Macroeconomic and Sectoral Impacts of Climate Change Mitigation in Thailand

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Introduction

- Lack of in-depth assessment of economic impacts of CC mitigation policies in developing countries
- Carbon tax is considered as one of the CC mitigation policy instruments, however the literature is limited
- Double and triple dividend hypothesis
- It could be of interest to DC policy makers and other stakeholders to understand the economy wide impacts of CC mitigation
- The purpose of the study is not to recommend carbon tax to DCs instead to demonstrate how would CC mitigation impact development economies

Policy Design

Carbon tax rate = $40/tC

Equivalent indirect tax rates on fuels (%)

Coal	Oil	Gas
118	23	31

Revenue Recycling Schemes

Public (government) consumption (Scheme 1)

Household consumption through a lump-sum transfer (Scheme 2)

Financing cuts in existing labor tax rates (Scheme 3)

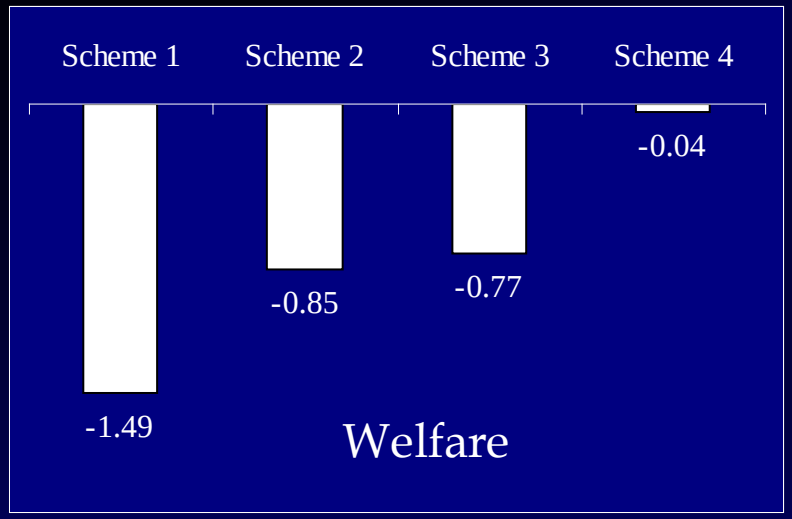
Financing cuts in existing indirect tax rates of non-energy goods (Scheme 4)

