UNIVERSITY of STRATHCLYDE
FRASER OF ALLANDER INSTITUTE

Distributional analysis of the Scottish Government's Cost of Living Guarantee

June 2026

Fraser of Allander Institute
University of Strathclyde Business School
199 Cathedral Street
Glasgow, G4 0QU
Scotland, UK
www.strath.ac.uk/fraser

UNIVERSITY of STRATHCLYDE
FRASER OF ALLANDER INSTITUTE

Contents

Summary **2**

Overview 2

Phase 1: literature review 3

Phase 2: further analysis 4

Implications 9

Introduction **11**

Phase 1: Literature review **15**

Methodology 15

Findings 15

Implications 22

Phase 2: Further analysis **24**

Methodology 24

Findings 25

Conclusions **50**

Annex 1: Sample sizes **52**

Annex 2: Detailed methodology for Phase 1 ..... **53**

Annex 3: Detailed methodology for Phase 2 ..... **55**

Distribution 55

Valuation 58

Annex 4: Additional information on Phase 2 methodology **61**

Data 61

Model 61

Classification 62

Performance 62

Annex 5: Composition of income quintiles **65**

Summary

Overview

The Fraser of Allander Institute was commissioned by the Poverty and Inequality Commission to examine the distributional impacts of the Scottish Government's Cost of Living (CoL) Guarantee. The Guarantee was announced in the 2025-26 *Programme for Government* as a central part of the Scottish Government's response to the cost-of-living crisis.

This work is intended to support the capacity of the Commission to make informed recommendations on how public spending benefits people across the population, with a focus on low-income households and groups that experience particular disadvantages. The value of distributional analysis is especially evident at a time when stated ambitions such as tackling child poverty are matched by significant pressures on the public finances, sharpening the trade-offs faced by policymakers.

The CoL Guarantee consists of the following policies:

- **Lower income tax than in the rest of the UK for the majority of taxpayers.** Since the devolution of income tax in 2017, Scotland has moved to a system of lower rates for those with lower earnings and higher rates for those with higher earnings as compared to the rest of the UK.
- **Continuation of free prescriptions and free eye appointments**. Eye tests have been free in Scotland since 2006. People aged under 16 and over 59 and those with sight impairment or diabetes are entitled to an annual test, with the rest of the population entitled to one test every two years. Free prescriptions were introduced in 2011 and cover all NHS-prescribed medications.
- **Free bus travel for 2.3 million people.** Since 2006, people aged 60 and over and those with disabilities have been entitled to free bus passes across Scotland, while people aged 5 to 21 have been entitled since 2022.
- **Scottish undergraduate students will continue to pay no tuition fees**. This policy has been in place since 2008, although up-front fees had been replaced by a graduate fee since 2001. Free tuition is restricted to those who are ordinarily resident in Scotland, have a settled immigration status, have lived in the UK for at least three years, and are pursuing their first undergraduate degree.
- **Funded childcare hours, which would otherwise cost families more than £6,000 a year per eligible child.** All three- and four-year-olds in Scotland, as well as two-year-olds in low-income families, are eligible for 1,140 hours of funded childcare per year. This policy has been in place since 2021, increasing the entitlement of 600 hours that had been in place since 2014.

- **Free school meals, which save the average family who take up the offer £400 per child per year, will be expanded, and more breakfast clubs introduced**. School meals in Scotland are currently free for all children in Primary 1 to 5, with a household means test applied to students in Primary 6 and 7 and those in secondary school. Free school meals have become increasingly universal, most recently with a commitment to ensure that all primary-school children can access a free breakfast club by August 2027.
- **Winter fuel payments restored for Scottish pensioners in 2025-26**. Winter fuel payments, which have been replaced by Pension Age Winter Heating Payment in Scotland, are an annual lump-sum benefit of £100 to £300 for pensioners earning £35,000 or less. This policy has undergone a series of changes in recent years, moving from universal age-based provision to a more means-tested version.

Distributional analysis of these policies involves quantifying the benefits that they confer to different groups of households. In particular, we are interested in the impacts on households with different levels of income, as this provides a broad indication of 'progressivity' – that is, the extent to which each policy benefits lower-income households compared to higher-income households. We are also interested in the impacts on families with children, given that the Scottish Government has set eradicating child poverty as its top priority. This includes analysis of impacts across the six child poverty priority groups, which comprise:

- Lone parent families
- Minority ethnic families
- Families with a disabled adult or child
- Families with a mother aged under 25
- Families with a child under one
- Larger families (3+ children).

These groups have been identified by the Scottish Government as being at greatest risk of child poverty owing to the specific barriers they face, with around 9 in 10 children in poverty falling into at least one of the groups.

The research consists of two phases: 1) a review of the literature to identify gaps in the evidence base; and. 2) further analysis to help fill those gaps.

Phase 1: literature review

Our literature review finds that strong evidence exists on the distributional impacts of three of the seven policies in the CoL Guarantee, namely **income tax**, **funded childcare**, and **winter fuel payments**, now replaced by Pension Age Winter Heating Payment.

The distributional analysis published by the Scottish Government alongside the annual budget is the primary source of evidence, covering impacts by household income as well as a number of the child poverty priority groups, though the Institute for Fiscal Studies has also modelled the impacts of the Scottish income tax system by household income.

Not all of the child poverty priority groups are covered by the Scottish Government's modelling. However, two of the three outstanding groups, namely minority ethnic families and families with mothers under 25, cannot be robustly modelled using the primary source of data on household income, namely the Family Resources Survey. This is because the number of households interviewed – that is, the sample – is too small to be reliable (see Annex 1). The Scottish Government does present results for households with a disabled person, but this includes households without children.

The review finds that partial evidence exists on the distributional impacts of **free bus travel**. The Scottish Government modelling presents impacts of this policy by household income, but not for any of the child poverty priority groups. Meanwhile, we find little to no evidence on the distributional impacts of the remaining policies, namely **free prescriptions**, **free eye appointments**, **free undergraduate tuition fees**, **and free school meals**, across our groups of interest.

Policies for which evidence is lacking or limited are taken forward into Phase 2, along with funded childcare to provide a direct comparison with the Scottish Government's modelling and to allow us to explore specific aspects of the policy.

Phase 2: further analysis

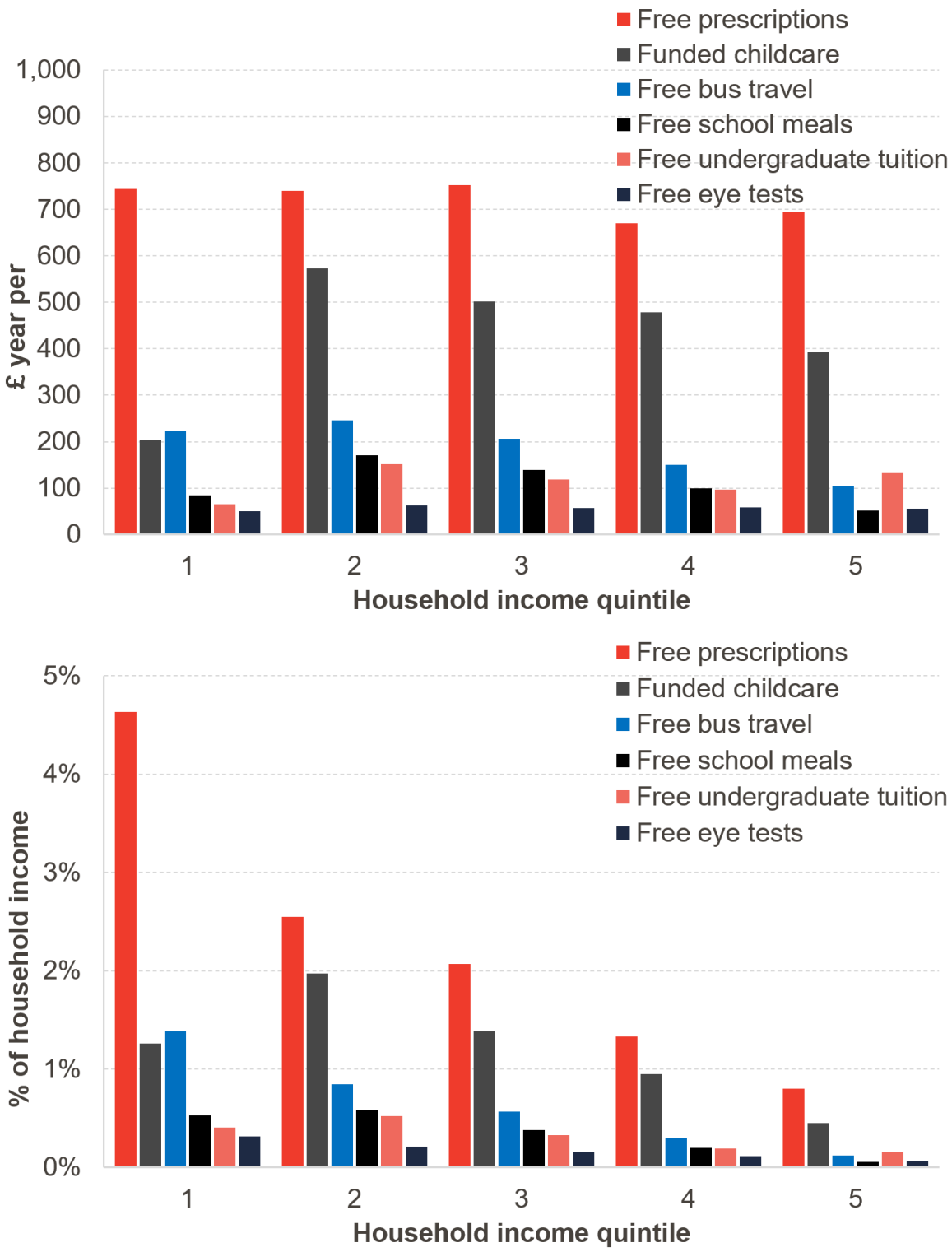
This phase of the research involves using a range of modelling tools and data sources to identify households that benefit from each of the policies in scope. Where possible, this is based on actual use or receipt of the policy, meaning that the model takes into account variations in access and uptake as well as eligibility. The total value of each policy, as represented by the amount of public resource spending associated with it, is then distributed among beneficiary households.

Results can be presented in multiple ways, each of which can paint a different picture of how impacts are distributed. The most common method is to present average impacts by group, in cash terms or as a percentage of household income. Figures 1 presents both of these averages by household income quintile. Each quintile represents one-fifth of households in Scotland, where households in the lowest quintile have the lowest incomes and those in the fifth quintile have the highest. Figure 2 presents average impacts for the four child poverty groups with sufficient sample sizes, namely those with lone parents, those with three or more children, those with a child under 1, and those with children and at least one disabled adult or child.

Another method for presenting the distribution of impacts is to show the proportion of spending on each policy that falls within each group of interest. This is particularly

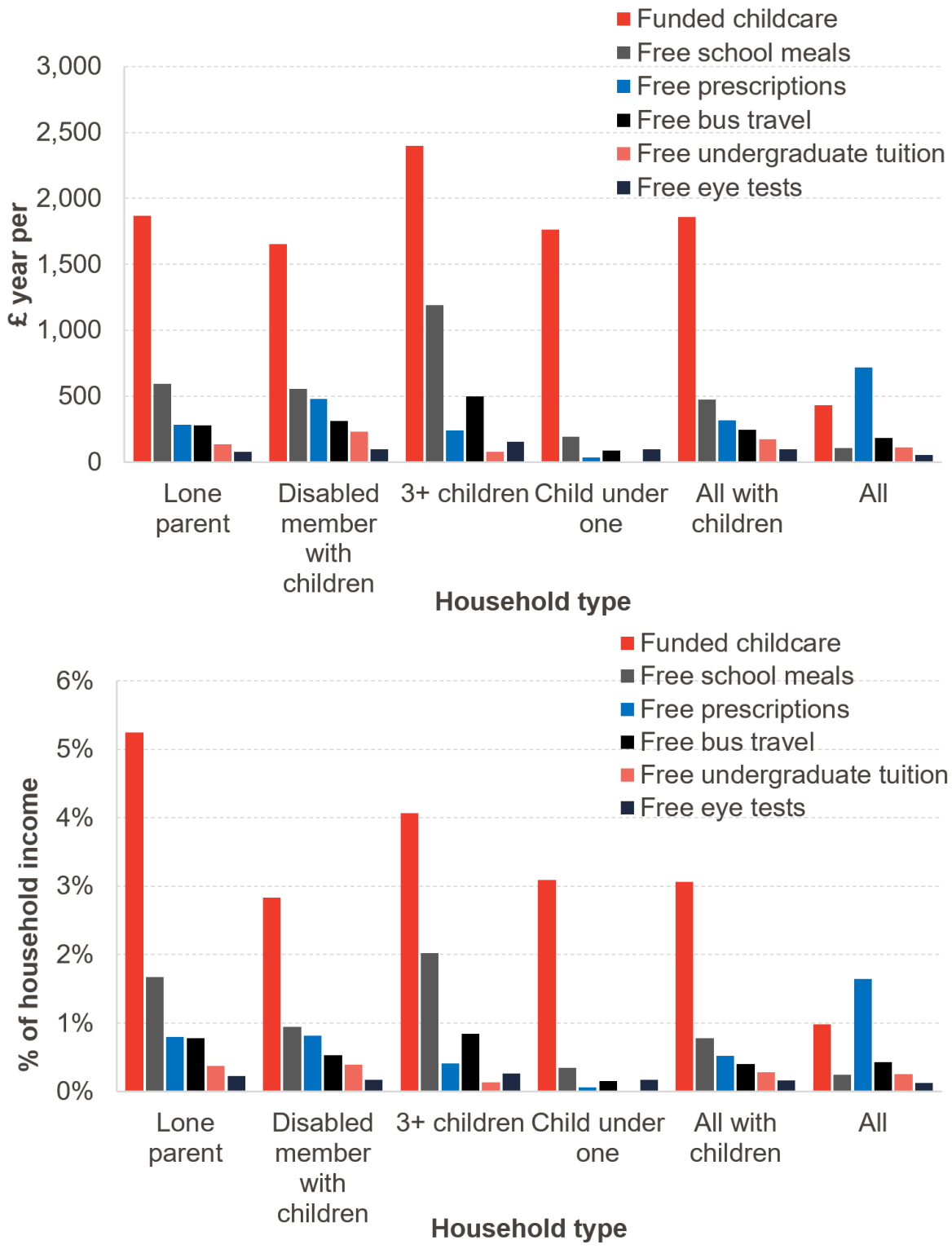
helpful for comparing impacts distributions across policies with substantially different levels of total spending, but is less suitable when the groups of interest differ in size. Figure 3 therefore presents this breakdown by household income quintile only.

Figure 1: Average impacts by household income quintile, Scotland, 2026-27
The legend is presented in the same order as the bars in the clusters.



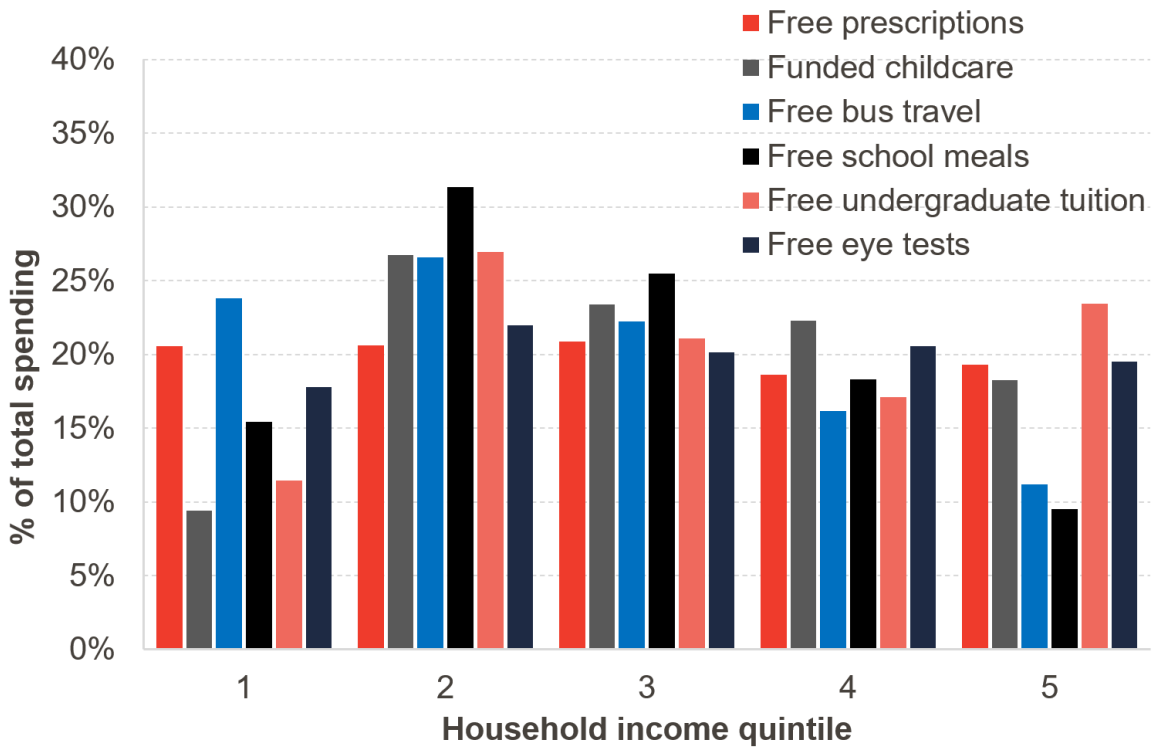
Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

Figure 2: Average impacts by child poverty priority group, Scotland, 2026-27
The legend is presented in the same order as the bars in the clusters.



Notes: household income defined as net equivalised household income before housing costs; people in higher education are not classified as children; 'disabled member with children' designates households with children and at least one disabled adult or child
Source: FAI analysis using UKMOD

Figure 3: Share of total spending by household income quintile, Scotland, 2026-27
The legend is presented in the same order as the bars in the clusters.



Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

Key findings from this analysis include:

- **Free school meals, funded childcare, and free bus travel all benefit lower-income households more than higher-income households**. This progressive distribution of impacts partly reflects the presence of means-tested elements in two of the policies, namely free school meals and funded childcare, such that lower-income households are directly targeted. However, it also reflects the fact that these policies target demographic groups that tend to have lower household incomes – particularly children in the case of free school meals, funded childcare, and free bus travel, but also disabled people and those aged 60 and over in the case of free bus travel. If we remove both of these effects when analysing funded childcare by restricting the analysis to the universal element and to households with children, average impacts are in fact largest among the highest-income families, meaning the distribution of impacts is regressive when presented this way, possibly reflecting variations in uptake (see Figure 13).
- **Households with the lowest incomes tend to benefit less than those with slightly higher incomes.** This is especially true for policies that are otherwise progressively distributed, even when impacts are presented as percentages of income. For example, the average impact of funded childcare is almost three

times as high for households in the second quintile compared to those in the bottom quintile in cash terms, and almost twice as high in percentage terms. This is partly explained by the fact that households in the bottom quintile are the least likely to have children, raising questions around whether groups that tend to be the poorest are adequately served by Scottish Government policies more generally. On the other hand, the wider literature suggests that some households at the very bottom of the distribution may have higher incomes than is recorded in the data.

- **Free prescriptions and free eye tests tend to benefit households equally regardless of income.** This reflects the universal nature of these policies and the fact that they are not restricted to particular demographic groups. Impacts of all policies are progressively distributed when presented as percentages of household income, although there may be less rationale for presenting impacts this way given that, unlike monetary tax and benefit transfers, public services do not represent components of income. It is perhaps more meaningful that these policies are not skewed away from the bottom quintile in the same way as those that are otherwise more progressively distributed. Indeed, when comparing shares of total spending, these policies feature higher shares in the bottom quintile than most of the other policies.

- **On average, all six policies except for free prescriptions benefit households with children more than households without children**. This is to be expected in the case of funded childcare and free school meals, which only affect families – and to some extent free bus travel and free eye tests, which contain age-based differences in entitlements. It is perhaps less expected in the case of free undergraduate tuition given that people in higher education are not counted as children. However, many of these individuals will have siblings, who are counted as benefitting from the policy by virtue of impacts being measured at the household level.

- Out of the four child poverty priority groups modelled, **households with three or more children tend to benefit the most in cash terms**, with the exception of free undergraduate tuition and free prescriptions. However, when presented as a percentage of income, **households with lone parents also benefit more than other groups**. On the other hand, with the partial exception of funded childcare, **households with children under one tend to benefit less than other households with children**, although results for this group should be treated with caution as the underlying sample size is limited.

Implications

The policies within the CoL Guarantee are diverse. They involve a range of policy areas, including health, education, and transport as well as tax and social security, and they target different groups of the population. This makes the Guarantee a particularly strong

test case for demonstrating the feasibility and value of distributional analysis with respect to government policy in general. However, the same diversity also makes it difficult to draw clear-cut implications from the results of the analysis without applying a normative standard. While the policies within the Guarantee share a common objective in mitigating the cost of living – as well as cross-cutting priorities such as reducing child poverty – they also contain their own, distinct rationales.

