each year, immediately post Budget, the TI cuts its profits by absorbing the tax increases and thus preventing any sudden increase in price the consumer would face, instead smoothing that increase throughout the year. The degree and duration of undershifting is, in general, most marked in the cheapest price segments and in recent years more marked in FM cigarettes than RYO tobacco. The industry then drives up profits later in the year, with the extent of overshifting most marked in the more expensive price segments. This approach to pricing means that tobacco prices in the lowest segments are kept artificially low and leads to the growing range in price between the most expensive and cheapest products.

In subsequent chapters we examine the impact of these strategies on quitting and whether or not they affect sociodemographic groups differently.

Chapter 5 Changes in the affordability of tobacco products over time

Introduction

Tobacco taxes are intended to reduce the affordability of tobacco over time. In this chapter, we consider whether or not there were any other developments in addition to taxes that might have influenced affordability in the time period we studied. We also studied whether or not there were changes in the affordability of tobacco products over time.

Background: affordability in the commercial literature

The 'Great Recession' was alluded to in the commercial literature, the effect of which was seen as producing down-trading via reduced incomes and welfare freezes, affecting the disposable income of (particularly low-income) smokers. In 2009, and still in 2012, the recession was seen as a driver pushing smokers to switch to RYO tobacco, at least partially:

> *'Dualling' is [. . .] a trend identified by Imperial Tobacco towards smoking both roll-ups and factory made cigarettes [. . .] partial down-trading [. . .] More and more UK smokers, and particularly, younger women, are turning to roll-ups. Part of the reason is the recession.*
>
> *Euromonitor International Ltd[219]*

> *The RYO market continues to expand as people feel the pinch from government cuts and wage freezes.[220]*

In 2010, Watkins from Imperial Tobacco did not think that 'convincing smokers to trade back up will be an issue' after the recession,[169] but down-trading was still apparent in 2014 despite the end of the recession:

> *. . . while there appear to be the early signs of a wider economic recovery, many smokers are still feeling the pinch and so growth remains the preserve of the value for money subsector of cigarettes, RYO and even value for money RYO.*
>
> *Hegarty[221]*

Thus, in 2014, there were still stated to be affordability problems. Wholesaler Paul Ford was quoted in *Wholesale News*, stating 'consumers cannot afford to smoke, drink, drive a car'.[211]

Hence, the commercial literature suggested that tobacco products were becoming less affordable partly due to reduced incomes via the government response to the recession.

ITC data study 2: changes in tobacco affordability over time among smokers

Methods

Notable methodological differences between our measure and existing measures of tobacco affordability

As noted in *Chapter 1*, existing aggregate measures of affordability use average national estimates of income and average cigarette prices to make cross-country comparisons of tobacco affordability over time. For this project, we wanted to capture what individual smokers were actually spending on tobacco, taking into consideration the specific products (FM cigarettes vs. RYO tobacco), price segments and purchase

sources they were using to potentially minimise costs: something that cannot be captured using average estimates of cigarette prices based only on a few popular brands. The ITC data allowed us to do this and also to use participants' actual reported incomes to calculate affordability, the advantage of this being a more sensitive measure to explore the associations between affordability and individual differences. Capturing individual incomes is particularly important for smokers, as smokers are over-represented among low-SES groups whose incomes would be overestimated by national averages. At the time of conducting this research,[222] we were aware of only one other study[223] to have used individual reported tobacco prices to calculate tobacco affordability and no other studies using individual incomes (but see the recent work of Nargis and colleagues[224]). Thus, ours, to the best of our knowledge, was the first study to adopt a completely individualised measure of tobacco affordability and the only one to consider the impact of RYO tobacco on affordability.

There is another important point of difference between our new measure and traditional measure of affordability. Traditional measures, regardless of whether they use aggregate or individual-level data on incomes and tobacco prices, are based on a simple ratio of price to income. However, our measure uses the ratio of expenditure to income (expenditure being consumption × price) (see also *Chapter 2*). This adds a level of complexity to our measure because it incorporates three moving parts (consumption × price/income) rather than two (price/income), one of which (consumption) is endogenous to the individual. In our view, incorporating consumption in this way provides valuable extra information. Our aim was to evaluate whether or not tobacco taxes have led to smokers paying more for their tobacco, in a way that takes into account that they might respond by changing purchasing behaviour to mitigate increased pack prices. Owing to its addictiveness, the relationship between tobacco price and demand is less elastic than some other products, so we think it is helpful to incorporate elasticity and examine smokers' response to price increases via changes in expenditure, rather than just the price change itself. The ability of smokers to minimise costs by reducing consumption (and by our new metric potentially keeping smoking equally or even more affordable, despite an increase in absolute prices relative to incomes) is an important public health concern. This is because, for RYO tobacco, purchasing less tobacco does not necessarily translate to fewer cigarettes (see *Chapter 7*) and, even when it does, the health benefits of reducing the number of cigarettes smoked without quitting altogether are debatable.[225] We also felt that it was important to monitor and illustrate to policy-makers that beyond the negative health consequences there are financial consequences of smoking. Rather than reducing demand, price increases prompt some smokers to spend more of their income on tobacco and we hoped that seeing this in a straightforward metric would be useful for policy-makers. Thus, although we feel that our novel individual-level affordability measure is an alternative way of conceptualising 'affordability', given its departure from traditional measures of affordability via the inclusion of consumption, it might also be helpful to think of our new measure as 'tobacco budget share'.

Data and exclusions

The first 10 waves of the ITC UK surveys (2002–14) were analysed. We excluded non-daily smokers ($n = 394$) and 'mixed' smokers of both FM cigarettes and RYO tobacco throughout ($n = 636$), and exclusive RYO smokers from waves 1–4 ($n = 420$) because relevant questions needed to calculate affordability were not included. Invalid responses on tobacco price were excluded as previously defined ($n = 186$) (see *Chapter 2*), as well as the top and bottom one percentile of responses on the affordability variable (see *Chapter 2*) to minimise outliers ($n = 480$, of which 94% were improbable responses such as spending none or > 100% of income on tobacco), and anyone with missing data on the included covariates ($n = 58$). The resulting sample included 4062 current daily smokers, providing 8943 observations over the 10 surveys (average of 2.2 observations per individual).

Analyses

We calculated changes over time for both the individualised and aggregate (FM cigarettes only) versions of our 'Budget-share' affordability measures (using the equations described in *Chapter 2*; see *Equations 2* and *3*). We also calculated the changes over time of the constituents of affordability (tobacco price and income) to examine their relative contributions.

We used random-effects linear regression analyses with maximum likelihood estimation, clustered over individuals (to control for correlations between multiple observations provided by the same individual in different surveys), in order to examine changes in individualised affordability over time and the associations with individual differences. We analysed the affordability of FM cigarettes (2002–14) separately to RYO tobacco (2006–14). Our individualised measure of affordability was the dependent variable. Independent variables were tobacco tax year (using the 2002 tobacco tax year as reference and testing for linear trends, and also conducting reverse adjacent contrasts to examine whether or not each successive survey period resulted in a change in affordability that was statistically significant from the last), sex, age and age squared (to test for non-linear associations with age), ethnicity, region, education, TTFC and purchase source (UK store-based or non-UK/non-store-based sources). We used a random-effect regression model (rather than fixed effect) because of the emphasis on population-level effects rather than cluster-level effects of random-effects modelling, the ability to utilise small clusters (including clusters of one) as present here and the ability to model-time-invariant variables (e.g. sex, ethnicity) on the outcome. In our data set, tax changes overlapped with the time variable and, hence, tax changes were a confound that we could not include in our regression model.

We computed three regression models. In model 1, affordability was regressed separately on each independent variable, unadjusted for other covariates, in order to identify any simple associations between each independent variable and affordability. In model 2, all independent variables were included concurrently, in order to identify which independent variable was a significant predictor of affordability after controlling for all other variables. In model 3, we repeated model 2 but excluded participants purchasing from non-UK/non-store sources. This allowed us to observe changes in affordability only for purchases when full duties were likely to have been paid (see *Chapter 8*). Our SES indicator was level of education, as we could not include income because it was used to derive the affordability measure itself; tobacco consumption (CPD) was excluded for the same reason. A sensitivity analysis was also conducted to examine how smokers changed their tobacco consumption over the survey period and the degree to which any observed changes in affordability were due to changes in tobacco consumption. This analysis regressed CPD onto all the independent variables included in model 2. Demographic and smoking-related affordability differences between FM cigarette and RYO tobacco smokers are discussed in *Chapter 9*.

As our method of equivalising income (see *Chapter 2* and *Report Supplementary Material 1*) differed slightly from published methodologies, we also ran sensitivity analyses using income not equivalised for household composition. The results did not differ substantially from the results or conclusions presented (data not shown).

Results
The characteristics of the included sample are given in *Table 11*. There were slightly more females (58%) than males, the mean age was 49 years (SD 14.2 years) and the majority were white with low to moderate levels of education. Most smoked their first cigarette within 30 minutes of waking and average cigarette consumption was 16.8 CPD (SD 8.2 CPD).

There was an average annual decrease of 1.6% in incomes for our sample of smokers over the study period (*Figure 11*). This deviated considerably from national annual per capita GDP, which increased from £26,206 to £30,299 between 2002 and 2007, when mean income in our sample decreased from £32,202 to £29,423. From 2007, incomes in our sample continued to decrease at a more marked rate than GDP, to a low in 2012 of £24,976 (GDP declined to £27,196). From 2012, both income in our sample and annual per capita GDP modestly increased (see *Figure S6* in *Report Supplementary Material 3*).

There was an average annual increase of 2.6% in the price of FM cigarettes (see *Figure 11*), which, combined with the decrease in income, contributed to an average annual decrease in the affordability of FM cigarettes of 0.24%, from 91.5% [± 95% confidence interval (CI) 91.0% to 91.9%] in 2002 to 87.8% (± 95% CI 87.0% to 88.5%) in 2014 (see *Figure 11*, model 1 unadjusted). Similarly, the average annual increase of 4.5% in the price of RYO tobacco (see *Figure 11*) and the decrease in income contributed to an

TABLE 11 International Tobacco Control Policy Evaluation Project study 2: sample characteristics for the combined sample and separately by tobacco format (FM cigarettes or RYO tobacco)

		Smokers	
Sample characteristics	Combined sample	FM	RYO
Total observations, *n* (%)	8943 (100.0)	7475 (100.0)	1468 (100.00)
Individualised affordability, mean (SD)	91.4 (9.7)	90.6 (10.1)	95.5 (5.9)
Annual income (£), mean (SD)	29,347 (21,832)	30,277 (22,464)	24,608 (17,534)
Price per cigarette (£), mean (SD)	0.265 (0.080)	0.273 (0.075)	0.227 (0.092)
CPD, mean (SD)	16.8 (8.2)	16.7 (8.1)	17.0 (9.1)
Sex, *n* (%)			
Female	5196 (58.1)	4647 (62.2)	549 (37.4)
Male	3747 (41.9)	2828 (37.8)	919 (62.6)
Age (years), mean (SD)	49 (14.2)	48 (14.4)	50 (12.9)
Region, *n* (%)			
London	1094 (12.2)	964 (12.9)	130 (8.9)
Yorkshire and The Humber	729 (8.2)	645 (8.6)	84 (5.7)
East Midlands	634 (7.1)	513 (6.9)	121 (8.2)
Eastern	753 (8.4)	601 (8.0)	152 (10.4)
North East	393 (4.4)	340 (4.6)	53 (3.6)
South East	1139 (12.7)	930 (12.4)	209 (14.2)
South West	657 (7.6)	478 (6.4)	197 (13.4)
West Midlands	797 (8.9)	679 (9.1)	118 (8.0)
North West	951 (10.6)	819 (11.0)	132 (9.0)
Wales	479 (5.4)	368 (4.9)	111 (7.6)
Scotland	1009 (11.3)	882 (11.8)	127 (8.7)
Northern Ireland	290 (3.2)	256 (3.4)	34 (2.3)
Ethnicity, *n* (%)			
White	8534 (95.4)	7094 (94.9)	1440 (98.1)
Not white	409 (4.6)	381 (5.1)	28 (1.9)
Education, *n* (%)			
Low	5236 (58.6)	4389 (58.7)	847 (57.7)
Moderate	2380 (26.6)	1998 (26.7)	382 (26.0)
High	1327 (14.8)	1088 (14.6)	239 (16.3)
TTFC, mean (SD)			
Least addicted (> 60 minutes)	1218 (13.6)	1066 (14.3)	152 (10.4)
31–60 minutes	1879 (21.0)	1593 (21.3)	286 (19.5)
6–30 minutes	4407 (49.3)	3667 (49.1)	740 (50.4)
Most addicted (within 5 minutes)	1439 (16.1)	1149 (15.4)	290 (19.8)
Purchase source, *n* (%)			
UK store based	7495 (83.8)	6439 (86.1)	1056 (71.9)
Non-UK/non-store	1448 (16.2)	1036 (13.9)	412 (28.1)

Note
Total *n* = 4062 (observations = 8943).

(a)

(b)
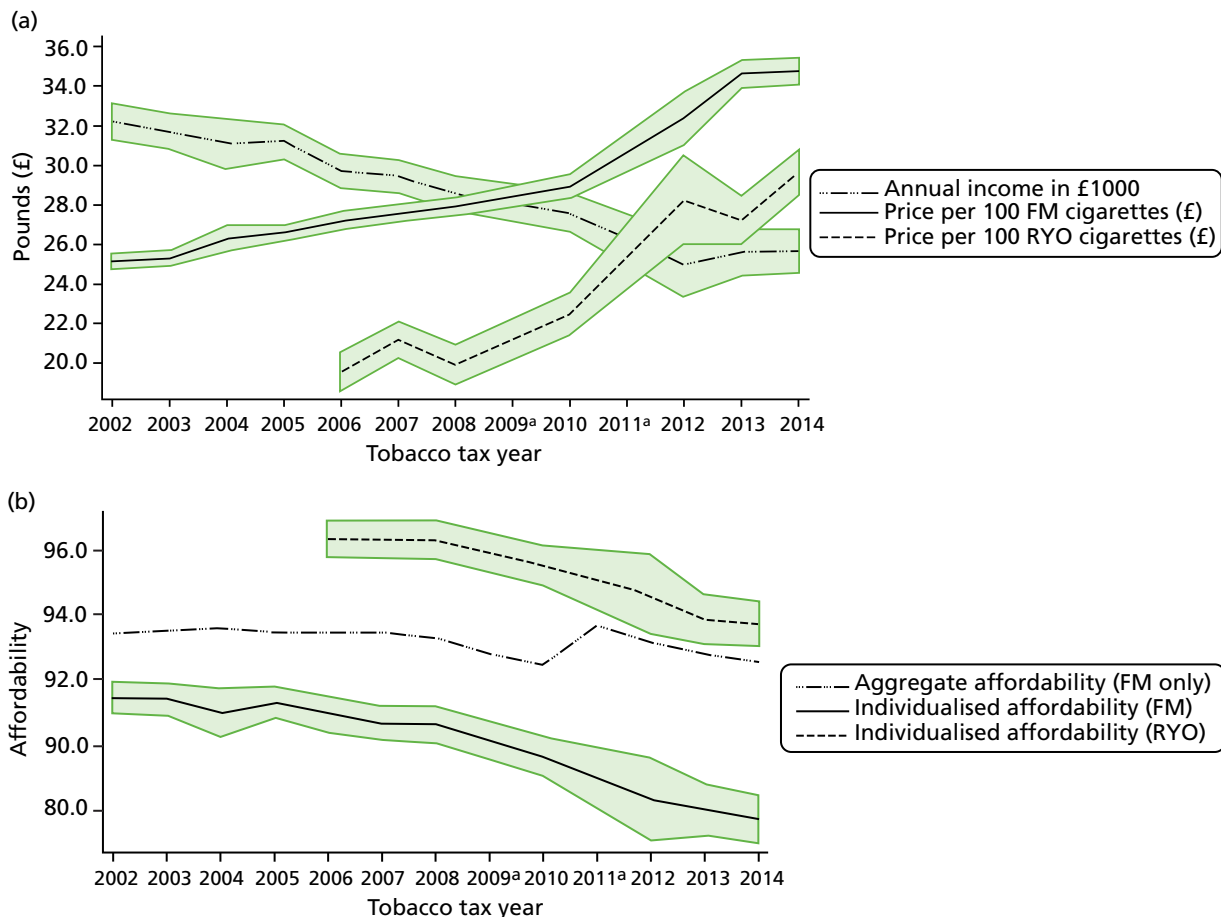
FIGURE 11 International Tobacco Control Policy Evaluation Project data study 2: measures of affordability (individualised and aggregate versions) and their constituent components (income and tobacco prices) over time. (a) Annual gross income and tobacco prices for FM cigarettes and RYO tobacco (values are adjusted for inflation using CPI with 2014 as the base year); and (b) individualised measures of affordability (for FM cigarettes and RYO tobacco) and the aggregate version of affordability (FM only). Individualised measures are unadjusted and inclusive of all purchase sources. The aggregate version of affordability is based on annual per capita GDP and mean cigarette prices from annual sales in the MPPC (prior to 2011) or WAP (2011 onwards) for FM cigarettes from fully taxed UK sources only. Note, shaded areas indicate 95% confidence intervals. a, No ITC data collected for this year.

average annual decrease in the affordability of RYO tobacco of 0.31%, from 96.3% ($\pm$ 95% CI 95.7% to 96.9%) in 2006 to 93.7% ($\pm$ 95% CI 93.0% to 94.4%) in 2014 (see *Figure 11*, model 1 unadjusted). RYO tobacco was significantly more affordable than FM cigarettes.

The aggregate version of affordability (fully taxed FM cigarettes only) also decreased (see *Figure 11*). There was an increase in aggregate affordability between 2010 and 2011, which coincided with the change in calculation of cigarette prices from the MPPC to the WAP and, hence, marks the switch between these two data series. When MPPC was used, aggregate affordability decreased at an average annual rate of 0.13% between 2002 (93.4%) and 2010 (92.5%); when using the WAP, an average annual rate of 0.40% between 2011 (93.7%) and 2014 (92.5%) was observed.

For FM cigarettes, focusing on the fully adjusted regression (model 2), there was a significant linear decrease, $\chi^2(1) = 59.8$ ($p < 0.0001$), in individualised affordability over time (*Table 12*). However, as indicated by the reverse adjacent contrasts, none of the year-to-year decreases were significant, except for the two instances when there was a 2-year interval between surveys: 2008–10, $\chi^2(1) = 5.4$ ($p < 0.05$) and 2010–12 $\chi^2(1) = 4.3$ ($p < 0.05$), a period that also coincided with tax increases greater than the rate of inflation. The same pattern of results was obtained for the fully adjusted model 2. For model 3, when non-UK/non-store sources were excluded, a significant linear decrease in affordability was still observed over time, $\chi^2(1) = 54.3$ ($p < 0.0001$).

TABLE 12 International Tobacco Control Policy Evaluation Project data study 2: linear random-effects clustered regression analyses of individualised affordability regressed on time (tax year) and other covariates (fully adjusted), separately for FM cigarette and RYO tobacco smokers

Time (tax year)	FM cigarettes ($n = 3420$, observations = 7475)			RYO tobacco ($n = 734$, observations = 1468)		
	β	SE	*p*-value	β	SE	*p*-value
	$\chi^2(1) = 59.84$; $p < 0.0001$			$\chi^2(1) = 39.45$; $p < 0.0001$		
2002	Ref					
2003	−0.05	0.23	0.842			
2004	−0.44	0.40	0.267			
2005	−0.07	0.27	0.806			
2006	−0.36	0.28	0.208	Ref		
2007	−0.54	0.30	0.069	0.26	0.30	0.388
2008	−0.38	0.31	0.224	0.18	0.32	0.568
2010	**−1.11**	0.35	0.002	−0.36	0.34	0.305
2012	**−2.45**	0.66	< 0.001	−0.92	0.63	0.141
2013	**−2.56**	0.44	< 0.001	**−1.94**	0.41	< 0.001
2014	**−2.82**	0.42	< 0.001	**−1.80**	0.40	< 0.001
Reverse adjacent contrasts						
	$\chi^2(10) = 78.73$; $p < 0.0001$			$\chi^2(6) = 48.45$; $p < 0.0001$		
2003 vs. 2002	−0.05	0.23	0.842			
2004 vs. 2003	−0.40	0.40	0.326			
2005 vs. 2004	0.38	0.38	0.314			
2006 vs. 2005	−0.29	0.26	0.264			
2007 vs. 2006	−0.18	0.27	0.495	0.26	0.30	0.388
2008 vs. 2007	0.16	0.28	0.561	−0.08	0.31	0.799
2010 vs. 2008	**−0.73**	0.31	0.020	−0.54	0.33	0.100
2012 vs. 2010	**−1.33**	0.65	0.039	−0.57	0.62	0.354
2013 vs. 2012	−0.11	0.71	0.873	−1.01	0.67	0.128
2014 vs. 2013	−0.25	0.45	0.575	0.13	0.41	0.745

Ref, reference.
Notes
Analyses are fully adjusted for tobacco tax year, sex, age, age squared, region, ethnicity, education, TTFC and purchase source.
Chi-squared statistics are for overall effects of linear trends (time) and any variables with three or more categories.
Values in bold are significant.

However, the adjacent contrasts indicated that none of year-to-year decreases remained statistically significant. Model 3 was the most similar to the generalised affordability measure, but was around 3–6% lower each year and showed a more marked decline. In both models 2 and 3, 2010 was the first year that FM cigarettes became significantly less affordable than they had been in 2002. Full results for FM cigarettes for all three models and including all covariates can be found in *Table S11* in *Report Supplementary Material 2*.

For RYO tobacco, the changes in individualised affordability over time were similar to FM cigarettes (see *Table 12*). The fully adjusted model 2 indicated a significant linear decreasing trend, $\chi^2(1) = 39.45$ ($p < 0.0001$) in affordability over time; however, there were no significant year-to-year changes indicated in the reverse adjacent contrasts. Findings were similar for the unadjusted model 1 [except the decrease from

2008 to 2010, $\chi^2(1) = 5.3$ ($p < 0.05$), was statistically significant] and model 3, excluding purchases from non-UK/non-store sources. Full results for RYO tobacco for all three models and including all covariates can be found in *Table S12* in *Report Supplementary Material 2*.

Results of the sensitivity analysis looking at changes in tobacco consumption showed that FM cigarette smokers made a slight reduction in their CPD from 17.5 (95% CI 17.2 to 17.9) cigarettes in 2002 to 16.1 (95% CI 15.6 to 16.7) cigarettes in 2014, with a statistically significant linear trend: $\chi^2(1) = 40.9$ ($p < 0.0001$). The consumption of RYO tobacco smokers changed from 16.8 g (95% CI 16.0 g to 17.6 g) in 2006 to 17.3 g (95% CI 16.4 g to 18.3 g) in 2014, but the linear trend was not statistically significant: $\chi^2(1) = 1.7$ ($p = 0.20$). Given that tobacco became less affordable during this period, this decrease cannot be attributed to these observed decreases in CPD (an increase in CPD would result in a decrease in affordability). However, it is possible that the decreases in consumption (especially for FM cigarettes) attenuated the magnitude of the observed decrease in affordability and we might have observed a greater reduction in affordability had smokers not reduced their consumption to compensate.

Limitations

As we included only current smokers, some recent ex-smokers may have quit because they could not afford tobacco, which would mean that our data somewhat underestimated the decrease in affordability. We also excluded non-daily smokers and those who usually smoked both FM cigarettes and RYO tobacco because of insufficient data, which may have slightly underestimated affordability, as these groups might be particularly adept at controlling their tobacco expenditure by smoking less or switching as necessary. We also used repeat cross-sectional, rather than longitudinal data. Finally, we had data only on gross (before tax) rather than net (after tax) income. Individuals in the UK with higher incomes are taxed at progressively higher rates, so their net income (what is actually available to spend on tobacco) will be reduced by relatively more than those on lower incomes. For the high-income groups, affordability will therefore be slightly overestimated; we do not expect this to cause a large bias in our estimates, as just over two-thirds of our sample (68%) had gross incomes < £30,000, which was below the threshold for moving beyond the lowest tax rate in all years analysed, except the 2002–3 tax year in which the threshold was £29,000. Income differences between our sample and national figures are probably reflective of smokers being more disadvantaged overall.

