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On the Off-shoring of CO_2 Responsibilities and Carbon Content of Trade: the Case of Austria

11th Symposium on Energy Innovation

10-12 February 2010

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Introduction

- The current accounting emission system is based on Production-Based Principle (PBP).

  PBP = EE Domestic Consumption + EE Exports

- The so called 'carbon leakage problem' emerges when emissions inventories are only focused on the PBP.

- An emission accounting that relies on the Consumption-Based Principle (CBP) has been offered as one solution.

  CBP = EE Domestic Consumption + EE Imports

Note: EE = emissions embodied

Objectives

a) To estimate the CO_2 emissions on the basis of the Consumption-Based Principle (CBP) for Austria in the years 1997 and 2004.

b) To estimating the corresponding carbon balances between exports and imports for the two years under analysis.

c) To provide insights into the physical dimensions of the carbon leakage problem between the countries comprising Annex I (developed countries) and non-Annex I (developing and emerging economies).

Methodology: Multi-Regional Input-Ouput Analysis (MRIO)

		Intermediate Demand (A)						Final Demand (F)		
Region\Region	code	Austria (AT)	Germany (DE)	China (CH)	Russia (RU)	Italy (IT)	R.o.W (W)	Austria (AT)	R.O.W. (W)	Total Outputs (XX)
Austria	(AT)	$Z^{at,at}$						$Y^{at,at}$		X^{AT}
Germany	(DE)									
China	(CH)									
Russia	(RU)									
Italy	(IT)									
Rest of the World	(W)									
Value-Added	(VA)									
Total Output	(XX)	X^{AT}								

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China	(CH)			$Z^{ch,ch}$						X^{CH}
Russia	(RU)				$Z^{ru,ru}$					X^{RU}
Italy	(IT)					$Z^{it,it}$				X^{IT}
Rest of the World	(W)						$Z^{w,w}$		$Y^{w,w}$	X^{W}
Value-Added	(VA)									
Total Output	(XX)	X^{AT}	X^{DE}	X^{CH}	X^{RU}	X^{IT}	X^{W}			

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Germany	(DE)	$Z^{de,at}$	$Z^{de,de}$	$Z^{de,ch}$	$Z^{de,ru}$	$Z^{de,it}$	$Z^{de,w}$	$Y^{de,at}$	$Y^{de,w}$	X^{DE}
China	(CH)	$Z^{ch,at}$	$Z^{ch,de}$	$Z^{ch,ch}$	$Z^{ch,ru}$	$Z^{ch,it}$	$Z^{ch,w}$	$Y^{ch,at}$	$Y^{ch,w}$	X^{CH}
Russia	(RU)	$Z^{ru,at}$	$Z^{ru,de}$	$Z^{ru,ch}$	$Z^{ru,ru}$	$Z^{ru,it}$	$Z^{ru,w}$	$Y^{ru,at}$	$Y^{ru,w}$	X^{RU}
Italy	(IT)	$Z^{it,at}$	$Z^{it,de}$	$Z^{it,ch}$	$Z^{it,ru}$	$Z^{it,it}$	$Z^{it,w}$	$Y^{it,at}$	$Y^{it,w}$	X^{IT}
Rest of the World	(W)	$Z^{w,at}$	$Z^{w,de}$	$Z^{w,ch}$	$Z^{w,ru}$	$Z^{w,it}$	$Z^{w,w}$	$Y^{w,at}$	$Y^{w,w}$	X^{W}
Value-Added	(VA)	V^{AT}	V^{DE}	V^{CH}	V^{RU}	V^{IT}	V^{W}			
Total Output	(XX)	X^{AT}	X^{DE}	X^{CH}	X^{RU}	X^{IT}	X^{W}			

Data

- The data base of the Global Trade Analysis Project (GTAP) was used to construct the MRIO.
- GTAP v7 gives details for 113 regions, while GTAP v5 is comprised of 66 regions
- 57 industries per region
- $C0_2$ data refers to CO_2 emissions from fuel combustion and CO_2 emissions stemming from industrial processes.

