
# Non-replicable assets and forward-looking cost

Dr Tom Hird
Jason Ockerby

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COMPETITION ECONOMISTS GROUP

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# 1 Overview

## 1.1 Introduction

1. We have been asked by Chorus for our opinion on aspects of a report from WIK-Consult (WIK) titled *Submission In response to the Commerce Commission's – "Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services (9 July 2014)"*, dated 5 August 2014 (referred to as "WIK report" hereafter). We have been asked to provide our opinion on WIK's report in so far as it relates to the appropriate valuation of "non-replicable' assets when setting prices based on forward-looking costs.

## 1.2 Summary of WIK's position

2. WIK argue that an 'efficient operator' would not replicate the existing ducts and pole assets in Chorus' network and as such:[1]

> *WIK recommends a Brownfield approach of deriving the costs of a [modern equivalent asset] MEA network, since otherwise, besides the risk of double cost recovery of fully depreciated civil engineering assets, inefficient network investment decisions may be the consequence.*

3. In order to prevent 'over-recovery' WIK recommend that compensation for ducts and poles be based on an 'appropriately indexed' historic cost value, net of 'accumulated depreciation', but excluding 'fully depreciated' assets.[2] None of these terms are defined in the WIK report.

## 1.3 Our comments on WIK's approach

4. In summary, our view is that the annualised cost of non-replicable assets should be modelled based on the optimised replacement cost of those assets over their full economic life using economic depreciation (e.g., a tilted annuity). We hold this view because the Commission is required to set prices based on forward-looking cost. The forward-looking cost of using assets that are still in-use (whether they are fully depreciated in accounting terms or not) is the saving from not having to replace those assets with new assets – which is the annualised cost of new assets over the remaining life of existing assets. That is, forward-looking cost is, by definition, based on optimised replacement costs (ORC).

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[1] WIK report, paragraph 3

[2] WIK report, paragraph 16

5. A pricing method that uses replacement costs to set compensation for assets that are not new is not biased in favour of overcompensation for those assets. Annuity compensation will only be received over the remaining life of the asset. For example, if a '10 year' reusable asset has a remaining life of 5 years, the owner of the asset will only receive 5 years of annuity revenue before having to incur the cost of replacing it. That is, the value of compensation provided for an old asset over its remaining life is much less than replacement costs – even though the annual compensation is based on replacement costs.

6. We consider that WIK's approach is arbitrary in relation to how a 'non-replicable' asset is defined. For example, it assumes existing ducts will be not be replicated but not the fibre already in many of those ducts. Moreover, we note that consistent application of WIK's approach overtime will presumably mean that new investments made by Chorus and others become 'existing' infrastructure that may be found in the future to be inefficient to replicate. The method of compensating for such assets needs to be consistent with how they were originally valued and depreciated, i.e., ORC using tilted annuity. Otherwise, investors in such assets that might in the future be deemed to be non-replicable will be reluctant to invest.

7. We also note that a replacement cost based tilted annuity is consistent with the profile of compensation for these assets determined in the past (based on benchmarked prices).

# 2 Non-replicable assets

## 2.1 Forward-looking costs

8. The use of forward-looking costs for pricing access to telecommunications services has typically been justified on the basis that it will provide good build/buy decisions for potential new entrants. In particular, it was considered that the profile of prices should track the costs that would be incurred by a hypothetical new entrant.

9. All regulatory regimes for pricing access to long-lived assets have two basic ingredients – a method for setting the value of assets and a mechanism to recover that value. TSLRIC based on forward-looking costs is no exception. First, it sets the value of assets equal to the current cost of replacing them ("optimised replacement costs"). This exercise is repeated each time prices are set. Specifically, when forward-looking prices are set at the outset of each regulatory period, the assets are re-valued, based on current optimised replacement costs at that time.

10. Second, at each price reset, the amount of the asset value (as assessed at that time) that is allowed to be recovered in the coming period is set equal to the expected change in the value of assets over that period, i.e., between then and the next price reset. This asset recovery profile (or depreciation) is typically based on a formula which requires forecasts of asset lives and expected changes in the cost of replacing the network, both of which are uncertain.

11. In expectation, forward-looking cost based pricing meet the basic requirement of allowing the sunk cost of an investment to be recovered in an unbiased manner.[4] However, it is important to note that this is true in expectation only. It may not be true *ex post*. This is because, when prices are reset, there is no "wash up" of the inevitable differences that emerged over the previous period between forecast and outturn changes in asset values. This means that when forecast movements in asset values turn out to be wrong, future prices will reflect windfalls from these forecasting errors.

