The distributional incidence of carbon taxation: The double dividend of redistribution

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Motivation

- Often used argument against a CO2 tax: it increases inequality.

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REVIEW & OUTLOOK

Carbon-Income Inequality

Obama's new energy rule is a huge tax on the poor and middle class.

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President Obama vowed last year that he wouldn't wait on Congress to bless his anticarbon agenda, and the rule his Environmental Protection Agency proposed on Monday is equal to that promise. The agency is bidding to transform and nationalize U.S. energy the way ObamaCare is doing to medicine, but in this case without even the pretense of democratic consent.

- ‘‘Obama‘s new energy rule is a huge tax on the poor and middle class .[…] The lowest 10% of earners pay three times as much as a share of their income for electricity compared to the middle class.‘‘

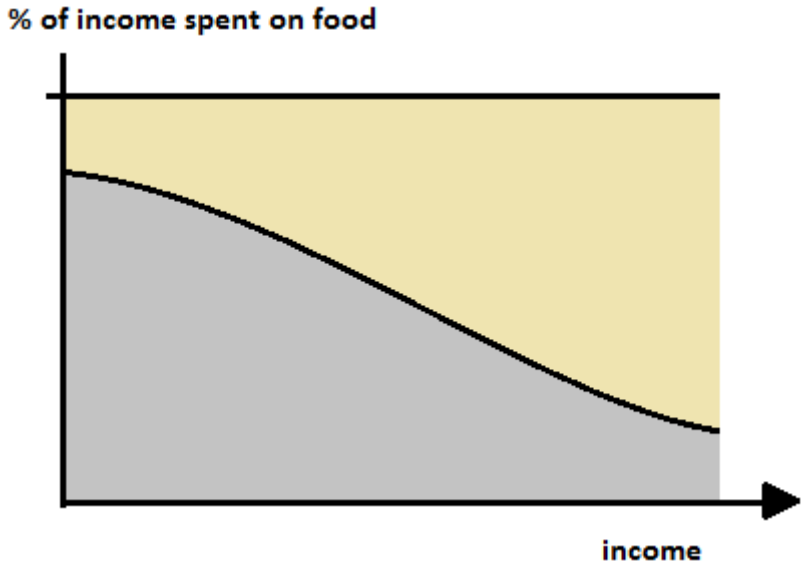
Motivation

- Developing countries: CO2 tax not regressive (Yusuf & Resosudarmo 2007, Sterner 2011)
- CO2 tax can be regressive in industrialized countries (Wier et al., 2005; Hassett and Metcalf, 2009; Bento, 2013)
- …recycling the carbon tax revenues can render a carbon tax reform neutral or progressive (Metcalf 1999, Bento 2009)

Motivation: Mechanism behind regressivity

- Mechanism (Poterba 1991): Low-income households spend a larger share of their income on carbon-intensive goods than high income households.

- Is there an Engel's law for certain types of carbon intensive goods? (Engel, 1857)



Motivation: Is there an Engel‘s law for certain types of carbon consumption?

- Wier et al. (2001), Denmark, U.S. (Herendeen et al., 1981), New Zealand (Peet et al., 1985), Germany (Weber and Fahl, 1993), …
  - CO2 intensities vary strongly between consumption goods.
  - Low-income cohorts: mainly consume carbon-intensive necessities
  - High-income cohorts: "luxury" items with a higher service component.
- Grainger and Kolstad (2008): confirm existence of an Engel’s law for food, electricity and natural gas for U.S.

Outline

- What are the implications of explicitly modeling a subsistence level of polluting consumption when assessing the distributional consequences of a CO2 tax in combination with different recycling mechanisms?

- What is the effect of this assumption in a standard Double Dividend type of model?

- Result preview:
  - Subsistence assumption changes distributional effects of certain revenue recycling mechanisms.
  - Uniform tax cuts (Double Div.) increase inequality and thereby reduce efficiency -> Other mechanisms preferable
  - Optimal level of a carbon tax depends on the recycling mechanism.

