Obsolescence and depreciation – a simple take – Comments by Robin Lynch

Dear Paul, Charlie, Nadim and Irwin

Please find attached some detailed comments on the paper discussed at the Canberra II meeting in Canberra. As you will see from my comments, I didn't find the paper easy, and this in an area where I thought I had finally got a good grasp of the basics, thanks to reading previous papers and listening to discussion at Canberra II. So I have set out what is my current quite simple understanding of the issue of depreciation and obsolescence, and invite you (and others) to explain where I've got the wrong end of the stick.

1. The value of an asset is the sum of discounted rentals expected over the remaining life of the asset.

2. The life of an asset is determined by two factors:

    a. the asset can wear out through use and the quantity of service delivered becomes and remains zero

    b. the price of the service delivered becomes and remains zero because of reduced demand.

3. When either of these two factors results in a return which does not justify the costs of retaining the asset, the owner may decide to retire the asset before the absolute zero rental value position is reached.

4. This combination of the wearing out of the asset and reduced demand resulting in lower rental price for a reduced quantity of service, results in lower asset value and this reduction is called depreciation.

5. The wearing out of an asset is a function of its previous use, and we can take its age as a reasonable proxy for this, assuming continuing use in each period of its life so far. We can describe the reduction in quantity of service provided through an age – efficiency chart. In broad terms, the older the asset, the less quantity of services provided in a period.

6. The reduction in price of the service is a function of how demand for the service varies with time. The price is not a function of previous use reflected in its age, but purely reflects how the demand for this service has changed. This reduction in demand over time, reflected in the reducing price, is what commonly known as obsolescence.

7. In theory, it is necessary to estimate how the demand for the service of an asset will vary over time in the future, whilst the asset wears out through use until the volume of service delivered becomes zero. Whilst it may be reasonable to estimate how the quantity reduces through use, it is extremely difficult to estimate how demand for the product will vary in the future. A practical assumption may be that the price drops in a linear fashion over time until there is no longer any significant demand, and it becomes cost-effective

to replace the asset with a new one better able to meet the new demand. Or perhaps the price remains the same whilst general inflation raises the price of other services in the economy. Or perhaps the price remains the same as general inflation. All of these are possible, and will affect the current asset value.

8. It is likely nevertheless that the main determinant of value will be to estimate the life of the asset in terms of how long the services will command a price which makes it worthwhile keeping the asset used in production. Experience with similar assets can be useful and a guide to the effective life span. For example, computer types become out-moded after 5 years, medicine patents may have a specified life of twenty years.

9. All of the above seems completely in line with Griliches' view of depreciation. Asset value is a function of the following three factors

   a. Periods in use (old age) – how many periods of use are left

   b. Wear and tear – what reduced quantity of service is available in the remaining periods of use

   c. Obsolescence – what price reduction can be expected over time for the services

10. Notice that some of the terms commonly used to describe how the asset value changes are asymmetric without strict appropriateness. For example, as intellectual property such as a play becomes more popular as it is performed, the price of the delivered services will rise and the asset value will appreciate rather than depreciate. And rather than the asset becoming obsolete, it is more appropriate to say that demand for the asset changes so that the price for its services rises or falls, with associated changes in asset value as it appreciates or depreciates.

11. For an asset that has been used for T periods, asset value is given through the normal equation, ignoring discounting, as

Value = SUM (i = t to end of life) of (quantity of services) i+T x (price of services) i

Depreciation = (quantity of services from an asset that has been used for T periods)

x (price of services delivered during the period of depreciation)

12. If we wish to calculate the asset value in real terms, then we should apply the average price of service rental over the base period to succeeding periods. I assumed that this is what is meant in the SNA 1993 by "at average prices".

Having established the model that makes sense to me based on my readings and listening to Canberra discussion, I can make the following observations and recommendations:

13. Drop the term cross-sectional age efficiency. It is too confusing. Although the concept is about wear and tear in an asset, and not change over time per se, you do not need to bring in the idea of another asset to get the message across. Simply call it usage-efficiency, and make clear it is the relationship between the usage that the asset has had, and the quantity of services available after this usage. As stated earlier, age is not strictly appropriate as the asset may lie unused for a period and this should be allowed for, at least conceptually. The word age has been used as short-hand for "number of periods in use". Using "usage" makes it clear that this is different from the simple passage of time.

