Seirbhís Thithe an Oireachtais
Houses of the Oireachtas Service

EVE: a model of indirect taxes using household micro-data

Summary Slide Deck of PBO Working Paper 1 of 2024

Expenditure, VAT and Excise (EVE) Model

- The PBO has developed an indirect tax microsimulation model- the EVE model
- EVE analyses household expenditure and estimates the taxes they pay on goods and services they purchase
- We then model how changes to indirect taxes would affect households and the fiscal cost involved
- EVE is a powerful tool to aid Members of the Oireachtas in understanding the cost and distributional impact of policy proposals
- Contact pbo@oireachtas.ie or pbocostings@oireachtas.ie (if related to requests for the PBO's policy costing service) for more details

What can EVE do?

Tax Header	Sub-components modelled	Costings	Impact Analysis
Excises			
Mineral Oil Tax	Light Oil (Petrol), Heavy Oil (Diesel), Fuel Oil (Home-heating oil)	✓	Urban-rural, household income, household type
Alcohol Products Tax	Beer (>2.8%), Wine (Still >5.5%, Still >15% & sparkling >5.5%), Spirits, Cider & Perry (>2.8% and <6.6%)	✓	Urban-rural, household income, household type
Tobacco Products Tax	Cigarettes (per thousand & ad valorem), Cigars, Fine-cut tobacco	✓	Urban-rural, household income, household type
Carbon Tax	Petrol, Diesel, Kerosene, LPG, Solid Fuels (Coal & Peat), Natural Gas	✓	Urban-rural, household income, household type
VAT	Domestic household sector (4 VAT rates & >500 expenditure items)	✓	Urban-rural, household income, household type

Data

- The Household Budget Survey (2015/2016) contains detailed expenditure data
- Households (n=6,839) keep detailed expenditure diaries for two weeks
- Data biased towards non-durable consumption
- Over 500 expenditure item categories:
  - 237 food items, 22 alcohol/tobacco, 18 clothing & footwear, 4 fuel & light, 24 housing, 10 household non-durables, 46 household durable, 37 transport, 115 miscellaneous goods & services

Making the data more timely

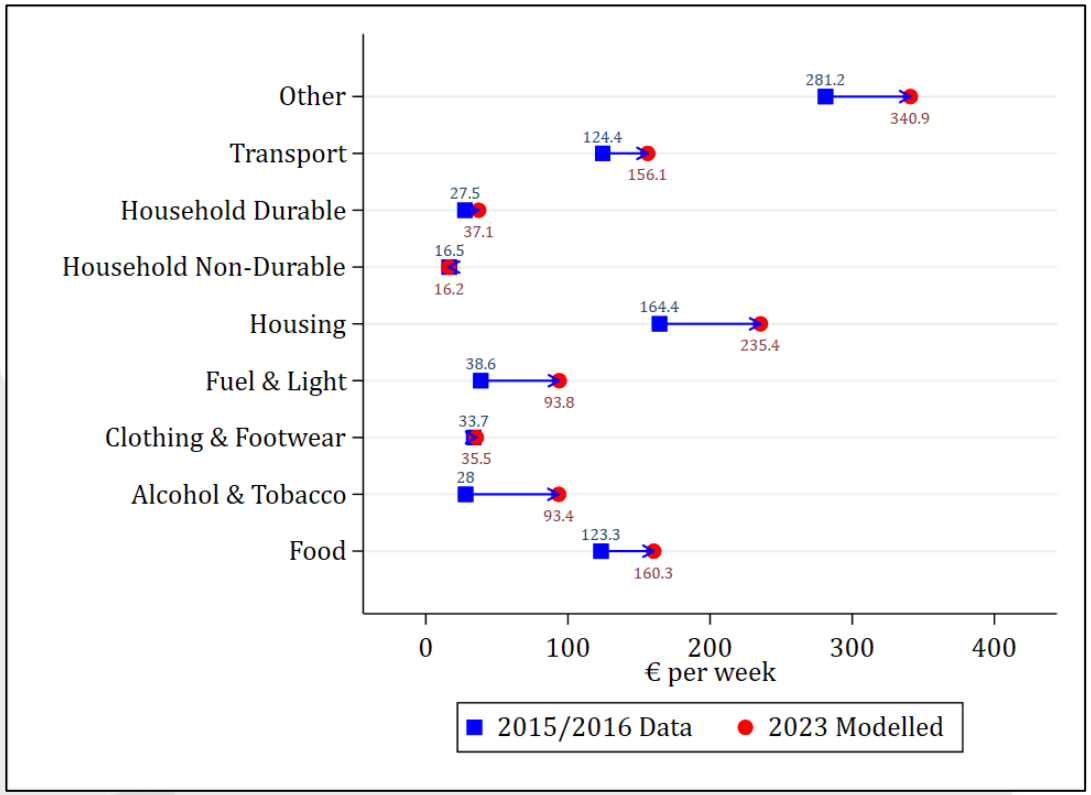
1. Initially, assume basket of goods/services consumed in 2023 is the same as in the 2015/2016 data

