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WATER SECTOR OWNERSHIP AND OPERATION

AN EVOLVING INTERNATIONAL DEBATE WITH RELEVANCE TO PROPOSALS FOR NATIONALISATION IN ITALY

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EXECUTIVE SUMMARY

A proposal to nationalise the Italian water and waste water sector (AC52) is currently before the Italian Parliament. This report provides a review of international evidence and economic considerations relevant to this decision and nationalisation debates in other countries, while not taking a view as to whether public or private ownership is generally preferable in the water sector. The report also provides a framework for thinking about the issues at hand. In particular, this report highlights that the issues are complex with the incentives created by the regulatory regime arguably being more important than simply the ownership of assets and operators.

It is also important to note that the current proposals in draft law AC52 go beyond merely a transfer of ownership with, for example, control of the water sector moving from an independent regulator to the Ministry of the Environment. With a large number of changes being made simultaneously, the challenge is increased for assessing the combined impact of the proposals.

As water is essential to life and water expenditure can constitute a non-trivial share of income, it is a product with high political salience and one where delivery by an unregulated private market may well not bring all the objectives society considers to be important. Nevertheless, public ownership has its own issues and from the 1990s onwards in many countries there has been increasing private involvement in the water sector. At present the Italian water sector represents a hybrid system involving a mixture of public and privately owned water utilities monitored by a combination of local regulators (EGAs) and a national regulator (ARERA).

Core end objectives for a water system generally include the reliable supply of high quality water and sanitation, operational efficiency to ensure affordability, protecting the wider environment, and water conservation to recognise water is often a scarce resource. There are likely to be explicit or implicit trade-offs between these objectives, such as between the level of environmental protection and cost, and these differences will exist regardless of ownership structure. Local geography and climate will also significantly affect the nature of water systems, and these factors in addition to differences in objectives, may limit the generalisability of particular empirical results.

Perhaps the key economic feature of the water sector is its reliance on a long-lived fixed infrastructure that is too costly to duplicate which implies that those parts of the water supply chain are a natural monopoly, with limited potential scope for direct competition. The condition of this infrastructure is fundamental in determining the ability of the water system to deliver on society's objectives and a central question is how to ensure an optimal quantity of infrastructure investment occurs.

This report compares in general terms the different incentives on water operators in the public and private sectors that affect investment decisions and efforts to drive cost efficiency. For example, while decisions in the private sector are driven by the profit motive (subject to regulatory requirements on water quality, etc.), government's goals are likely to be multi-dimensional. While a common argument in favour of public ownership of the water sector is that the cost of borrowing to fund investment is lower for the public rather than private sector, a system of independent regulation and private

ownership may offer a commitment to a larger quantity of sustained investment. At times, government decision makers may have an incentive to delay required investments to keep water bills low in the short-term and/or to limit the extent of public sector borrowing.

However, when evaluating public sector involvement in the water sector it is important to note that the public ownership of assets does not necessarily imply the public operation of water services nor the public funding of these services from general taxation. Public sector involvement in the water sector is a multi-dimensional decision, and is not only limited to public ownership or a public department running a water system but can also involve majority or minority publicly-owned companies that include standard features of corporate governance.

Also, while conventional competition *in* the market may not be possible in the water sector for retail households, appropriate regulatory structures and the presence of multiple operators (who need not necessarily be privately owned) can create competitive pressures that can encourage cost efficiency and quality of service improvements.

There are two potential forms of competition relevant to the water sector: (i) competition *for* the market and (ii) benchmark (or yardstick) competition. A tendering process for concessions to run a water network where multiple potential operators exist represents competition for the market with potential operators competing to offer the best set of outcomes to win the tender. Benchmark competition involves creating incentives for operators to reduce costs and/or improve their service by assessing the performance of an operator in one geographic area according to the performance achieved by operators in other areas.

After discussing these general points, an overview of water regulation in OECD countries is provided as well as detail on water regulation in Italy. The vast majority of OECD countries have economic regulators for water with considerable independence from government and which employ cost-plus regulation in combination with the consideration of other factors. Focusing on the Italian water sector specifically, a key issue is that while some very large water operators exist, there are a large number of very small water operators. A range of academic papers question whether these small operators are able to exploit the available economies of scale, i.e. retaining small operators may increase the cost of water.

“The vast majority of OECD countries have economic regulators for water with considerable independence from government and which employ cost-plus regulation in combination with the consideration of other factors.”

The review of the international evidence (both from Europe and further afield) on the impact of private sector involvement on water operator efficiency reveals a mixed set of results regarding whether efficiency is increased or not. This mixed overall picture is likely explained by the role of local circumstance and the importance of the nature of regulation governing operator behaviour.

The report concludes by drawing some general principles for understanding the performance of water systems in different ownership scenarios. Certain points emerge clearly. The first is that appropriate and independent regulation plays a key role in water system operation. In particular, while the need for a regulator in the private operations is clear, we note that public operation does not eliminate the value of oversight in financial and operational management. The second is that trade-offs are inherently made when choosing between public and private modes of operation, with the advantages of public ownership (such as potentially lower costs of capital) balanced against certain advantages of private participation in the water sector (notably when there are large investment needs and tight public budgets).

> **“Appropriate and independent regulation plays a key role in water system operation.”**

These two findings interact. Focusing on the need to finance infrastructure investment, we note that if private sector involvement is selected then, on the one hand, risks of over-investment call for oversight of rates of return while, on the other hand, investors do need assurance they will receive an appropriate return on their investment.

An independent regulator can both act to prevent excess investment and act as a commitment device, limiting the potential for political intervention in the sector and thereby encouraging private sector investment. With public operations, political pressures may push water rates down and public sector borrowing constraints may lead to publicly owned water operators under-investing in infrastructure.

> **“An independent regulator can both act to prevent excess investment and act as a commitment device, limiting the potential for political intervention in the sector and thereby encouraging private sector investment.”**

As a result, even under public operation an independent economic regulator can be valuable, for example in mitigating under-investment. Ultimately, determining the ‘optimal’ level of water sector investment is difficult but remains crucial for water systems going forwards, whether the system management is private or public.

1. INTRODUCTION

This report focuses on economic impacts from alternative organisations of the water sector. The water sector remains one in which substantial debates remain about the efficient and desirable properties of the structure(s) providing services. It also remains one exhibiting substantial heterogeneity in organisational forms for delivery of the sector's various activities, both across and within countries. The report will highlight the strengths and weaknesses of different forms of organisation.

Politicians regularly take an interest in the water sector. Proposals for changes in the organisational form for the water sector have recently been put forth in both Italy and the UK. This report will pay particular attention to the proposals in Italy, which are further advanced having been embodied in draft legislation currently before the Italian parliament. At the time of writing this report, the Italian proposals have not yet been finalised.

The water sector[1] represents a complex amalgam of activities which include providing an essential ingredient for life, the environment, and various business activities. Common activities that we will subsume under the category of "water sector" are presented in Figure 1. While the typical citizen is most familiar with household water supply, it is worth emphasising that supply for business, agriculture and institutions is also an important activity, representing by far the bulk of water consumed in most countries. More generally, the potable water coming out of a household tap represents only a small share of the sets of actions necessary for the smooth operation of the water sector.

Figure 1. Water sector operational activities

[1] In this report we use the term "water sector" to include both the supply of water and the handling and processing of wastewater. Elements of this activity can include: bulk water collection, storage, transfer, water treatment, retail supply, sewerage collection, distribution and treatment as well as drainage and irrigation. We focus primarily on mains water systems involving an infrastructure network, however, we note one source of variation between areas is the extent of 'off-grid' water use e.g. direct abstraction by farmers.

An effective water sector must deliver a variety of outcomes. In the view of the authors, key elements of a well-functioning water sector include, in no particular order:

- Operating efficiency (Inefficient operations, from the perspective of productive efficiency, can either lead to poor water quality and treatment, on the one hand, or excessively high costs. Management of personnel is likely to be a key factor with potentially different levels of flexibility present across private and public sector bodies.)
- Public Health (Drinking water must be of sufficient quality, and sewerage appropriately treated and disposed of, to ensure the health of the population. Equally, setting ever higher standards will likely increase operating costs. The provision of drinking water and sewerage treatment must be reliable and secure, due to the consequences of non-provision.)
- Appropriate investment over the long run (Long-lived assets are a key feature of the water sector, and their maintenance is essential. Judging the extent to which too much or too little investment is occurring is difficult. While some indications do exist for unduly low investment, such as low water quality or high leakage, these indicators must be examined in the context of local circumstances.[2] Even when substantial evidence is available, conclusions can be subject to debate.)
- Water conservation and managing water scarcity (There are generally physical limits to the availability of freshwater and the cost of supplying freshwater to users varies by location. Ideally water users should face an incentive to avoid wasteful use and allocate water to the most valued activities. Also, water suppliers need to use the value of water to balance supply and demand, including the optimal amount of water loss (leakage) to tolerate and the new water sources to develop.)
- Environmental performance (National and EU regulations establish criteria that must be met for water to be considered clean and for water systems to operate appropriately, including the sufficient cleaning of sewerage.)
- Affordability (The cost of a water system can be a noticeable share of spending, particularly for the poor. That water is essential for life may have a significant influence on how the sector is perceived politically, for example, disconnecting non-paying households may face resistance.)

These objectives are sometimes complementary but may also at times conflict with each other. For example, operating efficiency may enhance affordability, meaning that these two objectives are complementary. In contrast, better environmental performance can work against affordability by raising system costs. While it might be straightforward to identify factors that maximise delivery of any single objective, it is harder to assess whether the bundle of characteristics of a particular water system is well functioning compared to another, or whether a society has simply made different choices regarding the balance between different objectives.[3] Some of these objectives, such as the last two, may be more fundamentally in the realm of government responsibility or oversight, as opposed to under the purview of water company stakeholders.

[2] High leakage when water is plentiful may not be a concern, for instance.
[3] While the balance between the last three elements are social choices, arguably maximising operating efficiency is always beneficial (at least conditional on achieving specified levels of public health and environmental protection). Also, long-run investment is always important to consider as it is about the long-run sustainability of the system.

2. OPERATION AND OWNERSHIP OPTIONS

The water sector exhibits a spectrum of ownership, operation and regulatory structures. Common options for provision of water services include not only public ownership and private ownership, but also some form of lease contract or concession structure in which the private sector has a major operating role. Frequently, a variety of organisational structures are found within a single country.

Common options for organising the ownership and operation of the water sector are illustrated in Table 1. Common forms of ownership would be full public ownership, full private ownership or combined ownership, in which ownership shares are divided between different entities, including at least one private one.[4] For a given form of ownership, management (or operations) can be separated from the entity owning the physical assets, and this is a relatively common occurrence. Common forms of operational management involve pure public operation, private concessions (or franchises) awarded for many years, lease contracts in which facilities are leased to an operator and pure private operation. In all these systems of different ownership and management, a key question becomes how to create the right incentives for investment, so the conditions governing who pays for investment and how investments are reimbursed at the end of a contract (notably when it is not renewed) are crucial.

Table 1. Ownership and operation options

	Public ownership	Mixed public/private ownership	Private ownership
Public operation	Pu/Pu	PuPr/Pu	Pr/Pu (rare or unknown)
Concessions	Pu/Co	PuPr/Co	Pr/Co
Lease contract	Pu/Le	PuPr/Le	Pr/Le
Private operation	Pu/Pr	PuPr/Pr	Pr/Pr

Interpreting Table 1, the abbreviations can be applied to particular systems. In the case of England, there is a uniform pattern of ownership where the fully privately owned and operated water system would be classified as Pr/Pr, for example. Currently, many of the large water systems in Italy would be classified as PuPr/Co or Pu/Co; while typically the smaller operators (that are larger in number) would be Pu/Pu. Under the proposed Italian reforms, the often larger PuPr/Co systems would change to Pu/Pu.

In addition to the distinction between public ownership and operation, further variations in the organisation of the water sector arise if one considers the source of funding for water sector investments and operations. The key question is the extent to which public funds are used, i.e. costs are covered through general taxation and the government's budget, relative to them being recovered through the tariffs charged to water users. A further potential distinction one might consider is the level of government that provides asset ownership, operation and/or funding.

[4] Note that public sector ownership can involve ownership by multiple entities, for example, when individual municipalities own local sections of a larger water system.

Furthermore, in some instances there are ownership structures that cannot be easily fitted into the public-private dichotomy. For example, since 2001 Welsh Water has been a not-for-profit organisation owned by Glas Cymru, a company limited by guarantee. While not being run to generate profits, the entity is still able to access private debt markets. It also remains under regulation of the economic regulator for England and Wales' water sector, Ofwat.

The distribution of public and private interests in water supply varies. Private water supply covers more than 50% of the population in 5 out of 30 OECD countries and below 10% of the population in 17 out of 30 countries (Perard, 2009). This diversity is explained by a variety of factors that will be discussed later in this report. Also, it is worth emphasising that the delegation of water services to the private sector is by no means a new phenomenon. It has existed since 1782 in Paris, when water supply was outsourced to a private enterprise[5]; in Mexico, there were 20 concessions in operation by the 1920s; and, in London, private suppliers operated for more than 200 years prior to their nationalisation in 1903 (Perard, 2009).

The 1980s and 1990s witnessed a move towards private ownership or operation of water and wastewater services in a number of countries, though this move was less pronounced than for some other infrastructure sectors, such as electricity and telecommunications. Independent regulation of the water sector has been particularly important in providing private investors with sufficient confidence to invest. In some instances, where it was felt that broader geographic coverage of water sector providers would be valuable, companies providing water services in adjacent areas have joined together.

