Green Tax Reform:
Labour market impact of carbon pricing and revenue recycling

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OVERVIEW

- Introduction
- Model
- Empirical application
- Conclusion

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- Green tax reform: Carbon pricing + revenue recycling
  - Double dividend due to labor supply effects from revenue recycling
    - But: also increased prices induce behavioral effects
    - But: distributional impact (incl. GE effects)

    ➢ Heterogeneity in direct and indirect effects -> microsimulation

  - Modelling strategy
    - Arithmetic MSM of direct and indirect taxes with
    - "Random Utility – Random Opportunity" job choice model
      - Capéau et al. 2023

    ➢ Capture wide heterogeneity in
      - Consumption patterns & labor supply responses (detailed budget constraint)

    ➢ Allow feedback from partial/general equilibrium (e.g. in labor demand)

- Overview paper of carbon taxes
  - Timilsina 2022
- Random Utility Random Opportunity framework
  - E.g. Aaberge and Colombino 2014, Dagsvik et al. 2014
- Few examples of micro-based labor supply simulation of joint reform
  - Bach et al. 2006, Capéau et al. 2009, Pestel and Sommer 2017, Savage 2017
- RURO with (endogenous) labour demand effect
  - Narazani, Colombino and Palma 2021

➢ Tractable strategy for behavioral impact of joint direct and indirect tax reform with two-stage budgetting approach, and

➢ First step toward integrated micro-macro approach to include general equilibrium effects on employment opportunities, (relative prices and wages.)

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Structure on preferences

from: $\max_{\mathrm{x},\, h} \ \Omega(x, h)$ s.t. $\mathrm{q}'\mathrm{x} \leq f(w, h; M, \mathrm{z})$, $\mathrm{x} \geq 0$, $0 \leq h \leq T$

to: $\max_{(w,h)\in\mathcal{B}} \ \widetilde{\Omega}(\mathrm{q}, w, h) = H\left(\frac{f(w,h;M,\mathrm{z})}{Q(\mathrm{q})}, h\right) + \varepsilon$ s.t. ...

- Deterministic part, $H(\cdot,\cdot)$, and random term, in utility.
- Weak separability assumption: two-stage budgeting: $H(u(\mathrm{x}), h)$
  - For each level of h the household optimizes subutility of consumption $u(\mathrm{x})$
  - Indirect utility from second stage used in the first stage: $H(v(\mathrm{q}, y), h)$
  - If we assume Cobb-Douglass $u(\mathrm{x})$, we have indirect utility:

$$v(\mathrm{q}, y) = \frac{y}{\prod_i q_i^{\omega_i}} = \frac{y}{Q(\mathrm{q})}$$

- First stage is labor market choice (w, h), dependent on consumer prices q
- We assume Box Cox utility function $H(\cdot,\cdot)$ over real consumption and leisure

Structure on labor market alternatives: random opportunities

- Not all alternatives equally available
  - $g_w(w)$ lognormal wage distribution
  - $g_h(h)$ uniform distribution with peaks at 20, 30 and 38 hours per week
  - θ relative intensity of job offers, dependent on personal characteristics

- "likelihood of being available"

$$\frac{\varphi(w,h)}{\varphi(0,0)} = g_w(w)g_h(h)\theta \quad \text{for } w,h > 0$$

- For each individual a (random) choice set, drawn from individual distribution
  - Allows to model heterogeneous changes in employment opportunities offered on the labor market
  - exogenous labor demand shock for three types by educational attainment

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- Estimate model on Belgium data
  - Imputation of HBS on SILC: synthetic dataset with w^*, h^*, ω
    - SILC: 2015, 2017, 2019 & HBS: 2014, 2016, 2018
    - Subsample: those available to the labor market
  - Euromod + Indirect Tax Tool for $f(\cdot)$ and $\mathrm{q} = (1 + \tau)\mathrm{p}$
  - With maximum likelihood procedure => model parameters

- Simulation on subsample of 2019
  - Draw set of random opportunities from estimated distribution $\theta g_w(w) g_h(h)$
  - Calculate deterministic utility
  - Draw error terms, such that observed choice in baseline gives highest utility
  - Simulate change in
    - indirect taxation (τ) and/or direct tax-and benefit system (f) and/or
    - job intensity (θ), i.e. change number of jobs available to individual
  - Repeat 100 times, and calculate expected outcomes

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Introduction of carbon tax for households (change in τ and thus in q)

