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SMOKING AND THE PUBLIC PURSE

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Summary

- This discussion paper provides the first estimate of the net effect of smoking on UK taxpayers per annum. Up until now, estimates have used a methodology that typically includes intangible costs, including costs to smokers themselves, while ignoring tangible savings to the state and tax revenues from tobacco duty.

- We estimate a net saving of £14.7 billon per annum at current rates of consumption, with the costs smokers incur significantly outweighed by the sum of tobacco duty paid and old-age expenditures avoided due to premature mortality.

- The government spends £3.6 billion treating smoking-attributable diseases on the NHS and up to £1 billion collecting cigarette butts and extinguishing smoking-related house fires. But these costs are covered more than four times over by early death savings and tobacco duty revenue.

- In the absence of smoking, the government would spend an extra £9.8 billion annually in pension, healthcare and other benefit payments (less taxes forgone). Duty paid on tobacco products is £9.5 billion a year. In total, the gross financial benefit to the government from smoking therefore amounts to £19.3 billion. Subtracting the £4.6 billion of costs (above) produces an overall net benefit of £14.7 billion per annum.

- We estimate 15.9 per cent of deaths in the UK (96,045) were attributable to smoking in 2015, in line with previous studies. Each individual lost 13.3 years of life on average. Net government spending data were

used to estimate the amount saved by the health and welfare system per life year lost, and a three per cent discount rate was applied to turn the flow of foregone entitlements into present values.

- Previous cost-of-smoking studies for the UK have universally ignored savings from premature mortality, meaning their results showed an incomplete picture of the situation faced by taxpayers. Ours is the only study that shows the impact on government finances of a counterfactual scenario in which there is no smoking.

- This paper is the final instalment of a three-part series looking at three lifestyle factors that are said to be a drain on taxpayers. The first two papers looked at alcohol and obesity respectively. The former incurs a gross cost which is amply offset by alcohol duty revenues. The latter incurs an annual net cost of up to £2.5 billion. The current paper finds that smoking results in a net saving of £19.8 billion. Taken together, Britain's public finances would be £22.8 billion worse off if there were no drinking, smoking or obesity.

1. The external cost of smoking

Introduction

Costs to the taxpayer are often cited as a justification for government intervention in people's eating, drinking and smoking habits. Estimates of the external costs of these activities typically imply that many billion of pounds could be saved if rates of drinking, smoking and obesity were reduced. However, as we have shown in previous research (Snowdon 2015; Tovey 2017), claims about the burden of alcohol consumption and obesity on public services have been greatly exaggerated by researchers who have wrongly portrayed private costs as external costs and ignored the costs of old age that would accrue if people lived longer.

In this report, we turn to the issue of smoking which is said to cost the UK anything from £2.7 billion to £47 billion per annum. The lower figure is a plausible estimate for the gross healthcare costs associated with smoking-related diseases (Callum et al. 2011) whereas the higher figure is a very broad estimate of the societal costs, including lost productivity (Dobbs et al. 2014: 16[1]), which are not necessarily borne by third parties.

What is an external cost?

'Societal' costs can be defined very broadly and an 'economic' cost can be defined more broadly than a purely financial cost. As a member of society, any cost you incur could be counted as a cost to society. The money you spend on a product and the healthcare costs you incur can be quantified, and a few cost-of-smoking studies have included private expenditure on tobacco and the associated NHS costs as societal costs. Some studies have also attached monetary values to a year of life and calculated the

1 The McKinsey report (Dobbs et al. 2014) does not fully explain its smoking estimate. The £47 billion figure is its estimate of the cost of obesity, most of which consists lost productivity, which it says is 'in line with that of smoking'.

cost to premature mortality to smokers, again including it as a societal cost. The inclusion of such costs can be justified if the intention is to calculate the gross cost to consumer wellbeing from an activity, although we would also need to know what the gross benefit to wellbeing was before the tally could be useful. These are not external costs, however, and should be of little interest to policy-makers and economists. In standard economic theory, the benefits of consumption from a voluntary activity, assuming the individual is conscious of the risks, must exceed the private costs to the consumer. These private costs are ultimately a matter for the individual. It is the external costs to third parties that are of relevance to policy-makers.

External costs can also be broadly defined. If emotional and intangible factors are included, there is scope for the cost estimate to rise almost without limit. One cost-of-drinking study, for example, included arbitrary monetary valuations of the emotional costs that are incurred when drinkers 'negatively affect a social occasion' or 'fail to do something they had been counted on to do'. The study also included the emotional costs of 'avoiding drunk people or places where drinkers are known to hang out' (Laslett et al. 2010).

Since no man is an island, the ups and downs of personal relationships can be viewed as societal costs in a cosmic sense, but it is doubtful whether the average person has these tenuous emotional costs in mind when told that drinking costs society billions of pounds. A lay reader is more likely to assume that such figures relate to the NHS and other public services, and yet direct costs to taxpayers only make up a small share of most 'public health' estimates.

There is much scope for confusion when societal cost estimates are directly compared to tangible financial figures, such as a country's GDP or to the amount of revenue received by the government in taxation. For example, a study published in 2017 claimed that the global 'economic cost of smoking' was $1.4 trillion per annum which, the authors said, is 'equivalent in magnitude to 1.8% of the world's annual GDP' (Goodchild et al. 2017). When reported in the media, it was claimed that '[t]hese losses exceed annual global revenue from tobacco taxes, estimated to be US$269 billion' (*New Zealand Herald* 2017). Some newspapers went further by wrongly assuming that the $1.4 trillion was a direct healthcare cost. *The Daily Express*, for example, headlined its story: 'Treating ill smokers costs the world £1.14 TRILLION'.

