Application of AIM/CGE Model for China: Exercises in 2006

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Outline

- Assessment of the Impacts of Fuel Tax in China Using AIM/CGE China Model
- Assessment of China Energy Intensity Reduction Target: Linking AIM/CGE with AIM/Enduse

1. Assessment of the Impacts of Fuel Tax in China Using AIM/CGE China Model

1.1 Background and study objective

- With fast economic growth, oil consumption in China keeps a rapidly increasing tread in the past over 20 years.
- In 2006, China's oil import came to *162.87 million tonnes*, and oil dependence rate rose to *47%.*
- Discussion on levying a ***fuel tax*** (a kind of ad valorem tax, only imposing on oil products) in China has continued for over 10 years.
- Some argue that imposing a tax may ***hurt*** the auto-making sector, and raise costs at manufactures. It would also impact the country's hundreds of millions of farmers, who use the fuel for ploughing and irrigation. The above concerns have held it up so far.
- The objective of this study is:

to assess the impacts of fuel tax on energy consumption, emissions, total economy, and each sector in China if considering different tax revenue recycling systems using a static CGE single country model.

1.2 **Model descriptions**

- 1997 IO table
- 30 sectors - 8 energy sectors

  Coal, raw oil, natural gas, oil products, coke, electricity, heat, and coal gas
- Production & Consumption:

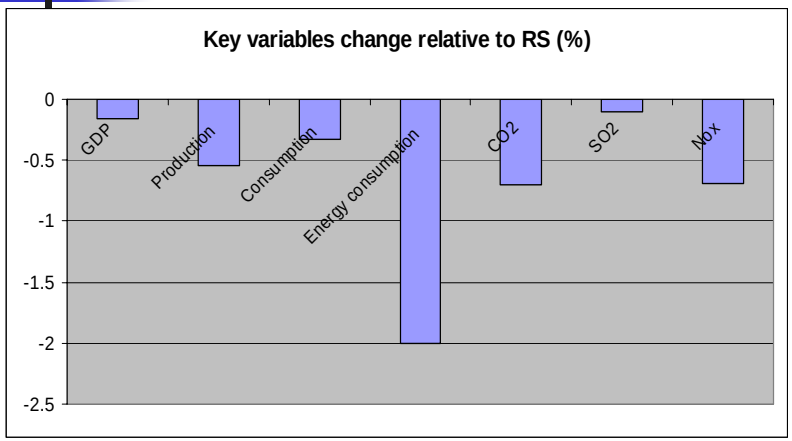
  - Nested CES function
- International Trade:

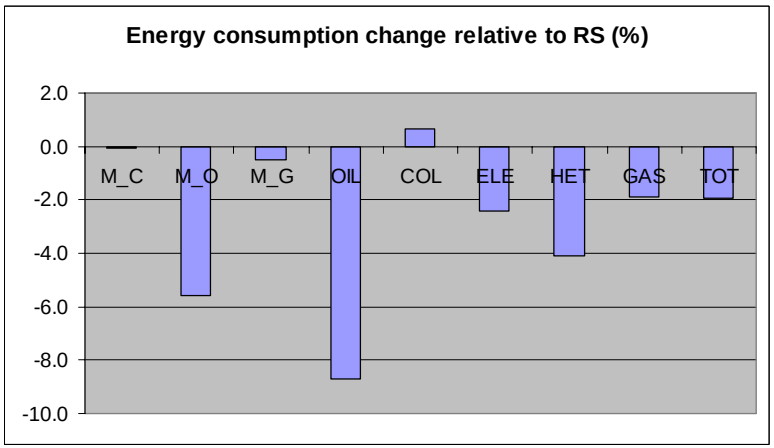
  - Small open economy assumption,
  - CET function, and
  - Armington function
- Environment: CO2, SO2, NOx

1.3 Scenarios

	Reference Scenario (RS)	Fuel Tax Scenario	Fuel Tax + Revenue Recycling Schemes		
			Lump-sum	Food tax break	Indirect tax break
Fuel tax	No	30%	30%	30%	30%
Revenue Recycling	No	No	Transfer to the household	a decrease in tax on food	a general decrease in indirect tax

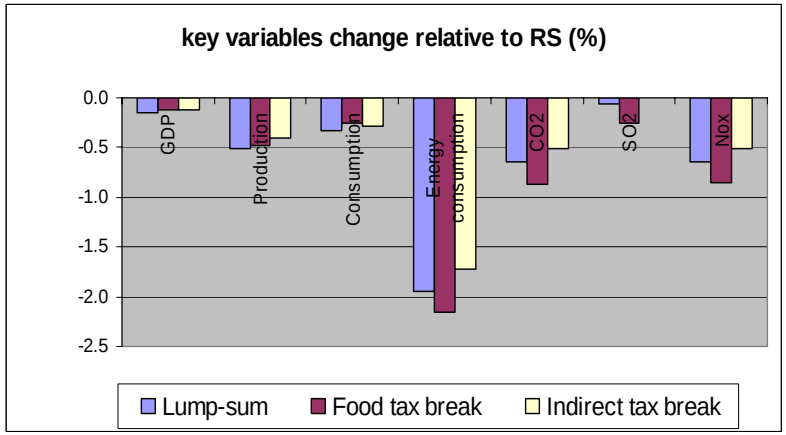
1.4 Results and key conclusions: Fuel Tax Scenario

