frontier economics

# Water and Sewerage Productivity Growth

## Centre for Productivity and Performance, Loughborough University

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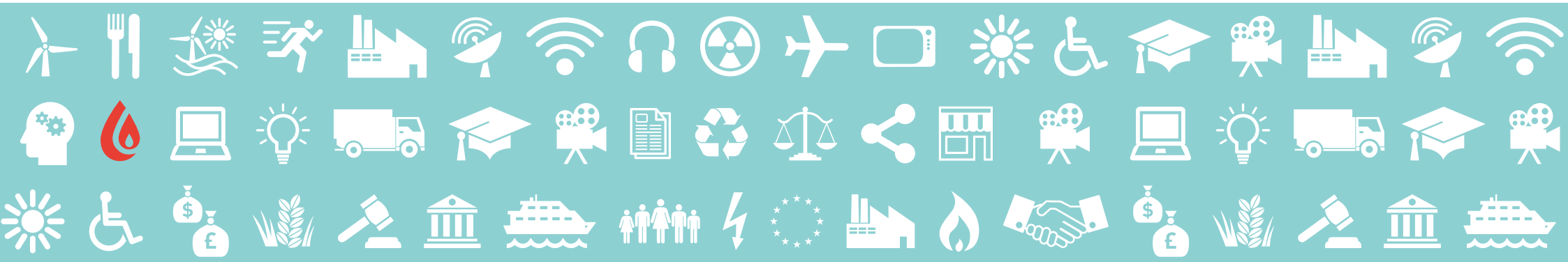


# Background and context to our study for Water UK

## Background and context

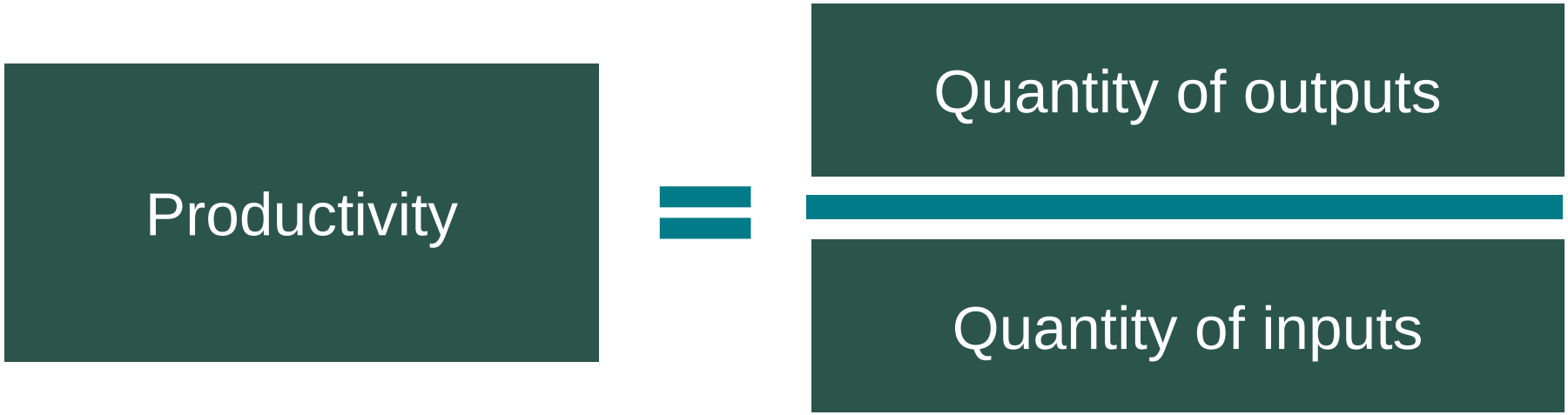
### Growing debate around the performance and future structure of the sector


### Forthcoming PR19 price review


### Aims & objectives

- To contribute to an evidence base on sector performance to inform debate
- Not to address issues around ownership model or form of regulation
- Building on existing methods and research – core project team Frontier and David Saal, Tom Weyman-Jones as academic review

# Total factor productivity is the most common measure of growth in productivity and efficiency




| What is TFP? | ▪ A measure of total factor productivity (TFP) aims to capture all the outputs produced by an entity and all the inputs used to produce those outputs |
|---|---|

