Cost Benefit and Public Finance Model of Smoking, Version 2.4

Howard Reed, Landman Economics

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Introduction

This document provides an overview of the structure and workings behind version 2.4 of the Cost Benefit and Public Finance Model of Smoking commissioned from Landman Economics by ASH (referred to in this document as the CBPF model) and also presents headline results for the cost of smoking to the economy and public finances of the UK and its constituent countries (England, Scotland, Wales and Northern Ireland).

Version 1 of the CBPF model was developed by Howard Reed in 2009-10 building on the cost-benefit model developed for ASH by Paul Johnson (Johnson, 2009; Reed, 2010).

Version 2.0 of the model, coded in 2021-22, was a complete rewrite which brought the model up to date while incorporating the latest and widest evidence on the costs of smoking to the UK economy and public finances. The model is designed to be updated at regular intervals as new evidence on the costs of smoking is produced and new data become available. See Reed (2023a) for details of Version 2.0.

Version 2.4 (June 2026) updates the model with new evidence on the wider impacts of tobacco consumption on the UK economy compared to other goods and services, and presents headline results averaged across the three years 2022, 2023 and 2024 in line with the most recent statistics on smoking prevalence from the Annual Population Survey. We also present headline results for 2025 and forward projections.

The structure of this document is as follows:

Section 1 provides an overview of the components of the cost-benefit and public finance aspects of the model as well as showing which aspects are new in this version of the model.

Sections 2, 3 and 4 explain how each element of the costs of smoking to the economy and the public finances is estimated. Section 2 looks at costs relating to productivity, Section 3 looks at taxes and benefits, and Section 4 explains how the costs of smoking to services (healthcare, social care and the fire service) are estimated.

Section 5 explains the assumptions and modelling processes used to produce estimates for future years (over a 50-year time period).

Section 6 focuses on particular methodological issues which have been addressed during the rewrite of the CBPF model for Version 2.0 and subsequent revisions.

Section 7 presents estimates from the model for the cost of smoking to the UK economy and the public finances and the employment effects of smoking. averaged across the three years 2022 to 2024.

Section 8 offers conclusions.

Acknowledgements

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The data from the UK Family Resources Survey and Understanding Society (UK Household Longitudinal Study) used in this report were made available through the UK Data Archive and are Crown Copyright.

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1 Overview

1.1 Aims

The CBPF model is designed with two main functions in mind:

1) Estimating the total costs of smoking to the UK (at a national level) and the impact of changes in smoking prevalence on these costs – both now, and decades into the future.
2) Estimating the overall impact of smoking on the public finances (taking into account tax revenue and public spending impacts) and the impact of changes in smoking prevalence on the public finances.

1.2 Overview of model components

Table 1.1 gives an overview of the components of costs of smoking and public finance impacts of smoking which are included in the current version of the CBPF model. The left-hand column outlines each component of the model and also indicates whether the component is a new addition to since version 2.0 of the model, or whether it is an update of a component that was already in version 1.

Table 1.1 Components of the CBPF model Version 2.4 and guide to where they are discussed in detail in the report

Component	Costs to the economy and society	Impact on public finances
1. productivity related costs	**Lost & reduced productivity – *Section 2***	**tax and benefit impacts related to lost & reduced productivity – *Section 3***
Early deaths due to smoking	Lost productivity due to early death	i) Reduced tax receipts due to lost productivity due to early death ii) Reduced pension payments due to early death
Reduced employment levels for smokers compared to non-smokers	Reduced productivity due to lower employment levels	i) Reduced tax receipts due to lower employment levels ii) Increased benefit payments (e.g. ESA) due to lower working age employment levels for smokers
Lower wages for smokers compared to non-smokers	Reduced earnings for smokers compared to non-smokers (conditional on being in employment)	Reduced tax receipts due to lower wages
Economic impacts of tobacco expenditure compared to other goods and services ***New in version 2.0 Revised version 2.2, 2.3 and 2.4***	Reduced Gross Value Added resulting from expenditure by smokers on tobacco products compared to other goods and services that they would have bought instead if they were non-smokers (including multiplier effects of spending)	Reduced tax receipts resulting from lower GVA and employment due to expenditure on tobacco compared to other goods and services
2. Increased costs of service provision	**Service costs (public and private) – *Section 4***	**Public service costs – *Section 4***
Costs of smoking to NHS	i) Additional hospital admissions for smoking-related conditions ii) Treating smoking-related illness via primary and ambulatory care service	i) Additional hospital admissions for smoking-related conditions ii) Treating smoking-related illness via primary and ambulatory care service
Costs of smoking to social care system ***New in version 2.0***	i) Cost to local authority social care budgets ii) Additional self-funding costs for individuals/families who fund private care iii) Implicit cost of additional informal care iv) Cost of additional unmet need	Cost to local authority social care budgets
Costs of house fires ***New in version 2.0***	i) Cost to Fire and Rescue services for responding to smoking-related fires ii) Property damage arising from smoking-related fires	i) Cost to Fire and Rescue services for responding to smoking-related fires

	iii) Value of fatalities due to smoking-related fire iv) Injury from smoking-related fire	
3.Value of preventable fatalities due to smoking – *Section 6.5. New in Version 2.1, revised Version 2.2*	Value of fatalities due to early deaths from smoking-related diseases – measured and valued using QALYs	n/a

In addition, the model also contains a module which estimates the relationship between changes in tobacco taxation and smoking prevalence using assumptions about the elasticity of demand for cigarettes and hand rolling tobacco in the UK. This is discussed further in Section 3.4.

Finally, the model also estimates the reduction in employment due to smoking – which comprises two components:

i) Employment effects due to productivity (lower employment for smokers than non-smokers);
ii) Lower employment due to expenditure by smokers on tobacco products supporting fewer jobs than other goods and services that they would have bought instead if they were non-smokers.

The employment effects are discussed in more detail in Section 2.2 (for the productivity-related effects) and Section 2.4 (for the employment impacts of tobacco expenditure compared to other goods and services).

2 Estimation of productivity costs of smoking

This section explains how each component of the productivity costs of smoking is estimated. The headline estimates from the model are presented as an average of the years 2022, 2023 and 2024 in line with the UK Government's recent decision to present headline smoking rates averaged over three years rather than on a single-year basis (DHSC, 2026). However, in Appendix A of this report we also present results for the most recent calendar year (2025) for easy comparison with previous versions of the CBPF model.

2.1 Early deaths due to smoking

This module estimates the number of early deaths due to smoking and then calculates the productivity losses due to early death (among people of working age). The technical details of these calculations are set out in Appendix B to this report.

