Modelling UK alcohol and tobacco demand using the Living Costs and Food Survey

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Agenda

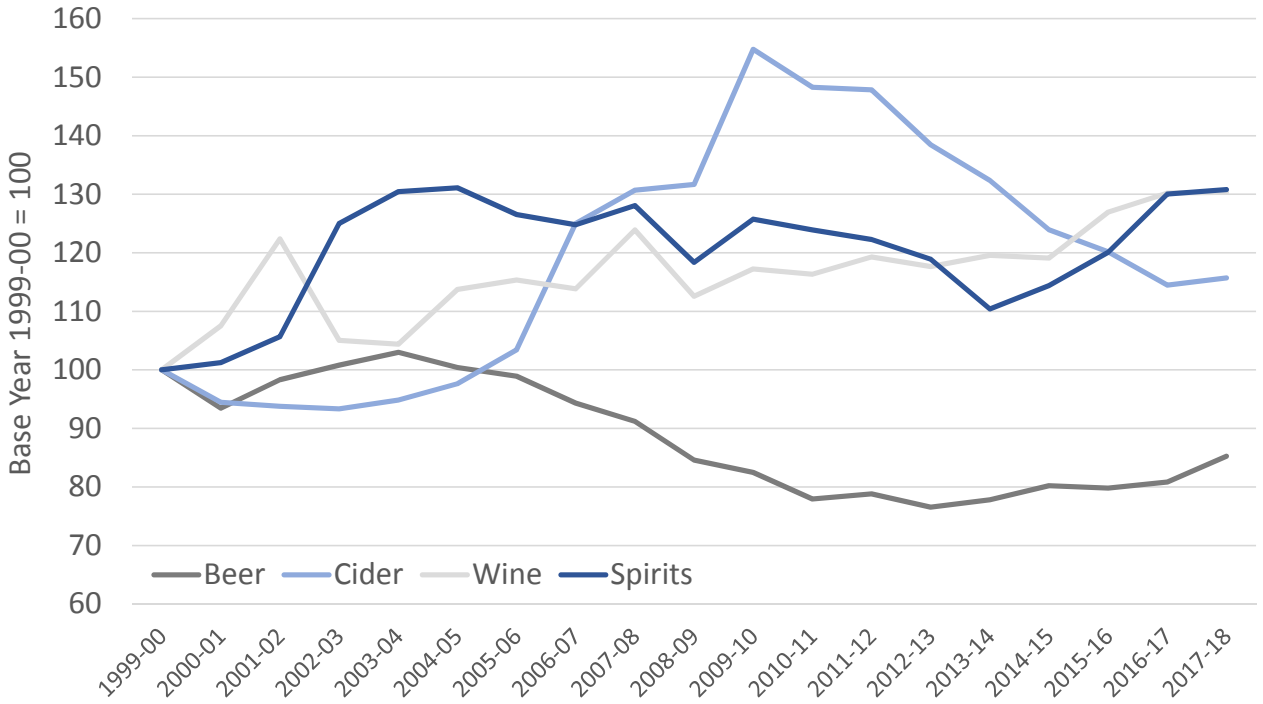
- Recent trends in alcohol and tobacco consumption
- What are elasticities? Why are we interested in them?
- Previous studies
- Choosing the data
- Methodology and Approach
- Results
- Conclusions

Recent trends in alcohol consumption (1)

Marked changes in composition of UK alcohol market in recent years

- Clearances are alcohol volumes that have been certified as UK Duty Paid (UKDP) by HMRC
- Wine and Spirits now more popular: volumes 30% higher than in 1999-00
- Beer in decline since 2003-04, 15% lower than in 1999-00

