

Impact on U.S. Industries of Carbon Prices with Output Based Rebates over Multiple Time Frames

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Outline

- Motivation/Aims
- Framework for analyzing carbon price policies
- Very short-run and short-run effects
- Medium and long-run effects
 - * Output effects
 - * Leakage effects
- Conclusions

Motivation

- CO₂ price policy may cause decline in certain sectors (including output, jobs, profits), plus increase in imports and/or foreign production
- Energy intensive, trade exposed (EITE) industries most vulnerable
- Why? Pricing of CO₂ increases firms' production costs, leading to market adjustments
- Issue not just political: if production shifts abroad to unregulated firms, emissions *leakage* could undermine policy goals, especially if foreign production is less efficient
- Btu tax, recent legislative proposals suggest need for transparent basis to identify true hardship cases
- Study goal is to examine effectiveness of proposed policies on EITE industries

Summary of Market-Based Climate Change Bills in 111th Congress

	Who's Regulated	Competitiveness
Larson (H.R. 1337)	Economywide tax: fossil fuels taxed by CO ₂ content at production and import points. 80% emissions reductions by 2050.	Tax applied to fossil fuel imports and fossil fuel exports are exempt with border adjustments.
Waxman- Markey (H.R. 2454)	Economywide cap: electricity and industrial facilities at emitters; producers and importers of fossil fuels and F-gases; NG distributors. Economywide reductions from 2005 levels: 3% by 2012, 20% by 2020, 42% by 2030, 83% by 2050.	Rebates (in form of 15% free allocations) for energy or trade-intensive industries, determined by direct compliance effects and product of emission intensity and electricity efficiency factors. International Reserve allowances to be issued for eligible industries starting in 2020.
Kerry-Boxer (S.1733)	Economywide cap: electricity and industrial facilities at emitters; producers and importers of fossil fuels and F-gases; NG distributors	Rebates for energy or trade-intensive industries, determined by direct compliance effects and product of emission intensity and electricity efficiency factors until 2035. Will contain border measures, though no specific stipulations currently.
Cantwell- Collins (S.2877)	Economywide cap: regulates entry point (first seller) of fossil-based carbon into economy, as determined by Treasury. Prohibition of carbon market derivative sales by regulated parties...	CERT Funds can be used to for targeted trade-exposed industries based on output and cost per unit and for worker training programs. Production process carbon adjustment (border tax) imposed on imports starting in 2013.

Provisions in H.R. 2454

- Output-based allocations to energy-intensive trade-exposed industries (EITEs) (15%)
[EITE: energy costs $> 5\%$ and trade share $> 15\%$
or energy costs $> 20\%$]
- Gratis allocations to electricity and natural gas local distribution companies (LDCs) for ratepayer benefit (30% and 9%)
- Gratis allocation to petroleum refiners (2%)

Methodologies to estimate GHG policy effects

- ‘bottom-up’ models contain technology detail for narrowly defined industries, but do not explain prices/quantities as part of whole economy
- ‘top-down’ CGE models cover the whole economy, or even the world, and determine prices and quantities endogenously, but often do not have detailed industries.
- Short-run and long-run effects often not clearly distinguished.

This study considers 4 different time horizons for effects of carbon policies

- Very Short Run: All input quantities fixed, output price fixed.
- Short Run: Higher prices reduce sales and output; but no input substitution
- Medium Term: General Equilibrium Analysis; Input substitution allowed; Industry Capital Fixed
- Long run : General Equilibrium Analysis; Reallocation of Capital allowed

Methodology for short and long run

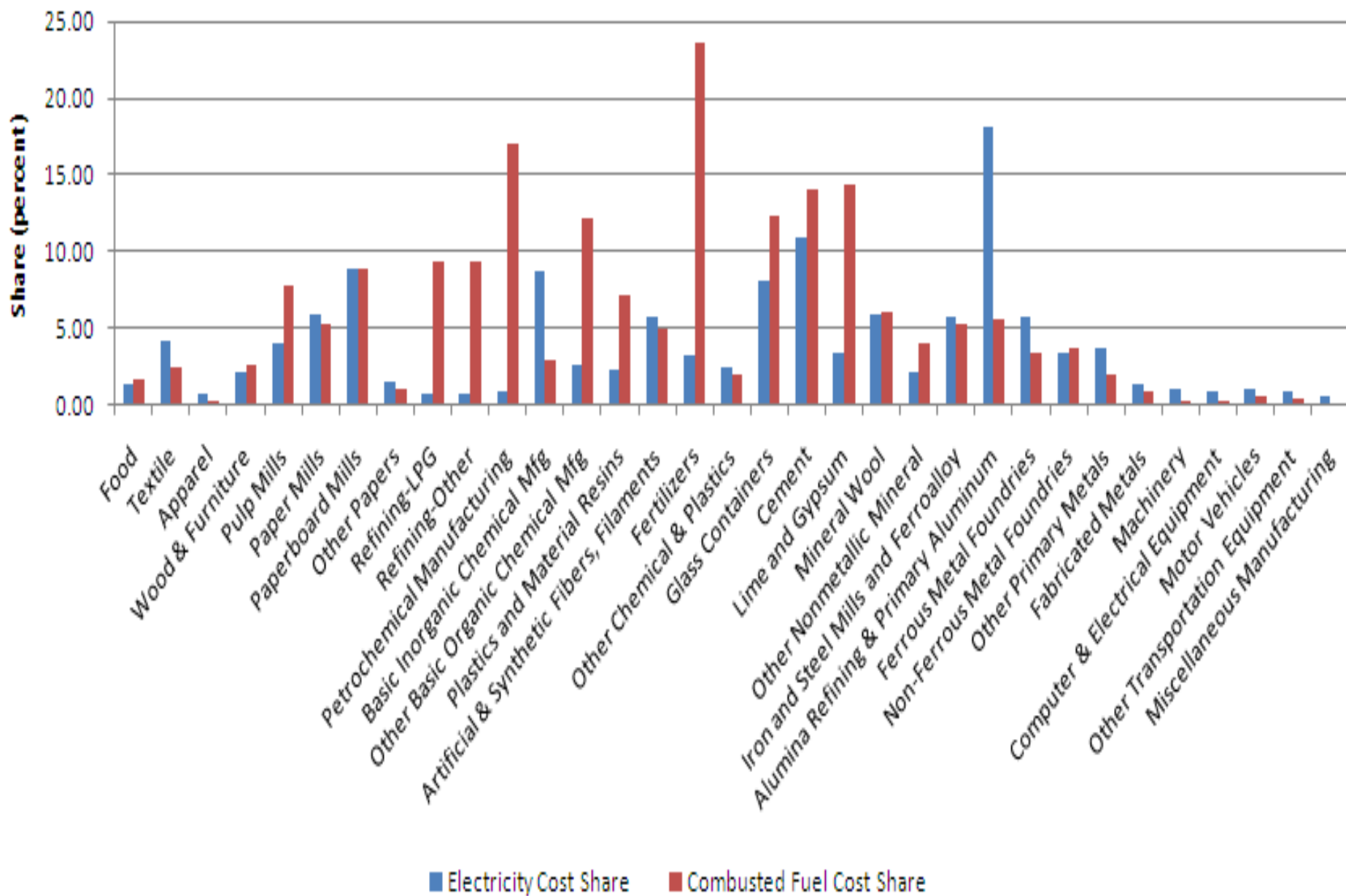
Short run and Very SR partial equilibrium analysis:

