Private management and public finance in the water industry: a marriage of convenience?

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Abstract

In many countries reforms of water and sanitation utilities have favoured private sector involvement. The drivers of this trend are the need to improve efficiency and professional capabilities of service operation and willingness to relieve public budgets from the heavy burden of investment. Little attention has been devoted, in turn, to the heavy impact this strategy can have on water bills because of the higher cost of capital, what is implicit given the economic risk that the private sector is required to accept. We argue here that these consequences can be very important and outweigh the potential benefits of liberalization. As a capital intensive industry with long economic life of assets, the water industry is particularly vulnerable to the cost of capital, and this creates the case for publicly-supported financial schemes in order to keep this cost as low as possible and guarantee long-run viability as well as affordability. More general implications and policy recommendations concerning the finance of water infrastructure are finally derived.

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Introduction

Water and sanitation services (WSS) have been widely recognized as a textbook case of market failure, thus opposing serious obstacles to liberalization (Massarutto, 2006; Finger et al., 2007; NRC, 2002). Nonetheless, private sector involvement (PSI) has been driven both by the increasing need for professional expertise, technical capabilities and capacity to manage complex and globalized value chains; and at the same time, by the willingness to relieve public budgets from heavy investment requirements. This results in the strategy of creating self-sufficient WSS undertakings, completely based on market finance on a full-cost recovery base. Despite the available models are many and very different (ranging from delegation via competitive tendering to regulated private monopolies and public-private partnerships), all of them involve partial or total assumption of responsibility by the private company and market finance geared by user fees.

On the other hand, the impact of this strategy on total costs of public services is often underrated or misunderstood. PSI is generally associated with improved efficiency, both concerning operational and capital expenditure. Private companies are argued to have greater incentives to reduce costs and have easier access to capital markets. Higher prices after privatization are considered just as an effect of cost recovery and defiscalization.

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This is too often assumed as a truth that requires no further demonstration; however, it is at odds with the very trivial consideration that capital cost is a function of the economic risk that investors are actually sustaining, and is therefore affected by the regulatory environment. Due to the monopoly over taxation, the state can achieve far better conditions than private companies on capital markets, and this is obviously reflected by a lower interest rate (Stiglitz, 1992). Therefore, the implicit logic behind PSI is that superior incentives to efficiency provided by the market can more than outweigh the higher cost of capital. This is certainly true in many cases, but not necessarily for capital-intensive infrastructural services.

This argument is of paramount importance for WSS. It requires large, bulky, lump-sum investment whose economic life can last for decades and even for centuries, and represent the highest share (75% or more) of total cost (Massarutto, 2007). The private sector can hardly accept such a long depreciation schedule without a due remuneration of risk; on the other hand, since investment is sunk, it is permanently exposed to the risk of expropriation of quasi-rents represented by depreciation cash flows (Noll et al., 2000). In the past water investment has been almost totally covered by public expenditure, while PSI was considered as an option for operation only.

The traditional model, however, can generate serious shortcomings with respect industry viability, system resilience and efficiency of investment choices in the long term. Although this issue has never been analyzed with specific reference to the water industry, many contributions argue about the superiority of solutions that integrate operational and investment decisions in the same subject due to the information problems occurring otherwise, and show the spontaneous tendency of infrastructural services towards integration even after legal unbundling (von Hirschhausen et al., 2004; Petretto, 2006). Involving the (private) operator in investment decisions through private-public partnerships is argued as superior to separation whenever designing management contracts involves more information asymmetries and risk than procurement contracts (Hart, 2003). Apparently, the argument is that bearing the economic risk of investment provides incentives to efficient capital expenditure, while the possibility to discharge the risk onto taxpayers or onto service users (via cost-based tariff schemes) can generate well-known pathologies such as risk of over-investment, gold-plating, capture by suppliers of inputs etc.

Evidence of uneconomic investment choices driven by political reasons, if not capture by suppliers, construction industry and large users, is actually well documented for large waterworks (Anderson, 1983); this is probably less true at the level of urban infrastructure (pipelines, treatment plants), since technical choices are to some extent straightforward and less open to discretional decision; while a certain over-capacity is somewhat necessary in order to anticipate future demand growth and ensure system resilience.

This paper draws attention on the need to marry efficient choices in WSS undertakings (both concerning capital and operation) with the capacity to obtain capital resources at the lowest possible cost, especially in the dynamic phases of the industry, when substantial first-time or replacement investment has to be done. Separating operation and asset management from finance can allocate risks in a more efficient way and achieve durable results at a lower cost.

Drawing on an original study conducted on two Italian Regions, we show that alternative ways to allocate economic risk conduce to rather different final costs; and this will reflect in dramatic changes in the final impact on water bills. This might be critical in the medium-long term, both because total costs of water will be higher and because of the distributional implications.

Building on this evidence and on a comparative analysis of other European systems, some insights on the long-run viability of the financial model introduced in Italy by the 1994 reform are provided; some potential corrections are finally suggested and some more general conclusions are provided.

Economic transactions and economic risk in the water sector

From a purely theoretical point of view, the cost of capital of WSS – as for any other business – should consider two components: depreciation of assets value and remuneration of investors at the market price of capital.

