



Australian Energy Market Commission

DESIGN DISCUSSION PAPER

Review into the use of total factor productivity for
the determination of prices and revenues

28 August 2009

REVIEW

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Citation

AEMC 2009, *Review into the use of total factor productivity for the determination of prices and revenues*, Design discussion paper, 28 August 2009, Sydney

About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy, established the Australian Energy Market Commission (AEMC) in July 2005 to be the Rule maker for national energy markets. The AEMC is currently responsible for Rules and policy advice covering the National Electricity Market. It is a statutory authority. Our key responsibilities are to consider Rule change proposals, conduct energy market reviews and provide policy advice to the Ministerial Council as requested, or on AEMC initiative.

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Summary

As part of its total factor productivity (TFP) Review, the Australian Energy Market Commission has published this discussion paper which presents a design of a TFP methodology for the determination of revenues and prices.

The purpose of this TFP design is to provide a basis for all parties to consider and discuss in detail the feasibility and possible operation of a TFP methodology for revenue and pricing decisions as an alternative to the current building block approach. It responds to stakeholders' comments that further information on the design of a TFP methodology is required to enable them to reach a view on the relative merits and disadvantages of applying TFP. Stakeholders' views and comments in this regard will be a critical input into the draft report for this Review.

The TFP design example presented here is one possible approach to a TFP methodology. The paper steps through each of the various elements of a TFP methodology, and sets out an example of how each element could be designed. In some areas a range of options for discussion is presented. The paper also recognises that for certain elements further analysis would be needed before a TFP methodology could be applied.

There are two parts to the example methodology presented. The first part comprises the core elements of a TFP methodology that would need to be prescribed in the Rules. This includes the option for service providers to choose between either the TFP methodology or the existing building block approach at the start of each regulatory period. It would also include the formulae and processes for calculating the TFP growth rate and determining the X factor.

The second part considers the elements of the methodology that the service provider should be able to seek to adapt to its own circumstances with the regulator's approval. These elements include the length of the regulatory period and the use of off ramps and capital modules.

This discussion paper does not represent a preferred design, nor does it suggest that the example presented should be adopted as an alternative methodology for economic regulation of the Australian electricity and gas sectors. These are matters for the draft and final reports of the Review.

Also, the design has been developed under the assumption that the necessary data would be available. The TFP methodology should determine the required data rather than the existing data-set dictating the design of the TFP methodology.

Submissions are to be lodged by 30 October 2009. In September and October 2009, two workshops will be held to discuss the key issues raised in this discussion paper. One workshop will focus on gas distribution and the other electricity distribution. We look forward to engaging with stakeholders on the matters raised in this paper. The feedback on this TFP design will assist in the development of the draft report for this Review.

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Abbreviations

AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
Commission	see AEMC
CPI	Consumer Price Index
ESC	Essential Services Commission of Victoria
FCM	Financial Capital Maintenance
MCE	Ministerial Council on Energy
MTFP	Multilateral Total Factor Productivity
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
NGL	National Gas Law
NGO	National Gas Objective
NGR	National Gas Rules
OEB	Ontario Energy Board
PEG	Pacific Economics Group
PFP	Partial Factor Productivity
Rules	National Electricity Rules and National Gas Rules
TFP	Total Factor Productivity

Glossary of terms

Brattle Incentives Report	The Brattle Group, <i>Incentives under total factor productivity based and building-blocks type price controls</i> , June 2009.
Brattle International Review Report	The Brattle Group, <i>Use of total factor productivity analysis in network regulation: case studies of regulatory practice</i> , October 2008.
Building block approach	The approach specified by NER and NGR to determine the total revenue of a service provider. Total revenue is the sum of a return on the capital base, depreciation, corporate income tax, increments and decrements resulting from an incentive mechanism and forecast operating expenditure.
Capital module	A mechanism to manage extraordinary capital expenditure during a regulatory period.
Cost pass through mechanism	A mechanism to manage, and pass through to users, specific costs or savings that are incurred by a service provider during a regulatory period.
Depreciation	The amount representing the return to a service provider to cover its investment costs. This is calculated based upon the profile that reflects the nature of the assets over the economic life of the asset.
Economic Insights Data Availability Report	Economic Insights, <i>Assessment of data currently available to support TFP-based network regulation</i> , 9 June 2009.
Economic Insights Sensitivity Report	Economic Insights, <i>Energy network total factor productivity sensitivity analysis</i> , 9 June 2009.
External benchmarking	The comparison of a service providers actual or forecast costs to an exogenous reference level (for example, the most efficient business in the sector). A benchmark is deemed to be external if a business cannot influence the benchmark against which it is assessed through its own actions.
Expert Panel	Expert Panel on Energy Access Pricing
Fixed X	Where X is determined from an estimate of TFP growth and that estimate is fixed for the entire regulatory period.
Inputs	Those components which the service providers employs to provide its services.
Issues Paper	AEMC 2008, <i>Review into the use of total factor productivity for the determination of prices and revenues: framework and issues paper</i> , 12 December 2008, Sydney.
NAS Expenditure Profiles Report	Network Advisory Services, <i>Issues in relation to the availability and use of asset, expenditure and related information for Australian electricity and gas distribution businesses</i> , August 2009.
Normalisation	Adjusting data to account for differences in operating environment conditions.
Off ramp	A mechanism to manage service provider specific exogenous events during a regulatory period.
Outputs	The dimensions of services provided valued by customers.

P ₀	Initial price or revenue cap set for the start of the regulatory period.
Perspectives on the building block approach	AEMC 2008, <i>Review into the use of total factor productivity for the determination of prices and revenues: perspectives on the building block approach</i> , 30 July 2009, Sydney.
Regulatory period	The period for which the terms of the regulatory determinations on allowed prices/revenue are set. Under the framework established under the NEL, this is referred to as the regulatory control period. Under the framework established under the NGL, it is called the access arrangement period.
Review	AEMC Review into the use of total factor productivity for the determination of prices and revenues.
Revised statement of approach	AEMC 2009, <i>Review into the use of total factor productivity for the determination of prices and revenues: revised statement of approach</i> , 28 April 2009, Sydney.
Rolling X	Where X is determined from an estimate of TFP growth that is annually updated using a rolling average approach.
TFP methodology	TFP based revenue and pricing methodology.
Victorian Proposal	Victorian Minister for Energy and Resources, <i>Rule change proposal to allow the use of total factor productivity methodology in distribution</i> , 18 June 2008.

