From shadow to green: linking environmental fiscal reforms and the informal economy

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BASQUE CENTRE FOR CLIMATE CHANGE
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OUTLINE

1. Introduction
2. Case study
3. Model
4. Results
5. Concluding Remarks

1. INTRODUCTION

- Environmental fiscal reform (EFR) and the “double dividend” (DD):

  - introducing environmental taxes

  - using revenues to reduce other (distortionary) taxes

  - improves not only the environment but also the economy

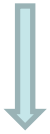
- Reviews of the literature agree that:

  “Switching taxation from labour to energy/carbon can increase welfare, employment and reduce emissions”

- **SIZE**?

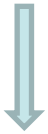
1. INTRODUCTION

- No research so far relates Environmental fiscal reform (EFR) and the **shadow economy**



"production activities that are legal but deliberately concealed from public authorities in order to avoid

- paying taxes
- meeting legal standards (minimum wages, maximum hours)
- complying administrative procedures"



Informal employment (informal labor market)

1. INTRODUCTION

- Why may be important the relationship between **EFR** and the **shadow economy**?

(i) Labour taxes affect the decision to work formal or informally

(ii) Informal markets represent a relevant (and growing) part of GDP

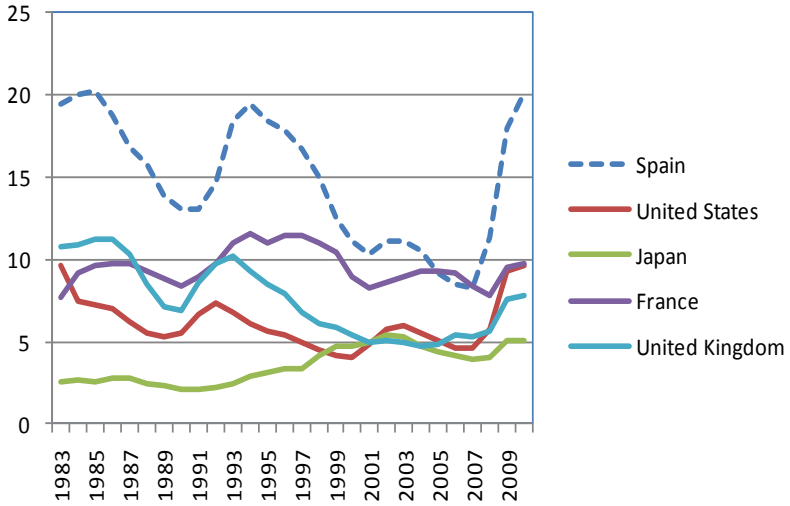
(iii) Reducing the shadow is an important policy target (distortions in efficiency, competition and equity)

1. INTRODUCTION

- Equal yield tax reform:
- Revenues from **CO2 tax used to** reduce
  - taxes on labour (TaxL)
  - taxes on capital (TaxK)
  - to make lump sum transfers to consumers (LST)
- We also take account of the ancillary benefits on local air pollutants.

2. Case study: Spain

High unemployment rate



High shadow economy

Size of shadow economy 2005	
Greece, Italy, Spain, Portugal and Belgium	21-29%
Norway, Sweden, Denmark, Ireland, France, The Netherlands, Germany and Great Britain	12-18%
Japan, Austria, United States and Switzerland	8-10%
Spain (Arrazola et al 2011)	19-23%

Buehn and Shneider (2011)

- Low environmental taxation

- EFR Spain: Lanvandeira et al 2001, 2004, etc., Manresa y Sancho 2005

3. Model: standard structure

- We use an Applied General Equilibrium (AGE) model
- Main features similar to previous studies
  - Single household + 9 sectors
  - Revenue neutral, small open economy, etc.
- Difference with previous models are in the **labour market**
  - involuntary unemployment
  - Formal and informal labour (shadow economy)

3. Model: labour market

- Unemployment, in the formal market, is determined by a "wage curve":

$$\frac{w_F}{p} = \left(\frac{u}{\bar{u}}\right)^{-\theta}$$

(Blanchflower and Oswald, JEL1995):

- Real wage $\frac{w_F}{p}$ is a declining function of u

- θ is an elasticity parameter that measures the sensitivity of the wage rate to the unemployment rate

