Analysis of Carbon Emission Reduction Effect of Environmental Protection Tax

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26 September 2019

Outline

- **Introduction**
- **Theoretic analysis**
- **Econometric analysis**
- **Sector analysis**
- **Concolusion**

Introduction

- **China started to implement Environmental Protection Tax Law(EPTL) on 1 January 2018**

- **The revenue collected by the Tax in the first three quaters of 2018 was somewhat equal to that of pollution levy, about 20 billion RMB yearly.**

- **However there are quite a lot of tax reduction occurred, indicating innovation for pollution reduction by polluters**

The research question

- **As there is no tax category for CO2 in EPTL, can EPTL contribute to CO2 emssion?**

Pollutants	Pollutant equivalent (Kg)
1. SO2	0.95
2. NOx	0.95
3. CO	16.7
4. CL	0.34
……	———
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44. CS2	20

Tax rate for air/water pollutants

| Catergory		Unit	Rate
Air pollutants		Pollutant equivalent	1.2yuan-12yuan
Water pollutants		Pollutant equivalent	1.4yuan-14yuan
Solid waste	Coal dry stone	Ton	5yuan
	Coal dry stone	Ton	15yuan
	Dangerous solid waste	Ton	1000yuan
	Smelting slag , fly ash , slag and other solid wastes	Ton	25yuan
Noise	Industrial	＞1-3db	350yuan/month
		＞4-6db	700yuan/month
		＞7-9db	1400yuan/month
		＞10-12db	2800yuan/month
		＞13-15db	5600yuan/month
		＞16db	11200yuan/month

Analysis in three aspects

- **Theoretical analysis**
- **Econometric analysis**
- **Sectoral analysis**

Theoretical Analysis for EPTL incentive to reduction of pollutant and CO_2 emissions

- Positives effects on pollution reduction by environmental taxes has been recognized by the literature

- Literature on the synergy between CO2 reduction and pollutants reduction

- EPTL with no CO2 category can fulfill the goal of both reductions of pollutants and CO2?

Functional framework for pollutants and CO2 reduction
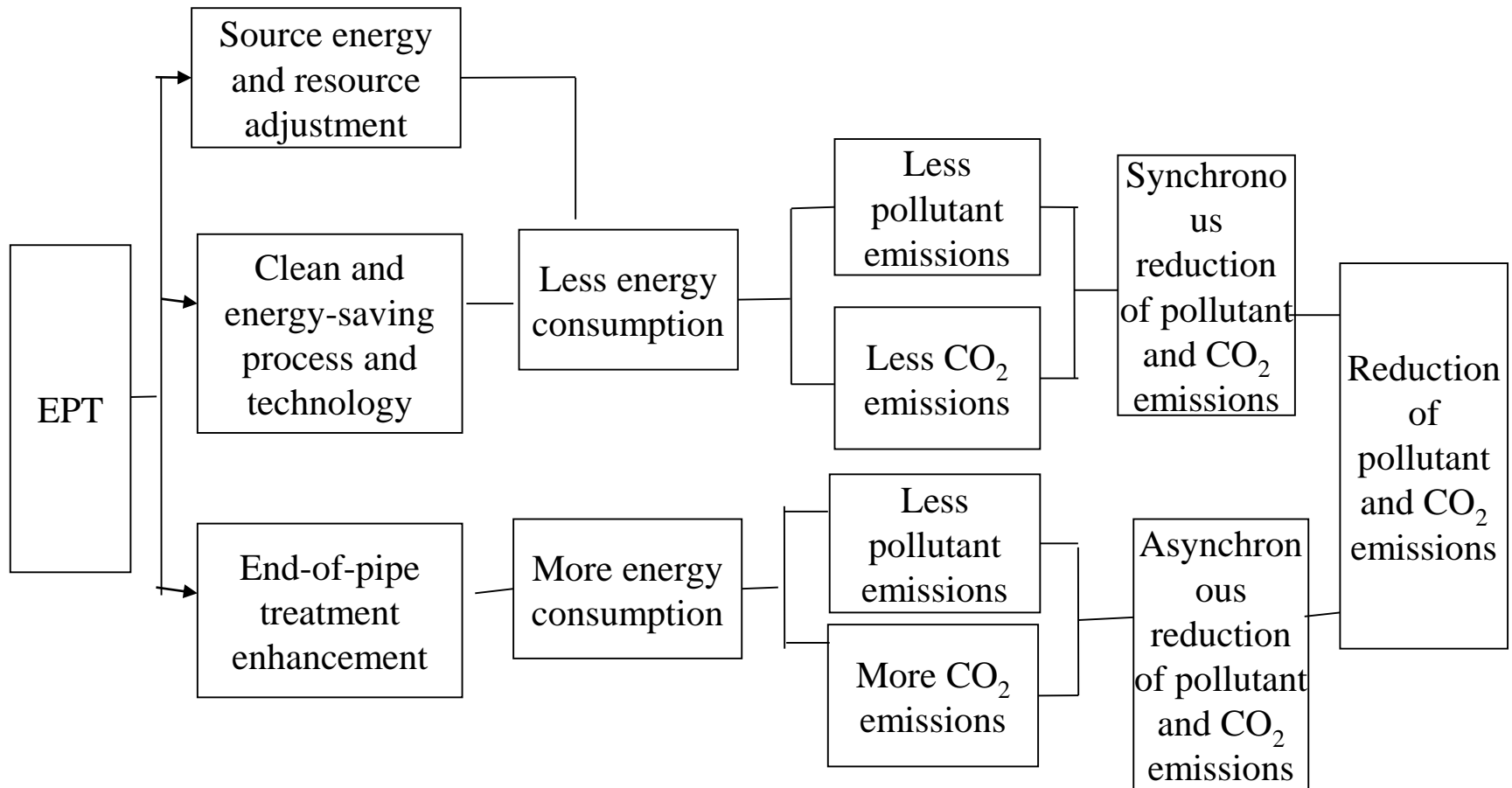
Empiric analysis using GREAT-E model