Implications

Our new individualised measure of tobacco affordability provided a more sensitive and nuanced insight into the impact of tobacco taxes compared with aggregate measures based on national estimates of income and average tobacco prices. In the UK, tobacco was significantly less affordable in 2014 than in 2002, although the rate of decrease (0.24% annually) was low and year-to-year declines were not significant, and potentially attenuated by slight reductions in consumption. Affordability was modified by larger tax increases and RYO tobacco was considerably more affordable than FM cigarettes.

We have developed a novel measure of affordability which, beyond using individual reported tobacco prices and incomes, departs from traditional price/income conceptualisations of affordability by also incorporating tobacco consumption. The two other studies[223,224] of which we are aware that have adopted individualised[224] or partly individualised[223] measures of tobacco affordability, although they did not incorporate consumption directly into their calculation of affordability, weighted their estimates of tobacco prices by consumption. It is therefore necessary to discuss the implications of this.

Owing to the inclusion of (or weighting for) consumption, it is possible for these analyses to indicate that tobacco has become more affordable, even if prices have increased relative to incomes. This would only occur only if smokers reduced their consumption by more than what is necessary to compensate for the price increase. We think this is unlikely. The more likely scenario is that they have reduced consumption just enough to compensate for the price increase (we have observed exactly this with users of RYO tobacco; see *Chapter 7*), in which case our measure would indicate no change in affordability. It is also possible, as we observed in this case, that smokers reduce their consumption, but not enough to

compensate for the price increases, which would lead to smaller than expected (based solely on prices relative to incomes) reductions in affordability. It is important to examine this interrelationship among price, income and consumption, because the health gains of reducing consumption without quitting are limited,[226] but small reductions in consumption (e.g. by 1.4 FM cigarettes over the 12-year study period we observed here) might be just enough to offset tobacco price increases to a satisfactory level to deter smokers from quitting, thereby undermining the effectiveness of tobacco tax increases. For researchers using our measure, we therefore recommend that, as we have done here, that our measure be examined alongside the separate trends in prices, incomes and consumption, to gain a more comprehensive understanding of how smokers are adjusting their behaviour to keep tobacco affordable.

Summary

Both the commercial literature and ITC data indicated a decrease in tobacco affordability over the study period. Using our individualised method of affordability, tobacco was significantly less affordable for UK smokers in 2014 than it had been in 2002. Using an aggregate version of affordability for FM cigarettes purchased in UK stores only (and therefore likely to be fully taxed), affordability also decreased over time The individualised method of affordability indicated that FM cigarette smokers retained 87.8% of their income after paying for tobacco in 2014, compared with 91.5% in 2002. For RYO tobacco smokers, tobacco was more affordable, but this also decreased significantly, and they retained 93.7% of their income after paying for tobacco in 2014, compared with 96.3% in 2006 (the years for which data were available). Decreases in the income of smokers (1.6% annually) and increases in mean cigarette prices (2.6% and 4.5% annually for FM cigarettes and RYO tobacco, respectively) contributed to the decrease in affordability. However, the decrease in affordability was lower (0.24% and 0.31% annually for FM cigarettes and RYO tobacco, respectively) than would be expected from the observed changes in income and cigarette prices. It is possible that the potential magnitude of this decrease was attenuated by slight reductions in consumption, especially among FM smokers. It is also likely that individual characteristics are playing a role, a subject we explore in *Chapter 9*.

However, year-to-year changes in affordability were not statistically significant, except when the gap between surveys was 2 years rather than 1 year. This suggests that it was probably not large enough to prompt smokers, especially the more dependent ones, to quit smoking. The largest decrease in affordability was from 2008 to 2012. Across the study period, it was only from 2009 that taxes increased over the rate of inflation, and in 2011 a sharp increase in RYO tobacco prices occurred (see *Table 1*) and we observed that FM cigarettes became significantly less affordable only from 2010 onwards compared with 2002. Incomes were also observed to reduce most sharply from 2010 onwards, probably due to the recession. As our surveys did not occur in 2009 and 2011, we are unable to determine the strength of the relative contributions of these changes to affordability.

Chapter 6 The impact of tobacco tax increases, as moderated by tobacco industry pricing, on smokers' legal purchasing patterns

Introduction

Smokers can take a number of steps to minimise the cost of their smoking behaviour. They can alter the products that they purchase, such as buying cheaper brands or variants of the same product, purchase a cheaper product (e.g. RYO tobacco or an illicit product), or alter their smoking behaviour (e.g. reduce consumption or quit). This chapter explores what smokers purchase from legal sources and how this is impacted by price increases. In *Chapter 7*, we focus on changes in smoking behaviour (reducing consumption and quitting) and in *Chapter 8* we assess whether or not there are changes in purchases constituting potential tax avoidance or evasion.

Background: evidence of down-trading in the commercial literature

For industry, down-trading from expensive products to cheaper products was interpreted as a consequence of tax increases[136] and the recession:[227]

> *The one concession [rather than quitting] smokers are likely to make to tougher times [Watkins from Imperial Tobacco claims] is to save money where possible: there is already a trend to down trade and this is likely to be accelerated over the coming months.*
>
> *Hegarty[169]*

In 2008, PMI, with a limited share of the UK market and a predominance of premium brands (notably Marlboro), claimed to be unaware of down-trading in the UK:

> *The down-trading that everyone is referring to or afraid of, we have just not seen.*
> *Hermann Waldemar, Chief Financial Officer from PMI, quoted in* The Grocer[228]

However, spokespeople from both JTI and Imperial Tobacco described evidence of smokers down-trading.[229]

Imperial Tobacco had noticed similar trends:

> *Increasing numbers of adult smokers are moving down through the cigarette price sectors into the economy sector.*
> *Iain Watkins, trade communications manager at Imperial Tobacco quoted in* Wholesale News[230]

Dual use of manufactured cigarettes and RYO was later reported to be a growing trend.[139] Furthermore, even RYO tobacco users were noted to be trading down from more expensive to cheaper RYO tobacco brands.[169]

In 2014, 90% of smokers switching brands were now switching to a lower priced brand,[231] causing a 'full blown subprime crisis in the heart of the global cigarette market'.[232] Down-trading became increasingly essential because 'consumers cannot afford to smoke, drink, drive a car – something has to give; although tobacco is the last thing some people will give up, they will down-trade' (wholesaler Paul Ford, quoted in *Wholesale News*)[211] and possible because 'Smokers used to be embarrassed to buy the cheaper brands, but the culture has changed radically' (retailer quoted in *Retail Newsagent*).[233]

Thus, there was evidence from the commercial literature to suggest that down-trading was smokers' behavioural response to the reduced affordability discussed in the previous chapter. Down-trading was discussed as an issue in the commercial literature throughout the time period studied (2008–14) and was seen as a more likely response to financial pressures than smoking cessation.

Nielsen data study 4: what are sales volumes overall and by tobacco type over time?

Overall, the total volume of FM and RYO stick equivalents sold declined markedly in the UK: from 50.5 billion sticks in 2009 to 42.6 billion sticks in 2015 (a 13% decline) (*Figure 12* and see also *Figure S13* in *Report Supplementary Material 2*). However, the overall decline consisted of a 17% decline in FM stick sales but a 46% increase for RYO tobacco sales, although RYO tobacco sales stabilised post 2012. Seasonal effects are apparent in both FM cigarettes and RYO tobacco (e.g. New Year's resolutions and/or post-Christmas penury affect tobacco sales).

These data imply that smokers were moving from FM cigarettes to RYO tobacco. However, sales data do not provide information on smokers' behaviour, so it is necessary to use the ITC data to assess this.

ITC data study 3: smokers' tobacco purchasing behaviours by product and store type (licit purchases)

In this study, rather than using commercial data on product sales, we turn the question around and ask smokers what they purchased. These two approaches help to triangulate our results. Using ITC data, in addition to looking at overall RYO tobacco and FM cigarettes purchases, we were also able to break down FM cigarettes purchases into single packs and cartons. In this chapter, we are concerned with legal

FIGURE 12 Nielsen data study 4: monthly tobacco sales volumes (millions of sticks sold) for FM cigarettes and RYO tobacco. Vertical reference lines are for December each year, marking the beginning of the Christmas/New Year holiday period.

purchases likely to be from legal sources, that is, UK store-based sources (using the same definitions as in ITC data study 1, described in *Chapter 4*). Potential tax avoidance and evasion purchasing patterns are assessed in *Chapter 8*.

Methods

The population-weighted proportion of smokers using cheap tobacco (types and sources) at each survey was calculated. To test for linear trends in these proportions, clustered logistic regression analyses using GEEs were employed. These analyses used a binomial distribution with a logit link function and an unstructured correlation matrix (or exchangeable when the unstructured failed to converge). In these analyses, covariates are not controlled for.

Results

Product type

Over the course of the study, exclusive RYO tobacco use increased significantly (main increase from 2002 to 2010 then plateauing) and exclusive FM cigarette use decreased significantly (in 2014, 55% were exclusive FM cigarette smokers, 30% were exclusive RYO tobacco users and 15% were a mix) (*Table 13*). Mixed FM cigarette and RYO tobacco use did not show a statistically significant linear trend, although the increase from 10.2% in 2010 ($\pm$ 95% CI 7.2% to 13.1%) to 18.2% in 2013 ($\pm$ 95% CI 15.3% to 21.2%) coincided with the plateauing of exclusive RYO tobacco use.

There was also a significant linear increase over time in the proportion reporting that their last purchase was their usual brand for exclusive FM cigarettes users, exclusive RYO tobacco users and mixed users. Typically, > 90% of exclusive FM cigarette or RYO tobacco smokers in each wave reported that their last purchase was their usual brand, compared with between 66.0% ($\pm$ 95% CI 58.0% to 74.1%) in 2003 and 83.8% ($\pm$ 95% CI 74.9% to 92.8%) in 2010 for mixed users. This pattern suggests that exclusive FM cigarette or RYO tobacco smokers are most brand loyal, whereas brand loyalty among mixed users is lower, although increasing with time.

Based on the last product purchased, FM cigarette purchases (both FM-P and FM-C) also declined significantly as RYO tobacco purchases increased. In 2014, just under half (45.9%) reported purchasing a FM-P as their last purchase, one in six (16.9%) FM-C and 35% RYO tobacco.

Purchase source

Consistently throughout the study period, most ($\geq$ 80%) purchases were from UK store-based sources, mostly from convenience stores and supermarkets. Our GEE analysis (using an unstructured correlation matrix; see *Chapter 2*) did not indicate any significant linear trends over time for UK purchase sources overall (β = 0.019, 95% CI –0.002 to 0.041; p = 0.081); however, the QIC model fit comparison indicated a slightly better fit using an exchangeable correlation matrix (QIC = 15,014) when compared with an unstructured correlation matrix (QIC = 15,020) (see *Table S1* in *Report Supplementary Material 2*). The results, using an exchangeable correlation matrix, did indicate a statistically significant increase over time in the proportion of tobacco purchases, overall, from UK store-based sources (β = 0.018, 95% CI 0.0025 to 0.033; p = 0.023). However, given our theoretical preference for the unstructured correlation matrix (see discussion in *Chapter 2*) and the very small magnitude of difference between the QIC statistics, our focus here will remain on the findings using the unstructured correlation matrix (however, see the discussion in *Chapter 8* relating to purchases from non-UK/non-store sources).

With respect to the different tobacco types, at each survey, at least 97% of FM-P purchases were made from UK store-based sources. These ceiling effects precluded carrying out a statistical test for linear trend. Between 45% and 71% of FM-C purchases were from UK store-based sources, a significant linear increase over time. RYO purchases from UK store-based sources also increased significantly over time (see *Table 13*).

TABLE 13 International Tobacco Control Policy Evaluation Project data study 3: usual tobacco product, product last purchased and source of last purchase (weighted data), with tests for linear trends over time

Product purchased and source	ITC UK survey number (year)										Beta (95% CI)[a] for time trends
	1 (2002)	2 (2003)	3 (2004)	4 (2005)	5 (2006)	6 (2007)	7 (2008)	8 (2010)	9 (2013)	10 (2014)	
Usual tobacco product, %											
FM cigarettes only	69.6	68.0	68.8	67.2	62.6	62.2	61.5	57.7	53.5	55.0	–0.044*** (–0.054 to –0.034)
Last purchase = usual	82.6	94.1	91.4	95.2	89.6	89.4	92.9	93.9	94.3	93.2	0083*** (0.055 to 0.111)
RYO tobacco only	17.5	19.3	20.3	22.5	25.0	26.5	24.7	30.0	28.3	30.3	0.057*** (0.042 to 0.072)
Last purchase = usual	78.9	90.2	86.7	98.3	90.1	95.0	94.2	95.5	87.1	95.9	0.104*** (0.060 to 0.149)
Mixed (combo of FM cigarettes and RYO tobacco)	12.9	12.5	10.9	10.2	12.4	11.2	13.7	10.2	18.2	14.5	0.014 (–0.002 to 0.030)
Last purchase = usual	69.1	66.0	75.4	81.7	73.2	78.3	73.8	83.8	77.1	83.0	0.048** (0.016 to 0.080)
Product last purchased, %											
FM-P	59.4	58.0	58.3	57.1	52.4	47.6	51.6	45.2	49.0	45.9	–0.034*** (–0.044 to –0.023)
UK, store based	97.0	97.2	97.5	97.3	99.2	98.9	98.9	98.9	96.8	98.2	N/A
FM-C	21.4	20.5	20.2	19.6	17.8	18.4	17.1	16.7	15.2	16.9	–0.039*** (–0.04 to –0.025)
UK, store based	55.8	45.1	49.8	54.5	54.3	50.2	57.9	61.5	70.7	55.0	0.025* (0.003 to 0.048)
RYO tobacco	17.3	19.0	20.7	22.5	29.5	30.0	30.5	32.2	33.2	35.0	0.066*** (0.053 to 0.080)
UK, store based	71.7	64.9	68.1	65.6	69.4	78.1	66.7	74.2	82.9	80.0	0.045** (0.016 to 0.074)
Source of last purchase, %											
UK, store based	83.7	79.9	81.6	81.8	82.4	83.3	81.5	83.2	87.1	83.7	0.019 (–0.002 to 0.041)
Convenience store	51.2	49.7	50.5	46.4	45.0	50.1	48.0	44.2	40.0	41.0	–0.033*** (–0.044 to –0.022)
Supermarket	41.4	42.4	44.5	49.8	50.6	47.4	47.9	52.4	54.1	54.2	0.040*** (0.028 to 0.051)
UK, store based other[b]	7.4	7.9	5.0	3.9	4.4	2.6	4.0	3.4	5.9	4.8	–0.038** (–0.066 to –0.010)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. N/A, not applicable.
a Tests for trend were not conducted (N/A) when floor or ceiling effects were apparent.
b 'UK, store based other' category includes discount stores, tobacconists, bars/entertainment venues, off-licenses, vending machines and unclassified UK store-based responses.

Over the course of the study period, within purchases made from UK store-based sources, those made from convenience stores significantly decreased with a corresponding increase in purchases from supermarkets. By 2014, there were significantly more purchases from supermarkets (54.1%, ± 95% CI 50.0% to 58.1%) compared with convenience stores (40.0%, ± 95% CI 36.0% to 44.0%). The economic recession that occurred in the UK in the last quarter of 2008 may have contributed to this, as it was around this time that supermarkets overtook convenience stores as the most popular purchase source.

Limitations

As previously discussed, we cannot rule out the trading of illicit tobacco products from UK store-based sources, such as 'under-the-counter' purchases. To mitigate this, we excluded purchases which had very low prices, as described in *Chapter 4*.

Implications

UK smokers most commonly purchased from UK stores, but changed their purchasing patterns during the study period. Exclusive RYO tobacco use significantly increased, whereas exclusive FM cigarette use significantly decreased, with around one in six smokers smoking both FM cigarettes and RYO tobacco. Supermarkets also became more popular than convenience stores. Both these changes would have conferred price reductions.

We have thus far (from commercial literature and ITC data) illustrated that FM cigarette sales and purchases declined, whereas those for RYO tobacco grew. This suggests that reduced affordability of tobacco was leading to changes in smokers' behaviour, but was not necessarily stopping them buying tobacco products. In the next sections, FM cigarette and RYO tobacco sales are broken down to see if there is sales differentiation between high- and low-priced FM and RYO products to provide further evidence of down-trading.

Nielsen data study 5: what are sales volumes by differently priced segments over time?

Similar patterns of sales and purchasing of FM and RYO products, overall, were revealed using Nielsen and ITC data. Nielsen data allow both FM and RYO products to be grouped into price segments. If down-trading was occurring, as reported in the commercial literature, we would expect to see volume decline in expensive price segments and volume growth in the cheap price segments.

Results

Changes in volumes of FM and RYO sticks sold varied by segment (*Figure 13* and see also *Table S14* in *Report Supplementary Material 2*). Among FM cigarettes, annual volumes of premium and mid-price products declined markedly throughout the period (54% and 61% declines, respectively). Volumes of FM value cigarettes grew by 126% over the study period, although growth slowed from mid-2011. From their introduction in 2012, volumes of FM subvalue cigarettes increased to 4.3 billion sticks in 2015.

Within the RYO tobacco segment, from 2009 to 2015, premium sales declined by 43%, whereas mid-price volumes grew by 78% overall, although they have stagnated since 2013. RYO value tobacco grew to 2.3 billion stick equivalents, but growth slowed after 2012.

Implications

The market share of price segments varied considerably over the study period. FM mid-price cigarettes and RYO premium tobacco were the most popular of each type of product at the beginning, whereas at the end of the study period FM value cigarettes and RYO mid-price tobacco were most popular. Tobacco sales data therefore provide further evidence of down-trading, as sales of expensive FM and RYO products declined, but sales of cheap FM and RYO products grew.
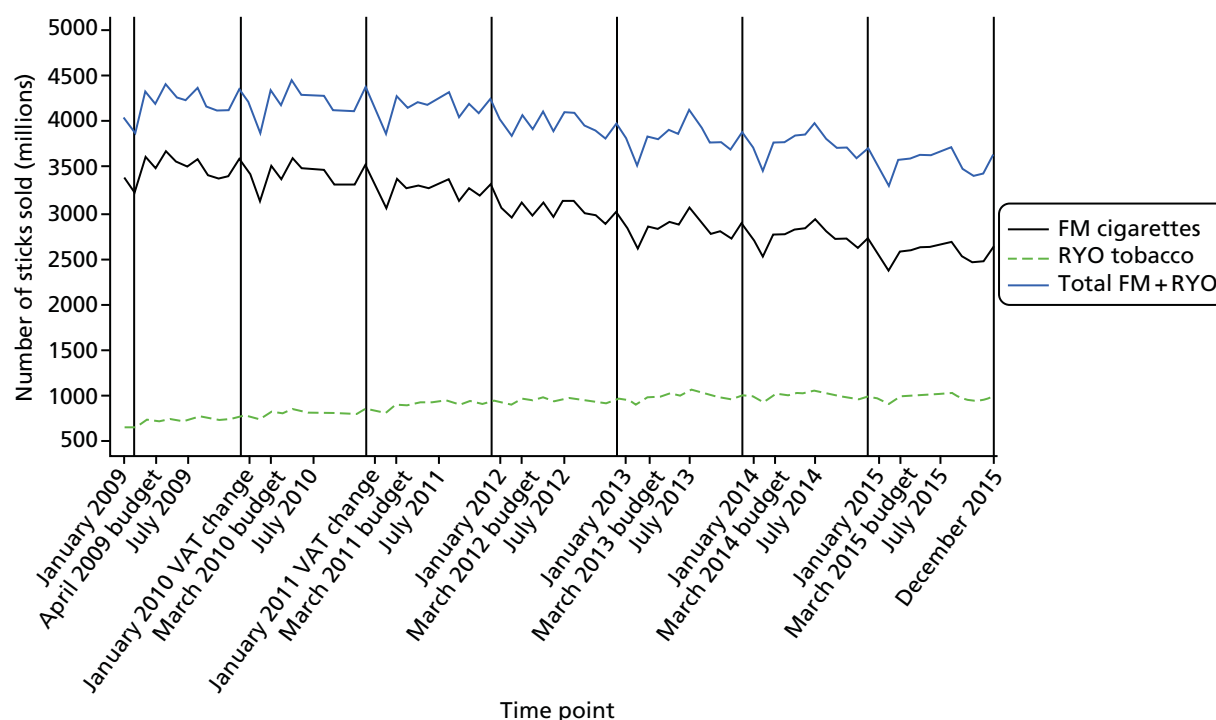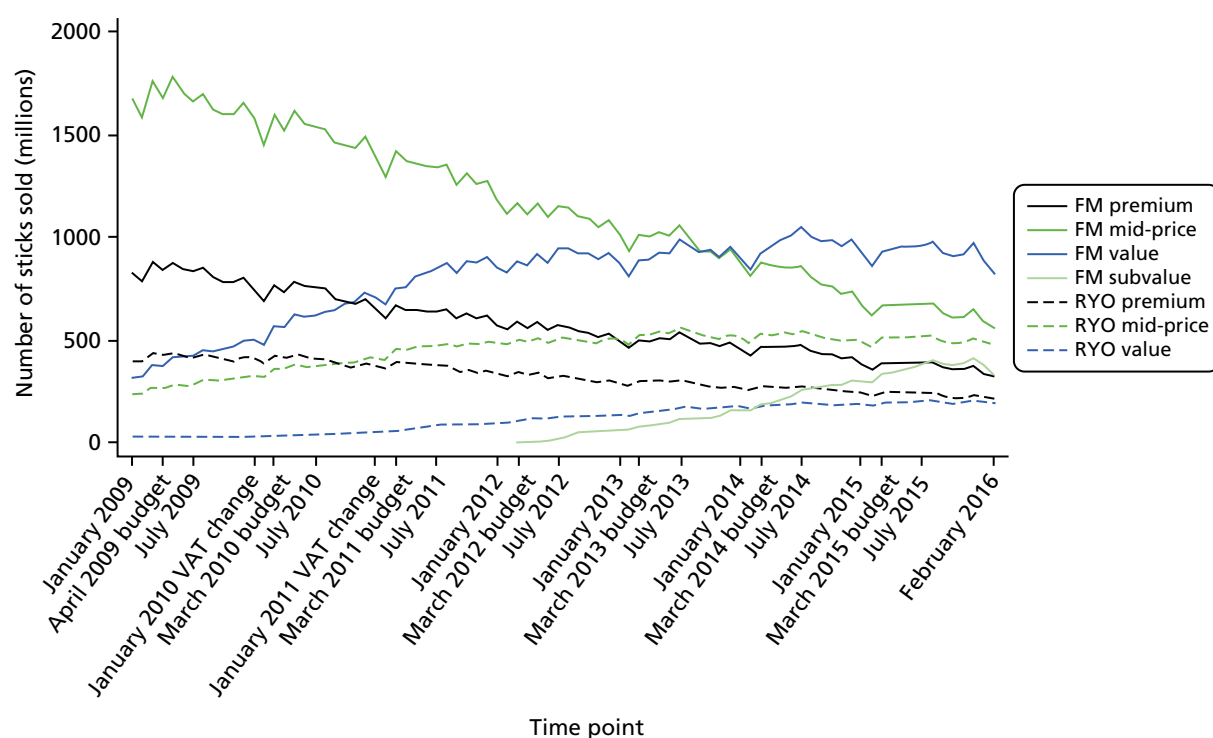
FIGURE 13 Nielsen data study 5: monthly tobacco sales volumes (millions of sticks sold) for FM cigarettes and RYO tobacco, by price segments.

