Can Oil Based Power Companies Improve the Welfare in Bangladesh Economy? A DSGE Analysis

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Introduction

- The importance of energy in any economy became clear after the first oil shock in 1973 which would have significant impact on the rest of the economy.
- Bangladesh also considers energy as a prerequisite for her technological, societal and economic growth.
- Historically, there was a mismatch between the demand and supply of electricity in Bangladesh.

Emergence of Quick Rentals in Bangladesh

- The several power crisis compelled Bangladesh government to introduce high cost temporary solution for the energy sector-mainly the oil fired quick rental companies.
- A total of 43 quick rental companies are introduced in Bangladesh in 4 phases.
- Energy sector in Bangladesh has witnessed a huge success (Generation increases from 5272 MW (2009) to 17000 MW (2018); however at the cost of using liquid fuel.

Contributions of the Quick Rentals towards Bangladesh Economy

- Bangladesh is the 42nd largest economy in the world & the 31st largest in terms of Purchasing Power Parity
- Bangladesh's economy was the second fastest growing major economy in 2016
- Bangladesh is the 2nd largest garments exporter in the world
- In spite of all adversities-the country has achieved a sustainable economic growth over 7% in the last decade.

Criticisms Against the Quick Rentals

- Average Cost of Electricity has increased from BDT 2.53/kWh (2009) to BDT 5.88/kWh.
- Fuel Subsidy remains very high!
- Instead of terminating the contracts, the government continued extending their mandates.
- The over-reliance on the quick rentals is alarming for Bangladesh as the global oil price is volatile.

MAIN RESEARCH QUESTION

- Experts say that the move toward to increase electricity generation with oil powered quick rentals would affect the household welfare in Bangladesh.
- This paper investigate the impact of Quick Rental companies on Bangladesh economy.
- Despite of the extensive literature on Dynamic Stochastic General Equilibrium (DSGE) models, there is no model that focuses on a detailed disaggregation of the energy sector till now.

LITERATURE REVIEW

- Amin (2015)
- Amin and Marsiliani (2015)
- Dhawan and Jeske (2007)
- Finn (2000)
- Glomm and Jung (2013)
- Jamasb (2006)
- Kydland and Prescott (1982)
- Kim and Loungani (1992)
- Mujeri and Chowdhury (2013)

THE MODEL

- The model considered in this paper is a DSGE model of a small economy that needs to import oil to generate electricity.
- There are four sectors in the economy:

1. the production sector
2. the energy sector
3. the household sector and
4. the government sector

THE PRODUCTION SECTOR

- There are three production sectors in the model: a service sector and an industrial sector where final goods are being produced using energy as an additional productive input which is produced in the third sector, the energy sector.
- The representative firm uses labour, capital and electricity to produce the final good of the respective sector.

THE PRODUCTION SECTOR

$$Y = A_t^Y \, l_{Y,t}^{\alpha_Y} [(1-\psi_Y) k_{Y,t}^{-v^g} + \psi_Y \cdot g_t^{-v^g}]^{\frac{\upsilon^Y}{v^{gg}}}$$

$$X = A_t^X \, l_{X,t}^{\alpha_X} [(1-\psi_X) k_{X,t}^{-v^s} + \psi_X \cdot s_t^{-v^s}]^{\frac{\upsilon^X}{v^{ss}}}$$

THE ENERGY SECTOR

- **Energy enters in our model as consumption good for households in the form of electricity, as a production of input for industrial and service sectors.**

$$G = A_t^G \, l_{G,t}^{\alpha_G^G} \left[(1-\psi_G) \, k_{G,t}^{\bar{v}^{m,G}} + \psi_G \, . \, m_{G,t}^{\bar{v}^{m,G}} \right]^{\frac{\upsilon^G}{v^{m,G} \, G}}$$

$$I = A_t^I \, l_{I,t}^{\alpha_I^I} \left[(1-\psi_I) \, k_{I,t}^{\bar{v}^{m,I}} + \psi_Y \, . \, m_{I,t}^{\bar{v}^{m,I}} \right]^{\frac{\upsilon^I}{v^{m,I} \, I}}$$

$$H = A_t^H \, l_{H,t}^{\alpha_H^H} \left[(1-\psi_H) \, k_{H,t}^{\bar{v}^{h}} + \psi_H \, . \, h_t^{\bar{v}^{h}} \right]^{\frac{\upsilon^H}{v^{h} \, h}}$$