## 2.2 WIK's approach is not forward-looking

12. WIK say assets that are not going to be replicated should not be modelled on a forward-looking basis. Instead, WIK propose that compensation for these assets be based on valuing them on an indexed historic cost basis taking into account accumulated depreciation. Depending on how 'accumulated depreciation' is calculated relative to economic depreciation, this proposal runs the risk that it will set compensation that is above or below the forward-looking costs of those assets.

4 Sometimes known as expected financial capital maintenance (FCM) or the NPV=0 principle.

13. For example, if we imagine that the replacement cost of a brand new asset with a 10 year life was determined to be \$100 at $t_0$. With 0% cost inflation and a 10% WACC, the forward-looking annuity compensation for that asset is \$16.3 for each year of its remaining life. After 5 years, economic depreciation is less than 50% (because, due to the nature of compounding, the discounted value of future services from an asset falls less slowly in the early years of an assets life). However, imagine that after 5 years the asset was determined to be 'reusable' in a new network design and, on this basis, it was valued based on straight-line depreciation of the initial \$100. Under this interpretation of WIK's proposal it would only be valued at \$50 and the associated annuity over the remainder of its life just \$13.2 per year. This is \$3.1 per annum less than is required to deliver back to the efficient operator the original \$100 investment. Switching between economic compensation and a straight line depreciated valuation will result in an unjustified reduction in compensation.

14. Similarly, it appears that WIK proposes to assume that the asset that may be replicable has no residual value. In the case of the above example, the hypothetically efficient operator is assumed at time $t_0$ to fund the (then efficient) long-lived asset. However, at time $t_5$ the hypothetical efficient operator is assumed to require compensation only for the (now cheaper) new asset. The effect of which is that the hypothetically efficient operator only received annuity compensation for its efficient investment in the initial asset at $t_0$ for 5 years. Beyond that they receive less than this.

15. Of course, any hypothetically efficient operator subject to these types of future stranding risks at time $t_5$ would not invest unless they were provided with sufficient compensation above and beyond the annuity cost of their deployed technology at time $t_0$.

16. WIK propose that the Commission adopt the European Commission recommendation for the valuation of reusable asset, which WIK describe as follows:[6]

> *… when building the BU LRIC+ model, NRAs should not assume the construction of an entirely new civil infrastructure network for deploying an NGA network". In order to avoid over-recovery of costs, the methodology outlined in the recommendation foresees the determination of a Regulatory Asset Base (RAB) for reusable legacy civil engineering assets (ducts, poles, etc.) through the indexation method:*
>
> - *this method relies on historic data on expenditure for the reusable assets, accumulated depreciation and asset disposal as well as the indexation through an appropriate price index;*

6 WIK report paragraph 15

- *reusable legacy civil engineering assets still in use but fully depreciated are not to be included in the RAB.*

*Thus, the Regulatory Asset Base (RAB) consists of the historic costs of the reusable civil engineering assets not completely depreciated, net of the accumulated depreciation at the time of calculation and indexed by an appropriate price index. The indexation ensures that historic costs are "updated" to reflect today's value of the investment, i.e. prices that would have to be paid today for these assets.*

17. An immediate point to note is that WIK's proposal is not fully specified. In particular, WIK do not specify how "accumulated depreciation" is to be calculated. To the extent that its approach to calculating depreciation yields a different revenue outcome to what would be expected if the reused asset continue to be compensated based on an optimised replacement cost valuation with economic depreciation (e.g., using a tilted annuity), we consider that WIK is making an error or intentionally proposing a method that yields price at less than forward-looking costs.

18. In other words, to the extent WIK's "appropriately indexed" historic cost value net of "accumulated depreciation" is:

    - indexed using something other than the path of replacement cost;[7] or
    - depreciated using something other than economic depreciation (we might assume straight-line deprecation),

    it is not producing an outcome that is consistent with forward-looking costs. This point is demonstrated empirically below. In our view, the fact that WIK propose to place no value on "fully depreciated" assets, despite them being in use, will, by definition, ensure that prices are set below forward-looking cost. These points are demonstrated empirically in following sections.

19. To the extent that WIK's proposal is intended to achieve this outcome it amounts to an opportunistic breach of the implied regulatory contract that underpins forward-looking prices. This is particularly important in light of the depreciation assumptions that have underpinned regulated prices in the past.

