

Profits and Productivity in the Privatized English and Welsh WaSCS:1991-2015

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Brief Background of the WaSCs Regulation and Privatisation (1)

- 1989/90 FY– the WASCs are privatized and RPI+K regulation introduced with 10 year regulatory period
- 1994 Price Review - caps reopened due to excess profit concerns and a 5 year regime is established
- 1999 Price Review -significantly tighter price caps implemented for first time

Brief Background of the WaSCs Regulation and Privatisation (2)

- Since circa 2010 increased emphasis on increasing competition
- Concerns with regard to high equity returns and high gearing
- In 2015 the industry's regulator moved from a cost assessment framework based on total economic costs, to one with greater reliance on TOTEX(CAPEX+OPEX) which is essentially cash flow based and not based on an economically consistent definition of costs
- Commentators such as the National Audit Office (2015) the first water regulator (Byatt,2017) and the Financial Times (2017) are raising concerns with regard to the performance and appropriateness of the industry's model, returns to investors, and consumer outcomes.

Profits and Regulatory Cost Determination from Privatisation until 2015

ex ante Regulatory Cost
Determination and *ex post* estimates
of Economic Costs and Profitability
in the English and Welsh Water
Industry: 1991-2015

ex ante Regulatory Cost/Revenue Determination

- ▶ Following Weyman-Jones, et al's (2003), discussion of a building blocks approach to *ex ante* regulatory cost determinations under price cap regulation in the UK

$$RCD_{R,t} = OPEX_{R,t} + D_{R,t} + (wacc_{R,t})RCV_{R,t}$$

- ▶ $RCD_{R,t}$ = *ex ante* regulatory total cost assessment
- ▶ $OPEX_{R,t}$ = *ex ante* assessment of operating expenditures
- ▶ $D_{R,t}$ = *ex ante* assessment of depreciation
- ▶ $WACC_{R,t} RCV_{R,t}$ *ex ante* assessment of the required return on capital
 - ▶ $WACC_{R,t}$ the *ex ante* regulatory estimate of the weighted average cost of capital
 - ▶ $(RCV_{R,t})$ should be the regulator's *ex ante* estimate of the required capital stock

IN PRINCIPLE REGULATOR SETS REVENUE CAPS EQUAL to the EX ANTE ASSESSMENT OF “POTENTIAL EFFICIENT” COSTS, VIA RPI+K formula for 5 year regulatory period

ex post regulatory total cost assessment

Based on an *ex post* assessment of realized regulated costs

$$C_t = OPEX_t + D_t + (wacc_t)K_t$$

- ▶ C_t = *ex post* estimate of realized economic costs
- ▶ $OPEX_t$ = is equivalent to the standard definition of total operating expenditures in Ofwat's regulatory accounts (at least until 2015)
- ▶ D_t = is equivalent to the sum of IRC and current cost depreciation charges which Ofwat allowed for in regulated costs (until 2015)
- ▶ $WACC_t K_t$ is an *ex post* assessment of the financial opportunity cost required to fund the firm's actual capital investment.
 - ▶ $WACC_t$ is an appropriate *ex post* estimate of the effective financing cost of capital
 - ▶ K_t is the realized stock of invested capital

Empirical implementation of the ex post regulatory total cost assessment

Consideration of the WACC

For the $WACC_t$ we largely accept the underlying assumptions built into Ofwat's price reviews

OFWAT'S REAL TERM ASSUMPTIONS WITH REGARD TO COST OF CAPITAL AT PRICE REVIEWS (Assuming Mid Range where a range of estimates was provided in PR)

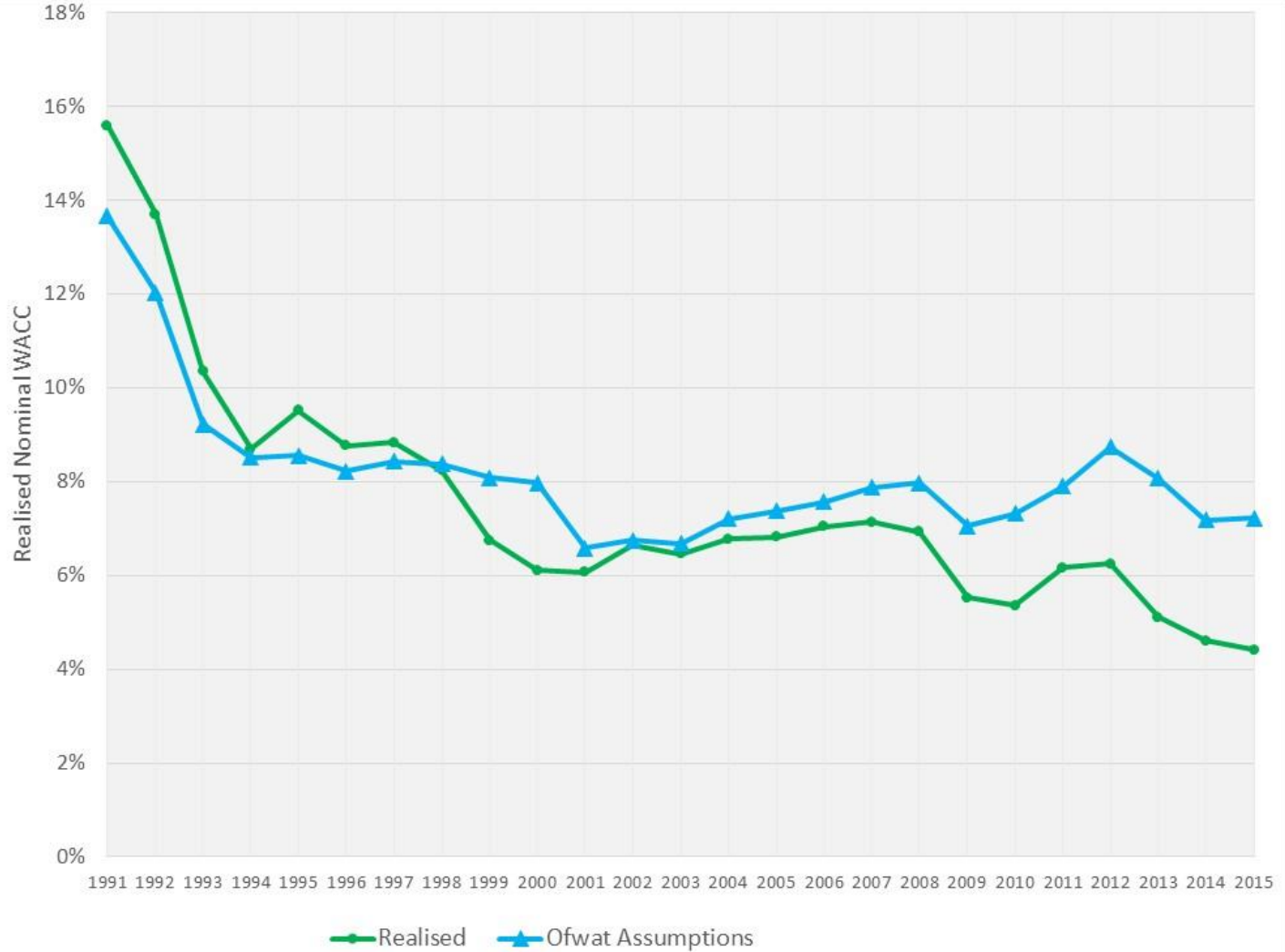
	Price Reviews					
	Privatisation	1994	1999	2004	2009	
Cost of equity						
Risk-free rate	3%	3.5%	2.75%	2.75%	2%	
Equity beta	0.50	0.90	0.80	1.00	0.90	
Equity risk premium	7%	3%	3.50%	4.50%	5.40%	
Cost of equity (post tax)		6%	5.50%	7.25%	7.10%	
Cost of debt						
Debt premium	1%	1%	1.75%	1.20%	1.60%	
Cost of debt (post tax)	4%		3.15%	3.85%	3.60%	
Gearing	25%	50%	50%	55%	57.50%	
Taxation	2%	2%	17%	30%	16%	
		1991-1995	1996-2000	2001-2005	2006-2010	2011-2015
IMPLIED Price Review Estimated WACC post tax		5.86%	5.31%	4.64%	4.78%	4.65%