Broad cross-country and cross-sector reviews of privatisation, such as those of Megginson and Netter (2001) and Shirley and Walsh (2000) find that privatisation has generally improved efficiency. Such reviews are not focused specifically on the water sector, though. There are a number of reasons based on the cost structure and competitive conditions to believe the results may be more nuanced in the water sector. This report will therefore focus on the relative strengths of public and private operation and ownership, with a specific focus on the issues and evidence in the water sector.

This report will not take a view on whether private or public ownership is generally preferable or whether it is preferable in the water sector. Rather, the approach will be to review the arguments in favour of private and public ownership and compare these with data. One point that will emerge is that the decisions about private and public ownership and operation of the water sector are complex, and the success of either regime, as well as the definition of success, depends critically on the associated regulatory regime. In this report we focus on the role of economic regulation of the water sector, as distinct from the regulation of environmental standards. Unless otherwise stated, all general references to regulation and regulators refer to economic regulation.

[5] This company was run by the brothers Perrier, and ultimately responsible for the well-known brand of drinking water.

3. POLITICAL ECONOMY

The water sector is, like many infrastructure sectors, one in which political salience is high (Tutton, 2019). When there are suspected or realised problems with the delivery or safety of water, the problem can become political in nature; political careers can be on the line. Drinking water is necessary for survival and actual or perceived water costs may seem high to citizen-voters, particularly if the consumers start to pay for water when costs were once covered by general taxation, and thus not transparent. The political logic of having an interest in how the water sector is run is thus clear (see Straub 2009 and Tutton 2019). The political salience is increased by environmental objectives, universal service obligations and social policy features of the water sector.

The fundamental necessity and positive externalities of clean water on health, combined with the concern for helping the poor, mean that some countries do not allow non-paying customers to lose their water service. The limited ability of companies to cut off non-paying consumers may be one reason that explains non-payment rates that can reach 20% in some parts of developed countries, such as southern Italy.

While political salience of the sector is high, issues associated with direct political control over infrastructure industries have generally led to the separation of political oversight from the day-to-day operational role of infrastructure providers. One way of ensuring such separation is by allowing private operation with a public but independent economic regulator. The problem of potential appropriation of quasi-rents exists both under a public and private operation and, in both cases, would need control, as suggested by Straub (2009). At least in theory, an independent regulator can make long-term decisions in an impartial fashion thereby avoiding decision making that follows politicians' potential desires for short-term political advantage, e.g. aggressive price cuts before elections.[6] Even if a government does not follow a regulator's recommendations, a regulator's analysis may still inform debate and increase transparency. Another way of separating operational decisions from political involvement when services are publicly operated is to appoint a board with public-spirited members who may be requested to pursue the public interest[7]. Even with such a structure, though, the direction to pursue the public interest is not always clear and may not be sought without further oversight.

Where public boards have been appointed, and have a clear ability to engage in borrowing or substantial free cashflows, the politically prudent move may be for them to overinvest, to avoid "bad" outcomes that inflict large reputational damage. This over-investment may have been the case with electricity generation investments in the formerly nationalised UK regime, which featured relatively high excess generation capacity (Tutton 2019). On the other hand, if a government is running a tight budget, it is quite possible that it will underinvest substantially on maintaining capital assets.[8] This underinvestment is alleged to have been one of the reasons for water privatisation in the UK, with officials knowing that assets were in a state of repair that would require

[6] However, in practice, the independence of regulators from government in some instances, such as in the UK energy sector, may be less clear cut than it first appears, see chapter 3, Deller and Waddams Price (2018).
[7] Of course, defining what is meant by the public interest may well remain contentious.
[8] This is assuming that funding water sector investment depends on general government funds. If there is a commitment for a publicly operated water company to be self-financing, i.e. for costs to be fully recovered from users via water tariffs, the under-investment problem could be alleviated.

substantial new investment after years of low maintenance spending, particularly in light of EU environmental standards and limits on borrowing due to macroeconomic factors.

It is worth noting that in the EU context, many aspects of setting water quality and environmental protection sit at the EU level and, hence, not within the direct control of national governments (for example, with the provisions of the EU Water Framework Directive). Since higher standards often lead to higher operating and investment costs, this EU framework could be seen as a commitment device making member states deliver a high level of investment in the water sector.

Under-investment can also be seen in railways, in which standard rail lines have suffered from low investment/maintenance in the UK (under both public and private ownership) prior to some disastrous crashes, and in France where investment in maintenance of the provincial network (outside high speed train systems and densely used metropolitan services) have been consistently underfunded. Under-investment may occur under private operation, particularly when there is a perceived political and regulatory risk, as suggested by Straub (2009). That privatisation may have been viewed as a method to achieve increased investment also further complicates attempts to assess the impact of privatisation on costs and prices.

While public operators may prefer to over-invest to avoid risk, private operators may also seek to over-invest, if regulators allow a return on investment exceeding the cost of capital, in accordance with the Averch-Johnson hypothesis.[9] However, they will only do so if they have a high likelihood of receiving appropriate extra returns from extra investment. The U.S. electricity generation sector in the 1970s is frequently cited as having experienced over-investment due to the pricing formula for return on investment, though this literature may be subject to limitations, notably by failing to distinguish simple monopolist inefficiency from over-investment due to the positive return of marginal investment.[10] Guasch and Straub (2009) have studied renegotiation of contracts in Latin America, a common feature of privatised water systems there. In countries that exhibit a more corrupt environment, firm-instigated renegotiations are more common, while government-instigated renegotiations are less common. This suggests that, to some degree, corrupt environments may be related to renegotiations; this does not suggest that all renegotiations arise from such a source, as genuine and legitimate needs for renegotiation may arise. Government-instigated renegotiation may at times, for example, be a form of expropriation of sunk investments by firms.

The problem of potential over- or under-investment illustrates that, whatever form of ownership is selected, appropriate regulation remains a crucial part of the equation for determining costs, efficiency and investment.

Ultimately a key question for society is how to achieve the benefits of appropriate long-term investment and maintenance programmes, when the political election cycle is much shorter than the asset lifespan, and maintenance and investment spending can often be postponed one election cycle in order to reduce government spending.

[9] See Averch and Johnson (1962).
[10] See Joskow and Rose (1989), and note that the primary focus of research has been other utility sectors besides the water sector.

4. GOVERNMENT OWNERSHIP COMPARED WITH PRIVATE INTERESTS AND OPERATION

Overall, the move to privatise infrastructure ownership over the last three decades has been less intense in the water sector than in the electricity or telecommunications sectors. Reasons for this include that in the water sector the natural monopoly element of the system, i.e. the physical water network connecting water sources and treatment plants to consumers, forms a much larger element of the cost than in other infrastructure sectors.[11] For example, in electricity it is possible for rival power stations to compete. This situation arises because of the high cost of transporting water over long distances and also means the notion of alternative water sources competing is often impractical though at times competition might be possible for treatment centres for water and waste water. As a result, the potential of competition to regulate firms and generate strong performance incentives is less likely to occur. Although, competition in the retailing of water (i.e. over billing and customer service elements, which represent a small element of total costs) for business and non-domestic customers was introduced in Scotland in 2008 and in England in 2017.

A second reason that privatisation is less common in this sector is that significant externalities are present in water, and in certain respects, it may be easier for governments to address these. Externalities can relate to the spread of water-borne diseases or other water contaminants, for which identifying origins of problems can be more difficult with multiple (competing) operators using the same infrastructure. Another externality is the harm from taking water from an aquifer faster than it can be replenished. This externality provides one reason to ensure that water supply systems based on aquifers be joined across an aquifer's users, rather than split up. Addressing these externalities will likely involve common regulatory standards covering larger geographic areas and bodies extending beyond solely economic regulation.

A third reason is that sector assets are fixed in place and long-lived. The installation of pipes, for example, is a major part of the infrastructure costs and the installed pipes cannot be easily changed to another use. In the absence of a robust regulatory structure, the risk of expropriation of private investments may hold back private investment. Expropriation can occur in a number of subtle ways, including indirectly by government setting tariffs that are below the long-run average costs of running a system, but above the operating costs.

A fourth reason for keeping a fixed infrastructure industry under public control is a presumed advantage in terms of the cost of funds (in terms of interest rates) as these can be somewhat lower than for private companies, reflecting the government's lower borrowing costs (partly resulting from its ability to use tax to pay debt, an option not available to the private sector)[12]. This benefit of public ownership may not arise from nationalisation, however, if private owners are paid the full market price of their

[11] In the UK, for example, the supply network accounts for about 2/3 of the cost of water supply, while the network for electricity accounts for only about 40 percent of costs of electricity. (London Economics, 1998)

[12] Municipalities may not have equally low interest rates as governments; moreover, even national governments sometimes suffer from relatively high risk compared to private debt. The U.S. government, for example, had lower S&P credit ratings than Johnson & Johnson or Microsoft, during 2011.

shares.[13] If the full share price is paid the private owners will need to be reimbursed for their expected future profit stream when their shares are acquired, and this profit stream may well exceed the benefits that would otherwise accrue from lower borrowing costs in government. The advantage of lower public borrowing costs continues to apply when private entities operate a water system, as in the French concessions. The advantage of lowering borrowing costs hinges on the ownership (and any debt issued to support new building) of the assets. If the debt is issued with government backing, it will have a lower "government" interest rate even when the water company is privately run.[14]

Concerns about the performance of publicly owned and operated utilities meant that ownership options were put under review in many countries. (Vickers and Yarrow, 1989; Hodge, 2000). It has been commonly argued that, all else being equal, private firms will outperform public ones (Megginson and Netter, 2001). Sometimes these reviews resulted in privatisation. But a key point to consider is that ownership, competitive conditions and regulations interact very strongly in determining the extent to which private ownership or operation delivers better outcomes than public ownership or operation. In particular, under one reasonable model, "unit costs are lower under private ownership if and only if the private monitoring and incentive system is significantly better than the public system." (Vickers and Yarrow 1989, p.8)

One category of implications for private ownership arises from principal agent theory. Under principal agent theory, a principal (e.g. shareholders) seeks to motivate an agent (e.g. management) to undertake efforts that are in the interests of the shareholders. In the simplest case, in which all parties can observe the state of the world and the efforts of management, fixed price contracts can yield profit-maximising effort by management. However, in situations with unobservable effort by management or in which the state of the world is not known with certainty, when agents are risk averse, agents must be given incentives to perform and a degree of insurance in case of bad "outcomes" that are beyond their control. Profit-maximisation can involve keeping costs under control, considering the quality of outputs, adjusting the quantities of outputs, and/or a focus on pricing. When prices are regulated, and determined externally, the margin for managerial effort focuses on costs, innovation and investment. One feature of this model is that society's preferences must be made explicit in order to have well-defined regulation. Compared with private ownership, a public ownership model may have multiple and complex objectives that can be less transparent than in the privately regulated scenario.[15]

Managers may also be constrained by: (i) the takeover constraint, in which the stock value of an under-performing firm is below potential (e.g., due to unachieved potential cost reductions) and (ii) the bankruptcy constraint, in which managers may be removed from their positions in the case of a company being unable to pay its debt. The

[13] The UK's opposition Labour party has recently suggested it would pay a price at nationalisation equal to the book value of water companies' assets rather than their market share price.
[14] Note that lower interest rates for government would not necessarily apply equally to local authorities that do not have the ability to raise taxes.
[15] If stock ownership were concentrated in the hands of the company's consumers, the consumer shareholders may have an incentive both to achieve high profits but also lower prices for their own consumption, something incompatible with strict profit maximisation. As a result, at least in principle, shareholder objectives may not be as clear in practice as they are in theory.

combination of these constraints from shareholders, potential takeovers and potential bankruptcy shape much of the incentive environment for managers in the private sector and may be viewed to sharpen their desire for clear and tough goals in management.

In contrast, the principal-agent impact may be different for publicly owned firms. Their management, often civil servants under a civil servant pay structure or privately-employed persons appointed by public owners and subject to certain publicly established limits regarding salaries and personal needs, may be viewed as responding to government departments or local city or regional councils. If the government seeks to pursue social welfare maximisation, it may place less emphasis on profits and more on lower prices.

In the UK, for example, before privatisation the nationalised industries had a minimum target return on capital and after privatisation moved to a maximum return on capital. The government's goals may be multi-dimensional, and include an emphasis on distribution. Due to the political origins of government power, while the government may still wish to keep costs under control, it may have other goals. First, those in power may at times wish to place, via nepotism or connections, particular people into particular posts and may, politically, have an incentive to create more posts than are necessary, if this helps to increase their political support. Second, government may also wish to keep prices low, to satisfy its citizens. Third, tariff structures may be constructed that imply cross subsidies favouring groups with greater political influence. Fourth, service improvements or large investments may be targeted at locations offering electoral support to politicians.

A government may be unhappy to invest its own assets in supporting a water company, given that a subsidy of 1 EUR to a firm will cost society substantially more than 1 EUR, due to the inefficiencies of raising funds via taxation.[16] Moreover, to the extent that government is approaching constraints on its spending or borrowing capacity, investment and maintenance may, in particular, be postponed.

The argument for lower borrowing costs can be a red herring if the main impact of government ownership is to limit future investment, due to a government choosing or being forced to limit its borrowing.