- use input-output table (2006)
- assume fixed input coefficients
- demand elasticities simulated from CGE model
- 52 industries (19 EITE)

Medium and Long run analysis:

- CGE model based on GTAP7
- 29 industries; 8 world regions

Electricity and Combusted Fuel Cost Shares



Total CO₂ Intensity for Manufacturing Industries

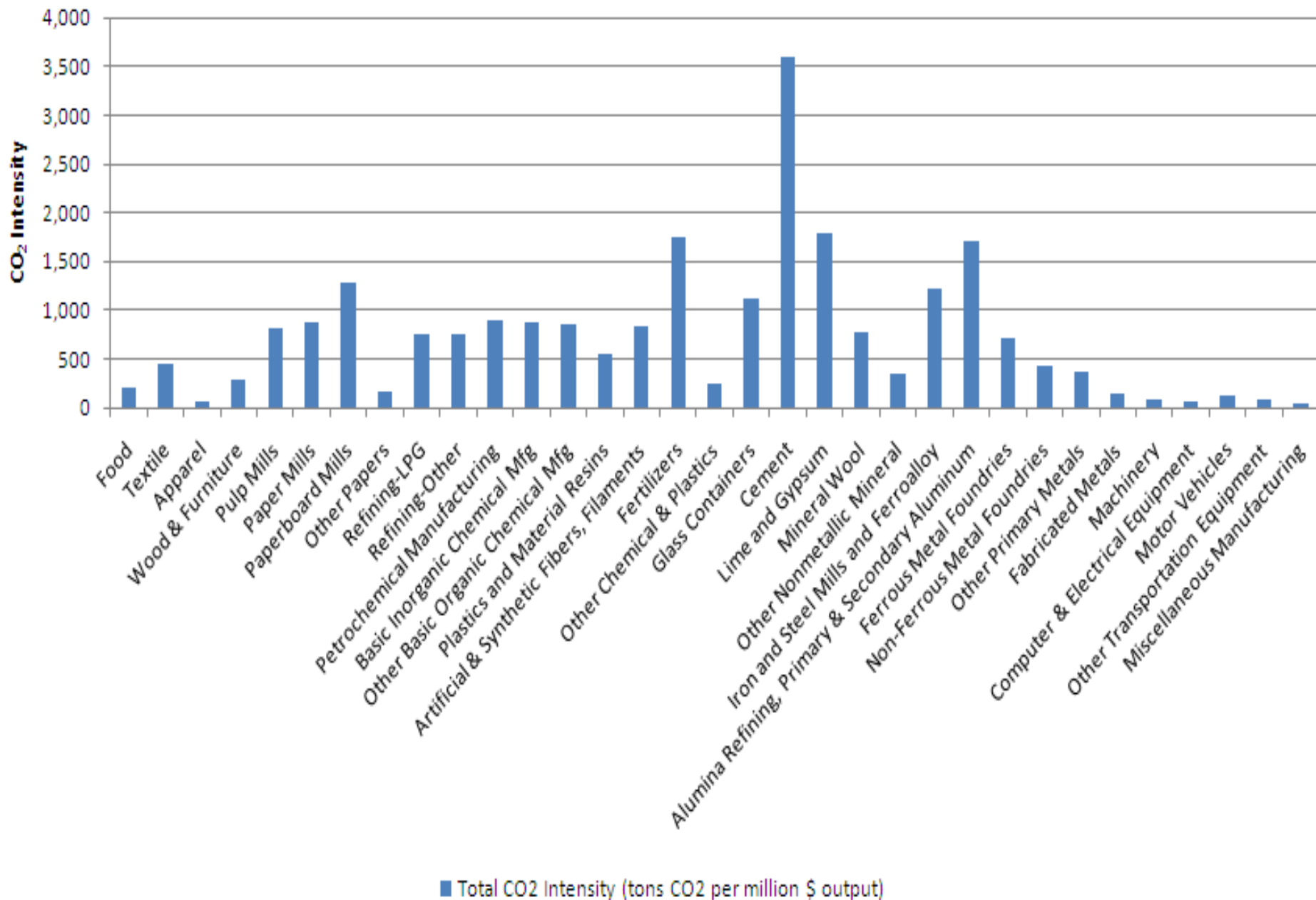
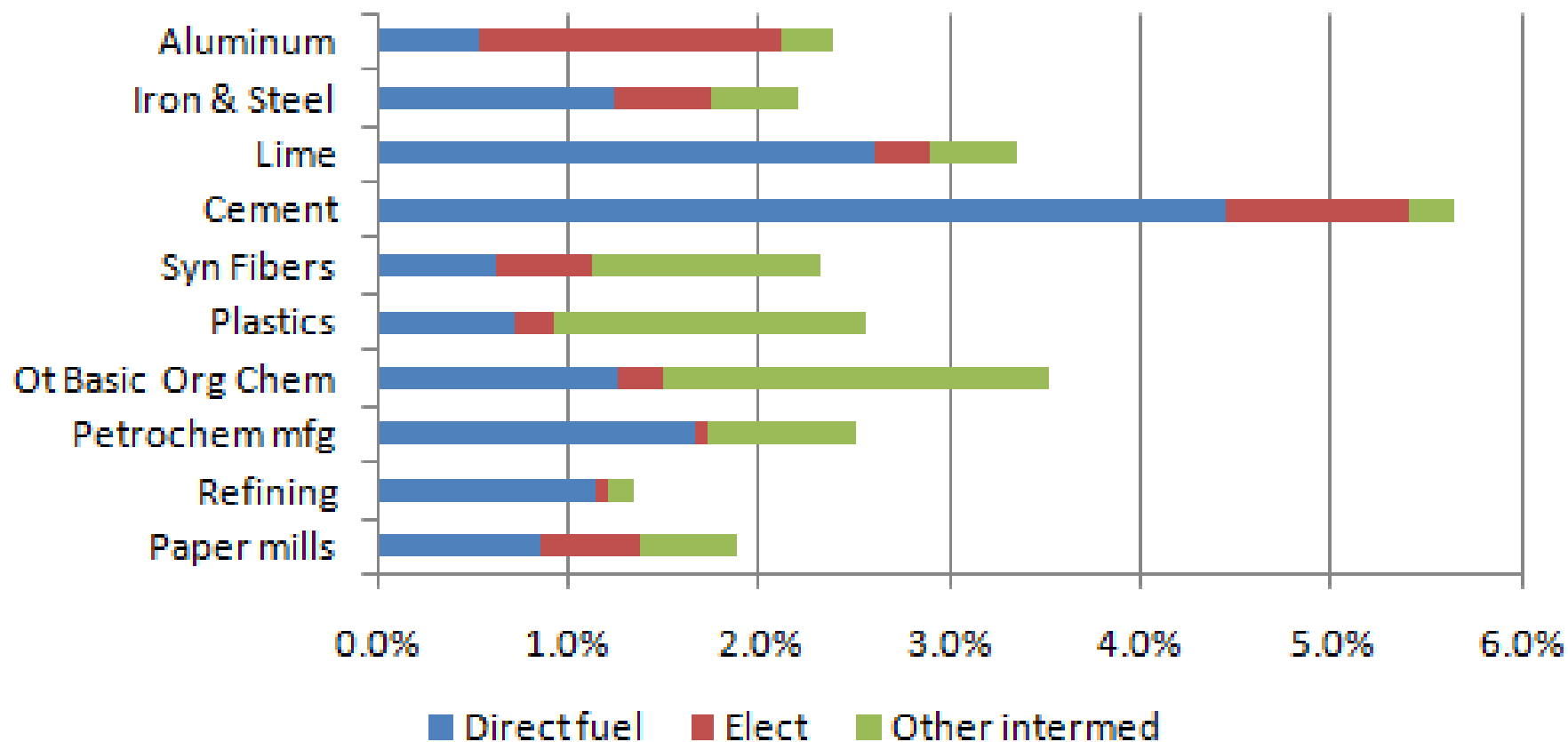