2. Uprate by real per capita consumption growth (+14.7%)
   - Larger basket, consume proportionally more of every good/service
   - Scalar, doesn't affect the share of expenditure on different goods/services

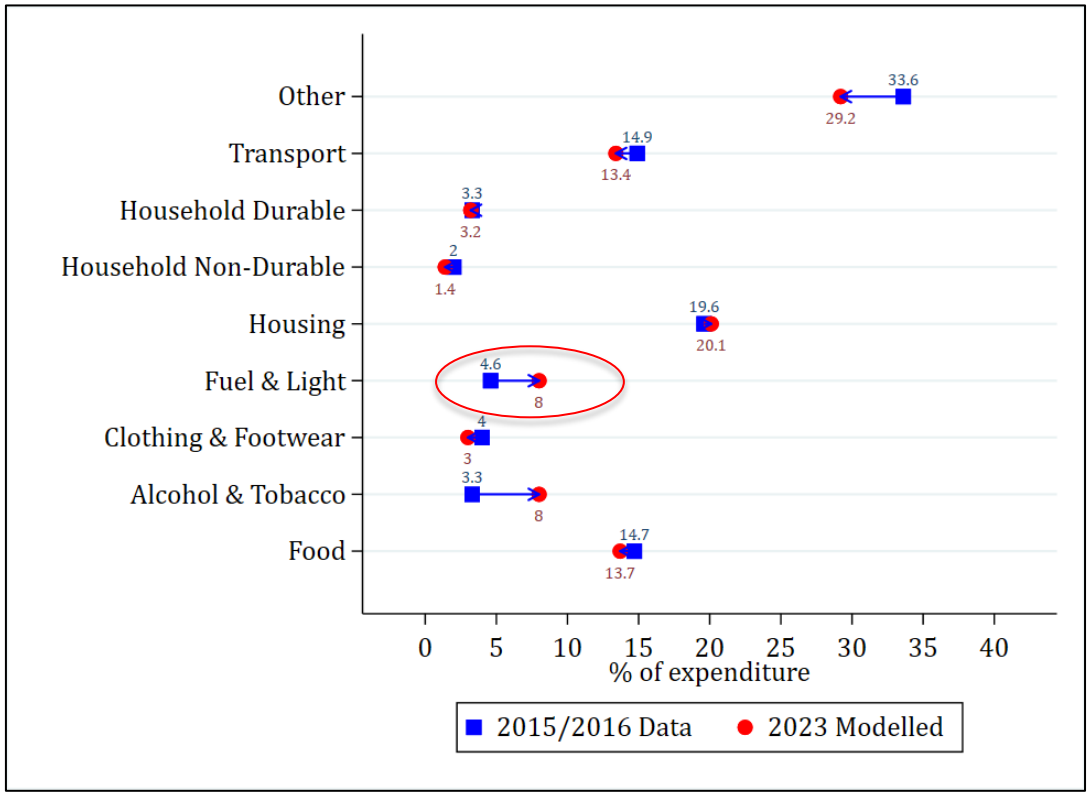
3. Uprate by price growth: need to spend more money to afford the initial basket
   - Prices have grown differentially, affects expenditure shares e.g. overall CPI: +17.6% compared to gas +150%
   - Uprate prices at the commodity level for most non-durable items e.g., meat, milk, etc.