For example, the fact that the impacts of free prescriptions are relatively constant across the income distribution implies that a large proportion of spending on this policy – which totals some £1.8 billion per year – is benefitting households that do not strictly need support. However, since free prescriptions fall under NHS provision, which is generally meant to be free at the point of use for all citizens, the distribution of impacts may nevertheless be deemed appropriate. Similarly, as we would expect older people to rely more heavily on health services, it is not immediately clear that this policy should be criticised for primarily benefitting households without children, notwithstanding the priority to tackle child poverty.

Without passing judgement on individual policies, the analysis therefore raises broader questions regarding the overall approach to public service provision, including what criteria should be used to design and assess different policies and how fiscal trade-offs should be framed and navigated at a strategic level. At the same time, the lack of distributional analysis that is currently available, particularly outside government, is likely to constrain this debate. This report therefore shows not only that distributional analysis is feasible across a range of policy areas, but also that there is a need for such analysis to be produced and used more widely in Scotland.

Introduction

The Fraser of Allander Institute (FAI) is a leading economic research institute based at the University of Strathclyde. In 2026, the FAI was commissioned by the Poverty and Inequality Commission ('the Commission') to examine the distributional impacts of the Scottish Government's Cost of Living (CoL) Guarantee. In particular, the research sets out to review the available evidence on the distributional impacts of the CoL Guarantee and to carry out new analysis where this evidence is limited.

This work is intended to support the capacity of the Commission to make informed recommendations on how public spending benefits people across the population, with a focus on low-income households and groups that experience particular disadvantages. The value of distributional analysis is especially evident at a time when the public finances are strained, which sharpens the fiscal trade-offs that policymakers face and raises questions regarding the allocation of government resources. Distributional analysis can help reveal the extent to which government is 'putting its money where its mouth is' when it comes to navigating these trade-offs, not least regarding its stated priority of eradicating child poverty.

In this context, the CoL Guarantee provides a test case for examining the distributional impacts of government policy as a whole. The Guarantee was announced in the 2025-26 *Programme for Government* as a central part of the Scottish Government's response to the cost-of-living crisis.[1] It is not a specific policy, but rather a collection of policies that are intended to mitigate cost-of-living pressures, with the express aim of ensuring that people in Scotland receive more robust support than is available in other UK nations. These include a mixture of means-tested and universal policies, and a mixture of policies that are targeted at children, policies that are targeted at other population groups, and policies that are not explicitly targeted. Many of these policies are longstanding.

Specifically, the CoL Guarantee consists of the following policies:[2]

- **Lower income tax than in the rest of the UK for the majority of taxpayers (referred to as 'income tax').** Since April 2017, powers to set the tax schedule for non-savings non-dividend (NSND) income have been devolved in Scotland, although the personal allowance remains reserved. The Scottish Government has used these powers to create additional tax bands, while setting somewhat lower rates for lower earners and somewhat higher rates for higher earnings. However, the claim that this tax schedule results in most Scottish earners paying less income tax than they would in the rest of the UK is based on forecasts of median earnings, which are subject to change and error.[3] For purposes of

[1] Link to Scottish Government Programme for Government 2025-26
[2] Link to the First Minister's Cost of Living Guarantee
[3] Link to Scottish Fiscal Commission Median Incomes Fact Sheet – November 2025

distributional analysis, we interpret this policy as simply the Scottish NSND income tax schedule as compared to the rest of the UK.

- **Continuation of free prescriptions ('free prescriptions') and free eye appointments (referred to as 'free eye appointments')**. Free NHS eye tests were introduced in Scotland in April 2006. People aged under 16 and over 59, and those with sight impairment or diabetes, are entitled to annual tests, with the rest of the population entitled to one test every two years.[4] As a comparison, an adult eye test at an English branch of Specsavers costed £25 as of May 2026.[5] Free NHS prescriptions were fully introduced in Scotland later, in April 2011, after charges had been gradually reduced over several years. In England, NHS prescriptions are charged at £9.90 per item, although some items such as contraception are free.[6]
- **Free bus travel for 2.3 million people (referred to as 'free bus travel')**. In Scotland, free bus passes are provided to people aged 60 and over, people aged 5 to 21, and people with disabilities. This policy was also rolled out in stages. Historically, councils operated their own schemes, albeit subject to national minimum requirements from 2002. The nationwide scheme for older and disabled people was introduced in April 2006, with the young persons' scheme introduced in January 2022. In England, a national scheme exists for older and disabled people, but is more stringent in terms of its eligibility criteria (for example, the age floor is set at State Pension Age rather than 60) and is only valid at certain times of day. There is no national scheme for younger people in England, although different localities provide their own schemes.
- **Scottish undergraduate students will continue to pay no tuition fees (referred to as 'free undergraduate tuition')**. Up-front tuition fees for Scottish undergraduates were replaced in 2001 by a graduate endowment – a fixed contribution to the higher education system, payable after graduation once income exceeded a certain threshold – which was in turn abolished in 2008. Free tuition is restricted to those who are ordinarily resident in Scotland, have a settled immigration status, have lived in the UK for at least three years, and are pursuing their first undergraduate degree. In the rest of the UK – and for UK students in Scotland who do not qualify for free tuition – tuition fees are currently capped at £9,790 per year across most undergraduate courses, although student loans are available.
- **Funded childcare hours, which would otherwise cost families more than £6,000 a year per eligible child (referred to as 'funded childcare')**. The first major expansion of funded early learning and childcare in Scotland came in

[4] Link to NHS Scotland free eye examination guide
[5] Link to Specsavers eye test landing page
[6] Link to NHS prescription charges

2014, when the Scottish Government introduced 600 hours per year for all three-to-four-year-olds and eligible two-year-olds, roughly doubling existing levels of entitlement. This was followed by the expansion to 1,140 hours that remains in force, equivalent to around 30 hours per week during term time. The policy is universal for three- and four-year-olds and means-tested for two-year-olds. This is in contrast to England, where parents are only entitled to the same level of provision as parents in Scotland if they are in work and do not earn above a certain threshold; otherwise they receive half the number of hours. The figure of £6,000 is based on an hourly rate of £5.30,[7] derived from the 2025 Coram Childcare Survey.[8] Across the UK, funded childcare hours are accompanied by tax-free childcare support – effectively a government co-payment scheme – as well as childcare support through Universal Credit.

- **Free school meals, which save the average family who take up the offer £400 per child per year, will be expanded, and more breakfast clubs introduced (referred to as 'free school meals')**. The recent history of free school meals in Scotland has been marked by a move towards universalism – particularly since 2015, when the policy was first extended to all students in Primary 1 to 3 across Scotland. This has since been extended to Primary 4 and 5, with eligibility for students in Primary 6 and 7 and those in secondary school continuing to be means-tested. A long-running commitment to universal free school meals for all primary students has been repeatedly delayed, although the eligibility criteria have been expanded, for example by including Scottish Child Payment in the list of qualifying benefits. The cited savings of £400 per year reflects an assumed value per meal of between £2 and £3 on average across 190 school days. In England, free school meals are universal only for infants, equivalent to Primary 1 to 3. The expansion of breakfast clubs refers to a commitment in the 2026-27 Budget to ensure all primary school children are able to access a free breakfast club by August 2027; a similar commitment was made for England in the UK Government's 2025 child poverty strategy.

- **Winter fuel payments restored for Scottish pensioners in 2025-26 (referred to as 'winter fuel payments')**. Winter fuel payments, which have been replaced by Pension Age Winter Heating Payment in Scotland, are an annual lump-sum benefit for older people to help with heating bills. Besides being devolved, the policy has undergone a series of changes in recent years, moving from universal age-based provision to a more means-tested version. The current policy pays between £100 and £300 to people of State Pension Age, with the payment clawed back through the tax system for those with incomes over £35,000 per year.

[7] Link to Scottish Government National Evaluation of Early Learning Childcare Expansion report
[8] Link to Coram Childcare Survey 2025

The abolition of peak rail fairs is often mentioned in conjunction with the CoL Guarantee, but is not listed as a component of it and is therefore not covered in our analysis.

The research proceeds in two phases. In the first phase, we undertake a systematic literature review to assess the strength of the available evidence on the distributional impacts of the policies above. The second phase of research intends to fill the gaps identified in Phase 1 through new analysis. In both phases, we are interested in the impacts of the CoL Guarantee across the income distribution, which provides a broad indication of progressivity, and in the impacts across the child poverty priority groups, which the Scottish Government has identified as being at especially high risk of poverty due to the specific disadvantages that they face. These include:

- Lone parent families
- Minority ethnic families
- Families with a disabled adult or child
- Families with a mother aged under 25
- Families with a child under one
- Larger families (3+ children).

The two main sections of this report focus respectively on the two phases of research, with the significance of the findings discussed in the conclusion. The annexes provide a detailed description of our methodology along with supporting evidence and supplementary information.

Phase 1: Literature review

Methodology

In this phase of the research, we systematically review existing evidence on the distributional impacts of policies within the CoL Guarantee. The review is limited to evidence that is available in the public domain.

Our approach to this review involves a number of key steps:

1) A set of search terms were developed and applied to a set of databases and specific sources to identify an initial collection of studies that could be relevant to our topic of interest, namely the distributional impacts of the policies within the CoL Guarantee.
2) These studies were screened by applying a set of inclusion criteria to their titles, abstracts, and keywords, narrowing down the initial collection of studies.
3) The studies that survived the screening process were further assessed for relevance through a full-text examination.
4) The evidence contained in the studies that were deemed to be relevant was reviewed and the strength of evidence available for each policy was appraised.

Out of 110 studies identified in Step 1, twenty-five contained some form of distributional analysis on a policy area relevant to those within the CoL Guarantee, meaning they survived the screening process in Step 2. In Step 3, four of these studies were deemed to be directly relevant in that they were specific to Scotland and were conducted within the last decade.

This section focuses on the findings from Step 4, with Annex 2 containing further detail on our methodology for Steps 1-3.

Findings

The main source of distributional analysis is the modelling that accompanies the Scottish Budgets for 2024-25, 2025-26 and 2026-27, which quantifies how tax, social security, and key spending measures affect households at different income levels.[9] The modelling also estimates the distributional impacts of government spending decisions and policies across a set of demographic groups. Outside government, the Institute for Fiscal Studies (IFS) has provided Scotland-specific modelling of the distributional effects of devolved tax reforms.[10]

Otherwise, most analysis of government spending decisions is high level, without a focus on the specific policies outlined in the CoL Guarantee. The evidence base for

[9] Links to Scottish Government Distributional Analysis accompanying 2024-25 budget; Scottish Government Distributional Analysis accompanying 2024-25 budget; Scottish Government Distributional Analysis accompanying 2026-27 budget

[10] Link to IFS Scottish Government's record on tax and benefit policy report

distributional analysis is also stronger for certain policies than others. For example, changes in income tax, including comparisons to the UK, have been analysed in detail, whereas there is a lack of evidence on the distributional impacts of policies such as free prescriptions or free bus travel.

Table 1 provides a broad overview of the distributional evidence that exists for each of the policies in scope.

Table 1: Level of evidence available on distributional impacts of selected policies

Policy	Level of evidence	Breakdown						
		Household income distribution	Lone parent families	Larger families (3+ children)	Families with a child under one	Families with a disabled adult or child	Minority ethnic families	Families with a mother under 25
Income tax	Evidence exists	✓	✓	✓	✓	×[1]	×	×
Free prescriptions and eye tests	No evidence exists	×	×	×	×	×	×	×
Free bus travel	Some evidence exists	✓	×	×	×	×	×	×
Undergraduate tuition fees	No evidence exists	×	×	×	×	×	×	×
Childcare	Evidence exists	✓	✓	✓	✓	×[1]	×	×
Free school meals	No evidence exists	×	×	×	×	×	×	×
Winter fuel payments	Evidence exists	✓	✓	✓	✓	×[1]	×	×

1. Scottish Government modelling shows impacts for households with a disabled person, not restricted to families with children.

The remainder of this section sets out the available evidence for each policy in detail.

Income tax

Our review finds that income tax is one of the few areas within the Cost of Living (CoL) Guarantee supported by robust distributional analysis, including clear comparisons with the rest of the UK. Both Scottish Government and Institute for Fiscal Studies (IFS) analysis provide consistent evidence on how Scottish policy affects taxpayers relative to the UK system.

The strongest direct evidence on the "lower tax for the majority" commitment comes from comparative modelling of Scottish and UK income tax liabilities. The IFS estimates that around the lowest 55% of Scottish taxpayers pay slightly less income tax than they would elsewhere in the UK, while the remaining 45%—primarily higher earners—pay more, with differences increasing significantly at higher income levels. This provides clear support for the overall direction of the policy, although as noted above the outturn data on median income is not always consistent with the specific claim.

Scottish Government distributional analysis complements this by showing how Scottish income tax changes are concentrated at the top of the income distribution.

Across recent Budgets, most low- and middle-income households experience little or no change in their income tax liabilities, reflecting both lower exposure to higher tax bands and, in many cases, limited tax liability. By contrast, higher earners consistently bear the largest increases. This structural pattern underpins the relative position versus the UK system: lower- and middle-income households are largely protected, while divergence is driven by higher taxes at the top.

However, the evidence also suggests that the extent to which most taxpayers are actively "better off" is modest. For many in the lower half of the distribution, differences in income tax compared to the rest of the UK are small in cash terms, and in many cases the effect is neutral rather than a clear gain. This reflects the fact that income tax changes have limited direct impact on those with lower taxable incomes.

Across both sources, it is also clear that outcomes are driven primarily by income level rather than household type. While some subgroup analysis is available (including for certain priority family types), the relative advantage compared to the UK system is largely determined by position in the income distribution.

Overall, the evidence supports the conclusion that Scottish income tax policy delivers on the principle that most taxpayers pay less (or no more) than in the rest of the UK, with higher earners paying more. However, it also shows that the scale of this advantage for most households is relatively small, and that the largest distributional differences—both within Scotland and relative to the UK—are concentrated among higher income taxpayers rather than the majority.

Free prescriptions

As part of their distributional analysis, the Scottish Government model health expenditure across household income quintiles, in which free prescriptions are included. Despite the long-standing nature of free prescriptions in Scotland, however, we have not identified any specific existing evidence of distributional for this policy. Instead, most of the evidence relates instead to the usage, costs and changes in volumes, with no distributional components estimated.

For distributional analysis of spending on free prescriptions in Scotland, the Prescribing Information System (PIS) held by Public Health Scotland could in theory be used.[11] This is the definitive administrative dataset covering all NHS prescriptions that are prescribed, dispensed, and reimbursed in the community, with near-complete population coverage. At the microdata level (accessible from around 2009 onward), PIS contains patient identifiers (CHI), detailed drug information, prescriber and dispenser characteristics, and the cost of each dispensed item. These records can be used to construct individual-level measures of publicly financed pharmaceutical spending, and records can potentially be linked to other datasets using CHI to retrieve additional characteristics. Access to PIS requires a formal application through Public Health Scotland (often coordinated via Research Data Scotland) and analysis takes place

[11] Link to Public Health Scotland Prescribing Information System National Data Landing Page

within a National Safe Haven – a secure environment that allows de-identified, linkable data to be analysed under strict governance. The timescale for gaining access to this data is beyond the scope of the present project, although government officials may be able to utilise more direct routes.

An alternative, more accessible route is to use the Scottish Health Survey (SHeS) microdata available via the UK Data Service. This is a representative household survey that includes information on prescribed medicines and health service use, alongside rich socioeconomic variables. Access is relatively straightforward: researchers register with the UK Data Service, download anonymised microdata, and analyse locally (or via secure access for more detailed files). The main advantage is ease of access and the availability of detailed characteristics (income, education, housing, etc.) that support distributional analysis. The SHeS relies on self-reported medication use rather than administrative records and does not directly observe NHS reimbursement costs, making it less precise and less comprehensive than PIC. We explore this approach in Phase 2.

Free eye appointments

Our review has not identified any specific existing evidence of distributional analysis for this policy. Instead, most of the evidence relates instead to the usage, costs and changes in volumes, with no distributional components estimated.

To conduct distributional analysis of spending on free eye examinations in Scotland, the key data source would be the General Ophthalmic Services (GOS) administrative dataset held by Public Health Scotland.[12] This dataset captures all NHS-funded eye examinations delivered by community optometrists, based on the payment claims they submit to the NHS. The data contain a range of information that could enable distributional analysis, including age, sex, and area-based deprivation (e.g. SIMD) and can be further linked through CHI. Like PIS, access to the GOS microdata requires a formal application, and researchers typically request access via Public Health Scotland's data access process or the National Safe Haven. Also like PIS, the timescale for gaining access to this data is beyond the scope of the present project.

Despite this, free eye examinations are available to all individuals in Scotland every two years, with these examinations more frequent for those over 65 and with certain conditions. This enables a simpler approach to distributional analysis, which we explore in Phase 2.

Free bus travel

Our review has highlighted that the Scottish Government produce a breakdown of their distributional analysis by type of transport spending, including bus and bus pass travel, published as part of the modelling alongside the 2025-26 and 2026-27 budgets. These include estimates of public spending on (non-concessionary) bus travel and,

[12] Link to Public Health Scotland Ophthalmic Statistics, year ending March 2025

separately, concessionary bus pass travel, by household income quintile. The analysis also includes the value of the policy (referred to as the "bus pass") within the broader assessment of transport spending.

Unlike income tax or means-tested benefits, this policy is not income-targeted, and eligibility is instead based on characteristics such as age or disability. As a result, when examined across the income distribution, the value of free bus travel shows a slight progressive trend in cash terms, with this argument strengthened when looking at spending on bus pass travel as a share of household income. This reflects the wider finding that spending on services such as transport is distributed uniformly across income groups, rather than being concentrated at the bottom.

The Scottish Government's modelling of free bus passes is based on the Scottish Household Survey, and specifically the travel diary. We take a similar approach in Phase 2.

Free undergraduate tuition

At present, we have not identified any existing evidence of distributional analysis specifically for the offering of free undergraduate tuition fees in Scotland. The Scottish Government model higher education spending within their distributional analysis of government spends by department, however specific modelling for free tuition fees is not available.

Available evidence, instead, tends to focus on the costs, sustainability, governance and take up of university places, rather than the differential impacts of the policy on different groups of the population.

We have, therefore, identified this as a policy to be taken forward in Phase 2.

Funded childcare

Funded Early Learning and Childcare (ELC) is a major cost-of-living intervention, with clear financial benefits for families with young children through reduced childcare costs. However, the distributional evidence highlights that its impact differs in nature from income tax, as it is not primarily targeted at most households.

Scottish Budget analysis for 2025–26 and 2026–27 shows that the value of funded childcare provision is relatively evenly distributed across the income distribution in cash terms, albeit with a slightly progressive pattern. This reflects the combination of a universal entitlement of 1,140-hours for 3- and 4-year-olds and a means-tested entitlement for 2-year olds, combined with the fact that children overall tend to be located further down the income distribution. The progressive pattern is strengthened when impacts are presented as percentages of income.

The most important distributional feature of ELC is that it is targeted by life stage rather than income. Benefits are concentrated almost entirely among households with young children, who receive substantial in-kind support, while households without young children receive no direct benefit regardless of income. As a result, distributional

outcomes are driven more by household composition than by position in the income distribution, as shown only in the 2026-27 analysis.

Overall, the evidence suggests that funded childcare reduces costs significantly for eligible families but does not operate as a broad-based mechanism that lowers costs for most households. Its contribution to the CoL Guarantee is therefore more specific: it delivers substantial, targeted support to families with young children rather than system-wide cost reductions.

Free school meals

At present, we have not identified any distributional analysis on free school meals in Scotland that is available in the public domain. Any existing evidence, instead, relates to uptake rates or descriptive statistics of those using the policy, rather than differential analysis for subgroups of the population.

Winter fuel payments

Alongside income tax and childcare, winter fuel payments are one of the few areas within the CoL Guarantee where distributional analysis is available. Scottish Budget analysis assesses the impact of the Pension Age Winter Heating Payment (PAWHP), which replaces Winter Fuel Payments (WFP), across the income distribution and by household type, particularly for pensioner households.

This policy has undergone a series of changes in recent years. Prior to 2024, the UK-wide WFP scheme was provided universally on the basis of age, with £200 per household if the oldest eligible person was under 80 and £300 if someone in the household was aged 80 or over ('the universal policy'). In July 2024, the UK Government announced that the policy would be restricted to pensioners receiving means-tested benefits as of winter 2024-25 ('the means-tested policy'). This coincided with the replacement of the policy in Scotland by the devolved PAWHP.

PAWHP mirrored the means-tested WFP scheme in winter 2024-25, albeit delivered by the UK Government under a transitional arrangement. However, later in 2024, the Scottish Government announced that it would introduce an additional element of PAWHP from the following winter, paying £100 per pension-age household not in receipt of qualifying benefits ('the hybrid policy'). This policy was then obviated in June 2025 by a further reform to WFP by the UK Government, whereby most pensioners would receive the payments but those with incomes above £35,000 per year would repay it through the tax system ('the clawback policy'). The Scottish Government followed suit with PAWHP, with the reformed, clawback policy active as of winter 2025-26.