Empirical implementation of the ex post regulatory total cost assessment

But we calculate a realized nominal WACC for all WaSCs where realized risk free rates, gearing, and effective tax rates are employed

METHODOLOGY ACCEPTED IN MANY ACADEMIC PUBLICATIONS BUT ALSO BY OFWAT FOR STONE AND WEBSTER (2004), AND BY SEVERN TRENT WATER ON WORK ON SCOPE AND SCALE ECONOMIES

Estimates of Ofwat's intended Realized Nominal WACC after Realized RPI protection versus realized WACC with Gilt based risk free rate and observed taxation and gearing.



- Ofwat's assumptions were built into its *ex ante* price determinations and hence *ex post* revenue. Our *ex post* cost estimates are based on the estimated realised WACC

Empirical implementation of the ex post regulatory total cost assessment

Consideration of the Stock of Invested Capital

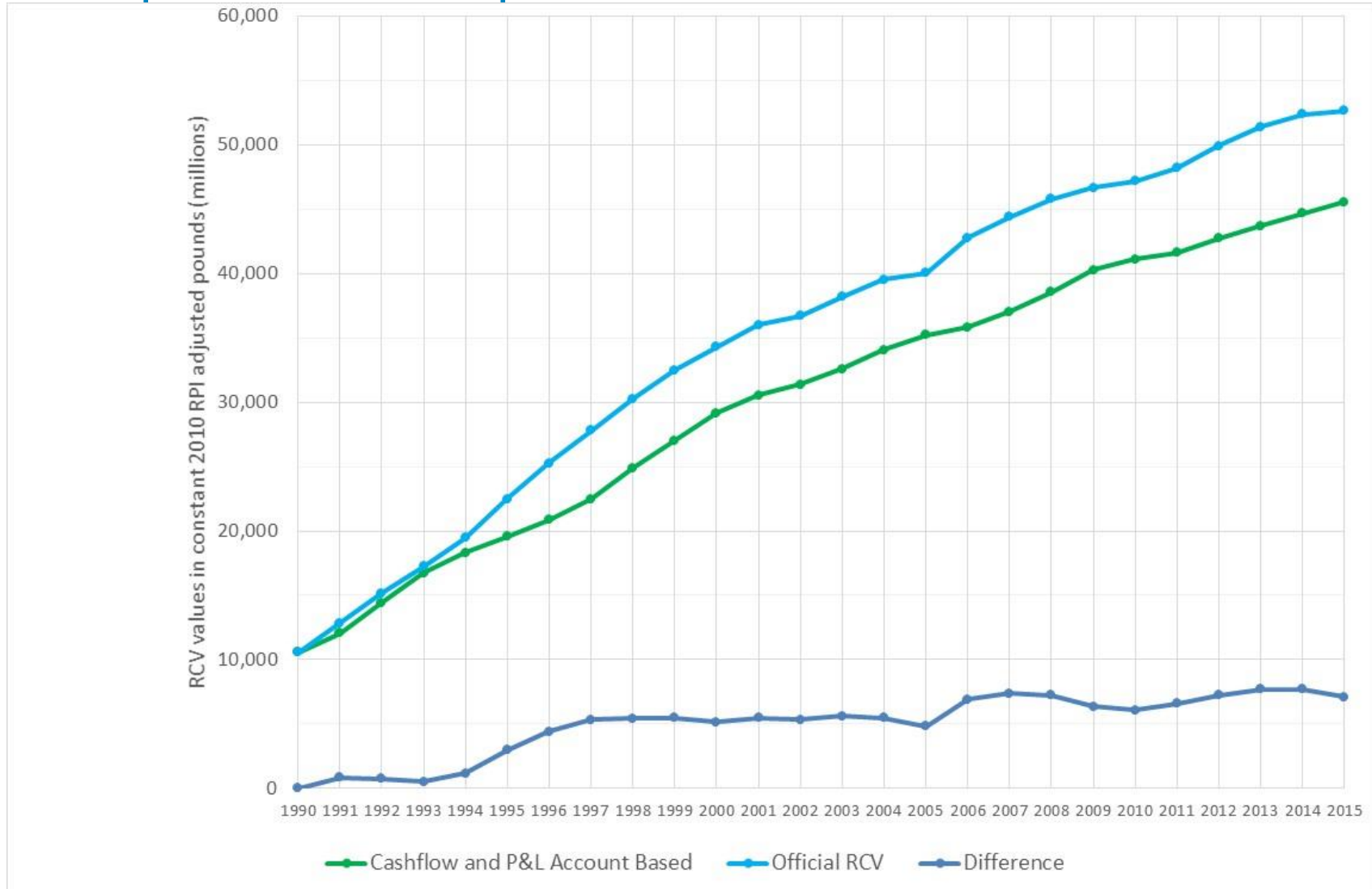
K_t is the realized stock of invested capital $K_{t,r}$, reflecting actual investment and depreciation flows in the regulated company.