THE ENERGY SECTOR

- We further assume that a certain amount of electricity (χ) is lost while transmitting by the distribution companies to the end consumers. So, equilibrium in electricity market:

$$e + s + g = H + I + G - \chi(H + I + G)$$

THE HOUSEHOLD SECTOR

- **The representative household maximizes expected utility subject to the following resource constraint:**

$$Max E \sum_{t=0}^{\infty} \beta^t \phi \log \left[X_t (\theta c_t^{\rho} + (1-\theta) e_t^{\rho}) \right]^{\frac{1-\gamma}{\rho}} + (1-\phi) \log(1-l_t)$$

$$s.t.$$

$$k_{t+1} + c_t + n.X_t + q_t^e.e_t = (1-\tau^l) w l_t + \mathrm{B} + (1-\tau^k) r k_t + (1-\delta) k_t$$

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$$k_{t+1} + c_t + n.X_t + q_t^e.e_t = (1-\tau^l) w l_t + \mathrm{B} + (1-\tau^k) r k_t + (1-\delta) k_t$$

The Government Sector

- The government , like any other entity in the economy, must satisfy the following resource constraint:

$$w.l.\tau^{l} + r.k.\tau^{k} + (v^{m} - \delta^{c})(m^{I} + m^{G}) + (v^{h} - v^{e})h + p^{G}.G - r.k^{G} - w.l^{G} - v^{m}.m^{G} - \mathrm{B} = b$$

THE GOVERNMENT SECTOR

- **Total Subsidy is :**

$$-b = q^{e}.e + q^{s}.s + q^{g}.g - p^{I}.I - p^{H}.H - p^{G}.G$$

- **Combining household resource constraint, government resource constraint and the subsidy equation, the economy wide resource constraint can also be derived.**

$$k_{t+1} = Y_t - c_t - v^{e}.h + (1-\delta)k_t - \delta^{c}(m^{I} + m^{G})$$

Model Shocks

- **Our model is driven by five different shocks:**

$$\ln v_t^e = \Omega^v + \omega \ln v_{t-1}^e + \kappa t$$

$$\ln A_t^Y = \Omega^Y + \mu^Y \ln A_{t-1}^Y + \eta_t^Y$$

$$\ln A_t^G = \Omega^G + \mu^G \ln A_{t-1}^G + \eta_t^G$$

$$\ln A_t^I = \Omega^I + \mu^I \ln A_{t-1}^I + \eta_t^I$$

$$\ln A_t^H = \Omega^H + \mu^H \ln A_{t-1}^H + \eta_t^H$$

Dataset, Parameter and Calibration

The model is calibrated for Bangladesh economy following Kydland and Prescott (1982) and Amin (2015).

The dataset is reported in the following table and reflects the variable values in 2011-2012.

Dataset: Main Model Parameters									
q^e=4.93	q^g=6.95	q^s=9.00	p^H=7.79	P^I=3.20	V^m=.775	V^h=5.72	V^e=8.19	δ^C=1.1	P^G=2.30

Dataset, Parameter and Calibration

Parameter values are reported in the following table:

Calibration: Main Model Parameters									
$\beta=0.96$	$\varphi=0.60$	$\theta=0.91$	$\rho=-0.11$	$\gamma=0.81$	$\alpha_H=0.004$	$\alpha_I=0.036$	$\alpha_G=0.058$	$\alpha_Y=0.2$	$\alpha_X=0.31$
$\Psi_H=0.59$	$\Psi_I=0.30$	$\Psi_G=0.30$	$\Psi_Y=0.073$	$\Psi_X=0.079$	$\vartheta_H=0.89$	$\vartheta_I=0.86$	$\vartheta_G=0.85$	$\vartheta_Y=0.7$	$\vartheta_X=0.58$

Solution Algorithms

- We run the program Dynare version 4.4.3 to solve and simulate the model and to approximate the dynamics of our model economy (Adjemian et al, 2011).

Main Results

Table : Percentage Change in SS Values from by introducing the Quick Rentals Benchmark Scenario: No Quick Rentals

Policy Experiment	c	x	y	Total Generation	GDP	Transfer	Subsidy
Introducing the Quick Rentals	0.52%	0.45%	0.06%	17.93%	0.04%	28.5%	58%

Conclusions

- Given our results, the introduction the quick rentals in Bangladesh can be justified, however, not as a long term solution.

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THANK YOU FOR YOUR ATTENTION

QUESTIONS?