

# **WATER SUPPLY REFORMS AND CHILD MORTALITY IN COLOMBIA 1990-2004**

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# Motivation

- The proper provision of water and sewerage services is necessary to overcome poverty and to improve the quality of life.
- One of the Millennium Summit 2000 is to decrease child mortality in children under 5, from 37.4 to 17 deaths per 1000 live birth.
- After more than ten years of the implementation of the water reforms, the evaluation of their results emerges as a priority.

# Objectives

- Evaluating empirically the impact of reforms of water provision on child mortality from 1990 to 2004.
- Establishing the variables linked to the municipality decision to reform
- Determining the likely transmission channels of the results found

# Literature

- The relation between drinking water and sanitation availability, and the population quality of life has been widely acknowledged in the literature (Esrey et al, 1991, Lavy, Strauss, Thomas and Vreyer 1996, Abou Ali, 2002, Jalan and Ravallion, 2003, Fajardo, 2004).
- Specifically, the lack of water supply and sewerage systems is related to incidence of infectious and transmissible diseases, including diarrhea and cholera, among others, to which child population is specially vulnerable. (Payment and Hunter, 2001).
- In general, results show that access to these services reduce the child mortality rate by 5% to 27%, disease incidence by about 20% (Galdo and Briceño, 2005), and disease duration by 29% (Jalan and Ravallion, 2003).
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# Literature

- Bhattacharyya, Parker and Raffiee (1994) compared the efficiency of 225 public companies and 32 private companies in USA. The results show a higher efficiency of the public companies regarding the use of production factors. However, variance is of results for public companies.
- Estache and Rossi (2002) analyze the performance of 50 companies in 29 countries of Asia and the Pacific. The results do not show a higher efficiency of the private companies when compared to the public companies.
- Coelho, Da Silva and Moreira (2005), compared the efficiency of 148 companies in Brazil, and found that efficiency of private companies is only marginally higher than the public companies.

# Literature

- Clarke, Kosec and Wallsten (2004) carried out a different analysis from the ones described above, as they studied the effect of participation of private sector on the water and sewerage services in Brazil, Argentina and Bolivia. For none of the two services of water supply and sewerage system, any correlation between private participation and coverage is found.
- Galiani, Gertler and Schargrotsky (2005) studies the effect of privatization on child mortality in Argentina in a group of 494 municipalities. By applying a difference-in-difference model, they found that privatization is associated to a decrease in child mortality by 9%. The effect is in poor municipalities.

# Literature

Authors	Country / Region	Methodology	Results
Giraldo y Rosales 2004	Colombia	Difi-in diff model	More and better access of water and electricity increase household productivity.
Arévalo y Shippner 2002	Antioquia	Case study	Mixed schemes are more efficient for water and sewage provision
Barrera y Oliveira 2007	Colombia	Difi-in diff model	Privatization affects positively access and quality of water services in urban areas. Differences in impact by income level.

# Literature

- The development of reforms in the sector in Colombia has been studied by Silva and Andia (2006) studied the development of reforms and found a low relation between the allocated resources and the change in coverage, as well as a high heterogeneity of the results in different regions of the country.
- Conclusion. No clear effects

# Colombia's reform

- The management resources for financing for water supply and sewerage systems was under the control of the Fondo de Fomento Municipal (FFM) (*Municipal Development Fund*) until 1950.
- After 1950 and until 1987 Instituto de Fomento Municipal (INSFOPAL) (*Municipal Development Institute*). INSFOPAL was in charge of planning, designing, building, operating, maintaining, managing, and financing services in municipalities (Maldonado et al., 2001).
- Low provision of the service because of the presence of that entity, local authorities disregarded the provision of the service