20. It is damaging to incentives for investment in assets that might be regulated using forward-looking cost regime, because it truncates returns below those that are needed to achieve expected present value neutrality of investment over time.

21. It should also be noted that even if, for some unexplained reason, only Chorus could or would ever expect to replace the asset, this does not negate the need to provide a level of compensation for its past and future investment in such assets. As we

[7] However, we do note that WIK does appear to be proposing indexation based on the path of replacement costs. WIK states that "indexation ensures that historic costs are "updated" to reflect today's value of the investment, i.e. prices that would have to be paid today for these assets".

discuss in the following section, declaring an asset 'non-replicable' and switching between a (back-loaded) economic depreciation profile to a (front-loaded) straight line depreciation profile part way through its life will, other things equal, result in under-compensation for the initial investment.

## 2.3 Depreciated indexed historic costs should not give a different answer

22. If WIK's "appropriately indexed" historic cost value net of "accumulated depreciation" is based on indexation of historic costs using the path of replacement cost and depreciated using economic depreciation then it gives the same level of compensation over the remaining life of the asset as using replacement costs. That is, if depreciation is based on economic depreciation and indexation is based on trends in replacement costs then you get the same compensation.

23. We might reasonably assume that WIK is proposing an alternative to economic depreciation in its proposal of "accumulated depreciation". For the purposes of this section we assume that WIK may be proposing the approach previously proposed by Frontier Economics (Frontier), which in our view, amounts to straight-line depreciation.[8]

24. If this is the case, it can be demonstrated that these two alternative approaches to deprecation give different levels of future prices (and hence a different implied current valuation of reusable assets). This can be shown as follows.

25. With the simplifying assumption of no operating expenditure, the expected present value of future prices will simply be equal to the current (depreciated) valuation of assets. Using WIK/Frontier's proposed approach to the depreciation, this w would be equal to:

$$NPV\ of\ future\ prices_t = ORC_t\ x\ \frac{Remaining\ economic\ life\ of\ existing\ asset_t}{Economic\ life\ of\ replacement\ asasset_t}$$

26. This valuation may be recovered over an infinite number of future depreciation profiles within a building block model. We note that WIK is silent on the appropriate future depreciation profiles, whilst Frontier recommended a flat annuity.[9]

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8 Frontier Economics, *Determining a TSLRIC price for Chorus' UCLL service*, A Report Prepared for Vodafone New Zealand, Telecom New Zealand and Callplus, February 2014.

9 We note that Frontier present this as a DORC which reflects 'accumulated depreciation'. Similarly, WIK present this as a indexed historic value net of 'accumulated depreciation'. In our view, neither of these approaches is forward-looking. A forward-looking DORC valuation will give identical compensation to using ORC in a tilted annuity. Any attempt to arrive at a DORC value where this does not hold is not a forward-looking DORC valuation.

27. In contrast, the expected level of future prices using economic depreciation is equal to the present value of the tilted annuity price path received over the remaining life of the existing asset.[10] That is, the level of future prices over the remaining life of the existing asset will be based on the initial years of a price path that will recover $ORC_t$ over the full economic life of the replacement asset.[11]