However, it is important to distinguish between the public ownership of assets and the public funding of investments. Strictly speaking, the key under-investment risk arises from the source of funds rather than the ownership of assets, if a publicly owned water operator was self-financing through tariff revenue, government borrowing limits may not restrict water sector investment. An example of this arrangement is the publicly owned Scottish Water with investment levels guided by the Water Industry Commission for Scotland, an independent economic regulator. In contrast, in the Republic of Ireland, the majority of funding for Irish Water comes from the central government's budget. As discussed below, while full self-financing through tariffs is possible, the presence of 'quasi-rents' means it is often tempting for politicians to set tariffs at a level below that

[16] This social cost includes: (i) the cost of raising tax revenue, i.e. the direct cost of running a nation's tax department, (ii) the costs to individuals and businesses of complying with tax law e.g. the time spent filling out tax forms, and (iii) the economic distortions arising from taxation e.g. a higher income tax rate potentially reduces workers' incentive to exert effort.

needed to adequately maintain asset conditions. Unless supported by a strong legal framework, an independent regulator may struggle to compel a government to increase its budget allocation for the water sector.

A major factor in determining whether investment levels would be harmed in the water sector under public, compared to private, ownership is whether the government's presumed lower investment rate (due to a desire to stay under a given borrowing level) is greater than the possible constraint on private sector investment from the risk of expropriation. The potential savings for a 'low-risk' government 10-year maturity bond and an AAA-rated corporate bond is typically in the favour of the government.

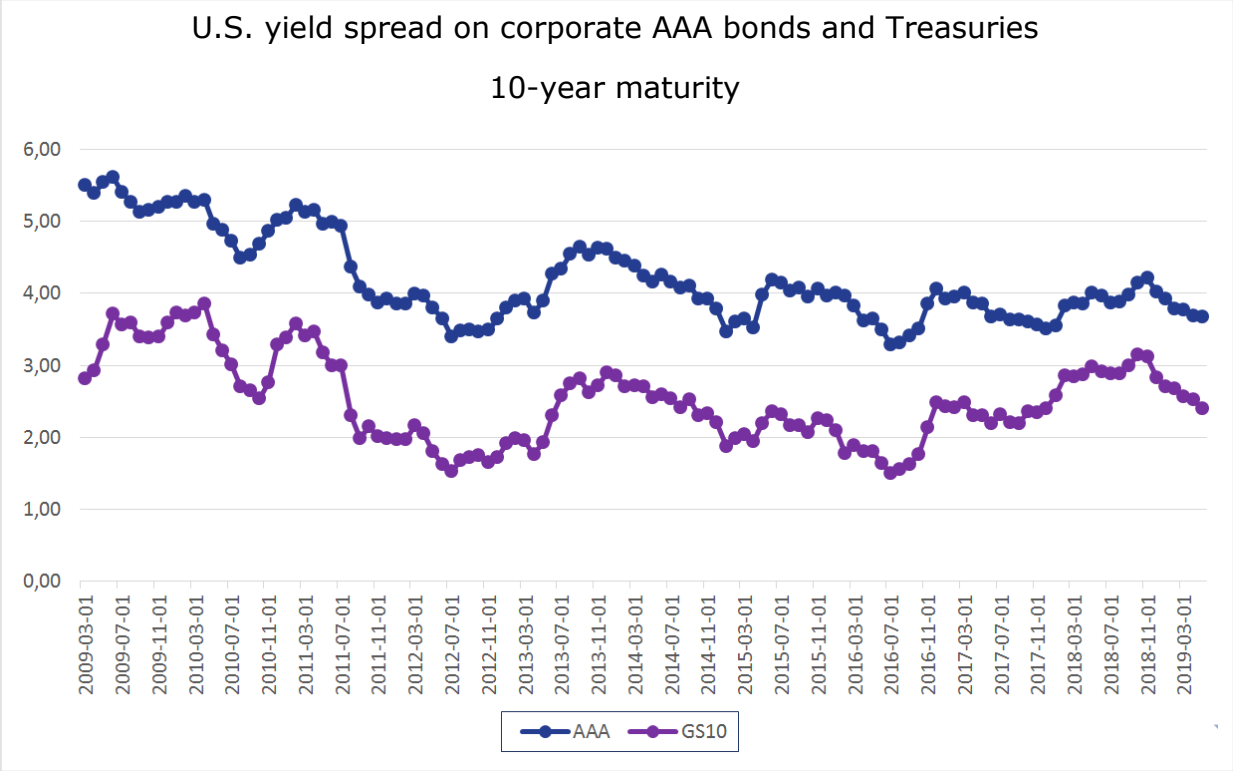
Some of the most reliable and broadest comparative data on corporate and government debt rates is found in the U.S., due to the highly developed corporate debt markets. This evidence suggests the interest rate differential over the last 10 years has been about 1.6% and relatively stable over time (See Figure 2). In contrast to this situation, the Financial Times[17] reported that in August 2018 some of Italy's largest corporate firms, including ENEL, ENI and Ferrari, had lower yields (implied interest rates) than Italian government debt of equivalent maturity. The article suggested this result was related to these largest firms being diversified across international markets.

The generally lower cost of government debt can result in substantial savings, in aggregate, for a fixed amount of borrowing. However, if infrastructure spending is substantially constrained by government, or if the costs of private operation are substantially less than government operation, the cost of borrowing advantage for government operation can be easily outweighed by the size of these counter-balancing effects.

As a result, even with the cost of borrowing advantage, private operation might still be advantageous. Moreover, Rosa (1993) and Rosa and Perard (2007) find that the cost of funds for government differs not only because of lower interest rates for central government, but also because of the social cost of collecting tax revenue, which can amount to between 26% and 126% of the revenue (OECD, 2003) due to the costs of collecting revenues as well as the marginal incentive to earn revenue in the face of different tax rates.

[17] See 'Italian corporate bonds outperform sovereign debt' by Kate Allen, Financial Times, 1 August 2018, available at: https://www.ft.com/content/3aecefc6-94ad-11e8-b747-fb1e803ee64e

Figure 2. Corporate vs US government borrowing costs



Due to the large share of fixed costs in the operational costs of utilities, and because systems can operate with only slowly declining performance in the absence of further substantial investment, utilities that are fully self-financing will obtain quasi-rents[18] (Noll 2002). These quasi-rents can be diverted for a time without significant immediate harm to a water system, but creating a backlog of capital investment and required maintenance. Whatever form of ownership and operation is in place, the existence of quasi-rents will create pressures to use the quasi-rents for purposes other than self-financing. Politicians may wish to take advantage of these quasi-rents to lower prices to consumers. Private operators may wish to use these rents for dividends as opposed to reinvesting them. Hence, in either a public or private water system, a key question is whether institutional structures can be established that credibly commit these quasi-rents to being used to maintain the fixed infrastructure. Establishing an independent regulator is a common way to increase the strength of this commitment.

[18] An economic rent occurs when a producer receives a revenue exceeding the cost of supply. The term quasi-rents refers to the fact that while the price charged exceeds the short-term cost (marginal cost) of supplying water, this higher price is required to offset the long-term costs of maintaining the network infrastructure.

The Potential for Competition

Relatively few customers are able to access competing options for water supply, a rare exception being retail competition for non-domestic customers in England and Scotland. Moreover, sometimes, large customers near a border between water suppliers may find it in their interest, due to differences in pricing, to build a connection to a second water supplier, but such scenarios are rare.[19] Similarly, for irrigation, some farmers or industrial users may access aquifers directly rather than obtaining processed water from a supplier, which creates an outside option in these cases. Governments have increasingly regulated water supplies such that small scale supply (via pumps or wells or small scale sewage processing) is simply illegal. Such rules reinforce the monopoly positions of local water companies.

As noted earlier, the water industry features increasing returns to scale and the fixed costs of a network such that most water suppliers are natural monopolies (Abbott and Cohen, 2009; Straub, 2009). The high costs of moving water over long distances also means any markets would be local rather than national.

In addition, the price elasticity of demand for water is relatively low. Bhattia et al (1995) reports estimates ranging from -0.2 to -0.6. When elasticities are low, and competition absent, the need to find ways to oversee pricing is substantial.

Generally, two forms of competition tend to exist when there is private sector involvement in the water sector: competition for the market and benchmark (yardstick) competition.

Competition for the market may best be illustrated by competition for operating concessions[20], as in much of France. Under the French system, contracts to manage water utilities are put out for tender, with a maximum length of 12 years. Due to the maximum legal length of the contracts being much shorter than the lifespan of the assets, special conditions are needed to ensure that investment costs are either covered by the government, if it owns the assets, or that any new operator must purchase the assets at a price that reflects all investments made by the previous operator.

Prior to the introduction of the French loi Sapin (loi no 93-122 du 29 janvier 1993), contracts were frequently renewed without advertisement, or simply advertised in a local paper that potential competitors would not see. These purely local arrangements had been subject to a number of corruption scandals that placed pressure on the government to modify the rules to increase transparency, as in the loi Sapin (OECD, 2004). Chabrost et al (2018) suggest that corruption accusations against municipalities over their negotiations with a private provider in France led to a reduction in discretionary negotiations by nearby municipalities to those found to have acted in a corrupt manner. Subsequently, the loi Barnier (loi no 95-101 du 2 février 1995) imposed a maximum contract length for private operators and stopped the possibility of a payment by the

[19] For example, a Polish industrial customer near the border with the Czech Republic made a cross-border connection to a Czech Republic water supplier to obtain better pricing.
[20] In the UK, competition has also been applied to the provision of specific products/services e.g. providing a network extension to new housing estates.

water operator in return for the right to run the water services.[21] Improving the nature of contracting, via public announcement of tenders and establishing sufficient time for response, which started after these laws were passed was followed by a price reduction of about 10% (Brunet et al 2002). It is worth noting that Chabrost et al. (2018) also suggest that discretionary negotiation can often achieve better outcomes for a municipality than simple passive tender processes, even if they increase the risk of corruption.

Benchmark competition is another option for providing some competitive pressure even when customers do not have a choice of provider. The approach involves giving firms a yardstick by which they can profit from better performance by basing a firm's prices on other firms' costs, as suggested by Shleifer (1985). Under this approach, the firm has stronger incentives to lower its own cost structure than in the classic regulatory game where a firm expects that if it improves its performance, the regulator will simply reset the allowed price, meaning that incentives to improve are muted. In contrast, if a group of firms in a sector, with similar cost structures, are regulated jointly, but each one has prices based on others costs instead of its own, the incentives to perform, such as by reducing its own costs, are strong. The English and Welsh water privatisation reforms implemented a limited form of benchmark competition, in the sense that benchmarks would be reviewed every five years. Water services do not need to be privately run for benchmark competition to provide useful incentives. It can be applied to the public sector, although, it is likely to be easier to create credible high-powered financial incentives for private rather than public entities.[22]

Wallsten and Kocek (2008) find that benchmarking (in the sense of having multiple local options to compare) seems to be positively associated with improved performance in the sense of fewer contaminants and fewer monitoring and reporting violations. Their study is based on a panel dataset of U.S. community water systems, of which about 80% are publicly owned and operated. Benchmarking is based on incentives to outperform a company's prior performance. Further, it can occur outside the operational function. For example, in the Republic of Ireland, regulatory benchmarking of IT and corporate functions has occurred between electricity, gas and water companies.

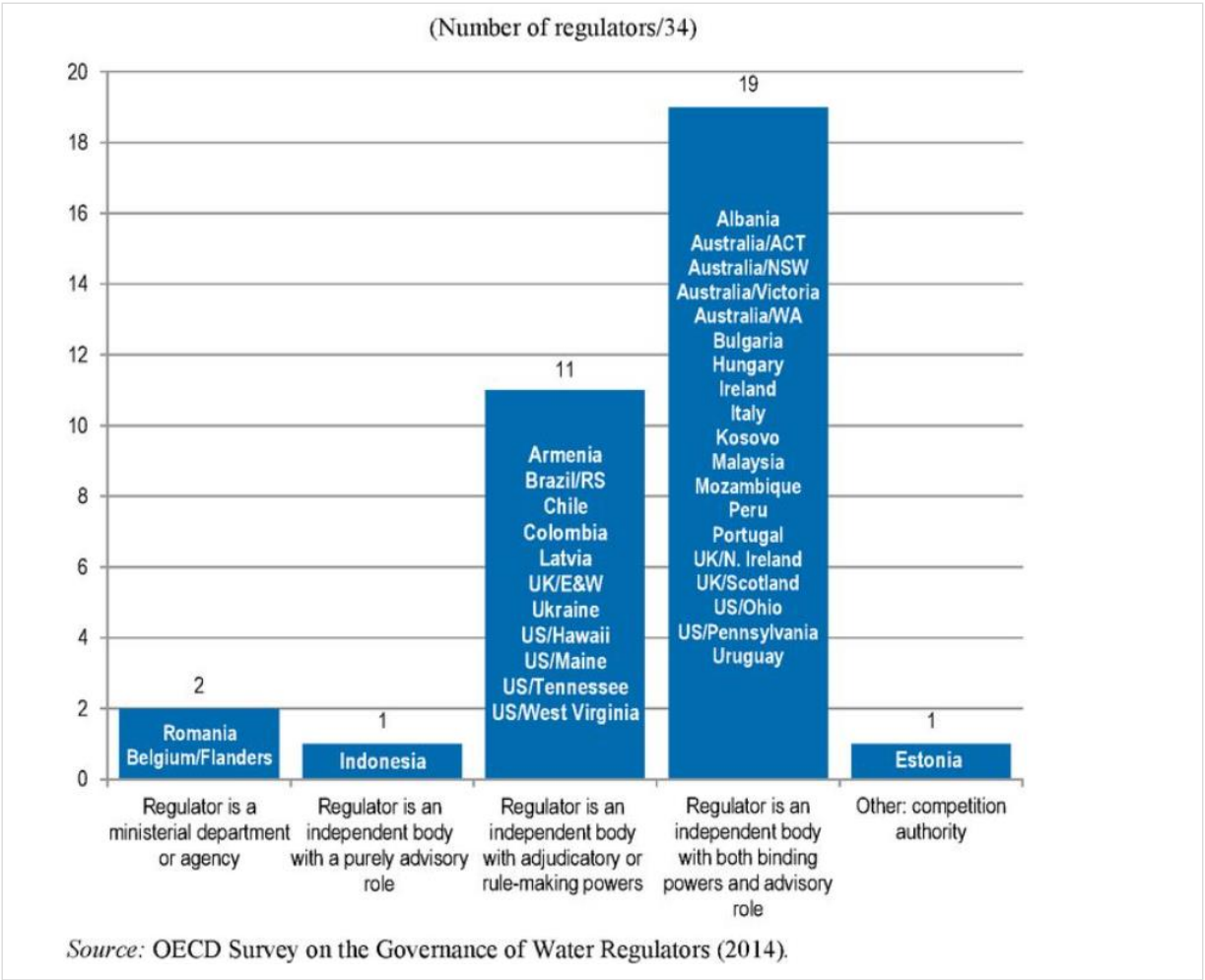
[21] Without price regulation in place, government awarding the right to run a water system to the firm offering the most financially advantageous terms to the government could create an incentive for the winning firm to maximise operating profits by raising prices.