# Colombia's reforms

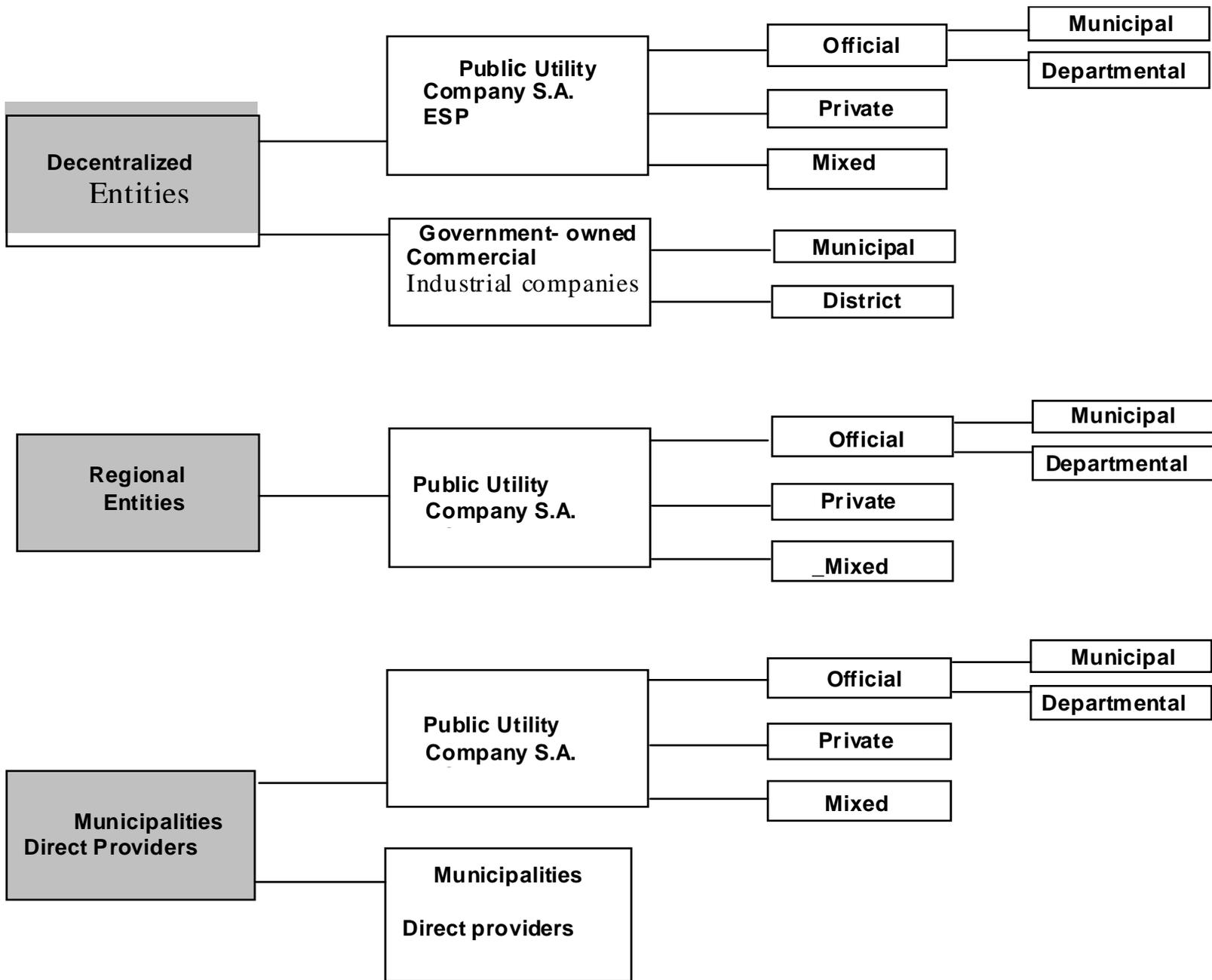
- In 1987 the service delivery was transferred to the municipalities but with co-financing of the Central Government
- In 1993 the Law 60 set the transfers for the sector of water and sewage.
- The transfers to municipalities should be spend either in subsidies to the poor to cover water costs or in new infrastructure to increase coverage.

# Colombia's reforms

- Law 142 introduced a new institutional framework for the household public utilities provision with the creation of the Regulatory Committees for each public service (water, electricity, telephones)
- Under this new institutional framework municipalities **have the responsibility of providing efficient household public utilities either through public services companies or directly by the municipality.**

# Colombia's reforms

- Several providers could be used :
  1. Public services companies incorporated as public limited liability companies (S.A. ESP),
  2. Municipalities as direct providers
  3. Government-managed industrial and commercial companies (EICE, Empresas Comerciales e Industriales del Estado),
  4. Marginal or independent producers, and
  5. Organizations authorized to provide service in rural areas or specific urban area