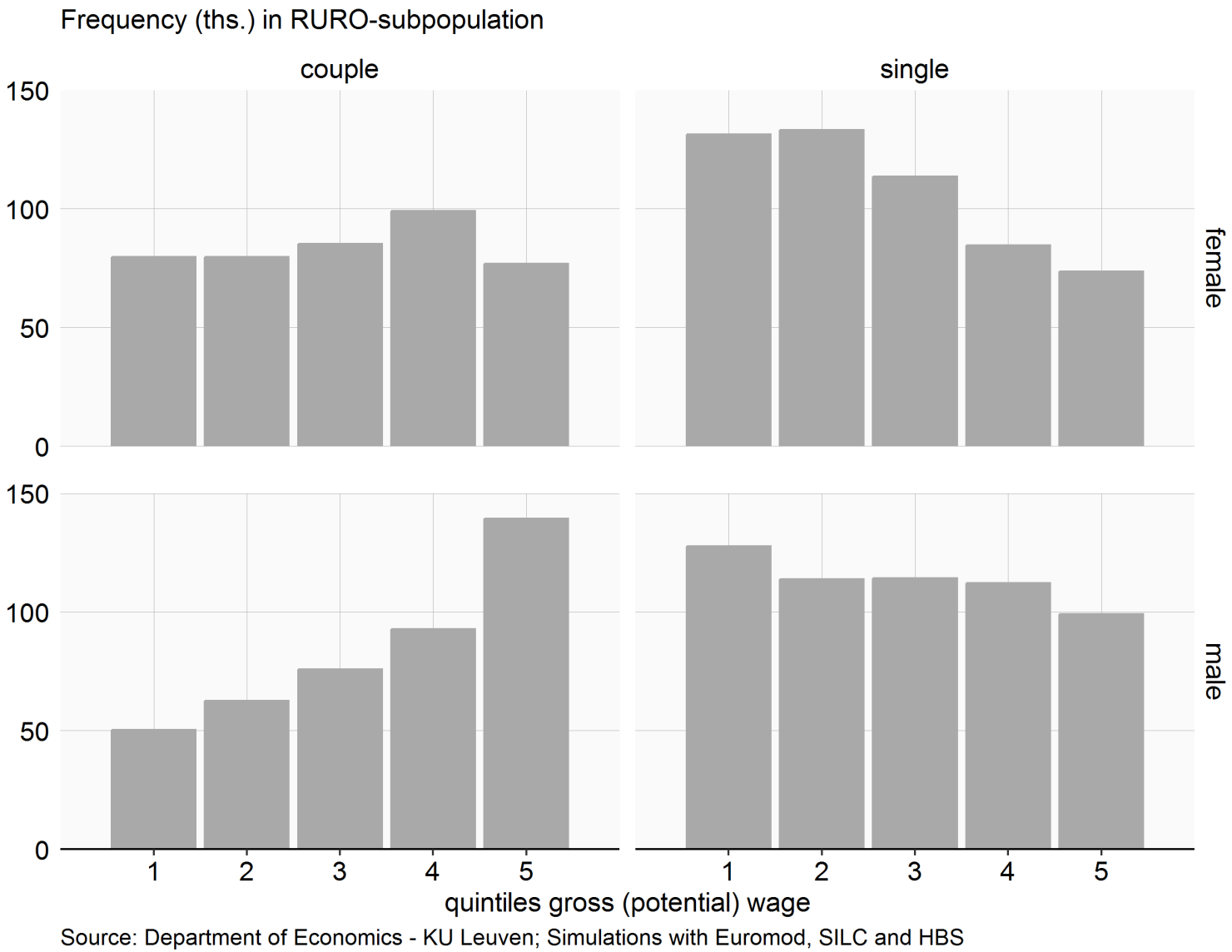
- Equivalent to carbon price of €150
  - Change in excises on Gas (x 30), Heating oil (x 15), Electricity (x 3)
  - based on Effective Carbon Rates (Cornille et al. 2021)

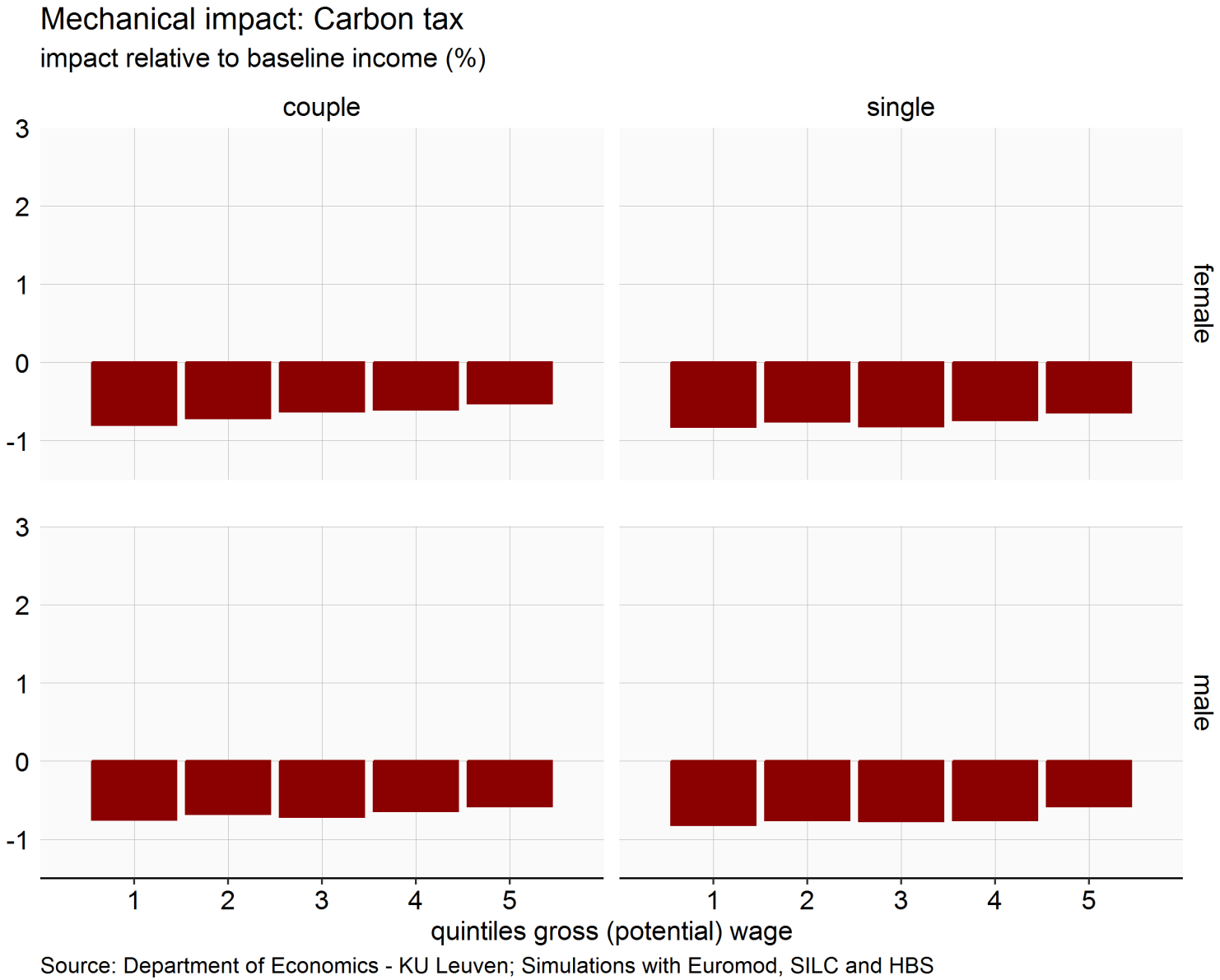
Budget of +/- €3.3bn recycled in lower income taxes (change in $f(\cdot)$)

- Increase of EITC "*werkbonus*" & shift upwards of 50% tax rate bracket
  - Lower effective marginal tax rates across distribution of wages
    - *Werkbonus* phase out ends at €5 000 instead of €2 560 (gross monthly wage)
    - 50% marginal rate starts at €60 000 instead of €40 480 (yrly taxable income)