Expenditure levels & shares

A. Mean expenditure, nominal € per week



B. Mean expenditure shares



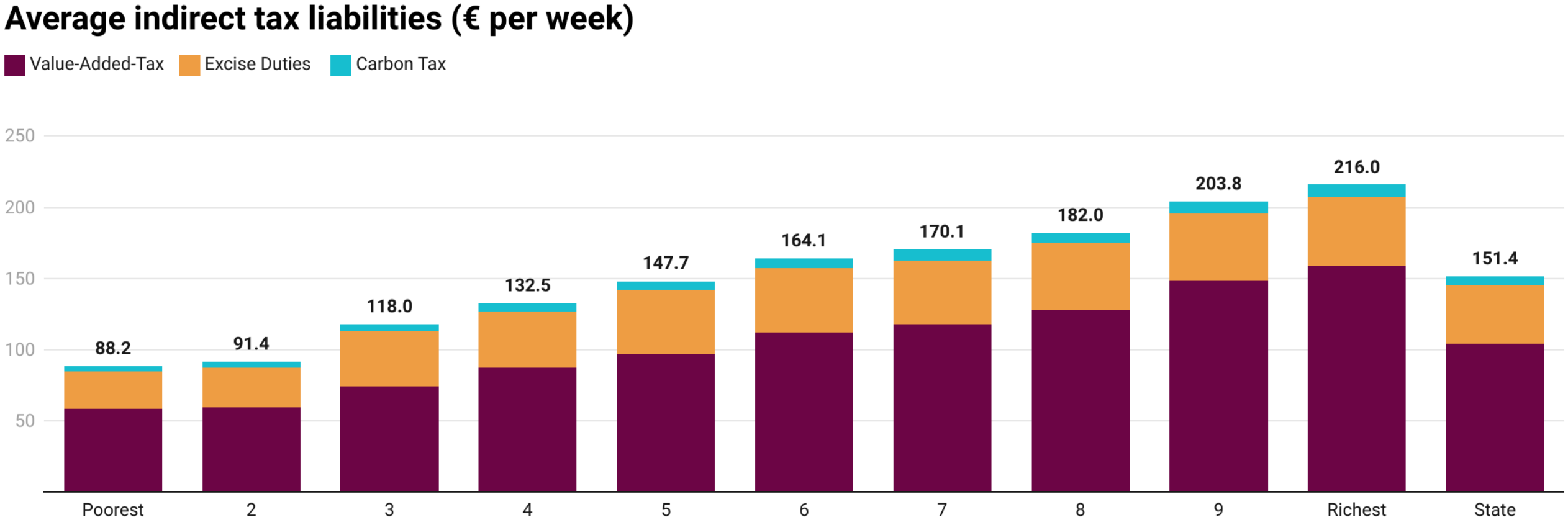
- Mean household expenditure increases from €837 per week to €1,169 per week (+40%)
- Fuel & Light increases as a share of expenditure, reflecting rapid inflation in energy
- Adjustments made for the under-reporting of Alcohol & Tobacco

EVE replicates outturn data well

Item	Modelled (2023) € million	Revenue (2022/2021) € million
Excises		
Beer	390	392
Wine	326	375
Cider	52	52
Spirits	310	411
Diesel	605	1,430*
Petrol	473	445
Tobacco	173	181
Cigarettes	1,284	1,137
Carbon Tax	560	563
VAT (Household Sector)	9,231	9,776**

*~43% of diesel used in transport attributable to private care usage- SEAI Energy Balance Accounts 2019
**Revenue 2022 figure with relativities from European Commission VAT Gap 2022 for VAT origin in 2019