Indexed HMRC alcohol clearances, base year 1999-00

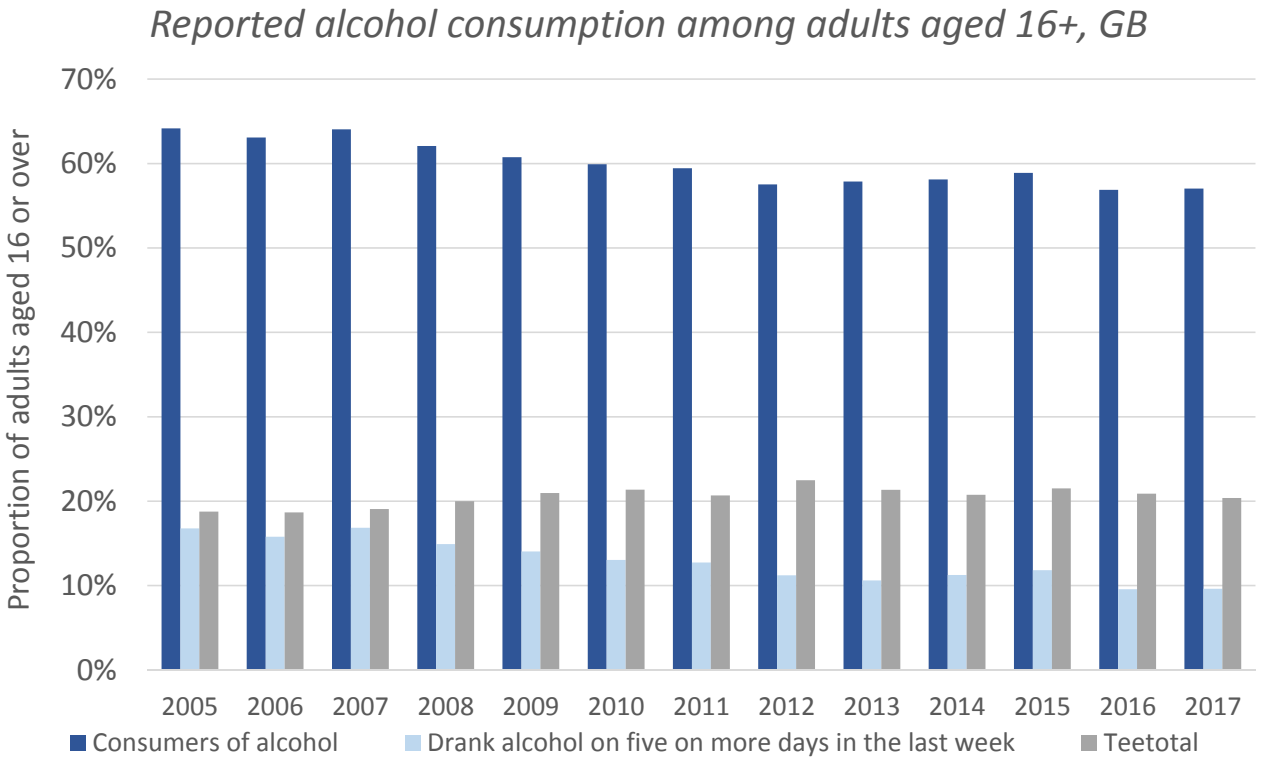


Source: HMRC

Recent trends in alcohol consumption (2)

Slight declines in levels of alcohol consumption in Great Britain in recent years

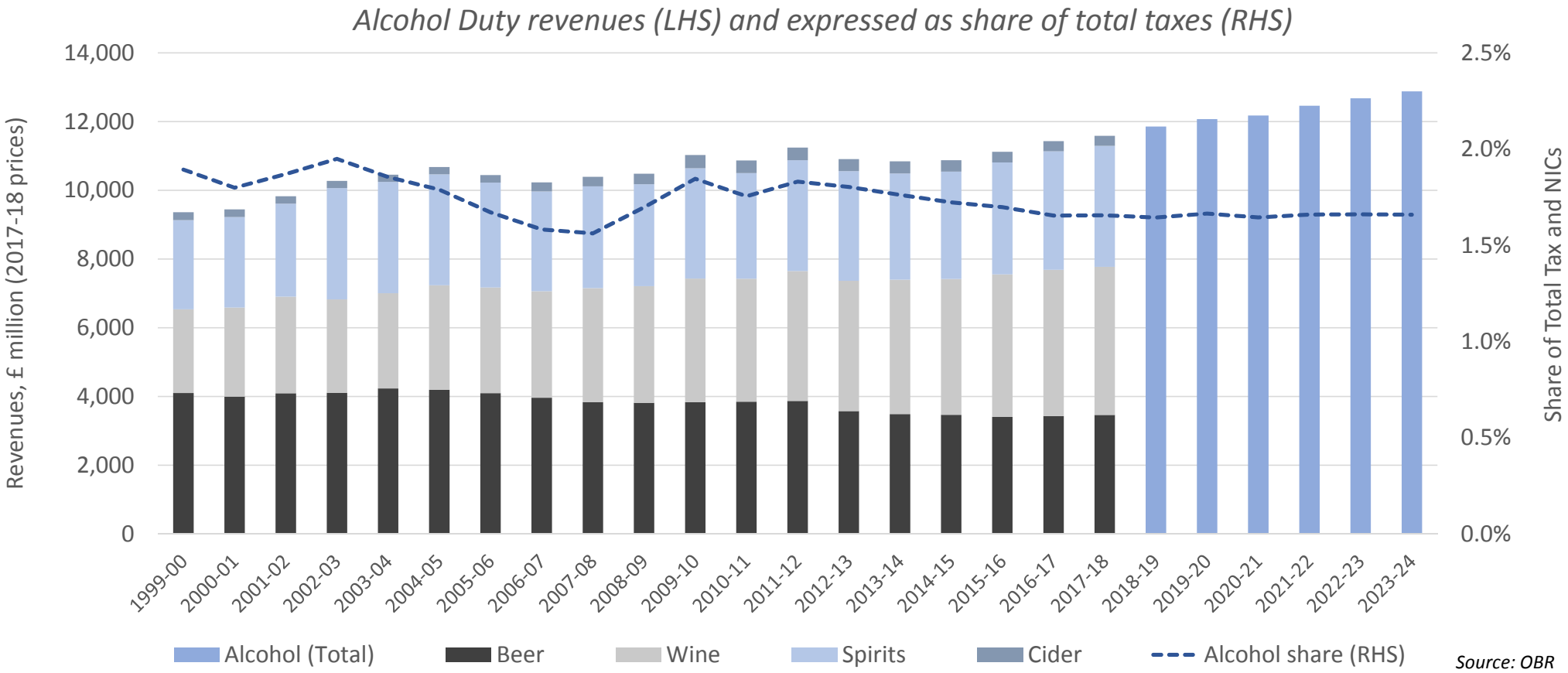
- Proportion of adults reporting some recent alcohol consumption declined slightly from 64% to 57% between 2005 and 2017
- Decline in frequent drinking, and slight rise in teetotalism



Source: ONS

Recent trends in alcohol consumption (3)

