

Report on *Agility*'s approach to DORC valuation.

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In August 2000, *Agility Management* provided a paper on “The construction of DORC from ORC”. I have been asked to consider the methodology adopted by this paper. In particular, I have been asked to comment on

1. The appropriateness of the construction of DORC from ORC as proposed in the paper, including the assumptions adopted;
2. Whether the DORC value under *Agility*'s approach is a well-recognised asset valuation methodology; and
3. Whether the approach is a reasonable interpretation of what is meant by DORC.

The context of the *Agility* paper needs to be kept in mind. The paper was a submission relating to the access arrangements for gas networks in the ACT region. The National Third Party Access Code for Natural Gas Pipeline Systems (the Code) has been developed to facilitate such access. The code requires that the regulator establish an initial capital base for the relevant assets. Section 8.10 of the Code lists factors that should be considered when establishing the initial capital base. 8.10.b states that one of these factors is “[t]he value that would result from applying ‘depreciated optimized replacement cost’ methodology in valuing the Covered Pipeline”.

The Independent Pricing and Regulatory Commission *Draft Decision* defines Depreciated Optimised Replacement Cost. “DORC is the replacement cost of an ‘optimised’ system less accumulated depreciation” (p.67).

1. The *Agility* approach

The *Agility* paper notes the standard arguments that are put forward in support of DORC. These include the argument that a DORC valuation allows regulatory pricing to mimic the behaviour of a perfectly contestable market. Also, a DORC valuation of assets represents the maximum valuation that would prevent system-wide bypass of the relevant assets.

The aim of this report is not to comment on either of these justifications for DORC as an asset valuation methodology. While I view both of these justifications as having limited economic merit, I will take them as given for the purpose of evaluating the *Agility* approach.

The *Agility* approach begins at the contestability argument. First, it considers the maximum intertemporal flow of revenues or ‘net income’ that would ensure that another firm would just not wish to purchase new assets and provide the relevant service. This flow of revenues essentially is equivalent to the revenues that would exist in a perfectly contestable industry.¹

There are clearly an infinite variety of ‘perfectly contestable’ revenue flows. Any intertemporal revenue or income flows that have a net present value equal to the current cost of the asset will be equivalent from the perspective of an investor. For example, suppose that an asset had a current cost of \$10 and a life of two years. If there is an interest rate of zero, then a flow of revenue involving \$6 this year and \$4 next year gives a present value of \$10. Also, revenue of \$5 each year has a present value of \$10. More generally, with a current asset cost of \$ V , a life of two years and an interest rate r , any flow of revenue or income f_1 and f_2 in the first and second years respectively, will represent a ‘contestable’ flow so long as

¹ The revenues discussed below are the revenues that would accrue to the firm to cover its fixed capital costs. In other words, it is total revenue, less all variable costs. A more useful term might be ‘variable profit’. The *Agility* report uses the term ‘net income’.

$$V = \frac{f_1}{1+r} + \frac{f_2}{(1+r)^2}$$

Contestability theory, however, is a theory about pricing rather than present value calculations. The theory of perfect contestability would not predict an arbitrary series of prices and revenues but would predict a specific flow over time depending on factors such as the rate of demand growth, the rate of inflation and the expected rate of technological change. The *Agility* report implicitly considers the revenue flows associated with perfect contestability under three assumptions:

1. The rate of demand growth is zero;
2. The rate of inflation is zero; and
3. There is no expected future technological change.

Under these three assumptions, a perfectly contestable market will have both constant prices and sales over time. As such, the perfectly contestable revenue or income will be constant over time. Thus, the *Agility* report is able to focus on flows of income that are constant over time (eg. the figure under section 3 of the report). In terms of the simple two-period example presented above, these three assumptions mean that $f_1 = f_2$.

Up to this stage, the *Agility* report provides no new insight. It is simply taking the value of the new assets, the expected life of those assets and calculating the constant flow of income that represents the present value of those assets over the defined asset life for a given rate of interest (or rate-of-return).

The additional insight provided by the *Agility* report is its use of these figures to calculate depreciation. “Having determined the income stream for the new entrant’s assets, the DORC value for the existing assets is then determined as the NPV of the first L years of that stream, where L is the remaining life of the existing assets”.

To understand the *Agility* approach it is best to focus on a simple example. Suppose that the price of a new asset is \$85.14 and that such a new asset has a life of exactly 20 years. Further, suppose the competitive interest rate facing the

owners of this new asset is 10%. If we take assumptions 1, 2 and 3, and consider the constant flow of income over 20 years that gives a net present value of \$85.14 at a discount rate of 10%, then a flow of exactly \$10 per year achieves this. In other words, a flow of exactly \$10 per year for 20 years with a 10% interest rate has a NPV of exactly \$85.14. In this sense, \$10 per year represents the annual income under a perfectly contestable market that uses this asset.

