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Power Outages and Firm Efficiency in Asian Emerging and Developing Countries

by

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Agenda

1. Motivation
2. Literature Review
3. Empirical Model
4. Data
5. Results
6. Conclusions

1. Motivation

- World Energy Outlook (2016) reports that more than one billion people have limited access to electricity consumption around the world.
- Developing and less developed countries account for approximately 75% of the world total population but they consume only 30% of total global energy.
- Both industrial and residential sectors are suffering from unsatisfied energy demand in Asian emerging and developing countries. Energy demand has grown by 60% over the past 15 years (IEA, 2017).
- 12% of business owners in developing countries perceived power outages as the highest resistance to business activities and economic output (World Bank Enterprise Survey Data, 2016).
- World Bank Enterprise Survey indicates that power outages are a major obstacle to firm activities and have a negative impact on firm efficiency.
- The concept of firm efficiency is regarded as producing as much output as possible, with given inputs.

2. Literature Review

- Cole et. al., (2018); Mensah J. T., (2016); Cissokho L., (2015); Abotsi et al., (2014); Doe & Asamoah (2014); Nyanzu & Adarkwah (2016) investigated the impact of outages on firm performance for Sub-Saharan Africa and found a negative relationship.

- Baten et al., (2010); Allcott et. al., (2014): Chakravorty et. al., (2014); found a negative relationship between power outages and firm performance for Bangladesh, Indian and rural India, respectively.

- Srithanpong, T., (2015) also estimated negative relationship for Thai manufacturing industries.

- However, only a few have estimated the impact of power outages on firm efficiency.

- Among them, Cissokho and Seck (2013) investigated a said relationship of power outages on firm efficiency by using Data Envelopment Analysis (DEA).

- Our study contributes to the empirical literature by analyzing the impact of the number of power outages on firm efficiency for firms in 17 Asian emerging and developing countries over the period from 2009-2016

3. Translog Model

- The translog function can be written as:

  - $$lnTS_i = \alpha_0 + \alpha_L\, lnLabor_i + \alpha_E\, lnEnergy_i + \alpha_C\, lnCapital_i + \alpha_O\, lnOutages + \frac{1}{2}\,\alpha_{L,L} lnLabor_i\, lnLabor_i + \frac{1}{2}\,\alpha_{E,E}\, lnEnergy_i\, lnEnergy_i + \frac{1}{2}\,\alpha_{C,C}\, lnCapital_i\, lnCapital_i + \frac{1}{2}\,\alpha_{O,O}\, lnOutages_i\, lnOutages_i + \alpha_{L,E}\, lnLabor_i\, lnEnergy_i + \alpha_{L,C} lnLabor_i\, lnCapital_i + \alpha_{E,C} lnEnergy_i\, lnCapital_i + +\alpha_{O,L}\, lnOutages_i\, lnLabor_i + \alpha_{O,E}\, lnOutages_i\, lnEnergy_i + \alpha_{O,C}\, lnOutages_i\, lnCapital_i + \alpha_G\, lnGDP_i + \alpha_{PD}\, lnPopDensity_i + \alpha_{Inf}\, lnInflation_i + \sum_{t=2}^{T} \alpha_t\, DT_t + \sum_{fs=2}^{FS} \alpha_{fs}\, DS_s + v_i - u_i$$

- We modify the inefficiency part of the composed error term as a dependent variable and find out the impact of external factors on inefficiency

  - $$u_i = \delta_0 + \delta_{PO}\, Power\ Outage + \delta_{ME}\, Manager\ Experience + \delta_{GO}\, DGenerator\ Owne + \delta_{FO}\, DFemale\ Owner + \delta_{QC}\, DQuality\ Certificate + \delta_{FA}\, Firm\ Age + e_i$$

4. Data

- We use 17 Asian Emerging and Developing Countries from 2009 to 2016 for 3,998 firms.
    - 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 country level variables
    - World Bank Enterprise Survey (WBES) for firm-level variables
    - Penn World Table 9.1 for exchange rate variable

