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Corporate Social Responsibility of Hydropower Companies in Alpine Regions – A welfare-economic approach

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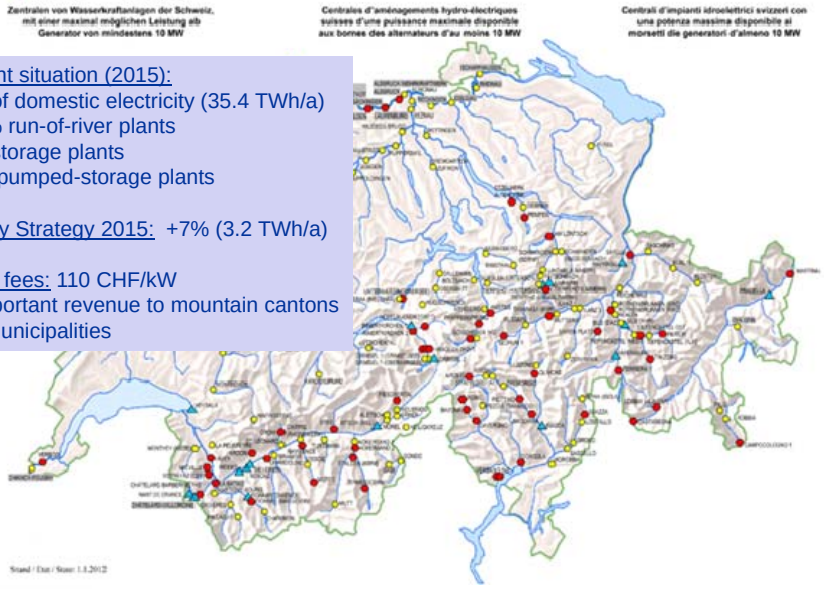
Motivation

- Hydropower (HP) activities must increasingly be evaluated from a sustainable development (SD) perspective.
- Corporate social responsibility (CSR) is the business equivalent:
  - o a shift from a pure shareholder perspective (maximizing profits and corporate value)
  - → a broader concept (multiple stakeholder concerns and values).

Definitions of CSR:

WBCSD	… the commitment of business to contribute to sustainable development
OECD (2001)	… business's contribution to sustainable development.
Heal (2005)	… reduce externalized costs and avoid distributional conflicts.
Beltratti (2005) Hediger (2010)	Socially responsible firms do try to maximize profits but at the same time try to improve the welfare of other stakeholders. ~ concept of Pareto improvement (Lange 1942)

Hydropower in Switzerland



Current situation (2015):
56% of domestic electricity (35.4 TWh/a)
47.6% run-of-river plants
48% storage plants
4.4% pumped-storage plants

Energy Strategy 2015: +7% (3.2 TWh/a)

Water fees: 110 CHF/kW
→ important revenue to mountain cantons and municipalities

A micro-economic foundation of CSR

A Paretean view of the firm:

- Definition 1: CSR is "a program of action where a firm's objective is to maximize its corporate value and, at the same time, to contribute to the improvement of social welfare" (Hediger, 2010).

$$\max_{\{x_{jit}\}} \pi(\mathbf{x}_{jt}) \qquad s.t. \qquad W(\mathbf{z}(\mathbf{x}_{jt})) \geq W(\mathbf{z}^{\circ}) \equiv \underline{W_0}$$

Externalities and reputation capital:

$$E_{jt} = E(\mathbf{x}_{jt}) \equiv W(\mathbf{z}(\mathbf{x}_{jt})) - \underline{W_t} \qquad \dot{R}_{jt} = \frac{dR_{jt}}{dt} = \psi(R_{jt}) \cdot \alpha^{-E_{jt}} \cdot E(\mathbf{x}_{jt})$$

CSR and corporate value:

$$\max \; L_{jt} = H(\mathbf{x}_{jt}, \mathbf{k}_{jt}, y_{jt}, R_{jt}) + \lambda_{jt} \cdot [W(\mathbf{z}(\mathbf{x}_{jt})) - \underline{W_t}] \quad \forall t$$

$$H_{jt} = H(\mathbf{x}_{jt}, \mathbf{k}_{jt}, y_{jt}, R_{jt}) = y_{jt} + \varphi_{jt} \cdot \dot{\mathbf{k}}_{jt} + \mu_{jt} \cdot \dot{R}_{jt}$$

Integrating the firms' and societal perspectives

- SD is not a fixed state of harmony (WCED, 1987).
- SD involves a continuous evaluation of trade-offs among economic, social and environmental system goals (Barbier, 1987)
  → usefully formalized in terms of a social welfare function (Hediger, 2000):

$$W = W(Y, M, S, Q)$$

with:
W = social welfare, Y = aggregate income, M = macroeconomic stability, S = social capital, Q = ecological capital.