Illustration of labour demand feedback

- Assume 10% increase in energy price for industry due to carbon tax
- Labour demand elasticities w.r.t. energy prices
  - Educational attainment (low: -0.48, middle: -0.06, high: -0.69) (Cox et al. 2014, DE)
  - Unconditional (i.e. different output level implied)


Frequency (ths.) in RURO-subpopulation
couple
single
female
male
150
100
50
0
1
2
3
4
5
quintiles gross (potential) wage
Source: Department of Economics - KU Leuven; Simulations with Euromod, SILC and HBS



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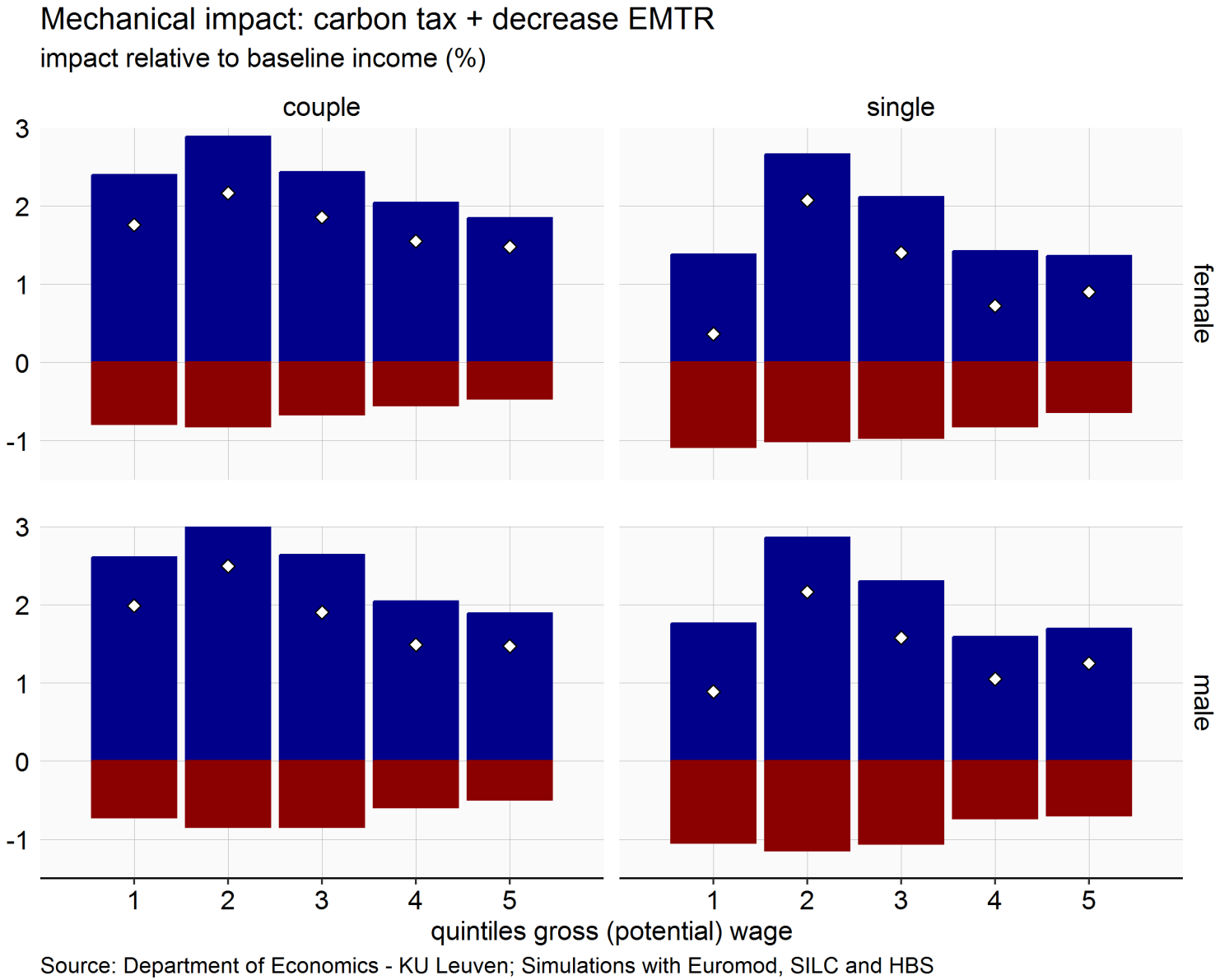