[22] In the public sector, actions to cut profits cannot be taken and it is highly likely that any entities providing key services approaching bankruptcy will be bailed out, albeit with a possible change of management.

Regulation

While the exact nature of, and the rules governing, regulation are not the focus of this report, the nature of regulatory decision making has high relevance. Whatever the form of ownership, the structure for determining prices, investment and the method of operation is affected by regulation. Recent OECD work has focused on the importance of independent regulators. Independent regulators are those in which "the regulator is not subject to the direction on individual regulatory decisions by executive government". Evidence from an OECD survey of water regulators suggests that most OECD countries choose to have independent water regulators, as shown in Figure 3. Notably, in 28 out of 34 countries, decisions are taken "without being subject to government assessment" (OECD 2015 p. 31).

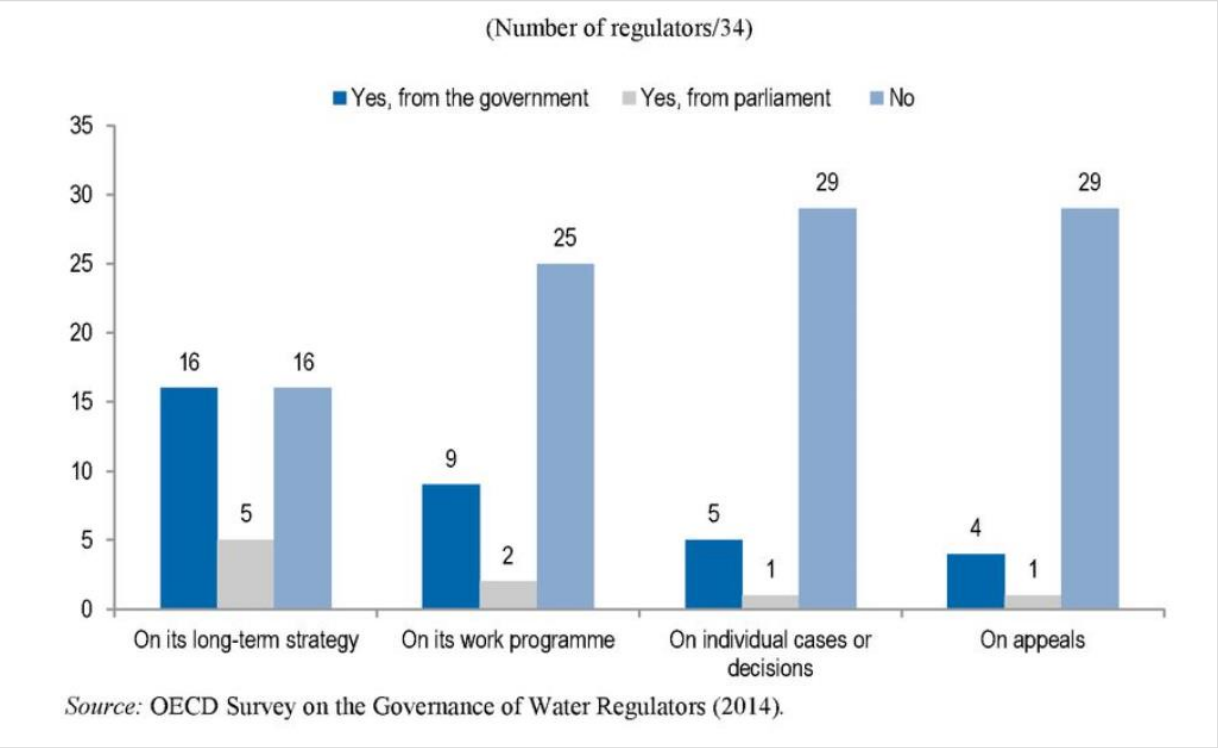
Figure 3. Status of the water regulator in different jurisdictions



Source: OECD Survey on the Governance of Water Regulators (2014).

Moreover, by far the majority of OECD countries do not permit the government to give specific instructions to the regulators, though many more permit limited strategic guidance to be provided, as shown in Figure 4.

Figure 4. Can the regulator receive official instructions or guidance from the government or the parliament?



Source: OECD Survey on the Governance of Water Regulators (2014).

Overall, the nature of economic regulation by the regulators is predominantly a cost-plus methodology. This is shown by Figure 5 from the OECD.

Figure 5. Retail tariff methodology in different jurisdictions

	Frequency of tariff setting (years)	Cost plus	Price cap	Consideration of revenue (number & affordability of customers)	Profit regulation	Consideration of Performance	Other
Albania		+				+	
Australia/Capital Territory	6	+		+		+	
Australia/NSW	4		+	+			
Australia/Victoria	5	+		+			
Bulgaria			+				
Chile	5	+					+
Estonia	°	+					
Hungary	1	+				+	
Ireland	6		+			*	
Italy	4				+		+
Kosovo	3	+					
Latvia		+			+		
Mozambique		+				+	
Peru	5	+		+		+	
Portugal	1	+			+	+	
Romania	°	+					
UK/England and Wales	5		+				
UK/Northern Ireland	6		+				
UK/Scotland	6		+				
Ukraine		+					
US/Hawaii		+					
US/Ohio		+					
US/Pennsylvania		+					
US/Tennessee		+					
Uruguay	1	+					

° At the request of the water companies.

+ In use.

* Under consideration.

5. ITALIAN WATER SECTOR: FROM 1994 TO THE PRESENT

Water system operators

Italy's water supply and sanitation systems are currently characterised by a wide diversity of ownership and operation patterns. There are over 2,000 water operating entities that vary considerably in scale. Municipalities are involved directly in managing the provision of services for 88% of these entities, but these are small systems, with municipalities supplying only 10% of consumers. As a result, while water companies operate only around 12% of water systems, they supply about 90% of consumers.

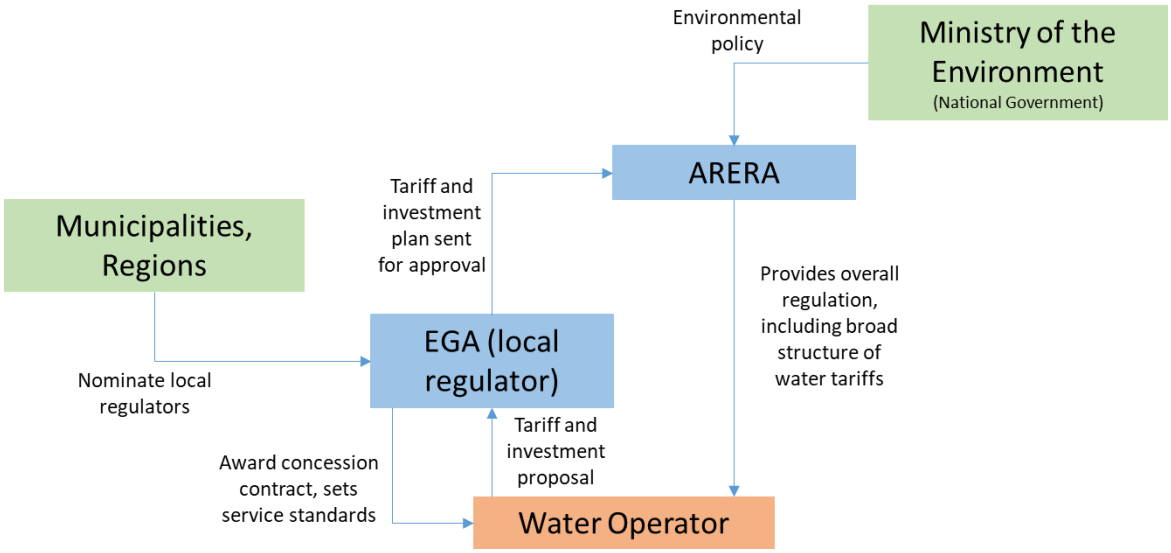
The water system assets remain publicly owned, with water companies holding concessions that can run for a maximum of 30 years. This is a substantially longer period than the 12 years that is allowed in France, but may be more consistent with the relevant asset lifespans, in particular following the DG REGIO "Guide to Cost-Benefit Analysis of Investment Projects" which suggests a 30-year time horizon for water system assets, under normal conditions[23].

Current Regulatory Framework

The existing economic regulatory framework for water involves both a national economic regulator, ARERA (formally the national energy regulator), and local regulators, 'Enti di Governo d'Ambito' (EGAs).

The local regulator, whose organisation is influenced by regional laws and nominated generally by municipalities, selects the governance structure of water operators (direct management vs concession), determines local service objectives, assigns concessions and monitors performance of the concession operators against the previously determined local objectives. The current regulatory structure is provided in Figure 6.

Figure 6: Italian Water Regulation



[23] See p. 152, https://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf.

The multi-level regulatory structure involves the water operator sending their tariff proposal to the local EGA along with an investment plan and policies to satisfy local objectives. The EGA then reviews the tariff plan while assessing the investment plan for financial feasibility and efficiency. The reviewed tariff and capital expenditure plan is then sent to ARERA for approval.

ARERA's regulation includes incentive regulation for operating expenditure, pass-through for non-controllable operating expenditures (such as electricity) and cost of service regulation for capital expenditure. Revenues can be adjusted if there are differences between actual and projected revenues as a result of differences between forecast and actual volumes. Recent regulatory initiatives have included: (a) an additional tariff component to promote quality-improving investments, (b) tariff exemptions for low income households, and (c) support in identifying investment priorities at the national level.

The evolution of regulation and the water sector

In the late 1980s the Italian water sector was even more fragmented than it is today with a total 23,500 operators, comprising 5,500 drinking water suppliers, 7,000 sewerage operators and 11,000 operators of purification services.[24] For a variety of reasons the "Galli Act", Law 36/1994, was passed in 1994 which was designed to encourage private investment and re-organisation of the sector through a variety of measures. Fraquelli and Giandrone (2003) suggest an aim of the act was to encourage the integration of companies (both horizontally and vertically) until they reached sufficient scale to access financial markets. Over time there has been a steady and significant reduction in the number of water operators to 7,848 by 2000[25] and 2,857 by 2015[26].

Fraquelli and Moiso (2005) describe how the 1994 Law created 91 Ambiti Territoriali Ottimali (ATOs or Optimal Size Territorial Areas) where the management of water services would be unified. The idea was that within each ATO operations could ultimately be transferred to a private firm or a public-private partnership through a process of competitive tendering. It could also be transferred to in-house companies. There was a transitory period to enable the re-organisation of the main incumbents where public firms could maintain their current concession albeit with the restriction that they could not bid for operations in other ATOs. According to Fraquelli and Moiso (2005) re-organisation proved slower than hoped.

Antonioli and Filippini (2001) go on to describe how the incentives for more efficient production and pricing were generated by a form of yardstick (or benchmark) regulation regarding firms' variable costs. It was also intended that a cost-recovery principle would be followed so that water revenues would cover costs to reduce the reliance on local government budgets to finance operating deficits. At the same time, EU directives such as 91/271 and 91/676, imposed tougher environmental and water cleanliness standards.

Romano et al (2017) describe how Law 152/2006 required a national regulator for water to be created that would provide a national framework for all water operators regarding their tariff mechanism, service contract and to monitor adherence to rules. Economic regulation was transferred to the energy regulator AEEGSI (now named ARERA) in 2011. The authors also note that the change in regulator brought a change in regulatory mechanism that ended the role of yardstick competition in water regulation.

Also, in June 2011 a referendum ended mandatory competitive tendering of water concessions and ended the explicit requirement that firms receive a fair rate of return when water tariffs were set. Additionally, in 2012, the European Court of Justice ruled that Italian authorities were breaching EU Law regarding environmental regulation as in several areas of the country urban waste water was not being sufficiently collected and treated.