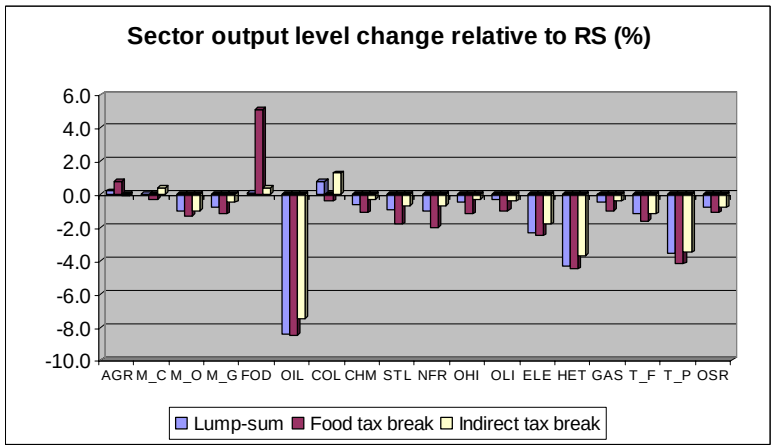




- If introducing ***30%*** fuel tax on oil products, there is ***8.7%*** decrease on oil products, about ***6%*** on crude oil, and more than ***2%*** on total energy consumption, but the GDP loss is less than ***0.2%.***
- Thus, taxation on oil products can put the brakes on runaway ***oil demand*** and import with ***small GDP loss*** and ***welfare*** impacts.
- But the air pollutant reduction is ***much smaller*** than reduction in energy consumption especially for SO2.

1.4 Results and key conclusions: Tax Revenue Recycling Scenarios





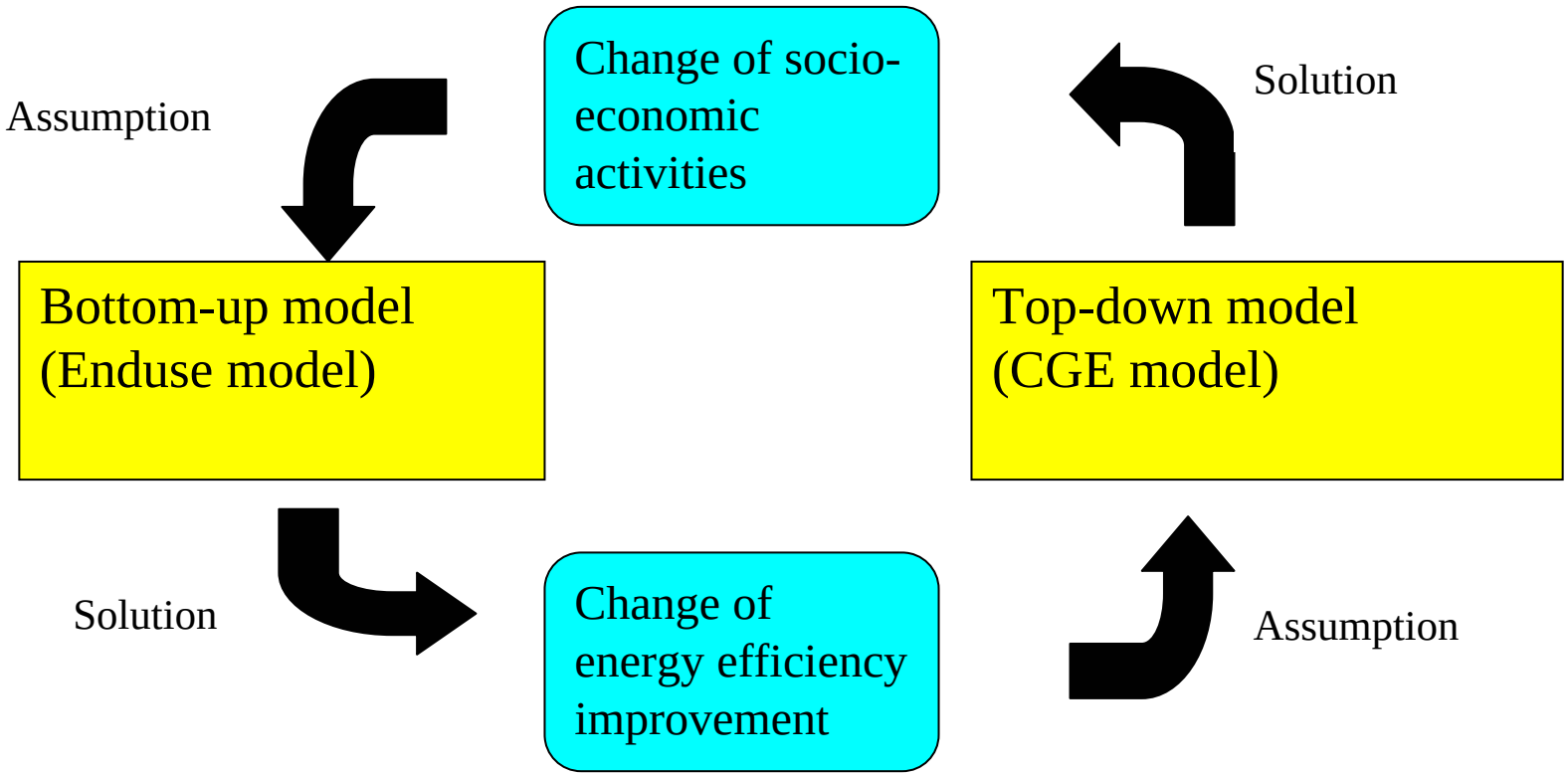
- When comparing the three tax hand-back systems, ***Food Tax Break*** renders the best results. Because it induces the ***largest reduction*** in oil consumption, total energy consumption, and air pollutant emissions, with ***smallest GDP loss***.
- Furthermore, it can also stimulate the development of food processing and agriculture sector, which can mitigate the impact of fuel tax on farmers.