# Measuring TFP using the Tornqvist index

Outputs (Y) weighted by their revenue share in year t and s

$$\ln TFP_{st} = \frac{1}{2}\sum_i \left(R_{is} + R_{it}\right)\left(\ln Y_{is} - \ln Y_{it}\right) - \frac{1}{2}\sum_j \left(C_{js} + C_{jt}\right)\left(\ln X_{js} - \ln X_{jt}\right)$$

TFP growth between the years t and s

Inputs (X) weighted by their share of costs in year t and s

## Assumptions

- Constant returns to scale
- That inputs are paid the value of their marginal products

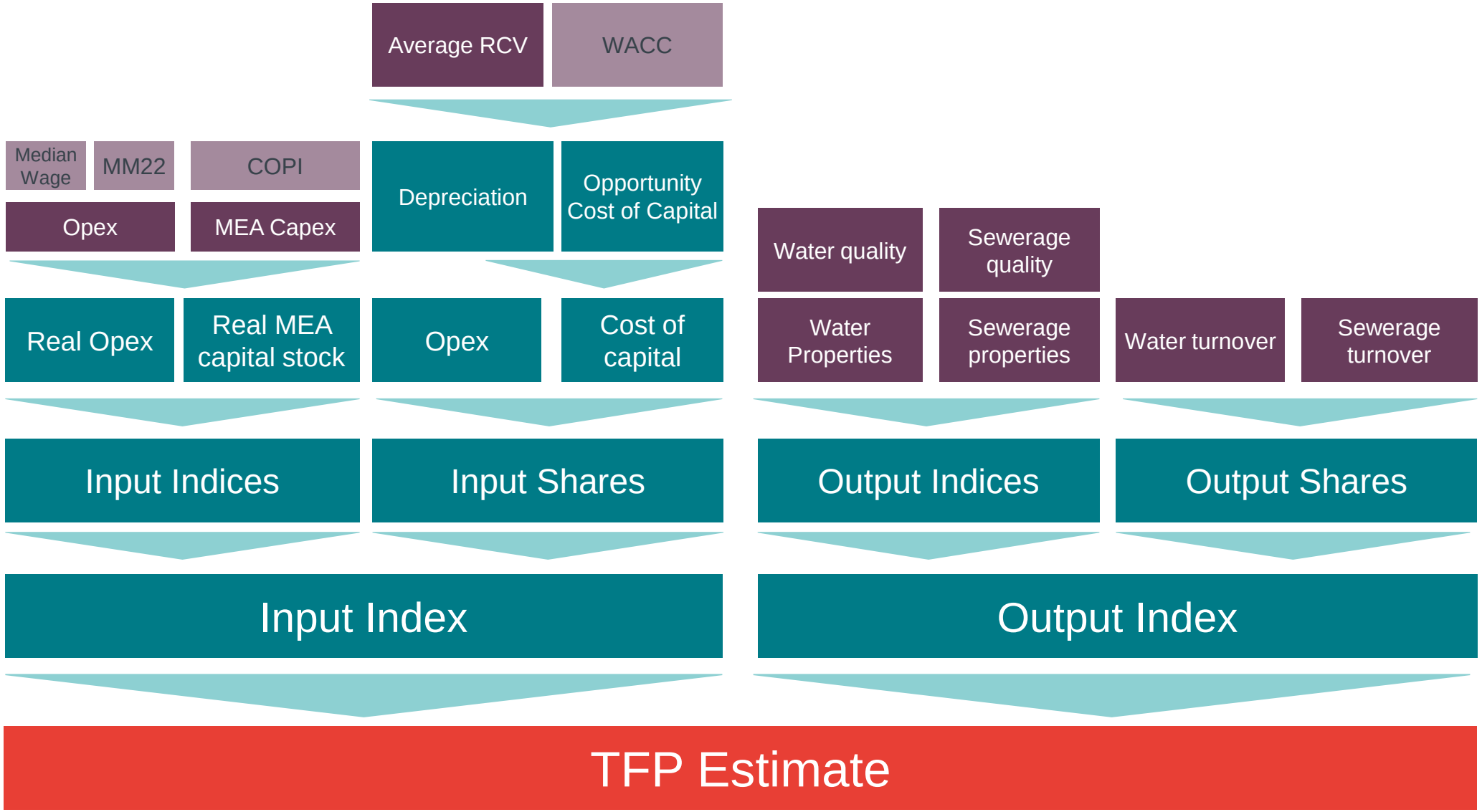
## Advantages

- Able to capture aggregate growth in a simple way
- Able to implement using a small sample of data

