Higher Prices, Lower Costs?
Minimum Prices in the EU Emissions Trading Scheme

Jan Abrell

joint with
Sebastian Rausch and Hidemichi Yonezawa

ETH Zurich

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Why Price Bounds?

- Given
  - Partitioned environmental regulations
  - Uncertainty over abatement cost and baseline emissions

- Imposing price/abatement bounds and holding the environmental target constant leads to
  - State-dependent reallocation of permits
  - Decrease of (expected) cost of abatement

Main Assumptions

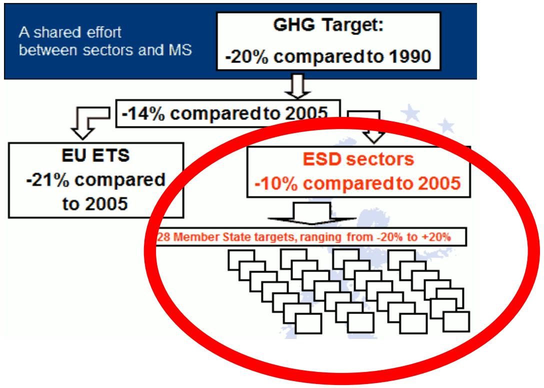
1. **Constant environmental target**
   - ➔ Adjusting target can lead to ex-post efficient outcome
   - ➔ Roberts and Spence argument requires equalized marginal abatement cost

2. **Existence of mechanism to implement and reallocate emission permits**
   - ➔ Mechanisms for permit rationing already exist in various systems (California emissions trading, market stability reserve)

3. **Cost efficient regulation of non-ETS sectors**
   - ➔ Reallocation offers possibility to address existing cost-inefficiencies

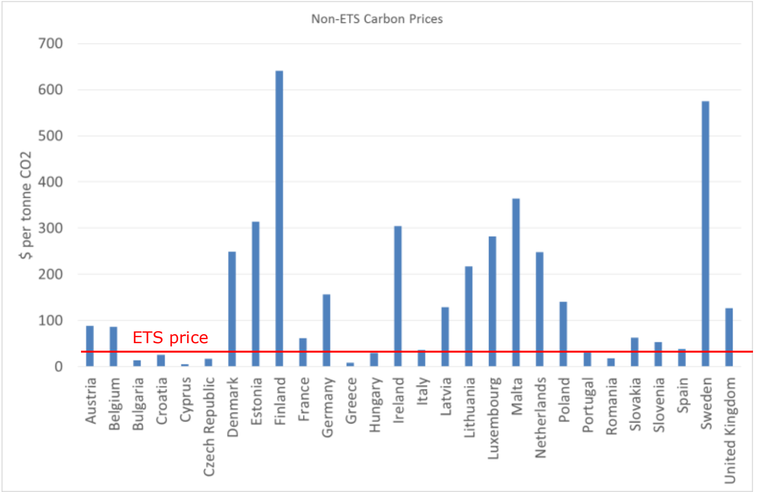
Addressing Existing Cost Inefficiencies

Effort sharing decision allocates abatement to member states' non-ETS sectors



Sub-optimal allocation leads to price differences across non-ETS partitions

➔ Cost-inefficiency



Basic idea

Use reallocation to address these cost-inefficiencies

Research Questions

Imposing a minimum price in an ETS system and reallocate permits to regions' non-ETS sectors

1. What is the impact on aggregated and regional welfare?
2. Which rule to choose to re-allocated permits across regions?

Specific example: European Emission Trading System

Theoretical Result

Increasing ETS permit price and re-allocating abatement to non-ETS sectors decreases total abatement cost if

1. ETS prices is below the weighted average of non-ETS carbon prices
2. Weights: Given by chosen re-distribution rule

$$\frac{\partial \Psi}{\partial P_T} = \frac{\partial A_T}{\partial P_T}\left[P_T - \sum_r \phi_r P_{Nr}\right]$$

Ψ	Total abatement cost
A_T	Abatement in trading system
P_T	Permit price emission trading
P_{Nr}	Non-ETS carbon price in region r
ϕ_r	Share of permits re-distributed to region r
	$\sum_r \phi_r = 1$