In € terms, low-income households pay less indirect taxes

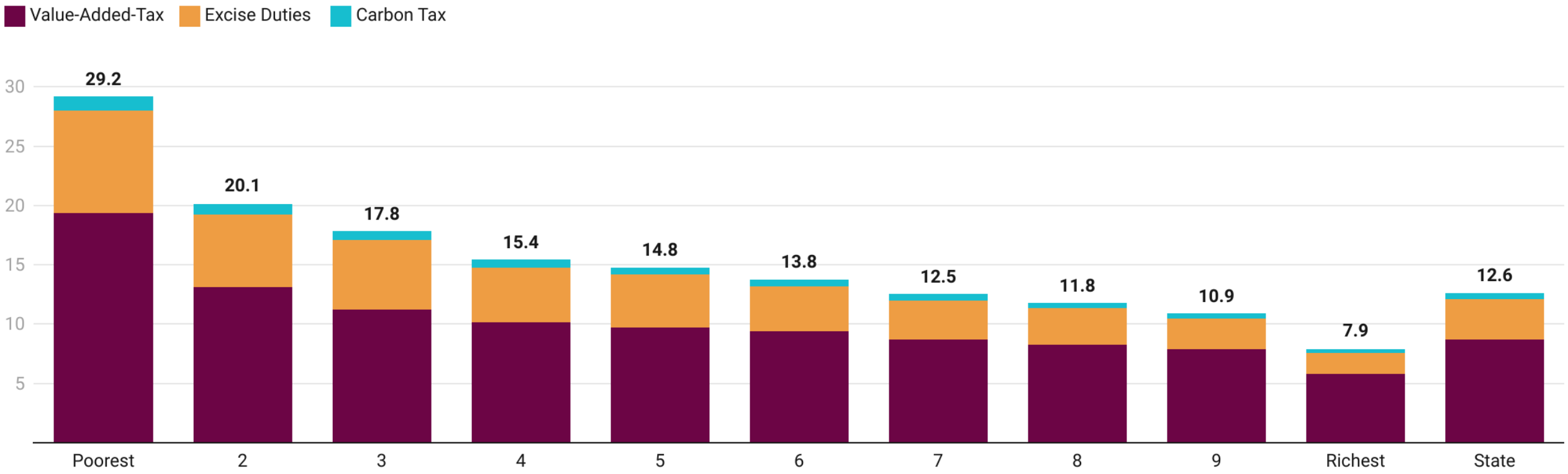


Notes: Households are sorted into ten equally sized groups based on equivalized household disposable income.

Source: PBO analysis using the EVE model • Created with Datawrapper

...but indirect taxes are regressive when compared to income

Average indirect tax liabilities (% household income)

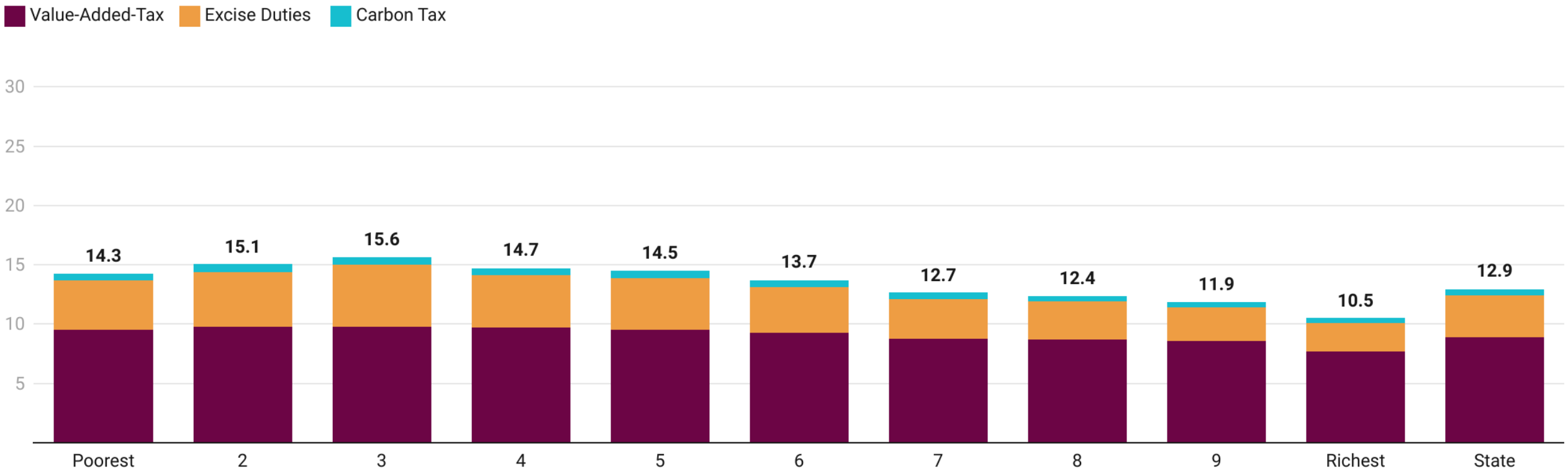


Notes: Households are sorted into ten equally sized groups based on equivalized household disposable income.