In principle, the first component should correspond to the long-run marginal cost of assets, namely the cost of their replacement at today's prices divided per the economic life. In most industries, the book value is considered as a good approximation of this value; this is not the case in WSS, where assets have been constructed in the past by the state using public funds, often with no economic accounting; the very long time lag makes it very unlikely that this value, even if occasionally updated, corresponds to the reconstruction cost (Noll et al., 2000).

Since the economic life of infrastructure can last for more than one generation, this poses a delicate issue of inter-generational fairness. If the present generation does not set aside enough economic resources for the replacement, a future generation will have to make a new investment out of its own resources, while continuing to pay the debt that was originally started when the initial investment was made. In order to ensure sustainability, prices paid by each generation should reflect the "true" economic cost; on the other hand, the corresponding cash flow should be set aside for a long time, until replacement will actually take place, and adequate controls should be performed in order to guarantee that the way this money is used until then will not affect the availability of funds when needed.

The second component depends on the opportunity cost of capital on the market. According to the well-known CAPM model, this can be seen as the sum of the risk-free interest rate (pure intertemporal preference) plus a premium for the economic risk. The risk premium is not only industry-specific, but also depends on the institutional framework and the ways responsibilities and tasks are allocated.

Table 1– Principal typologies of risk in the water industry and their main determinants

Risk typology	**Description**
Operational	Quality of actual management system; Status of knowledge on infrastructure and investment needs; Performance standards to be guaranteed and allowed flexibility margins Patterns of enforcement of performance (quality and environmental) standards Patterns of water demand in relation with tariff structure (eg water consumption if tariffs are based on volumetric charges) Pespective change in the number of (captive and eligible) customers
Capital	Level of knowledge on the physical status of the network Perspective investment needs for replacement of ageing infrastructure Commitments regarding investment (fixed vs. variable according to needs)
Tariff	Perspective tariff dynamics vs. operators' commitments Cost-based (RoR) vs. price caps Cost pass-through clauses and guarantees of minimum total revenue
Profitability	Expectations on capital remuneration; measurability of risk exposure Guarantees of minimum profit / limitation of maximum profits
Competition	Contract length vs. sunk costs Barriers to entry and exit; Post-contract arrangements (e.g. how are sunk costs compensated after termination) Bidding procedures (eg open tender vs. beauty contest)
Regulatory	Is regulation clear and coherent ? Are regulators formally and explicitly committed to ensure industry viability ? Is the legislative framework stable / coherent / predictable ? Is there a discretional margin for regulators? Is new environmental/quality regulation envisaged, and does the contract take this into consideration? How will be the corresponding cost be transferred into tariffs ? Clauses concerning circumstances, procedures and terms of contract renegotiation
Municipal	Financial standing of municipality and capacity to respect financial obligations Credibility of commitment to ensure financial viability of water company Patterns of urban development
Political commitment	Likelihood of expropriation of quasi-rents Political attitude towards private companies; Political commitment to ensure financial viability of operating company
Instability	General economic situation, currency issues, financial rating of the Country etc
Civil society	Social attitude towards private companies and pricing policies
Country interest	Expectations on GDP growth, water market development, long-term perspectives

Economic risk can be defined as the likelihood of differences (positive and negative) between expected and actual costs and revenues. The high capital intensity and the very long depreciation schedule of physical assets contribute to make WSS a risky business, what would seem otherwise strange given that demand is quite static and predictable (Oecd, 2000a). Two broad risk categories can be individuated, namely *operation-related risks*, which are associated with operating and maintaining service; and *investment-related risk*, which are associated with investment in new infrastructure (World Bank, 2004). More in detail, the sources of risk can be analyzed according to the scheme presented in Table 1, stressing the importance of different factors arising from service characteristics, behavior of regulators and socio-political environment.

The major sources of risk in the medium-long run concern the need for maintenance and renewal of assets, especially when the network status is not known with precision; risk that new regulations, unexpected pollution of existing resources or adverse climatic events will require new investment in the future; commitment of regulators to guaranteeing the economic viability of the business, face to social pressure against price increase, who will thus not allow to pass through the new investment costs; the fact that demand varies unexpectedly and/or connection of new customers will be required (Pricewaterhouse&Coopers et al., 2004).

It is also important to understand that risks arise from different sides and depend substantially on how transactions among actors are regulated. The peculiarity of the WSS sector with this respect is the contemporary presence of 4 axes of transactions, each representing a potential and distinctive source of risk (Table 2).

