September 2022

AER staff comments on the expert statement by Professor Richard Schmalensee (July 2022)

Introduction

We review and provide comments on the July 2022 statement (report) prepared by Professor Richard Schmalensee on behalf of the ENA. The ENA asked Schmalensee to evaluate Dr Martin Lally's (2021) characterization of Schmalensee (1989) and its implications. Specifically, the ENA has asked the following two questions:

1 Do you agree with the characterization of Schmalensee (1989) that appears in Lally (2021)?

2 If an economic regulator seeks to reach "an unbiased estimate of the expected efficient return, consistent with the relevant risks involved in providing regulated network services" to be applied over a defined regulatory period, does Schmalensee (1989) have any implications for the way that return should be estimated?

Schmalensee answered 'No!' to both questions. Further, he provided some comments on Lally's and the AER's mathematical modelling, which we review below.

We note that the 2022 Draft Rate of Return Instrument Explanatory Statement (Explanatory Statement) did not directly rely on Schmalensee (1989) in the analysis of the benchmark equity term. Further, while Lally (2021) did refer to Schmalensee (1989), this reference does not appear pivotal to his main conclusions. Therefore, we provide only brief comments on Schmalensee's response to the ENA's questions and focus our attention on his criticisms of Lally's 2021 report and the AER analysis in the 2022 Explanatory Statement.

Our main conclusions are:

- We find no inconsistency between Schmalensee (1989) and the mathematical model(s) presented in Lally (2021). The inconsistency suggested in Schmalensee (2022) is due to the notational differences between Schmalensee (1989) and Schmalensee (2022).
- Schmalensee's first line of criticism of the AER analysis appears inaccurate and may also be attributed to the notational differences. Schmalensee's second line of criticism reflects an inconsistency in the propositions put to us in submissions in support of the 10-year benchmark equity term.
- Schmalensee (1989) contains references to 'one-period', 'short-term' interest rates and 'T-period long rate'. These references appear to be relevant to the concept of the term of the allowed rate of return as we understand it.

We provide more detailed analysis below.

Brief overview of Schmalensee (1989)

Schmalensee (1989) observes that 'even though rate-of-return regulation is based on accounting profitability, rate-of-return regulation is in principle fair to both investors and rate-payers *no matter how depreciation is computed*' (p. 293). The paper then goes on to state its key result, referred to as the **Invariance Proposition** (p. 293):

> '… if a regulated firm is allowed to earn its actual (nominal) one-period cost of capital on the depreciated original costs of its investments, and if actual earnings equal allowed earnings, then the net present value of all investments is zero for any method of computing depreciation.'

This result is demonstrated by using a mathematical model that considers the net present value (NPV) of investment in a regulated asset. The Invariance Proposition holds even if future values of the one-period costs of capital and depreciation are not known with certainty (p. 296):

> 'Whatever the realised values of the firm's one-period costs of capital [ρ_t] and its depreciation deductions, the net present value of any investment will be zero as long as regulators adjust the accounting rate of return [r_t] to equal to ρ_t in each period and depreciation deductions eventually add up to the asset's initial cost. … Even if regulatory behaviour is uncertain, as long as the expected value of r_t is equal to ρ_t for all values of ρ and *t*, then … the expected NVP [is equal to zero].'

To enable further discussion and comparison with the 2022 expert report, we note the following:

- Schmalensee (1989) has two separate variables for the **allowed rate of return** and the **cost of capital**. The allowed rate of return in period t is denoted r_t and the cost of capital in period *t* is denoted ρ_t. Schmalensee (1989) examines the consequences of setting the allowed rate of return to match the one-period cost of capital.
- To demonstrate his main proposition, Schmalensee (1989) allows the **one-period** cost of capital ρ_t and the allowed rate of return r_t to **vary over time** (p. 294). The paper then explains:

  'The Invariance Proposition rests on the assumption that the regulated firm's actual rate of return on the book value of its assets [r_t] is adjusted each period to equal the current one-period interest rate [ρ_t]' (p. 296, emphasis added).
- Schmalensee (1989) then briefly considers a case where 'the rate of return were set equal, **once and for all**, to the *T*-period long rate', where *T* is the asset's accounting lifetime (p. 296, emphasis added).

