

# Do Organizational Form Matter ?

## Innovation and liberalization in the German wastewater sector


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# Project

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# Structure

1. Background & research question
2. Survey description
3. Econometric model
4. Estimation results
5. Policy implications

# Background

**Technical standard of German water services generally high**

**Unsolved Problems e.g.:**

- Partly outdated grid-type network requiring enormous future investment
  - Some environmental problems not addressed yet (e.g. hormones, drug residua)
  - Raising waste water charges/(alleged) economic inefficiency
- ⇒ Innovations considered as possible mean to solve such problems

# Policy Background

- Liberalization of telecommunication and electricity markets in the 1990s
- Discussion about liberalizing water and waste water services too
- No decision to substantially open the sector to some form of competition
- How to improve performance of the sector alternatively?
- Innovations might be such an alternative (cf. state ministers of economics)

# Research Questions

- What are determinants of firms' innovativeness in the waste water sector and thus can innovativeness be fostered by policy measures?
- Are innovations in fact substitutes to the introduction of some form of competition, rather than complements?
- Might some form of competition and/or private commitment be a driver for innovations?
- Do we get a similar result like Haug (2008) who analyzed for the water sector that the more independent utilities are of municipal influence the more efficient they are?

# The Role of Local Governments

- Important role of municipalities/waste water disposal sovereign duty of the local government
- Local authorities responsible for sewage disposal
- Municipality can choose how the task is fulfilled (organizational arrangement)
- Different organizational forms reflect certain levels of municipalities' interference
- Reducing the influence of local authorities is regarded as a first step to open the sector to the market

# Organizational Arrangements

- Municipal department (Regiebetrieb) **(24%)**
- Semi-autonomous agency (Eigenbetrieb) **(40%)**
- Public law incorporation (Anstalt öff. Rechts) **(16%)**
- Inter-municipal agency (Zweck- bzw. Wasserverband) **(9%)**
- Municipal enterprise under private law (Eigengesellschaft AG / GmbH) **(4%)**
- Operating /Co-operating Enterprise (Betreiber-/Kooperationsgesellschaft AG / GmbH) **(3%)**
- Others **(4%)**



# Survey Description

- Survey among ATV-DVWK members
- 683 firms randomly drawn, stratified by location and size
- 237 completed questionnaires, 161 used for estimation
- Majority of questions concerned with perceptions about drivers and obstacles to innovations
- Here focus is on questions concerning adaptation of organizational novelties (*already implemented, implementation planned, or implementation not considered*)

# Organizational Innovations

## Distribution of dependent variables:

Organizational innovation	neither planned nor implemented	adaptation planned	already adapted
Split waste water charges	93	24	44
Success-related fees	133	21	7
Service and operation directions	50	33	78
Cost and activity accounting	80	30	51
Internal performance indicators	105	24	32
Benchmarking	117	16	28
Management systems	128	20	13
Incentive wages	137	13	11

# Explanatory Variables

## Preferred Specification:

- Dummies for organizational form
- Controls for size (population) and characteristics of disposal area (population density)

Explanatory Variable	Mean	Median	Std. Dev.	Measuring Unit
municipal department	0.2733		0.4470	indicator
semi-autonomous agency	0.3602		0.4816	indicator
inter-municipal agency	0.2360		0.4260	indicator
public law incorporation	0.0621		0.2421	indicator
private law	0.0683		0.2531	indicator
population	0.1198	0.0185	0.4031	10 <sup>6</sup> people
population density	0.0490	0.0210	0.0673	10 <sup>4</sup> people/km <sup>2</sup>

# The Econometric Model

## The Modeling Strategy:

- Innovations are measured by output not inputs
- Individual innovations are observed
- Analysis is interested in innovativeness in general, not single innovations
- No ex ante measure of innovativeness is constructed
- Multivariate analysis & structural model allow for identification of effects on the unobserved variable **“innovativeness”**

# The Structural Model

1. Propensity  $X_{li}^*$  to implement an innovation is determined by observable firm-specific variables  $z_i$  and the latent variable innovativeness  $Y_{li}^*$ :

