Calculating economic depreciation for regulatory accounts

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Any telecommunications service provider deemed to have ‘significant market power’ will be obliged to prepare so-called *regulatory accounts* which will be used as the basis for setting statutory price controls and interconnection rates. As such, not only is this task sufficient obligation to warrant the existence of a whole department, it is also critical to ensure accuracy and transparency so that the interests of the operator are fairly presented, and to avoid any possible legal challenges to questionable calculations.

A large external consulting project has been the typical response to these requirements. Money will buy the greatest intellect, but the most typical large Excel deliverable leaves much to be desired in terms of consistency and reliability. Even the perceived transparency is questionable if it would take a suitable expert an order of weeks to trace the logic through and audit with any certainty.

It was from this perspective that we decided to explore the feasibility of calculating the necessary *economic depreciation* in STEM as the basis for a *long run incremental cost* (LRIC) model. This article explains in some detail how our solution provides a solid foundation for these calculations which is guaranteed to be consistent across all relevant elements. A demonstration model is available online via the link below.

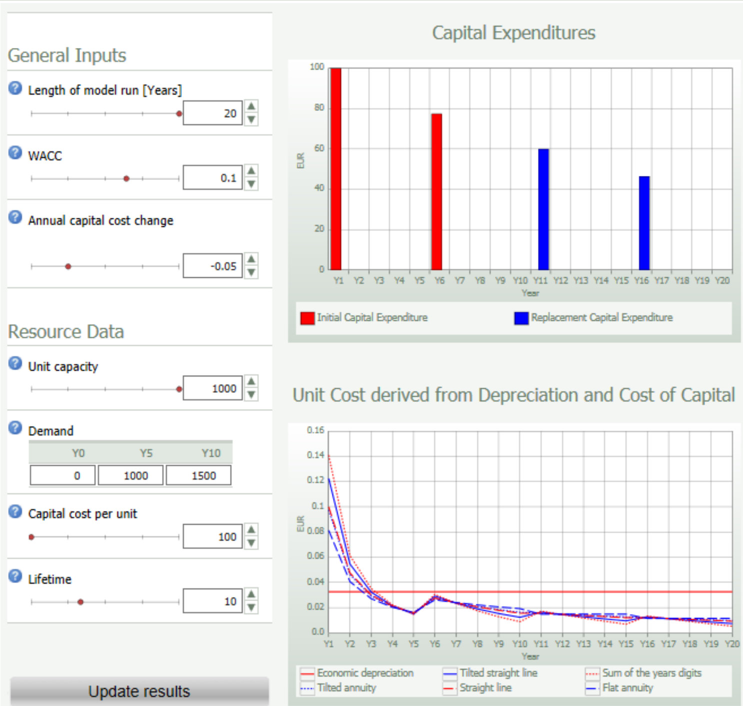

Figure 1: Illustrative depreciation-model interface live on our website

Please click the screenshot above to access the model now.

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1. Alternative depreciation schedules and capital recovery

Depreciation which considers the economic value of the assets in question is widely used in cost models to support the regulation of telecommunications markets. The STEM business-modelling software has immediate built-in capabilities to calculate *straight-line* and *reducing-balance depreciation*. Built-in cost trends and explicit depreciation schedules may then be combined to model a wider variety of depreciation policies.

We have created a model which exhibits the following alternative calculations, which are independent of the usage of the assets in question:

- *straight-line depreciation*
- *tilted straight-line depreciation*
- *sum of the years digits depreciation*
- *annuity*
- *tilted annuity*.

These depreciation policies can reflect price changes and the effects of later capital investment or market entry, and can be combined with *Cost of Capital* to recover the total cost. A common approach in the context of regulatory cost modelling is the consideration of asset usage over its lifetime as a measure for the economic value. As this requires a forward-looking approach, the options are:

- to run a model twice,
- to use offline calculations (e.g., MS Excel-based), or
- to derive the depreciation from STEM-based user-defined results after the model run.

The example model applies user-defined results to show *economic depreciation* based on *units of production.*

Note: some of the depreciation schedules listed in the beginning also fulfil the requirements for economic depreciation but, for easier separation, only the usage-based economic depreciation is named as such.

