

The role of board diversity on the cost of hydropower companies

Massimo Filippini, Samuel Schenk
07.11.2025



Introduction

Hydropower Sector

- Hydropower accounts for approximately 60% of total electricity generation in Switzerland.
- The public (cantons, municipalities) own utility companies, which build and run hydropower plants.
- Switzerland gradually opened the electricity market for more competition in 2008. Although the opening was heavily limited, it created pressure on utilities to reduce costs and adapt to remain competitive. → One possible way to be cost efficient is through (good) corporate governance.

Research Question: Does gender balance on managerial boards increase cost efficiency?

Literature

Literature on production in the hydropower sector

- Classical production literature is broad and well-researched, Barros 2008, Motwani et al. 2013, Filippini et al. 2018, Wang et al. 2018, and many more.
- Primary focus is production/cost efficiency with standard inputs or impact of policies.

Literature on corporate governance and gender balance

- Positive: Simpson 2000, Srinidhi et al. 2011, Terjesen et al. 2016
- Negative: Adams and Ferreira 2009 (with quotas)

We want to contribute to the literature by studying the effect of gender balance on performance in the hydropower sector.

Empirical Specification I

“Classical” Energy Economics:

- Public production data from annual utility reports, 2004 – 2020
- Simple structural model to estimate a cost function

$$TC = f(Y, N, F, DS, DP, T)$$

Translog functional form specification:

$$\begin{aligned} \ln TC_{it} = & \alpha_0 + \alpha_Y \ln Y_{it} + \alpha_N \ln N_i + \alpha_F F_{it} + \alpha_{DS} DS_i + \alpha_{DP} DP_i + \alpha_t T_t \\ & + \frac{1}{2} \alpha_{YY} (\ln Y_{it})^2 + \frac{1}{2} \alpha_{NN} (\ln N_i)^2 + \frac{1}{2} \alpha_{FF} F_{it}^2 \\ & + \alpha_{YN} (\ln Y_{it} \times \ln N_i) + \alpha_{YF} (\ln Y_{it} \times F_{it}) + \alpha_{NF} (\ln N_i \times F_{it}) \\ & + \epsilon_{it} \end{aligned}$$

Empirical Specification II

Corporate governance and gender balance:

- Hydro-Utilities appoint managerial board → traditionally not diverse
- Include presence of (at least one) woman on managerial board as dummy in model

Translog functional form specification:

$$\begin{aligned} \ln TC_{it} = & \alpha_0 + \alpha_Y \ln Y_{it} + \alpha_N \ln N_i + \alpha_F F_{it} + \alpha_{DS} DS_i + \alpha_{DP} DP_i + \alpha_T T_t \\ & + \frac{1}{2} \alpha_{YY} (\ln Y_{it})^2 + \frac{1}{2} \alpha_{NN} (\ln N_i)^2 + \frac{1}{2} \alpha_{FF} F_{it}^2 \\ & + \alpha_{YN} (\ln Y_{it} \times \ln N_i) + \alpha_{YF} (\ln Y_{it} \times F_{it}) + \alpha_{NF} (\ln N_i \times F_{it}) \\ & + \alpha_{Gender} Gender_{it} \\ & + \epsilon_{it} \end{aligned}$$

Potentially endogenous → IV needed.

Share Women vs. Dummy

Estimation Procedure

We estimate a random effects model with an endogenous binary variable.

This raises two questions:

1. Why random effects?
2. How to correct for binary endogenous variable?

Estimation Procedure

Why random effects?

- Many variables (such as number of stations or power plant type) do not vary over time.
- Fixed effects estimates will most likely not be accurate due to low within variance of certain variables.
- Having a translog specification leads to high multi-collinearity.
- We include variable group means (so called Mundlak adjustments) which allow us to approximate the fixed effects model by accounting for some correlation between individual effects and regressors (Mundlak 1978, Wooldridge 2021).

Estimation Procedure

How to correct for binary endogenous variable?

We employ the Wooldridge approach (Wooldridge 2010):

1. Estimate a panel probit model which includes instruments as well as Mundlak adjustments
2. Predict probabilities
3. Use predicted probabilities as an IV and conduct standard 2SLS

Instrument I

Four year lagged share of women in the cantonal parliament where the utility is located

- Utilities are often partially owned by cantons or municipalities
- Connection to the local population and politicians is important
- Members of the cantonal parliament are likely candidates for managerial board positions
- If cantons are (part-)owners they often can choose a member themselves

Why lagged?