▶ We could use the published RCV values provided by Ofwat, but these reflect *ex ante* determinations at price reviews and may or may not reflect true trends in invested capital

▶ Instead, we accept the initial regulatory capital value determined by Ofwat (March 31st 1990) and update this with RCV inflation and accounting for charged CC depreciation and IRC as Ofwat does, **but employ realised expenditure on the purchase of fixed assets drawn from the 1991-2015 CC Cash Flow Tables**

realized capital expenditure equals purchase of fixed assets and infrastructure renewal expenditures net of grants, contributions and income from the disposal of assets.

The Estimated Cash Flow Based RCV for the WaSCs, suggests a 17.3 percent bias in the official RCV in 2013, This bias peaked at 22.7 percent in 1998 but remains substantial



Decomposing the Sources of Changes In Economic Profitability

Profitability - Defining Profitability

Revenues

Revenue in period t is given by $R^t = p^t y^t = \sum_{m=1}^M p_m^t y_m^t$

Costs

Cost is given by $C^t = w^t x^t = \sum_{n=1}^N w_n^t x_n^t$

Profitability in base period $t = b$ can be expressed as

$$\Pi^b = \frac{R^b}{C^b} = \frac{p^b y^b}{w^b x^b}$$

Profitability in any other period t can be expressed as

$$\Pi^t = \frac{R^t}{C^1} = \frac{p^t y^t}{w^t x^t}$$

Profitability is determined by:

- ▶ Output Prices (Determined by Price Reviews)
- ▶ Input Prices
- ▶ The amount of output(s) produced
- ▶ The amount of input(s) employed

Profitability - Defining Profitability Change

Profitability change can be expressed as

$$\Pi = \frac{\Pi^t}{\Pi^b} = \frac{\frac{R^t}{C^t}}{\frac{R^b}{C^b}} = \left[\frac{\frac{p^t y^t}{w^t x^t}}{\frac{p^b y^b}{w^b x^b}} \right] = \left[\frac{\frac{p^t}{p^b}}{\frac{w^t}{w^b}} \right] \left[\frac{\frac{y^t}{y^b}}{\frac{x^t}{x^b}} \right] = \left[\frac{p^{t,b}}{w^{t,b}} \right] \left[\frac{y^{t,b}}{x^{t,b}} \right]$$

$$\Pi^{t,b} = \frac{\Pi^t}{\Pi^b} = \left[\frac{p^{t,b}}{w^{t,b}} \right] \left[\frac{y^{t,b}}{x^{t,b}} \right] = [TPP^{t,b}] [TFP^{t,b}]$$

- ▶ TPP Measures Total Price Performance and Indicates Output Prices Change Relative to Input Price Change
- ▶ TFP measures Total Factor Productivity and Measures Changes in Productivity as the ratio of output growth to input growth

Post Privatised WaSC Profitability Decomposition in England and Wales:1991-2015

Decomposition of Profitability Index: Impact During Each Regulatory Period

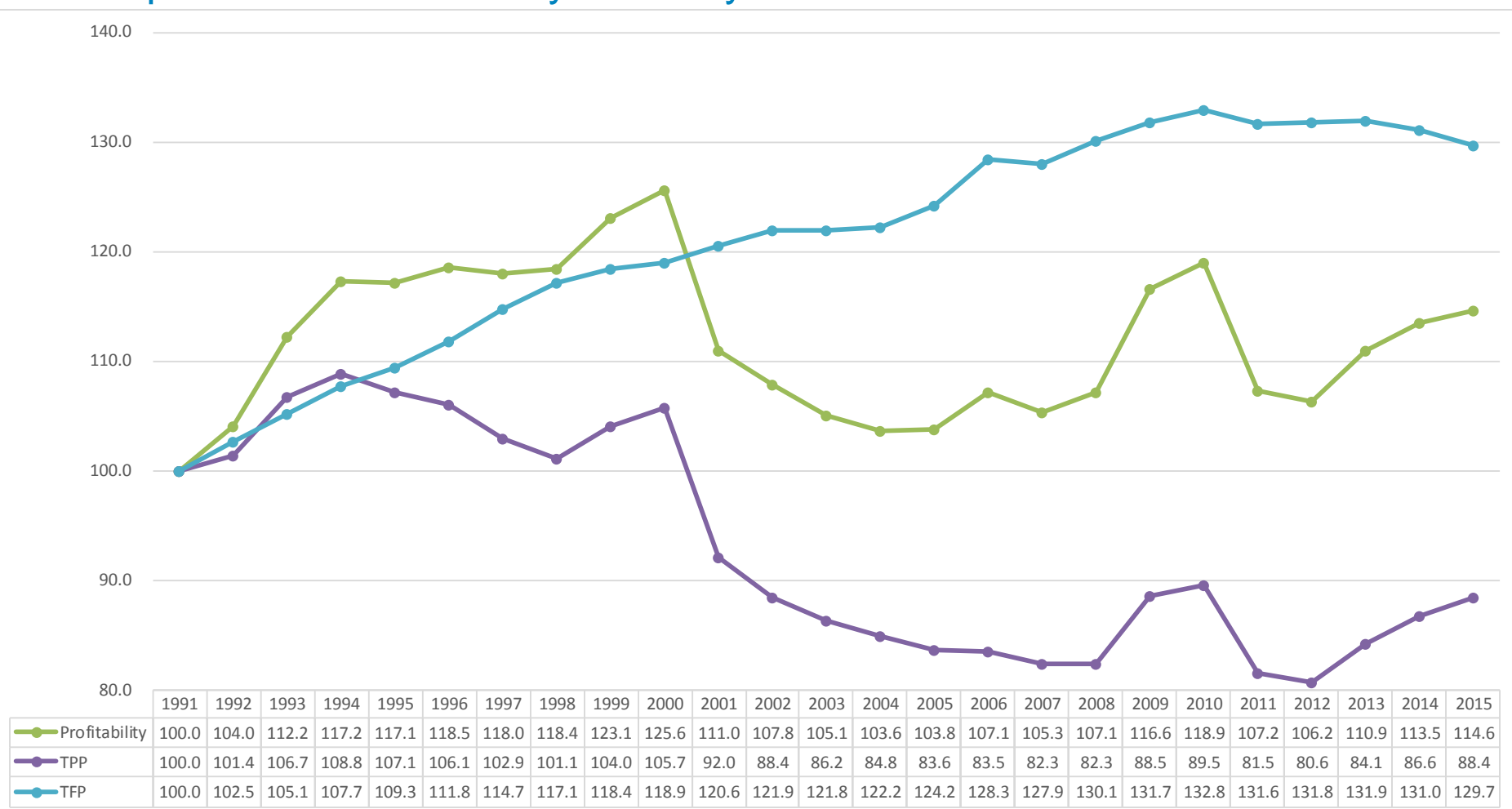
Decomposition of Profitability Index (1991=100)