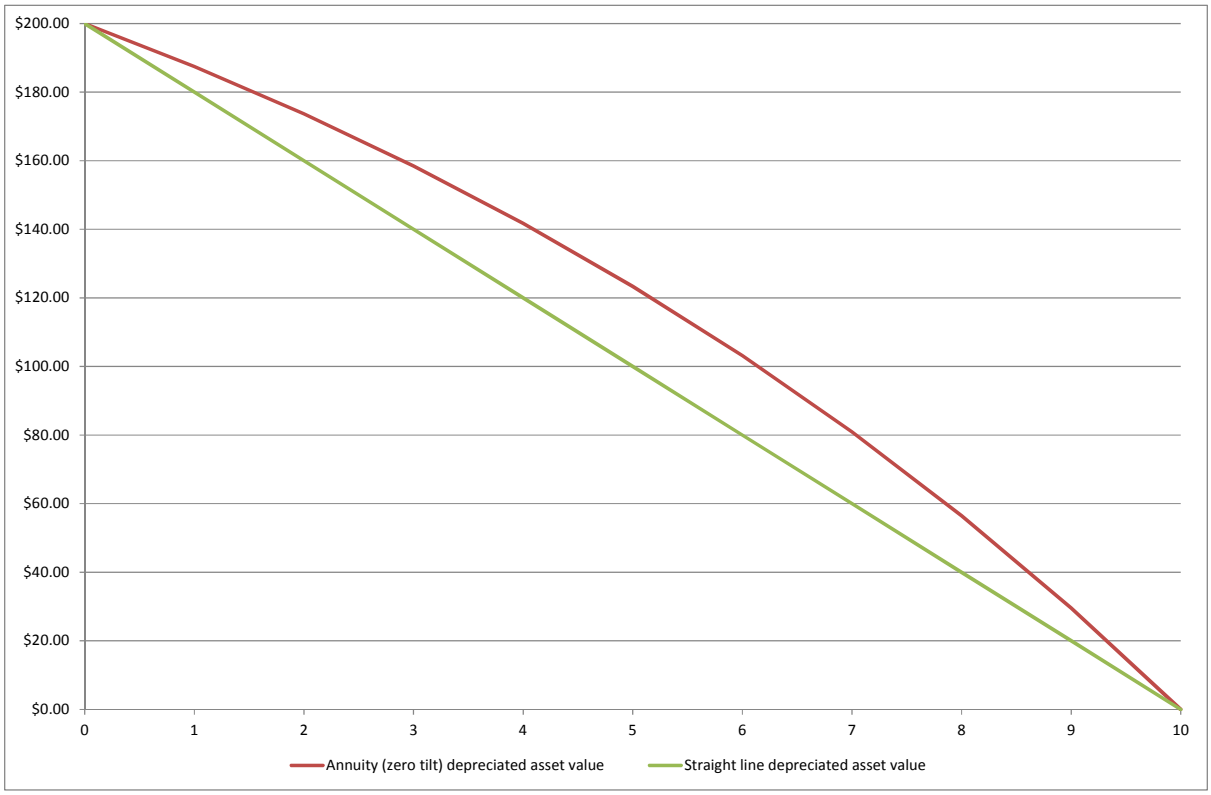
28. A simple example demonstrates the difference in outcome. Imagine an asset with an initial cost of $200 with a 10 year life. Assuming a zero tilt, the tilted annuity path of prices are constant because technology is constant (i.e., new entrant or efficient operator costs are neither rising nor falling). The constant annuity that recovers $200 over 10 years when WACC is 10% is $32.55. This annuity will be received over the remaining life of an asset. If the asset is new the remaining life is 10 years and the present value of the annuity received will be $200. However, as the remaining life reduces the value of the annuity payments over that remaining life also falls (as the number of remaining payments of $32.55 falls to less than 10).

29. However, the present value *does not* fall in a straight line. The present value of remaining annuity payments initially fall slowly because the end of the life (and the cash-flows) is most distant at this point – and present value calculations place exponentially less weight on the future the further away it is. As the end of the life (and cash flows) comes closer the asset value declines faster. This is why the tilted annuity asset value initially rises above the straight line depreciated asset value and then falls back to the straight line depreciated asset value in the last year of the assets life. The accumulated depreciation is the same ($200) over the life of the asset but the profile is not. The profile is more 'back-loaded' with economic depreciation.

[10] The prices can only be charged over the remaining life of the asset as the asset, in this example, is not replaced.

[11] See Appendix A.

**Figure 1: Straight line versus economic depreciation of initial $200 asset value**




30. The above graph provides just one example of economic depreciation – where the tilt is zero and the WACC is 10%. The profile will be different with different tilts and discount rates. If the replacement cost of the asset is falling, this would increase tilted annuity depreciation in the early years of an assets life and bring the tilted annuity asset value closer to, or even below, the straight line depreciated value of the asset. The mathematics of this is described more fully in Appendix A.

31. However, it would only be chance that the present value of future prices will be equal under the building block model proposed by WIK/Frontier and a continuation of the ORC based annuity approach to the reusable assets. In our view, this demonstrates a conceptual inconsistency in using a straight-line approach to the depreciation of any depreciated indexed valuation.

32. Whilst there may be merit in a building block method because it reduces future uncertainty and the likelihood of windfall gains and losses, it should not yield a different expected present value of prices to continuing with the annuity compensation based on economic/annuity depreciation. This would be inconsistent with the principle of expected NPV neutrality of regulation and would be inconsistent with forward looking cost estimation.

## 2.4 No such thing as a forward looking fully depreciated asset that is still useful

33. One significant (and economically incorrect) aspect of WIK's proposal to value reusable assets is its view that fully depreciated assets should be excluded. WIK state:[12]

> *... reusable legacy civil engineering assets still in use but fully depreciated are not to be included in the RAB*

34. If an asset is still being used it has not reached the end of its life. It, therefore, is not fully depreciated in any meaningful economic sense.

