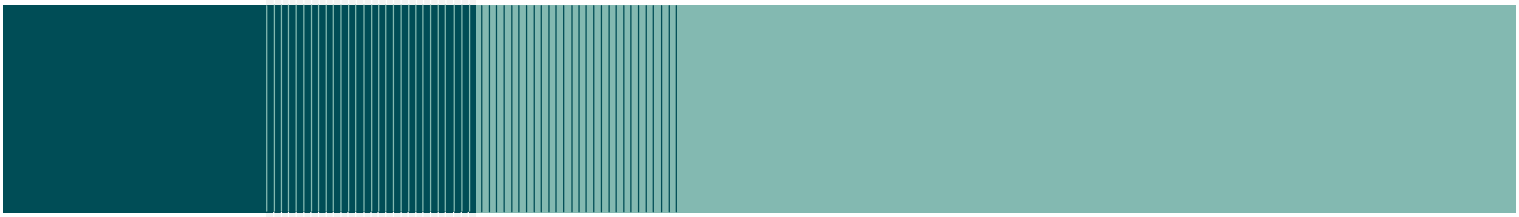
25 July 2006

Comparison of DORC Estimation Procedures

A Report for the ACCC



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Summary of Conclusions

1. Economic DORC is the value of an existing asset given the option exists to replace the existing asset. However, this is not a fully defined concept until we have defined 'value to whom'?
2. Economic DORC must include a valuation of optimal differences in service quality. NPV cost based DORC does not include such a valuation and, as a result, is an upward biased estimator of economic DORC.
3. Straight line DORC may over or underestimate economic DORC. While there is no a priori conceptual reason to believe it is biased, neither is there any conceptual presumption of accuracy in estimating economic DORC.
4. It is not possible to conclude that one or the other is, in general, a more accurate estimate of economic DORC without detailed further empirical work. Even then, it is likely that the available data will not yield conclusive results.
5. As a proxy for economic DORC, NPV cost based DORC has two material practical disadvantages relative to straight line accounting DORC:
    i. it is more informationally and conceptually complex;
    ii. it can only be implemented using information that is held asymmetrically by an interested party (ie, the regulated business).
6. On the basis of the above, it would be reasonable for the ACCC to estimate economic DORC using straight line accounting DORC. (There is no compelling reason to expect this to be a more inaccurate estimate than NPV cost based DORC. At the same time, it would reduce the complexity and improve the transparency and predictability of the regulatory process.)
7. Conclusion 6 is strengthened to the extent that investors' expectations, consistent with Australian regulatory precedent, is that "DORC" means straight line accounting DORC.

Executive Summary

NERA has been asked to advise on the relative advantages and disadvantages of estimating depreciated optimised replacement cost ('DORC') using straight line depreciation of an ORC ('straight line DORC') versus an estimate based on the difference in the NPV of costs between the existing and an optimised pipeline ('NPV cost based DORC'). This advice has been sought in the context of section 8.10 (b) of the Gas Code (the Code) which lists DORC as a factor that should be considered when setting an initial capital base (ICB) for a gas pipeline.

Assessment Criteria

To assess the relative advantages of each estimation technique we adopt the following three criteria:

1. The accuracy of the estimation technique in approximating the 'conceptually correct' DORC value;
2. The impact on economic efficiency of adopting the relevant estimation technique;
3. The degree to which each technique is simple, transparent and consistency with commercial practice.

'Conceptually Correct' DORC Valuations?

An important prior question is 'what conceptual value each technique attempting to estimate'?

Legislative intentions

Unfortunately, the Code does not define the conceptual meaning of 'DORC'. In general usage, DORC is interpreted as meaning:

1. Straight line 'accounting' depreciation of an ORC value. Call this 'accounting DORC'; or
2. Economic valuation of the existing asset given the option exists to replace it with a new, optimally designed, asset. Call this 'economic DORC'.

This report is written on the assumption that legislators' may have intended a meaning consistent with 2 above (economic DORC). This does not suggest we believe this was actually the intention of legislators. Rather, we only adopt this approach because if it could be established that legislators intended DORC to mean 'accounting DORC' then there would be little or no need for this report.

For the purposes of this report we assume that the ultimate objective is to estimate 'economic DORC'. We further assume that this is conceptually defined as:

> *"Economic DORC is the economic value derived from the existing asset given the possibility exists to replace the existing asset with a new and optimised asset."*

Value to whom?

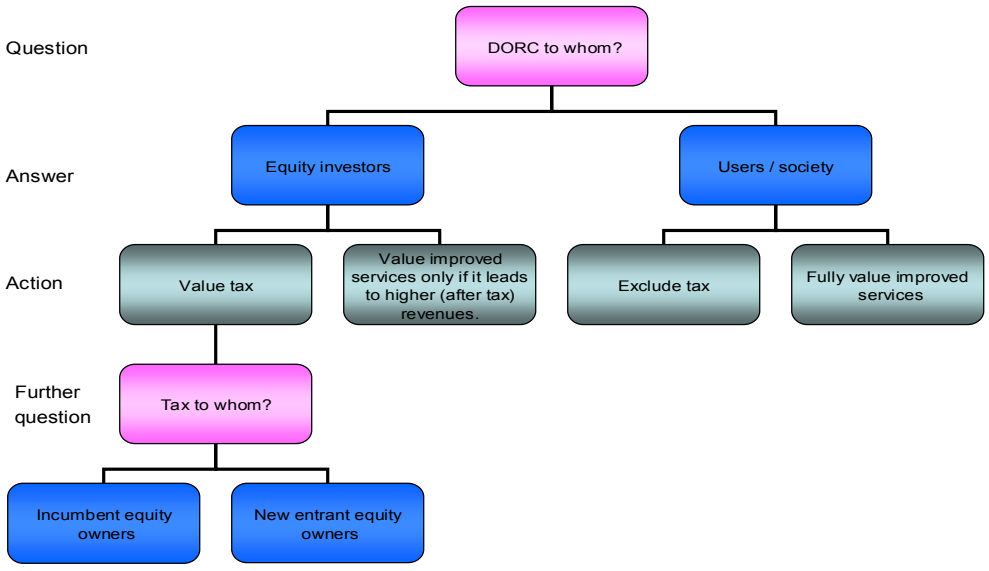
If we accept that we are attempting to estimate an economic value, a further unresolved conceptual issue is economic value *to whom*? Consider the valuation of 'tax costs' on a new pipeline. From society's perspective, tax payments are a transfer not an economic/resource cost. (Tax provides other services society values (eg, roads) while steel in the pipeline has value only in so far as it contributes directly to pipeline services.) The DORC valuation of the existing pipeline to society will not include tax payments as an economic cost.