These changes have been reflected in the Scottish Government's distributional analysis. The 2025-26 Budget was published in December 2024, shortly after the Scottish Government announced the introduction of the hybrid policy. It models this policy as compared to the universal policy, with the strictly means-tested iteration not modelled even though it was in place in the winter of 2024-25. In other words, it models the impacts of replacing full PAWHP entitlement with a lower payment for pensioner

households who are not in receipt of qualifying benefits. The impacts are accordingly negative, but relatively small when averaged across income deciles or broad household types given their restriction to pensioner households, and without any clear pattern across the income distribution. The analysis also models the overall impacts of PAWHP – that is, compared to a counterfactual without any PAWHP – but the results are too small to meaningfully observe and are dwarfed by the rest of the devolved social security system.

The 2026-27 Budget was published in January 2025, after the clawback policy had been announced. It therefore models this policy as compared to the preceding, hybrid policy. The resulting impacts are broadly progressive, but are again strongly influenced by the restriction of the policy to pensioners.

Overall, it is clear from the design of the policy and the results that are available that while the policy provides targeted support to lower-income pensioners, particularly under the more recent design, it plays a limited role in driving system-wide redistribution within the CoL Guarantee.

Implications

In this phase of the research, we have conducted an extensive review to identify all existing evidence of distributional analysis relevant to the policies set out as part of the CoL Guarantee in Scotland, with a particular interest in impacts across the income distribution and the child poverty priority groups.

Our review has highlighted that of the policies contained in the Guarantee, there exists good evidence of distributional analysis for the policies related to income tax, funded childcare and winter fuel payments. On the other hand, our review has highlighted that there is no evidence of distributional impacts for free prescriptions and eye tests, free undergraduate tuition, or free school meals, and only partial evidence for free bus travel.

Phase 2 of the analysis, which is covered in the next section, attempts to fill the evidence gaps identified in Phase 1 by modelling those policies for which existing evidence is partial or absent. Free prescriptions and free eye tests are separated out to enable more detailed analysis, even though these policies are listed together in the CoL Guarantee.

We have also chosen to model one policy for which the evidence base is relatively strong, namely funded childcare, as this allows us to validate our modelling against the results published by the Scottish Government. Given that the impacts of funded childcare by household type are stacked with other public services in the Scottish Government's publication, are only presented as a percentage of household income and not in cash terms, and are broken down for households with a disabled member but not specifically those with children, there is also some value in showing a complete set of results for this specific policy. Finally, modelling this policy allows us to explore

particular aspects, such as the distinction between its means-tested and universal elements.

In terms of the breakdowns of interest, we are able to model impacts across the income distribution as well as four of the six child poverty priority groups, namely households with lone parents, those with three or more children, those with a child under one, and those with children and at least one disabled adult or child. As shown in Annex 1, sample sizes in the Family Resources Survey, which forms the base of our model, are too small to provide meaningful results for ethnic minority families or families with mothers under 25.

Phase 2: Further analysis

Methodology

Building on the findings of our literature review, this phase of the research models six policies in the CoL Guarantee, namely free prescriptions, free eye tests, free school meals, free undergraduate tuition fees, free bus travel, and funded childcare.

Our method for modelling the distributional impacts of each of these policies involves two broad steps. The first step is to identify the distribution of use or receipt across households, for example in terms of number of funded childcare hours used or the number of free school meals received. The second step is to assign a value to each unit used or received.

The Family Resources Survey (FRS), which contains a nationally representative sample of households in Scotland, forms the core dataset onto which the distribution of use/receipt is mapped. This is supplemented by the tax-benefit model UKMOD, which, among other advantages, allows us to project the FRS data forward to 2026-27, the year for which our analysis is conducted.

The information contained within the FRS/UKMOD is sufficient to identify a distribution of use/receipt for all six policies except free bus travel and free prescriptions. Additional data sources – primarily the Scottish Household Survey and the Scottish Health Survey – are used to predict which households in the FRS use/receive these two policies. Generally, this method is sensitive to variations in access and uptake, though all eligible individuals are treated as users/recipients where information is lacking (as in the case of free eye tests) or where totals would otherwise be more severely underreported (as in the case of free school meals).

We assign monetary values to the distribution of use/receipt based on the total amount of public resource spending on each policy that is estimated for 2026-27. These figures are taken from a combination of the Scottish Budget (for free undergraduate tuition, free bus travel, and free eye tests), local government finance statistics (for free school meals and funded childcare) and analysis of administrative data (for free prescriptions).

Overall, the methodology used to model these policies shows that it is feasible to do so. However, there are some limitations, including that the modelling undercounts the number of users/recipients for some of the policies. The modelling is also based on a number of key assumptions, which include:

- Government spending on a policy is an accurate representation of the total value of that policy;
- The benefits that a household experiences from a given policy depend on their use/receipt of that policy;

- All users/recipients benefit equally, except in the case of funded childcare and free eye tests for which information on the intensity of use/receipt is readily available;
- Benefits are shared equally within the users'/recipients' households.

Some of these assumptions are more defensible than others, and some could potentially be altered. Ultimately, however, a modelling exercise of this kind will require simplifying assumptions, besides being subject to various sources of uncertainty.

The methodology for this phase of research is discussed in more detail in Annexes 3 and 4.

Findings

Coverage

Table 2 shows the total value of each policy, quantified as the total amount of public resource spending on that policy. The six policies modelled are associated with substantially different levels of spending, and thus the values assigned to them in our modelling, ranging from less than £150 million for free eye tests to over £1.8 billion for free prescriptions. Note however that these figures reflect the amounts that are formally allocated to the respective policies, which may not represent their full fiscal costs – and this in turn can make it problematic to compare across policies. For example, the budgeted amount for free tuition covers the fees that students would otherwise pay; but since those fees are already capped at a subsidised level, the total cost of providing free tuition is higher than this figure suggests.

Table 2: Modelled value of each policy per year, Scotland, 2026-27

Policy	Value
Free school meals	£278m
Funded childcare	£1,093m
Free undergraduate tuition	£288m
Free bus travel	£473m
Free eye tests	£144m
Free prescriptions	£1,830m

Notes: see Annex 3 for information on how these figures are estimated

Following the methodology outlined above, these amounts are distributed among those who are modelled to be users or recipients of each policy. This allows us to show how the impacts of each policy vary, on average, by household income group or by child poverty priority group. However, while averages provide a concise summary of how impacts are distributed, and are accordingly common in the literature, they in fact represent the product of two factors, as per our methodology: a) the proportion of households within each group who use/receive the policy (along with the number of units that they use/receive) and b) the value enjoyed by each of those households (or the value per unit). It is worth examining these factors directly before seeing how they combine to produce the headline results.

Table 3 shows the proportion of households that benefit from each policy, the average value across benefitting households, and the average value across all households. Table 4 then repeats this analysis specifically for households with children. Free eye tests benefit all households by assumption; but since a relatively small amount of spending is spread over the whole population, households only benefit by around £100 per year. On the opposite end of the spectrum, funded childcare benefits a relatively small proportion of households, including only one in ten households with children, reflecting the relatively narrow age band of children who are eligible for the policy. Combined with a total value of over £1 billion, the result is that this policy has by far the largest value per benefitting household.

Free prescriptions, on the other hand, are associated with a high level of spending but also a wide coverage of the population, such that the impact per benefitting household is relatively small. The opposite is the case for undergraduate tuition, which features one of the lowest levels of both spending and coverage such that the average value per benefiting household is relatively large.

Table 3: Percentage of households benefitting and average annual value per household, all households, Scotland, 2026-27

	Households benefitting	Average value – benefitting households	Average value – all households
Free school meals	10%	£1,100	£100
Funded childcare	3%	£17,000	£400
Free undergraduate tuition	4%	£3,100	£100
Free bus travel	62%	£300	£200
Free prescriptions	67%	£1,000	£700
Free eye tests	100%	£100	£100

Notes: rounded to nearest percentage / £100.
Source: FAI analysis using UKMOD

Table 4: Percentage of households benefitting and average annual value per household, households with children, Scotland, 2026-27

	Households benefitting	Average value – benefitting households	Average value – all households
Free school meals	41%	£1,100	£500
Funded childcare	11%	£17,000	£1,900
Free undergraduate tuition	6%	£3,100	£200
Free bus travel	64%	£400	£300
Free prescriptions	32%	£1,000	£300
Free eye tests	100%	£100	£100

Notes: rounded to nearest percentage / £100.
Source: FAI analysis using UKMOD

Impacts by household income

Figures 4 to 9 show the estimated average impacts of the six modelled policies by income quintile. Each quintile represents one-fifth of households in Scotland, where households in the lowest quintile have the lowest incomes and those in the fifth quintile have the highest. We have chosen to present impacts by quintile rather than by decile (i.e. tenths of the population) to highlight broad trends and smooth out variations that may not be meaningful.

In keeping with analysis by Scottish Government, HM Treasury, and the Institute for Fiscal Studies, we present impacts in cash terms (absolute impacts) and as a percentage of household income (relative impacts). However, there may be less rationale for presenting impacts as percentages of income in the case of public services as compared to cash transfers. One justification for presenting impacts in this way is that lower-income households may derive more value than higher-income households from each unit of a particular service, for example because they would not be able to afford as much of the service in a world of private provision.[13] While this may be true, our analysis allocates public spending among households rather than estimating the value they receive from that spending, which would be additionally determined by a range of other factors. A related justification is the redistributive effect of public spending, whereby even a distribution of spend that is flat in cash terms can be said to be 'equalising'. However, this presentation will tend to show a progressive distribution of impacts unless the policy is strongly regressive in cash terms. Ultimately, the relative impacts should be interpreted in combination with the absolute impacts.

Also in keeping with other analyses, we measure household income as net equivalised household income before housing costs (BHC). Although after-housing-cost income (AHC) is commonly used in poverty statistics, it is less suitable for distributional analysis because its income components do not add up to 100% and because it permits negative incomes, which can pose complications when performing certain calculations such as expressing impacts as percentages of income. These issues are arguably less severe in the case of public services as compared to cash transfers, but there is also value in maintaining consistency with existing analysis.

The figures show that free school meals, funded childcare, and free bus travel all have progressive distributions of impacts in cash terms, with lower-income households tending to benefit more than higher-income households. In general, this is to be expected. Two of these policies contain means-tested elements, namely free school meals for students in Primary 6-7 and secondary school, and funded childcare for two-year-olds. In addition, all three policies are targeted at population groups that, as shown in Annex 5, are disproportionately likely to be living in lower-income households, including older and disabled people (free bus travel) but primarily children (free school

[13] Link to IFS Distributional Public Service Spending

meals, funded childcare, and free bus travel). Finally, people in lower-income households are also more likely to be using bus services in general.[14]

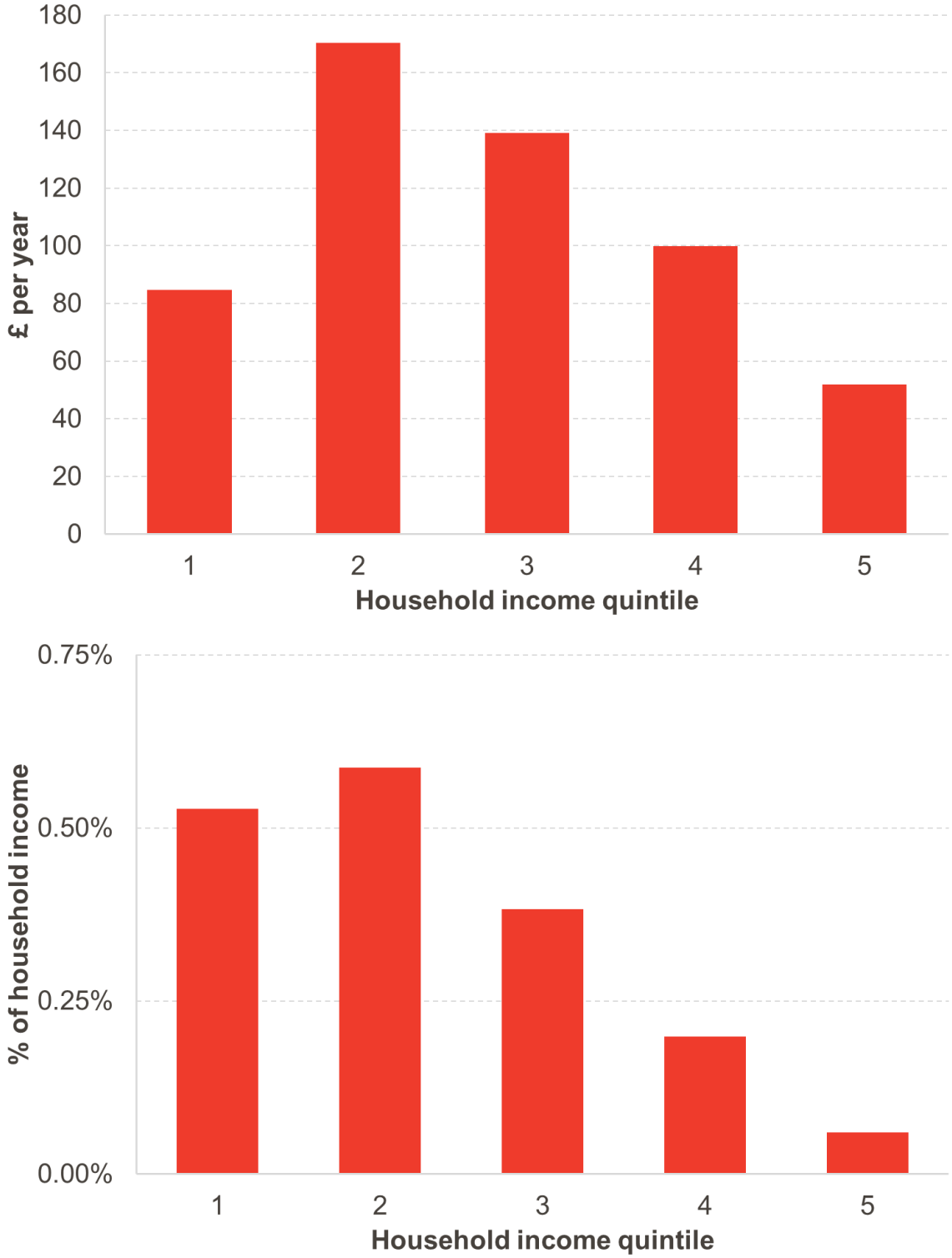
Free prescriptions and free eye tests show relatively flat distributions of impacts by household income. This is to be expected given that these policies are universal and not directly targeted at population groups that tend to have lower incomes, although underlying demand will still vary across the population. The predictive model used to estimate the distribution of free prescriptions does indicate that lower-income households are more likely to be benefitting from this policy, in keeping with external evidence on the relationship between deprivation and health, although any indication of this tendency in the results is not clear-cut.[15] The pattern may have been more pronounced if we had taken the intensity of prescription use into account rather than taking a binary approach; but on the other hand, to the extent that a higher prevalence of health conditions leads to a lower life expectancy, this may act to reduce the number of prescription users in lower-income households.[16] Meanwhile, no clear pattern can be discerned in the case of free undergraduate tuition. This policy is also universal, but benefits a smaller segment of the population, resulting in a more varied distribution. All policies do however show progressive distributions if impacts are presented as percentages of income.

Across the three policies that show a clearly progressive pattern of impacts, one exception to the pattern is that that households in the first quintile – i.e. those with the lowest incomes – tend to benefit less than those in the second quintile. As shown in Annex 5, this can be at least partly explained by the fact that the bottom quintile is largely comprised of working-age households without children, who are thus ineligible for free school meals and funded childcare and less likely to be eligible for a bus pass. Households with lower incomes will also be less likely to be in work, and therefore less likely to be using childcare or bus services to support employment. Finally, the wider literature indicates that some households at the very bottom of the distribution may be under-reporting their incomes and may accordingly belong in higher quintiles.[17]

Results for funded childcare closely match those produced by the Scottish Government in their 2026-27 budget analysis. We understand that, unlike our approach, Scottish Government have not included five-year-olds who are not yet in school – this likely explains the marginal differences that exist between the two pieces of modelling.

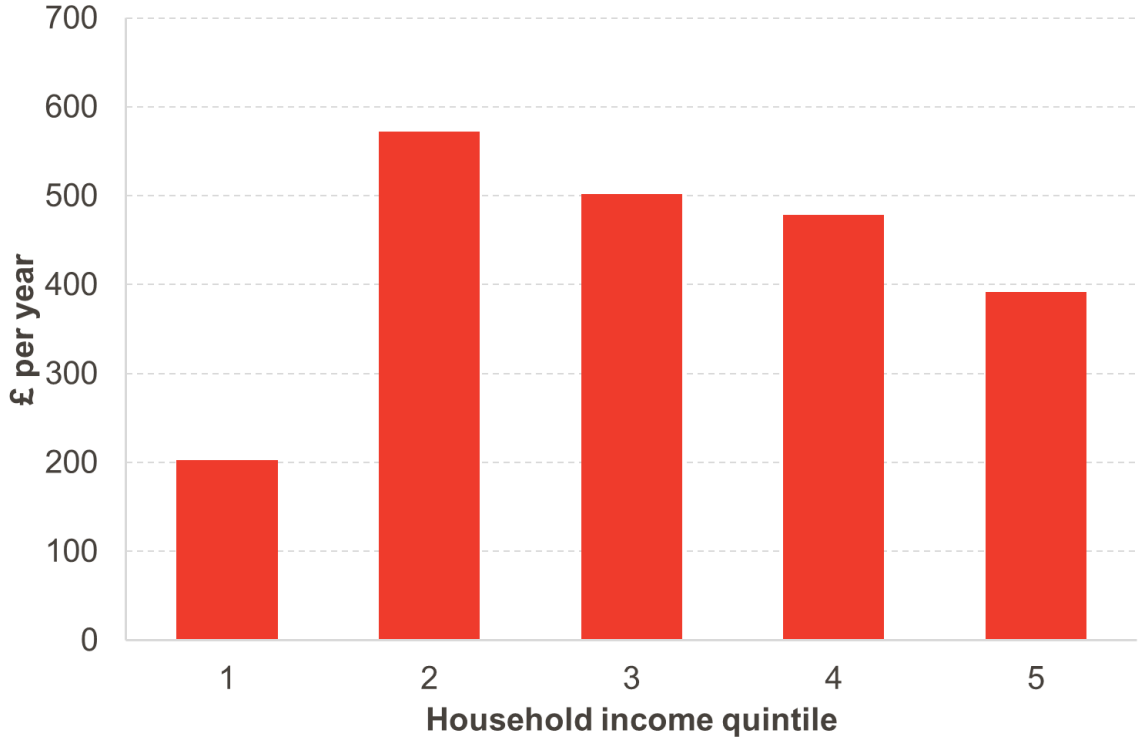
[14] Link to SPICe article on accessibility and affordability of bus travel
[15] Link to Public Health Scotland long term monitoring of health inequalities in Scotland publication.
[16] Link to NRS Health Life Expectancy 2022 – 2024 publication
[17] Link to Brewer. et. al (2017)

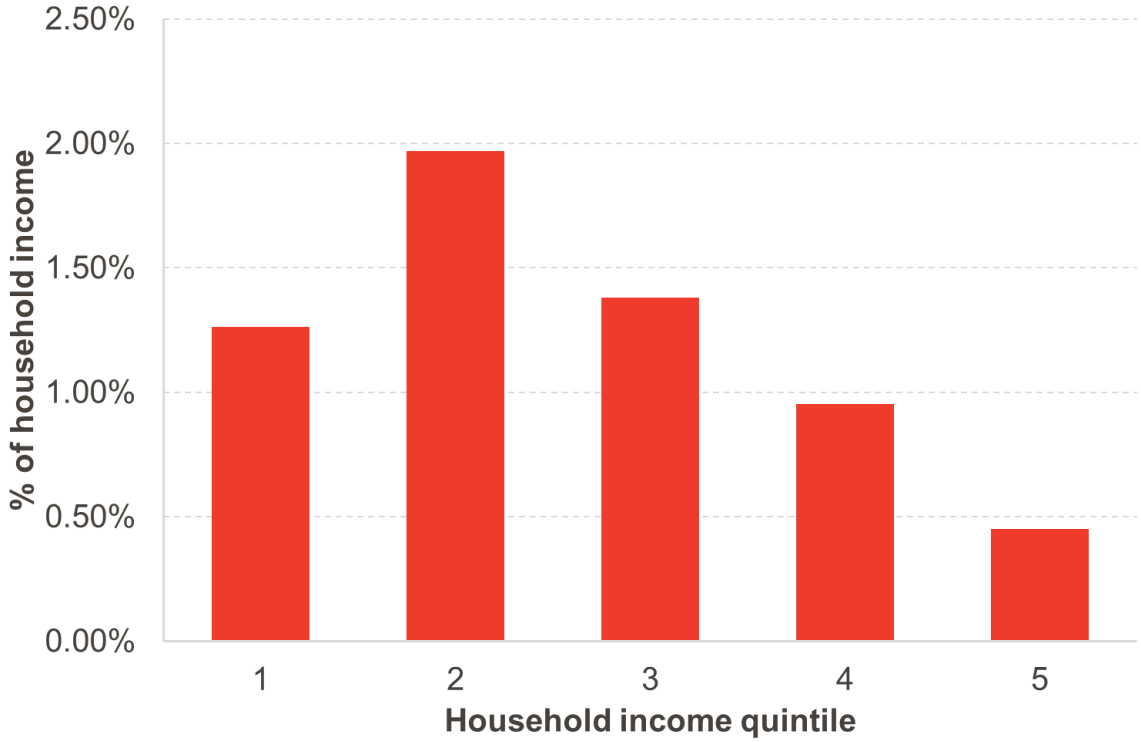
Figure 4: Average impacts of free school meals by household income quintile, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