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1 Introduction

The Australian Energy Market Commission (AEMC) is undertaking a review on the possible use of total factor productivity (TFP) for the determination of prices and revenues in regulatory decisions (Review).

This discussion paper responds to stakeholders' comments that further information on the design of a TFP based revenue and pricing methodology (TFP methodology) is required to enable them to reach a view on the relative merits of applying a TFP methodology.¹ This discussion paper presents a design as an example of a possible TFP methodology for consultation and discussion.

The background and purpose of this discussion paper, together with further information on proposed consultation is set out in the remainder of this chapter. This paper does not make any assessment on whether this or any other example of a TFP methodology would be consistent with the National Electricity Objective (NEO) or the National Gas Objective (NGO).

More details on the background and progress to date of the Review can be found in Appendix A.

1.1 Background to design

Stakeholders have commented that given the importance of the Review, more extensive consultation and stakeholder involvement is needed. A number of parties suggested that they would like a greater understanding of the details of a possible TFP methodology and its operation to be able to evaluate TFP, its associated issues and suitability for Australian energy regulation.²

The revised statement of approach acknowledged these points and noted that there are numerous choices or options that can be made when designing a TFP methodology. Accordingly, we undertook to:

- release consultant reports as they are concluded;
- prepare and release for consultation a example of a TFP design; and
- conduct more, and focused, discussions with parties on TFP design issues.

This discussion paper addresses the second of these points.

¹ AEMC 2009, *Review into the use of total factor productivity for the determination of prices and revenues: revised statement of approach*, 28 April 2009, p. 7. (Revised statement of approach) The revised statement of approach for the Review stated the need for a more co-operative approach with stakeholders on analysing the relevant issues before the release of the Review's draft recommendations.

² Revised statement of approach, p. 7.

1.2 Purpose of the design

The particular TFP design in this paper has been prepared to encourage and enhance discussion on the possible application of a TFP methodology. This paper raises specific questions for comment and presents options on certain aspects to the design. The information obtained through this consultation will assist in the development of the draft report for this Review.

This discussion paper does not:

- represent a preferred design of a TFP methodology;
- imply that the design presented is consistent with the NEO and NGO;³ or
- indicate that the AEMC has decided that this example, or any other example of a TFP methodology, should be adopted as an alternative methodology for economic regulation of the Australian electricity and/or gas sectors.

These are matters for the draft report of the Review.

The discussion paper focuses on the essential elements of a possible TFP methodology for the setting of revenue or prices for regulated service providers. Not all the details required for a functioning TFP methodology are covered in this example. Further work would be required on a number of elements before the design would be complete.

Of the essential elements, certain features have been selected in preference to others to form an example of a total TFP methodology suitable for consultation. In making these selections, regard has been had to the NEO and NGO and the revenue and pricing principles, as well as submissions and consultant reports, the previous analysis undertaken by the Essential Service Commission of Victoria (ESC) and the information contained in the Rule change proposal lodged by the Victorian Minister for Energy and Resources.⁴

The TFP design example set out in this discussion paper has been guided by the following criteria:

- consistency with the economic theory supporting the use of a TFP methodology;
- providing an incentive to minimise costs to the level of efficient costs and share those with users;
- supporting the efficient investment in assets and providing the opportunity to recover the capital and non-capital costs consistent with those incurred by an efficient service provider;

³ NEL, ss. 7-7A and NGL, ss. 23-24.

⁴ Victorian Minister for Energy and Resources, *Rule change proposal to allow the use of total factor productivity methodology in distribution*, 18 June 2008. (Victorian Proposal)

- having regard to the possibility of variations in expenditure profiles of service providers in the future;
- good regulatory practice through clarity, certainty and transparency of the regulatory framework; and
- minimising the cost and impact of regulation.

Consideration has not been given to the adequacy of any existing data-set. Rather, the design has been developed under the assumption that the necessary data would be available. The TFP methodology should determine the required data rather than the existing data-set dictating the design of the TFP methodology.

Another focus has been the application of any TFP methodology in a broadly consistent manner to the electricity and gas distribution sectors.⁵ There would necessarily be some differences in detail due to the current differences between the National Electricity Rules (NER) and National Gas Rules (NGR), and the particular needs of the sectors. However, where feasible the approach in this paper has been to form a TFP methodology that may be applicable to both sectors.

This discussion paper draws on, but does not discuss in detail, information on the theory of TFP and its use in economic regulation as well as information about the building block approach. Background material on these matters has been provided in the following chapter, the Issues Paper and various consultant reports prepared during the course of the Review.⁶

1.3 Consultation process

1.3.1 Consultant and AEMC reports

A number of consultant reports have been published as part of this Review which have aided the preparation of this discussion paper. The AEMC released its report *Perspectives on the building block approach* on 30 July 2009. Most recently, a report by Network Advisory Services (NAS) was released on 21 August 2009.⁷ More details on these reports can be found in Appendix A.⁸

Stakeholders wishing to comment on any of the matters raised in any of these reports are invited to lodge their submission online through the home page of the AEMC's website by Friday 30 October 2009, quoting project reference number 'EMO0006'.

⁵ The Revised statement of approach stated that the Review will now focus on the possible application of TFP to the electricity and distribution sectors and that the possible application to the transmission sectors will be assessed at a later stage. See Revised statement of approach, p. 9.

⁶ AEMC, *Review into the use of total factor productivity for the determination of prices and revenues: framework and issues paper*, 12 December 2008. (Issues Paper)

⁷ Network Advisory Services, *Issues in relation to the availability of use of asset, expenditure and related information for Australian electricity and gas distribution businesses*, August 2009. (NAS Expenditure Profiles Report)

⁸ All documents relating to this Review are available from the AEMC's website.

1.3.2 Workshops and submissions

As stated previously, the purpose of this discussion paper is to facilitate consultation through written submissions and discussion at planned workshops.

Consultation on matters contained in this discussion paper will take two forms. First, two workshops will be held to discuss key issues raised in this discussion paper. These workshops will be held during September 2009. One workshop will focus on gas distribution and the other on electricity distribution. All stakeholders will be invited to attend the workshops. Further details and invitations to attend will be provided shortly.