These are apples-and-oranges comparisons, but the media could be forgiven for their misunderstanding. One of the authors of the study told the press that $1.4 trillion was 'the economic cost of smoking-attributable diseases'. Such a claim might be defensible at an economics conference if put in context, but it was no surprise when journalists equated this with a bill that had to be paid by the health service.

But it is not. Of the $1.4 trillion total, $1 trillion was made up of lost productivity due to premature mortality and absenteeism. This is not an external cost, let alone an external cost to the government. The economic value of lost productivity may be more quantifiable than the intangible costs of being negatively affected at a social occasion, but it is not a cost imposed on other people. Just as income earned is a private benefit to the employee, forgone earnings are a private loss, as Crampton et al. (2011: 24) explain:

> *'Employer and employee are bound by a contractual nexus; the worker's reduced productivity is internal to his relationship with his employer. A less productive employee is less likely to receive future promotions and salary increases; he bears the burden of his reduced productivity.'*

The World Health Organisation (2010: 34) correctly notes that premature mortality 'should not be included' in cost estimates of this sort because job vacancies are filled by other workers with minimal impact on company productivity. The costs of absenteeism are limited in most modern workplaces because companies tend to have 'coping strategies' with other staff providing cover, but even when this is not possible the costs of absenteeism fall on the absentee worker through lower wages and, ultimately, dismissal.

The healthcare costs in the 2017 study are substantial at $0.4 trillion - it does cover the whole world, after all - but this is still only 28 per cent of the $1.4 trillion total. Moreover, the healthcare figure is a gross cost which does not take into account the healthcare spending that would be required if today's smokers did not smoke. A substantial body of research shows that smokers require less government expenditure over the course of their lifetime than nonsmokers, thereby indicating that the net costs of smoking are negative, ie. cost-saving (see Snowdon 2016 for a discussion of this literature).

Does smoking cost Britain £13.7 billion per annum?

In the UK, the most commonly cited estimate comes from a report by the Policy Exchange think tank in 2010 (Nash and Featherstone 2010). This claimed that the annual external cost of smoking was £13.74 billion, but, again, this was also dominated by lost productivity. Its components were as follows:

Healthcare costs: £2.7 billion

Lost productivity (smoking breaks): £2.9 billion

Lost productivity (absenteeism): £2.5 billion

Lost productivity (premature mortality): £4.1 billion

Passive smoking (premature mortality): £0.7 billion

Environmental costs: £0.34 billion

Fire damage: £0.5 billion

No less than 69 per cent of the total (£9.5 billion) is made up of various lost productivity costs. Given that the purpose of the Policy Exchange report was to establish the correct level of tobacco duty, the inclusion of these external costs was inappropriate. If we want to establish the socially optimal level of tobacco taxation (a Pigouvian tax), we need a figure for the net externalities of tobacco consumption. Alternatively, if we wish to set tobacco taxes at a level that recoups the money spent by the government on smoking-related issues, we need a figure for the net externalities of tobacco consumption to public services. The Policy Exchange report provides neither. Instead, it combines the gross costs to private and public services and combines them with internal costs in the labour market, some of which are dubious even as estimates of lost output.

The inclusion of lost productivity through smoking breaks is particularly difficult to defend. Policy Exchange's figure comes from taking an estimate of the number of hours lost to smoking breaks and multiplying it by the average hourly wage. This is problematic for several reasons:

First, as mentioned above, lost productivity creates internal costs to the employee through lower wages (since wages are paid according to productivity). Income forgone in this way is no more a societal cost than the opportunity cost of taking early retirement or working part-time.

Second, it cannot be assumed that smoking employees take longer (or more) breaks than nonsmokers. By law, all employees must be given a rest break of at least 20 minutes per day and employers typically allow more breaks than this because it improves staff morale and productivity.

Third, studies have shown that rest breaks either have no negative effect on productivity or improve it (Dababneh et al. 2001; Henning et al. 1997).

Fourth, with the possible exception of some agricultural and manufacturing jobs (such as line worker), productivity is not evenly spread throughout the day. Businesses tend to be more or less busy at different times of the day and employees will tend to take a break at quiet times. This is true even in labour intensive jobs when, for example, machinery breaks down.

With the exception of passive smoking (see below), none of the lost productivity costs included by Policy Exchange are external costs and the authors inflate them by making unwarranted assumptions. For example, they assume that smokers who die prematurely would otherwise have worked to the age of 74 and 'would not have been affected by any other health problems' (Nash and Featherstone 2010: 14). They also assume that the higher rates of absenteeism among smokers are entirely due to smoking, thereby ignoring important factors that distinguish smokers from nonsmokers such as income, education and alcohol consumption. The authors of a study which found that smokers earn 20 per cent less than nonsmokers noted that 'education level was the largest contributing variable. Nonsmokers tend to be more educated' (Safdar 2013).