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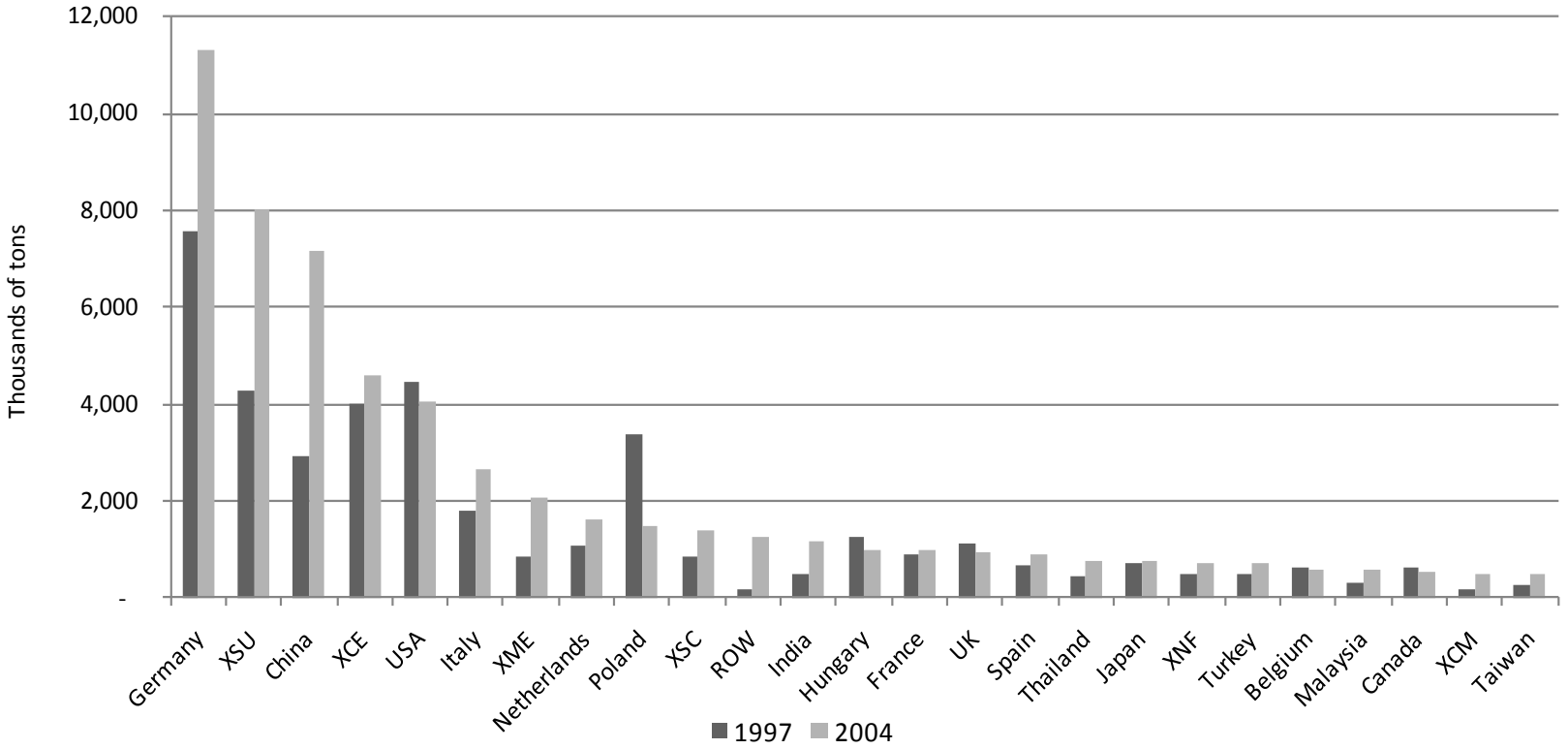
Results

Categories and Indicators \Year	1997	2004
Domestic Consumption	44,314	47,780
Consumption in products domestically produced	27,695	29,153
Household (direct consumption)	16,619	18,627
Exports	22,943	31,800
Exports Domestically produced	20,483	27,558
Exports of International Transport	2,460	4,242
Imports (for Austrian Consumption)	44,366	61,988
Imports coming from Annex I countries	34,343	41,408
Imports coming from Non-Annex I countries	10,023	20,581
Imports of International Transport	Not available	Not available
Indicators		
Net Emission Balance (excluding Int. Transport)	- 23,884	- 34,430
Consumption-Based Principle (CBP)	88,680	109,768
Production-Based Principle (PBP)	67,257	79,580
Ratio CBP/PBP	1.32	1.38
CO_2 Emissions per capita based on PBP (*in tons*)	8.44	9.74
CO_2 Emissions per capita based on CBP (*in tons*)	11.13	13.42