However, from the perspective of an equity investor in the pipeline, she bears the full cost of tax paid but only receives an insignificant fraction of the associated Government services (the latter is spread across all of society while the former is paid by her alone). Consequently, equity investors do treat tax liabilities as an economic cost to them and would include these in a DORC valuation. Moreover, the incumbent firm will tend to have higher tax costs associated with the existing pipeline than a hypothetical new entrant (reflecting the fact that current owners will already tend to have 'used up' available tax depreciation).

Similarly, there will be different valuations of any improved service levels provided by an optimised pipeline. The true economic value of improved service levels is the value placed on those services by users. However, from an equity investor's perspective this is only 'value' to the extent they can reflect this in higher prices /revenues (and if they can avoid paying tax on these higher revenues).

In summary, before DORC is conceptually defined we need to make a prior assumption about 'value to whom'. The below figure provides an example of the type of decision tree that must be undertaken (and how different answers to the 'to whom' question will affect the value of DORC).

A 'Value to Whom?' DORC Decision Tree



Accuracy of Estimation

Assessment against criteria 1 - Accuracy of Estimation

Both NPV cost based DORC and straight line accounting DORC are conceptually flawed proxies for economic DORC. Only NPV cost based DORC is conceptually biased. Practical estimation of NPV cost based DORC relies more heavily on information that is held asymmetrically and, therefore, introduces greater scope for error from this source.

Given these facts it is not possible to conclude that either approach (accounting DORC or NPV cost based DORC) will be a more accurate proxy for economic DORC.

An important question we have been asked to answer in this report is, at least implicitly, is:

> *'does accounting DORC provide a sufficiently accurate estimate of the economic DORC for it to be used in preference to NPV cost based DORC?'*

To answer this question it is instructive to note that economic DORC is **not** the same as NPV cost based DORC. Differences in service levels must be included in the definition of economic DORC. This is a simple reflection of the fact that, other things equal, the market value of an existing asset falls as the quality of services provided by a new asset improves (just as the existence of colour TVs depress the market value for black and white TVs and the existence of 3G Mobile technology depresses the value of 2G mobile networks).

Valuing an existing pipeline on the basis of optimal replacement cost without taking into account optimal differences in service quality must overestimate the true economic value of the existing pipeline. It is akin to valuing an old black and white TV on the basis of the cost of manufacturing a new black and white TV. The true market value of an old black and white TV will, in reality, be depressed by the fact that most people prefer the services provided by new colour TVs. In our companion report[1] we detail why these issues are material in the context of the RBP.

Failure to take differences in optimal service levels into account must result in an upward bias in the estimate relative to the true economic DORC. This means that 'NPV cost based DORC' will result in a conceptually upward biased estimator of economic DORC (as it focuses solely on differences in costs).

By contrast, straight line accounting DORC is not conceptually biased, however, it is a good proxy for economic DORC only if the strong assumption is made that the nature of service and cost differences between the existing and optimal asset results in uniform depreciation in the economic value of that asset over its life. Thus, while straight line accounting DORC may not be conceptually biased it does not follow that it will always provide a more accurate estimate of economic DORC than NPV cost based DORC.

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[1] NERA, Assesment of Elemetns of APT's DORC Calculations for RBP.

On the basis of the above conceptual analysis it is not possible to conclude which of the above estimation procedures is likely to provide a better proxy for economic DORC.

However, at a practical level, asymmetrically held cost information makes it more difficult, and costly, for the regulator to accurately implement NPV cost based DORC. Direct estimation of NPV cost based DORC requires the regulator to know the medium to long term planning strategy of the business and the associated expenditures to be undertaken and service levels that would be provided. It also requires the regulator to gather this information for a business that does not even exist (being the profile of expenditure and services on the optimal replacement asset).

Access to this information is held asymmetrically with the regulated business who has a strong incentive to present information in a manner designed to underestimate the need for future expenditures (which increases the NPV cost based DORC). The regulator must then expend material resources in an attempt to correctly estimate the value of future expenditures. The process of doing so inevitably introduces material inaccuracies into the valuation process.

Impact on economic efficiency

Assessment against criteria 2 - economic efficiency

There is no direct efficiency advantage from the estimation of straight line accounting DORC versus NPV cost based DORC.

A potential indirect efficiency benefit could exist if investors strongly expected one or the other of the above meanings to be applied. However, we are unaware that any such case can be made.

Existing gas pipelines are 'sunk' assets meaning that their value in alternative use is close to zero (you can not economically dismantle a gas pipeline and reconstruct it elsewhere). Provided the ICB is set above scrap value and below that which would materially discourage end use of the asset,[2] the business will have an incentive to continue to operate the pipeline efficiently.[3] There is, therefore, little direct (as opposed to indirect) economic efficiency grounds for preferring one DORC valuation over another provided that both will establish values in the relevant range.

On the other hand, equity considerations, including fulfilling reasonably held expectations, are important in setting an ICB. This is not just out of fairness to the owner of the existing pipeline, but also because treating that owner unfairly may create a perception of regulatory bias amongst other investors and, hence, may deter investment across regulated industries more generally. That is, when the potential ramifications for future investment are

[2] That is, provided it does not result in prices so high that it promotes inefficient bypass or unduly deters efficient consumption.