	1995	2000	2005	2010	2015
Profitability	117.13	125.6	103.8	118.9	114.64
TPP	107.1	105.7	83.6	89.5	88.4
Output Price Index	119.1	122.3	109.5	127.4	123.3
Input Price Index	111.15	115.7	131.0	142.3	139.47
TFP	109.3	118.9	124.2	132.8	129.7
Output Index	102.8	108.3	114.6	118.8	120.8
Input Index	94.1	91.1	92.3	89.4	93.2

Decomposition of Change in Profitability Index (Annualized Growth Rates)

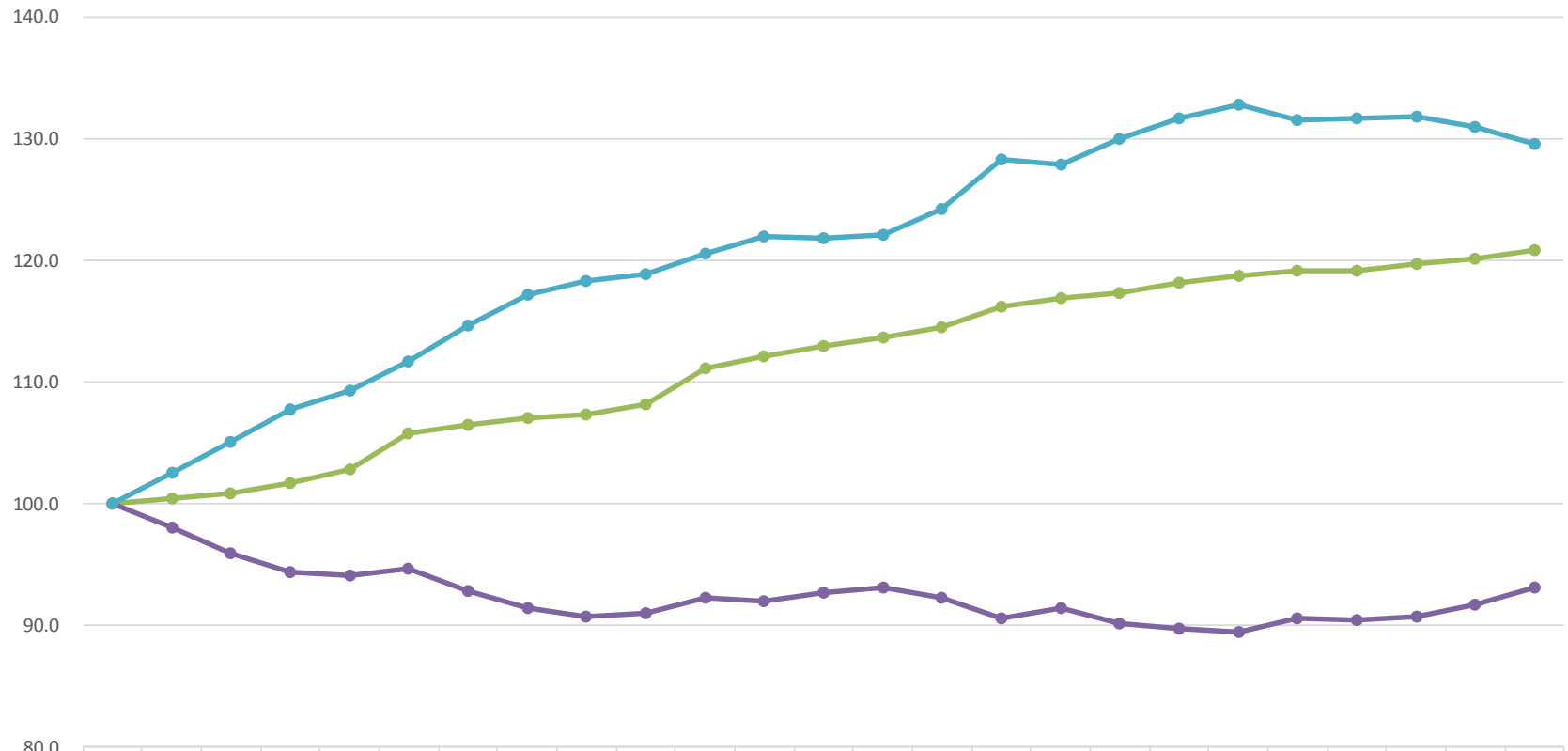
	1991- 1995	1995- 2000	2000- 2005	2005- 2010	2010- 2015	1991- 2015	1995- 2015
Profitability	3.95	1.40	-3.82	2.72	-0.73	0.57	-0.11
TPP	1.72	-0.27	-4.69	1.37	-0.25	-0.51	-0.96
Output Price Index	4.36	0.53	-2.21	3.03	-0.65	0.87	0.18
Input Price Index	2.64	0.81	2.48	1.66	-0.41	1.39	1.13
TFP	2.23	1.68	0.88	1.34	-0.48	1.08	0.85
Output Index	0.70	1.03	1.14	0.72	0.34	0.79	0.81
Input Index	-1.53	-0.65	0.26	-0.62	0.82	-0.29	-0.05