Section 6.5 of this report also discusses estimation of the value of preventable fatalities due to smoking (the third component of the costs of smoking in Table 1.1 above). The value of preventable fatalities due to smoking is estimated based on the total number of years of life lost due to smoking among the current smoking population aged 35 and older. This is converted into a total number of Quality-Adjusted Life Years (QALYs) lost due to smoking using data on the distribution of deaths due to smoking by age and sex. The value of lost QALYs is estimated using the HM Treasury Green Book estimate of the value of a QALY (HMT, 2022) which is £70,000 in 2022 prices (around £85,000 in 2025 prices). This element is distinct from the productivity costs of early death due to smoking.

2.2 Reduced employment levels for smokers compared to non-smokers

Recent work for ASH by Reed (2023b)[1] models the relationship between smoking and employment status and smoking and earnings using data from a British longitudinal dataset, Understanding Society – the UK Household Longitudinal Study (UKHLS)[2]. The research estimates the impact of smoking in Waves 2 through 11 of

[1] The estimates in Reed (2023b) are an updated version of Reed (2020). As discussed in Reed (2023b), the new estimates are robustness-checked using data from Wave 10 of the UKHLS (interviews for which concluded in December 2019, just before the Covid-19 pandemic) to ascertain whether Covid affected the estimated employment and earnings impacts from Waves 11 and 12. Overall, there is no statistically significant impact of Covid on the estimated results.
[2] For more details see "Understanding Society: The UK Household Longitudinal Study", https://www.understandingsociety.ac.uk/

the survey (interviewed annually between 2010-11 and 2019-20) – as well as information on whether people were smokers before Wave 2 of the survey – on the probability of employment and the earnings from employment of respondents in Wave 12 of the survey, in 2020-21. The estimate of the lower probability of employment for smokers compared to non-smokers from Reed (2023b) is used in the CBPF model (adjusted to take account of changes in overall employment rates since the original estimate was made). Full details of the methodology and empirical specification for the employment model are given in Reed (2023b).

The reduction in employment levels due to smoking is included as an additional output in the CBPF model results (as shown in Section 7.2 below).

2.3 Lower wages for smokers compared to non-smokers

The method of estimating lower average earnings for smokers compared to non-smokers explained in Section 2.2 and taken from Reed (2023b) is used in the CBPF model (adjusted to take account of changes in average earnings since the original estimate was made). Full details of the methodology and empirical specification for the earnings model are given in Reed (2023b).

2.4 Economic impacts of tobacco expenditure compared to other goods and services

Consumption of goods and services in the UK economy has multiplier effects because of the derived demand for goods and services used by industries which supply goods and services for final consumption. Every pound spent on cigarettes or hand rolling tobacco is a pound not spent on something else in the economy. The approach taken is an updated version of the methodology used by Buck et al (1995) at the Centre for Health Economics, University of York. The multiplier effects of tobacco consumption are relatively limited compared to most other goods and services that consumers can spend their money on, for three reasons:

a) employment in the tobacco industry in the UK is close to zero[3].
b) Tobacco expenditure supports relatively few jobs in the supply chain (e.g. distribution, retail).
c) Taxes (excise duties and VAT) make up around three-quarters of the price of a typical pack of cigarettes. Therefore, only around one-quarter of expenditure on cigarettes supports employment in the tobacco industry or its supply chain.

Therefore, as tobacco consumption declines, we would expect output and employment in the UK to increase as consumers switch expenditure away from tobacco and towards other goods and services which support additional output and

[3] The Tobacco Manufacturers Association (2017) gives a total figure of 5,000.

employment due to larger multiplier effects. A report for ASH by Reed (2025), updating previous work for ASH by Reed (2021a), estimates the positive economic impact of tobacco consumption falling from current levels to zero on output and employment in the UK using an input-output analysis. The estimate of the output gain (measured as Gross Value Added) from tobacco expenditure falling to zero in the UK is used as a measure of the economic cost arising from current levels of tobacco expenditure. The CBPF model uses the estimate from Reed (2025) adjusted to take account of changes in tobacco consumption since the original estimate was made. Full details of the methodology and empirical specification for the economic impacts model are given in Reed (2025) and Langley and Reed (2026).

The reduction in employment levels due to the lower number of jobs supported by tobacco expenditure compared to other goods and services is included as an additional output in the CBPF model results (as shown in Section 7.2 below).

3 Estimation of tax and social security impacts of smoking

This section explains how each component of the impacts of smoking on tax receipts and social security expenditure (also known as benefits or welfare expenditure) is estimated.

3.1 Reduced tax receipts due to early deaths, lower employment and lower earnings in employment

This estimation procedure uses the distribution of earnings from employment and self-employment in the UK estimated using the Family Resources Survey dataset. Because the UK income tax and National Insurance system is non-linear (due to the progressivity of the tax system), quantile points from across the distribution (10 within-decile means) are used to estimate the income tax and national insurance payable at different distributional points. This provides a more accurate estimate of lost tax receipts due to early deaths than simply using the income tax and NICs payable on average earnings.

A similar approach is used for estimating the reduced tax receipts due to lower employment for smokers compared to non-smokers. To estimate the reduced earnings of smokers relative to non-smokers, an extended version of the earnings model outlined in Reed (2023b) is used to model the difference in earnings *across the distribution of earnings* for smokers compared to non-smokers – i.e. the difference in within-decile earnings means across the ten deciles of the distribution.

3.2 Increased social security payments due to lower employment and increased working age morbidity

The estimate of increased social security payments due to lower employment and increased working age morbidity uses data from the UKHLS on smoker status and receipt of various types of benefit received by people with disability and ill health including Universal Credit and Personal Independence Payment (PIP). The UKHLS data contains information on benefit receipt and smoker status which makes it possible to model differences in the propensity to receive various benefits by smoker status. The estimates from UKHLS are combined with data on average payments of each type of benefit from the DWP's Stat-Xplore data to estimate the relationship between smoker status and overall benefit expenditure.

3.3 Changes to state pension and other social security payments for pensioners

Because smoking increases the numbers of early deaths it results in lower aggregate state pensions and other social security payments (such as Pension Credit and Housing Benefit) to pensioners; conversely, reducing smoking prevalence in the population leads to a higher overall pensions and social security bill.

The model estimate of the impact of smoking on state pensions costs assumes that people who have retired receive a state pension until death, and models state pensions based on a breakdown of levels of state pension payment by age group from the DWP's Stat-Xplore data[4]. We do not assume that everyone who is retired gets the full state pension payment because there are a large number of people who do not have a full contribution record and therefore do not have a full entitlement.

We also model additional payments of means-tested benefits – principally Pension Credit and Housing Benefit – for pensioners, using an analysis of amounts received by individuals aged 66 and over from recent Family Resources Survey data to calibrate the results.