Intuition for re-distribution rule

Re-distribute first to countries with higher non-ETS carbon price

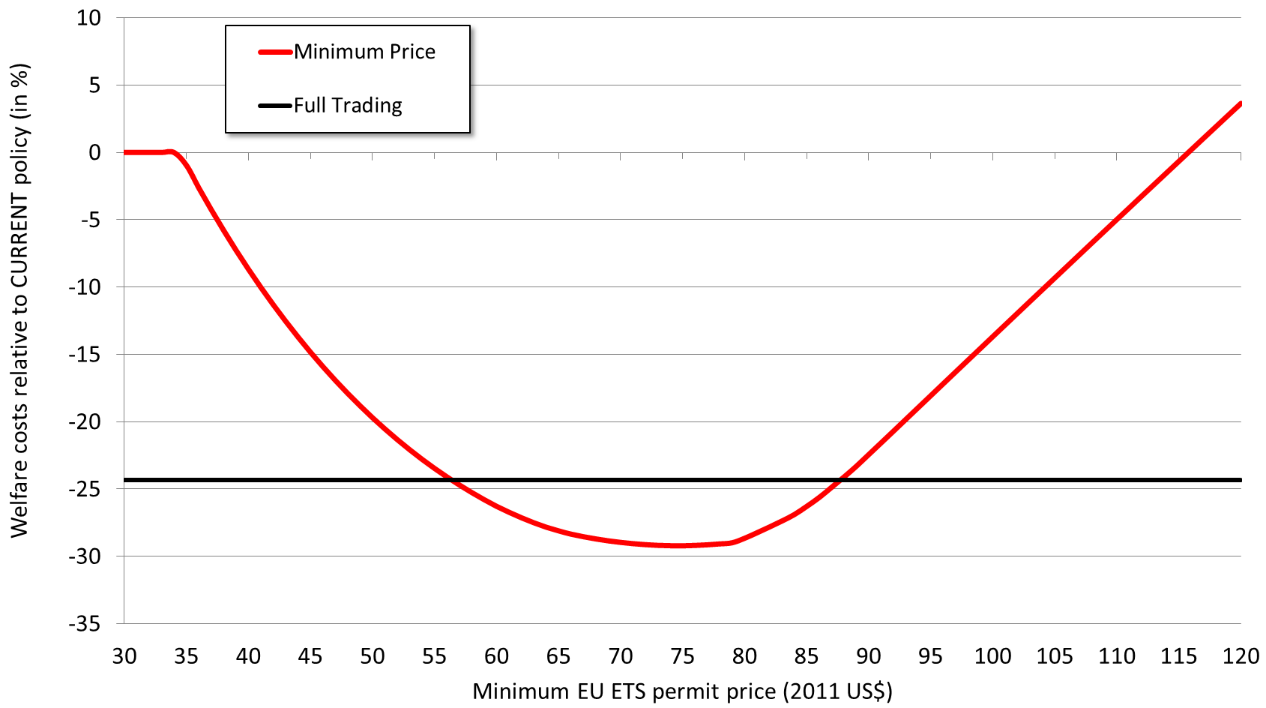
Aggregated Welfare Impacts of Price Floor

Based on Computable General Equilibrium model for EU28 under EU-ETS partioning

Re-distribution rule

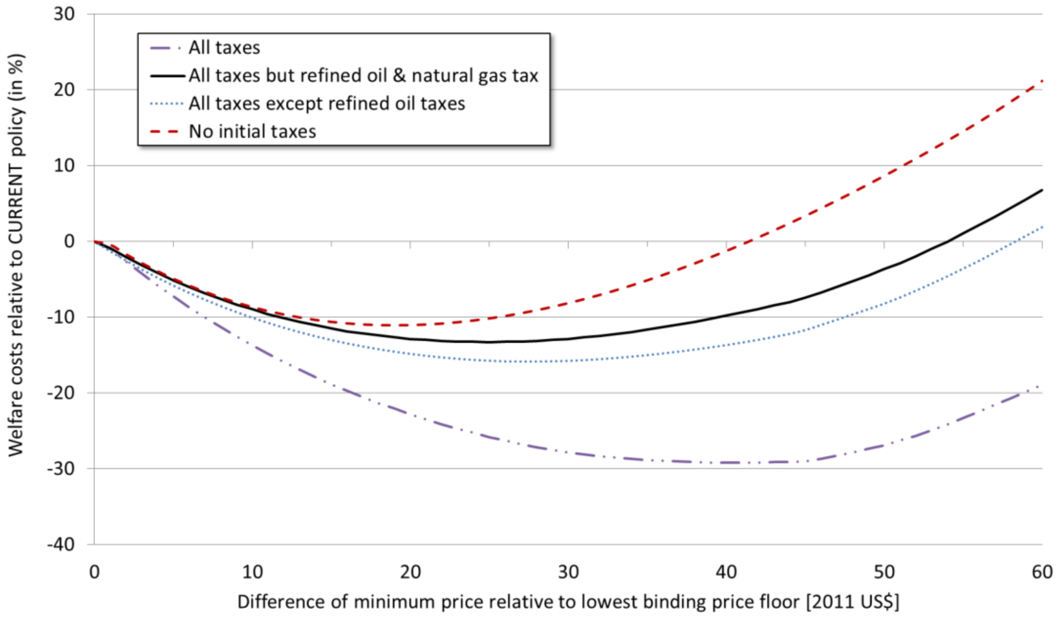
Re-distribution share based on effort sharing decision