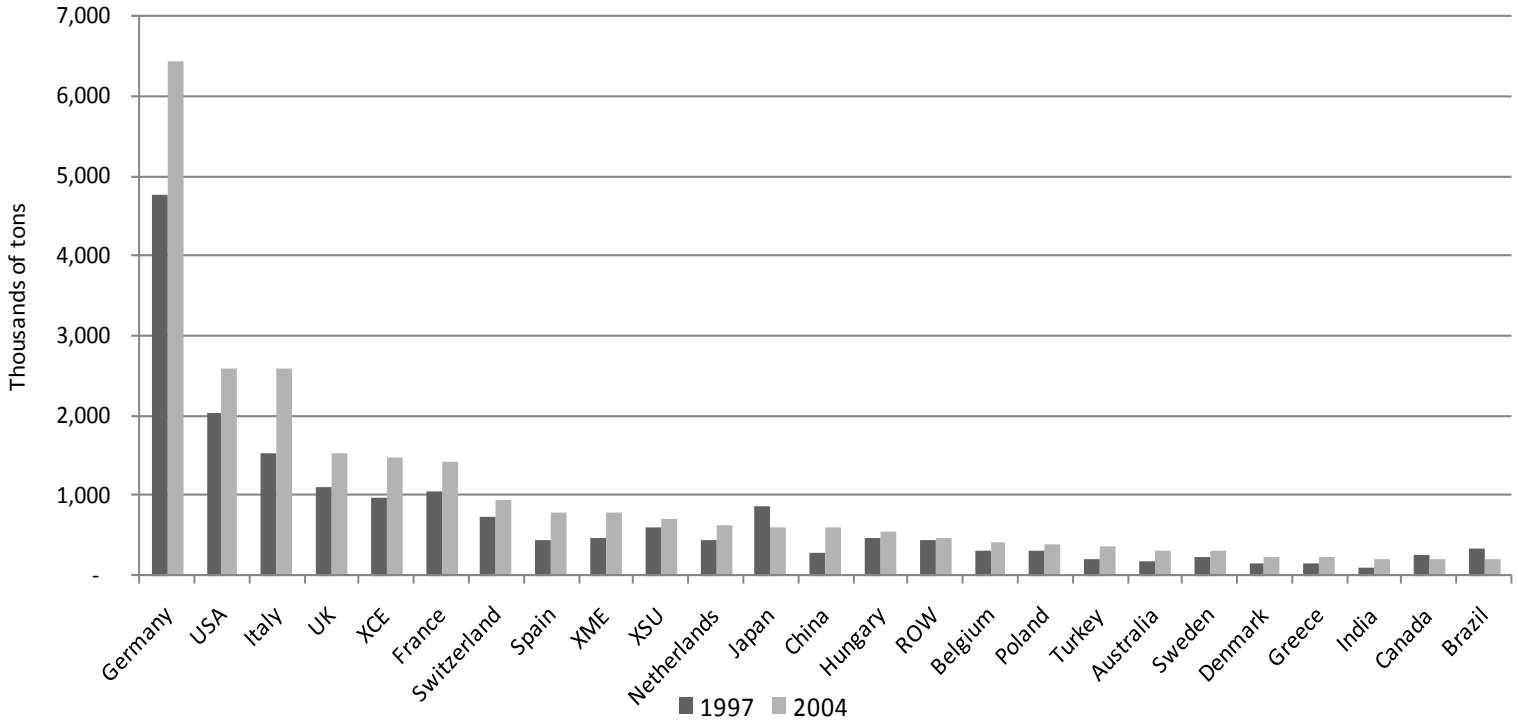
In thousands of tons of CO_2.

CO_2 flows embodied in Austria's imports per region in the year 1997 and 2004 (in thousands of tons)



XSU = Former Soviet Union; XCE = Rest of Central European Associates; USA = United States of America; XME = Rest of Middle East; XSC = Rest of South African Customs Union; ROW = Rest of World; UK = United Kingdom; XNF = Rest of North Africa; XCM = Central America and the Caribbean.