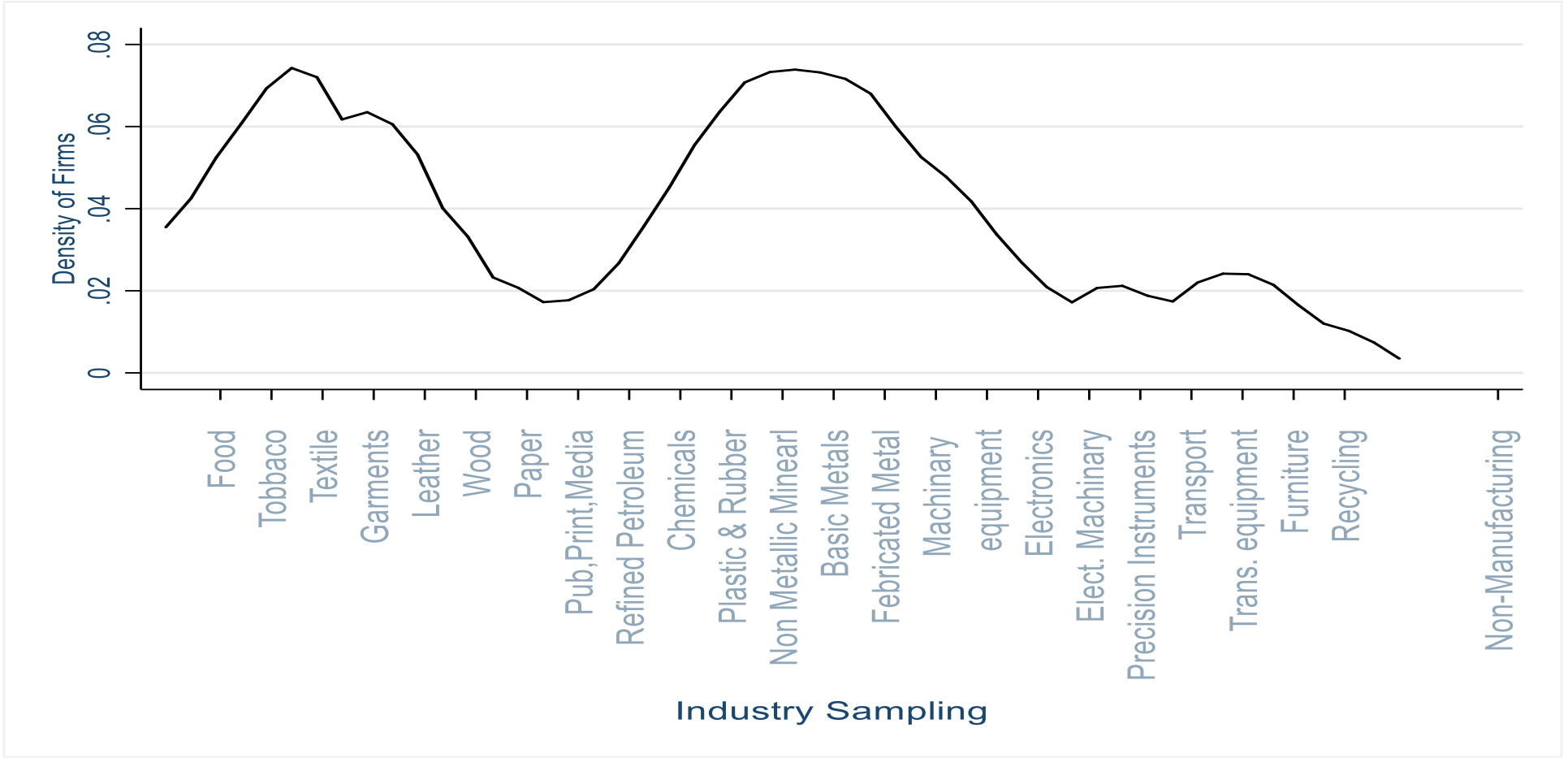
4.1. Data Discription

SUMMARY STATISTICS OF KEY VARIABLES						
VARIABLES	Unit of Measurement	Obs.	Mean	SD	Min	Max
DEPENDENT VARIABLE						
TOTAL SALES	US Dollars	3,415	1.90e+07	1.76e+08	1154.96	5.6e+09
INPUT VARIABLE						
CAPITAL	US Dollars	3,415	5.9e+07	3.3e+09	6.1596	1.9e+11
ENERGY	US Dollars	3,415	529799.2	1.6e+07	42.123	9.0e+08
LABOR	Numbers	3,415	138.90	497.85	2	21000
OUTAGES	Numbers	3,415	25.06	26.84	1	270
COUNTRY-LEVEL CONTROLS						
GDP PER CAPITA	Constant 2010 US$	3,415	1925.43	966.93	645.25	5910.45
POPULATION DENSITY	People per sq. km	3,415	435.33	272.99	1.71	1210.50
INFLATION	Annual (%)	3,415	5.957	1.580	-.574	10.48
FIRM-LEVEL CONTROLS						
GENERATOR OWNER	Dummy 1 if yes	3,415	.776	.416	0	1
FEMALE OWNER	Dummy 1 if yes	3,415	.223	.416	0	1
QUALITY CERTIFICATE	Dummy 1 if yes	3,415	.383	.486	0	1
FIRM SIZE	Dummy 1 if yes	3,415	1.96	.735	1	3
MARKET	Dummy 1 if yes	3,415	1.82	.653	1	3
MANAGER EXPERIENCE	No. of Years	3,415	15.5	9.05	1	70
FIRM AGE	No. of Years	3,415	20.5	13.7	0	162

4.2. Data Discription I

DISTRIBUTION OF FIRMS BY SIZE AND YEARS IN ASIAN EMERGING AND DEVELOPING COUNTRIES				
Year	**Small**	**Medium**	**Large**	**Total**
2009	71	69	61	201
2011	72	65	24	161
2012	42	81	54	177
2013	260	273	147	680
2014	716	1128	537	2381
2015	108	110	73	291
2016	24	40	43	107
TOTAL	1293	1766	939	3998