Table 2– Transactions in the WSS value chain and related market failures

Axis	Description	Concerned dimensions and related cost	Regulatory issues / market failures
I	Transactions between the WSS operator and public entities holding the responsibility for service provision	Use and depreciation of infrastructure Investment Network expansion Supply of local public goods and positive externalities	Incomplete contracts Transactions costs Sunk costs Information aymmetries
II	Transactions between the WSS operator and suppliers of inputs along the value chain	Procurement Make/buy	Vertical integration Cost of capital for long-run undertakings Principal-agent relations in procurement
III	Transactions between WSS operator and entities holding the property rights on natural resources	Sustainable use of water resources (conservation of the natural capital) External costs caused to other water users Large infrastructure for water resources management at the basin level and price of bulk water supplies	Externalities Long-run sustainability of water management systems Transactions costs in the trade of water rights
IV	Transactions between WSS operators and final consumers	Respect of service quality standards Guarantee of supply Universal service Cross-subsidies to less favored areas / groups	Natural monopoly Public good dimensions (eg health issues) Accessibility and affordability issues Resilience and flexibility

Risk can be allocated in many different ways (Correlje et al., 2006): on the water company itself (reduced corporate performance); on suppliers along the value chain (loss of jobs, lower salaries, reduced volume of purchases etc); on water consumers (cost pass-through and/or underperformance); on taxpayers (contributions from the general budget); on other water stakeholders (failure to achieve environmental and water policy targets), on future generations (bad maintenance and depreciation of assets, higher investment needs due to deterioration of the water resource base, loss of critical natural capital etc).

Understanding the allocation of economic risks among stakeholders is crucial; tariff systems, regulatory schemes and contractual arrangements are, to this respect, more important than the management model itself (Correlje et al., 2006). In principle, alternative ways to allocate risk are compatible with many different models, regardless the ownership structure of water operators and the underlying model of competition. So for example price caps shift the economic risk from consumers to water company owners; clauses that guarantee minimum total revenues can be introduced in order to shift away from the water company the risk deriving from insufficient future demand development; quality regulation could be enforced in many ways (moral suasion, fines, termination of concession) shifting the risk of underperformance from final consumers to operators.

Alternative models for allocating economic risk and sustainability

In the European WSS industry four alternative financial models can be identified, each one with its specific advantages and weaknesses. All models are in principle compatible with full-cost recovery, even though the vehicle through which cost recovery is achieved varies (prices, use charges, taxes etc) (Massarutto, 2004 and 2007). What matters for our purposes is, instead, the fact that each model implies rather different criteria for calculating the cost and spreading it along time.

In the first model, that we can label as "traditional" (still in practice in many cases, especially where direct public management prevails), capital assets are financed by public funds and are not depreciated; what is considered instead is the cash expenditure. All investment for maintenance and replacement will continuously be paid by the public budget and financed out of general taxation; eventually, inter-governmental lending agencies could provide initial capital, later reimbursed by the beneficiary out from its annual budget. Tariffs paid by water users might represent a share of the total, allowing perhaps the coverage of operational costs and some investment. This model is being abandoned or restrained almost everywhere, basically because of increasing budget restrictions and need to reduce public expenditure. Nonetheless, it survives for at least a part of the capital expenditure of the sector, with the significant variant that public funds do not necessarily originate from general taxation, but rather from ear-marked taxes (eg compulsory use charges, property taxes, connection fees, environmental taxes). This occurs in particular in Northern Europe, where direct public management of WSS systems largely prevails. Usually initial capital is provided by public institutions specialized in long-term subsidized credit lines and credit insurance, such as the Dutch *Waterschapsbank* and is later reimbursed by user charges (Linares, 2007).

The obvious advantage of this model is that the capital cost is lowest; in the extreme hypothesis of 100% of funds are derived from taxation, this cost would be zero (or, if we wish to consider the opportunity cost of public funds, correspond to the pure cross-temporal preference rate). On the other hand, this advantage could turn into a disadvantage: even if we imagine to create self-sufficient public units bounded to reach budget equilibrium, this could be easily overlooked since the capital market will perceive these entities as public, and therefore will be much more keen to allow them excess leverage that would be unsustainable without the expectation of some state intervention in the future to avoid bankruptcy. This is in fact what happened to the British Water Authorities before 1989 privatization (Buckland and Zabel, 1998). Despite the legal requirement of FCR, their debt grew continuously until becoming unmanageable. Water price revenues could cover financial expenditure but did not allow for adequate depreciation, thus investment requirements had to be financed through an increasing recourse to loans. In order to draw investors' attention on the WAs, the government had to write off all this debt and absorb it into the public debt (the so called "green dowry").

In the second model, assets are continuously revaluated at reconstruction cost, in order to ensure that the book value corresponds to the economic value. Depreciation schedules are determined according to standard parameters that keep the economic life into account: for example in Germany guidelines for municipalities provided by Laender suggest an economic lifespan that reaches 100 years for some assets such as underground mains (LAWA, 2005). Capital costs depend on the interest rates on the long-term loans that have financed investment. Public sector banks specialized in dedicated credit lines complete the scene. For example in Germany this role is provided by the local savings banks (*Sparkassen*), where local authorities usually have an important share.