3.4 Modelling the impact of changes in tobacco taxation on smoking prevalence and tax receipts

The estimate of the impact of changes in the level of tobacco taxation on smoking prevalence and tax receipts uses the same methodology as the original public finance model as set out in Reed (2010), Section 3.1. The 2010 model used a tobacco consumption elasticity of -0.5 based on estimates by Townsend (1996) and assumed that the *prevalence* elasticity of tobacco consumption (the extent to which smoking prevalence falls in response to an increase in tobacco prices) is equal to 50% of the consumption elasticity. Version 2.0 of the model used a more recent consumption elasticity estimates from HMRC of -1.19 (see Czubek and Johal, 2010 and HMRC, 2015).

Version 2.4 of the model revises the consumption elasticity estimates based on new modelling from July 2025 by HMRC and verified by the Office of Budget Responsibility (OBR, 2025a). The latest HMRC estimates provide separate price elasticities for cigarettes (-1.5) and handrolling tobacco (-1.0) and the CBPF model has been modified to reflect this[5].

[4] https://stat-xplore.dwp.gov.uk/webapi/jsf/login.xhtml. The most recent available data for the State Pension at the time of publication was November 2025.
[5] The HMRC modelling in OBR (2025) also estimates a cross-price elasticity of 0.01 between cigarettes and handrolling tobacco, and for the first time, cross-price elasticities between tobacco products and vapes. These are not included in the current version of the CBPF model but we plan to add them in a future update.

Version 2.4 of the CBPF model continues to assume that the prevalence elasticity of tobacco consumption is equal to 50 per cent of the consumption elasticity, based on recent reviews by Ekpu and Brown (2015) and the World Bank (2017).

The baseline projections for smoking prevalence are modelled as set out in Section 5.1 below, while baseline assumptions regarding future increases in tobacco taxation are set out in Section 5.5. We do not model the relationship between tobacco prices and smoking prevalence explicitly for the baseline scenarios as we assume that the impact of tobacco tax increases on smoking prevalence is already taken into account in the baseline smoking prevalence projections. However, the model is capable of analysing the impact of changes to tobacco taxation (for example, an additional increase in tobacco taxation over and above the increase in the tobacco duty escalator) on smoking prevalence, using the elasticity estimates presented above.

In versions of the CBPF model up to and including Version 2.1, revenue from VAT on tobacco purchases was included as part of the tax receipts from smoking. VAT has now been removed from the tax receipts estimate on the grounds that if people stop smoking and reallocate expenditure from tobacco products to other goods and services, most of those goods and services will also be subject to VAT – so Exchequer revenue from VAT would be similar regardless of the amount of expenditure on tobacco products in the UK economy. From Version 2.2 onwards, the model only includes excise duties on cigarettes and hand-rolling tobacco in the estimate of tax receipts from consumer spending on tobacco. Note that the model does not currently include excise duties from other tobacco products such as cigars or cigarillos; it is planned to add these in a future update.

3.5 Modelling the tax implications of diversion of expenditure from tobacco products to other goods and services

As explained in Reed (2025), reductions in smoking prevalence have the direct effect of reducing tax revenue (because of reductions in tobacco duty) but there is also an indirect *increase* in tax revenues due to the higher employment generated when consumers reallocate expenditure from tobacco products to other goods and services which support higher levels of employment. This increase in tax revenues comprises the additional income tax and NICs payments from the extra workers employed due to the consumption shift, as well as any additional indirect taxes paid by those workers.

3.6 Reductions in indirect tax revenues arising from reduced employment due to smoking

As well as the impact of smoking on the public finances through reduced employment due to increased numbers of early deaths and lower employment and earnings for smokers compared to non-smokers, there is also a knock-on impact on indirect tax revenues because of lower aggregate consumer expenditures due to lower employment. This is calculated using estimates from the Office for Budget Responsibility of the marginal propensity to consume out of net earnings (after income tax and NICs).

4 Estimate of public service costs of smoking

This section explains how the model estimates how the cost of smoking to public services – health, social care and fire services – is estimated in the most recent year.

4.1 Costs of smoking to NHS

The estimate of the costs of smoking to the NHS from DHSC (2017) is used, combined with estimates from DHSC's *Fingertips Profiles* online information portal for hospital admissions attributable to smoking[6]. These are adjusted to take account of increases in NHS costs and changes in population size, smoking prevalence and the distribution of ex-smokers (in terms of years since quitting) since the original estimate (which estimated NHS costs in 2015) was made. The data are also scaled up from the England level to the UK level using data on the size of the adult smoking population in the UK compared to England.

4.2 Costs of smoking to social care system

Local authority social care spending

Previous work for ASH by Reed (2021b) estimates the cost of smoking to the local authority-funded components of the social care system, including domiciliary care and residential care, using data from English Longitudinal Study of Ageing (ELSA) and the Health Survey for England. Full details of the methodology and empirical specification for the economic impacts model are given in Reed (2021b). The estimate from Reed (2021b) is used, adjusted to take account of increases in social care costs and population changes since the original data period which the estimate refers to. The data are also scaled up from the England level to the UK level as with the NHS costs above.

Cost of social care to self-funders

Unlike healthcare where private healthcare expenditure is relatively small in comparison to NHS funding, private expenditure on social care ("self-funding") is a

6 https://fingertips.phe.org.uk/search/SMOK#page/4/gid/1/pat/159/par/K02000001/ati/15/are/E92000001/iid/1208/age/202/sex/4/cat/-1/ctp/-1/yrr/1/cid/4/tbm/1

significant part of overall social care expenditure[7]. Social care is means-tested and needs-tested, with local authorities only funding care for individuals whose income and assets are below a certain level. Reed (2021b) models the relationship between smoker and ex-smoker status and the cost of self-funded social care for individuals in the ELSA survey, but no significant impact of smoker status on self-funded care expenditure was found. Therefore, the cost of smoking to self-funded social care is not included in the CBPF model.

Informal care costs of smoking

Informal care - where social care services are provided by relatives and friends of the care recipient on an unpaid basis – accounts for a significant proportion of social care in the UK[8]. Reed (2021b) estimates the costs of smoking to the informal care system in terms of the additional informal care required for smokers (conditional on age) compared to non-smokers. The additional informal care required for smokers is then valued as if it were purchased on the market and an aggregate figure estimated for the cost of smoking to the informal care system. The estimate from Reed (2021b) is used in the CBPF model, adjusted for population changes and care costs and scaled up from the England to the UK level. These costs are not included in the public finances analysis (because informal care is not publicly funded) but they are included in the cost-benefit analysis.