The first common requirement for the depreciation and cost recovery methods used is that the *Net Present Value* (NPV) of *Depreciation* + *Cost of Capital* should equal the initial investment, which in turn guarantees that:

- depreciation recovers the initial investment
- there is a recovery of capital employed.

The second requirement is that *Depreciation* + *Cost of Capital* should reflect (theoretical) changes in the underlying cost, thereby allowing investigation of the situation for later market entry.

2. Using depreciation schedules in STEM

First let's see how the built-in *depreciation schedule* feature can be used in conjunction with *cost trends* to drive a range of alternative depreciation calculations. *Please contact us for more explicit instructions on how to achieve these results.*

Straight-line depreciation

Straight-line depreciation is the simplest method and is based on *Historic Cost Accounting* (HCA). The initial investment is evenly written off over the lifetime of the asset. In order to include *Cost of Capital*, one normally takes the *Net Book Value* (NBV) and multiplies it by the *Weighted Average Capital Cost* (WACC). Although both the initial investment and *Cost of Capital* are recovered, this method has several disadvantages:

- cost changes during the asset lifetime are not considered
- replacement of an expired unit leads to a sharp increase in the *Cost of Capital*, which can't be justified.

Tilted straight-line depreciation

Applying *Current Cost Accounting* (CCA) methods to the *straight-line depreciation* allows consideration of cost changes during the lifetime of the assets. This means that the depreciation over lifetime is not calculated based on the initial investment, but rather on the replacement value. Hence, this leads to under-recovery of the assets (assuming declining cost trends), and so one needs to consider re-evaluation of the existing assets, adding the corresponding asset value change to the depreciation. The resulting depreciation is therefore calculated as follows, and leads to a recovery of the initial investment:

Depreciation = *Replacement value* / *Lifetime* + *Book value* * (*Cost trend*)

Cost of Capital can be considered based on the NBV. Although the effect of cost trends (e.g., for regulatory calculations for later entrants) is considered, there are some disadvantages; e.g., the NBV would not be in line with the NBV in financial accounts and we will again see sharp increases in the case of asset replacement.

Sum of the years digits

The *Sum of the years digits* method (SYD) is an accelerated depreciation method. It is based on the assumption that assets are generally more productive when they are new and that their productivity decreases as they become old.

Depreciation for a given year is calculated as:

$$Depreciation_{CurrentYear} = Initial\ Investment * \frac{Remaining\ lifetime}{SYD}$$

$$\text{where } SYD = lifetime * \frac{(lifetime + 1)}{2}$$

Initial Investment is recovered and one can calculate *Cost of Capital* for the NBV as for the straight-line depreciation schedules. However, cost trends are not considered.

Flat annuity

A widely-used approach to get steady charges is the annuity method. The annuity comprises a declining *Cost of Capital* part and an increasing *depreciation* part. Standard annuity is calculated as follows:

$$Annuity = \ Initial\ Investment * \frac{WACC}{1 - \left(\frac{1}{1 + WACC}\right)^{lifetime}}$$

Investment and *Cost of Capital* are recovered completely and there are no sharp increases due to replacement of assets. However, cost trends during lifetime are not considered.

Tilted annuity

In order to consider cost trends the annuity calculation can be based on CCA methods.

$$Tilted\ annuity = \ Initial\ Investment * (1 + P)^{CurrentYear-1} * \frac{WACC - P}{1 - \left(\frac{1 + P}{1 + WACC}\right)^{lifetime}}$$

where P is the annual cost change (price trend).

This approach recovers *Investment* and *Cost of Capital* completely, and there are no sharp increases due to replacement of assets. Cost trends are considered and would reflect the situation for later entrants.