Alcohol Duties continuing to rise each year and stable as share of all taxes

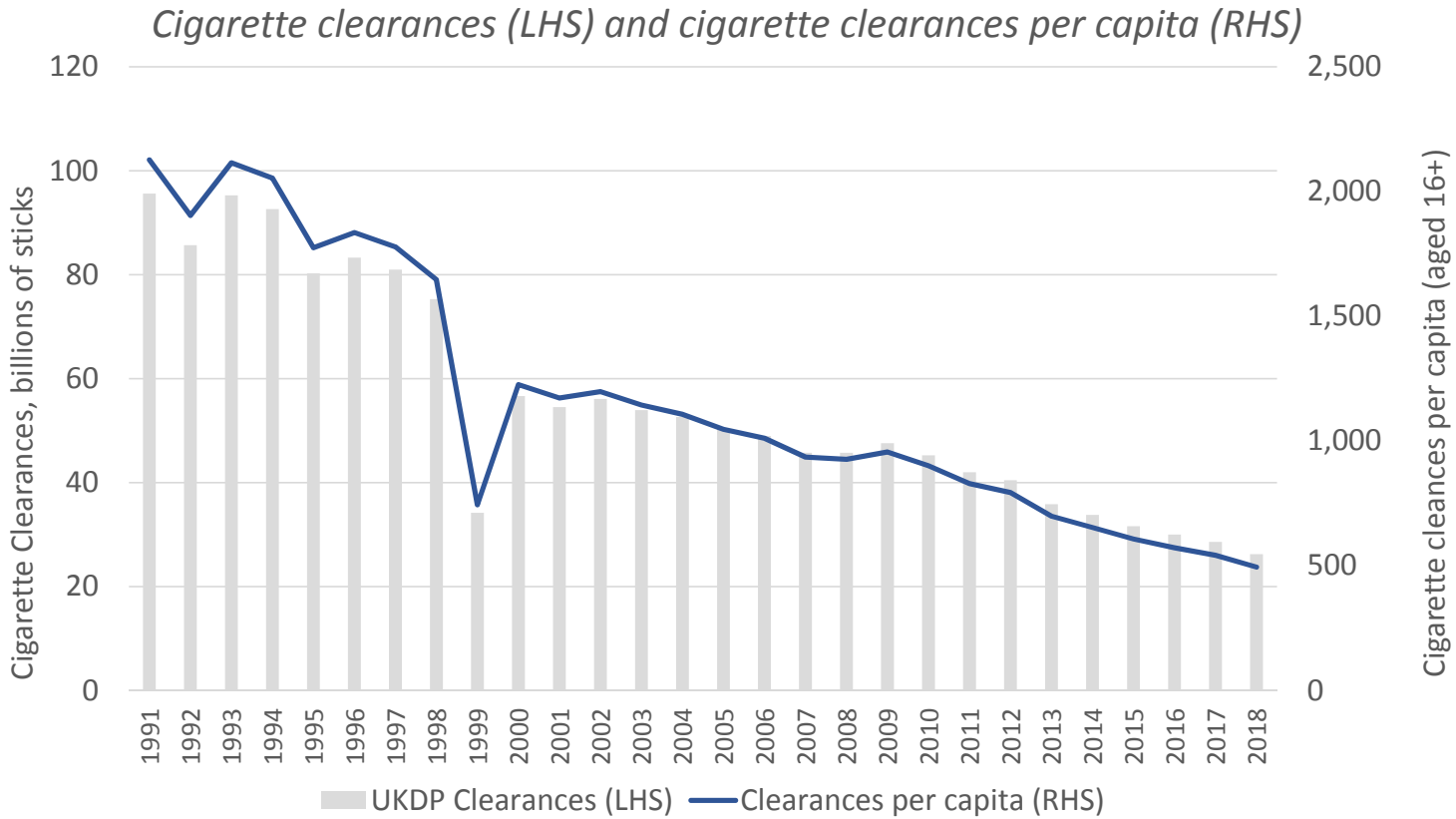


Source: OBR

Recent trends in tobacco consumption (1)

Different story in tobacco: persistent declines in cigarettes, shift towards rolling tobacco

- UK tobacco market dominated by cigarettes, but persistent decline in clearances: 73% fall over period
- OBR forecast cigarette clearances to continue to fall over next 5 years
- Steady growth in rolling tobacco clearances since late 1990s