[3] This also requires that forward looking regulation fully compensates for forward looking efficient expenditures.

considered, equity considerations can not easily be disentangled from efficiency considerations. This undoubtedly explains why issues of fairness loom large in 8.10 of the Code (see parts (a), (c), (f), (g) and (j)).

If it could be shown that investors strongly understood that 8.10 (b) referred to one or the other estimation procedure for DORC this might represent an indirect efficiency argument for that DORC's adoption. We are aware of no compelling evidence that this is the case.

Simplicity, Transparency and Consistency with Commercial Practice

Assessment against criteria 3 - Simplicity, Transparency and Consistency with Commercial Practice

NPV cost based DORC scores poorly against the simplicity criteria. Its need for information that is held asymmetrically also means it scores poorly against the transparency criteria.

Straight line accounting DORC is both simple and transparent.

Straight line accounting DORC is consistent with commercial *accounting* practice although it is inconsistent with *economic* valuation. However, neither is NPV cost based DORC consistent with commercial practice in economic valuation.

Consistency with commercial practice

Straight line depreciation of a capital value is a well understood *accounting* valuation methodology used in commercial practice. It is not, however, a well accepted economic valuation method.

Economic DORC is not a well understood and practiced economic valuation method. Economic DORC *hypothesises* a 'competitive market' and *theorises* that in a competitive market second hand prices will reflect differences in costs and services provided by the existing and an optimised new asset. This theorising allows economic DORC to be calculated without reference to revenue. However, this valuation technique is not common commercial practice precisely because potential investors are interested in the actual value of assets (which depends on actual revenue forecasts) not the hypothetical value 'as if' they were in a (perfectly) competitive market. Moreover, NPV cost based DORC is also inconsistent with commercial practice in that it ignores differential service quality between new and existing assets.

Simplicity and Transparency

The more complex the regulatory process, and the more information intensive it is, the greater the potential pay-off from strategic behaviour by interested parties. Similarly, the greater will be the resources consumed by the regulatory process - both by interested parties and by the regulator in response.

Directly estimating NPV cost based DORC is a complex undertaking. It requires estimates of expenditures tens, and even hundreds, of years into the future. It is also difficult to undertake in a transparent manner as it requires access to information that is not publicly available and which resides primarily with only one of the interested parties. This report, and all the expert reports that have gone before it, provide examples of the resources consumed by the regulatory process when complexity is introduced - in this case a complex and informationally intensive technique for estimating DORC.

Given the large number of assumptions that must be made on a paucity of publicly available data, there will inevitably remain a great deal of uncertainty surrounding the final value estimated - irrespective of the resources put into that estimation process. It is therefore important to ask whether a compelling case exists that the additional complexity, and the resources consumed as a result, can be justified on the basis that it would further the requirements or objectives in the Code?

In our view the answer to this is 'no'. Even if NPV cost based DORC was a more reliable estimate of economic DORC, we see limited efficiency or equity benefits from such resources being consumed (as discussed in section 5.2 above). In any event, there can be no such presumption. NPV cost based DORC is only a proxy for economic DORC and need not be a more accurate proxy than straight line accounting DORC.

The last conclusion is consistent with the ACCC's acceptance of advice from Allen Consulting Group[4] that there was little value, and considerable cost, in periodically revaluing electricity transmission assets on the basis of economic DORC.

By contrast, straight line accounting DORC is transparent and simple. The only information required is the efficient cost of an optimally designed pipeline that provides the same services as the existing pipeline at minimum cost (ORC), the remaining life of the existing pipeline and the economic life of the replacement pipeline. With this information DORC is formulaically calculated as:

$$DORC = ORC \cdot \frac{\text{Remaining Life of Existing Pipeline}}{\text{Economic Life of Replacement Pipeline}}$$

If this definition of DORC is implemented then the scope for argument is reduced to the value of the ORC and the economic/remaining life of the pipelines. This also largely eliminates the reliance on information that is held asymmetrically (namely future expenditures on the existing pipeline).

Overall conclusion

Neither straight line DORC nor NPV cost based DORC can be presumed to provide a more accurate estimate of economic DORC. Similarly, neither can be presumed to better promote economically efficient outcomes in the gas pipeline industry or more generally.

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[4] See ACG's August 2003 Report for the ACCC "Methodology for updating the regulatory value of electricity transmission assets".

However, in the context of 8.10 (b) of the Code, grounds do exist for preferring the adoption of straight line DORC. Specifically:

(a) Straight line DORC is simpler and can be estimated in a more transparent and predictable manner than NPV cost based DORC;

(b) Straight line DORC relies less heavily on information that is asymmetrically held;

(c) Partly of a consequence of (a) and (b), the resource costs associated with establishing a straight line DORC estimate will be lower than the resource costs associated with establishing an estimate of NPV cost based DORC (including the costs associated with rent seeking);

(d) Straight line DORC can not be presumed to be a biased estimator of economic DORC.

The above considerations suggest that, in a regulatory context, the ACCC could reasonably prefer straight line DORC to NPV cost based DORC as an estimate of economic DORC.

Of course, an alternative to both approaches is to attempt to estimate economic DORC directly, ie, to estimate the NPV of differences in service levels. However, the practical difficulties associated with estimating NPV cost based DORC would be dramatically compounded if this were attempted.

1. Introduction

NERA has been asked by the ACCC to advise, in the context of informing the choice of initial capital base (ICB) under the Gas Code, on the relative advantages and disadvantages of different methodologies for estimating depreciated optimised replacement cost (DORC). Specifically, NERA has been asked to compare the relative merits of estimating DORC using straight line depreciation of an ORC ('straight line DORC') versus DORC based on the difference in NPV costs between the current and an optimised pipeline ('NPV cost based DORC').