➔ States with higher abatement burden receive higher amount of re-distributed permits



Tax interaction effects: Which taxes are relevant?

Figure 4. Impact of pre-existing tax distortions on welfare costs of introducing a minimum ETS permit price



Tax interaction effects are main driver of efficiency gains

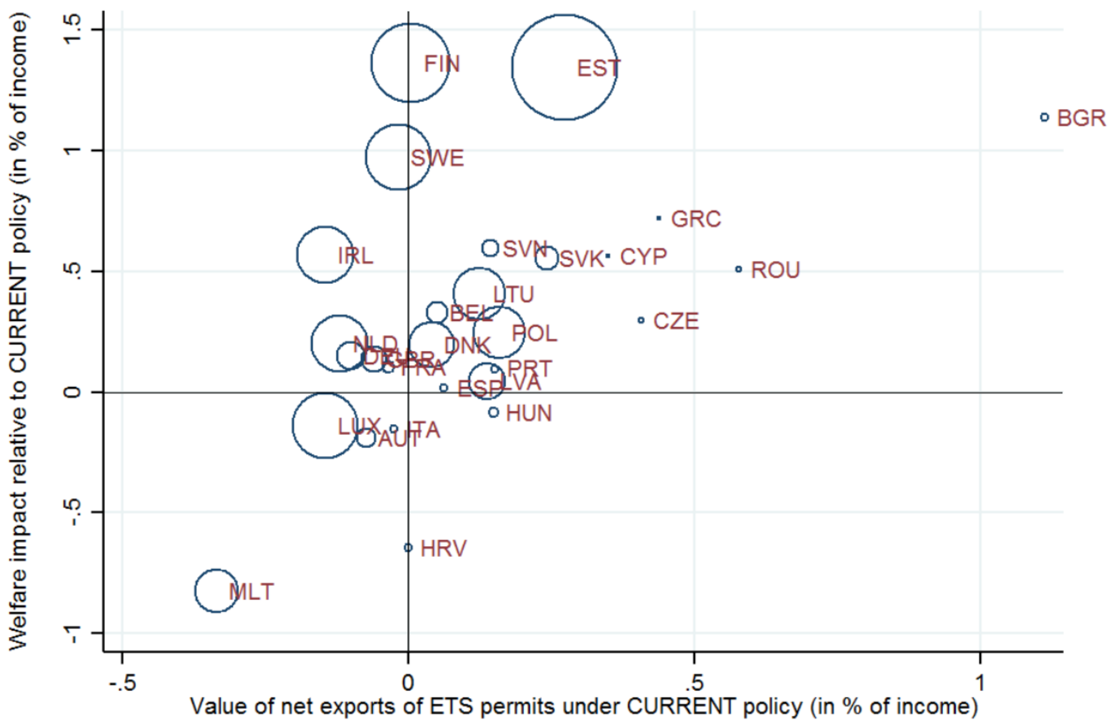
Refined oil taxes cause main interaction effect

Regional Welfare Effects of Optimal Price Floor

Regional welfare (y-axis) impacted by

- Increase in EU ETS price (exporters gain; x-axis)
- Savings in non-ETS abatement cost (bubble size)

Figure 6. Country-level welfare impacts of introducing an optimal minimum ETS price