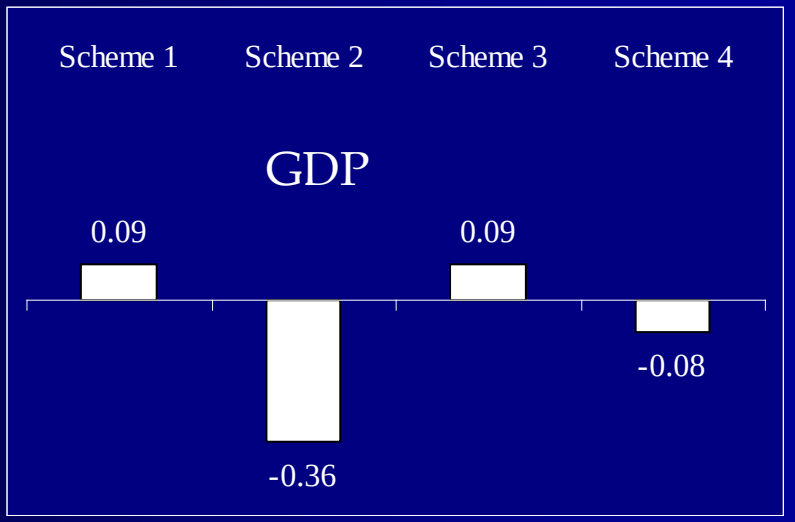
The Model

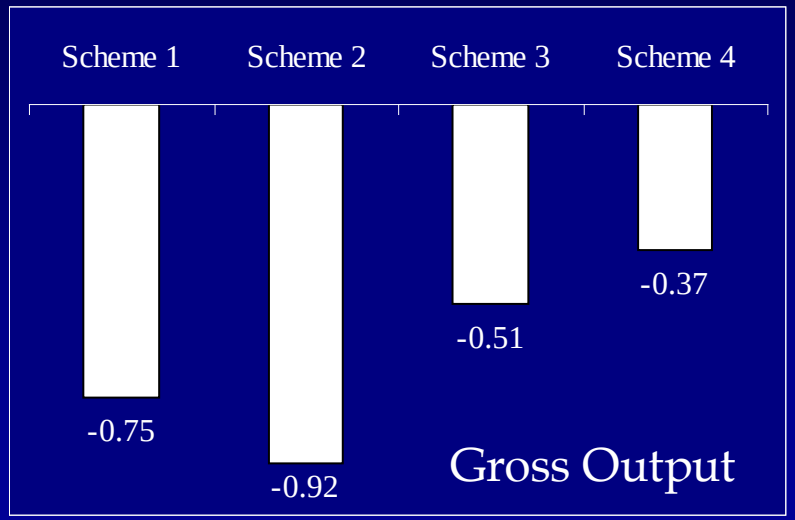
- A static, multi-sector, SAM based CGE model for Thailand
- 21 economic sectors, of which 6 are energy sectors (coal, oil, gas, fuel wood, oil refinery, electricity generation)
- The electricity sector is further divided into seven sub-sectors: hydro; coal-, oil- and gas- fired steam turbine; oil- and gas- fired combined cycle; and diesel fired internal combustion engine
- Producers' behavior in all sectors and electricity sub-sectors are represented through four step nested CES production functions
- A representative household that follows a five-step hierarchical optimization process to maximize utility
- Fixed real government consumption
- Armington assumption for imports
- Walrasian approach to clear the markets

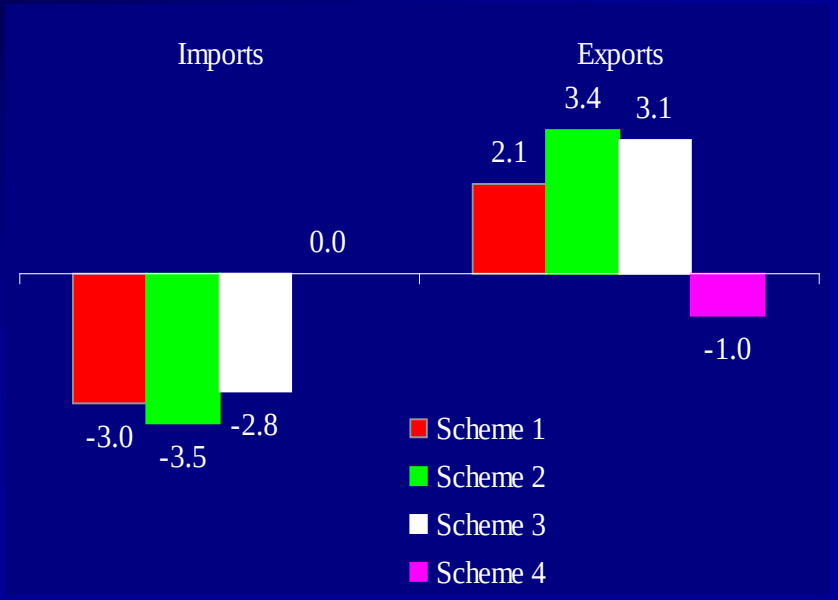
Macro Impacts

(% change from the base case)