- Estimation of θ: around 0.1 (Blanchflower 1995, 2005 and others):
  - Doubling of U (100% increase) ->10% decline in real wages

3. Model: labour market

- We model **formal and informal labor** as **imperfect substitutes** using a CES function

  $\delta_j \longrightarrow$ share of informal employment (sector j) in the benchmark

  $\sigma_L \longrightarrow$ elasticity of substitution between formal and informal labour

- Mobility between formal and informal labour is determined by
  - an endogenous parameter (m)
  - an equilibrium condition: $w_I = w_F (1 - u)$

Harris and Todaro, AER 1970
Rutherford and Miles, 2001

informal wage

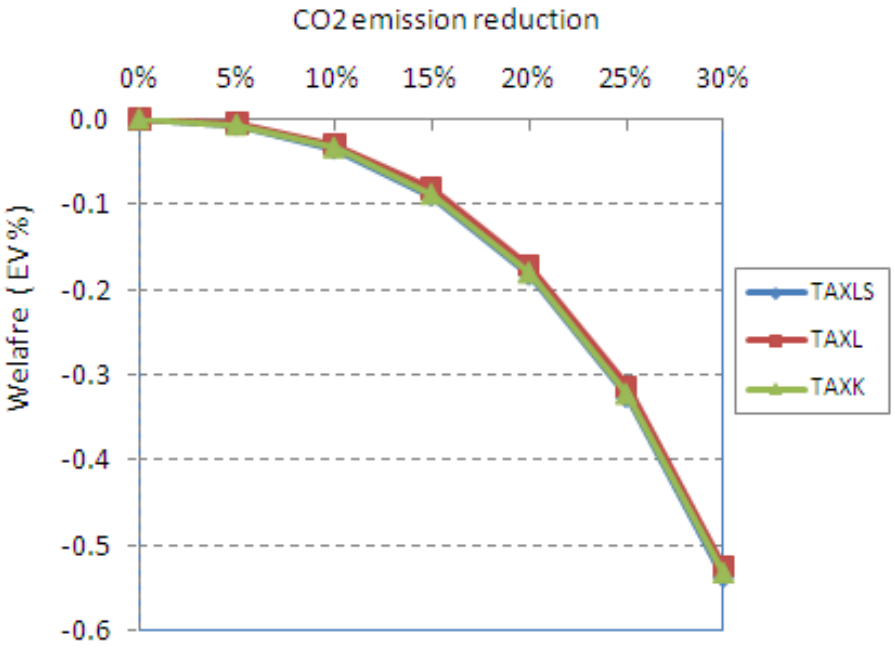
formal "expected wage"

3. Model: calibration

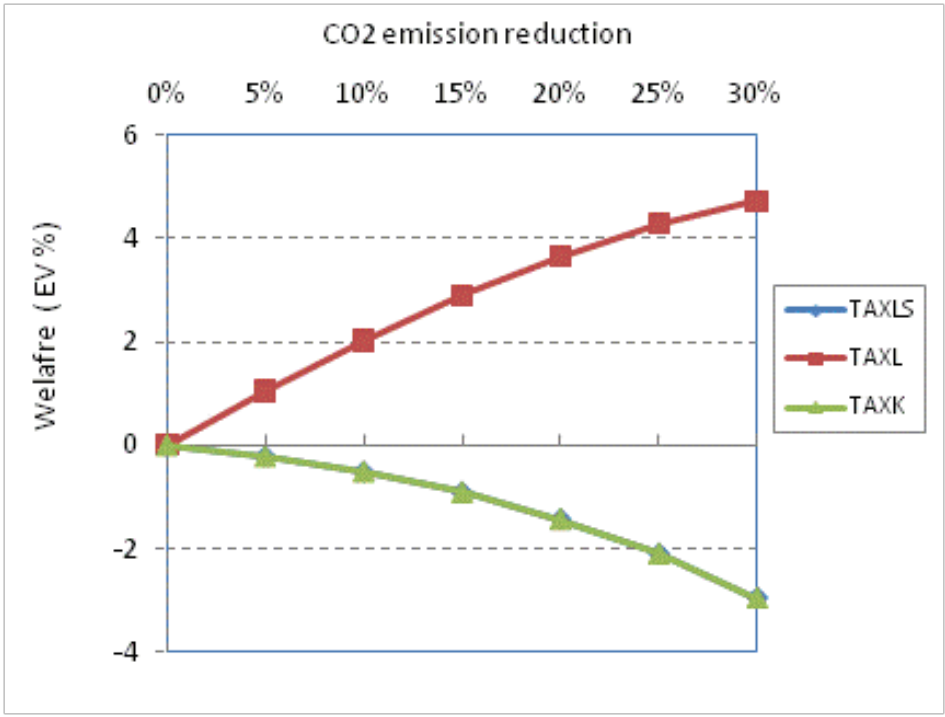
- Symetric IO table for Spain 2005 (INE 2009a)
- Sectoral emissions (Enviromental Accounts, INE 2009b)
- Elasticities from literature
- Official Unemployment U=20%
- Shadow Economy: S= 20%
- Damage from emissions:
  - CO2-eq. European Commission (2009): range 17-33€/tCO2
  - Local pollutants. ExternE project and Markandya et al. (2010)