Unmet need for social care

There is a significant amount of unmet need for social care in the UK – where individuals require social care services but do not receive them[9]. Unmet need is defined as a situation where an individual's receipt of formal and/or informal care services does not meet all their care needs. Reed (2021b) estimates the costs of smoking in terms of additional unmet needs for social care using data from the Health Survey for England. The cost of meeting the additional unmet social care needs due to smoking is estimated using assumptions on how much it would cost to provide the additional social care to meet those unmet needs. The estimate from Reed (2021b) is used in the CBPF model, adjusted for population changes and care costs and scaled up from the England to the UK level. As with informal care costs, the additional unmet care needs associated with smoking are included in the cost-benefit analysis but not the public finances analysis.

[7] A report by the National Audit Office (2018) into social care provision and funding in England found that in 2016/17, self-funder expenditure on social care was £10.9 billion, compared to local authority expenditure on social care of £16.9 billion.
[8] The NAO (2018) reports that estimates of the total value of informal care in England range from £59 billion to nearly £100 billion per year.
[9] Age UK (2019) estimated that 1.4 million people over the age of 65 had some level of unmet care needs in 2018.

4.3 Costs of house fires

The UK Government's *Fire Statistics Data Tables* (Home Office, 2023) are combined with estimates for the economic cost of fire (DCLG, 2011) to produce estimates for the overall cost of smoking-related fires across England, which are then scaled up to the UK level using population data. The public finances analysis includes only the cost of smoking to the fire service, whereas the cost-benefit analysis includes the overall economic cost of smoking-related fires including property damage, injuries and fatalities from fire.

5 Producing forecasts for future years

Sections 2, 3 and 4 explain how costs and public finance estimates are produced for an average of the three years used for the UK Government's smoking prevalence estimates (2022 to 2024) and the most recent calendar year (2025 at the time of writing). However, the CBPF model is designed to produce estimates for future years as well – up to 50 years into the future. This section explains the assumptions used to uprate each data source for future years and the methodology used to produce each component of the estimates using the uprated data.

5.1 Assumptions regarding future smoking prevalence and future investments in tobacco control

The baseline forecast scenario

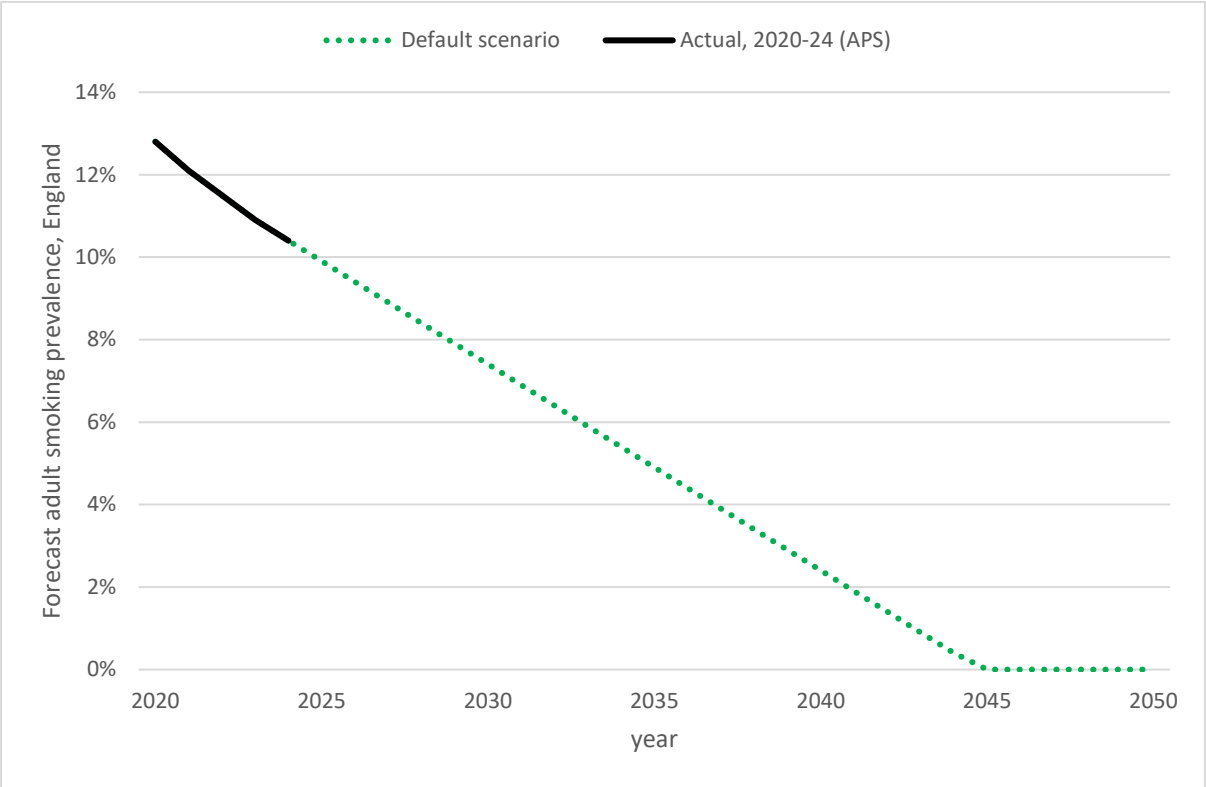
The current version of the CBPF model uses a baseline forecast scenario for future trends in smoking prevalence in England assuming a trend reduction in smoking prevalence of 0.5 percentage points per year after 2024. A crucial parameter here is the date when adult smoking prevalence falls to 5 per cent – which is the UK Government's definition of a "Smokefree" England.

For the other three countries in the UK we assume that the percentage point reduction in smoking prevalence each year under both scenarios is the same as for England but from a slightly higher base, reflecting the most recent smoking prevalence statistics from the 2024 Annual Population Survey[10].

Figure 5.1 shows the projections from the baseline scenario for adult smoking prevalence from 2025 up to 2050. With the additional tobacco control investments recommended in Scenario 2, we forecast that smoking prevalence in England will fall to 5 per cent by 2035.

[10] As measured by the Annual Population Survey, adult smoking prevalence in 2024 was 10.4% in England, 12.0% in Scotland, 11.4% in Wales and 10.5% in Northern Ireland (ONS, 2025).

Figure 5.1. Adult smoking prevalence forecast for England, baseline scenario: 2025 to 2050



Source: Default scenario – assume smoking prevalence falls by 0.5 percentage points per year from 2024 onwards.

Additional policies

Previous versions of the CBPF model featured additional scenarios modelling the impact of tobacco control policies recommended by the APPG on Smoking and Health (2023) for the years 2025 through 2030 inclusive, plus the additional spending announced in the government's Command Paper *Stopping the Start: Our new plan to create a smokefree generation* published in October 2023 (DHSC, 2023).