ITC data study 4: impact of tobacco pricing changes on smokers' purchasing patterns and product choices (cross-sectional and longitudinal analyses)

Although the Nielsen data can tell us that volumes changed, they cannot tell us about the behaviour of individual smokers over time. The longitudinal ITC study was set up for such analyses. We have already established that smokers had ample opportunities to access cheap tobacco from legal sources. It is also evident that smokers could access tobacco in 2014 at 2002 prices and that there had been little change over time in the prices smokers were paying for their tobacco, although overall affordability decreased. The aim of this study was to examine the extent to which smokers were taking the opportunity to buy cheaper sources of tobacco, rather than stopping purchasing altogether.

The analyses presented here update and extend previous research by examining cross-sectional patterns in the prevalence of cheap tobacco use between 2008 and 2014 (analysis 4a), and the longitudinal impact of tobacco pricing on purchase patterns among FM cigarette smokers at baseline over the same period (analysis 4b). All cheap purchases, licit and illicit, were included in this study, although frequency of purchasing illicit tobacco was controlled for (see *Chapter 2*).

Methods

Data
Participants were current adult smokers from the ITC UK surveys between 2008 and 2014 (four surveys, surveys 7–10) (see *Table 4*). Of the 2808 individuals who took part in at least one of these surveys, we excluded 275 (9.8%) who were not smoking at least monthly when first surveyed, 44 (1.6%) who had missing data on their tobacco product type and 71 (2.5%) who had missing data on any of the other variables of interest (see below), leaving a final cross-sectional sample (analysis 4a) of 2418 participants who provided 4339 observations over the four surveys.

A subset of this group was also included in longitudinal analyses if they were present in at least two consecutive surveys, thereby creating a 'survey pair' between the baseline and follow-up surveys. Each individual included in the longitudinal analyses provided at least one item of longitudinal data involving one survey pair. Individuals could have taken part in more than one survey pair; for example, if an individual had completed all four surveys they would have three longitudinal pieces of data [survey 7 (baseline) to survey 8 (follow-up), survey 8 (baseline) to survey 9 (follow-up), and survey 9 (baseline) to survey 10 (follow-up)]. Thus, the maximum number of survey pairs that an individual could be involved in was three, if they completed all four surveys.

Measures

The variable of primary interest was tobacco product type. Participants provided the specific brand variant of FM cigarettes they usually (if they indicated having a regular brand) or currently smoked. These were classified into one of three price segments: premium, mid-price or value, as described in *Chapter 3*. The two cheapest FM segments (value and subvalue) were combined because of the low prevalence of subvalue brands in our ITC sample, a segment that only appeared on the market from 2012. RYO tobacco was a fourth category.

We also examined the tobacco taxation increase rate, brand and product loyalty, when appropriate, to assess degree of adherence to particular brands/products, the HSI to assess level of tobacco dependence and frequency of purchases from cheap (probably illicit) sources. Sociodemographic variables (sex, age, education, income, region of residence, relationship status and ethnicity) were also included, as were the sample design control variables of recruitment type (replenishment vs. recontacted samples) and survey mode (telephone vs. online). More details relating to these variables are provided in *Chapter 2*. The influence of tobacco dependence and sociodemographics is discussed in *Chapter 9*, and of frequency of purchases from cheap sources in *Chapter 8*; however, these variables were all controlled for in the present analyses.

For the longitudinal analysis (analysis 4b), we assessed the prevalence of product switching by examining the relationship between tobacco product type at baseline and product type at outcome. Baseline RYO tobacco smokers were excluded as they were not able to trade down. This resulted in the baseline–outcome matrix presented in *Table 14*, which we used to classify participants to one of four outcomes: (1) traded up/no change, that is participants who remained smoking FM cigarettes from the same price segment or traded up to a more expensive segment (trading up was combined with no change because of its low prevalence of $n = 74$, comprising 5.4% of the sample); (2) traded down FM cigarettes, that is participants changed to a cheaper FM cigarette; (3) switch to RYO tobacco, that is participants switched from FM cigarettes to RYO tobacco; and (4) stop purchasing (having quit for at least 6 months with no relapse recorded at the time of the outcome survey). As the length of their quit attempt could not be determined, participants recorded as quit for < 6 months at outcome were excluded from analysis 4b.

TABLE 14 International Tobacco Control Policy Evaluation Project data study 4: classification matrix for product purchase changes from baseline to outcome surveys

Baseline survey	Outcome survey				
	Premium FM cigarettes	**Mid-price FM cigarettes**	**Value FM cigarettes**	**RYO tobacco**	**Stop purchasing**[a]
Premium FM cigarettes	1. Traded up/no change	2. Traded down FM cigarettes	2. Traded down FM cigarettes	3. Switch to RYO tobacco	4. Stop purchasing
Mid-price FM cigarettes	1. Traded up/no change	1. Traded up/no change	2. Traded down FM cigarettes	3. Switch to RYO Tobacco	4. Stop purchasing
Value FM cigarettes	1. Traded up/no change	1. Traded up/no change	1. Traded up/no change	3. Switch to RYO tobacco	4. Stop purchasing

a Stop purchasing defined as quitting for at least 6 months with no reported relapse at outcome survey.

Analyses

Initially, patterns in the prevalence of cheap tobacco product use over time were assessed descriptively, then two analyses performed.

Analysis 4a

Analysis 4a (2418 participants providing 4339 observations) was a cross-sectional analysis using aggregated data from all four surveys. Given the categorical outcome (premium FM cigarettes, mid-price FM cigarettes, value FM cigarettes or RYO tobacco), we used multinomial logistic regression analyses of survey responses clustered over individuals.

Analysis 4b

Analysis 4b (854 participants providing 1397 observations) was longitudinal, using aggregated data from the three consecutive baseline–outcome survey pairs, with only smokers of FM cigarettes at baseline included. Similarly, multinomial logistic regression analyses (survey response clustered over individuals) were conducted. Characteristics were measured at baseline, with the exception of the tobacco tax increase rate, which was measured at outcome.

For both analyses, only participants with valid data on all covariates were included. Analyses were checked for variable multicollinearity and fully adjusted results are reported (for all covariates, including those described in later chapters).

Results

Sample characteristics for the cross-sectional sample (analysis 4a) are presented in *Table 15* and are broadly similar to the characteristics of the longitudinal subsample in analysis 4b (data not shown). Overall, 25.0% of participants smoked premium FM cigarettes, 25.6% smoked mid-price FM cigarettes, 19.0% smoked value FM cigarettes and 30.4% smoked RYO tobacco. Only 4.2% of observations were made in an interval in which the tobacco tax increase rate was 5%. The vast majority (93.2%) were brand and product loyal (87.6%).

Patterns in the prevalence of cheap tobacco product use over time

Overall, the use of cheap tobacco (mid-price FM cigarettes, value FM cigarettes and RYO tobacco) in our sample increased modestly, but significantly, from 72.4% (95% CI 70.1% to 74.7%) in 2008 to 77.6% (95% CI 75.0% to 80.2%) in 2014, with a corresponding drop in premium FM cigarettes from 27.6% (95% CI 25.3% to 29.9%) in 2008 to 22.4% (95% CI 19.8% to 25.0%) in 2014 (*Figure 14*). The greatest increase (17 percentage points) was observed for value FM cigarettes and there was actually a decrease of 15 percentage points in mid-price FM cigarette use. These time-related trends were interrupted in the 2012 tax year, when the rate of tobacco tax increase was highest (5% above inflation) and there was an apparent marked dip in premium and mid-price FM cigarettes and a spike in value FM cigarette and RYO tobacco use. These patterns mirror those in the Nielsen tobacco sales data.

Analysis 4a: aggregate cross-sectional predictors of product choice

In the aggregated data, analysis 4a (*Table 16*), value FM cigarettes and/or RYO tobacco were more likely to be used than premium FM cigarettes when there was a higher tobacco tax increase rate. In addition, RYO tobacco was more likely to be smoked than premium FM cigarettes by smokers who were not brand-loyal.

Analysis 4b: aggregate longitudinal predictors of changing smoking behaviour

Analysis 4b (*Table 17*) examined the predictors of changing smoking behaviour among baseline smokers of FM cigarettes only (trading down to cheaper FM cigarettes, switching to RYO tobacco or stopping purchasing) compared with traded up/no change. Traded up/no change between the baseline and outcome surveys was most common at 72.0%, comprising not changing (66.5%) and traded up (5.5%). A further 13.5% traded down to cheaper FM cigarettes, 6.2% switched from FM cigarettes to RYO tobacco and 8.3% stopped purchasing tobacco products for at least 6 months. Large tobacco tax increases were the only

TABLE 15 International Tobacco Control Policy Evaluation Project study 4: descriptives for the cross-sectional sample (aggregate data from four surveys) used in analysis 4a, by product type

	Total (100%)		FM cigarettes Premium (25.0%)		Mid-price (25.6%)		Value (19.0%)		RYO tobacco (30.4%)	
Sample characteristics	Observations (n)	%	Observations (n)	%	Observations (n)	%	Observations (n)	%	Observations (n)	%
Total	4339	100	1085	100	1111	100	824	100	1319	100
Tobacco tax increase rate (%)[a]										
0	1424	32.8	393	36.2	490	44.1	139	16.9	402	30.5
1	892	20.6	234	21.6	238	21.4	134	16.3	286	21.7
2	1841	42.4	425	39.2	359	32.3	493	59.8	564	42.8
5	182	4.2	33	3.0	24	2.2	58	7.0	67	5.1
Dependence (HSI)										
Low	1893	43.6	539	49.7	493	44.4	330	40.0	531	40.3
Moderate	2124	49.0	472	43.5	551	49.6	435	52.8	666	50.5
High	322	7.4	74	6.8	67	6.0	59	7.2	122	9.2
Sex										
Female	2345	54.0	565	52.1	718	64.6	541	65.7	521	39.5
Male	1994	46.0	520	47.9	393	35.4	283	34.3	798	60.5

TABLE 15 International Tobacco Control Policy Evaluation Project study 4: descriptives for the cross-sectional sample (aggregate data from four surveys) used in analysis 4a, by product type (*continued*)

| | Total (100%) | | FM cigarettes | | | | | | RYO tobacco (30.4%) | |
| | | | Premium (25.0%) | | Mid-price (25.6%) | | Value (19.0%) | | | |
Sample characteristics	Observations (*n*)	%	Observations (*n*)	%	Observations (*n*)	%	Observations (*n*)	%	Observations (*n*)	%
Age (years)										
18–39	1002	23.1	255	23.5	312	28.1	129	15.7	306	23.2
40–54	1803	41.6	470	43.3	416	37.4	420	51.0	497	37.7
≥ 55	1534	35.4	360	33.2	383	34.5	275	33.4	516	39.1
Education										
Low	2298	53.0	458	42.2	602	54.2	511	62.0	727	55.1
Moderate	1210	27.9	317	29.2	334	30.1	205	24.9	354	26.8
High	831	19.2	310	28.6	175	15.8	108	13.1	238	18.0
Income										
Low	1043	24.0	189	17.4	251	22.6	241	29.2	362	27.4
Moderate	1636	37.7	365	33.6	442	39.8	339	41.1	490	37.1
High	1286	29.6	446	41.1	329	29.6	186	22.6	325	24.6
Not disclosed	374	8.6	85	7.8	89	8.0	58	7.0	142	10.8
Region										
London	474	10.9	180	16.6	100	9.0	75	9.1	119	9.0
Northern	929	21.4	185	17.1	286	25.7	220	26.7	238	18.0
Midlands and Eastern	1067	24.6	280	25.8	257	23.1	173	21.0	357	27.1
Southern	967	22.3	234	21.6	176	15.8	188	22.8	369	28.0
Outside England	902	20.8	206	19.0	292	26.3	168	20.4	236	17.9

| Sample characteristics | Total (100%) | | FM cigarettes | | | | | | RYO tobacco (30.4%) | |
| | | | Premium (25.0%) | | Mid-price (25.6%) | | Value (19.0%) | | | |
	Observations (*n*)	%	Observations (*n*)	%	Observations (*n*)	%	Observations (*n*)	%	Observations (*n*)	%
Relationship status										
Single	2147	49.5	485	44.7	526	47.3	443	53.8	693	52.5
Partnered	2192	50.5	600	55.3	585	52.7	381	46.2	626	47.5
Ethnicity										
White	4095	94.4	973	89.7	1062	95.6	788	95.6	1272	96.4
Not white	244	5.6	112	10.3	49	4.4	36	4.4	47	3.6
Brand loyalty										
No	293	6.8	55	5.1	55	5.0	66	8.0	117	8.9
Yes	4046	93.2	1030	94.9	1056	95.0	758	92.0	1202	91.1
Product loyalty										
No	540	12.4	143	13.2	133	12.0	101	12.3	163	12.4
Yes	3799	87.6	942	86.8	978	88.0	723	87.7	1156	87.6
Recruitment type										
Replenish	1245	28.7	327	30.1	333	30.0	252	30.6	333	25.2
Recontact	3094	71.3	758	69.9	778	70.0	572	69.4	986	74.8
Survey mode										
Telephone	2853	65.8	705	65.0	813	73.2	443	53.8	892	67.6
Online	1486	34.2	380	35.0	298	26.8	381	46.2	427	32.4

a Tobacco tax increase rate was determined on the basis of the date surveyed rather than individual survey responses or baseline characteristics.
Note
Percentage distributions were comparable for the longitudinal analysis.
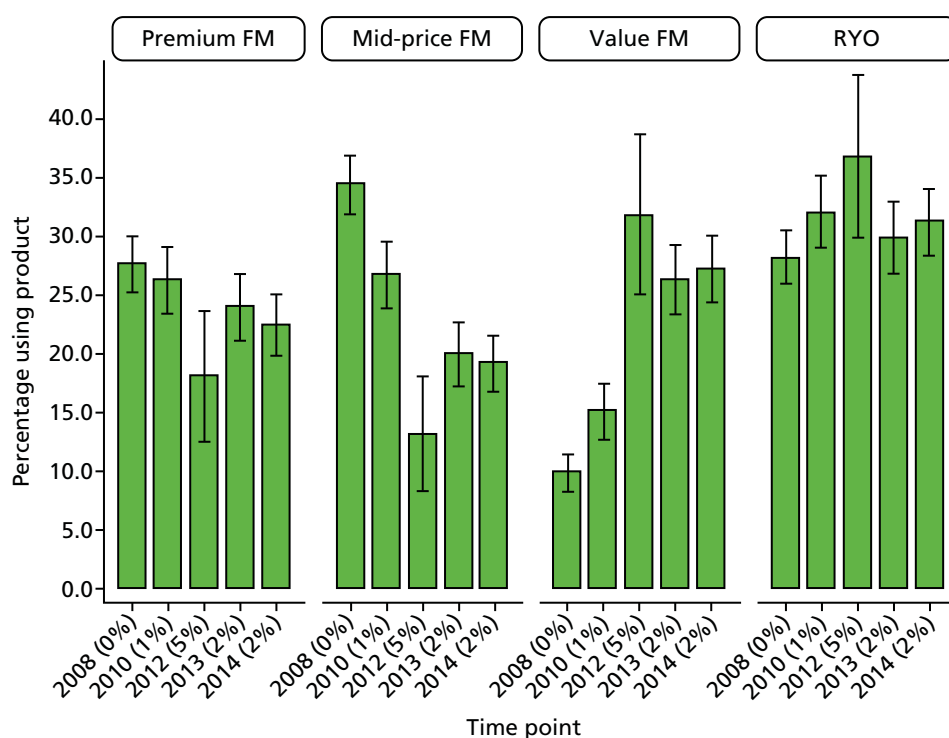
FIGURE 14 International Tobacco Control Policy Evaluation Project data study 4: percentage of participants using each product type over time (tax year) with tobacco tax increase rates (per cent above inflation) in brackets. Note that these data are from the cross-sectional sample (analysis 4a, $n = 2418$, observations = 4339). Error bars represent 95% CIs.

significant predictor of all these behaviours. Smokers were significantly more likely to alter their smoking behaviour at the highest tax increase rate (5%) than at the lowest tax increase rate (1%).

Limitations

Owing to survey timings, only 4.2% of observations across the data set experienced the highest tobacco tax increase rate (of 5%), which could be allocated only to participants surveyed during February 2013 and, hence, there is the possibility that this is a seasonal effect only. Our analysis of Nielsen data indicated that price increases in response to taxation changes occurred throughout the year (see *Chapter 4*), rather than all at once, which would make it less likely that there were seasonal patterns for switching and down-trading.

Conclusions

Cheaper tobacco products (mid-price FM cigarettes, value FM cigarettes and RYO tobacco) were used by 72% of our sample in 2008, consistent with the 71% reported in our earlier work.[12] This increased by six percentage points by 2014; a modest increase in comparison to prior years (15 percentage points increase from 2001 to 2008[12]), although use of the cheapest type of FM cigarettes (value FM cigarettes) rose by 17 percentage points during the period. Continuing with the same products and down-trading to a cheaper FM product were more common outcomes for smokers than stopping purchasing tobacco. Switching to RYO tobacco was a similar proportion to stopping.

Summary

Commercial literature and ITC data indicate that smokers changed their purchasing patterns in response to tobacco price increases and changes in affordability. Although store-based purchases remained the most common source, supermarkets became more popular than convenience stores, which would have conferred a price reduction.

TABLE 16 International Tobacco Control Policy Evaluation Project data study 4 (analysis 4a): fully adjusted clustered, multinomial logistic regression of tobacco product type (premium FM cigarettes is reference, with 25.0% using this product) on individual-level predictors (tax increase rates, brand and product loyalty) ($n = 2418$, observations $= 4339$)

| Individual-level predictors | FM cigarettes | | | | | | | | |
| | Mid-price (25.6%) | | | Value (19.0%) | | | RYO tobacco (30.4%) | | |
	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value
Tobacco tax increase rate (%)	Overall effect for tobacco tax increase rate: $\chi^2(9) = 187.43$; $p < 0.0001$								
0	Ref			Ref			Ref		
1	0.92	0.76 to 1.12	0.401	1.58	1.25 to 2.00	< 0.001	1.36	1.15 to 1.61	< 0.001
2	0.83	0.64 to 1.08	0.160	4.17	3.13 to 5.54	< 0.001	2.24	1.75 to 2.86	< 0.001
5	0.81	0.47 to 1.38	0.434	5.39	3.36 to 8.67	< 0.001	3.60	2.32 to 5.58	< 0.001
Brand loyalty									
No	Ref			Ref			Ref		
Yes	1.00	0.65 to 1.55	0.988	0.64	0.41 to 1.01	0.053	0.62	0.41 to 0.92	0.017
Product loyalty									
No	Ref			Ref			Ref		
Yes	0.95	0.70 to 1.30	0.762	0.94	0.67 to 1.32	0.731	0.81	0.60 to 1.10	0.173
Recruitment type									
Replenish	Ref			Ref			Ref		
Recontact	0.87	0.70 to 1.08	0.210	1.05	0.83 to 1.33	0.707	1.38	1.11 to 1.72	0.004
Survey mode									
Telephone	Ref			Ref			Ref		
Online	0.91	0.80 to 1.03	0.145	1.04	0.91 to 1.19	0.592	0.81	0.71 to 0.92	0.001

Ref, reference; RRR, relative risk ratio.
Notes
Tobacco tax increase rates are presented as per cent above inflation.
RRRs are for the fully adjusted model.

TABLE 17 International Tobacco Control Policy Evaluation Project data study 4 (analysis 4b): fully adjusted clustered, multinomial logistic regression of tobacco purchase changes (trading up/staying the same is reference, with 72.0% achieving this outcome) on individual-level predictors (tax increase rates, brand and product loyalty) ($n = 854$, observations = 1397)

Individual-level predictors	Trade down to FM cigarettes (13.5%)			Switch to RYO tobacco (6.2%)			Stop purchasing[a] (8.3%)		
	RRR	95% CI	p-value	RRR	95% CI	p-value	RRR	95% CI	p-value
Tobacco tax increase rate (%)	Overall effect for tobacco tax increase rate: $\chi^2(6) = 40.36$; $p < 0.0001$								
1	Ref			Ref			Ref		
2	1.15	0.78 to 1.71	0.481	1.48	0.84 to 2.61	0.179	1.42	0.88 to 2.30	0.151
5	4.13	2.33 to 7.35	< 0.001	5.87	2.66 to 12.98	< 0.001	2.89	1.38 to 6.01	0.005
Brand loyalty									
No	Ref			Ref			Ref		
Yes	0.96	0.47 to 1.96	0.915	0.99	0.36 to 2.71	0.983	1.15	0.43 to 3.06	0.782
Recruitment type									
Replenish	Ref			Ref			Ref		
Recontact	**1.58**	1.00 to 2.51	0.052	1.00	0.55 to 1.83	0.991	0.96	0.58 to 1.56	0.857
Survey mode									
Telephone	Ref			Ref			Ref		
Online	0.88	0.71 to 1.09	0.247	0.76	0.55 to 1.03	0.077	0.90	0.70 to 1.17	0.443

Ref, reference; RRR, relative risk ratio.
a Not purchasing because currently (at time of outcome survey) had quit for at least 6 months.
Notes
Values in bold are significant.
Tobacco tax increase rates are presented as per cent above inflation.
RRRs are for the fully adjusted model.
All predictors are measured at baseline, except for tobacco tax rates, which were measured at the outcome survey.
Participants smoking RYO tobacco at baseline were excluded. Participants who were currently quit at outcome but for under 6 months are excluded.

There was evidence of down-trading in both the ITC and Nielsen data: exclusive RYO tobacco use significantly increased, whereas exclusive FM cigarette use significantly decreased and around one in six smokers smoked both FM cigarettes and RYO tobacco. Furthermore, the market share of FM and RYO product segments varied considerably over the study period. FM mid-price cigarettes and RYO premium tobacco were the most popular of each product type at the outset, but at the end FM value cigarettes and RYO mid-price tobacco were most common.

The ITC data from 2008 to 2014 indicated that cheap (non-premium FM cigarettes and RYO tobacco) were used by > 70% of smokers and consistent with the Nielsen data, there were some changes in the different types of cheap tobacco products over time, which seemed to be related to tobacco tax increases. Despite the tax rises that took place over this period, smokers were more likely to continue to purchase the same product or down-trade to a cheaper product than they were to stop purchasing tobacco products.

Chapter 7 The impact of tobacco tax increases, as moderated by tobacco industry pricing, on smoking behaviour via quitting and reducing tobacco consumption

Introduction

In *Chapter 4* we showed how TI pricing strategies, tobacco taxes and the recession reduced the affordability of tobacco. In *Chapter 6* we showed how this reduced affordability led to changes in smokers' purchase patterns, with many tobacco smokers trading down to cheaper products, such as subvalue FM cigarettes and RYO tobacco, particularly cheap RYO tobacco. These cheap products were still available in a high-tax environment through the introduction of cheaper brand variants by the TI, smaller packs and price-marked packs (see *Chapters 4* and *6*). In this chapter, using the ITC data, we consider smoking behaviours (quitting and smoking smaller RYO cigarettes). Although quitting leads to health gains, smoking fewer or smaller cigarettes does not necessarily do so. This is because smokers can smoke their smaller cigarettes more intensively, thus being exposed to similar levels of carcinogens. In addition, much of the negative health impact, particularly the cardiovascular impacts, occur at low doses of exposure.[226] For unequivocal health gains smoking cessation is required.

ITC data study 5: impact of tobacco pricing changes on quitting behaviours (longitudinal analyses)

The analyses presented here extend those presented in *Chapter 6* (ITC data study 4). Here, our research question is whether or not smoking different products is associated with quit attempts and 6-month quit success over time.

Methods

Data and analyses

The samples were taken from the same four ITC surveys (surveys 7–10) as the ITC data study 4 described in *Chapter 6*. Analyses were longitudinal, so only participants who remained in the study for at least two consecutive surveys were included. As previously, we included only current (at baseline) at least monthly smokers who had valid data on all variables of interest. Data were aggregated across the three survey pairs and we assessed two quitting outcomes. Analysis 5a focused on quit attempts: whether or not participants reported having made any quit attempts between the baseline and outcome surveys ($n = 1304$ participants providing 2202 observations). Analysis 5b focused on 6-month sustained quitting: whether or not participants had achieved at least 6 months' sustained smoking abstinence at any point between the baseline and outcome surveys, regardless of status at the outcome survey ($n = 1194$ participants providing 2017 observations). As with analysis 4b of ITC data study 4, participants who had quit at the time of the outcome survey but for < 6 months (8.4% of potentially valid observations) were excluded, as it could not be determined if this quit attempt eventually lasted for at least 6 months.