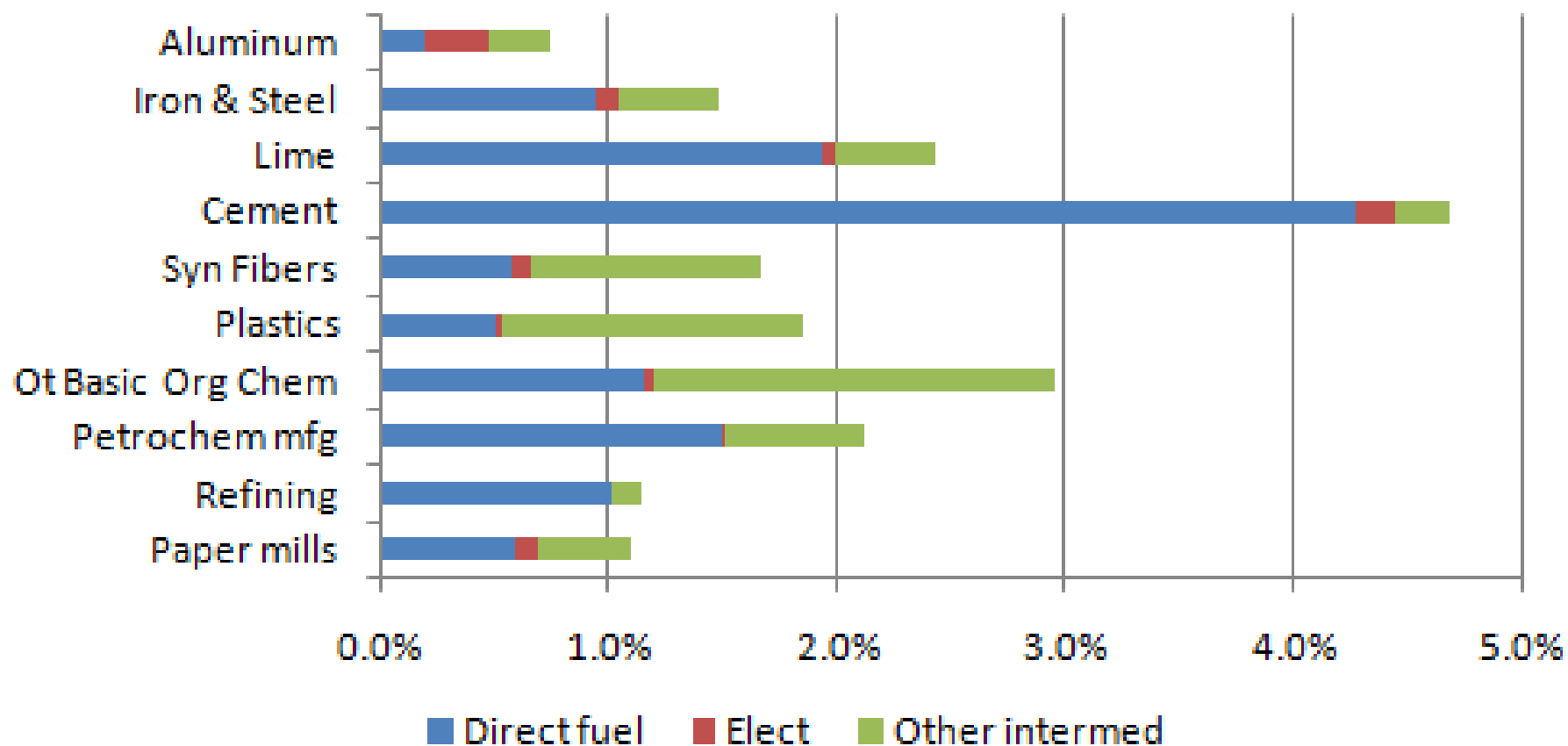
Table 3. Waxman-Markey subsidies to EITE Industries (2006)

	Free alloc. \$mil	Output subsidy (%)	Qualifying share of output
Paper Mills	397	0.77%	1.00
Refining-Other	1,906	0.42%	1.00
Chemicals group	1,818	0.25%	
Petrochem mfg	648	1.23%	1.00
Other basic inorg chem	167	0.65%	1.00
Synthe. Fibers	72	0.84%	1.00
Fertilizers	64	0.58%	0.32
Cement	460	4.47%	1.00
Lime and Gypsum	36	0.40%	0.19
Iron and Steel	943	1.13%	1.00
Aluminum	168	0.73%	1.00
Electric Utilities	26,933	7.23%	
Gas Utilities	8,080	7.00%	