Based on these inflated cost estimates, the Policy Exchange authors concluded that tobacco was undertaxed; their £13.74 billion exceeded the £10 billion raised by HMRC in tobacco duty in 2010. The £13.74 billion figure has been used ever since as proof that smokers impose excess costs on nonsmoking taxpayers and are not 'paying their way'. For example, Public Health England's Director of Health and Wellbeing, Kevin Fenton, made a direct comparison between Policy Exchange's figure and the £9.5 billion collected each year in tobacco duty:

> *'It's been calculated that overall in England, smoking costs society over £13 billion each year. And even adjusting for the duty that smokers pay on tobacco, the country is still worse off, to the tune of £4 billion each year.' (Fenton 2014).*

This is another apples-and-oranges comparison. There is no reason why the amount paid in tobacco duty should be equal to the output forgone by smokers. Nonsmoking taxpayers would not be better off if smokers were more productive. Third parties do not become richer by other people working harder. Even if they did, there would be no obligation on workers to maximise their productivity for the good of others.

It would be absurd to claim that those who take early retirement or work part-time are imposing a cost on other people, and yet that is the implication of the logic used in cost-of-smoking studies. Although early retirement does not impose a cost on others, there is an economic cost insofar as it means GDP will be marginally lower than it would have been if the individual had continued working, but even this tenuous 'cost' does not apply when lost productivity is due to premature mortality. GDP can only be calculated meaningfully on a per capita basis. All things being equal, the death (or birth) of an individual has no impact on GDP per person.

The net external costs of smoking

If lost productivity costs are properly excluded from the Policy Exchange estimate, it leaves a total of £4.14 billion made up of passive smoking, healthcare costs, fire damage and environmental costs. The authors attribute £700 million to lost productivity due to passive smoking. Leaving aside the points already made about lost productivity, and the questionable science that underpins claims about passive smoking, it is difficult to see these costs as truly external. Smoking has been banned in all indoor public places for ten years in the UK. It is hard to imagine a situation in which a nonsmoker would be involuntarily exposed to secondhand smoke for more than a few seconds. Those who choose to visit or live with smokers do so of their own free will, knowing that they will be in a smoky environment at times. This suggests that they are either unworried about the alleged risks to their health or regard time spent in the company of smokers as being worth it. In either case, they are assuming the risk as part of a trade-off. Any costs that result from this are self-imposed.

The other three sets of cost - healthcare costs, fire damage and environmental costs - are mostly external and taxpayers generally foot the bill for them. However, they are gross costs rather than net costs. As we have shown previously in the case of obesity (Tovey 2017; Snowdon 2016), costs to the NHS must be weighed against savings to the health and welfare system before we can calculate the overall cost to taxpayers.

In this study we assume that there are no savings to offset the costs of fire damage (£500 million) and litter collection (£340 million). We further assume that the figures cited by Policy Exchange for these costs are correct. This is a generous assumption for several reasons:

Firstly because fire damage due to discarded cigarettes mostly affects the houses of smokers and is therefore an internal cost to a large extent.

Secondly because the number of house fires has fallen by 15 per cent since 2010, and only six per cent of house fires are caused by smoking materials (Home Office 2017).

Thirdly because the £340 million estimate for cigarette litter disposal seems high given that it is 40 per cent of the entire bill for litter collection in the UK in 2010 (Gray 2010).

And finally because the cost of picking up cigarette butts and tackling smoking-related house fires is likely to have fallen as cigarette consumption has fallen.[2] With these caveats in place, we take Policy Exchange's assumption that the fire and environmental costs amount to a maximum of £834 million in 2010 prices, or £1,027 million in 2017 prices, while cautioning that this is almost certainly an over-estimate.

This leaves healthcare costs, which are by far the largest component of the external costs generated by smoking. Policy Exchange assume smoking-related healthcare costs of £2.7 billion in England based on research conducted by Christine Callum for the anti-smoking pressure group Action on Smoking and Health in 2008 (ASH 2008). Callum reiterated this figure in 2011 (Callum et al. 2011). It was increased to £3.3 billion by Scarborough et al. (2011) to cover the whole UK, and is equal to £3.6 billion in 2017 prices.[3]

2 Legal cigarette sales have fallen by a third since 2010. Incidentally, the amount of cigarette litter increased significantly after smoking was banned in enclosed places in 2007, and so part of this cost could be attributed to anti-smoking legislation rather than smoking *per se*.

3 The same authors estimated the cost at £5.2 billion in 2009 (Allender et al. 2009). As the highest figure available, it continues to be widely cited, but the authors make it clear in Scarborough et al. (2011: 531) that it has since fallen.

The basic methodology behind Callum et al.'s £2.7 billion figure is as follows:

> *'Health service use among current and ex-smokers is compared with that of never-smokers and the excess attributed to smoking' (Callum et al., 2011: 490).*

As mentioned above, smokers and nonsmokers tend to have different traits, incomes, backgrounds and levels of education that mean that their different healthcare costs are unlikely to be solely due to smoking. For the most part, this is likely to bias the cost estimates upwards. With that caveat in mind, we will nevertheless work on the same principle as Callum et al. in this report.

Some of these costs are based on relative risks, rather than direct hospital data. For example, it is assumed that smokers have a relative risk of visiting the GP of 1.18, which is to say that they have 18 per cent more GP consultations than nonsmokers (ibid.: 495).