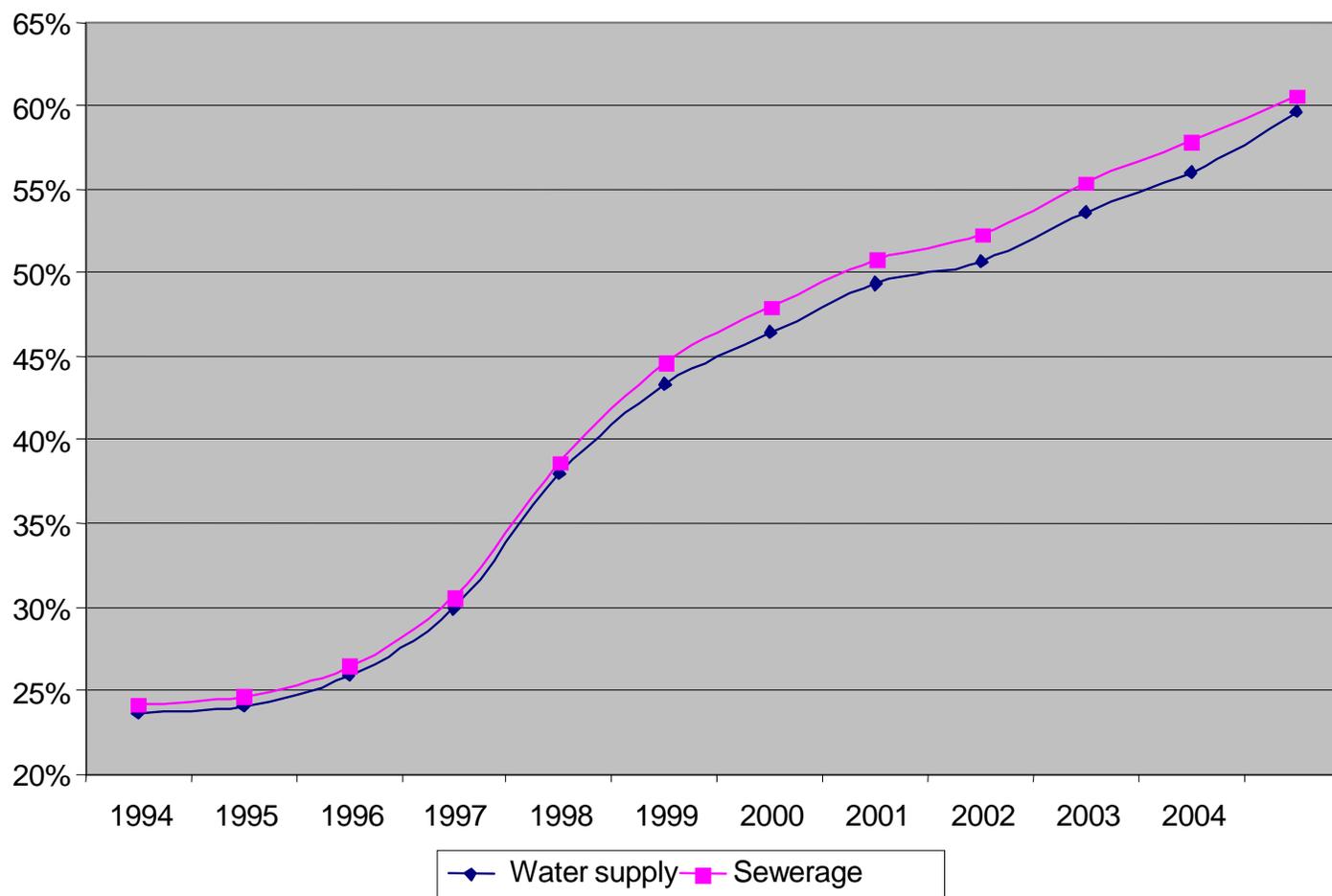
# Evolution of reform

## Results as of 2007

TYPE OF PROVIDER	REGISTERED COMPANIES			MUNICIPALITIES SERVED	
	Water and Sewerage	Only Water supply	Only Sewerage System	Water supply	Sewerage system
EICE	142	14	2	169	154
Municipality	190	21	7	213	188
Authorized organization	32	292	0	329	32
Marginal Producer	3	11	0	14	3
Sociedades (ESP)	55	7	4	163	142

# Evolution of the reform

Evolution of the percentage of municipalities that reformed the provision of water supply and sewerage services



