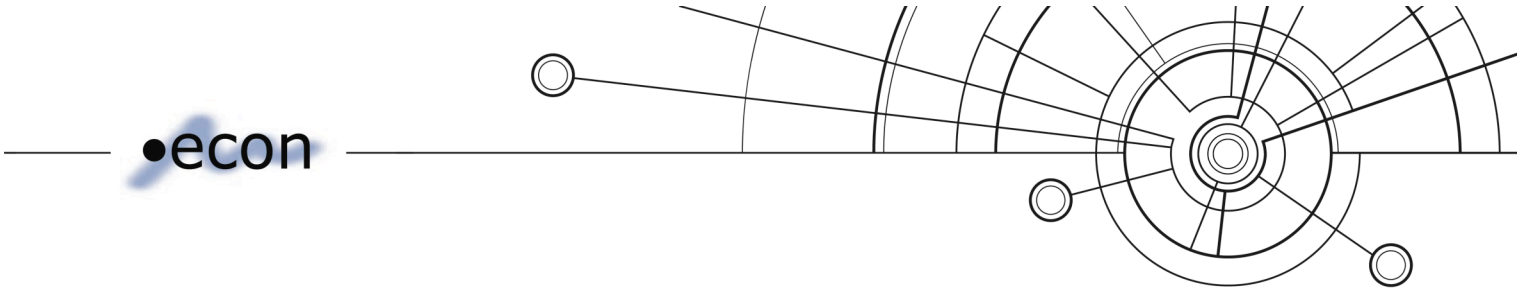

Peer review of Form of Control Model

Report prepared for Ofwat by DotEcon Ltd.

Confidential as at 06 June 2007

1 Introduction

1. This report follows on from our recent report, *Forms of price control for the water industry*, dated 25 April 2007 ("our April report"). As set out more fully in our April report, Ofwat has commissioned DotEcon to provide it with advice on selecting the form of the control to apply on the water companies.

2. Ofwat required DotEcon to undertake the following tasks:

   - To build on a literature study undertaken by Ofwat and undertake a review of the current body of knowledge of forms of price control with relevance to the water industry;
   - To use existing expertise of regulated industries with forms of price control different to the water industry in England and Wales to draw up a list of lessons learned of existing or past forms of price control with reference that has relevance to the water industry;
   - Following the first two tasks, to critically review the provisional list of forms of price controls and the list of criteria (providing an initial report on these two assessments); and
   - Finally, to provide an expert to work on site for six days assessing whether the forms of price control are accurately modelled and if the modelling will yield robust assessments (and then to provide a final report on this peer review).

3. Our April report addressed the first three of those tasks. This report summarises the fourth task, our peer review of the financial model developed by Ofwat to help it assess its shortlist of alternative forms of control against its assessment criteria.

4. The peer review was led by Adam Mantzos, a DotEcon associate. Details of DotEcon, and of Adam's experience, are provided at Annex 1.

1.1 Our approach to the peer review

5 As suggested in the Invitation to Tender and confirmed with Ofwat during the course of the peer review, the primary aim of the review was to assist with the development of a robust and reliable model on an informal and interactive way, not to conduct a formal audit of the model.

6. We therefore structured our work accordingly. We first sought to understand the structure of the model and its approach to providing information relevant to the assessment of the different forms of control. We then reviewed each key component of the financial model to check that the calculations being performed were consistent with and sufficient for the model's purpose.

7. During our review we identified a number of potential improvements to the model. Some related to significant points of principle, others to the detail of specific calculations. In each case we discussed the potential improvements with Ofwat staff (Peter Jordan and Jim McLaughlin) as and when they were

identified, agreed jointly as to whether a revision to the model was required, and assisted as necessary in the implementation of the revision.

8. The aim of this approach was to implement improvements as the peer review progressed, so that by the conclusion of the peer review and the issue of this report, all required improvements had been implemented and no outstanding issues remained.

9. We also agreed with Ofwat that, consistent with this style of working and in order to maximise the effectiveness of the time allowed for the peer review, no formal record needed to be kept of the identified and implemented improvements. We also agreed that this report need not list the improvements, since they should all have been made at the time of its issue and a listing of improvements that have already been implemented would serve little practical purpose.

