

**Regulatory interventions to reduce uncertainty in Brazil significantly increase critical electric distribution utility investments.**

CPCS expert **Dr. Samantha Witte** exploits a pseudo-natural experiment event in 2015 to conduct a Regulatory Impact Assessment. The results: increases in the frequency of tariff adjustments for exogenous costs reduce the option value of awaiting further information on lumpy investment returns for utilities. These electric utilities respond by increasing irreversible investments in electricity quality:

**1** The tariff reform caused a **13% increase** in the number of lumpy investments among treated firms, relative to the control utilities and to pre-2015:

	Dep. var: Lumpy investment incidents		
	(1)	(2)	(3)
Flag × Post	0.341** (0.104)	0.265** (0.101)	0.124* (0.05)
Post	0.404* (0.200)	0.235** (0.098)	0.094* (0.040)
Year FE	X	X	X
Municipality FE		X	X
Controls			X
R Squared	0.67	0.67	0.69
Observations	36,116	37,451	36,988

Notes: \*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ . Table reports impact of policy-induced uncertainty reduction on the number of lumpy investments, estimated in a PPML model. Standard errors in parentheses are clustered by electricity firm. Fixed effects by municipality and by year are included.

In context:

With an average annual number of **3.7** lumpy investments → Increase from **3.7** to **4.2** lumpy investments per year, worth **\$1.7-\$2.1 million** in investments per utility

Reversible, ongoing operating expenditures did not significantly rise because of the intervention policy, suggesting that uncertainty disproportionately affects businesses engaged in sunk cost type services:

**2** Marginal investments **did not** significantly respond to the tariff reform policy:

	Dep. var: Rev. Operating expenditure		
	(1)	(2)	(3)
Flag × Post	0.700* (0.342)	0.577 (0.346)	0.451 (0.379)
Post	0.565 (0.342)	0.471* (0.225)	0.399* (0.178)
Year FE	X	X	X
Municipality FE		X	X
State-level time trends	X	X	X
Controls			X
R Squared	0.54	0.58	0.59
Observations	35,025	35,011	34,908

Notes: \*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ . Table reports impact of policy-induced uncertainty reduction on reversible operating expenses (in R \$), estimated by OLS. Standard errors in parentheses are clustered by electricity firm. Fixed effects by municipality, year and state-specific trends are included.

→ Evidence suggests **uncertainty affects lumpy decisions more than reversible investments** (through both a higher discount rate and a higher option value).

The empirical results – which are robust to structural break tests and a matching-on-observables algorithm, hold 4 key implications for practitioners' intent on best practice intervention design:

**1**

Uncertainty can reduce critical investments by sunk cost service providers even if “on average” cost-recovery exists.

→ investors and regulators advised to dedicate specialized attention towards tariff formula details.

**2**

Uncertainty affects the investment hurdle rate more when investments are irreversible.

→ service providers engaged in the sunk cost business require distinct frameworks when conducting economic impact assessments, cost-benefit analysis and other analytics.

**3**

Generation mix that is susceptible to exogenous volatility can constrain the quality of electricity supply.

→ assessment is needed of potential adverse impacts of renewable energy capacity additions.

**4**

Quantification of causal damages can be deployed as prioritization tool for ranking binding constraints to economic growth and development:

Problem magnitude: changes in target × impact multiplier

The analysis provides a framework for evaluating uncertainty-reducing policy reforms on an ex-post and ex-ante basis. Further, it proves that the magnitude of the impact of volatility on critical investments is an empirical question with theoretical underpinnings that can be answered through economic modelling.

Uncertainty mitigation tools exist, and can be grouped into three broad solution approaches: market reform, regulatory interventions and design, and contract design:

## A global pathway for uncertainty mitigation.

10 relevant solutions delivered by CPCS's power, PPP and Africa practice experts



### CPCS contacts

#### Contributors

#### Samantha Witte

United Kingdom

[switte@cpcs.ca](mailto:switte@cpcs.ca)

<https://cpcs.ca/team/samantha-witte/>

<https://www.linkedin.com/in/samanthawitte/>

#### Manuel Tinoco

Canada

[mtinoco@cpcs.ca](mailto:mtinoco@cpcs.ca)

<https://cpcs.ca/team/manuel-tinoco/>

<https://www.linkedin.com/in/manuel-tinoco-0b3b8631/>

#### Anirudh Gautama

Canada

[agautama@cpcs.ca](mailto:agautama@cpcs.ca)

<https://cpcs.ca/team/anirudh-gautama/>

<https://www.linkedin.com/in/anirudhgautama/>

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### About the expert

Dr. Samantha Witte, Senior Consultant, is a regulatory economist specialized in advanced analytics spanning economics and finance. Her current work includes a power sector financial model in Ethiopia, and an economic impact assessment for a private investment transaction in Ghana.

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