The advantage of this model is that cost recovery is practiced in literal terms; at any moment in time, the book value – and consequently the price paid by consumers – corresponds to the true economic cost. On the other hand, the cash flow that originates from depreciation is higher than the cost of the loans – since the latter is reduced in real terms by inflation, while depreciation is calculated on the inflated value. While allowing in any moment to replace the infrastructure, this amount of money does not necessarily need to be spent at the same time; the operator might therefore be tempted to use it for over-investing in the water system or for financing other activities and businesses. Evidence of both outcomes is indeed present: for example, the German system has the highest rate of replacement of ageing pipelines (officially with the aim of reducing leakage); cash flows originating from the depreciation of all network systems represent the main source of capital expenditure for local authorities, in an integrated way (Kraemer, 1998). Inter-service cross-subsidies and adequate time schedules for investment planning allowed this to occur. In present times, however, this system is being challenged by the process of growth and orientation to the market of most of the previously municipally-owned companies. The risk is that cash flows are diverted from their original purposes and used for financing acquisitions or other investment, functional to corporate growth instead than urban development.

In the third model the water company owns the assets, whose book value is conventional and generally reflects the market price paid by subscribers of water company shares; in England and Wales, for example, the price paid for water company shares corresponds to the 3,6% of the full replacement value of infrastructure. This figure was calculated on the consideration that at current water prices at the time of privatization the sector was earning the 2% on the replacement value of all assets, and on the assumption that this would continue in the future (Grout et al., 2004).

Asset ownership is reflected by a perpetual commitment to keep them in good status in order to be able to respect service obligations. New investment will be accounted for and reflected in prices as soon as it is made.

The advantage of this model is twofold. First of all, if we assume that privatization has followed an open market procedure and information is transparent enough, the market price of shares will reflect the value of the discounted cash flow, therefore incorporating the existing margin between revenues and direct costs and the expected remuneration on new investment. Of course, this requires that regulators are committed to follow pre-determined pricing philosophy in the future and their behaviour is predictable. The second advantage concerns the fact that corporate cash flows will be a function of actual investment, therefore avoiding the risk that the water company will obtain cash flows that are higher than the historical cost.

On the other hand, there is no guarantee that investment levels will be high enough to actually correspond real depreciation. This means that assets will continue losing value along time, until a point in which it will have to be replaced, and no provisions will have made; at that point a new first-time investment will be needed, with a sudden increase of prices and/or the need for public funds (Kraemer, 1998). Again the English and Welsh experience is illuminating: as soon as replacement requirements had become pressing, some water companies have run into financial difficulties that in one case (Welsh Water) has led to the creation of a completely different system with a public-controlled non-governmental institution assuming property and long-run maintenance responsibilities on assets (Bakker, 2003; Thomas, 2001).

The fourth model is somewhat intermediate, and is based on a clear distinction between capital and operational tasks. In this model, a private (or semi-private) company accepts responsibility on running the existing system on behalf of the responsible entity on a contractual base; the former raises a tariff, out of which operational costs are recovered and a lease fee is paid to the latter. Capital assets are owned by the responsible entity; lease fees are aimed at covering financial costs encountered by it (eg loan repayment), but the municipality will carry the related risk.

The advantage of this model is the separation between operational and capital risks. Assets are depreciated according to public sector conventions; this value, corresponded by the lease canon paid by operators to municipalities, ends in the water bill. Municipalities may have access to public sector banks (eg the former *Caisse de Depots*, now *Dexia* in France) and inter-government transfers, as well as to closed-circle financial system. Again the French system provides the interesting example of the *Agences de l'Eau*, financed by water taxes and using their revenues for subsidizing investment: the system is able to mobilize nearly 15% of all capital expenditure in the sector (Barraqué, 2004). On the other hand, this model emphasizes the risk of overinvestment, since the water company will have incentives to make pressures on the municipality: they will bear no cost, since the lease fee is passed-through on tariffs; and will instead obtain revenues, either from the correlated services (project, engineering, supervising etc) or from the possibility to attribute works to parent companies (in France all water companies are vertically integrated).

An application to the Italian case

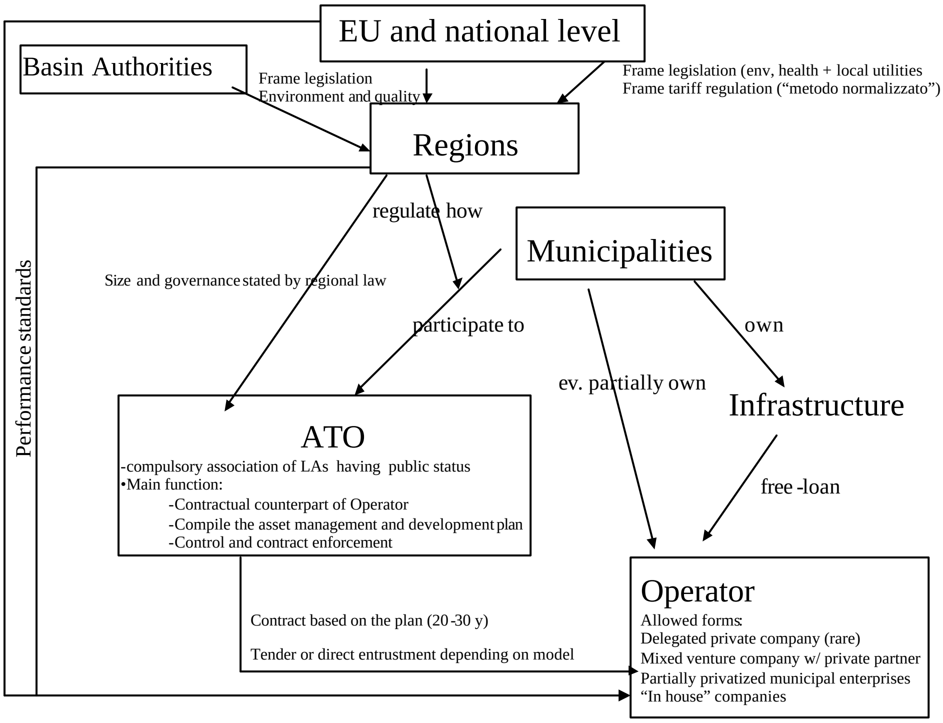
Italy has developed an original model that combines some of the features discussed in the previous section (Danesi et al., 2006). The so called "Galli law" (l.36/94) aims at an overall restructuring of the whole WSS system. In the past, WSS was a local responsibility of municipalities – ev. associated on a voluntary base.

