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FIRM SELF-GENERATION DECISION AND OUTAGE LOSSES: EVIDENCE FROM EMERGING AND DEVELOPING ASIAN COUNTRIES

by

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Agenda

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1. Motivation

- The poor access to reliable and quality electricity halters or hampers economic and business activities.
- This, in return, leads to poor economic growth and development in emerging, and developing countries. For instance, most emerging and developing Asian countries encounter electricity shortages that lead to power outages.
- Therefore, the frequent power outages in these regions affect firms' productivity, hence having implications on their global competitiveness as it affects the production efficiency of companies, loss in revenues and outputs, and the profits they earn.
- A power loss in emerging and developing Asian countries has the direct repercussions. First, power failures result in both non-proportional and proportional expenses, such as lost computer data and programs, as well as proportional costs, such as idle equipment and workforce (Brussevich et al., 2020).
- Secondly, power outages disrupt production processes, lowering intermediate and ultimate outputs. Additionally, increased power shortages drive enterprises to use backup power sources like generators (Ndiaye et al., 2018).
- Against this background, the study investigates the role of self-power generation in reducing the power outage loss to the firm and calculates the power outage loss differential among the firms engaged in self-power generation and that is functioning without self-power generation.

2. Literature Review

- The developing countries experience power outage crises that threaten the stability of their economies (Allcott et al., 2014; Andersen & Dalgaard, 2013; Billinton et al., 1982; Canada, 2016).
- The World Bank Enterprise Survey shows that firms in developing countries suffer an approximate 77 hours per month power outage. Coupled with lack of financial stability, power outage poses a significant challenge to the objective achievement of such firms (Abdisa, 2018; Adenikinju, 2003; Alby et al., 2012).
- Most developing countries cannot provide reliable power, which pushes the firms to fight for low electric power (Balducci et al., 2002; Beenstock et al., 1997; Cissokho, 2019; Cole et al., 2018; Moyo, 2012).
- Several studies examine the power outage loss differential among companies that have invested in generators and companies that have not (Oseni & Pollitt, 2013; Oseni & Pollitt, 2015). .
- The outage time coefficient is positive and significant, which shows that the frequency of power outage influences the decision to self-generate, as is recorded by (Fisher-Vanden et al., 2015; Geginat & Ramalho, 2018; Ghosh & Kathuria, 2014; Lokshin & Sajaia, 2004; Maddala, 2006; Marno Verbeek, 2017).

3. The Model

$$lny_{1i} = \alpha_1 lnOT_i + \alpha_2 lnE_i + \alpha_3 lnEC_i + \alpha_4 Ex_i + \alpha_5 Ow_i + \alpha_C Country_i + \alpha_I Sector_i + \varepsilon_{1i} \text{ if } G_i = 1 \quad (1)$$

$$lny_{2i} = \alpha_1 lnOT_i + \alpha_2 lnE_i + \alpha_3 lnEC_i + \alpha_4 Ex_i + \alpha_5 Ow_i + \alpha_C Country_i + \alpha_I Sector_i + \varepsilon_{2i} \text{ if } G_i = 0 \quad (2)$$

$$pr(G_i = 1) = \alpha_1 lnOT_i + \alpha_2 lnE_i + \alpha_3 lnEC_i + \alpha_4 Ex_i + \alpha_5 Ow_i + \alpha_6 lnAge_i + \alpha_5 ln\, Exp_i + \alpha_C Country_i + \alpha_I Sector_i + \mu_i \quad (3)$$

- Where y_{i1} and y_{i2} are the dependent variables of continuous regressions and represent the amount of power outage loss for firms that invested in self-generation and those that did not, respectively.
- OT_i is the power outage time duration that firm i faces per day in a year. outage days is determined from a company's stated frequency and duration of power outages throughout a month. For each month, multiply the frequency of power outages by the length of each power outage (Callegari et al., 2018).
- E_i , the number of permanent full-time workers employed in firm i.
- EC_i, is the annual electricity cost of firm i.
- Ex_i, represent the export of firm, defined as the firm has more than 50% share of direct export in total annual sales.
- Ow_i , is the firm ownership owned by private foreign individuals or firms.
- G_i , is the dependent variable of binary regression, shows the firm has generator ownership or not.
- Exp_i is the manager experience, defined as a working experience of firm manager.
- Age_i, is the firm age expressed as the difference between conducting a survey and the year of actual operation.