## Limitations

- Limited insight into the origins of productivity
- Separate quality adjustment necessary and limited ability to include environmental factors

# We applied a simplified version of Saal & Parker (2001) separating outputs into water and sewerage, and costs into opex and capex

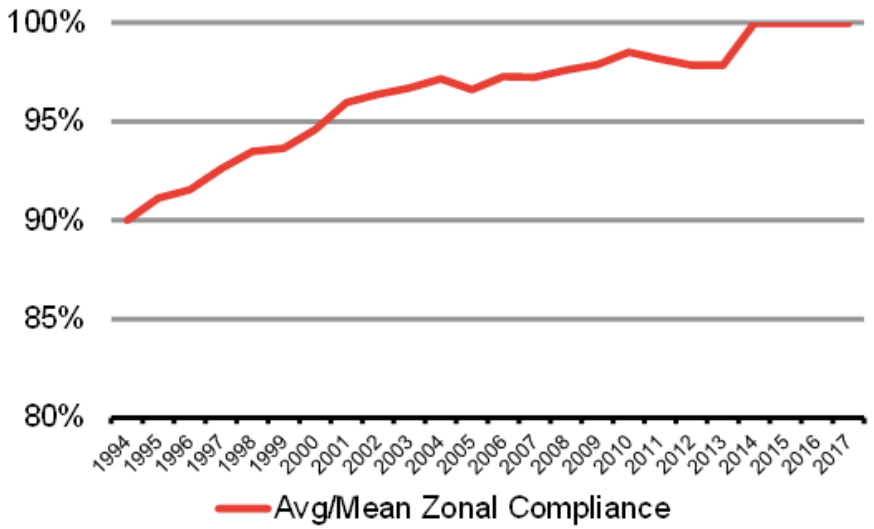


# Including quality metrics for water and wastewater was a core element of the analysis

## Water quality metric – drinking water quality

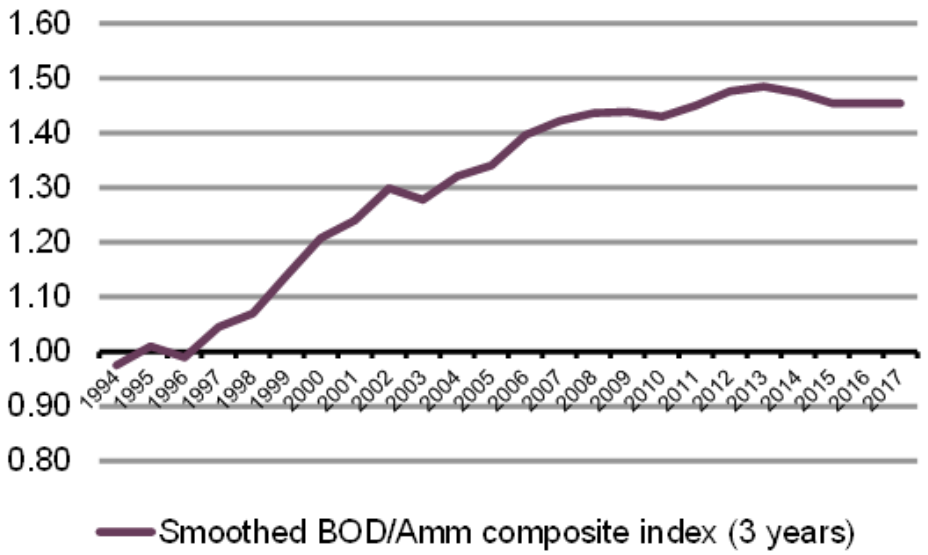
Average compliance - used up until 2011 (WoCs) and 2013 (WaSCs)

Mean zonal compliance - used after 2011 (WoCs) and 2013 (WaSCs)



