

Implicit CO₂ prices of fossil fuel use in Switzerland

Switzerland's CO₂ policy goal:

20 percent domestic reduction of CO₂ emissions by 2020

Question to be analyzed:

How efficient is the current Swiss policy mix to attain this goal?

What is new:

Question is answered by simultaneously taking into account:

- Domestic external costs of fossil fuel use
- Fiscal taxes on fossil fuels
- Problem that motor fuel charges are not the first-best instrument to internalizing mileage-dependent external costs

In this context, the novel concept of implicit CO₂ price is introduced.

The multiple externality problem of fossil fuel use

The burning of fossil fuels causes:

- Global external costs: Global warming due to CO₂ emissions
- Domestic external costs: e.g. air pollution due to PM₁₀ emission

Costs of global warming are extremely difficult to monetize.

→ Price-standard approach is an appropriate alternative to Pigouvian taxes

Quantification of domestic external costs is not an easy task either but its results are less contentious.

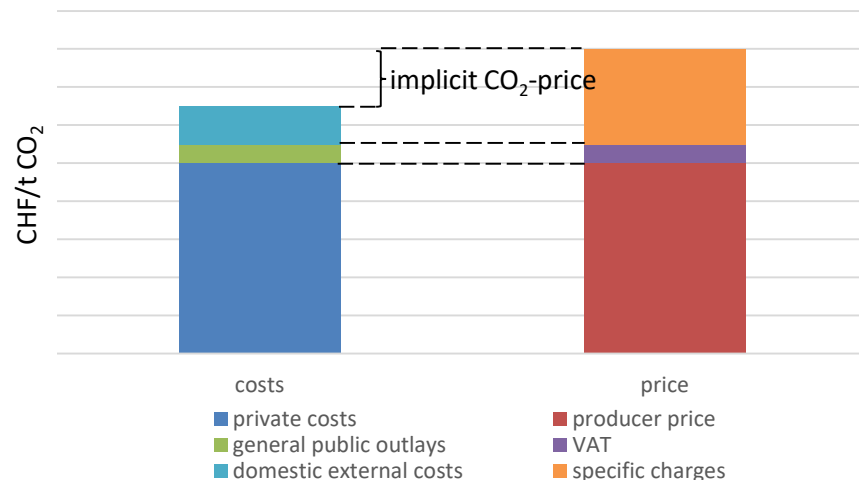
Efficient policy mix consists of:

- Pigouvian tax with a rate that equals domestic external costs and varies for different fossil fuel uses
- Plus a uniform CO₂ price for all fossil fuels

The implicit CO₂ price

Within the context of multiple externalities the implicit CO₂ price is defined as:

Current consumer price of fossil fuel minus efficient domestic fossil fuel price



Efficient domestic fossil fuel price consists of:

- Private production costs (assuming to equal producer price)
- Mark-up to finance public expenditure (mirrored by a uniform VAT rate)
- Domestic external costs of fossil fuel use

With a uniform VAT, the implicit price is simply the difference of specific charges and domestic external costs (s. Figure).

The uniformity of the implicit CO₂ price is taken as efficiency indicator of the current CO₂ policy.

Results: Road traffic

Passenger cars

	(1) CHF/l	(2) CHF/vkm	(1) + (2) CHF/t CO ₂
Total external costs	0.12	0.13	748
Total charges	0.75		313
Difference charges minus external costs	0.63	0.13	-435
Pigou tax rate ($\rho = 0.5$) on fuel use	0.96		400
Implicit CO ₂ price ($\rho = 0.5$)	-0.21		-87

Heavy good vehicles

	(1) CHF/l	(2) CHF/tkm	(1) + (2) CHF/t CO ₂
Total external costs	0.36	0.11	1'114
Total specific charges	0.77	0.09	1'100
Difference charges minus external costs	0.41	-0.02	-13
Pigou tax rate ($\rho = 0.5$) on fuel use	0.59		224
Implicit CO ₂ price ($\rho = 0.5$)	0.19		72

Note: A fuel charge is an imperfect substitute of a mileage-dependent charge, since it impacts fuel efficiency. In this case, the optimal fuel tax rate is:

$$t_P = MEC_{fuel} + \rho\gamma MEC_{distance}$$

ρ : share of tax-induced fuel reduction due to reduced driving
 γ : fuel efficiency

The implicit CO₂ price for passenger cars is negative, i.e. the current price is below its efficient price.

The implicit CO₂ price for heavy goods vehicles is 72 CHF/t CO₂ which is close to the explicit CO₂ levy of 84 CHF/t CO₂ on heating oil and natural gas.

Results: Passenger aviation

	CHF/t CO ₂
External costs	
Air pollution	28
Noise	36
Accidents	2
Total external costs	66
Specific charges	
Air pollutant charge	1
Noise charge	12
Missing VAT on aviation fuel	-18
Total charges	-5
Charges minus ext. costs = implicit CO ₂ price	-71

- The specific charges do not cover external costs.
- There is not VAT levied in aviation fuel.
- As a result, the implicit CO₂ price is clearly negative.

Results: Heating oil and natural gas

	Heating oil	Natural gas
	CHF/t CO ₂	CHF/t CO ₂
External costs air pollution	40	20
Specific charges		
Mineral oil tax	1	2
CO ₂ charge	84	84
VAT on CO ₂ charge	7	7
Total charges	92	93
Charges minus ext. costs = impl. CO ₂ price	52	73

Note:

The VAT is charged on the price including the CO₂ levy. This part of VAT is considered a specific tax.

The implicit CO₂ prices are below the explicit levy rate of 84 CHF/t CO₂ since it partly covers external costs of air pollution.

Due to the relatively clean burning of natural gas its implicit CO₂ price is higher than the price of heating oil.

Conclusions

Overview on implicit CO₂ prices

	Road traffic		Aviation	Heat production	
	Passenger cars	Heavy good vehicles		Heating oil	Natural gas
Implicit CO ₂ price (CHF/ t CO ₂)	-87	72	-71	52	73

- There are striking differences of implicit CO₂ prices for different fossil fuel uses.
→ There is a large potential to reduce CO₂ emissions at lower costs.
- The negative implicit CO₂ price for passenger cars and aviation indicates that raising prices would be efficiency enhancing from a purely domestic point of view.

Policy recommendations

- For passenger cars a mileage dependent fee analogous to the heavy vehicle fee could internalize mileage dependent external cost directly.
- The notorious undertaxation of aviation is based on an international treaty, the so called Chicago Convention, which prohibits the taxation of aviation fuel. Here international action is needed.