Macro Impacts

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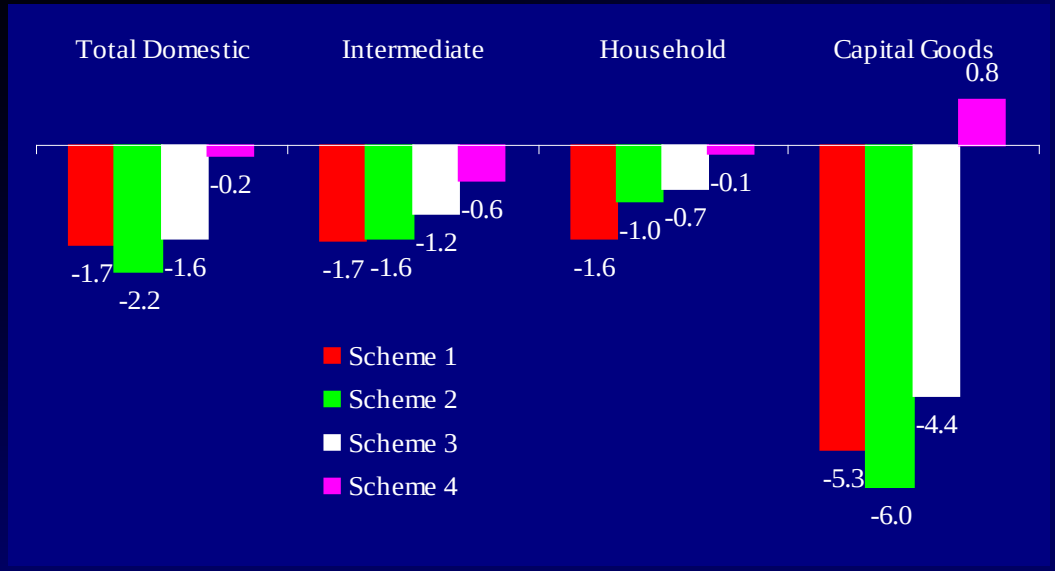