Both analyses had binary outcomes and used logistic regression, with odds ratios (ORs) reported. The regressions clustered survey pairs within individuals. Models were checked for variable multicollinearity and fully adjusted results are reported.

Measures

Independent variables were the same as in *Chapter 6*: tobacco tax increase rate, product choice at baseline (premium FM cigarettes, mid-price FM cigarettes, value FM cigarettes or RYO tobacco), brand and product

loyalty, tobacco dependence (HSI), frequency of cheap purchases, sociodemographic variables (sex, age, education, income, region of residence, relationship status and ethnicity) and sample design variables (see *Chapter 2* for more details). Characteristics were measured at baseline, with the exception of the tobacco tax increase rate, which was measured at outcome. Results pertaining to frequency of cheap purchases are discussed in *Chapter 8*, and to tobacco dependence and sociodemographics in *Chapter 9*.

Results

In analysis 5a (*Table 18*), a quit attempt was made by 39.4% of smokers. Overall, baseline tobacco product type significantly predicted making a quit attempt. However, those using cheaper tobacco (mid-price FM cigarettes, value FM cigarettes or RYO tobacco) did not significantly differ from users of premium FM

TABLE 18 International Tobacco Control Policy Evaluation Project data study 5: fully adjusted clustered logistic regression of making a quit attempt and achieving at least 6 months' sustained abstinence

	Analysis					
	5a: making a quit attempt ($n = 1304$, observations = 2202)			5b: achieving at least 6 months' quit ($n = 1194$, observations = 2017)		
Predictors	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Tobacco product type	$\chi^2(3) = 7.95$; $p < 0.05$			$\chi^2(3) = 8.78$; $p < 0.05$		
Premium FM cigarettes	Ref			Ref		
Mid-price FM cigarettes	1.28	0.90 to 1.82	0.167	**2.31**	1.17 to 4.55	0.016
Value FM cigarettes	1.31	0.89 to 1.94	0.174	**2.81**	1.35 to 5.88	0.006
RYO tobacco	0.83	0.59 to 1.18	0.308	**2.22**	1.15 to 4.29	0.018
Tobacco tax increase rate (%)	$\chi^2(2) = 7.79$; $p < 0.05$			$\chi^2(2) = 6.29$; $p < 0.05$		
1	Ref			Ref		
2	**1.47**	1.11 to 1.93	0.006	**1.96**	1.07 to 3.62	0.030
5	1.45	0.93 to 2.26	0.100	**2.66**	1.16 to 6.08	0.020
Brand loyalty						
No	Ref			Ref		
Yes	0.66	0.40 to 1.09	0.108	0.89	0.38 to 2.07	0.784
Product loyalty						
No	Ref			Ref		
Yes	1.46	0.98 to 2.17	0.062	1.08	0.54 to 2.18	0.824
Recruitment type						
Replenish	Ref			Ref		
Recontact	0.89	0.67 to 1.20	0.462	1.35	0.75 to 2.42	0.3112
Survey mode						
Telephone	Ref			Ref		
Online	1.01	0.86 to 1.18	0.932	0.92	0.72 to 1.20	0.552

Ref, reference.
Notes
In analysis 5a, 39.4% made a quit attempt and, in analysis 5b, 9.7% achieved sustained abstinence for at least 6 months, between baseline and outcome surveys.
Tobacco tax increase rates are presented as per cent above inflation.
ORs are for the fully adjusted model.
Chi-squared statistics are for overall effects of any variables with three or more categories.
All predictors are measured at baseline, except for tobacco tax rates, which are measured at the outcome survey.
Achieving at least 6 months' quit is defined as achieving at least 6 months' sustained abstinence between the baseline and outcome surveys, regardless of status at the outcome survey. Participants currently quit for < 6 months at the outcome survey were excluded from analysis 5b.
Values in bold are significant.

cigarettes in their likelihood of trying to quit. To help understand the overall significant finding better, when RYO tobacco was used as the reference category, those smoking mid-price FM cigarettes (OR 1.54, 95% CI 1.08 to 2.18) and value FM cigarettes (OR 1.57, 95% CI 1.07 to 2.31) were significantly more likely to try to quit (data not shown). Quit attempts were more likely at the higher tax increase rate of 2% rather than 1% above inflation (OR for 5% was consistent with the 2% tax increase rate, but non-significant). No significant associations were observed between quit attempts and brand or product loyalty.

In analysis 5b, sustaining a quit attempt of at least 6 months was achieved by 9.7% of participants and was significantly more likely among smokers of mid-price FM cigarettes, value FM cigarettes and RYO tobacco, compared with premium FM cigarettes (see *Table 18*). Quitting was more likely the higher the tobacco tax increase rate at the outcome survey. Neither brand nor product loyalty was significantly associated with sustained quitting.

Limitations

As described in *Chapter 6*, only 4.2% of observations across the data set experienced the highest tobacco tax increase rate (of 5%) in February 2013 and, hence, it is possible that this is a seasonal effect only. However, smokers surveyed in February 2013 could have begun their quit attempt any time between July 2010 (if they were interviewed at the beginning of the second survey) and July 2012 in order to have achieved a minimum of 6 months quit by the time they were reinterviewed for the third survey in February 2013; this would mean that there were a number of months over which the March 2012 5% tax increase could have had an impact on the findings (March 2012–July 2012), thus reducing the chances of a seasonal effect being responsible. Our assessment of quitting for at least 6 months meant that those who had quit for < 6 months at the follow-up surveys were excluded. As most smokers relapse soon after quitting, our interest was in those who were able to sustain a quit attempt for a longer period of time.

Implications

Overall, baseline tobacco product type significantly predicted making a quit attempt and the likelihood of achieving at least 6 months' abstinence at follow-up. Those smoking mid-price or value FM cigarettes were more likely to make a quit attempt than those smoking RYO tobacco. Six months' abstinence was significantly more likely among smokers of mid-price FM cigarettes, value FM cigarettes and RYO tobacco than among premium FM cigarette smokers. Quit attempts and success were also more likely during periods of higher tobacco tax increase rates. Whether smokers had a usual brand, were exclusive or were mixed users was also not associated with the quitting outcomes.

ITC data study 6: weight of roll-your-own tobacco cigarettes, analysis over time and international comparison

In this study, we assessed how the weight of RYO tobacco changed among UK users over time and by demographic groups (see *Chapter 9*). We were interested in whether or not the weight of tobacco used in RYO cigarettes reduced as prices increased. We also compared these data with three other countries: Australia, Canada and the USA, which were also included in the ITC four-country study and used similar methodologies, but had different tobacco tax environments. There were some differences in survey timings in the other countries (see *Table S15* in *Report Supplementary Material 2*).

Methods

Data

Data for this study were from surveys 5–10 (2006–15; see *Table 4*), as questions relating to the weight of RYO tobacco were not included in the earlier surveys. Over the four countries, there were 19,277 participants providing 42,238 observations over these six surveys. The study focused only on current exclusive daily RYO tobacco smokers, so 18,048 individuals who provided 38,445 observations were therefore excluded [current quitters or of unknown smoking status (*n* = 5830, observations = 9594);

exclusive FM cigarette smokers ($n = 12,813$, observations = 25,573); those smoking a mixture of FM cigarettes and RYO tobacco, as the RYO tobacco questions needed to derive weight were not asked consistently ($n = 2121$, observations = 2919); those who did not report what type of tobacco they smoked ($n = 192$, observations = 202); and non-daily smokers ($n = 114$, observations = 157)]. Of the remaining 1924 individuals (providing 3793 observations), we excluded a further 410 observations for missing information (86 observations for incomplete data on other variables of interest and 121 observations for likely misreporting of RYO tobacco weights). For the latter, we used the criteria reported by Gallus and colleagues,[234] by excluding anyone with a weight per cigarette of < 0.1 g or > 3.0 g. The final sample therefore consisted of 1639 individuals who provided 3176 observations over the six surveys (averaging 1.9 observations per participant). Characteristics for this sample are displayed in *Table 19*.

Sociodemographic measures
Across all countries, age was grouped into 18–39 years (18–24 year olds comprised only 2.9% of observations), 40–54 years and ≥ 55 years. There were some measurement differences for Australia, Canada and the USA, compared with the UK. In Australia, the ethnicity measure gauged whether participants spoke only English at home or English as a secondary language. Education was stratified slightly differently in each country due to differing education systems, but broadly corresponded to low (high school or lower), moderate (trade school, technical or community college or some university but no degree) and high (completed university). Income was based on annual household income before tax and stratified as low [< US$30,000 (Canada, USA and Australia) or < £15,000 (UK)], moderate [US$30,000–59,000 (Canada, USA and Australia) or £15,000–40,000 (UK)] or high [≥ US$60,000 (Canada, USA and Australia) or ≥ £40,001 (UK)]. Participants who did not disclose their income (around 8.5% of the sample) were retained as a separate valid category.

Weight of tobacco
We calculated the weight of tobacco per cigarette as described in *Chapter 2*, based on participants' last reported tobacco purchase.

Analyses
Each observation was allocated to the calendar year of the survey (see *Table S15* in *Report Supplementary Material 2*) and time was treated as a continuous variable in the analyses. TTFC was used as the indicator of nicotine dependence and treated as a continuous variable (CPD and HSI were used to calculate tobacco weights so could not be used).

There were too few observations for Canada and the USA (see *Table 19*) to enable reliable statistical analyses of trends. To compare the weight per cigarette across countries, we therefore pooled the data across all survey waves. A clustered linear regression analysis was carried out, with weight as outcome and country as predictor. We controlled for TTFC and the sociodemographic measures, and used maximum likelihood estimation with a robust variance estimator.

To assess changes in weight of RYO tobacco over time, and the effects of sociodemographic differences, only the UK and Australia ($n = 1349$, observations = 2705) were included. We conducted multilevel linear regression analyses clustered over individuals, with maximum likelihood estimation and robust variance estimators. The outcome variable was weight of tobacco per cigarette and the predictor variables were time (calendar year), country (UK vs. Australia), TTFC and the sociodemographic variables. We first examined the unadjusted univariate effects of each predictor variable and then looked at the fully adjusted multivariate effects in which all predictors were included simultaneously. We report the sociodemographic findings in *Chapter 9*.

Results
Sample characteristics are presented in *Table 19*. A missing data comparison between the 1924 individuals suitable for the RYO tobacco weight study and the final sample of 1639 individuals indicated that the final sample featured participants who were significantly more likely to be from Australia or the UK, be male,

TABLE 19 International Tobacco Control Policy Evaluation Project data study 6: sample characteristics by country

| Characteristic | Total | Country | | | |
		UK	Australia	Canada	USA
Total sample size, *n*					
Individuals	1639	821	498	168	122
Observations	3176	1770	935	296	175
Observations by year, *n*					
2006	456	233	132	75	16
2007	702	412	197	70	23
2008	463	271	128	41	23
2009	171	104	26	29	12
2010	414	252	103	39	20
2011	42	0	25	4	13
2012	0	0	0	0	0
2013	461	252	167	21	21
2014	424	246	157	17	4
2015	43	0	0	0	43
Weight per cigarette (g), mean (SD)	0.57 (0.37)	0.51 (0.32)	0.53 (0.28)	0.76 (0.45)	1.07 (0.51)
Dependence (TTFC) in minutes, mean (SD)	46 (92)	47 (91)	48 (96)	44 (103)	32 (50)
CPD, mean (SD)	17.7 (9.7)	16.9 (9.4)	18.1 (10.0)	20.4 (9.7)	19.1 (10.1)
Sex, %					
Female	38.1	38.9	35.4	38.9	42.9
Male	61.9	61.1	64.6	61.2	57.1
Age group (years), %					
18–39	20.9	22.5	19.3	17.2	20.0
40–54	41.6	39.9	46.4	38.2	37.7
≥ 55	37.5	37.5	34.3	44.6	42.3
Ethnicity, %					
White, English speaking	95.4	97.9	93.3	89.1	91.2
Not white/non-English speaking	4.6	2.2	6.7	10.9	8.8
Education, %					
Low	58.0	58.6	57.5	57.8	53.7
Moderate	26.9	25.8	27.5	26.7	34.3
High	15.2	15.5	15.0	15.5	12.0
Income, %					
Low	38.4	35.9	38.2	47.3	49.1
Moderate	32.5	33.6	30.0	31.8	36.0
High	20.7	20.1	25.7	16.5	12.6
Not disclosed	8.5	10.5	6.2	7.4	2.3

Note
Percentages are percentage of observations, not individuals.

younger, with a high income, and to be white with an English-speaking background and likely to have higher nicotine dependence (shorter TTFC). These variables were controlled for in the statistical analysis. No significant differences between the samples were found on education level (see *Table S16* in *Report Supplementary Material 2*).

Just over one-quarter (25.8%) of UK smokers from 2006 to 2015 (six ITC surveys) used RYO tobacco exclusively; this proportion was 3.5% in the USA, 6.0% in Canada and 13.8% in Australia. Pooled data across the survey period indicated that the mean weight of tobacco per RYO cigarette was lowest in the UK (mean 0.51 g, SD 0.32 g) and Australia (mean 0.53 g, SD 0.28 g), intermediate in Canada (mean 0.76 g, SD 0.45) and highest in the USA (mean 1.07 g, SD 0.51). All pairwise country differences (clustered linear regression results adjusted for TTFC and SES) were statistically significant, except for the UK and Australia, as the weight of tobacco per RYO cigarette was comparable (see *Table S17* in *Report Supplementary Material 2*).

For the UK and Australia, there was a statistically significant decrease of approximately 0.01 g per RYO cigarette per year using clustered linear regression analysis of tobacco weights over time [$\beta = -0.011$ (SE 0.0021); $p < 0.001$ for the unadjusted model]. This is roughly equivalent to a 2% decrease of the average weight per cigarette per year and persisted even after adjusting for TTFC and SES [$\beta = -0.014$ (SE 0.0021); $p < 0.001$]. As may be seen in *Figure 15*, in the UK, the mean tobacco weight per cigarette decreased from 0.59 g (SD 0.42 g) in 2006 to 0.46 g (SD 0.25 g) in 2014. In Australia, the comparable change was 0.59 g (SD 0.29 g) to 0.48 g (SD 0.26 g). The differences in weights between the two countries was not statistically significant [$\beta = -0.026$ (SE 0.014); $p = 0.057$ for the fully adjusted model].

Limitations

International Tobacco Control Policy Evaluation Project (ITC) data are self-reported and did not directly report on the weight of tobacco used in hand-rolled cigarettes, so that had to be calculated using several other points of information. The resulting estimates could not be verified by independently ascertaining the weight through a direct measurement process. It is possible that some participants might have shared their pouches, although sharing between individuals might balance out over time, thus mitigating any biasing effect.
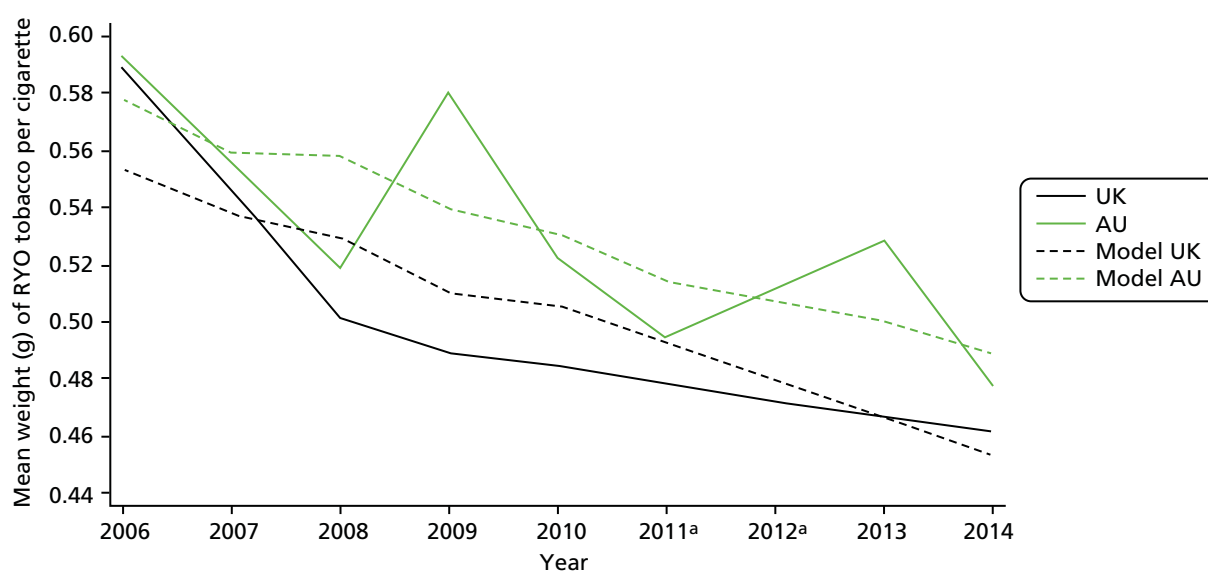
FIGURE 15 International Tobacco Control Policy Evaluation Project data study 6: changes in the mean weight of tobacco (in grams) per RYO cigarette over time for the UK and Australia (AU). Also shown are the model-predicted values from a fully adjusted clustered linear regression, controlling for TTFC, sex, age, ethnicity, level of education and income. a, No data were collected from the UK in 2011 or from Australia in 2012. Sample sizes from Australia for 2009 and 2011 were low ($n = 26$ and $n = 25$, respectively, see text and *Table 19* for more details).

Although the ITC data set is larger than any other data set previously used to investigate the weight of tobacco in hand-rolled cigarettes, there were still not enough observations to consider how the weight of tobacco changed over time in Canada and the USA. This analysis was also limited because ITC survey waves did not cover all countries on a yearly basis.

Implications

UK smokers reduced the weight of RYO tobacco over time, by about 2% per year. This will have offset, to some extent, the annual tax increases designed to make tobacco less affordable. Smokers in higher tax/tobacco price countries, such as the UK and Australia, used less tobacco per RYO cigarette than those in the USA and Canada, where taxes and prices were generally lower. This suggests, again, that the weight of tobacco is linked to price changes. Although the number of RYO cigarettes smoked per day was similar across the four countries, the UK had the lowest at 16.9 cigarettes and Canada had the highest at 20.4 cigarettes, suggesting that smokers in high tobacco price countries also smoke fewer cigarettes.

Any reduction in the weight of tobacco used in RYO cigarettes is unlikely to benefit the health of smokers, as evidence to date indicates that thinner cigarettes do very similar damage to fatter ones.[235–239]

Applying the most recent weight of RYO tobacco in the UK we observed here (0.46 g per cigarette), would mean about 2174 cigarettes per kilogram of RYO tobacco. Using 2017 taxation rates, this means that on a per cigarette basis, a tax of £0.28 per FM cigarette would apply, compared with just £0.10 per RYO cigarette, just over one-third of the level.

Summary

In this chapter, we illustrated that smoking behaviour is changing: smokers are engaging in quit attempts and RYO tobacco smokers are reducing consumption by reducing the weight of tobacco in their cigarettes over time. In the longitudinal analyses, between survey waves, over one-third of smokers made quit attempts and around 1 in 10 were managing 6 months' abstinence. These quitting behaviours were less likely among premium smokers, which may reflect the numerous options available to them to reduce price without quitting. This supports the idea that quitting is more likely among those with few options available to reduce costs. In *Chapter 8* we will examine how purchasing potentially illicit products affects these behaviours. Both quit attempts and quit success were associated with times of higher tax increases.

The decline in affordability, shown in *Chapter 5*, appears to have prompted a change in smokers' behaviour. However, this behaviour change was not necessarily quitting smoking; smokers also reduced tobacco consumption and, as we saw in *Chapter 6*, began to purchase cheaper products. These last two changes make smoking more affordable and would offset, to some extent, any annual tax increases designed to make tobacco less affordable. Changing to a cheaper product will not reduce the harm from smoking and even reducing consumption does not necessarily translate into meaningful health gains.

Chapter 8 Purchasing tobacco products that are likely to constitute tax avoidance or evasion

Introduction

It is difficult to assess the extent of tobacco purchases through illicit channels, similar to measuring other illicit behaviours. Research participants might give socially desirable responses or be unaware that they are purchasing illicit tobacco. Duty-free or overseas purchases are easier to ascertain. In this chapter, we explore those purchase sources classified as non-UK/non-store purchases (see *Chapter 2*), to gain an insight into the pricing of products that are likely to have been obtained via tax avoidance or evasion. These non-UK/non-store sources were broken down into purchases from friends/relatives or informal sellers (likely to be tax evasion), purchases from overseas and duty-free sources (likely to be tax avoidance) and 'other' sources, such as the internet (see *Figure 1*). We will also explore the frequency of cheap (probably illicit) purchases using the more direct measure that was available.

ITC data studies 1 and 3: tobacco obtained via tax avoidance or evasion – smokers' purchasing patterns, sources and prices paid

In *Chapter 6* (see *Table 13*), using ITC data from 2002 to 2014 we noted that the most common ($\geq 80\%$) purchase source of tobacco for UK smokers was UK stores, likely to represent legal, fully taxed purchases. We now use the same data set to explore products purchased from non-UK/non-store sources over this time and the prices paid for them.

Methods
First, we assess the proportion of smokers purchasing from non-UK/non-store sources and, of these, which sources were the most common over the study period [see *ITC data study 3: smokers' tobacco purchasing behaviours by product and store type (licit purchases)*, *Methods* and *Limitations* in *Chapter 6*]. Then we compare the price of products purchased through these sources with the prices of products purchased through UK store-based sources (see *ITC data study 1: prices paid for tobacco by smokers over time*, *Methods* and *Limitations* in *Chapter 4*). Sample characteristics are shown in *Table 7*.

Results

Non-UK/non-store purchase sources (ITC study 3)
Overall, non-UK/non-store purchases constituted $\leq 20\%$ of purchases from 2002 to 2014 and reduced significantly over time (*Table 20*). This is consistent with the concomitant significant increase in purchases from UK store-based sources observed in our GEE analysis when an exchangeable correlation matrix was specified (see *Chapter 6*). Despite the better model fit of an exchangeable correlation matrix indicated by the data-driven QIC statistic, we felt that, as discussed in *Chapter 2*, on theoretical grounds an unstructured correlation matrix was more appropriate for our data. However, our GEE analysis specifying an unstructured correlation matrix did not indicate a concomitant significant increase in UK store-based purchases. Assuming that this is indeed a true effect, it is probably accounted for by the proportion of participants with missing data on purchase source. It is likely that these participants were purchasing from non-UK/non-store sources, as those having missing data on price showed a pattern of missing data consistent with using cheap tobacco. If the missing data category was assumed to be non-UK/non-store, the decreasing trend in non-UK/non-store sources was no longer statistically significant (data not shown). Debates about correlation structures notwithstanding, and however the missing data are treated, there was no indication from these data that the proportion of smokers purchasing tobacco from non-UK/non-store sources was increasing over the study period.