Source: PBO analysis using the EVE model • Created with Datawrapper

...less so when compared to aggregate expenditure

Average indirect tax liabilities (% household expenditure)



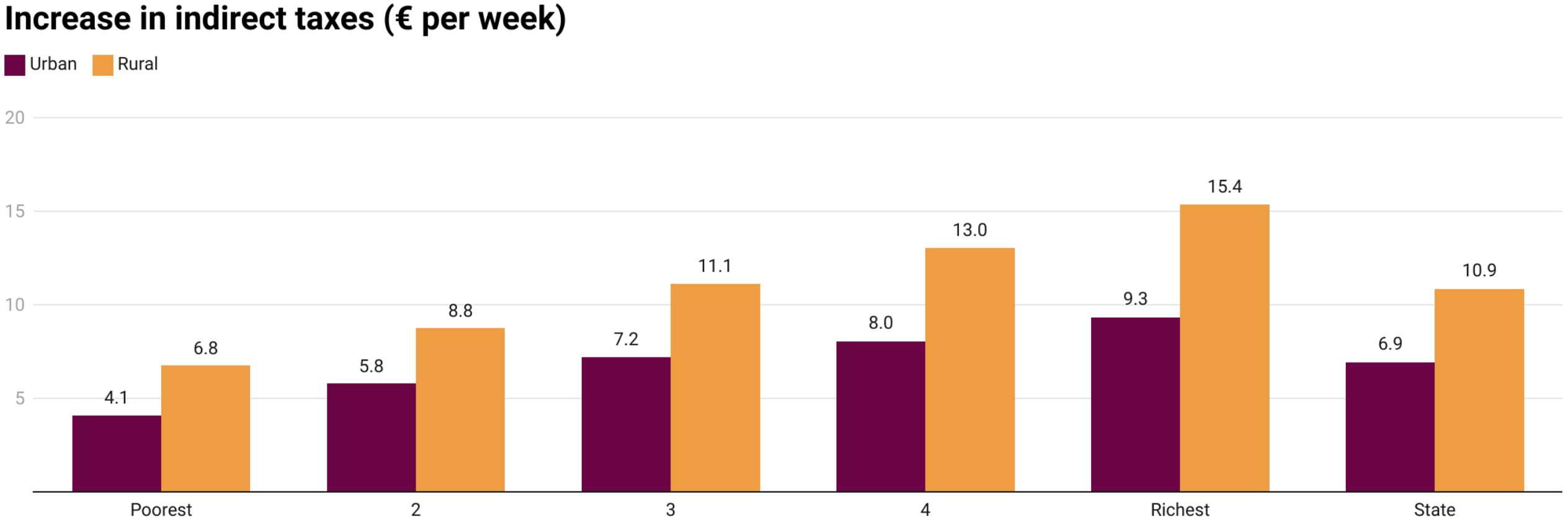
Notes: Households are sorted into ten equally sized groups based on equivalized household disposable income.