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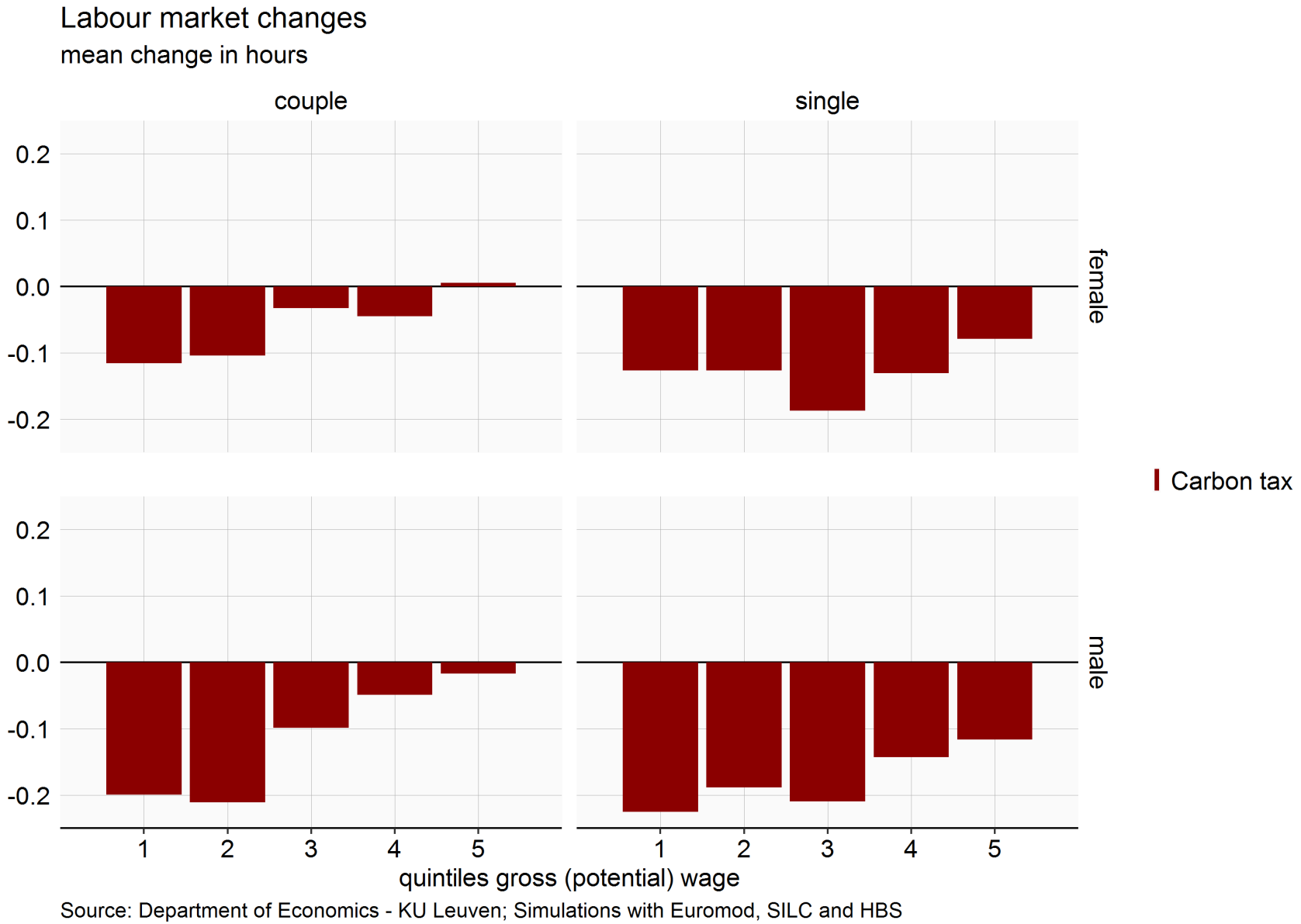
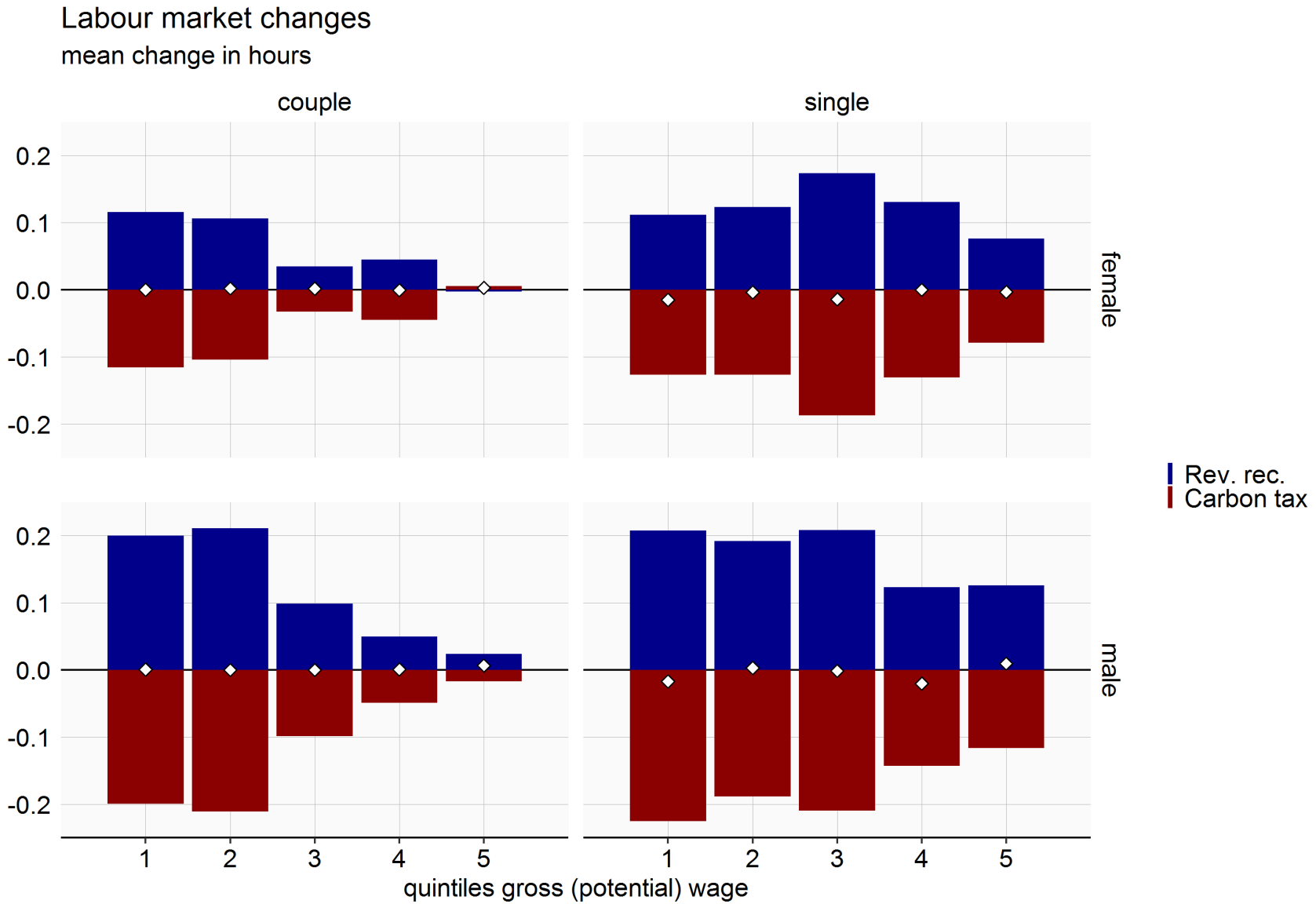

Labour market changes
mean change in hours
couple
single
female
male
0.2
0.1
0.0
-0.1
-0.2
1
2
3
4
5
quintiles gross (potential) wage
Carbon tax
Source: Department of Economics - KU Leuven; Simulations with Euromod, SILC and HBS