The remainder of this report has the following structure:

- Section 2 establishes the assessment criteria against which the DORC estimation techniques should be assessed;
- Section 3 defines, at a theoretical level, the concept of DORC that it is being attempted to estimate;
- Section 4 provides an overview of the information requirements for a direct estimate of the 'conceptually correct' DORC;
- Section 5 uses the information developed in sections 3 and 4 to assesses the estimation techniques against the criteria developed in section 2; and
- Section 6 draws together the reports conclusions.

2. Assessment Criteria

To transparently assess different practical DORC estimation techniques we first need to establish the benchmarks against which they are to be measured. In this report we adopt the following three criteria:

1. Accuracy of estimation technique in approximating the 'conceptually correct' DORC value;
2. Impact on economic efficiency if ICB set equal to the relevant DORC estimate;
3. Simplicity, transparency, and consistency with commercial practice.

The justification for the first criteria is obvious. If we are to compare two or more estimation techniques the natural first question is which is likely to result in more accurate estimates? This requires that a number of prior questions have been answered. Specifically, is there a single theoretically correct concept that we are attempting to estimate? If so, what is that concept? These are questions that are addressed in the following section.

Criteria 2 requires that the efficiency impacts of relying on different estimation techniques be assessed. The resources that should be expended in pursuing an accurate estimate of a conceptually correct DORC should be proportional to the efficiency benefits of doing so. If there are limited benefits from accuracy then limited resources should be employed in obtaining accuracy. In this sense, criteria 2 serves to provide information on the appropriate weight that should be applied to criteria 1 versus criteria 3.

The third criteria requires that the estimation techniques be assessed for their ease of application and understanding. Simplicity and transparency are desirable properties in and of themselves. However, they are also desirable from the perspective of ensuring that the regulatory process itself does not consume an inefficiently large amount of resources and, as such, promotes efficient outcomes. The more complex the regulatory process the more resources it consumes. On these grounds, complexity in the regulatory process should be removed to the extent possible without inappropriately compromising other efficiency and equity objectives.

3. 'Conceptually Correct' DORC Valuations?

3.1. Legislators' intentions

In order to analyse performance against criteria 1 'accuracy' it is necessary to first establish the 'correct' conceptual definition of DORC. Given the context of this report we would ideally establish the conceptual meaning intended in the Gas Code (the Code). Unfortunately, the Code does not define the conceptual meaning of 'DORC' nor does 'DORC' have an unambiguous meaning in general usage.

In general usage, DORC is normally interpreted as:

1. Accounting depreciation of an ORC value (generally 'straight line' depreciation over the life of the asset). Call this 'accounting DORC'; or
2. Economic valuation of the existing asset given the option exists to replace it with a new, optimally designed, asset. Call this 'economic DORC'.

Accounting DORC was the methodology used to set initial capital values for Australian electricity and gas businesses in the late 1990s and is the concept that has typically, although not universally, been intended when using the term DORC in a regulatory process.[5] Economic DORC is often described as the second hand value that an asset *would* have if there was a competitive market where second hand assets had to compete with new assets.

It may be that the legislators' intended DORC to mean accounting DORC. If so, accounting DORC would clearly perform strongly on all three criteria. In fact, it would perform so strongly that there would be little need for this report. Consequently, the remainder of this report is carried out on the assumption that legislators' may have intended a meaning consistent with economic DORC. We only adopt this approach because there is no need for our report otherwise. (It does not imply we believe legislators actually meant economic DORC (on the contrary, given the regulatory practice and literature from the time, we find it quite possible that they did not intend this)).

3.2. Differences in cost and service quality

The value of the existing asset, *given the option exists to replace it with an optimally designed asset,* must reflect both cost and service differences between the two assets. For example, an existing black and white TV would, in all probability, be optimally replaced by a colour TV. The market value of second hand black and white TVs will reflect both the cost of replacing them with colour TVs *and* the higher service potential of colour TVs - with the latter serving to depress the market value of black and white TVs.

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[5] For example, see the 1998 ICB deliberations in Victoria where gas businesses proposed, and the ORG accepted, DORC values based on straight line accounting DORC. "ORG, Access Arrangements: Multinet, Westar and Stratus, Final Decision, October 1998" available at http://archive.esc.vic.gov.au/docs/Gas/gasfin.pdf. There was no discussion of alternative conversions of ORC into DORC in that decision.

The Allen Consulting Group (ACG) has defined the 'conceptually correct' definition of DORC in precisely the above manner.[6] This conception of DORC can be expressed in the form of an equation by:

DORC = Net economic value of future services provided by an optimally designed new asset - Net economic value of future services provided by the existing asset

Where 'net economic value' is economic value of services less the costs incurred in providing those services.[7] The above definition can be restated equivalently as:

DORC = PV of future costs with new asset *less* PV of future costs with existing asset - PV of future services provided by the new asset *less* PV of future services provided by the existing asset

Equation 1

It must be noted that economic DORC is **not** the same as NPV cost based DORC - where NPV cost based DORC ignores the second term on the right hand side of the above equation. Differences in service levels must be included in the definition of economic DORC if economic DORC is intended to capture the value (or hypothetical value) of a second hand asset. This is a simple reflection of the fact that, other things equal, the market value of existing assets falls if potential replacement assets offer better quality services (consider the TV scenario above or the value of 2G mobile network given the presence of 3G mobile technology).

Failure to account for differences in optimal service levels means that NPV cost based DORC will only be a satisfactory conceptual proxy for economic DORC if current service levels are the same, or substantially similar, to optimal service levels. It may be tempting to think that this will generally be the case with gas pipelines as, unlike TV images or mobile phone products, 'delivered gas is delivered gas'. However, in reality, there can be very large differences in service quality between gas pipelines - in terms of both the number of customers served and the volume of gas that can efficiently be delivered to those customers. In fact, Venton's report has implicitly recognised that their optimised route for the RBP would materially improve service quality:

> *"A new pipeline constructed along the existing route will:*
> - *Introduce increased public safety issues by construction of a high pressure pipeline through existing and future residential areas.*
> - *Not provide for an existing and expected future significant gas loads in the Swanbank area.*
>
> *It will also limit a potential opportunity to deliver gas to the Amberley region.* (Ventons report Page 17.)"