# Distribution by type of provider, 1994-2004

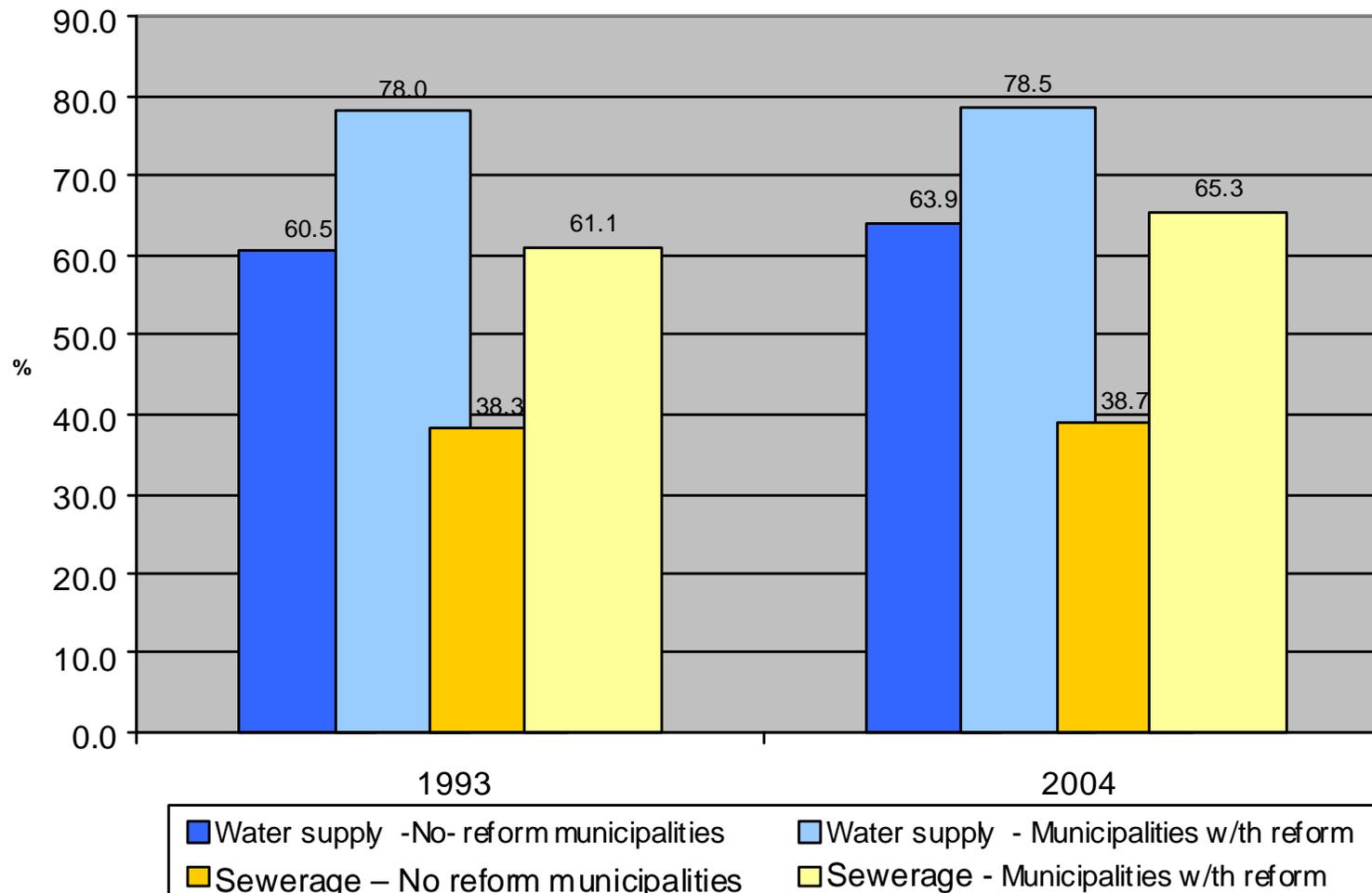
TIPO DE PRESTADOR	SERVICIO			Total	%
	Water supply and sewerage	Only water supply	Only sewerage		
EICE	101	9	2	112	57%
Incorporated companies (ESP)	71	13		84	43%
<i>Official</i>	4			4	5%
<i>Private</i>	58	11		69	82%
<i>Mixed</i>	9	2		11	13%

# Reforms

- Most municipalities that implemented a reform in service provision decided to set up an EICE. 43% of reforms in service provision were implemented through ESP incorporated companies.
- The involvement of private participation in service provision was implemented in 80 out of the 84 municipalities that implemented a reform through the setting up of a Public Utility Company, S.A. ESP.
- Only in 5% of the municipalities, ESP was created with exclusively official-capital, and in 82%, totally funded with private capital.