CO_2 flows embodied in Austria's exports per region in the year 1997 and 2004 (in thousands tons)



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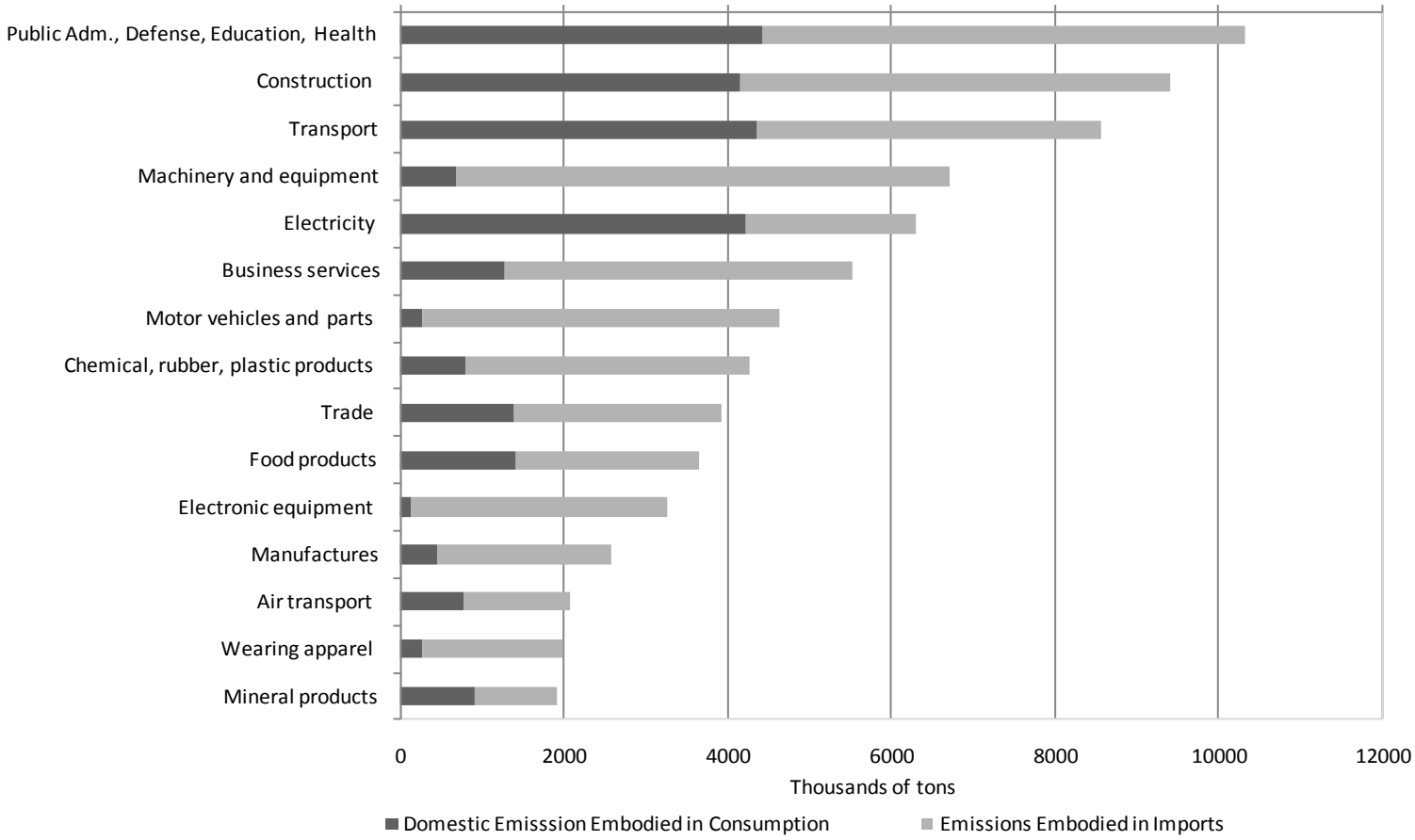
Emissions embodied in Austria's final consumption by sectors



Final Comments

- In 1997 CO_2 responsibilities based on CBP were 32% larger than those based on PBP. The CBP indicator of 2004 was 38% larger than the PBP.

- CO_2 emissions per capita based on a CBP suggest that about 3.5 million tons per capita need to be added in comparison with production based indicators.

- Imports are double as much as exports.

Final Comments

- Unilateral implementation of climate mitigation policies may be causing import substitution or firm relocating.
- One-third of the emissions embodied in Austrian imports originated in non-Annex I countries in 2004.
- The accounting principle used in assessing emissions is of considerable importance when assigning carbon responsibilities.

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Thank you!