Conclusions

Imposing a minimum price in an ETS system and reallocate permits to regions' non-ETS sectors

1. What is the impact on aggregated and regional welfare?

   Reallocation can be used to address inefficiencies existing in effort sharing agreement
   ➔ Welfare increases in the aggregate and for most countries
   ➔ Tax-interaction effects in the non-ETS sectors are one of the main drivers for efficiency gains

2. Which rule to choose to re-allocated permits across regions?

   Allocate permits to countries with highest carbon prices (usually the ones with highest non-ETS abatement burden)

Backup slides

CGE model

Standard computable general equilibrium model for carbon abatement

EU28 and Rest of the World region

Based on GTAP9 data forward calibrated to 2020 using IMF GDP forecasts

Electricity, energy-intensive sectors, refined oil products, and air transport under EUETS

Non-ETS sectors include coal, natural gas, crude oil, water transport, and other transport

Emission targets are recalculated for 2020 business-as-usual level

Forward Calibration and Emission Targets

Table 3. Baseline country-level CO_2 emissions and reduction targets for non-ETS sectors

	CO_2 emissions (in million metric tons)						Reductions targets for non-ETS sectors (in %) relative to emissions in year	
	Historic year-2005 values			Projected year-2020 values without climate policy[a]				
	Total	ETS (E^0_{rT})	Non-ETS (E^0_{rN})	Total	ETS ($\overline{E}_{rT}$)	Non-ETS ($\overline{E}_{rN}$)	2005[b] (τ^0)	2020[c] ($\overline{\tau}_r$)
Austria	79.4	32.1	47.3	76.7	32.2	44.6	16.0	10.9
Belgium	124.3	48.8	75.6	115.6	42.2	73.4	15.0	12.4
Bulgaria	50.3	37.7	12.6	61.5	46.8	14.7	-20.0	5.0
Croatia	23.5	10.6	12.9	22.1	9.0	13.1	-11.0	5.0
Cyprus	7.9	2.8	5.0	7.5	2.8	4.7	5.0	5.0
Czech Rep.	126.2	89.3	36.8	133.2	94.8	38.3	-9.0	5.0
Denmark	51.2	25.5	25.7	49.7	22.4	27.3	20.0	24.6
Estonia	16.4	11.2	5.2	24.2	15.7	8.6	-11.0	32.3
Finland	56.5	35.9	20.6	59.9	35.5	24.4	16.0	29.0
France	421.6	124.2	297.4	400.4	122.2	278.2	14.0	8.1
Germany	861.7	480.3	381.4	904.0	517.8	386.2	14.0	15.1
Greece	112.9	34.5	78.4	102.1	28.8	73.3	4.0	5.0
Hungary	59.9	27.9	32.0	59.1	24.2	34.9	-10.0	5.0
Ireland	47.6	26.2	21.4	46.9	24.5	22.4	20.0	23.5
Italy	488.1	235.8	252.2	417.0	194.7	222.2	13.0	5.0
Latvia	7.7	2.7	5.0	10.7	3.5	7.2	-17.0	18.3
Lithuania	14.0	7.2	6.8	18.9	8.7	10.2	-15.0	23.9
Luxembourg	12.1	4.1	8.0	13.4	4.4	8.9	20.0	28.5
Malta	2.7	2.3	0.4	3.4	2.8	0.6	-5.0	28.2
Netherlands	175.9	87.2	88.7	183.3	84.5	98.8	16.0	24.6
Poland	318.4	215.1	103.2	431.8	274.4	157.4	-14.0	25.2
Portugal	69.2	35.1	34.2	52.8	26.4	26.5	-1.0	5.0
Romania	99.3	63.9	35.3	111.0	69.4	41.6	-19.0	5.0
Slovakia	41.9	24.5	17.4	47.2	24.6	22.6	-13.0	12.9
Slovenia	16.7	8.1	8.6	17.9	8.2	9.7	-4.0	7.9
Spain	365.5	183.3	182.1	308.7	150.0	158.7	10.0	5.0
Sweden	53.2	19.0	34.2	58.3	19.0	39.2	17.0	27.7
UK	558.1	261.5	296.6	554.0	256.0	298.0	16.0	16.4
EU	4262.3	2137.0	2125.3	4291.1	2145.5	2145.7	10.0	13.1