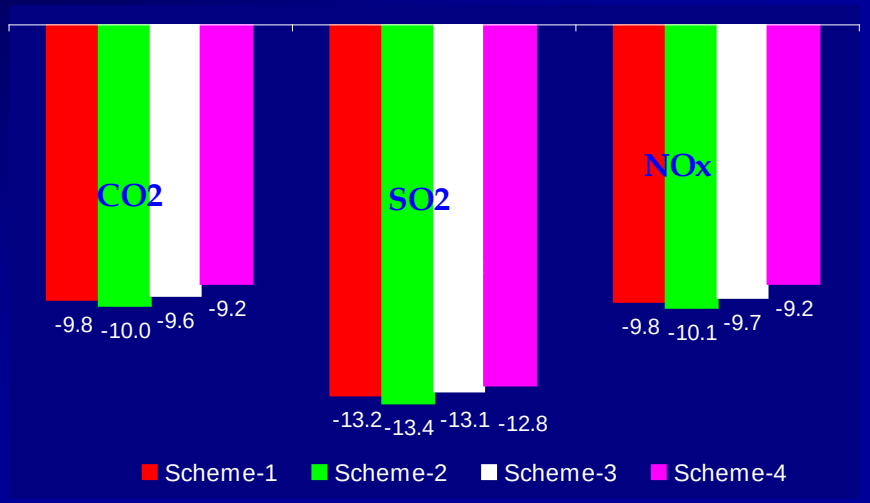
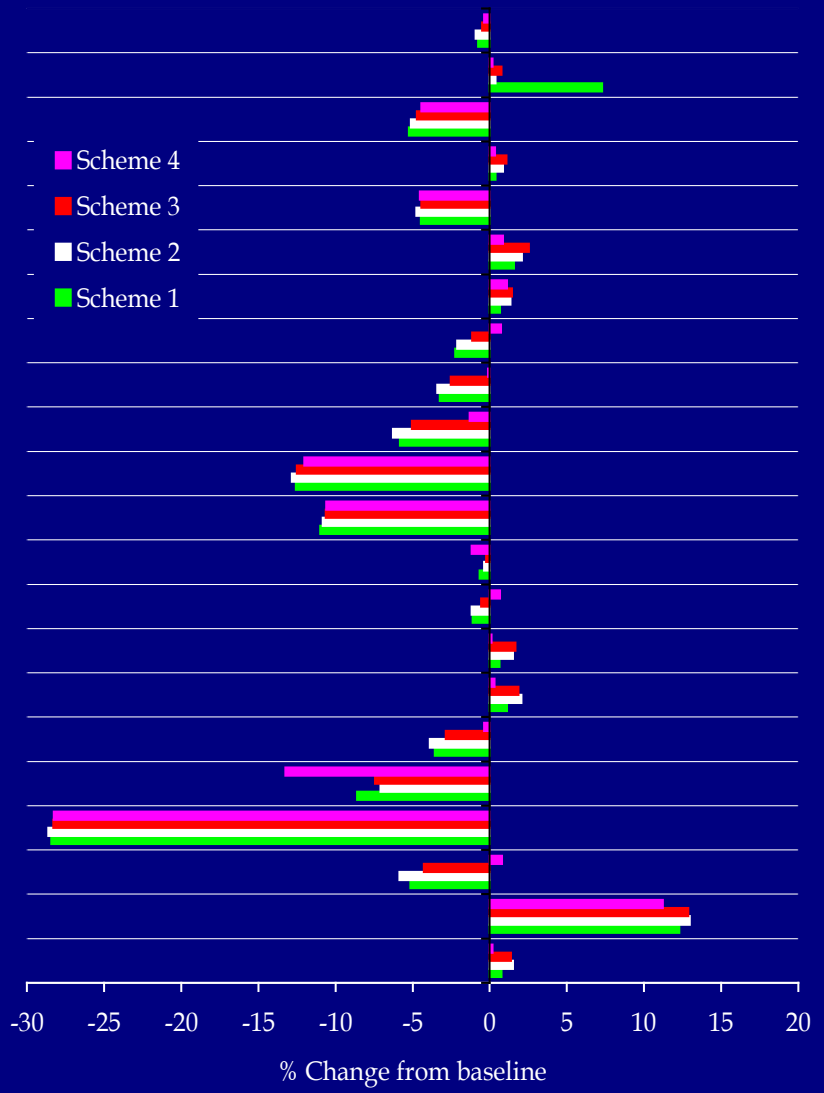