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[6] See pages 20 to 23 of ACG's August 2003 Report for the ACCC "Methodology for updating the regulatory value of electricity transmission assets".

[7] Eg, the net economic value of the services provided by the new asset equal "NPV of services optimally supplied by the new asset *less* NPV of optimally incurred forward looking costs in delivering those services".

No attempt is made to include these improved service levels in APT's calculation of DORC. Correcting this oversight would require a value to be placed on improved public safety for the optimised pipeline and the value associated with better serving Swanbank and Amberley regions. Valuing these factors alone would be an extremely informationally difficult process (what value safety?), however, if economic DORC is to be directly estimated they must be valued. There are other significant service quality benefits associated with Venton's proposed optimised assets (for discussion see our companion report[8] addressing APT's estimate of DORC for the RBP).

This also raises the question 'should straight line accounting DORC be assessed against economic DORC rather than NPV cost based DORC'? Specifically, do the difficulties posed in valuing differences in service levels outweigh the inaccuracies associated with not valuing those differences. We are unable to definitively answer this question and, therefore, consistent with the purpose of this report, make the primary comparison between straight line accounting DORC and NPV cost based DORC. Nonetheless, given the practical difficulties in estimating the value of optimal service differences, many of our conclusions regarding the difficulties of NPV cost based DORC apply with materially greater force to directly estimating economic DORC.

3.3. Value to whom?

A further unresolved conceptual issue in defining economic DORC is value *to whom*? Consider the valuation of 'tax costs' on a new pipeline from the perspective of three different market participants:

- pipeline users / society at large;
- the incumbent owner's shareholders; or
- a potential new owner's shareholders.

From society's perspective, tax payments are a transfer not an economic/resource cost. A tax payment goes to provide government services which provide offsetting benefits to society (including taxpayers). That is, tax provides value above and beyond that provided by the pipeline (unlike the cost of steel in the pipeline which has value only in so far as it contributes directly to pipeline services). The DORC valuation of the existing pipeline to society will not include tax payments as a pure cost.

However, from the perspective of an equity investor in the pipeline, s/he bears the full cost of tax paid but only receives an insignificant fraction of the associated Government services (the latter is spread across all of society while the former is paid only by her). Consequently, equity investors do treat tax liabilities as an economic cost to them and would include these in a DORC valuation.

That said, tax paid by equity investors will depend on whether they are incumbent equity investors (ie, owners of equity in the firm that currently owns a gas pipeline) or a new entrant equity investor (ie, owners of equity in a firm that might hypothetically purchase the existing pipeline). An incumbent will tend to have higher tax costs associated with the existing

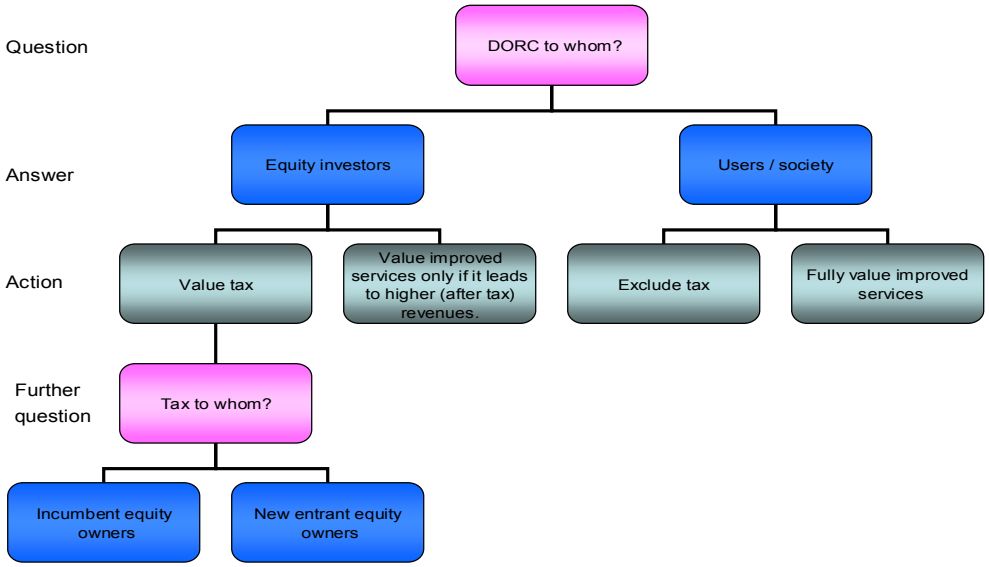
[8] NERA op cit.

pipeline than a hypothetical alternative firm that bought the existing pipeline (reflecting the fact that current owners will already tend to have 'used up' some available tax depreciation).

Similarly, there will be different valuations of any improved service levels provided by an optimised pipeline. The true economic value of improved service levels is the value placed on those services by users. However, from an equity investor's perspective this is only 'value' if they can fully reflect this in higher prices /revenues (and if they can avoid paying tax on these higher revenues).

In summary, before DORC is conceptually defined we need to make an assumption about 'value to whom'? If economic DORC is to reflect *all* economic costs and benefits then it is the perspective of users/society that is relevant. Choosing a narrower perspective will result in the exclusion of some costs or benefits. The below figure provides an example of the type of decision tree that must be undertaken (and how different answers to the 'to whom' question can affect the value of DORC).

A 'Value to Whom?' DORC Decision Tree



This illustrates that there is no unique conceptual definition of economic DORC. There are as many definitions as there are classes of people who might value the asset differently. It is therefore difficult to sustain an argument that NPV cost base DORC[9] better approximates economic DORC given that economic DORC is not itself uniquely defined.

[9] Or straight line accounting DORC.

4. Information Requirements for DORC Valuation

A perfectly accurate estimate of economic DORC requires the following information.

