The Two-Country CGE for Malaysia and Indonesia for Energy Subsidy Removal

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Background: Indonesia

- Energy subsidy in Indonesia started in 1967
- The distributional effects have been unequal and favored the rich who are more capable to consume more
- The energy subsidies appeared to drive for more inefficient use of fuels and electricity, and distort the market signals for energy-related investments
- On the government side, they became a fiscal burden and limits the fiscal policies’ capability to stimulate economic growth
Background: Malaysia

• Malaysia also provides subsidies on petroleum fuels and electricity.

• Specially, the subsidies on electricity has two channels. One is through subsidizing the natural gas supplied to TNB (one half of the company’s power generation capacity is natural gas-fired), the Malaysian national power corporation.

• The other is through special rebates given to low income households.

• Energy subsidies are found to cause more serious problems in Malaysia than in Indonesia. Specially, such subsidies in Malaysia were believed to incentivize the use of outdated and dirtier technologies with negative environmental impacts.
Literature on Indonesia’s Energy Subsidies

• The impacts of Indonesia’s energy subsidy removal have been studied by a few studies which arrived at controversial conclusions.
• Clement et al. (2007) estimated that there would be 2% real output loss in the case of Indonesia.
• The study by Widodo et al. (2012), using a Social Accounting Matrix method, shows a negative impact of subsidy removal on GDP. However, with reallocation of the subsidy to targeted sectors could offset the negative impacts to a large extent.
Literature on Malaysia’s Energy Subsidies

• The Malaysia government is considering the so-called rationalization of subsidies, implying liberalization of pricing to reflect the cost of supply while keeping the subsidies to targeted social groups.

• The impacts of Malaysia’s energy subsidy removal has been studied by Hamid and Rashid (2012), using a CGE model with the I-O table partitioned into energy and non-energy blocks.
  – This study shows a painful process of subsidy removal to the economy, including declining wages and rising costs of production factors which could substitute for reduced use of fuels.
  – However, the authors emphasize that such is healthy to long-term economic growth path of Malaysia and boost the competitiveness of Malaysia Industries.
Research Questions

• Indonesia and Malaysia are well linked in economics.
  – For Indonesia, Malaysia is the 7th biggest export market
  – For Malaysia, Indonesia is the 9th biggest market for its exports
  – They share a lot in terms of culture, language, as well as economic structure
  – To ask how energy subsidies on both sides have affected each other
• Both countries are embarking on massive reduction of energy subsidies
  – To see what would be the cross-border impacts of such actions
  – To see the difference in timing of action from either of the two countries
    • If Malaysia cut energy subsidies first, what the impacts on Indonesia would be, and vice versa.
• To identify the most vulnerable sectors to subsidy removal
• To see how the reallocation of the fund of energy subsidies as public transfer for investment and consumption in different sectors would affect real output and welfare
Methodologies

• A two-country CGE model
  – Econometric sub-models will be built
  – Simulations to show not only the impacts of energy subsidy reduction, but also the impacts of different sequence in doing so by the two countries.

• To extend Hosoe et al. (2004) by incorporating energy sectors as well as energy products as factor inputs and commodities for consumption.
  – The model is static and nonlinear
  – It serves as a tool for short-term impact analysis
  – In the future, the framework could be extended into dynamic models

• Results to be compared to single country models from other ERIA projects
The Data Structure I

- **Payments**:
  - Branches
    - Intermediate Consumption
  - Sectors
    - Final Demand

- **Receipts**:
  - Branches
    - Revenues from Sectors
  - Sectors
    - Institutional Transfers

- Surplus or deficit by agent
## The Data Structure II

| 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
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### Total intermediate inputs

- Operating surplus: KA
- Wages and Salaries: LA
- Social security contributions: SS

### Total Value Added

Total supply at basic prices: [3]+[1]+[2]

### Households

- FSEFA: labour income
- FSEFA: income from operating surplus

### Firms

- FSEFA: income from operating surplus

### VAT

- Subsidies: TX_VAT*(vat_base)
- Subsidies: TX_SUB*(sub_base)

### Direct taxes

### Social security contributions

- Indirect taxes: TX_IT*(it_base)
- Duties: TX_DUT*(dut_base)
- Environmental taxes: TX_ENV*(env_base)

### Government - Firms

### Government - Rest of the World

### Total taxes

Total supply at producer prices: [5]+[4]+[3]

### Imports

Savings: IMP

### Total supply

Demand = Supply: [7] = [15]

**Definitions:**
- FSEFA: Transactions from sector to sector
- FSEFA: Transactions from factors to sector
- FGRF: Government ownership of firms
- FGRS: Transactions of government with the other economic agents
Electricity Production

PRODUCTION

TECH

DIST

CAPITAL

SKILLED LABOUR

UNSKILLED LABOUR

MA

COAL fires

GAS fired

OIL fired

NUC

HYDRO

BIOMASS

PV

WIND

CCS COAL

CCS GAS
Integrating the Energy Sector in the CGE Model

- Domestic production - Composite factor aggregation function:
  \[ Y_{j,r} = b_{j,r} \cdot \prod_{h} F_{h,j,r}^{\beta_{h,j,r}} \]

- \( F \) includes capital, labor, electricity, and other energy

- Intermediate demand function:
  \[ X_{i,j,r} = a x_{i,j,r} \cdot Z_{j,r} \]

- Composite factor demand function:
  \[ Y_{j,r} = a y_{j,r} \cdot Z_{j,r} \]

- Factor demand function:
  \[ F_{h,j,r} = \frac{\beta_{h,j,r} \cdot p y_{j,r} \cdot Y_{j,r}}{p f_{h,r}} \]
Electricity Generation

• Technologies: coal-fired, gas-fired, oil-fired, hydro, biomass, geothermal, solar PV, wind
• Electricity producing technologies are characterised by different cost structures and conversion efficiencies.
• Generation costs are conceived in three categories: i) investment costs, ii) operating and maintenance costs and iii) fuel costs.
• A cost minimization method is adopted to produce the desired amount of electricity
• A 8% transmission and distribution system losses is assumed.
Electricity Generation Function and Demand for Fuel Mix

\[ F_{ELE,j,r} = CE_{oil} \cdot ef_{oil} + CE_{gas} \cdot ef_{gas} + CE_{coal} \cdot ef_{coal} + CE_{hydro} \cdot ef_{hydro} + CE_{bio} \cdot ef_{bio} + CE_{geo} \cdot ef_{geo} + CE_{spv} \cdot ef_{spv} + CE_{wind} \cdot ef_{wind} \]

Linear cost of electricity generation leads to corner solution – dispatch by merit order
Scenarios for Subsidy Removal

• Simultaneous subsidy removal by the two countries
• Indonesia removes subsidies
• Malaysia removes subsidies
• Partial / selected removal
• Subsidies for targeted social groups only
Expected Policy Implications

• To identify policies that are needed to ensure net welfare gain for the economy in implementing energy subsidy reduction
• To suggest policies that could reduce energy subsidies while minimize the negative impacts on its own economy as well as possible leakages to trade partners
• To identify policies that are needed to minimize the negative impacts on specific sectors and social groups
• To suggest policies that are needed to optimally reallocate the funds for energy subsidies to various sectors and social groups
• To identify how to synchronize policies for removing energy subsidies to minimize negative impacts and to maximize possible gains