TABLE 20 International Tobacco Control Policy Evaluation Project data study 3: source of last purchase and product last purchased (weighted data), with tests for linear trends over time

Product purchased and source	ITC UK survey number (year)										Beta (95% CI)[a] for time trends
	1 (2002)	2 (2003)	3 (2004)	4 (2005)	5 (2006)	6 (2007)	7 (2008)	8 (2010)	9 (2013)	10 (2014)	
Source of last purchase, %											
UK store-based sources	83.7	79.9	81.6	81.8	82.4	83.3	81.5	83.2	87.1	83.7	0.019 (–0.002 to 0.041)
Non-UK/non-store sources	15.9	19.6	18.3	18.1	17.4	16.1	17.9	16.5	11.5	14.3	–0.025** (–0.041 to –0.009)
Outside the UK	55.6	52.9	53.2	43.5	41.1	57.6	28.8	33.6	37.7	39.5	–0.077*** (–0.11 to –0.048)
Duty free	25.8	27.6	27.8	34.7	34.1	21.8	36.8	35.1	32.4	36.3	0.044** (0.015 to 0.072)
Informal sellers	16.1	16.4	7.2	6.6	5.9	5.8	13.9	7.8	11.5	6.4	–0.081** (–0.14 to –0.027)
Friends/relatives	2.2	0.4	9.8	13.9	15.2	14.2	19.3	23.6	11.5	13.4	0.12*** (0.086 to 0.14)
Non-UK/non-store other[b]	0.2	2.7	2.0	1.3	3.7	0.6	1.2	0.0	6.9	4.4	N/A
Other[c] sources (%)	0.4	0.5	0.1	0.2	0.2	0.6	0.6	0.3	1.4	2.0	N/A
Product last purchased, %											
FM-P	59.4	58.0	58.3	57.1	52.4	47.6	51.6	45.2	49.0	45.9	–0.034*** (–0.044 to –0.023)
Non-UK/non-store	2.6	2.7	2.5	2.6	0.8	0.8	1.1	1.1	2.7	1.1	N/A
FM-C	21.4	20.5	20.2	19.6	17.8	18.4	17.1	16.7	15.2	16.9	–0.039*** (–0.04 to –0.025)
Non-UK/non-store	44.1	54.9	50.2	45.5	45.7	49.8	42.1	37.3	27.4	44.3	–0.032** (–0.054 to –0.009)
RYO tobacco	17.3	19.0	20.7	22.5	29.5	30.0	30.5	32.2	33.2	35.0	0.066*** (0.053 to 0.080)
Non-UK/non-store	27.9	34.5	31.3	34.0	30.0	21.7	33.3	25.8	16.8	17.6	–0.048** (–0.06 to –0.019)

**p < 0.01; ***p < .0001.
a   Tests for trend were not conducted (N/A) when floor or ceiling effects were apparent.
b   'Non-UK/non-store other' category includes military commissaries, toll-free numbers, internet purchases and refusals to answer.
c   Other sources include missing responses or responses that could not be clearly classified as UK store or non-UK/non-store sources.
Notes
Shaded figures were also presented in *Chapter 6*.
Percentages in the subcategories are those within each super-category.

Among non-UK/non-store purchases, purchasing outside the UK was most common (≥ 40% for most waves), although purchasing from this source decreased significantly over time, with the largest decline occurring between 2007 and 2008. Purchasing from duty-free sources was the next most common source of non-UK/non-store purchases, and this and purchasing from friends or relatives significantly increased over time. Purchasing from informal sellers decreased significantly over time and constituted ≤ 17% of all the non-UK/non-store purchases throughout the period of study. Purchasing from online and telephone sources combined constituted < 3% of non-UK/non-store purchases over the study period.

Non-UK/non-store purchase prices (ITC study 1)

Overall, the most common purchase bought from non-UK/non-store sources was FM-C (≈10%), followed by RYO tobacco (≈6%); very few were FM-P (< 2%). Given the small proportion of tobacco purchases that were non-UK/non-store FM-P and, hence, limited data to calculate median prices, trend analyses were not conducted. Median prices for FM-P purchased from non-UK/non-store sources were consistently at least £0.02 below that of FM-P from UK store-based sources from 2002 to 2014, although with large fluctuations (*Figure 16*). For FM-C and RYO tobacco purchases, more consistent price estimates could be obtained. Median prices for FM-C increased significantly from £0.11 per stick in 2002 to £0.16 in 2014
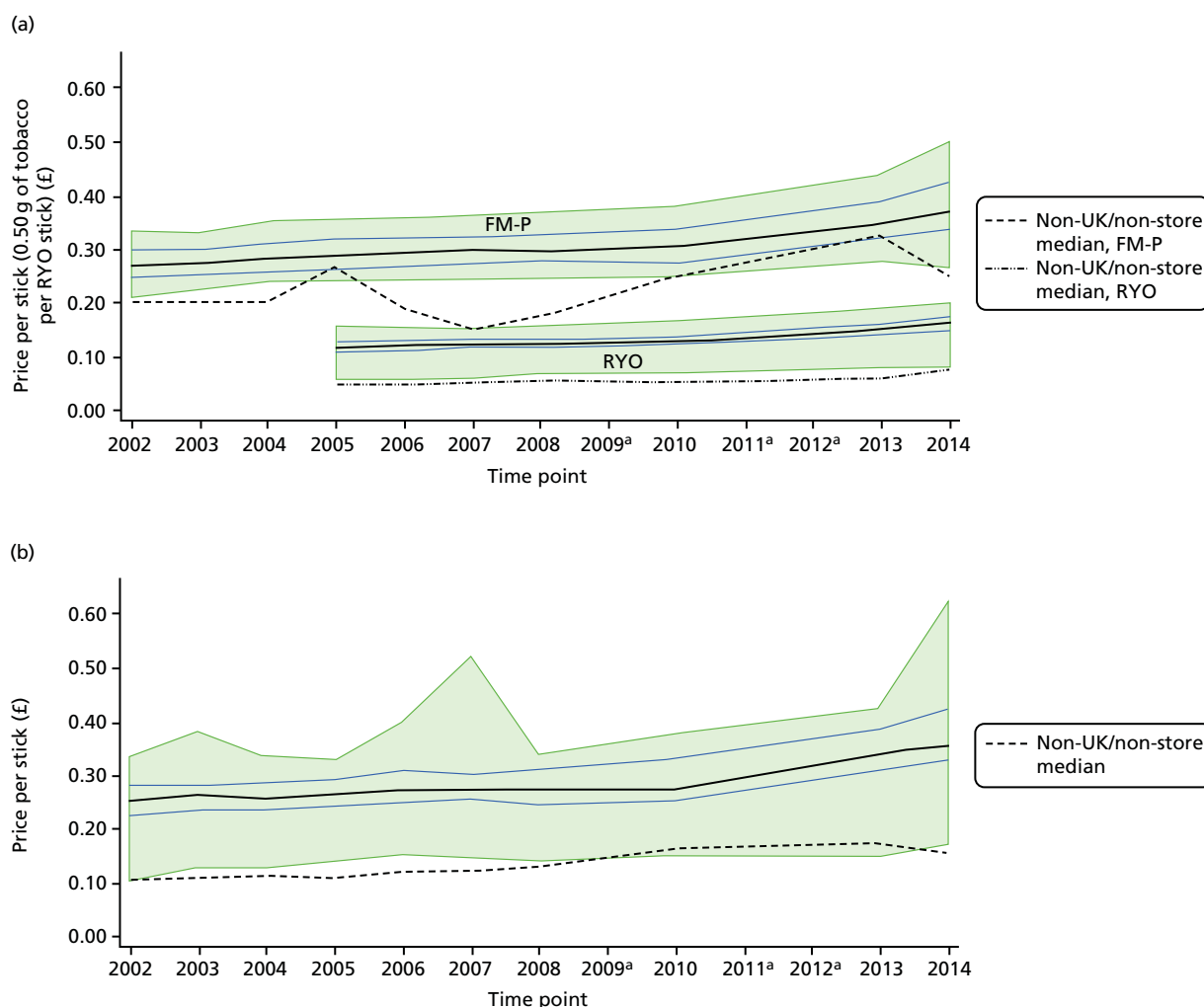
FIGURE 16 International Tobacco Control Policy Evaluation Project data study 1: weighted median prices of different product types purchased from UK store-based and non-UK/non-store-based sources. (a) FM-P and RYO tobacco; and (b) FM-C. Medians for non-UK/non-store sources are superimposed on the UK store-based purchases originally shown in *Figure 6*. For UK store-based sources, black lines represent medians, with shading for 95% ranges (top and bottom 2.5% excluded, blue lines are 25th and 75th percentiles). Dashed lines are medians for non-UK/non-store sources. All prices are adjusted to 2014 values and based on the most recent reported tobacco purchase. a, No data collected for these years.

and were often less than half the price of FM-C from UK store-based sources. Median prices for RYO tobacco purchases from non-UK/non-store significantly increased from £0.05 per stick in 2005 to £0.08 in 2014, considerably cheaper than RYO tobacco from UK store-based sources. For all product types, median prices from non-UK/non-store sources were often cheaper than the cheapest products available from UK store-based sources.

As already discussed, it is difficult to ascertain with any certainty which purchases were truly illicit and which were legal untaxed sources. When we examined the trends in prices from only the sources arguably most likely to represent illicit purchases (i.e. from informal sellers, friends/relatives and non-UK/non-store 'other' responses), median values were comparable to those presented in *Figure 16* from all non-UK/non-store sources combined (see *Figure S7* in *Report Supplementary Material 3*). However, sample sizes were low and these findings should be interpreted with caution.

Implications

Overall, there was no evidence of an increase in the proportion of non-UK/non-store purchases, even when using the most liberal assumptions. The majority of non-UK/non-store purchases appeared to be tax avoidance, constituting duty free (which significantly increased during the study) or sources outside the UK (which significantly decreased, most likely influenced by the UK 'Great Recession' that commenced at the start of 2008). Typically, less than one-quarter of non-UK/non-store purchases and < 5% of all tobacco purchases were from sources likely to constitute tax evasion (e.g. informal sellers or from friends or relatives). Purchasing tobacco from friends or relatives significantly increased from 2002 to 2014, peaking in 2010 at just under one-quarter of all non-UK/non-store purchases. More research is required to understand whether this constitutes a form of tax avoidance and/or evasion, or an effort to pool resources and buy in bulk. Purchases from informal sellers significantly decreased. Purchases from the internet and from toll-free telephone lines together accounted for < 3% of all non-UK/non-store purchases. FM-C and RYO were the products most commonly purchased from non-UK/non-store sources, but purchase of both decreased during the period of study.

These data indicate that UK strategies aimed at reducing illicit tobacco supplies and use[77,84,85] appear to have been successful and hence we found no evidence to support TI arguments that illicit tobacco usage has been increasing. The price analysis presented in *Chapter 4* supports the theory that smokers have little need to turn to illicit products to obtain cheap tobacco, because large price differences exist between different types of products purchased legally (from UK store-based sources). Thus, although the median prices for all product types (FM-P, FM-C and RYO tobacco) purchased from non-UK/non-store sources were typically lower than the cheapest products from UK store-based sources, all three product types could be purchased legally in 2014 below their median prices in 2002.

ITC data study 2: changes in tobacco affordability over time among smokers (purchases from non-UK/non-store sources)

In *Chapter 5* (ITC data study 2), we analysed changes in the affordability of cigarettes for exclusive daily FM cigarette (from 2002 to 2014) and RYO tobacco (from 2006 to 2014) smokers, focusing on UK store-based sources. The impact of buying tobacco from non-UK/non-store sources on affordability (our new measure) is discussed here.

Methods

This study uses the same sample, methods and limitations as described in *Chapter 5*, and sample characteristics are shown in *Table 11*. In brief, our new measure of tobacco affordability was regressed onto purchase sources, separately for FM cigarette and RYO tobacco smokers. The fully adjusted model controlled for time (tobacco tax year), sex, age, region of residence, ethnicity, education and TTFC (see *Chapters 2* and *5* for more details).

Results

Sixteen per cent of smokers included in this sample purchased from non-UK/non-store sources. RYO tobacco smokers were more likely to purchase tobacco from non-UK/non-store sources (28.1%) than FM cigarette smokers (13.9%) (see *Table 11*). FM cigarettes were significantly more affordable from non-UK/non-store sources [$\beta = 4.15$ (SE 0.25); $p < 0.001$ for the unadjusted and $\beta = 4.10$ (SE 0.25); $p < 0.001$ for the fully adjusted model]. Similarly, RYO tobacco was also significantly more affordable from non-UK/non-store sources, although the effect was not as strong [$\beta = 2.50$ (SE 0.31); $p < 0.001$ for the unadjusted and $\beta = 2.35$ (SE 0.30); $p < 0.001$ for the fully adjusted model].

Purchasing FM cigarettes from non-UK/non-store sources rather than UK stores conferred a saving of around 5% of smokers' annual incomes (*Figure 17*), which was approximately £1300 in 2014. A similar saving was observed from purchasing RYO cigarettes from non-UK/non-store sources rather than UK stores.
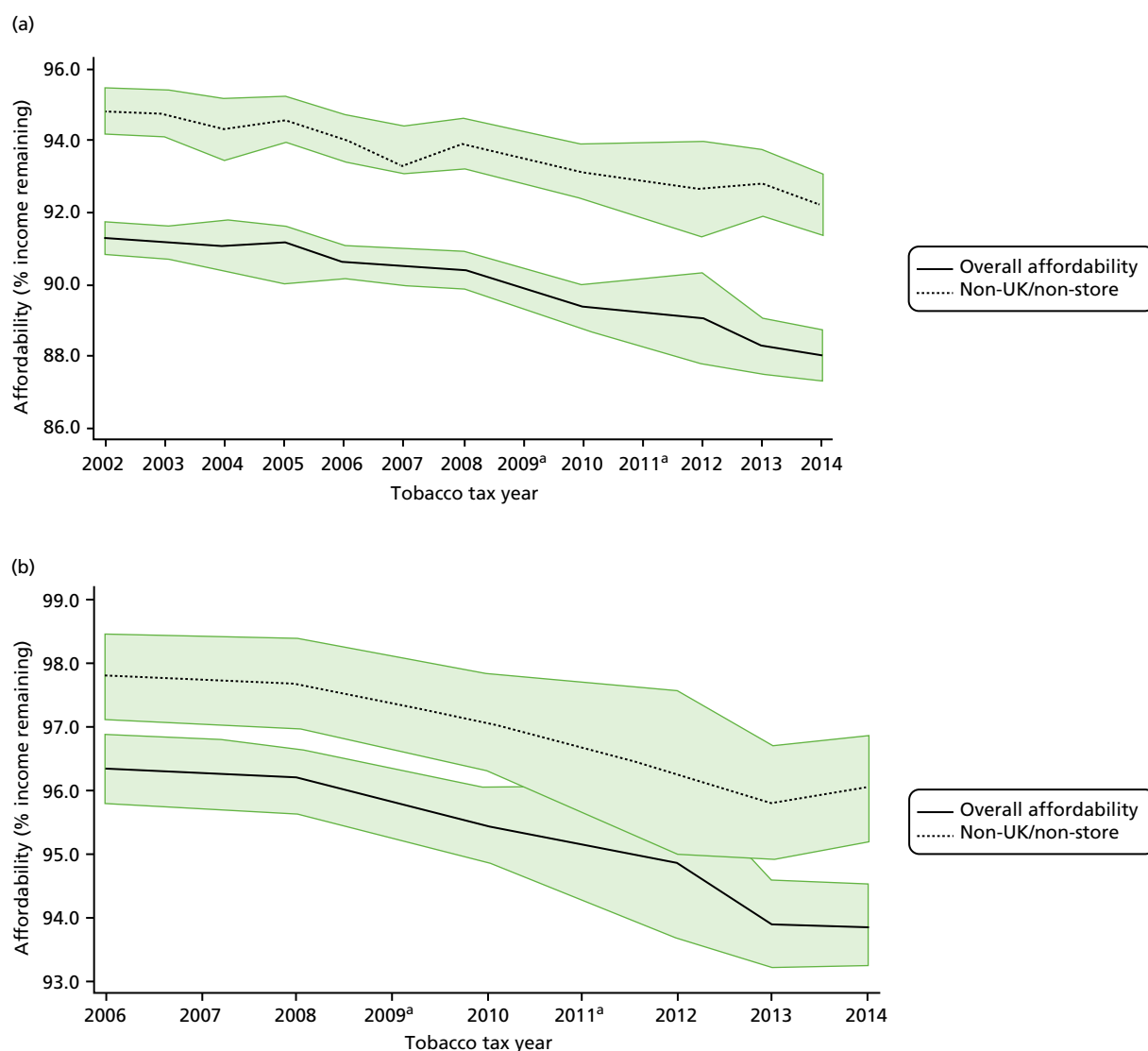
FIGURE 17 International Tobacco Control Policy Evaluation Project study 2: individualised tobacco affordability over time for (a) FM cigarette smokers; and (b) RYO tobacco smokers, for purchases made from all sources and separately for non-UK/non-store sources only. Affordability estimates are from the fully adjusted model 2 (see *Chapter 5*), controlling for all covariates. a, No ITC data collected for this year.

Implications

As expected from the lower prices, non-UK/non-store-based sources of tobacco were more affordable than those purchased from UK store-based sources. This means that smokers can manage the affordability of their tobacco through purchasing from non-UK/non-store sources. This study did not differentiate the different price segments of products purchased through UK store-based sources, so it is not possible to compare the differences between the affordability of using cheaper legal tobacco products and using products potentially purchased to avoid or evade tax.

ITC data study 4: how does purchasing illicit tobacco influence products purchased (cross-sectional and longitudinal analyses)?

In this study, we explore the impact of frequency of illicit purchases on product choices.

Methods

Data and analyses

This study employs the same sample and analyses as described in *Chapter 6*, from four ITC surveys conducted between 2008 and 2014. As we were not looking at price, we were able to use the frequency of cheap purchases measure (see *Chapter 2*) as a more direct indicator of illicit tobacco use. Frequency of cheap purchases was dichotomised as low versus high. More detailed methodology and limitations are provided in *Chapter 6*, and basic sample descriptives are presented in *Table 15*.

Briefly, we report here the results of analyses 4a and 4b of ITC data study 4 (see *Chapter 6*), pertaining only to the associations with frequency of cheap purchases. Analysis 4a (cross-sectional clustered multinomial logistic regression, aggregated over four surveys, with 2148 participants providing 4339 observations) examined product choice (premium FM cigarettes, mid-price FM cigarettes, value FM cigarettes or RYO tobacco). Analysis 4b (longitudinal, clustered, multinomial, logistic regression, aggregated over three survey pairs, with 854 participants providing 1397 observations) examined changes in smoking behaviour (FM cigarettes trading up/no change, FM cigarettes trading down, switching to RYO tobacco or stopping purchasing) among only exclusive smokers of FM cigarettes at baseline. All regression analyses controlled for tobacco tax increase rates, HSI, brand loyalty, sex, age, education, income, region of residence, relationship status, ethnicity and survey design variables. Analysis 4a additionally controlled for product loyalty, which was not applicable for analysis 4b, which included only exclusive FM smokers at baseline. Results pertaining to sociodemographics and dependence will be discussed in *Chapter 9*.

Results

Analysis 4a: product type

Overall, 7.6% of our sample reported frequently purchasing from illicit sources. This figure was 8.4% among users of premium FM cigarettes, 3.6% for mid-price FM cigarettes, 3.6% for value FM cigarettes and 12.7% for RYO tobacco.

Smokers who reported a high frequency of illicit purchases were significantly less likely than those with a low frequency to use mid-price FM cigarettes [relative risk ratio (RRR) 0.45, 95% CI 0.29 to 0.67; $p < 0.001$] or value FM cigarettes (RRR 0.70, 95% CI 0.35 to 0.93; $p = 0.023$), and significantly more likely to use RYO tobacco (RRR 1.68, 95% CI 1.22 to 2.33; $p = 0.002$) than to use premium FM cigarettes (see *Table S18* in *Report Supplementary Material 2* for full results).

Analysis 4b: changes in smoking behaviour

Trading up (5.5%) or not changing (66.5%) between the baseline and outcome surveys was most common (72.0% combined); 13.5% traded down to cheaper FM cigarettes, 6.2% switched from FM cigarettes to

RYO tobacco and 8.3% achieved a current sustained quit attempt of at least 6 months. Frequency of illicit purchases had no significant association with any of these measures, even after controlling for all included covariates (*p*-values for all RRRs > 0.05) (see *Table S19* in *Report Supplementary Material 2* for full results).

Implications

Factory-made cigarette smokers who have easy access to cheaper premium FM products, through sources likely to be illicit, appear to have less incentive to smoke cheaper, non-premium, FM brands. However, this analysis indicated that those who frequently purchased from potentially illicit sources were most likely to buy RYO tobacco. In the longitudinal analysis, the frequency of purchasing illicit products did not affect subsequent purchasing patterns (i.e. trading down, switching or sustained quitting).

ITC study 5: how does purchasing illicit tobacco influence reducing and quitting behaviours (longitudinal analysis)?

In this study, the association between frequent illicit tobacco purchases and quitting behaviours is explored.

Methods

Here we report the results of longitudinal analyses 5a and 5b of ITC data study 5 (see *Chapter 7*), pertaining only to associations with illicit purchases. Analysis 5a (1204 participants providing 2202 observations) examined making quit attempts and analysis 5b (1194 participants providing 2017 observations) examined 6 months' sustained quitting. Both analyses were longitudinal clustered (aggregated over three survey pairs) logistic regressions, controlling for product type (premium FM cigarettes, mid-price FM cigarettes, value FM cigarettes or RYO tobacco), tobacco tax increase rates at outcome, HSI, brand loyalty, product loyalty, sex, age, education, income, region of residence, relationship status, ethnicity and survey design variables. Detailed methodology and limitations are provided in *Chapter 7*.

Results

No significant associations were observed between frequent purchasing from cheap (probably illicit) sources and quit attempts (analysis 5a), or sustained quitting (analysis 5b), with *p*-values for all ORs > 0.05 (see *Table S20* in *Report Supplementary Material 2* for full results).

Implications

Frequent purchasing from sources that were potentially used to avoid or evade tax did not appear to influence subsequent quit attempts or success.

Summary

We found no evidence of increasing engagement with tax avoidance or evasion, even when using the most liberal assumptions, despite TI arguments to the contrary. These data indicate that UK strategies aimed at reducing illicit tobacco supplies and use appear to have been successful.

Most non-UK/non-store purchases appeared to be tax avoidance, constituting duty free (which significantly increased during the study) or sources outside the UK (which significantly decreased). Typically, less than one-quarter of non-UK/non-store purchases and < 5% of all tobacco purchases were from sources likely to constitute tax evasion (e.g. purchases from informal sellers, or from friends or relatives). Purchasing tobacco from friends or relatives significantly increased from 2002 to 2014, peaking in 2010 at just under one-quarter of all non-UK/non-store purchases. More research is required to understand whether this constitutes a form of tax avoidance and/or evasion or an effort to pool resources and buy in bulk.

Purchases from informal sellers significantly decreased. Purchases from the internet and from toll-free telephone lines together accounted for < 3% of all non-UK/non-store purchases. FM-C and RYO tobacco were the products most commonly purchased from non-UK/non-store sources, but both decreased during the period of study.

The most common type of product purchased from non-UK/non-store sources was FM-C followed by RYO tobacco. FM-P purchases were less common and the median price was consistently at least £0.02 below that of FM-P from UK store-based sources during the period of study. For FM-C and RYO tobacco, purchase price increased significantly during the study; however, both were purchased at prices well below those of UK store-based sources, often less than half the price. For all product types, median prices from non-UK/non-store sources were often cheaper than the cheapest products available from UK store-based sources (see *Figure 16*).

As expected from the lower prices, non-UK/non-store based sources of tobacco were more affordable than those purchased from UK store-based sources. This means that smokers can manage the affordability of their tobacco through purchasing from non-UK/non-store sources. Indeed, purchasing FM cigarettes from non-UK/non-store sources, rather than UK store sources, conferred a saving of around 5% of smokers' annual incomes. However, this study did not break down the products purchased through UK store-based sources, so it is not possible to compare the differences to affordability of using cheaper legal tobacco products with using products purchased to avoid or evade tax. The price analysis presented in *Chapter 3* indicated that there was a large price difference between different types of products purchased legally (from UK store-based sources). Thus, although FM-P, FM-C and RYO tobacco purchased from non-UK/non-store sources typically cost less than the cheapest products from UK store-based sources, all three product types could be purchased legally in 2014 below their median prices in 2002 (real prices adjusted to 2014 values).

Finally, there were no significant differences between sustained quitting, trading down or switching to RYO tobacco over time compared with no change/trading up in relation to frequency of illicit purchases. Similarly, there was no significant difference on quit attempts or sustained quitting over time by whether or not participants frequently purchased illicit products.