Second, written submissions are invited on any aspect of the possible TFP design as outlined in this discussion paper. Parties wishing to provide written submissions are invited to lodge their submission online through the home page of the AEMC's website by Friday 30 October 2009, quoting project reference number 'EMO0006'.

1.4 Way forward

As outlined above, the focus of this discussion paper is to obtain further information from stakeholders on TFP. This will be a valuable input into the development of the draft report for the Review.

In addition to the TFP design in this discussion paper and submissions and comments on it, the following will be taken into account in developing the draft report:

- submissions made by stakeholders throughout this Review process;
- reports from consultants commissioned by the AEMC;
- other information on TFP and the regulation of electricity and gas service providers in Australia and other jurisdictions;
- work carried out by ESC on the application and use of TFP in Victoria; and
- the Expert Panel's report.⁹

In taking into account this information, the draft report will address the question set out in the terms of reference for the Review.¹⁰

The stage 1 draft report of the Review will be released in December 2009. The remainder of the Review process will then follow the timetable set out below.

⁹ Expert Panel on Energy Access Pricing, *Report to the Ministerial Council on Energy*, April 2006.

¹⁰ AEMC 2008, *Review into the use of total factor productivity for the determination of prices and revenues: terms of reference*, 21 November 2008, Sydney.

Date	Milestone
Public forum on the stage 1 draft report	late January 2010
Submissions on the stage 1 draft report due	late February 2010
Provide the stage 1 final report to the MCE	April 2010
Consultation on the stage 2 draft Rules (if required)	May 2010
Provide stage 2 final report on draft Rules to the MCE (if required)	June 2010

1.5 Structure of paper

The next chapter provides a brief explanation of TFP and the rationale for using TFP in incentive regulation. Chapter 3 provides a summary of the features of the TFP design presented in this discussion paper. Chapters 4-8 discuss more in detail the elements of that TFP design. Appendix A outlines the progress of the Review. Appendices B-D provide greater detail on TFP design issues.

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2 Rationale for a TFP methodology in incentive regulation

This Review is assessing whether a TFP methodology for regulatory determinations should be permitted as an alternative to the building blocks approach in the national energy markets. This chapter briefly sets out some of the theoretical context and concepts for the Review. It contains a brief description on what TFP is, how TFP can be useful in incentive regulation and the use of TFP growth estimates in setting regulatory paths. Other background information is also available in the Issues Paper.

2.1 What is TFP?

TFP measures how businesses, industries or regions use all the inputs in their production processes to produce outputs that are valued by customers and can identify the component of the change in outputs that is not explained by changes in inputs. TFP indices provide a way of comparing how productive businesses or industries use their resources. For example, an industry TFP growth index measures the rate at which the productivity of a group of businesses changes over time. However, such measures do not identify whether the average business or any particular business is 'technically efficient' as they do not attempt to measure whether the business is producing as much as possible with the given inputs.

2.2 Using TFP in incentive regulation

2.2.1 Aims of incentive regulation

The aim of incentive regulation is to provide strong incentives for regulated businesses to reduce costs, improve service quality, and undertake efficient investment. The incentive to reduce costs is provided by setting the prices or revenue to apply during the regulatory period at the start of the regulatory period, regardless of what actual costs during the regulatory period turn out to be. In doing so, incentive regulation attempts to replicate the discipline competitive market forces would impose on the regulated business if they were present. These forces compel businesses that realise productivity gains to pass these gains on to their customers in the form of lower prices (after accounting for changes in input prices).

There are two distinct aspects to incentive regulation: the initial level of the cap (on allowed revenue or prices) and the rate of change to the cap over time:

- The initial cap is estimated by the regulator to reflect the efficient level of costs for the business. Hence, the business is incentivised to out-perform that cap.
- The rate of change sets the allowed path at which the business's inflation adjusted prices or revenues may change over time. The rate of change is typically represented by a 'CPI-X' term.

The X factor consists of two aspects: the estimation of the expected efficiency gains of the industry net of the general economy wide efficiency growth and an allowance for

the difference between the growth of input prices for the business and the economy wide input price growth rate.

The initial level of the (price or revenue) cap and the rate of change to the cap – the X factor – can be set either according to business-specific analysis of costs, or on the basis of external benchmarks.

2.2.2 Building block approach

The building block approach determines the initial price or revenue cap and the rate of change (or price or revenue path) through the use of business specific information. The approach requires summing the indexation of the regulatory asset base and forecasts of the return on capital, depreciation, cost of corporate income tax, revenue increments or decrements resulting from the operation of an incentive scheme and the operating expenditure of a specific business.

The X factor under a building block approach is a business specific adjustment factor set to reflect the efficient level of expenditure that the business would need to incur over time to meet the required levels of service reliability and quality, expected demand growth and cost of capital financing. In doing so, the regulator is required to make assumptions about the future productivity of the business.

2.2.3 TFP methodology

TFP indices do not measure profitability or efficiency and therefore cannot help regulators to set the initial price or revenue cap at a level that gives the business a reasonable return. The initial price or revenue level must be determined by another method; for example, using a building block approach.

However, TFP indices can be used to determine the price or revenue path, providing an alternative to the building block approach of carrying out an analysis of business specific cost forecasts. Under a TFP methodology, the X factor is set according to an external benchmark. That is, the productivity performance (or rate of change in productivity) of a relevant ‘industry group’ (that is, group of comparable businesses) over time.

Under a TFP methodology, if the initial cap is set to recover the efficient level of costs (including capital funding costs), and the historical TFP growth rate reflects productivity growth that can be expected going forward, then the business should be able to earn a reasonable rate of return and recover efficient costs when TFP growth measures are used to determine the X factor.

A simple TFP methodology is where the X factor is set equal to the estimated TFP growth rate. However, overseas applications of a TFP methodology sometimes only use the TFP growth rate as a starting point for setting X and have taken into account other considerations. Therefore, additional components can be included in the determination of X. The term – sometimes referred to as a stretch factor – that incorporates these other considerations could be justified for a number of reasons. For example, to adjust the rate of change to allow for circumstances specific to the

regulated business or to better reflect the incentive performance in moving to a TFP based methodology. This is discussed further in chapter 8.

A TFP methodology could also be designed to incorporate other factors such as a capital module and off ramps. A capital module would create a provision for recovery of future increases in capital expenditure which would not be reflected in the TFP formula. An off ramp is a mechanism which provides the opportunity to intervene into a regulatory period prematurely and reset costs and prices by setting a new price cap level. Both concepts are discussed further in chapter 7.