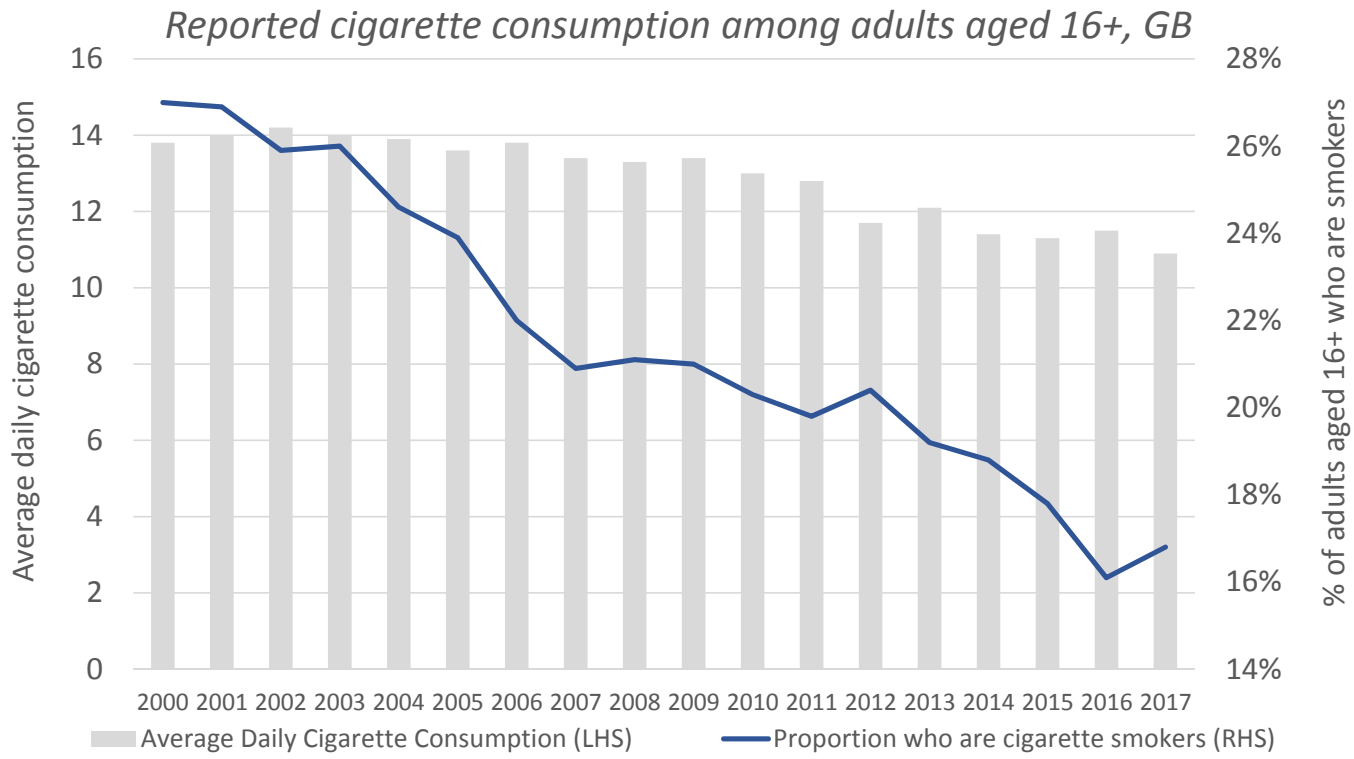


Source: HMRC

Recent trends in tobacco consumption (2)

Falling cigarette clearances data mirrored by falling reported consumption rates

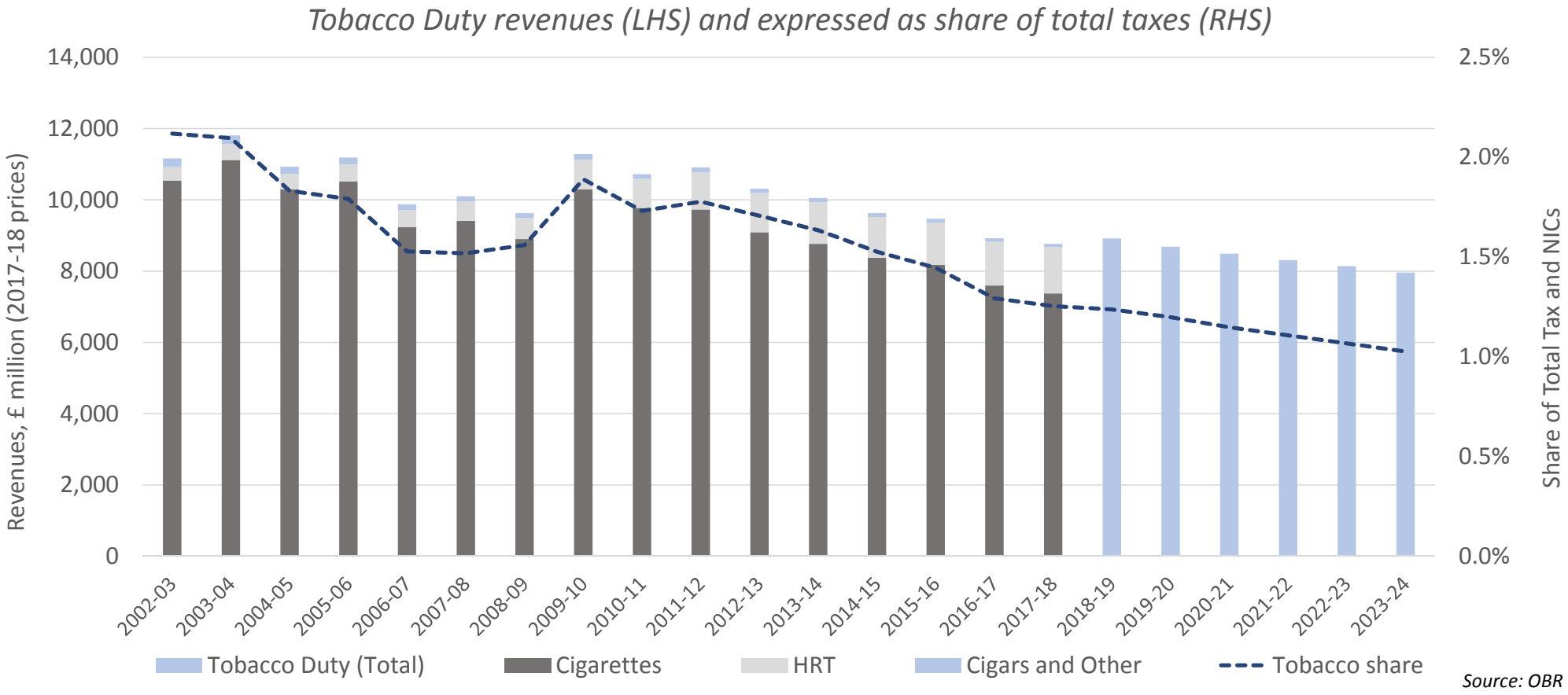
- In 2000 the ONS estimate that the average person smoked just under 14 cigarettes a day, and that around 27% of the GB population in was a cigarette smoker
- By 2017, this had fallen to just under 11 cigarettes a day, and just 17% of the population



