Consumer Choice in the Water Sector

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Overview

Choice in the water sector has traditionally been driven by government and providers rather than by customers. This note examines the issues which arise in considering customer choice (especially choice available to final consumers), the available evidence, and potential changes with alterations in the industry's structure. Here we identify and summarise the evidence in each area.

The paper first examines individual choice and then possibilities for collective choice. The latter will be particularly important if some form of negotiated settlement is pursued, since household consumers will need to have a 'legitimate voice'. The implications for both individual and collective choice of market opening and of potential developments in the industry are assessed, using the three scenarios identified by Ofwat. The implications for the principles of better regulation are addressed.

Some suggestions for Opportunities for further research/information are provided at the ends of sections of the overview and at the end of the paper

A. Individual Choice

1. Metering
2. Tariff choice
3. Consumption
4. Provider

Lessons from other industries

A. Individual choice

1. Metering

The UK's position is unusual in distributing large amounts of unmeasured water among households, with optional metering for most consumers, which leaves a gradually shrinking base of unmeasured consumers. Studies have suggested that the consumption effect of changing to a meter is to reduce demand by around 10 to 12%, but since few models of the decision to be metered are published, it is difficult to separate the consumption effect from the decision to be metered in the first instance. While Simon Cowan has modelled this in theoretical terms, empirical evidence is sparse. Early analysis reported here for the first time indicates that, as anticipated, 'optants' are those who are likely to have most to benefit because they have high rateable value houses (which determines unmeasured charged) and low consumption (which determines measured charges). Extrapolation of past decisions to be metered and the effect on consumption are complicated by the fact that the pioneers in opting for metering are likely to have most to gain, so those who follow are not necessarily similar, and that those who are later compulsorily metered are likely to be a different group again, whether because they have less incentive to choose metering or because they are difficult to meter. This raises distributional questions, and the need to identify the demographic and income characteristics of those who remain unmeasured, particularly as their bills will increase as more relatively low cost consumers opt for metering. Some implications for consumer choice are considered.

Unmeasured consumers exercise less direct choice through consumption, though arguably this is itself a choice since they have the option to be metered, while most of those who are metered do not have this choice, even if it was once available to them. Unmeasured consumers are unable to control their bills/respond to price changes through changing their demand, and this may be a particular issue for equity/support see discussion under section D.

Consumers' current decisions on metering depend on the policy of government, regulator and individual companies. For example the request by Southern Water to introduce near universal metering, and the agreement of the regulator, constrains the choice of consumers in that area more than in others. The provision of information to consumers is also crucial in determining how much advantage they take of voluntary opportunities. The insights of more recent findings on consumer choice and the influence of information framing on responses can help elicit appropriate responses.

2. Tariff choice

Metered consumers often have a choice of tariff, though it is not clear how much they are aware of this choice. The metering/tariff/consumption choices are clearly closely related and require information and understanding about the alternatives available.

There are two competing theories about consumer choice of tariff structure where demand is not fully predictable. Consumers may welcome the greater control offered by tariffs which are heavily consumption related, but if they are risk averse they may prefer the greater certainty offered by tariffs with a high fixed charge (unmeasured supply providing the most extreme example). It is not clear how far competition between suppliers will lead to purely cost reflective tariff structures, and this may be an area where the regulator has to make tariff choices on behalf of consumers.

Just as the choice of tariff is nested in the choice to be metered, so the choice of tariff is intimately intertwined with consumption decisions.

3. Consumption

While there are several studies of the responsiveness of water demand to changes in price and income, few of these are based on UK data, for obvious reasons, and the estimates of price and income elasticity vary over an enormous range, including figures which are difficult to reconcile with 'reasonable' expectations. Inherent in the consumption decision may be decisions about choice of tariff, and with multi block tariffs there are conceptual issues about the appropriate price against which to measure response. Work from both the water and electricity industries indicates that consumers' estimates of their own consumption is biased towards the average consumption level, so that users of small amounts overestimate their consumption, and of large amounts underestimate theirs. Perhaps related to this is that consumers' main response is to the total bill size rather than the individual elements, raising questions over whether average or marginal price is the relevant determinant of consumption. Summaries and 'meta analyses' suggest a mean figure of -0.4 to -0.5 for price elasticity and 0.3 to 0.4 for income elasticity, but there are enormous variations around these. The only analysis which includes a UK estimate for price elasticity (considerably lower) raises serious methodological concerns.

Consumer understanding of consumption, price and information provided on bills is low in the UK. The main relevance of bills to unmeasured consumers is to determine whether or not they should switch to meters. For metered consumers there is a more direct relationship between payment and consumption. Ofgem has been conducting research on consumer understanding of bills and has introduced some new license conditions for improvements. Though these are mostly focused on the choice of supplier (not available to households for water) the information gathered and the study of the effects of changes to be introduced in 2010 will have some relevance to the water sector.

Empirical investigation can confirm how far consumers are 'rational' in their acquisition, processing and response to information relevant to their water decisions. Insights from

behavioural economics might also be helpful in determining how far such actions are subject to influence in directions deemed desirable by company or regulator..

Options to explore choice in metering, tariff choice and consumption

Any opportunities to use data from companies, particularly where there is information on consumption before consumers are 'aware' of having their consumption measured, would lead to better estimates to inform policy making, and to prepare for the effects of increased metering, whether accelerated or not. The experiences of Folkestone and Dover Water company and Southern Water in introducing near universal metering offer excellent opportunities to study the effect of metering on different groups, and assess the effect of accelerated metering on those who do not choose to be metered. Trials planned by Scottish Water are also likely to provide information relevant to England and Wales.
Companies are likely to have data which would enable some of these questions to be addressed, whether from metering trials or more aggregate data. Some companies have undertaken their own analyses and made data available to others, but it would be good to explore possibilities for further collection and exploitation of such data in a way which would benefit companies as well as policy makers. One issue for further exploration is the responsiveness to price for water and sewerage services separately.

Ofwat could explore with Ofgem the common factors in consumer (mis)understanding of bills and the implications for consumption decision,s and identify appropriate investigation methods. Added relevance is provided by the implications for energy consumption of increased water consumption. Such joint investigation should enhance the understanding of 'behavioural' elements. Analysis of data provided in the CCWater annual tracking survey would provide a good basis for designing further work.

4. Provider

Individual households do not have a choice of water provider in the UK. There is some choice for developers who are close to the boundary of water companies. Choice for individuals is not seen as a priority, or necessarily desirable, in the foreseeable future. There is choice for users of large amounts of water, but this has been comparatively little exercised in changing supplier, either in England and Wales, or in Scotland, where choice has been available for a wider range of consumers over a longer period. However there is evidence that in all three countries the threat of moving to another supplier has enabled individual customers to obtain improved terms from the incumbent.

This lack of choice has implications for how decisions are made about quality and price, reflecting those which Ofwat has made in price determinations. These are discussed further in section B below.

5. Lessons from other markets

Some of the lessons from energy market opening (both small business and residential) might be relevant to small businesses who are being given choice for the first time in the UK. Ofwat should be aware of the incentives provided by partial market opening, and particularly how these may be exacerbated by the price cap (see C below).

B. Collective Choice

Given the limited choice available to individual consumers, some decisions will need to be made for them collectively. Some are inevitable because of the monopoly nature of the provision, and are common in network industries. For example, the trade off between cost and reliability of supply (in electricity risk of power failure, in water risk of sewer flooding) are inevitably 'common' among a group of households and so not amenable to individual choice. In these areas some choice about trade off between costs and benefits needs to be made on behalf of the group affected.