2. Assessment of China Energy Intensity Reduction Target — Linking AIM/CGE with AIM/Enduse

2.1 Background

- Energy consumption in China is large in volume and shows rapid growth in the past 20 years. Therefore, in 11th Five-Year Plan (2006-2010) Chinese government annouced that energy consumption per GDP should be ***20%*** decline in 2010 from the level of that in 2005.
- This study is to analyze the possibility of the above target and propose policy suggestions.

2.2 Methodology



2.3 CGE Model description

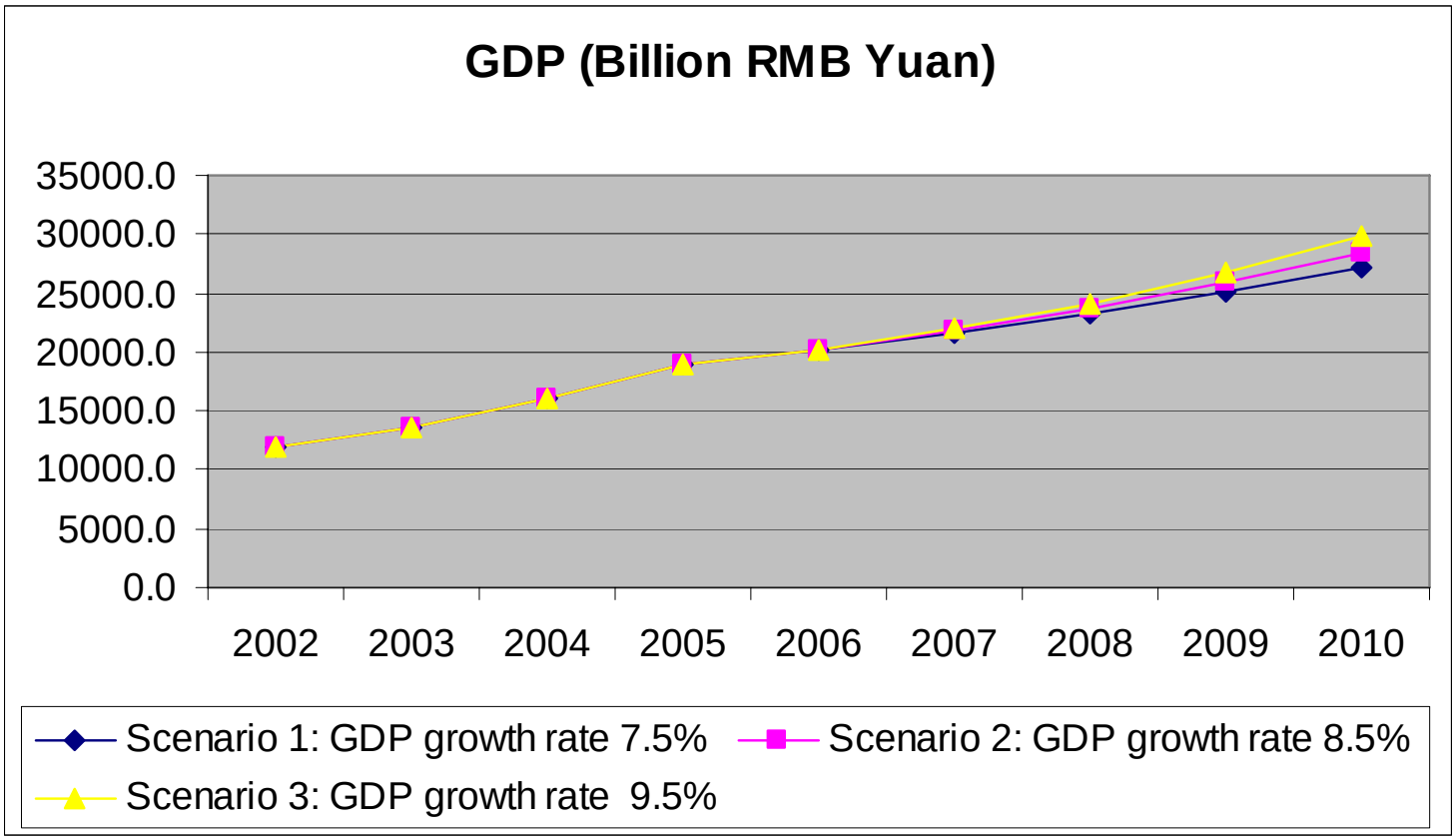
- 2002 IO table (Published in Sep.,2006)
  - Historical data: 2003-2005;
  - Simulation period: 2006-2010;
- 38 sectors, including 8 energy goods

