Highlights

Beyond Headcounts: The Compensation Gap for Distributional Policy Evaluation

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- Headcount rankings can depend on whether households or individuals are counted.
- The compensation gap is the residual budget needed to meet a common loss tolerance.
- The gap ranks policies identically whether reported per household or per person.
- Belgian carbon dividends illustrate a reversal in headcount rankings.
- The gap favours a per-household over a per-capita carbon dividend in Belgium.

Beyond Headcounts: The Compensation Gap for Distributional Policy Evaluation

Audric De Bevere[a,*], Gilles Grandjean[a]

[a] *UCLouvain Saint-Louis Bruxelles, blvd. du Jardin botanique, 43, 1000, Brussels, Belgium*

Abstract

Headcounts of winners and losers are widely used in distributional policy evaluations. Yet which policy leaves fewer losers may depend on whether households or individuals are counted. We propose the compensation gap: the residual household compensation budget needed to keep losses within a common tolerance. Reporting this budget per household or per person does not change which policy requires less compensation. In a Belgian carbon-pricing microsimulation with revenue recycling, the estimated compensation gap is smaller for per-household than for per-capita dividends.

Keywords: policy evaluation, distributional incidence, compensation, unit of analysis, carbon pricing, revenue recycling.
JEL: H22, H23, D31, D63, Q52, Q58.

1. Introduction

Distributional evaluations of public policies often report the shares of winners and losers (see seminal examples by King (1983); Immervoll et al. (2007)). Yet, which policy leaves the smaller share of losers can depend on whether households or individuals are counted. Consider three households: a three-person household and two one-person households. Under policy A, only the three-person household loses, by €1; under policy B, only the two one-person households lose, by €1 each. Policy A leaves a smaller share of losing households (one-third versus two-thirds), whereas policy B leaves a smaller share of individuals living in losing households (two-fifths versus

*Corresponding author: audric.debevere@uclouvain.be

three-fifths). These headcounts answer different incidence questions. More generally, distributional conclusions can depend on the choice of unit of analysis (Creedy and Scutella, 2004).

We propose the compensation gap to answer a complementary question: how much compensation is needed to ensure that no household's loss exceeds a common tolerance level? For a given policy, it sums the amounts needed to bring each household's loss within that tolerance. Under perfect targeting and abstracting from administrative costs and financing effects, this gives the gross residual compensation budget; the gap reports that budget per household or per person. Like the poverty-gap measure (Foster et al., 1984), it aggregates shortfalls from benchmarks. A conventional poverty gap uses a common poverty threshold, whereas the compensation gap uses household-specific benchmarks determined by pre-policy disposable income and a common loss tolerance. In energy-poverty research, gap indices likewise complement headcounts by capturing the intensity of deprivation (Croon et al., 2023).

Related work on corrective taxation considers both the share of households left worse off and the aggregate residual losses among them (Sallee, 2019). Our contribution is to define the compensation gap for a chosen proportional loss tolerance and population subgroup, and to show that comparisons across policies are unchanged when the same household-level budget is reported per household or per person.

The compensation gap is not intended to replace winner–loser headcounts or to determine the appropriate unit of analysis. It provides a complementary metric of residual compensation needs. Once these needs are defined at the household level, the comparison between policies is unchanged when the same aggregate budget is reported per household or per person.

In the example, total compensation is €1 under policy A and €2 under policy B. The corresponding average gaps are €0.33 and €0.67 per household, or €0.20 and €0.40 per person. Policy A therefore requires less compensation under either normalisation.

We illustrate the practical relevance of this property using microsimulation to assess the distributional effects of carbon pricing under two revenue-recycling schemes in Belgium: per-household and per-capita dividends. Carbon-pricing studies document substantial heterogeneity in household-level impacts, including shares of households experiencing losses above an income-relative threshold (Rausch et al., 2011; Cronin et al., 2019). In our application, the share of losing households is smaller with the per-household divi-

dend, whereas the share of individuals living in losing households is smaller with the per-capita dividend. The estimated compensation gap, however, is smaller with the per-household dividend under either normalisation. Although illustrated through carbon pricing with revenue recycling, the measure applies more broadly to fiscal and regulatory policies that affect household income.