10. Accordingly, this report acts more as a matter of record that our peer review took place, than as a description of the details of the peer review itself.

11. It is important to emphasis that our peer review did not amount to a formal audit of the correctness of the model or a validation of its assumptions. Whilst we sought to highlight and address any shortfalls in the accuracy and internal consistency of the model that we identified in the course of our review, we did not test the accuracy of every single calculation and the correctness of formulae in every single cell in the model. Such an approach was not requested by Ofwat, would not have been possible during the period of the review (since the model was being continuously developed), and would have required considerably more time. Although we are not aware of any errors in the latest version of the model, this report should not be interpreted as a guarantee that none exists.

1.2 Structure of this report

12. The remainder of this report is structured as follows:

- Chapter 2 provides an overview of Ofwat's model; and
- Chapter 3 summarises our conclusions from the peer review

2 Overview of model

13. The model has three main components:

- PCR Inputs: this component captures the assumptions that would be made during the Price Control Review (PCR) process, including forecasts of costs and demand for the price control period;
- Uncertainty Options: this component captures the scale and nature of the uncertainty surrounding the outturn level of parameters such as costs and demand during the price control period; and
- Criteria Calculations: this component models, for each form of control, the implications of the PCR assumptions and estimated uncertainties on results such as variances in net revenue and bill levels which are relevant to the assessment of criteria.

2.1 PCR Inputs

14. The PCR inputs component captures PCR assumptions in the following areas:

- base year data;
- consumption growth forecasts;
- property growth forecasts;
- meter penetration forecasts;
- billing constraint forecasts;
- existing price control period bill forecasts;
- allowable revenue forecast; and
- other forecasts such as RPI, etc.

15. The assumptions input into the model are understood to equate to actual assumptions made at the time of the last PCR for specific water companies, in order to assist the realism of the model's outputs.

2.2 Uncertainty Options

16. This component of the model captures the scale and nature of the uncertainty surrounding the outturn level of the following parameter groups during the price control period:

- customer consumption, including the impact of dry years and droughts;
- meter penetration;
- property growth;
- identification of unregistered properties;
- large customer demand; and
- water efficiency initiatives.

17. Uncertainties are captured by estimates of the probability distributions of the outturn levels of parameters. For the most part, the mean of those probability distributions is set equal to the PCR input assumptions.

18 In principle, one would expect that gaming of forecasts by companies, to the degree that it is not corrected for during the PCR, will affect the nature of uncertainty. Moreover, one would expect the nature of uncertainty to differ for different forms of price control.

19. So for example, under the existing form of control, one would expect companies to try and game forecasts so as to understate future levels of consumption by measured households. This is turn should make outturn uncertainty over the consumption of metered households biased towards the upside. Conversely, under say a fixed revenue cap form of control, one would expect companies to overstate future levels of consumption, this introducing a bias towards the downside.

20. The model does not attempt to reflect these likely biases in the estimates of uncertainty, which are held constant across all forms of control. Instead, the model is used to estimate the volatility of net revenues to understatements and overstatements of parameters under different forms of control. These estimates are then used to assess the companies' incentives to game under different forms of control. Put simply, there is more to be gained from gaming under those forms of control where net revenues are sensitive to understatements and overstatements, so more gaming can be expected under those forms of control.

2.3 Criteria Calculations

21 Calculations can be run in three modes, by setting "triggers" to different values:

- trigger = 0: the model calculates outturn values on the basis of PCR input parameter values, i.e. it replicates expectations for outturn values at the time of the PCR;
- trigger = 1: the model calculates a probability distribution for each outturn value on the basis of the uncertainty inputs, using a Monte Carlo style simulation (the simulation is performed by the @Risk software embedded into the model); and
- trigger = 2: the model calculates outturn values on the basis of the central value for each uncertainty input.