- **Evaluation of corporate contribution to society from a SD view:**

$$dW = W_Y dY + W_M dM + W_S dS + W_Q dQ = 0$$

$$dY = -\left[\frac{W_M}{W_Y} dM + \frac{W_S}{W_Y} dS + \frac{W_Q}{W_Y} dQ\right] = -\left[\beta_M dM + \beta_S dS + \beta_Q dQ\right]$$

CSR of hydropower companies

The case of Swiss mountain areas

- Corporate profit: $\pi_{jt} = \pi_{jt}(\mathbf{x}_{jt}\mathbf{k}_{jt}, R_{jt}) = y_{jt} + q_t I_{jt} + \Omega_{jt} + \mathrm{T}_{jt} = \mathbf{p}_t \mathbf{x}_{jt} - \mathbf{c}(\mathbf{x}_{jt})$

- **Company / HP plant j's contribution to society:**

$$\Gamma_{jt} = \left[\sum_{l=0}^{4} y_{ljt} + \varphi_{jt}\dot{k}_{jt} + \mu_{jt}\dot{R}_{jt}\right] + \left\{\sum_{l=1}^{3} \Omega_{ljt} + \sum_{l=1}^{5} \mathrm{T}_{ljt}\right\} + \sum_{l=1}^{6}\left[\omega_{ljt} + \beta_M dM_{ljt} + \beta_S dS_{ljt} + \beta_Q dQ_{ljt}\right]$$

total profit prospect (corporate income) H_{jt} at time t

Water fee and tax payments to the public (municipal, cantonal, …)

external evaluation of the firm's contribution to society (at time t), defined from a SD perspective

Consider the societal evaluation of macroeconomic, social and environmental performance in monetary (income-related) terms: β_M, β_S and β_Q.

Conclusion

- CSR is usefully formalized as a constrained optimization problem of Pareto improvement and capital accumulation, including reputation capital.
- This allows us to assess the opportunity cost of a firm's voluntary or enforced commitment to improve the well-being of other people.
- CSR implies externally determined accounting prices that must express individual preferences, community values and risk premiums for the anticipation of potentially irreversible changes (critical limits) at the boundaries of the opportunity space for sustainable development.
- CSR involves
  - externalities (→ reputation) and
  - distributional concerns (→ water fees, taxes, HP governance).
- The discussion about water fees and HP concessions must involve a discussion about the governance and ownership structure of HP companies, as well as the fiscal incidence of these decisions.
- The "public hand" as well as philanthropic investors who also care about those societal values might have to play a role as additional investors in HP.

CSR of hydropower companies

The total value of hydropower

- **Total value of HP:**

$$TV_{j0} = \int_0^T e^{-rt}\Gamma_{jt}\,dt + e^{-rT}TV_{jT}$$
$$= \int_0^T e^{-rt}\left(\sum_{l=0}^{4} y_{ljt} + \varphi_{jt}\dot{\mathbf{k}}_{jt}\right)dt + \int_0^T e^{-rt}\left\{\sum_{l=1}^{3}\Omega_{ljt} + \sum_{l=1}^{5}\Psi_{ljt}\right\}dt + \int_0^T e^{-rt}\mu_{jt}\dot{R}_{jt}\,dt$$
$$+ \int_0^T e^{-rt}\sum_{l=1}^{6}\left[\omega_{ljt} + \beta_M\,dM_{ljt} + \beta_S\,dS_{ljt} + \beta_Q\,dQ_{ljt}\right]dt + e^{-rT}TV_{jT}$$

- **Private value:**

$$PV_{j0} = \int_0^T e^{-rt}\left(\sum_{l=0}^{4} y_{ljt} + \varphi_{jt}\dot{\mathbf{k}}_{jt}\right)dt + \int_0^T e^{-rt}\mu_{jt}\dot{R}_{jt}\,dt + e^{-rT}PV_{jT}$$

- **External value:**

$$EV_{j0} = \int_0^T e^{-rt}\left\{\sum_{l=1}^{3}\Omega_{ljt} + \sum_{l=1}^{5}\Psi_{ljt}\right\}dt$$
$$+ \int_0^T e^{-rt}\sum_{l=1}^{6}\left[\omega_{ljt} + \beta_M\,dM_{ljt} + \beta_S\,dS_{ljt} + \beta_Q\,dQ_{ljt}\right]dt + e^{-rT}EV_{jT}$$

CSR of hydropower companies

The total value of hydropower (cont.)

- **Total value of HP:**

$$TV_{j0} = \int_0^T e^{-rt}\pi_{jt}dt + \int_0^T e^{-rt}\mu_{jt}\dot{R}_{jt}dt + \int_0^T e^{-rt}\sum_{l=1}^{6}\left[\omega_{ljt} + \beta_M dM_{ljt} + \beta_S dS_{ljt} + \beta_Q dQ_{ljt}\right]dt + e^{-rT}TV_{jT}$$

- **Private value:**

$$PV_{j0} = \int_0^T e^{-rt}\left(\sum_{l=0}^{4} y_{ljt} + \varphi_{jt}\dot{\mathbf{k}}_{jt}\right)dt + \int_0^T e^{-rt}\mu_{jt}\dot{R}_{jt}dt + e^{-rT}PV_{jT}$$

- **External value:**

$$EV_{j0} = \int_0^T e^{-rt}\left\{\sum_{l=1}^{3}\Omega_{ljt} + \sum_{l=1}^{5}\Psi_{ljt}\right\}dt + \int_0^T e^{-rt}\sum_{l=1}^{6}\left[\omega_{ljt} + \beta_M dM_{ljt} + \beta_S dS_{ljt} + \beta_Q dQ_{ljt}\right]dt + e^{-rT}EV_{jT}$$

Thank you for your attention.

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