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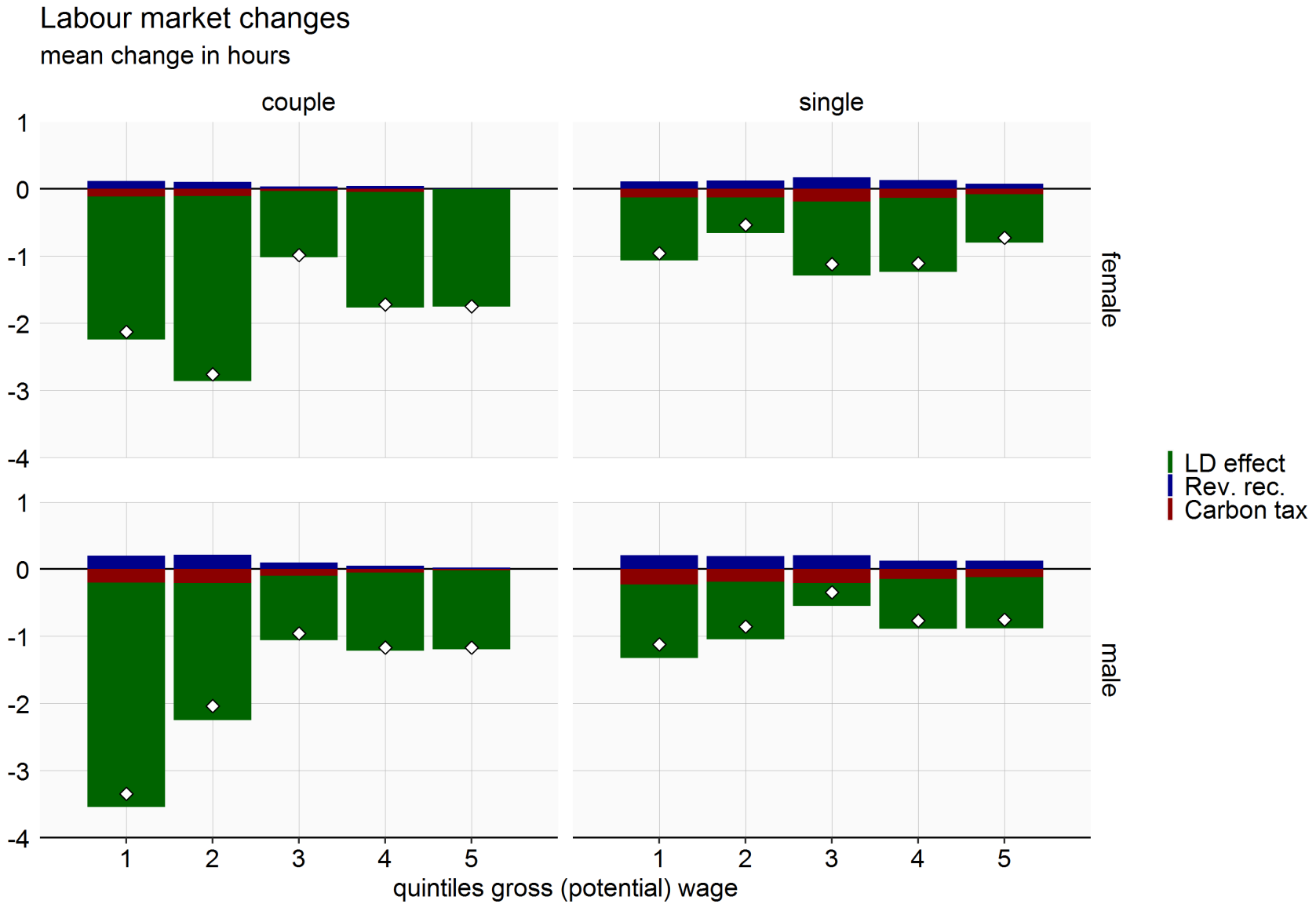