Chapter 9 Sociodemographic disadvantage, taxes, pricing and smoking behaviour

Introduction

People who are socioeconomically disadvantaged are over-represented among smokers.[240] Tobacco control methods generally reduce smoking least among socioeconomically disadvantaged groups, but tobacco taxes have been shown to be the exception, as these are associated with larger reductions in smoking prevalence and/or consumption in lower than higher SES groups.[20] However, socioeconomically disadvantaged smokers have previously been found to be more likely to smoke cheap tobacco[12] and, hence, the new cheap tobacco products identified in our research may have prevented quitting among disadvantaged smokers. It is also possible that the recession and higher tobacco taxes in recent years may have stimulated more quitting among such smokers. In this chapter, we therefore look at if socioeconomically disadvantaged smokers and other subpopulations of smokers who might be vulnerable to socioeconomic disadvantage, such as ethnic minorities and more dependent smokers, were particularly affected by reductions in affordability, or were more likely to down-trade, reduce consumption or quit.

ITC study 2: changes in tobacco affordability over time (sociodemographics and dependence)

In our individualised affordability analyses, we explored sociodemographic differences in affordability and whether or not affordability was affected by strength of dependence.

Methods

This study uses the same sample and analyses as in ITC data study 2, described in *Chapter 5*, of daily FM cigarette smokers from surveys 1–10 (2002–14) and RYO tobacco smokers from surveys 6–10 (2006–10). We focus on the fully adjusted clustered linear regression analyses (model 2), regressing affordability onto all predictor variables (tobacco tax year, smoking dependence, purchase source and sociodemographic variables) concurrently, to identify any significant independent predictors. Here we report the findings pertaining only to the sociodemographic variables: sex, age (and age squared, to test for non-linear associations with age), ethnicity, region, education and smoking dependence (TTFC). Detailed methodology and limitations are provided in *Chapter 5*.

Results

In the overall sample, FM cigarette and RYO tobacco smokers were broadly comparable in age and education, but differed on other characteristics (see *Table 11*). FM cigarette smokers were less likely to be white (95% vs. 98% RYO tobacco smokers) and male (38% FM vs. 63% RYO tobacco smokers) and there were regional differences (e.g. more RYO tobacco smokers from the South West region). Cigarette consumption was similar (16.7 FM cigarettes vs. 17.0 RYO tobacco), but a higher proportion of RYO tobacco smokers were most addicted (19.8% of RYO tobacco smokers smoked within 5 minutes of waking vs. 15.4% of FM cigarette smokers).

Factory-made cigarettes

In the multilevel linear regression analyses, the following subpopulations were estimated to find smoking FM cigarettes less affordable (*Table 21*): women (vs. men); older smokers (but please note that there were very few under 25s in the sample); socioeconomically disadvantaged smokers, as measured by education and region (smokers living in Scotland, Northern Ireland and the north-east of England, areas which include some of the poorest localities in the UK). Smokers who were more dependent (as assessed by TTFC) also found smoking less affordable. These sociodemographic and smoking dependence patterns were the same even when excluding non-UK/non-store purchases (see *Table S11* in *Report Supplementary Material 2*).

TABLE 21 International Tobacco Control Policy Evaluation Project data study 2: linear random-effects clustered regression analyses of individualised affordability regressed on sociodemographic and other covariates (fully adjusted), separately for FM cigarette and RYO tobacco smokers

Sample characteristics	FM cigarettes ($n = 3420$, observations = 7475)			RYO tobacco ($n = 734$, observations = 1468)		
	β	SE	*p*-value	β	SE	*p*-value
Sex						
Female	Ref			Ref		
Male	**1.93**	0.31	< 0.001	**0.90**	0.39	0.021
Age (continuous)						
Age	**0.23**	0.05	< 0.001	**0.16**	0.08	0.047
Age squared	**−0.0033**	0.00060	< 0.001	**−0.0023**	0.00083	0.006
Region	$\chi^2(11) = 31.12$; $p = 0.0011$			$\chi^2(11) = 18.87$; $p = 0.064$		
London	Ref			Ref		
Yorkshire and The Humber	−0.45	0.64	0.481	−0.84	0.97	0.385
East Midlands	−0.46	0.69	0.505	−0.64	0.88	0.465
Eastern	−0.29	0.64	0.648	0.67	0.83	0.421
North East	**−1.82**	0.81	0.024	−0.77	1.12	0.492
South East	0.19	0.55	0.729	0.41	0.79	0.600
South West	−0.71	0.75	0.322	0.57	0.79	0.473
West Midlands	−0.82	0.65	0.210	−0.82	0.88	0.350
North West	−0.85	0.61	0.163	0.89	0.86	0.300
Wales	−0.33	0.80	0.681	**−1.94**	0.93	0.037
Scotland	**−1.50**	0.61	0.013	0.18	0.92	0.844
Northern Ireland	**−4.09**	0.93	0.000	−0.38	1.32	0.771
Ethnicity						
White	Ref			Ref		
Not white	−0.26	0.68	0.698	−0.08	1.13	0.947
Education	$\chi^2(2) = 95.14$; $p < 0.0001$			$\chi^2(2) = 17.15$; $p = 0.0002$		
Low	Ref			Ref		
Moderate	**1.45**	0.35	< 0.001	**1.49**	0.43	< 0.001
High	**4.23**	0.44	< 0.001	**1.75**	0.54	0.001
TTFC (minutes)	$\chi^2(3) = 116.41$; $p < 0.0001$			$\chi^2(3) = 23.89$; $p < 0.0001$		
> 60	Ref			Ref		
31–60	**−1.25**	0.31	< 0.001	−0.05	0.48	0.913
6–30	**−2.33**	0.31	< 0.001	**−1.10**	0.40	0.019
Within 5	**−3.78**	0.38	< 0.001	**−2.00**	0.53	< 0.001

Ref, reference.
Notes
Analyses are fully adjusted for tobacco tax year, sex, age, age squared, region, ethnicity, education, TTFC and purchase source.
Chi-squared statistics are for overall effects of linear trends (time) and any variables with three or more categories.
Values in bold are significant.

Figure 18 illustrates individualised affordability for FM cigarette smokers, showing female smokers, those with high levels of education and those who are more dependent (i.e. smoke their first cigarette within 5 minutes of waking) compared with overall affordability. It is evident that these demographic and smoking groups are spending relatively more of their income on tobacco.

Roll-your-own tobacco

The same subpopulations were estimated to find RYO tobacco smoking less affordable (see *Table 21* and see also *Table S12* in *Report Supplementary Material 2*), with one exception (Wales was the only area to find RYO tobacco smoking less affordable). Again, Wales has areas of particular socioeconomic disadvantage. However, the overlapping CIs in *Figure 19* illustrate that RYO tobacco is uniformly cheap and, as yet, there is not as much differentiation by sociodemographic and dependence factors, compared with FM cigarette smokers.
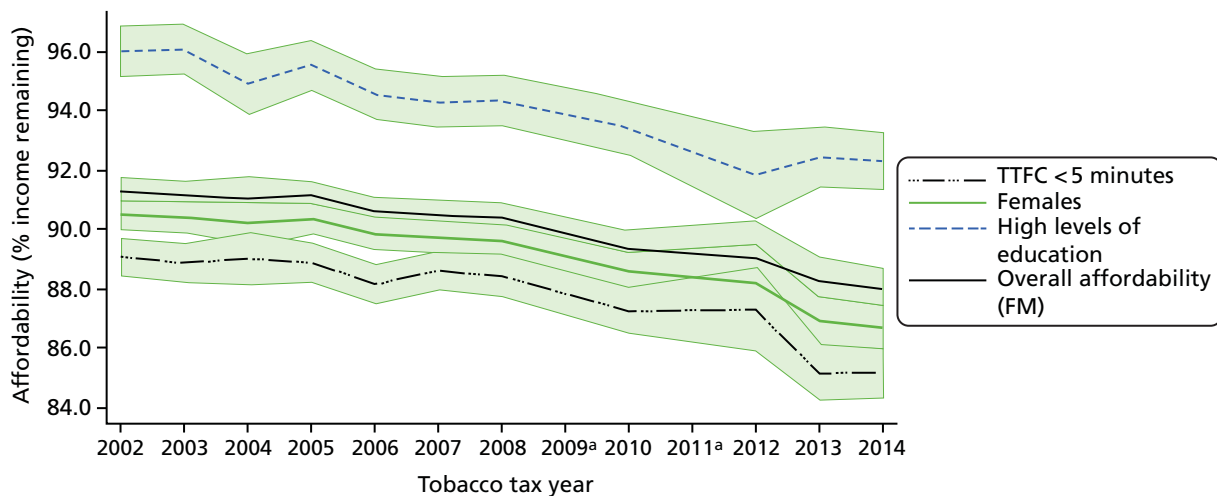
FIGURE 18 ITC data study 2: individualised affordability for FM cigarette smokers, showing female smokers, those with high levels of education and more dependent smokers, compared with overall affordability. Shaded areas represent 95% CIs. Affordability estimates are from the fully adjusted model 2 for FM cigarette smokers only. More dependent smokers are those who smoke their first cigarette within 5 minutes of waking (TTFC < 5 minutes). a, No ITC data collected for this year.
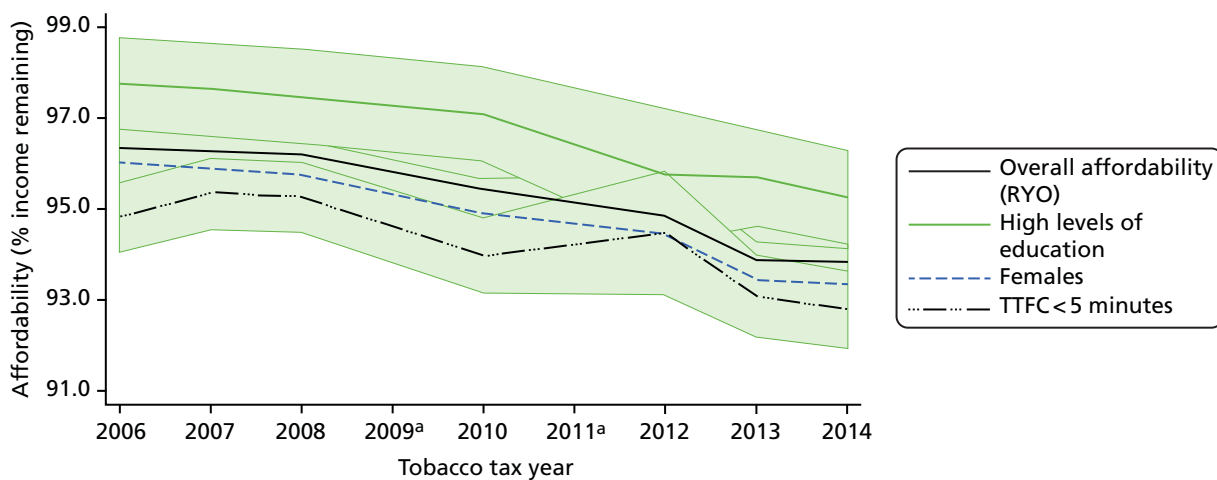
FIGURE 19 International Tobacco Control Policy Evaluation Project data study 2: individualised affordability for RYO tobacco smokers, showing female smokers, those with high levels of education and more dependent smokers, compared with overall affordability. Shaded areas represent 95% CIs. Affordability estimates are from the fully adjusted model 2 for RYO smokers only (see text for details). More dependent smokers are those who smoke their first cigarette within 5 minutes of waking (TTFC < 5 minutes). a, No ITC data collected for this year.

To illustrate the differences in affordability across sociodemographic and smoking dependence factors, we used the fully adjusted regression coefficients from model 2 (see *Tables S11* and *S12* in *Report Supplementary Material 2* for a complete list of regression coefficients) to plot the affordability curves for two hypothetical groups of smokers by age in 2014, one group with low affordability and one with high affordability. These plots were based on the fact that model-based estimates can be obtained for any theoretical values of the included variables, using the regression equation ($y = b_0 + b_1x_1 + b_2x_2 + \ldots + b_nx_n$), where *y* is the outcome (in this case affordability), x_n represents each predictor variable and b_n is its corresponding standardised regression coefficient (b_0 is the constant or *y*-intercept). As we wanted to plot affordability over different ages, we did not estimate values for age or age squared, so these were left as *x* and x^2 in our equations, respectively. For the remainder of the variables (all categorical), we chose the values corresponding to the highest or lowest affordability. Categorical variables are dummy-coded, so *x* is set to 0 for all non-selected categories and set to 1 for the selected category (*b* for the reference category = 0). For example, for our low-affordability curve (based on FM cigarettes, as they are generally more expensive than RYO tobacco), we selected TTFC to be within 5 minutes, as this was associated with the lowest regression coefficient (–3.78) (see *Table 21*), so the part of our equation pertaining to TTFC was [(0 × 0) + (–1.25 × 0) + (–2.33 × 0) + (–3.78 × 1)], which solves to –3.78. Thus, we selected the high-affordability group to be white, male, smoking RYO tobacco, residing in London, with high levels of education, smoking their first cigarette after 60 minutes from waking and purchasing from non-UK/non-store sources. The low-affordability group was selected to be female, non-white, smoking FM cigarettes, living in Northern Ireland, with low levels of education, highly addicted (smoking their first cigarette within 5 minutes of waking) and purchasing from UK store-based sources. Time was set to 2014 for both groups. The curves are displayed in *Figure 20*, which shows how affordability decreases with age, but illustrates the large differences in affordability across all ages, with some groups, depending on their characteristics and product choices, potentially spending > 15% more of their incomes on tobacco than others.
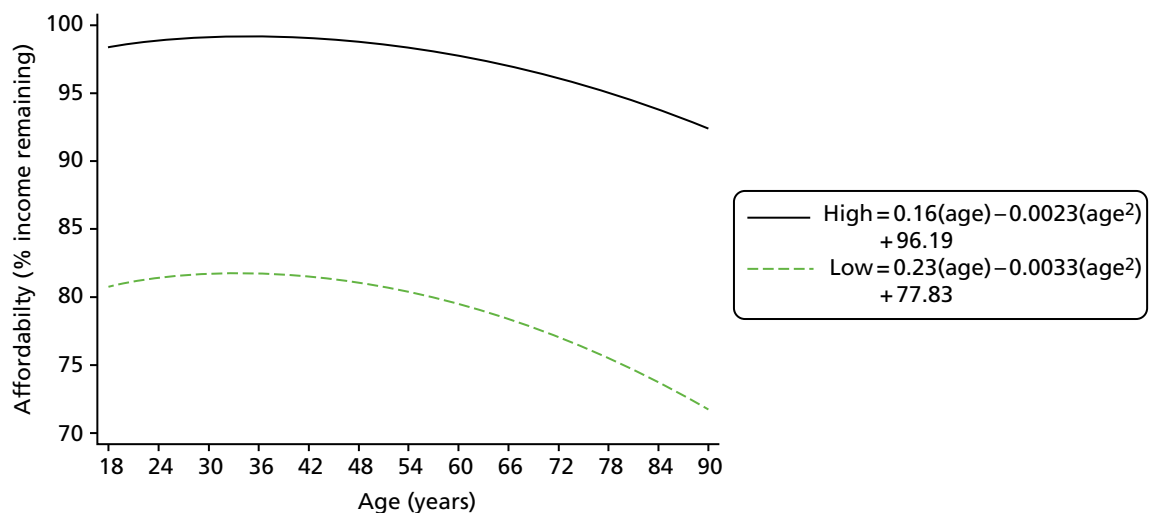
FIGURE 20 International Tobacco Control Policy Evaluation Project data study 2: individualised affordability in 2014, for two theoretical smokers by age [based on regression coefficients for the fully adjusted model 2 for RYO tobacco (high) and FM cigarette (low) smokers; see *Report Supplementary Material 2*]. The high affordability smoker is a white, male, RYO smoker, residing in London, with high levels of education, a TTFC > 60 minutes, and purchasing from a non-UK/non-store source. The low-affordability smoker is female, non-white, smokes FM cigarettes, resides in Northern Ireland, has low levels of education, is highly addicted (TTFC within 5 minutes of waking) and purchases from a UK store-based source.

Implications

Socioeconomically disadvantaged groups, women and dependent smokers were more likely to struggle to afford smoking as tobacco prices increased. In theory, we would expect that this would make them more likely to quit. However, from *Chapters 6–8* we know that there were other options available: smoking cheaper products and smoking fewer CPD, or using less tobacco in RYO cigarettes. We now assess whether or not there were differences in quitting or reducing behaviours related to sociodemographics and dependence.

ITC study 4: impact of tobacco pricing changes on smokers' purchasing patterns and product choices (sociodemographics and dependence)

This study uses the same sample and analyses as in ITC study 4, described in *Chapter 6*, from the four ITC surveys conducted between 2008 and 2014. Here we focus only on the results pertaining to sociodemographics and tobacco dependence, and how these affect product choices (premium FM cigarettes, mid-price FM cigarettes, value FM cigarettes or RYO tobacco) and smoking behaviours (traded up to FM cigarettes/no change, traded down to cheaper FM cigarettes, switching to RYO tobacco or stopping purchasing).

Methods

Methodological details and limitations are provided in *Chapter 6*, with basic sample characteristics in *Table 15*. Analyses were clustered, multinomial logistic regressions: analysis 4a was cross-sectional, whereas analysis 4b was longitudinal and included only exclusive FM cigarette smokers at baseline.

Results

Notable characteristics of the cross-sectional aggregate data sample (see *Table 15*) include < 8% classified as being highly dependent and an under-representation of younger smokers (with over three-quarters of the sample being aged ≥ 40 years).

Analysis 4a (product choice)

The results of analysis 4a (*Table 22*) indicated that white smokers were more likely to smoke any of the cheaper products than non-white smokers (building on our previous finding showing that those of white ethnicity were more likely to smoke RYO tobacco). Value FM cigarettes and/or RYO tobacco were more likely to be chosen than premium FM cigarettes by smokers with moderate dependence (HSI), low-SES smokers (as measured by income and education), smokers living outside London and smokers who were single. In addition, RYO tobacco was more likely to be smoked than premium FM cigarettes by men, smokers aged < 40 years (compared with aged ≥ 55 years), and smokers living in the Midlands, east and south of England. Women, however, were more likely to smoke cheap FM products. Mid-price FM cigarettes were significantly more likely to be smoked by those in northern regions and outside England than in London.

Analysis 4b (smoking behaviours)

The results of analysis 4b (*Table 23*) indicated that, compared with trading up to FM cigarettes/no change (the reference category) trading down to cheaper FM products was more likely among younger smokers (aged < 40 years), single smokers and smokers with low levels of education (vs. moderate levels of education). Switching to RYO tobacco was significantly more common among males, younger smokers (aged < 55 years) and low-income smokers. The only significant predictor of stopping purchasing was not disclosing income.

Implications

The findings that men, but also younger smokers, were more likely to switch to RYO tobacco may be the result of shifting perceptions among younger groups of the desirability of RYO tobacco smoking, which has been traditionally more common among men.[12] Furthermore, RYO tobacco was marketed as a natural product that may have particularly appealed to young environmentally conscious smokers.[241]

TABLE 22 International Tobacco Control Policy Evaluation Project data study 4 (analysis 4a): fully adjusted clustered, multinomial logistic regression of tobacco product type (premium FM cigarettes is reference, with 25.0% using this product) on individual-level predictors (dependence and sociodemographics) ($n = 2418$, observations = 4339)

| | FM cigarettes | | | | | | | | |
| | Mid-price (25.6%) | | | Value (19.0%) | | | RYO tobacco (30.4%) | | |
Predictors	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value
Dependence (HSI)	Overall effect for HSI: $\chi^2(6) = 16.19$; $p < 0.05$								
Low	Ref			Ref			Ref		
Moderate	1.20	0.96 to 1.49	0.101	**1.46**	1.15 to 1.86	0.002	**1.42**	1.13 to 1.78	0.002
High	0.90	0.57 to 1.41	0.636	1.08	0.65 to 1.79	0.761	1.38	0.90 to 2.12	0.143
Sex									
Female	Ref			Ref			Ref		
Male	0.64	0.50 to 0.81	< 0.001	**0.63**	0.49 to 0.83	0.001	**1.97**	1.53 to 2.53	< 0.001
Age (years)	Overall effect for age: $\chi^2(6) = 47.40$; $p < 0.0001$								
18–39	Ref			Ref			Ref		
40–54	0.73	0.55 to 0.96	0.024	1.30	0.94 to 1.80	0.108	1.00	0.74 to 1.34	0.975
≥ 55	0.54	0.41 to 0.72	< 0.001	1.29	0.92 to 1.80	0.135	**0.59**	0.43 to 0.82	0.001
Education	Overall effect for education: $\chi^2(6) = 33.30$; $p < 0.0001$								
Low	Ref			Ref			Ref		
Moderate	0.80	0.61 to 1.05	0.114	0.59	0.43 to 0.80	0.001	0.76	0.57 to 1.02	0.065
High	0.53	0.39 to 0.73	< 0.001	0.39	0.27 to 0.55	< 0.001	0.66	0.48 to 0.93	0.015
Income	Overall effect for income: $\chi^2(9) = 63.46$; $p < 0.0001$								
Low	Ref			Ref			Ref		
Moderate	1.00	0.74 to 1.35	0.998	0.79	0.57 to 1.08	0.142	**0.66**	0.49 to 0.88	0.005
High	0.77	0.55 to 1.06	0.107	**0.43**	0.30 to 0.61	< 0.001	**0.36**	0.26 to 0.50	< 0.001
Not disclosed	0.81	0.52 to 1.28	0.371	**0.56**	0.34 to 0.91	0.020	0.94	0.59 to 1.49	0.791

Predictors	FM cigarettes								
	Mid-price (25.6%)			Value (19.0%)			RYO tobacco (30.4%)		
	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value
Region	Overall effect for region: $\chi^2(12) = 73.47$; $p < 0.0001$								
London	Ref			Ref			Ref		
Northern	**2.38**	1.55 to 3.65	< 0.001	**2.64**	1.43 to 3.58	< 0.001	1.50	0.95 to 2.36	0.079
Midlands and Eastern	1.40	0.93 to 2.11	0.108	1.19	0.77 to 1.85	0.440	1.57	1.04 to 2.38	0.033
Southern	1.13	0.74 to 1.70	0.574	1.63	1.04 to 2.55	0.032	2.03	1.33 to 3.10	0.001
Outside England	**2.13**	1.40 to 3.23	< 0.001	1.49	0.95 to 2.34	0.086	1.28	0.82 to 2.00	0.281
Relationship status									
Single	Ref			Ref			Ref		
Partnered	0.85	0.68 to 1.07	0.161	**0.62**	0.48 to 0.80	< 0.001	**0.70**	0.55 to 0.89	0.003
Ethnicity									
White	Ref			Ref			Ref		
Not white	**0.82**	0.32 to 0.84	0.007	**0.51**	0.31 to 0.83	0.006	**0.33**	0.20 to 0.54	< 0.001

Ref, reference.
Notes
Tobacco tax increase rates are presented as per cent above inflation.
RRRs are for the fully adjusted model, controlling for all variables listed.
Values in bold are significant.

