**Introduction**

**Data and Methods**

*Overview of study design*

We combined data on self-reported spending on tobacco products by smokers in England, adjusted for underreporting to estimate the proportion of income spent on tobacco overall and by sociodemographic group, and the smokefree dividend overall and by region and local authority.

*Self-reported consumption and spending on tobacco*

We used data on weekly spending on tobacco products from the Smoking Toolkit Study (STS) (Fidler, et al., 2011), a repeated cross-sectional study in which data on smoking and quitting behaviours is collected from a representative sample of the English population each month. We used data from April 2014 to February 2020. These dates were chosen to cover the full period in between local authority identifiers first being available in the data and the start of the Covid-19 pandemic in the UK. This range provides an adequate sample size for calculations at local authority level. The spending figures were adjusted to December 2018 prices using the Consumer Prices Index (CPI) for tobacco products. Figure 1 presents the distribution of all inflation-adjusted weekly expenditures in the data, which yields a self-reported median spend of £20.28 and mean spend of £25.57 per smoker per week for England as a whole. We also obtain consumption information from the STS, which has information on average cigarettes smoked per day, and compare this to expenditures in our local authority level analysis in order to investigate differences in spending across local authorities.

*Adjustment for underreporting of spending*

The estimated total annual expenditure based on the mean self-reported weekly expenditure on tobacco, and an estimated 6.131 million smokers in England (OHID, 2020), is £8.152 billion per year. This figure is below the total collected by the UK government in tobacco duty alone, receipts of which totalled £8.84 billion in the calendar year 2018 and £8.75 billion of which came from cigarettes and hand-rolling tobacco (HRT) (HM Revenue and Customs, 2021). To estimate the duty receipts specifically from spending by smokers in England, we adjusted the total duty receipts for the UK by the percentage of UK smokers who are English (calculated from the Annual Population Survey and estimated at approximately 82.25% (ONS, 2020)). When making the England-only adjustment, total tobacco duty receipts from England are still estimated at £7.64 billion. Considering that total expenditure must also comprise value added tax and industry profit margins, the implied total expenditure of £8.152 billion estimated from the STS is still low. This suggests that the mean weekly expenditure figure of £25.57 is an under-estimate of the true mean due to under-reporting of expenditures.

To produce mean weekly spending estimates from the STS which are consistent with the amount of total expenditure implied by HMRC duty receipts, we therefore estimated an upshift factor to apply to the spending data.

To calculate the required upshift factor we first estimate the total annual expenditure implied by the total duties received by HMRC. The upshift factor is then obtained by taking the ratio of this figure to the £8.152 billion estimate based on the STS data. We calculated the total expenditures separately for factory-made cigarettes and hand-rolling tobacco (HRT). The approach for each product is to take the price (per pack of 20 cigarettes or per 100g of HRT) and calculate the total duty paid on the respective quantity – based on the duty rates on December 2018 of £228.29 per 1,000 sticks of factory-made cigarettes plus ad-valorem tax of 16.5% of the retail price, and £234.65 per kilogram of HRT.

Price data for cigarettes is obtained from the ONS and the December 2018 price of £10.63 for a pack of 20 cigarettes is used in the calculation [REF]. For HRT, price is taken as an average of online supermarket prices in December 2020 and deflated to December 2018 prices using the All-Tobacco component of the Consumer Prices Index (CPI). The percentage of the market price which is paid as duty is calculated from these figures and applied to the duty receipts data to estimate total expenditure on (legally supplied) tobacco.

As some consumption of tobacco products is from illicit sources, we also estimate expenditure on illicit tobacco. HMRC estimate the “tax gap” which arises from the market for illicit tobacco (HM Revenue and Customs, 2021). Using the estimates from the 2018/19 tax year of the volumes of illicit cigarettes and HRT, expenditures on illicit sources of consumption are calculated as the volume of illicit consumption multiplied by the average price adjusted by the ratio of average illicit to legal prices. The average cost of illicit sources of tobacco have been estimated at approximately half of the average legal price for both factory-made cigarettes and hand-rolling tobacco (ASH Scotland, 2021). The estimated total expenditure on illicit tobacco in England is £1.445bn, 10.63% of estimated total tobacco expenditure of £13.590bn.

A detailed breakdown of the upshift factor calculation is presented in Table 1. The initial STS tobacco spending estimates were multiplied by this upshift factor accordingly.

