

The efficiency and equity of carbon tax revenue recycling: A case study of France

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I. Introduction

Carbon pricing

- ▶ efficient way to mitigate climate change (Pearce, 1991)
- ▶ however, concerns about:
 - ▶ competitiveness distortion
 - ▶ negative impact on the poorest households (Ekins, 1999)
- ▶ social impact depends on use of tax revenues

Two polar views on revenue recycling:

- ▶ reduce distortionary taxes (indirect compensations)
- ▶ redistribute revenues to households through lump-sum transfers (direct compensations)

I. Two polar views on revenue recycling

- ▶ **Indirect transfers** (cuts in distortionary taxes)
 - ▶ usually superior in terms of allocative efficiency (higher employment and GDP)
 - ▶ ... therefore may also improve the situation of the most vulnerable groups
- ▶ **Direct transfers** (lump-sum transfers)
 - ▶ guaranteed compensation to all, including the most vulnerable households (whose energy bills are a large part of income)

This paper

This paper:

- ▶ clearly separates the positive features of the economic model and the normative evaluation of policies.
- ▶ considers macroeconomic behaviours far distant from the well theoretically-founded model of a perfect market economy
- ▶ represents the dilemma between equity and efficiency in a realistic way

Method:

- ▶ model of an open economy in general equilibrium
- ▶ multi-criteria analysis, focus on the equity-efficiency trade-off
- ▶ sensitivity analysis

II. Analytical framework

- ▶ **Comparative statics**: we distort the 'image' of an economy hit by a carbon tax
 - ▶ no optimisation
 - ▶ **'counterfactual retrospective'**: we examine the effect on 2004 France of implementing a carbon tax in 1984
- ▶ **Policies**: two polar schemes and hybrid recycling schemes
- ▶ **Multi-criteria analysis**: two distributive and two aggregate indicators
- ▶ **Central case**: oil importing economy, high pre-existing labour taxes, high final energy consumption, non-clearing labour market, open market for goods
- ▶ **Sensitivity analysis**: terms of trade (also wage rigidities, horizontal inequalities)

The model

- ▶ Model of an open economy in **general equilibrium**
- ▶ 3 types of agents (households, government, firms) and the rest of the world
- ▶ Households are disaggregated into 20 income classes
- ▶ 4 types of production: crude oil, automotive fuels, other energy goods, composite good (all non-energy goods and services)
- ▶ **Hybrid model**: describes energy volumes from the harmonisation of national accounts statistics with energy balances and energy prices statistics in the reference year

Tax revenue recycling: labour tax cuts vs. lump-sum transfers

- ▶ Both options feed demand, but via different channels:
 - ▶ labour tax cuts reduce prices, which benefits external demand
 - ▶ lump-sum transfers feed household budgets and sustain internal demand

III. Results

1. Two polar cases
2. Hybrid recycling schemes
3. Sensitivity analysis

1. Labour tax cuts: a strong form of double dividend

Macroeconomic impacts of a €300/tCO₂ tax recycled in labour tax cuts compared to the case without a carbon tax in 2004

Recycling	labour tax cuts
Total CO ₂ emissions	-34.1%
Real gross domestic product	+1.9%
Effective consumption (aggregate)	+1.5%
Total employment (full time equivalent)	+3.5%
Government expenditure	+5.4%
Real investment	+1.9%
Producer price of the composite good	-1.0%
Labour intensity of the composite good	+1.4%
Effective consumption	+1.5%

- ▶ strong form of **double dividend**: the reform improves the initial overall tax system
- ▶ unemployment decreases, household demand and **consumption** rise

1. Labour tax cuts stop the spread of rising production costs

Sources of variation of the composite producer price if carbon tax proceeds are used to cut labour taxes, compared to the case without a carbon tax

Use of tax proceeds (€300/tCO ₂)	labour tax cuts
Producer Price of the composite good	-1.0%
Decreasing returns to scale and technical progress	+0.1%
Cost of energy	+1.6%
Net wages	+1.5%
Payroll taxes	-3.6%
Other	-0.6%

- ▶ spread of **rising production costs** has stopped, domestic production remains **competitive**
- ▶ counterbalancing force: **upward pressure on wages**, increasing the purchasing power of households