22 The model can be run for each of the following forms of control:

- Option A: Fixed Revenue Yield, with no correction;
- Option B: Fixed Revenue Yield, with symmetrical correction;
- Option C: Fixed Revenue Yield, with asymmetrical correction;
- Option D: Dynamic Revenue Yield, with a property driver;
- Option E: Dynamic Revenue Yield, with a property and a volume driver;

- Option F: Average Revenue Yield;
- Option G: Current Cap;
- Option H: Current Cap, with annual pain/gain sharing;
- Option I: Current Cap, with pain/gain sharing in the subsequent price control period;
- Option J: Current Cap, with an adjustment for water efficiency initiatives; and
- Option K: Average Price Cap.

23 There are many possible variants to some of these forms of control. Under a Dynamic Revenue Yield control, for example, property and volume drivers can be based on actual property and volume numbers in the charging year, or on historical property and volume numbers. Moreover, the marginal revenue for each extra property or unit of volume can be set equal to, below or above the marginal cost.

24 The model contains assumptions as to which variant of each form is used, based on Ofwat's current view of the most appropriate variant in each case. The variants chosen are not inappropriate. However it is important to recognise that different variants of the same form of control could perform quite differently against Ofwat's criteria.

25 The calculations include forecasts of:

- consumption per property, including the impact of consumption growth, dry years and droughts;
- meter switching;
- property growth, through both new households and the identification of unregistered properties;
- loss of large customers volume;
- the cost and impact of water efficiency initiatives;
- levels of water consumption; and
- the impact of cost variances from PCR levels on the company's efficiency band.

26 The model then calculates total revenue, taking into account the form of control being modelled and outturn values relevant to the setting of the level of the control. This leads to a forecast of:

- the level of unmeasured household bills (based on measured bills and the measured/unmeasured differential);
- the level of measured household bills; and
- non-household revenue.

27 The model summarises, under each form of control, the NPV impact of uncertainties on the company's finances, reflecting variances from PCR forecasts of:

- total revenue;
- the incremental costs of variances in property numbers and volumes;
- the net impact of water efficiency initiatives;
- the net impact of unregistered property initiatives; and
- the financial impact of efficiency band movements.

28 The @Risk software used allows extensive reporting of the various outputs in statistical terms, including mean values, standard deviations, and probability distributions.

29 The model thus allows the testing of the different forms of control against the following criteria identified by Ofwat:

- Household bill stability - the model calculates the outturn level of bills and various measures of volatility, including divergence from the bill levels forecast during the PCR;
- Implications for cost of capital - the model calculates the NPV impact of uncertainties, i.e. the volatility of cashflows;
- Strong incentives for general operating efficiency - the model does not directly address incentives for general operating efficiency as it is assumed that this is constant under different forms of control;
- Fair share of (net) revenue out-performance between customers and companies - the model calculates the revenue and NPV impact of variances which are either partially or wholly outside the control of companies, e.g. the number of new households and household consumption;
- Consistency of bill movements with price control - the model forecasts both bill movements and K factors;
- Strong incentives for cost effective water efficiency - the model forecasts the NPV of water efficiency initiatives;
- Strong incentives to bill all possible customers - the model forecasts the NPV of initiatives to identify and bill all customers;
- Reduce revenue gaming at price setting (i.e. conservative forecasts) - as noted above the model does not predict forecast gaming explicitly but does reveal incentives for forecast gaming by showing how NPV varies as the outturn level of forecast parameters vary;
- Impact on competition - the model does not directly address this issue, which it is understood is being considered qualitatively;
- Simplicity - the model helps with a consideration of simplicity by setting out explicitly the calculations and estimates required under each form of control; and
- Reduce (net) revenue risk for company - the model calculates the volatility of NPV in response to uncertainties.

3 Conclusions of peer review

30. Ofwat has developed a sophisticated and complex model that appears capable of providing a robust assessment of the performance of different forms of price control against the criteria it has specified.

31. As with any model, the reliability of the results is critically dependent upon the chosen input assumptions. The key assumptions in this case, none of which we have sought to verify, include:

- the PCR inputs;
- the probability distributions assumed for the uncertainties;
- cost estimates for water volume variances, property number variances, water efficiency and billing initiatives; and
- the assumed variants for some forms of control.

32. Our peer review did not amount to a formal audit of the model. Whilst we sought to highlight and address any shortfalls in the accuracy and internal consistency of the model that we identified in the course of our review, we did not test the accuracy of every single calculation and every single cell in the model. Although we are not aware of any errors in the latest version of the model, this report should not be interpreted as a guarantee that none exists.