[24] See p. 7, Camera Dei Deputati (1996)
[25] See p .17, Camera Dei Deputati (2000)
[26] See p. 1, Istat (2017)

The allocation of water regulation to ARERA (formerly (AEEGSI) was intended to: (i) build on best practice from energy regulation[27], (ii) improve service quality through a shift to output-based regulation, (iii) develop a transparent set of nationwide rules, and (iv) introduce an incentive scheme for firms accounting for their individual characteristics, plus standardised business planning models and templates for concession agreements.

Bardelli (2016) describes how under ARERA/AEEGSI there have been two main regulatory periods: 2012-15 and 2016-19. In the second period enforcement of service quality regulation (e.g. regarding complaint handling) began after steady improvements in data availability. Prior to this point quality of service had followed a self-regulatory regime.

Bardelli and Biancardi (2018) characterise the current regime as one involving 'menu regulation' where the maximum allowed price increase can vary according to the level of planned investments, planned variations in quality improvements and whether operating expenditures are above or below a benchmark value. Bardelli and Biancardi suggest the regulatory regime has been associated with an increase in investment covered by water tariffs from €1bn in 2012 to €1.7bn by 2016 and a planned level of €2.1bn in 2018.[28] This has been reflected in the proportion of total expenditures accounted for by operating expenditures falling from an average of 74% in 2014 to a projected 65% in 2019. Bardelli and Biancardi suggest that this proportion (potentially suggesting under-investment) is high compared to other European countries where the equivalent proportion is 30-35%

Similarly, Bardelli and Biancardi report the water industry has shown consolidation with the number of water operators in Italy falling from around 2,900 in 2012 to around 2,100 in 2017. However, the costs of investment have likely been central to consumers facing an average annual price increase of 4%. Also, Bardelli (2016) notes that between 2013 and at least 2016 there was a legal dispute around the financing of investments.

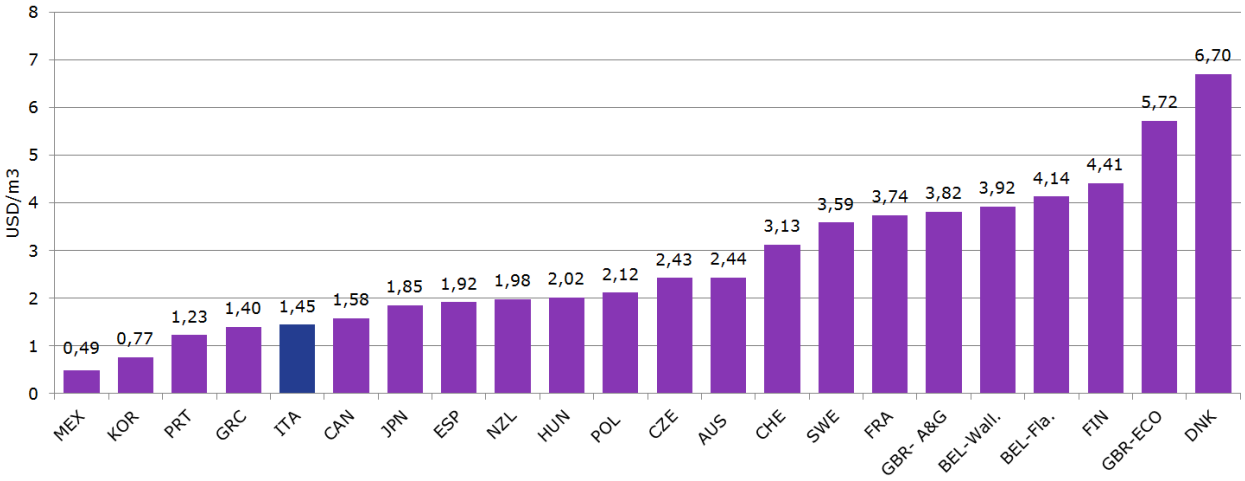
By 2018 the Italian Parliament had also asked ARERA to support local authorities in delivering their planning functions. National budget law n.205/17 required ARERA to identify priority water infrastructure investments in a National Water Plan and then monitor the implementation of these investments.

[27] ARERA's oversight of the energy sector began in 1995.
[28] Already some of the planned investments are provided by public funds rather than being recovered via water tariffs.

International comparisons of performance

Italy had among the lowest water prices per household in the OECD in 2008, and the place of Italy in these rankings has not changed substantially, as Italian prices have increased only at moderate levels (See Figure 7 and Figure 8).

Figure 7: Unit price of water and sanitation services to households inclusive of taxes (USD/m^3)



Source: OECD estimates based on country replies to 2007-08 survey or public sources validated by the countries. OECD 2009.

A more recent comparison is provided by data collated by the International Water Association[29], which compares the cost of 200 cubic metres of water (including charges for waste water and sewerage as well as taxation) in US$ for 195 global cities in 2017. This finds the Italian cities considered to be towards the cheaper end of the water pricing spectrum. Milan is ranked 27th cheapest, Naples 51st, Rome 83rd, Turin 101st and Bologna 109th. The cost in Milan was $182, Naples $345, Rome $400, Turin $467 and Bologna $539. For context, a range of South American cities were cheapest with a recorded cost of $0 and Odense was recorded as the most expensive city with a cost of $2,116.

[29] See http://waterstatistics.iwa-network.org/graph/6

A report by Global Water Intelligence[30] provides a comprehensive comparison of the outcomes of the Italian water industry with other large European countries. A summary of the results are provided in Figure 8 below.

Overall, Figure 8 shows that water supply in Italy is low cost and delivers water quality comparable to other European nations, but the low cost comes at the price of poor customer service, a low level of waste water treatment and a high level of unbilled water/water loss (termed non-revenue water). For example, 57.8% of households in Italy are connected to wastewater treatment and 34.7% of water is classified as non-revenue water. As a comparison, 91.3% of German households are connected to wastewater treatment and only 7.18% of water in Germany is classified as non-revenue water. However, the total cost per person of water supply in Italy is €156 compared to €343 in Germany.

Also illuminating is that the change in performance for Italy since 1990 is relatively weak compared to the other countries considered. While total costs per person have increased by 82% since 1990, Italy is the only country to see the proportion of non-revenue water increase (by 10.4%) and see the percentage of households whose wastewater is treated fall (by 3%) since 1990.

[30] Hosted on the Water UK website

Figure 8: Performance comparisons of six European countries

Water Quality		% change since 1990
E&W	99.71%	+0.96%
Germany	99.70%	+0.10%
France	99.65%	+0.54%
Italy	99.57%	+0.06%
Spain	98.89%	+3.31%
Ireland	96.50%	+5.57%

Wastewater Treatment		% change since 1990
Germany	91.3%	+16.3%
E&W	88.6%	+31.9%
Spain	80.9%	+51.1%
France	79.3%	+2.0%
Italy	57.8%	-3.0%
Ireland	45.3%	+43.6%

Customer Service	
E&W	5.8
Ireland	2.7
Spain	2.7
France	2.6
Germany	2.5
Italy	1.5

Non-revenue Water		% change since 1990
Germany	7.18%	-5.40%
Spain	18.90%	-4.80%
France	21.25%	-4.30%
E&W	23.37%	-7.74%
Italy	34.71%	+10.40%
Ireland	44.41%	-2.40%

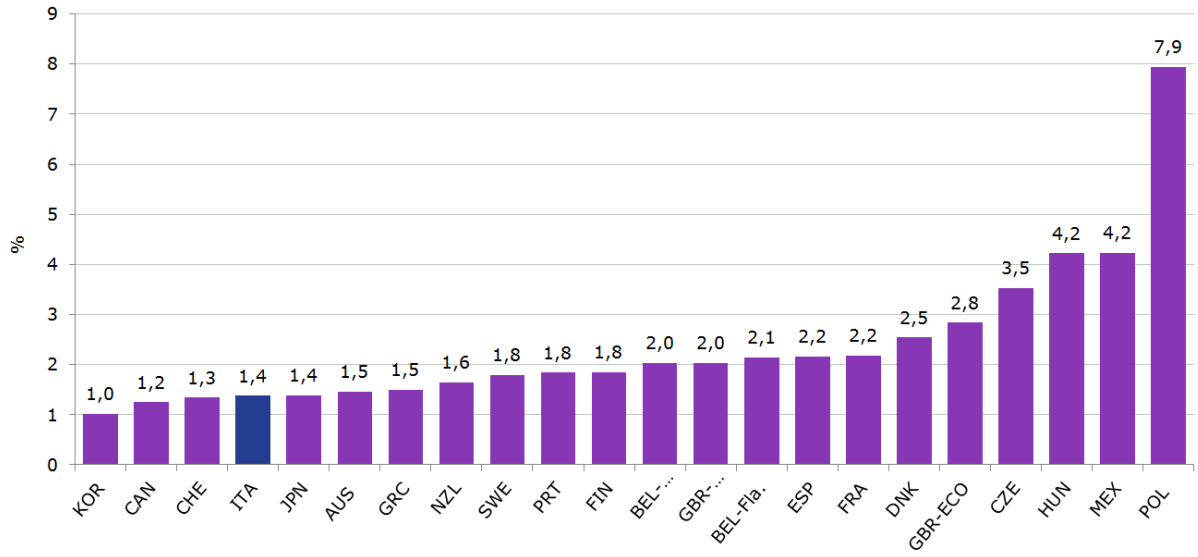
Charge to Customers		% change since 1990
Germany	€4.66	+15.03%
E&W	€4.14	-21.80%
France	€3.48	+38.09%
Italy	€1.50	+15.14%
Spain	€1.32	+93.90%
Ireland	€0.06	0.00%

Total Costs per Person		% change since 1990
Italy	€156.39	+82.27%
Spain	€249.72	+56.59%
E&W	€272.70	-36.91%
Ireland	€329.22	+147.23%
Germany	€343.40	+5.73%
France	€521.47	+33.81%

Source: Global Water Intelligence (2018)

The prices for Italian water are also among the lowest in the OECD as a percentage of the income of the lowest decile of the population (see Figure 8 and Figure 9).

Figure 9: Water supply and sanitation bills as a share of disposable income: average income of the lowest decile of the population.

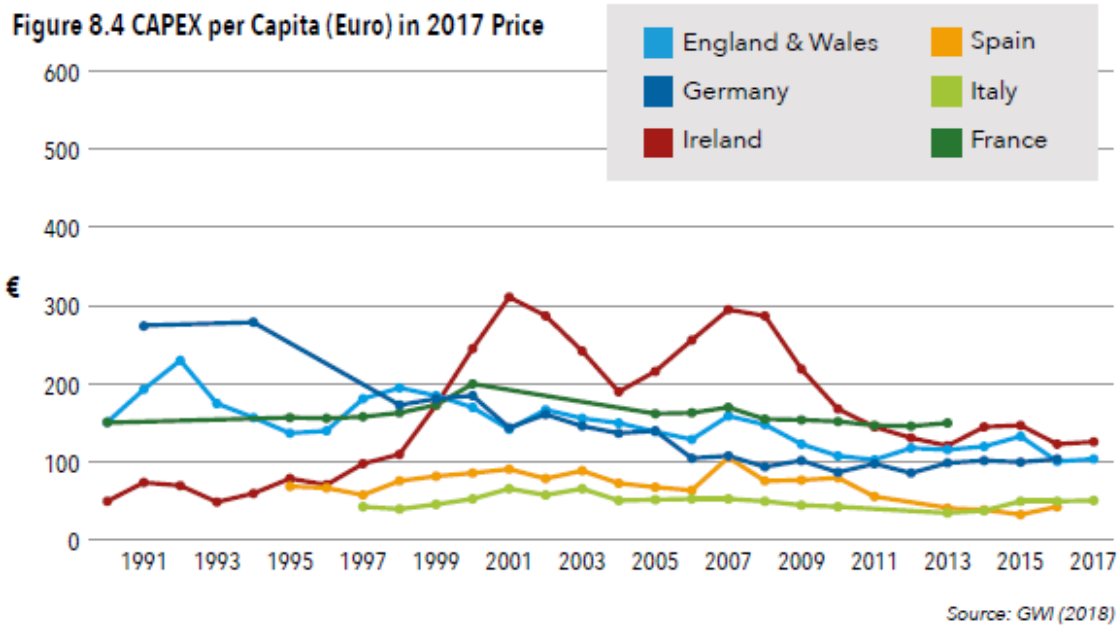


Notes: Data for water tariffs are calculated for a consumption of 15 m^3 per month and expressed in USD adjusted at 2007 PPPs for private consumption. Source: OECD survey or public sources validated by the countries, OECD 2009.

The Italian water association has estimated that in order to close the gap with the best performing OECD countries, investment levels would need to reach about EUR 80 per capita, while planned investment is only at EUR 54.6 per capita, leaving a gap of EUR 25.4, suggesting a need to increase investment by 46%. Where water services are directly managed by municipalities, the investment gap is much higher. ARERA (2013) estimated that to meet EU commitments total annual investment expenditure of 5.07 billion euros in was needed 2015, and for the five years following this a combined total of 19.55 billion euros of investment was needed. Using figures that may not be entirely comparable, ARERA (2018) reports a planned investment requirement in 2016 of 2.23 billion euro rising to 3.08 billion euro by 2018. These data come from investment plans approved by the EGAs, suggesting the extent to which planned investments would not approach the OECD estimates of needed investment. In 2018, 24% of this planned investment would be from public funding rather than from tariff revenue.

