

THE INCOME DISTRIBUTION IMPACTS OF CLIMATE CHANGE MITIGATION POLICY

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INTRODUCTION

- MARKET INSTRUMENTS:
 - CARBON TAXES & TRADABLE PERMITS
- NEGATIVE MACROECONOMIC EFFECTS
- DISTRIBUTION IMPACTS
 - FEW STUDIES

IMPORTANCE OF DISTRIBUTION EFFECTS

- UNEVEN ACROSS STAKEHOLDERS
 - EQUITY ISSUES

- SECOND BEST WORLD
 - EQUITY AND EFFICIENCY INTERTWINED
 - POLITICAL CONSIDERATIONS
 - SCALE ISSUES
 - DOUBLE-DIVIDEND HYPOTHESIS

FACTORS IN DISTRIBUTION OUTCOMES

- ENERGY INTENSITY
- NATURE OF THE TAX
- SUBSTITUTION POSSIBILITIES
- FACTOR MOBILITY
- GENERAL EQUILIBRIUM EFFECTS
- REVENUE RECYCLING OPTION
- DYNAMIC EFFECTS
- TECHNICAL CHANGE

THE COMPUTABLE GENERAL EQUILIBRIUM MODEL

- CLIMATE CHANGE IN A REGIONAL ECONOMY
- 49 PRODUCTION SECTORS
- ELECTRICITY SUB-DIVIDED INTO 5 TYPE
 - GAS, COAL, PETROLEUM, NUCLEAR AND HYDRO
- 9 HOUSEHOLD INCOME GROUPS
 - \$0-\$5k; \$5-\$10k; \$10-\$15k; \$15-\$20k; \$20-\$30k; \$30-\$40k; \$40-\$50k; \$50-\$70k; > \$70K

THE COMPUTABLE GENERAL EQUILIBRIUM MODEL

- PRODUCTION: NNCES FUNCTION
- CONSUMPTION: NON-MARKET LINEAR EXPENDITURE SYSTEM
- LABOR AND CAPITAL INCOME ALLOCATION: OCCUPATIONAL MATRIX
- PARAMETERS: ESTIMATION AND LITERATURE

SIMULATIONS: CLOSURE CONDITIONS

CONSUMPTION TAX CONDITIONS: \$25/tC			
Sector	Fuel Price	Emission Factor	Percent Tax
Coal	\$26.8/short ton	0.027 ton/mmbtu	53
Crude Oil	\$17.2/barrel	0.021 ton/mmbtu	18
Natural Gas	\$2.8/mcf	0.015 ton/mmbtu	13
GENERAL CLOSURE CONDITIONS:			
Sectoral occupational wage rates are linear functions of a freely adjusting average wage rate			
Sectoral government expenditures are constant shares of total government spending, while government balance is fixed at the benchmark level			
Transfers are constant shares of transferors' income			
EXTERNAL CLOSURE:			
Import and export prices adjust to maintain 1995 relative domestic and external prices			
External agents savings adjust to maintain a zero overall balance of payments			
SHORT-RUN CLOSURE RULES:			
Capital stock is fixed by sector, and sectoral return rates adjusts freely			
LONG-RUN CLOSURE RULES:			
Capital is mobile across sectors, and sectoral return rate is a linear function of average rate of return in the economy			
Total capital stock is flexible, and relative wage and capital return rate is constant			

SIMULATIONS: MACROECONOMIC EFFECTS

(% Changes)

	Short-Run	Long-Run
Gross Output	-0.41	-0.90
Real GRP	-0.30	-0.68
Employment	-0.11	-0.23
Capital Stock	0.00	-0.26
Tax revenue	-0.51	-1.15
Household income	-0.44	-1.06
Government income	0.46	-0.17
Average wage rate	-0.44	-1.02
Average capital return rate	0.00	-1.02
Producer price index	-0.24	-0.33
Carbon emission	-27.41	-39.23

