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Competitiveness in Unilateral Climate Policy: Border Tax Adjustments or Integrated Emission Trading?

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Agenda

- Motivation
- Theoretical model
- Simulation model & Policy scenarios
- Conclusions

Motivation

- March 2007, **EU Spring Summit**: *Commitment to a European Post-Kyoto regime, envisioning a unilateral reduction of greenhouse gas emissions by 20% by 2020 in the European Union*

- July 2007, **G8 Summit**: *Despite rising awareness of climate change problems, international disagreement over a global climate policy persists*

- December 2007, **UNCCC**: *Roadmap to a Post-Kyoto Agreement, but no commitment of major industrial nations to binding emission caps*

⇔ **Research question**: What instruments may be used to offset the potentially negative impact of unilateral actions on the EU international competitiveness and to reduce leakage outside Europe?

Border Tax Adjustments

...offset detrimental effects of domestic taxation on international competitiveness:

- Bhagwati & Srinivasan (1973)
- Meade (1974)
- Grossman (1980)

…are a useful policy instrument to protect economies of carbon abating countries:

- Ismer & Neuhoff (2004)
- Babiker & Rutherford (2005)
- Petersen & Schleicher (2007)

Theory: Model

- GE model with two countries *r*, i.e. *d* (domestic) and *f* (foreign)
- Representative household in each country disposes of initial wealth
- Armington assumption: domestic goods and imports are imperfect substitutes, both enter into Cobb-Douglas preferences
- Representative firm in *r* chooses quantity q_d^r of standard good for market in *d* and q_f^r for market in *f* and energy intensity of production μ^r
- Costs of production $C(\mu, q) = c(\mu)q$ are CRS w.r.t. quantity and decreasing in energy intensity
- Energy intensity and quantities determine emissions $E^r = \mu^r (q_d^r + q_f^r)$

Abatement Policies

- All abatement policies are conducted only by domestic government
- Unilateral Abatement Policy (UAP): *tax* τ *on emissions from domestic production, such that they remain below cap* $\overline{E}$
- Border Tax Adjustment Policy (BTA): *tax emissions* τ *(as under UAP), but put a tariff* κ *on imports and pay a tax compensation* κ *on the exports with* $\kappa = \tau\mu^d$
- Integrated Emission Trading (IET): *tax emissions* τ *on domestic firm producing for domestic market and imports of foreign firm exporting to the home country*

The firm's maximization problem

- Unilateral Abatement Policy (UAP):

$$\Pi^d = p^d_d q^d_d + p^f_d q^d_f - c^d(\mu^d)(q^d_d + q^d_f) - \boxed{\tau \mu^d (q^d_d + q^d_f).}$$
$$\Pi^f = p^f_d q^f_d + p^f_f q^f_f - c^f(\mu^f)(q^f_d + q^f_f).$$

- Border Tax Adjustment Policy (BTA):

$$\Pi^d = p^d_d q^d_d + p^f_d q^d_f - c^d(\mu^d)(q^d_d + q^d_f) - \boxed{\tau \mu^d (q^d_d + q^d_f) + \kappa q^d_f}$$
$$\Pi^f = p^f_d q^f_d + p^f_f q^f_f - c^f(\mu^f)(q^f_d + q^f_f) - \boxed{\kappa q^f_d}$$

- Integrated Emission Trading (IET):

$$\Pi^d = p^d_d q^d_d + p^f_d q^d_f - c^d(\mu^d)(q^d_d + q^d_f) - \boxed{\tau \mu^d q^d_d}$$
$$\Pi^f = p^f_d q^f_d + p^f_f q^f_f - c^f(\mu^f)(q^f_d + q^f_f) - \boxed{\tau \mu^f q^f_d}$$

Results Theory: Comparison of Price and Output Effects

- BTA and IET lower price of exports (vis-à-vis UAP)
- BTA and IET increase price of imports
- Under BTA *domestic* output is higher than under IET
- Under BTA *foreign* output is lower than under IET only if marginal abatement costs in foreign country are much lower than in the domestic country ⇔ Assuming symmetry of cost functions or higher costs, BTA induces higher foreign production than IET