35. If an asset is still being used it has a forward looking economic value. In order to assign a zero forward looking cost to an asset that has forward looking economic value then it needs to be the case that forward looking 'cost' and forward looking 'value' have different meanings. In common parlance, it may be the case that a layman would use these terms in different ways. For example, a publicly provided bridge might be thought of as 'free' (costless to cross) but valuable. However, as a matter of economics, the cost and value of the bridge are the same thing – namely the costs that would need to be incurred to replace it if it was not there (either with another bridge or withy an alternative infrastructure).

## 2.5 Valuing old assets at their current replacement cost does not necessarily lead to windfalls

36. To a non-economist, the forward-looking cost notion of giving someone a revenue stream based on valuing an old (depreciated) asset as if it were new may seem unfair and this perception will be strengthened if the replacement cost of the asset has risen above the original cost. Of course, we note that the use of forward looking costs rather than RAB based regulation will inevitably give rise to windfalls (gains and losses) when the path of forward looking costs differs from what was reasonably expected and compensated in the past. Thus, there is a potential for such windfalls under forward looking cost compensation. However, there is no reason to believe that there is an inherent bias associated with using replacement cost that creates expected windfalls.

37. The reason that this perception is wrong is that this revenue stream is only received over the remaining life of the old assets. That is, even though forward-looking costing ascribes an asset a value equal to the full replacement cost of a new asset, the annual revenues that are set are based on depreciating that asset over its full economic life of the asset. If the existing asset is half way through its life, the owner

[12] WIK report, paragraph 16

of the asset will only receive around half (abstracting from present value calculations) of those revenues. Consequently, the real value of the asset to the owner is actually depreciated even though forward-looking asset values do not require a depreciation calculation. Moreover, the shorter the remaining life of the actual asset the higher the level of effective depreciation that is applied to it.[13]

38. In addition, we note that applying forward-looking costs consistently through time will anticipate any trend in replacement costs. This means that, if it was expected that the value of the old assets would be revalued up (down) in the future, the level of compensation (in particular, the economic depreciation component of annualised cost) allowed for those assets will have been low or negative (high). As the methods used for accounting depreciation for these old assets is different to that used in TSLRIC modelling, the written down value in the accounts gives little insight into whether those assets have been recovered and hence whether there is expected to be windfall.

39. We note, as an aside, that providing a revenue stream over the remaining life of an existing asset based on its current replacement cost and economic life if newly installed is consistent with the way in which these assets have implicitly been regulated in the past. Historically, prices have been based on benchmarking forward-looking cost-based prices for New Zealand. That is, prices have been based on forward-looking cost models in other jurisdictions that were meant to be comparable to New Zealand. In these models, the prices in each year reflect an expectation of the life of the asset and the expected change in the value of the asset.

40. Specifically, prices have been set to achieve recovery of the current costs of new assets based on an assumption that the asset will be revalued in the future and that new value will be used to set prices. This has generally been implemented using a tilted annuity approach to depreciation where the level of depreciation is set to achieve recovery of the value of new assets over its expected life, with a 'tilt' to reflect the expected change in the value of assets. This means that if the value of assets were expected to rise in the future then the level of depreciation (and prices) will have been set lower at that time to reflect an expectation of higher depreciation (and prices) in the future. This future higher depreciation (and prices) would reflect an expected higher asset value.

41. In our experience, an upward tilt in the annuity was commonly assumed for civil assets such as ducting and trenches, whilst electronic equipment was given a downward tilt. In the context of the UCLL this resulted most commonly in an

[13] Another way of thinking about this is that, unlike building block style regulation, with forward-looking costings there is no additional compensation for the asset owner to cover the future cost of replacing those assets (i.e., no capex is rolled into the regulated asset base). Consequently, the value of the existing asset is the replacement cost used in forward-looking cost model less the present value of expected costs of replacing the actual asset at the end of its life.

upward (positive) trend in the unit cost of these assets (i.e., low or negative depreciation).

42. It is relevant to emphasise that the depreciation profile from a positive tilted annuity is very different to that which is assumed in Chorus' asset register. The nominal straight-line form of depreciation would be regarded as 'front-loaded' because it achieves a greater amount of recovery of the initial assets (in NPV) terms early in the life of the asset. In contrast a positive tilted annuity would be regarded as a 'back-loaded' profile of depreciation because cost recovery has been assumed to be delayed to the back end of the life of the asset. As such, the written down value of assets in Chorus' accounts will not give a good indication of whether those assets have been recovered and whether there is expected to be a windfall to Chorus.