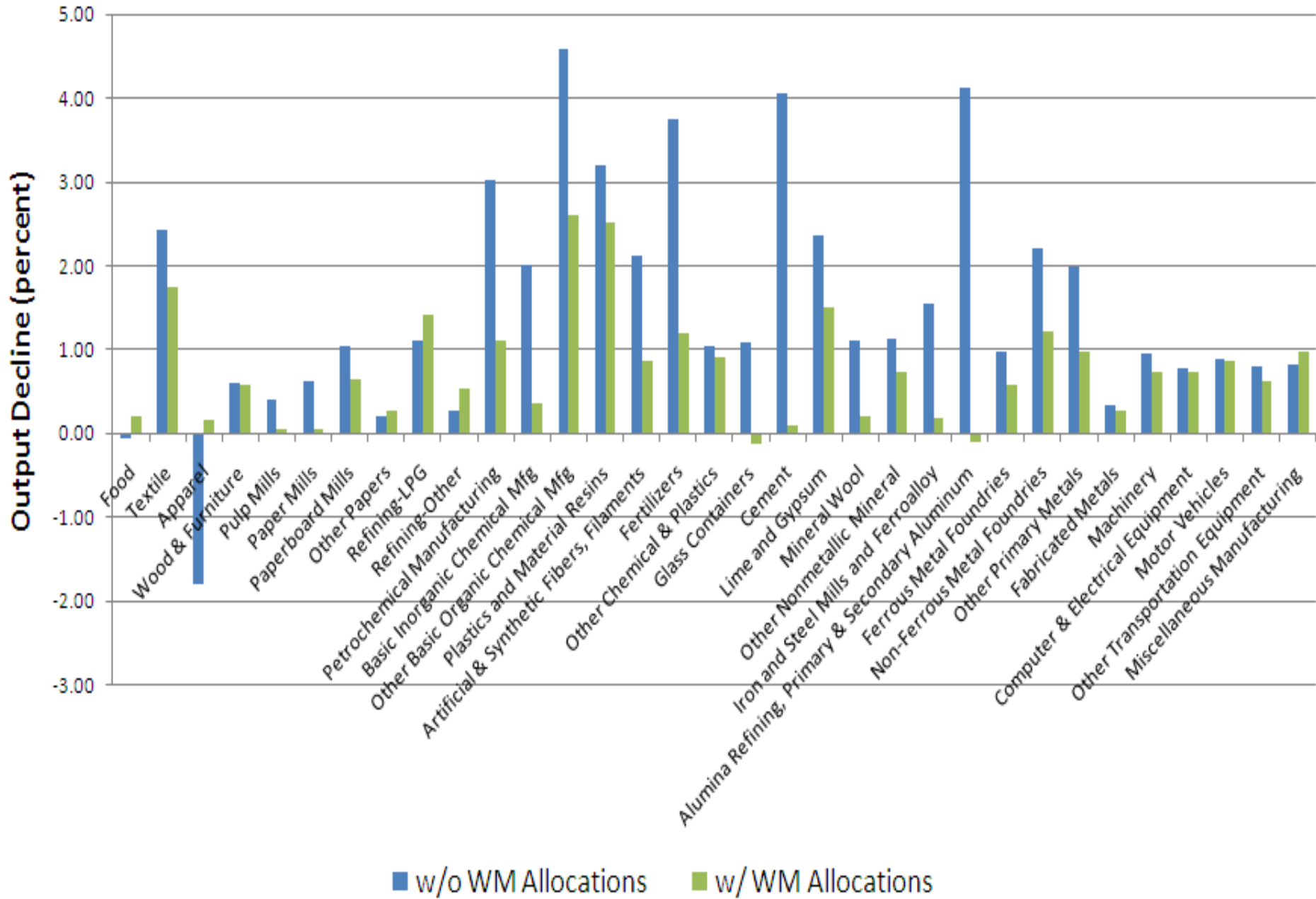
VSRun % increase in costs, \$15/ton CO2, no subsidies



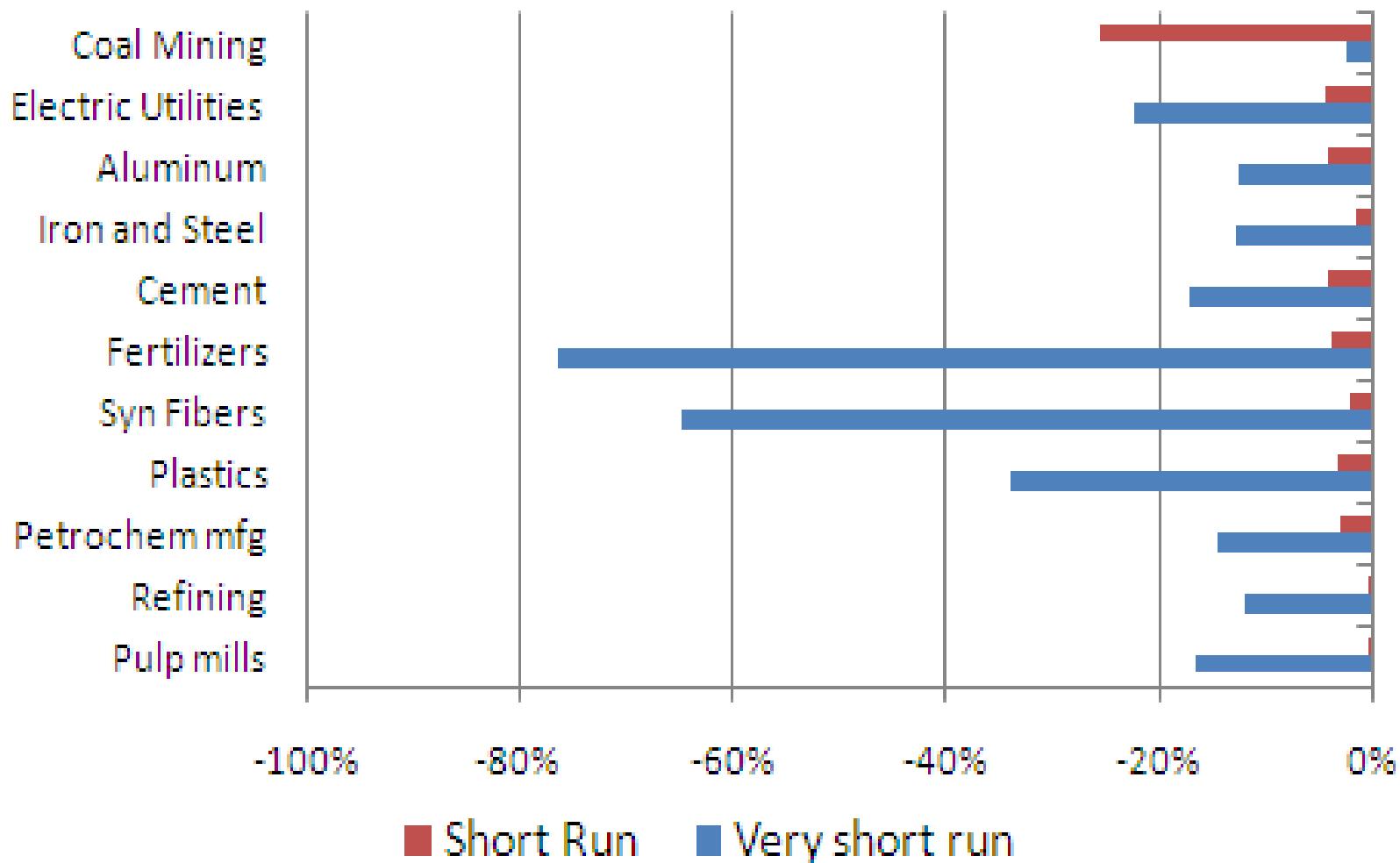
VSRun % increase in costs, \$15/ton CO2, with subsidies