Double Dividend - a reminder

- "Weak" Double Dividend: using the revenue from carbon taxation to cut distorting taxes (instead of lump-sum recycling them)
  - ➢ reduces pollution AND
  - ➢ renders the tax system more efficient.

  It thus reduces the gross cost of climate policy.

  Bovenberg (1999), review in Siegmeier et al. (2014).

- We follow the standard Double Dividend approach, but introduce a subsistence level of polluting consumption.

A model of subsistence consumption

Households

- Two consumption goods, clean (C) and polluting (D)
- A minimum level D_0 of the polluting good has to be consumed by each household (Stone 1954, Geary 1950)
- n different households, distinguished only by their productivity ϕ_i
- Households have a choice between working and enjoying leisure time l_i

Firms

- Cobb-Douglas, with labor time T and pollution Z as inputs
- The price on pollution is set by the government

Government

- Maximizes the sum of all utilities minus disutility from pollution
- Has a fixed budget, which has to be financed by labor income or pollution taxation

A model of subsistence consumption

Households

- Labor leisure choice, income tax

leisure

$$U(C_i, D_i, l_i) = C_i^{\alpha}(D_i - D_0)^{\beta} l_i^{\delta}$$

time endowment

$$C_i \cdot p_C + D_i \cdot p_D = (1 - \tau_w) I_i + L_i \qquad I_i = \phi_i w (T - l_i)$$

Government

- Maximizes total welfare W for three different recycling schemes

$$W(C_i, D_i, l_i, Z_C, Z_D) = \sum_{i=1}^{N} U(C_i, D_i, l_i) - \xi(Z_C + Z_D)^{\theta}$$

$$\text{const.} = p_C C_G + p_D D_G = \sum_{i=1}^{N} L_i + \tau_{w,i} I_i + \tau_Z (Z_C + Z_D)$$

A model of subsistence consumption

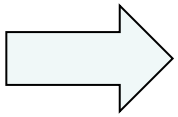
Firm

- Cobb-Douglas, labor and pollution (Z_C, Z_D) as production inputs

$$F_C(T_C, Z_C) = A_C T_C^{\gamma} Z_C^{1-\gamma}$$

$$F_D(T_D, Z_D) = A_D T_D^{\epsilon} Z_D^{1-\epsilon}$$

- Government sets price on polluting input directly



$$w = \frac{\partial F_C(T_C, Z_C)}{\partial T_C} \qquad w = \frac{\partial F_D(T_D, Z_D)}{\partial T_D}$$

$$\tau_Z = \frac{\partial F_C(T_C, Z_C)}{\partial Z_C} \qquad \tau_Z = \frac{\partial F_D(T_D, Z_D)}{\partial Z_D}$$

Model calibration

- Number of households N=5 (quintiles)

- ϕ_i is the share of total income, calibrated to US Data†:

Quintile	lowest	second	middle	fourth	top
Income share	3.2	8.4	14.3	23.0	51.1

† U.S. Census Bureau 'Income, Poverty and Health Insurance Coverage in the U.S. 2011', pre-tax distribution