4. Results: general

- Mobility not allowed $\sigma_L = 0$
- unemployment fixed $\theta \to \infty$
- **Weak DD if TaxL are reduced**



- Mobility $\sigma_L = 5$
- flexible unemployment $\theta = 0.1$
- **Strong DD if TaxL are reduced**



4. Results: general

- Why is welfare increasing in TAXL scenario?
- Increases the demand (and price) of formal labour:
  - Lower labour taxes
  - Economic structural change: tax on CO2 affects more capital/energy intensive sectors and less to labour intensive
- As a result, unemployment (U) and the shadow economy (S) are reduced
- The higher the CO2 tax, the higher the welfare increase:
  - more revenues to reduce labour taxes
  - higher increase in the demand for labour.
- This effect would continue until U or S are zero
- The opposite happens in TAXK and TAXLS scenario

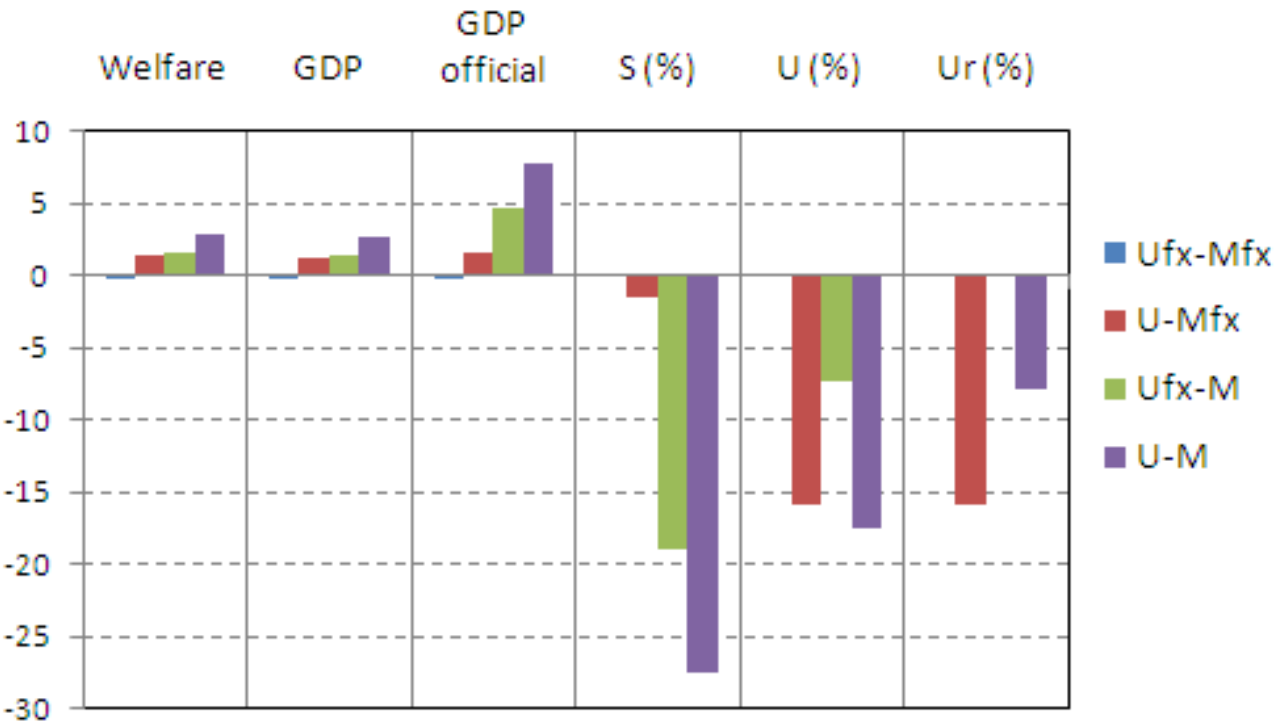
4. Results: general