TABLE 23 International Tobacco Control Policy Evaluation Project data study 4 (analysis 4b): fully adjusted clustered, multinomial logistic regression of tobacco purchase changes (trading up/staying the same is reference, with 72.0% achieving this outcome) on individual-level predictors (dependence and sociodemographics) ($n = 854$, observations = 1397)

Predictors	Trade down to FM cigarettes (13.5%)			Switch to RYO tobacco (6.2%)			Stop purchasing[a] (8.3%)		
	RRR	95% CI	p-value	RRR	95% CI	p-value	RRR	95% CI	p-value
Dependence (HSI)	Overall effect for HSI: $\chi^2(6) = 8.94$; $p = 0.18$								
Low	Ref			Ref			Ref		
Moderate	0.85	0.61 to 1.19	0.343	1.36	0.83 to 2.21	0.217	0.80	0.53 to 1.20	0.280
High	1.00	0.52 to 1.91	0.999	0.44	0.13 to 1.56	0.203	0.40	0.13 to 1.19	0.099
Sex									
Female	Ref			Ref			Ref		
Male	0.98	0.72 to 1.35	0.918	**2.30**	1.44 to 3.68	0.001	1.12	0.74 to 1.71	0.591
Age (years)	Overall effect for age: $\chi^2(6) = 20.90$; $p < 0.005$								
18–39	Ref			Ref			Ref		
40–54	0.80	0.52 to 1.23	0.315	**0.55**	0.31 to 0.53	0.043	0.65	0.36 to 1.16	0.145
≥ 55	0.63	0.41 to 0.98	0.041	0.28	0.15 to 1.49	<.001	0.84	0.48 to 1.47	0.594
Education	Overall effect for education: $\chi^2(6) = 6.60$; $p = 0.360$								
Low	Ref			Ref			Ref		
Moderate	**0.64**	0.45 to 0.91	0.013	0.87	0.50 to 1.49	0.605	1.03	0.64 to 1.66	0.896
High	0.86	0.55 to 1.32	0.487	1.09	0.54 to 2.19	0.806	0.99	0.53 to 1.83	0.972
Income	Overall effect for income: $\chi^2(9) = 17.82$; $p < 0.05$								
Low	Ref			Ref			Ref		
Moderate	1.10	0.75 to 1.61	0.617	0.57	0.31 to 1.02	0.059	1.12	0.61 to 2.04	0.717
High	0.90	0.58 to 1.40	0.649	**0.47**	0.24 to 0.91	0.026	1.83	0.98 to 3.42	0.058
Not disclosed	1.17	0.66 to 2.09	0.590	0.73	0.28 to 1.90	0.526	**2.57**	1.20 to 5.01	0.015

Predictors	Trade down to FM cigarettes (13.5%)			Switch to RYO tobacco (6.2%)			Stop purchasing[a] (8.3%)		
	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value	RRR	95% CI	*p*-value
Region	Overall effect for region: $\chi^2(12) = 12.32$; $p = 0.420$								
London	Ref			Ref			Ref		
Northern	1.58	0.89 to 2.80	0.116	2.03	0.81 to 5.09	0.129	1.36	0.67 to 2.75	0.352
Midlands and Eastern	1.13	0.62 to 2.06	0.691	2.34	0.97 to 5.63	0.057	1.11	0.75 to 1.66	0.840
Southern	1.52	0.85 to 2.74	0.161	2.01	0.79 to 5.11	0.143	0.62	0.22 to 1.75	0.742
Outside England	1.64	0.92 to 2.91	0.094	1.53	0.61 to 3.88	0.367	0.80	0.53 to 1.20	0.388
Relationship status									
Single	Ref			Ref			Ref		
Partnered	**0.71**	0.52 to 0.97	0.031	0.64	0.40 to 1.03	0.068	1.11	0.75 to 1.66	0.596
Ethnicity									
White	Ref			Ref			Ref		
Not white	0.55	0.20 to 1.47	0.234	0.44	0.17 to 1.13	0.088	0.62	0.22 to 1.75	0.365

Ref, reference.
a Not purchasing because currently (at time of outcome survey) had quit for at least 6 months.
Notes
Tobacco tax increase rates are presented as per cent above inflation.
RRRs are for the fully adjusted model, controlling for all variables described in text.
All predictors are measured at baseline, except for tobacco tax rates, which are measured at the outcome survey.
Participants smoking RYO tobacco at baseline and those currently quit at outcome but for < 6 months are excluded.
Values in bold are significant.

Low-income smokers were more likely to switch to RYO tobacco than high-income smokers; and those with low levels of education more likely than those with moderate levels of education to trade down to cheaper FM products. However, there were no other clear indications that down-trading was more common among socioeconomically disadvantaged smokers overall. This might be because socioeconomically disadvantaged smokers were already smoking cheaper products and thus did not have down-trading as an option. However, the data also suggested that there was no socioeconomic difference in quitting. This explains why the over-representation of socioeconomic disadvantage among smokers has been perpetuated, despite high tobacco taxes. If equal proportions of low-SES and high-SES smokers quit, there will still be more low SES smokers because there was a larger pool to start with.

Limitations

We note that for this study, the first outcome survey was in 2010/11 and the largest tax increases were in 2011 and 2012, so it is possible that had the study started post 2012 then more socioeconomic differentiation would be apparent. We could not isolate the post-2012 period due to an insufficient number of cases. Another limitation was that the numbers for the highest dependence (HSI) group were relatively low (see *Table 15*). This may have contributed to our lack of significant findings relating to dependence, although we note that the ORs were in the expected direction, with trends for the highest HSI group to be more likely to use value FM cigarettes or RYO tobacco (than premium FM cigarettes) and less likely to achieve a sustained quit attempt. Future research needs to examine this further.

ITC study 5: impact of tobacco pricing changes and product choices on smokers' quitting behaviours (sociodemographics and dependence)

This study examines the impact of sociodemographics and dependence on smokers' quitting behaviours, with methodological details and limitations discussed in *Chapter 7*.

Methods

Here we report the results of longitudinal analyses 5a and 5b of ITC data study 5, pertaining only to sociodemographics and dependence (HSI). Both analyses were longitudinal, clustered, logistic regressions, with analysis 5a predicting making quit attempts and analysis 5b predicting achieving at least 6 months' sustained abstinence from smoking. We focus our reporting on model 2 of these analyses, which fully controlled for all included predictors.

Results

Analysis 5a: quit attempts

As may be seen in *Table 24*, smokers with moderate (vs. low) tobacco dependence (HSI scores) were significantly less likely to make a quit attempt. Those with high levels of education were more likely to make a quit attempt, relative to those with low levels of education, but no effects of income were observed. Older smokers were less likely to make a quit attempt than those aged 18–39 years and partnered smokers were more likely to make a quit attempt than single smokers.

Analysis 5b: sustained abstinence

The overall effect of dependence (HSI) on sustained quitting did not quite reach significance ($p = 0.069$), although ORs were in the expected direction of abstinence being less likely with increasing dependence. There were no significant relationships between our sociodemographic measures and 6 months' sustained abstinence.

Implications

After taking account of dependence on tobacco, products smoked, loyalty to brand and product, and tobacco tax rate, we found no sociodemographic differences in quit success (achieving at least 6 months' sustained abstinence) and no consistent patterns in relations to sociodemographics and quit attempts.

TABLE 24 International Tobacco Control Policy Evaluation Project data study 5: fully adjusted clustered logistic regression of making a quit attempt and achieving at least 6 months' sustained abstinence

Predictors	Analysis						
	5a: making a quit attempt (*n* = 1304, observations = 2202)			5b: achieving at least 6 months' quit (*n* = 1194, observations = 2017)			
	OR	95% CI		*p*-value	OR	95% CI		*p*-value
Dependence (HSI)	$\chi^2(2) = 9.57$; $p < 0.01$				$\chi^2(2) = 5.36$; $p = 0.069$			
Low	Ref				Ref			
Moderate	**0.67**	0.52	0.86	0.002	0.62	0.44	1.09	0.113
High	0.73	0.44	1.20	0.213	**0.31**	0.10	0.92	0.035
Sex								
Female	Ref				Ref			
Male	0.87	0.67	1.15	0.328	1.10	0.70	1.74	0.685
Age (years)	$\chi^2(2) = 8.91$; $p < 0.05$				$\chi^2(2) = 2.57$; $p = 0.276$			
18–39	Ref				Ref			
40–54	**0.62**	0.43	0.88	0.007	0.62	0.34	1.13	0.118
≥ 55	**0.60**	0.42	0.86	0.005	0.80	0.44	1.44	0.457
Education	$\chi^2(2) = 10.98$; $p < 0.005$				$\chi^2(2) = 3.38$; $p = 0.184$			
Low	Ref				Ref			
Moderate	1.00	0.73	1.36	0.978	1.42	0.84	2.40	0.187
High	**1.82**	1.25	2.65	0.002	1.75	0.92	3.33	0.088
Income	$\chi^2(3) = 0.42$; $p = 0.935$				$\chi^2(3) = 3.63$; $p = 0.305$			
Low	Ref				Ref			
Moderate	1.00	0.72	1.39	0.989	1.32	0.73	2.40	0.363
High	1.06	0.73	1.54	0.747	1.69	0.88	3.23	0.113
Not disclosed	1.14	0.69	1.89	0.607	1.99	0.85	4.68	0.115
Region	$\chi^2(4) = 1.4$; $p = 0.836$				$\chi^2(4) = 1.41$; $p = 0.842$			
London	Ref				Ref			
Northern	1.16	0.71	1.90	0.542	0.85	0.38	1.92	0.693
Midlands and Eastern	1.08	0.67	1.73	0.746	0.99	0.45	2.15	0.973
Southern	0.94	0.59	1.51	0.805	0.72	0.32	1.62	0.434
Outside England	0.97	0.60	1.59	0.915	0.74	0.32	1.69	0.45
Relationship status								
Single	Ref				Ref			
Partnered	**1.31**	1.01	1.70	0.040	1.35	0.87	2.09	0.182
Ethnicity								
White	Ref				Ref			
Not white	1.43	0.74	2.77	0.284	1.50	0.50	4.50	0.470

Ref, reference.
Notes
In analysis 5a, 39.4% made a quit attempt, and in analysis 5b 9.7% achieved sustained abstinence for at least 6 months, between baseline and outcome surveys.
Tobacco tax increase rates are presented as per cent above inflation.
ORs are for the fully adjusted model, controlling for all variables described in text.
Chi-squared statistics are for overall effects of any variables with three or more categories.
All predictors are measured at baseline, except for tobacco tax rates, which are measured at the outcome survey.
Achieving at least 6 months' quit is defined as achieving at least 6 months' sustained abstinence between the baseline and outcome surveys, regardless of status at the outcome survey. Participants currently quit for < 6 months at the outcome survey were excluded from analysis 5b.
Values in bold are significant.

Thus, future studies of smoking inequalities should take tobacco product smoked into account. Other studies may have found that socioeconomically disadvantaged smokers may be less likely to quit because they are willing to smoke cheap products (e.g. see *Table 22*). Thus, if the availability of cheap tobacco products declined, socioeconomically disadvantaged smokers might be more willing to quit.

ITC study 6: weight of roll-your-own tobacco cigarette analysis over time and international comparison (sociodemographics and dependence)

Here we examine the impact of sociodemographic differences and tobacco dependence, among exclusive RYO tobacco smokers, on the weight of tobacco used in RYO cigarettes over time.

Methods
This study uses the same sample and analyses as for ITC data study 6, with methodological details and limitations reported in *Chapter 7*. Briefly, this was a cross-sectional study among exclusive RYO tobacco smokers from the UK, USA, Canada and Australia, with data aggregated over the six ITC surveys (surveys 5–10), conducted between 2006 and 2015 (see *Table 4*). For data from Australia and the UK, clustered linear regression analyses were used to regress tobacco weights on the predictor variables (time, country, TTFC, sex, age, ethnicity, education and income). Here our focus is on the influence of tobacco dependence (TTFC) and sociodemographics.

Results
Sample characteristics are presented in *Table 19*. Results of the regression analyses are presented in *Table 25*, for the data from Australia and the UK. The weight of tobacco was significantly associated with TTFC, increasing by around 0.00024 g for every minute participants took to smoke their first cigarette after waking, and this persisted after controlling for time, country and sociodemographic variables. There was a significant association between weight and age, even after controlling for TTFC. Older participants used more tobacco than younger participants (e.g. smokers aged ≥ 55 years used around 0.12 g more tobacco per cigarette than those aged < 40 years) (*Figure 21*). Although the unadjusted effects of income on weight were not significant, there was a significant effect after controlling for time, country, TTFC and other sociodemographic factors in the fully adjusted model. Participants with moderate and high income used more tobacco per cigarette (an average of 0.033 g and 0.05 g, respectively), compared with low-income participants (*Figure 22*). Sex, ethnicity and level of education had no significant effects on weight in unadjusted or fully adjusted analyses.

Implications
Smokers who were more addicted, younger smokers and those with lower incomes were able to reduce tobacco expenditure by rolling cigarettes with less tobacco.

Summary: were tobacco industry price strategies and tax structures influencing inequalities?

Socioeconomically disadvantaged smokers and older smokers, particularly those smoking FM cigarettes, faced higher struggles with affordability of smoking in the period studied. Associations between sociodemographic variables and making quit attempts but not with quit success (achieving at least 6 months' sustained abstinence) were inconsistent with previous research.[240–242] Previous research has not taken tobacco products used into account. There was a significant effect of dependence, as expected, with more dependent smokers having a lower likelihood of quit success. Smoking Toolkit Study data[243] suggest that smoking prevalence declined by one-third among high-SES smokers (36%), but only one-quarter among low-SES smokers (26%), between November 2006 and February 2018. From the present research, we suggest two reasons for lack of quitting among low-income smokers despite affordability concerns: (1) low-income smokers took the opportunity, like other smokers, to trade down to cheaper forms of FM cigarettes or switch to RYO tobacco; and (2) they were more likely to use less tobacco when rolling RYO cigarettes.

TABLE 25 International Tobacco Control Policy Evaluation Project data study 6: clustered linear regression predicting the weight of tobacco per RYO cigarette ($n = 1349$, observations = 2705)

Predictors	Analysis					
	Univariate effects (unadjusted)			Multivariate effects (fully adjusted)		
	β	SE (β)	*p*-value	β	SE (β)	*p*-value
Dependence (TTFC in minutes)	0.00024	0.000089	< 0.01	0.00024	0.000083	< 0.005
Sex						
Female	Ref			Ref		
Male	−0.0049	0.014	0.735	−0.020	0.014	0.175
Age group (years)	$\chi^2(2) = 26.6$; $p < 0.0001$			$\chi^2(2) = 42.3$; $p < 0.0001$		
18–39	Ref			Ref		
40–54	0.046	0.015	< 0.005	0.052	0.015	< 0.001
≥ 55	0.088	0.014	< 0.001	0.12	0.018	< 0.001
Ethnicity						
White, English speaking	Ref			Ref		
Not white/not English speaking	0.034	0.041	0.398	0.041	0.040	0.309
Education	$\chi^2(2) = 1.12$; $p = 0.573$			$\chi^2(2) = 0.18$; $p = 0.913$		
Low	Ref			Ref		
Moderate	−0.016	0.016	0.319	−0.0062	0.015	0.685
High	0.0007	0.018	0.969	−0.00022	0.019	0.991
Income	$\chi^2(3) = 4.93$; $p = 0.177$			$\chi^2(3) = 9.58$; $p = 0.023$		
Low	Ref			Ref		
Moderate	0.016	0.015	0.289	0.033	0.015	0.032
High	0.043	0.020	0.029	0.060	0.021	0.004
Not disclosed	0.0079	0.024	0.741	0.019	0.024	0.428

Note
Multivariate analyses are fully adjusted for time, country, TTFC, sex, age group, ethnicity, education and income.
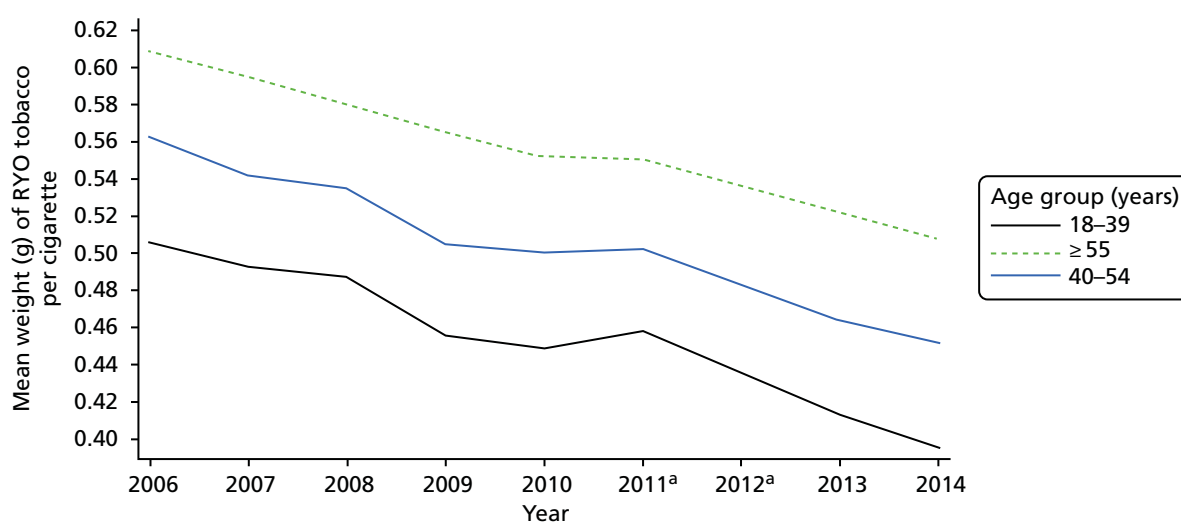
FIGURE 21 International Tobacco Control Policy Evaluation Project data study 6: mean model-predicted weight of tobacco (in grams) per RYO cigarette over time, for different age groups (pooled data from Australia and the UK). The model-predicted values are from a fully adjusted clustered linear regression, controlling for country, TTFC, sex, age, ethnicity, level of education and income. No data were collected from the UK in 2011 and no data were collected from the UK or Australia in 2012. The sample size from Australia for 2011 was low ($n = 25$). See *Table 19* for more details. a, No ITC data collected for this year.
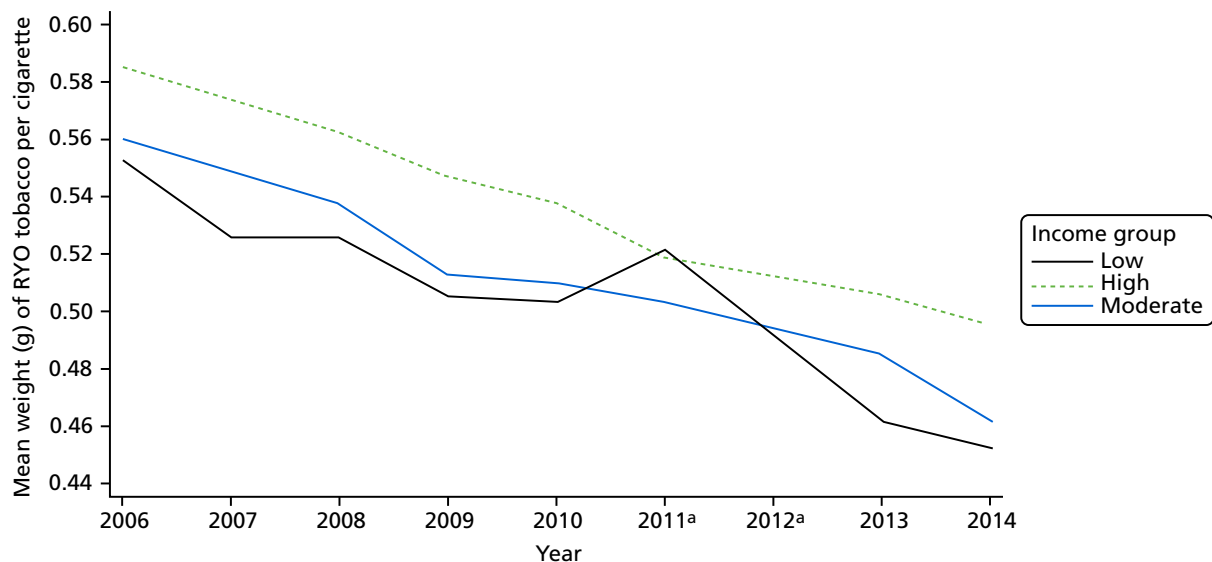
FIGURE 22 International Tobacco Control Policy Evaluation Project data study 6: mean model-predicted weight of tobacco (in grams) per RYO cigarette over time, for different income groups (pooled data from Australia and the UK). The model-predicted values are from a fully adjusted multilevel linear regression, controlling for country, TTFC, sex, age, ethnicity, level of education and income. No data were collected from the UK in 2011 and no data were collected from the UK or Australia in 2012. The sample size from Australia for 2011 was low ($n = 25$). See text and *Table 19* for more details. a, No ITC data collected for this year.

These findings suggest that the tax system needs to reduce the ability for price differentiation within FM cigarettes by a further move towards specific taxation, and between FM cigarettes and RYO tobacco by equalising specific taxation rates. Introducing sales restrictions, as in Uruguay, where only one variant per brand is allowed, would also reduce price differentiation. Low-income smokers have faced severe income reductions since the recession, yet their higher dependence on tobacco[244] means that they continue to smoke. This will affect their spending power in other areas.[245] Government funding for school meals, the pupil premium, extracurricular clubs and activities, and social services is important so that smokers' children can reach their potential despite their parents' dependence on tobacco. In addition, addressing the stress of income insecurity (via insecure employment, housing and benefits) is important so that low-income smokers find it easier to quit.[246]

Chapter 10 Overall synthesis of findings

Introduction

Tobacco control and tobacco tax policies both influence and need to be informed by TI pricing and profitability, and by smokers' behaviour, including levels of cheap and illicit tobacco use (*Figure 23*).

This study brings together diverse evidence covering these inter-related issues to inform the development of maximally effective approaches to tobacco taxation and regulation. Specifically, it combines data on TI behaviour (from a review of the commercial literature from 2008 to 2014); analysis of Nielsen data (monthly data on tobacco sales and price from 2008 to 2016); and smokers' behaviour (10 surveys of the ITC data from 2002 to 2014), providing information on the purchase source of tobacco and price paid, smokers' SES and behaviours, such as quitting and switching. In this chapter we summarise the key study findings and their implications.

Industry pricing and what smokers pay for their tobacco (see *Chapters 3* and *4*)

Industry pricing and profit maximisation suggests scope for further tax increases

1. Overall, the TI is overshifting taxes (increasing prices on top of tax increases) on FM cigarettes and RYO tobacco, thereby increasing its revenues on both products. This occurred throughout the study period, even when tax increases were high.
   There is scope to increase tobacco taxes further. The public health costs of smoking far outweigh tobacco tax revenues. Increasing taxes further would cover such revenue deficits, as we found no evidence to support TI rhetoric that price (tax) increases drive illicit trade.
2. Generally, a higher proportion of tobacco price rises has been to meet government taxes than for industry revenue generation. However, tax increases have become a smaller proportion of price increases in recent years. Thus, more recently, a relatively larger proportion of the price rise has been for industry revenue generation, as indicated by the increase in overshifting (see *Table 10*). The proportion of price rises for industry revenue rather than taxes has at least doubled for all RYO tobacco price segments and for premium FM cigarettes and mid-price FM cigarettes. There has been little change for value FM cigarettes, and subvalue FM cigarettes have undershifted. The high rate of overshifting on RYO tobacco indicates room for an added increase in RYO tobacco taxation.
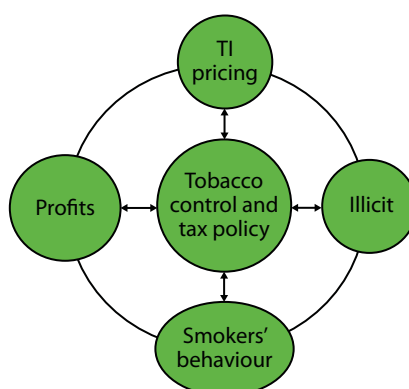

FIGURE 23 The inter-relationship between tobacco control and tax policy, TI and smokers' behaviour.

Recently, supplementary RYO tobacco tax rises (March 2016 and November 2018) have occurred. However, these findings suggest that there is particular scope to increase taxes on RYO tobacco further. This would also serve to reduce the large difference in prices per cigarette between FM cigarettes and RYO tobacco (see finding 20), thereby discouraging smokers from saving money by switching from FM cigarettes to RYO tobacco.

Industry pricing undermining the impact of tax increases

3. As in finding 2, although the overall pattern is one of overshifting, detailed analysis shows that the TI is differentially shifting taxes between price segments. It overshifts taxes on the more expensive products while absorbing tax increases on the cheapest products, such that their real price per pack (in both FM cigarette and RYO tobacco segments) has remained stagnant in recent years. This has increased the price range between the most and least expensive products both within and between FM cigarettes and RYO tobacco (e.g. *Figure 7*), and increased the opportunities for smokers to down-trade. Consequently, the volume of sales in the cheapest segments has grown in recent years (see *Table 8*). In May 2017, a minimum excise tax (MET) was introduced in the UK, with the aim of narrowing the range between the most and least expensive products. Although this is after our period of study, our findings suggest that the impact of this needs to be monitored carefully and that it will probably need to be regularly increased, at least in line with inflation. Indeed, steady increases in the MET above the rate of inflation would start to reduce the ability of the industry to offer cheap FM cigarettes, so a formula for such regular adjustments should be developed [see also finding 15 for discussion of the possibility of a minimum consumption tax (MCT), a variant of a MET].