Results Theory: Comparison of Energy Intensities

$$(\mu^d)^{UAP} > (\mu^d)^{BTA} \qquad (\mu^f)^{UAP} = (\mu^f)^{BTA}$$

$$(\mu^d)^{UAP} = (\mu^d)^{IET} \qquad (\mu^f)^{UAP} > (\mu^f)^{IET}$$

$$(\mu^d)^{BTA} < (\mu^d)^{IET} \qquad (\mu^f)^{BTA} > (\mu^f)^{IET}$$

Results Theory: Comparison of Leakage

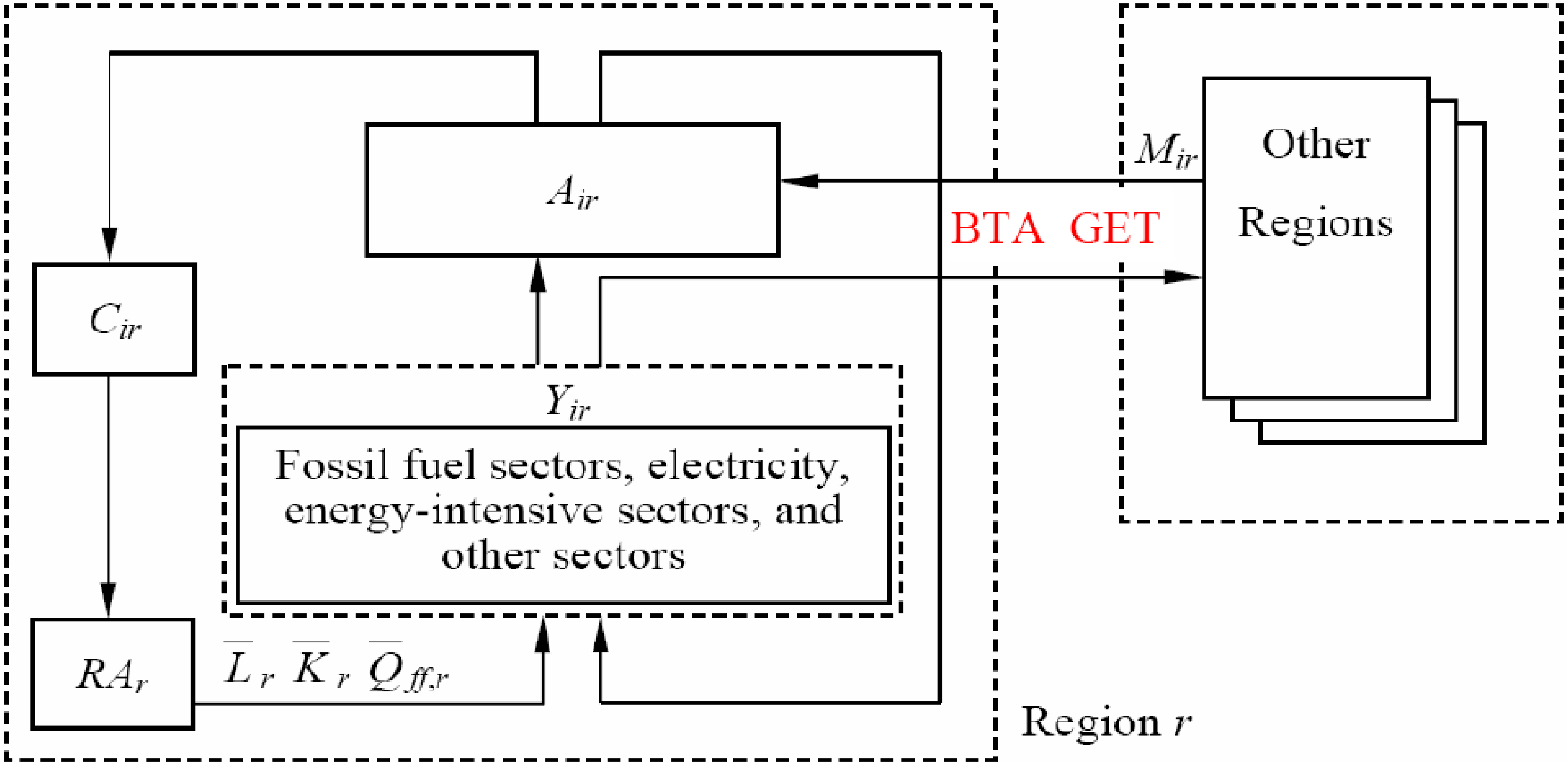
$$(E^f)^{UAP} > (E^f)^{BTA}$$

$$(E^f)^{UAP} > (E^f)^{IET}$$

$$(E^f)^{BTA} >_s (E^f)^{IET}$$

- Emissions in foreign country are reduced by both BTA and IET regimes
- Assuming symmetry of cost functions or higher abatement costs, reduction is higher under IET