Source: ONS

Recent trends in tobacco consumption (3)

Despite rising duty rates, falling consumption is leading to ever-lower Tobacco Duties



Source: OBR

What are elasticities? Why are we interested in them?

Responsiveness of quantity demanded to changes in price or income

- Provides insight into how households or individuals will likely respond when faced with changes in prices or income – **such as a tax increase**

- Demand for alcohol and tobacco generally thought to be relatively *price inelastic* – i.e. % change in demand smaller than % change in price, partially due to addictive nature

- Other (non-price) factors also influence demand – availability of products, advertising, licensing restrictions, personal circumstances…

Previous studies (1) - Alcohol

Price elasticities for off-trade alcohol generally higher than for on-trade

Category	Channel	Alcohol	Beer	Cider	Wine	Spirits	RTDs
Collis et al (2010)	On	-	-0.77	-0.85	-0.46	-1.15	-0.91
	Off	-	-1.11	-1.34	-0.54	-0.90	-0.93
Arnoult and Tiffin (2010)	On	-	-0.92	-0.92	-0.74	-1.53	-
	Off	-	-0.95	-	-0.82	-1.22	-1.09
Sousa (2014)	On	-	-0.34	-0.49	-0.24	-1.25	-0.24
	Off	-	-0.74	-0.74	-0.08	-0.45	-0.52
Meng et al (2014)	On	-	-0.79	-0.59	-0.87	-0.89	-0.19
	Off	-	-0.98	-1.27	-0.38	-0.08	-0.59
Tomlinson and Branston (2014)	On	-	-1.68	-	-	-	-
	Off	-	-1.60	-	-	-	-
Pryce et al (2018)	On	-0.41	-	-	-	-	-
	Off	-0.66	-	-	-	-	-

Previous studies (2) - Tobacco

Majority of studies focus on demand for cigarettes, with studies suggesting demand may now be more elastic

- Czubek and Johal (2010); long-run elasticity for cigarettes of -1.05. 2015 update found long-run elasticity for cigarettes had increased to -1.19
- Nguyen, Rosenqvist and Pekurinen (2012) model cigarette demand in Europe and find that short-run price elasticities ranged from –0.30 to –0.40, while the long-run elasticities ranged from –0.21 to –1.49, with the typical value around –1.0
- Kennedy, Pigott and Walsh (2015) focus on demand for cigarettes in the Republic of Ireland, price elasticity for cigarettes ranges from -1.6 to -2.0, averaging at -1.8
- Less evidence covering demand for rolling tobacco or other products, but elasticities thought to be smaller in magnitude than for cigarettes

Choosing the data

The Living Costs and Food Survey (LCF) was chosen as the chief data source, as it offers numerous advantages over other potential sources, such as the Family Resources Survey (FRS) or General Lifestyle Survey (GLS)

Advantages

- Highly granular data on spending patterns, captured over several years, with 5,000-6,000 responses each year
- LCF also has information on incomes, socioeconomic status and other useful characteristics / factors
- Crucially, expenditure and quantities captured for alcohol and (some) tobacco products, with new data for alcohol quantities

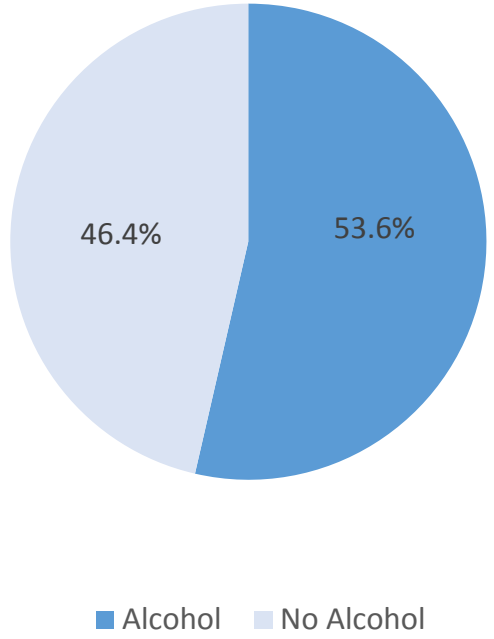
Disadvantages

- No explicit information on prices, quality of products – prices have to be inferred, and then only for recorded purchases where expenditure and quantities are captured
- Data on consumption is by household and not individual
- Data not longitudinal across time
- Likely underreporting of consumption among household surveys

Data summary (1)