Global Water Intelligence (2018) also enable a comparison of Italian capital expenditures and operating expenditures with EU countries. Figure 10 shows that capital expenditure per capita is generally the lowest among the six comparator nations with only Spain having similarly low capital investment. Indeed, the other four comparator nations have capital expenditures per person consistently more than *double* the level in Italy.

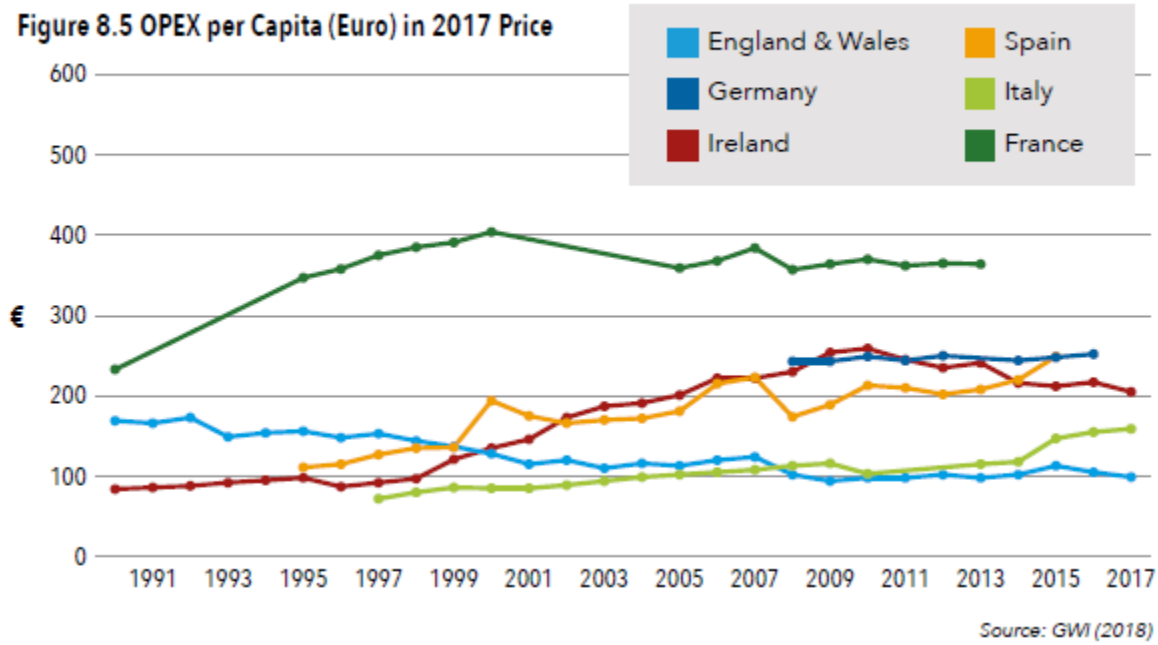
Figure 10. Capital expenditure in six European countries



Source: Global Water Intelligence (2018)

Equally, operating expenditures per capita in Italy are also among the lowest for the six nations considered, as seen in Figure 11.

Figure 11. Operating expenditure in six European countries



Source: Global Water Intelligence (2018)

Academic evidence on the Italian water system

A range of academic papers have used data from Italy to consider the impact of ownership and water operator characteristics on performance, in part due to the diversity of company types observed in Italy. Given the evolution of regulation detailed above, it is worth noting the time period from which the data in the studies originate. Overall the results appear mixed regarding the impact of ownership on efficiency, although there is evidence that the smallest water operators probably did not fully exploit economies of scale. However, it is unclear whether this lack of scale is due to poor organisational choices or due to other factors, such as geography.

Cost Efficiency: Romano and Guerrini (2011) consider the cost efficiency of Italian water operators using data from 2007 for 43 monopoly water companies that operated exclusively in the water, wastewater and sewerage industry. Romano and Guerrini cluster these firms by location (North vs Central-South), ownership (public vs private vs mixed) and by number of customers. Using data envelopment analysis, these authors found that the majority of firms are a long way from the efficient frontier. Considering how efficiency varied by operator type, publicly owned firms were found to have higher efficiency scores. Also, evidence was found that economies of scale exist with the highest

scale efficiency score for medium-sized firms, i.e. those with 50,000 to 250,000 customers.

More recently, Romano et al (2017) use data from 2010-2014 for 16 water utilities located in Tuscany and Veneto to incorporate quality of service considerations into their data envelopment analysis. They find that public water companies and public-private partnerships had very similar efficiency scores, relative to the efficient frontier, when only their quantitative (i.e. cost) performance was considered. However, when quality is assessed by (i) the time to establish a new connection and (ii) the time to repair breakdowns, public-private partnerships are found to be closer to the efficient frontier than the public water companies, a difference that is statistically significant. Romano et al interpret this result as showing that publicly owned and public-private partnership water companies potentially place varying weights on particular objectives. The authors suggest that political pressures steer publicly owned firms to emphasise low tariffs which, alongside creating a pressure for operating efficiency, also potentially limits investment. Lower investment then impacts on a lower quality of service.

However, analysing data on 54 water operators[31] in 2009, Romano et al (2013) find that public operators have a greater level of net assets than those with a mixed ownership structure. Romano et al (2013) report that publicly owned utilities averaged €247 of net tangible assets per capita compared to €135 for water utilities with a mixed ownership structure. The greater net assets for publicly owned firms is even more marked when assessed per kilometre of mains pipes: €66,313 against €12,483. Probably associated with this stronger asset position, publicly owned water utilities are found to have an average interest rate of 4.26% compared to 5.55% for utilities with mixed ownership.

Romano et al (2018) move beyond solely looking at the ownership dimension to consider how details of corporate governance influence efficiency. Using data on 85 water utilities for the period 2010-2012 they find that wholly publicly owned firms have a slightly lower efficiency than those involving some private involvement. Romano et al (2018) potentially associate this to legal provisions (Law 78 of 2010 and Decree 175 of 2016) restricting the size of publicly owned utilities' boards to having no more than five members. The authors find that operators with boards with 7-9 members had higher efficiency than those with 4-6 members, and operators with only 1-3 board members had the lowest efficiency relative to the efficient frontier.

Looking at the impact of Italian privatisations extending beyond the water sector, Fraquelli and Erbetta (1999) conclude that across 39 medium-sized firms privatised in the 1980s and 1990s there was no statistically significant difference in total efficiency in the five years following privatisation compared to the five years before. However, some evidence was found that output per employee increased after privatisation and that overall efficiency did increase following privatisation when the firms were purchased by foreign groups.

Economies of Scale: Fabbri and Fraquelli (2000) estimate a hedonic cost function model for 173 larger water firms observed in 1991 to identify whether economies of scale operate in the Italian water sector. Fabbri and Fraquelli find that at the mean size of the

[31] Out of a possible 115 water utilities.

analysed firms (29,505 customers) economies of scale were still present. Since the analysed utilities were generally larger than the full population of water utilities, Fabbri and Fraquelli conclude that many water utilities in 1991 were subscale in the sense that they were not fully exploiting economies of scale. As such, the authors argue that the aim of consolidating the Italian water sector was a legitimate objective for the 1994 reforms.

Additionally, Fraquelli and Moiso (2005) form a panel dataset from the business plans of 18 of the ATOs that run for 20-30 years to estimate a translog cost frontier. Fraquelli and Moiso identify economies of scale (referring to proportionately increasing both water output and network length simultaneously) up to an output of around 90m cubic metres. Since the average size of ATOs in Italy is 59m cubic metres, and many are much smaller, the authors suggest larger ATOs could deliver cost economies.

Looking specifically at waste water treatment plants, Fraquelli and Giandrone (2003) estimate the minimum efficient scale for these plants. Using survey data for 103 plants (each with a capacity exceeding roughly 10,000 inhabitants) from 1996, Fraquelli and Giandrone estimate the minimum efficient scale for treatment plants to be around 15m cubic metres per year (roughly equivalent to 100,000 inhabitants). Given the large number of small water companies in Italy, the authors suggest that consolidation of water companies should help with moves to more efficient wastewater treatment. However, Fraquelli and Giandrone do concede that the actual scale of treatment plants could be constrained below the efficient level due to non-cost factors such as geography.

In contrast, Antonioli and Filippini (2001) analysing a panel of 32 publicly owned Italian water companies using data from 1991-95 find slight diseconomies of scale[32] are present on average for the analysed firms. In other words, Antonioli and Filippini conclude against larger water utilities leading to economies in water distribution. However, the authors caution that the results may not hold for the smallest water utilities which are large in number. Also, the overall diseconomies of scale are driven by increasing the size of the area served by a water operator: economies exist when either water output or number of customers served are increased, but the area covered by the operator is fixed.

Fraquelli et al (2004) turn their attention to addressing questions of economies of scale and scope for 'multi-utilities', i.e. where a single operator provides services for gas, water and/or electricity. Fraquelli et al apply a Composite Cost Function model to data from 90 Italian municipal utilities over the period 1994-96. Of the analysed firms 14 supply all three services, 37 provide two services (31 combine gas and water), and 39 firms provide one service (16 only offer water). The authors find that when output is below the median level in the sample[33] there are economies of scope (the cost of a single firm producing output across the three services is lower than for three separate specialist firms) and economies of scale (increasing output increases costs less than proportionately) for utilities providing all three services. For outputs larger than the median, the results are statistically insignificant and so constant returns to scale and no

[32] In this instance, economies of scale are assessed by a simultaneous and proportionate increase in output, number of customers and the physical size of the water system.
[33] Median outputs were: 71.2m cubic metres of gas, 10.6m cubic metres of water and 221.2m kilowatt-hours of electricity.

advantages from diversification cannot be ruled out. Scope economies are also found for small operators with respect to specific services, in particular combining gas and water is found to offer the greatest cost advantage.

6. INTERNATIONAL EVIDENCE ON EFFICIENCY AND REGULATION

Evidence on efficiency

This section reviews detailed studies related to efficiency, grouping them together by the geographic area covered. As noted at the beginning, for a broad spectrum of sectors, some evidence suggests privatisation is associated with a successful increase in efficiency (see Megginson and Netter, 2001 and Shirley and Walsh, 2000). This section focuses specifically on efficiency under different ownership structures in the water sector.

Efficiency can be measured in a variety of ways. Measures can relate to operating efficiency, possibly in cost per litre of delivered water or in terms of water lost in the system, or relate to water quality such as keeping bacterial levels within a standard range a high percentage of the time.

Studies of the water sector are often not easily generalised to other locations and so are potentially misleading. Case studies, for example, may not be representative. Furthermore, privately run water suppliers could be, on average, more complex to operate than others, or simpler to operate, depending on the criteria used to privatise operators and the relative attractiveness of these operators to private companies. In France, for example, a mayor who has a publicly run water system is personally liable for negligence in the water system. If the system is operated by a private company, the mayor is not personally liable. Thus one might expect that, where risks of bad water quality events are highest, the mayors may prefer to outsource the management. This difficulty may not be easily observable, leading to an empirical problem of missing variables that could lead to misleading conclusions on efficiency.

The conclusions of studies may also be affected if they do not account for any changes in the balance of objectives for the water sector between the public and private sectors. In particular, water quality standards alter operational costs and investment requirements, so to provide an accurate performance comparison of different ownership structures variations in water quality regulations would need to be taken into account.

UK

The UK, in particular England and Wales, provides one of the main examples of a privatisation programme in water. The privatisation of the English and Welsh systems occurred in 1989. Welsh water left private ownership in 2001, moving to a mutual structure in which it was purchased by a non-profit entity. The bills in Wales remain quite reasonable. At the same time, the Scottish water system remained under public control. According to The Economist, in the early 1990s, English bills were 70% higher than those in Scotland. Since then, the relative prices have converged and Scottish

Water[34] has underperformed in some respects. The Economist (2003) provides comparative statistics for the different systems.[35] These are shown in Table 2.

Table 2. Key performance indicators compared across UK water markets, 2003

	England	Scotland	Wales	N. Ireland
Average HH water bill (£)[36]	236	263	277	375
Average medium-sized business water bill (£)	1,772	2,849	1,820	643
Drinking water quality tests passed (%)	99.9	99.2	99.8	98.4
Sewage discharge regulations compliance (%)	94	85	97	69
Leakage rate, cubic metres per km of main per day	9.8	23.7	9.7	10.3

Source: Economist (2003) and Ofwat, Environment Agency; Scottish Executive; Northern Ireland Office.

However, Saal and Parker (2001) find that prices rose faster than costs but there was little productivity improvement following the water privatisation in England and Wales. Likewise, Cowan et al. (2000) estimate that privatisation led to a net welfare loss.

It should be noted that, as in Scotland, there is public ownership of the water sector. There is also independent regulation in Northern Ireland, provided by The Utility Regulator (Northern Ireland).

Spain

Spain is a country that has seen a number of interesting studies of private and public operations of water supply. Using Data Envelopment Analysis techniques, Suarez-Varela et al (2017) find that private sector management made more efficient use of labour inputs, largely because of legal and institutional restrictions faced by public bodies, while private management might be less efficient at managing some operational costs.