1. Labour tax cuts: increased inequalities

Distributional impacts of a €300/tCO₂ tax recycled in labour tax cuts compared to the case without a carbon tax

Recycling		labour tax cuts
Effective consumption	TOTAL	+1.5%
	Poor (F0-5)	+1.1%
	Lower class (F5-35)	+1.2%
	Middle class (F35-65)	+0.9%
	Upper class (F65-95)	+1.8%
	Rich (F95-100)	+3.8%
	Gini index	+2.0%

- ▶ more consumption **inequality** (consumption of the poor increases less than that of the rich)
- ▶ energy expenses of the poor increase more
- ▶ the poor are closer to their basic needs, and have lower elasticity of substitution between energy and composite

1. Labour tax cuts vs. lump-sum transfers

Macroeconomic impacts of a €300/tCO₂ tax recycled in labour tax cuts or lump-sum transfers, compared to the case without a carbon tax in 2004

Recycling	labour tax cuts	lump-sum transfers
Total CO ₂ emissions	-34.1%	-34.8%
Real gross domestic product	+1.9%	-0.7%
Effective consumption (aggregate)	+1.5%	+0.4%
Total employment (full time equivalent)	+3.5%	+0.3%
Real investment	+1.9%	-0.7%
Producer price of the composite good	-1.0%	+3.7%
Labour intensity of the composite good	+1.4%	+0.8%
Effective consumption	+1.5%	+0.4%

- ▶ comparable levels of **emission reduction**
- ▶ labour tax cuts: **higher employment** and **effective consumption**
- ▶ lump-sum transfers: **rising production costs** spread throughout the economy (higher energy costs are not counterbalanced by lower labour costs)
 - ▶ this leads to degraded terms of trade and lower purchasing power of households, lower demand for domestic products, hence lower employment

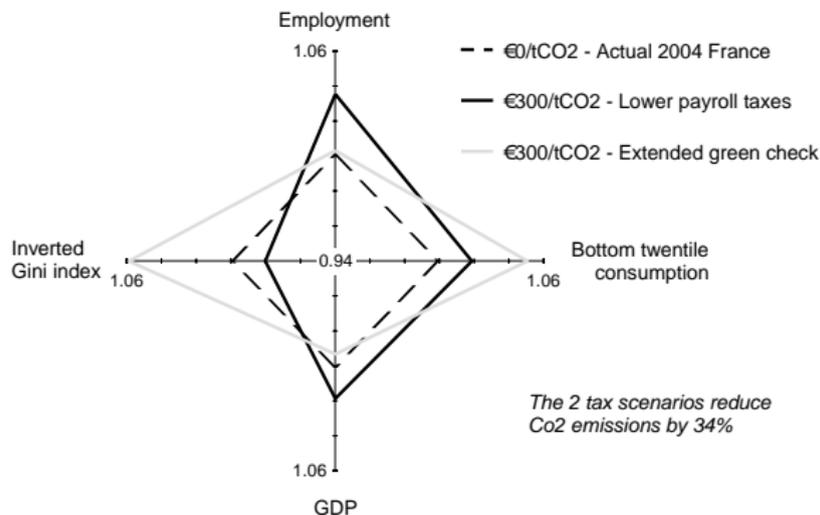
1. Labour tax cuts vs. lump-sum transfers: distributional impact

Distributional impacts of a €300/tCO₂ tax recycled in labour tax cuts or lump-sum transfers, compared to the case without a carbon tax

Recycling		labour tax cuts	lump-sum transfers
Effective consumption	TOTAL	+1.5%	+0.4%
	Poor (F0-5)	+1.1%	+5.1%
	Lower class (F5-35)	+1.2%	+2.7%
	Middle class (F35-65)	+0.9%	+0.2%
	Upper class (F65-95)	+1.8%	-0.9%
	Rich (F95-100)	+3.8%	-0.6%
	Gini index	+2.0%	-5.5%

- ▶ lump-sum transfers are strongly **progressive**
 - ▶ consumption of the poor **increases**, leading to reduction of consumption **inequality**
- ▶ equity-efficiency dilemma between labour tax cuts and lump-sum transfers!