Carbon Prices

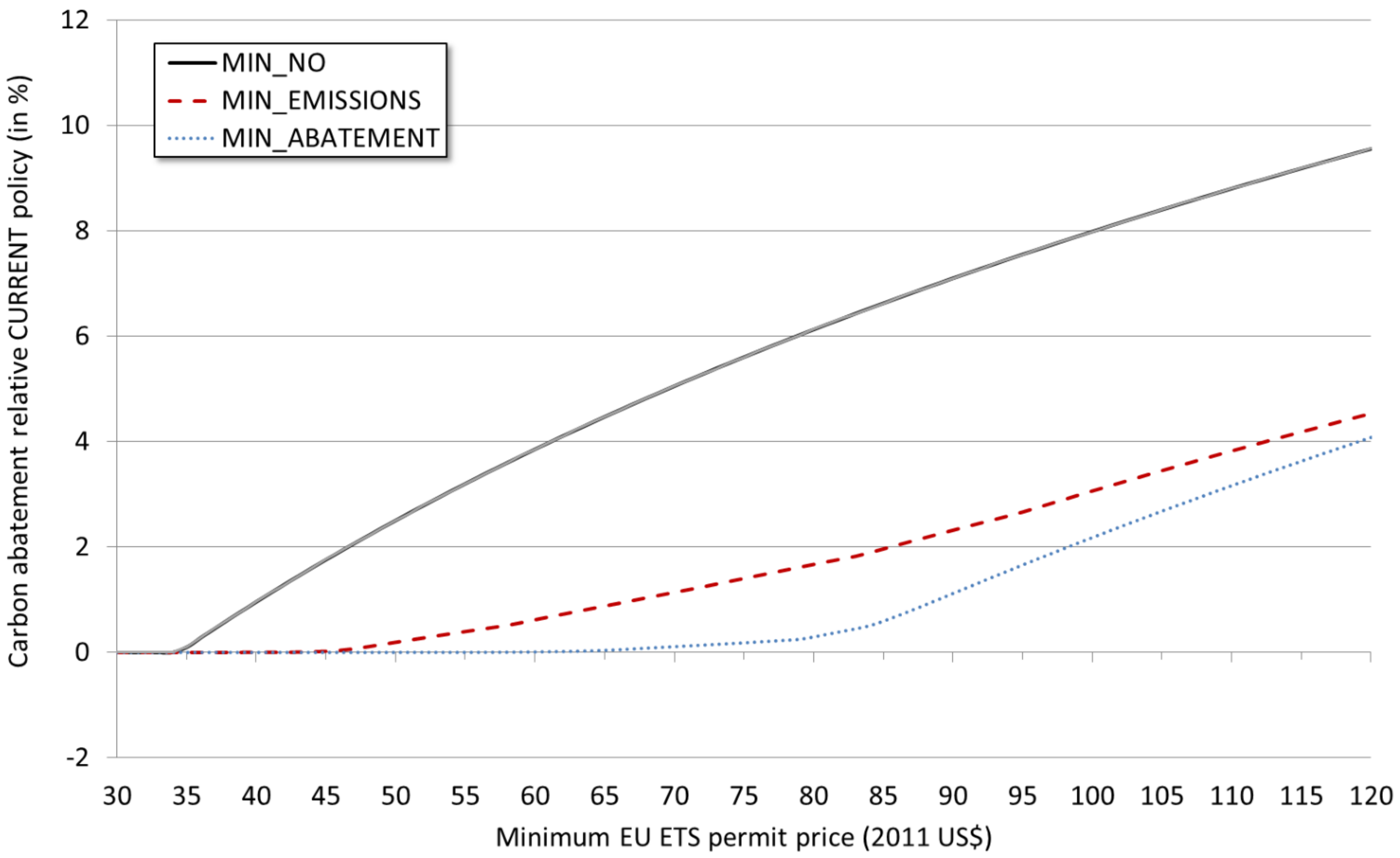
Table 4. Carbon abatement and carbon prices for national carbon markets and EU ETS under current policy and with an optimal minimum ETS price for alternative distribution schemes ϕ_r