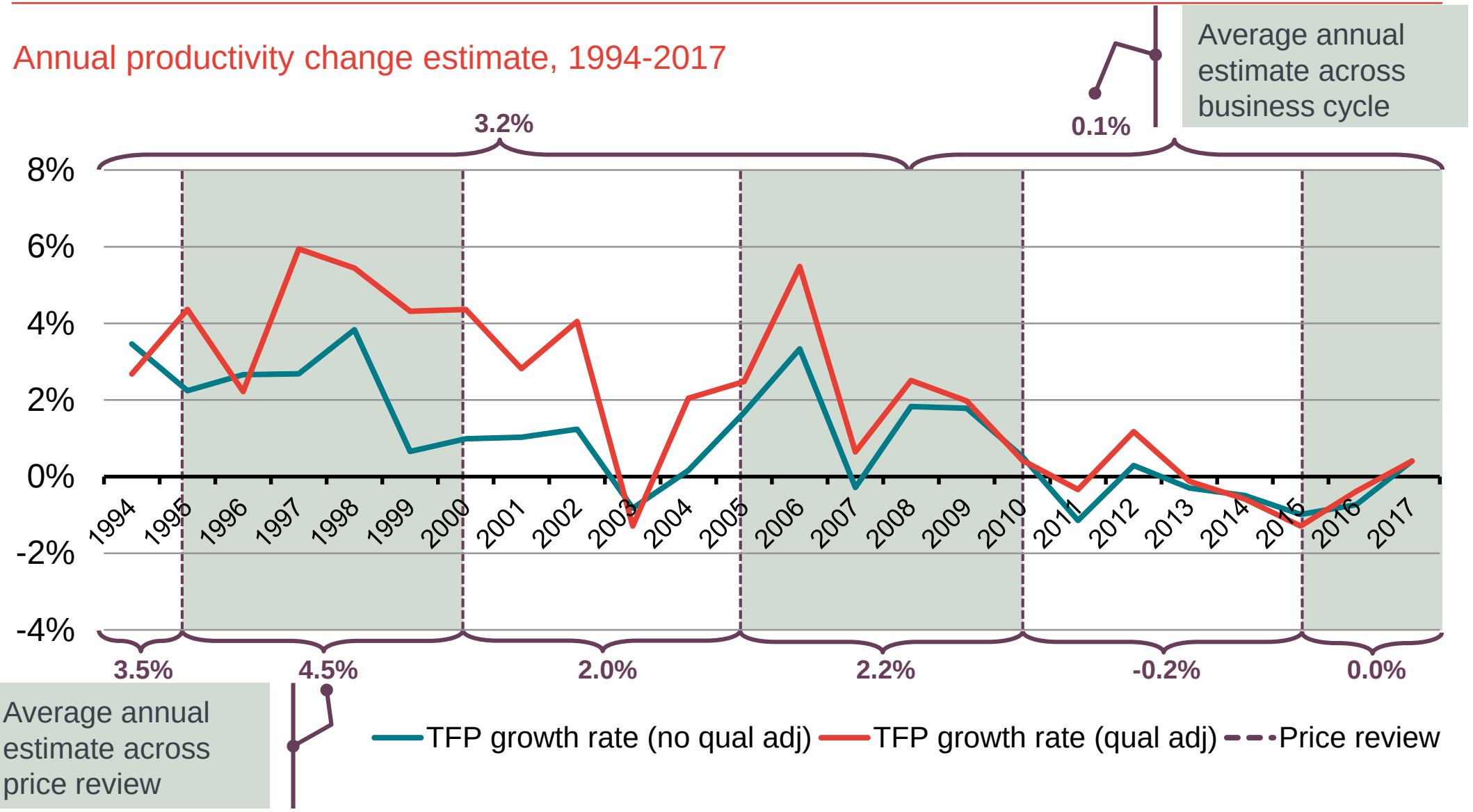

## Wastewater quality metric – river water quality

Alternative measures based on bathing water compliance and proportion of population receiving primary and secondary treatment also considered