The current Labour Government is committed to tobacco control policies as outlined in the Tobacco and Vapes Act which received Royal Assent in April 2026 (UK Government, 2026). A future update of the CBPF model will include modelling of the additional policies in the Tobacco and Vapes Act, most notably the creation of a smoke-free generation (whereby children turning 15 in 2024 or younger can never legally be sold tobacco), powers to extend the indoor smoking ban to specific outdoor spaces, and a new retail licensing scheme in England, Wales and Northern Ireland for tobacco, vapes and nicotine products.

5.2 Forecasts for England, Scotland, Wales and Northern Ireland population by age group

The CBPF model uses the population forecasts from the ONS's 2022-based central projection, which provides projections forward for the next 100 years (only the years up to 2074 are currently used in the model)[11].

5.3 Smoking-attributable mortality rate

The number of deaths due to smoking per 100,000 adults aged over 35 in the England population is assumed to be constant in future years, at the level of the estimate used in Section 2.1 above. This means that the number of deaths due to smoking evolves in proportion with the size of the over-35 smoking population. The over-35 smoking population is assumed to fall in future years in proportion to the trends in the whole adult smoking population, using the prevalence estimates for the whole adult smoking population in Figure 4.1 above.

5.4 Economic forecasts

Labour market variables

The two labour market variables used in the model are average earnings growth and working-age employment rate. For the years 2026 through 2030 these are assumed to evolve as outlined in the Office for Budget Responsibility's March 2026 *Economic and Fiscal Outlook* (OBR, 2026). For 2031 and subsequent years the forecasts in the OBR's most recent *Long Term Economic Determinants* publication (from June 2025) are used (OBR, 2025b).

Price indices

The model uses Consumer Prices Index (CPI) and Retail Prices Index (RPI) forecasts from the OBR's March 2026 *Economic and Fiscal Outlook* (OBR, 2026) for the years 2026 through 2030. For 2030 and subsequent years the long-term OBR forecasts from OBR (2025b) are used.

[11] The sources for population forecasts are ONS (2025b, 2025c, 2025d, 2025e, 2025f).

5.5 Uprating of tobacco duties

The current commitment is for a tobacco duty escalator for this parliament which increases duties on factory made (FM) cigarettes by RPI plus 2 per cent each year. This and the escalator are assumed to continue for the entire duration of the model (the next 50 years). Hand rolling tobacco (HRT) duties are assumed to increase by RPI plus 4 per cent until tax as a proportion of average retail price for HRT is equal to tax as a proportion of average retail price for FM cigarettes; after this point, HRT and FM cigarette duties are both assumed to increase by RPI plus 2 per cent.

5.6 Tax and benefit thresholds and rates

Income tax and National Insurance rates and thresholds

Tax and NICs thresholds are assumed to be uprated each year with CPI inflation (the default) unless overridden by pre-announced policy decisions (for example, the announcement that income tax and NICs thresholds will be frozen in nominal terms until 2030, and the reduction in the Secondary Threshold for employer NICs to £5,000 from April 2025). Income tax and NICs percentage rates are assumed to be fixed unless specified otherwise in policy decisions (e.g. the increase in employer NICs to 15% from April 2025).

Universal credit and benefit uprating

Universal credit and other benefits except the state pension are assumed to be uprated in line with CPI inflation each year unless overridden by pre-announced policy decisions. The state pension is assumed to be uprated by the "triple lock"[12] each year, with short-run triple lock projections taken from OBR (2026) while long-run projections are taken from OBR (2025).

5.7 Public services cost increases

NHS costs are assumed to rise by 2 per cent per year above CPI, with social care and fire costs increasing in line with CPI. The higher cost increase assumption for the NHS compared to other public services reflects the fact that spending in the NHS has tended to increase at a faster rate than other public services in recent years (King's Fund, 2022).

[12] The triple lock uprates the state pension each year by whichever is the highest of (a) CPI inflation, (b) average earnings growth, or (c) 2.5 per cent.

6 Methodological issues

This section sets out specific parts of the model where we have revisited the modelling assumptions used in version 1 of the CBPF model back in 2010 to assess whether they were still optimal, and adjusted them if this was not the case.

6.1 Choice of forecast time period

Version 1 of the model used a 50-year time horizon for calculating the costs of smoking and the benefits of reducing smoking prevalence, discounting the future stream of costs of benefits into Net Present Values (NPVs) using a 3.5% per year discount rate (as specified in the Treasury Green Book[13]).

The public finance aspect of the 2010 model used a five-year time horizon as the default timeframe for the model results, for two reasons, as given in the 2010 report that accompanied the original version of the model:

"First, public finance issues are a particular concern for governments in the short term. It is most important for them to know what the effect of policy changes on revenue and spending in the next few years will be. The longer-term effects of policy decisions are of less immediate usefulness (although obviously still interesting). Second, there is huge uncertainty regarding the long-term effect of some of the components which would have to be included in a public finances analysis over a fifty year time horizon" (Reed, 2010).

Version 2 of the model includes an option to display the public finance results as NPVs over a 50-year time horizon as well as over shorter timescales such as 5 or 10 years. This reflects the fact that official analysis of the long-term public finance impacts of policy decisions is more sophisticated now than it was in 2010 (for example, the OBR regularly publishes long term fiscal modelling analysis).

6.2 The relationship between NHS costs and the profile of ex-smokers by length of time since quitting smoking

When people stop smoking, their relative risk of developing smoking-related diseases (compared to smokers) does not fall instantaneously, but declines gradually. Some risks fall faster, and others slower. For example, there is evidence of a small more-or-less instantaneous decline in the risks of acute myocardial infarction and stroke following smoking cessation (Naidoo *et al*, 2000). Following this initial decline, the risks of stroke and coronary heart disease fall gradually to the same level as for non-smokers within 5 and 15 years (respectively)[14]. The risk of

[13] HM Treasury (2022)
[14] See for example Hurley S (2005).

developing lung cancer falls dramatically but remains positive even 25 years after the last cigarette (Peto *et al*, 2000).

The previous version of the cost benefit and public finance model developed in 2009-10 (Reed, 2010) followed Naidoo *et al* (2000) in assuming that the aggregated risk of developing smoking-related diseases declines by 2 percentage points instantaneously for ex-smokers compared with people who carry on smoking. For the rest of the risk profile, the previous version of the model followed the approach adopted in Rasmussen *et al* (2005) in assuming that the aggregated risk declines linearly for 15 years and stabilises afterwards.