	CURRENT	MIN_EMISSIONS	MIN_ABATEMENT
Carbon abatement in EU (in % relative to "no-climate policy" benchmark)			
	17.0	17.8	17.2
Carbon prices (2011$/ton CO_2)			
EU Emissions Trading System (ETS partition)			
Permit price	34.5	63.0*	75.0*
National carbon markets (non-ETS partition)			
Austria	88.5	0.7	0
Belgium	86.2	16.1	7.2
Bulgaria	14.1	0	0
Croatia	25	0	0
Cyprus	4.9	0	0
Czech Republic	16.8	0	0
Denmark	248.8	143.5	32
Estonia	314.2	215.4	56.4
Finland	641	388.5	78
France	61.2	0	4.3
Germany	156.1	47.6	9
Greece	8.5	0	0
Hungary	29.2	0	0
Ireland	304.3	162.4	37.6
Italy	36	0	0
Latvia	128.3	59.3	14.9
Lithuania	216.6	115.5	23.5
Luxembourg	282.3	171.2	35
Malta	363.8	205.5	40.7
Netherlands	247.7	138.3	28.1
Poland	140.5	66.9	11
Portugal	31.9	0	0
Romania	17.4	0	0
Slovakia	62.8	12.4	2.3
Slovenia	53.1	0	2.2
Spain	37.7	0	0
Sweden	574.8	362.3	89.2
United Kingdom	126.7	46.6	13.1
Weighted average of national non-ETS carbon prices			
ϕ_r based on emissions	117.7	43.7	–
ϕ_r based on abatement	110.3	–	9.3

Notes: *Denotes the optimal, i.e. welfare-maximizing, minimum price given the respective redistribution scheme.

Carbon Abatement Might Increase

Figure 2. EU-wide CO_2 abatement for ETS and non-ETS sectors (in %) relative to CURRENT policy