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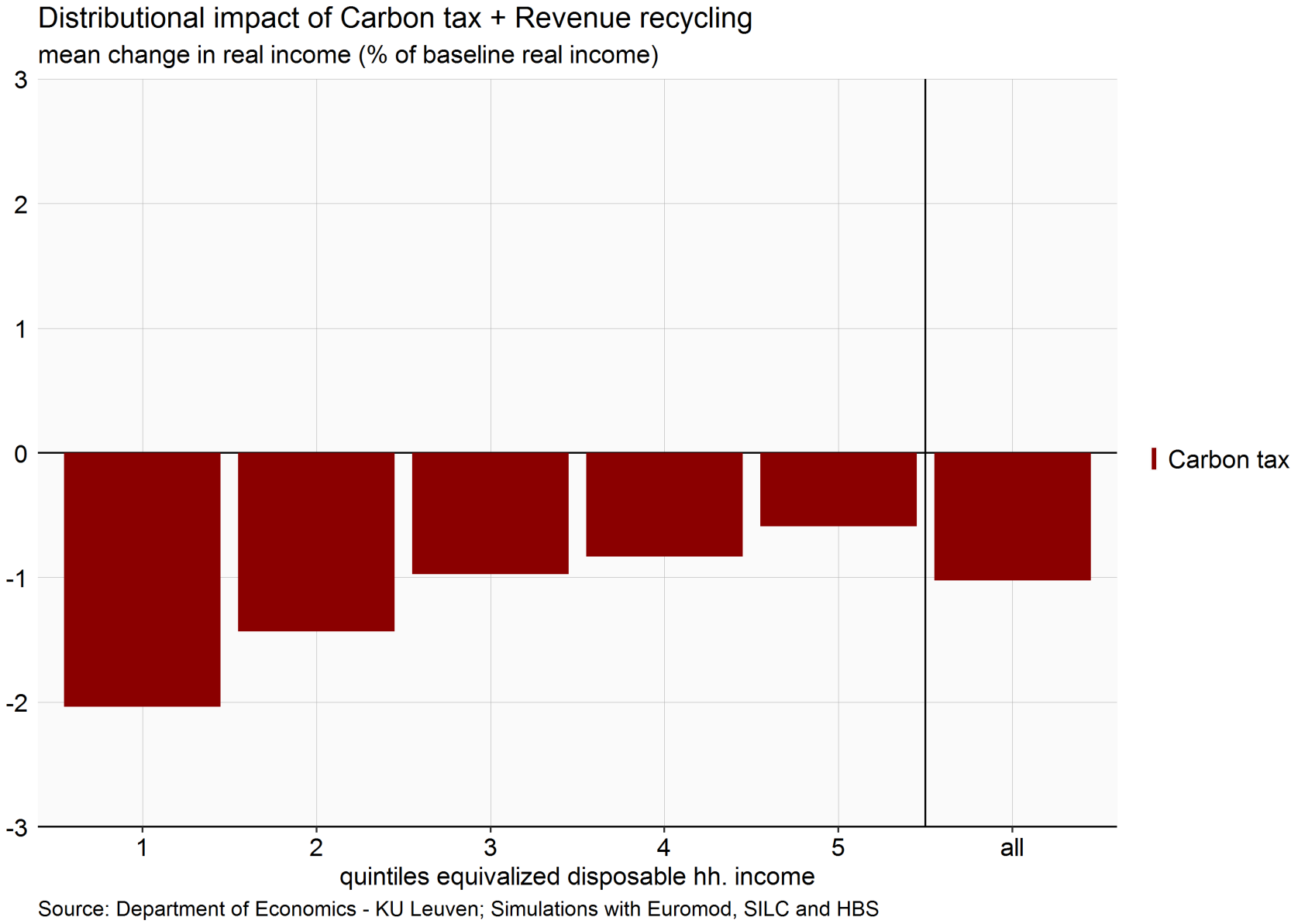