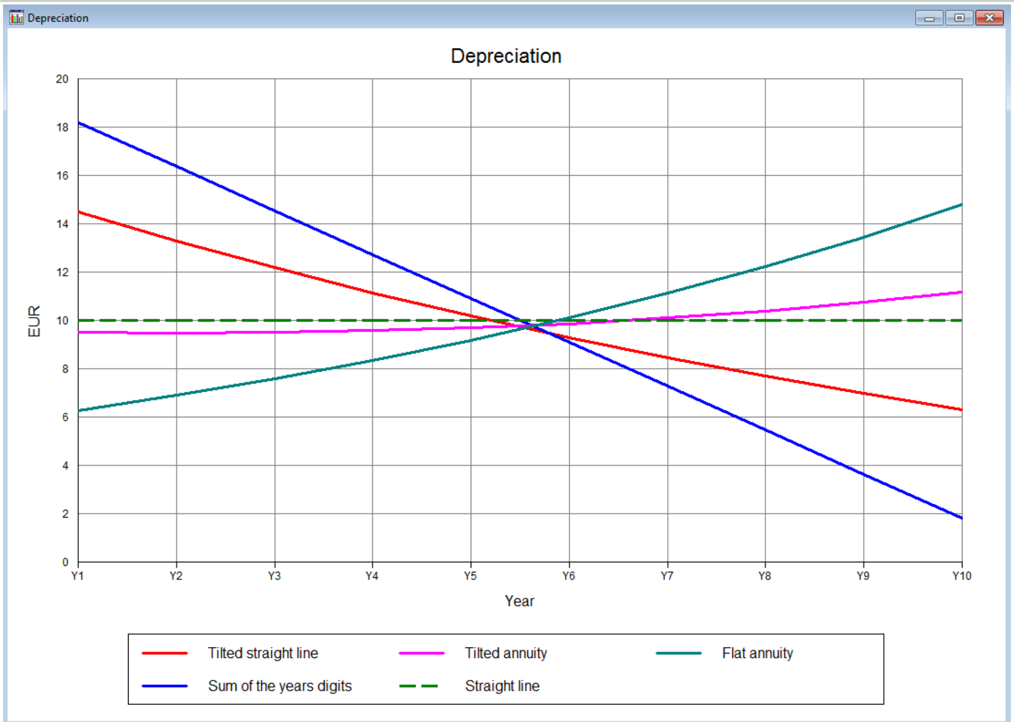

Figure 2: *Depreciation* as a result of different depreciation policies

3. Calculating economic depreciation with user-defined results

All the depreciation methods shown so far are independent of the usage of the assets in question. This means that the unit cost of production will be inversely proportional to the amount of units sold and can change significantly over time. A way to overcome this is the *units of production* method. The basic idea is that the lifetime of the asset is expressed in terms of the total units expected to be produced, and the depreciation in a period is proportional to the ratio of units used in that corresponding period to the total units of the lifetime.

$$Depreciation_{CurrentYear} = Initial\ Investment * \frac{Used\ capacity_{Currrent\ Year}}{Used\ capacity_{Lifetime}}$$

This approach leads to a complete recovery of the initial investment and produces a stable unit cost. In order to recover also the *Cost of Capital* employed one needs to add another component. If this should not distort the stable unit cost it can't be derived from the NBV of the assets but instead the necessary amount must be distributed over time following the production units; thus, it becomes proportional to the depreciation.