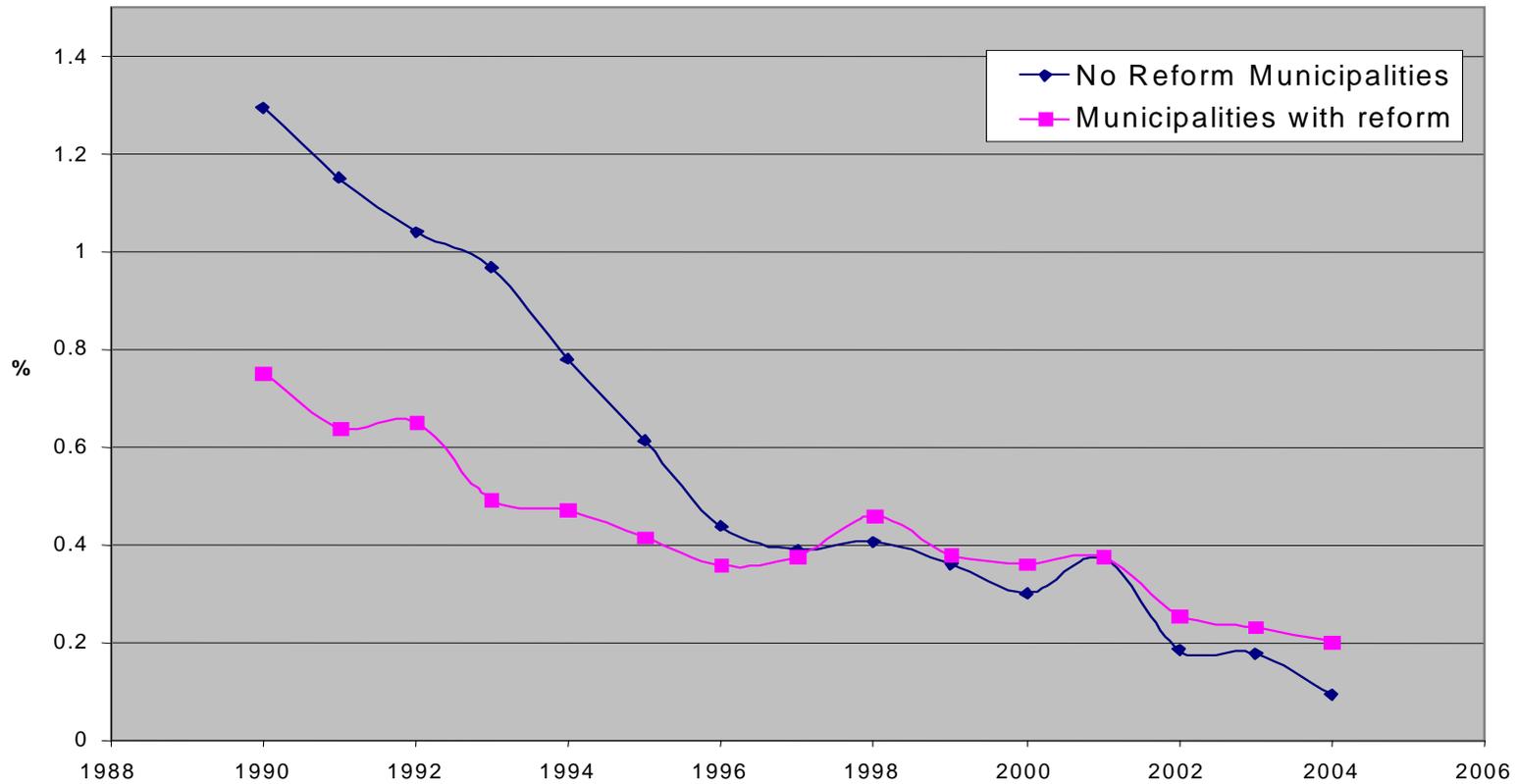
# Evolution of coverage

*Evolution of coverage of water supply and sewerage services 1993-2005*



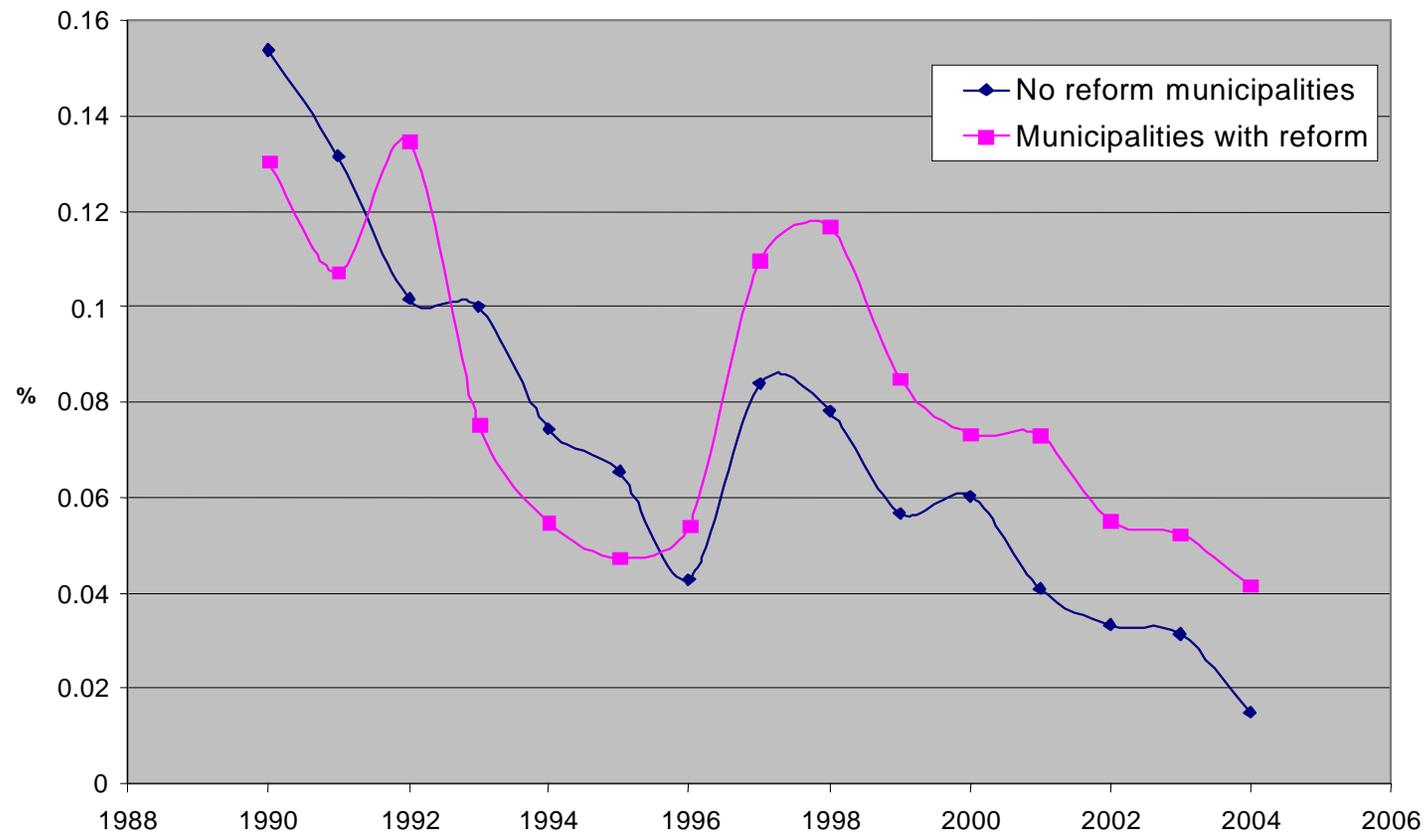
# Total Child Mortality, 1988-2004

Evolution of child mortality rate from non-external causes



# Child mortality from infectious and transmissible diseases

Evolution of child mortality rate from infectious and transmissible diseases



- Discrete Duration model to determine the decision of reforming
- Logistic distribution