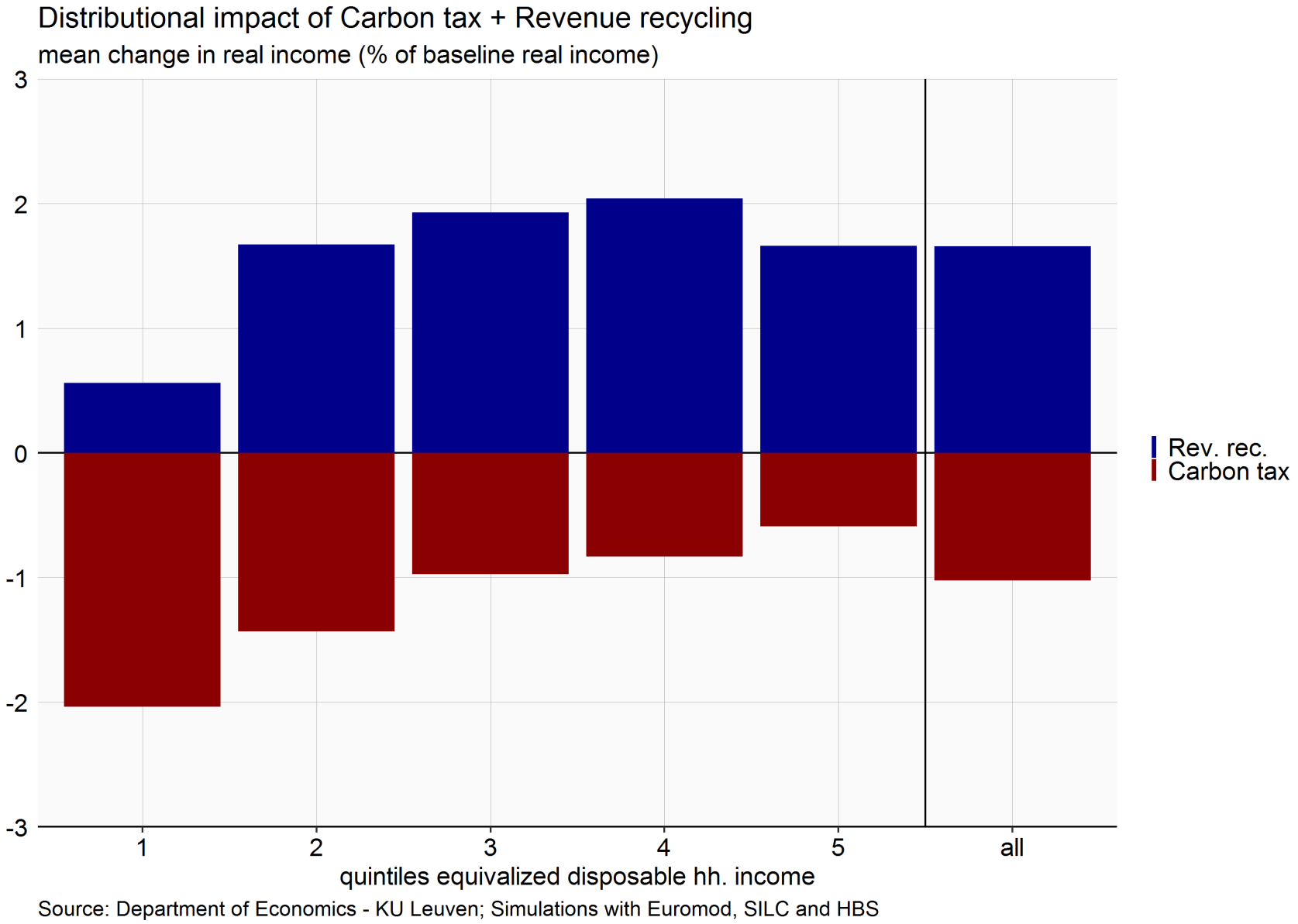
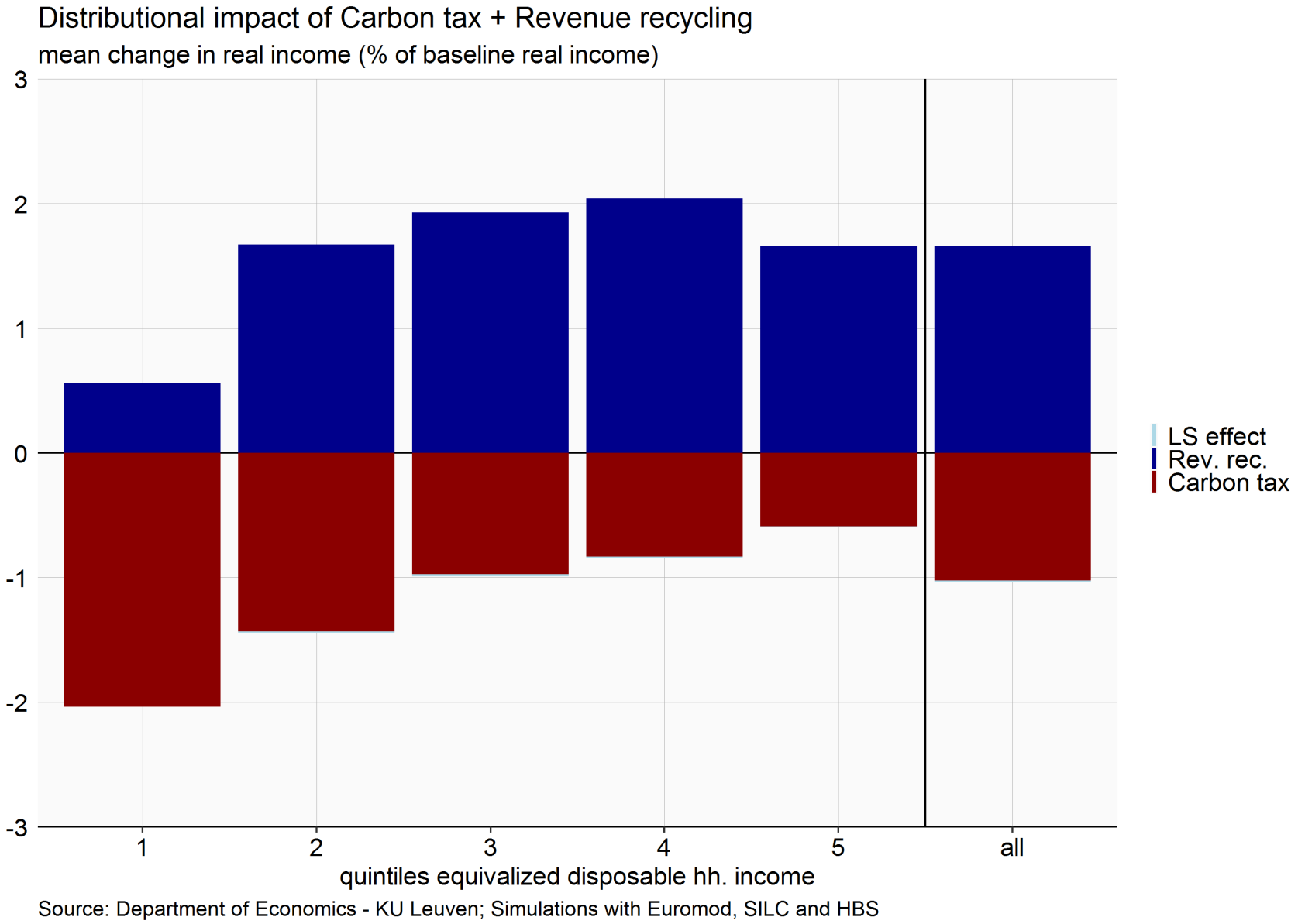
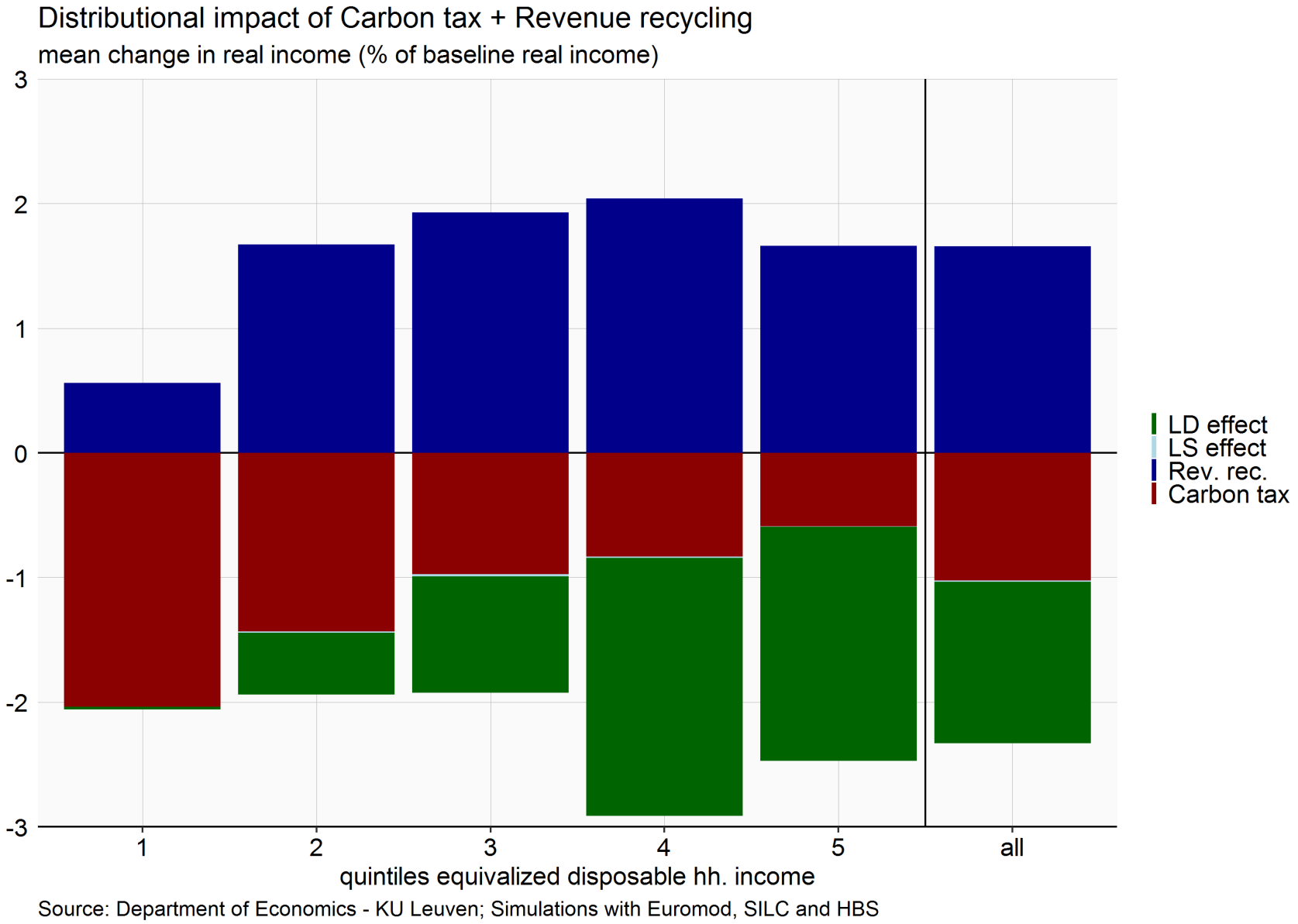