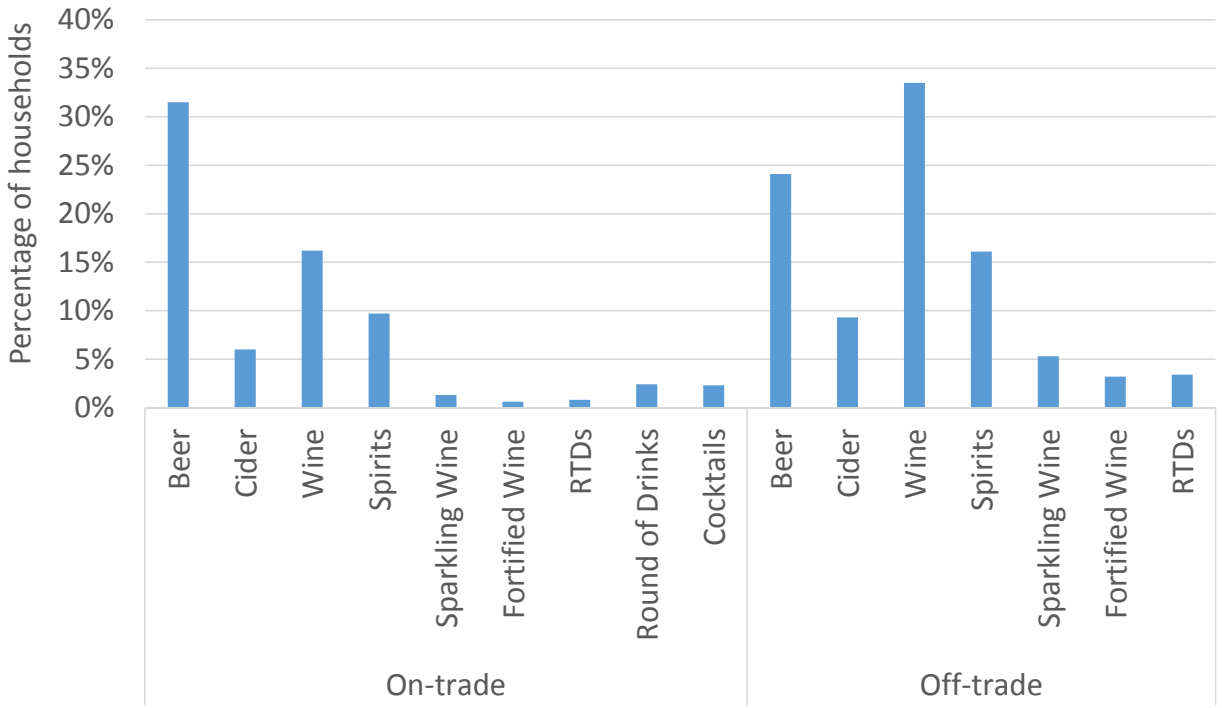
Household alcohol consumption disaggregated by on-trade (e.g. purchased in bars, clubs and restaurants) and off-trade (e.g. alcohol bought for home consumption)

Household UK Alcohol Consumption, 2012 to 2016-17 (% households)



Source: LCF

Consumption by product type, full sample

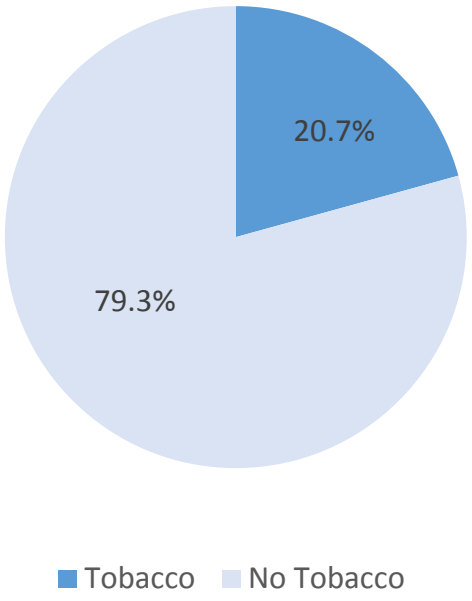


Source: LCF

Data summary (2)

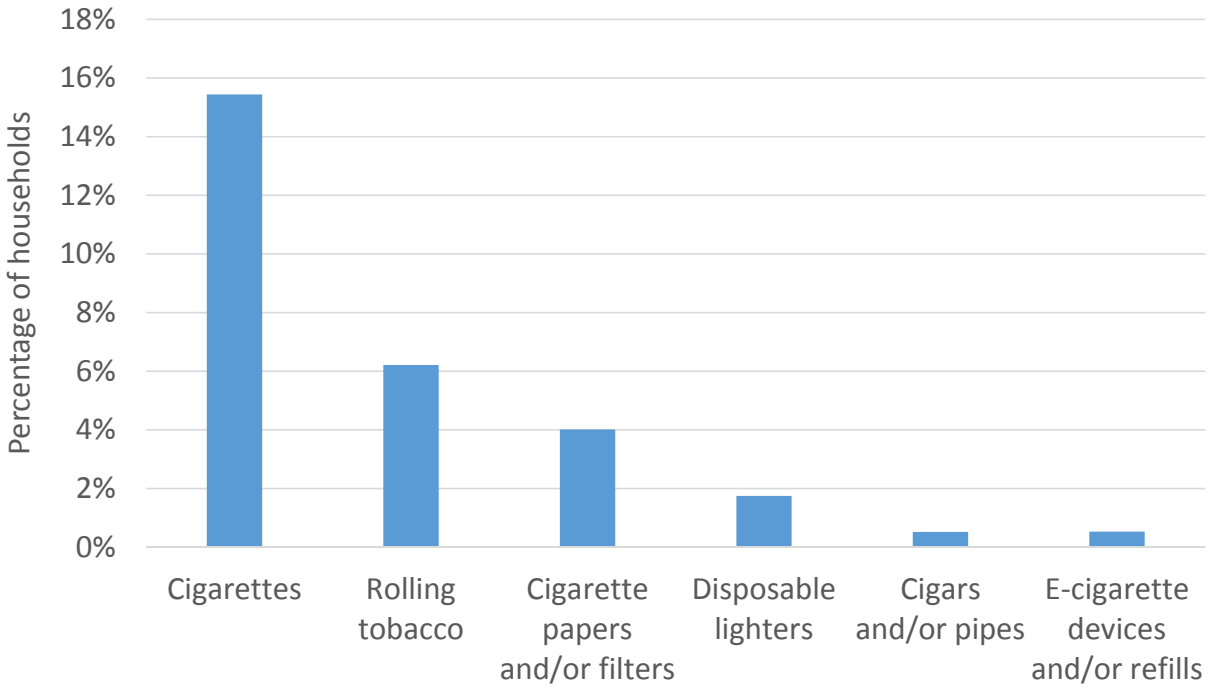
Majority of households appear to be non-smokers, and there are observed gradual declines each year in consumption – in line with HMRC clearances data