In other areas, such as retailing, individual choice is not intrinsically impossible, but is not likely to be available to households in the foreseeable future. The usual market solution available to individuals to change to another supplier, who may offer them possibilities more attuned to their own priorities (for example over frequency of billing), is not available. Similar issues arise as for the monopoly elements. In both cases a collective decision needs to be made, and has been exercised by Ofwat. Special attention may need to be paid to consumers with unmeasured demand if it is thought that price increases will pose particular problems for them which they cannot control through changing consumption.

The Consumer Council for Water and the companies have undertaken a number of surveys to try to assess how satisfied consumers have been with such trade offs as part of the information provided to Ofwat for PR09. These provide information on consumer priorities across a number of areas. The deliberative research in particular sought to identify consumers' priorities and willingness to pay, but was constrained by very low overall acceptability of price increases. A number of contingent valuation surveys on environmental benefits have been undertaken, but comparatively few studies of the trade off between private benefits to an individual consumer and costs.

The main issues around collective choice are (i) how to assess consumers' preferences, given the well known difficulties of assessing willingness to pay and willingness to accept; (ii) how to aggregate the different valuations, given disparity both in consumers' priorities and how they value them; and (iii) how to balance the interests of different 'stakeholders' including companies, where such issues cannot be left to the market.

The Consumer Council for Water has played an active role in collecting information and has a good understanding of the process and the limitations. Ofwat has acted as 'honest broker' in confronting consumers with companies' plans and their implications. How far companies can themselves be left to mediate in this trade off depends very much on the

context in which they are operating. If as part of a negotiated settlement, in which consumers' interests are (somehow) represented by a third party such as CCWater, there are not obvious incentives for them to misrepresent or distort consumers' views, since this would prejudice an appropriate settlement. But if they continue to be regulated under an implicit rate of return process (even if they are negotiating under the shadow of such a 'backup' arrangement) there will be incentives to provide gold plating and higher quality and price (and profits) than would be socially optimal. This is exacerbated by the current sequence of decision making where the environmental regulator determines standards first, and the economic regulator is required to finance that level of quality.

How much information is already available from the various surveys undertaken prior to PR09? Does Ofwat/CCWater have access to the raw data and could this be analysed for a first attempt at estimating some of the quality/price trade offs?

Who should make the decisions about which consumers' interests should be collectively represented?

What are the intrinsic biases which the system of regulation introduces to companies in the way they respond to consumer preferences (however expressed) and how can these be allowed for?

C. Market opening

1. The three scenarios and their implications for customer choice

The discussion above has been written in the context of 'structure 1', the status quo, in which there remains substantial vertical integration. Many issues for household consumer choice are little changed by consideration of the different structures, since all scenarios assume continued monopoly retail provision. Indeed unless consumers contract separately for the various upstream services, exercise of their choice is likely to be little affected. However the way in which the collective choice is exercised within the industry will differ, in that negotiations on behalf of consumers will likely be held with different entities within the water industry, which will enhance the 'buyer power' of the consumer voice.

The merger regime is changed in structures 2 and 3, with the implication that there will be more freedom of market structure. Since the proposal is that the 'regular' merger regime applies, the extent of mergers will depend on how far they are perceived as likely to lead to a substantial lessening of competition by the competition authorities if the merger regime remains unchanged. If a public interest test is introduced for water mergers (at infrastructure or other level) it is unclear that there will be more structural freedom than under the present regime.

Experience from the energy sector, where companies were split at privatisation, is that there has been a considerable move to (re) consolidation wherever the legislation allows,

raising some (unresolved) concerns about joint dominance between (in energy) six large actors.

2. Implications for price caps

In one respect, extending choice to more customers may have an adverse effect on others (primarily residential consumers) who do not have a choice, even if they remain protected by price caps, and these will be exacerbated if the charges remain within the same price cap. Any company supplying a regulated and competitive sector has an incentive to maximise the share of costs within the regulated sector. This effect is clear from the relative changes in prices during the phased opening of energy markets in the nineteen nineties. The effect is exaggerated if the competitive and regulated prices are within the same price cap, which poses some difficult choices for when to remove the cap from markets which are being opened to competition, or whether to have separate price caps for the different sectors.

D. Better Regulation Principles

In considering the implications for consumer choice in each of the three scenarios in the light of the better regulation principles, care must be taken over the 'counterfactual'. Consumer choice in 'regular' markets is generally considered not to be regulated, but choice itself can impose costs on consumers, as the behavioural economics literature emphasises. These can broadly be divided into 'psychic' costs, such as the anxiety and time taken to make a decision; and 'material' costs, where the choice allows a decision which is not in the best economic interests of the consumer (taking account of the consumer's preferences). So in assessing the role of consumer choice in different structures it is important not to assume that the alternative is perfect costless consumer decisions. Some consumers do not want more choice, and there may be particular reluctance or anxiety about exercising it amongst special vulnerable groups, including perhaps the elderly. One reaction to being given more choice may be a refusal to exercise it which could bestow additional market power on companies.

1. Proportionality

Assessing consumer preferences is difficult and expensive, and there are benefits in leaving choices to individuals where possible (notwithstanding the paragraph above). The decision not to introduce retail competition for households in the foreseeable future partly recognises the difficulty of introducing choice between providers, as well as difficulties on the supply side.

2. Accountability

Where consumers are able to make choices, for example about the amount of consumption, no separate accountability is generally required. Any process of assessing, aggregating and applying consumer preferences can have enormous implications for outcomes, particularly bills, and needs to be discussed with stakeholders and determined

by an independent body such as the regulator. This is particularly important in light of the inherent incentives of companies to interpret consumer preferences in particular ways, especially when under regulatory constraint.

3. Consistency

Consumer choices may themselves not be mutually consistent on an individual basis, which poses an additional challenge for those who are trying to represent the choices and preferences of a group. Consumer preferences are almost inevitably mutually contradictory, and the weights given to different groups is crucial here. From the surveys of consumers it seems that more weight might be given in decisions (but not necessarily in representing consumer choices) to the needs of vulnerable consumers.

4. Transparency

There should be no difficulty in devising a system for choice which is clear to all, both where individual and collective choice is concerned.

5. Targeting

There may be difficulties in combining 'consumer sovereignty' with other regulatory objectives, reflecting Ofwat's own statutory responsibilities to protect the interests of consumers, and take particular account of the needs of certain types of households. Ofwat might want to distinguish two concerns here: a specific concern for individual households who might find it difficult to meet their water bills; and concern for groups of vulnerable consumers who, on average, might be disadvantaged by changes in the industry, for example by being part of the 'rump' unmeasured group for which prices rise more rapidly than for others. Additional help might be required to encourage them to exercise choice which will lead them to make decisions in their own best interests, particularly where failure to do so reflects lack of information or understanding. If hardship occurs for other reasons, different interventions might be necessary.

Similar issues might arise if the different scenarios unwind cross subsidies which are currently reflected in charges. While these will be economically more efficient in giving better signals to consumers, there may be quite serious distributional effects, particularly in the short run.

Consumer Choice in the Water Sector

Introduction

One of the assumptions of competitive markets is that consumers are able to exercise choice in a way which optimises their own well being. More recently this has been challenged by 'behavioural economics' which questions consumers' ability to choose the best outcome for themselves, either because of difficulty in processing all the available information, or because of bias in the decision making process itself. Within this area there is a distinction between 'bounded rationality' where consumers may not be able to achieve the optimum outcome, but for quite rational reasons of minimising the decision burden may choose a 'compromise'; and more pure 'behavioural' issues where consumers may choose sub optimally, even allowing for the cost of gathering information, because of pure bias[1]. A common example is 'hyperbolic discounting' where consumers value present benefits very much more highly than future gains, and make decisions which are inconsistent both over time and with their own underlying preferences.