- GREAT-E model was used to analyze the impacts of applying environmental protection tax, including pollutant reduction and CO2

- Different scenarios with high\medium/low tax rated are designed for the analysis

- Look at the impact of conventional pollutants reduction and CO2 reduction

Figure 2–1 Basic structure of the GREAT-E model
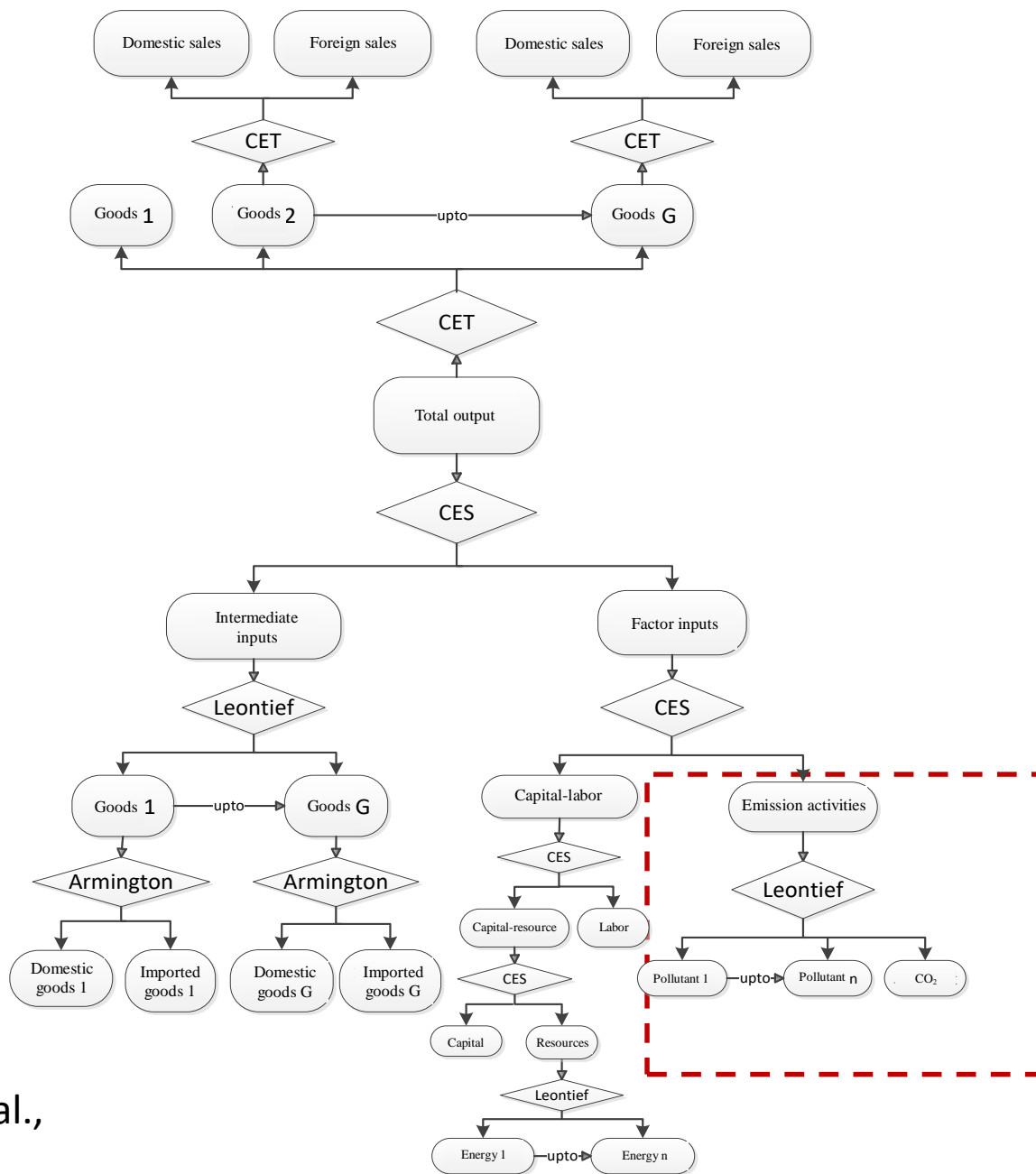
Source: Wang, et al., 2016; Qin, 2013?