Version 2 of the CBPF model takes a different approach which is more data-driven. The new version of the model analyses the relationship between current and ex-smoker status and use of NHS services directly using data from the Understanding Society panel survey, which contains information on the number of visits to GPs, the number of hospital outpatient appointments and the number of nights spent in hospital as an inpatient for all adult survey respondents. Regression equations are estimated for GP services, hospital outpatient, and hospital inpatient services controlling for gender and age. The results from the regression are used to apportion NHS costs to current smokers, ex-smokers (quit up to 8 years ago), ex-smokers (quit more than 8 years ago) and never-smokers. Simulated changes in future smoking prevalence produce a time profile for current smokers and ex-smokers by quit date – including assumptions on how the reduction in smoking prevalence breaks down into number of quitters and people who never start smoking, building on analysis of the Understanding Society data (see Section 6.3 below).

6.3 Assumption about how the reduction in the number of smokers breaks down into quitters and non-starters

A reduction in smoking prevalence can be achieved either by (a) current smokers quitting (and becoming ex-smokers), or (b) a reduction in the number of non-smokers starting smoking for the first time, or a combination of these two impacts. (a) is an increased *outflow* from the pool of current smokers, whereas (b) is a reduced *inflow* to the pool of smokers. The assumption in the model regarding the balance between these two effects will affect the model results (primarily because ex-smokers have a higher cost to the NHS than never-smokers). The default assumption in the original version of the CBPF model was that 50% of any reduction in smoking prevalence was achieved through quits, and 50% through a reduction in the number of new starters. This default assumption could be altered by the front end user.

Version 2 of the CBPF model uses data from the ONS's *Adult Smoking Habits in Great Britain* publication (ONS, 2025), which features time series data on the breakdown of the adult population into current smokers, ex-smokers and never smokers from 1974 to 2023. Analysis of the data for the decade 2013 to 2023 suggests that 22% of the decline in smoking prevalence was due to smokers

quitting, whereas 78% was due to fewer people taking up smoking for the first time. The model assumes that this 22-78 split between quitters and non-starters is maintained in future years.

6.4 Treatment of end-of-life healthcare costs

Sometimes it is argued that in cost benefit analyses of policies which result in a reduction in the number of premature deaths in the population (such as tobacco tax increases or tougher tobacco regulations), the additional end-of-life healthcare costs incurred by the people who live longer should be taken into account. In the 2010 version of this model we argued that, even if this were the case, it would be a mistake to include these costs in the cost-benefit analysis (CBA) because there is a fundamental methodological flaw in this approach.

Taken to its logical conclusion, the inclusion of end-of-life healthcare costs in CBAs of this type would lead to the perverse conclusion that policies which result in larger numbers of premature deaths in the population have a positive benefit to society because they reduce healthcare expenditure on elderly people.

The health impact evaluation literature in medicine and epidemiology, which uses very similar techniques to those employed in this model, has already taken this insight on board. Evaluations of healthcare interventions, such as new drugs or other treatments, do not generally include the medical costs of people living longer as an addition to costs for obvious reasons: one of the key objectives of advances in medical care is to increase life expectancy in the population.

For these reasons, neither the original version nor any of the subsequent updates of the CBPF model include end-of-life healthcare costs.

6.5 Valuing life using Quality Adjusted Life Years (QALYs) instead of the Value of a Prevented Fatality (VPF) method

The methodology for valuing lives lost due to smoking-related illnesses in Version 1 of the CBPF model (as well as Version 2.0, as discussed in Reed (2022)) used the Value of a Prevented Fatality (VPF) method for each life lost as specified in the Treasury Green Book (HMT 2022, Section 6.37-6.38):

> "The Value of a Prevented Fatality (VPF) measures the social value of changes in risk to life. It is used to value small changes in fatality risks, where levels of human safety vary between options. This is not the value of a life, it is the value of a small change in the risk of probability of losing a statistical life. Not to value this in appraisal would effectively value human safety at zero.
>
> In cases where alternative levels of fatality risk are involved in option design, VPF allows this to be taken into account. The value concerned is known as

the value of the risk of "a statistically prevented fatality". It has been widely used for many years, particularly in transport."

From Version 2.1 of the model onwards, lives lost due to smoking-related illnesses are valued using Quality Adjusted Life Years (QALYs) instead of the VPF method. Using QALYs produces a more realistic estimate of the value of lives lost as most early deaths due to smoking-related illnesses occur for adults aged above 35 (and in most cases above age 50) and the number of QALYs lost is smaller for early deaths when aged 50 or older than for deaths at the median age of the whole UK population.

The data from DHSC's Local Tobacco Control Profiles data are used to produce the England-wide smoking attributable mortality rate per 100,000 population, age 35 years and over, broken down by sex and age. For men of women of each year of age, an average number of years of life lost is calculated using data from the ONS National Life Tables (ONS, 2024f). These age- and sex-specific average number of years of life lost are then converted into average number of QALYs lost for men and women in each age year using tables in McNamara *et al* (2023), who calculate quality-adjusted life expectancy norms for the English population[15]. These estimates for QALYs lost are then summed across the estimated number of lives lost for men and women in each year-of-age group (from 35 up to 99 and above) to produce an estimate of total number of QALYs in the UK lost due to smoking-related illnesses.

The QALYs are then valued using the HMT Green Book (HMT, 2022) suggested value of £70,000 per QALY (in 2022 terms) which is uprated to 2023 levels using the Consumer Price Index (giving a value per QALY of around £77,000 at 2023 prices).

This QALYs-based method produces an estimate for "value of lives lost due to smoking-related illnesses" which is substantially smaller than the VPF-based method used in earlier versions of the CBPF model. We believe that the results using the QALY-based method are more realistic.

Because the cost of smoking in terms of value of life is an intangible cost (as opposed to tangible costs such as lost productivity), we do not include the value of life in estimates of the cost of smoking as a percentage of UK Gross Domestic Product. However, we do include it in the overall cost estimates presented in Chapter 7 of this report and elsewhere.

[15] Because we do not have separate quality-adjusted life expectancy norms for the populations of the other three UK countries, we use the England conversion tables from McNamara *et al* (2023) for Scotland, Wales and Northern Ireland as well as England.

7 Headline results from the CBPF model: the costs and public finance impacts of smoking averaged across the three years 2022 to 2024

This section presents headline results from Version 2.4 of the CBPF model. In line with the UK Government's decision to use a three-year average of the statistics from the Annual Population Survey as its headline measure of smoking (DHSC, 2026) we present the results averaged across the years 2022, 2023 and 2024. Appendix A shows the results for the costs and public finance impacts of smoking for the most recent full calendar year (2025), for the purposes of comparison with previous versions of the model.