*Income*

Income data are obtained from the ONS at middle layer super output area (MSOA) level for the financial year ending March 2018. These data are aggregated to upper tier local authority level, by taking the population-weighted average. These figures can be matched to local authority level spending calculated from the STS data to estimate average tobacco spending as a proportion of income by local authority. The income figure used throughout is net equivalised household income after housing costs.

*Smoking prevalence*

The data on smoking prevalence and the number of smokers by local authority, used in combination with average weekly spending calculated from the STS to obtain population total spending estimates, are obtained from the Public Health England local tobacco control profiles for 2019 (OHID, 2020) derived from Annual Population Survey (APS) data.

*Calculation of smokefree dividend*

The smoke free dividend is defined as the portion of spending on tobacco not directly benefiting the local economy, due to being transferred to the treasury as tax revenue, to manufacturers, or to criminals through the illicit trade. There is, therefore, a potential “dividend” to the economy of this money not being spent on tobacco products. Of total retail sales of tobacco an estimated 7% is profit margin to the retailer (ASH, 2016). Of total annual expenditure on tobacco products from legal suppliers we therefore calculate 93% of that spending is smoke free dividend. We attribute all expenditure on illicit tobacco as smoke free dividend.

We calculate and present the smoke free dividend at the local authority and government office region levels. The aggregate estimate of the share of illicit tobacco out of total tobacco expenditure, across cigarettes and HRT, is approximately 10%, based on our calculations of total legal and illicit tobacco spending in Table 1. We apply this percentage to each local area to divide spending into legal and illicit:

**Results**

*Spending on tobacco*

Table 2 presents the upshifted average weekly expenditure on tobacco by smokers, estimated for different population subgroups in the STS data. The overall average spending per week is £45.93. Average spending is slightly higher for those in lower social grades at £46.22 in C2DE - the working class and non-working social grades - compared to £45.45 in the middle class ABC1 social grades. These very similar spending figures suggest that smokers at lower social grades, whose incomes will be lower on average, spend a higher proportion of their disposable income on smoking. Average weekly spending is also similar for male and female smokers - £46.55 per week compared to £45.23. The starkest differences are by age and by region. Expenditure on smoking increases, at a diminishing rate, with age. The oldest three groups (45-54, 55-64, and 65+) smokers all spend around £50 per week on tobacco while the 16-24 age groups spend around £35 per week. The smokers in the 65+ age group spend the most of any group at £52.61 per week. Regional variation is also substantial, ranging from an average weekly spend per smoker of £39.49 in the South West compared to £54.28 in the North East. This differential of around £15 per week between the highest-spending and lowest-spending regions amounts to a non-negligible £780 difference over a year.

*Smokefree dividend*

Table 3 presents estimates of the annual smoke free dividend by region. In total we estimate that the approximately 6.1 million smokers spend a total of £14.654bn on tobacco products, of which £13.733bn is the potential dividend from making smoking obsolete.

*Proportion of income spent on tobacco*

This variation in average spending by region is reflected in differences in the proportion of average income by region that the spending figures represent. The proportion of disposable income spent on tobacco is under 8% in London, the South East and South West, between 8% and 9% in the East of England and East Midlands, and larger in the Northeast, Northwest, Yorkshire and the Humber, and in the West Midlands. The proportion is particularly high in the North East – the region with the highest average spending per smoker - where tobacco spending is over 11% of disposable income.

At local authority level, of the 151 UTLAs, 10 had fewer than 10 observations in the pooled STS 2014-2020 data and so we excluded these from the analysis. Differences in the financial burden of tobacco between regions can arise due to differences in spending and differences in incomes. When comparing spending and income at the local authority level, Figure 2 illustrates a very slight negative correlation between spending and disposable income, showing that in the more deprived areas of the country smokers spend more money on tobacco products – or at least spend no less than in the wealthier local authorities. The Pearson correlation coefficient is -0.101 but this is not significantly different from 0 (The 95% confidence interval is [-0.262, 0.066]). This weakly negative correlation between weekly spending on tobacco and disposable income suggests a clear social gradient in the financial burden of smoking, with poorer smokers spending similar amounts of money on tobacco to wealthier smokers and consequently dedicating a larger proportion of their disposable income to tobacco consumption. The bottom panel of Figure 2 plots annual average income and the percentage of a smoker’s net disposable income (after tax and housing costs) spent on tobacco products. There is a much stronger negative correlation of -0.656 between the average income of a local area and the average proportion of income which is spent on tobacco products by smokers in the local area, and this is significantly different from zero.