- Results for a reduction of 15% in CO2 emissions (tax 46.2€/tCO2) and reducing taxes on labour (TaxL)
  - Welfare gain (EV) ~ 3%
  - Official GDP could increase ~ 7%
  - Official unemployment falls ~ 3%
  - Shadow economy falls ~ 5%
  - (An extra 0.3-1% on “green” GDP if environmental damage is accounted)

4. Results: the effect of labour market conditions

Reduction of 15% in CO2 emissions

- Mobility between formal and informal sector
  - **M** (σ_L=5)
  - **Mfx** (σ_L=0)
- Formal unemployment flexibility
  - **U** (θ=0.1)
  - **Ufx** ($\theta = \infty$)

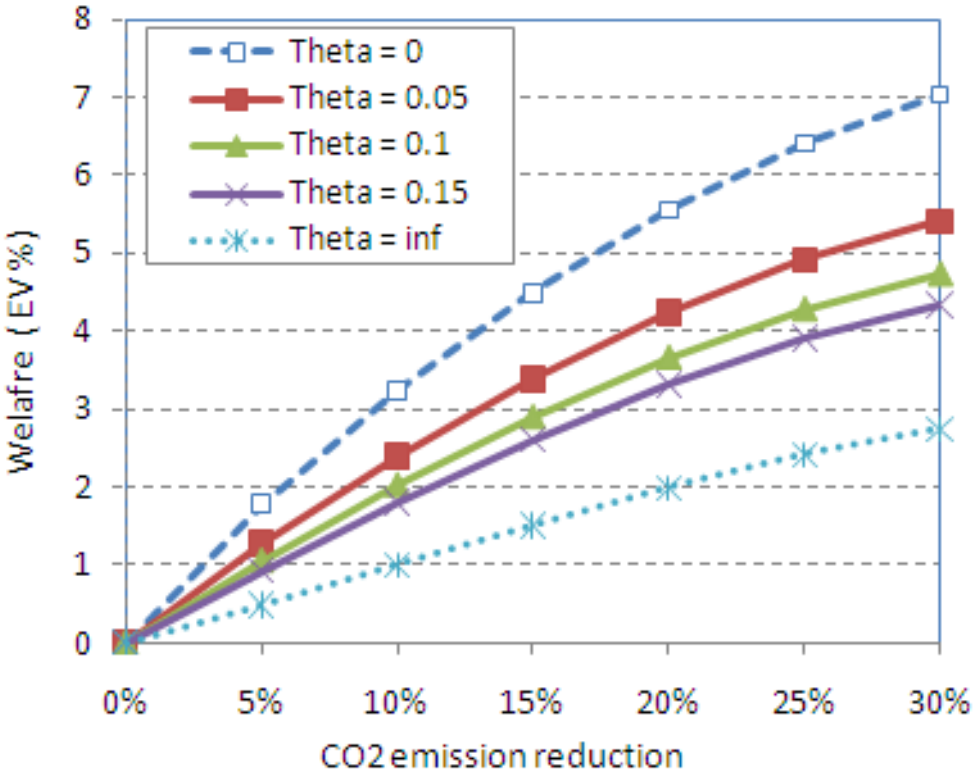


4. Results: Sensitivity analysis

- Sensitivity analysis of the key parameters of the model:
  - size of the shadow economy (So)
  - size of official unemployment (Uo)
  - unemployment flexibility (θ)
  - substitutability between formal and informal labour (σ_L)
  - sectoral distribution of the shadow economy (δ_j)

