CARBON TAXATION IN IRELAND: DISTRIBUTIONAL EFFECTS OF REVENUE RECYCLING POLICIES

M.A. Tovar Reaños and M. Lynch, ESRI QEC Special Article (June 2019)

Dorren Mc Mahon

Introduction

Reducing carbon emissions by taxation is seen as a useful means of addressing a key element in climate change (De Bruin and Yakut, 2019). Public worries about carbon taxation centre on energy affordability and how carbon taxes will contribute to income inequality (Kolstad et al., 2014). Concern is largely focused on less well-off households who spend more of their income on energy and also on the effect of carbon taxation on rural households. Ease of switching to alternative fuels is central to the efficacy of carbon taxation contributing to a decrease in emissions (Patt and Lilliestam, 2018; Vasilakou, 2010).

Literature

Research on carbon taxation in Ireland has been carried out since the early 1990s (FitzGerald and McCoy, 1992). Overall, research has estimated the impact of carbon taxation on both households and various sectors of the economy (Bergin et al., 2004; Wissema and Dellink, 2007; Conefrey et al., 2013). It has also estimated the changes in behaviour generated by carbon taxation and the decrease in emissions. Research has not previously considered how household characteristics and behaviour is affected by carbon taxation, which requires the use of microdata. Irish research which has used microdata finds that carbon taxation is regressive, but the effects can be negated if the revenue is appropriately recycled back to households. [1]

The current paper by Tovar Reaños and Lynch advances research by examining the impact of increased carbon taxation on both carbon emissions and household income and equality. Carbon taxation mainly affects household spending on energy-related products such as fuel and transport. However, carbon taxation also affects spending on non-energy-related products by shifting the share of the household budget that is spent on each type of good.

[1] Scott and Eakins, 2004 and Callan et al., 2009

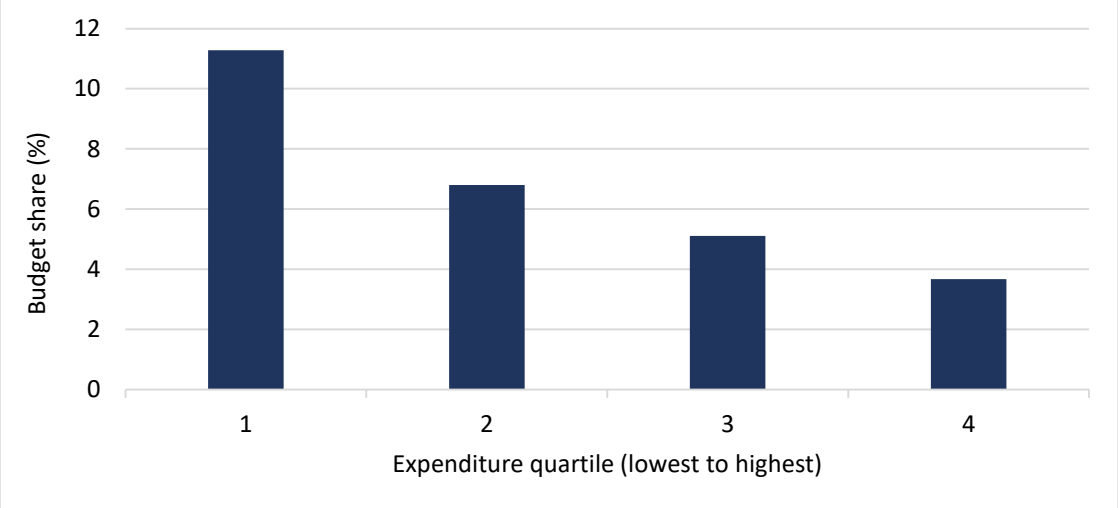
Methods

Using the Household Budget Survey (HBS) from the Central Statistical Office (CSO), the following waves are used: 2015-2016, 2009, 2004, 1999 and 1994. Consumption goods are grouped into six categories: food, housing, heating and lighting, transport, education and leisure, and other goods and services.[2] Energy covers expenditure on electricity, natural gas, liquid fuels and solid fuels. Transport expenditure comprises petrol and/or diesel, vehicle maintenance, insurance and public transport. As carbon taxes affect the prices of both heating and fuels for private transport, the changes in income distribution for both groups are estimated.

Results

Figure 1 shows that low income households spend the largest share of their budget on residential energy. Similar patterns are found for the expenditure on private transportation as shown in Figure 2. Higher energy prices (via a carbon tax or otherwise) will potentially harm low income households disproportionally. Figure 3 shows that more affluent households have higher carbon emissions. The use of a progressive policy where carbon taxes increase with income should be considered.