Table 2–1 EPT rate scenarios

Tax sub-item	Low tax rate option	Medium tax rate option	High tax rate option
COD (yuan/kg)	1.4	4.2	5.6
NH_3-N (yuan/kg)	1.75	5.25	7.0
SO_2 (yuan/kg)	1.26	3.78	5.04
NO_x (yuan/kg)	1.26	3.78	5.04

Synergistic emission reductions of EPT collection (%) is observed

| Scenario	COD	NH_3-N	SO_2	NO_x	CO_2
Low tax rate	-0.04	-0.04	-0.03	-0.03	-0.02
Medium tax rate	-0.19	-0.18	-0.17	-0.15	-0.12
High tax rate	**-0.26**	**-0.26**	**-0.24**	**-0.21**	**-0.17**

Sector analysis using power plants

- **Power plants have been under great pressure for pollution control to reduce conventional pollutants as there are major sources for air environmental quality management**

- **Various measures have been applies: closure of small\polluted\low energy use efficient units, clean coal technologies, ultra-low emission units**

- **Pollutants have been reduced substantially while energy use per KWH is down, leading to the reduction of CO_2**

CO_2 and pollutant emissions in the thermal power sector

Annual emissions	CO_2 emissions per unit of electricity generated (g/kWh)	SO_2 emissions per unit of electricity generated (g/kWh)	NO_x emissions per unit of electricity generated (g/kWh)	Soot emissions per unit of electricity generated (g/kWh)
2013	890	1.85	1.98	0.34
2014	870	1.47	1.47	0.23
2015	850	0.47	0.43	0.09
2016	822	0.39	0.36	0.08
2017	844	0.26	0.25	0.06
2018	841	0.20	0.19	0.04