7.1 Costs of smoking to the UK economy and society

Table 7.1 shows the estimated overall average annual costs of smoking for England alone and for the whole UK for the three year period 2022-2024, presented in billions of pounds. The figures are presented in three sections:

1. **Productivity costs.** These total just under £27.4 billion for England, and just over £33 billion for the UK. The largest single component is reduced earnings levels for smokers compared to non-smokers (as discussed in Section 2.3 above), which amounts to just under £9.5 billion for England and just over £11.2 billion for the UK. Reduced GVA due to the multiplier effects of expenditure on tobacco products compared to other goods and services (as discussed in Section 2.4) accounts for just under £9.3 billion of productivity costs for England and just under £11 billion for the UK. Reduced employment levels for smokers compared to non-smokers accounts for just over £8 billion of productivity for England and around £9.5 billion of productivity losses for the UK.
2. **Service costs.** These total around £17 billion for England, and around £20.15 billion for the UK. The additional cost of informal care in the social sector is the largest single component of service costs at almost £9.9 billion for the UK, followed by the cost of additional unmet need for social care services at just under £6.3 billion, and the cost of smoking to the NHS at just under £2.1 billion.
3. **Cost of early deaths from smoking.** This is estimated to be around £38.6 billion for England, and £45.8 billion for the UK.

The total average annual cost of smoking to the UK economy for the three years 2022 to 2024 is estimated to be just under £99 billion for the UK, and just under £83.5 billion for England.

Table 7.1. Overall costs of smoking, England and UK: annual average, 2022 to 2024

Costs of smoking	£bn	£bn
1: productivity costs	**England**	**UK**
Lost productivity due to early death	1.051	1.274
Reduced employment levels for smokers compared to non-smokers	8.031	9.520
Reduced earnings for smokers compared to non-smokers	9.479	11.236
Reduced GVA due to expenditure on tobacco products compared to other goods and services	9.270	10.989
Total productivity costs	**27.382**	**33.019**
2: service costs		
Healthcare: cost of smoking to NHS	1.770	2.098
Social care: cost to local authorities	1.215	1.441
Social care: cost of additional informal care	8.329	9.873
Social care: cost of additional unmet need	5.305	6.288
Fire service: overall economic cost of smoking-related fires	0.383	0.455
Total service costs	**17.003**	**20.154**
3: Cost of early deaths due to smoking		
Cost of early deaths valued using QALYs	**38.629**	**45.791**
TOTAL COST OF SMOKING	**83.487**	**98.964**

Source: Landman Economics calculations using CBPF model version 2.4. Costs are presented in 2025 prices.

7.2 Public finance costs of smoking

Table 7.2 shows the estimated net impacts of smoking on the public finances in England and the UK averaged across the three years 2022 to 2024. Section 1 of the table shows the impact of smoking on tax receipts, while section 2 shows the impacts on social security spending. Any impact of smoking that worsens the public finances has a negative sign in Table 7.2, while impacts that improve the public finance have a positive sign. Mostly the public finance impacts in table 7.2 have a negative sign, indicating that the impact worsens the public finances (i.e. a net cost). For example, reduced tax (and NICs) receipts due to lower earnings for smokers compared to non-smokers are estimated to worsen the UK Government's fiscal position by just over £4.5 billion per year on average between 2022 and 2024 (for

England only the equivalent result is just over £3.8 billion). The only positive values in the table (i.e. positive fiscal benefits from smoking) are:

- the revenue from excise duties on cigarettes and hand rolling tobacco, which is estimated at just under £8.9 billion annually at the UK level;
- reduced pension payments due to early deaths from smoking (estimated at around £335 million per year for the UK).

At the UK level, the total tax impact of smoking is estimated to worsen the public finances by just over £3 billion per year on average between 2022 and 2024, while the additional social security expenditure worsens the public finances by just over £4.1 billion.

The bottom half of the table shows the cost of smoking in terms of additional annual spending on public services, which totals £3.55 billion for the UK, and just under £3 billion for England. Note that for social care we only include the cost of smoking to the public finances (additional local authority expenditure) in Table 7.2, not the informal care or unmet need costs.

In total, the net cost of smoking to the public finances per year averaged over the three years 2022 to 2024 is estimated at just under £10.8 billion for the UK, and just over £9.1 billion for England. Were it not for the revenue from cigarette and hand rolling tobacco taxation and the reduction in pension benefits due to earlier death, over the same time period smoking would cost the public finances just under £19.7 billion in total for the UK, and around £16.6 billion for England.

Table 7.2. Net impacts of smoking on public finances, England and UK: annual average, 2022 to 2024

Public finance net costs of smoking	**£bn**	**£bn**
1: impact on tax receipts arising from productivity costs	**England**	**UK**
Reduced tax receipts due to early death	-0.330	-0.391
Reduced tax receipts due to lower employment levels for smokers	-3.029	-3.591
Reduced tax receipts due to lower earnings levels for smokers	-3.836	-4.547
Reduced tax receipts due to fewer jobs being generated by tobacco spending compared to other goods and services	-2.839	-3.366
Revenue from excise duties on cigarettes and HRT	7.498	8.888
Total impact on tax receipts	**-2.537**	**-3.007**
2: impact on social security spending		
Increased spending due to lower employment rates for smokers	-2.079	-2.465
Increased in-work social security spending due to lower earnings for smokers	-0.517	-0.613
Increased spending due to reduction in jobs due to tobacco spending	-1.259	-1.493
Reduced pension payments due to early death	0.284	0.336
Total social security spending impact	**-3.572**	**-4.234**
3: public service costs		
Healthcare: cost of smoking to NHS	-1.770	-2.098
Social care: cost to local authorities	-1.215	-1.441
Fire service: cost to fire and rescue services for responding to smoking-related fires	-0.010	-0.012
Total public service costs:	**-2.995**	**-3.550**
Total impact of smoking on public finances (excluding revenue from cigarette and HRT taxes)	-16.601	-19.678
TOTAL IMPACT OF SMOKING ON PUBLIC FINANCES	**-9.103**	**-10.790**

Source: Landman Economics calculations using CBPF model version 2.4. Costs are presented in 2025 prices.

7.3 Employment impacts of smoking

Table 7.3 shows the estimated employment impacts of smoking on the UK economy, averaged across the years 2022 to 2024. The estimated reduction in employment due to smoking breaks down into two components:

i) Employment effects due to productivity (lower employment for smokers than non-smokers)
ii) Lower employment due to expenditure by smokers on tobacco products supporting fewer jobs than other goods and services that they would have bought instead if they were non-smokers.

Table 7.3 shows that in England, the average annual reduction in headcount employment due to smoking over the years 2022 to 2024 is 429,000. Slightly more than half of this (235,000) is due to the effect of smokers being less likely to be in employment than non-smokers, with the rest being due to the effects of consumer spending on tobacco. Across the UK as a whole the overall reduction in employment is estimated at 508,000 per year.