Impacts on Demand

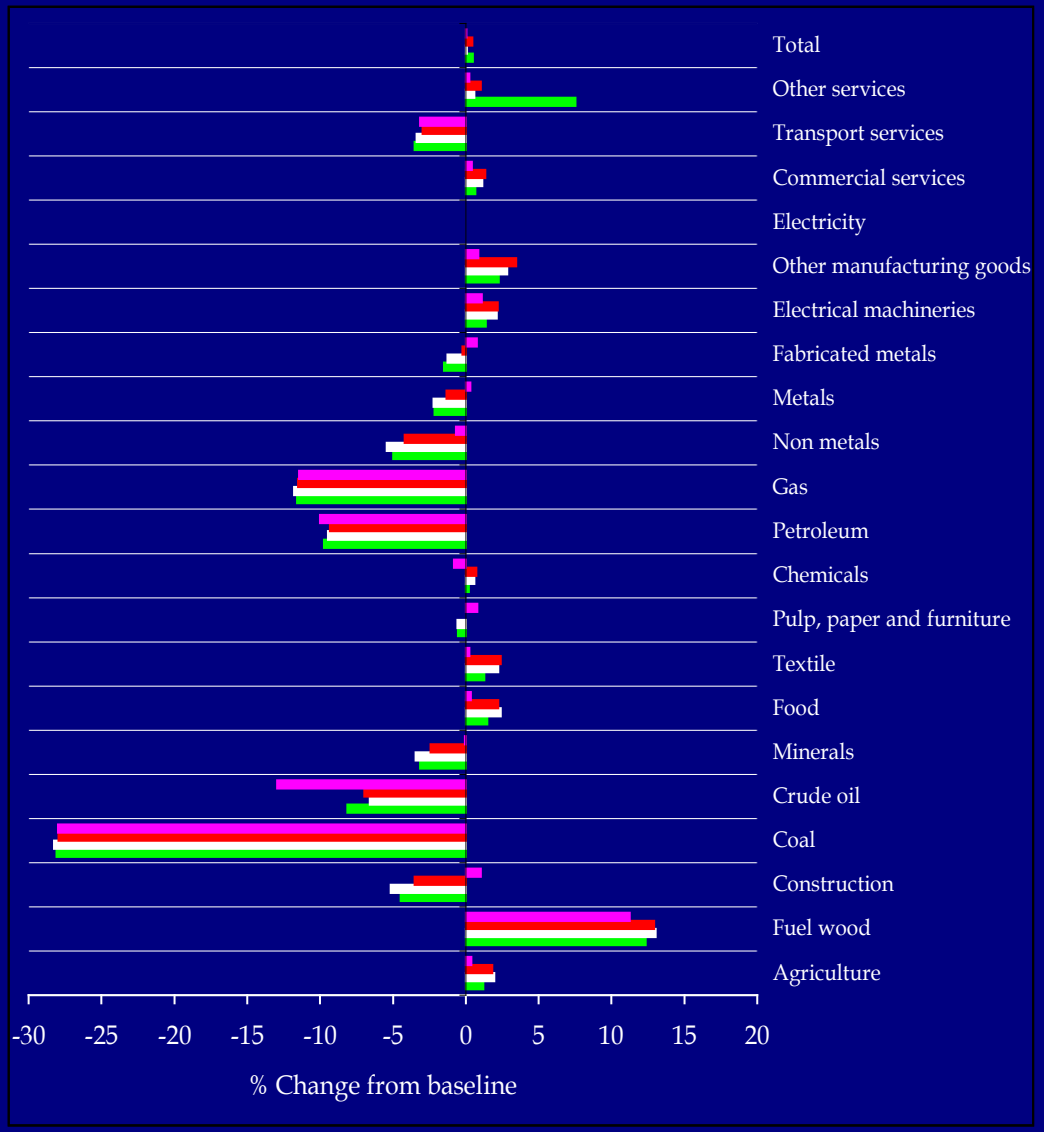
Impacts on Emissions



Sectoral Impacts – VA and Outputs



(a) Sectoral Output

