The Water Industry, Competition and Climate Change

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Introduction

1. The Context

The papers that follow discuss water industry supply issues and competition in a world in which climate change appears to be having significant effects on rainfall patterns and hence on the supply of raw water via rivers, lakes and underground acquifers. Although the water supply industry includes waste-water management and sewerage, the focus of the papers is primarily on water supply topics although the latter issues are also discussed in some papers, particularly Hughes et al[1].

In the past, economists have paid relatively little attention to the water supply industry – massively less than to telecoms, electricity or even railways. This has been for two main reasons:

(i) In water there has in the past been a relatively settled, 'natural' industry model based on local (e.g. municipal or regional) vertically integrated water supply companies of the type we currently see in France, Germany, Japan, the US and many other countries, including the UK. Outside England and Wales, these are frequently publicly owned. In addition (and perhaps relatedly) the rate of technical progress and innovation in the water industry has been much less than in telecoms or even the network energy industries.

(ii) In the past, the supply of raw water (in terms of rainfall, river flows, etc) has meant that an adequate supply of raw water has not been a substantial problem in most developed countries. This is certainly true for most of Europe and for much of North America, but not for the Western US states or Australia. This, however, is now coming under challenge and the predictions for the next 30-50 years suggest major problems with raw water supply in a number of countries as a result of even central estimate climate change impacts.

These settled positions are, though, now changing substantially and this has sparked a major revival in interest in the structure and regulation of the water industry by both economists and policy makers, including a serious consideration of the role of water trading, markets and competition.

[1] In Great Britain, the 10 main regional water supply companies provide waste water and sewerage services to their own customers and the customers of water-only companies. This is not the case in other countries e.g. Germany. In England and Wales, sewerage costs account for more than one-half of household customer bills.

1.1. A British Perspective on Water Industry Structure Regulation and Climate Change

In England and Wales (E&W), there were over 1,000 water undertakings in the mid-1950s. By the early 1970s, this had fallen to 198, of which 165 were publicly owned (64 by individual local authorities and 101 by joint boards from more than one local authority) and 33 were privately owned. There were also over 1,300 sewerage authorities in 1970[2]. However in 1973, the local authority owned part of the industry was consolidated into 9 regional water authorities providing water and sewerage authorities operating on an integrated river basin management basis. This consolidation was primarily to achieve economies of scale and scope. There are now 21 privately owned and operated E&W water companies, of which 10 are relatively large water and sewerage companies plus 11 smaller water-only companies. The question of whether to consolidate in this way is one of the issues currently under discussion in a number of countries including Germany and Japan. In Scotland, consolidation has gone further and there is one (publicly owned) water company – Scottish Water.

In E&W and some other countries, there is some degree of interconnection between the networks of different companies. However, the structure of the industry has remained one where over 90% of water supplies for customers comes from within-area water resources and only a very small part is from imported water. Of the imported water, 80% of bulk trade is of raw (untreated) water and this is dominated by a few large, long-standing contracts e.g. North Wales to Birmingham. In consequence, Ofwat (the E&W water regulator) faces the growing problem of how to continue and sustain its regular regulation of vertically integrated de facto monopolies Regulation – particularly the 5-yearly price cap regulatory resetting - has become a repeated game where the regulator suffers from severe information asymmetry problems. Other countries face similar issues e.g. France with regular recontracting of affermage and similar contracts.

In E&W, this has raised questions as to whether increased competition, retail and wholesale, might improve efficiency and productivity growth as well as introducing much greater transparency into the regulatory process. Ofwat have launched a consultation process on this topic. Scotland introduced retail competition after 2005 so that all non-household customers can choose their water retailer[3]. In addition, lessons from other utility industries, particularly natural gas and electricity, have raised the question as to whether the development of wholesale and retail competition in the water (and sewerage) industry might lead to more effective regulation, greater efficiency and lower prices to customers.

Although improving regulatory efficiency is an important issue, this would probably not be enough in its own right to raise water supply competition onto the political agenda. What has made the difference is the outlook for water supplies and the expected problems with supply under continued climate change. Hence, climate change issues - the second major consideration listed above - significantly bolsters the arguments for competition and trading in water.

In 1601, in Feste's song at the end of Twelfth Night, Shakespeare could write "For the rain, it raineth every day". This was an exaggeration for Britain even in the 17th century but is massively

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2 See Vickers and Yarrow (1988), Chapter 11.