- Four years is usually one election cycle
- Experience matters in both industry as well as politics
- It takes time to be known and well connected

Instrument I

Verwaltungsrat

Dr. Thomas Hefti (Präsident)
Beat Imboden (Vizepräsident)
Georg Anton Buchli
Angela Casanova-Maron
Thomas Fürst
Jörg Huwyler
Peter Jans
Peter Lustenberger
Thomas Müller

Wohnort

Schwanden (Glarus Süd)
Steg VS
Versam
Domat/Ems
Olten
Wilten (Sarnen)
St.Gallen
Wettswil a.A.
Rorschach

Vertreter des Aktionärs

SN Energie AG
Alpiq Suisse SA
Korp. der Konzessionsgemeinden
Kanton Graubünden
Alpiq Suisse SA
Axpo Hydro AG
SN Energie AG
Axpo Hydro AG
SN Energie AG

Example

Instrument II

Share of yes votes on reform of pension system

- Referendum held in 2021
- Time-invariant but varies over cantons
- Increased the retirement age for women by one year (while keeping the male retirement age fixed)
- We use this as a measure of general attitude over cantons towards women in the labor market

Table: Panel Probit Regression

	(1) Dummy for Woman
Four-Year-Lag-Share	0.0678*** (0.0261)
Initiative AHV 21	0.0998** (0.0467)
Year FE	Yes
Translog Specification	Yes
Mundlak Adjustments	Yes
Observations	730

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results

Table: Regression Results

	(1)	(2)	(3)	(4)	(5)
	Model 1	Model 2	Model 3	Model 2 IV	Model 3 IV
Woman Dummy	-0.0526** (0.0211)	-0.0511** (0.0209)	-0.0518** (0.0209)	-0.2813* (0.1520)	-0.3032* (0.1559)
log Output	0.6855*** (0.0660)	0.6154*** (0.1343)	0.4423*** (0.1606)	0.5954*** (0.1450)	0.4057** (0.1791)
log Stations	0.4072*** (0.1172)	0.3169*** (0.1179)	0.2928** (0.1226)	0.2927** (0.1230)	0.2690** (0.1299)
Load Factor	-0.2709*** (0.0772)	-0.2948* (0.1692)	-0.0089 (0.2206)	-0.2730 (0.1816)	0.0342 (0.2455)
Year FE	Yes	Yes	Yes	Yes	Yes
Translog Specification	Yes	Yes	Yes	Yes	Yes
Mundlak Adjustments	No	First Order	No Interactions	First Order	No Interactions
IV	No	No	No	Yes	Yes
Observations	730	730	730	730	730

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Discussion

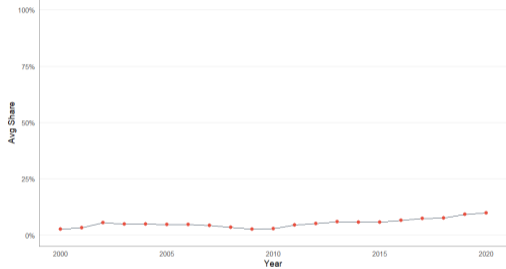
- Our findings suggest a significant decrease in cost associated with the presence of a woman on the managerial board.
- The size of the effect varies depending on model specification.
- There might be simultaneity issues present, specifically a negative feedback loop.

Further work:

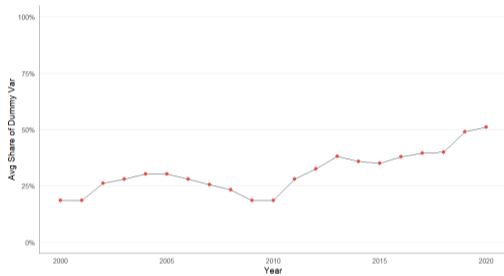
- Collect data for more utilities and update data to 2024
- Find additional IVs
- Robustness and sensitivity checks

Thank you for your attention!

Share of Women on managerial Boards



Share of Dummy



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Instrument I

Name	Party	Canton	Company
Peter Neukomm	SP	SH	Kraftwerk Schaffhausen AG
Kaspar Becker	Mitte	GL	Linth Limmern AG
Barbara Egger-Jenzer	SP	BE	Kraftwerk Oberhasli AG
Martin Schmid	FDP	GR	Engadiner Kraftwerk AG
Angela Casanova-Maron	FDP	GR	Kraftwerke Zervreila AG
Franziska Biner	Mitte	VS	Enalpin AG
Ferdinand Riederer	FDP	SG	Kraftwerke Sarganserland AG
Robert Cramer	Grüne	GE	Services Industriels de Genève SIG
Pia Häfliger	SVP	NW	Kraftwerk Engelbergeraag AG
Delessert Frédéric	FDP	VS	Electricité de la Lienne SA
Marco Passalia	Mitte	TI	Maggia Kraftwerke AG
Isaac Reber	Grüne	BL	Kraftwerk Birsfelden AG

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