



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

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$$\text{Productivity} = \frac{\text{Quantity of outputs}}{\text{Quantity of inputs}}$$

# Measuring TFP using the Tornqvist index

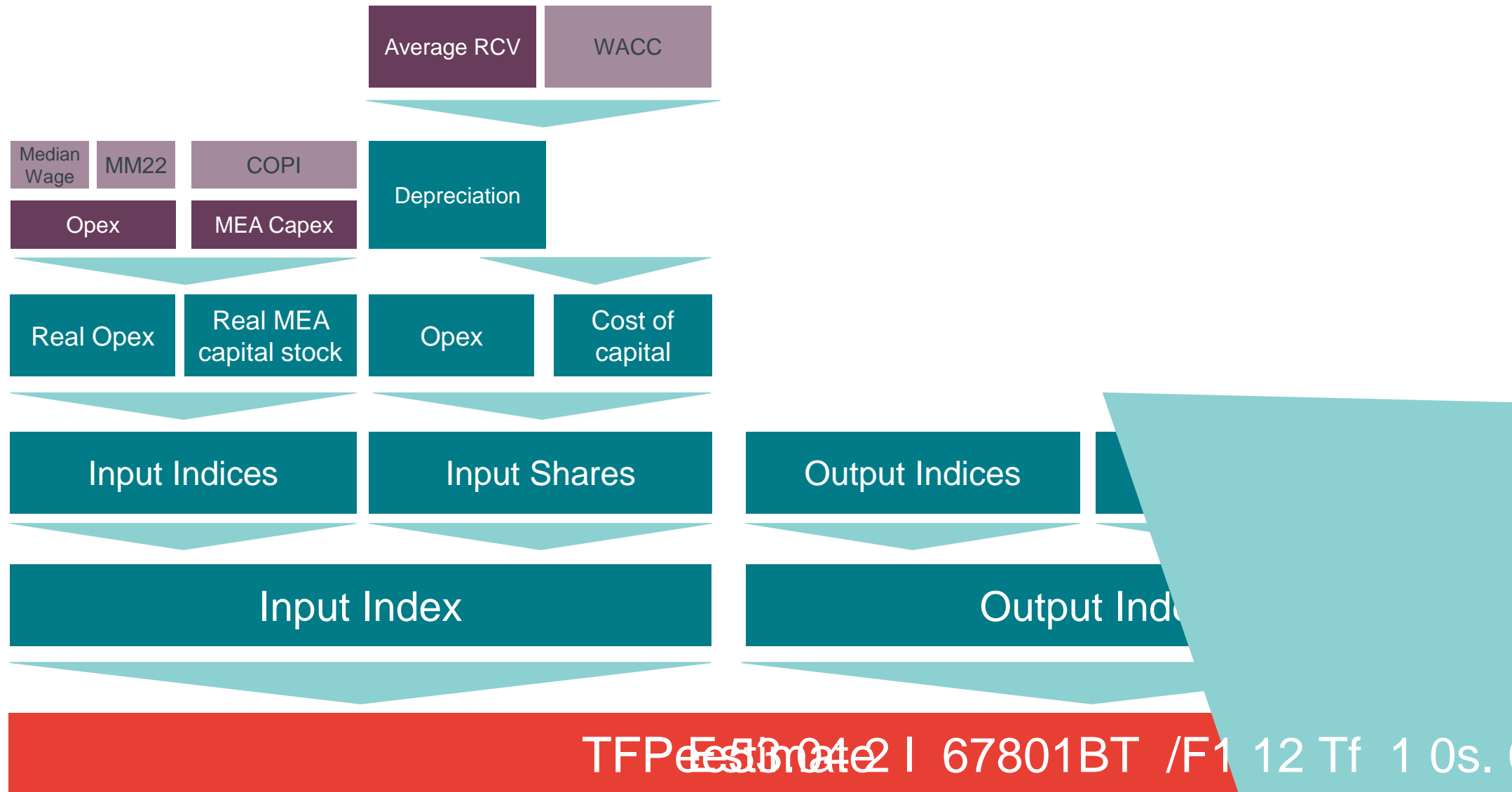
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## Assumptions