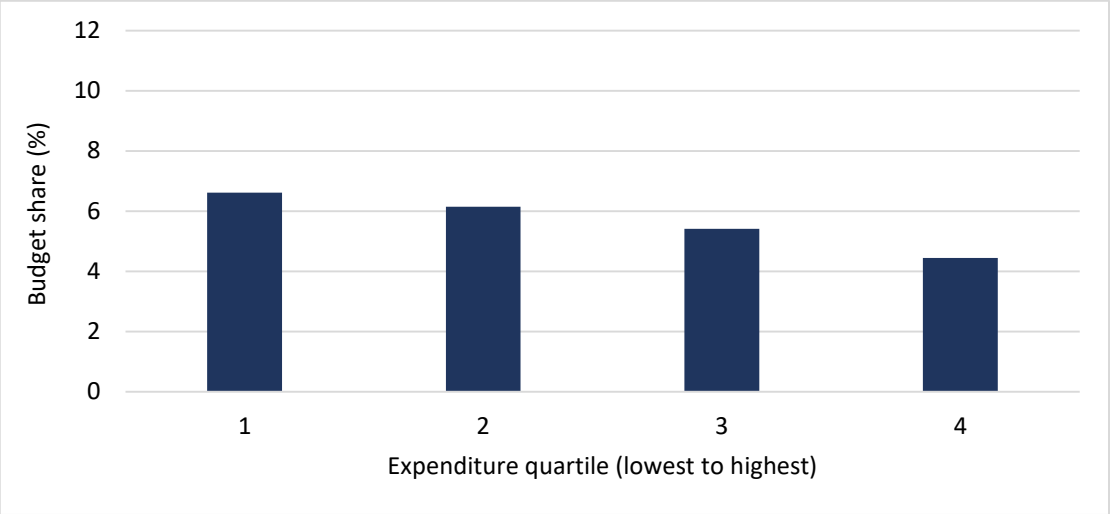
FIGURE 1 BUDGET SHARE OF EXPENDITURE ON HEATING AND LIGHTING USED IN THE RESIDENTIAL SECTOR ACROSS EXPENDITURE QUARTILES



Source: Own estimation based on the HBS.

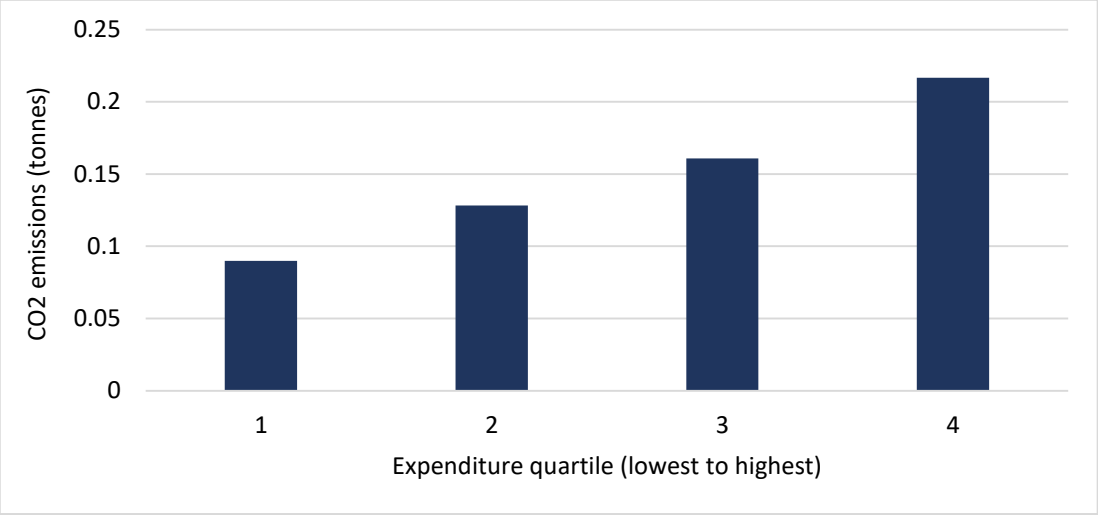
[2] As in Baker et al. (1989) the purchase of vehicles and big appliances such as washing machines, dryers, etc. are not included as part of the commodity bundles. Instead, dummy variables for ownership of these commodities are included in the analysis.