$$X_{1i}^* = \delta_{10} + \delta_{11}Y_i^* + \beta_1' z_i + \varepsilon_{1i}$$

$$X_{2i}^* = \delta_{20} + \delta_{21}Y_i^* + \beta_2' z_i + \varepsilon_{2i}$$

$$\vdots \quad \quad \quad \vdots$$

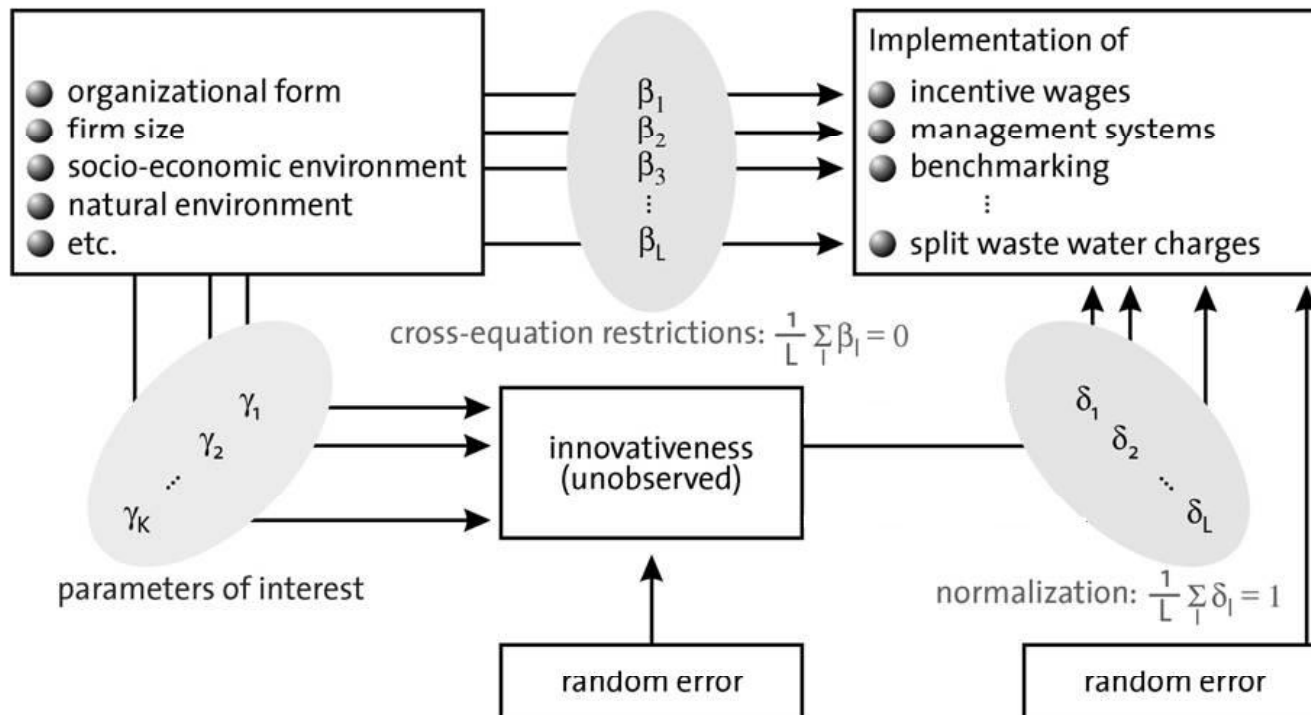
$$X_{Li}^* = \delta_{L0} + \delta_{L1}Y_i^* + \beta_L' z_i + \varepsilon_{Li}$$

2. Innovativeness is determined by characteristics  $z_i$  too:

$$Y_i^* = \gamma' z_i + \eta_i$$

# The Structural Model

## Model structure



# A Reduced Form Representation

- Structural model not operation since  $Y_{li}^*$  is not observed
- Substituting  $Y_{li}^*$  leads to a reduced form
- Reduced form can easily be estimated using  $L$  ordered probit models
- Left hand side:  $0, 1, 2$ , i.e. innovation not implemented, implementation planned, already implemented
- Right hand side:  $z_i$
- **Problem:** structural parameters  $\gamma$  matter, not the reduced form coefficients

# Identification of the Structural Parameters

## Two assumptions necessary to identify $\gamma$ :

1. An explanatory variable cannot systematically influence the propensity to implement innovations in any other way than through a firms' innovativeness, i.e.:

$$\frac{1}{L} \sum_{l=1}^L \beta_l = 0$$

2. Effects of innovativeness needs an innocent normalization, e.g.:

$$\frac{1}{L} \sum_{l=1}^L \delta_l = 1$$

⇒  $\gamma$  calculated as average of the reduced form coefficients



# Estimation Results

## Estimated structural model parameters:

Explanatory Variable	Estimated Coefficient	Standard Error
semi-autonomous agency	0.2689	0.5545
inter-municipal agency	0.2164	0.5636
public law incorporation	-0.1255	0.8335
private law	0.7389	0.8221
population	1.4746*	0.7085
population density	4.2511**	1.2862

- Absolute size of estimated coefficients has no natural interpretation
- Signe and significance matter

# Estimation Results

## Main qualitative results:

1. Dummies indicating organizational neither individually nor jointly significant
2. Population (i.e. size) positive and - marginally - significant
3. Population density positive and highly significant (holds for any specification estimated)

# Robustness Check

## Conventional Count-Data Analysis (ZIP Model):

Explanatory Variable	Only implemented		Imp. & planned	
	Est.	S. E.	Est.	S. E.
semi-autonomous agency	0.179	0.125	0.198	0.115
inter-municipal agency	0.068	0.141	0.132	0.133
public law incorporation	0.059	0.236	0.157	0.285
private law	0.603*	0.227	0.333	0.176
population	0.152	0.172	0.020	0.188
population density	3.754**	1.404	3.312**	1.274

- Results largely confirm earlier findings
- Organizational arrangements jointly insignificant
- Population density significant

# Interpretation of Estimation Results

- 1. Estimation results do not support the hypothesis that changes in organizational arrangement (in particular a reduced influence of municipal councils and privatization) will improve the innovativeness of service providers**
  - Results different from similar research in German water supply sector.
  - Elements of competition and innovation rather complements than substitutes.
  - Very low degree of private commitment hamper identification of privatization effects.

# Interpretation of Estimation Results

2. Estimation results suggest that larger firms are more innovative than small ones.
  - Result is not fully robust
  - Restructuring the – very fragmented – sector leading to larger units appears to be beneficial
  - Process has already started

# Interpretation of Estimation Results

- 3. Estimation results suggest that firms located in densely populated area are more innovative than firms at the periphery**
  - Alternative specifications suggest that “population density” captures socio-economics rather than geographical effects
  - Integration into innovations enhancing networks and access to human capital seems to be important for innovative activities of firms providing waste water services

# Policy Implications

- Competitive elements at least as in the German water supply sector ought to be considered
- Restructuring leading to larger units is likely to improve the sector's innovativeness
- Investments that generally enhance innovations (research, education ...) are likely to be beneficial for the waste water sector's innovativeness