2.2.4 Advantages and disadvantages of the methodologies

The current building block approach for revenue regulation provides a degree of certainty for investors as it is considered to be a well understood, relatively straight forward and stable process which yields sufficient incentives for service providers to seek cost efficiencies. Also, the building block approach has the potential advantage of being able to focus on the specific circumstances facing each service provider and to be forward-looking.

However, as reported in *Perspectives on the building block approach*, the building block approach has been criticized for:¹¹

- failing to cater for innovation;
- being too resource and cost intensive;¹²
- requiring subjective judgments by the regulator resulting in a level of efficient prices being too low to allow for sufficient returns;¹³
- information asymmetry between the regulator and the service provider;
- leading to disputes; and
- being open to gaming by service providers.¹⁴

In addition, the building block approach:

- tends to focus on benchmarking a service provider against its own past performance rather than against an average or best industry performance; and

¹¹ AEMC, *Review into the use of total factor productivity for the determination of prices and revenues: perspectives on the building block approach*, 30 July 2009. (Perspectives on the building block approach)

¹² A building block methodology is an information intensive exercise. Also, the preparation of and participation in this regulatory process is costly.

¹³ The analysis of what the service provider's efficient costs might be subjective and non-reproducible as it depends on professional opinion rather than an explicit model.

¹⁴ When applying a building block approach, the regulator invariably faces information asymmetry relative to the service provider and there is a risk the regulator can be 'gamed' by being misled about the true level of efficient costs and how quickly efficiency gaps can be bridged.

- may result in prices that are too high, permitting inefficiencies or excess returns to persist.

As a TFP methodology reduces the use of business-specific cost data, its proponents consider that it has high powered incentive properties by benchmarking service providers against industry wide productivity performance. Other potential benefits from a TFP methodology, compared with the building block approach, are:

- overcoming, or avoiding, the current information asymmetry problem;
- less likelihood of disputes (provided there is a generally accepted TFP methodology) since the allowed price path would be based upon historical industry wide data which would be known and measurable instead of relying on firm specific forecasts; and
- lower regulatory costs.

A potential disadvantage of TFP is that it is fundamentally dependent on the availability of high quality data to accurately calculate industry wide productivity trends. Collecting the required data through a transparent process that ensures the data to be clearly defined, consistent, comparable and reliable could increase the regulatory costs for businesses. Also, there may be disagreements upon the specification of the methodology used to calculate TFP growth (for example, defining the appropriate range of inputs and outputs).

The objective of this Review, is to determine under what circumstances the adoption of a TFP methodology, as an alternative to the existing building block approach, can be expected to deliver economic benefits.¹⁵ This will involve assessing and balancing the advantages and disadvantages of the two methodologies in the light of the NEO and NGO and revenue and pricing principles. A key part of this assessment will be analyzing and specifying how a TFP methodology could be applied in the national energy markets. The TFP example presented in this discussion paper represents the development of a workable methodology to provide a more detailed basis for assessment and comment on the merits of the two regulatory approaches. The discussion and submissions on this paper will be of assistance to this assessment.

¹⁵ This includes the question to propose to the MCE to introduce or not TFP as an alternative methodology for revenue regulation.

3 Overview of TFP design

This chapter sets out the various elements of the TFP design example presented in this paper. The supporting reasoning and explanation behind the design elements are provided in the subsequent chapters. As a general principle, the same design would be used for the electricity revenue determinations and gas access arrangements.

Applying a TFP methodology

- A high level of prescription on the TFP methodology would be included in the NER and NGR. All the TFP principles, key mechanics (such as formulas, calculations and definitions), key rights and obligations and procedural requirements would be clearly and comprehensively established in the NER and NGR.
- In addition, the regulator would produce a set of non-binding TFP guidelines covering two aspects of the methodology:
 - technical matters on which the regulator would have discretion as a complement to the Rules; and
 - those aspects of the methodology that could be adapted by the service provider to its circumstances, subject to the regulator's approval..
- The initial selection of a TFP methodology and its continued application beyond the first regulatory control period would be a decision for the service provider. No approval of the regulator would be required.
- Once the service provider selects the TFP methodology for its regulatory determination, the same timetable and processes currently applicable for the building block approach would apply. The only change would be that for electricity, the regulator would have to prepare a framework and approach paper covering the possibility of a service provider using either a TFP methodology or a building block approach.
- The decision to revert back to using the building block approach after a regulatory period using the TFP methodology would lie with the service provider. No approval by the regulator would be required. The timetable and processes currently set out in the NER or NGR would apply.
- The principles and mechanisms of the TFP methodology would be locked in for a particular service provider and would remain unchanged for the entire regulatory period.

Calculating the TFP growth rate

- Only an index number approach would be permitted for calculating TFP. The regulator would choose the index number method it considers appropriate, provided the method chosen satisfies the important technical requirement of being 'superlative' (that is, it can provide a close approximation to an arbitrary smooth function).
- The specification for calculating the TFP growth rate (that is, inputs, outputs and weightings) would be prescribed in the NER and NGR. However, at this stage further analysis and consultation is needed to determine the correct specification.
- For defining the industry group, two options for further discussion are presented:
 - (a) there would be one single TFP growth rate factor that would be applied to any service provider within the respective sector. This would be based on the average TFP growth rate for all regulated service providers in that sector; or
 - (b) the industry would be divided into subsets according to operating conditions. There would be four sub-groups:
 - (i) urban, high density
 - (ii) urban, low density
 - (iii) rural, high density
 - (iv) rural, low density
- In both options, all service providers operating in the sector would be required to provide TFP data, even if they have not elected to use the TFP methodology themselves. For gas, all covered pipelines would be included (even if the covered pipeline is subject to light regulation).
- The regulator would only be permitted to remove a service provider from the calculation under exceptional circumstances such as if there are serious gaps or problems with the data provided by that service provider.
- Inclusion of data on any businesses which are outside the jurisdiction of the NEL or NGL (for example, overseas businesses) would not be permitted.
- The regulator would be required to use audited historical data as provided by the service providers. It would only be permitted to make adjustments to the data to:

- adjust for structural differences to improve the consistency of the data (for example, for different classifications of services); or
 - to adjust certain years data for certain service providers because of exceptional circumstances.
- Any adjustments would be made transparent and done in accordance with the guidelines. The data-set used would be available to all service providers to allow them to undertake their own modelling (subject to any confidentiality issues). Normalising the data for operating environment differences would not be permitted.
- The regulator would have the option to decide whether to use an average annual growth rate approach or a regression-based trend method in calculating the TFP growth rate.
- The regulator would be required to use the longest time period that is possible provided that the available data is robust. It would also need to be consistent with a minimum time series of eight years of data being required before a TFP methodology could be applied to revenue determinations.
- If the service provider is subject to a rolling X under the TFP methodology then the inputs and output weights would be updated on an annual basis as well.