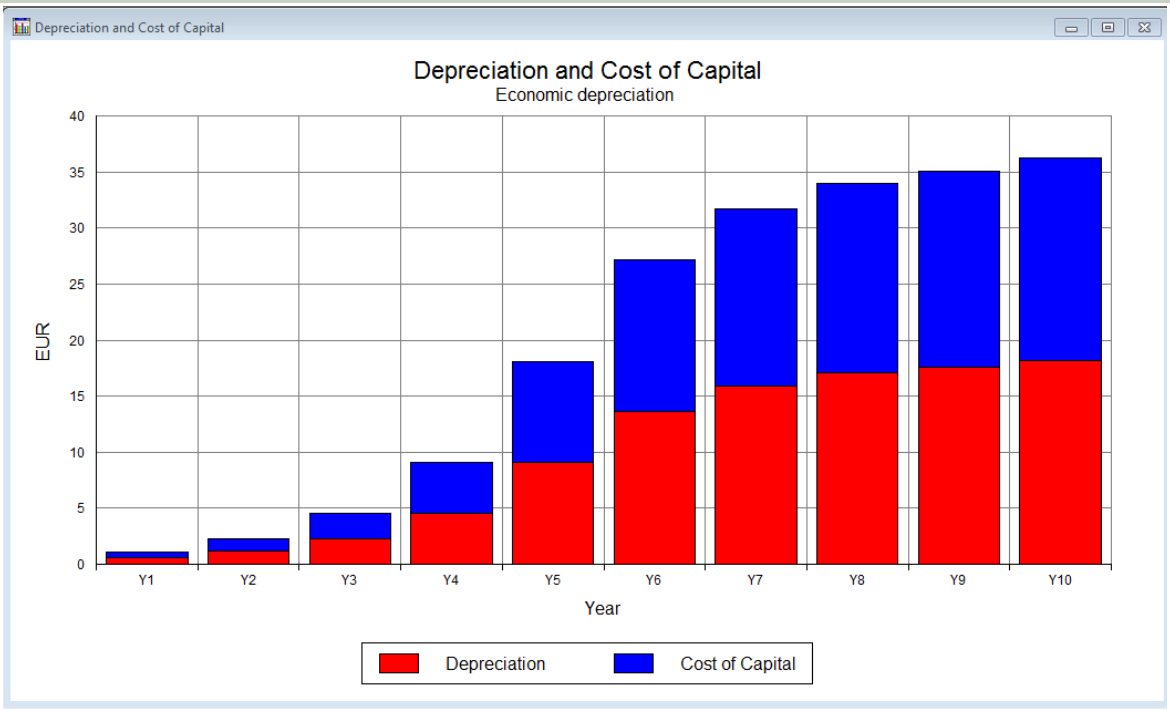

Figure 3: *Depreciation* and *Cost of Capital* for economic depreciation

4. Defining *Cost of Capital* on a resource level

STEM provides built-in functionality to consider *Cost of Capital* (interest) and discounted results for the whole network. However, for some models (e.g., LRIC, regulation), a *Cost of Capital* result on a resource level is required.

Cost of Capital on a resource level is normally calculated based on the written-down value or book value of the asset. This result is available in STEM and can be used in all cases in which the built-in depreciation is used.

However, as the depreciation result for economic depreciation in this model is derived offline, we can't rely on the standard book value of the asset. The current approach calculates the *Cost of Capital* over the runtime of the model and spreads it according to the usage of the resource over time.

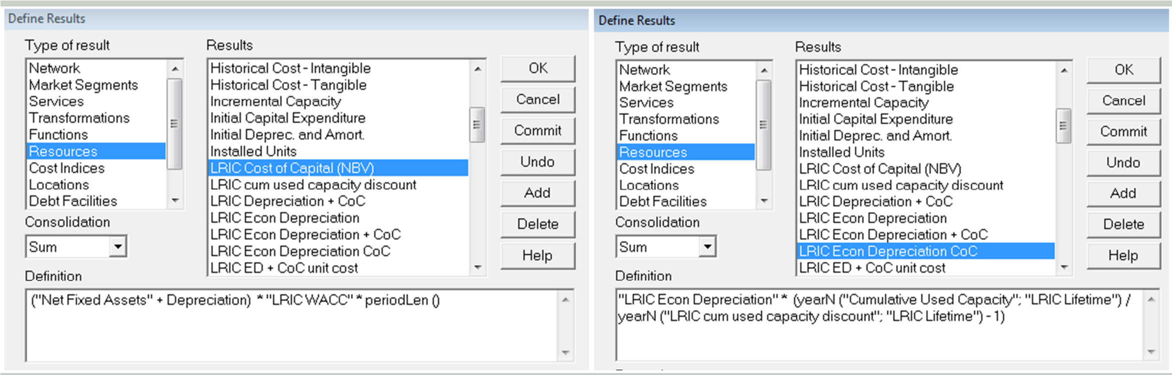

Figure 4: User-defined results to calculate *Cost of Capital*

5. Key results and comparison

The capital investment is recovered with all depreciation schedules if the model runtime matches the asset life.