Constant returns to scale

That inputs are paid the value

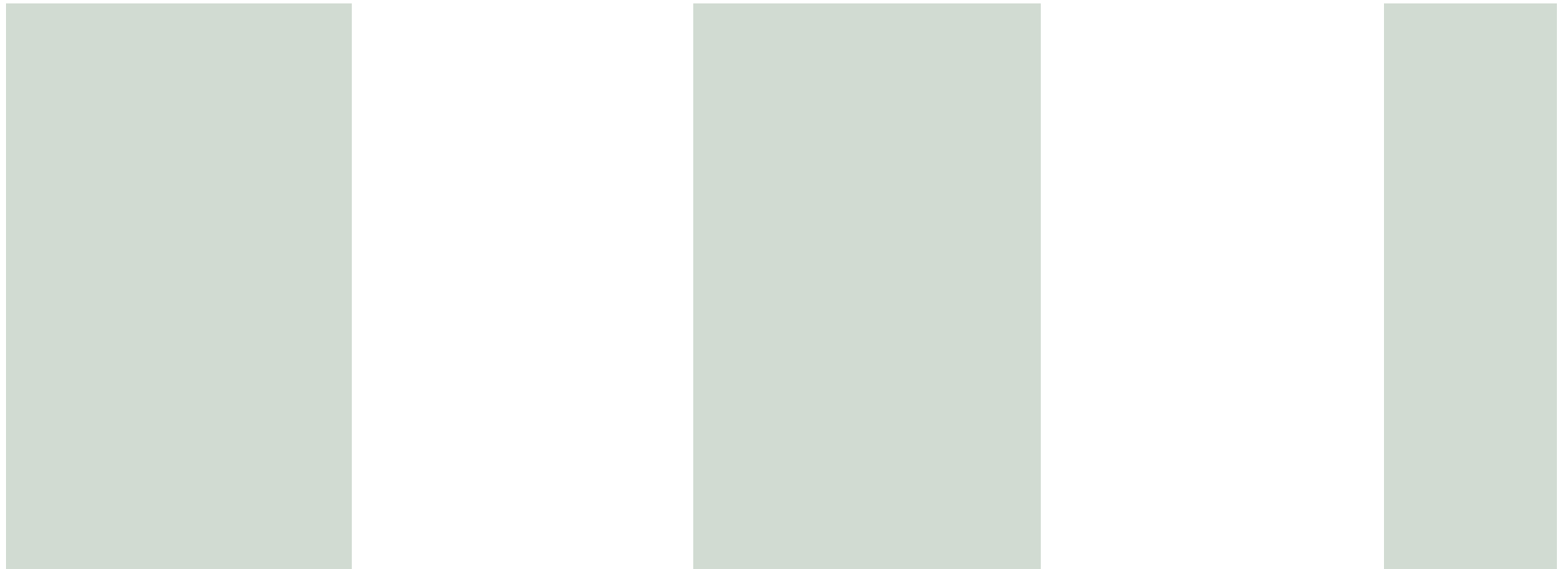
We applied a simplified version of Saal & Parker (2001) separating outputs into water and sewerage, and costs into opex and capex





# Average annual quality-

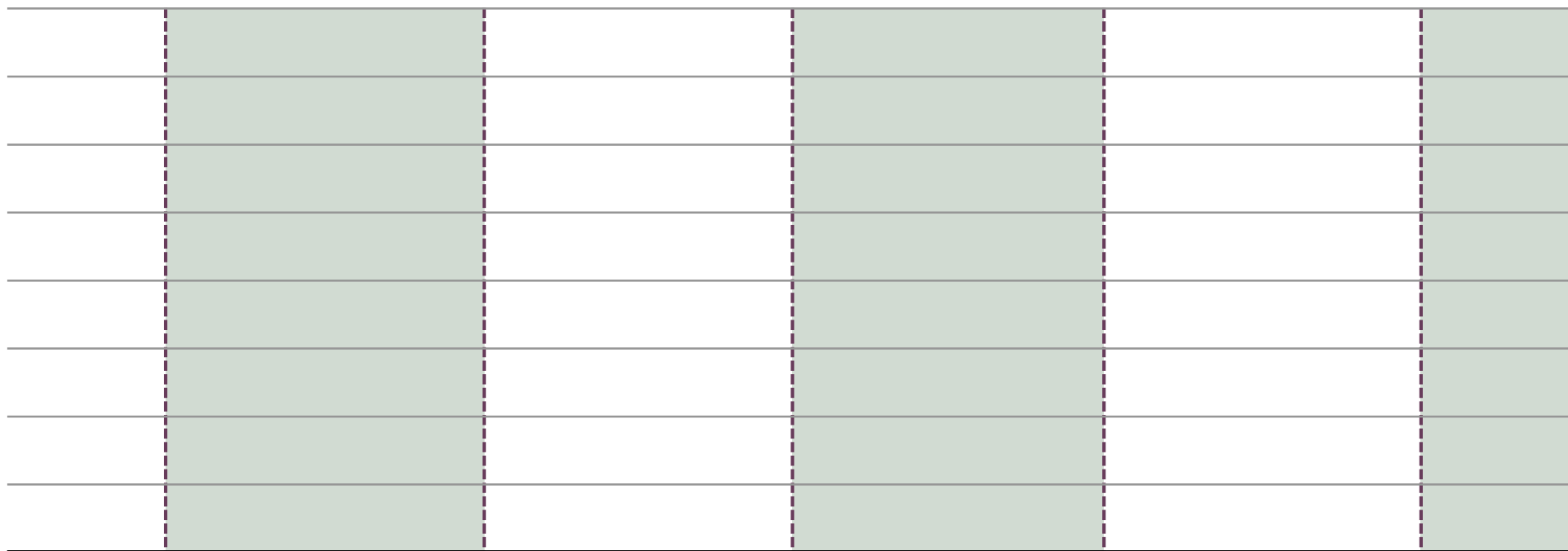
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This corresponds to cumulative quality-adjusted growth of 64% since 1993 (27% with no quality adjustment)