Setting the initial cap

- The method to set the initial price or revenue cap at the start of the regulatory period would be a partial building block approach where the regulator:
 - determines the level of operational and capital expenditure for that year based upon an reasonable assessment of actual costs incurred in the current period;
 - calculates the regulatory asset base in accordance with the existing roll forward methodology;
 - estimates the efficient rate of return for the duration of the new regulatory period in accordance with the existing methodology; and
 - estimates the efficient tax for the initial year in accordance with the existing methodology.
- This method would be used regardless of whether under the current regulatory period the service provider is using the building block approach or a TFP methodology. It would be applied both to electricity and gas distribution service providers.

Additional design terms

- Longer regulatory periods are consistent with a TFP methodology and would be available to service providers. This is consistent with the current provisions of the NER and NGR which provide service providers with the ability to propose an extended regulatory period under the building block approach. That is, for electricity service providers, a regulatory control period would be at least five years. For gas service providers, an access arrangement period could be of any length. Service providers and regulators would have the same level of discretion as currently exists.
- A cost pass through mechanism would be available for service providers to include in their revenue or access arrangement proposals at their discretion. The regulator would then respond to the proposed mechanism within the decision making process.
- A service provider could include a capital module in its proposed revenue or access arrangement to recover actual efficient, extraordinary significant increases in capital expenditure during a regulatory period. The regulator would need to be satisfied that the expenditure is outside the scope of the cost drivers that are taken into account in setting the X. Discussions with stakeholders would be needed to determine the most appropriate design of this module.
- Off ramps would be available under a TFP methodology. An off ramp mechanism would:
 - be proposed by the service provider or required by the regulator;
 - clearly specify the 'off ramp event' at the start of the regulatory period. This could be an specified event or a rate of return or revenue band (for example, that the actual rate of return varies by more than 20 per cent of allowed rate of return);
 - require an 'off ramp event' to be significant; and
 - require that the need and specification of an off ramp mechanism be assessed for each forthcoming regulatory period
- Service providers would propose the form of X (that is, either a fixed or rolling X) for the duration of the forthcoming regulatory period. In making its proposal, a service provider should take into account the length of the forthcoming regulatory period, and the use of off-ramps and cost pass through mechanisms.
- The service provider can propose any combination of the all design elements for the regulator's approval (similar to the current arrangements). The regulator's assessment on the proposed package would have regard to the NEO or NGO and the revenue and pricing principles.

- An efficiency carryover mechanism should be excluded from operating in conjunction with a TFP based methodology as it is not consistent with that methodology.
- Any efficiency carryover mechanism existing at the commencement of a TFP regulatory period should continue to run its course as initially planned.
- The existing demand management and service incentive schemes would continue to be available to service providers under a TFP methodology. There should be no difference in their operation that reflects a service provider's use of either a building block approach or a TFP methodology to the determination of revenues and prices.

Price path under a TFP methodology

- The allowed rate of change of the price cap under the TFP methodology would be calculated in accordance with the following formula:

$$\Delta \text{ allowed prices for regulated business} = \Delta \text{ consumer prices} - \{[\Delta \text{ industry TFP} - \Delta \text{ economy TFP}] - [\Delta \text{ industry input prices} - \Delta \text{ economy input prices}]\}$$

- A separate measure for industry input prices growth would be included into the determination of the X factor, and prescribed in the Rules. Further work and consultation with the industry would be required to determine the most appropriate measure. The producer price index would be used for the economy input price growth term.
- An additional term would be included in the formula for determining the X factor to permit the regulator to make business specific adjustments. Such adjustments would only be justified if the regulator considers that the industry TFP growth rate should be adapted to reflect a significant difference in the productivity growth potential of that specified service provider. The regulator's decision would need to be consistent with the relevant national objective and the revenue and pricing principles. The adjustment could be positive or negative.

Further analysis would be needed to develop the appropriate framework, including the potential use of benchmarking techniques, governing this decision.

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4 Applying a TFP methodology

Before discussing the elements of the TFP design, this chapter sets out some high level principles on how a TFP methodology could be included in the existing regulatory framework and applied.

4.1 Prescription in the Rules

Issue

An important consideration when designing a framework for TFP is the balance between setting out the principles and obligations for the service provider and regulator in the Rules and providing for flexibility and discretion through the use of guidelines. Hence, the relevant questions in respect of this issue are:

- what should be the level of specification of a TFP methodology included in the Rules? and
- is there a role for supporting guidelines, and if so, what form should those guidelines take?

There are areas of regulatory decision making that should involve the exercise of judgement and discretion by the regulator. This is because good economic regulation should be sufficiently flexible to adapt to the individual circumstances of regulated businesses across different periods of time. Importantly however, where the Rules confer discretions upon regulators, the Rules should also specify the criteria and scope for exercising those discretions.¹⁶

Design element

A high level of prescription on the TFP methodology would be included in the NER and NGR. All the TFP principles, key mechanics (such as formulas, calculations and definitions), key rights and obligations and procedural requirements would be clearly and comprehensively established in the NER and NGR.

In addition, the regulator would produce a set of non-binding TFP guidelines covering two aspects of the methodology:

- technical matters on which the regulator would have discretion as a complement to the Rules; and
- those aspects of the methodology that could be adapted by the service provider to its circumstances, subject to the regulator's approval.

¹⁶ AEMC, *Draft National Electricity Amendment (Economic Regulation of Transmission Services) Rule 2006*, Rule Determination, 16 November 2006, pp. 33-34.

Considerations

A sufficient level of prescription in the Rules for the application of a TFP methodology would be an essential precondition to ensure an acceptable level of regulatory predictability, transparency, clarity, certainty and investor confidence. It would also be required to maintain consistency with the existing regulatory regime.