Until 1994, Italy was following the traditional financial model, almost fully based on public funds. WSS assets had been typically started through local public finance, complemented by long-term cheap loans allowed by the National Investment Bank (*Cassa Depositi e Prestiti*). During time, this system has been integrated and progressively substituted by centralized planning under the responsibility of Regions and, in some cases, of the Central State. Municipalities continued supplying the service without cost recovery requirements, even for operational costs. This situation started to change in the end of the 80s, when budget laws increasingly required municipalities to guarantee a cash balance between revenues and direct (at least, operational) costs, while investment continued to be financed by Regional and State budget.

As a result, until 1994 the water bill covered only a small fraction of the total, reaching a balance with operational costs only; Only in a few cases local water companies were able to obtain from tariffs some cash flow for investment (Malaman and Cima, 1998).

The reform is inspired by the concept of integrated management and full cost recovery. The first objective concerns a new division of competences between regional planning and operators, the latter becoming fully responsible for investment decisions: management plans and technical choices will be made through an agreement between local authorities and professional operators; full costs required for implementing plans, including investment, will be paid by tariffs.

Figure 1 – A scheme of the Italian WSS after the reform



The expected increase of water prices is intended to be equalized by the creation of larger management units. Nearly 90 management units ("ambito territoriale ottimale", ATO) will replace the more than 12.000 existing undertakings; within each ATO a compulsory association of local authorities is created, holding joint responsibility for service provision in the whole area. Regional laws and national guidelines define their size, scope and internal governance.. Each management unit will typically contain both urban and rural areas, what actually creates the scope for some territorial cross-subsidy, being settlement density one of the most important cost drivers. However, no further instruments are foreseen in order to compensate eventual differences between ATOs, neither within Regions nor between different Regions, although some Regions, like Piemonte, have later introduced a Regional fund aimed at compensating investment needs in less favoured areas.

The law adopts a comprehensive definition of financial cost, including capital remuneration. Depreciation is calculated according to rates allowed by tax legislation. A return of 7% on equity is allowed, while payable interest is fully included in the eligible costs.

According to the price regulation system issued after the law – so-called "metodo tariffario normalizzato", hereafter MTN – price should increase above inflation at a maximum yearly rate, in order to avoid dramatic impacts on water bills, until they reach the total cost; this is defined following a cost-plus scheme, with an econometric formula aimed at benchmarking some operational costs and set a maximum level for admissible revenues. Once cost recovery will be achieved, maximum yearly rates are intended to function as price caps aimed at fostering cost reduction (Massarutto, 1997).

This increase is aimed at generating the cash flow that is necessary in order to finance investment plans that are established in the concession document (the "ATO plan", representing the base for the tender and/or the service contract). Existing assets are supposed to be put at the operator's disposal on a free loan base. The chosen financial mechanism resembles therefore the one adopted in England and Wales (model III in par. 3), with asset depreciation entering into tariffs as soon as investment (both for new facilities and replacement of existing ones) is actually made; the duration of the plan is much longer than in E&W (30-40 years instead than 5 years), therefore allowing some margin for anticipating or postponing price increase within the regulatory time lag.

In order to evaluate the potential effects of alternative ways of allocating the cost, we have made a simulation based on the data of two Regions – Lombardia and Emilia-Romagna. The study was conducted in the context of the economic evaluation of water policies to be implemented after the Water Framework Directive (Massarutto and Muraro, 2006). The aim was, first, to understand the differential cost implied by the new additions to the WSS systems required by the directive (new treatment facilities etc), distinguishing it from the investment needed for modernizing and maintaining what is already in place; second, to evaluate the impact on water tariffs under different alternative scenarios. Since the study was mainly concerned on sustainability and inter-generational fairness, we have adopted a long-run approach.

Scenarios are characterised in terms of depreciation rules and capital remuneration. For each scenario we have assumed a reconstruction cost based on the existing inventory of assets and the list of planned new actions. All data have been calculated following parametric formulas derived from existing literature (Regione Lombardia, 1991). This assumption, therefore, does not leave space to alternative (and eventually more efficient) investment solutions. However strong it can seem, this assumption is not unrealistic: the already existing system of networks and facilities can hardly be radically modified, while new investment is by large driven by EU requirements, with limited space for discretional decisions.