43. We also note that the lives adopted by Chorus for accounting purposes need not bear a close relationship to the actual economic lives of the assets.

44. In summary, in our view, using a current valuation of old (partially or fully) depreciated assets (in accounting terms) is not biased in favour of delivering a windfall to Chorus. In contrast, if the Commission were to follow WIK's advice and exclude those assets from the asset count it will would not only be inconsistent with forward looking costs, but it would set up a method that was biased in favour of under compensation.

## 2.6 Errors in deciding what is replicable and what is not

45. WIK invites the Commission to say that there is 'spare capacity' in Chorus' existing network that would be available to an efficient operator and can be utilised by the efficient operator at something less than the forward-looking replacement costs of that capacity.

46. This may have profoundly negative implications for investment in the future because it would set a precedent which, at future regulatory resets, says the Commission could deem some assets that have been efficiently made in the past to be non-replicable, and apply a lower (non-forward-looking) approach to costing.

47. For example, we note that WIK propose that the Commission incorporate FWA in its proposed MEA. The deployment of which (either in the model or in practice) will require investment in towers and backhaul equipment from those towers. If WIK's logic is accepted, it will be open for the Commission in some future regulatory reset to treat these investments differently to other investments by deeming them to be non-replicable assets and applying a lower compensation, even though they were considered to be efficient investments in the past and would efficiently be reused in the newly assessed efficient operator's network.

48. It should also be noted that WIK's approach to identifying non-replicable is entirely arbitrary and therefore the above example is probable. For example, in the current

context it has unilaterally determined that ducts and poles are reusable, but has not given any reason for distinguishing these assets from other assets such as fibres in Chorus backhaul network that may have spare capacity and/or can be reused by an 'efficient operator'. Use of such assets would be equally beneficial in terms of minimising the incremental costs to the 'efficient operator'.

49. Indeed, given that WIK proposes to build a model to serve the demand that Chorus is already serving then, by definition, 100% of Chorus' existing capacity will be 'spare' as Chorus will be completely displaced by the efficient operator. In our view, WIK has proposed a very poorly thought through thought experiment that involves an efficient operator displacing Chorus and, in so doing, only using capacity on Chorus' network that is 'spare'. Of course, if the efficient operator displaces Chorus then all of Chorus sunk assets will be 'spare' in the sense that Chorus will have no use for them.

50. To the extent that it is useful to engage in such a thought experiment, the logically consistent way to think about the price a new entrant would pay for access to Chorus ducts and trenches is the opportunity cost of not having access. This would be based on the cost to the new entrant of building their own assets (i.e., replacement costs). A similar thought experiment might be applied to the price that third-party civil providers would charge a new entrant (or Chorus) for access to their infrastructure.

# Appendix A Economic and straight-line depreciation in existing asset valuations

51. Economic depreciation can be intuitively understood in the simplest scenario where:

- the new asset lasts forever (or, at least, so long lived that the PV of future replacements can be ignored) but the remaining life (RL) of the existing asset is less long lived;
- the new asset is expected to have the same cost in RL years as it has now; and
- operating and maintenance costs are the same for the existing and new assets;

then the value of the existing asset collapses to:

$$Value\ of\ existing\ asset\ = Cost\ of\ new\ asset - \frac{Cost\ of\ new\ asset}{(1+r)^{RL}}$$

52. This formula has a simple intuitive meaning. The immediate saving from having an existing asset is the cost avoided by not having to build the new asset – the first term on the right hand side of the above equation. However, this overstates the savings because the existing asset will have to be replaced earlier than the new asset. Therefore, the PV of the expected replacement cost in "RL" years must be subtracted from the cost of the new asset to arrive at the true value of the existing asset.

53. That is, the *depreciation* of the existing asset is given by the higher PV of replacement costs on the existing asset, which reflects its shorter remaining life. Moreover, the shorter is the remaining life of the existing asset, the higher the amount of depreciation becomes. However, at least in this simple example, the relationship between depreciation and the RL is not consistent with a straight line depreciation profile.