Decomposition of Profitability Index by Year: 1991=100



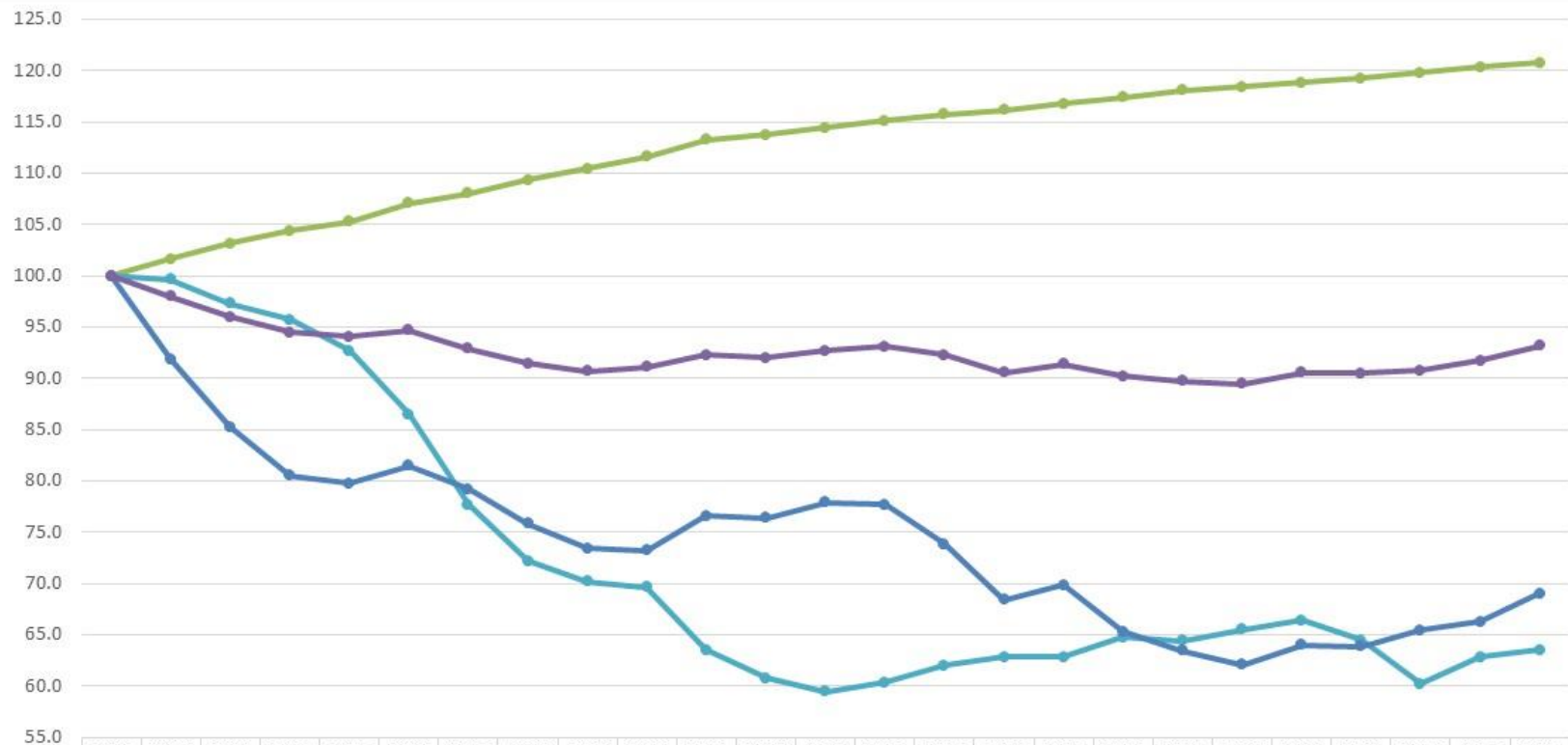
- ▶ Aggregate WaSC TFP Growth Rates were positive until 2010, but a small decline in productivity has occurred since.
- ▶ Profitability trends are supported by TFP, but driven by TPP which is largely driven by regulatory determinations except for the decline in capital prices circa 2008, and the general moderation of growth in real input prices since the financial crisis

Decomposition of Quality Unadjusted TFP Index by Year: 1991=100



- ▶ 2015 TFP was 29.7 percent above 1991 levels, supported by a reduction of the aggregate input index to 93.2 percent of 1991 levels despite a 20.8 percent increase in the output index based on connected water and sewerage properties
- ▶ But TFP reached a peak of 132.8 in 2010 and the aggregate input index also reached its minimum of 89.4 percent in the same year
- ▶ **A serious shift in trend in TFP dates to after the 2010 price review, not the start of the financial crisis**

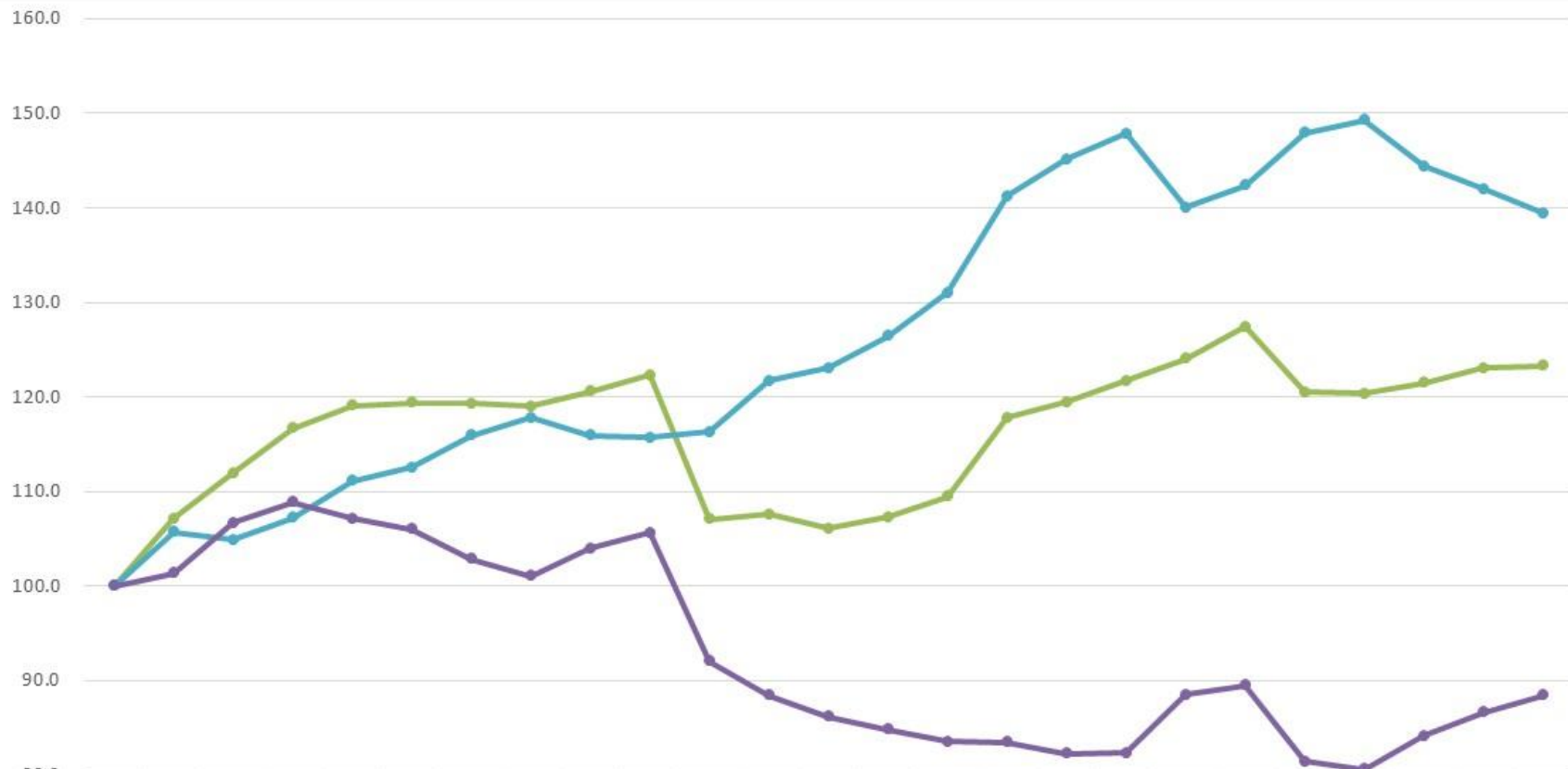
Aggregate Input Usage Index and its Components: 1991=100