Operational costs derive from accounting data or are estimated on the base of the econometric benchmarking formula contained in the MTN (Massarutto, 1997). In all scenarios we assume that the same technical investment is made at the same cost, in order to focus on the effects of depreciation and capital remuneration. We have finally extrapolated from the total cost the share regarding domestic consumers.

The first scenario (baseline) assumes the basic parameters of the actual model. We assume that all investment in the long term will be financed by the operator through market mechanisms (of course this will take place only in the long run, once all assets will have to be replaced). We assume therefore the legally provided remuneration rate of 7%. This is probably a lower estimate of the true market rate in the same conditions. Cooper and Currie (1999) estimate that a 6,6% risk premium over the risk-free interest rate would be appropriate for England and Wales; in the Italian case we can assume that the risk profile is higher, given the poor information base existing on actual investment requirements, the unclear regulatory environment and the potential market risk of tendering. In a benchmarking of 10 European countries including newly accessed members, Italy ranks very bad in the industry and financing institutions perception on the water sector (8^{th} under 10) (Pricewaterhouse&Coopers et al., 2002),

We have also assumed that private operators will have higher incentives to reduce costs, what implies a reduction of operational costs by 10% off actual levels.

In the second scenario, we assume instead that public companies are created for owning assets; these will raise capital on the market and will later obtain a corresponding lease fee from the operator. This public company can therefore adopt longer depreciation schedules, coherent with conventional accounting principles, while borrowing on the market at a lower rate that takes into account the existence of state guarantees (we have assumed 4,5%). The incentive to cost reduction operates also in this case, although it is assumed to be weaker (5%)

The third scenario assumes that finance is made through the public budget (either general taxation or ear-marked taxes). We have considered an interest rate corresponding to the pure cross-temporal preference, assumed at 2%. Depreciation schedules follow the technical life of assets, assuming that replacement will take place only in case of necessity.

Table 3 – Characterization of scenarios

Scenario	Hypotheses
Chickens	• All investment remunerated at market rate (7%) • Depreciation schedule adapted to tax legislation (max 30 years) • Operational cost saving of 10%
Intermediate	• All investment remunerated at 4,5% (public sector borrowing rate) • Depreciation according to conventional accounting principles (max 40 years) • Operational cost saving of 5%
Public finance	• All investment remunerated at 2% (pure cross-temporal preference rate) • Depreciation schedule according to economic life (max 100 years)

The main results, aggregated at the regional level, are summarized in table 4. As we can see, the sustainability gap (difference between actual prices and long-run cost recovery price) is quite pronounced in both Regions but especially in Emilia-Romagna (where a larger amount of investment has been made in the past); conversely, the additions required to the existing system are comparatively greater in Lombardia.

In both Regions, the starting point shows a substantial gap between water prices and full costs. The gap increases due to new investment requested by the WFD, yet the gap with the recovery of actual costs is the most important.

Overall, a significant increase of the water price is expected. Table 4 shows the effects of alternative ways of calculating depreciation and capital cost. In the first scenario, based on the MTN, actual tariff only covers respectively 40 and 27% of the total cost; water price should rise by 151% and 348% respectively. This increase is far larger than the maximum allowed by the MTN.

The difference with the other scenarios is quite striking. Price increases are 106 and 249% in scenario 2, and 60-149% in scenario 3.

Table 4 – Summary of main economic indicators (€/year per capita) – Regional averages

	Scenario 1		Scenario 2		Scenario 3	
	ER	**L**	**ER**	**L**	**ER**	**L**
Actual tariff	111	77	111	77	111	77
Actual operational cost	81	49	85	52	90	54
Actual margin for depreciation	30	28	26	26	21	23
Full cost existing	191	180	266	117	137	76
Full cost after WFD	12	28	8	19	5	14
Total (existing +WFD)	204	208	273	136	143	89
FCR - existing	58%	43%	42%	66%	81%	102%
FCR - existing + WFD	54%	37%	41%	57%	78%	86%
Price increase	84%	169%	147%	76%	29%	16%

Table 5 illustrates the meaning of this increase in terms of affordability. The chosen indicator is the incidence of annual water bill on individual income, either on average or considering low-income families. We have considered an annual income of 6.000 € as a poverty threshold. Being water an essential good, we assume that consumption is income inelastic. We assume, as in the MTN, that bills are proportional to quantity. As a reference term, we can consider that a figure around 1-3% is commonly considered as a threshold that should not be trespassed (Gleick, 1998)

Actual water bills represent 0,45 and 0,31% of the average individual income; for low-income people, the ratio reaches 1,16-1,28%. If the price would raise up to the cost-recovering level, this ratio would reach 1,56-1,08% and 0,80-0,46%, according to scenarios. Low-income people would have to spend 5,04-3,77% of their income on water in the first scenario, and far less – although still a lot – in the third scenario (2,58-1,62%).