The emergence and discussion of such issues indicate that consumers may sometimes benefit from having their choices curbed, even when such choices are available. They are relevant to the water sector, where individual choice is often unavailable, because similar problems may arise in trying to elicit individual preferences through non market mechanisms. But where choice is not available, the regulator faces other challenges in taking account of consumer preferences in its decisions, particularly given its primary duty to protect the interests of consumers. Thus there may be challenges arising both from the supply side where there are monopolies and/or consumers need to make some 'common' choice (for example for local solutions to the reliability of supply/quality/price trade off); and from the demand side because of limits to consumers' ability to choose what is in their own individual or collective interests.

This discussion discusses different aspects of individual choice at both household and firm level; in the following section the issues of collective choice are discussed. Then how market opening would affect each of these aspects is addressed. We then assess the regulator's role in mediating and/or mimicking the preferences of consumers and customers, and how this might differ for different stages of market opening. Some evidence from energy markets is then presented, followed by questions for policy and research.

[1] For a review of these issues, see 'Activating Consumers' by Luke Garrod, Morten Hviid, Graham Loomes, and Catherine Waddams, a report for the Office of Fair Trading, 2008

Individual Choice

1. Metering

Differences in levels of meter penetration across different regions can affect consumer choice on a number of levels. These relate to reduced choice (point 1.1 and 1.2) and the potential for enhanced choice (points 1.2 to 1.5). These are discussed below in turn.

1.1 Reduced choice through unwanted metering

Consumers face reduced choice if they are charged on a metered basis but would rather not be. This might arise for several reasons. Firstly, a consumer might live in a water scarce area with compulsory metering. This is currently only applicable to Folkestone and Dover Water, but consumers in Southern Water which has been designated an area of 'severe water stress' and is adopting (near) universal metering will face similar issues. Alternatively, a consumer might move into a property where a meter has been requested by a previous occupant, or which has been installed under the change of occupancy provisions for water companies. In addition, consumers may be metered at their present address as a result of the provisions for companies to meter households with high levels of non-essential use (swimming pools, sprinklers etc.).

Differences in companies' approaches to metering have affected the level of consumer metering choice across the country. For example, consumers in Folkestone and Dover's service area may face reduced metering choice as they are more likely (74% meter penetration) to move into an already-metered property in comparison to consumers in the Portsmouth Water service area (15% meter penetration).

1.2 The effect of company policies on the metering choice

In contrast to unwanted metering, differences in companies' meter promotion policies can also affect levels of consumer choice with respect to meter uptake. For example, a company like Anglian Water which has an active policy of metering might make more effort to promote metering to consumers. This could be through the use of additional mailings, information on its website, prompts from customer representatives when dealing with other customer queries and emphasis on the ability of consumers to switch back to unmetered charges within one year of installation.

The accuracy of information provided to consumers can also affect consumer choice by encouraging or discouraging the uptake of metering. For example, interactive web-pages which advise customers as to whether they are likely to save money by changing to metering can heavily influence consumer decisions.[2]

[2] It was the experience of one of the authors of this report that the questionnaire on water consumption/meter uptake provided on a major WaSCs website was extremely inaccurate. This would have discouraged the uptake of a meter had the author not been able to utilise her own consumption information. As a result of uptake (and no change in water-using habits) the metered bill was one third of the unmetered bill. This provision of inaccurate advice prompts questions about whether the WaSC concerned faced incentives to discourage meter uptake.

1.3 Consumer control over metered consumption

Metered billing enhances consumer choice by providing the consumer with greater control over their bill compared with (no control) under unmetered billing. While standing and volumetric charges are clearly beyond consumers' control, metered billing provides the consumer with information on their consumption and the opportunity to reduce their bill by reducing consumption. This choice may be particularly valuable to low income households or households more broadly that face affordability constraints. There is evidence in the international water demand modeling literature which suggests that low income households are more price responsive than high income households[3]. While equity, hygiene and health concerns may be associated with these findings, they suggest that metering increases consumer choice for low income households to control their water bills.

1.4 Consumer empowerment in achieving a supply-demand balance (welfare-loss minimization)

More broadly, metering can enhance choice by empowering consumers to choose how to achieve the demand reductions that might be necessary as resources become increasingly constrained. Alternative policies for achieving a supply-demand balance include restrictions, installation of water efficient devices and supply enhancement. Price-based demand management policies (changes in the level of water price and charging structure reform) minimize welfare loss by enabling consumers to alter their water consumption in accordance with the strength of their preferences. Other policies restrict individual choice and impose larger welfare losses on society.

Equally, if price based demand management policies do not result in sufficient demand reductions to achieve a supply-demand balance, this indicates that there is sufficient strength of demand to support supply enhancements and the costs associated with these – i.e. it facilitates consumers signaling their willingness to pay for these services. Unmetered billing does not provide the opportunity for consumers to signal their willingness to pay for supply enhancement and imposes the costs of expansion on all consumers, rather than those who are willing to pay for it.

1.5 What do we know about choosing to be metered and the likely effect on consumption/other decisions?

The UK is unusual in its use of an optional metering regime. Reviews of the international evidence base on the metering effect have not highlighted the existence of optional regimes in use in other countries. The choice of meter installation in other countries is therefore a policy choice rather than a consumer choice.

The uniqueness of the UK significantly limits the evidence base with respect to optional metering as comparisons with other countries cannot be made. One exception is a

[3] Forthcoming work by Kerry Clayton

hypothetical (contingent valuation) discussion of optional metering, by Vossler, Espey and Shaw[4]. Indeed, the UK evidence on the effect of metering itself has not adequately addressed the optant regime issue. This is problematic because analysis of metering effects in the UK is based on a biased sample (that is, of households who face incentives to adopt a meter). Therefore, the domain of application of UK metering evidence has to be restricted to the effects of optant metering – it cannot be projected onto households who are metered on change of occupancy or compulsorily metered as their demand response might be different from optant households. This limitation is rarely recognised in the existing literature.

A theoretical discussion of the UK's optional metering regime has been undertaken by Cowan and explores the issue of optional metering in full information and asymmetric information contexts.[5] He concludes that "The current policy in England and Wales of requiring privatized water companies to offer free meters was … found to have potential distortions, and … requiring the water company to provide free meters entails a distortion in its tariff structure to recover the costs. Progress in the design of policy for selective metering will require detailed econometric analysis of the demand for water of both metered and unmetered households". This detailed econometric analysis remains a gap in research. However, several consumption monitors of major WaSCs generate the data necessary to address this question.

No papers in the academic literature discuss the determinants of a household's decision to adopt a meter. However, the following 'thought experiment' is proposed. A rational household's decision to adopt a meter should be based on the expected difference between their existing unmetered bill and their hypothetical metered bill. The absence of consumption information can make this comparison difficult. Equally, even if previous consumption information is available, a consumer must be able to find the appropriate charging schedule on their water company's website and calculate their metered bill. Whether they invest the time in doing so is likely to be affected by their expectation of potential savings from adopting a meter. Consumers' might therefore adopt a 'heuristic' approach to the meter adoption decision by comparing key determinants of metered and unmetered bills.

Metered bills will be driven by consumption levels which in turn are highly influenced by occupancy levels, outdoor water use and general attitudes to water use. Unmetered bills are driven by the rateable value of the property concerned. If a consumer is aware of the unmetered charging basis, those in higher rateable value properties are more likely to gain financially from adopting a meter, ceteris paribus. However, alongside this a household may desire an 'option value' to be able to use more water now or in the future without facing marginal charges for this (for example, difficulties in controlling the water consumption of family members, guests staying for extended periods, anticipation of

[4] Vossler, C., J. Espey, et al. (1998). "Trick or treat? An offer to obtain metered water." JAWRA Journal of the American Water Resources Association **34**(5): 1213-1220.