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Cumulative TFP growth, 1993-2017

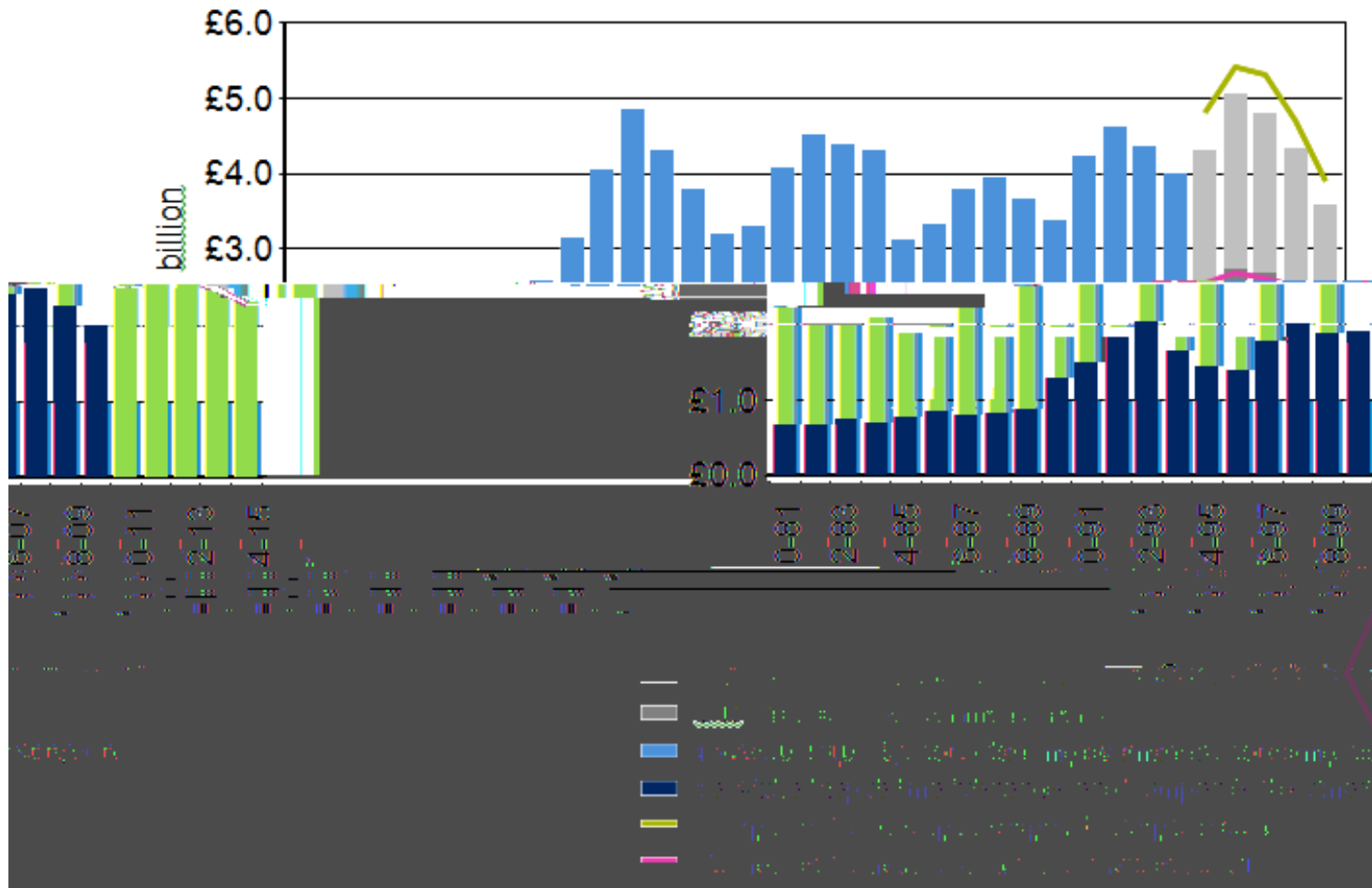


Source: Figure 3, Productivity improvement in the water and sewerage industry in England since privatisation



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

Actual and projected capital investment 1981-2015 – Ofwat figures



## 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

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Choice of  
comparator UK  
sectors



Sectors chosen based on similarities of activities, inputs and regulatory environment.

Utilities, transport, chemicals, construction, motor vehicles, post &