The above cited figures are regional averages. If we disaggregate them on the base of individual ATOs, we can note that the range of variation around the average is quite high (between 0,5 and 2 times). In the less favoured ATOs – namely, those characterized by lower densities – the impact is quite striking.

Table 5 – Affordability of water services with full-cost recovery

		Scenario 1		Scenario 2		Scenario 3	
		ER	**L**	**ER**	**L**	**ER**	**L**
Incidence of water bill on average income	Actual	0,45%	0,31%	0,45%	0,31%	0,45%	0,31%
	Mean	1,56%	1,08%	1,11%	0,71%	0,80%	0,46%
	Min	1,42%	0,79%	0,99%	0,50%	0,70%	0,30%
	Max	2,80%	2,86%	2,15%	1,89%	1,71%	1,48%
Incidence of water bill on low incomes	Actual	1,16%	1,28%	1,16%	1,28%	1,16%	1,28%
	Mean	5,04%	3,77%	3,60%	2,46%	2,58%	1,62%
	Min	3,66%	2,44%	2,56%	1,55%	1,80%	0,93%
	Max	6,98%	8,10%	4,99%	5,28%	3,67%	3,29%

In terms of affordability the overall cost remains below critical thresholds on average (around 1% of individual average GDP in all cases); on the other hand low-income families can suffer a much higher impact, that in some districts has been estimated in 4-7%.

Table 6 – Impact of alternative management models on the WSS system of Milano

			Scenario	
		Chickens	Intermediate	Public
Actual tariff (€/person/year)		96	96	96
Annual per-capita full cost before WFD		234	164	98
Annual per-capita full cost after WFD		290	215	139
Expected increase for achieving FCR (%)		202%	124%	45%
Incidence on average income				
	actual	0,38%	0,38%	0,38%
	FCR	1,16%	0,86%	0,55%
Incidence on low income				
	actual	1,60%	1,60%	1,60%
	FCR	4,80%	3,60%	2,30%

Source: Iefe, 2006

We have made a more detailed case study on the ATO of Milano, for which we have had at our disposal true accounting data both for operational costs and capital investment. The results are illustrated in table 6, and confirm substantially the same conclusions; it should be considered that as a large metropolitan area with concentrated distribution systems, Milano enjoys very favourable cost conditions. The estimate made with true data shows figures that are slightly higher than those obtained from desktop calculations, therefore raising the doubt that our parametric functions represent an underestimate of the effective cost.

These figures have to be compared with the allowed price increase and the estimated volume of investment that is contained in the first ATO plans.

The national regulatory authority on water services, Coviri, estimates that an investment plan in the reach of 50 billion € over 30 years (30 €/year per capita) can be financed while remaining in the price increase limits that have been set by the MTN. An extrapolation from existing ATO plans shows that this investment effort will imply a price increase of 46% in real terms for the first 20 years; in the following 10 years efficiency gains are expected to drive costs down and allow a reduction of 14%; in the whole 30 years period, the combined effect shows an increase of 26% over actual tariff levels (Proaqua, 2005).

According to our simulation, these values seem severely underestimated. The investment plan that can be afforded by this tariff increase corresponds to only a fraction of the true capital depreciation (in the reach of 20-25%). One can contend that 50 billion € is far better than nothing (between 1995 and 2005 the investment levels in the water sector have precipitated to nearly zero); on the other hand, even this massive effort can hardly compensate the previous decades of underinvestment, and will thus shift investment burdens onto next generations. Allowed price increases are compatible with industry viability only in the third scenario, that requires all capital expenditure be financed through public systems sustained by taxation.

Discussion and conclusions

The data presented in the previous section should not be dramatized. After all, they are based on a desktop study considering investment needs as given; our estimate of operational cost savings is probably prudent, and we have not considered that significant improvements might arise from technological innovation. Some of the outcomes we have outlined can be corrected or accommodated by different criteria of allocating costs among areas and consumers, without affecting too much the core of the financial model adopted. Moreover, our analysis is concentrated on the long term. If we imagine that individual income with also grow during time, and imagine alternative ways to account for depreciation (eg non-linear schedules) the impacts on prices and the judgment concerning inter-generational fairness might be well tempered.

However, we believe that our analysis raises some concerns on the long-run sustainability of the model put in place by the Italian reform. We have deliberately considered a rigid way to intend MTN provisions, and showed quite clearly that this approach will lead in the long term to hardly affordable water prices, at least once replacement of existing assets will be complete. If we consider that already planned investment is not sufficient for complying with all environmental requirements and further efforts will be needed in order to comply with the European Water Framework Directive, this concern becomes more severe.

We believe that our analysis suggests at least 4 issues that could justify some innovative transformation of the status-quo generated by the Italian reform, and also provide some more general conclusions.

The first issue concerns the poor evaluation of long-run outcomes made by the legislator. The model chosen (market finance, all investment responsibilities on the operator) can be sustainable in the short term: the size of new investment required by the WFD is significant, but comparable with the financial means that can be mobilized by a reasonable increase of tariffs. Yet the full cost including existing assets is much higher, and will have to be paid sooner or later.