[5] Cowan, S. (2010). "The welfare economics of optional water metering." The Economic Journal **120**(545): 800-815

starting a family or unexpectedly high outdoor water consumption). Households will also be influenced by anecdotes on other households' experiences of meter installation – whether others experienced lower bills or higher bills. Lastly, households may be risk averse with respect to the metering decision and may place a high value on knowing what their water charges are, even if these are higher than they would be under a meter. These various drivers are summarized below.

Factors affecting the decision to adopt a meter:

- Expected difference between unmetered and metered bill
- Existence of consumption information
- Whether the consumer is aware that they can return to unmetered billing within a year of meter installation
- Awareness of the unmetered charging basis (rateable value)
- Rateable value of the property
- Perception of level of household water consumption
- 'Option values'
- Anecdotes of other households metering decisions
- Risk aversion and certainty value

There is limited evidence on the factors listed above. However, some provisional analysis of a WoC's consumption monitor compared the bill savings of optional and 'compulsorily' (change of occupancy) metered households.[6] This found that the mean saving of optant households was £115 per annum whereas compulsorily metered households saved £45 per annum on average. These savings reflect differences in consumption; optant households have a mean consumption of 76 m^3 per annum while compulsory households have a mean of 115 m^3 per annum. This is consistent with the expectation discussed above (albeit that it is households' perceptions of their consumption that influence their metering decision if they do not have pre-existing consumption information). As expected, rateable values between these groups also differ. Optant households had a mean rateable value of £200 in comparison to £171 for compulsorily metered households, consistent with the expectation that optant households have higher rateable value properties, ceteris paribus. All of these differences were statistically significant.

Much of the provisional evidence cited here is descriptive in nature. Ideally, further work is required to model the meter adoption decision using logistic regression.

2. Choice of Tariff

Metered consumers often have a choice of tariff, though it is not clear how much they are aware of this choice or, when they have made it, which choice they have made. The metering/tariff/consumption choices are of course closely related and require information and understanding about the alternatives available.

[6] Clayton, work in progress

Literature from other countries and industries suggest two opposing factors in choosing between different tariffs. One is based on risk aversion in a market where consumers cannot fully predict (or control) their own demand because of external factors such as weather. While water consumption is both less sensitive to such influences than energy, and easier to control, this element is present, for example for gardeners whose needs will depend on rainfall. This factor would attract risk averse customers to a high fixed charge/low volumetric charge tariff. There is evidence from the telephony sector that consumers do indeed prefer predictability in their bills,[7] even though there is more direct control over telephone bills than over water use. Interestingly much of the evidence on telephony is from the US, where those who receive telephone calls generally pay the costs of doing so – an area where there is clearly much less control than over outgoing calls. Those who use hose pipes are often not permitted to remain on an unmeasured tariff (the ultimate 'fixed bill' for the risk averse), and while this prohibition is likely to be motivated mostly by concerns for the incentives provided by a zero marginal cost tariff, it also shifts the uncertainty of costs provoked by an unpredictable climate onto the consumer rather than the company (which of course still has to make provision for potential peak conditions, but knows that the costs will be met predominantly by the consumers whose demand will determine the additional capacity required).

A contradictory element in terms of tariff choice is that consumers may seek greater control over their bills, which would encourage them to choose low fixed cost, high volume related tariffs if they feel they have a reasonable amount of control over their consumption. This may be particularly relevant to consumers who have received unmeasured supplies in the past, particularly if there is some technical reason such as shared provision which prevents movement to a measured supply. Water consumers in Australia[8] showed a clear preference for higher volumetric charges and lower access charges, emphasising the importance of control overcoming any risk aversion which they may experience.

Just as the choice of tariff is nested in the choice to be metered, so the choice of tariff is intimately intertwined with consumption decisions.

[7] Miravete, E. J. (2003). "Choosing the wrong calling plan? Ignorance and learning." American Economic Review **93**(1): 297-310.

[8] Crase, L. and S. O'Keefe (2007). "Consumer preference for water billing structures: A choice modelling approach." Presented at AARES 51st Annual Conference

3. Consumption

3.1 Evidence on the Price and Income Elasticities of Water Demand

The majority of price and income elasticity estimates are contained in water demand modeling literature in economics journals. This literature has a long history, dating back to 1926[9]. The literature is vast – at least 250 studies have been reviewed for the most recent meta-analysis.[10].In this review, price elasticity estimates range from -7.47 to 3.5 and income elasticity estimates from -7.45 to 7.83. These ranges are clearly not consistent with a theoretical expectation of inelastic demand, constrained between -1 to 0 and 0 to 1 respectively[11]. Within this wide range 89% and 84% of price and income elasticity estimates fall within an inelastic range and 5% and 10% take on 'perverse' values (opposite to the theoretical expectation of the sign) respectively. Even within the inelastic range, differences of more than an order of magnitude exist, thwarting any useful application of elasticity estimates for policy purposes.

Within the literature there is substantial heterogeneity in terms of geographical coverage, data characteristics and the specification of demand. Estimations have been undertaken for over 41 countries including the United States,[12] Australia,[13] Cambodia,[14] Saudi Arabia,[15] Italy[16] and Portugal[17] among others. Despite this wide coverage no estimates of price and income elasticities exist for residential water demand in the UK. The paucity of UK evidence has been recognised in international reviews.[18]

The econometric methods used to generate elasticity estimates have varied widely from standard OLS[19] to instrumental variables,[20] generalised-least squares,[21] generalised

[9] Metcalf, L. (1926). "Effect of water rates and growth in population upon per capita consumption." Journal of the American Water Resources Association: 1-22.
[10] Clayton, forthcoming
[11] Assuming that water is a normal good rather than an inferior good.
[12] Olmstead, S., M. Hanemann, et al. (2007). "Water demand under alternative price structures." Journal of Environmental Economics and Management **54**(2): 181-198.
[13] Hoffmann, M., A. Worthington, et al. (2006). "Urban water demand with fixed volumetric charging in a large municipality: the case of Brisbane, Australia." Australian Journal of Agricultural and Resource Economics **50**(3): 347-359.
[14] Basani, M., J. Isham, et al. (2004). "Water demand and the welfare effects of connection: empirical evidence from Cambodia" Working Paper 0429, Department of Economics, Middlebury College, Vermont.
[15] Rizaiza, A. (1991). "Residential water use: a case study of the major cities of the Western Region of Saudi Arabia." Water Resources Research **27**(5).
[16] Mazzanti, M. and A. Montini (2006). "The determinants of residential water demand: empirical evidence for a panel of Italian municipalities." Applied Economics Letters **13**(2): 107-111.
[17] Martins, R. and A. Fortunato (2007). "Residential water demand under block rates - a Portuguese case study." Water Policy **9**(2): 217-230.
[18] Twort, A., D. Ratnayaka, et al. (2000). Water Supply, Arnold, London, 5th edn.; Todini, E., (2003) "A more realistic approach to the 'extended period simulation' of water distribution networks" in C. Maksimovic, D. Butler et al (eds.) Advances in Water Supply Management., Balkema, Rotterdam, 173-184.
[19] Gottlieb, M. (1963). "Urban domestic demand for water: a Kansas case study." Land Economics **39**: 204-210
[20] Nieswiadomy, M. and D. Molina (1991). "A note on price perception in water demand models." Land Economics **67**(3): 352-359.

method of moments,[22] probit,[23] logit[24] and cointegration.[25] The greater part of water demand models have been undertaken using revealed preference data, with a few studies using contingent valuation methods.[26] Studies using revealed preference data have used cross-sectional data,[27] time-series data,[28] pooled data[29] and panel data.[30] Both household[31] and aggregate[32] level data have been utilised.