SIMULATIONS: SECTORAL EFFECTS

(% Changes)	Price		Output	
	Short-Run		Long-Run	
Coal	-0.32	-22.90	11.25	-32.93
Crude Oil	-7.19	-5.03	1.31	-8.43
Natural Gas	0.03	-0.93	1.81	0.75
Manufacturing	-0.34	-0.91	-0.09	-1.91
Petroleum products	5.96	-3.44	13.69	-7.16
Transportation	-0.55	-0.32	-0.32	-0.77
Electric Services	3.30	-1.09	2.91	-1.26
Gas Utilities	3.20	-0.41	7.26	-1.41

SIMULATIONS: HOUSEHOLD DEMAND

	1	2	3	4	5	6	7	8	9	10
Short-Run										
Food	0.30	0.38	0.45	0.41	-0.10	-0.05	-0.12	-0.31	-0.38	-0.07
Housing	0.79	0.80	0.64	0.61	-0.07	-0.14	-0.19	-0.31	-0.32	-0.09
Fuel/Utilities	-0.41	-0.64	-0.30	-0.40	-0.43	-0.34	-0.33	-0.56	-1.03	-0.52
Household Operation	0.67	0.69	0.67	0.59	-0.21	-0.19	-0.33	-0.53	-0.46	-0.22
Clothing/Jewelry	0.36	0.43	0.49	0.49	-0.13	-0.29	-0.13	-0.31	-0.37	-0.17
Transportation	0.04	-0.06	0.09	0.00	-0.47	-0.34	-0.23	-0.34	-0.52	-0.34
Health	0.76	0.75	0.70	0.68	-0.10	-0.25	-0.10	-0.28	-0.30	-0.04
Recreation	0.53	0.70	0.78	0.96	-0.10	-0.13	0.01	-0.11	-0.03	0.04
Others Commodities	0.69	0.73	0.71	0.75	-0.10	-0.16	-0.24	-0.44	-0.38	-0.15
Long-Run										
Food	0.07	0.09	0.13	0.05	-0.39	-0.23	-0.45	-0.65	-0.77	-0.39
Housing	0.46	0.54	0.40	0.36	-0.37	-0.51	-0.51	-0.66	-0.66	-0.41
Fuel/Utilities	-1.16	-1.56	-0.92	-1.07	-0.87	-0.64	-0.63	-0.94	-1.67	-1.00
Household Operation	-0.14	-0.14	-0.06	-0.09	-0.90	-0.98	-1.16	-1.41	-1.36	-1.04
Clothing/Jewelry	0.04	0.06	0.02	-0.02	-0.52	-0.83	-0.49	-0.68	-0.80	-0.59
Transportation	-1.69	-2.01	-1.43	-1.33	-1.72	-1.34	-0.78	-1.01	-1.62	-1.31
Health	0.44	0.50	0.44	0.39	-0.45	-0.71	-0.40	-0.55	-0.53	-0.35
Recreation	-0.12	-0.12	-0.12	0.04	-0.79	-0.89	-0.62	-0.80	-0.88	-0.71
Others Commodities	0.31	0.39	0.27	0.34	-0.48	-0.60	-0.83	-0.99	-0.84	-0.63

SIMULATIONS: SENSITIVITY ANALYSIS

- AGGREGATE IMPACTS OF THE TAX IS NON-LINEAR
- WEAK FORM OF THE DOUBLE-DIVIDEND HYPOTHESIS
- LUMP SUM TRANSFER HAS BETTER DISTRIBUTIONAL IMPACT THAN PERSONAL TAX REDUCTION

CONCLUSIONS

- MODEST AGGREGATE IMPACTS
- ENERGY SECTORS BEAR BRUNT
- MILDLY PROGRESSIVE
 - DETAILED DISTRIBUTIONAL MODELING
- MANY OTHER EFFECTS REMAIN
 - DYNAMICS
 - TECHNICAL CHANGE