# Average annual quality-adjusted productivity increase is 2.1%
## (1.0% with no quality adjustment)

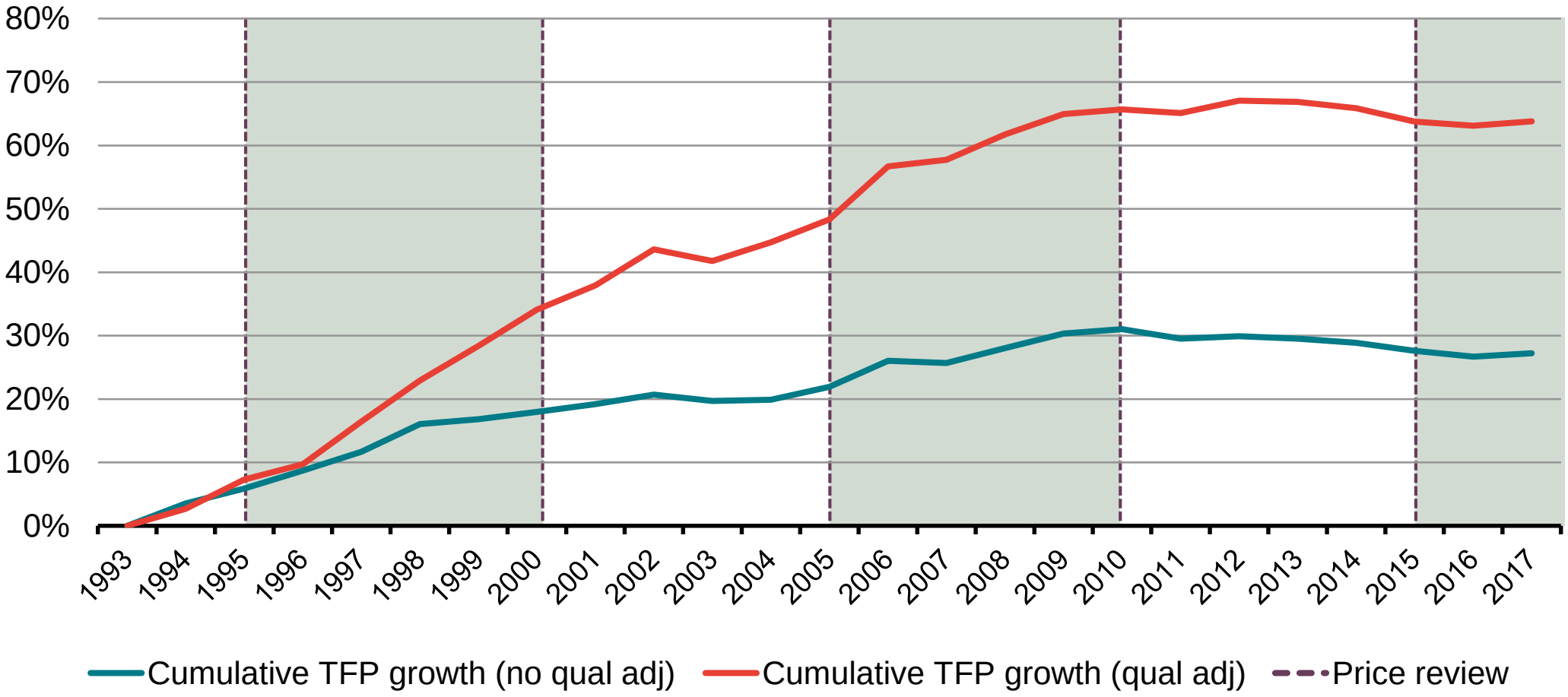
### Annual productivity change estimate, 1994-2017




*Source: Figure 1 & 2, Productivity improvement in the water and sewerage industry in England since privatisation*