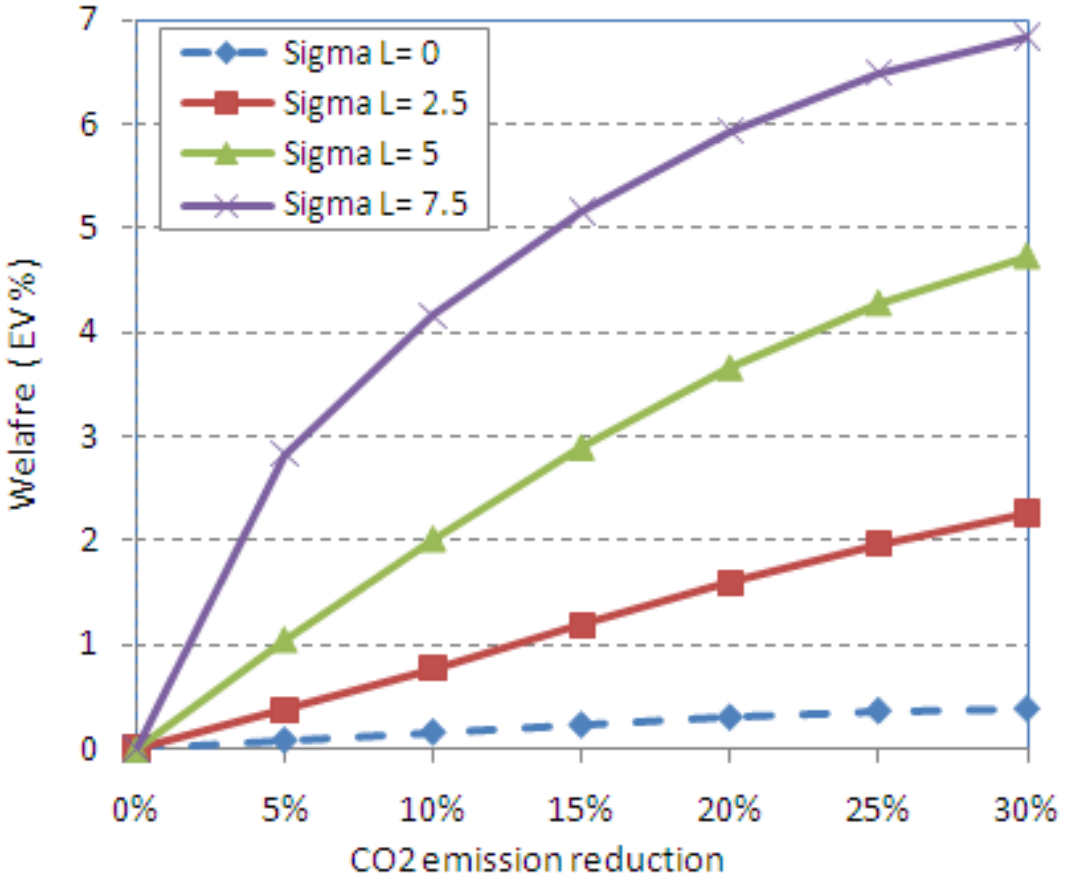
4. Results: Sensitivity analysis

- Unemployment flexibility (wage curve elasticity parameter: θ)
- Base case: θ = 0.1



4. Results: Sensitivity analysis

- Mobility between formal and informal sector
- Base case: $\sigma_L = 5$



6. Concluding remarks

- We analyse the role of shadow economy in an environmental tax reform.
- Standard AGE model for Spain with: involuntary unemployment and formal and informal labour link.
- If the shadow economy is considered, a strong double dividend is more likely when revenues from a tax on CO2 are used to reduce labour taxes.