Other costs are based on assumptions about the proportion of diseases caused by smoking, based on epidemiological studies. For example, it is assumed that 20 per cent of coronary heart disease cases are caused by smoking (ibid.: 498). Adjusting for age (heart disease is more expensive to treat among older people), Callum et al. (2011: 500-1) estimate that 16 per cent of the cost of treating coronary heart disease can be attributed to smoking. Their figures are shown in Table 1 below.

Table 1: Gross costs of smoking to the NHS

	NHS costs (millions)	% of all NHS costs
Hospital admissions	£1,017	5%
Outpatient attendances	£193	4%
GP consultations	£532	11%
Practice nurse consultations	£54	8%
Prescriptions	£903	12%
Total cost of smoking	£2,699	3.3%

Callum et al. take into account diseases that are prevented by smoking, such as Parkinson's, and reduce their total by the value of these savings. However, they do not include the cost of substitute diseases. Substitute diseases are illnesses that smokers would have contracted had they never smoked. If we wish to know what the net cost of smoking is to the health service we need to have a counterfactual of what healthcare spending would look like if nobody had ever smoked. It is often assumed that the eradication of smoking would save the NHS £2.7 billion, but this cannot be inferred from Callum et al.'s estimate of gross costs. As the authors acknowledge, their figures do not reflect excess costs from nonsmokers living longer:

> *'.. if life expectancy increases, ceteris paribus, more will be spent on health care in total over a lifetime, although the annual spend per individual may well fall. Our focus is on the extra cost to the NHS in a particular year associated with smoking, that is, we take a cross-sectional approach. Account is not taken of any savings that may occur in that year as a result of excess deaths of smokers in previous years.' (ibid.)*

To calculate the full financial impact of smoking on nonsmoking taxpayers, we must look first at the healthcare costs that would be incurred if there were no smoking and then at the costs of state pensions and welfare payments that would be incurred in this counterfactual. The following chapter provides a detailed estimate of these costs to arrive at the first published estimate of the net costs of smoking to the UK government.

2. Government savings due to smoking-attributable mortality

Section 1: Lives and years lost

Method

To estimate the impact of smoking on mortality we did the following:

- **Step 1:** The fraction of disease burden attributable to smoking was identified using the WHO's Global Burden of Disease Project, which cites population attributable fractions (PAFs) for every part of the world (WHO 2002: 221). The United Kingdom and other rich European countries with low child mortality fall under the so-called 'Euro-A region'. Sex-specific PAFs were taken for chronic obstructive pulmonary disease; trachea, bronchus and lung cancer; other cancers; and cardiovascular disease. These data were chosen because they featured in Scarborough et al.'s 2011 estimate of the NHS cost of smoking, and we aimed to promote comparability between that estimate and our own.

- **Step 2:** The PAFs were applied to 2015 mortality data. Cause-specified deaths for England and Wales, broken down by sex and age, came from the Office for National Statistics (ONS), and for Scotland from the General Register Office. Because appropriate mortality data for Northern Ireland could not be found, a UK-wide estimate was created by inflating the sum of deaths for England, Wales and Scotland by 3.1 per cent.[4] This straightforward extrapolation is defensible, because 'there is a large degree of comparability in death statistics between countries within the UK' (ONS 2016).

4 Wales makes up 3 per cent of the UK by population (ONS 2016a). Therefore, 97% x 1.031 = 100%

While the ONS reported death counts for ‘acute myocardial infarction’ and ‘aortic aneurysm and dissection’, the General Register Office combined them under the umbrella of ‘other heart diseases’. We split the deaths in this umbrella category between acute myocardial infarction and aortic aneurysm and dissection, apportioning them between the two based on their frequency in the ONS data.

- **Step 3:** Having found the number of smoking-attributable deaths in six age categories (35-44, 45-54, 55-54, 65-74, 75-84 and 85+) we sought to find the number of life years lost. An online ONS data tool answered this question by estimating remaining life expectancy for any input age (ONS Digital 2015). We plugged the number at the midpoint of these age ranges into the calculator, for males and females. Thus, we found that a female in the 65-74-year-old age category who died a smoking-attributable death lost 19 years of life, while a male of the same age lost 17 years, etc.

Results

We found 96,045 deaths were attributable to smoking-related diseases in the UK in 2015. This is equal to 15.9 per cent of total deaths (22.8 per cent of male deaths and 10.5 per cent in females). This is similar to the widely cited estimate of 99,300 deaths per annum reported by the Office for National Statistics (2017).

The largest number of deaths (32,420) occurred in the 75-84 age category, making up 34 per cent of the total, followed by the 85+ category with 28 per cent of total deaths. Taken together, this means 62 per cent of smoking-attributable deaths involved individuals who were over 74 years old.

Figure 1: Smoking-attributable deaths and life years lost, by sex and age category

Age/Sex	Number of smoking-attributable deaths in the UK in 2015	Remaining life expectancy at mid-point of age category
35-44	**697**	
Female	147	49
Male	550	47
45-54	**3,436**	
Female	790	39
Male	2,646	36
55-64	**9,992**	
Female	2,693	28
Male	7,300	26
65-74	**22,919**	
Female	6,646	19
Male	16,274	17
75-84	**32,420**	
Female	9,755	11
Male	22,666	10
85+	**26,581**	
Female	9,888	5
Male	16,693	4
Grand total:	**96,045**	

Figure 2 shows smoking-attributable deaths across 22 disease categories in the UK in 2015. The majority of mortality can be accounted for by just three causes: chronic obstructive pulmonary disease; ischaemic heart disease; and trachea, bronchus and lung cancer. The remaining 19 causes account for less than 30 per cent of smoking-attributable deaths.