1. A trade-off between equity and efficiency



Variations of the consumption of the bottom twentile and GDP are in real terms. The inverted Gini index is computed on consumption rather than income.

- ▶ the redistributive effect of uniform labour tax cuts does not offset the regressive effect of higher energy bills
- ▶ direct redistribution (lump-sum transfers) narrow inequalities at the cost of lower employment and production

2. Hybrid recycling schemes

- ▶ All include a system of direct compensation to households
- ▶ Funds not used to finance direct compensation are recycled in labour tax cuts
- ▶ Ordered below with increasing share of revenues to lump-sum transfers
- ▶ (a) **Generalised tax credit**: lump-sum to all households, corresponding to the tax levied on basic energy needs (56% of the before-tax energy consumption of the bottom twentile).
- ▶ (b) **Targeted tax credit with accompanying measures**: restricts the previous tax credit to the 80% lower-income households (remaining tax proceeds goes to labour tax cuts), additional measures for the energy poor households (inc. provision of energy efficient equipment)
- ▶ (c) **Mixed recycling**: lump-sum to all households, corresponding to the tax levied on their energy expenses only. The carbon tax levied on production is recycled in labour tax cuts.

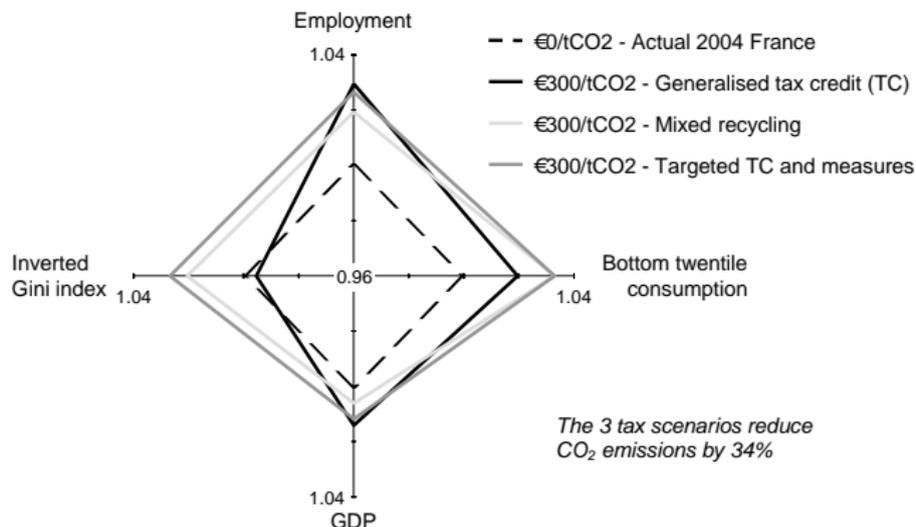
2. Hybrid recycling schemes

Macroeconomic and distributive performance of three hybrid revenue recycling schemes (€300/tCO₂ tax).

Type of direct compensation	Generalised tax credit (1)	Targeted tax credit (2)	Mixed recycling (3)
Share of tax proceeds to lump-sum transfers	+16.3%	+24.3%	+42.8%
Producer price of the composite good	-0.2%	+0.3%	+1.3%

- ▶ the cost of direct compensations depends on the resources devoted to their funding
 - ▶ if larger resources, less revenues available to control the rise of production costs

2. Hybrid recycling: there is room for compromise



The 3 tax scenarios reduce CO₂ emissions by 34%

Variations of the consumption of the bottom twentile and GDP are in real terms. The inverted Gini index is computed on consumption rather than income.