Thanks

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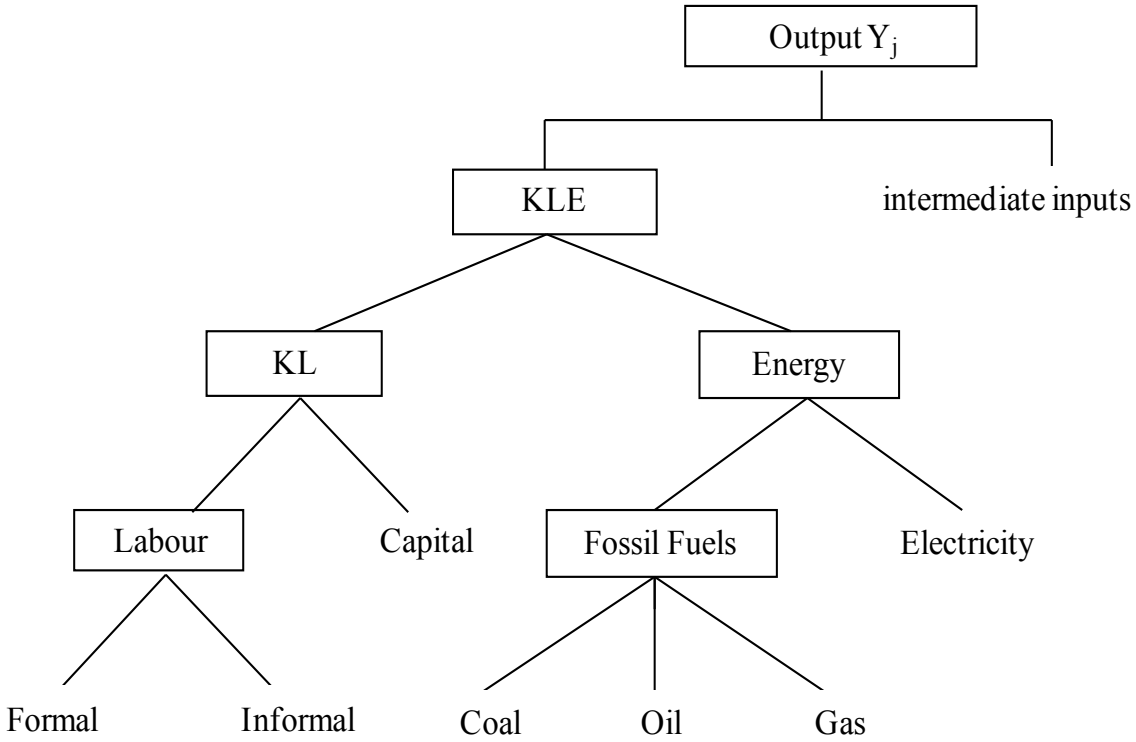
6. Concluding remarks

Limitations of the study:

- CGE model is highly stylized and static: results are trends and will happen in some years.
- Trade impacts are restricted in the model and effects on competiveness are not fully incorporated.
- Results are strongly dependant on substitutability between formal and informal labour (uncertainty about (σ_L))

3. Model: production function (4/4)



Source: MIT-EPPA model (Babiker et al 2001)

Elasticities of substitution in production, trade and consumption

Material inputs and Capital-Labour-Energy	0
Capital-Labour and Energy	0.25
Capital and Labour	1
Formal labour and informal labour	5
Electricity and Fossil Fuels	0.5
Coal, Oil and Gas	1
Domestic and imported goods	3
Domestic goods and exports	3
Consumption of energy and non energy goods	0.5
Consumption of energy goods	1
Consumption of non energy goods	1

Source: MIT-EPPA Babiker *et al*. (2001), expect formal and informal labour that is our own

4. Results: general

- Results for a reduction of 15% in CO2 emissions (part I)

	Alternative Tax Recycling		
	LST	TaxK	TaxL
General (% change in volumes)			
Welfare	-0.91	-0.91	2.89
GDP	-0.83	-0.83	2.62
GDP official	-1.55	-1.55	7.65
General (change in % points)			
Shadow Economy (base S=20%)	0.88	0.88	-5.62
Unemployment official (base U=20%)	1.18	1.17	-2.93
Unemployment (base Ur=10.9%)	0.61	0.60	-0.87
Tax Burden (base=14.5%)	0.33	0.35	-2.20
Private consumption (% change in volumes)			
Agriculture	-0.99	-1.81	1.17
Energy	-2.67	-3.04	0.53
Industry	-1.68	-2.09	1.95
Construction	-0.62	-0.70	3.70
Transport	-1.65	-1.23	1.76
Services	-0.32	-0.21	3.74