Figure 3 shows that, there are higher levels of self-reported tobacco consumption by smokers in poorer local authorities. Given similarities in the total spending in local authorities with differing levels of incomes, this may be due to differences in the types of tobacco product consumed across local authorities with, with smokers in poor local authorities smoking cheaper products. We find no evidence, however, that the proportion of smokers consuming HRT differs by local authority average income, and average consumption of both factory-made and HRT cigarettes is higher in lower income areas. One possible explanation for the greater variation in consumption by levels of income relative to differences in spending is that there is geographic variation in the prices of similar products, with lower income areas also experiencing lower prices. Another possible explanation is that low-income smokers smoke cheaper brands. We cannot, however, identify geographical variation in either prices or brands consumed in our data.

Tobacco consumption is higher among smokers from the poorer areas of England relative to wealthier areas. This, combined with average spending figures which are roughly similar across local authorities of differing average incomes, means that a greater amount of disposable income is spent on tobacco in poorer areas than by smokers in richer areas, leading to a greater financial burden. Along with the health risks of smoking, the higher smoking prevalence and tobacco consumption in lower-income areas combined with the financial burden means there are significant inequalities, both health and economic, that can be alleviated by making smoking obsolete.

Figure 4 illustrates the geographic inequalities in income and the financial burden of tobacco, plotting deciles of average income on the map in the left panel and the proportion of average income spent on tobacco on the map in the right panel. In both cases a lighter shade represents a higher decile. The figure illustrates the geographical location of the higher and lower-income local authorities, the former being primarily located in the south of the country and the latter in the Northeast and Northwest. There is a clear contrast with the geographic dispersion of higher and lower spending proportion local authorities. The UTLAs in the lowest deciles for tobacco spending as a proportion of income are generally in the Southeast, Southwest, and East of England.

Tables 4 and 5 respectively summarise the local authorities with the highest and lowest expenditures on tobacco as a proportion of weekly income. The highest proportions range from 12.63% (Newcastle upon Tyne) to 14.84% (Halton), whereas the lowest proportions range from 5.44% (West Berkshire) to 6.38% (Southwark).

Comparing the two tables, higher spending as a proportion of income is a result of both higher spending and lower incomes in the high-proportion local areas relative to the low-proportion areas – average annual incomes range from around £21,000 to £26,000 per year in the former and £30,000 to £40,000 in the latter. Concurrently, the average weekly spend on tobacco in the high-proportion areas is in the range of £53 to £71, compared to £30 to £48. The regional disparities are also highlighted by comparing these two tables. Of the top 10 local authorities by spending as a proportion of income, 8 are in the Northeast and Northwest with one each in the East of England and the West Midlands. Conversely, of the bottom 10 local authorities, all are in London and the Southeast/Southwest except for Bedford, in the East of England.

In addition to higher spending in the top 10 local authorities the smoking prevalence is also generally higher, ranging from 13% in Newcastle upon Tyne to 19.26% in Hartlepool. In the bottom 10 local authorities this range is 8% (Richmond upon Thames) to 17.5% (Brighton and Hove). High smoking prevalence and high average tobacco spending combine to produce particularly large potential economic benefits to everyone giving up smoking. The estimated smoke free dividends for Salford, Bolton, and Stockport are all in excess of £100m. Even in very low prevalence areas such as Richmond upon Thames or areas with relatively low average spending such as Bedford, the benefits to the local economy are substantial, with smoke free dividends of £28.250 million and £24.401 million respectively.

Figure 5 compares the geographical spread of average income with that of the smoke free dividend (scaled by total population of the local authority). As with Figure 4, lighter shades represent a higher decile of the distribution – higher average incomes/higher smoke free dividend. As with the comparison of income and the tobacco spend as a proportion of income in Figure 4, the heat maps suggest that the greatest potential economic benefits from making smoking obsolete are obtained in the regions with lower incomes. The largest dividends per capita are generally found in the (geographically) smaller, urban local authorities and primarily those in the Northeast and Northwest, as well as some of the poorer areas of London.

This highlights that the potential gains from elimination of smoking are also good for addressing inequalities. Not only is smoking a larger financial burden on the smokers themselves in poorer regions in England than rich ones, but the economic benefit to the whole local population is larger in the lowest income parts of the country.

