



Nature's Bounty

The Nethergill Axioms: Glossary of Terms

Note 16 October 2020

1. **“Free-issue”**: This is a term borrowed from industry where issues of parts are made to production cost centres for conversion into products. These issues of parts are charged out at a cost and the costs are eventually collected up into overall product costings. In some cases, items are issued without charges (eg nuts and bolts) to simplify the accounting process and these issues without charge are known as “fee-issues”. In farming, grass is provided effectively on a “free-issue” basis (courtesy of Nature) and this grass, by virtue of the costs-avoided in purchasing a substitute, makes a significant contribution to farm profitability.
2. **Maximum Sustainable Output (MSO)**: In the Nethergill models (for hill farming) MSO is defined as **the volume of output commensurate with the point at which the natural grass runs out**. Beyond this point grass substitutes will be needed and these will be not only more expensive than natural grass but they will push stocking rates beyond the point that can be maintained entirely (and therefore, sustainably) by *Nature*
3. **Natural Capital**: When the natural resources in a business (eg land) are capable of delivering a revenue (eg from mineral ores) or a benefit in the form of cost avoidance (eg from “free-issue” grass) it has become the fashion to regard the resources as part of the natural capital of the business. This is a simple, powerful, and common notion; but this notion presents all sorts of problems when attempts are made to put a value on natural capital. In the Nethergill models natural capital is defined as **the capital equivalent of the operating profits made at the point of maximum sustainable output (MSO)**. This form of natural capital has been designated as **notional natural capital (NNC)**
4. **Capital Equivalents**: Consider the following question. What is an income stream, of say £x per annum, worth if it has to be taken in a single up-front payment? It is the converse of the situation when a single investment buys an annuity income. Suppose an income stream of x commands a price X. Then it will be true that $X = Fx$ where F is an *annuity factor*. This is analogous to the price/earnings ratios that are found in the valuation of financial securities. F can be calculated whenever the interest rate is specified and the term (ie number of years) of the income stream is agreed. Technically, X will be the **net present value of the discounted cash flow of the income stream x over the term of the arrangement at prevailing interest rates**.

5. **Environmental Stress Index (ESI):** Operating profitabilities (expressed as profits as a % revenues) are maximised at MSO. This is true because beyond MSO corrective variable costs (CVCs) come into play and these invariably will increase at rates greater than the corresponding growth in revenues. Natural capital (NNC), as defined in the Nethergill models, must therefore be maximised too at MSO. Arithmetically, as this form of natural capital is maximised its inverse ($= 1/NNC$) must be minimised. This simple relationship provides a basis for the measurement of environmental stress (as it is a parameter that is minimised at the point of maximum benefit from natural capital). In the Nethergill models the environmental stress index (ESI) is defined by the relationship $ESI = KTq/NNC$ where K is a constant scaling factor, where T is a topographical rating reflecting acreage and elevation, and where q is a factor reflecting cover-type classifications.

6. **Imaginary Numbers:** In mathematics both 1 squared and -1 squared produce the value 1. Conversely, the square root of 1 can be 1 or -1. This raises the interesting question as to what would be the square root of -1. Mathematicians introduced a dodge to resolve the matter. The square root of -1 was designated as i1 where “i” was called an imaginary number. In the Nethergill models the ESI at zero output becomes simply a function of the support payments less the fixed costs. This can be positive or negative. This raises the question as to what a negative ESI would represent. It suggests that doing nothing not only reduces the natural capital (as it delivers no economic benefit) but it indicates that it incurs a cost liability even to keep the land inactive. This is the consequence of a managed landscape and analogously with the “i” concept it signals that a totally unmanaged landscape is in an imaginary space.

7. **The 2nd Law of Thermodynamics:** This states that it is impossible to transfer thermal energy from a colder to a hotter body without doing work. In farming terms this is equivalent to postulating that it is impossible to substitute for natural grass without putting work/energy/cost into transforming some other material/substance into a concentrate. As the role of grass is simply to provide calorific energy **it will therefore take extra calorific energy to convert the components of some concentrate into a state equal to the calorific value of the grass it replaces.**

8. **Valuing NNC**
 The relationship between a stream of income and its equivalent capital value
 - a. If a person is offered a payment of £x this year and the same amount for the three years following, what would be the equivalent single payment as an alternative?
 - b. Suppose the interest rate today is R%. This is equivalent to a factor r where $r = R/100$
 - c. Then £x today is worth:
 - i. $x/(1+r)$ next year ($=x1$)
 - ii. $x/\{(1+r)(1+r)\}$ the year after ($=x2$)
 - iii. and $x/\{(1+r)(1+r)(1+r)\}$ the year after ($=x3$)

- d. So £x paid each year for this and the following three years is equivalent to a lump sum paid today of £X where $X = x + x1 + x2 + x3$
- e. This process is called **discounting**. Conversely, if £X is invested for the next four years it would be possible to draw £x for each of the next four years in the expectation that no monies would be left after that time. Arithmetically, $X = fx$ where f is an annuity factor. Annuity factors convert income streams into equivalent capital sums and will be set by the prevailing interest rate (R%) and the term (four years in the example) of the arrangements.
- f. If as a consequence of having access to “free-issue” natural resources, such as grass, a farm business makes a profit of £P this income stream will have an equivalent capital value of £fP. This capital value is defined as the notional natural capital (NNC) employed in the business