- An optimally designed replacement asset.
  - An optimal design must take into account not just the lowest cost way of providing existing service levels but also whether a new asset should optimally provide different services. This must take into account current and future costs, current and future user valuations of services and potential future market developments (eg, will a competing pipeline be built? Will a connecting pipeline be built?).
- The current cost of the optimally designed replacement asset (ORC) and the expected timing and magnitude of all future expenditures on the optimally designed replacement asset (on a probability weighted basis);
- The difference between the expected value of services provided by the optimally designed replacement asset and the expected value of services that the existing pipeline provides (both now and at all times in the future);
  - Noting that value will depend on whose perspective is adopted;
- The timing and magnitude of all future expenditures on the existing pipeline including replacement timing (on a probability weighted basis);
  - Noting that these expenditures will depend on whose perspective is adopted (eg, tax expenditures by incumbent owners versus new entrant owners of existing asset); and
- The covariance between all of the above future values and the return on a diversified portfolio (as an input into determining the appropriate discount rate to be applied to future values).

Embodied in the above dot points is a great deal of information some of which would not even be considered when deciding whether to invest in a pipeline in the first place. The above values will be stochastic in nature, ie, the values used will be probability weighted averages of values that pertain to various credible scenarios (eg, gas from New Guinea does/does not get transported along RBP route, a new energy technology is/is not discovered over the next 50 years etc).

The above informational requirements are in excess of the information required by regulators when making periodic assessments of prices in proposed access arrangements.

4.1. The relationship to SL and NPV cost based DORC

There appears to be a general presumption that the economic value of business assets depreciates more quickly than implied by straight line depreciation. The Australian 2006-07 Budget announced measures that increase tax depreciation to approximately double that provided by straight line depreciation in the early years of an asset's life. The stated purpose for this change was to:

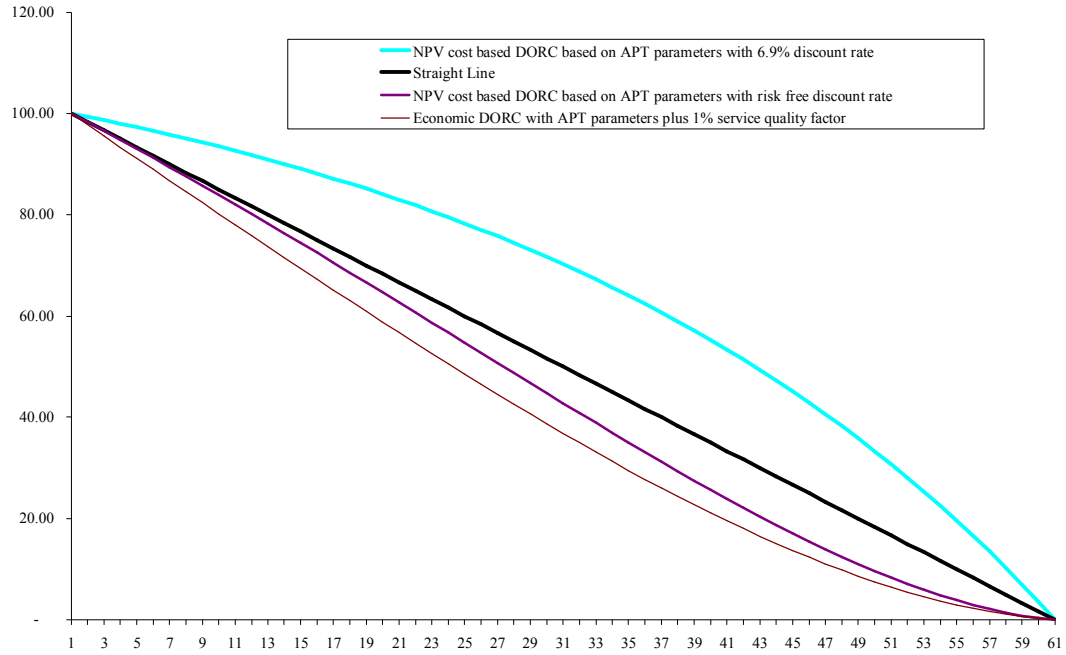
> *"... more accurately align depreciation deductions for tax purposes with the actual decline in the economic value of assets. ... By increasing the diminishing value rate to*

200 per cent, this measure will ensure that tax depreciation rates more closely align with economic depreciation."[10]

Whether this general presumption should be applied to gas pipelines is a separate question and we do not have sufficient information for us to reliably answer it.

Nonetheless, the relationship between straight line DORC, NPV cost based DORC and economic DORC under different scenarios is illustrated in the below graph. The top (blue in colour print outs) curve illustrates the relationship between NPV cost based DORC and remaining life based on the parameter values and formulae proposed by APT.

Figure 4.1
Illustration of variation in DORC values



The second highest (straight black) line represents straight line accounting DORC. The curve immediately below this (purple) is the NPV cost based DORC based on the formulae and assumptions APT has used to describe how costs vary over time - except we use the risk free rate as the discount rate. (Our companion report[11] addresses why we believe the risk free rate is the correct discount rate to use in these formulae.) The bottom (brown) curve arbitrarily derives an economic DORC from this NPV cost based DORC by deducting a value of service quality differences that is assumed to grow at a rate of 0.5% of NPV cost based DORC per

[10] 2006/07 Budget Paper No. 2, Part 1, Revenue Measures.

[11] NERA (2006) *Assessment of Elements of APT's DORC Calculations for RBP: A report for the ACCC.*

annum.[12] This assumption is purely for illustrative purposes. In reality, we only know that this curve will lie below the NPV cost based DORC curve.

This graph illustrates that, at least for the parameters and formulae proposed by APT, straight line DORC and NPV cost based DORC are relatively close in value - provided that the risk free rate is adopted as the discount rate. By contrast, NPV cost based DORC is much higher than straight line accounting DORC if APT's proposed adoption of a 6.9% discount rate is accepted. . It also illustrates that straight line DORC and both versions of NPV cost based DORC overestimate economic DORC (with the overestimate being worse for NPV cost based DORC using APT's proposed discount rate).