  Coal, raw oil, natural gas, oil products, coke, electricity, heat, and coal gas
- Scenarios:
  - ✓ 3 Scenarios for Reference Case: Annual GDP growth rate: 7.5%, 8.5%, and 9.5%, respectively
  - ✓ Policy Case ?
- Recursive Dynamic Single Country Model

Recursive Dynamic

- Capital stock
- Total investment is calculated from expected GDP growth rate in the next period, present capital stock, and technology change.
- The energy sectors follow the future plan.
- The rest investment is distributed into each sectors based on logit function taken into account profit from capital.

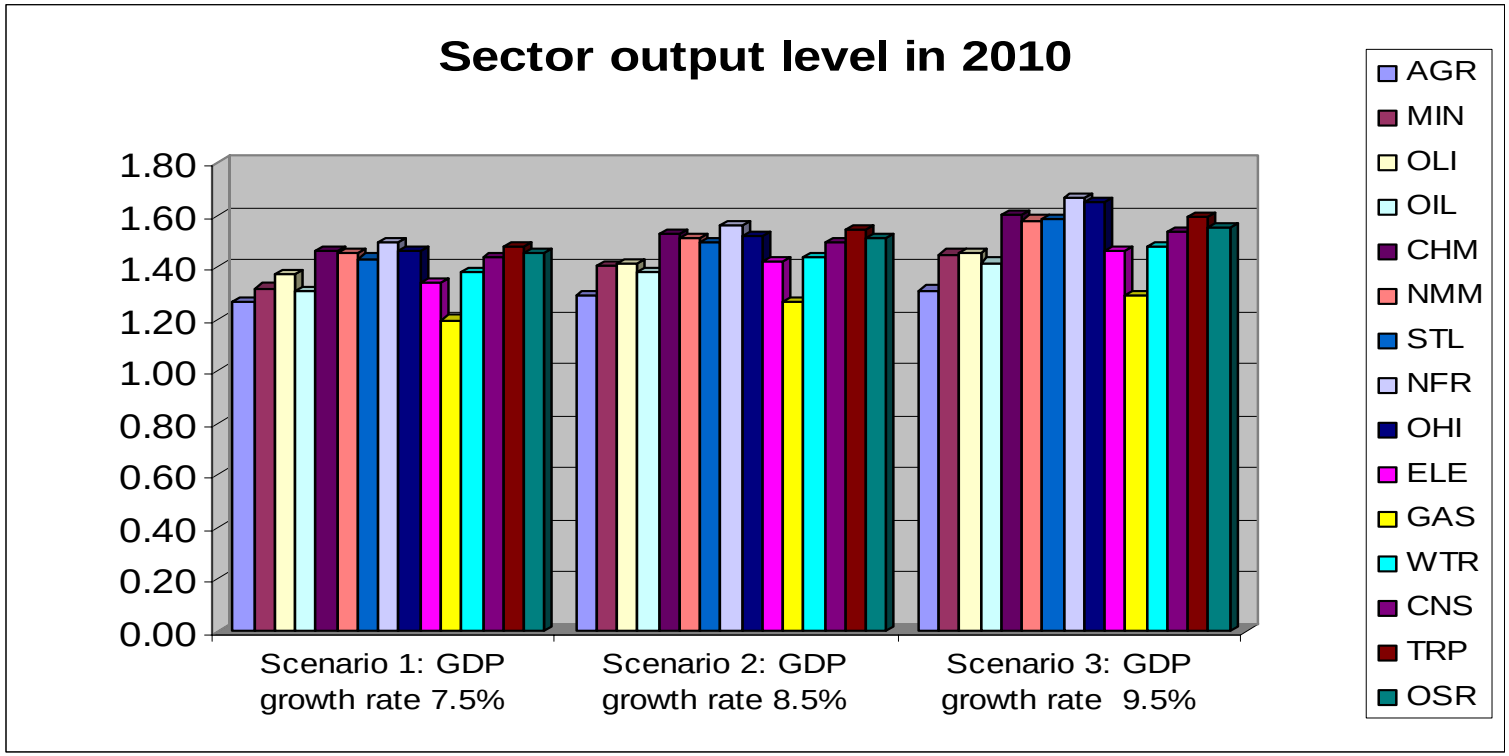
2.4 CGE Simulation results: GDP



2.4 CGE Simulation results: GDP disaggregating

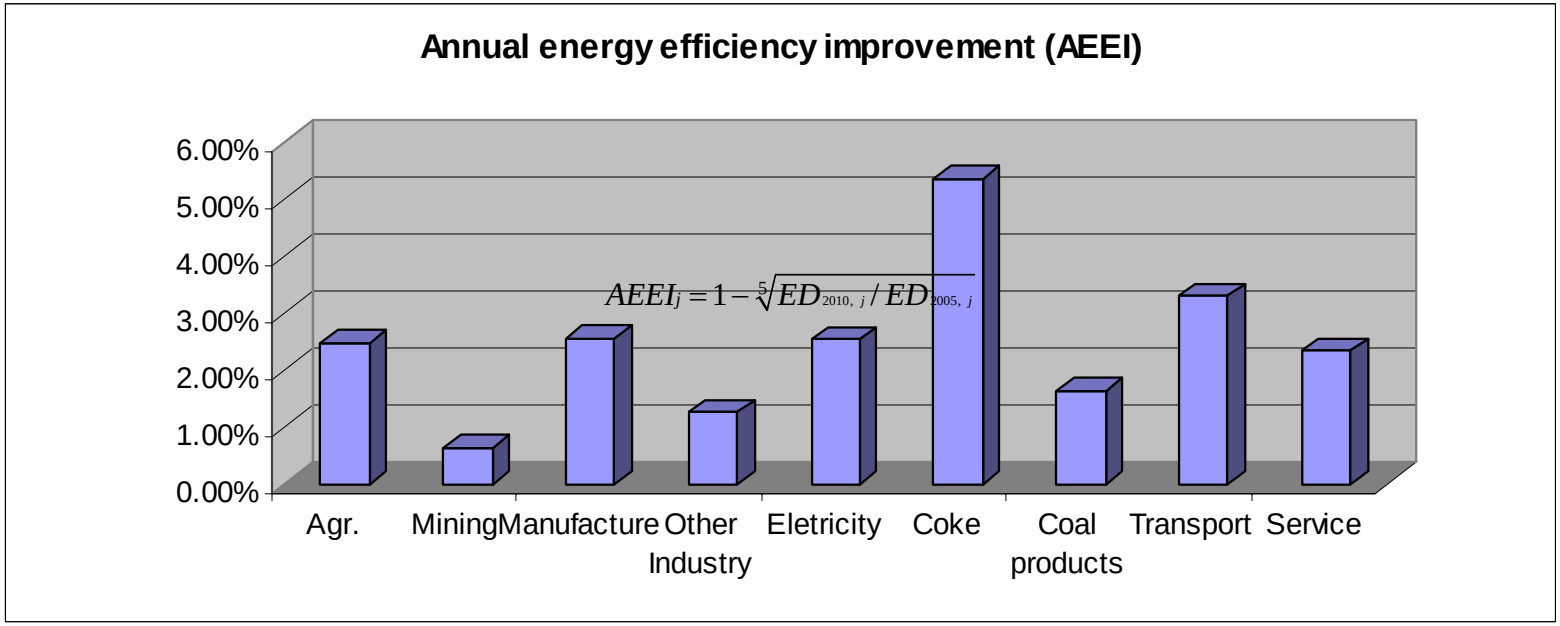
	Scenario 1: Low economic growth	Scenario 2: Middle economic growth	Scenario 3: High Economic growth	History data: 2001-2005
GDP growth rate (2006-2010)	7.50%	8.50%	9.50%	9.54%
Agriculture	4.18%	4.62%	4.98%	3.93%
Industry	7.44%	8.56%	10.06%	10.91%
Construct	8.13%	9.13%	10.07%	9.66%
Transport	9.00%	10.13%	10.96%	11.68%
Other service	8.39%	9.42%	10.12%	10%

2.4 CGE Simulation results: Sector output level in 2010



Note: Sector output level in 2005 =1;