France

France has historically had one of the strongest elements of private sector participation in the water sector. Today, this is mainly through leases, which are shorter term, or concessions, which are for longer time periods and may include a broader set of responsibilities. There have been substantial difficulties in producing financial measures of performance across water systems, as detailed in Canneva and Guerin-Schneider (2011). Nonetheless, due to the bidding system for concessions, it has been possible to observe some information on prices and price changes around the time of new contracts for privately managed systems being awarded, with the finding that prices fell by about

[34] This is the single publicly owned water company serving Scotland.
[35] Note it is unclear the extent to which the differences in average bills reported are due to price differences or differences in consumption.
[36] Before drawing firm conclusions from differences in the size of water bills for households and medium-sized businesses it would be necessary to check for differences between households and businesses in different parts of the UK. For example, it may be that particularly water intensive businesses are located in Scotland.

10% (Brunet et al 2002). One reason for the difficulties in studying price impacts has apparently arisen due to increases in the prices of water services in partly being required to upgrade systems for environmental reasons.

A study by Chong et al. (2015) focuses on prices and finds that small municipalities would tend to pay a significant price premium for franchisee-provided water compared to publicly-provided water. In contrast, large municipalities would not pay a premium on average. Large municipalities would be less likely to renew an incumbent franchisee that charged an "excessive" price, while small municipalities would tend to renew their franchisees no matter the price, perhaps suggesting that large municipalities had an ability to discipline franchisees, while smaller municipalities would be less able to discipline due to less interest from companies to take over a small franchise and less ability of small municipalities to self-operate a water company.

United States

The United States has a mix of provision, with private waterworks accounting for about 49% of all waterworks in 2005 (Perard 2009). This mix, which has fluctuated over time, is important for ensuring sufficient examples are present to test between features associated with private and public provision. According to Battacharayya et al (1994), who estimate a generalised cost function, public water utilities are more productively efficient than private ones on average, but also find evidence that public water utilities have a wider dispersion "between best and worst practice." Using a translog cost function, Bhattacharyya et al (1995) find that for small operations, private water utilities are relatively more efficient, while for large operations, public water utilities are relatively more efficient. These studies account for the possibility that public utilities may not be cost minimising, however, they may not sufficiently account for differences in tax treatment and regulations (Seidenstat et al. 2000).

Latin America

Latin America has witnessed a number of privatisation efforts in water. Some of these have been studied rigorously.

In one widely cited study, Galiani et al (2005) find that in Argentina, child mortality fell by 8% in areas that privatised water services, with the largest effect in the poorest areas.

In research focused on Buenos Aires, Abdala (1996) found that productivity in the Buenos Aires water system increased substantially in the first years after privatisation with, on average, a doubling in output per employee and a price cut of 26.9% at the time of privatisation. Subsequent experience in Buenos Aires suggested that regulation was weak, politicised and that opportunities for exploiting regulation may have existed, with a re-negotiation of the base contract in 1997 and ultimately public control being re-established in 2006.*Overview of findings from the economics literature*

Internationally, there is a considerable body of published research examining the impacts of private versus public operation and ownership on efficiency in the water sector. A large number of these are listed in Table 3 below.

Table 3. Review of econometric tests and case studies on privatisation and the delegation of water services

Country	Methodology	Conclusion	Papers
Africa	Stochastic Production Frontier	Private operators are more cost efficient	Estache and Kouassi (2002)
Africa	Stochastic Production Frontier/ Data Envelopment Analysis	No differences in costs	Kirpatrick et al (2004)
Africa	Stochastic Cost Frontier Analysis/ Data Envelopment Analysis	No differences in efficiency	Kirkpartick, Parker and Zhang (2006)
Argentina (Buenos Aires)	Multiple Case Studies	Positive effect of private sector participation on sector performance	Abdala(1997), Alcazar, Abdala, and Shirley (2002), Artana, Navajas, and Urbiztondo (1999), Crampes and Estache (1996), Rivera (1996)
Argentina (Cordoba)	Case Study	Positive effect of private sector participation on sector performance	Nickson (2001a)
Argentina (Corrientes)	Case Study	Positive effect of private sector participation on sector performance	Artana et al (1999)
Argentina (Salta)	Case Study	Positive effect of private sector participation on sector performance	Salatiel (2003)
Argentina (Tucuman)	Multiple Case Studies	Negative effect of private sector participation on sector performance	Rais, Esquivel, and Sour (2002 Navajas and Urbiztondo (1998
Asia	Stochastic Cost Frontier	No differences between public and private sectors	Estache and Rossi (2002)
Bolivia (Cochabamba)	Multiple Case Studies	Negative effect of private sector participation on sector performance	Nickson and Vargas(2002), Hall and Lobina (2002)
Bolivia (LaPaz–ElAlto)	Multiple Case Studies	Mixed results of private sector	Hall and Lobina (2002),

		participation on sector performance	Komives (1999), Komives (2001), Komives and Brook-Cowen (1998)
Brazil	Data Envelopment Analysis	No differences between public and private sectors	Seroa da Motta and Moreira (2004)
Brazil	Stochastic Cost Frontier Model	Public firms are more efficient but this declines over time	Faria and Moreia (2008)
Brazil	Stochastic Frontier Model	No differences in efficiency	Da Silva e Souza, De Faria and Moreia (2007)
Brazil	Fixed Effects Panel Data	Public sector (at the regional level) has lower costs	Sabbioni (2008)
Chile (Santiago)	Multiple Case Studies	Positive effect of private sector participation on sector performance	Rivera (1996), Shirley, Xu and Zuluaga (2002)
Colombia (Barranquilla)	Case Study	Positive effect of private sector participation on sector performance	Avendano and Basanes (1999)
Colombia (Cartagena)	Multiple Case Studies	Positive effect of private sector participation on sector performance	Rivera (1996), Nickson (2001b), Beato and Diaz(2003), Avendano and Basanes (1999)
Colombia (Marinilla)	Multiple Case Studies	Positive effect of private sector participation on sector performance	Avendano and Basanes (1999)
Colombia (Monteria)	Case Study	Positive effect of private sector participation on sector performance	Avendano and Basanes (1999)
Cote d'Ivoire	Multiple Case Studies	Positive effect of private sector participation on sector performance	Collignon (2002), Kerf (2000), Ménard and Clarke (2002a),Tremolet, Browning and Howard (2002)
Estonia	Data Envelopment Analysis	No differences in efficiency	Peda, Grossi and Liik (2013)
France	Regression Model	No difference in compliance with water quality regulation	Ménard and Saussier (2000)
France	Data Envelopment Analysis/ Stochastic	Public sector slightly more efficient	Lannier and Porcher (2013)

	Frontier Model		
Gabon	Multiple Case Studies	Positive effect of private sector participation on sector performance	Tremolet (2002), Tremolet and Neale(2002)
Gambia	Case Study	Negative effect of private sector participation on sector performance	Kerf (2000)
Germany	Data Envelopment Analysis	No differences in efficiency	Zschille and Walter (2012)
Guinea	Multiple Case Studies	Mixed results of private sector participation on sector performance	Brook-Cowen (1999), Brook and Locussol (2001), Clarke, Menard and Zuluaga (2002), Kerf (2000), Menard and Clarke (2002b), Rivera (1996)
Honduras (San Pedro Sula)	Case Study	Positive effect of private sector participation on sector performance	Dıaz (2003)
India (Prune)	Case Study	Negative effect of private sector participation on sector performance	Zerah (2000)
Italy	Data Envelopment Analysis	Private sector more efficient	Lo Storto (2013)
Italy	Data Envelopment Analysis	Public sector more efficient than Public Private Partnerships	Romano and Guerrini (2011)
Latin America (Argentina,Bolivia,Brazil)	Regression Model	Private sector participation per se does not improve water coverage	Clarke, Kosec, and Wallsten (2004)
Malaysia	Data Envelopment Analysis	No differences in efficiency	Hon, Boon and Lee (2014)
Mexico (Cancun and Isla Mujeres)	Case Study	Mixed results of private sector participation on sector performance	Rivera (1996)
Mexico (Mexico City)	Case Study	Mixed results of private sector participation on sector performance	Haggarty, Brook, and Zuluaga (2002)
Philippines	Multiple Case Studies	Mixed results of private sector	Dumol (2000), Santos

		participation on sector performance	(2003)
Poland (Gdansk)	Case Study	Positive effect of private sector participation on sector performance	Rivera (1996)
Portugal	Total Factor Productivity/ Data Envelopment Analysis	Private sector more productive with higher quality, but public sector more efficient	Marques (2008)
Portugal and Italy	Comparative Case Study	Public ownership more efficient	Cruz, Marques, Romana and Guerrini (2012)
Senegal	Multiple Case Studies	Positive effect of private sector participation on sector performance	Kerf (2000), Tremolet et al. (2002)
South Africa (Queenstown)	Case Study	Mixed results of private sector participation on sector performance	Palmer Development Group (2000)
Spain	Data Envelopment Analysis	No differences in efficiency (Including with Public Private Partnerships) once environmental factors are considered	Gonzalez-Gomez, Garcia-Rubio, Alcala-Olid and Ortega-Diaz (2013)
Spain	Data Envelopment Analysis	Private sector uses labour more efficiently	Suarez-Varela, Garcia-Valinas,Gonzalez-Gomez and Picazo-Tadeo (2017)
Spain (Andalusia)	Data Envelopment Analysis	Public sector has more efficient management of labour	Picazo-Tadeio, Saez-Ferandez and Gonzalez-Gomez (2009)
Trinidad and Tobago	Multiple Case Studies	Negative effect of private sector participation on sector performance	Nankani (1997), Stiggers (1999)
England and Wales	Financial Analysis	No differences after privatisation	Shaoul (1997)
England and Wales	Cost Function	Regulation lowered costs but privatisation did not	Saal and Parker (2000)

England and Wales	Productivity Analysis	No difference in efficiency after privatisation	Saal and Parker (2001)
England and Wales	Stochastic Frontier Model	No differences in productivity growth	Saal, Parker and Weyman-Jones (2007)
United States	Cost Function	Private sector has lower costs	Morgan (1977)
United States	Cost Function	Private sector has lower costs	Crain and Zardkoohi (1978)
United States	Cost Function	Public sector has lower costs	Bruggink (1982)
United States	Cost Function	No differences in costs	Feigenbaum and Teeples (1983)
United States	Data Envelopment Analysis	No differences in efficiency	Byrnes, Grosskopf and Hayes (1986)
United States (Atlanta), Canada (Hamilton)	Comparative Case Study	No differences in efficiency	Ohemeng and Grant (2011)
Worldwide	Meta-Analysis	No differences in costs	Bel, Fageda, Warner (2010)
Worldwide	Meta-Analysis	Diseconomies of scale and scope more likely in public sector	Carvalho, Marques and Berg (2012)
Worldwide	Differences in Differences Regression Model	Private more efficient (labour)	Gassner, Popov and Pushak (2008)

Source: Updated from Perard (2008)

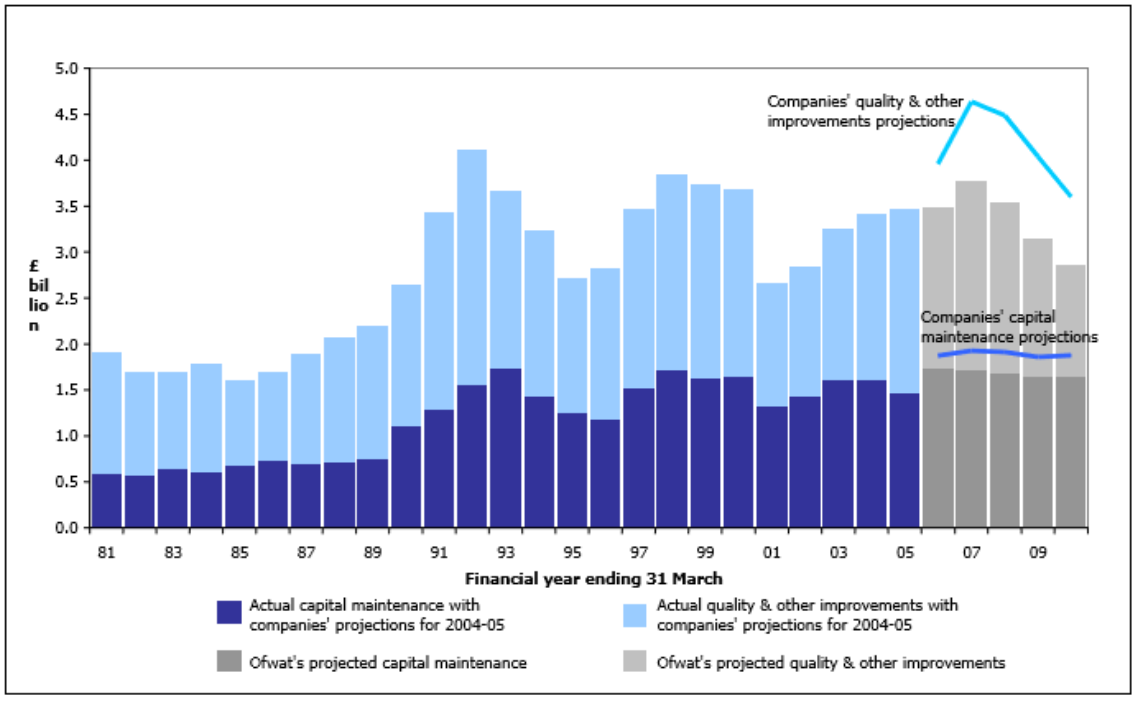
Evidence on regulation

As noted earlier, the relationship between regulation and outcomes is close, and in some ways, particularly for the water sector, may determine outcomes more than ownership.