Most water demand studies have estimated residential demand separately from industrial or agricultural demand, reflecting the structural differences in their nature. Therefore in addition to the body of literature on residential demand there are also related bodies of literature for agricultural[33] and industrial[34] demand[35]. Some papers undertake comparisons between different classes of user.[36] Within the residential demand literature, data limitations are often such that municipal or small commercial demand is included

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[21] Nauges, C. and A. Thomas (2000). "Privately operated water utilities, municipal price negotiation, and estimation of residential water demand: the case of France." Land Economics **76**(1): 68-85

[22] Garcia, S. and A. Reynaud (2004)."Estimating the benefits of efficient water pricing in France." Resource and Energy Economics **26**(1): 1-25.

[23] Carter, D. and J. Milon (2005) "Price knowledge in household demand for utility services." Land Economics **81**(2): 265-283

[24] Nieswiadomy, M. and S. Cobb (1993). "Impact of pricing structure selectivity on urban water demand " Contemporary Economic Policy **11**(3): 101-113.

[25] Martínez-Espiñeira, R. (2007). "An estimation of residential water demand using co-integration and error correction techniques." Journal of Applied Economics **10**(1): 161-184.

[26] Thomas, J. and G. Syme (1988)."Estimating residential price elasticity of demand for water: a contingent valuation approach." Water Resources Research **24**(11): 1847-1857; Van Vuuren, D., H. Van Zyl, et al. (2004). "Payment strategies and price elasticity of demand for water for different income groups in three selected urban areas." Water Research Commission Report: 04, Zambia.

[27] Reynaud, A., S. Renzetti, et al. (2005). "Residential water demand with endogenous pricing: the Canadian case." Water Resources Research **41**(11): W11409

[28] Ipe, V. and S. Bhagwat (2002). "Chicago's water market: dynamics of demand, prices and scarcity rents." Applied Economics **34**(17): 2157-2163.

[29] Hewitt, J. and W. Hanemann (1995)."A discrete/continuous choice approach to residential water demand under block rate pricing." Land Economics **71**: 173-173

[30] Billings, R. (1982). "Specification of block rate price variables in demand models." Land Economics **58**(3): 386-394.

[31] Arbues, F. and I. Villanua (2006). "Potential for pricing policies in water resource management: Estimation of urban residential water demand in Zaragoza, Spain." Urban Studies **43**(13): 2421

[32] Martins, R. and A. Fortunato (2007). "Residential water demand under block rates - a Portuguese case study." Water Policy **9**(2): 217-230.

[33] Wheeler, S., H. Bjornlund, et al. (2008). "Price elasticity of water allocations demand in the Goulburn-Murray Irrigation District." Australian Journal of Agricultural and Resource Economics **52**(1): 37-55.

[34] Renzetti, S. (1992)."Estimating the structure of industrial water demands: the case of Canadian manufacturing." Land Economics **68**: 396-396.

[35] For a review of industrial demand studies see de Gispert, C. (2004). "The economic analysis of industrial water demand: a review." Environment and Planning C: Government and Policy **22**(1): 15-30.
For a review of irrigation demand studies see Scheierling, S., J. Loomis, et al. (2006). "Irrigation water demand: A meta-analysis of price elasticities." Water Resources Research **42**(1): W01411.

[36] Turnovsky, S. J. (1969). "The demand for water: some empirical evidence on consumers' response to a commodity uncertain in supply." Water Resources Research **5**(2): 350-361; Schneider, M. and E. Whitlatch (1991)."User-specific water demand elasticities." Journal of Water Resources Planning and Management **117**(1): 52-73; Lahlou, M. and D. Colyer (2000). "Water conservation in Casablanca, Morocco." Journal of the American Water Resources Association **36**(5): 1003-1012.

alongside residential demand[37]. The determinants of such demand are considered to be sufficiently structurally similar for this data pooling. Initially water demand studies were undertaken for developed countries but in more recent years a growing number of studies for developing countries have been presented.[38] An early contribution in this area is Katzman 1977.[39]

The discussion here focuses on residential price and income elasticities for water as the vast majority of the available literature focuses on this. The following sections discuss the unsuitability of evidence available for the UK, the international evidence available, and the results of new research into why there is so much disparity in the international evidence base.

3.2 *The UK Evidence Base*

Although a large number of countries are covered in the residential water demand modelling literature, only two studies relate to the UK[40] Of these neither contains a suitable price or income elasticity estimate, as discussed below.

Batchelor generates a wealth elasticity estimate for UK households based on the first metered area in the UK, Malvern (wealth elasticity estimates are often considered to be a sufficiently strong proxy for income elasticity estimates in the water demand literature, hence the consideration given to this research). Rateable value data is used to represent wealth. However, these wealth estimates derived by Batchelor are couched in models of water demand based on different household water-using technologies (garden sprinkling, bathroom showers, car washing, dishwashing and machine washing): a household owning none of these technologies is estimated as having an elasticity of 0.38 compared to a representative technology-ownership household's elasticity of 0.93. This technology-contingent wealth elasticity estimate arises due to the indirect consideration given to wealth elasticities in the paper, with the main focus being on the direct effects of technology on water demand. Batchelor notes that these estimates are high in comparison to US estimates and rationalises this as being due to different living standards placing households on different portions of the Engel curve for water.

This income elasticity estimate is not sufficiently strong to provide information on the responsiveness of UK households to income changes. The contingency of the estimates

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[37] Berry, D. and G. Bonem (1974). "Predicting the municipal demand for water." Water Resources Research **10**(6): 1239-1242.

[38] Rietveld, P., J. Rouwendal, et al. (1997). "Estimating water demand in urban Indonesia: a maximum likelihood approach to block rate pricing data." Tinbergen Institute Discussion Papers 97-072/3, Tinbergen Institute; Ayadi, M., J. Krishnakumar, et al. (2002). "A panel data analysis of residential water demand in presence of nonlinear progressive tariffs" Cahiers du Département d'Économétrie 2002.06, Université de Genève; Zhou, Y. and R. Tol (2005). "Water use in China's domestic, industrial and agricultural sectors: an empirical analysis." Working Paper FNU-67, Sustainability and Global Change Research Unit, Hamburg University.

[39] Katzman, M. (1977). "Income and price elasticities of demand for water in developing countries " Journal of the American Water Resources Association **13**(1): 47-55.

[40] Batchelor, R. (1975). "Household technology and the domestic demand for water." Land Economics **51**(3): 208-223

on specific combinations of technology ownership restricts the general applicability of the model, and significant changes in water-use technology have occurred since the 1970s. Furthermore, the estimates relate to an extremely small sample from one area of the UK and the apparent inconsistencies in the relative and absolute magnitudes of the estimated technology-based demand brings into question the robustness of the model from which the wealth estimates were obtained . In addition, the relatively high value of the estimates compared to US estimates from similar time periods calls for caution in the application of these estimates.

A more recent study by Baker and Toft[41] includes an estimate of the price elasticity of demand for UK households of -0.14. However the model associated with this price estimate raises questions about the suitability of the price coefficient for generating a price elasticity given that unmetered households, who have no price-response incentive, are included in the sample . A price response from unmetered households who face a zero marginal price has no economic interpretation. Furthermore, Baker and Toft do not refer to the estimated price coefficient as a price elasticity and do not discuss it in these terms.