4. Data

- We use 7 Asian Emerging and Developing Countries:
    - By definition of the IMF, Asian emerging and developing countries are: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Lao PDR, Mongolia, Myanmar, Nepal, Philippines, Papua NG, Solomon Islands, Sri Lanka, Thailand, Timor Lieste, Vietnam (IMF 2017).

- Cross sectional data over the time period of 2009 to 2016 collected from:
    - World Development Indicator (WDI) Database for 2010 exchange rate
    - World Bank Enterprise Survey (WBES) for firm-level variables

4.1. Data Description

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Table 1: Descriptive statistics

country	Firm Share in generator owning		Annual power outages time per day		Percentage Share of export in total sales		Share of Annual power outage losses in total sales (ln)		Annual electricity cost (ln)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bangladesh	0.43	0.49	1.37	3.45	0.13	0.33	2.64	1.83	2.33	1.88
China	0.51	0.50	6.18	5.69	0.11	0.31	3.73	1.65	4.88	1.67
India	0.42	0.49	5.19	11.8	0.12	0.32	2.47	3.96	2.61	2.54
Indonesia	0.83	0.36	1.98	2.20	0.06	0.24	1.98	2.20	4.26	1.71
Sri Lanka	0.42	0.49	1.71	1.43	0.05	0.23	2.35	2.06	2.06	2.18
Myanmar	0.86	0.33	2.34	2.38	0.14	0.35	2.34	2.38	2.97	1.95
Philippines	0.45	0.50	3.56	5.37	0.11	0.31	3.56	5.37	4.23	2.52

5. Outage loss by the firm with self-power generation

Variables	With Self-power generation (1)	Without Self-power generation (2)	Investment decision (3)
(ln)Outages per days	0.252***	0.538***	0.118***
	(0.0279)	(0.0732)	(0.0214)
(ln)Employment	0.499***	1.112***	0.342***
	(0.0274)	(0.200)	(0.0286)
(ln)Electricity costs	0.419***	0.446***	0.0686***
	(0.0198)	(0.0491)	(0.0162)
(D)Firm Exports	0.0666	0.825***	0.272***
	(0.0941)	(0.297)	(0.0936)
(D)Foreign ownership	-0.222	-0.531	-0.421***
	(0.203)	(0.414)	(0.141)
(ln)Age of firm			0.0577*
			(0.0306)
(ln) Manager experience			-0.0469*
			(0.0271)
_cons	-0.0117	0.161	-0.901***
	(0.144)	(0.294)	(0.149)
Industry dummies	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes
Rho1	-0.014		
	(.062)		

5.1. Predicted outages loss for the firm with and without self-power generation

Country	With Self-power generation			Without Self-power generation		
	Actual (A)	Counterfactual (B)	%TT (C= B-A/A)	Actual (D)	Counterfactual (E)	%UT (F= E-D/D)
Bangladesh	3.23	5.41	67.5	3.27	2.00	-63.5
China	4.25	6.03	41.8	4.59	3.54	-29.6
India	4.59	7.90	72.1	6.27	3.67	-70.8
Indonesia	4.05	5.96	47.2	2.44	1.97	-23.8
Myanmar	3.60	7.95	120.8	6.28	2.74	-129.2
Philippines	4.46	6.93	55.4	4.79	3.09	-55.0
Sri Lanka	3.34	5.91	76.9	2.55	1.36	-87.5

6. Conclusion

- In conclusion, the findings show that self-power generation helps organizations reduce the cost of power outage loss.
- Firms without such investments risk facing unmitigated risks. However, even for firms that invest in self-power generation, there are some levels of power outage losses, given that self-power generation does not offer complete backup.
- the study estimates show that firms that invest in self-power generation reduce an approximate 42-121% losses, a reduction that would have been impossible had they foregone the investment.
- In the same way, firms that fail to invest in self-power generation forego a possible loss reduction of 24-129% had they invested.
- Even with self-power generation, firms do not seem to experience optimal benefit from the investment; it is, therefore, essential to look at factors that ensure optimal return on investment.

7. Policy Recommendations

- The government should set up a compensation plan that offers compensation to the firms that experience power outage losses. It can be possible through power outage covers that mitigate the unplanned power outages based on market conditions at the time of power outage loss.

- Secondly, energy producers can improve power generation through using improved technology as well as effective power management. Producers can achieve efficiency in different forms, including retiring old power plants and replacing them with advanced technology.

Thanks for your Attention