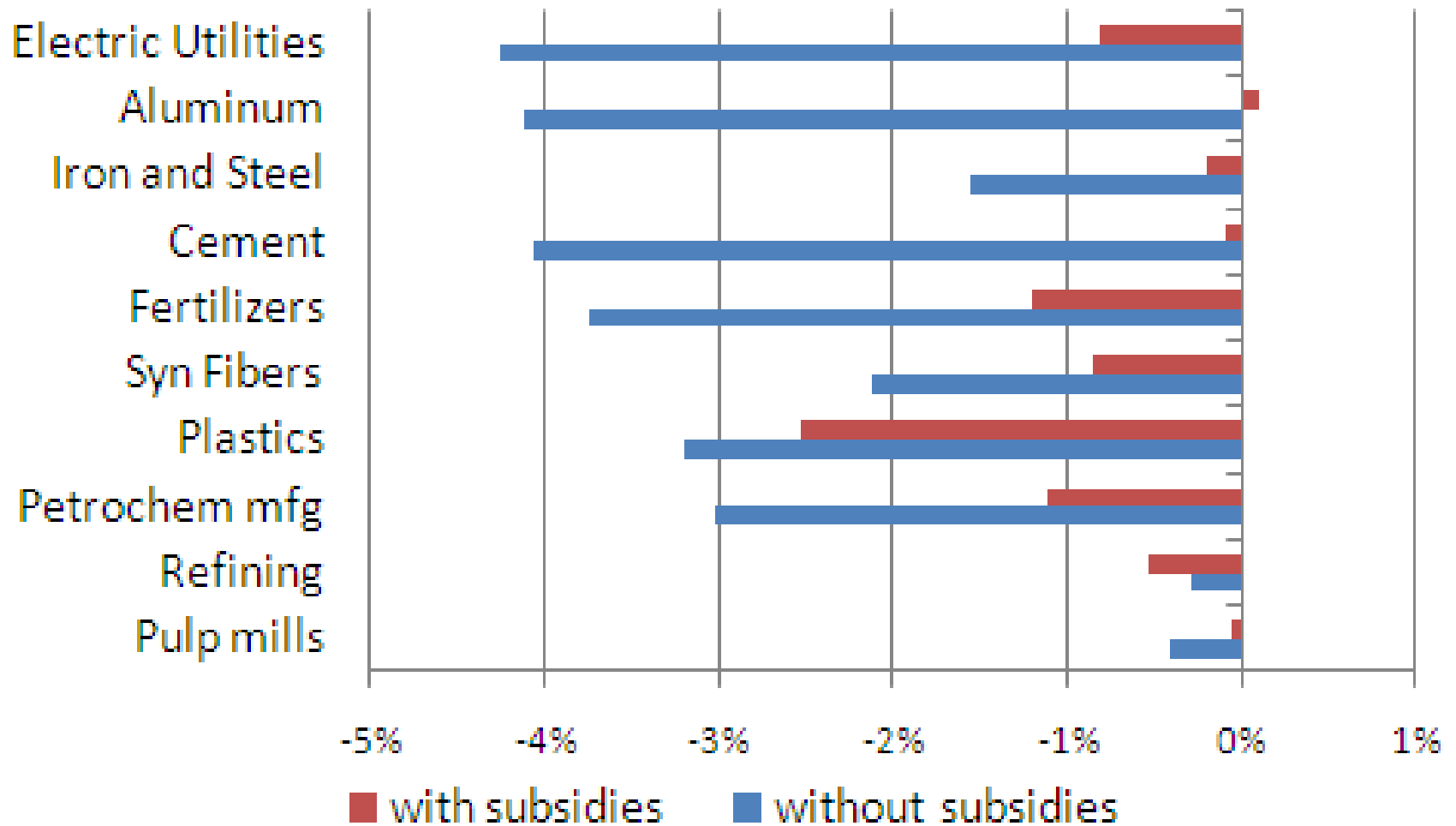
Short-Run Manufacturing Output Declines



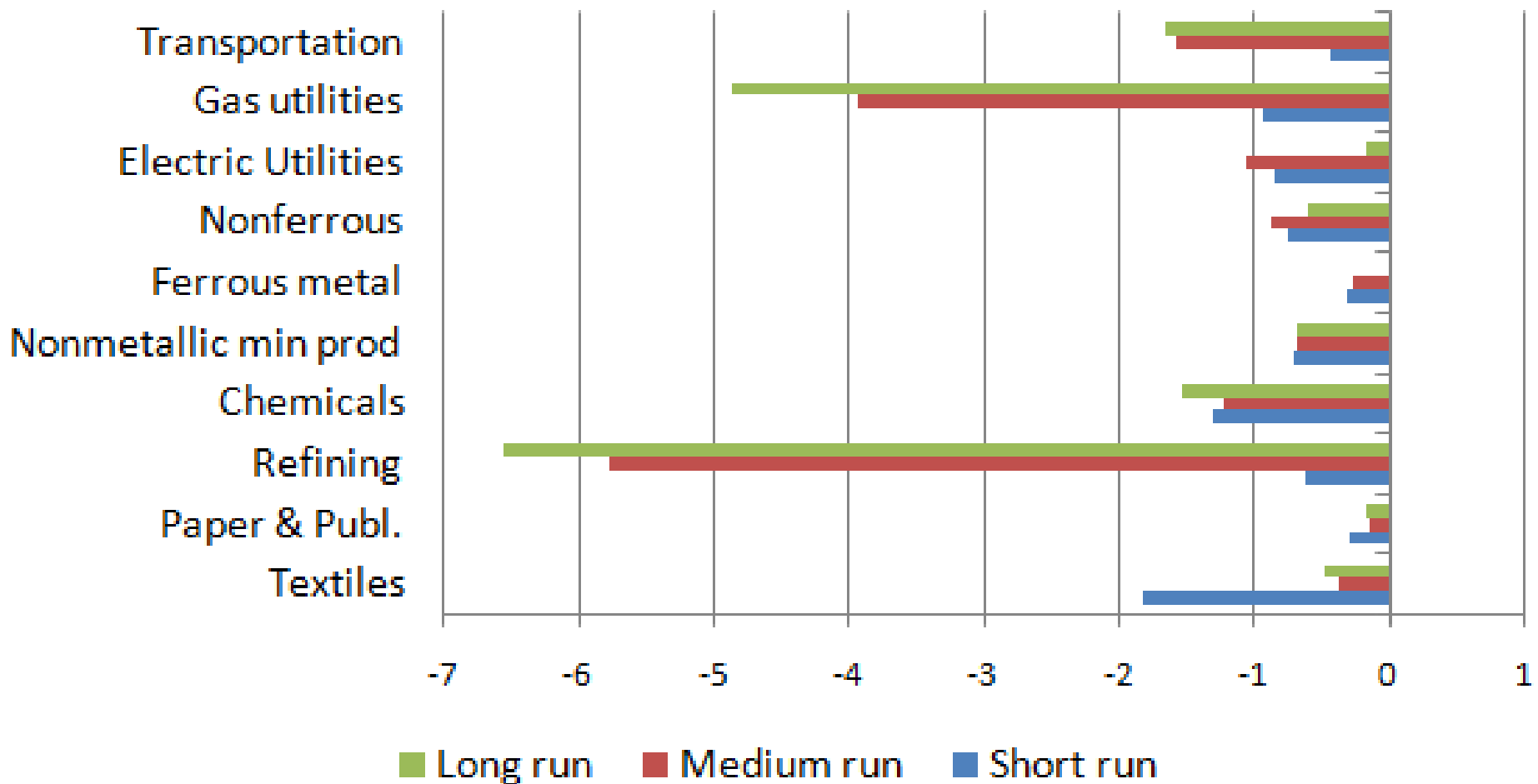