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
MEA Capital Stock	100.0	101.6	103.1	104.4	105.2	107.1	108.0	109.3	110.5	111.6	113.2	113.7	114.4	115.1	115.7	116.1	116.8	117.4	118.0	118.4	118.8	119.3	119.8	120.3	120.7
Labour	100.0	99.6	97.3	95.7	92.7	86.5	77.7	72.2	70.2	69.6	63.5	60.8	59.5	60.4	62.0	62.8	62.8	64.7	64.4	65.5	66.4	64.5	60.2	62.8	63.5
Other Costs	100.0	91.8	85.3	80.5	79.7	81.5	79.2	75.8	73.4	73.2	76.6	76.4	77.9	77.6	73.8	68.4	69.8	65.3	63.4	62.0	64.0	63.8	65.4	66.2	69.0
Input Index	100.0	98.0	96.0	94.5	94.1	94.6	92.9	91.4	90.7	91.1	92.2	92.0	92.7	93.1	92.3	90.5	91.4	90.2	89.7	89.4	90.5	90.4	90.8	91.7	93.2

- ▶ The reduction in the aggregate input index is based on the offsetting of 20.7 percent increase in adjusted MEA capital stock, by a respective reduction of labour and other input usage to 63.5 and 69.0 of their 1991 levels
- ▶ The rate of capital stock growth is notably lower after the 1999 price review
- ▶ Aggregate Input Usage has been increasing since 2010

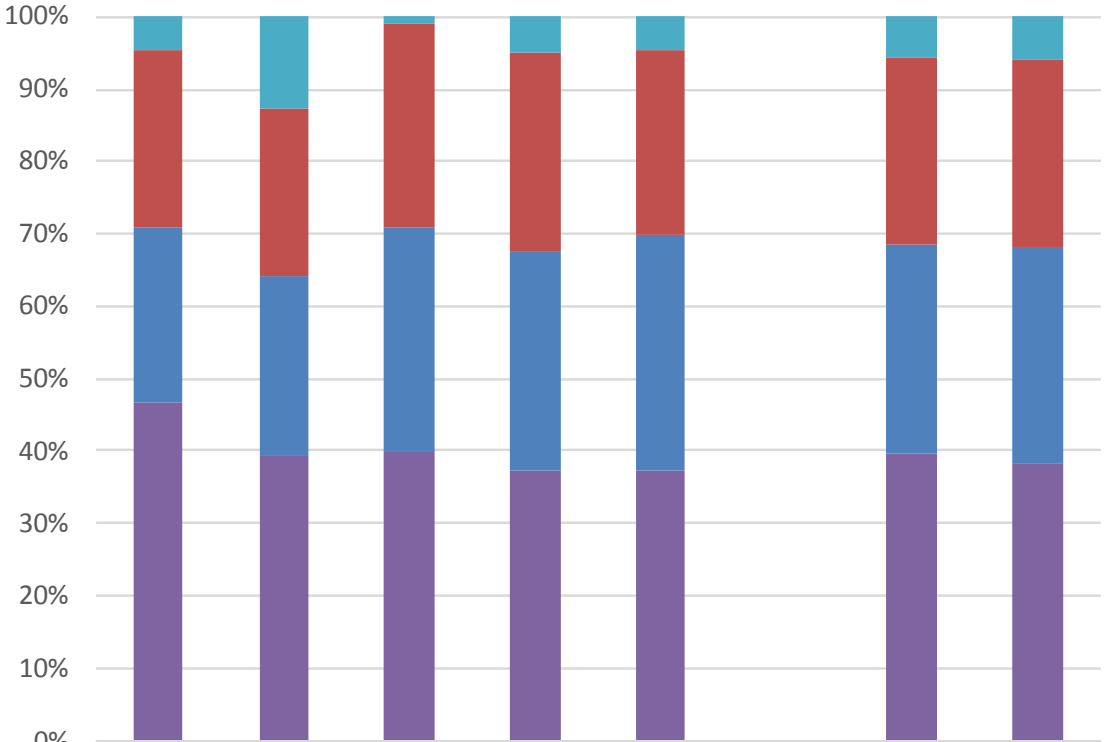
Decomposition of Quality Unadjusted TPP Index by Year: 1991=100



	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Output Price Index	100.0	107.2	111.9	116.7	119.1	119.4	119.3	119.0	120.6	122.3	107.1	107.6	106.1	107.3	109.5	117.8	119.5	121.7	124.0	127.4	120.5	120.3	121.5	123.0	123.3
Input Price Index	100.0	105.7	104.9	107.2	111.2	112.6	115.9	117.8	115.9	115.7	116.3	121.7	123.1	126.5	131.0	141.2	145.2	147.9	140.1	142.3	147.9	149.3	144.4	142.0	139.5
TPP	100.0	101.4	106.7	108.8	107.1	106.1	102.9	101.1	104.0	105.7	92.0	88.4	86.2	84.8	83.6	83.5	82.3	82.3	88.5	89.5	81.5	80.6	84.1	86.6	88.4

- ▶ Quality unadjusted output prices are 21.4 percent higher now than in 1991, and have recovered virtually all the decline that occurred in 2001.
- ▶ Aggregate Real Input price Index Growth halted post financial crisis, driven by decline in realised WACC, and supported by real wage declines

Share of Revenue Attributable to Cost Components and Economic Profits by Regulatory Period



	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015		1991-2015	1996-2015
Realised Economic Profits ("Outperformance")	0.044	0.128	0.009	0.051	0.047		0.056	0.059
Financial Opportunity Cost of Capital	0.246	0.230	0.283	0.274	0.255		0.258	0.260
CC Dep and IRC Charges	0.242	0.250	0.308	0.302	0.324		0.287	0.297
OPEX	0.467	0.392	0.400	0.373	0.374		0.398	0.384

Haven't Price Increases in the Water Industry Been Necessary to Fund Substantial Post Privatisation Capital Investment in a Cash Negative Industry?