Source: PBO analysis using the EVE model • Created with Datawrapper

Application: carbon tax increase from €48.50 to €100/tonne

- To show what the EVE model can do, we simulate the effect of scheduled carbon tax increases
- Carbon tax set to rise by €7.50 per annum in order to tax carbon at €100/tonne by 2030
- Simulate an increase in the carbon tax from €48.5/tonne to €100/tonne using EVE
  - Demand for energy (level and composition) held at 2023 levels
  - No behavioural response considered
  - No wider macroeconomic effects considered
- Estimate how this carbon tax increase would affect urban and rural households
- EVE also accounts for the VAT implications of a carbon tax increase

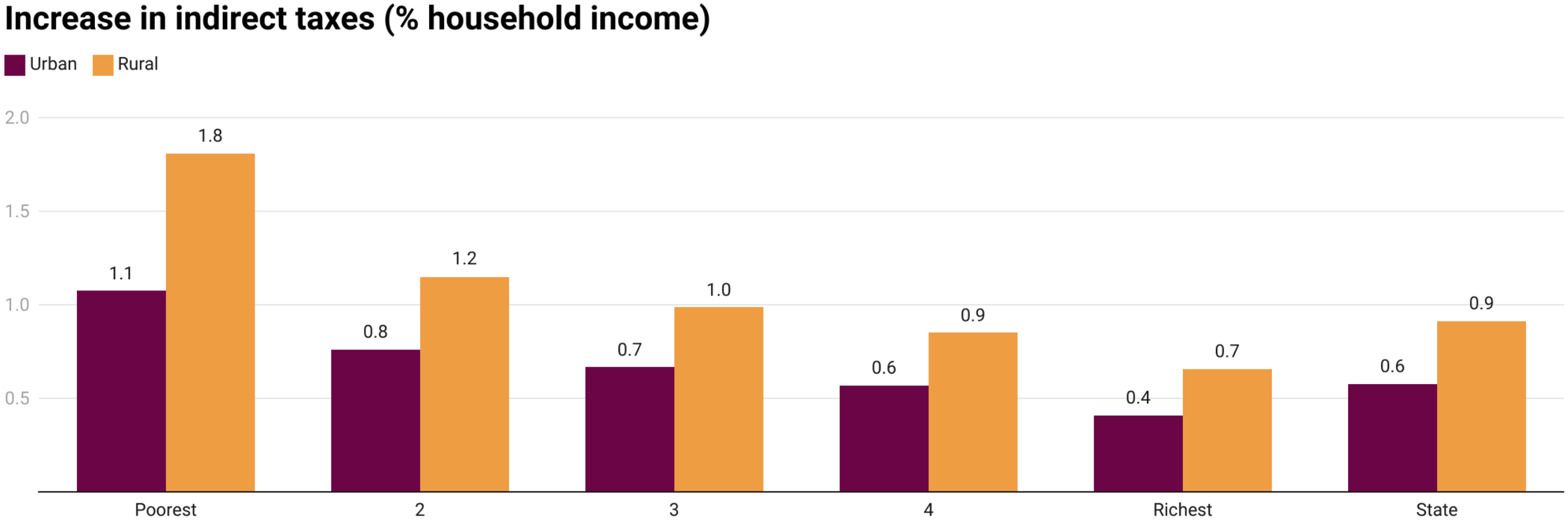
Rural households most affected by this carbon tax increase



Notes: Households are sorted into five equally sized groups based on equivalized household disposable income.

Source: PBO analysis using the EVE model • Created with Datawrapper

...with low-income households seeing their resources stretched



Notes: Households are sorted into five equally sized groups based on equivalized household disposable income.

Source: PBO analysis using the EVE model • Created with Datawrapper

Revenue recycling of carbon tax yields

- Since Budget 2020, yields from increases to the carbon tax have been allocated to the Carbon Tax Fund

- A portion of these revenues are recycled directly to households to offset the known regressivity of carbon tax increases