2. Measurement

2.1. Headcounts and the unit of analysis

Let h index households and n_h denote household size. We treat households as resource-sharing units. Pre-policy and post-policy disposable incomes are therefore defined at the household level. Consider a fixed subgroup S and a policy r. Let $Y_h > 0$ denote household h's pre-policy disposable income, and let Y_{hr} denote its post-policy disposable income under policy r.

For a loss tolerance $x \in [0, 1]$, expressed as a proportion of pre-policy disposable income, the household-specific benchmark is $(1-x)Y_h$. We define household h's monetary shortfall from this benchmark as

$$g_{hr}(x) = [(1-x)Y_h - Y_{hr}]^+, \qquad [a]^+ \equiv \max\{a, 0\}. \tag{1}$$

Thus, $g_{hr}(x) > 0$ if household h's loss under policy r exceeds x times its pre-policy disposable income, and $g_{hr}(x) = 0$ otherwise.

Let $|S|$ denote the number of households in subgroup S and let $N_S = \sum_{h \in S} n_h$ denote the corresponding number of individuals. The household-level headcount and the corresponding person-weighted household-loss headcount are

$$L_r^H(S, x) = \frac{1}{|S|} \sum_{h \in S} \mathbf{1}\{g_{hr}(x) > 0\}, \tag{2}$$

$$L_r^I(S, x) = \frac{1}{N_S} \sum_{h \in S} n_h \mathbf{1}\{g_{hr}(x) > 0\}, \tag{3}$$

where $\mathbf{1}\{\cdot\}$ is the indicator function, equal to one when the condition holds and zero otherwise. Equation (3) is a person-weighted household-loss headcount: it measures the share of individuals living in households whose loss exceeds the tolerance, rather than the share of individuals experiencing

losses defined independently of household resource sharing. It assigns each member the outcome of their household and thus gives household h a weight proportional to n_h. Equation (2), by contrast, gives every household the same weight. If households experiencing losses beyond the tolerance level differ in size across policies, a policy may leave a smaller share of households with such losses but a larger share of individuals living in those households.

2.2. The compensation gap

We define the gross residual compensation budget as

$$B_r(S,x) = \sum_{h \in S} g_{hr}(x). \tag{4}$$

The compensation gaps per household and per person are, respectively,

$$CG_r^H(S,x) = \frac{B_r(S,x)}{|S|}, \qquad CG_r^I(S,x) = \frac{B_r(S,x)}{N_S}. \tag{5}$$

Both quantities normalise the same gross residual compensation budget, obtained by summing households' monetary shortfalls. The second quantity is therefore a compensation gap per person, rather than an individual compensation gap. It does not count a household's shortfall once for each member because $g_{hr}(x)$ is the single transfer required to bring the household's post-policy disposable income up to the benchmark $(1-x)Y_h$. At $x = 0$, this budget is the compensation needed to restore every losing household back to its pre-policy disposable income. For $x > 0$, it includes only the portion of each household's loss that exceeds x times its pre-policy disposable income.

Proposition 1 (Invariance to reporting normalisation)**.** *For any two policies r and r', evaluated for the same subgroup S and tolerance x,*

$$CG_r^H(S,x) \leq CG_{r'}^H(S,x) \quad \Longleftrightarrow \quad CG_r^I(S,x) \leq CG_{r'}^I(S,x).$$

Proof. Both normalising factors, $|S|$ and N_S, are positive and common to the policies. Each inequality is therefore equivalent to $B_r(S,x) \leq B_{r'}(S,x)$. □

The numerical level of the compensation gap changes with its reporting unit, but the comparison between policies does not. By aggregating household shortfalls, the gap reflects both the prevalence and the magnitude of residual losses. As an aggregate measure, however, it does not show which population groups face the largest shortfalls. Calculating the gap for relevant subgroups can provide this information.