14. Drop the term obsolescence – it is too asymmetric and brings in ideas of withdrawal which can cause confusion with the simpler concept of change in demand and so price that the price – time function describes. I would suggest demand change rather than obsolescence.

So the equations then become

Asset value = the sum of a discounted stream of rentals for services provided in the future, for an asset that has been used for a known number of periods (usually the age of the asset assuming continuous use since formation) , at prices described by the time price function. This function will often be extremely difficult to hypothesise, and we will usually a simple form such as assuming the current price until the useful life of the asset is extinguished through lack of demand generating a price of zero. So this reduces to guessing how long the asset services will remain in demand.

Phew. So now I find myself in agreement with your final resting place in the paper, but got there in a away which seems to me more straightforward.. The paper seems determined to have an argument about the meaning of the word obsolescence, but without any great outcome, except that obsolescence does determine the future return through reduced demand and the possibility of withdrawal after the point of diminishing returns comprared to replacement is reached.

I have not addressed the issue that you have with Peter Hill over the implications of the price assumptions – that sounds like an interesting discussion, but one which is not necessary to have to obtain a clearer model of depreciation with respect to usage leading to wear and tear and so reduced quantity of service, and passage of time leading to changes in demand with corresponding changes in prices of future rentals.

I attach my original comments on the paper, and I hope the tortuous journey I went through helps to convince you that a simpler exposition is needed along the lines I have set out above.

ANNEX

Comments on "Depreciation and Obsolescence", by Ahmad, Aspden and Schreyer.

The SNA definition of depreciation is the loss of value over time of a capital asset, caused by a combination of reduced length of life, reduced volume of services and reduced demand for these services.

In the paper, in the definition of terms on page 4 the definition of obsolescence is not satisfactory. It is described as "the process whereby an asset goes out of use, out of date or experiences a decline in capacity to generate returns for reasons other than wear and tear and catastrophes." It says that this definition of obsolescence has a volume dimension – "obsolescence is a process that one way or another impacts on the present or future flow of capital services delivered by an asset". This statement certainly does not follow from the first sentence – of course demand affects the quantity of services supplied, but it manifests itself through the price, not directly through a changed volume.

The next definition also seems wrong. I have taken the age-efficiency function as a profile of how the volume of services delivered in a period of account changes as the asset ages. But this paragraph says that that the expected service life shapes the form of the age-efficiency function – well of course it shapes the form by giving it an end-point, but that doesn't seem like "shaping the form". The next sentence also does not make intuitive sense to me "The economically useful service life is chosen by the user-producer of an asset". This can't be right as neither the user nor producer can dictate the external demand for the services provided by the asset as time passes. An asset which produces services that are no longer economically valuable due to the replacement in the market by another preferred service must be at the end of its economically useful life, but this is not determined by the user or producer, but by the market in which these activities are assumed to take place.

The next bullet is also misleading. I have taken the age-price function as how the price of the services provided by the asset varies over the life of the asset, but taking the life as a proxy for the elapse of time since the asset first began to produce services. Prices cannot be solely linked to the age of an asset, they must be a function of demand for the services.. So I see the age-price function better described as a time-price function, reflecting market demand. This approach is essential if we are to make sense of the depreciation of knowledge assets, where the idea of volume of services deteriorating with age does not seem appropriate.

The last bullet seems a convoluted way of saying that asset value is the sum of the expected flow of services priced according to the service price profile, discounted to net present values.

So I am going to have great trouble with this paper, given all the problems I am having with these fundamental definitions.

Para 8 reflects my problem – the issue of expected versus unexpected variables is described in terms that make no sense to me "unexpected price changes **or (my emphasis)** unexpected obsolescence should not enter measures of depreciation. But in my model, obsolescence and price change over time are identical concepts.

Para 11. This definition of cross-section depreciation maintains an artificial distinction between two assets A and B. This conceit is not necessary – we are simply

talking about a reduction in volume of services provided by an asset due to ageing as opposed to the asset being valued in two different time periods. But the reference to two assets A and B is an unnecessary conceit. If we take depreciation as the difference in value between an asset at the start and end of a period, then this difference in value is due to the delivery of a value of service during the period, obtained by multiplying the volume of services by the price of service during the time period.

Para 18, third bullet point is revealing. Obsolescence is about demand, reflected through price changes. Price changes are driven by demand. So there is a contradiction between the first two bullet points.

Para 19.