In general, the AEMC's approach has been to include in the Rules those elements of a regulatory methodology and process which are comparatively uncontroversial, unlikely to need to vary in application across different service providers in different circumstances or which are necessary to be determined on an ex ante basis for the efficient administration of the regulatory process. The Rules should also contain the rights and obligations of service providers and the regulator.

Consistent with this, the Expert Panel made the point that the Rules should address matters that are likely to change relatively infrequently over time and that do not rely on an assessment of individual market conditions or circumstances.¹⁷ A TFP methodology should be applied consistently across all service providers and should be stable over time. This is consistent with the Expert Panel's view.

One argument made against placing material aspects of a TFP methodology in guidelines is that stakeholders cannot seek a change to guidelines as guidelines can only be amended by the regulator at its instigation.¹⁸ The NEL and NGL both provide a transparent, consultative Rule change process which allows any person to propose a Rule change. This supports the design example described in this paper which specifies the TFP methodology in the NER and NGR rather than in guidelines.

However, there would be aspects of the TFP methodology and process which would not be fundamental; these would include elements that could be at the regulator's discretion.¹⁹ There would also be areas of the methodology that could be adapted by the service provider to suit its own circumstances (for example, the length of the regulatory period). For these elements, guidelines could provide assistance to service providers in the formation of their revenue or access arrangement proposals while still allowing flexibility.

The design example in this discussion paper provides a balance between prescription in the Rules and detail in guidelines. This is consistent with the current design of the building block approach for electricity revenue determinations.²⁰

¹⁷ Expert Panel on Energy Access Pricing, *Report to the Ministerial Council on Energy*, April 2006, p. 26.

¹⁸ This point was made in various submissions on the Victorian Proposal.

¹⁹ Regulatory discretion would be bound by criteria in the Rules. It would also be bound by legislation and good and consistent regulatory practice.

²⁰ Under the current building block approach for electricity revenue determinations, Chapter 6 of the NER contains all high level building block principles, mechanisms and processes. It also provides limited discretion to the AER through non-binding guidelines.

4.2 Process for selecting a revenue methodology

4.2.1 Initial selection of TFP

Issue

Under this Review, a TFP methodology is being considered as an optional alternative to the current building block approach. Hence, a TFP methodology would only be applied on the initiation of the service provider.

In this context, the issue is whether the use of a TFP methodology by a particular service provider must be approved by the regulator.

Design element

The initial selection of a TFP methodology and its continued application beyond the first regulatory period would be a decision for the service provider. No approval of the regulator would be required.

Once the service provider selects the TFP methodology, the same timetable and processes currently applicable for the building block approach would apply. The only change would be that for electricity, the regulator would have to prepare a framework and approach paper covering the possibility of a service provider using either a TFP methodology or a building block approach.

Considerations

The possible benefit of the regulator having the ability to grant or refuse a service provider proposal to be regulated under a TFP methodology is that it would allow an assessment of whether the necessary conditions for a TFP methodology exist for that particular service provider.

The Issues Paper discussed two possible pre-conditions: having an adequate data-set; and that the industry has reached a steady state.²¹ This design example includes a threshold test (regarding the length and quality of necessary data-set) before a TFP methodology would be permitted (see section 5.2.5). This test would be in the Rules as an objective threshold which would not involve any discretion by the regulator.

For the reasons set out in the NAS Expenditure Profiles Report, it is unlikely that the sectors will ever be in a 'steady state'. Any TFP methodology would need to be able to cope with future variations in the profile of expenditures. Accordingly, the need for such a pre-condition or threshold test decreases.

Importantly, if a TFP methodology were to be included into the NER or NGR then a decision would have been made that a TFP methodology is suitable for revenue and

²¹ Issues Paper, pp. 17-22.

pricing determinations. To give the regulator an additional discretion over a service provider's choice of using a TFP methodology for its revenue or access arrangement proposal would create ambiguity.

Similarly, at the end of any regulatory period, the service provider would have the option to continue being regulated under a TFP methodology.

The existing regulatory frameworks in the NER and NGR are based upon the premise that a service provider develops and submits a proposal for its future revenue requirements to the regulator. Through a public consultation process the regulator then assesses the proposal against the relevant principles and criteria set out in the Rules and any relevant guidelines, and responds to the proposal. This should also be the underlying framework for a TFP methodology.

4.2.2 Selection of the building block approach after TFP

Issue

A service provider may decide to revert back to using the building block approach after having used a TFP methodology. In this case, similar questions arise with respect to the role of the regulator and the process to be implemented. Again, the issue is whether the regulator should have the ability to override the service provider's selection of a revenue methodology.

Design element

The decision to revert back to using the building block approach after a regulatory period using the TFP methodology would lie with the service provider. No approval by the regulator would be required. Once the service provider selects the building block approach for its revenue methodology, the timetable and processes currently set out in the NER or NGR for the building block approach would apply.

Reverting back to the building block approach after using a TFP methodology should only be possible after at least one regulatory period. It would not be feasible to change within a regulatory period.

Considerations

The Victorian Proposal raised a concern about giving the service provider the ability to move between a TFP methodology and the building block approach. It considered that giving service providers the ability to select methodologies may encourage them to seek to change their methodology when it would deliver a short term financial benefit. This would provide scope for windfall gains to service providers as well as increasing the administrative cost of the whole regulatory regime.

An example of this behaviour is where the service provider does not spend any capital expenditure while under a TFP methodology and then, in the subsequent period, seeks a higher expenditure allowance under the building block approach. To

address this, the Victorian Proposal suggested that the agreement of the regulator would be needed before a service provider could return to using the building block approach.²² However, giving the regulator the ability to override the service provider's choice of methodology would not be required. Any expenditure gaming could be prevented:

- by the fact that the service provider would be required to maintain a safe, reliable network in accordance with its licence conditions; and
- when the regulator is determining the efficient level of expenditure under the building block approach it can have regard to previous levels of expenditure, irrespective of what revenue methodology was applied in the previous regulatory period.²³

Also, it could be difficult to provide an objective framework for the regulator to make such a decision. Providing such discretion would create significant regulatory uncertainty. This could decrease the likelihood that service providers would seek to use a TFP methodology in the first instance.