- ▶ the targeted tax credit with measures performs best on all dimensions

3. Sensitivity analysis: set-up

- ▶ Central case:
 - ▶ **flexibility of wages**: elasticity of nominal wages to the unemployment rate = -10%
 - ▶ wages respond negatively to unemployment (tensions in the labour market increase) and positively to consumer prices (workers wish to index their income on the cost of living)
 - ▶ **terms of trade**: domestic price elasticity of exports = -0.06; domestic price elasticity of imports = 0.01
 - ▶ **constraint on public debt**: balanced government budget (i.e. no debt creation)
- ▶ Sensitivity analysis:
 - ▶ **terms of trade**: price elasticities of imports and exports either reduced or increased by 1/3

3. Relatively open economy

Wages: -10% elasticity	Trade (central case)			Relatively open economy		
	labour tax cuts	lump -sum	hybrid	labour tax cuts	lump -sum	hybrid
Employment	+3.5	+0.3	+2.7	+3.8	-0.7	+2.6
Real GDP	+1.9	-0.7	+1.2	+2.1	-1.6	+1.1
Gini index	+2.0	-5.5	-2.6	+2.0	-5.0	-2.4
Cons. of the poorest 5%	+1.1	+5.1	+3.3	+1.4	+3.5	+3.1

- ▶ open economy: more **contrasts** between recycling strategies
- ▶ labour tax cuts clearly superior to lump-sum transfers
 - ▶ labour tax cuts help to maintain low production costs and low domestic prices
 - ▶ crucial to sustain high GDP and employment when domestic producers face international competition
- ▶ distributive parameters: **gap narrows** between options in an open economy
 - ▶ lump-sum transfers directly redistribute wealth but bring lower employment and GDP, which indirectly impacts the ultimate distribution

3. Relatively closed economy

Wages: -10% elasticity	Trade (central case)			Relatively closed economy		
	labour tax cuts	lump -sum	hybrid	labour tax cuts	lump -sum	hybrid
Employment	+3.5	+0.3	+2.7	+3.1	+2.0	+2.8
Real GDP	+1.9	-0.7	+1.2	+1.4	+0.9	+1.3
Gini index	+2.0	-5.5	-2.6	+2.0	-6.3	-2.9
Cons. of the poorest 5%	+1.1	+5.1	+3.3	+0.5	+7.8	+3.6

- ▶ closed economy: trade-off between controlling production costs and redistributing wealth is **less compelling**
 - ▶ the mechanism that would damage the competitiveness of domestic firms when those are hit by a carbon tax is mitigated when assuming a lower price elasticity of imports and exports

What I showed

- ▶ Lump-sum transfers vs. labour tax cuts boils down to a **trade-off** between **controlling production costs** and **redistributing wealth directly**
 - ▶ with lump-sum transfers: rising production costs due to higher energy costs not counterbalanced by lower labour costs
 - ▶ ... but they reduce inequalities
- ▶ **Hybrid** solutions strike a **compromise** by redistributing some wealth to the poorest household while using some revenues to cut labour taxes
- ▶ General conclusion: **no recycling scheme is universally superior**. It depends on:
 - ▶ the economic context
 - ▶ the level of inequalities that a society finds acceptable
 - ▶ this calls for **country-specific analyses**

Thank you!

back-up

The effect of a carbon tax with labour tax cuts

- ▶ Higher production costs, general price inflation, lower aggregate demand
- ▶ **Labour tax cuts** can lower labour costs
 - ▶ **external demand**: increases thanks to reduced labour costs, hence reduced domestic production prices
 - ▶ **internal demand**: overall effect is unclear
 - ▶ domestic agents face higher energy bills ... but lower non-energy prices
 - ▶ employment and income increase thanks to improved trade balance
 - ▶ **wages**: overall effect is unclear
 - ▶ few substitution possibilities on the demand side raise the CPI
 - ▶ workers may succeed in getting higher after-tax wages
 - ▶ ... could cancel out cost reduction from lower labour taxes

The effect of a carbon tax with lump-sum transfers

- ▶ Higher production costs, general price inflation, lower aggregate demand
- ▶ **Lump-sum transfers** do not mitigate price inflation as labour tax cuts do
 - ▶ **external demand** may be reduced
 - ▶ higher energy costs not compensated by lower labour costs
 - ▶ ... which may deteriorate the trade balance
 - ▶ **internal demand** may be sustained
 - ▶ lump-sum transfers feed the budget (but possibly mitigated by lower employment due to lower external demand)
 - ▶ **wages**
 - ▶ again, high CPI: workers may get higher after-tax wages
- ▶ **To sum up: both options feed demand**, but via different channels
 - ▶ labour tax cuts reduce prices, which benefits external demand
 - ▶ lump-sum transfers feed household budgets and sustain internal demand