Figure 2: Number of smoking-attributable deaths by disease in the UK in 2015, and PAFs from the WHO's Burden of Disease Project

Sex	Disease	Smoking-attributable deaths in UK, 2015	Percentage of disease burden attributable to smoking (i.e., PAF)
Male	Acute myocardial infarction	4598	32
Female	Acute myocardial infarction	955	10
Male	Aortic aneurysm and dissection	1151	32
Female	Aortic aneurysm and dissection	237	10
Male	Cerebrovascular disease	5302	32
Female	Cerebrovascular disease	2104	10
Male	Cerebrovascular infarction	738	32
Female	Cerebrovascular infarction	199	10
Male	Chronic obstructive pulmonary disease	13294	79
Female	Chronic obstructive pulmonary disease	9530	57
Male	Hypertensive disease	886	32
Female	Hypertensive disease	393	10
Male	Intracranial haemorrhage	1306	32
Female	Intracranial haemorrhage	517	10
Male	Ischaemic heart disease	13456	32
Female	Ischaemic heart disease	2786	10
Male	Leukaemia	460	19
Female	Leukaemia	34	2

Male	Malignant neoplasm of bladder	703	19
Female	Malignant neoplasm of bladder	34	2
Male	Malignant neoplasm of cervix uteri	0	19
Female	Malignant neoplasm of cervix uteri	16	2
Male	Malignant neoplasm of colon	915	19
Female	Malignant neoplasm of colon	94	2
Male	Malignant neoplasm of kidney	472	19
Female	Malignant neoplasm of kidney	29	2
Male	Malignant neoplasm of larynx	132	19
Female	Malignant neoplasm of larynx	3	2
Male	Malignant neoplasm of liver and the intrahepatic bile ducts	585	19
Female	Malignant neoplasm of liver and the intrahepatic bile ducts	42	2
Male	Malignant neoplasm of oesophagus	958	19
Female	Malignant neoplasm of oesophagus	56	2
Male	Malignant neoplasm of ovary	0	19
Female	Malignant neoplasm of ovary	80	2
Male	Malignant neoplasm of pancreas	852	19
Female	Malignant neoplasm of pancreas	91	2
Male	Malignant neoplasm of rectosigmoid junction, rectum and anus	691	19

Female	Malignant neoplasm of rectosigmoid junction, rectum and anus	52	2
Male	Malignant neoplasm of stomach	536	19
Female	Malignant neoplasm of stomach	31	2
Male	Stroke, not specified as haemorrhage or infarction	2128	32
Female	Stroke, not specified as haemorrhage or infarction	1010	10
Male	Trachea, bronchus and lung cancer	17280	90
Female	Trachea, bronchus and lung cancer	11309	69
Grand Total		**96045**	

Section 2: Savings from early deaths

Method

The following steps were involved in estimating the present value of pension, healthcare and other benefit payments (net of forgone tax payments) avoided because of smoking-attributable mortality in the UK in 2015.

- **Step 1:** The net amount spent by the government on different age groups while they are alive was found in a statistical bulletin produced by the ONS on benefits received and taxes paid for the financial year ending 2015 (ONS 2016b). We adjusted for the effect of inflation with the GDP deflator index. We then aggregated the data into four age categories using population weights: 35-44, 45-54, 55-64 and 65+.

  The ONS bulletin lacked information on social care spending by age group, which we obtained instead from the Health and Social Care Information Centre (HSCIC 2013: 4). Around half of the inflation-adjusted £17.7 billion social care bill goes on over 65 year olds (HSCIC 2013: 5). Without any information about the other age groups, we assumed the remaining 50 per cent is distributed equally between under 35s, 35-44 year olds, 45-54 year olds and 55-64 year olds.

- **Step 2:** Because we were investigating a counterfactual in which people lived longer due to the absence of smoking-attributable diseases, we had to remove the influence of such illnesses from NHS spending per age group. Without smokers, the NHS would incur new costs treating people who were living longer; however, that toll would not be well represented by the ONS's NHS spending figures by age group. In our counterfactual, average healthcare costs would be lower than in the real world because there would be no smoking-attributable morbidity.

  To remove the influence of smoking-attributable illness on the data, we used an inflation-adjusted estimate of the gross cost of smokers to the health service: £3.6 billion per year (Allender et al. 2009). We subtracted five per cent of this from the health cost of 35-44 year olds, five per cent from 45-54 year olds, 20 per cent from 55-64 year olds and 70 per cent from the 65+ group. This assumed distribution of the cost was loosely based on a WHO-produced estimate of the allocation of disease burden from smoking (measured in disability-adjusted life years, or DALYs) between age groups, which quoted a 70:30 spread between people who are over and under 60 years of age (WHO 2002: 223).

  The social care bill similarly needed to be cleansed of the effects of smoking-attributable illnesses. A report by Action on Smoking and Health (ASH) estimated that smoking was responsible for £760 million of social-care spending in England alone (2017). We inflated this number by 19 per cent so as to make it applicable to the UK, and then subtracted it from the social care bill.