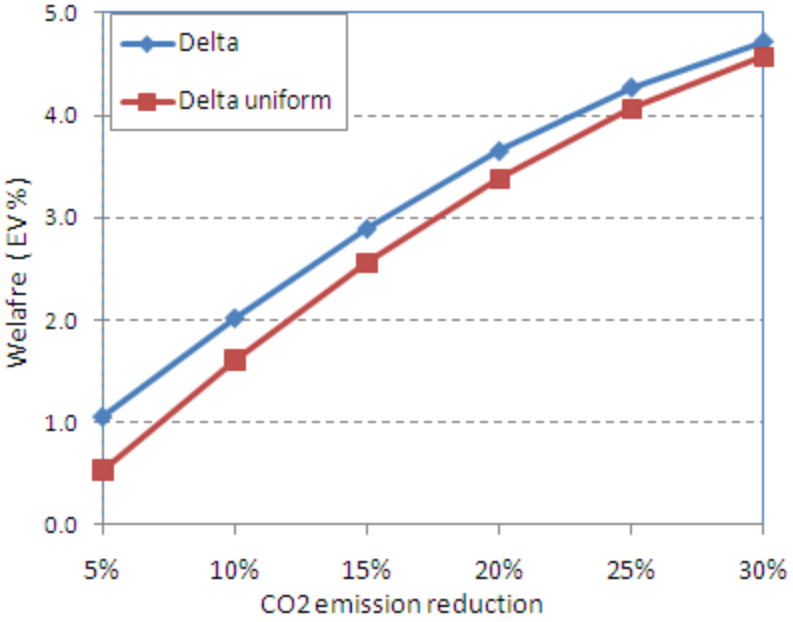
4. Results: general

- **Results for a reduction of 15% in CO2 emissions (part II)**

	Alternative Tax Recycling		
	LST	TaxK	TaxL
Energy consumption by source (% change in volumes)			
Coal	-34.4	-34.4	-37.1
Oil	-9.63	-9.52	-9.10
Gas	-1.76	-2.20	0.72
Electricity	-2.77	-2.92	0.06
Emissions (% change in volumes)			
CO2 emissions	-15.0	-15.0	-15.0
CO2 tax (€/tCO2)	33.9	33.8	46.2
Prices (% change)			
Capital price index	-2.15	-0.08	0.75
Formal labour price index	-0.43	-0.44	0.66
Informal labour price index	-1.53	-1.55	2.26

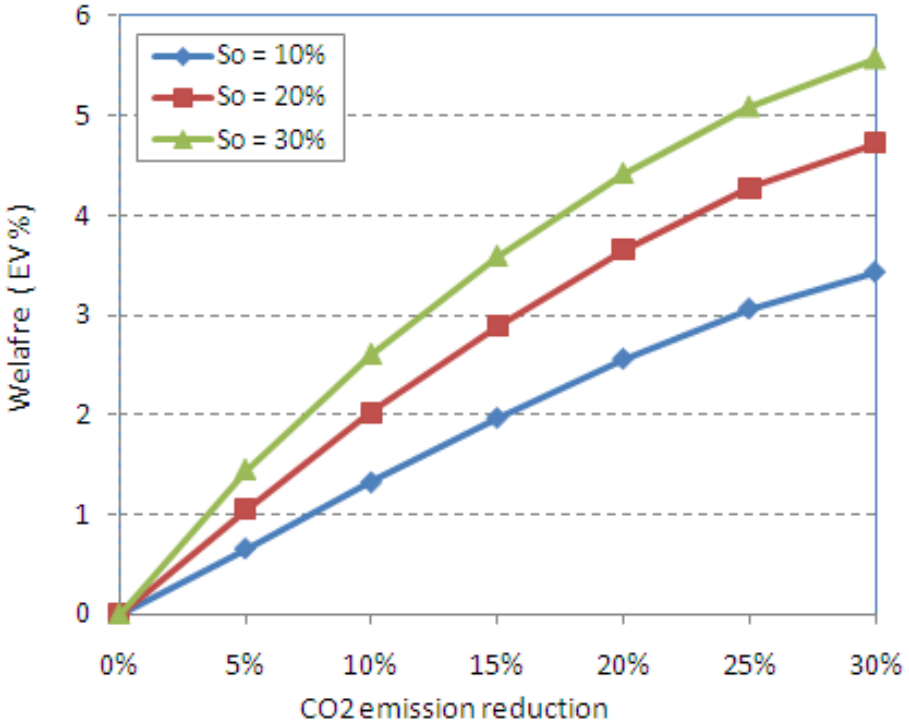
4. Results: Sensitivity analysis

- Distribution of informal labour among sectors (δj)
- Benchmark: Based on Hvidtfeldt 2011
- Alternative: Uniform distribution