FIGURE 2 BUDGET SHARE OF EXPENDITURE ON DIESEL AND PETROL USED IN PRIVATE TRANSPORTATION ACROSS EXPENDITURE QUARTILES



Source: Own estimation based on the HBS.

FIGURE 3 CARBON EMISSIONS BY INCOME QUARTILE (TONNES)



Source: Own estimation based on the HBS.

The impact of a change in carbon taxation on behaviour is next considered. Two carbon tax scenarios are analysed where an additional carbon tax of €30 and €80 per tonne are considered. When combined with the existing carbon tax of €20 per tonne, total carbon taxes come to €50 and €100 per tonne. Additionally, two mechanisms for recycling the additional carbon tax revenue are considered; a *flat allocation* and a *targeted allocation*. The *flat allocation* scenario simulates the "green cheque", which has been backed by some policymakers. An equal cash transfer is given to every household, the sum total of which is equal to the total carbon tax revenue. Under the *targeted scenario*, the revenue is distributed amongst households in *inverse* proportion to the households' share of aggregate income.

Table 1 shows how the cost of increasing the carbon tax by an additional €30 per tonne impacts on the household types. Every household bears some cost, but the cost is greatest for the poorest households. Poorer households (1st quartile) suffer disproportionately more from carbon taxes. In addition, single households with children are the most affected by this policy. Table 1 does not assume how the revenues from carbon taxes are used and presumes that the revenue raised from so doing leaves the economy completely.[3]

TABLE 1 HICKS' EQUIVALENT VARIATION RELATIVE TO HOUSEHOLD INCOME

	1st_quartile	2nd_quartile	3rd_quartile	4th_quartile
Single_no_children	-0.83	-0.41***	-0.34***	-0.23***
Single_+65	-0.94	-0.58	-0.41	-0.16***
Single_with_children	-1.01***	-0.67***	-0.45	-0.37
All_households	-0.88	-0.59	-0.48	-0.39

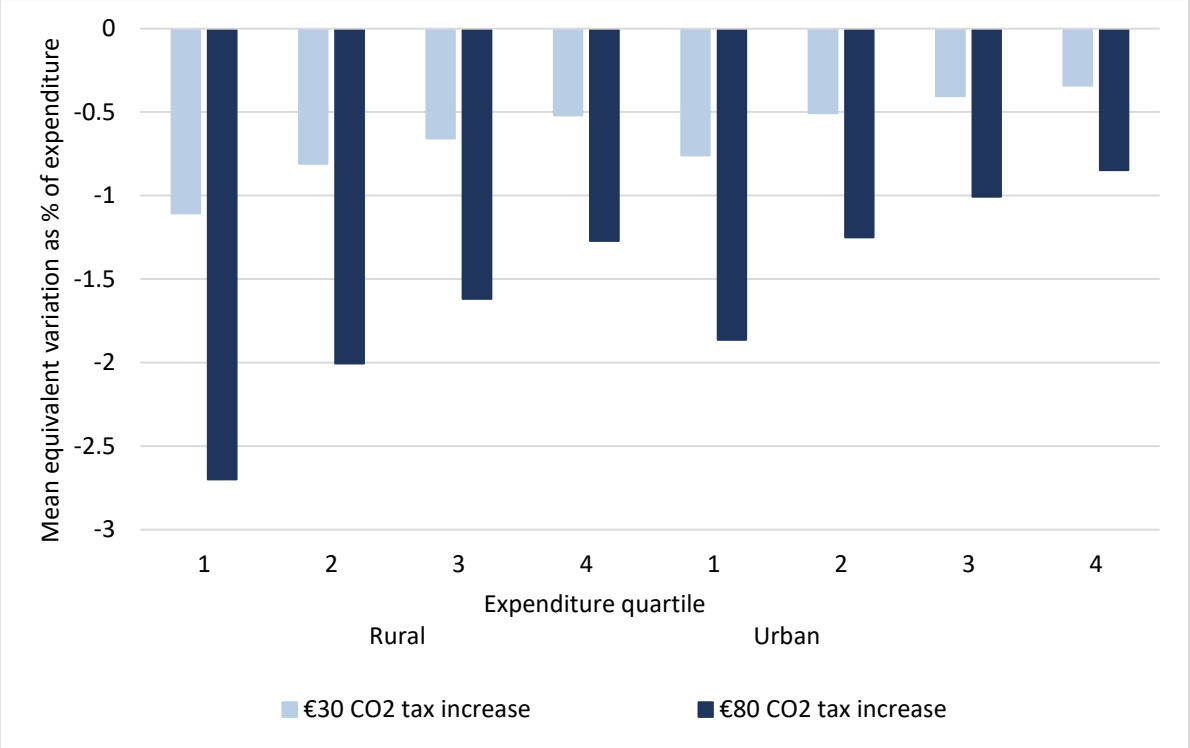
Source: Authors' own estimation.