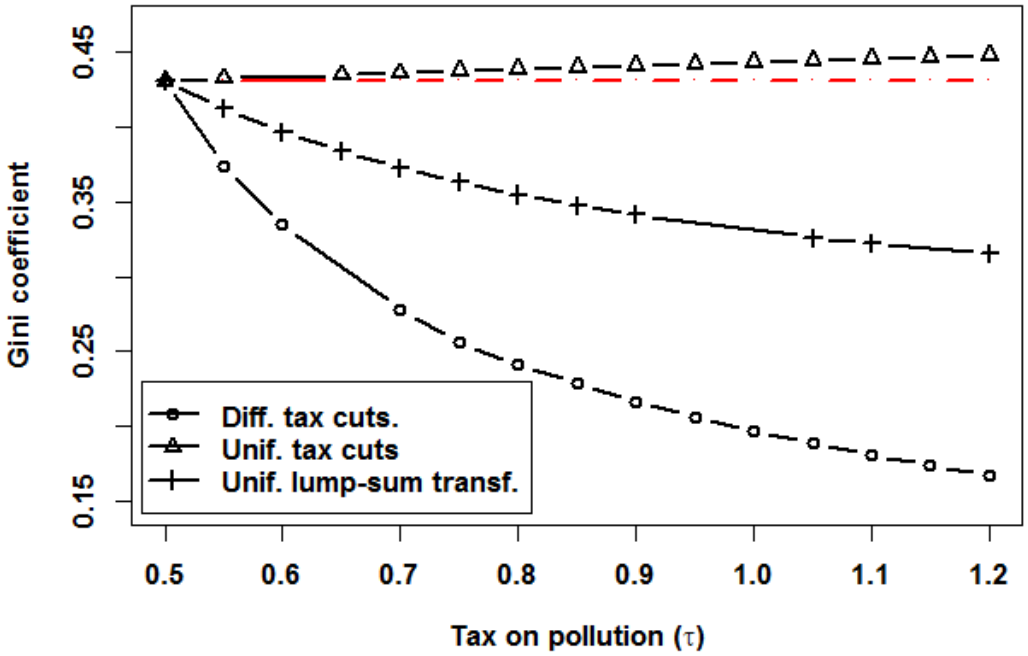
The analyzed scenarios

I. Classic Double Dividend
- Recycling occurs through a *uniform* cut in income taxes

II. Progressive Double Dividend
- Recycling occurs through *differential* cuts in income taxes

III. Uniform lump-sum transfers
- Each household receives the same lump-sum transfer

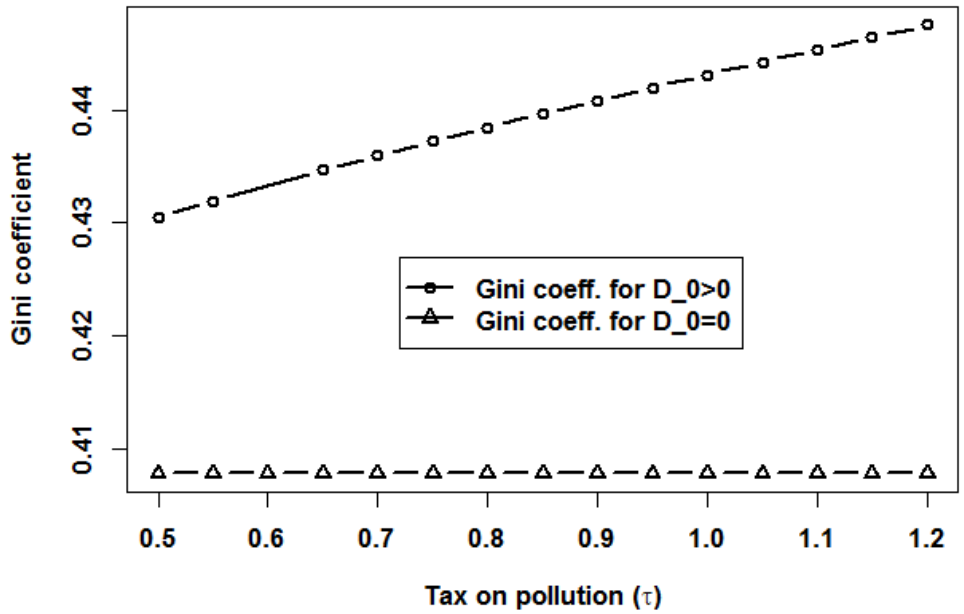
Results: Distribution



- Classic Double Dividend (Unif. Tax cuts) increases inequality
- Progressive Double Dividend (Diff. Tax cuts) reduces inequality the most
- Uniform lump-sum transfers are somewhere in between
  - ➢ Are these results due to the assumption of a subsistence level of polluting consumption?