# This corresponds to cumulative quality-adjusted growth of 64% since 1993 (27% with no quality adjustment)

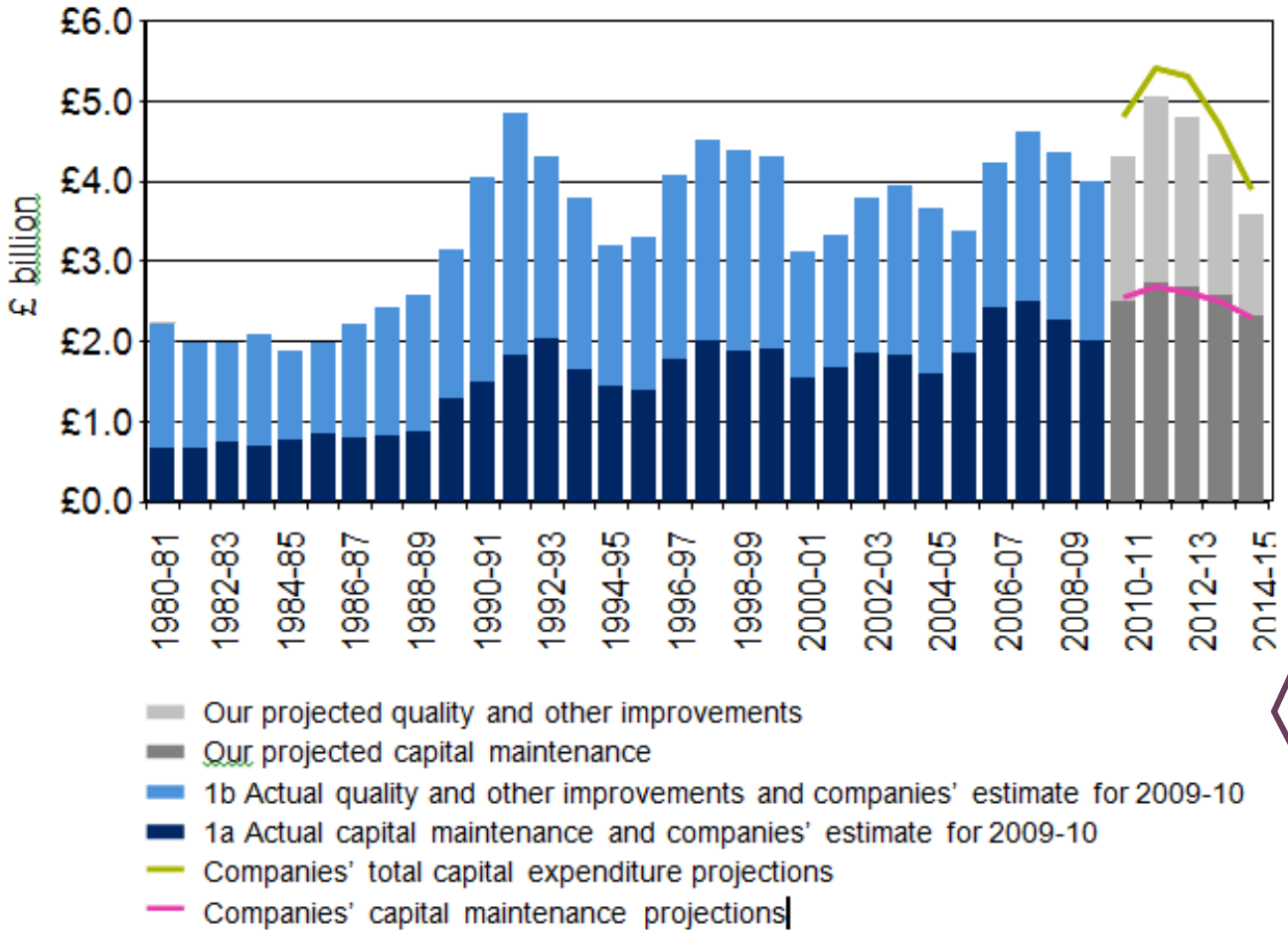
## Cumulative TFP growth, 1993-2017




*Source: Figure 3, Productivity improvement in the water and sewerage industry in England since privatisation*

# Expenditure on enhancement has not slowed by the extent that our quality measure indicates

## Actual and projected capital investment 1981-2015 – Ofwat figures




*Source: Figure 9, Future water and sewerage charges 2010-15: Final determinations*

**Other possible quality metrics**

- Leakage
- Supply interruptions
- Sewer flooding
- Water quality (taste & appearance)
- Resilience metrics
- Ecosystems & habitats
- Customer service

Data issues with including further metrics.

Including other quality metrics would influence level and profile of TFP growth.

# Productivity performance in comparator sectors

**Choice of comparator UK sectors**

- Sectors chosen based on similarities of activities, inputs and regulatory environment.
- Utilities, transport, chemicals, construction, motor vehicles, post & telecoms, retail, finance and insurance.

**Data source**

- Productivity data sourced from EU KLEMS dataset (ONS for public services).
- Data sample split 1994-2008 and 2009-2015, corresponding to business cycles.

| | 1994 - 2008 | 2009 - 2015 |
|---|---|---|
| Water (quality adjusted) | 3.2% | 0.2% |
| Average of comparator sectors | 1.7% | -0.3% |

# Summary of findings

**Our approach**

- Measuring TFP using Tornqvist method is well-established and robust method.
- Important feature of this analysis was adjusting for quality improvements.

**Water and sewerage productivity performance**

- 2.1% annual productivity growth (1994-2017), 1.0% with no quality adjustment.
- Sector has delivered productivity growth over recent business cycles that compares well to comparator industries.
- Recent TFP trends have been weaker across all sectors.

**Areas for further work**

- Further work on developing quality indices, focussing on recent areas of expenditure.
- Further sensitivity analysis of weighting for capex shares and quality.
- Alternative methodologies, e.g. cost / distance function techniques that could provide richer insights (Saal, Parker and Weyman-Jones, 2007).