Now suppose that there is already an existing asset that is able to provide identical services to the new asset. If this asset had a life of exactly 20 years then its DORC value would simply be given by the value of the equivalent new asset, or \$85.14.² However, suppose that the existing asset has a life of only 10 years. How should the value of the new asset be ‘depreciated’ to provide a value for the existing asset?

If the aim of the regulatory regime is to mimic the perfectly contestable revenues of \$10 per year, then there is only one depreciation methodology that can be applied to the existing asset both initially and on an ongoing basis that will lead to revenue flows of \$10 per year. This methodology is simply the one implied by working ‘backwards’ from the prices. In other words, if the asset has a life of ten years left and it is to be given a value V such that, when the discount rate is 10%, the asset generates exactly \$10 per year under the regulatory regime, then the value of V must be the NPV of the flows of \$10 per year over ten years. In the example given here, this implies an initial asset value of \$61.45.

It needs to be noted, however, that this is not the only implication of the desire to replicate the perfectly contestable flow of revenues. In fact, the entire path of both asset values and depreciation for the existing asset are completely specified given the desire to replicate the flow of \$10 per year. In particular, the depreciation that must accrue to the existing asset in the first year must equal \$3.86 so that the value of the asset after one year is exactly \$57.59. This is exactly the NPV of \$10 per year over nine years when the relevant interest rate is 10%. Similarly,

² I am assuming that any optimization has already occurred.

depreciation in the second year is given by \$4.24. The full results are presented in the table below.

Year	Asset value at beginning of year	Depreciation (return of capital)	Allowed return on capital (at 10%)	Allowed income ³
1	\$61.45	\$3.86	\$6.14	\$10
2	\$57.59	\$4.24	\$5.76	\$10
3	\$53.35	\$4.67	\$5.33	\$10
4	\$48.68	\$5.13	\$4.87	\$10
5	\$43.55	\$5.64	\$4.36	\$10
6	\$37.91	\$6.21	\$3.79	\$10
7	\$31.70	\$6.83	\$3.17	\$10
8	\$24.87	\$7.51	\$2.49	\$10
9	\$17.36	\$8.26	\$1.74	\$10
10	\$9.09	\$9.09	\$0.91	\$10

The *Agility* approach represents *both* a current asset valuation methodology and an on-going methodology of depreciation that replicates the perfectly contestable income flow under assumptions 1-3. In this sense, the *Agility* approach takes the contestability justification of DORC valuation seriously. Further, it is the only internally consistent valuation methodology that gives the relevant flow of income over time. In particular, start with *any other* asset valuation in the initial year.

³ Differences in addition are due to rounding errors only. Answers have been truncated to two decimal places for convenience in the table.

Then given the interest rate there is no internally consistent method of depreciation such that a revenue flow of exactly \$10 per year is achieved.

To see this, suppose that a simple ‘straight line’ depreciation was applied to the ORC value of \$85.14 in the above example. The initial starting value of the asset would then be \$42.57. Given an interest rate of 10%, this implies a return on capital of \$4.26 in the first year. So to maintain total revenue of \$10 in the first year, the return of capital or depreciation must be \$5.74. This means that the value of the asset at the beginning of the second year would be \$42.57 less the depreciation of \$5.74, or \$36.82. Given the interest rate of 10% this implies a return on capital of \$3.68 in the second year and, to maintain \$10 flow of revenue, depreciation of \$6.32. This gives a starting value of the asset in year three of \$30.51. If we continue this procedure, we find that the value of the relevant asset must become negative at the beginning of year 7.

An alternative way to see that the *Agility* approach is the only valuation methodology consistent with the contestable income flow, is to ‘work backwards’. In our simple example, consider the tenth and final year. The value of the asset at the beginning of that year must be given by V_{10} where $0.1(V_{10}) + V_{10} = 10$. This value is the only one that will give the return of capital plus the return on capital, at 10% interest, equal to \$10. Thus, solving for V_{10} , we know it must equal \$9.09.

Now consider the ninth year. We know that the value of the capital at the end of the year must equal \$9.09. But then the value at the beginning of the ninth year must be V_9 where $0.1(V_9) + (V_9 - 9.09) = 10$. Note that the first term is the return on capital and the second term is the depreciation. Solving for V_9 gives an asset value at the beginning of the ninth year of \$17.36.

This process can simply be repeated each period and gives the initial asset value of \$61.45, the same value that *Agility* suggests.

2. Discussion

The approach to DORC asset valuation presented in the *Agility* report is reasonable and internally consistent so long as the methodology is used not only for initial valuation but also for ongoing depreciation. In other words, the methodology is not a one-shot valuation method but rather an on-going method of valuing and depreciating an asset over time. It is obvious from the above examples that if the *Agility* methodology was not taken as a package but was, for example, combined with straight line depreciation, then it would not retain its property of replicating a specific path of real income.