<b>Duration Model for the Decision to Reform</b>				
	<b>Acueducto</b>		<b>Alcantarillado</b>	
	<b>Modelo 1</b>	<b>Modelo 2</b>	<b>Modelo 1</b>	<b>Modelo 2</b>
Log time	1.789 ** (0.755)	2.138 ** (0.891)	2.009 ** (0.944)	2.304 ** (1.040)
<b>Municipal variables in 1993</b>				
Coverage	0.018 ** (0.0079)	0.021 ** (0.009)	0.017 ** (0.008)	0.018 * (0.001)
Rurality rate		-0.019 * (0.011)		-0.016 (0.012)
Infant Mortality rate		-0.088 (0.115)		-0.147 (0.129)
<b>Variables that change over time</b>				
Rurality rate	-0.019 ** (0.009)		-0.017 * (0.010)	
Infant Mortality rate	-0.079 (0.233)		-0.049 (0.252)	
Political participation	-2.283 *** (0.8789)	-2.387 *** (0.916)	-2.611 ** (1.037)	-2.775 *** (1.043)
Number of parties	0.358 *** (0.119)	0.374 (0.126)	0.331 ** (0.132)	0.339 ** (0.136)
Observations	2278		2018	
Groups	357		318	

# Model

- Results show that probability to reform exhibits a positive dependency of duration.
- For the two services and in both models, **initial coverage is significant, and it affects the probability to reform positively.** The result shows that reforms are not directed to regions with the widest problems in coverage.
- The findings show that whereas the electoral participation decreases the probability of a reform, the NEP (*effective number of political parties*) increases that possibility.

# Decision Model

- Child mortality rate is not correlated to the decision of reforming service provision in any case.
- This result is relevant as it allows to establish a causal relation between the service provision reform and the mortality rate, without incurring in a problem of endogeneity.

# Econometric models for infant mortality and coverage

$$m_{it} = \alpha R_{it} + \beta x_{it} + \gamma_t + \delta_i + \varepsilon_{it}$$

# Reform and Child Mortality

- In order to find the reform effect and control non-observed variables, a model of difference-in-difference was estimated from a panel data following the specification, with fixed effects and time dummies

$$m_{it} = \alpha R_{it} + \beta x_{it} + \gamma_t + \delta_i + \varepsilon_{it} \quad (1)$$

### Effects of water and sewage reforms on infant mortality

Variable independiente	Infant mortality (non external causes)		Infant Mortality (infectious diseases)	
	Total sample (1)	With common support (2)	Total sample (3)	With common support (4)
Reform	-0.057 (0.052)	-0.016 (0.053)	-0.073 *** (0.022)	-0.046 * (0.026)
Reform before 1994	-0.384 *** (0.044)	-0.358 *** (0.051)	-0.072 *** (0.016)	-0.076 *** (0.023)
Reform*Private or mixed	-0.225 ** (0.098)	-0.221 * (0.099)	-0.031 (0.039)	-0.031 (0.046)
Reform*More than 2500 clients	0.264 *** (0.074)	0.257 *** (0.080)	0.142 *** (0.027)	0.142 *** (0.034)
Reform*More than 2500 clients*Private or mixed	0.305 ** (0.127)	0.244 * (0.142)	0.048 (0.046)	0.043 (0.061)
% Health Insurance Coverage	-0.419 *** (0.071)	-0.400 *** (0.085)	-0.211 *** (0.038)	-0.184 *** (0.049)
Observations	7725	6435	3332	2386
Groups	515	429	380	307

# Results

- Reform favored small municipalities
- Infant mortality decrease at a lower rate in bigger municipalities and even at a much lower rate in bigger municipalities where there was private participation.

## Effects of Reforms on Coverage of Public Services

### Diff-in-diff and fixed effects

	<b>Acueducto</b>	<b>Alcantarillado</b>
Dummy 2005	12.356 ***	9.185 ***
	-1.253	-0.319
Reform	0.177	4.627 *
	-2.299	-2.413
Reform*More than 2500 clients	-6.163 ***	-1.079
	-2.22	-2.332
Reform*Private or mixed	-6.275 ***	-1.843
	-2.26	-2.428
Constant	64.3	43.75
	-0.56	-0.58
Observations	1044	932
Groups	545	484

# Results

- Municipalities that reform had no increase in coverage
- Greater municipalities that reformed and those with private providers performed worse in coverage

# Conclusions

- Results indicate that municipalities with more than 2500 subscribers and that reformed service provision exhibit slower reduction of child mortality rate from infectious and transmissible diseases than the one in municipalities that maintained service provision on the hands of local government.
- In the case of water supply service, municipalities that include private capital in service provision show a coverage increase at a lower rate than those that did not reform the provision.

# Work ahead

- Identifying why such results: possible channels
- A) Failure in regulation. Contracts do not establish coverage goals
- B) The municipality pay tariff subsidies which guarantees profitability of the provider. It reduces the resources for investment (coverage expansion)
- C) The marginal client (as being poor) it is not profitable for the provider.