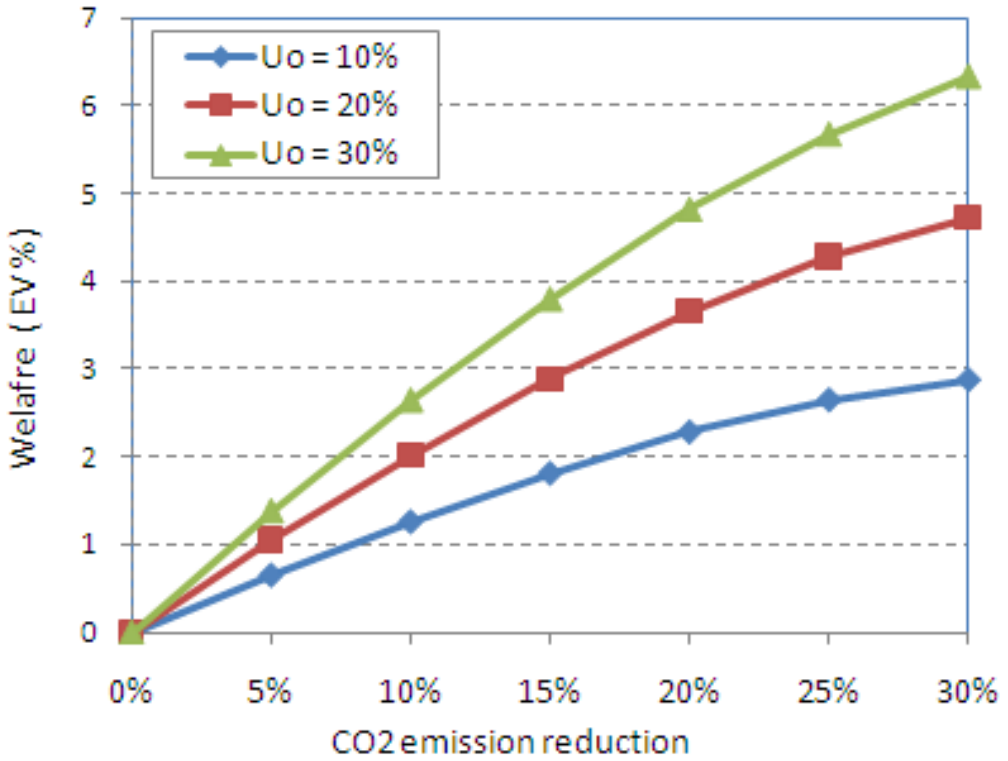
4. Results: Sensitivity analysis

- Size of the shadow economy in the benchmark (So)
- Base case: So =20%



4. Results: Sensitivity analysis

- Size of the official unemployment in the benchmark :Uo
- Base case: Uo =20%



5. Results: ancillary benefits of CO2 reductions

- Local pollutants will also decline
- Estimated cost avoided for TaxL: between 0.9 and 1.7 billions

	Alternative Tax Recycling		
	LST	Tax K	Tax L
Environmental Impact (% change in volumes)			
CO2	-15	-15	-15
SO2	-3.5	-3.6	-0.8
NOX	-2.7	-2.8	0.6
NMVOC	-3.5	-3.8	0
CH4	-3.1	-3.2	0
N2O	-3.7	-4.1	-0.5
NH3	-4.2	-4.7	-1
PPM	-3.7	-3.9	-0.5
Damage avoided (M€)			
CO2-eq. (High estimation)	1818.8	1824.6	1752.2
CO2-eq. (Low estimation)	977.6	980.7	941.8
Rest of Pollutants	425	449.2	38.2
Total Damage as % of GDP			
High estimation (Base=3.8%)	2.90%	2.90%	2.70%
Low estimation (Base=2.4%)	2.20%	2.20%	2.10%