**Discussion**

# **References**

ASH. (2016). *Counter Arguments - How important is tobacco to small retailers?* Retrieved from Action on Smoking and Health: https://ash.org.uk/information-and-resources/reports-submissions/reports/counter-arguments-how-important-is-tobacco-to-small-retailers/

ASH Scotland. (2021). *Calculating the cost of smoking.* Retrieved from https://www.ashscotland.org.uk/media/850413/28-calculating-the-cost-of-smoking-june-2021.pdf

Fidler, J., Shahab, L., West, O., Jarvis, M., McEwan, A., Stapleton, J., . . . West, R. (2011). The smoking toolkit study: a national study of smoking and smoking cessation in England. *BMC Public Health*, 11 (1-9).

HM Revenue and Customs. (2021). *Measuring tax gaps 2021 edition - tax gap estimates for 2019 to 2020*. Retrieved from HM Revenue and Customs: https://www.gov.uk/government/statistics/measuring-tax-gaps/measuring-tax-gaps-2021-edition-tax-gap-estimates-for-2019-to-2020

HM Revenue and Customs. (2021, November 30). *Tobacco Bulletin.* Retrieved from https://www.gov.uk/government/statistics/tobacco-bulletin

OHID. (2020). *Local Tobacco Control Profiles*. Retrieved from Office for Health Improvement and Disparities: https://fingertips.phe.org.uk/profile/tobacco-control

ONS. (2020). *Annual Population Survey, January-December 2018. [data collection]*. Retrieved from UK Data Service. SN: 8461: DOI 10.5255/UKDA-SN-8461-5

**Figures and Tables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 1. Upshift Calculations** |  |  |  |
| HMRC estimated spend | Cigarettes | HRT | Total (£m) |
| Total duty receipts (£m) a (England) | 6,372 | 1,188 |  |
| Pack Price Dec 2018 (£ per 20 cigarettes b/100g HRT) | £9.31 | £47.90 |  |
| Ad-Valorem tax rate c | 16.50% | 0.00% |  |
| Ad-Valorem tax (£ per pack) | 1.54 | 0.00 |  |
| Specific duty rate (per 1000 sticks) d | £228.29 | £234.65 |  |
| Specific duty (£ per pack) c | £4.57 | £23.46 |  |
| Total excise (£ per pack) | £6.10 | £23.46 |  |
| Total excise duty % of price | 65.56% | 48.98% |  |
| Total tax (excise duty + VAT) % of price | 82.23% | 65.65% |  |
| Total legal spend (£m) | £9,720 | £2,425 | £12,145 |
| Total illicit cigarette spend (£m) e,f | £583 | £862 | £1,445 |
| Illicit share of total expenditure | 5.66% | 26.22% | 10.63% |
| Total grossed-up expenditure |  |  | £13,590 |
|  |  |  |  |
| Survey data estimated spend | | | |
| Total grossed-up expenditure |  |  | £8,152 |
|  |  |  |  |
|  |  | Upshift: | 1.6670 |
| [(a) 2018/19 figures obtained from the HMRC July 2021 Tobacco Bulletin tables](https://www.gov.uk/government/statistics/tobacco-bulletin) | | | |
| [(b) OECD. Weighted Average Price in 2016 inflated to 2018 prices](https://www.oecd.org/tax/consumption/tax-burden-cigarettes-ctt-trends.xlsx) | | | |
| [(c) Tobacco duty rates as of December 2018. HMRC Tobacco Bulletin](https://www.gov.uk/government/statistics/tobacco-bulletin/tobacco-duty-rates) | | | |
| (d) With duty charged per kilogram, we assume one stick of HRT = 1 gram | | | |
| [(e) 2018/19 illicit consumption obtained from the HMRC Measuring tax gaps tables](https://www.gov.uk/government/statistics/measuring-tax-gaps-tables) | | | |
| [(f) estimates of illicit tobacco product prices obtained from ASH Scotland](https://www.ashscotland.org.uk/media/850413/28-calculating-the-cost-of-smoking-june-2021.pdf) | | | |