3. Fully flexible wages

Trade: central case	-10% elasticity of wages (central case)			Fully flexible wages		
	labour tax cuts	lump -sum	hybrid	labour tax cuts	lump -sum	hybrid
Employment	+3.5	+0.3	+2.7	+0.0	+0.0	+0.0
Real GDP	+1.9	-0.7	+1.2	+1.0	-0.9	-0.9
Gini index	+2.0	-5.5	-2.6	+3.1	-5.2	+2.7
Cons. of the poorest 5%	+1.1	+5.1	+3.3	-1.6	+4.6	-1.3

- ▶ central case: labour tax cuts are clearly superior to lump-sum transfers in terms of **employment** and **GDP**
- ▶ fully flexible wages: all recycling strategies have **comparable** effects on employment
 - ▶ fully flexible wages maintain full employment, hence little impact of tax reform on aggregate indicators
- ▶ lump-sum recycling is superior to labour tax cuts, as performs better along the **distributive dimensions**, cf. (Proost and Regemorter, 1995)

3. Fixed wages

Trade: central case	-10% elasticity of wages (central case)			Fixed real wages		
	labour tax cuts	lump -sum	hybrid	labour tax cuts	lump -sum	hybrid
Employment	+3.5	+0.3	+2.7	+10.2	-11.5	-3.2
Real GDP	+1.9	-0.7	+1.2	+7.4	-10.0	-3.5
Gini index	+2.0	-5.5	-2.6	+0.4	+9.4	+9.4
Cons. of the poorest 5%	+1.1	+5.1	+3.3	+6.8	-12.5	-6.8

- ▶ fixed wages: more **contrasts** between recycling strategies
- ▶ labour tax cuts clearly superior to lump-sum transfers
 - ▶ fixed wages: higher real-wage costs (combined with higher energy costs) lead to lower profitability of firms
 - ▶ higher prices to preserve profitability, hence lower demand, investment, employment
- ▶ effect is mitigated with labour tax cuts, cf. (Proost and Regemorter, 1995)

3. Vertical vs. horizontal equity

Impact of the type of distribution considered on policy performance

Trade and wages: central case	Vertical equity (20 income groups)		
	labour tax cuts	lump-sum	hybrid
Employment	+3.5	+0.3	+2.7
Real GDP	+1.9	-0.7	+1.2
Gini index	+2.0	-5.5	-2.6
Consumption of the poorest 5%	+1.1	+5.1	+3.3

Trade and wages: central case	Horizontal equity (6 territorial groups)		
	labour tax cuts	lump-sum	hybrid
Employment	+3.6	+0.3	+2.6
Real GDP	+1.9	-0.7	+1.1
Gini index	+13.4	+35.9	+17.0
Consumption of rural households	+0.0	-4.0	-1.9

- ▶ Very similar results in terms of employment and GDP
 - ▶ second order effect of income distribution on aggregate indicators because of no geographical segmentation of labour market in the model

3. Vertical vs. horizontal equity

Impact of the type of distribution considered on policy performance

Trade and wages: central case	Vertical equity (20 income groups)		
	labour tax cuts	lump-sum	hybrid
Employment	+3.5	+0.3	+2.7
Real GDP	+1.9	-0.7	+1.2
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- ▶ Results greatly differ along equity indicators
 - ▶ share of energy expenditures in household budget varies more according to the degree of urbanization (between 2.5% and 9.5%) than according to income (between 5.3% and 8.5%)

3. Vertical vs. horizontal equity

Impact of the type of distribution considered on policy performance

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Gini index	+13.4	+35.9	+17.0
Consumption of rural households	+0.0	-4.0	-1.9

- ▶ Both lump-sum and hybrid recycling **increase inequalities**: counter-intuitive?
 - ▶ revenue recycling options do not distinguish between rural and urban households
 - ▶ lump-sum transfers very small compared to the burden of the tax on rural households, who may disproportionately suffer from lower GDP and employment

The model

Monetary and physical accounting
(Energy in ton oil equivalent)