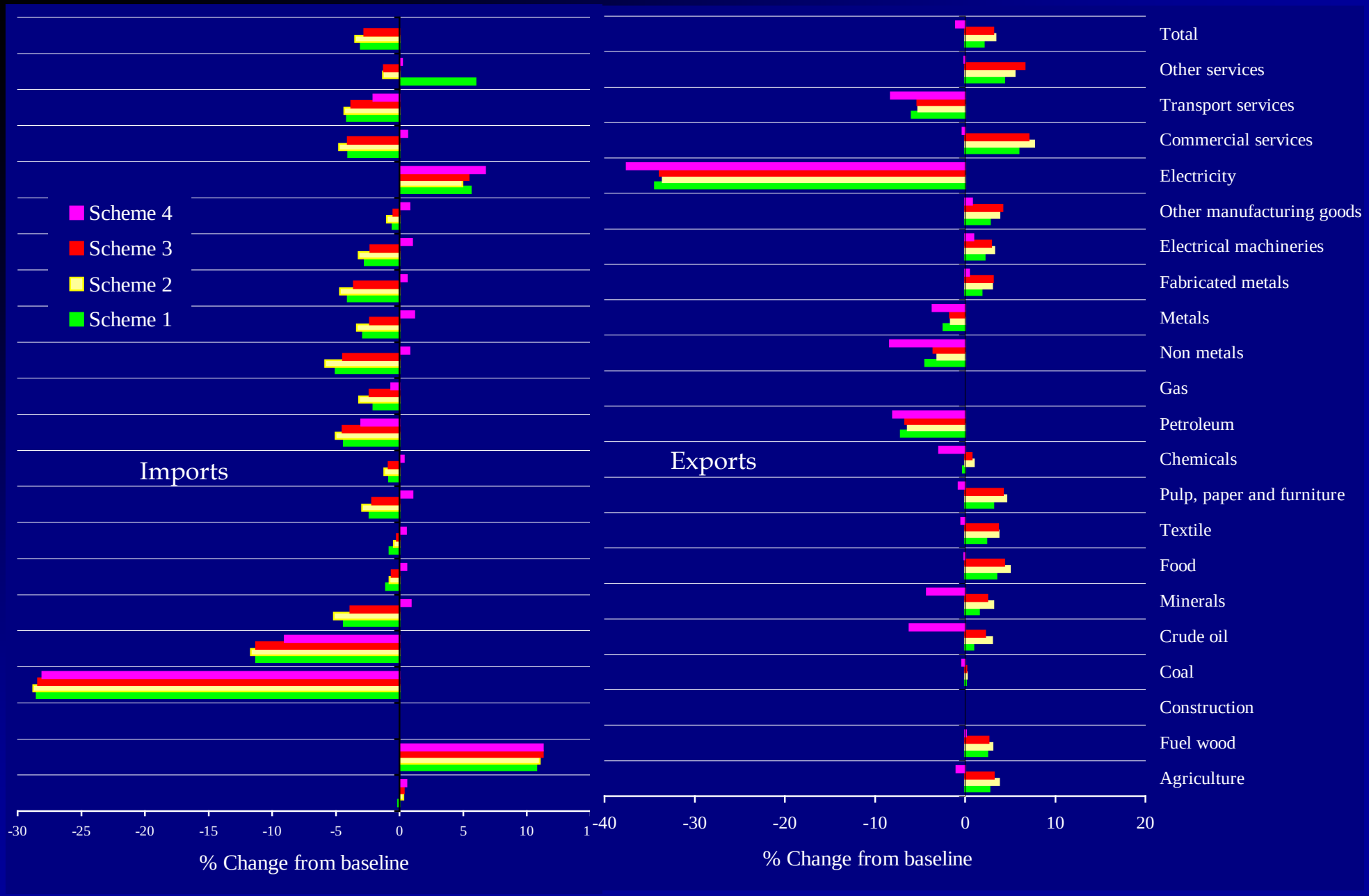


(b) Sectoral Value Added

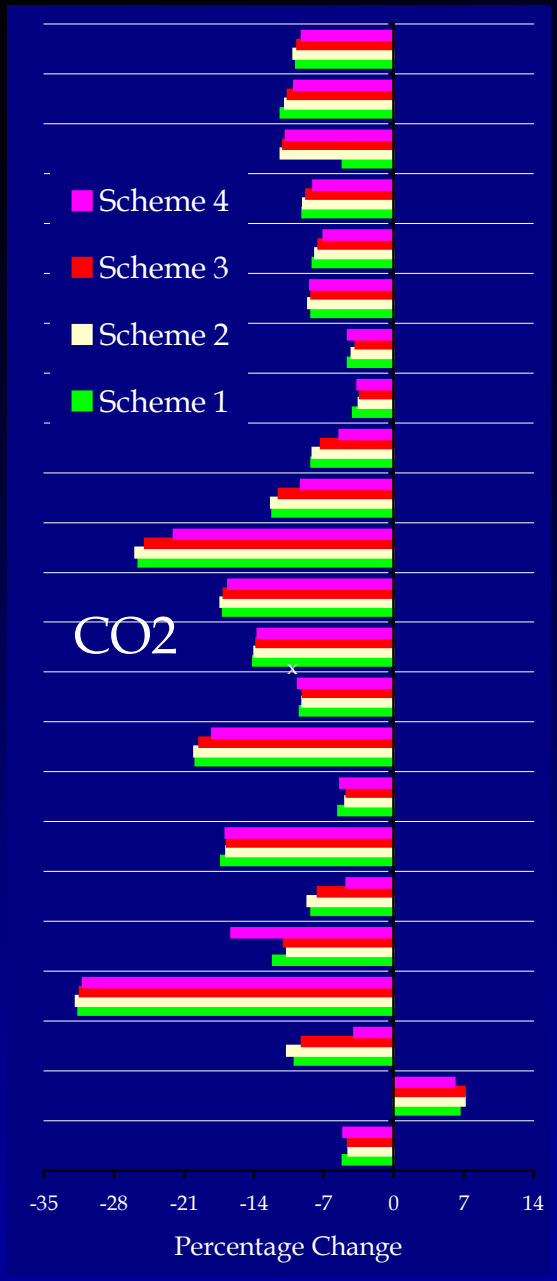
Sectoral Impacts -- Demands for Goods & Services