Insights from Integrating Cashflow
and Economic Cost Analysis

Cash Expenditures

- ▶ Cash Expenditures for a Regulated Company Can be Defined as Falling into Three Main Components

$$CASH_t = OPEX_t + CAPEX_t + FINEXP_t$$

- ▶ OPEX=operating costs
- ▶ CAPEX=Gross Capital Investment net of contributions and grants
- ▶ FINEXP=expenditure on capital servicing, company taxes and related payments

$$FINEXP_t = (Int_t + Div_t + Tax_t)$$

Reconciling Cash Flow and Regulated Costs

Subtracting realised regulatory total cost (slide 6) from realised cash expenditure (slide 23) and rearranging terms yields the following expression .

$$\begin{aligned} CASH_t - C_t &= (OPEX_t - OPEX_t) + (CAPEX_t - D_t) + \left(\frac{FINEXP_t}{K_t} - wacc_t \right) K_t \\ &= (CAPEX_t - D_t) + \left(\frac{FINEXP_t}{K_t} - wacc_t \right) K_t \end{aligned}$$

- ▶ This illustrates the two most important distinctions between cash flow and economic costs.
- ▶ The first term indicates that cash flow will exceed (underestimate) economic costs when net investment is positive (negative).
- ▶ The second term indicates that cash flow will exceed (underestimate) economic costs when the realized average effective rate of capital finance related payments exceeds (is below) an appropriate wacc representing the realized economic opportunity cost of capital to the firm.

(All Costs are Annual Averages Expressed in 2010 prices using RPI FY Avg Deflation)								
	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015		1991-2015	1996-2015
Total Cash Flow	7,876	10,270	8,881	10,555	9,921		9,501	9,907
Calculated Economic Costs	6,604	6,894	7,405	8,374	8,548		7,565	7,805
Total Difference	1,272	3,376	1,477	2,181	1,373		1,936	2,102
Capital Financing Expenditure	1,197	3,352	2,506	3,431	2,782		2,654	3,018
financial opportunity cost of capital	1,703	1,822	2,113	2,417	2,285		2,068	2,159
Shortfall(-)/ Excess(+) of Capital Financiing Expenditure to Finacial Opporutnity Cost of Capital	(505)	1,530	393	1,014	497		586	859
Net Cash Cost of Gross Capital Formation	3,448	3,821	3,387	3,833	3,782		3,654	3,706
capital depreciation	1,671	1,975	2,303	2,667	2,906		2,304	2,463
"Net Investment" Net Cost of Capital Formation less Depreciation Charges	1,777	1,846	1,083	1,167	876		1,350	1,243
Reconciled Difference/Estimated Economic Costs	0.19	0.49	0.20	0.26	0.16		0.26	0.27
Shortfall(-)/ Excess(+) of Capital Financiing Expenditure to Finacial Opporutnity Cost of Capital	-0.08	0.22	0.05	0.12	0.06		0.08	0.11
"Net Investment" Net Cost of Capital Formation less Depreciation Charges	0.27	0.27	0.15	0.14	0.10		0.18	0.16

1996-2015 period saw a 27 percent 2.1 billion per year cumulative excess of cash expenditure to costs

- 16 percent or 1.24 billion per year due to net investment
- 11 percent or 859 million per year due to capital financing expenditures in excess of the WACC.

Scottish Water and its Predecessors

- Profitability Decomposition 2001-2013
- Reconciled Difference Between Cash Expenditure and Realised Costs 1997-2013

Empirical implementation of the ex post regulatory total cost assessment :

Consideration of the WACC

- ▶ In **Scotland**, we are taking an approach that we believe is fully consistent with the stated *ex ante* assessment of the WACC by WICS in the 2006-10 reviews, as well as the “true” underlying *ex ante* assessment underlying the 2010-15 price determination.
- ▶ E.g. we are measuring the realized nominal WACC so it reflect the realized yield on inflation linked gilts, and also allowing for realized RPI Inflation and a 0.30 premium on the resulting nominal inflation protected yield.

Profitability Index Decomposition for Scottish Water and its Predecessors

Decomposition of Profitability Index

Decomposition of Profitability Index (2001=100)

	2002	2006	2010	2013
Profitability	110.46	105.7	92.1	87.3
TPP	105.91	91.0	73.0	70.0
Output Price Index	111.65	115.4	109.4	97.2
Input Price Index	105.42	126.8	149.9	138.8
TFP	104.30	116.2	126.3	124.7
Output Index	101.30	104.0	108.2	109.5
Input Index	97.13	89.5	85.7	87.8