**Table 3. Smoke free dividend estimates by region**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Region | Spend per smoker (£) | Number of Smokers | Total Annual Spend (£m) | % of Income on Tobacco | Dividend (£m) |
| East Midlands | £46.17 | 566,850 | £1,361 | 8.49% | £1,275 |
| East of England | £46.34 | 669,833 | £1,614 | 8.05% | £1,513 |
| London | £46.46 | 896,639 | £2,166 | 7.66% | £2,030 |
| North East | £54.28 | 326,442 | £921 | 11.38% | £864 |
| North West | £46.03 | 837,814 | £2,005 | 9.49% | £1,879 |
| South East | £44.47 | 873,863 | £2,021 | 7.37% | £1,894 |
| South West | £39.49 | 631,799 | £1,298 | 7.42% | £1,216 |
| West Midlands | £48.03 | 650,297 | £1,624 | 9.72% | £1,522 |
| Yorkshire and the Humber | £46.64 | 677,670 | £1,644 | 9.34% | £1,540 |
|  |  |  |  |  |  |
|  |  | 6,131,207 | £14,654 |  | £13,733 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 4. Expenditure on smoking in the local authorities with the highest tobacco expenditure as a proportion of income** | | | | | | | | | | | | |
| Local Authority | Region | | Prevalence | | Weekly spend (£) | | % of income | | Annual Income (£) | | Dividend (£m) | |
| Halton | North West | | 14.90% | | £68.21 | | 14.84% | | £23,906 | | £49.860 | |
| Hartlepool | North East | | 19.26% | | £61.36 | | 14.55% | | £21,925 | | £42.401 | |
| Salford | North West | | 19.09% | | £64.15 | | 14.53% | | £22,953 | | £120.166 | |
| Middlesbrough | North East | | 17.17% | | £61.39 | | 14.30% | | £22,326 | | £55.577 | |
| Luton | East of England | | 16.84% | | £66.43 | | 13.49% | | £25,614 | | £84.830 | |
| Bolton | North West | | 15.87% | | £62.37 | | 13.33% | | £24,329 | | £105.693 | |
| Knowsley | North West | | 14.25% | | £53.35 | | 13.22% | | £20,985 | | £43.373 | |
| Stockport | North West | | 13.39% | | £71.15 | | 13.16% | | £28,107 | | £106.762 | |
| Sandwell | West Midlands | | 15.35% | | £51.15 | | 12.71% | | £20,924 | | £94.108 | |
| Newcastle upon Tyne | North East | | 13.01% | | £58.50 | | 12.63% | | £24,086 | | £90.672 | |
| *\* Local authorities with fewer than 10 observations are excluded.*  **Table 5. Expenditure on smoking in the local authorities with the lowest tobacco expenditure as a proportion of income** | | | | | | | | | | | | |
| Local Authority | | Region | | Prevalence | | Weekly spend (£) | | % of income | | Annual Income (£) | | Dividend (£m) |
| West Berkshire | | South East | | 10.35% | | £35.69 | | 5.44% | | £34,086 | | £22.108 |
| Cheshire West and Chester | | North West | | 11.34% | | £30.54 | | 5.45% | | £29,140 | | £46.322 |
| Merton | | London | | 13.55% | | £38.32 | | 5.63% | | £35,368 | | £40.256 |
| Richmond upon Thames | | London | | 8.00% | | £47.63 | | 6.11% | | £40,526 | | £28.250 |
| Bath and North East Somerset | | South West | | 13.04% | | £35.13 | | 6.12% | | £29,867 | | £35.072 |
| Bedford | | East of England | | 10.76% | | £35.11 | | 6.12% | | £29,835 | | £24.401 |
| Wandsworth | | London | | 13.47% | | £43.51 | | 6.31% | | £35,881 | | £75.725 |
| Brighton and Hove | | South East | | 17.50% | | £36.45 | | 6.34% | | £29,897 | | £74.803 |
| Camden | | London | | 12.05% | | £39.81 | | 6.37% | | £32,493 | | £50.865 |
| Southwark | | London | | 15.56% | | £37.67 | | 6.38% | | £30,700 | | £72.415 |

*\* Local authorities with fewer than 10 observations are excluded.*

**Figure 1. Distribution of Weekly Spending on Tobacco**

A picture containing diagram

Description automatically generated

**Figure 2. Average Weekly Spending and Local Authority Average Income**

Graphical user interface, diagram, timeline

Description automatically generated

**Figure 3. Local Authority Average Daily Cigarette Consumption**

Diagram

Description automatically generated

**Figure 4. Deciles of Income and Spending as a Proportion of Income by Local Authority**

Map

Description automatically generated

**Figure 5. Deciles of Income and Smoke free dividend per capita by Local Authority**

Map

Description automatically generated

**Extra Figures/Tables**

**Distribution of Weekly Spending by Region**

Chart

Description automatically generated

**Percent of smokers who consume HRT and average income**

Diagram

Description automatically generated