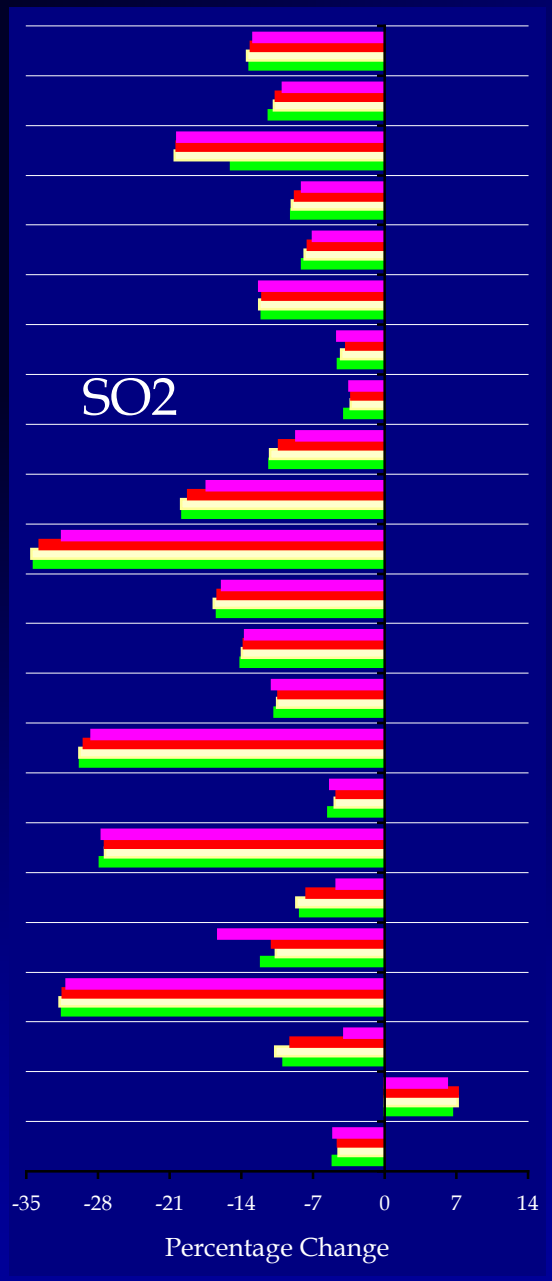
	Total Domestic Demand				Intermediate Demand				Final Demand			
	Scheme 1	Scheme 2	Scheme 3	Scheme 4	Scheme 1	Scheme 2	Scheme 3	Scheme 4	Scheme 1	Scheme 2	Scheme 3	Scheme 4
Agriculture	0.6	1.3	1.2	0.3	1.1	1.8	1.6	0.3	-0.9	-0.3	-0.3	0.1
Fuel wood	12.4	13.0	12.9	11.3	27.7	28.4	28.2	25.1	-9.0	-8.4	-8.2	-7.8
Construction	-5.1	-5.9	-4.3	0.8	0.4	-0.8	-0.4	0.1	-5.3	-6.0	-4.4	0.8
Coal	-28.4	-28.6	-28.3	-28.3	-28.4	-28.6	-28.3	-28.3	-28.4	-28.6	-28.3	-28.3
Crude oil	-11.1	-11.0	-10.8	-10.5	-11.1	-11.0	-10.8	-10.5	-8.6	-7.1	-7.4	-13.3
Minerals	-4.1	-4.6	-3.4	0.1	-4.1	-4.6	-3.4	0.1	-3.6	-4.0	-2.9	-0.4
Food	-0.4	0.1	0.2	0.5	0.7	1.1	1.1	0.6	-1.4	-0.8	-0.6	0.4
Textile	-0.3	0.3	0.5	0.4	0.6	1.2	1.4	0.4	-1.6	-1.1	-0.7	0.4
Pulp, paper and furniture	-1.8	-2.2	-1.4	0.9	-1.5	-1.9	-1.1	1.1	-2.6	-2.9	-2.1	0.5
Chemicals	-0.8	-1.1	-0.8	0.1	-0.6	-0.9	-0.6	0.1	-1.7	-1.9	-1.6	0.1
Petroleum	-8.1	-8.3	-8.0	-7.3	-8.3	-8.3	-7.9	-7.2	-7.0	-8.6	-8.5	-7.9
Gas	-12.3	-12.6	-12.2	-11.7	-12.3	-12.6	-12.2	-11.7	0.0	0.0	0.0	0.0
Non metals	-5.8	-6.4	-5.0	-0.8	-5.9	-6.5	-5.1	-0.8	-2.8	-3.3	-2.6	-0.4
Metals	-3.0	-3.5	-2.4	0.9	-3.0	-3.4	-2.4	0.9	-3.6	-3.9	-2.9	0.1
Fabricated metals	-3.7	-4.0	-2.9	0.7	-2.4	-2.6	-1.7	0.5	-4.5	-5.0	-3.7	0.8
Electrical machineries	-2.5	-2.8	-1.9	1.1	-0.5	-0.7	-0.2	1.4	-4.5	-5.0	-3.7	0.8
Other manufacturing goods	-0.3	-0.6	-0.1	0.9	1.5	1.1	1.6	1.1	-1.7	-2.0	-1.3	0.7
Electricity	-4.2	-4.6	-4.2	-4.3	-3.6	-3.7	-3.3	-3.5	-7.0	-8.0	-7.9	-7.7
Commercial services	-0.4	-0.1	0.2	0.4	0.4	0.6	0.9	0.4	-1.0	-0.6	-0.3	0.5
Transport services	-5.0	-5.1	-4.5	-3.2	-5.5	-5.7	-5.1	-3.8	-4.5	-4.5	-4.1	-2.8
Other services	7.3	0.3	0.6	0.2	1.4	0.8	1.8	0.3	8.6	0.2	0.4	0.1
Total	-1.7	-2.2	-1.6	-0.2	-1.7	-1.6	-1.2	-0.6	-1.8	-2.8	-2.1	0.3