- **Step 3:** The pension data needed to be adjusted to account for the fact that some proportion can be paid out after death in lump sum or annual amounts to surviving kin. From the statistical bulletin produced by the ONS (2016b) on benefits received per household reference person, we knew the inflation-adjusted average state pension plus pension credit paid to over-65s in England, Wales and Scotland was £9,869 per year. A Freedom of Information request to the Department of Work and Pensions revealed that the average state pension was £130 per week in 2012, and was expected to remain at that level following the introduction of the new state pension in 2016 (DWP 2012). From this, we were able to unpick the aggregate number reported above into its two components: £6,760 state pension, £3,109 pension credit.

Some part of the state pension can continue to be paid after death to a surviving spouse or civil partner, but no part of the pension credit entitlement can be transferred.

To estimate the average amount of state pension paid to the deceased's next of kin, we used the old, pre-2016 state pension guidelines, for they were the clearest on issues of inheritance. According to these guidelines, only the second state pension, which has an average value of £10.70 per week, can be inherited; no part of the basic state pension continues to be paid after death.

The second state pension was assumed to be entirely inherited in 75 per cent of cases, and paid to the deceased's spouse or civil partner for every year of life they lost to smoking. This certainly overstates the generosity of the system, because only men over 79 years of age and women over 74 are entitled to 100 per cent of their deceased partners' second state pensions, whereas we assumed everybody over 65 got the entirety in 75 per cent of cases (gov.uk 2016). The assumption that in 25 per cent of cases nothing is inherited was designed to cover those individuals who die without a spouse or civil partner and without being subject to any pension sharing orders from a terminated marriage.

The annual amount of state pension and pension credit saved per death was estimated to be (£119.30 + 0.25(£10.70)) x 52 + £3,106 = £9,451.

To round off our pension calculations, we added the savings from public sector pensions. Spending on public sector pensions was estimated to be £42 billion in 2016, with an average value of £10,321 per year (UK Public Spending 2016). Approximately 2.3 million people were in receipt of an unfunded public pension in 2014, according to our survey of annual reports produced by the pension schemes of different classes of public sector employees. This is around 20 per cent of the over-65 population in the UK, and so per person in this age category the government spends 0.2 x £10,321 = £2,064 in public pension payments every year.

Again, the amount paid out while alive does not equal the amount the government saves per death, because some fraction of the pension

can be inherited as a lump sum or regular payment by the deceased's next of kin. Each class of public sector employee has a separate set of guidelines governing inheritance. For example, the civil service pays 37.5 per cent of the deceased's pension to dependants along with a one-off lump sum worth five times the annual payment, in cases where the scheme member dies within five years of retirement (Civil Service Pensions 2016). Meanwhile, the armed forces 1975 pension scheme continues to pay out 50 per cent after death, but only to a spouse or civil partner, and only so long as that person does not re-marry or co-habit (Marsh 2014).

A considerable number of public pension scheme members presumably do not bequeath any fraction of their entitlement, due to their lack of a partner meeting the financial interdependence criterion present in most guidelines.

After surveying the conditions of inheritance for the different schemes, we decided it was conservative to assume each recipient of an unfunded public pension bequeaths on average 50 per cent of its value to a surviving partner. Therefore, the saving in terms of avoided public pension payments per over-65 who dies prematurely is, on average, 0.5 x £2,064 = £1,032.

Figure 3: Saving per person per life year lost, net of direct and indirect taxes, for four age categories, broken down by type of spending (£s)

Age bracket	Pension	Social care	Cash benefits	Education	Benefits in kind	NHS	Direct + indirect taxes	Net position
35-44	44	502	4506	6312	246	3709	18842	-3523
45-54	209	461	3561	3639	195	3628	17805	-6112
55-64	1529	572	2658	895	133	3047	15555	-6721
65+	10484	738	1736	99	162	6316	8032	11503

- **Step 4:** Finally, we multiplied lives and years lost by the net savings and used a three per cent discount rate to convert the numbers into present values.

  For example, a male who dies in the 45-54 age category loses an estimated 36 years of life. The first four of those years each costs the government £6,112 on average, as stated in row 2 of Figure 3. The next nine years also have a negative saving attached. However, the remaining 23 years are in the over-65 category, and would therefore have been lived as a net recipient of the welfare state. The government saves £11,503 on net for every year lost from this category.

  All of these figures need to be discounted before they can be directly compared, and the savings – being at least 13 years away from the present – are more harshly affected by this procedure than the more immediate costs. Still, the net present value of the death of a male in the 45-54 category is positive and equal to £47,541. Given that 2,646 smoking-attributable deaths occurred in 2015 in this age and sex bracket, the total savings from this group were £125,794,044.

  This procedure was repeated for the remaining deaths, and the results were summed to give annual government savings from smoking-attributable mortality.

Results

The UK government saved £9.8 billion in pension, healthcare and other benefit payments (net of forgone tax payments) due to smoking-attributable mortality in 2015.

Male smoking deaths saved the government £6.66 billion, more than twice the £3.15 billion saved by women. Though females have longer life expectancies and therefore forgo more years of dependency than their male counterparts by dying prematurely, men have higher rates of smoking-related mortality.