CO$_2$ generation in the desulfurization and denitrification processes in a typical thermal power plant
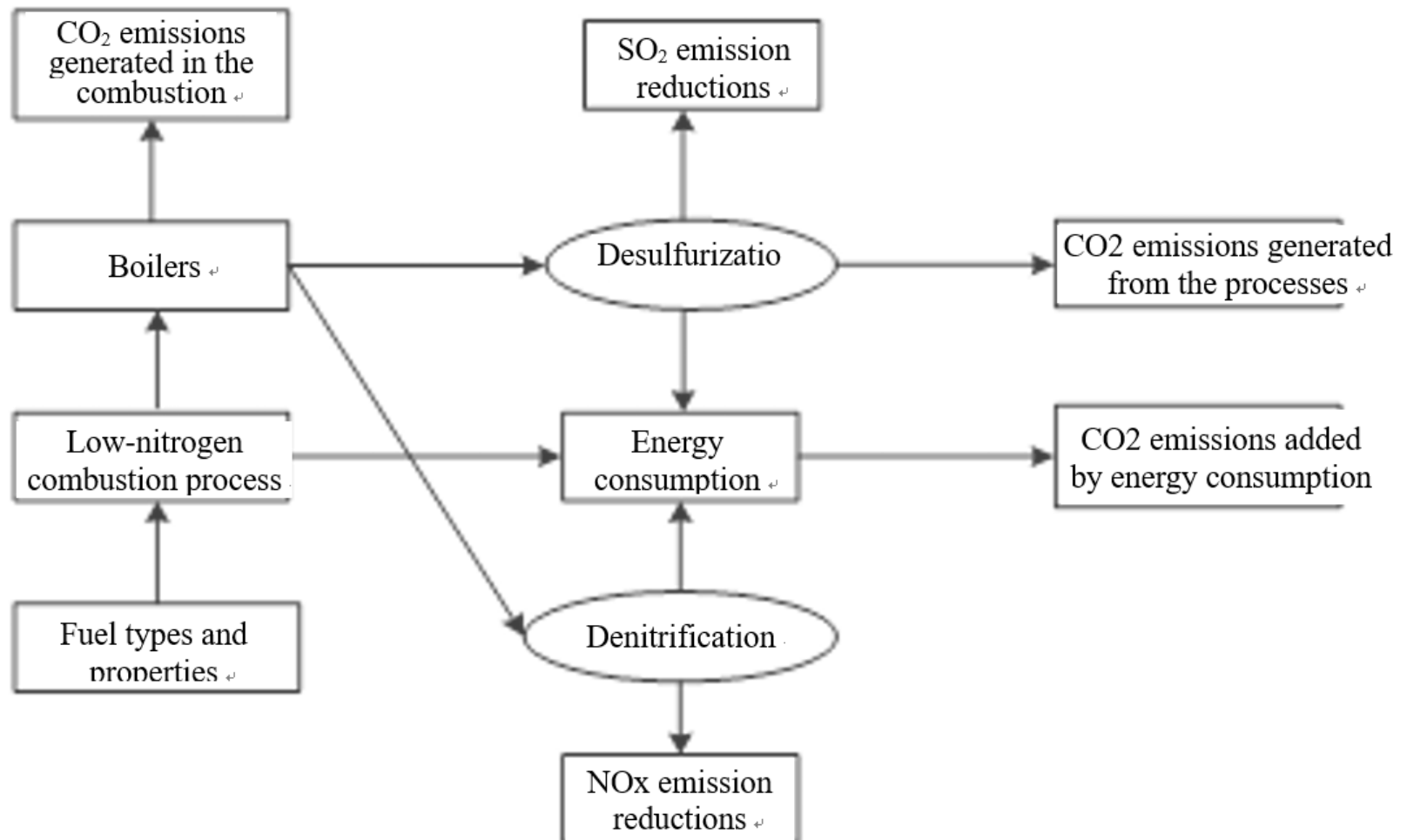
Conclusions

- The reduction rate of CO_2 emissions is less than that of pollutant emissions because CO_2 emissions are generated from energy consumption and chemical reactions in the end-of-pipe pollution control measures. The findings demonstrate that the best synergistic mitigation measures should be source control and process control and end-of-pipe measures can only achieve pollutant reduction targets with the possibility of increasing CO_2 emissions.

- Two options are suggested for giving further play to the EPT Law in reducing CO_2 emissions: (1) including CO_2 into tax items to directly tax CO_2 emissions; (2) raising and coordinating the tax rates for existing tax items to indirectly drive CO_2 emission reductions.

- More in-depth studies by using the proposed CGE model are needed to further analyze the reductions of pollutant and CO_2 emissions by sectors and enterprises and explore the inherent rules based on the current tax rates and pollutant discharge permit data platform.

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