Household Tobacco Consumption, 2008 to 2016-17 (% households)



Source: LCF

Consumption by product type, full sample



Source: LCF

Methodology and Approach (1)

Recap: The LCF offers a rich dataset with household consumption of several different categories of alcohol and tobacco products captured

We can pool the data together across the full sample, adjusting for inflation in different years and assuming for prices faced by non-drinkers/smokers are based on regional/household averages where prices are “known”

Next step – simply run a standard regression model (OLS), with consumption as the outcome (dependent) variable, with independent variables including prices, incomes and other characteristics thought to influence consumption?

BUT – a large number of households report zero consumption! Risk of inconsistent and biased estimates if using OLS

Methodology and Approach (2)

“So why not just drop non-drinkers and non-smokers from the sample?”

Risk of sample selection bias – consuming vs. non-consuming households are likely to have different characteristics.

Survey is already potentially subject to some bias due to respondents having different characteristics to non-respondents!

Solution – need to apply a robust model which can accommodate lots of incidences of zero consumption – and attempt to explain why this occurs

Can use OLS later to test whether model results are significantly different

Methodology and Approach (3)

Rather than standard regression, the **Heckman Correction Model** is applied to model demand for alcohol and tobacco

- First developed by Heckman (1979)
- Model has **two stages**: estimating the *probability of participation* in the sample (e.g. to smoke or drink) and then *estimating the quantity* consumed
- Model then features a list of variables thought to either influence participation or the quantity consumed
- Model is highly appropriate for both dealing with **large numbers of zeroes** and for handling **large datasets** like the LCF

Methodology and Approach (4)

Some issues with missing quantities in recorded household diary data

- As not food or drink in LCF, lots of missing quantities of tobacco products purchased!
- Rely on instances where LCF coders *have* recorded quantities of cigarettes or rolling tobacco purchased (e.g. pack of 20 cigarettes), and estimate quantities for other households based on averages
- Less of a problem for alcohol but still some missing quantities, particularly for on-trade purchases – estimation needed

Quantity of cigarettes by average price	Rounded quantity (cigs)
Less than 15	Pack of 10
Between 15 and 20	Pack of 20
Between 20 and 100	Multiple packs of 20
Between 100 and 150	Pack of 100
Between 150 and 200	Pack of 200
200 or more	Multiple packs of 200

Quantity of rolling tobacco by average price	Rounded quantity (gr)
Less than 11.25	Pack of 10
Between 12.5 and 15	Pack of 12.5
Between 15 and 25	Pack of 25
Between 25 and 31.25	Pack of 25
Between 31.25 and 37.5	Packs of 25 and 12.5
Between 37.5 and 43.75	Pack of 50
Between 43.75 and 50	Pack of 50
Above 50	Multiple packs of 25

Source: Deloitte

Variables (1) - Alcohol

Demand for four major alcohol categories estimated, and by channel for period 2012 to 2016-17

Category	Channel	Measure
Beer	On-trade	Pint (568 ml)
	Off-trade	Pint (568 ml)
Wine	On-trade	Pint (568 ml)
	Off-trade	Pint (568 ml)
Cider	On-trade	Glass (175 ml)
	Off-trade	Bottle (750ml)
Spirits	On-trade	Serving (25 ml)
	Off-trade	Bottle (700ml)

- Unfortunately not enough data to robustly estimate demand for Ready To Drink (RTDs), Sparkling or Fortified Wine products
- On-trade purchases sourced from eating-out diary entries; off-trade purchases sourced from shop diary entries
- Important caveat - no assessment of different levels of quality, or levels of drinking