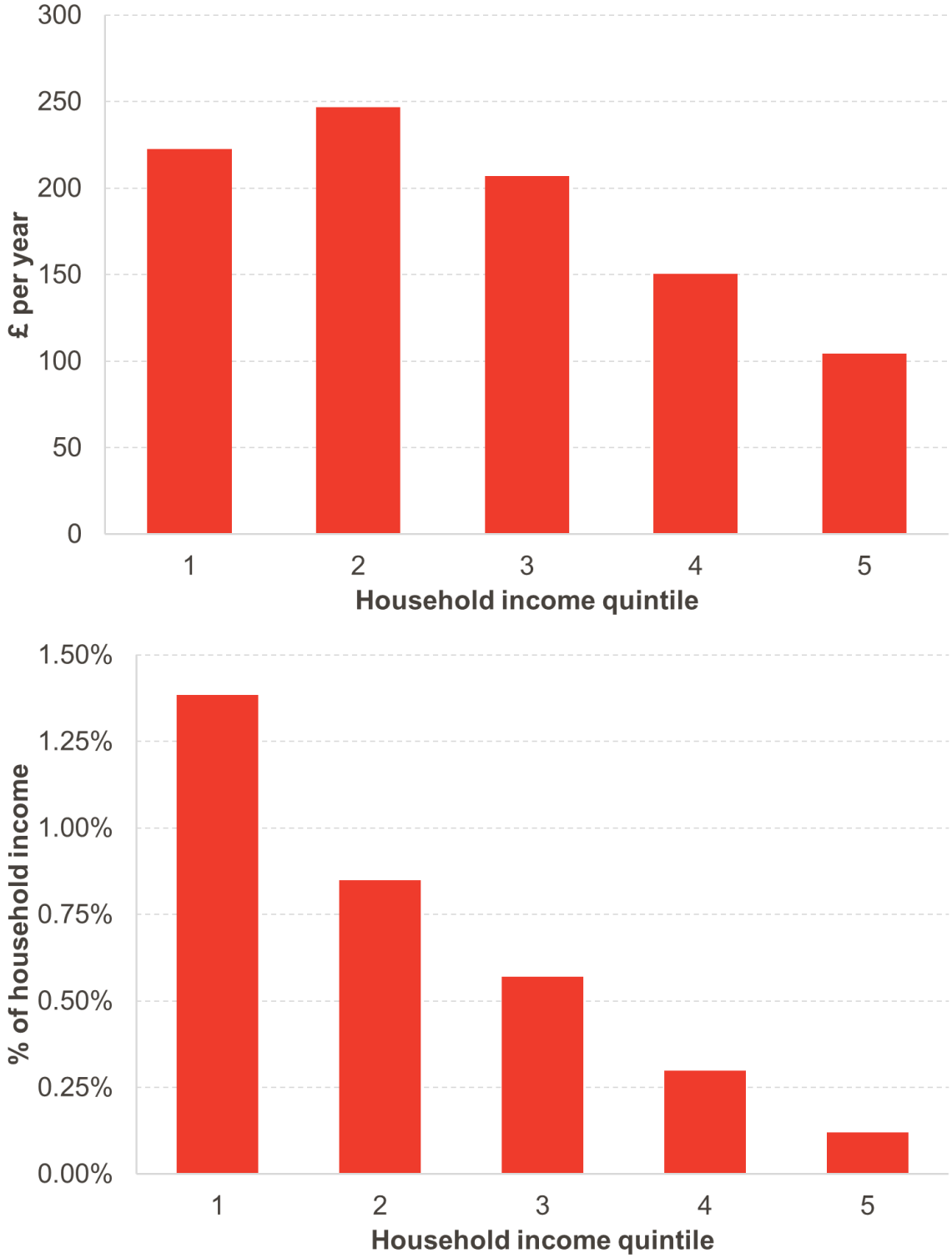
Figure 5: Average impacts of funded childcare by household income quintile, Scotland, 2026-27





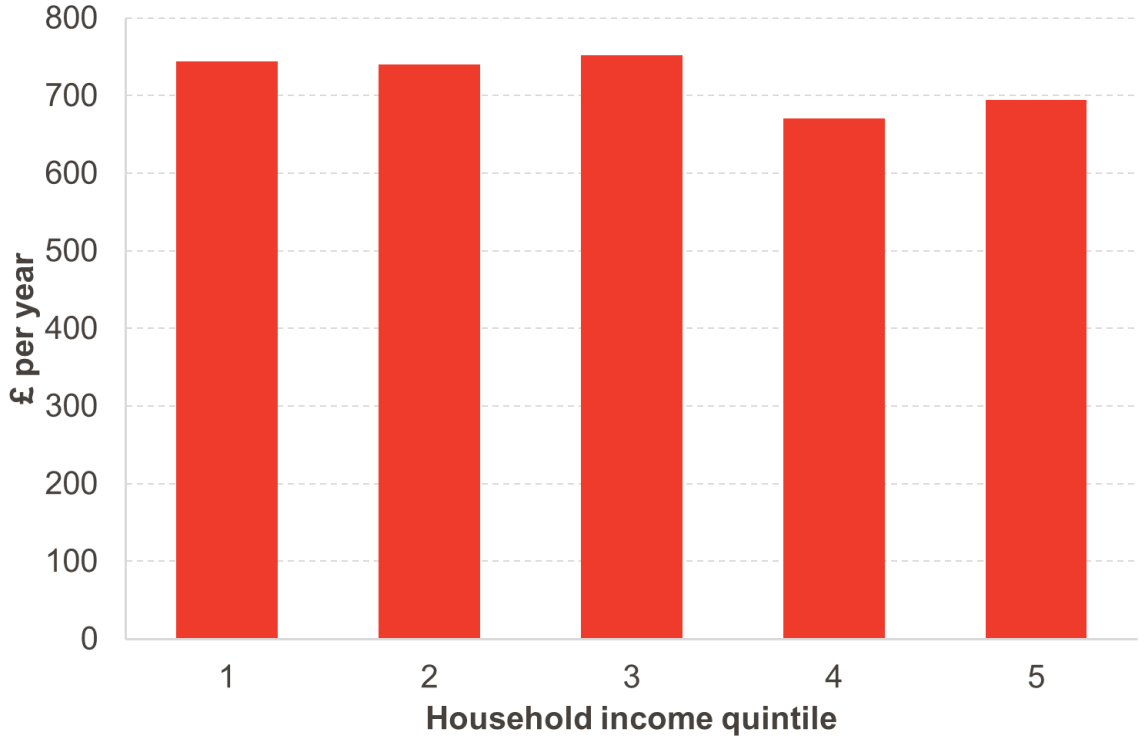
Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

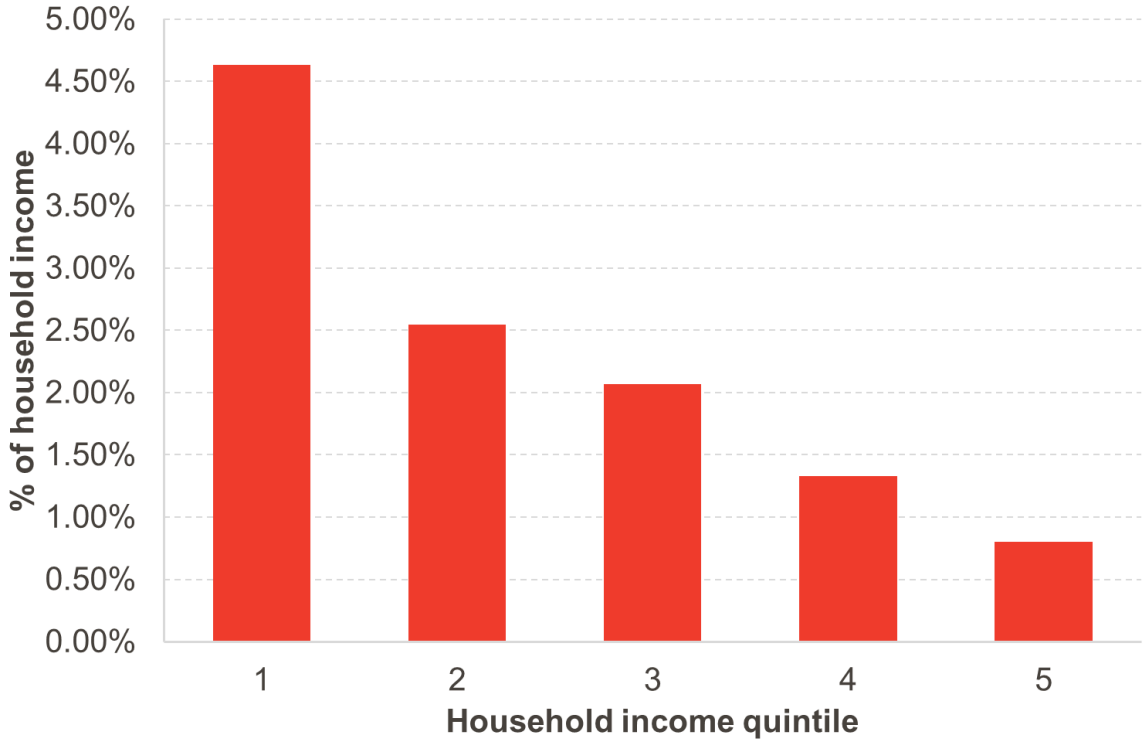
Figure 6: Average impacts of free bus travel by household income quintile, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

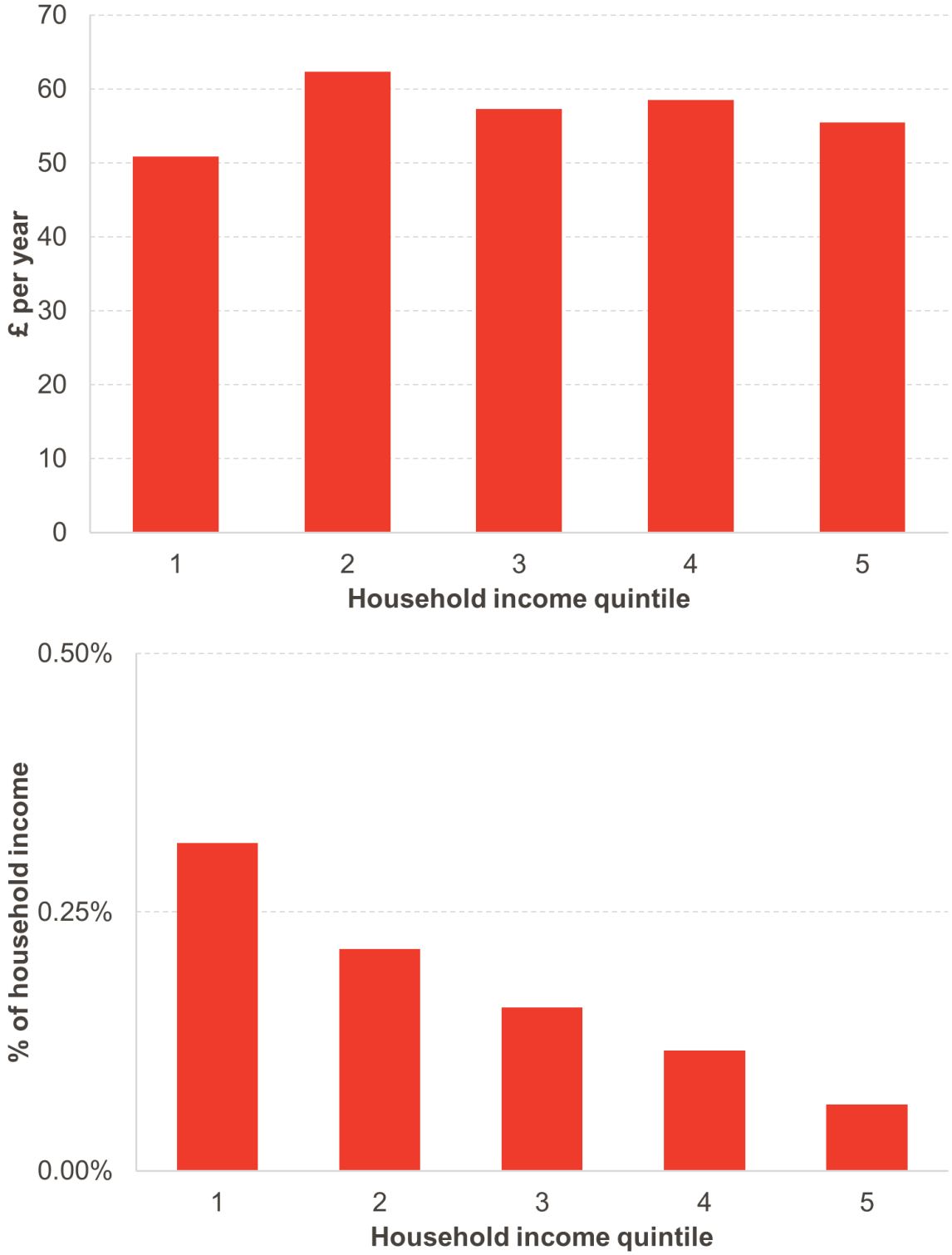
Figure 7: Average impacts of free prescriptions by household income quintile, Scotland, 2026-27





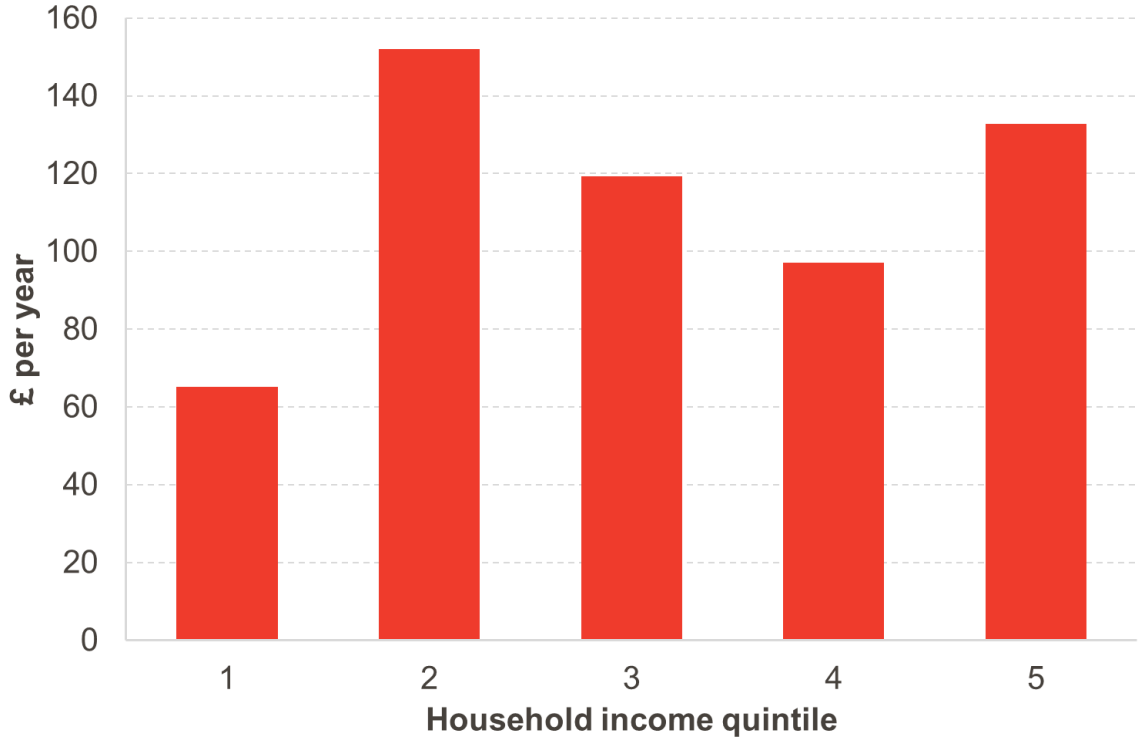
Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

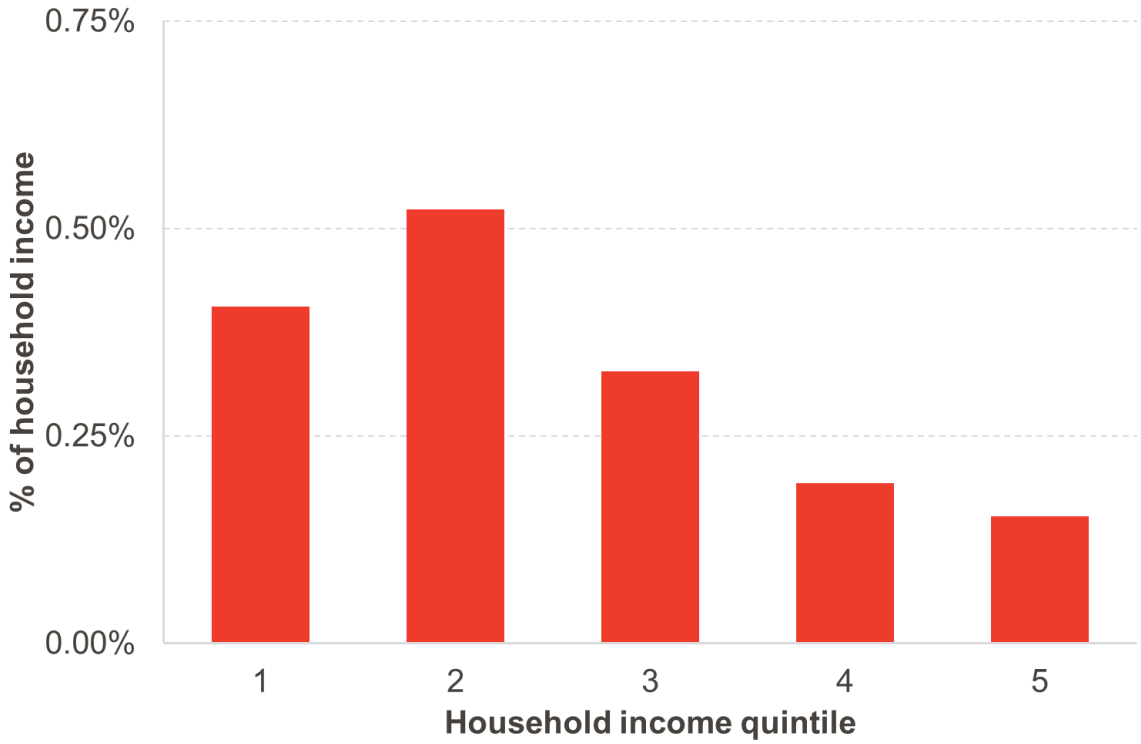
Figure 8: Average impacts of free eye tests by household income quintile, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

Figure 9: Average impacts of free undergraduate tuition by household income quintile, Scotland, 2026-27



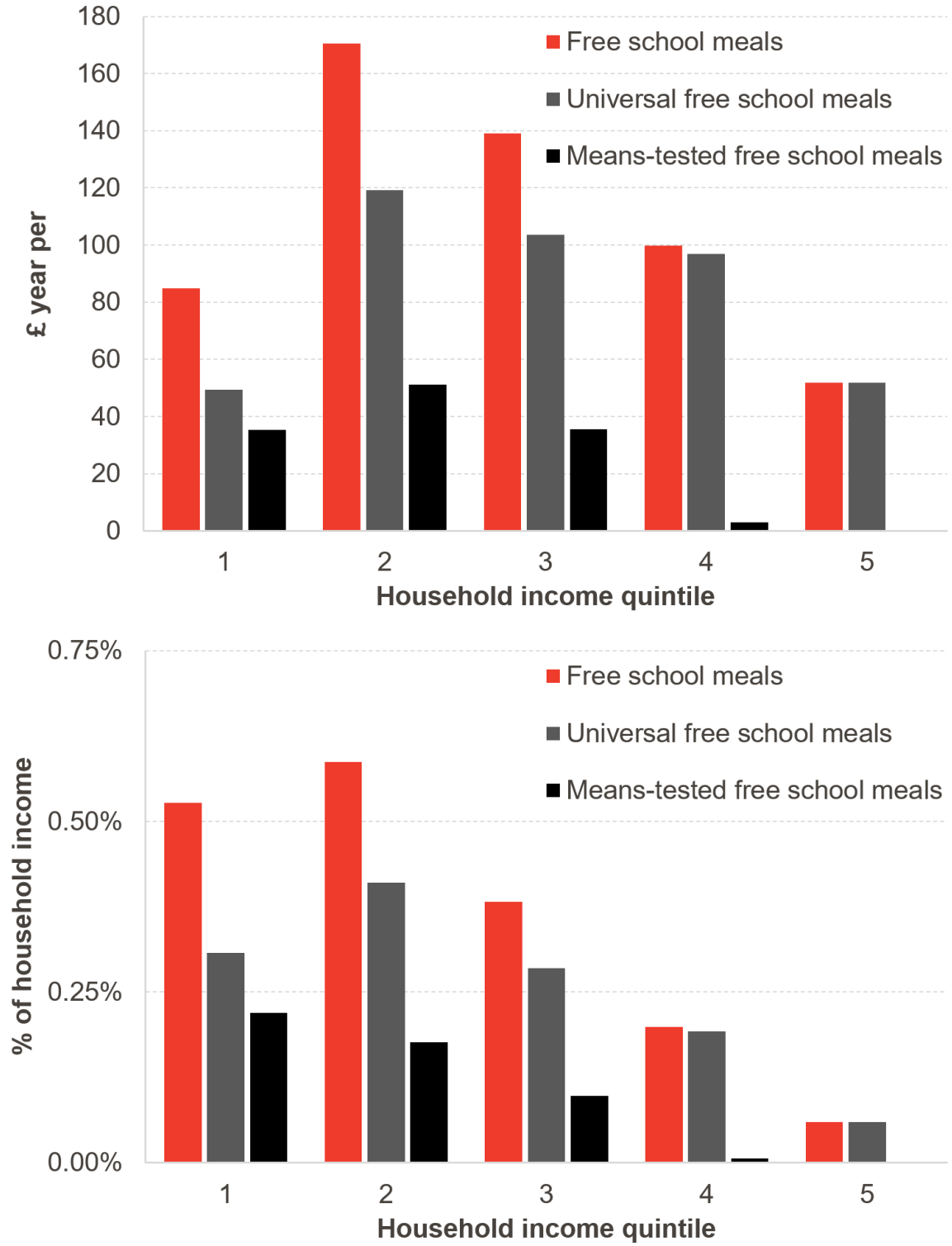


Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

Out of the six policies modelled, free school meals and funded childcare are unique in containing means-tested as well as universal elements. Separating these elements out can help us understand the extent to which the progressivity of their impact distributions is driven by income-based eligibility criteria as opposed to the fact that households with children tend to have lower equivalised incomes.