3 In E&W, only industrial customers using more than 50 megalitres per year can choose their supplier – and very few who do qualify opt for alternative suppliers.

far from the truth today. In South-East England, 15% of water resource zones are already classified as seriously water stressed. By 2050, central climate change predictions suggest that average annual river flows could fall by 15% across E&W and summer river flows could fall by over 50% - especially in the South and East[4]. The South and East of England are already heavily dependent on underground water sources and problems with pollution and the sustainable recharge of these aquifers is growing. In contrast, water resources remain plentiful in the North and West of England and in Wales so that the marginal cost of additional supplies of raw water *currently* range from zero to over £1 per m^3 by region[5].

In addition, in terms of population and economic activity, the South East and East of England (including Greater London) are much the largest and fastest growing areas of the country. These regions now account for 40% of E&W population – and accounted for 56% of the *increase* in E&W population between 1971 and 2008. This trend is expected to continue over the next 20 years. The East of England is also a major arable crop production area, accounting for around one-quarter of total UK wheat production[6].

These water supply problems are by no means unique to Britain. Among developed countries, California and other Western US States as well as Australia, Israel and other countries have long experienced chronic water supply problems and these appear to be worsening. There are even newspaper reports that, as a result of climate change, high quality Rhone and other French wines are in danger of losing their 'terroir' characteristics (i.e. their unique identity and subtlety) – and hence the premium prices for the best vineyards.

1.2 Climate Change and Water Markets

Interestingly, growing water scarcity has led directly to the development of *water markets and water trading*. Thus far, most of the trade has been in abstraction rights[7]. In consequence, abstraction rights trading has grown considerably in recent years in Australia and the Western US States, with some contracts that can have a similar impact as annual water supply contracts. There is also trade via long-term contracts in bulk raw water both in those countries and in E&W. In addition, the development of abstraction markets and bulk water trading will facilitate effective retail competition and help transmit the appropriate price signals to reflect growing water shortages to both water companies and final consumers. A particular issue is the argument growth of water markets and trading can help establish prices that would indicate a *value of (raw) water*, including environmental costs.

The threat to water supplies from climate change has greatly increased interest by economists and others not just in abstraction trading but also in developing markets and trading in upstream as well as downstream water. This debate has taken off in recent years in the UK, particularly in England. Ofwat, the E&W water regulator, are investigating these ideas and the previous government established:

(i) the Cave Review to investigate competition and innovation in the water industry; and

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4 See Cave Review Final Report (2009), Chapter 2.
5 See Ofwat Working Paper, March 2010.
6 See ONS tables for regional population and farming statistics.
7 Water *extraction* rights in US terminology.

(ii) the Walker Review to review the charging for household water and sewerage services.

We will say more about the Cave Review below. However, at this point, we note that the Walker Review was very clear that household water affordability issues could only sensibly be addressed if there were improved methods – preferably market-based – to establish the full, future-looking value of (raw) water, net of environmental effects.[8]

2. The Papers

The papers in this Special Issue reflect discussions on the future of the water industry and on climate change, both in England and Wales and in other EU and OECD countries.

The first paper is by Martin Cave and Janet Wright. Martin Cave directed the Cave Review and Janet Wright was heavily involved in its work. Their paper provides a good introduction to the Review – and to this Special Issue. It raises all of the main issues and provides a short discussion and a summary of the main recommendations for England and Wales[9]. They (and the main Review) recommend: (i) introducing competition into retail water trade – moving steadily towards the Scottish model whereby all non-household consumers can choose their supplier; (ii) developing scarcity based pricing and trading in water abstraction and discharge arrangements. For upstream (wholesale) water, they recommend that the regulator adopt an economic purchasing obligation and perhaps move to a single buyer model rather then move to a wholesale market with bilateral trading in the foreseeable future.