4. We also observe that this pattern (differential shifting of taxes and price widening) has been nuanced by tobacco tax interventions. Most notably, (1) following the larger 2011 tax increase on RYO tobacco than FM cigarettes, the price range between RYO tobacco and FM cigarette packs in each price segment narrowed (see *Figure 7*); (2) the shift towards specific tax on FM products in 2011 also appears to have temporarily narrowed the price range between the most and least expensive FM products, which then widens again post 2012 (see *Figure 7*); (3) the industry was less able to game the system (by differential shifting of taxes) in the 2010–12 period, which saw sudden, larger tax increases compared with a period with planned, steady, smaller tax increases (see *Table 10*); and (4) there was a narrower price range (per stick) observed for RYO tobacco than for FM cigarettes (see *Figures 6* and *7*). Tax interventions designed to narrow the price gap (increasing taxes on RYO tobacco relative to FM cigarettes and increasing the proportion of tax on FM cigarettes that is specific rather than ad valorem) can be effective. Sudden, large tax increases reduce industry's ability to game the system (see also finding 5). The narrower price range observed for RYO tobacco than for FM cigarettes is likely (at least in part) to reflect the fully specific tax structure on RYO tobacco.

5. The TI seeks to reduce further the impact of tax increases on smokers by smoothing the impact of the tax increase through the year, by absorbing the tax increases (and cutting profits) in the immediate post-Budget period and then gradually increasing prices (and profits) thereafter (see *Figure 10*). The extent and duration of this tax absorption and smoothing is most marked in the cheapest segments and in recent years is more marked in FM cigarettes than in RYO tobacco, again reflecting the greater scope for tax increases in RYO tobacco (see also finding 2). This minimises the public health impact of tax increases by ensuring that smokers never face a sudden, large price increase. Internal industry documents confirm that the TI is particularly fearful of sudden, large tax increases and evidence indicates that sudden, large price increases are most associated with quit attempts.[59,247,248] Findings 4 and 5 therefore lend further weight to the benefit of sudden, large tax increases. Consideration should be given to interlinked options: (1) implementing intermittent larger tax increases on top of the tax escalator; (2) making the timing of such tax increases unpredictable and with little notice so that industry has no time to game the system; and (3) limiting the number of times per year that the industry is able to change its prices.

Approaches the tobacco industry uses to keep some products cheap

6. The TI has been doing a number of things to keep some products cheap. Specifically, it has been introducing new and cheaper FM and RYO products and price segments (e.g. a new 'subvalue' FM segment was introduced in 2012 and the RYO tobacco market is now segmented like the FM cigarette market) (see *Figure 7*). The TI has also been using price marking, particularly on the cheapest products (see *Figure 8*), and cutting the number of sticks or weight of tobacco per pack, again particularly in cheaper segments. For example, by the end of the study period, all subvalue FM brands were sold in packs of < 20 cigarettes and 10-g RYO tobacco packs were introduced (see *Table 8*).
Many of these issues, such as price marking, have now been addressed through the UK's plain packaging legislation and the EU TPD. The former prevents price marking, whereas the latter sets minimum pack sizes for both FM cigarettes (20 cigarettes) and RYO tobacco (30 g), which will lead to significant changes to the UK tobacco market (e.g. in 2015, 90% of RYO tobacco packs sold were < 30 g). However, larger pack sizes might also be employed by the TI to disrupt price signals (e.g. a 24-stick pack being cheaper than a 25-stick pack), or to provide cheaper tobacco (potentially made possible due to larger packs having lower production costs). Pack size 'standardisation' (allowing only one pack or pouch size), rather than just minimum pack sizes, would prevent this.
A key remaining issue is the TI's ability to continually introduce new products, including cheaper variants of existing products such as L&B Blue, a value priced version of L&B. This could be restricted by allowing only one variant per brand, as in the latest Uruguayan legislation, and/or freezing the introduction of any new FM cigarette or RYO tobacco brands.

Importance of both pack and unit price to smokers and governments

7. Although government tax policy might increase the unit price of a product (e.g. the price per stick or gram), the TI minimises the price rises per pack that consumers face by cutting the number of sticks or the weight of tobacco per pack. Although this might reassure smokers because the prices per pack remain steady, the smoker is in fact gradually paying more per stick, thus ensuring industry profitability increases (see *Figure 7* and *Table 8*).
Consideration by tax authorities is needed for both the pack and the stick price of products in designing tax policy. Minimum pack sizes (see finding 6) will help address this issue in jurisdictions where this is not yet in place.

The prices smokers pay

8. The prices smokers end up paying for their tobacco reflect both the industry prices and the consumers' purchasing choices [see *Impact of tobacco tax increases, as moderated by tobacco industry pricing on smokers' purchasing patterns* (see *Chapter 6*)]. Analysis of 2002–14 ITC data on real (base year 2014) prices paid by smokers in UK stores showed how purchasing choices could affect price. Although the real price of all product types had increased across the study period, changes were very small and there was little change until 2010, reflecting the larger tax increases after that point. Smokers could access FM cigarettes in 2014 at 2002 prices (and RYO tobacco at 2005 prices) because of the widening range in prices, particularly in FM cigarettes, again more marked from the introduction of the tax escalator, suggesting that this was an industry response to tax policy. Approximately one in six smokers were buying FM cigarettes by the carton rather than the pack, at £0.01–0.02 less per stick. Smokers could make substantial savings by switching their product choice. For example, smokers of RYO tobacco could save around £0.18 a stick (a saving of £750 a year for an average consumer), compared with FM smokers. Changes since 2010 provide further evidence that the larger tax increases later in our study period had greatest impact (see also finding 9). Such large tax rises should be combined with the aforementioned measures to reduce the range of tobacco price points.
Banning carton sales would remove one avenue for smokers to obtain cheaper tobacco.

Changes in the affordability of tobacco over time (see *Chapter 5*)

9. Both the commercial literature and ITC data indicated a decline in tobacco affordability over the study period (2002–14) in both FM and RYO products (see *Figure 11*). Yet declines in affordability were small and year-to-year changes in affordability were not significant (see *Table 12*). The greatest decrease in affordability occurred when tax increases were greatest (from 2010 onwards).
    Large tax increases resulting in price rises greater than the rate of inflation are essential to reducing the affordability of tobacco. This finding reinforces findings 1, 4, 5 and 8 that there is both need and scope for further tax increases, and that such increases need to be significant to reduce affordability.

10. Although price increases in RYO tobacco were greater than in FM cigarettes, RYO tobacco remains more affordable than FM cigarettes (RYO tobacco smokers retained 93.7% of their income after paying for tobacco in 2014, compared with 87.8% among FM cigarette smokers).
    In line with finding 2, this signals greater scope to increase taxes on RYO tobacco (see also finding 5).

11. In our sample of smokers, income declined from 2002 to 2012 (see *Figure 11*), yet among the UK population as a whole, incomes were increasing from 2002 to 2008 (prior to the recession).
    This suggests that smoking is increasingly a hallmark of socioeconomic disadvantage and that it is increasingly important to provide additional support for smokers to quit when tobacco tax and prices increase.

12. Declines in affordability were due to both increases in tobacco prices and declining incomes, and were less than expected because smokers adjust their purchasing and smoking patterns (including slight reductions in consumption) [see finding 8 and *Impact of tobacco tax increases, as moderated by tobacco industry pricing on smokers' purchasing patterns (see Chapter 6)*].

Impact of tobacco tax increases, as moderated by tobacco industry pricing on smokers' purchasing patterns (see *Chapter 6*)

Purchase source: UK store-based sources

13. Over the study period, the proportion of smokers buying from a UK store remained steady. However, smokers switched significantly (albeit by a small proportion) from purchasing from convenience stores (51.2% of purchases in 2002 to 41% in 2014) to supermarkets (41.4% and 54.2%, respectively), the most marked change occurring around the time of the recession (see *Table 13*). This pattern probably reflects cheaper prices in supermarkets.

Product switching

14. Nielsen and ITC data, supported by the commercial literature, show that there has been a shift towards RYO tobacco from FM cigarettes. Nielsen data show that, although total tobacco sales overall have fallen (13% decline in stick sales), this is explained by a marked decline in FM cigarette sales (17% decline in stick sales) accompanied by a 46% increase in sale volumes of RYO tobacco across the whole study period (see *Figure 12*). In line with this, ITC data show that exclusive RYO tobacco use increased significantly (mainly from 2002 to 2010), whereas exclusive FM cigarette use declined significantly (see *Table 13*). In 2014, the latest year for which we have data, 55% were exclusive FM cigarette smokers and 30% were exclusive RYO tobacco smokers (15% smoked a mix). Both Nielsen and ITC survey data indicate that the increase in RYO use has now plateaued.
    This finding reinforces calls for equalising the tax on RYO tobacco to that on FM cigarettes, bearing in mind that UK smokers use around 0.5 g of tobacco in their RYO cigarettes, in order to reduce the price differential and the incentive to switch (see also findings 2 and 10).

Down-trading

15. Commercial literature and Nielsen data indicate that both RYO tobacco and FM cigarette smokers are down-trading to cheaper products, with sales in the higher price segments falling markedly and those in the cheapest segments growing (see *Figure 13*). ITC survey data mirror those findings, showing that non-premium use increased from 72% to 78% (with the most marked increase of 17% occurring in the value segment), whereas premium use fell (see *Figure 14*). Cheaper products were more likely to be used when the tax increase was highest, at 5% above inflation (see *Table 16*).
   The MET introduced in 2017 (after our study) should help to narrow the price gap between segments, but this needs to be carefully evaluated and increased over time. Alternative measures that would help address this issue include a fully specific tax structure on FM cigarettes (which should be possible post Brexit) and price cap regulation.[122,249] Another possibility is consideration of a MCT. The latter is similar to a MET, but includes VAT (a general sales tax) so would affect both FM cigarette and RYO tobacco sales, unlike the MET, which applies only to FM cigarettes.
16. Longitudinal analysis of ITC data with baseline FM cigarette smokers only showed that, overall, 66.5% of smokers made no changes to their smoking behaviour: 5.5% traded up, 13.5% traded down from one FM product to a cheaper one, 6.2% switched from FM cigarettes to RYO tobacco and stopping purchasing tobacco products for at least 6 months (i.e. quitting for a sustained period) was achieved by 8.3% (see *Table 17*).
   A more common outcome than quitting, in a context of growing taxes and reduced affordability, is trading down. This underlines the importance of both tax increases and narrowing the range in price between cheap and expensive products.

Impact of tobacco tax increases, as moderated by tobacco industry pricing, on smoking behaviour via quitting and reducing tobacco consumption (see *Chapter 7*)

17. Longitudinal analysis of quit attempts and success showed that both were more likely with high taxes. However, these outcomes also varied by product used (price). Mid-price and value FM cigarette users were more likely to attempt quitting than RYO tobacco users. Mid-price and value FM cigarette users and RYO tobacco users enjoyed greater quit success than premium FM cigarette users.
   The association of high tax rises with quitting supports previous findings.[59,247,248] Smokers of premium products were the least likely to achieve a sustained quit attempt. This may reflect the numerous other options available to them (trading down, switching) and suggests that quitting is more likely among those with fewer options available to reduce costs. More frequent purchasers of illicit tobacco were also more likely to buy premium cigarettes (and RYO tobacco) than mid-price and value FM cigarettes, which may also be contributing to this finding (but see point 26, as frequency of purchasing illicit products did not predict quitting). As the availability of cheaper tobacco options offers smokers the possibility of down-trading instead of quitting, policy measures should address the availability of cheaper legal tobacco.
18. There was no link between brand loyalty or product loyalty and either quit attempts or success (see *Table 18*).
19. We identified a small, but significant, decline in cigarette consumption among FM cigarette smokers from 17.5 to 16.1 CPD, but no such decline among RYO tobacco users. We therefore concluded that the changes in cigarette consumption did not make a substantial contribution to the observed decline in tobacco affordability.
   The fact that consumption of RYO cigarettes did not decline may reflect the fact that RYO tobacco smokers are instead reducing the weight of each RYO cigarette (see finding 20).

20. In the UK, the weight per RYO cigarette has fallen significantly and by approximately 2% a year, from 0.59 g in 2006 to 0.46 g in 2014 (see *Figure 15*). Applying the 2014 tobacco weight (0.46 g) to 2017 tax rates, we estimate that the tax per cigarette was £0.10 per RYO cigarette, compared with £0.28 per FM cigarette. This decline will have offset, at least to some extent, the impact of tax increases on RYO tobacco. Taxation of RYO tobacco should therefore increase to a greater extent relative to FM cigarettes, to address the greater affordability of RYO cigarettes.

21. A comparison of RYO tobacco use and weights in the UK, Australia (both with high taxes and a significant tax difference between RYO tobacco and FM cigarettes), the USA and Canada (both with lower taxes and more similar taxes on FM cigarettes and RYO tobacco) showed that in the higher tax jurisdictions there were higher levels of exclusive RYO tobacco use, less tobacco used when rolling a cigarette and falling weights over time of tobacco used when rolling.

    Countries starting to increase taxes on tobacco need to carefully balance taxes on FM cigarettes and RYO tobacco, in order not to encourage product shifting. To do this, they will need to carefully measure weights of RYO cigarettes. In the UK, this finding reinforces the need to significantly increase RYO tobacco taxation, in order to approximate taxes on RYO tobacco to FM cigarettes. Other findings (see findings 4 and 5) suggest that the best way to achieve this might be a sudden, large increase in tax on RYO tobacco. It also underlines the need to carefully monitor RYO tobacco weights and adjust tax levels accordingly. Maintaining a fully specific tax structure on RYO tobacco is also important to avoid creating further price differentials. Just prior to the full implementation of the EU TPD, we observed in the UK that the TI was supplying 30-g RYO tobacco packs with 60 rolling papers, implying that they were aware that smokers rolled approximately 0.5 g of tobacco per cigarette.

Purchasing tobacco likely to constitute tax avoidance and/or evasion (see *Chapter 8*)

Non-UK/non-store purchases

22. Non-UK/non-store purchases included overseas and internet purchases, duty free and purchases from informal sellers (i.e. all sources that might involve tax evasion or avoidance). Across 2002 to 2014, one-fifth or less of all tobacco purchases were from non-UK/non-store sources.

    The UK government's strategy to constrain illicit tobacco use appears to be successful and should continue.

23. Over the study period, despite regular claims from the TI that illicit tobacco use was increasing, we found no increase in non-UK/non-store purchases.

    Despite declining affordability, industry attempts to scaremonger over illicit products should be ignored while continuing to reinforce efforts to address both the supply of, and demand for, illicit tobacco.[250]

24. The majority of non-UK/non-store-based sources appeared to be tax avoidance, constituting duty free or sources outside the UK. Typically, less than one-quarter of non-UK/non-store purchases were from sources likely to be tax evasion.

    Limits on duty-free sales could be considered and further limits based on cross-border sales, given the UK's proximity to countries with lower taxes, and the TI's documented overproduction of cigarettes in low-tax jurisdictions (such as Ukraine[78]) and overexport to low-tax jurisdictions (such as Belgium[251]), all likely to fuel the illicitly trade.[252] It is important that sales of duty-free or low-duty-paid tobacco do not increase and will ideally decline.

25. The majority of non-UK/non-store tobacco products were FM-C, followed by RYO tobacco and very few were FM-P. The median prices for all product types were typically lower than the cheapest products from UK store-based sources (see *Figure 16*). Purchasing FM cigarettes and RYO tobacco from non-UK/non-store sources conferred a saving of around 5% of smokers' annual incomes (see *Figures 17*). Although non-UK/non-store purchases were on average cheaper, there appeared to be little additional incentive to purchase illicitly, given legal tobacco products could be purchased at prices in 2014 similar to prices 12 years previously.

    Restrictions or bans on product bundling as a form of price-related promotion (from both UK store-based and duty-free sources) would reduce the attractiveness of buying cigarettes by the carton.

26. Using ITC data, 7.6% of smokers indicated that they had a high frequency of buying from cheap sources (likely to be illicit). Frequent purchasers were less likely to use mid-price or value FM cigarettes and more likely to use RYO tobacco than premium FM cigarettes. There was no significant difference between frequent and non-frequent cheap (probably illicit) purchases and trading down, switching or quitting over time.
   Those accessing cheaper premium FM cigarettes through sources that are likely to be illicit appeared to have less incentive to smoke cheaper, non-premium FM brands.

Inequalities (see *Chapter 9*)

27. Socioeconomically disadvantaged groups, women and more dependent smokers were more likely to struggle to afford smoking as tobacco prices increased. More disadvantaged smokers, and smokers of white ethnicity, were more likely to smoke cheaper tobacco products. More dependent, disadvantaged and younger smokers were more likely to roll cigarettes with less tobacco.
   More disadvantaged groups struggle with the price of smoking and are more likely to use cheaper tobacco products. This is consistent with earlier findings that more price-conscious smokers are socioeconomically disadvantaged.[12] Removing these cheap products might draw more disadvantaged smokers into the quitting process, especially if smoking cessation attempts are well supported.
28. In multivariable longitudinal analyses using the ITC data, overall, there were no clear indications that down-trading, switching or sustained quitting were more common among the more disadvantaged. Quit attempts were more common among older, partnered and more educated smokers.
   After taking into account dependence, products smoked, brand and product loyalty, and tax rates, there were no SES differences in quit success. This suggests that future studies should take into account the tobacco product smoked. This supports finding 27, that if the availability of cheap tobacco products declined, low-SES smokers might be more likely to be drawn into quitting.
29. Among FM cigarette smokers, dependence did not significantly predict trading down or switching to RYO tobacco. This was possibly because use of value FM cigarettes and RYO tobacco (vs. premium FM cigarettes) was already significantly more prevalent among moderately (vs. low) dependent smokers (trends were in the same direction for high dependence but were not statistically significant, probably because of low numbers). Smokers with moderate compared with low dependence were also less likely to make a quit attempt, and those with higher dependence tended towards reduced quit success than those with lower dependence. More dependent smokers were also more likely to roll less tobacco in their RYO cigarettes.
   Those with higher dependence need more support in quitting. In recent years, stop smoking services have decreased. The cost-effectiveness of such services has been demonstrated and ways to protect them could include ring-fencing funding.

Implications outside the UK

Although many of the findings and recommendations outlined above will be relevant outside the UK, a few results are of particular relevance. Our findings indicate that, in any country where the TI is overshifting taxes and its profits are increasing, there is scope for further tax increases to help recoup the public health costs attributable to smoking. This would ensure that government revenues rather than industry profits increase. Such countries can also dismiss the standard industry argument that tax and price increases drive the illicit tobacco trade. Given that worldwide cigarette sales are declining, yet industry profits are increasing, this is globally relevant.

Our research highlights that standardised tobacco packaging with set pack sizes and bans on price marking has additional benefits: it reduces the industry's ability to use pack size changes and price marking to make its products cheaper, and undermine the intended public health benefits of tax policy.

Finally, our research suggests that product shifting could be discouraged by a careful balancing of taxes on FM cigarettes and RYO tobacco. Monitoring weights of RYO cigarettes can help to ensure that RYO tobacco taxes are appropriate.

Further research

Our findings have clearly established that the TI responds strategically to tax increases; however, we were unfortunately unable to explore the effects of this among a younger population. An exploration of how tax and pricing changes influence smoking initiation and uptake is critical for future research, in particular to gain an understanding of the extent to which these strategic responses induce people to start smoking, as opposed to switching products or brands.

There is also a need to monitor the impact of changes in minimum pack sizes for both FM cigarettes (20 cigarettes) and RYO tobacco (> 30 g), which our findings indicate will lead to significant changes to the UK tobacco market. We believe that qualitative research will be needed to explore this issue further, building on other research that indicates that smokers reducing the number of cigarettes they smoke (and hence possibly buying smaller pack sizes) are more likely to attempt to quit and succeed in quitting.[225] It is also possible that the availability of smaller RYO tobacco pouch sizes during our study period (in the UK and Australia) contributed to rolling smaller cigarettes (smaller 'serving sizes'), as might the restrictions on smoking in workplaces and entertainment venues, making smaller (quicker) RYO cigarettes more attractive. Qualitative research would help to shed light on these factors. Furthermore, an unintended consequence of the large minimum pack size for RYO tobacco might be that smokers end up using more tobacco, and this will also need to be monitored.

The effects of plain packaging legislation (which also eliminates price-marked packs) and the MET (introduced simultaneously) on tobacco prices will also need to be explored. Determining how the TI establishes and communicates pricing in the standardised packaging environment, and the continuing role of segmentation in this process, is a priority for future research. In relation to the introduction of the MET, both how it affects the availability of cheaper FM cigarettes and if there is any growth in RYO tobacco sales that are not covered by a MET (but would be by a MCT) will need to be examined.

Future studies should also explore the impact of sudden, large tax increases compared with smaller, continuous tax increases.

The increasing availability and use of e-cigarettes and other novel vaping and nicotine-containing products can potentially influence the trends examined in this report. As we noted in *Chapter 2*, we think that the likely impact of e-cigarettes on our data was low, with the e-cigarette market being less than one-twentieth the size of the tobacco market in 2015[121] (the end of our study period); however, future research will need to consider the influence of new products. Specifically, how e-cigarettes affect the prevalence over time of particular characteristics in the population of remaining smokers and the average number of cigarettes consumed among dual users need to be monitored. It is also possible that the availability of novel nicotine products is putting downwards pressure on the prices of tobacco products.

Finally, it is likely that there exist significant interactions between sociodemographics, dependence and smoking outcomes. Given the low numbers for some of our covariates, such as younger smokers and those with the highest levels of dependence, we did not test for any interaction effect in this study. This is an important avenue for future research.

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Stakeholder Group

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Academic Project Advisors

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Deborah Arnott, Chief Executive, ASH.

Martin Dockrell, Tobacco Control Lead, Public Health England.

Matthew Alford and Dan Griffin, UKCTAS Smokers' Panel representatives.

Fiona Andrews, Chief Executive, Smokefree South West (since disbanded due to funding cuts).

Contributions of authors

Publications

Partos TR, Gilmore AB, Hitchman SC, Hiscock R, Branston JR, McNeill A. Availability and use of cheap tobacco in the UK 2002–2014: Findings from the International Tobacco Control Project. *Nicotine Tob Res* 2017;**20**:714–24.

Branston RJ, McNeill A, Gilmore A, Hiscock R, Partos TR. Keeping smoking affordable in higher tax environments via smoking thinner roll-your-own cigarettes: findings from the International Tobacco Control Four-Country Survey 2006–15. *Drug Alcohol Depend* 2018;**193**:110–16.

Hiscock R, Branston JR, McNeill A, Hitchman SC, Partos TR, Gilmore AB. Tobacco industry strategies undermine government tax policy: evidence from commercial data. *Tob Control* 2018;**27**:488–97.

Partos TR, Branston JR, Hiscock R, Gilmore AB, McNeill A. Individualised tobacco affordability in the UK 2002–2014: findings from the International Tobacco Control Policy Evaluation Project. *Tob Control* 2019;**28**:s9–19.

Related publication to which the authors of this report contributed
Kuipers MAG, Partos T, McNeill A, Beard E, Gilmore A, Brown J. Smokers' strategies across social grades to minimize the cost of smoking in a period with annual tax increases: evidence from a national survey in England. *BMJ Open* 2019;**9**:e26320.

Data-sharing statement

Our ITC data are from the UK arm of a much larger consortium encompassing multiple countries. The procedure and forms for requesting the data are available on the ITC website (URL: www.itcproject.org/forms).

Nielsen data are commercial and therefore not available for analysis.

All queries should be submitted to the corresponding author.

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