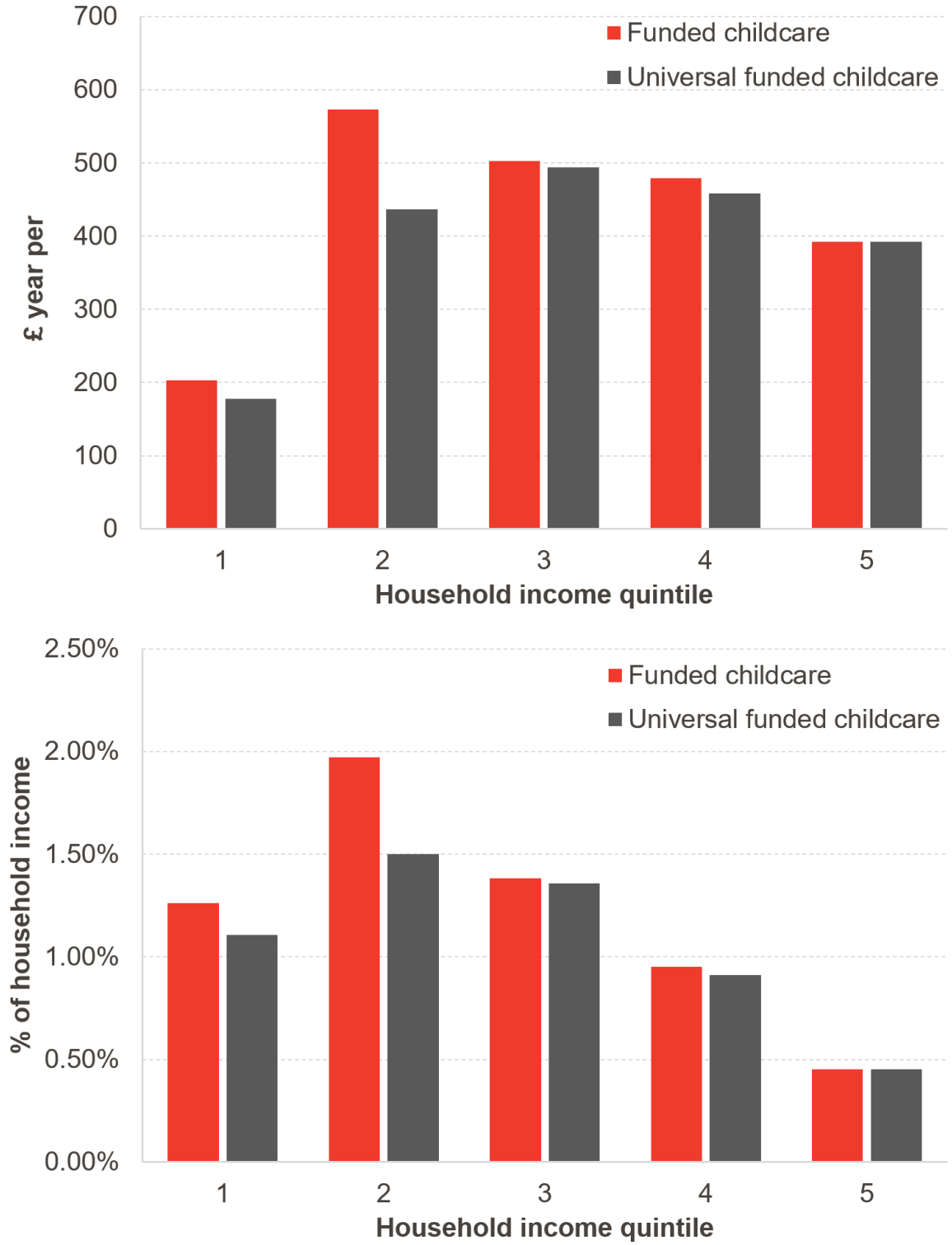
Figure 10 shows that both effects are at play in the case of free school meals, such that even the universal element – that is, provision of free school meals for all children in Primary 1 to Primary 5 – is progressively distributed with the exception of the first quintile. In the case of funded childcare, the sample size of eligible two-year-olds prevents us from showing the means-tested element of funded childcare separately. However, Figure 11 shows that the universal element – that is, provision for three to four-year-olds and for five-year-olds who have not yet started school – is discernibly less progressive than the policy as a whole. The main difference is that households in the second quintile – and not only the first – benefit less on average in cash terms than those in the third and fourth quintiles.

Figure 10: Average impacts of universal and means-tested free school meals by household income quintile, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs; universal free school meals include all children receiving free school meals in the relevant year groups
Source: FAI analysis using UKMOD

Figure 11: Average impacts of universal funded childcare by household income quintile, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs; universal childcare includes provision for all 3 to 4-year-olds and 5-year-olds who have not yet started school
Source: FAI analysis using UKMOD

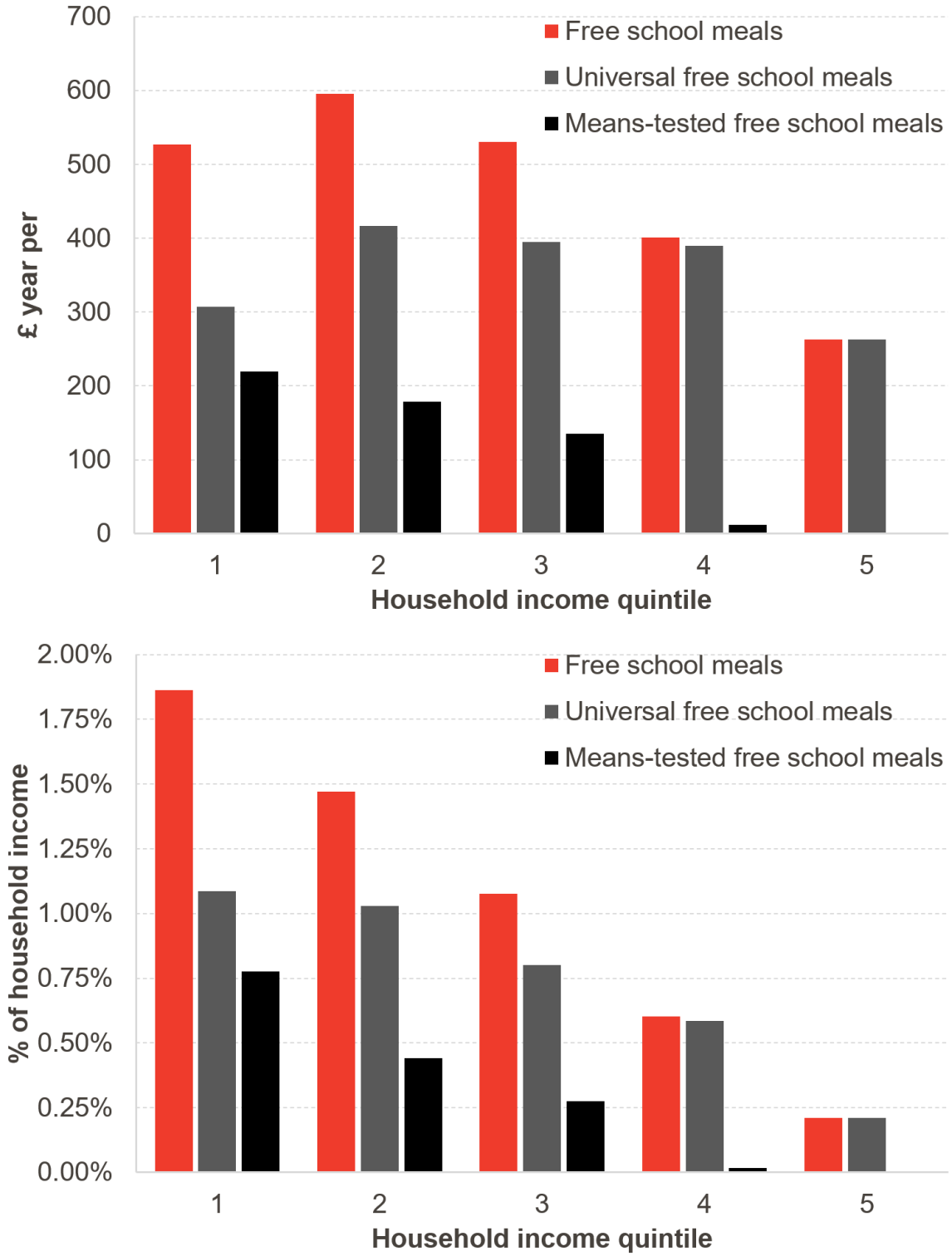
While the analysis above separates out the impacts of the universal and means-tested elements of each policy, the impacts of each element will still be influenced by the composition of the income distribution, with different quintiles containing different mixes of household types. We can further adjust for these compositional differences by restricting the analysis to a particular type of household, although differences by age and other relevant characteristics will persist. Indeed, free school meals and funded childcare are also unique among the policies in the CoL Guarantee in that they are strictly targeted at families with children. Although we consider the impacts of all six policies on households with children in the following subsection, it is also of interest to examine how impacts vary by income among these households.

Figure 12 shows the average impacts of free school meals by quintile among households with children. The policy is progressively distributed in cash terms even when focusing only on households with children – although, as expected, the universal element is less progressively distributed than it appears when averaging across all households. This confirms that the progressivity of free school meals reflects both the presence of means testing and the location of households with children in the income distribution.

Figure 13 repeats this analysis for funded childcare. When focusing on households with children, the progressive pattern of this policy disappears, with a broadly flat distribution observed in cash terms across all quintiles except the lowest. The universal element in fact becomes distinctly regressive in cash terms – though not in percentage terms – with families in the top quintile gaining the most on average. However, it is worth noting that our modelling of this policy suffers from an undercount in the number of childcare users (see Table 8). If this undercount varies systematically with household income, it could be overstating the regressivity of the policy.

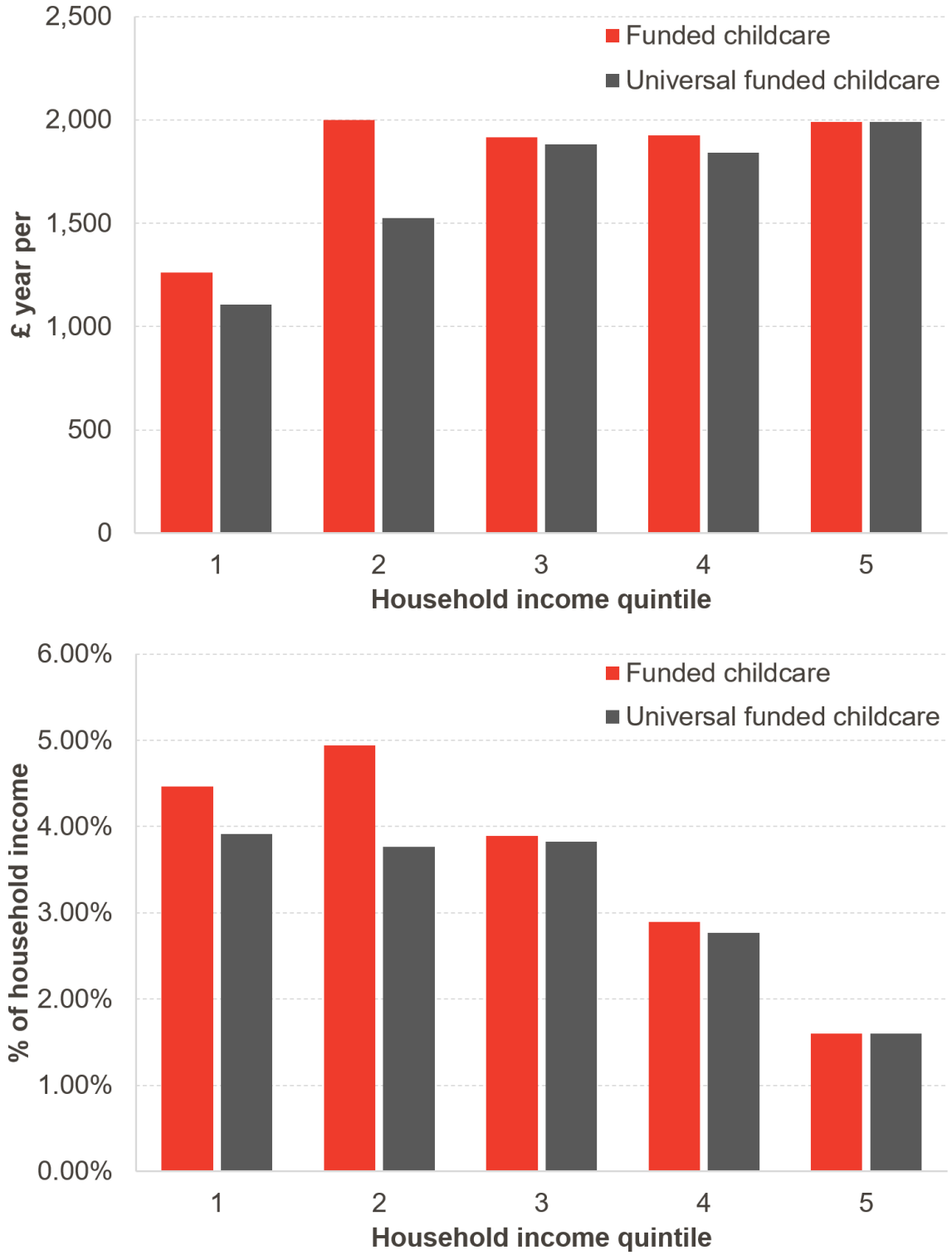
Overall, these findings underscore the importance of distinguishing between ‘composition’ and ‘incidence’ in distributional analysis. For example, a comparison of Figures 11 and 13 indicates that while most universal childcare hours are used by families with lower or medium equivalised incomes (composition), higher-income families are more likely to use these hours (incidence). Both figures represent valid ways to summarise distributional impacts, but they highlight different aspects and have different implications.

Figure 12: Average impacts of universal and means-tested free school meals by household income quintile, households with children, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs; quintiles constructed for all households; universal free school meals include all children receiving free school meals in the relevant year groups
Source: FAI analysis using UKMOD

Figure 13: Average impacts of universal funded childcare by household income quintile, households with children, Scotland, 2026-27

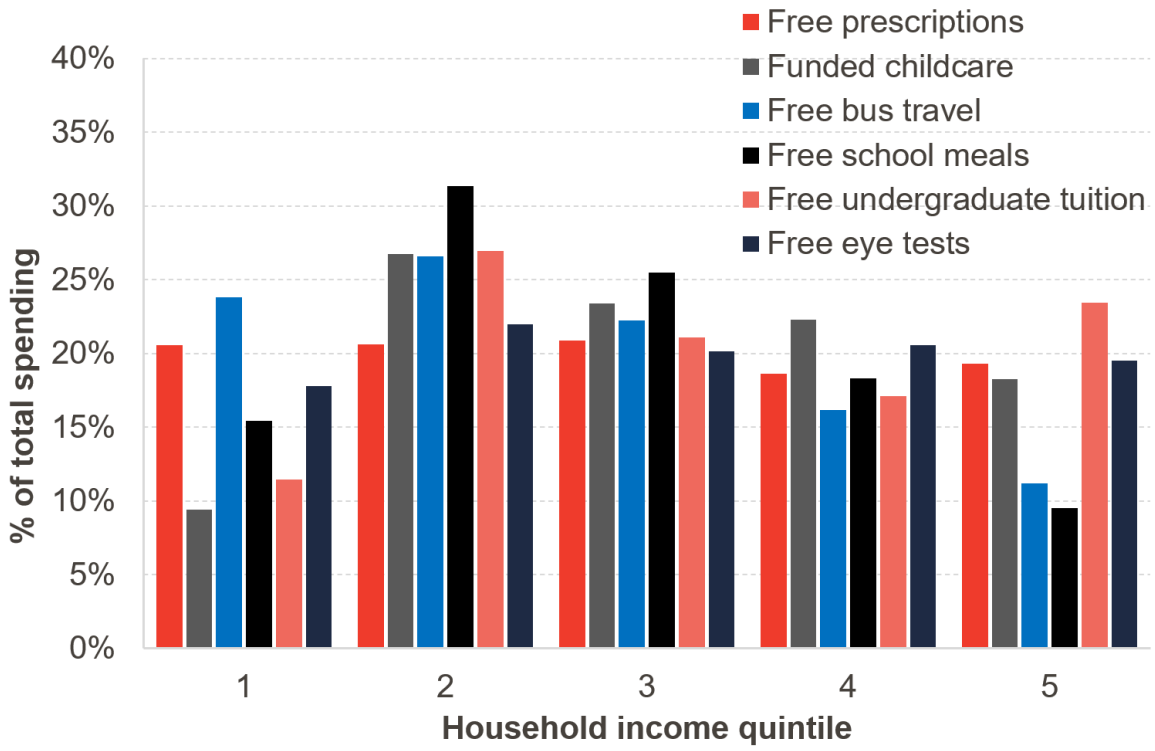


Notes: household income defined as net equivalised household income before housing costs; quintiles constructed for all households; universal childcare includes provision for all 3 to 4-year-olds and 5-year-olds who have not yet started school
Source: FAI analysis using UKMOD

So far, we have mainly been concerned with the distribution of impacts within each policy. However, it is also of interest to compare distributions between policies. This is complicated by the substantially different levels of spend associated with each policy, which mean that the impacts of some policies dwarf others when placed on a common axis. To address this, Figure 14 (reproduced from Figure 3) presents policy impacts as shares of total spending, with these shares adding up to 100% for each policy. [18]

Interestingly, two of the policies with the least progressive distributions overall – namely free prescriptions and free eye tests – in fact have higher shares of spending in the bottom quintile than most other policies. Outwith the bottom quintile, the most progressively distributed policy is free school meals, with a higher share of spending in the second quintile, and a lower share of spending in the top quintile, than any other policy.

Figure 14: Share of total spending by household income quintile, Scotland, 2026-27
The legend is presented in the same order as the bars in the clusters.