Figure 4: Present value of pension, healthcare and other benefit payments (net of forgone tax payments) avoided due to smoking-attributable mortality, broken down by age and sex

Sex	Age	Annual, net government savings due to smoking-attributable mortality, present value (£)
Female subtotal:		**3,147,207,078**
Female	35-44	178,083
	45-54h	46,414,013
	55-64	446,509,386
	65-74	1,094,991,874
	75-84	1,038,204,157
	85+	520,909,564
Male subtotal:		**6,661,822,413**
Male	35-44	-2,349,384.49
	45-54	125,794,044
	55-64	1,135,965,171
	65-74	2,464,642,714
	75-84	2,224,030,800
	85+	713,739,068
Grand total:		**9,809,029,491**

Figure 5: Average discounted saving per death for each age group

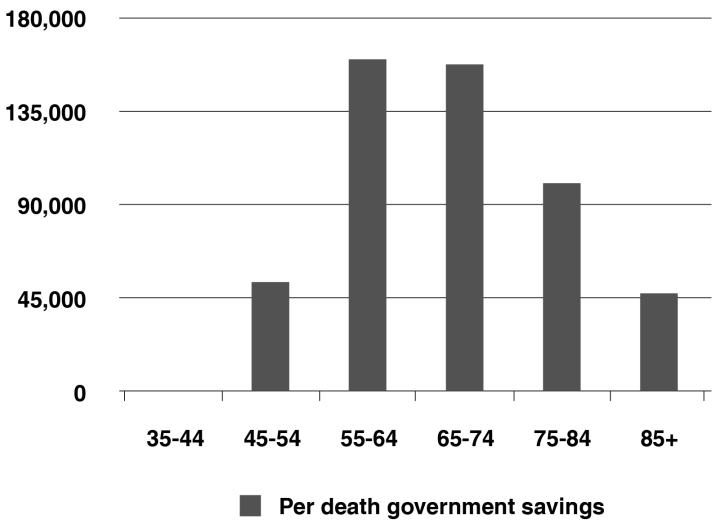
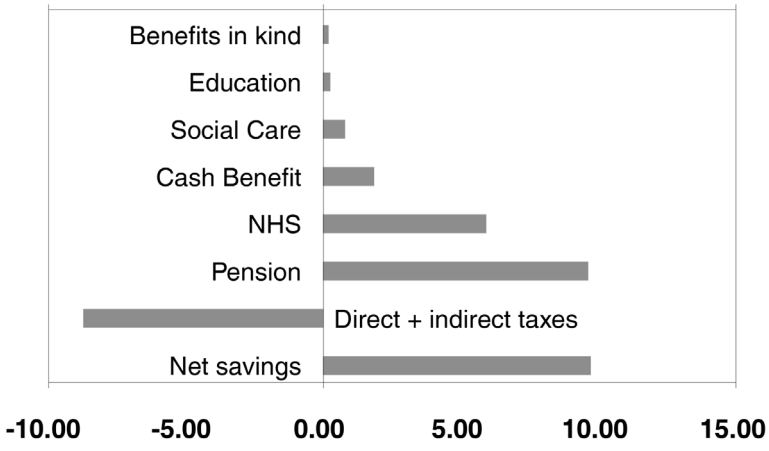


Figure 6: Gross savings from smoking-attributable deaths for each category of spending, compared with gross direct and indirect taxes forgone (£, billions)



The 65-74 and 75-84 age categories brought in the biggest savings for both males and females; however, this was only because of the much greater mortality in these age categories. As can be seen in Figure 5, neither of those age categories had the highest savings per death. That title went instead to the 55-64 group.

The savings to government from 96,000 premature, smoking-attributable deaths can be stated in gross terms as follows: the health service avoided spending £6 billion on treatment in the life years lost to smoking in 2015; the amount saved in benefits in kind was £159 million; education £231 million; social care £714 million; cash benefits £1.8 billion and pension payments £9.6 billion.

Therefore, the various departments of government have an estimated £18.6 billion less in spending obligations annually because of smoking-attributable mortality. At the same time, the government collects around £8.7 billion less in direct and indirect taxes, meaning the net financial benefit to the government is £9.8 billion[5]. These figures are presented graphically in Figure 6 above.

5 Figures do not sum because of rounding.

3. Discussion

We estimate that the UK government saved a net total of £9.8 billion from the 96,045 premature deaths attributable to smoking in 2015. In addition, £9.5 billion is taken annually in tobacco duty. That means in gross terms the government is £19.3 billion better off every year.

The offsetting costs are a £3.6 billion yearly bill for treating smoking-attributable illnesses on the NHS, and a £1 billion bill for extinguishing house fires and collecting cigarette butts (see above). Therefore, the government is £14.7 billion better off every year because of smoking.

Limitations

The precision of our estimates was limited by the data available. For example, the objective of our study was to construct a counterfactual in which there were zero smoking-attributable deaths to see the impact on government spending and revenues. However, when entering the ages of the deceased into the remaining-life-expectancy calculator, we were returned numbers that pertained to the real world, where people smoke and so do not live as long, on average, as in our counterfactual. This means our estimate of life years gained, and hence additional net government spending incurred, was not high enough.

On the other hand, the estimate of government savings from early deaths may have been too high, because no attempt was made to remove the effect of end-of-life costs. Spending on patients in the last months of their lives is notoriously high. By adding up average health spending on over-65s in the life years gained without adjusting for end-of-life costs, we overestimated

the additional spending attributable to longer lifespans, because the NHS and social care system pay these costs eventually regardless. However, since no attempt was made by Scarborough et al. to remove end-of-life costs from their estimate of the NHS cost of smoking, our net figure should be less affected, because the unwanted component was present in both figures and should thus have cancelled out during subtraction.