Given the applicability issues associated with Batchelor's wealth elasticity and Baker and Toft's price variable, the current residential water demand literature does not provide suitable empirical evidence on price or income elasticities for the UK.

3.*3 The International Evidence Base*

The Clayton meta-database covers the period 1963 to 2008, using 148 studies containing price elasticity estimates and 112 studies containing income elasticity estimates (between which there is overlap as studies contain models in which both elasticities are estimated).[42] Overall 1308 price elasticity and 654 income elasticity estimates were collated. Two much smaller databases have been analysed by Espey 1998, Espey et al. 1997; Dalhuisen, Florax et al. 2003.[43]

[41] Baker**,** W**.** and Toft**,** S**. (**2003**)** A Framework Methodology for Estimating the Impact of Household Metering on Consumption, UKWIR, London.

[42] Appendix D contains a list of the studies used to compile the database.

[43] Espey, M. (1998). "Gasoline demand revisited: an international meta-analysis of elasticities." Energy Economics **20**(3): 273-295; Espey, M., J. Espey, et al. (1997). "Price elasticity of residential demand for water: a meta-analysis." Water Resources Research **33(6)**: 1369-1374; Dalhuisen, J., R. Florax, et al. (2003). "Price and income elasticities of residential water demand: a meta-analysis." Land Economics **79**(2): 292-308.

Table 1 – Descriptive Statistics for Clayton Residential Water Demand Price and Income Elasticity Estimate Database

	No. obs	Mean	Min	Max	Std. Dev.	Skew	Kurtosis
Price Elasticity	1308	-0.38	-7.47	3.5	0.53	-2.46	43.58
Income Elasticity	652	0.28	-7.45	7.83	0.69	1.46	58.65

Table 1 provides descriptive statistics on the elasticity estimates. The mean price elasticity is -0.38, with a standard deviation of 0.53. This is broadly similar to the mean price elasticity of -0.41 found in Dalhuisen et al.'s sample and -0.51 for Espey et al.'s sample. As noted earlier, the range around the central estimates is large – from -7.47 to 3.5. Of the 1308 price elasticity estimates, 204 of these are positive.

The mean income elasticity is 0.28, with a standard deviation of 0.69. This mean is notably lower than that of 0.43 found in Dalhuisen et al.'s database (Espey et al.'s database did not examine income elasticities). Again, the range of income elasticity estimates here is large – from -7.45 to 7.83. Of the 654 income elasticity estimates, 65 are negative, suggesting that water may be an inferior good.[44] The skewness and kurtosis coefficients indicate that neither the price nor income elasticity estimates follows a normal distribution.

3.4 Using meta-analysis to investigate the disparity in the international evidence base

The range of results described above presents a challenge for econometricians to explain, and for policymakers to use. The size of the literature makes it difficult to provide a conclusive qualitative assessment of these results. Quantitative answers can be sought using meta-analytic techniques. These techniques have typically been applied in health and social policy where evidence on the impact of different policies or treatments is plentiful but often divergent.[45] In this context, meta-analysis is used to explore whether the variation in elasticity estimates is related to characteristics of the data used for estimation, the estimation techniques used, how demand is specified in the original model, the geographical location of estimates and the temporal dimension of estimates (variation over time).

[44] For example, food preparation might be reduced if more meals are eaten out or fewer showers taken if gym or sports club membership results from an increase in income.

[45] Meta-analysis has also increasingly being utilised within the economic field covering areas such as multinational companies and productivity spillovers: Görg, H. and E. Strobl (2001). "Multinational companies and productivity spillovers: a meta-analysis." Economic Journal: 723-739., time-series minimum-wage studies: Card, D. and A. Krueger (1995). "Time-series minimum-wage studies: a meta-analysis." The American Economic Review: 238-243., gasoline demand: Espey, M. (1998). "Gasoline demand revisited: an international meta-analysis of elasticities." Energy Economics **20**(3): 273-295. and economic freedom and economic growth studies: Doucouliagos, C. (2005). "Publication bias in the economic freedom and economic growth literature." Journal of Economic Surveys **19**(3): 367-387..

The results of the two previous meta-analyses have not resolved these issues.[46] In addition, a number of serious methodological concerns about the robustness of the existing results have been raised.[47] Consequently, a new meta-analysis has been conducted to investigate the disparity in the international evidence base[48]. This meta-analysis is the first study to address the issues of publication bias, heteroskedasticity and dependence together.

Early results indicate that some data characteristic effects are found, many demand specification variables are significant, estimation choices do not have much effect and identification of 'genuine' effects are limited. Each of these is discussed in turn.

Some data characteristics are found to influence price elasticity estimates. For example, panel data estimates (in the original equation generating the price elasticity estimate) result in less elastic (reduced) price elasticity estimates. Estimates based on annual data rather than intra-annual data result in more inelastic estimates. The use of household level (rather than aggregate), time-series or pooled data do not appear to have statistically significant effects on estimates price elasticities.

Many of the variables relating to the specification of demand are significant. For example, the inclusion of income, rain and evapotranspiration are found to generate more elastic price estimates. In contrast, the inclusion of occupancy reduces elasticity estimates. The results are important for understanding why different demand specifications can generate seemingly disparate results. They also provide evidence as to which variables are important to include when modeling demand.

Estimation choices such as the functional form used, contingent valuation estimation and segment estimation are not identified as having any statistically significant effect on price elasticity estimates. One variable – the use of Instrumental Variables techniques – is found to result in more elastic price estimates.

There is limited identification of 'genuine' variables - that is variables which relate to potential differences in consumer behaviour (rather than modeling and data characteristics). For example no significant time trend, locational effects or seasonal effects are identified. There are effects of the long-run (more elastic), some non-residential inclusion effects (less elastic) and tariff structure effects. It is possible that once modeling characteristics have been controlled for, seasonal and geographical differences are less pronounced and cannot be identified as statistically significant.

In addition to these results, the new meta-model also tested for 'provenance' effects – that is, characteristics of who estimated elasticities and where they were published.

[46] Worthington, A. and M. Hoffman (2008)."An empirical survey of residential water demand modelling." Journal of Economic Surveys **22**(5): 842-871.

[47] These issues relate to publication bias, truncation bias, exclusion of outliers, heteroskedasticity and dependence between observations.

[48] Forthcoming work by Clayton

Unpublished estimates and those from female authors were not found to be statistically significantly different from published and male/mixed authorship respectively. However, a statistically significant coefficient on the number of authors (squared) and on publication in the Journal of Water Resources suggests that provenance effects do exist.

In a new meta-analysis for income elasticity estimates, a fixed effects model with weighting is the preferred model. Some data characteristic effects are found, limited effects of estimation choices, many demand specification effects and greater identification of 'genuine' variables.

With respect to data characteristics, stratification, household-level data, time-series data and annual data were not identified as having statistically significant effects on income elasticity estimates. However, the number of observations, use of panel data and pooled models were identified as significant. A higher number of observations was found to result in less elastic price estimates whereas pooled and panel data models result in more elastic price estimates. As for the price elasticity meta results, estimation variables do not seem to have much effect.

Many of the variables relating to specification of demand were identified as significant. Interestingly, many of these are different from the variables which had an effect on price estimates. For example, the use of lagged dependent and price variables were associated with more and less elastic income estimates respectively. Other significant variables include nominal specification, evapotranspiration, seasonal separation and the use of an average price variable.

With respect to provenance, the same the variables are significant as for the price elasticity meta results – both publication in the Journal of Water Resources and the number of authors (squared) had the effect of increasing estimated income elasticities.