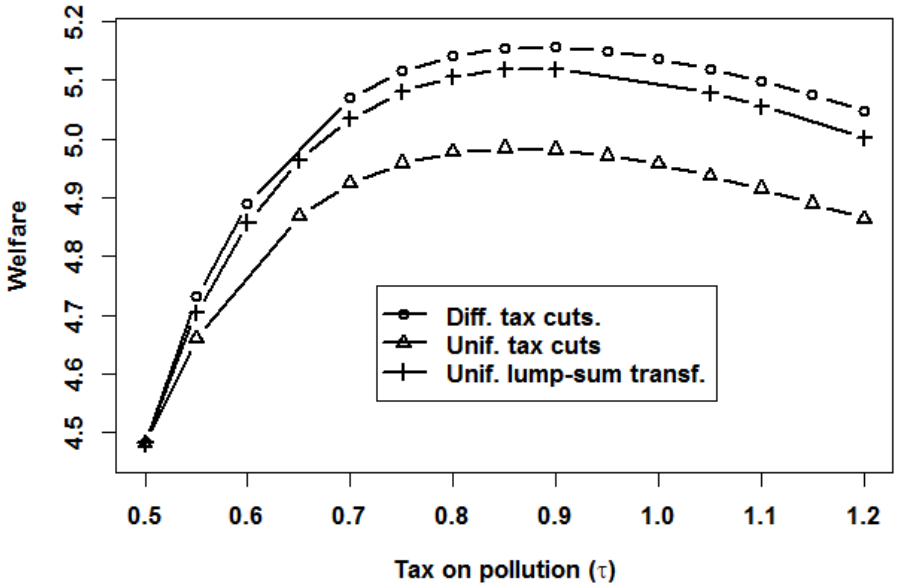
Results: Distribution

Deactivating the subsistence level of polluting consumption (i.e. $D_0 = 0$) for the case of uniform income tax cuts.



The assumption of a subsistence level of polluting consumption is necessary to show that the classic Double Dividend enhances inequality.

Results: Welfare



- A progressive Double Dividend (Diff. tax cuts) yields the highest welfare levels, the classic Double Dividend (Unif. tax cuts) yields the lowest.
- Optimal tax levels depend on the recycling of the revenues:

	tau_Z	Welfare	Gini (U)
Progressive Double Div.	0,885	5,157	0,220
Uniform lump-sum trans.	0,879	5,120	0,344
Classic Double Dividend	0,859	4,984	0,440

Results: Summary

- Accounting for a subsistence level of polluting consumption, changes the effect some revenue recycling mechanisms have on the distribution.
- The classic Double Dividend increases inequality.
- Equity and efficiency not separable: the more progressive the revenues of a carbon tax are redistributed, the higher total welfare levels become.
- Optimal carbon tax levels depend on recycling scheme: the more equity-enhancing the recycling, the higher the optimal tax level.
- Conclusion: Using the revenues from CO2 taxation for a progressive reform of the income tax system, enhances efficiency and equity (and yields higher optimal CO2 tax levels

Results: Policy implications

- Equity and efficiency considerations are not separable when it comes to carbon taxation:

  - Implementing a carbon price requires thinking about revenue redistribution.
  - The model suggests, that differential income tax cuts are the preferred revenue recycling option, since they enhance equity and efficiency.
  - This might be (at least partially) responsible for the unpopularity of implementing a carbon tax: to be efficient and not regressive, it requires a readjustment of the existing income tax system.

- If, for whatever reason, differential income tax cuts are not feasible, lump-sum transfers are still a more viable option than uniform income tax cuts. (As is already done in Switzerland (Imhof, 2012))

Thank you for your attention.

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