54. If we drop the simplifying assumption the new asset will last forever, and instead assume that its life is "T" then the above equation becomes:

$$Value\ of\ existing\ asset\ = \frac{Cost\ of\ new\ asset \cdot (1+r)^T}{(1+r)^T - 1}\left(1 - \frac{1}{(1+r)^{RL}}\right)$$

55. The first term of the right hand-side of this equation is simply the PV of the cost of building a new asset today and every T years thereafter. This is then multiplied by the second term on the right hand-side in order to give the difference between starting this series of payments now and starting them in RL years.

56. Plotting the competitively depreciated value against remaining life and comparing this to straight line depreciated value of the asset over a life of "T" years reveals that these valuation methods can be markedly different – especially for very long lived assets.

57. Figure 2 and Figure 3 illustrate the difference between deprival value estimated using the economic depreciation approach and straight line depreciation. In Figure 2, the assumed asset life is 100 years and the real discount rate is 10%. In Figure 3, the assumed asset life is 25 years and the real discount rate is 5%. It can be seen that the correct depreciation profile is very different from straight line depreciation in Figure 2 but much less so in Figure 3. In both cases the cost of a new asset is $100.

**Figure 2: Economic depreciation vs straight line depreciation (r=10% T=100)**

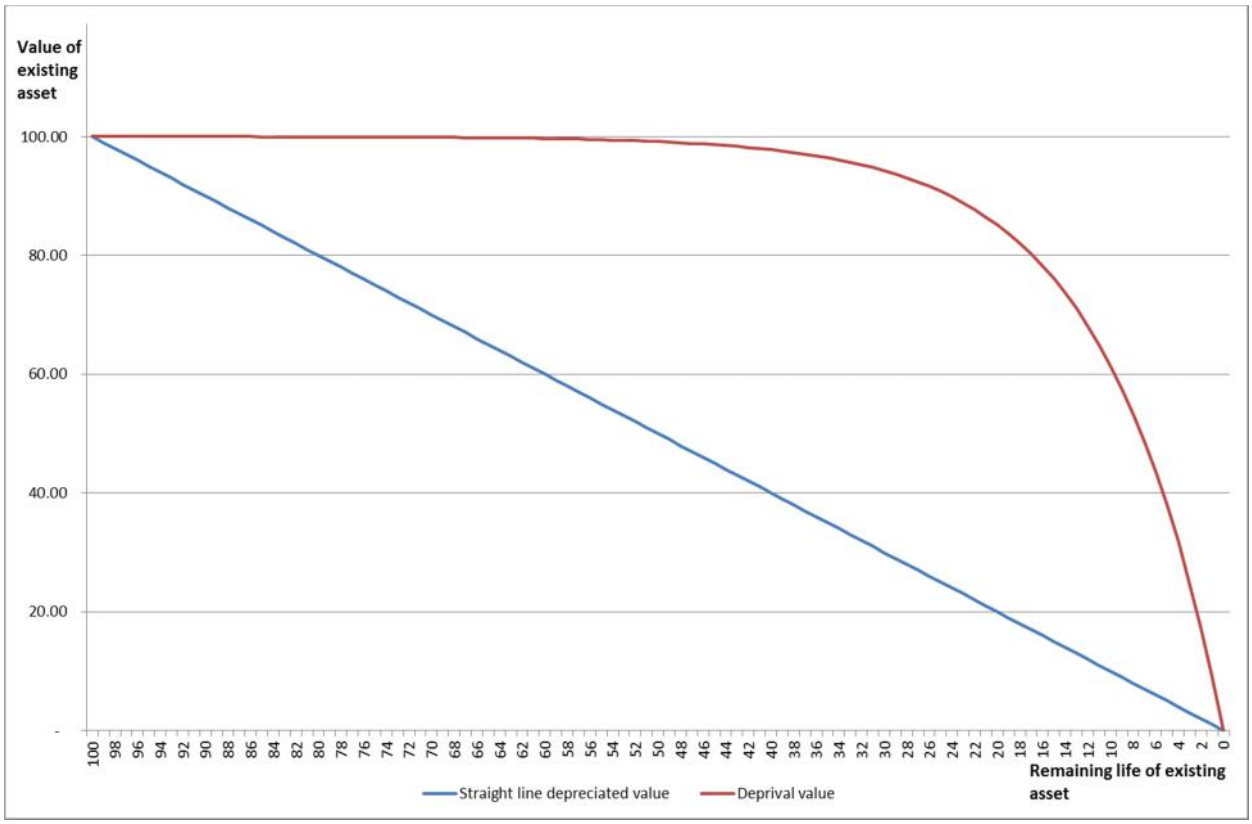
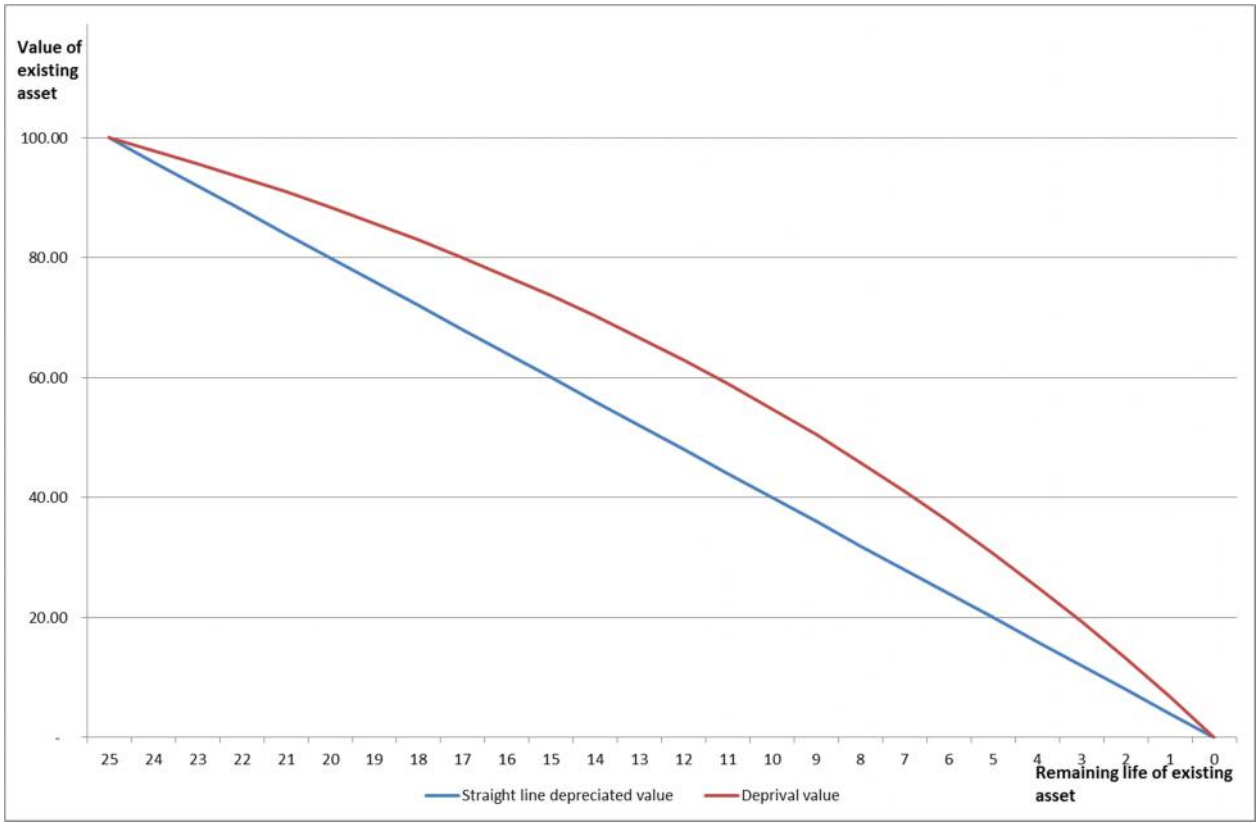


**Figure 3: Economic depreciation vs straight line depreciation (r=5% T=25)**




58. In Figure 2, the economically depreciated value of the asset hardly changes in the first 70 years of a 100 year asset's life. This is because of the nature of compound discounting. The discounted savings from delaying investment in a new asset by 99 years are not materially higher than the discounted savings from delaying the investment 30 years. By contrast in Figure 3, the economically depreciated value falls more or less in line with straight line depreciation (initially a bit slower and towards the end of the asset's life a bit faster). This reflects the shorter life of the new asset (25 years vs 100 years) in Figure 3 and the lower discount rate (5% vs 10%). Both of these changes reduce the impact of compound discounting in the competitively depreciated value calculation.

59. This suggests that while straight line discounting may provide a reasonable approximation of the "correct" deprival value in some circumstances, it will be highly inaccurate in others. In particular, based on the above results, straight-line depreciation is unlikely to be a good approximation where the asset lives are long (as is the case with ducts) and where maintenance/refurbishment costs are similar as between new and old assets.