

# 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/tCO<sub>2</sub> tax recycled in labour tax cuts compared to the case without a carbon tax in 2004*

Recycling	labour tax cuts
Total CO <sub>2</sub> 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 <sub>2</sub> )	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/tCO<sub>2</sub> 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/tCO<sub>2</sub> 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 <sub>2</sub> 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

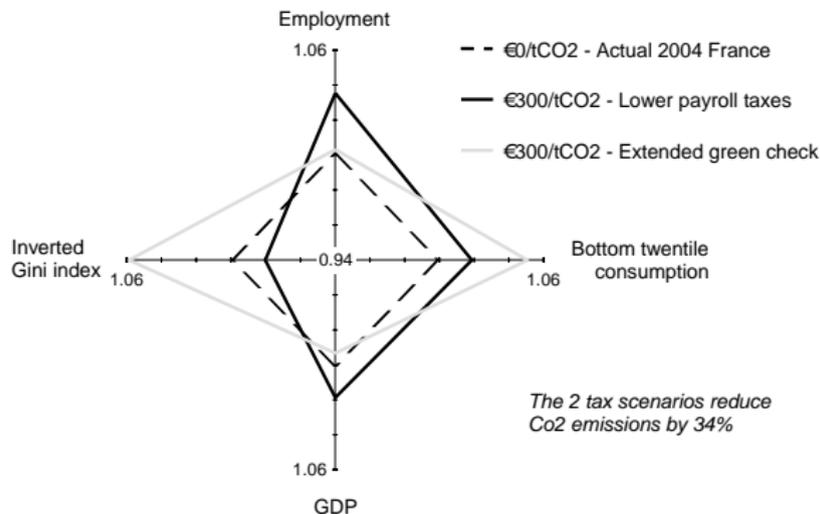
# 1. Labour tax cuts vs. lump-sum transfers: distributional impact

*Distributional impacts of a €300/tCO<sub>2</sub> 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.

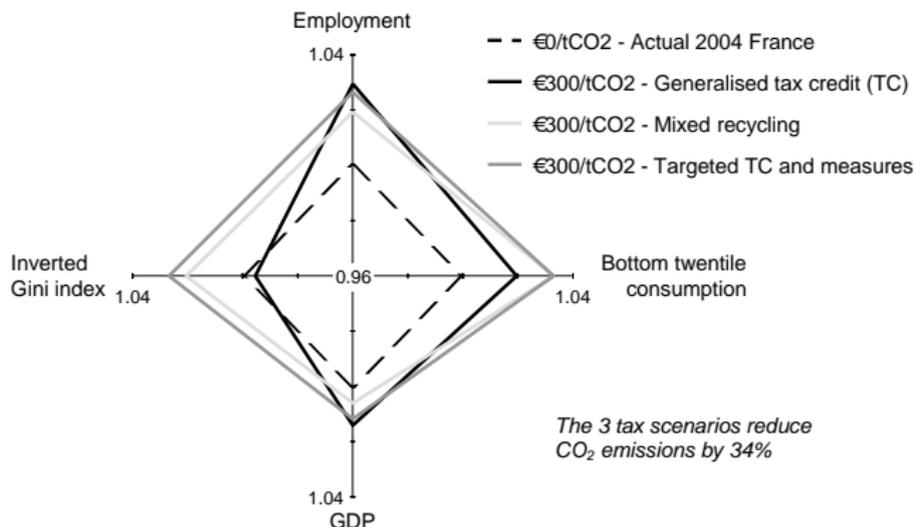
## 2. Hybrid recycling schemes

*Macroeconomic and distributive performance of three hybrid revenue recycling schemes (€300/tCO<sub>2</sub> 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 CO<sub>2</sub> 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*

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

- ▶ 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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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

- ▶ 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)