Distributional impact of Carbon tax + Revenue recycling
mean change in real income (% of baseline real income)
3
2
1
0
-1
-2
-3
1
2
3
4
5
all
quintiles equivalized disposable hh. income
Carbon tax
Source: Department of Economics - KU Leuven; Simulations with Euromod, SILC and HBS


Distributional impact of Carbon tax + Revenue recycling
mean change in real income (% of baseline real income)
3
2
1
0
-1
-2
-3
1
2
3
4
5
all
quintiles equivalized disposable hh. income
Rev. rec.
Carbon tax
Source: Department of Economics - KU Leuven; Simulations with Euromod, SILC and HBS


Distributional impact of Carbon tax + Revenue recycling
mean change in real income (% of baseline real income)
3
2
1
0
-1
-2
-3
1
2
3
4
5
all
quintiles equivalized disposable hh. income
LS effect
Rev. rec.
Carbon tax
Source: Department of Economics - KU Leuven; Simulations with Euromod, SILC and HBS



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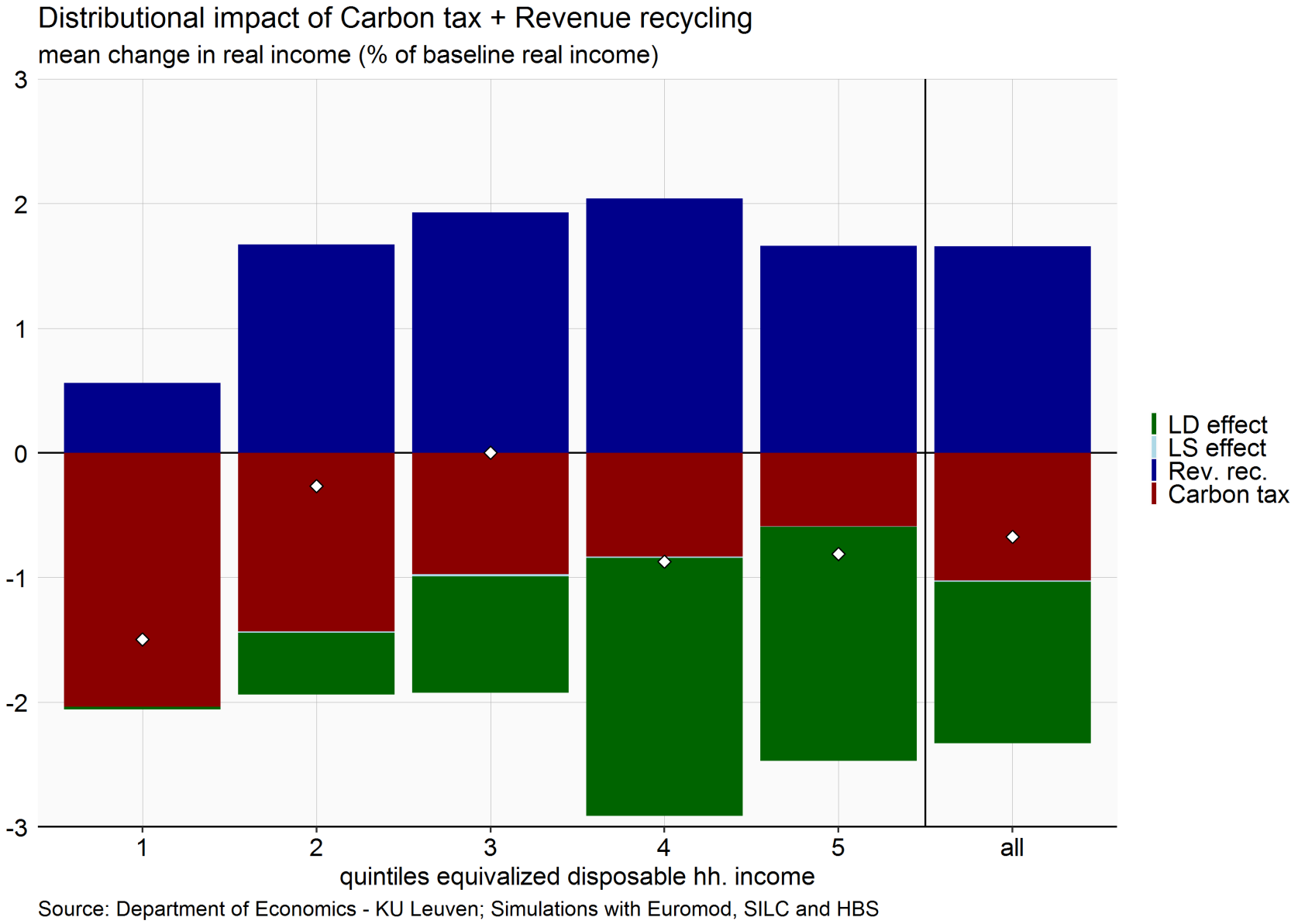

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- Piecemeal modelling strategy:
  - Often overlooked effect of prices on labor supply decisions
  - Two-stage budgeting in RURO framework

- Carbon tax impact on labor supply in Belgium:
  - Negative effect on hours worked
  - ➢ Neutral effect after revenue recycling (lowers EMTRs)

- Labor demand shock
  - Much more important than labor supply response

- Net distributional picture: mechanical impact and labor demand effect

- Limitations and next steps
  - Labour demand effect exogenous
  - Depends on linkage (education/occupation/sector)
  - Complete pass-through of carbon tax to consumers
  - ➢ Link with general equilibrium model for endogenous and granular effects on wages, opportunities and prices

  - Cobb-Douglas assumption driving important mechanisms
    - For construction of “real income”
    - For carbon emissions implied by consumption in the model
  - ➢ Estimate more flexible demand system with substitution away from carbon-intensive goods.

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