"While there does not appear to be any empirical analysis of benchmark competition, based largely on interviews Sawkins (1995) concludes that yardstick competition improved water regulation in England and Wales." (Wallsten and Kosec, 2008)

The key question, not measurable by the efficiency studies cited earlier, is whether private ownership or operation influences investment compared to public ownership. This matters to the extent that many water networks have allegedly suffered from underinvestment for long periods. The experience in England since privatisation may serve as an interesting example to show how, after allegedly years of under-investment, investment levels increased substantially following the move into the private sector in 1989. The increase in annual investment spending in real terms has, been quite substantial after privatisation. In all years between 1981 and 1987 investment was below £2 billion per annum, while for around two-thirds of years since privatisation investment has been above £3 billion per annum. However, this increase in investment was accompanied by an increase of approximately 40% in the real cost of water per household.

Figure 12. Actual and projected capital investment 1981-2010 (2003/04 prices)



Source: Ofwat

7. KEY ELEMENTS OF THE CURRENT LEGISLATIVE PROPOSALS

The proposal that is currently under consideration by the Assembly in Italy is draft law AC52 known as "PDL Daga". The draft law has a number of major features that would substantially change the nature of the water sector in Italy and which go beyond simply ending private involvement. Through the proposals there is a general theme of increasing local and public control. While the proposals increase this public involvement, perhaps the bigger question is how this public control will be used when trade-offs exist between different policy objectives such as environmental protection and cost control. Will the balance between different objectives for the water sector change substantially? While the draft law may be defeated or amended, it is used as a case study of how particular changes may potentially impact the water sector.

The most important elements of the proposal for economic incentives are detailed below:

1. Nationalisation of water concessions into "azienda speciale" or another "body governed by public law" (Article 8)

The process of nationalisation is covered by a transitory regulation (article 10) which: (i) bans the sale of publicly owned shares of water companies, (ii) ends concessions granted to third parties by 31 December 2020, and (iii) converts water companies with both public and private capital into bodies covered by public law. The sections above provide a full discussion of the potential impacts arising from this change in ownership.

2. A quantity of water for essential consumption to be provided for free and funded by general taxation (Article 3, paragraph 4).

This implies weakening of the price signal on households to conserve water, as well as requiring government funding to cover the cost of provision. Funding the cost of this free water through general taxation will potentially alter the burden of the costs of water provision across different members of society.

The key factor for the impact of this element of the proposal will be the size of the free allowance. As discussed in Lu et al (2019), setting the size of this allowance for "essential" water consumption requires knowledge regarding household water consumption and the size of individual households. Ideally, the free allowance might vary by the number of household occupants as this will likely be key in determining the water required for drinking, cooking, bathing and sanitation.

The Republic of Ireland's Water Services Act 2017 creates an explicit process for collecting data to establish the details of household water consumption and a threshold above which households are to be charged for consumption. However, the Act is framed so that excessive water use can be charged, rather than that essential water consumption is free. The Water Services Act defines 'excessive' consumption as being 70% above average household water consumption, with additional allowances included for households with more than 4 occupants.[37]

3. Water infrastructure investments will be funded by a National Fund for investment (Articles 13 and 14).

[37] See Sections 8-12, Water Services Act 2017, available at: http://www.irishstatutebook.ie/eli/2017/act/29/enacted/en/html

The Italian state will allocate capital to finance water investments. If the debt in this fund is classified as public debt, there could be government pressures to limit investment so as to limit national debt. As noted in the sections above, the incentives to delay investment in an infrastructure sector may be heightened by investment delays having a limited impact on short-term performance.

4. Making regulation of the water sector the exclusive competence of the Ministry of the Environment (Article 8)

This would end the role of the current regulator, ARERA. This would eliminate the independence of regulatory oversight at the national level, something which can act as a commitment device to the pursuit of the objectives specified by the regulator. The proposal may lead to a wider range of broader political factors entering into the management of the water sector. Potentially there may be greater variability in the objectives set for the water sector through time as those in political control change over time.

The role of the Ministry of the Environment will be to regulate water use, determine tariff components and environmental protection including monitoring compliance with relevant environmental legislation. This compliance function will be facilitated through a "Water Resources Supervision Office" supported by a data collection Observatory (Article 8, paragraphs 5 and 6).

The planning of major infrastructure investments in the national interest will be the responsibility of a committee including representatives beyond the Ministry of the Environment, from the: (i) Ministry of Infrastructure and Transport, (ii) Ministry of Agricultural, Food and Forestry Policies, and (iii) Ministry of Economy and Finance (Article 8, paragraph 1).

5. Measures limiting the size of water utilities and management authorities

Regarding the delivery of services, the proposals require the area covered by one operating entity not to be larger than a province or a metropolitan city. Also, the draft law allows municipalities of up to 5,000 inhabitants "in the territory of mountain communities or unions of municipalities" to manage an integrated water service independently. Interestingly, in 2014, the Republic of Ireland introduced reforms in the opposite direction to these Italian proposals with responsibility of water services being taken away from local authorities and consolidated into a single public utility, Irish Water.

Furthermore, changes to the water sector's governance arrangements also increase the number of entities potentially implying decisions will be taken over smaller geographic areas. The proposal is that the present structure of 64 EGAs and 148 reclamation and irrigation consortia will be replaced by 7 district authorities and around 400 Basin/Sub-Basin Councils.

The precise consequences of these changes will likely depend on the allocation of decisions between the large district authorities and the smaller Basin/Sub-Basin Councils. However, there are two potential concerns with limiting the size of water operations and management: (i) economies of scale in water service provision will go unrealised thereby increasing the cost of water, and (ii) decision-making at the local level may not place sufficient weight on the impact on water resources and the environment beyond the local area.

Other Considerations

Regarding quality of service, the proposals do not appear to elaborate on the specific incentive mechanisms to achieve this, although, article 9, paragraph 3 states that the Ministry of the Environment will introduce a mechanism which aims to cover costs as well as improving efficiency and the quality of service. Article 6, paragraph 3b also indicates that guidelines on the state of infrastructure will take account of factors such as leaks.

Additionally, the proposals frequently refer to the principle of public participation in water governance, in particular Article 15. This could be viewed as either a per se objective or as tool that it is hoped will drive improved performance of the water sector. This element of the proposal might be viewed as increasing the uncertainty around the outcomes of the package. By encouraging public participation at the local level it opens up the potential for greater variation in the objectives pursued, and outcomes achieved, between different localities. The uncertainty might be viewed as covering: (i) the form of participation, (ii) whether all citizens share a high enthusiasm to participate, and (iii) the strength of control participatory mechanisms are able to exert over water utilities.

This report does not take a specific view on the overall package of these proposals. Indeed, with so many changes happening simultaneously it is relatively difficult to predict the package's full impact. Overall, it has sought to present evidence from other countries and international organisations, such as the OECD, that may be relevant to assessing the likely impact of the proposals. However, it is worth noting that many of the proposals detailed above point towards increased direct political involvement in water sector decision making and an increased reliance on funding from general taxation for the sector. Together these moves could be seen as raising the likelihood that funding for investments in the water sector will be constrained relative to the optimum level.

8. LESSONS FOR GOOD OPERATION UNDER PUBLIC AND PRIVATE OPERATION AND OWNERSHIP

Factors influencing the choice between public or private operation

The diversity of management systems present in the French system allows for a comparison of operating choices for water companies, under a common regulatory and legal framework. Ménard and Saussier (2000) explore the economic rationales for allocating water supply according to different structures. They note that French water systems are primarily public bureaus ("Régies") or delegated management ("gestion déleguée"). The latter systems are further divided between *leases,* in which the franchisee is responsible for the operation and maintenance of the system while local government is in charge of major investments and absorbing major financial risks, and concessions, in which the private operator is responsible for daily operation, maintenance and investments, as well as financial risks, under a long-term contract in which all assets revert to the local authority at the end of the contract.

A framework for the government's decision between providing a service itself or outsourcing is provided by Williamson (1999). Key factors for explaining selected mechanisms of governance include the extent of asset specificity[38] and the risk surrounding transactions (such as the risk of expropriation). Ménard and Saussier test these arguments using data for 2,109 French water systems serving more than 5000 people (representing 73% of the French population) from 1993-1995. They test for: (i) asset specificity making public operation more likely than concessions (asset specificity may be correlated with areas requiring more investment), (ii) higher uncertainty being mitigated by tighter control, again increasing the likelihood of having public bureaus as opposed to concessions, and (iii) that local authorities with limited budgets are more likely to outsource.

The asset specificity for water systems will generally be high, due to difficulty of moving fixed assets e.g. waterworks; but the extent of investment will be more variable, depending on the locally available options. In addition, the extent to which asset investments can be paid off quickly may depend on population size. Uncertainty may be a result of climate (i.e. the likelihood of rainfall and drought) and other factors that influence the volume of water needed. Ménard and Saussier (2000) find that these factors[39] are significant in explaining the extent to which public or private operations are chosen, with high asset specificity and high uncertainty more strongly associated with public operation, and high local authority financial constraints associated more strongly with private operation.

Chabrost et al. (2018) study in particular those municipalities in France that have changed from one form of governance to another. They find that, in addition to the asset specificity inherent in particular systems, like that found in Ménard and Saussier (2000) and Chong et al. (2015), two other factors are also important for explaining switching. One is political ideology, with political groups in power with an ideology more favourable to state or private operation more likely to switch the water system to the type of

[38] A more specific asset is one that is harder to be used for alternative uses beyond the one for which it has been constructed/purchased.
[39] Often grouped under the term 'transaction costs'.

organisation they believe is superior. The other is fiscal problems in a municipality which would be expected to increase the likelihood of changing to private operation.

General principles

A number of general principles for assessing the water sector emerge from this report's discussion:

1. Economic explanations suggest the appropriate form of water system governance depends to a large extent on specific local conditions, including geography, water source, raw water quality and climate.
2. That the water system has the characteristics of natural monopoly, involves significant externalities and is vital to public health implies political interest and public sector involvement is likely to be higher than in many other sectors of the economy.
3. Comparing the performance of different water system structures is made more challenging due to changes in industry structure/ownership occurring at the same time as changes in the weight given to different water system objectives.
4. Investment is critical, particularly with ageing water systems, with one group estimating that OECD countries need to invest $17 trillion in their water systems in the coming decades. Whatever operational structure is chosen, a way needs to be found to pay for necessary infrastructure or treatment upgrades, or to encourage new technological solutions. Local or national governments with constrained budgets may be less able to make necessary investments implying public ownership may lead to under-investment.
5. Public financing of investments is generally cheaper than private financing, but this benefit needs to be weighed against the risk that there will be restrictions on the quantity of investment available from public funds.
6. Private involvement in investment requires protection from expropriation. When expropriation is more likely, due to a regulatory structure that allows political intervention or one that may encourage pricing below long-term costs, investment will be reduced.
7. The private sector may tend to over-invest, if it receives a rate of return from investment that is excessive. As a result, regulatory oversight of private investment is important.
8. Regardless of whether assets are publicly or privately owned, having a strong economic regulator independent of both government and firms can act as a commitment device to ensure the necessary level of investment occurs.
9. That the water sector has characteristics associated with a natural monopoly and little potential for competition in the market, implies price regulation is required for privately operated water systems.
10. Overall, regardless of whether a water system is publicly or privately operated, a key determinant of success is the nature of regulation that oversees the system.

Considerations arising from proposed Italian reform

Based on the prior discussion, there are a number of points that are worth exploring further regarding the potential future water system in Italy. Here we provide a summary, as the full detail is presented earlier in the report.

1. Role of ARERA as an independent regulator: benefits for the water system

The frequency and role of independent regulators for water has been increasing in recent years, according to OECD data. While regulators are guided by the legislation that oversees their actions, which is politically determined, there are advantages from regulatory independence. These include having a workforce outside the direct line management of politicians that can express objective views and encourage appropriate policies for a sector with substantial economic and social impacts.

2. Investments: risks and options arising from the proposal

The relative role of government and private operators in encouraging investment remains an important consideration. Figure 10, in particular, shows capital expenditure per capita over time, indicating that Italy has been among the lowest investors in its water systems over the last years.

3. The EU and the reform

The implications of EU regulations for the reforms are worth further exploration, in particular the EU's Water Framework Directive which followed on from the Urban Waste Water Treatment Directive and the Drinking Water Directive. Italy has been exposed to penalties for its handling of water quality and environmental impacts in the past. For any reforms undertaken, it is worth assessing whether they may have negative or positive impacts, both in the short-term and the long-term, for Italian compliance with EU regulations. For example, Article 9 of the Water Framework Directive indicates that, if water pricing policies (e.g. limitations on water pricing for social objectives) limit incentives for efficient water use, it is necessary to ensure overall objectives of the Water Framework Directive are nevertheless achieved.[40]

4. Other elements that may warrant further consideration (e.g. providing water for free below a cap)

The OECD has consistently recommended against systems that create a zero or unrealistically low marginal cost for water, particularly in countries that experience water scarcity. Despite the fact that water can be expensive, particularly as a percentage of the budget for those who are less well off, facing a positive usage price is essential in order to deter waste. The financial incentive to conserve water is no longer present when the marginal price is zero. Consumption quantities therefore increase when unit prices are not present, which can raise difficulties for the long-term sustainability of the water supply. The appropriate structure of water system charging is consequently a delicate balancing act.

[40] See paragraph 4, Article 9, Directive 2000/60/EC, Official Journal of the European Communities, 22.12.2000

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