Notes: household income defined as net equivalised household income before housing costs
Source: FAI analysis using UKMOD

Impacts on households with children

Figures 15 to 20 show the estimated average impacts of the six modelled policies by child poverty priority group and for households with children overall, in cash terms and as a percentage of household income. Note that the priority groups are defined at the

[18] Link to McIntyre et al (2011)

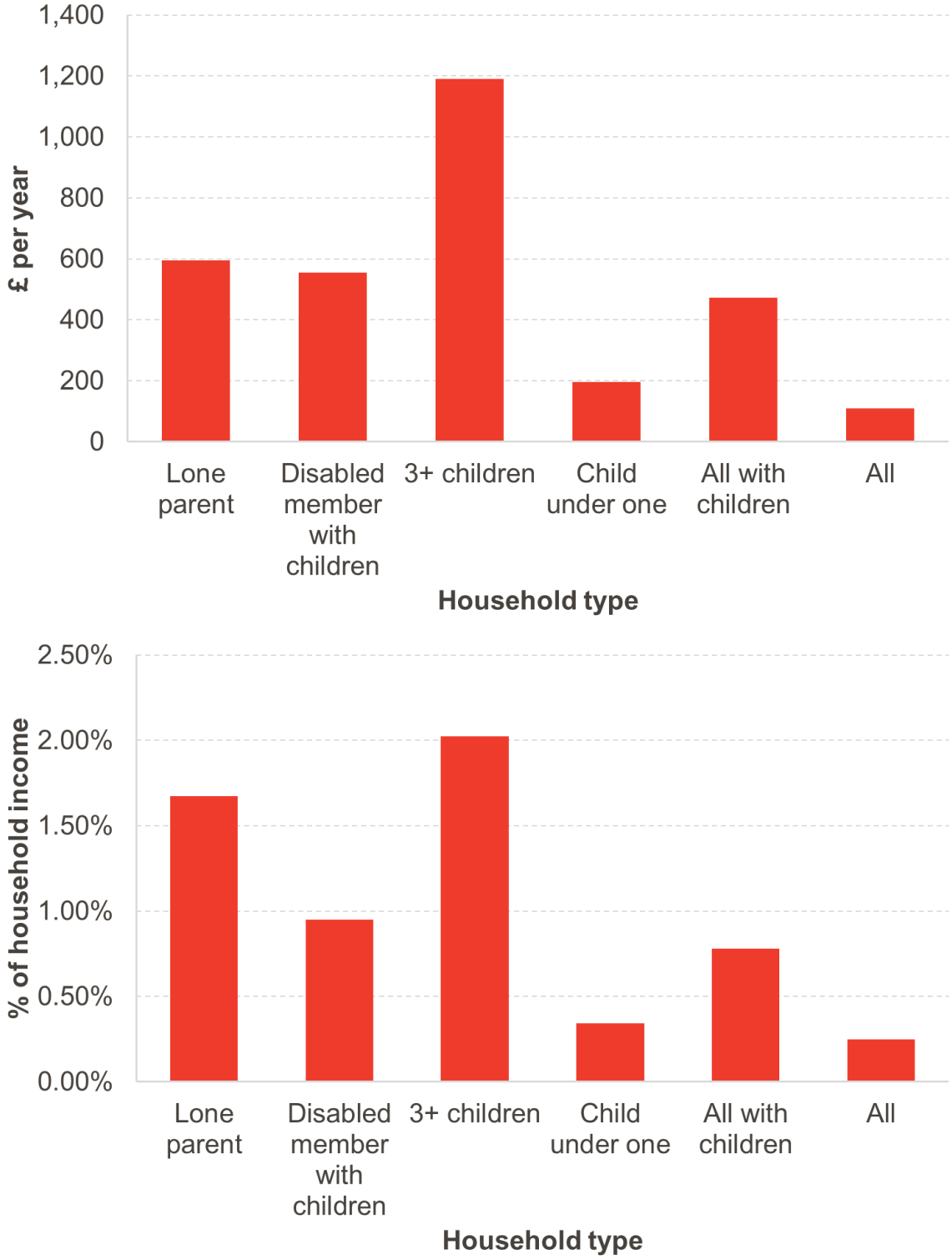
household level, with some households containing multiple family units. This means that a family with children will be included in one of the priority groups if, for example, a separate family within the same household contains a lone parent. In addition, the groups are not mutually exclusive: some families will fall into two or more priority groups, which can compound the disadvantages that they experience.

On average, households with children benefit more on average than the population as a whole for all of the six policies except free prescriptions. This is to be expected in the case of funded childcare and free school meals, which only affect families. Children are also targeted in the case of free bus travel and free eye tests, even though, as shown later in this section, the majority of spend on these policies benefits households without children. It is perhaps more surprising that free undergraduate tuition also tends to benefit households with children disproportionately, given that people in higher education are not counted as children. However, given their age, these people will have a higher-than-average probability of living in households with children, particularly siblings, when compared to the population as a whole.

Out of the four child poverty priority groups modelled, households with three or more children tend to benefit the most in cash terms, with the exceptions of free undergraduate tuition and free prescriptions. This is unsurprising given that these households tend to be the largest and are therefore most likely to contain multiple users/recipients. With funded childcare excepted, households with children and at least one disabled adult or child also tend to benefit slightly more than households with children overall, while this is true for lone parent households across most of the policies when impacts are expressed as percentages of income. On the other hand, households with children under one tend to benefit less, with the partial exception of funded childcare. However, results for this group should be treated with caution as the underlying sample size is limited (see Annex 1).

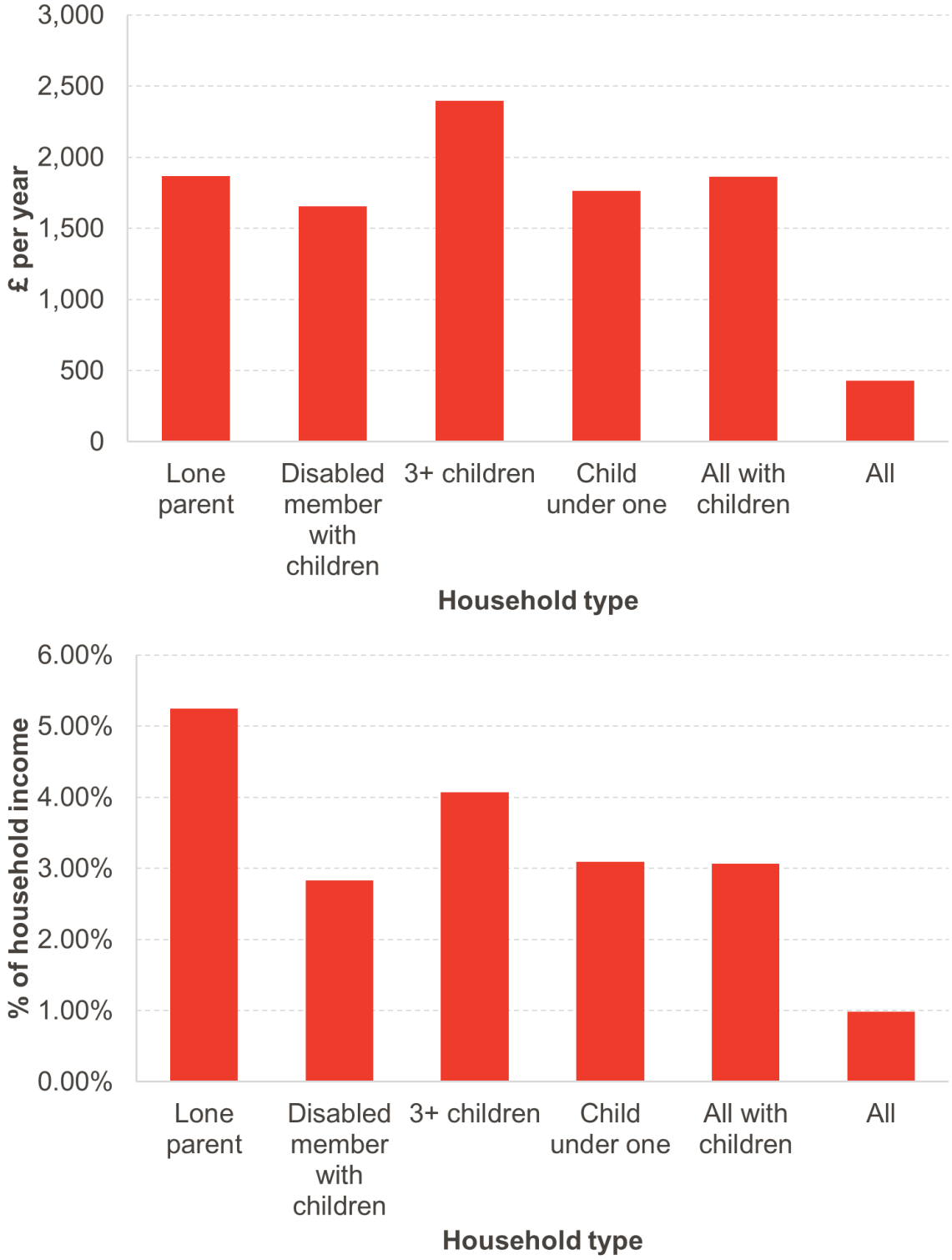
A precise comparison between our results for funded childcare and those of the Scottish Government is complicated by the way the latter are presented. However, the overall patterns are equivalent, which helps to validate our modelling.

Figure 15: Average impacts of free school meals by child poverty priority group, Scotland, 2026-27



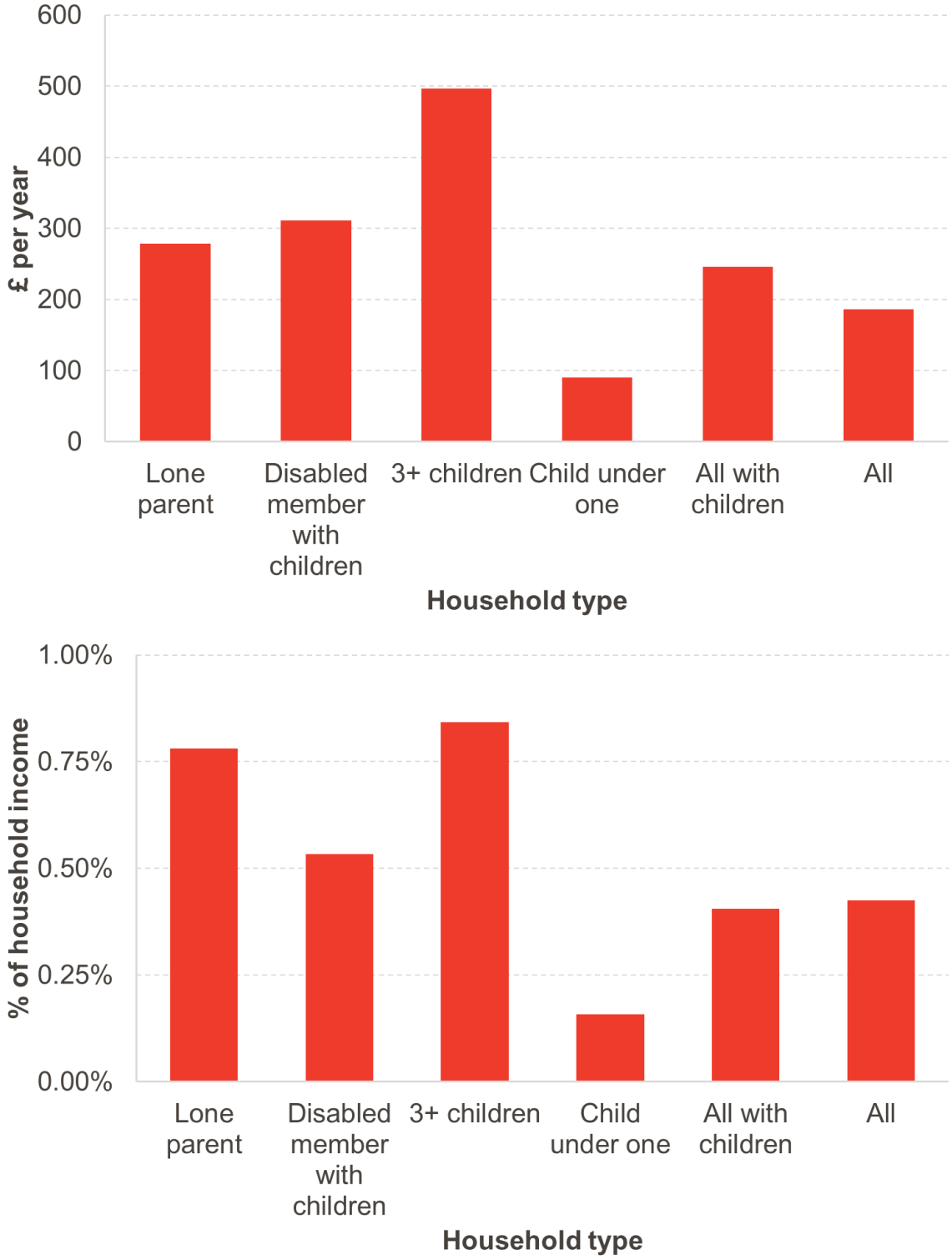
Notes: household income defined as net equivalised household income before housing costs; 'disabled member with children' designates households with children and at least one disabled adult or child
Source: FAI analysis using UKMOD

Figure 16: Average impacts of funded childcare by child poverty priority group, Scotland, 2026-27



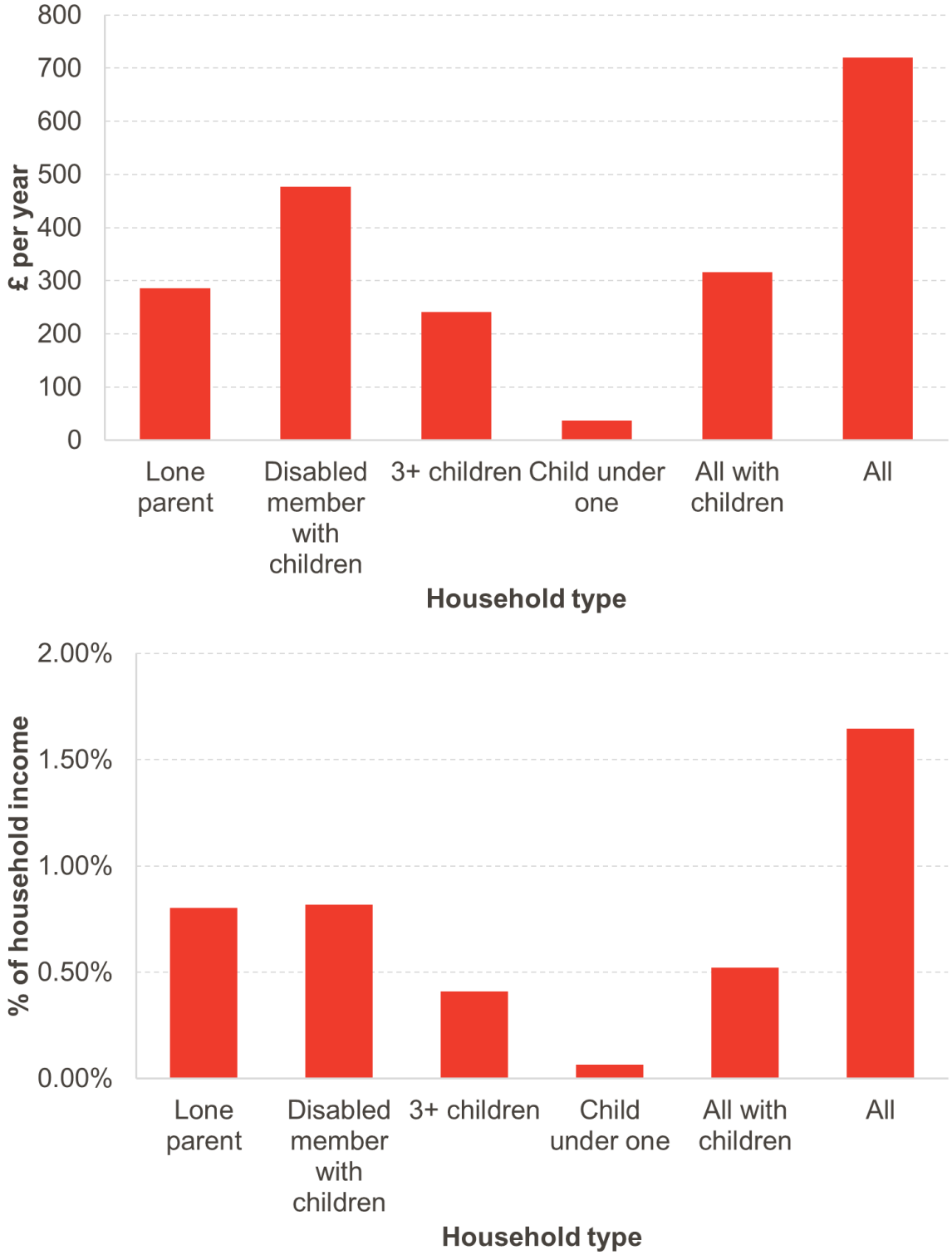
Notes: household income defined as net equivalised household income before housing costs; 'disabled member with children' designates households with children and at least one disabled adult or child
Source: FAI analysis using UKMOD

Figure 17: Average impacts of free bus travel by child poverty priority group, Scotland, 2026-27



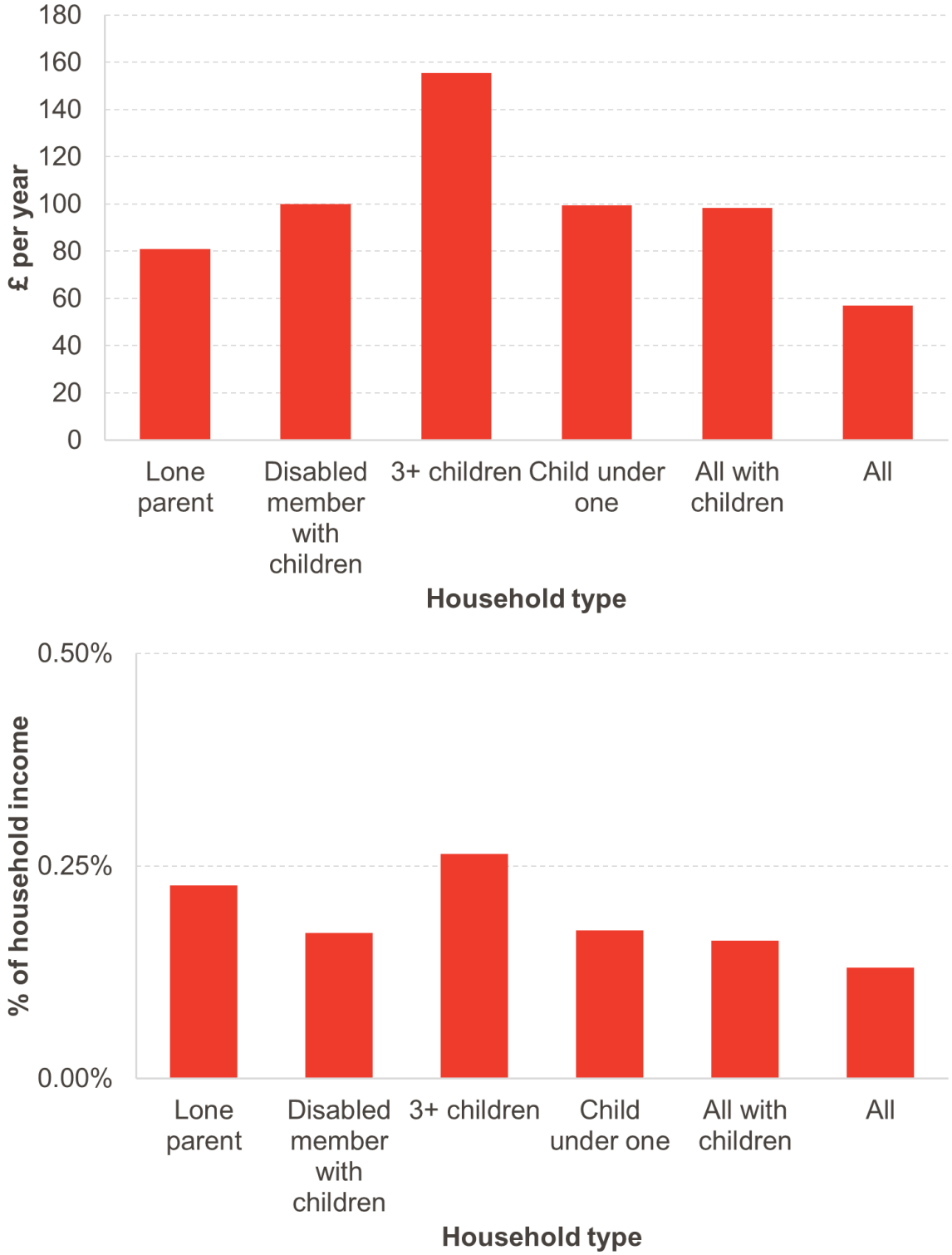
Notes: household income defined as net equivalised household income before housing costs; 'disabled member with children' designates households with children and at least one disabled adult or child
Source: FAI analysis using UKMOD

Figure 18: Average impacts of free prescriptions by child poverty priority group, Scotland, 2026-27