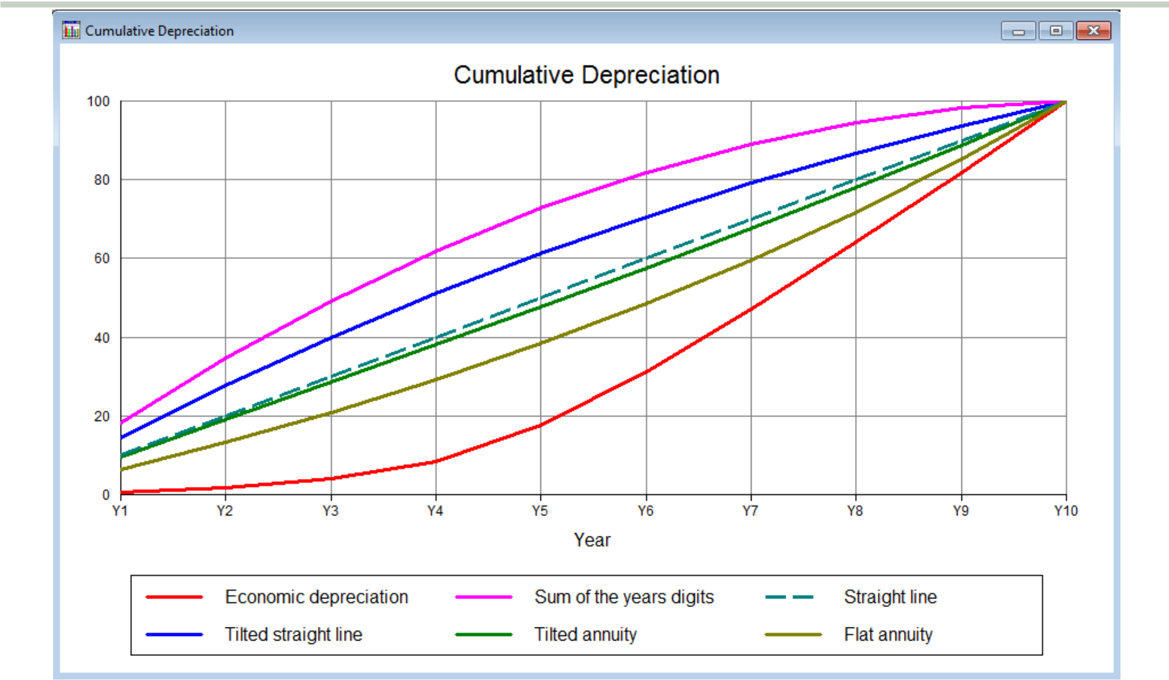

Figure 5: Cumulative Depreciation

For a gross depreciation charge we consider the derived result *Cost of Capital* in addition to the depreciation. The NPV of this gross charge then equates to the initial investment. In this way the initial investment is recovered and the capital employed remunerated.