SNA depreciation is defined in the context of a single asset thus distinguishing it from cross depreciation. No, cross depreciation can be expressed in terms of the ageing of a single asset and so SNA depreciation need not be different. It is not obvious to me why SNA excludes nominal or real holding gains. These are covered through the inclusion of obsolescence as reflected in the service price time profile.

Para 26.

 don't understand why the authors say that the SNA depreciation omits the effects of changing prices. Obsolescence is all about demand and so prices.

Paragraph 39

"In practice, SNA depreciation and cross-section depreciation coincide if asset lives are not changing over time. But asset lives are demonstrably changing over time as assets become obsolescent.

Page 11

The Griliches definition of depreciation seems conceptually appealing and wholly consistent with the SNA 1993 definition.

Without allowing for discounted values, it can be expressed as

Asset value = Sum (service vol (age dependent) x price (time dependent))

So if we know to what age and asset can produce services, and how the quantity of service provision decreases over time, and how the price of the service falls to zero or withdrawal whichever is earlier, we can work out what the asset value is. And so we can work out depreciation between any two periods.

Page 12, para 45

First bullet point – agreed that there is little difference if any between the Griliches definition and the SNA one

Second bullet point – the age price function is not a sufficient tool for calculating SNA depreciation – knowledge assets are a simple demo of how this approach is insufficient.

Para 55 – I don't understand. It seems obvious that we must take expected future price changes into our calculations of asset values and depreciation. Why should this change a fundamental principle of national income accounting? And if it does, so be it – it is essential to get a useful definition of depreciation.

Second, expected obsolescence is reflected in SNA depreciation

I doubt this very much indeed. Without including changes in price in services provision, obsolescence must be missing.

Para 58 quotes a reference Church (1917) as if it proves that obsolescence is not only to do with price effects. But the quote demonstrates that obsolescence occurs when demand drops, and if that doesn't manifest through a price effect, then I am a Durtchman's uncle.

As I thought. Para 59 is just wrong. You can't build service life expectations into age price and age efficiency profiles, as the life expectations are to do with time, not life. This is convincingly refuted in Hill's paper, at footnote 8 on page 19.

Para 63, bullet point 3

The false logic is repeated that "it seems wrong to conclude that price changes constitute the only manifestation of obsolescence". It is wrong – obsolescence can also lead to absolute withdrawal, but this does not negate the fact that the overwhelmingly main effect of obsolescence is driven by changing demand, as observed in price change. The examples given which suggest that demand factors other than the asset becoming outdated, show that obsolescence is not the sole determinant of demand and price change, is an attack on the appropriateness of the word obsolescence as a short-hand for demand driven price effects, rather than a logical argument supporting the case for omitting time dependent price change to play a part in depreciation quite separate from ageing effects.

The last bullet point opens a door to allow the time price element to enter into the recommended method by re-defining the age – efficiency function as a function of observed obsolescence. This is simply a back-door to the simpler method of allowing prices to enter directly into the calculations as a time dependent factor.

Summary and Conclusions

Para 77

The change in value of an asset over a period of time can be decomposed into three components

   a) changes in value due to wear and tear

b) change in value due to future demand for capital services (obsolescence)

c) change in value due to general price change

d) other changes in value – withdrawal, catastrophes etc.

Para 79

A very long paragraph in a section labelled Summary and conclusions. "This paper defines obsolescence as a process whereby a capital good goes out of use, out of date (?) or experiences a decline in its capacity to generate returns for reasons other than wear and tear and catastrophes."

Why? Why not stick to the commonly accepted use of obsolescence, and surely the way in which it was used in the 1993 SNA, to indicate an asset no longer in demand, an asset replaced by others.

I paraphrase the next sentence

"The appearance of a new model may render existing models obsolete, not by changing the existing models but economic usefulness is reduced". That seems to me another way of saying demand is reduced.

The next sentence accepts that the economic service life will be reduced, and that prices will change.

But then the authors draw back from the brink, again by using false logic by saying that "it seems wrong to conclude that price changes constitute the only manifestation of obsolescence". It certainly is wrong, but this does not gainsay the fact that price changes over time are the key feature of obsolescence which determines service life.

The next section repeats the false logic of para 63.

Para 80 should be framed and put in the Oxford debating chamber. It's irrelevant to the arguments.

The logic of the rest of this part of the paper is harder to follow, so that's when I began thinking along the lines that led to my first simpler exposition.