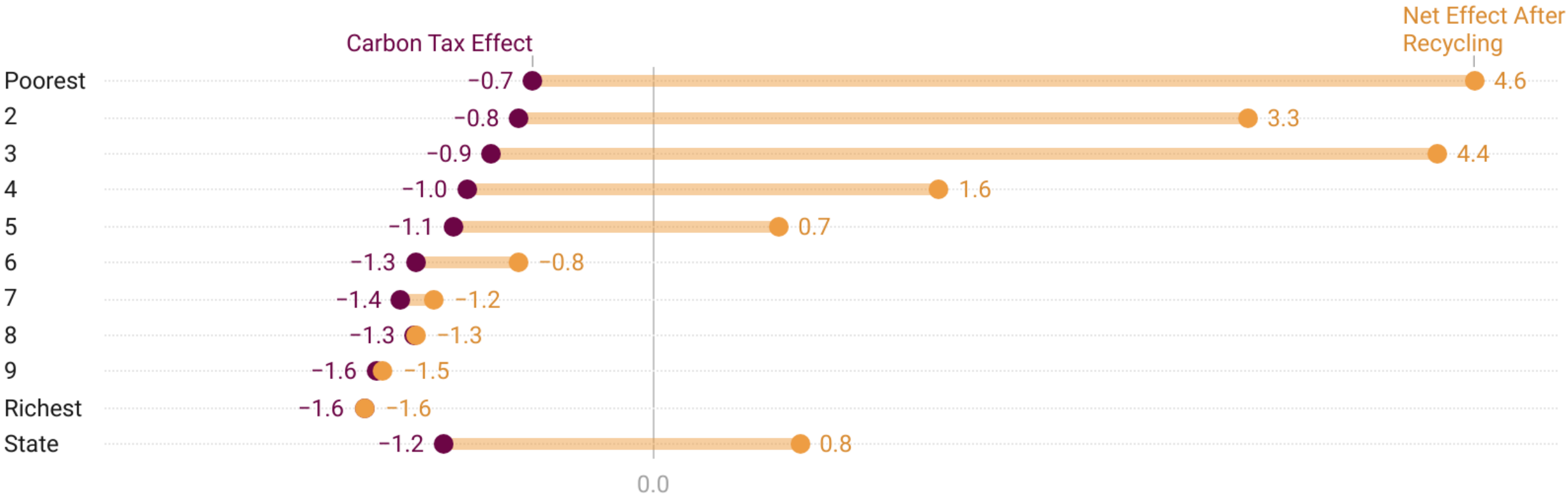
- In Budget 2024, these measures were via the social welfare system:
  1. A €4 per week increase to Increase Qualified Child Payments
  2. A €54 increase to the weekly income limits for the Working Family Payment

- We analyze how the above measures affect households while accounting for the impact of a €7.50 increase to the carbon tax

- Results indicate that revenue recycling is progressive, but concentrated, with large gains for low-income couples with children and lone parents, but less for other groups

In Budget 2024, on average, recycling more than compensates for the carbon tax increase, with low-income households better off