Notes: Statistically significant with respect to the sample mean in each quartile *p<0.10, **p<0.05, ***p<0.01.

[3] The metric measures the cost of the policy as the extra income that the household would require, were they to choose their original bundle of commodities, but at the new set of energy prices

Figure 4 shows how the tax burden is distributed across different income thresholds and also shows changes in rural and urban households. Rural households are disproportionally more affected, particularly those in the lowest income quartile.

FIGURE 4 DISTRIBUTIONAL EFFECTS OF CARBON TAX FOR URBAN AND RURAL HOUSEHOLDS



Source: Authors' own estimation.

Table 2 shows the average cost per week of carbon taxation on different household types. Households living in older dwellings and low skilled workers have larger costs. Table 3 shows that income inequality and the total expenditure of households declines by between 0.46 per cent and 1.14 per cent. A tax increase of €30 and €80 per tonne decreases CO2 emissions by 3.94 per cent and 10.24 per cent respectively, due to the behavioural changes made by households in response to the tax.

TABLE 2 CARBON TAX COST (€/WEEK). OWN ESTIMATED HICK'S EQUIVALENT VARIATION

	Tax_+30	Tax_+80
Dwelling_1980	-3.037***	-7.467 ***
Low_skill	-3.126 ***	-7.726 ***
All_households	-2.772	-6.841

Source: Authors' own estimation.

Notes: Values have been equalised to consider household size. Statistically significant with respect to the sample mean in each quartile. *p<0.10, **p<0.05, **p<0.01.

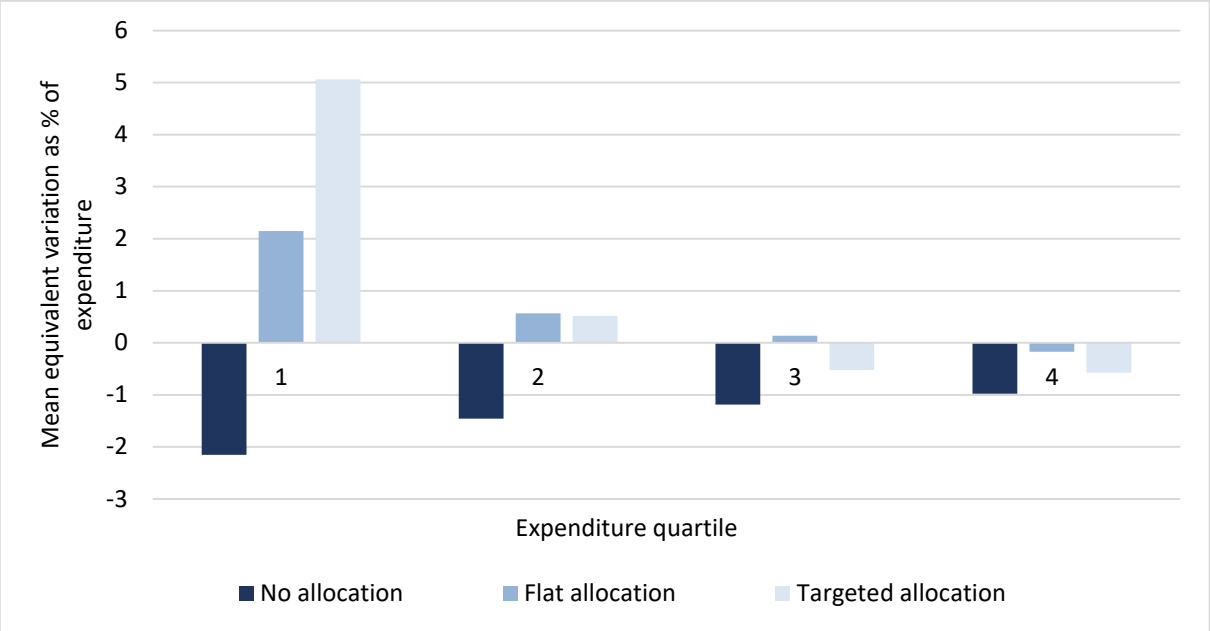
TABLE 3 CHANGES IN INEQUALITY, EXPENDITURE AND EMISSIONS IN %

Tax	Inequality %	Expenditure %	Emissions %
+€30	0.40	-0.46	-3.94
+€80	1.04	-1.14	-10.24

Source: Authors' own estimation.