CGE analysis with the PACE model



Parameterization of Static PACE Version

- Data base of global economy: GTAP V6

Production Sectors	Regions
Energy-intensive sectors: Refined Oil Products, Electricity Iron and Steel Industry Paper Products and Publishing Non-Ferrous Metals, Mineral Products, Chemicals and Air Transportation *Non-energy-intensive sectors:* Rest of Industry (Other manufactures and services) *Other sectors:* Coal, Crude oil, Natural gas	EU-12 (New member states) EU-15 (Old member states) Rest of OECD Former Soviet Union Rest of South and Middle America China (including Hongkong) Rest of South and East Asia OPEC Rest of World

Policy Implementation

- EU-27: 20 percent cutback of CO_2 emissions in 2020 compared to BAU
- Efficient implementation: Uniform taxation regime
- Sectors subject to the BTA and the IET regime: DIR_POL Sectors
  - ⇔ Iron and Steel Industry
    Paper Products and Publishing
    Non-ferrous Metals
    Mineral Products
    Chemicals
- No carbon abatement outside the EU

Simulation Results: Output Effects

	DIR_POL			DIR_NPOL			NDIR			TOTAL		
	UAP	BTA	IET	UAP	BTA	IET	UAP	BTA	IET	UAP	BTA	IET
EU15	-1.881	0.408	-1.772	-12.775	-12.478	-12.765	-0.151	-0.315	-0.158	-0.164	-0.316	-0.171
EU12	-3.223	-2.374	-3.140	-8.827	-8.731	-8.820	-0.268	-0.373	-0.275	-0.300	-0.399	-0.307
OOE	0.336	-0.186	0.371	0.955	0.899	0.958	-0.024	0.007	-0.025	-0.022	0.007	-0.024
RUS	0.817	0.117	0.680	1.011	0.786	0.969	0.065	0.122	0.071	0.080	0.127	0.084
SMA	0.543	-0.193	0.577	2.125	2.083	2.115	-0.021	0.034	-0.021	-0.017	0.034	-0.017
CHN	0.309	-0.188	0.265	0.645	0.463	0.501	0.000	0.061	-0.002	0.004	0.058	0.001
SEA	0.819	-0.419	0.781	1.052	0.865	1.057	-0.032	0.047	-0.031	-0.026	0.046	-0.025
OPC	1.946	0.763	0.900	2.402	2.271	2.291	0.061	0.136	0.096	0.075	0.145	0.106
XRW	1.283	0.026	0.887	3.291	2.820	3.029	-0.049	0.074	-0.014	-0.036	0.081	-0.003

- BTA is more effective at protecting competitiveness of the covered sectors than IET
- Total effects are different: greatest output reduction occurs under BTA

Simulation Results: Environmental Effects

	DIR_POL			DIR_NPOL			NDIR			TOTAL		
	UAP	BTA	IET	UAP	BTA	IET	UAP	BTA	IET	UAP	BTA	IET
EU15	-10.780	-8.120	-10.660	-32.130	-32.060	-32.130	-7.760	-7.900	-7.750	-19.436	-19.419	-19.435
EU12	-13.360	-11.840	-13.220	-29.960	-30.190	-29.990	-16.230	-16.480	-16.250	-23.059	-23.152	-23.069
OOE	0.550	-0.070	-0.070	1.040	1.000	1.030	0.320	0.330	0.340	0.742	0.710	0.735
RUS	1.100	-0.090	-0.510	1.660	1.450	1.640	0.510	0.480	0.540	1.223	0.985	1.073
SMA	0.660	-0.200	-0.400	2.220	2.160	2.240	0.060	0.080	0.060	0.982	0.889	0.888
CHN	0.610	0.080	0.000	1.570	1.430	1.560	0.420	0.460	0.410	1.180	1.063	1.128
SEA	0.930	-0.290	-1.060	1.510	1.340	1.540	0.520	0.590	0.540	1.145	0.938	0.962
OPC	1.980	0.450	-1.280	1.580	1.420	1.470	0.540	0.590	0.520	1.154	0.927	0.715
XRW	2.750	-0.310	-5.210	3.870	3.390	3.630	0.110	0.160	0.100	2.405	1.858	1.467

- IET is more effective at reducing leakage in the covered sectors outside EU than BTA
- Total effects are similar: greatest emissions reduction occurs under IET

Conclusion

- UAP causes leakage and a detrimental effect on EU sectoral competitiveness
- BTA and IET regimes are suitable to mitigate these problems
- BTA is more effective at protecting sectoral competitiveness than IET
- IET is more effective at reducing leakage in covered sectors than BTA
- CGE analysis confirms theoretical results
- Further insights: CGE analysis allows assessing total effects