Table 7.3. Impact of smoking on headcount employment, England and UK: Annual average, 2022 to 2024

	Employment impact (headcount)	
Component	**England**	**UK**
Productivity effect (due to smokers being less likely to be in employment than non-smokers, controlling for other characteristics)	235,000	278,000
Lower employment due to expenditure by smokers on tobacco products supporting fewer jobs than other goods and services that they would have bought instead if they were non-smokers	194,000	230,000
Total reduction in employment	**429,000**	**508,000**

Source: Landman Economics calculations using CBPF model version 2.4.

8 Conclusion

This report explains the rationale and methodology for Version 2.4 of the ASH Cost Benefit and Public Finances (CBPF) model of smoking.

Many of the data inputs into the model are based on previous work conducted by the author of this report for Landman Economics, and we plan to update these on a regular basis as well as checking for updates to external data sources on an annual basis.

Overall, the cost of smoking averaged across the three years 2022, 2023 and 2024 is estimated at £78.3 billion for England, and £93.0 billion for the UK (to the nearest £100 million). In total, the net cost to the public finances of smoking is estimated at £9.7 billion for England, and £11.5 billion for the UK (to the nearest £100 million). Smoking results in headcount employment being 429,000 lower in England, and 508,000 lower in the UK, than if smoking prevalence were zero.

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Appendix A: Model results for calendar year 2025

Table A.1. Overall costs of smoking, England and UK: calendar year 2025

Costs of smoking	**£bn**	**£bn**
1: productivity costs	**England**	**UK**
Lost productivity due to early death	0.977	1.183
Reduced employment levels for smokers compared to non-smokers	7.608	9.006
Reduced earnings for smokers compared to non-smokers	8.969	10.617
Reduced GVA due to expenditure on tobacco products compared to other goods and services	7.915	9.370
Total productivity costs	**25.470**	**30.176**
2: service costs		
Healthcare: cost of smoking to NHS	1.838	2.176
Social care: cost to local authorities	1.131	1.338
Social care: cost of additional informal care	7.684	9.096
Social care: cost of additional unmet need	4.981	5.896
Fire service: overall economic cost of smoking-related fires	0.347	0.411
Total service costs	**15.981**	**18.917**
3: Cost of early deaths due to smoking		
Cost of early deaths valued using QALYs	**35.016**	**41.451**
TOTAL COST OF SMOKING	**76.489**	**90.544**

Source: Landman Economics calculations using CBPF model version 2.4. Costs are presented in 2025 prices.

Table A.2. Net impacts of smoking on public finances, England and UK: calendar year 2025

Public finance net costs of smoking	**£bn**	**£bn**
1: impact on tax receipts arising from productivity costs	**England**	**UK**
Reduced tax receipts due to early death	-0.335	-0.396
Reduced tax receipts due to lower employment levels for smokers	-3.085	-3.652
Reduced tax receipts due to lower earnings levels for smokers	-3.878	-4.591
Reduced tax receipts due to fewer jobs being generated by tobacco spending compared to other goods and services	-2.599	-3.077
Revenue from excise duties on cigarettes and HRT	6.436	7.618
Total impact on tax receipts	**-3.461**	**-4.097**
2: impact on social security spending		
Increased spending due to lower employment rates for smokers	-1.936	-2.292
Increased in-work social security spending due to lower earnings for smokers	-0.489	-0.579
Increased spending due to reduction in jobs due to tobacco spending	-0.957	-1.133
Reduced pension payments due to early death	0.276	0.326
Total social security spending impact	**-3.107**	**-3.678**
3: public service costs		
Healthcare: cost of smoking to NHS	-1.838	-2.176
Social care: cost to local authorities	-1.131	-1.338
Fire service: cost to fire and rescue services for responding to smoking-related fires	-0.009	-0.010
Total public service costs:	**-2.977**	**-3.524**
Total impact of smoking on public finances (excluding revenue from cigarette and HRT taxes)	-15.981	-18.918
TOTAL IMPACT OF SMOKING ON PUBLIC FINANCES	**-9.545**	**-11.299**

Source: Landman Economics calculations using CBPF model version 2.4. Costs are presented in 2025 prices.

Table 7.3. Impact of smoking on headcount employment, England and UK: calendar year 2025

	Employment impact (headcount)	
Component	**England**	**UK**
Direct effect (due to smokers being less likely to be in employment than non-smokers, controlling for other characteristics)	218,000	258,000
Indirect effect (due to lower multiplier effects of tobacco spending compared to other goods and services)_	147,000	175,000
Total reduction in employment	**365,000**	**433,000**

Source: Landman Economics calculations using CBPF model version 2.4.

Appendix B: Detailed methodology for calculation of lost productivity due to smoking-related early deaths

a) DHSC's Local Tobacco Control Profiles data are used to produce the England-wide smoking attributable mortality rate per 100,000 population, age 35 years and over. If available, this is combined with similar data for Scotland, Wales and Northern Ireland to produce an overall UK figure; if not, the England-wide mortality rate is used as a proxy for the UK mortality rate.
b) The mortality rate from step (a) is applied to estimates from Public Health England of the number of smokers aged 35+ to give a gross figure for the estimated number of smoking-attributable deaths. This figure is scaled up from England to the UK (using information on adult smoking prevalence and population size in Scotland, Wales and N Ireland compared to England)
c) The distribution of all deaths in the UK is calculated across age and sex based on data from the National Life Tables published by ONS.
d) The gross number of smoking-attributable deaths (step b) is disaggregated by sex and age (35-89 years) according to the distribution calculated in step (c)
e) Employment rates (%) for the UK, stratified by sex and age group, are calculated from ONS Labour Market Statistics.
f) The estimates from steps (d) and (e) are combined to produce an estimate of smoking-attributable deaths across the UK as a whole in the different age/sex categories for people in employment only .
g) For each age/sex category, the number of years of potential productivity remaining is calculated based on analysis of employment rates for smokers and non-smokers by age group using micro-data from the Understanding Society panel survey. (the technical specification is known as a hazard model). This data analysis is used to produce an estimate of average remaining years in employment for non-smokers in employment by age.
h) Outputs from step (g) are combined with outputs from step (f) to produce an actuarial table of years of potential productivity lost due to smoking-attributable early deaths for each age/sex category.
i) The distribution of earnings from employment and self-employment in the UK (combined) is derived from Family Resources Survey data and broken down for each age/sex category using summary quantile points of the distribution (e.g. within-quintile means). Note that using multiple quantile points isn't necessary for the productivity analysis but *is* necessary for accurate modelling of the tax effects of productivity losses due to early death because of the progressivity of the tax system – see Section 3.1 of this report for more details on this.
j) The output from step (h) is combined with the output of step (i) to produce a gross estimate of lost labour income due to early deaths from smoking, stratified by sex and age group.
   A discounting table is produced using the years of remaining potential productivity from step (g) and the assigned discounting factor (3.5% by default) to calculate an age-, year- and sex-stratified discounting value.