Conclusion

Making these calculations is a macabre task but it is a necessary one if financial arguments are to be assessed on the basis of economics rather than a one-sided view of gross and partial costs.

Our paper is the first to measure the net effect of smoking on the taxpayer in the UK, including savings and focusing only on external costs. The net figure is interesting because of the complicated give-and-take between smokers and the Treasury. Our calculations allowed us to travel to an alternate reality in which nobody smokes and survey the impact on the public purse – we found the Treasury would be £14.7 billion worse off.

Dr. Steven Allender, an Oxford researcher who co-published an estimate of the NHS cost of smoking in 2009, clearly saw the appeal of venturing into our counterfactual. He told the media that his research revealed that if nobody smoked we would be better off by £5 billion (BBC 2009). He was basing this solely on an outlier estimate of the cost to the NHS of treating smoking-attributable diseases and ignored the countervailing forces – i.e. the reduction in tax revenue and the increased pension bill that would occur in a world without smokers. He was looking at a small part of a big picture.

Our research, by estimating the value of old-age expenditures avoided due to smoking-attributable mortality, has generated the missing component necessary for an assessment of the full effect of smoking cessation on public finances. Nonsmokers should not assume that they would pay less tax if fewer people smoked. On the contrary, they would have to pay more tax as tobacco revenues decline and public spending rises.

The present paper, *Smoking and the Public Purse*, constitutes the final chapter of a three-part series. In *Obesity and the Public Purse*, the second instalment, the savings from obesity-attributable mortality were estimated

using a methodology almost identical to the one described above. We found that obesity cost the government on net up to £2.5 billion per annum, a considerable sum but less than half the amount reported in studies which ignored the zero-obesity counterfactual.

Alcohol and the Public Purse also found a gross cost to public services (of £3.9 billion in England, or £4.6 billion for the whole UK), but this was much less than the duty paid by drinkers in alcohol duty. *Alcohol and the Public Purse* did not attempt to estimate any savings to the government from alcohol-related mortality, but these are likely to be quite trivial compared to our estimates for smoking and obesity. The number of lives lost to alcohol abuse is an order of magnitude lower than those attributed to smoking and obesity; the Office for National Statistics reports 8,757 alcohol-related deaths in 2015.

Alcohol and tobacco duty provide £10.7 billion and £9.5 billion to the government respectively, with an additional £4 billion of VAT charged on this duty. If, as expected, the forthcoming sugar levy raises £500 million per annum, the government will be in receipt of £24.7 billion of 'sin tax' revenue by 2018.

Taken together, the net benefit to the government from the three most hotly discussed 'lifestyle factors' - alcohol, obesity and smoking - is £22.8 billion.[6] Put another way, Britain's public finances would be £22.8 billion worse off if there were no drinking, smoking or obesity. In practice, the government would recoup a portion of this revenue if consumer expenditure were diverted from alcohol and tobacco to other products to which VAT is applied, but the shortfall would remain very large.

Smoking alone gains the government £14.7 billion in tax revenue and lower expenditure. Alcohol consumption yields the government £6.1 billion (£10.7 billion in tax minus £4.6 billion in costs). Only obesity incurs a net cost, albeit much less than is commonly believed - around £2 billion per annum once the sugar tax is introduced.

These savings to the public finances tell a different story to the one inferred

6 (£10.7 bn alcohol duty + £9.5 bn tobacco duty + £4 bn VAT on duty + £0.5 bn sugar tax + £9.8 savings = £34.5 bn) minus (£4.6 bn smoking-related costs + £4.6 bn alcohol costs + £2.5 obesity costs = £11.7 bn) = £22.8 bn.

from quasi-societal cost studies which ignore savings and benefits while inappropriately including internal costs. Quasi-societal cost estimates are of limited academic interest and are likely to mislead the lay reader. They give an accurate picture of neither the cost to the government nor the cost to third parties.

The ability of quasi-societal costs to imply that drinkers and smokers are a drain on public services when they are not is a feature, not a bug, of the 'public health' campaign literature. As Sloan et al. note in their detailed analysis of the cost of smoking in the USA, 'estimates of smoking-attributable cost often have been developed by advocates of a particular policy position, not as a guide to appropriate policy but rather as support for a position developed independently of the estimates.' They add that such estimates 'are in effect weapons, either to attack adversaries who oppose one's position or to be used in self-defence' (Sloan et al. 2004: 8). The political nature of such estimates is occasionally made explicit, as when Kang et al. (2003) introduced their study by openly stating that it 'was conducted to provide an estimate of the costs imposed on our society as a result of smoking to justify the establishment of tobacco control policies.'

As easy as it is to blame smokers, drinkers and the obese for rising NHS costs, it is doubtful whether those who are responsible for healthcare spending believe this moral fable. The winter crisis that hits the NHS every year tends to focus the mind on the factors that are really putting a strain on public services. During the annual winter panic, nobody seriously claims that the NHS is on the 'brink of collapse' because of obese teenagers, binge-drinkers or heavy smokers. The finger of blame is pointed, quite rightly, at the ageing population.

When non-political organisations such as the Office for Budget Responsibility look at the issue, they find that the ageing population, the rising cost of technology and the Baumol effect are the main causes of rising healthcare costs (Licchetta and Stelmach 2016: 5). The popular belief that costs will fall if people live healthier - and therefore longer - lives has always been an illusion.

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