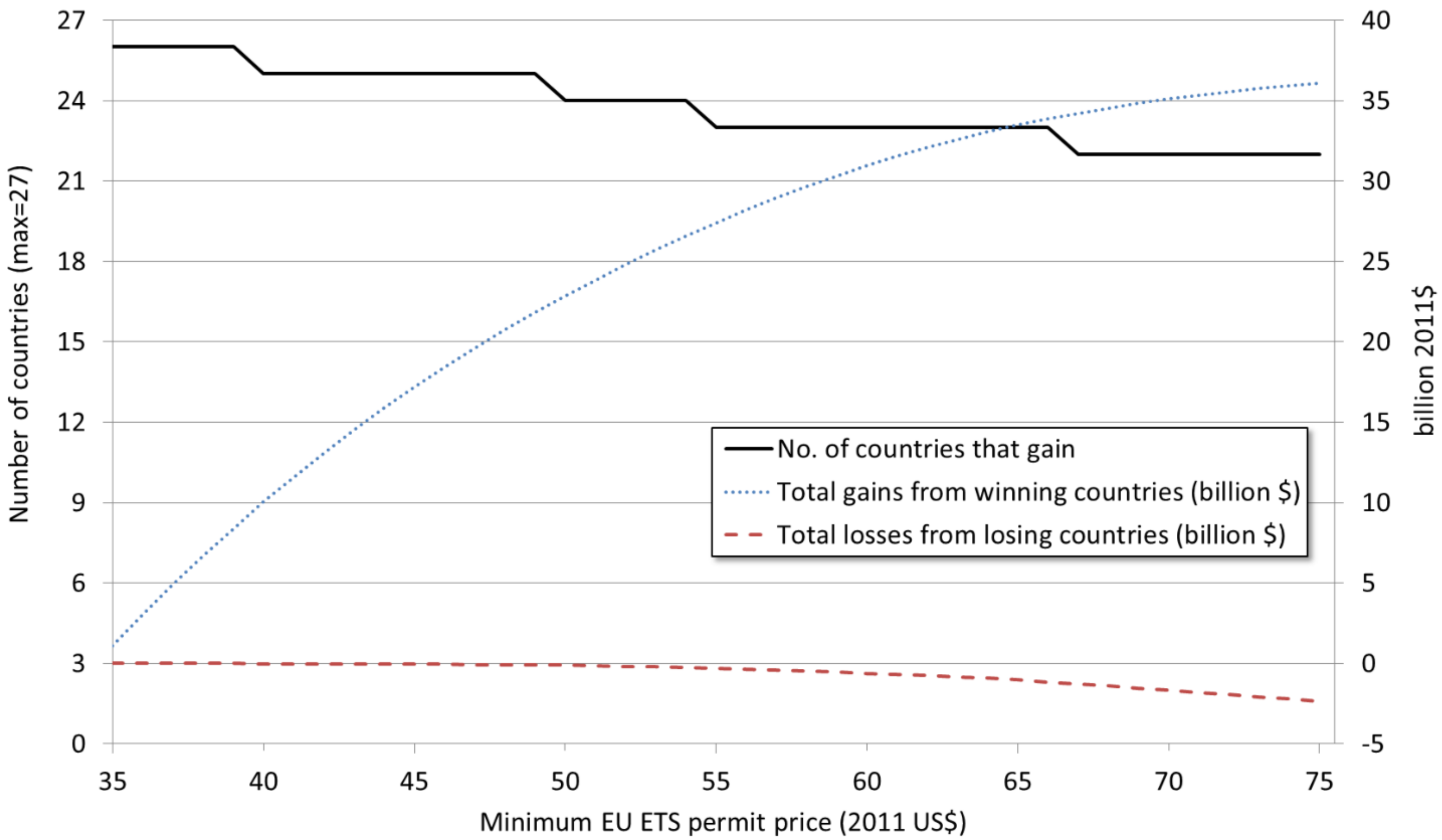
Theoretical Results: Tax Interaction

Given pre-existing tax interaction effects (α) the total change in abatement cost is given as:

$$\int_{P_T^0}^{\underline{P}} \underbrace{\frac{\partial A_T}{\partial P_T}\left[P_T - \sum_r \phi_r P_{Nr}\right]}_{\text{MAC effect}} + \underbrace{\sum_r \left[\alpha_{Tr}\frac{\partial A_{Tr}}{\partial P_T} P_T - \alpha_{Nr}\phi_r \frac{\partial A_T}{\partial P_T} P_{Nr}\right]}_{\text{Tax interaction effect}} \mathrm{d}\, P_T \,.$$

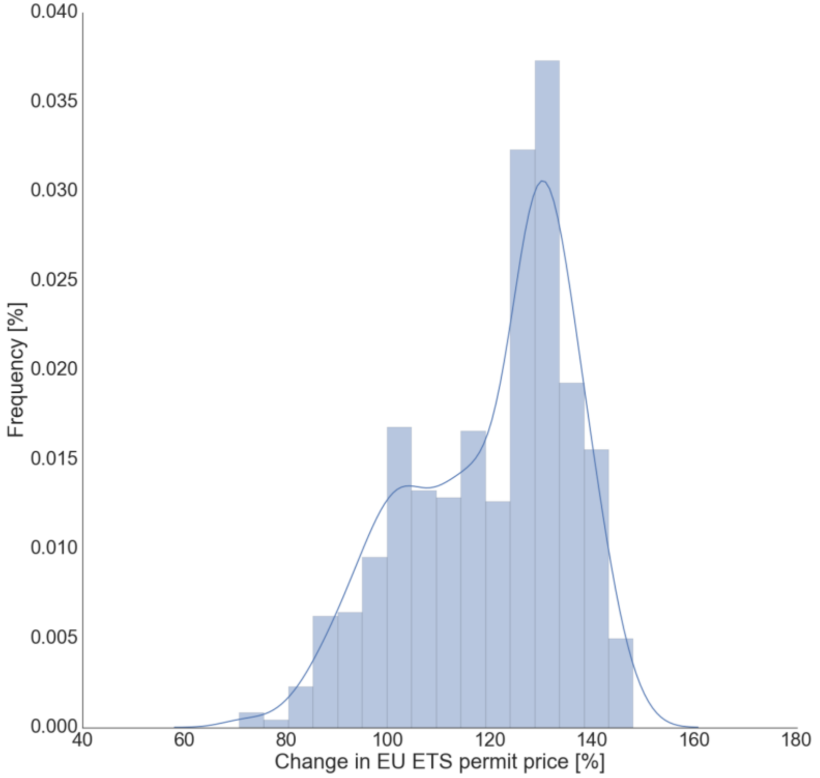
Winner and Losers

Figure 5. Number of countries with welfare gains, total gains, and total losses due to introduction of minimum EU ETS permit price



Results Sensitivity

(a) Welfare-maximizing minimum price (% change relative to ETS permit price under CURRENT climate policy)



(b) Aggregate EU welfare improvement (% relative to CURRENT climate policy)