Effect on Profits of \$15/ton CO2; no subsidies



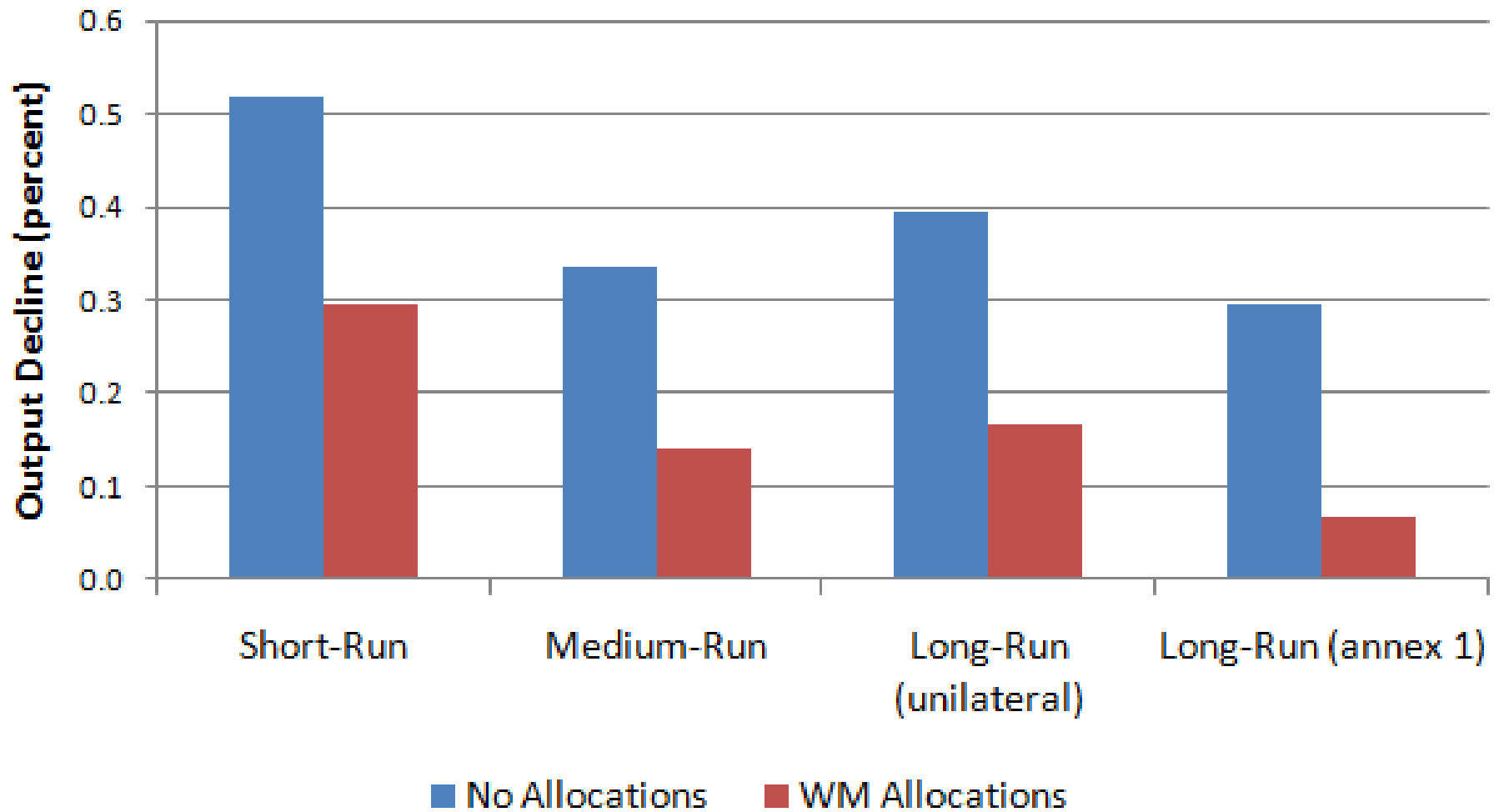
Effect on SR Profits; with and w/o subsidies