It is important to note that the assumptions implicit in the formulae underlying the above graphs are very strong and have little or no empirical justification. This is not intended as a criticism of APT as the formulae were originally developed in NERA's 2002 paper.[13] However, they were only ever intended as being for illustrative purposes. Since then, these formula appear to have developed a life beyond that which we intended to give them. As is well illustrated by the case of the RBP, expenditures on a pipeline are unlikely to take the smooth path implicitly assumed in our illustrative formulae. Similarly, expenditures will not be based solely on fixed asset lives (as in our formulae) but will, in reality, depend heavily on the path of consumption. For example, according to APT's own analysis demand growth alone over the next ten years drives over $100m of expenditure. The fact that the NERA's 2002 formulae did not have a role for demand growth illustrates the stylised nature of those formulae.

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[12] That is, the economic DORC (brown curve) is NPV cost based DORC (purple curve immediately above) multiplied by $(1-.005)^{L-RL}$ - where L represents economic life (60 years) and RL represents remaining life.

[13] NERA, 2002, Depreciation Within ODRC Valuations, A report for the ACCC.

5. Assessment Against Criteria

5.1. Accuracy of Estimation

An important question we have been asked to answer in this report is, at least implicitly, is:

> *'does accounting DORC provide a sufficiently accurate estimate of the economic DORC for it to be used in preference to NPV cost based DORC?'*

In the first year of a pipelines' life economic DORC and accounting DORC have the same value (ie, both are equal to ORC). The same is true in the last year of a pipeline's life where both accounting DORC and economic DORC are equal to zero. Thus, accounting DORC and economic DORC start and finish at the same value but may diverge over the course of the assets' life. In between these times, straight line accounting DORC will tend to exceed economic DORC (and vice-versa) to the extent that:

i. an optimally designed new asset would provide superior service levels;

ii. an optimally designed new asset will have lower operating costs and future capital cost than the existing asset;

iii. replacement costs are rising over-time (reducing the value of delaying replacement); and

iv. the discount rate applied to future costs is low (reducing the value of delaying replacement).

The interaction between the above factors will determine whether straight line accounting DORC exceeds economic DORC or *vice versa*. As discussed above, in a specific case there can be no presumption that one will exceed the other.

5.1.1. Conceptual accuracy

NPV cost based DORC is, conceptually, a good proxy for economic DORC only if the strong assumption is made that there would be no optimisation of service levels provided by a new asset. In all other circumstances, NPV cost based DORC is a conceptually biased[14] estimate of economic DORC because it fails to account for the additional value of investing in a new asset created by the option to optimise service levels.

Straight line accounting DORC is not conceptually biased, however, it is a good proxy for economic DORC only if the equally strong assumption is made that the nature of service and cost differences between the existing and optimal asset results in uniform depreciation in the economic value of that asset over its life. Thus, while straight line accounting DORC may not be conceptually biased it does not follow that it will always provide a more accurate estimate of economic DORC than NPV cost based DORC.

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[14] An estimation procedure is conceptually biased if, in all circumstances, it will always provide a biased estimate of the relevant value - even with perfect information. Straight line accounting DORC is not conceptually biased, however, it is quite possible that it is 'practically biased' in the sense that, in most circumstances actually observed, it will provide an overestimate of economic DORC (or *vice versa*).

On the basis of the above conceptual analysis it is not possible to conclude which of the above estimation procedures is likely to provide a better proxy for economic DORC.

5.1.2. Accuracy in practice

At a practical level, asymmetrically held cost information makes it more difficult, and costly, for the regulator to accurately implement NPV cost based DORC. Direct estimation of NPV cost based DORC requires the regulator to know the medium to long term planning strategy of the business and the associated expenditures and service levels that would be provided. It also requires the regulator to gather this information for a business that does not even exist (being the profile of expenditure and services on the optimal replacement asset).

Asymmetric information pervades almost all aspects of regulatory theory and practice. In the absence of asymmetric information, regulators would be able to directly estimate the efficient cost of doing business and set prices accordingly. In reality the business holds most of the information required to accurately estimate efficient costs but has a strong incentive to present this information in a manner that leads the regulator to overestimate efficient costs. Asymmetric access to information has led to the adoption of 'incentive regulation' as international regulatory best practice. Incentive regulation sets regulated prices/revenues based on indirect proxies the business's forward looking costs rather than on direct estimates (eg, by using benchmarking against other firms' costs or by instituting 5 year lags in the review of prices) precisely because direct estimation of costs relies too heavily on information held only by the regulated business.

Direct estimation of the economic DORC requires the regulator to gather and rely on precisely the same information that incentive regulation is designed to avoid relying on. Specifically, it requires the regulator to know the medium to long term planning strategy of the business and the associated expenditures and service levels required. It also requires the regulator to gather this information for a business that does not even exist (being the profile of expenditure and services on the optimal replacement asset).

If a regulator really could accurately estimate future expenditure on the existing pipeline (as required to directly estimate economic DORC) then it should, consistently, use these estimates to set long term price paths for the regulated business. For example, if it has enough confidence of future expenditure on the existing pipeline to 'lock in' a particular ICB then consistency would suggest that it 'lock in' a long term price path based on that expenditure. Alternatively, if a business has enough confidence to propose a long term expenditure profile for the purpose of calculating economic DORC it would be reasonable to expect them to accept a long term price path based on this assumption.

If neither has the confidence to do the latter, then it is not obvious why they should have the confidence to do the former.

Assessment against criteria 1

Straight line accounting DORC may be greater or less than economic DORC (there is no general presumption either way).

NPV cost based DORC will tend to overestimate economic DORC due to its failure to account for differences in service levels. Its estimation also requires the regulator rely on information that is held asymmetrically and which, in other regulatory contexts, is considered too unreliable to set prices.