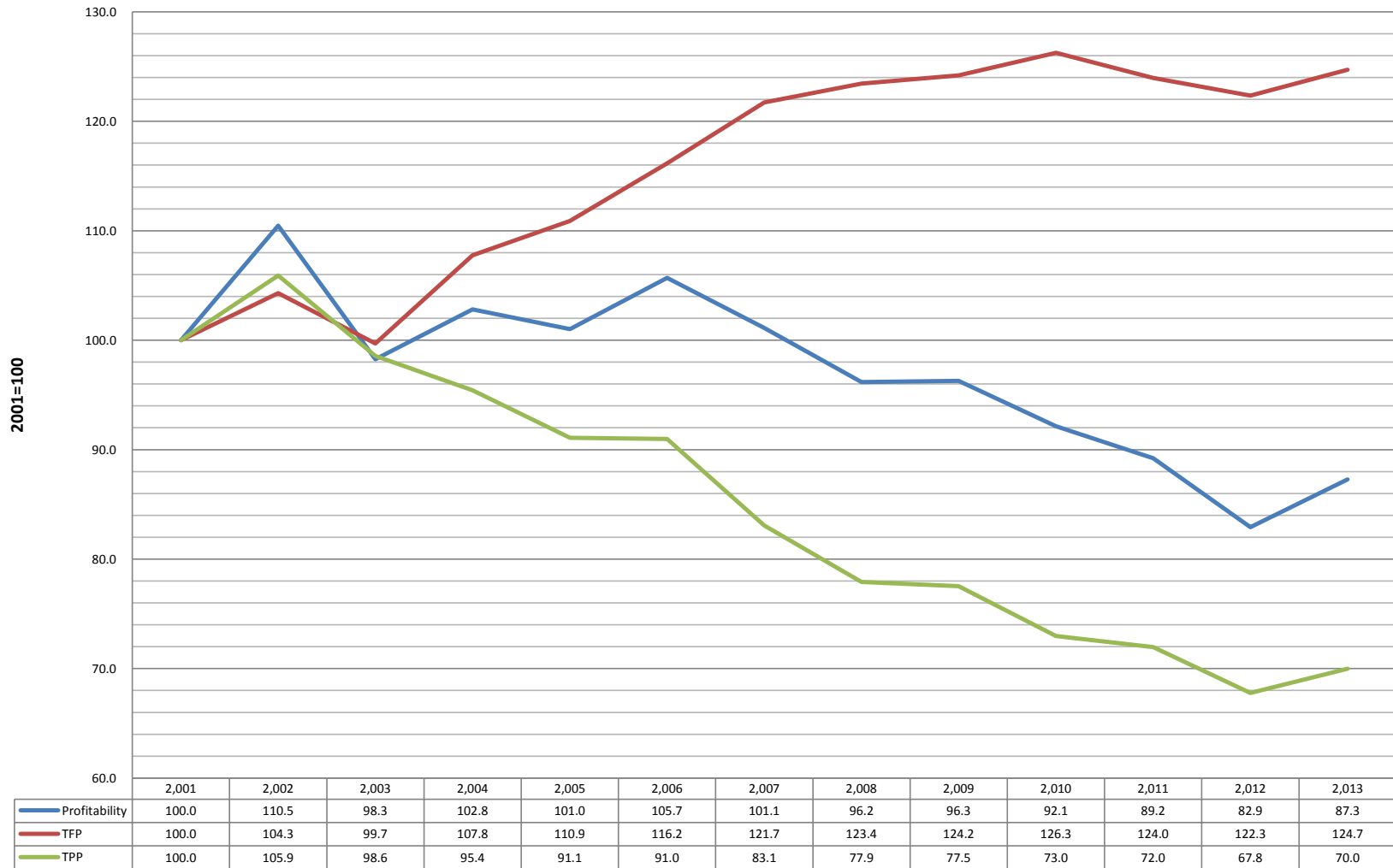
Decomposition of Change in Profitability Index (Annualized Growth Rates)

	2001-2	2002-6	2006-10	2010-13	2001-13	2006-13
Profitability	9.95	-1.10	-3.43	-1.80	-1.13	-2.73
TPP	5.74	-3.80	-5.51	-1.39	-2.97	-3.75
Output Price Index	11.02	0.82	-1.32	-3.95	-0.24	-2.45
Input Price Index	5.28	4.61	4.19	-2.56	2.73	1.30
TFP	4.21	2.69	2.08	-0.41	1.84	1.01
Output Index	1.29	0.65	1.01	0.40	0.76	0.74
Input Index	-2.92	-2.04	-1.08	0.81	-1.08	-0.27

- **Quality Unadjusted TFP growth of 24.7 percent for the 12 years between 2001 to 2013**
- **While TFP Growth Rates exceed 2 percent before 2010, they have been negative since 2010, with slow output growth and input usage increases.**

- **WaSC Productivity Comparison**
- 1991-2015 29.7 percent TFP growth
- 1991-2005 24.2 percent TFP growth

Profitability, TFP, and TPP 2001=100



- TFP growth rates were positive until 2010, but a substantial decline occurred until 2012 before recovery began in 2013.
- Profitability trends show a steady decline between 2006 and 2012 when recovery in both TFP and TPP increased profitability

Reconciled Difference Between Cash Flow Based and Economic Cost Based Total Cost Determination : Scottish Wa

(All Costs expressed in 2010 Prices using RPI FY Avg Deflation)

	1997-2002	2003-2006	2007-2010	2011-2013	1997-2013	2007-2013
Total Cash Expenditures	1,076.6	1,202.3	1,219.0	1,053.5	1,135.6	1,148.1
Calculated Economic Costs	758.5	952.5	995.9	1,047.2	910.9	1,017.9
Total Difference	318.1	249.7	223.1	6.3	224.7	130.2

Differences Resulting from Non compatibility With Economic Cost Definitions

Costs of Capital Financing	151.6	161.1	151.3	142.9	152.3	147.7
financial opportunity cost of capital	112.1	159.3	210.2	194.4	160.8	203.4
Understatement(-)/ Overstatement(+) of Financial Cost of Capital	39.6	1.8	(58.8)	(51.5)	(8.6)	(55.7)

Net Cash Cost of Gross Capital Formation	452.0	545.3	603.6	420.2	504.0	525.0
capital depreciation	173.5	297.3	321.6	362.4	270.8	339.1
"Net Investment" Net Cost of Capital Formation less Depreciation Cha	278.6	247.9	282.0	57.8	233.2	185.9

Reconciled Difference/Estimated Economic Costs	0.42	0.26	0.22	0.01	0.25	0.13
Understatement(-)/ Overstatement(+)	0.05	0.00	-0.06	-0.05	-0.01	-0.05
"Net Investment" Net Cost of Capital Formation less Depreciation Charges	0.37	0.26	0.28	0.06	0.26	0.18

- In contrast to the WaSCs, over the 1997-2013 period Scottish Water's 25 percent excess of cash expenditures to economic costs was entirely attributable to net investment as follows:
- 26 percent or 233.2 million per year due to net investment
- -1 percent or -8.6 million per year due to capital financing expenditures less than that assumed in the WACC.

Summary and Conclusions (1)

- **What Does Profitability Decomposition Reveal about the Determinants of Performance in the Water Industry?**
- **Quality Unadjusted TFP increased fairly steadily until 2010 but subsequently TFP has fallen** (We emphasise the need for the development of stronger quality controls and TFP models to improve these estimates as noted in the Frontier report for Water UK)
- **Profitability has remained relatively high and recovered substantially since the 2001-2005 period impacted by PR 1999**

Raises the Question Going Forward-

How have pro-competitive reforms beginning circa 2010 , and the change to a TOTEX based system in PR 2014 (with false aggregation of opex cost data and capex investment data) really influenced industry trends in productivity and profitability?

Summary and Conclusions (2)

- **Have Price Increases in the Water Industry Been Necessary to Fund Substantial Post Privatisation Capital Investment in a Cash Negative Industry?**

Yes they have, but analysis of the 27 percent excess of cash flow to economic costs during the 1996 to 2015 period when Ofwat set prices suggests that only 16 percent of this is due to net investment

In contrast, for Scottish Water, of the 25 percent excess of cash flow to economics cost during 1997 to 2013, 26 percent is due to net investment and -1 percent is due to capital financing expenditures less than that assumed in the realised WACC.

(Prompt for audience to debate if WACC assumptions are appropriate and difference in WACC assumptions given public ownership)