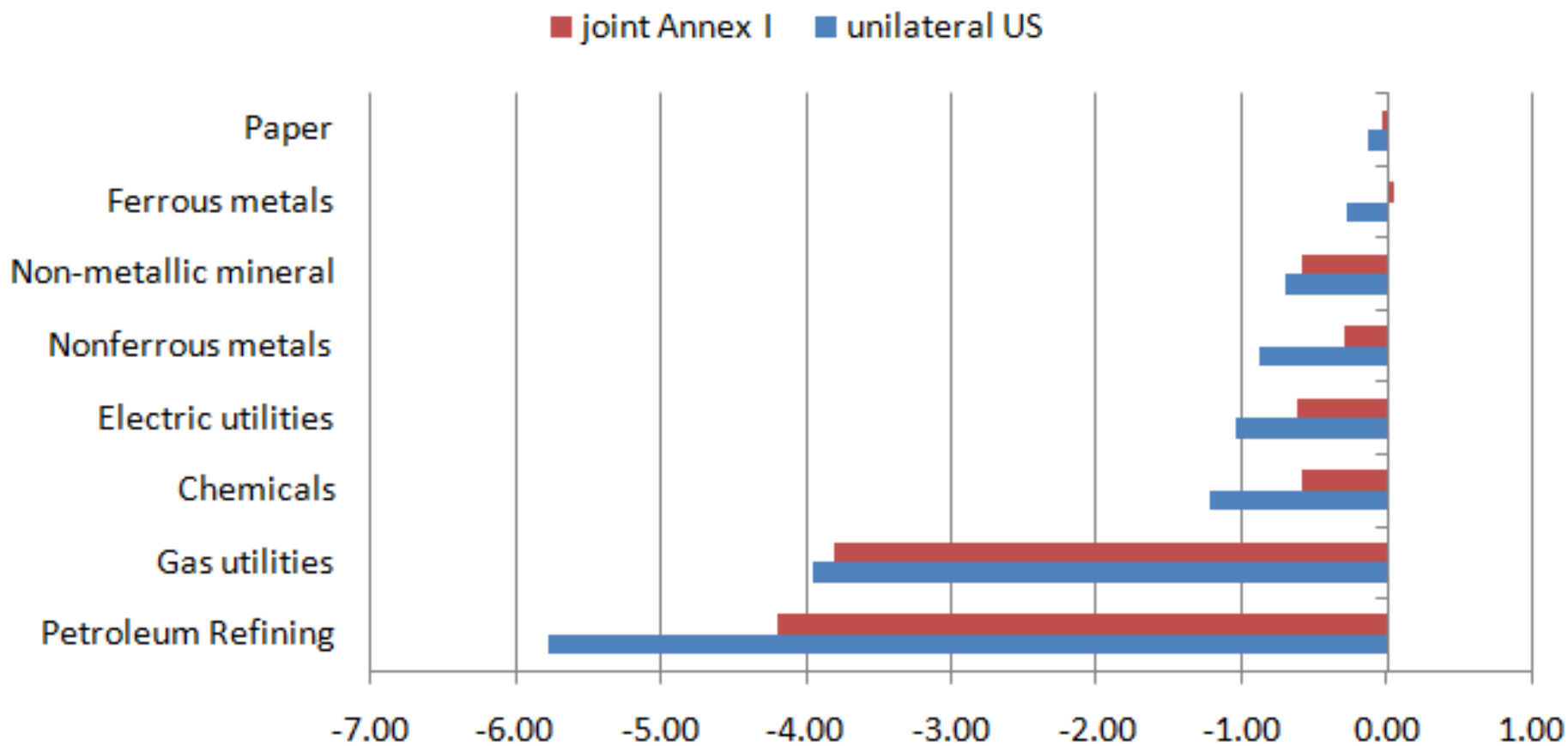
Effect on output over time, CO2 tax with subsidies (%)



Paper and Publishing - Output Declines



Effect of \$15/ton CO2 on output: unilateral vs. multilateral



% Change in Output (Medium run, with output subsidies)

Decomposing change in output to changes in Use, Exports and Imports

Medium-run Trade Effects of \$15/ton CO2 price; w/o WM Allocations					
	Consumption	% change	Contribution (Q=U+X-M)		
	(Base, \$bil)	in output	Use	Export	Import
Coal	38.9	-10.36	-19.70	8.30	-1.04
Paper	393.8	-0.34	-0.19	-0.09	0.06
Petroleum	309.6	-6.33	-6.08	-0.41	-0.16
Chemicals	732.8	-1.87	-0.65	-0.85	0.36
Nonmetallic	122.8	-1.22	-0.62	-0.28	0.33
Ferrous	149.6	-1.35	-0.64	-0.36	0.36
Nonferrous	116.8	-2.06	-0.90	-0.74	0.42

Trade Impact of \$15/ton CO2 price (% changes)