The design example in this paper proposes that the regulator should be given the option to include off ramps in a TFP methodology where it considers it appropriate. This would give the regulator a mechanism to prevent the service provider from capturing excess profit under a TFP methodology.

4.2.3 Amending a methodology during a regulatory period

Issue

Once a TFP methodology is applied for a regulatory period, modifications to the calculation formula may improve the accuracy of the growth estimate. For example, the set of inputs or the scope of the service providers included in the industry group could be changed if better data becomes available.

The issue in this regard is whether the possibility of modifications to a TFP methodology (as they apply to a particular service provider) could be permitted during a regulatory period.

Design element

The principles and mechanisms of a TFP methodology would be locked in for a particular service provider and would remain unchanged for the entire regulatory period.

²² Victorian Proposal, p. 21.

²³ It should be noted that under the current building block approach there already exists some potential for regulatory gaming due to information asymmetries between the regulator and the service provider.

Considerations

No modifications should be allowed to amend any aspects of a TFP methodology as applied to a service provider during a regulatory period. Such changes would undermine investor confidence and regulatory certainty. Also, a TFP methodology would include mechanisms and procedural requirements embedded in the NER and NGR. Changes to these terms during a regulatory period may be inconsistent with the provisions of NEL and NGL.²⁴

Hence, any change made to these Rules (or the relevant guidelines) would only be relevant to service providers lodging proposals after the date when the Rules or guidelines have changed. This means that, among other things, the calculation methodology of the growth rate would not alter for the duration of a regulatory period for a service provider.

This does not preclude the possibility of use of a rolling X. While the value of X would be updated annually, the methodology used to calculate the X would remain constant.

²⁴ See NEL, schedule 2, clause 33 and NGL, schedule 2, clause 41.

5 Calculating the TFP growth rate

This chapter discusses the elements to the methodology relating to how to calculate the TFP growth rate for determining the X factor. It supports the use of an index number based methodology and discusses each aspect of the calculation needed to compute a TFP index.

Measuring the productivity of network and pipeline businesses presents a number of challenges. Each aspect involves making choices to establish a clear approach to calculating the index. Substantial work has been done by ESC (with Dr Kaufmann of Pacific Economic Group (PEG)) and by Dr Lawrence of Economic Insights on developing an index-based methodology suitable for Australia. This chapter draws heavily on those streams of work. The chapter also has regard to the Economic Insights Sensitivity Report, which shows that the calculation of TFP growth rates can be very sensitive to specification and calculation choices.²⁵ It is acknowledged that there is no agreed settled approach and this chapter highlights the different perspectives and identifies where further work is needed.

5.1 Appropriate methodology

Issue

To estimate TFP growth a method is needed to combine changes in the quantities of a diverse range of outputs and inputs into measures of the respective change in total output quantity and total input quantity. There are two broad approaches to this - the index number approach and the econometric approach.

There are a number of alternative methodologies that can be used under the index number approach. The differences between these methodologies mainly relate to the method of aggregating changes in individual components into the change in the overall output or input measure.

Design element

Only an index number approach would be permitted for calculating TFP. The regulator would choose the index number method it considers appropriate, provided the method chosen satisfies the important technical requirement of being 'superlative' (that is, it can provide a close approximation to an arbitrary smooth function). The regulator would specify the index number form in guidelines.

²⁵ Economic Insights, *Energy network total factor productivity sensitivity analysis*, 9 June 2009. (Economic Insights Sensitivity Report)

Considerations

There are a number of reasons why an index method, rather than an econometric method, would be preferred. The index number method is relatively transparent and the results are readily reproducible. There is no practical limitation on the number of outputs and inputs that can be considered in the index number analysis. This is important since the TFP growth index ideally needs to include as many of the business's inputs and outputs as possible. Also, in practice index number approaches are predominantly used, particularly where there are a limited number of observations available.

There are a number of alternative index number forms that could be used. In practice, the Fisher and the Törnqvist index number forms are the most common. Under most scenarios and given the characteristics of energy distribution, these two methods should produce similar results.²⁶

This design would provide the regulator with the flexibility to decide which index method would produce the most accurate result (which could be the Fisher index, the Törnqvist index or another 'superlative' method). In making this decision, the regulator should have regard to the extent and characteristics of the available dataset. The relevant Rules would require that the regulator specify, in detail, its chosen method in guidelines.

5.2 Design of an index methodology

Whichever particular index number form method is used, the following items would be needed to calculate the industry TFP growth rate:

- specification of the service providers' outputs and how to measure each of them;
- specification of the service providers' inputs and how to measure each of them;
- the methodology for determining the weights for each output and each input;
- a selection of the group of comparable service providers (defining the industry) over which to calculate the measure;
- form of the growth rate calculation; and
- the time period over which TFP growth is to be calculated.

²⁶ PEG has used the Törnqvist index method but has noted that in practice Törnqvist index results are little different to those of the Fisher index. Economic Insights has noted that the Fisher index technique is increasingly favoured by statistical agencies because it satisfies all the desirable axiomatic properties for price and productivity indexes. Economic Insights noted that the Fisher and Törnqvist index methods produce very similar results where the shares of the items being aggregated are relatively stable over time. Where shares tend to increase rapidly from very low values (eg. where the uptake of a new technology suddenly increases), the Törnqvist index method can produce inaccurate results where the Fisher index will continue to produce accurate results in this situation. Economic Insights Sensitivity Report, pp. 22-23.

5.2.1 Outputs, inputs and appropriate weights

Issue

TFP is defined as the change in total output quantity divided by the change in total input quantity between two periods. To calculate this, both sets of outputs and inputs attributed to the industry need to be specified. In addition, a weighting must be allocated to each output quantity to calculate the output index. Likewise, in order to produce the input index another set of weightings is needed for each input quantity. The weightings must be reflective of the relative contributions of the inputs and outputs. The issue is: what is the correct specification to calculate the TFP growth rate.

Design element

The specification for calculating the TFP growth rate (that is, inputs, outputs and weightings) would be prescribed in the NER and NGR. However, at this stage further analysis and consultation is needed to determine the correct specification.

Questions for comment and discussion

- What should be the correct specification of inputs and outputs to be used to calculate the TFP growth estimate?
- Is the proposed set of criteria to identify the correct specification appropriate?