Annex 1: About DotEcon

DotEcon is an economic consultancy focusing on network industries. We offer analytical and empirical support to public sector bodies and private sector companies, assisting with:

- regulatory design and implementation;
- competition policy and commercial litigation cases;
- public policy design;
- market design and auction strategies; and
- business strategy.

DotEcon combines the ability to integrate rigorous theoretical economics with a thorough understanding of market realities to provide reliable, practicable and concise advice. We draw on a wide range of specialist skills, including econometric analysis, economic and financial modelling, and the development of bespoke software tools.

The company was founded in June 1999 by Dr. Christian Koboldt and Dr. Dan Maldoom, two former academic economists with extensive consulting experience. We have nine full-time economists based at our office in London.

Through our project work, we have acquired a reputation for producing rigorous and objective analysis to tight deadlines, and for finding innovative solutions to unusual problems. This reputation is reflected in the high volume of business we win through returning customers and client recommendations.

Dan Maldoom, Director

Dr Dan Maldoom is a director and co-founder of DotEcon. A former academic economist, Dan provides advice to companies and public sector bodies worldwide in competition and litigation cases, regulatory consultations and on public policy issues such as spectrum licensing. Dan has particular expertise in quantitative economics, game theory and economic modelling, and their application to competition economics, market design and business strategy.

Dan has many years of experience both as an academic economist and a business consultant. From 1990-99, he was an associate of the consultancy London Economics (LE), where he co-led the Telecoms and Media team, worked on antitrust and competition cases and provided business strategy advice across a wide range of industries. From 1994-97, Dan was Fellow and Tutor in Economics at University College, Oxford. Prior to that he was a University Lecturer in Economics at Cambridge University.

Christian Koboldt, Director

Dr Christian Koboldt is a director and co-founder of the economic consultancy DotEcon Ltd. A former academic economist, Christian provides advice to companies and public sector bodies worldwide in competition and

litigation cases, regulatory consultations and on public policy issues such as spectrum licensing. His expertise lies in applied economics, industrial economics and competition, regulatory economics, public policy and market design.

Previously, Christian was a Managing Consultant with economic consultancy London Economics (LE), working in LE's Competition and Litigation Support Team and co-leading LE's Telecommunications and Media Team. Before joining LE in 1995, Christian was research fellow and university lecturer in economics at the University of Saarbrücken, where he gained his doctorate. He remains a member of the University's Centre for the Study of Law and Economics.

Adam Mantzos, Associate

Adam Mantzos specialises in financial and economic issues in regulation and competition. His 16 years of experience in the area include the development of regulatory policy, the level and structure of price controls, the introduction of competition into monopoly markets, the analysis of anti-competitive behaviour, network access, cost attribution and forecasting, price discrimination, margin squeeze, and financial impact, modelling and viability issues.

Adam is a standing member of the independent expert advisory panels appointed by Postcomm, the UK postal regulator; the CAA, the UK aviation regulator; and the Office of Utility Regulation in Guernsey. Adam's experience covers the gas, electricity, telecoms, media, water, rail and postal industries.

Before practising as an independent consultant, Adam was a partner in Arthur Andersen for five years, having been a founder member of the firm's UK Economic Consulting group in the early 1990s after qualifying as a chartered accountant.

Adam's experience also encompasses a large number of financially oriented analytical consulting projects in a range of industries, including activity based costing, business planning and forecasting, financial modelling, valuations, investment appraisal, shareholder value analysis and financial impact assessments in commercial disputes. In addition to consulting, Adam has two years of senior financial management experience, as acting Finance Director of a £100m division of Arthur Andersen.

Adam has extensive experience of constructing and reviewing regulatory models, including:

- constructing an LRIC model of mobile call termination for Hutchison 3G UK, and reviewing Ofcom's LRIC model of call termination;
- reviewing Royal Mail's cost attribution system;
- construction of an integrated business forecasting and cost attribution model for Guernsey Post, on behalf of the Office of Utility Regulation, Guernsey; and
- reviewing Ofgem's 2005 Electricity Distribution Price Control Review financial model.