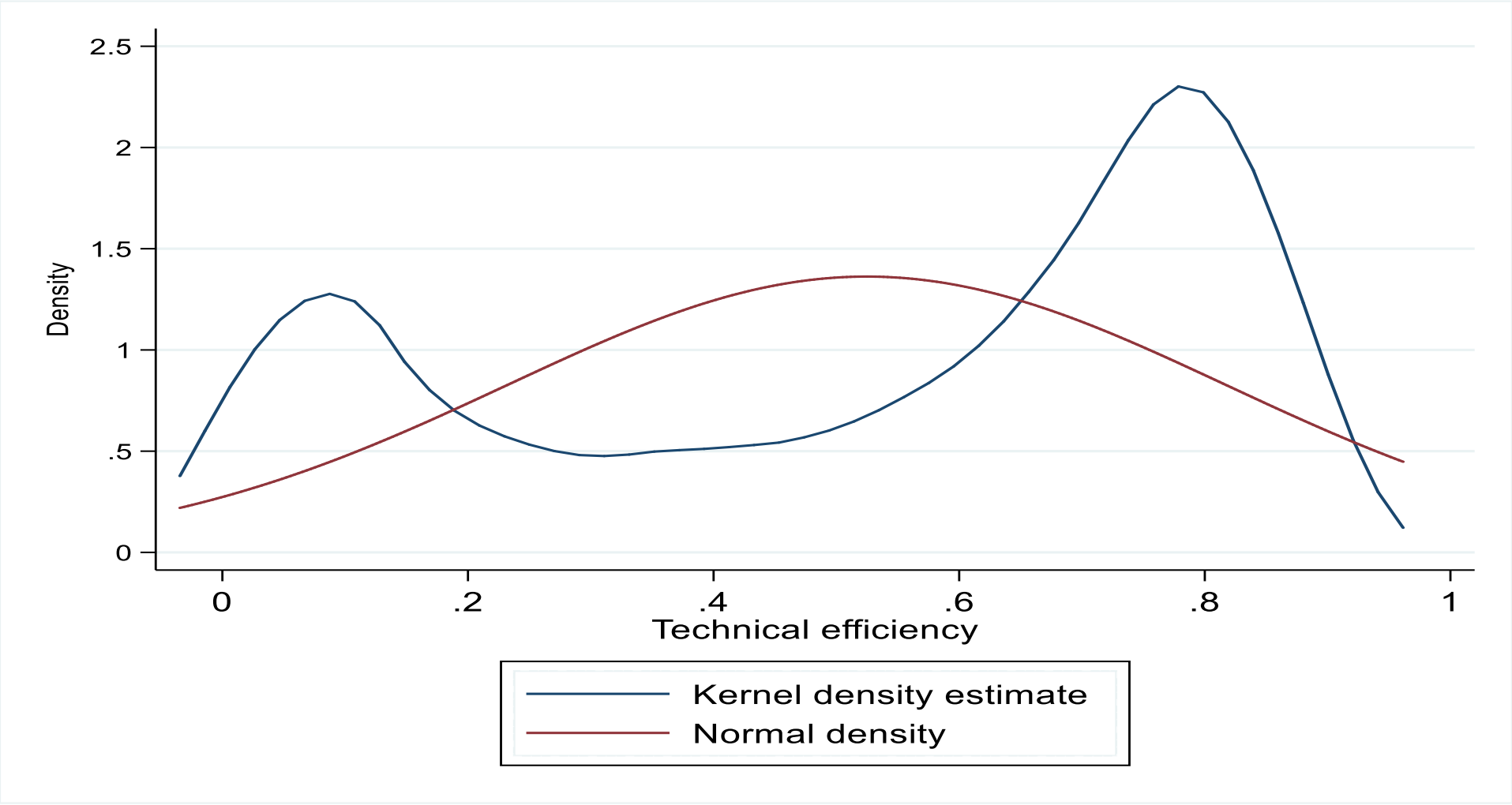
4.2. Data Discription II



5. Trans-log Stochastic Frontier Estimation

	Model. 1	Robustness Check
Variables	Coef.	Coef.
Labor	0.511***	0.508***
Energy	0.483***	0.451***
Capital	0.226***	0.216***
Power Outages	-0.519***	-0.568***
GDP	0.872***	0.761***
Pop_ Dens	0.094***	0.069**
Inflation	0.282***	0.199***
DFS_M	yes	Yes
DFS_L	yes	yes
Inefficiency		
Power Outages	-1.094***	-.987***
Gen_ Owner	-0.176***	-0.226***
Q_ Certificate	-0.578**	-0.530***
Market_ nat	-0.226***	-0.211***
Market_ Int	-0.387***	-0.382***
Manager Exp	0.0029	0.004
Firm Age	-0.0007	-0.002
Female Owner	0.004	-0.243

5.1. Technical Efficiency



5.2. Technical Efficieny at Percentiles

Technical Efficieny at Percentiles	
10th Percentiles	0.06
20th Percentiles	0.14
30th Percentiles	0.32
40th Percentiles	0.51
50th Percentiles	0.63
60th Percentiles	0.71
70th Percentiles	0.76
80th Percentiles	0.80
90th Percentiles	0.83

6. Conclusion

- This study contributes to the empirical literature by analyzing the impact of the number of power outages on firm efficiency for firms in 17 Asian emerging and developing countries over the period from 2009-2016.

- The results indicate that an increase in power outages is negatively related with firm performance and indirect impact on efficiency. These findings are consistent with the results of Moyo (2013) and Cissokho (2015). They found that power outages have potential negative effects on firm productivity.

- As energy resources of a country can determine economic growth and development, our results also indicating a strong relationship between energy and output production.

- The results of this study are suggesting some policy implications to policy makers regarding improving the conditions of energy supply with continue to invest in the energy sector and chalk out some alternative ways to avoid power outages.

- Asian Developing & Emerging states should effort to increase the availability of generators to the firm by improving the ability to purchase or lease generator, or by providing easy access to credit.

Thanks for your Attention