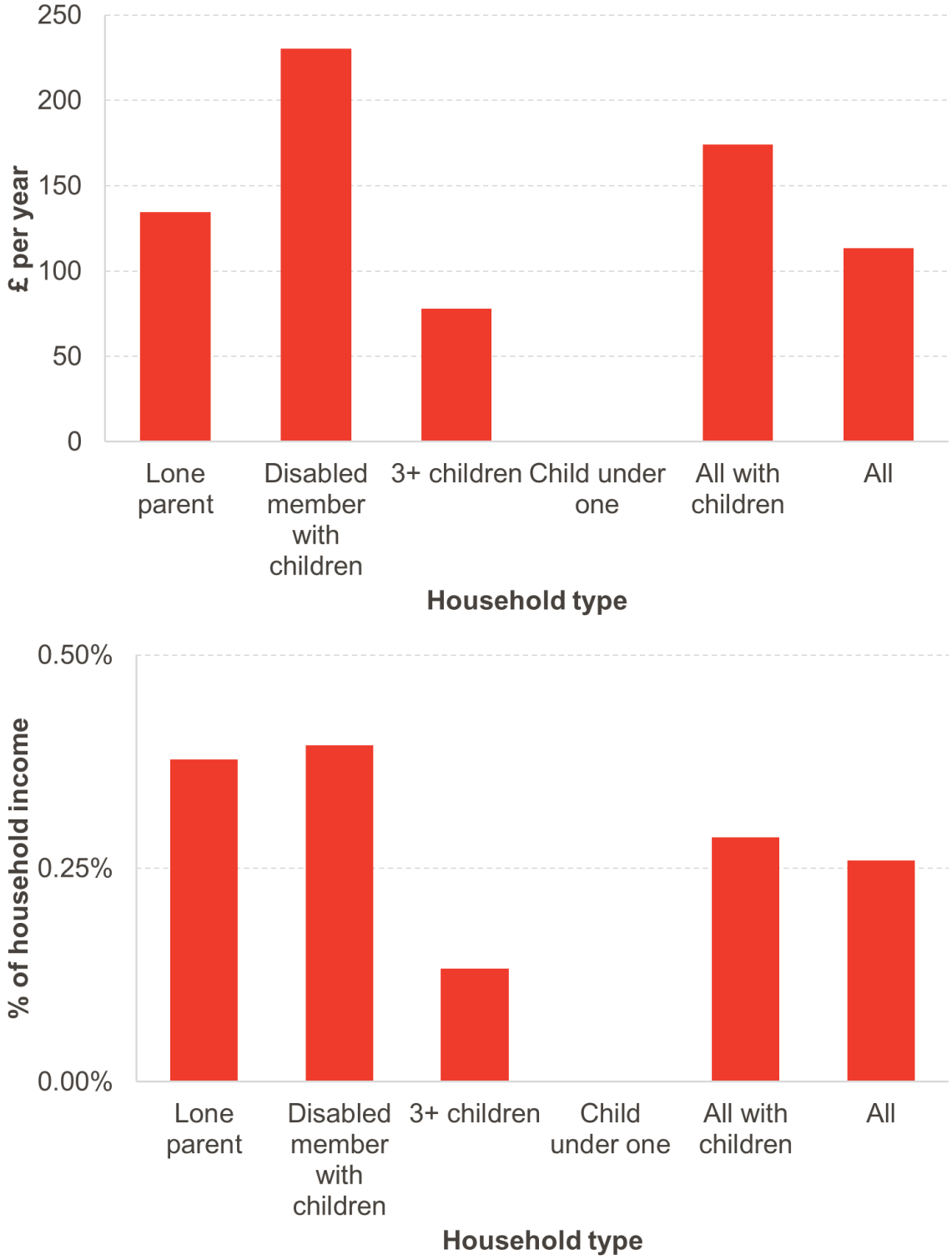
Notes: household income defined as net equivalised household income before housing costs; 'disabled member with children' designates households with children and at least one disabled adult or child
Source: FAI analysis using UKMOD

Figure 19: Average impacts of free eye tests by child poverty priority group, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs; 'disabled member with children' designates households with children and at least one disabled adult or child
Source: FAI analysis using UKMOD

Figure 20: Average impacts of free undergraduate tuition by child poverty priority group, Scotland, 2026-27



Notes: household income defined as net equivalised household income before housing costs; people in higher education are not classified as children; 'disabled member with children' designates households with children and at least one disabled adult or child
Source: FAI analysis using UKMOD

Unlike income quintiles, the household types analysed above are not equally sized. It can therefore be informative to examine not only average impacts, but also the total distribution of value. This can also help us understand whether it is children or other household members that are directly benefitting from each policy. Table 5 therefore breaks down public spending on each of the six policies into children, parents, other members of households with children, and people in households without children.

By design, free school meals and funded childcare are restricted to children, who therefore receive 100% of spending on these policies – although in practice we may consider that parents and other household members also benefit. The majority of spend on the other four policies benefits households without children. Among households with children, it is primarily children themselves who benefit from free bus travel and free eye tests. In the case of free prescriptions it is primarily their parents, and in the case of free undergraduate tuition it is primarily other people in the household besides parents and children, such as siblings or people in other family units that share the household.

Table 5: Distribution of government spending by person type

	Children	Parents	Others in households with children	People in households without children	Total
Free school meals	£278m (100%)	- -	- -	- -	£278m (100%)
Funded childcare	£1,093m (100%)	- -	- -	- -	£1,093m (100%)
Free undergraduate tuition	-	£12m (4%)	£90m (31%)	£186m (65%)	£287m (100%)
Free bus travel	£113m (24%)	£12m (3%)	£19m (4%)	£328m (69%)	£473m (100%)
Free prescriptions	£15m (1%)	£155m (8%)	£16m (1%)	£1,644m (90%)	£1,830m (100%)
Free eye tests	£35m (25%)	£20m (14%)	£3m (2%)	£87m (60%)	£144m (100%)

Notes: rounded to nearest percentage / £1,000,000.
Source: FAI analysis using UKMOD

Conclusions

Using the CoL Guarantee as a test case, the first phase of this research has demonstrated that evidence on the distributional impacts of government spending in Scotland is far from comprehensive. In recent years, the Scottish Government has provided distributional analysis to accompany the annual Budget, covering public services as well as taxes and benefits. This includes the policies in the CoL Guarantee, but in some cases as part of broader areas of spending. Outside of government, distributional analysis is rare. This is likely to limit the scrutiny that can be applied to government policy, including by assessing whether the allocation of resources is consistent with commitments such as tackling child poverty.

Phase Two of the research has demonstrated, firstly, that distributional analysis is feasible for all of the policies in the CoL Guarantee. There are some limitations to this analysis, which relies on a range of assumptions and is subject to various sources of uncertainty; but these are not prohibitive as long as the results are treated with caution, and improvements may be possible. Another lesson from this analysis is that the way results are presented – such as showing impacts in cash terms or as percentages of income, as averages or as proportions of total spending, and across all households or only those that benefit – can shape the story that they tell. This underscores the importance of asking a range of well-defined questions – as well as consulting a range of evidence sources – rather than relying on a single, all-purpose analysis.

In terms of the results themselves, the second phase of research has found that the CoL Guarantee contains a mixture of policies that are progressively distributed – with lower-income households tending to gain more than higher-income households – and policies with relatively flat distributions of impacts. Progressive patterns reflect not only the presence of means-testing in some policies, but also the location of target populations within the income distribution. In the case of funded childcare, the distribution of impacts in fact becomes regressive in cash terms if both of these effects are removed. Furthermore, even those policies that are progressively distributed overall seem to have lower impacts on the poorest households, who are least likely to have children. The implication is that policymaking needs to be informed by empirical evidence if distributional impacts are of interest – and also that the complexities of this evidence need to be appreciated.

Reflecting the analysis by income, the analysis has also shown that the impacts of policies within the CoL Guarantee vary between households with and without children – and also between different types of households with children as defined by the child poverty priority groups. In some cases, these patterns are expected, such as the fact that larger families tend to benefit more in cash terms, whereas in other cases they are more surprising, such as the fact that free undergraduate tuition benefits households with children disproportionately. The size of the underlying survey sample is too small to provide meaningful results for two of the six priority groups – namely minority ethnic families and families with mothers under 25 – and borderline for families with children

under one. This limits the ability of both government and its stakeholders to assess the extent to which key policies are benefitting disadvantaged groups.

The diversity of policies that are included in the CoL Guarantee, while providing a valuable test case, makes it difficult to draw immediate implications for the policies themselves. While we can compare their distributional impacts analytically, the results of this analysis must be set within a wider discussion on the overall approach to public service provision. This includes the criteria that should be used to design and assess different policies, as well as how fiscal trade-offs should be framed and navigated at a strategic level. Distributional analysis has an important role to play in informing this debate.

In summary, this report sheds light not only on the distributional impacts of a set of key government policies in Scotland, but also on the limitations of existing evidence and data, the care that is required in interpreting the results, and the possibilities for future analysis.

Annex 1: Sample sizes

Table 6: Sample sizes of child poverty priority groups in UKMOD output data, Scotland

Child poverty priority group	Number of households
Lone parent families	270
Larger families (3+ children)	146
Families with a child under one	104
Families with a disabled adult or child	431
Minority ethnic families	27
Families with a mother under 25	25

Notes: a sample size of 100 households is typically required for analysis to be undertaken robustly
Source: FAI analysis of UKMOD, based on Family Resources Survey data for 2021-24

Annex 2: Detailed methodology for Phase 1

Whilst our prior understanding of this research area informed some of the evidence within scope of this search, we opted to apply our PRISMA search to both academic and grey literature to identify additional evidence and ensure validity.

To assess academic literature, we performed an advanced search of Google Scholar and Scopus using pre-determined search criteria. For grey literature, we focused our search on the Scottish Government website, as well as other research-based organisations, including the Institute for Fiscal Studies, Joseph Rowntree Foundation and Resolution Foundation, among others. We also liaised with Scottish Government analysts working in each policy area, as well as those with responsibility for distributional analysis of the Budget, who signposted us to relevant evidence.

The search terms were developed through an iterative process, seeking to capture a broad range of evidence with specific reference to the analysis and policies within scope. Our overall aim was to capture as much relevant evidence as possible, whilst excluding any evidence that failed to meet our inclusion criteria. Given the specific focus of this research, we opted for a primary criterion and a secondary criterion:

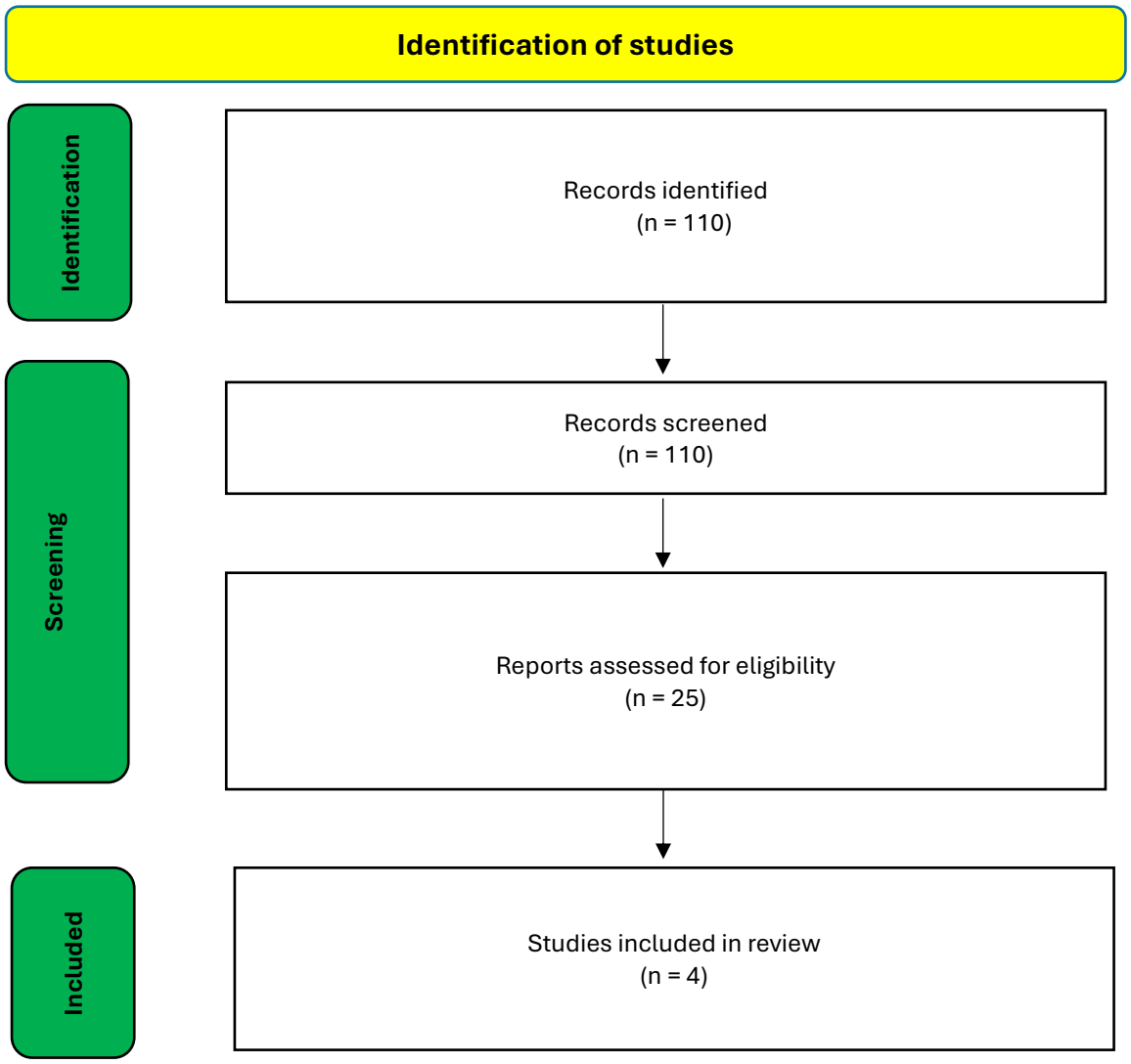
- **Primary:** Distributional analysis conducted on policies within scope for Scotland. We also chose to include only evidence from 2015 onwards, to ensure it was up to date.
- **Secondary:** Distributional analysis conducted on policies within scope across the UK, and international where relevant. This also included evidence for Scotland that existed before 2015.

All evidence identified through our search strategy was assessed for eligibility by examining their title, abstract and keywords to identify what studies were relevant. Any studies that did not meet any of our inclusion criteria were excluded.

After this screening stage, all remaining evidence was analysed for relevance to our study. This included a full text review and identification of policies analysed and for what groups of the population they were conducted, with a particular focus on the child poverty priority groups.

Figure 21 depicts our PRISMA approach in a flow diagram.

Figure 21: PRISMA 2020 flow diagram for new systematic reviews



Annex 3: Detailed methodology for Phase 2

This section provides further detail on our methodology for predicting usage of free bus travel and free prescriptions. The same broad method is used for both.

Distribution

For each of the six policies modelled, the distribution of use/receipt is mapped onto households in the Family Resources Survey (FRS), which is considered the gold standard for nationally representative data on household income. We pool FRS data from 2021-22, 2022-23, and 2023-24 to increase the size of the sample.

Before any analysis is undertaken, the FRS data is run through UKMOD, a model of the tax-and-benefit system that is maintained, developed, and managed by the Centre for Microsimulation and Policy Analysis at the Institute for Social and Economic Research (ISER), University of Essex.[19] This allows us to create a baseline that, among other advantages: corrects for shortcomings of the data, such as the underreporting of benefit income; ensures that incomes reflect policies that have been implemented or announced since the data was collected; and projects the data forward to the current financial year, namely 2026-27. At the time of writing, revised FRS data that links respondents to administrative benefit data was not yet available.[20]

Table 7 sets out the methodology we have used to model the distribution of use/receipt for each of the six policies. In the case of free school meals, free undergraduate tuition, free eye tests, and funded childcare, we are able to estimate the distribution of use/receipt based entirely on information that is available within the FRS. On the other hand, the FRS contains insufficient information to model the distribution of free bus travel and free prescriptions. We therefore make use of additional data sources, namely the Scottish Health Survey (SHeS) and the travel diary that is part of the Scottish Household Survey (SHS). This modelling is more experimental, carrying a greater degree of uncertainty.

For all policies, use/receipt is assigned to individuals but then aggregated to the household level, under the assumption that the benefits of each policy are shared equally within the household. While this is a strong assumption, it is consistent with the standard practice of measuring living standards at a household level and avoids the range of issues that arise when attempting to model impacts at an individual level. For example, if a child receives free school meals or funded childcare, both the children and the parents can be said to benefit.

Our methodologies for modelling the distribution of use/receipt broadly mirror those of the Scottish Government for those policies included in their modelling, namely funded childcare, free undergraduate tuition, and free bus travel.

[19] Link to UKMOD
[20] Link to article referencing linking Family Resources Survey to administrative benefits data

Table 7: Methodologies for modelling distribution of use/receipt

Policy	Method
Free eye tests	Determine eligibility using information on individual age as contained in the FRS/UKMOD. In line with NHS guidance, assume that all individual under 16 and those over 59 receive one free eye test every year, while all individuals aged 16 to 59 receive one free eye test every two years. No additional adjustments are made for individuals with specific health conditions.
Free school meals	Determine eligibility using information on child age, family income, and receipt of qualifying benefits as contained in the FRS/UKMOD. Assume that all eligible children receive the same number of free school meals.
Funded childcare	Determine eligibility using information on child age, family income, and receipt of qualifying benefits as contained in the FRS/UKMOD. Base distribution of use on the number of formal childcare hours that eligible children are reported to receive up to a maximum of 1,140 per child per year.
Free undergraduate tuition	Assume that all individuals who report being in higher education and identify as Scottish in the FRS/UKMOD receive free tuition. Assume that all recipients benefit equally.
Free bus travel	Predict the probability of bus usage by training a logistic regression model on the SHS and applying it to the FRS/UKMOD. Take the number of concessionary bus passes reported in the Scottish Transport Statistics and assign these to the individuals with the highest predicted probabilities. Assume that all bus pass holders benefit equally. A detailed methodology is provided in Annex 4.
Free prescriptions	Predict the probability of receiving prescriptions by training a logistic regression model on the SHeS and applying it to the FRS/UKMOD. Take the proportion of people in the SHeS who report receiving prescriptions and scale this up to the size of the population as given by the FRS/UKMOD to identify the total number of people receiving free prescriptions. Identify this number of individuals with the highest predicted probabilities. Assume that all people receiving free prescriptions benefit equally. A detailed methodology is provided in Annex 4.

As shown in Table 7, we generally assume that individual users/recipients of each policy use/receive the same number of units, with the exceptions of funded childcare and free eye tests. Because use/receipt is first modelled at the individual level and then aggregated to the household level, this does not preclude variation in use/receipt between households, but it is nevertheless a simplification. In reality, for example,

people who ride the bus more regularly, for longer distances, or in places where services are costlier to provide, may be said to benefit more, as may children who take up free school meals more often or at an older age or people who receive more or more expensive prescriptions.

Modelling this level of detail would be a challenge. To take an extreme example, analysis by Public Health Scotland on the costs of prescriptions lists nearly 4,700 different prescribed drugs or devices, with unit costs varying from 21p to over £22,700; and even at the highest level of aggregation there are 21 categories.[21] However, one source of variation that could be feasible to model would be the expansion of breakfast clubs to all primary school students that is cited in the CoL Guarantee. We have not taken this into account when modelling the distribution of value because the policy will not be fully rolled out until August 2027; any monies dedicated to the policy in the 2026-27 Budget will be included in the total valuation of free school meals, but will be spread equally across recipients in our methodology.

Table 8 compares the estimated number of users/recipients with external data sources. The methods for determining the distribution of free bus travel, free prescriptions, and free eye tests are designed to match external totals, resulting in full coverage. On the other hand, our modelling covers 76-93% of the target populations for free school meals, free undergraduate tuition, and funded childcare. These undercounts result in the same total value being allocated across the population, with a higher value per user/recipient spread across fewer users/recipients.

In the case of free undergraduate tuition, the most likely reason for the undercount is that the FRS does not cover students living in halls of residence. In the case of free school meals and funded childcare, the target numbers represent registrations and could therefore be overstating the actual numbers of users/recipients. Childcare usage may also be underreported in the FRS, and a portion of the data (i.e. the period from April to August 2021) predates the expansion to 1,140 hours. Finally, variability in the representativeness of the data for specific groups, such as children aged two to four, could be driving some of the undercount. Indeed, the undercount is particularly pronounced for funded childcare. While methods are available to boost the modelled population of users under the assumption that non-reporting users resemble reporting users, we have primarily included this policy to compare against the results produced by the Scottish Government, who do not appear to make any such adjustment.