Variables (2) - Alcohol

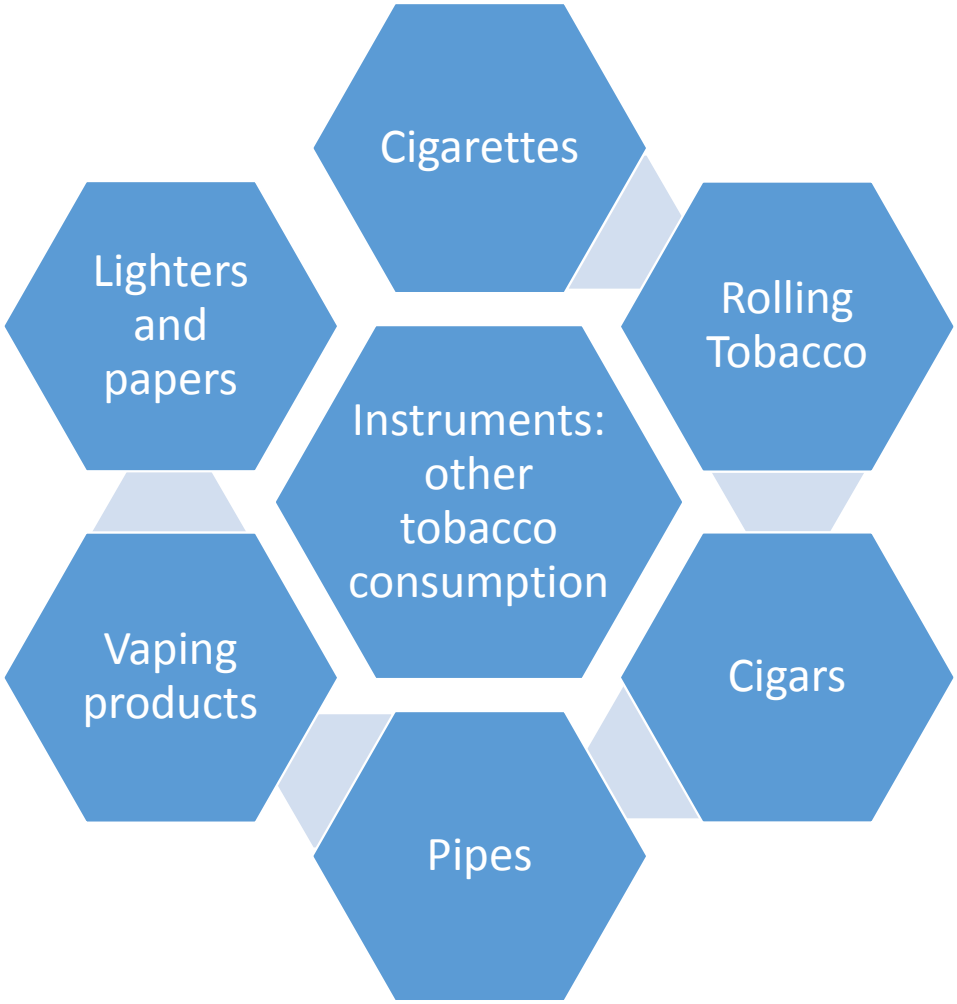
Variables (3) - Tobacco

Demand for two major tobacco categories estimated for period 2008 to 2016-17

Category	Measure
Cigarettes	Number
Rolling Tobacco	Grams

- Unfortunately not enough data to robustly estimate demand for less popular tobacco or related products: pipes, cigars, e-cigarettes…
- Tobacco purchases entirely sourced from shop diary entries – with additional coding information gathered for different shops
- Important caveat (again) - no assessment of different levels of quality, or levels of smoking

Variables (4) - Tobacco



Results (1)

Own-price elasticity of demand for alcohol and tobacco products

Category	Channel	Own-price elasticity
Beer	On	-0.45
	Off	-0.81
Cider	On	-0.42
	Off	-0.99
Wine	On	-0.43
	Off	-0.22
Spirits	On	-0.92
	Off	-0.19

Category	Own-price elasticity
Cigarettes	-1.32
Rolling Tobacco	-0.57

- Alcohol elasticities in line with previous research, slightly higher
- Demand for off-channel spirits and wine remain the most inelastic
- Significantly higher elasticity estimate for cigarettes than for rolling tobacco

Results (2) - Alcohol

Strong negative underlying trend in cigarette consumption; positive for rolling tobacco

Participation

- Household income positively associated with likelihood of consuming alcohol
- Consuming other alcohol can be good instruments for consuming any one type of alcohol
- Households which smoke also more likely to consume alcohol, alongside owner-occupiers
- Households with young children and older households less likely to drink

Consumption

- Higher household income strongly associated with consuming greater quantities of alcohol
- Households which smoke also likely to consume more alcohol
- Singles more likely to consume more on-trade alcohol; socioeconomic status likely to be factor influencing on-channel beer consumption

Results (3) - Tobacco

Strong negative underlying trend in cigarette consumption; positive for rolling tobacco

Participation

- Household income positively associated with likelihood of consuming tobacco
- Consumption of other tobacco and accessories likely to be good instruments for consuming either cigarettes or rolling tobacco
- Heavy-drinking households more likely to consume tobacco; socioeconomic and marital status also likely to be factors
- Households with young children, owner-occupiers and older households less likely to smoke

Consumption

- Higher household income strongly associated with consuming greater quantities of tobacco
- Households which drink heavily also likely to consume more tobacco
- Exclusively older households likely to consume fewer cigarettes

Conclusions

- Alcohol models find elasticities of similar magnitude to existing studies, albeit slightly higher and using new volumes data
- Overall demand for on-trade spirits found to be much more elastic than off-trade spirits; demand for off-trade wine remains highly inelastic
- Tobacco models suggest that price increases for cigarettes have a bigger effect on demand than price increases in rolling tobacco
- Incomplete data remains an issue, particularly for tobacco – what about vaping products?
- May now be very limited capacity for Government to raise further tax revenues from tobacco products, particularly cigarettes
- Full results will be published in two reports on Deloitte website shortly

QUESTIONS?

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