Figure 5 shows how the cost of an additional €80 per tonne changes when the *flat* and *targeted* allocations described above are used. A *flat* allocation is larger in comparison to total expenditure for poorer households than for richer households. However, a more *targeted* measure helps the poorest households far more than the flat measure.

FIGURE 5 DISTRIBUTIONAL EFFECTS OF DIFFERENT REVENUE RECYCLING MECHANISM



Source: Authors' own estimation.

Table 4 shows the effects of the tax increase and revenue recycling on inequality and expenditure. The targeted mechanism has large effects, potentially doubling the benefits obtained under the flat allocation mechanism. The extent to which recycling mechanisms can reduce income inequality increases as carbon taxation increases.

TABLE 4 CHANGES IN INEQUALITY, EXPENDITURE. DISTRIBUTIONAL EFFECTS OF TWO RE-ALLOCATION MECHANISMS

Flat allocation		
Carbon tax	Inequality %	Expenditure %
+€30	-0.46	0.16
+€80	-1.05	0.41
Targeted allocation		
Carbon tax	Inequality %	Expenditure %
+€30	-1.23	0.16
+€80	-2.78	0.41

Source: Authors' own estimation.

Conclusion

This paper has examined the impact of increased carbon taxation in Ireland and quantified its effects using Irish microlevel data. The results find a 3.94 per cent reduction in carbon emissions if carbon taxes are increased by €30 per tonne, and a 10.24 per cent reduction in emissions if taxes are increased by €80 per tonne. Results from previous research are replicated in this paper. Carbon taxation coupled with revenue recycling has the potential to be a useful tool for mitigating income inequality, independent of climate policy. On a note of caution the above results simulate behavioural changes based on historical climate and energy data as well as extant policies. Future climate and energy policies, with or without carbon taxation, can shift behaviour even further.

References

Baker, P., Blundell, R., & Micklewright, J. (1989). “Modelling household energy expenditures using microdata”. *Economic Journal*, 720-738.

Bergin, A., Fitzgerald, J., & Kearney, I. (2004). *The macro-economic effects of using fiscal instruments to reduce greenhouse gas emissions*. Environmental Protection Agency.

Callan, T., Lyons, S., Tol, R., & Verde, S. (2009). “The distributional implications of a carbon tax in Ireland.” *Energy Policy*, 407-412.

Committee, on Climate Change (2019, 03). "Committee on Climate Action". Retrieved from Oireachtas.ie: https://www.oireachtas.ie/en/committees/32/climate-action/

Conefrey, T., FitzGerald, J., Malaguzzi Valeri, L., & Tol, R. (2013). “The impact of a carbon tax on economic growth and carbon dioxide emissions in Ireland”. *Journal of Environmental Planning and Management*, 934-952.

De Bruin, K.C., and A. M. Yakult (2019). “The effects of an incremental increase in the Irish carbon tax towards 2030’. ESRI Working Paper No. 619, Dublin: The Economic and Social Research Institute.

FitzGerald, J., & McCoy, D. (1992). *The economic effects of carbon taxes*. Retrieved from The Economic and Social Research Institute: https://www.esri.ie/system/files?file=media/fileuploads/2015-07/JACB199204.pdf

Kolstad, C., Urama, K., Broome, J., Bruvoll, A., Carino-Olvera, M., Fullerton, D., Jotzo, F. (2014). “Social, economic and ethical concepts and methods”. *Climate Change 2014: Mitigation of Climate Change* (pp. 173-248). Cambridge University Press.

Lewbel, A., & Pendakur, K. (2009). “Tricks with Hicks: the EASI demand system”. *American Economic Review*, 827-863.

Patt, A., & Lilliestam, J. (2018). “The Case against Carbon Prices”. *Joule*, 2494-2498.

Scott, S., & Eakins, J. (2004). *Carbon taxes: which households gain or lose?* Environmental Protection Agency.

Vasilakou, A. (2010). “Making Climate Change work for us: European Perspectives on Adaptation and Mitigation Strategies”. *Geographical Journal*, 373-373.

Wissema, W., & Dellink, R. (2007). “Age analysis of the impact of a carbon energy tax on the Irish economy”. *Ecological Economics*, 671-683.