Given these facts it is not possible to conclude that either approach (accounting DORC or NPV cost based DORC) will be a more accurate proxy for economic DORC

5.2. Impact on economic efficiency

Existing gas pipelines are 'sunk' assets meaning that their value in alternative uses is close to zero (you can not economically dismantle a gas pipeline and reconstruct it elsewhere). Provided the ICB is set above scrap value and regulation fully compensates the business's future expenditure, the business will have an incentive to operate the pipeline efficiently. If the DORC estimation process results in a value that is within a large range of values[15] there is little economic efficiency grounds for preferring one over the other.

On the other hand, equity considerations, including fulfilling reasonably held expectations, are important in setting an ICB. This is not just out of fairness to the owner of the existing pipeline, but also because treating that owner unfairly may create a perception of regulatory bias amongst investors and, hence, may deter investment across regulated industries more generally. That is, when the potential ramifications for future investment are considered, equity considerations are also efficiency considerations. This undoubtedly explains why issues of fairness loom large in 8.10 of the Code (see parts (a), (c), (f), (g) and (j)).

This might suggest that the ACCC should prefer straight line accounting DORC or NPV cost based DORC if it could be shown that investors strongly understood that 8.10 (b) referred to one or the other kind of DORC.

We are unaware of any strong evidence that this was the case. It is reasonably clear that investors could not have always presumed 8.10 (b) of the Code implied the adoption of NPV cost based DORC. This reflects the fact that, to the best of our knowledge, NERA introduced the concept of NPV cost based DORC in our September 2002 paper.[16] Nonetheless, we note that when ICB values were initially set under the Code investors proposed DORC valuations based on straight line accounting DORC. For example, see the 1998 ICB deliberations in

[15] Above scrap value and below a value that would lead to prices which promote inefficient bypass or unduly deter efficient consumption (which may be quite high if price discrimination is possible).

[16] NERA, September 2002, "Depreciation within ODRC valuations" a report for the ACCC.

Victoria where gas businesses proposed, and the ORG accepted, DORC values based on straight line accounting DORC.[17]

Assessment against criteria 2

There is no direct efficiency benefit from the estimation of straight line accounting DORC, NPV cost based DORC, or economic DORC.

A potential indirect efficiency benefit could exist if investors strongly expected one of the other of the above meanings to be applied. However, we can not provide determinative assessment of what investors expected.

5.3. Simplicity, Transparency and Consistency with Commercial Practice

5.3.1. Consistency with commercial practice

Straight line depreciation of a capital value is a well understood *accounting* valuation methodology used in commercial practice. It is not, however, a well accepted economic valuation method.

Economic DORC is not a well understood and practiced economic valuation method. Economic DORC *hypothesises* a 'competitive market' and *theorises* that in a competitive market second hand prices will reflect differences in costs and services provided by the existing and an optimised new asset. This theorising allows economic DORC to be calculated without reference to revenue. However, this valuation technique is not common commercial practice precisely because potential investors are interested in the *actual* value of assets (which depends on actual revenue forecasts) not the hypothetical value 'as if' they were in a (perfectly) competitive market. Moreover, NPV cost based DORC is also inconsistent with commercial practice in that it ignores differential service quality between new and existing assets.

5.3.2. Simplicity and Transparency

In a regulatory context, simplicity and transparency of process is valuable in and of itself. Interested parties to the regulatory proceedings inevitably have vested interests which they seek to achieve by influencing the regulatory process. Put simply, the regulated business wants higher prices and its customers want lower prices (provided this does not jeopardise the quality of their service). The more complex the regulatory process, and the more information intensive it is, the greater the potential pay-off from strategic behaviour by interested parties.

[17] "ORG, Access Arrangements: Multinet, Westar and Stratus, Final Decision, October 1998" available at http://archive.esc.vic.gov.au/docs/Gas/gasfin.pdf.

Similarly, the greater will be the resources consumed by the regulatory process - both by interested parties and by the regulator in response.

Directly estimating NPV cost based DORC is, as discussed above, a complex undertaking. It requires estimates of expenditures tens, and even hundreds, of years into the future. This report, and all the expert reports that have gone before it, provide examples of the resources consumed by the regulatory process when complexity is introduced - in this case a complex and informationally intensive technique for estimating DORC. It is therefore important to ask whether a compelling case exists that the additional complexity, and the resources consumed as a result, can be justified on the basis that it would further the requirements or objectives in the Code?

In our view the answer to this is 'no'. Even if NPV cost based DORC was a more reliable estimate of economic DORC, we see limited efficiency or equity benefits from such resources being consumed (as discussed in section 5.2 above). In any event, there can be no such presumption. NPV cost based DORC is only a proxy for economic DORC and need not be a more accurate proxy than straight line accounting DORC.

By contrast, straight line accounting DORC is transparent and simple. The only information required is the cost of an optimal pipeline that provides the same services as the existing pipeline at minimum cost (ORC), the age of the existing pipeline and the economic life of the optimal replacement pipeline. With this information DORC is formulaically calculated as:

$$DORC = ORC \cdot \frac{\text{Remaining Life of Existing Pipeline}}{\text{Economic Life of Replacement Pipeline}}$$

If this definition of DORC is implemented then the only scope for argument is the value of the ORC and the relevant lives of the pipelines. Not only does this dramatically reduce the amount of information that must be collected (and argued) it also nearly eliminates the reliance on information that is held asymmetrically (namely future expenditures on the existing pipeline).

Assessment against criteria 3

NPV cost based DORC scores poorly against the simplicity criteria. Its need for information that is held asymmetrically also means it scores poorly against a transparency criteria.

Straight line accounting DORC is both simple and transparent.

Straight line accounting DORC is consistent with commercial *accounting* practice although it is inconsistent with *economic* valuation. Economic DORC is also inconsistent with commercial practice in economic valuation - as it attempts to value assets 'as if' they were in competitive markets rather than simply valuing those assets in their actual market conditions.

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