It is also interesting to note that the difference in the capital cost in the 3 scenarios is as large as the total operational cost. Even if a more substantial reduction of operational cost is assumed, this will hardly compensate the effect of the interest rate and the depreciation schedule. While confirming the importance of providing adequate incentives to efficient investment choices, this result also confirms the vulnerability of WSS to the cost of capital and the importance of setting up smart financial solutions aimed at providing capital at the lowest cost. A saving of 1% in the capital cost has the same impact on total costs as a 25% reduction of operational costs.

In our opinion, market finance is only appropriate for maintenance and refurbishing systems, but becomes unsustainably expensive once first-time investment or full replacement is concerned. In other countries, as we have seen in par. 3, arrangements are in place that allow public borrowing systems or taxation to be integrated within systems in which investment choices are delegated to the water company and costs are entirely or almost entirely recovered. In other words, the public sector does not provide subsidies to the investment – that continues to be paid by users – but rather provides guarantees and assumes a part of the risk, in order that the cost of capital can be significantly lowered.

In order to do something similar in the Italian context, at least 3 innovative solutions can be imagined and are being explored in some local cases (Fazioli, 2007). The first concerns the creation of publicly-owned asset ownership companies being able to operate in the capital market as public institutions (thus enjoying public sector borrowing conditions and convenient depreciation schedules); the second is to create dedicated financial institutions, operating with state guarantees and specialized in the provision of credit and equity to WSS undertakings, following the example of the Dutch water bank. The third regards the creation of closed-circle ear-marked taxation systems, similar to that operating in the French case (Agences de l'Eau), being able to mobilize funds raised through environmental taxation for financing capital expenditure in the water system at no (or very low) interest.

The second issue concerns equalization and affordability. Our data show that differences within ATOs in the same Regions remain significant, and differences among Regions are also significant. If we consider that Lombardia and Emilia-Romagna are two among the wealthiest areas of the country, a great concern arises about the outcomes in other areas. Moreover, if we maintain that water consumption is income-inelastic, the outcome on low-income subjects could be dramatic. These problems entail different issues and require different solutions.

In order to compensate difference between ATOs, some sort of Regional or Basin mutualisation systems should be introduced. Particularly, this looks appropriate when some ATO is required to put in place actions that are in the interest of the whole basin (eg extraordinary water quality restoration plans in heavily industrialized areas). Differences between Regions might justify some state intervention, that again could be eventually self-financed via closed-circle ear-marked taxes.

On the other hand, the protection of the poor within each ATO in our opinion should be left to other instruments, namely different criteria for allocating the cost instead than water quantity. Water tariffs per cubic meter have been advocated basically in order to foster water saving; yet this approach has many shortcomings and is not necessarily justified nor effective (Massarutto, 2007). Particularly, if financing the basic urban infrastructure is at stake, there is no reason to prefer a volumetric charge. The fixed cost could be allocated via lump-sum fixed charges, that might be very well correlated to some indicator of wealth, such as property size instead than water volumes. This could be implemented with a two-part tariff in place of the actual model, dominated by increasing-block variable charges.

This lesson is even more meaningful for developing countries, where individual income is much lower, while the cost of developing WSS systems remains high due to the prevalence of investment and technology over labour costs. It is hardly believable that the initial investment will be affordable at market rates, without a substantial intervention of taxation and a more equitable way of sharing the cost among citizens. After all, this is exactly what happened 150 years ago in the developed world, when the first water supply systems started to be built in the cities.

A third issue concerns the choice of the capital remuneration rate. The MTN has indicated a value of 7% that is intended to be valid for all undertakings and management models; on the other hand, the law allows to choose among very different models (delegation via competitive tendering, direct public management, legally-privatized publicly-owned monopolies). As we have argued in par. 2, the cost of capital is a direct function of the risk profile, that is arguably very different. A rate of 7% is probably severely underestimating the risk implied by tenders (this is probably a good explanation of the reason why many tenders have been left desert or have been participated only by local incumbents); on the other hand is probably exaggerate when applied to public or semi-public monopolies facing low or no market risk.

In order to achieve a more coherent and efficient pattern of risk allocation, significant innovations should be introduced in the regulatory system. Particularly, we believe that the most critical aspects regard the need to separate capital and operational risks; the need to clarify contractual responsibilities especially for what concerns renegotiation rules and post-termination clauses (Massarutto, 2005).

Finally, our study clearly shows that treatment facilities are a far less important cost driver than pipelines. In the search for economies of scale, many Regions have adopted a planning style that privileges centralized systems and interconnection. In the light of our discussion, this approach should be reconsidered, particularly as far as rural areas are concerned. Nowadays, alternative technologies are on the market, both for drinking water production and sewage treatment, allowing self-supply at reasonable costs, provided that the concerned communities are not too large (Massarutto and Paccagnan, 2006); the same applies to radical restoration of rivers' quality, that seems to be achievable at lower costs via reduction of abstraction and pollution loads than technological treatment. Again this lesson can be extended, in our opinion, to many parts of the developed and less-developed world, especially where large suburbs with low or medium-low density have to be connected.

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