Considerations

The specification of the output and input components included in the TFP calculation needs to reflect accurately the industry characteristics. The output measures used should represent the basket of services provided by the industry. Customer numbers, system capacity, peak demand and volumes would be the main output dimensions included. Similarly, the range of inputs used in the TFP growth rate calculation should reflect as many of the factors of production and purchased inputs used by network service providers as possible.

The specification of network outputs and inputs and the approach to weighting has varied across those jurisdictions that have adopted a TFP methodology.²⁷ There has been debate within Australia on the most appropriate methodology. Two possible specifications have been debated: the PEG/Kaufman specification developed for the ESC; and an alternative specification developed by Lawrence which has formed the basis of New Zealand's electricity distribution regulatory regime as well as having been applied in Australia. The key differences between these two approaches are:

²⁷ The Brattle Group, *Use of total factor productivity analysis in network regulation: case studies of regulatory practice*, October 2008, pp. 4-6. (Brattle International Review Report)

- measuring the capital input quantity: Lawrence argues that physical measures of capital (for example, line capacity times length and transformer capacity) provide the best proxy to the quantity of annual capital input given the physical deterioration characteristics of network assets. PEG/Kaufman advocates deflated asset value based quantity proxies;
- outputs to be included: Lawrence advocates using a functional output coverage including a network capacity measure as an output. PEG/Kaufman argues that the output measures should be only those billed items which regulated tariffs are based upon.
- output weights: PEG/Kaufman recommends using revenue share weights while Lawrence argues for using output cost share weights on the basis that revenue shares may not accurately reflect underlying costs given the non-competitive nature of the industry (that is, price will not equal marginal cost in these industries).

Further explanation on the reasoning behind the two specifications and the differences is contained in Appendix B. There are some common issues with both specifications relating to how to include quality of service measures and treat system security expenditure. These are also discussed in Appendix B.

Criteria to determine calculation methodology

It is suggested that a physical capital input measure should be used to realistically reflect the actual depreciation profile of the assets employed. Also, this should not affect the ability of the service provider to recover its regulatory asset base and would be consistent with the revenue and pricing principles. In relation to the outputs debate, the rationale put forward by ESC – that actual revenue shares must be used to be consistent with allocative efficiency – seems theoretically correct. However from a practical perspective, given the processes and considerations that go into establishing tariff structures, the current revenue shares may not appropriately reflect the value placed on each output by the consumer.

Economic Insights has recently shown that this proposition is based on the assumption that the energy distribution industry exhibits the characteristics of a competitive industry. When the increasing returns to scale nature of the industry and the role of sunk cost assets is taken into account allocative efficiency requires that all functional outputs (of which billable outputs will be a subset) be included and the deviation of market prices from marginal costs be allowed for (see Appendix D).

To assist any further analysis in this area, the following set of criteria to determine the appropriate specification is proposed:

- results in a stable index over time;
- creates no systematic bias in the TFP growth estimate;
- is consistent with promoting economic efficiency and does not result in any perverse incentives;
- is consistent with the service provider’s regulatory asset base; and

- results in reporting requirements which are proportionate and not onerous.

Importantly, the views of stakeholders need to be incorporated into this, as a TFP methodology will only be used if the service providers themselves have confidence in the specification used for the TFP calculation. Therefore, comments on both the debate between Lawrence and PEG/Kaufman and also the proposed criteria to determine the correct specification are sought.

5.2.2 Defining the industry

Issue

Definition of the group of service providers that would be used to calculate the industry TFP growth rate is required. The options for defining the industry are:

- any selection of businesses, including overseas businesses, as considered appropriate by the regulator;
- all regulated businesses in the relevant sector; or
- a subset of regulated businesses selected in accordance with defined criteria.

Design element

Two options for further discussion are:

- (c) there would be one single TFP growth rate factor that would be applied to any service provider within the respective sector. This would be based on the average TFP growth rate for all regulated service providers in that sector; or
- (d) the industry would be divided into subsets according to operating conditions. There would be four sub-groups:
 - (v) urban, high density;
 - (vi) urban, low density;
 - (vii) rural, high density; and
 - (viii) rural, low density.

In both options, all service providers operating in the sector would be required to provide TFP data, even if they have not elected to use the TFP methodology themselves. For gas, all covered pipelines would be included (even if the covered pipeline is subject to light regulation).

The regulator would only be permitted to remove a service provider from the calculation under exceptional circumstances, such as if there are serious gaps or problems with the data provided by that service provider. Inclusion of data on any

businesses which are outside the jurisdiction of the NEL or NGL (for example, overseas businesses) would not be permitted.

Questions for comment and discussion

- Is a single X factor for all regulated service providers in the sector appropriate? Or, would it be necessary to divide the sector into four subsets according to operating environment conditions or customer density?

Considerations

The selection of the industry group for the TFP growth rate calculation is a key element of a TFP methodology. Service providers would need to have a clear understanding of how the group would be determined. Thus clear prescription in the Rules on this would be needed.

Setting the industry as all the regulated service providers in that sector (for example, all electricity distribution service providers operating in the NEM) would ensure that the TFP growth rate is more comprehensive and representative of conditions for the entire regulated industry. In addition, a single X factor is easier to implement and administer and would promote the stability of a TFP methodology.

Alternatively, the sectors could be sub-divided, forming a number of TFP industry groups. However, given the small number of businesses within both distribution sectors, any attempt to sub-divide is likely to result in TFP estimates that are able to be readily influenced by the behaviour of one service provider within the sub-sector. This would undermine the incentive properties of a TFP methodology.

Importantly, any division of the regulated service providers into sub-groups could be to be relatively contentious. Also, having multiple industry groups within a sector could give businesses ongoing incentives to redefine industry definitions to their own advantage.²⁸

Parties may argue against having a single TFP factor on the grounds that there are substantial differences in the operating conditions and current productivity levels within the sector. This would suggest that the sector as a whole is not a comparable industry group and the resulting TFP rate is not suitable. In response to this, it is noted that the TFP growth rate is used to set the allowed rate of change and not the initial price level. The initial price or revenue would be set to reflect each service provider's operating conditions and practices. Also, TFP results for Victoria supports the view that while different operating conditions would impact on the level of productivity, such differences do not have a substantial impact on the rate of change of TFP.²⁹

²⁸ For example, to define the industry aggregates so that their business is placed within a group that has the lowest observed historical TFP growth rates and hence, the lowest X factor.

²⁹ ESC submission, March 2009, p. 13.