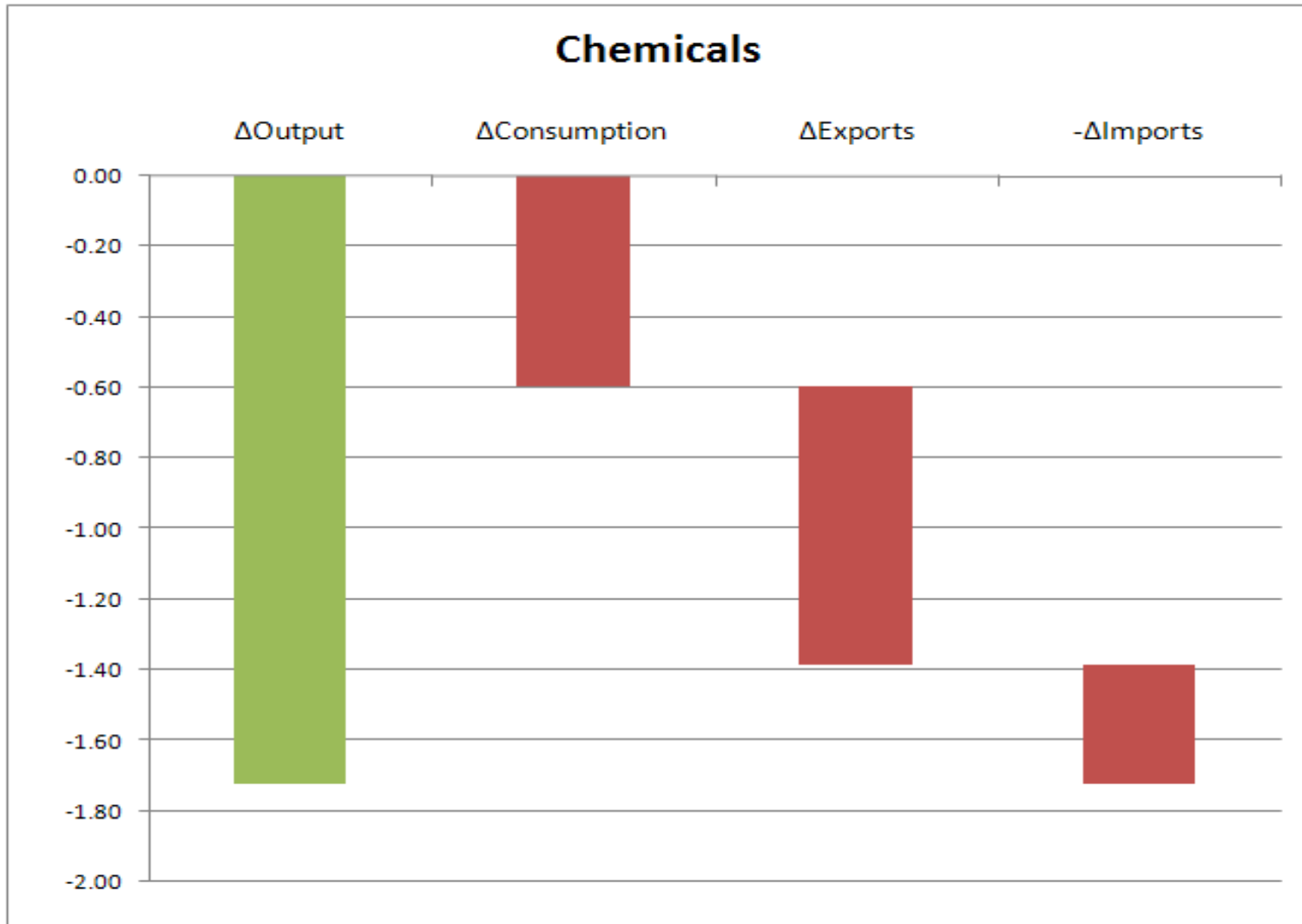
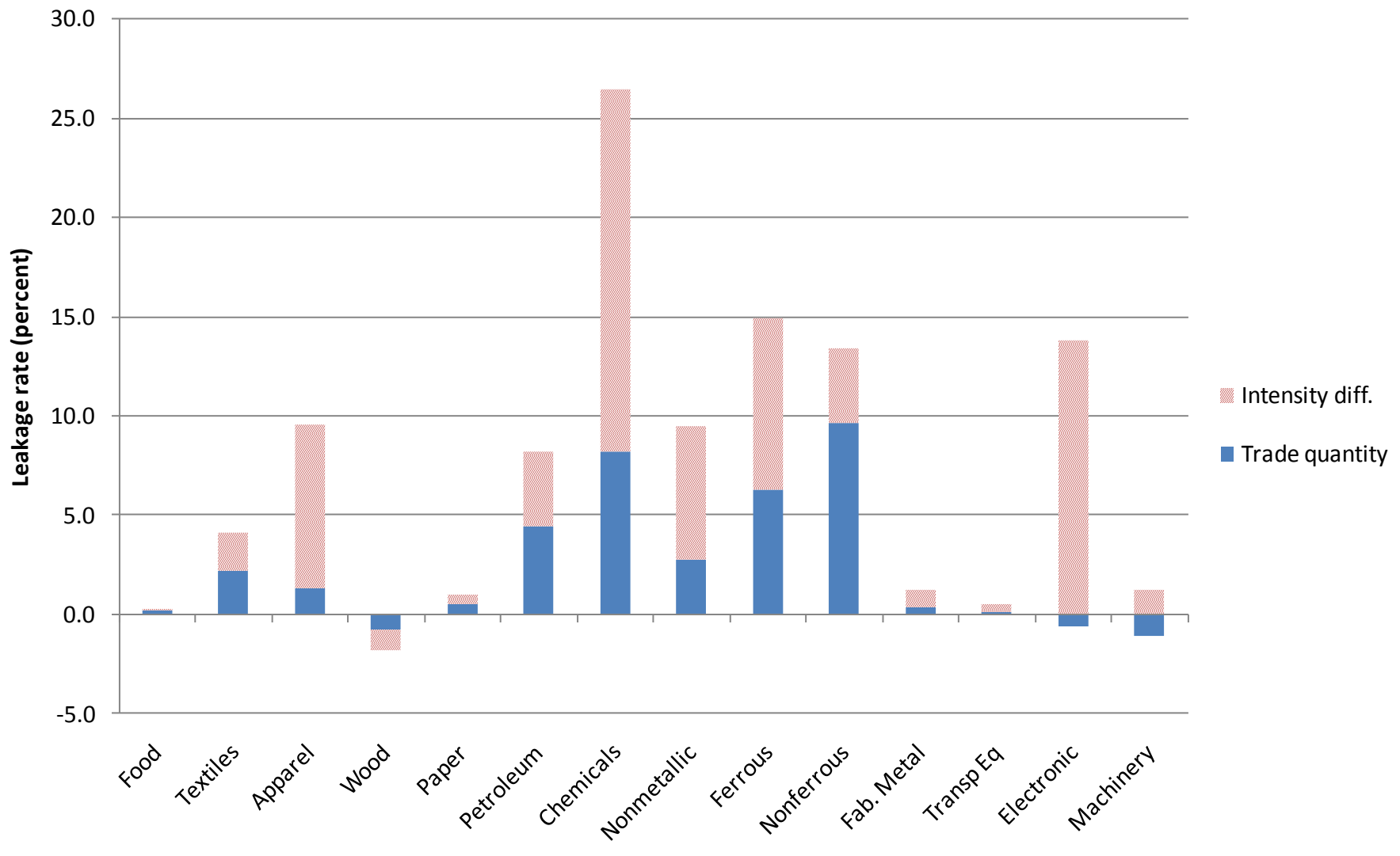


Figure 2. Industry Leakage due to Trade with the U.S. (Unilateral U.S. Policy without Rebates)



Leakage

- Aggregate leakage rates for unilateral U.S. policy with subsidies; assuming fixed “resources”
 - in medium run = 43.4%
 - in long run = 21.7%
- In the long run, a multilateral approach with all Annex I will reduce leakage = 17.5%.
- Results highly sensitive to supply elasticity assumptions in GTAP model. When an elastic “resources” supply is assumed, the leakage in the long run with multilateral action is only 5.2%

Conclusions

- Industries with largest output losses from carbon pricing readily identifiable
- On average, H.R. 2454 rebates offset large portion of output losses over all timeframes. But some industries do decline over time: nonferrous metals and fabricated metal products
- Ability to raise prices key to profitability over all timeframes
- Heterogeneous impacts: greatest harm in sub-categories of 3 digit industries (SR)

Conclusions (cont.)

- More diverse patterns in nonmanufacturing sector. In LR, coal, agriculture, transportation all decline
- On average only half of output losses result in reduced consumption, as net exports change substantially
- Trade related emissions leakage is generally small, in line with *Interagency Report*
- When increased fossil fuel use in LDC is included, leakage rates higher, 17-21%. With (assumed) elastic resources supply, leakage drops to 5.2% with multilateral policies