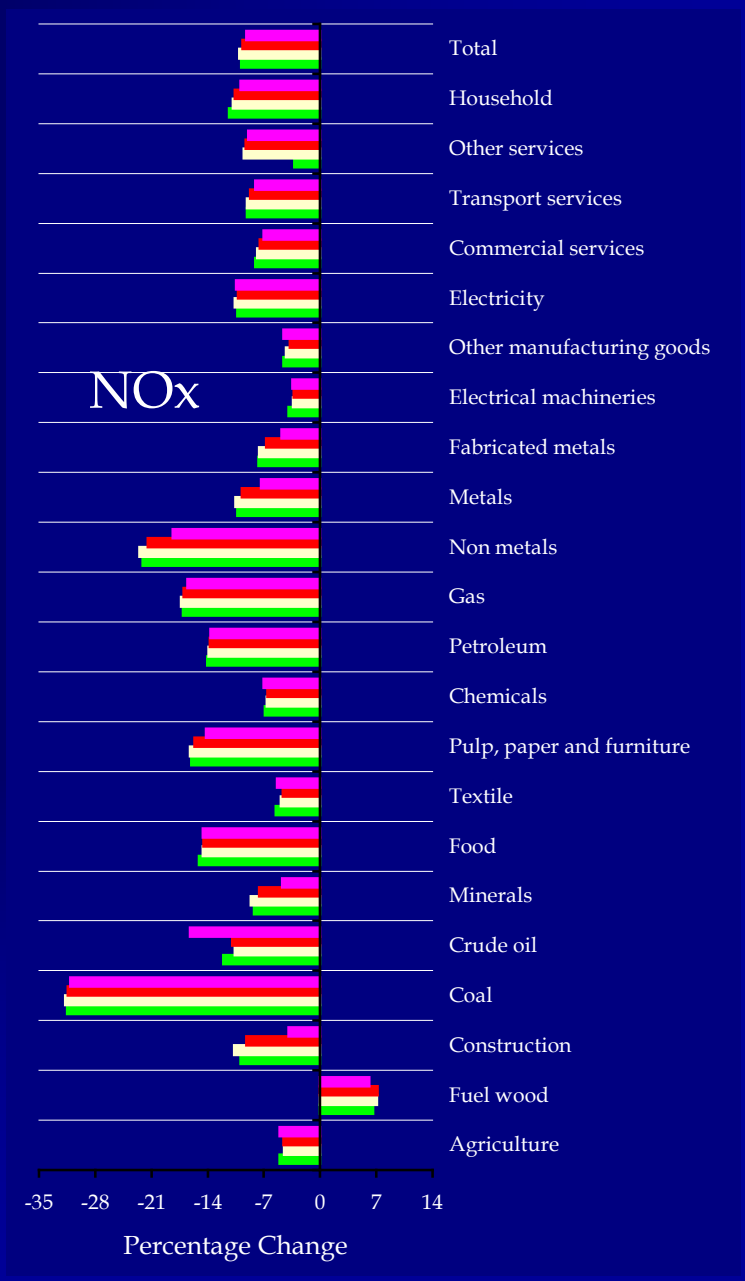
Sectoral Impacts – Imports and Exports



Sectoral Impacts -- Emissions







Conclusions

- A carbon tax of \$40/tC (~ \$10/tCO_2) would be required to cut CO_2 by 9% to 10%
- Welfare loss varies significantly across revenue recycling schemes:
  Highest -- public consumption
  Lowest -- cutting indirect tax rates
- GDP increases when tax revenue is recycled for public consumption or cutting labor tax rate
- Total exports increases except when tax revenue is used to cut indirect tax rates
- Greater SO_2 and the same level of NO_x reduction
- No significant variations in emission reductions across revenue recycling schemes

THANK YOU

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