[21] Link to Public Health Scotland Dispenser payments and prescription cost statistics 2024-25

Table 8: Comparison of modelled and target number of users

Policy	Users – modelled	Users – target	Proportion covered
Free school meals	330,000 children	356,671 children	93%
Funded childcare	70,000 children	89,882 children	76%
Free undergraduate tuition	100,000 students	115,335 students	87%
Free bus travel	2,430,000 people	2,430,643 people	100%
Free prescriptions	2,550,000 people	2,550,000 people	100%
Free eye tests	5,390,000 people	5,390,000 people	100%

Notes: Free school meals target represents sum of primary and secondary students registered for free meals in 2025; free undergraduate tuition target represents number of undergraduate students receiving tuition-fee support in 2024-25; funded childcare target represents sum of 2-5 year olds registered for funded childcare in 2025; free bus travel target represents number of people concessionary bus passes in 2025; free prescriptions target represents number of individuals who report that they are currently taking medication prescribed by doctor; free eye tests target represents total population; modelled numbers rounded to nearest 10,000.
Sources: Scottish Government, 2025, Pupil Census Supplementary Statistics 2025; SAAS, 2025, Higher Education Student Support in Scotland 2024 to 2025; Scottish Government, 2025, Funded Early Learning and Childcare Statistics 2025; Scottish Government, 2026, Scottish Transport Statistics 2025; Scottish Health Survey 2023 and 2024.

Note that use/receipt is not the only possible approach to estimating a distribution of impacts. For example, health policies are often modelled on a universal basis adjusted for cost, recognising that people who do not use health services still benefit from the insurance value that they provide.[22] Policies may also have broader effects on the economy and society that are not captured in use- or receipt-based analysis, such as funded childcare, free undergraduate tuition, and free prescriptions and eye tests helping to foster a more productive workforce. In addition, the kind of analysis presented in this report only captures the distribution of impacts at a point in time, which can conceal lifecycle effects: households that are not currently using a service will be presented as not benefitting from it, even if they used it in the past or will use it in the future.[23]

Valuation

The next step in our methodology is to allocate government spending on each policy in proportion to the distribution of use/receipt across households. In line with other analyses, this is confined to resource spending, with capital expenditure excluded.

Table 9 shows the amounts allocated to households in our modelling, along with the sources of these figures. The Scottish Government budgets specific amounts for free undergraduate tuition, free bus travel, and community eyecare – which includes free eye tests – whereas free school meals and funded childcare are funded by local authorities and must therefore be estimated using provisional figures. No budgetary

[22] Link to OECD impact of publicly provided services on distribution of resources publication
[23] Link to IFS distribution of public service spending publication

figures are available for free prescriptions, so the figure for this policy is based on Public Health Scotland analysis of administrative NHS data from the Prescriber Information System.

Table 9: Government spending allocated to households, 2026-27

Policy	Annual amount	Source
Free school meals	£278m	Provisional Outturn Budget Estimates
Funded childcare	£1,093m	Provisional Outturn Budget Estimates
Free undergraduate tuition	£288m	Scottish Budget
Free bus travel	£473m	Scottish Budget
Free eye tests	£144m	Scottish Budget
Free prescriptions	£1,830m	Public Health Scotland

Notes: Free school meals and funded childcare spending reflect estimated expenditure by local authorities on school meals and pre-primary education respectively, uprated by increase in Scottish Government Budget resource spend between 2025-26 and 2026-27 excluding health and social care, transport, and education and skills; free undergraduate tuition, free bus travel, and free eye test spending reflect level-4 budget lines on student support and tuition payments, concessionary fares, and community eyecare, respectively. Free prescription spend represents net cost of prescription items dispensed in 2024-25, uprated by total increase in health and social care budget.
Sources: Scottish Government, 2025, Provisional Outturn Budget Estimates 2025-26; Scottish Government, 2026, Scottish Budget 2026 to 2027; Public Health Scotland, 2025, Dispenser payments and prescription cost analysis - financial year 2024 to 2025.

Again, it is worth noting that other methods are possible. For example, in principle, it is possible to assign value based on the market price of the service – that it, the cost that the family would have to bear if they had to pay for the service privately. This is reflected in, for example, the figures cited by the Scottish Government for the amounts that families save through funded childcare and free school meals.[24] Valuing policies based on public spending is the most straightforward option and provides consistency with the Scottish Government's analysis. However, this option does pose issues of its own, since the complexities of government funding can make it difficult to identify exactly how much is spent on a particular policy.

Free undergraduate tuition is the most striking example. The budget line associated with this policy represents the amount that the Scottish Government provides to Students Awards Agency Scotland (SAAS) to cover tuition fees. However, the fees themselves are capped at a level that is subsidised through a separate source of funding, allocated through the Scottish Funding Council. The budget line for free tuition fees – £288m in 2026-27 – therefore does not reflect the full fiscal cost of providing free tuition. The Institute for Fiscal Studies has estimated this cost at £900 million in 2024-25, although this appears to be a rough calculation based on English tuition fees, which do not necessarily represent the full fiscal cost either.[25] On the other hand, the budget line

[24] Link to First Minister's Cost of Living Guarantee
[25] Link to IFS Scottish Budget Report 2024-25

used for free eye tests in fact encompasses a wider range of services, including "enhanced provision for community glaucoma and anterior eye management, as well as design and development work for a community low vision service".

A separate issue of valuation affects free school meals. In official measures of living standards such as poverty statistics, free school meals are treated as income, with a value per meal used to monetise each meal reported. Since additionally allocating government spend on free school meals to households would amount to double counting – with the policy counted as both a component of income and as an in-kind public service – we remove this policy from income in our FRS/UKMOD baseline. The disadvantage is that recipient households are presented as being poorer than they are in official measures.

Annex 4: Additional information on Phase 2 methodology

This annex sets out our methodology for predicting usage of free bus travel and free prescriptions. The same broad method is used for both.

Data

Modelling of free bus travel is based on the Scottish Household Survey (SHS) Travel Diary, which contains information on the travel made by individuals on the day prior to interview. In particular, we use the Stage dataset, which indicates if a bus formed part of a journey whether or not it was the main mode of transport, linked to the main SHS dataset to retrieve additional characteristics. We use data from 2022, the latest year available at the time of writing. SHS data from 2021 and 2020 were collected through telephone interviews and are not considered comparable with other years.

The Stage dataset contains one row for each journey stage of each journey made by each respondent. We aggregate the data up to the level of the individual to create a binary flag indicating whether or not the individual rode the bus in the day prior to interview.

Modelling of free prescriptions is based on the Scottish Health Survey (SHeS), which contains information on whether an individual is currently taking medication prescribed by a doctor. The relevant survey question is only asked of a subset of respondents. We use data from 2023 and 2024, the latest two years available at the time of writing. Some SHeS data for 2022 continued to be collected through telephone interviews following the Covid-19 pandemic.

Model

We train a logistic regression model on each of the SHS and the SHeS to predict usage of bus services and prescriptions respectively. The bus model uses gender, economic status, household income, housing tenure, and household type as predictors, while the prescription model uses age, gender, household income, housing tenure, household type, and receipt of disability benefits. These predictors are selected on the basis of having a plausible relationship with bus/prescription use, within the constraint that they must be present in both the SHS/SHeS and the FRS for the model to work in the next step of the method. We do not include age or disability as predictors in the bus model because these variables are used to allocate bus passes categorically in a later step.

The next step is to apply the fitted values from the regression models to the FRS in order to predict the probability of bus and prescription use based on the characteristics of each individual. Because the SHS Travel Diary collects information on the travel activities of one random adult per household, the regression model can only be used to predict bus use among adults. In order to extend the results to children, we aggregate

the predicted probabilities to the household level by calculating the probability that at least one adult in the household is a bus user and assume that the probability of bus use among children is associated with this household-level probability.[26]

Classification

Each of the predictive models yields a gradient of probabilities across all individuals/households. In order to translate this into a binary indicator for the use of a free bus pass, we first subset the FRS into people aged 60 or over, people aged under 22, and other people who are disabled. We then select the individuals in each category with the highest predicted probabilities, with these probabilities defined at the household level for under-22s, until the number of users in each category matches the number of concessionary bus passes reported in the Scottish Transport Statistics. Although adults under 22 will have their own predicted probabilities, we use the household-level probabilities for all people under 22 to ensure consistency within this group.

The method for classifying individuals as users of free prescriptions is essentially the same, but more straightforward as the SHeS covers individuals of all ages: that is, individuals with the highest probabilities are selected until the desired number of individuals is reached. This number is determined by taking the proportion of people in the SHeS who report that they regularly take prescribed medication, out of all individuals who provide a response to the relevant survey question, and applying this proportion to the total size of the population in the FRS/UKMOD.

To some degree, the fitted values of the predictive models will be sensitive to variation in the SHS and SHeS samples. We therefore use a method called bootstrapping, which involves taking random draws from the original sample to create 100 'resamples' in which records can be duplicated. The analytical pipeline set out above is repeated on each of these 100 samples to create 100 sets of binary 0/1 bus pass and prescription flags. For each of the two policies, the average of these flags is calculated for each individual, with the classification process run on these averages to determine the final set of bus pass and prescription users.

Performance

The performance of the logistic models can be evaluated by splitting each of the SHS Travel Diary and SHeS datasets into a training dataset, comprising 80% of records, and a testing dataset, comprising the remaining 20% of records. The data is split randomly, except that a similar proportion of bus/prescription users is retained in each partition. The model is trained on the training dataset and used to predict bus/prescription usage within the testing dataset. Since we know whether individuals in the testing dataset in

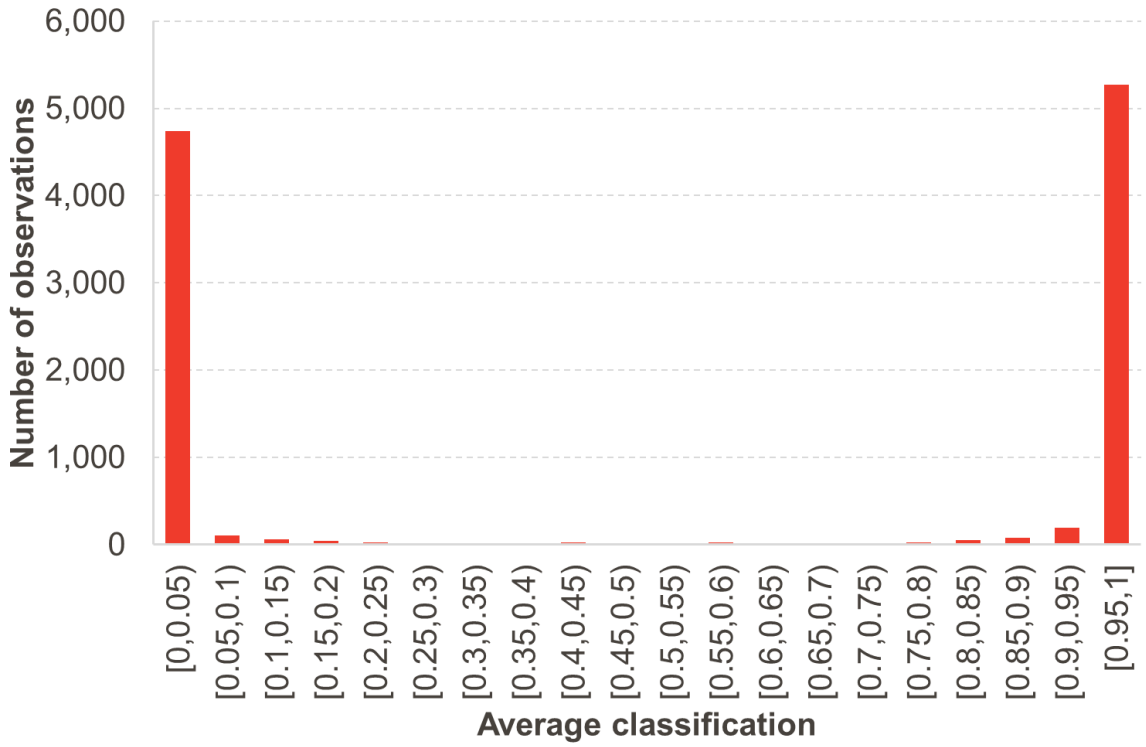
[26] Mathematically, this is defined as $1 - \prod_i(1-p_i)$, where p_i is the probability that adult *i* uses the bus, $(1-p_i)$ is the probability that adult *i* does not use the bus, and $\prod_i(1-p_i)$ is the product of $(1-p_i)$ across all adults, i.e. the probability that no adult in the household uses the bus.

fact used bus services or prescriptions, we can then compare the model's prediction with ground truth.

We quantify this comparison using a metric called AUC-ROC (Area Under the Receiver Operating Characteristic Curve), which represents the probability that a model ranks a random positive example higher than a random negative one. An AUC of 1.0 indicates a perfect model, while 0.5 is on par with random guessing. Both of the models generate scores of around 0.7, which is generally considered acceptable.[27]

However, our primary concern is not the performance of the models within the SHS/SHeS, but their accuracy when applied to the FRS. This cannot be directly evaluated, because the reason for using predictive modelling is precisely that we do not know whether individuals in the FRS used bus services or prescriptions. We can however evaluate model stability – that is, the sensitivity of our final allocation of bus passes to variation in the SHS/SHeS sample as indicated by our bootstrapping method. As shown in Figures 22 and 23, the classifications of bus pass and prescription users are highly stable, with most individuals predicted as either being a or user or not being a user in all iterations of the model.

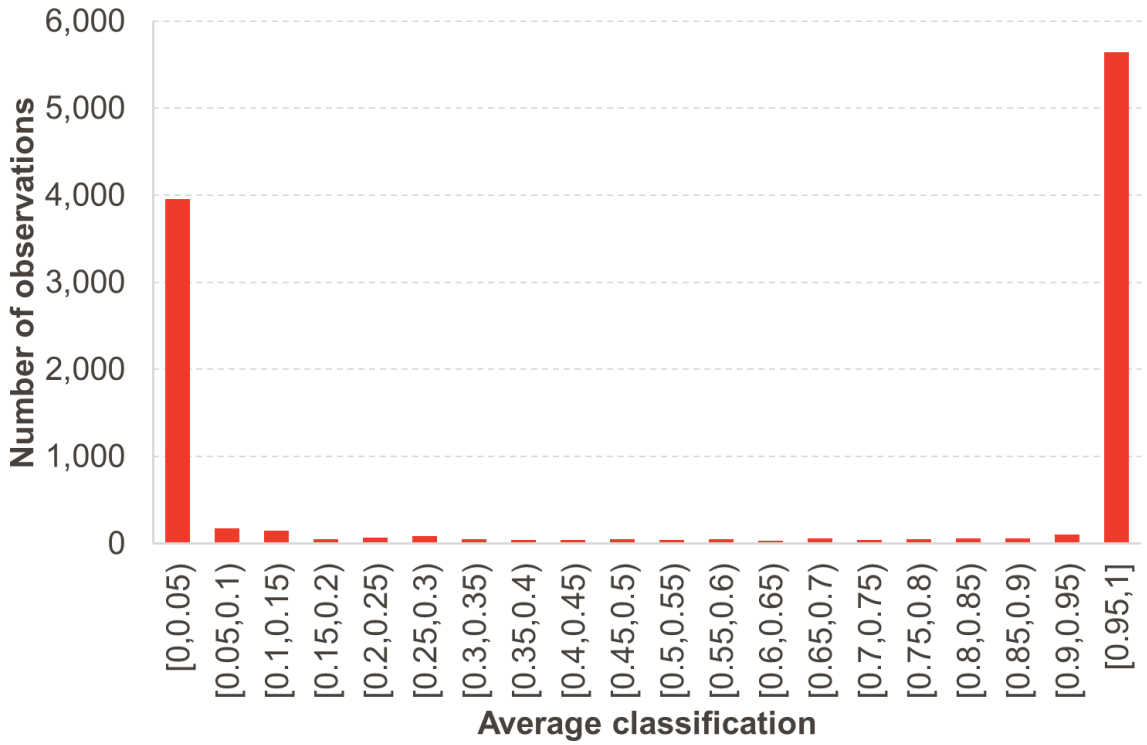
Figure 22: Stability of free bus travel prediction over 100 bootstrapped samples



Notes: observations are unweighted individuals
Source: FAI analysis of Scottish Household Survey and Family Resources Survey

[27] Link to Jayawant (2010)

Figure 23: Stability of free prescription prediction over 100 bootstrapped samples

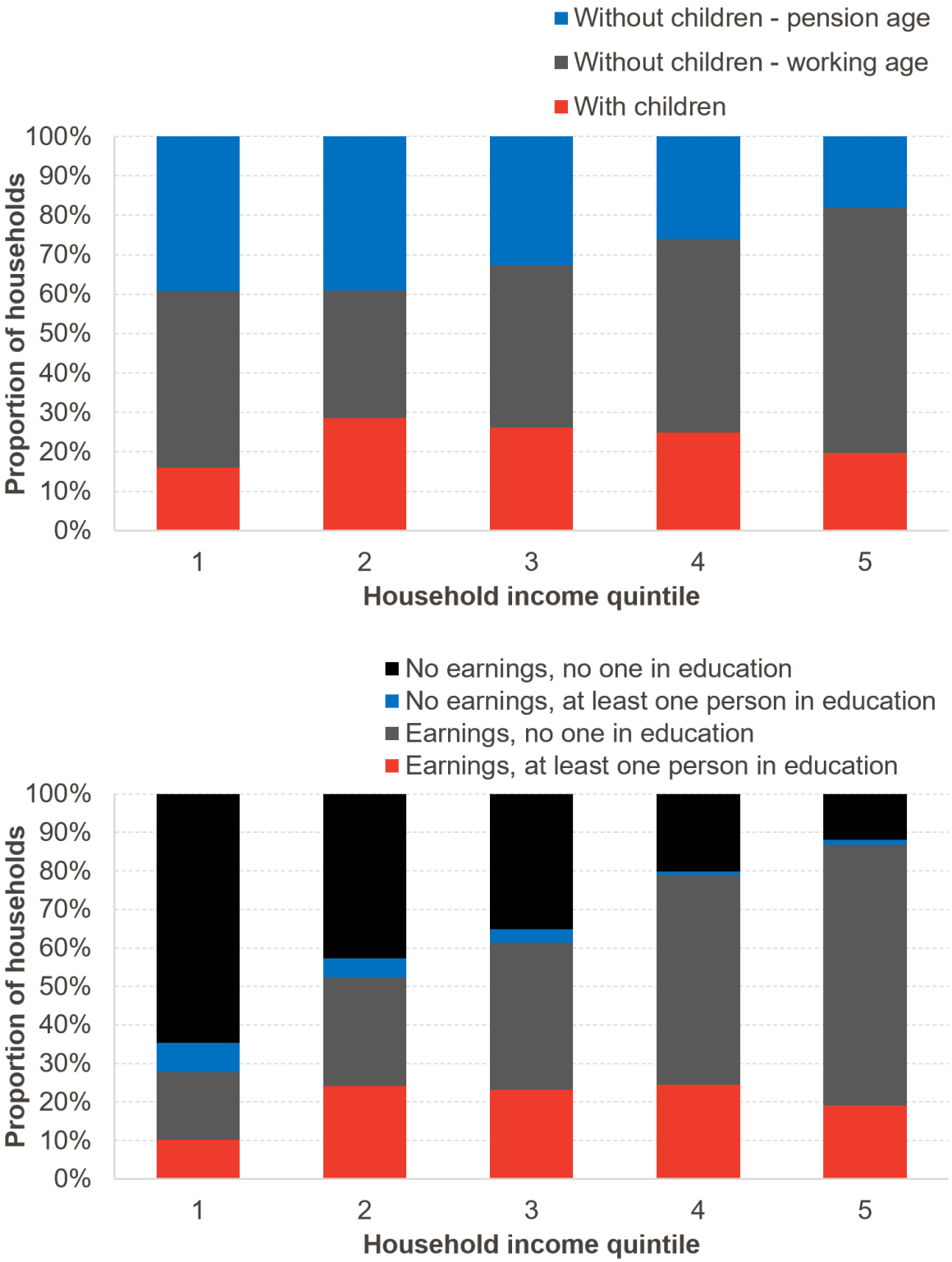


Notes: observations are unweighted individuals
Source: FAI analysis of Scottish Health Survey and Family Resources Survey

On the other hand, a comparison of the Scottish Transport Statistics and population estimates by National Records of Scotland suggest that most people who are eligible for free bus passes on the basis of age take them up – around 90% in the case of people aged 60+ and around 75% in the case of people aged under 22. This implies that treating all people in these age groups as users of free bus travel – and only using a predictive model for people with disabilities – may not incur a large loss of accuracy.

Annex 5: Composition of income quintiles

Figure 24: Composition of household income quintiles by household type



Notes: household income defined as net equivalised household income before housing costs; working-age includes households with anyone of working age
Source: FAI analysis using UKMOD

Fraser of Allander Institute
University of Strathclyde
199 Cathedral Street
Glasgow G4 0QU
Scotland, UK

Telephone: 0141 548 3958
Email: fraser@strath.ac.uk
Website: fraserofallander.org
Follow us on Twitter via @Strath_FAI
Follow us on LinkedIn: FAI LinkedIn

---

the place of useful learning
www.strath.ac.uk
University of Strathclyde Glasgow

The University of Strathclyde is a charitable body,
registered in Scotland, with registration number SC015263