The second paper is by Jon Stern. It was prepared in the context of the Cave Review and its main purpose is to establish what lessons can be drawn for E& W water from the restructuring and unbundling of the UK and EU network energy and telecoms industries. It places particular weight on the potential water supply outlook by region under current projections for the next 25 or more years. Like Cave and Wright, it strongly supports the introduction of (i) non-household retail competition abstraction trading and (ii) environmentally-based abstraction (and discharge) prices. However, based on energy sector experience, the paper is strongly critical of the use of single buyer(s) in upstream water; and, instead, argues for movement towards a wholesale market model with bilateral trade driven by highly differentiated scarcity-based abstraction prices. The paper recognizes that introducing this in the next few years as a national programme could be a major and potentially destabilizing exercise. Consequently, the paper concludes with advocating some experiments with upstream trading based on abstraction rights trade and pricing, particularly in the water-scarce South and South-East of England.

The third paper is by Fernando Dominguez. It explores the possibility and potential of virtual water operators in the E&W context. Virtual water operators are companies that operate in the market but do not *own* any water infrastructure (treatment plants, network pipes, etc) or abstraction rights. Instead, they purchase water from incumbent water operators who own the abstraction rights - e.g. on terms set by the regulator and possibly with compulsion on the incumbents. The paper outlines the necessary institutional arrangements - including effective,

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8 Walker Review Final Report (2009). See Chapter 4.

9 The Welsh Assembly Government rejected the recommendations so that the competition agenda is only currently relevant for England.

regulator-set network - and storage - access and pricing arrangements. It then explores the theoretical possibilities, using a relatively simple game-theoretic model. The paper draws on experience with virtual operators in telecoms and energy (e.g. Virgin Mobile and virtual capacity auctions in electricity and gas) which allow competition to develop without necessarily unbundling the existing industry structure. Dominguez also argues that this approach would be another way to help establish an environmentally based value (and price) of raw water. This is another idea to help further upstream competition and introduce market-based signals into the allocation and use of scarce water.

The fourth paper is by Delphine François, Aad Correljé and John Groenwegen. Their paper considers environmental and water scarcity issues in the light of the European Union's 2009 Water Framework Directive (WFD). The WFD requires introduction of cost recovery for water, where the relevant costs include environmental and resource costs. The approach adopted in the WFD is the 'polluter-pays' principle, which is intended to transmit environmental costs though to final consumers. It is intended to encourage the use of economic and market instruments rather than impose "command-and–control". The authors discuss the (inevitable) conflict with affordability considerations, which is clearly important. They suggest that the use of efficiency appraisals by water regulatory bodies may help reconcile the potential conflicts between environmental costs and incorporating them in water prices while making more of the environmental and other supply costs transparent to customers.

The fifth paper is by Gordon Hughes, Paul Chinowsky and Ken Strzepek. Their paper discusses the impact of climate change on water infrastructure costs. These infrastructure costs are primarily water (and waste-water) treatment plus sewerage costs. They use a 'top-down' modeling approach to estimate adaptation costs based on aggregate national data. This is in contrast to most previous work on adaptation costs, which has used a 'bottom-up' approach based on aggregating micro-level studies of utilities and/or localities. The authors focus on two main issues: firstly, the degree to which extreme weather conditions will significantly influence the amount of water infrastructure that countries provide; and, secondly, the frequency and severity of extreme weather events consequent on climate change and the impact of this on the building and maintenance costs of water infrastructure, via the new standards adopted. The results from the modeling suggest that the costs of adaptation to climate change are surprisingly low for water infrastructure – on average, around 2% of total cumulated infrastructure investment across the OECD. These are much lower than those from previous 'bottom-up' estimates. In addition, the adaptation costs are clearly lower if a price-based economic approach is adopted rather than a purely engineering approach.

The sixth (and final) paper is by Sophia Ruester and Michael Zschille. Their paper is an empirical study of the impact of governance choice – public or private – on the price of water in Germany. This is a topic which has been addressed in a number of studies in the US, Europe and Africa. The expectation is that private governance will increase efficiency so that prices to customers will be lower with private operation/ownership. Germany has a very large number of water distribution companies – 6,500 serving 82 million customers, of which 6% are privately owned although rather more have a private organizational form (e.g. concessions, PPPs). The paper uses a sample of 765 of these water companies and has data for 2003 on the price paid by a representative household consuming $150m^3$ of water per year. Counter to the authors' expectations, the authors find that private operation and/or ownership (including PPPs) is associated with *higher* rather than lower prices, taking account of economies of scale, water

source, and other control factors. The authors recognize that their econometric results depend on public utilities earning the same rate of return as private utilities and on some other considerations, but the result is robust in their modeling variants. The paper concludes by discussing how and why their main result may arise.

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