2.5 Feedback from Enduse: Energy efficiency improvement

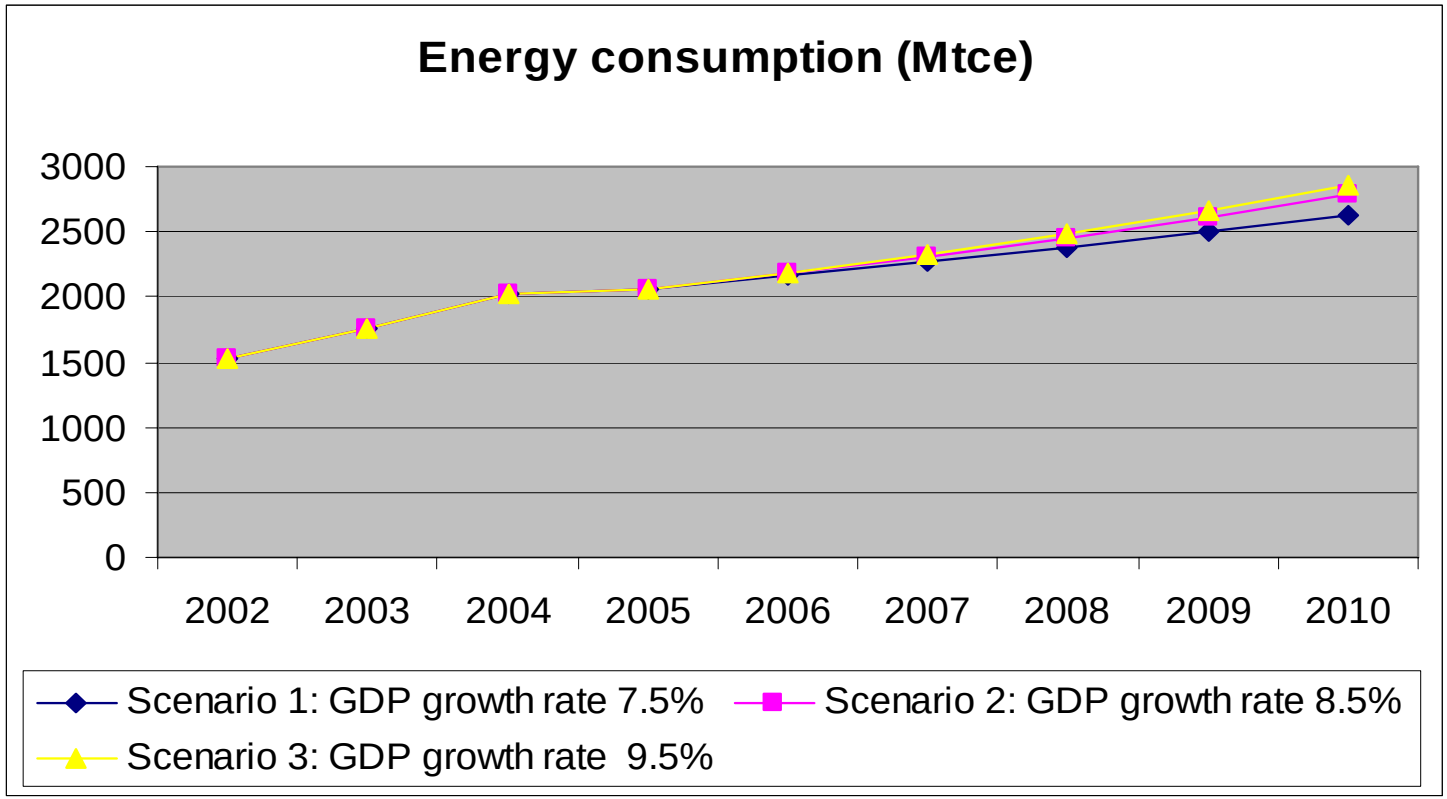


Based on energy demand from Enduse model and output level from CGE model

$$AEEI_j = 1 - \sqrt[5]{ED_{2010,\ j} / ED_{2005,\ j}}$$

$ED_{2010,}$ ED_{2005}: Energy demand per unit output in the year of 2010 and 2005 respectively;
j: sector

2.6 Results and key conclusions: Energy consumption



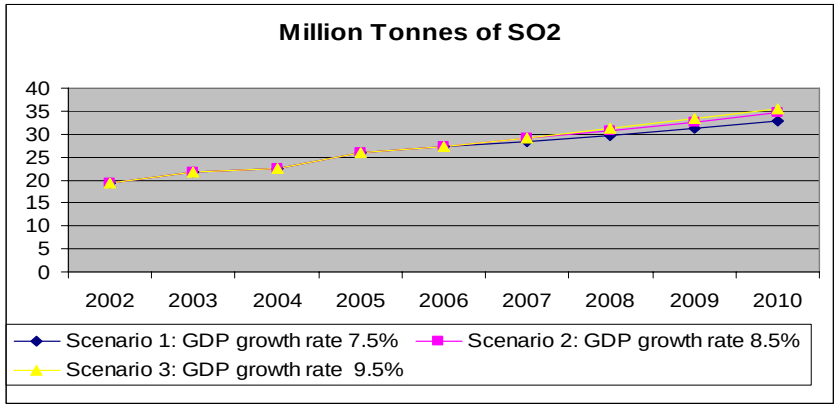
2.6 Results and key conclusions: Energy intensity