The income elasticity meta analysis identified more 'genuine' variables than the price elasticity meta analysis. While no time trend, locational effects or increasing block tariff effects were identified there are effects (in either the fixed effects or random effects model) for developing country estimates, the level of Gross National Income in the country of estimation, non-residential inclusion, long-run, summer demand and decreasing block tariff variables. Why more 'genuine' variables are identified for income than for price requires further consideration.

Overall, the meta-results suggest that price and income elasticity estimates are affected by some data characteristics, less so by estimation choices and significantly by demand specification choices. Some 'genuine' differences relating to consumer behaviour are identified, with these variables having a greater influence on income estimates. Provenance effects are also identified. This suggests that policymakers ought to have a view to the influence of these characteristics when examining price and income elasticity estimates, particularly for the UK. Best practice estimation should test the sensitivity of results to various specifications.

3.5 Information provision to facilitate consumer choice

Customers who are metered can have their consumption choices enhanced by the provision of information which helps optimize their consumption choices. This may be through the use of 'smart-metering' but equally through the use of 'smart billing' such as that being implemented by Folkestone and Dover Water.

International evidence suggests that the provision of information can enhance price responsiveness by around a third.[49] By providing customers with information about their consumption over time, relative to other households, and the relative uses of different water-using activities consumer consumption choice might be facilitated. The provision of such information is not necessarily to reduce demand but to help consumers understand their consumption and optimize it with respect to their personal preferences.

New evidence suggests that UK consumers' knowledge of their water bills and consumption is very limited. In a recent survey[50] only 2.44% of respondents knew the price of water within a 10% band of accuracy, and only 13% knew it within a 25% band of accuracy. However, 85% knew the price of petrol within 10%. Consumers were more aware of their total bill than the price of water, with 52% perceived their water bill within a 20% band of accuracy. Interestingly, given a choice between two tariffs in operation, only 26% of respondents could correctly state which tariff they were on – this is less than the 50/50 probability consumers had of selecting the correct tariff and therefore suggests there may be some systematic bias in perceptions of the charging basis.

With respect to consumption, only 8.7% of respondents knew their daily litre consumption within 10%, despite this being clearly displayed on their bill. Quarterly cubic meter consumption was more accurately perceived with 23% of respondents knowing their consumption within a 10% band of accuracy.

Knowledge of consumption and charging basis was also very limited. Equally the ability of consumers to rank different water-using activities was limited. Of five activities (a toilet flush, load of washing, power shower, bath and lawn sprinkling) only 45% (58%) of consumers were unable to identify the least (most) water-using activity. These results suggest that there may be significant scope to enhance consumer choice through informational policies which draw on metered billing.

[49] Gaudin, S. (2006). "Effect of price information on residential water demand." Applied Economics **38**(4): 383-393.
[50] Reported in forthcoming work by Clayton

Lessons from Other Markets: energy

Choice

There is little evidence of choice of water provider in other countries. Households have had a choice of energy supplier in the UK for more than a decade, and around half of households have exercised such a choice. Households are offered a greater choice of tariffs as a result, but there is concern that vulnerable consumers may have benefited less than others. Similar concerns are shown in the 2008 Consumer Council for Water survey on competition among households. Because of the volatility of wholesale prices in energy it is difficult to assess the effect on price levels, and there are concerns that suppliers may retain both individual and joint dominance which enables them to raise prices above 'competitive' levels. Detailed analysis of individual household decisions shows that there is a strong externality across markets, i.e. that households who change supplier in one market are more likely to do so in another. The corollary of this is that protection of consumers in one market which removes such choice, may have detrimental effect in others. Consumers who are classified as 'vulnerable' (both according to statutory provisions in terms of special responsibility of regulators and by more wide ranging definitions) have switched provider a little less often than average. At least a fifth of all consumers seeking to save money by switching increased their energy bill, and this was more likely if consumers were in rented accommodation[51].

Choice has been introduced at various stages of the energy supply chain, which could be applied to water. Apart from the choice of retailer, there is competition in upstream generation/provision and storage, which could in principle be introduced to water and sewerage treatment and storage. In energy these choices are mediated through the choice of retailer, so if markets are not to be fully opened, some other mechanism would be necessary in water. Competition has also been introduced into use of transmission and distribution systems through auctioning the space available; and to connections. But the scale of likely rivalry (or its threat) in practice needs to be carefully considered if there is little competition in other aspects of the supply chain, to ensure that competitive pressures are real.

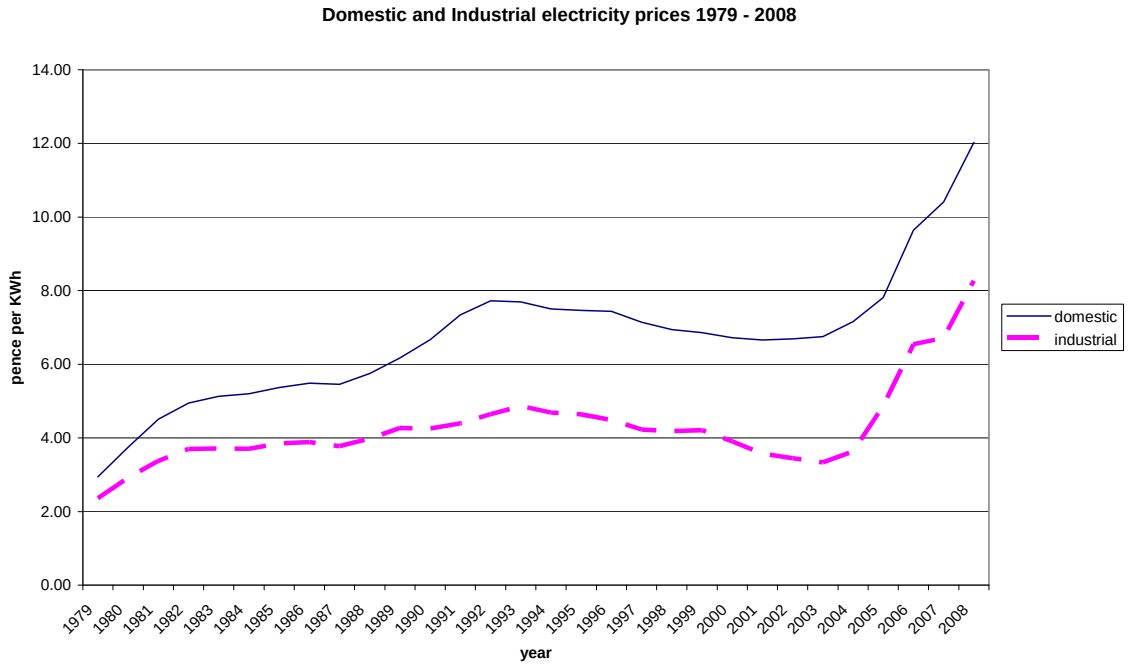
[51] Do Consumers Switch to the Best Supplier? by Chris M. Wilson and Catherine Waddams Price, forthcoming, Oxford Economic Papers, 2010

Relative prices during the partial opening of energy markets

Choice of provider in the electricity industry was introduced in phases, identified in advance in the privatisation acts, during the nineteen nineties. If the water sector is to do the same, the movement of relative prices in the industrial and residential sectors during partial opening is informative, as are the allocation of costs to monopoly distribution activities and competitive retail processes. A supplier who faces competition in one sector but not another has strong incentives to persuade the regulator that as many costs as possible are attributable to the monopoly sector, so that costs can be recovered from a regulated price[52]. This is exacerbated in a situation where the monopoly element includes distribution facilities, to which competitors in the contestable market require access. In this case raising the 'access' price to such facilities both increases the incumbent's profits directly and handicaps rivals by raising their costs. Both these factors are observed in the electricity sector during the 1990s.