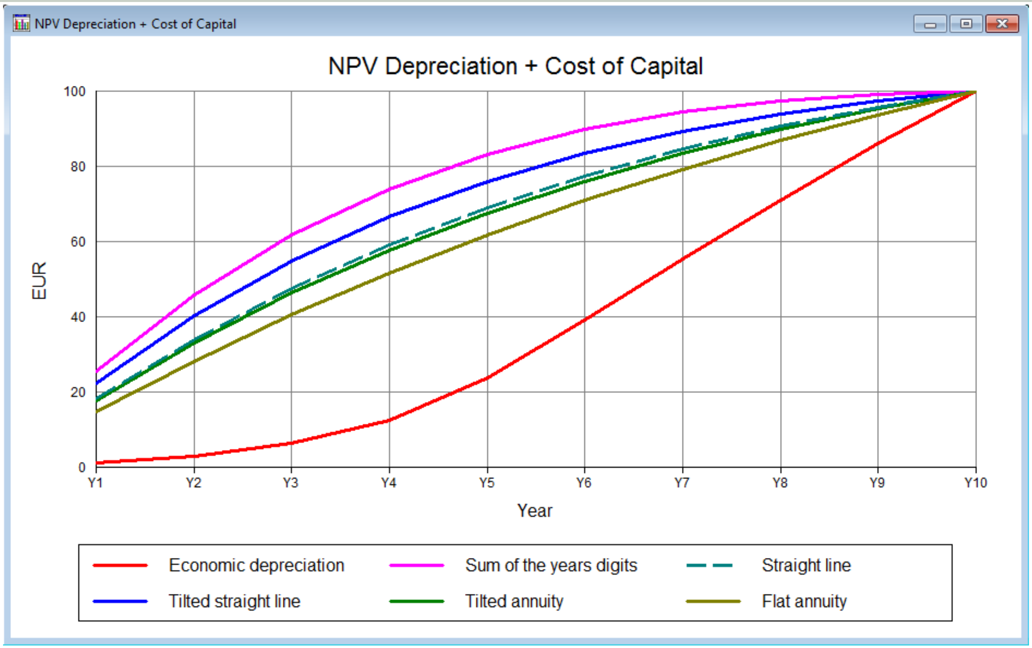

Figure 6: NPV of *Depreciation* and *Cost of Capital*

Only the production-based *economic depreciation* leads to a constant unit cost; all of the other depreciation policies show a behaviour that is inversely proportional to the usage.

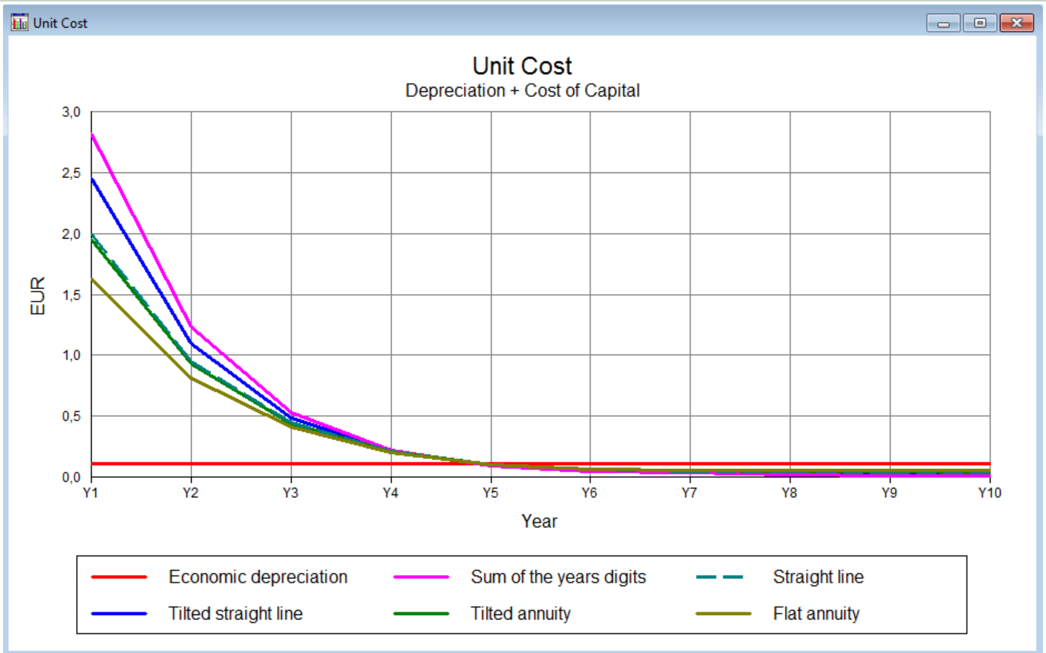

Figure 7: Unit cost

6. Calculating economic depreciation in a production environment

We have intentionally focused on the accounting mathematics rather than the platform upon which they were calculated, but it should be noted that all of the charts in this article were generated in STEM. Rules such as those illustrated in *Figure 4* are defined once and then automatically and consistently propagated across all resource elements considered by the model.

Establishing a regulatory accounting model has been the traditional preserve of the fly-in consultant with the ground-breaking spreadsheet. However, as the techniques become increasingly standardised, regulatory staff will naturally seek to own the modelling process themselves. The techniques outlined in this article provide a clear roadmap for transitioning such models onto a more transparent and readily maintainable platform.

Implied Logic can work with you to customise these techniques to your individual market and requirements. Our objective is to effect sufficient knowledge transfer for you to quickly take ownership of the modelling concepts and system considerations so that all the routine model updates and future expansion can be handled in-house. Please examine the online demonstration model and contact us if you would like to find out more about our established modelling process.

For more information please contact:

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