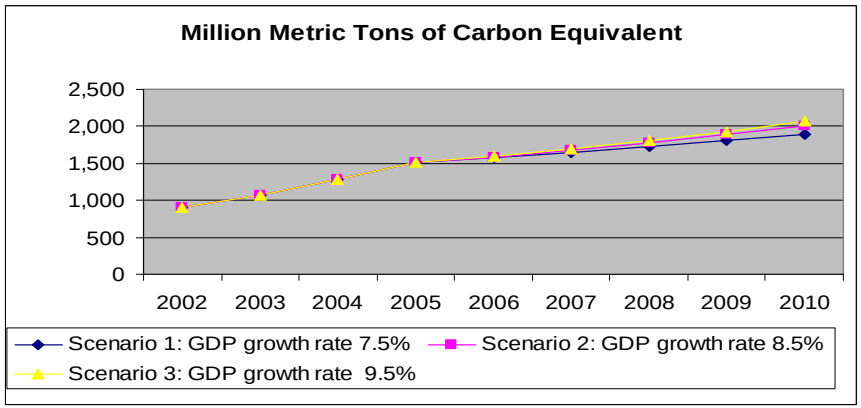
Unit: tce/10000 RMB Yuan

	Scenario 1	Scenario 2	Scenario 3
2005	1.091	1.091	1.091
2006	1.073	1.08	1.08
2007	1.05	1.06	1.058
2008	1.024	1.036	1.029
2009	0.995	1.008	0.995
2010	0.964	0.976	0.957
Energy intensity reduction	11.64%	10.54%	12.28%

- Under the reference case, the 20% reduction target can't be achieved.
- It is necessary to take more measures and policies to achieve that target.

2.6 Results and key conclusions: Emissions





- In the next five years, because of high economic growth, China will still have a big increase in energy consumption, and SO2, CO2 emissions;
- But the increase speed may slow down comparing to historical trend due to higher energy efficiency improvement.

3. Research plan in this year

- To utilize hybrid IO table

  - Keep consistency with physical energy data

- To introduce bio ethanol

  - Land;

- To improve dynamic model

  - Labor disaggregating

Thank you!
Your comments are welcome!