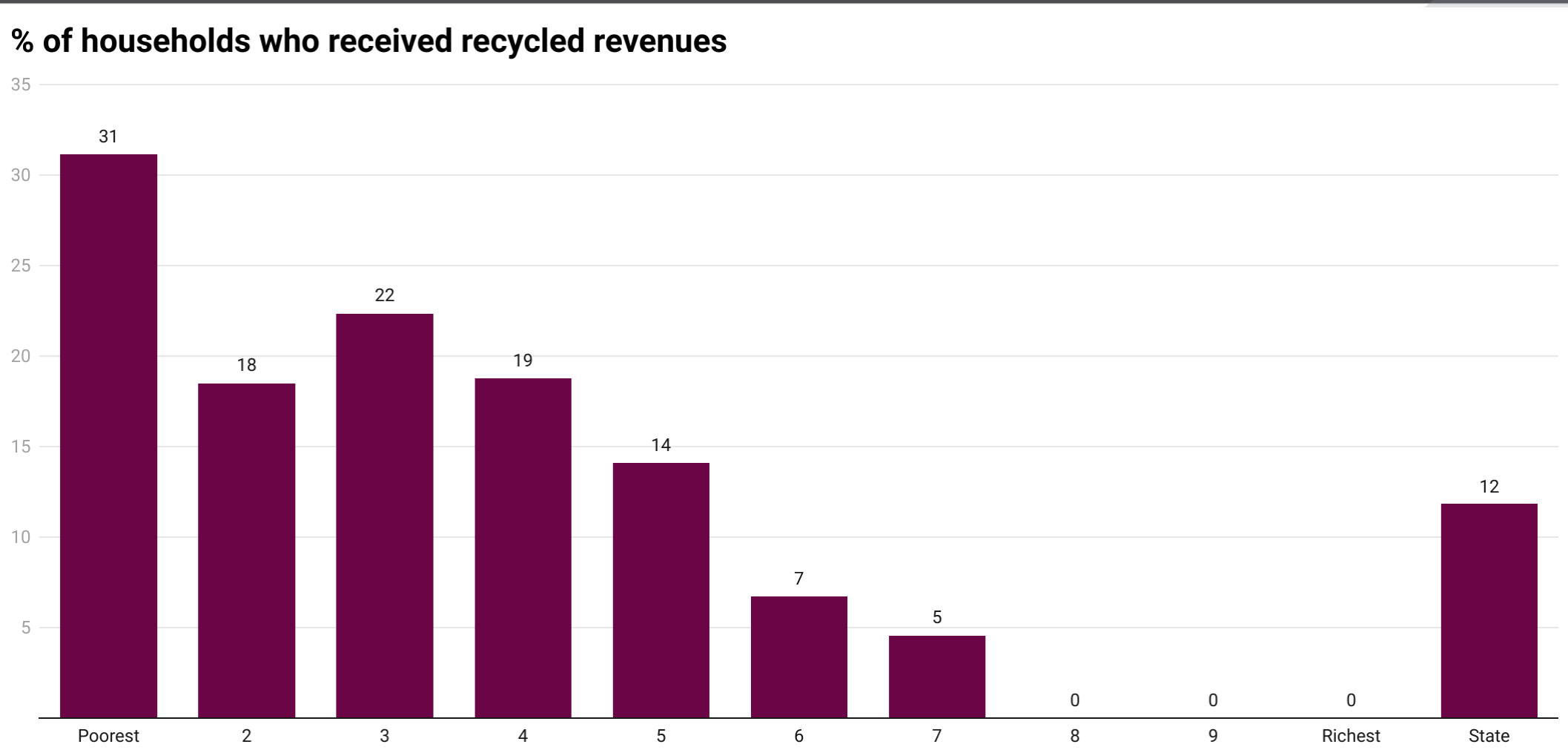
Change in disposable income (€ per week)



Notes: Households are sorted into ten equally sized bins based on equivalized household disposable income.

Source: PBO analysis using EVE and SWITCH v7.0 • Created with Datawrapper

...however, many households didn't receive any of the recycled revenues due to recycling occurring through a pair of policies



Notes: Households are sorted into ten equally sized groups based on equivalized household disposable income. Chart shows the share of households in each decile who benefitted from 1) a €54 increase to the Working Family Payment income limits or 2) a €4 rise to Increases for a Qualified Child on social welfare schemes.

Source: Notes: PBO analysis using SWITCH v7.0 • Created with Datawrapper

Conclusions

- EVE model a powerful tool for analysing costs and distributional effects of indirect taxes
- For more information, contact pbo@oireachtas.ie or pbocostings@oireachtas.ie (if related to requests for policy costing analysis for Members)
- Future work at the PBO will aim to model behavioural response within EVE

Appendix

Excises in the model

Table 1: Excise parameters, modelled 2023 scenario

Tax Heading	Tax Rate
Alcohol Product Tax	
Spirits	€42.57 per litre of alcohol
Beer/Stout/Ale/Lager (>2.8% ABV)	€22.5 per hectolitre per cent alcohol of beer
Cider (>2.8% & <6% ABV)	€94.46 per hectolitre of wine
Wine (Still, >5% & <15% ABV)	€424.84 per hectolitre of wine
Fortified Wine (Still, >15% ABV)	€616.45 per hectolitre of wine
Sparkling Wine (>5.5% ABV)	€849.68 per hectolitre of wine
Tobacco Product Tax	
Cigarettes	€403.32 per 1,000 cigarettes
+ Cigarettes (Ad Valorem)	Ad valorem charge of 8.73%
Cigars	€454.071 per kilogram
Fine-cut tobacco	€436.842 per kilogram
Mineral Oil Tax	
Petrol	€541.84 per 1,000 litres
Diesel	€425.72 per 1,000 litres
Home heating oil	€14.78 per 1,000 litres
Carbon Tax	
Petrol, Diesel, LPG, Natural Gas, Kerosene, Coal & Peat Briquettes	€48.50 per tonne of carbon