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Capital bias in the price cap and revenue cap regulation: Averch-Johnson critique revisited

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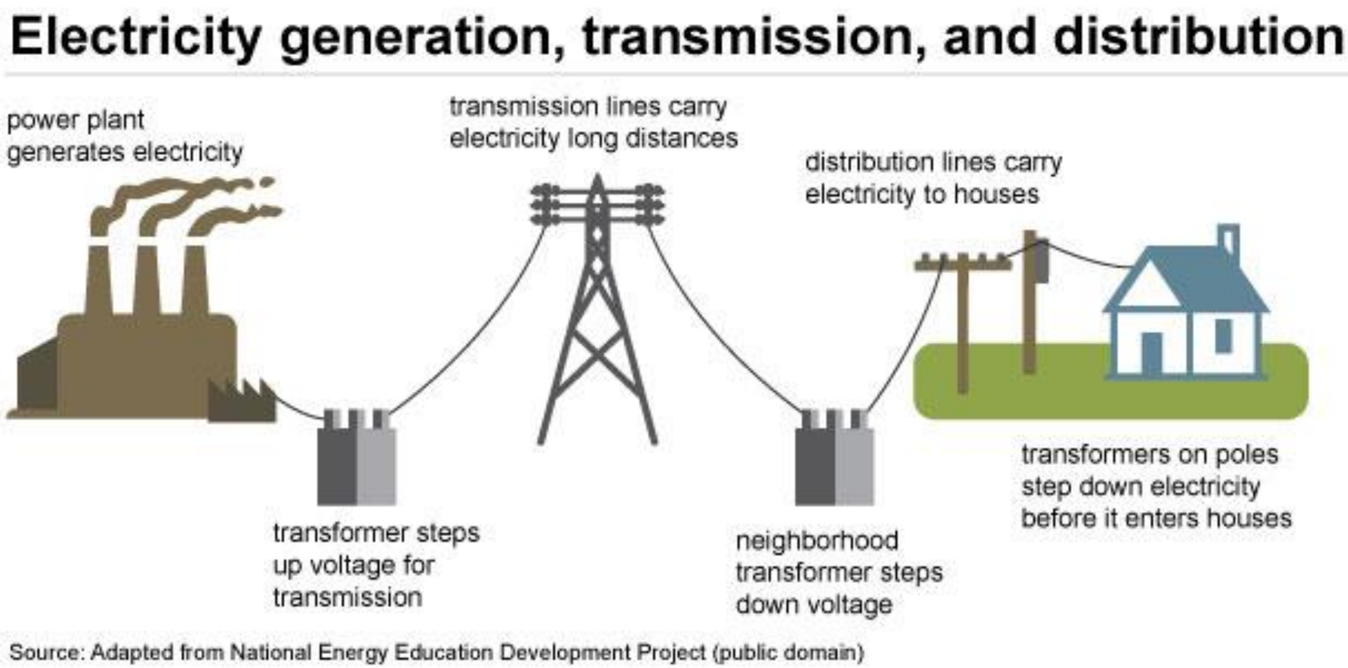
Outline

- Motivation: regulation of local monopolies in energy sector
- Averch-Johnson effect in the price cap and revenue cap regulation
- Numerical simulation

Further details: Kuosmanen & Nguyen (2018)
https://www.researchgate.net/publication/327645490_Capital_bias_in_the_price_cap_and_revenue_cap_regulation_Averch-Johnson_critique_revisited

Divestiture in electricity market

- **Electricity generation**: competitive market with many buyers and sellers
- **Transmission**: national monopoly
- **Distribution**: local mopolies



Unregulated monopoly

A monopoly produces a homogenous product y using a capital input x_1 and a variable input x_2 and production function $y = f(x_1, x_2)$ facing a strictly decreasing inverse demand function $p(y)$.

$$\max \pi(x_1, x_2) = p(y) \cdot y - r_1 x_1 - r_2 x_2$$

subject to

$$y = f(x_1, x_2)$$

Rate of return regulation

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$$\frac{p(y) \cdot y - r_2 x_2}{x_1} \leq s_1$$

Averch & Johnson (1962, *AER*)

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$$\frac{-dx_2}{dx_1} = \frac{r_1}{r_2} - \frac{\lambda}{(1-\lambda)} \frac{(s_1 - r_1)}{r_2}$$

Revenue cap

A monopoly produces a homogenous product y using a capital input x_1 and a variable input x_2 and production function $y = f(x_1, x_2)$ facing a strictly decreasing inverse demand function $p(y)$.

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Is revenue cap immune to the capital bias?

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Lemma 1: *If the regulator specifies the revenue cap based on the acceptable total cost as*

$$\bar{R} = s_1 x_1 + r_2 x_2 \, ,$$

then the revenue cap (5) is directly equivalent to the rate of return constraint (3). In this case, the revenue cap regulation is subject to the Averch-Johnson effect.

Simulation experiment

- Linear demand function $p(y)$
- Cobb-Douglas production function $f(x_1, x_2)$
- Input prices r_1, r_2 taken as given

How changes in the regulated rate of return s_1 influence:

- Output y
- Price p
- Total revenue py
- Monopoly profit
- Consumer surplus
- Capital intensity r_1 / r_2

Baseline scenario

Table 2: Comparison of the regulated vs unregulated monopoly: the percentage of the regulated monopoly's outcomes relative to that of the unregulated monopoly as a function of parameter s_1.

s_1	output	price	total revenue	monopoly profit	consumer surplus	capital intensity
1.02	110 %	92 %	101 %	2 %	121 %	9611 %
1.05	110 %	92 %	101 %	6 %	121 %	9068 %
1.25	110 %	92 %	101 %	24 %	121 %	6390 %
1.50	109 %	92 %	101 %	41 %	120 %	4444 %
1.75	109 %	92 %	101 %	52 %	119 %	3264 %
2.00	109 %	93 %	101 %	60 %	118 %	2502 %
2.25	109 %	93 %	101 %	67 %	118 %	1975 %
10.00	100 %	100 %	100 %	100 %	100 %	100 %

Conclusions

- Price cap and revenue cap regimes are not immune to the Averch-Johnson effect (capital bias)

- Numerical simulations demonstrate, that despite the capital bias, regulatory constraints have desirable effects
  - Output increases
  - Price decreases
  - Consumer surplus increases
  - Total revenue increases
  - Monopoly profit decreases

- Relatively light handed regulation suffices to achieve the main benefits

Thank you for your attention!

Questions, comments:

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