3. Application: two carbon-dividend designs

3.1. Microsimulation and dividend designs

We illustrate the measure using the 2022 Belgian Household Budget Survey, a nationally representative sample of approximately 4,500 households reporting their consumption expenditure (survey weights are used throughout). We simulate the immediate direct effect of a €45/tCO_2 price on household consumption of natural gas, heating oil, gasoline, and diesel. Fuel quantities are held fixed, the carbon price is fully passed through to consumers, and only the revenue collected from households is recycled back to them. These simplifying assumptions are adopted to keep the illustration transparent and focused on the measure; the exercise is not intended as a comprehensive behavioural analysis of carbon pricing.

The resulting revenue is recycled through two budget-neutral dividend designs. The per-household design pays each household €17.7 per month, whereas the per-capita design pays each person €8.1 per month. The former provides relatively more compensation to smaller households, whereas the latter provides relatively more to larger households.

3.2. Headcount reversal

Table 1 reports the shares of winners and large losers, classifying a household as a large loser when its loss exceeds an illustrative threshold of 0.5% of pre-policy disposable income. When households are counted, the per-household dividend yields a larger share of winners and a smaller share of large losers than the per-capita dividend. When individuals are counted, both comparisons reverse.

3.3. Compensation-gap results

Table 2 reports point estimates of the compensation gap at zero tolerance ($x = 0$). Without recycling, the gross residual compensation requirement averages €17.70 per household per month. It falls to €5.61 with the per-household dividend and €5.88 with the per-capita dividend. The per-household dividend therefore leaves a residual shortfall that is €0.27 smaller per household per month. Expressing both amounts per person would divide them by the same average household size and leave the comparison unchanged.

Among households classified as energy poor before the policy, the compensation gap per household is €9.59 under the per-household dividend and

	Household dividend	Per-capita dividend
Households as the unit of analysis		
Winners (%)	59.4	52.9
Large losers (%)	11.5	15.5
Individuals as the unit of analysis		
Winners (%)	54.1	61.1
Large losers (%)	11.6	10.3

Table 1: Headcount indicators by statistical unit

Notes: Large losers are defined here as households whose post-policy disposable income falls more than 0.5% below pre-policy disposable income. Individual-level rates assign every person the outcome of their household.

	No redistribution	Household dividend	Per-capita dividend
All households	17.70	5.61	5.88
Energy-poor households	24.77	9.59	13.05

Table 2: Compensation gap at zero tolerance, monthly euros per household

Notes: Energy poverty is measured before the policy using the Belgian measured energy-poverty indicator (Coene and Meyer, 2024).

€13.05 under the per-capita dividend. Average residual compensation needs are therefore larger among energy-poor households. The difference between the two designs is also much more pronounced in this subgroup: the compensation gap is markedly lower under the per-household dividend.

The per-household dividend also requires less compensation when the loss tolerance is set at 0.5% of pre-policy disposable income: the gaps fall to €1.28 and €1.72, respectively. The large-loser headcount measures the prevalence of losses exceeding the threshold, whereas the compensation gap aggregates the corresponding monetary shortfalls. In this application, the per-household dividend requires less compensation at both tolerance levels, although which policy requires less compensation may depend on the chosen level in other settings.

4. Conclusion

Which policy leaves the smaller share of losers may depend on whether households or individuals are counted. The compensation gap complements these headcounts by measuring the gross residual compensation budget required to keep household losses within a common tolerance. Under the maintained assumption that households share resources, expressing this same budget per household or per person changes its scale but not which policy requires less compensation. The measure does not select the appropriate unit of analysis or replace headcounts, which remain informative about the incidence of household losses.

The measure can be applied to a broad range of policies and calculated for any fixed population subgroup at any chosen level of tolerated loss. Headcounts show the incidence of losses, the compensation gap quantifies their residual magnitude, and subgroup calculations show how compensation needs vary across groups. Reporting these statistics together distinguishes how many households or people lose from how much additional compensation is required to limit their losses.

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Data availability

The data underlying this study are subject to access restrictions and cannot be made publicly available. Access to the Belgian Household Budget Survey microdata may be requested directly from Statbel under its applicable access conditions.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work, the authors used OpenAI's ChatGPT and Codex to assist with language editing and manuscript preparation. The authors reviewed and edited all output and take full responsibility for the content of the article.

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