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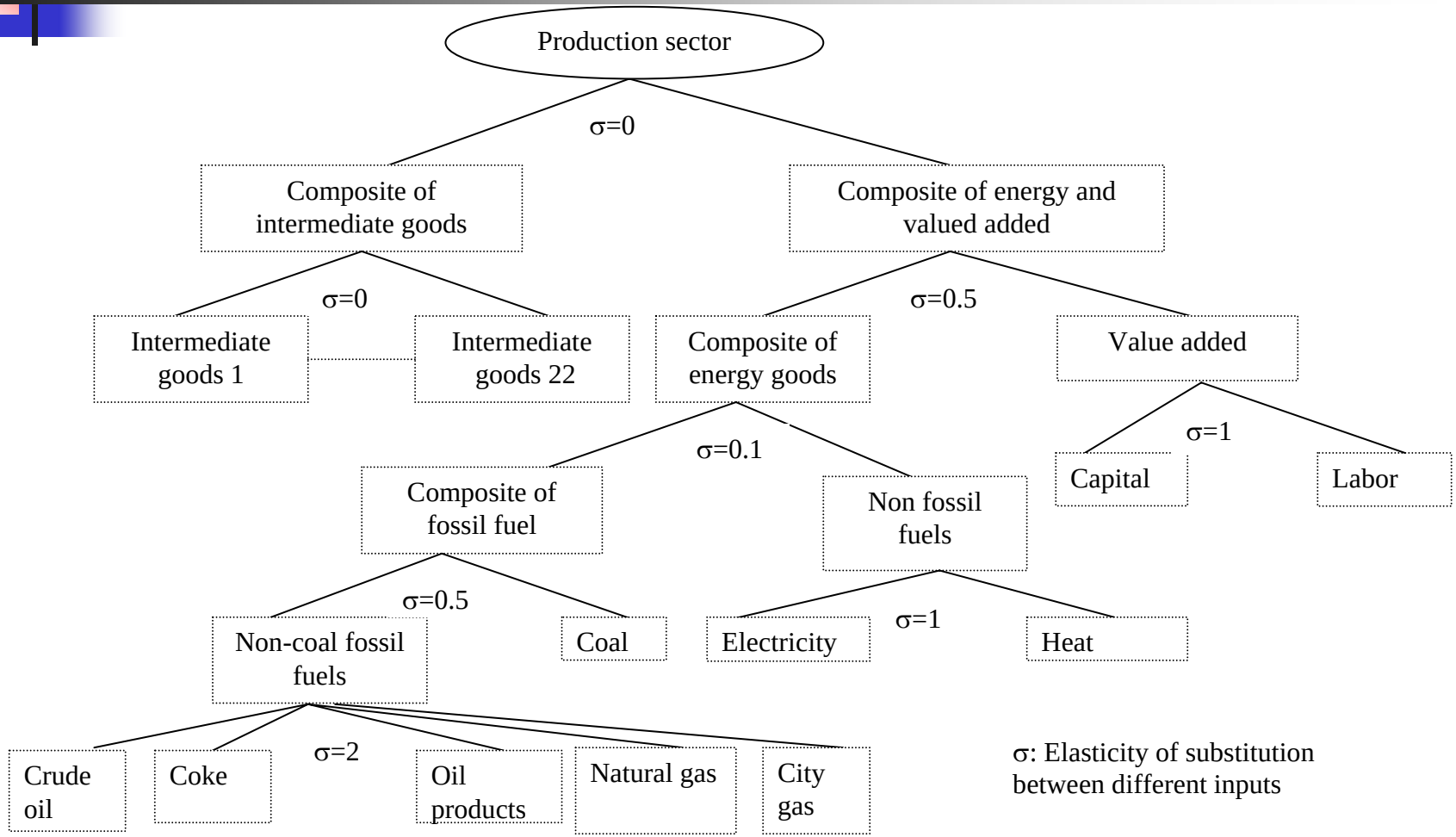
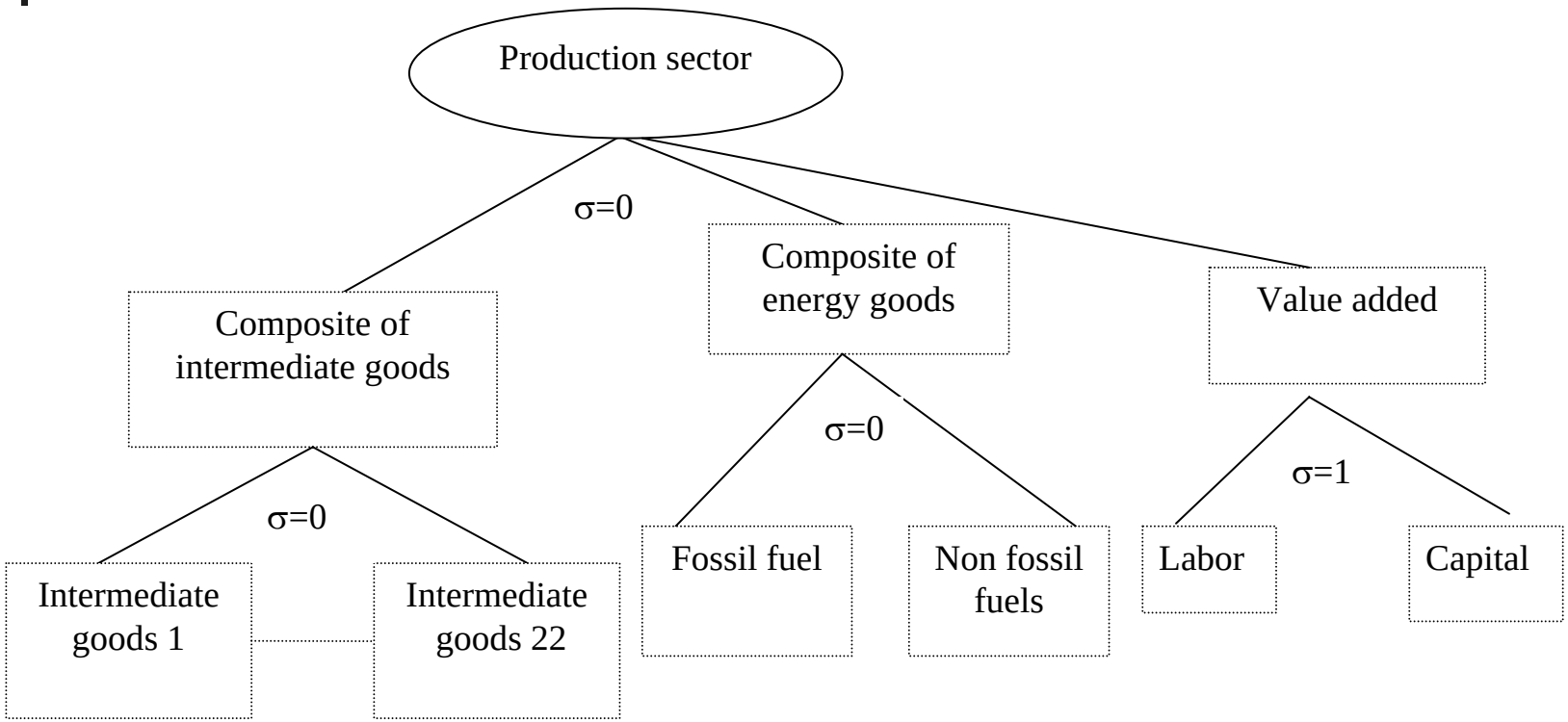
Nesting of the production structure in non-energy sector



Nesting of the production structure in energy sector



σ: Elasticity of substitution between different inputs