The following graphs show the movement in average electricity prices from 1979 to 2008. The Electricity Act, which privatised the industry, was passed in 1989, with phased opening of the market: large companies were able to choose suppliers from 1990; 'middle sized' companies from 1994; and all consumers from 1998 (though in the event this was delayed by a few months for some consumers).

Figure 1. Average price of electricity paid by domestic and industrial customers, p/KWh, money terms



[52] Bradley, I. and C. Price (1991) "Partial and mixed regulation of newly privatized UK monopolies", in W. Weitel (ed.) Economic Analysis of Law, Schriftenreihe der Bundeswirtschaftskammer, Wien

Figure 2. Figure 1, adjusted for long term RPI to 2008 price levels

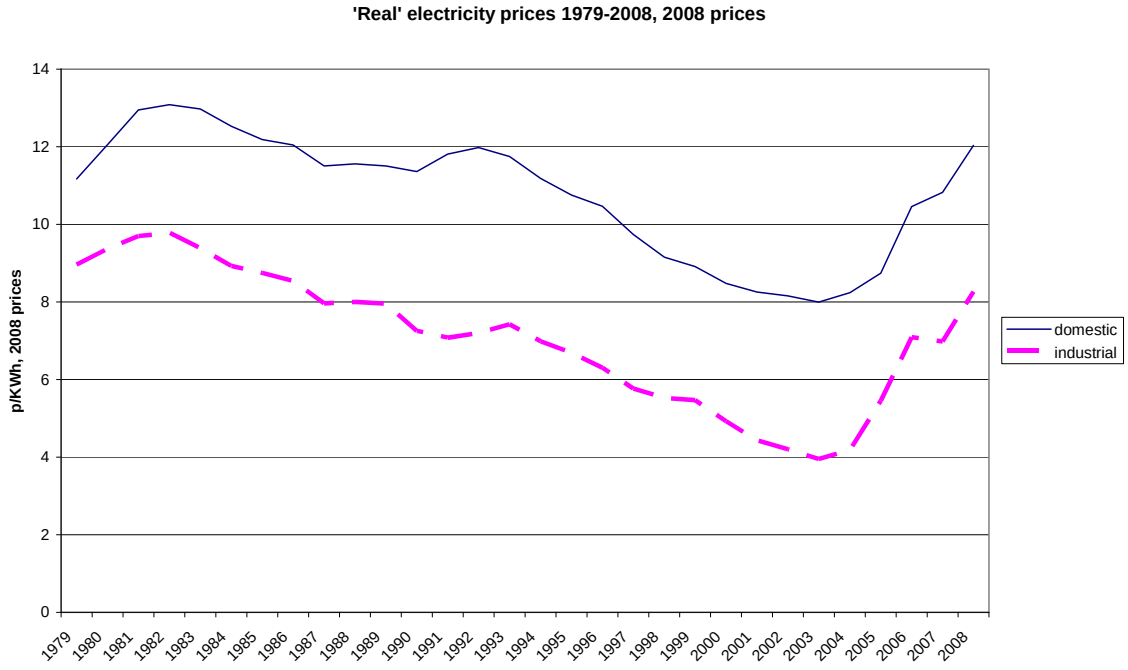


Figure 3. Difference between prices shown in figure 2 (p/kWh, 2008 prices)

Figure 1[53] shows the average price of electricity, in money values, for industrial and domestic consumers over the period. These are shown in 'real' values (2008 prices) in figure 2 and the difference between these 'real' prices is shown in figure 3. In the early eighties, while the industry was still nationalised, we see a narrowing of the gap between domestic and industrial consumers, as the cross-subsidy of the residential sector by the non residential tariffs was removed. This has levelled out by the mid 1980s, where we see a period of remarkable stability between the prices in figure 3. But the difference increased sharply in the early nineties, as the industrial market was opened to competition but the residential market was still monopolised. Over the nineties, as the opening of the residential market approached, the difference fell, and despite a jump in the early two thousands, particularly after consolidation of the 'big 6' who supplied the domestic market, the difference has stayed around the level of the later nineteen eighties.

Of course these graphs are merely indicative, and affected by many factors, including the loading of the costs of coal contracts onto the franchise market. But they do suggest that companies may be able to raise prices in the remaining monopoly markets when some of their markets are opened to competition. Even more striking is the allocation of costs between monopoly distribution markets and retail markets. In the price distribution review conducted by Ofgem in 1999, they concluded that nearly £300 million pounds had been 'wrongly' allocated by the public electricity suppliers (all of whom at that time owned both distribution wires and retail operations), out of a total standardised costs (after reallocation) of £927.2 million (all in 1997/98 prices). [54] In other words a quarter of the outgoings which the companies had wished to include in their distribution costs, to be covered by a regulated price cap, were judged by the regulator to be more properly attributed to the retail market, where the companies faced competition. The bulk of the transfers were for customer services and metering related costs (see table 2.2 of the draft proposals). The regulator also reallocated £75 million from capital to current expenditure, reversing another incentive for regulated firms to include as many costs as possible in the capital category since these can be counted in the regulatory asset base.

Both the relative movement of prices in the competitive and monopolised markets and the reallocation of costs from distribution to retail function suggest that additional regulatory caution is needed if markets are partially opened, to ensure that no disadvantage is suffered either by consumers in the still regulated market, or by competitors in the newly unregulated market.

[53] The graphs are derived from figures published by the Department of Energy and Climate Change. Industrial prices are calculated from the current fuel price index numbers for the industrial sector, net of CL, unadjusted for GDP [qep331], and converted to price per kWh using the current price of electricity purchased by non-domestic consumers excluding CCL, average, for 2005. The domestic prices are extracted from the domestic electricity prices in UK without tax [qep 551]. Real values were obtained by deflating by the long term indicator of prices of consumer goods and services (Jan 1974=100).

[54] Reviews of Public Electricity Suppliers 1998-2000, Distribution Price Control Review, Draft Proposals, Ofgem, August 1999

Questions for policy and research

The results and discussion presented above has provided a range of important evidence relating to metering and price and income elasticities of water demand. These sections have highlighted a number of areas where further understanding is required. The list below summarises these areas, and provides suggestions as to additional issues which are likely to concern policymakers.

- Price and income elasticity estimates for the UK
- Differentiation of price and income elasticity estimates by income group (international and UK) to aid distributional assessment
- Whether summer demand is more responsive than winter or year-round demand
- Long and short-run differences in elasticities
- Whether price and income responsiveness have changed over time (e.g. 1960s to 2000s?)
- Differences between regions, countries or continents and the scope for 'benefits' transfer of results using meta-analysis
- Whether higher income countries are more or less price responsive to price and income changes
- Whether the evidence on price and income elasticity estimates subject to publication bias – i.e. do price and income have genuine effects on demand and is the magnitude of estimates biased
- The contribution to supply-demand balance that price-based demand management policies can make relative to other demand management policies such as water-efficiency
- International evidence on the impact of different tariff structures on the demand for water
- Assessment of the impact of the numerous UK tariff trials
- Whether water consumers know the price of water, their consumption, or the relative consumption of different water-using activities within the home; comparison with energy
- How water consumers interact with their bills and how informational policies might enhance price responsiveness; comparison with energy
- Agricultural, industrial and commercial price and income elasticity estimates
- How theoretical debates in the water demand literature can inform best-practice investigation of UK consumption monitors and tariff trial data

- The cost base of activities in the water sector, and their allocation to distribution/retail activities and to different markets