It could be argued that the *Agility* approach is the only valuation method that is consistent with the ‘contestability’ justification for DORC. This is because it is equivalent to working backwards from the specific revenues allowed under perfect contestability to a path of asset valuation and depreciation. This was shown for the simple numerical example above. In this sense, the *Agility* approach is the only approach that takes contestability ‘seriously’. Of course, as I have noted elsewhere, the contestability justification for DORC is dubious and it may not be desirable to replicate the fictitious path of revenues that result from the restrictive assumptions of the contestability model.

The general approach taken by *Agility*, which involves setting desired revenues and working backwards to asset valuation, is not new. It has been known in economics for a long time. In this sense, the valuation methodology used by *Agility* is a well-recognized valuation methodology.

The *Agility* approach as presented in their paper, depends on the assumptions 1-3 given above. However, the approach is not limited by these assumptions and can easily be modified for other assumptions. After all, the approach is simply working backwards from a flow of revenues. In this sense, it can accommodate any mutually consistent assumptions. So long as there is *some* valuation that is consistent with the desired revenue flows, then the *Agility* approach can be modified to find that valuation.

Much of the concern with the *Agility* approach is likely to relate to the apparent high asset valuation that it implies. For example, in his fax of 28 August 2000, Bruce Connery of *Agility* notes that “[t]he ratio of DORC to ORC for the ACT is most likely to be in the range 90% to 96%”. These high numbers reflect that the valuation methodology essentially deletes the tail of a net present value calculation. As the deleted income flows relate to periods of greater than 30 years, they have little present value.

It should be noted, however, that the depreciation regime that is implied by the *Agility* approach involves very slow rates of depreciation. Depreciation is also calculated by deleting the extreme tail of an NPV calculation. As such, while current asset values are a high proportion of ORC, leading to a high value of return on capital, the return of capital given by depreciation is very small. Again this is reflected in the simple example above. The depreciation rates under the *Agility* approach are, for example, much slower than straight line depreciation.

Further, it needs to be noted that the *Agility* approach is *only* consistent if it is matched with the relevant (slow) depreciation schedule. If, for example, the *Agility* initial valuation was matched with straight line depreciation, then the resulting revenues would not be consistent with the contestable income flows. The underlying objective of the *Agility* approach would be lost in this situation.

Whether the *Agility* approach is appropriate for the purpose of gas access depends on other features of the Gas Code. In particular the form of depreciation required by the Code is critical. The *Draft Decision* notes that “[s]ections 8.32 and 8.33 of the Code provide for the depreciation schedule to be calculated in accordance with the cost of service method” (p.101). The *Draft Decision* determines that “[t]he depreciation schedule will be calculated using straight line depreciation over the economic life of the assets” (p.105).

The *Agility* approach is only appropriate if it is used together with the consistent form of depreciation that it embodies. In other words, the valuation methodology and the depreciation methodology are inseparable in the *Agility* proposal. The *Agility* proposal will only be appropriate as a DORC valuation if the associated

form of depreciation both is able to be used under the Code, and is in fact used as an adjunct to the valuation methodology. For example, if it was decided that a straight-line method of depreciation was appropriate then it could not be the case that the *Agility* method of calculating DORC was appropriate. The *Agility* valuation methodology is not consistent with straight-line depreciation and combining it with straight-line depreciation would lead to nonsensical results. If the *Agility* proposal for asset valuation and depreciation was accepted as an appropriate interpretation of DORC, then it must be remembered that this valuation is only one input into the process of setting access tariffs under the Code.

3. Summary

In summary, the *Agility* proposal presents a consistent method for both asset valuation and depreciation. It is consistent with the standard justification of DORC as reflecting contestable pricing. In fact it is the only methodology that is consistent with contestable pricing given assumptions 1-3 above. Further, these assumptions do not constrain the approach and the approach can easily be modified to be consistent with other modeling assumptions.

The asset valuation methodology presented by *Agility* essentially involves working ‘backwards’ from a flow of revenues or net incomes. This general approach to asset valuation is not new and in this sense the *Agility* approach is a well-recognised asset valuation methodology.

The *Agility* approach to asset valuation however cannot be separated from the depreciation regime that it implies. This form of depreciation regime is ‘back weighted’ in the sense that long-lived assets have very little depreciation in the early years of operation. The appropriateness of the *Agility* approach depends critically on whether this depreciation methodology can be used on an on-going basis under the Code. If this form of depreciation cannot be used on an on-going basis, then the *Agility* approach is not appropriate. The consistency of the *Agility* approach can only be maintained with its associated form of depreciation. Using

an alternative form of depreciation, such as straight-line depreciation, on an on-going basis would lead to the *Agility* approach being meaningless and inconsistent with the contestable revenues that are used to construct the valuation.