Observations on Schmalensee (2022) statement

Inconsistent notation

The 2022 statement uses notation that appears inconsistent with Schmalensee (1989):

- Schmalensee (2022) first introduces ρ as an '**economic rate of return**' on page 2. In this context, ρ is similar to the **internal rate of return** earned on the initial asset cost, as equation (1) illustrates:

$$NPV_U = -I + \sum_{t=1}^{T} \frac{X_t}{(1+\rho)^t} = 0$$

- ρ is referred to as economic rate of return again on the bottom of page 4, where Schmalensee suggests that the discount rate ρ can be determined 'in any way whatever'.
    - This notation seems to depart from Schmalensee (1989), where ρ_t is used for discounting and referred to as the **cost of capital** (p. 294).
- On top of page 5, it is discussed that ρ may be set above or below the firm's actual, market-determined cost of capital, though it would have consequences for the profitability of the regulated firm. However, on page 6, ρ_2 is referred to as the market-determined required return.
- On the top of page 4, on the other hand, ρ is also referred to as the 'regulator-determined allowed cost of capital' or simply as the '**allowed rate of return for the life of the asset**'.
- In Schmalensee (1989) the **allowed rate of return** is denoted by r_t (p.294). Since the actual earnings are assumed to equal allowed earnings, r_t is also referred to as the **accounting rate of return** (p. 296).
    - This is different to Schmalensee (2022), where r_t stands for an '**accounting rate of return**' (p. 3), but the **allowed rate of return** is denoted as ρ (p. 4).

As the allowed rate of return, opportunity cost of capital and the economic rate of return are distinct concepts and do not have to generally align, we find the notation of the 2022 statement and hence the 2022 overview of the original 1989 paper confusing.

For example, Schmalensee (2022) suggests that the fundamental result of the 1989 paper is that 'if the regulator determines *in any way whatever* that the regulated firm should earn an economic rate of return of ρ, and it requires the firm's accounting rate of return always to be ρ, the firm will in fact earn an economic rate of return equal to ρ' (page 4).

This appears to be a somewhat different statement than what Schmalensee (1989) seeks to establish, as Schmalensee (1989) refers to ρ_t as **cost of capital**. We consider the 'firm's actual … cost of capital' (p. 293 of the 1989 paper) has a well-defined meaning and is not the same as the economic rate of return determined 'in any way whatever'. Schmalensee (1989) also refers to ρ_t as 'one-period interest rate' (p. 296) and talks about 'future capital market conditions' in context of uncertainty around ρ (p. 296), which supports our proposition.

While we are not suggesting that the 2022 statement is wrong, we point out the 2022 overview of the 1989 paper appears to us to be somewhat at odds with the original paper.

Implications of Schmalensee (1989)

2.1.1.1 Lally (2021) report

Schmalensee (2022) restates the 1989 'fundamental result' as follows:

> '[T]he NPV of … regulated investment, computed using regulator-determined allowed rate of return as the discount rate … is always zero regardless of how depreciation is assessed' (p. 4).

Schmalensee (2022) illustrates this result for a two-period model by equation (6):

$$NPV_R = -I + \frac{\rho_1 I + D_1}{(1+\rho_1)} + \frac{\rho_2(I - D_1) + (I - D_1)}{(1+\rho_1)(1+\rho_2)} = 0$$

Here ρ_1 and ρ_2 refer to some allowed rates of return in period 1 and period 2, respectively, I is the initial asset cost and D_1 is the depreciation charged in period 1. Schmalensee (2022) emphasises that the above is true for *any* values of ρ_1, ρ_2 and D_1 (p. 6).

In our view **there is no inconsistency** between what Lally sought to demonstrate in his 2021 report and Schmalensee (1989). Further, equation (6) of Schmalensee (2022) does not invalidate Lally's conclusions. The difference is simply notational.

Lally (2021) originally considers an all-equity firm and denoted the allowed (accounting) rates of return on (equity) capital in his two-period model as k_0 and k_1. He denotes the two one-period costs of equity as ke_{01} and ke_{12}, the initial asset cost as A and the depreciation charged in the first period as DEP_1.

Assume a regulator determines that a regulated entity should earn the economic rate of return in each period consistent with its opportunity cost of capital. In Schmalensee (2022) notation, this means

$$\rho_1 = ke_{01}$$

$$\rho_2 = ke_{12}$$

Then, equation (6) becomes

$$NPV_R = -A + \frac{ke_{01}A + DEP_1}{(1 + ke_{01})} + \frac{ke_{12}(I - DEP_1) + (I - DEP_1)}{(1 + ke_{01})(1 + ke_{12})} = 0$$

Using Lally's model, setting the allowed rates of return (k_0 and k_1) equal to the respective one-period costs of capital (ke_{01} and ke_{12}) also results in the NPV of zero. So, Lally's analysis is not invalidated by equation (6). Potential for confusion arises from Schmalensee (2022) referring to **both** allowed rates of return and economic rates of return (or, alternatively, costs of capital) as the same variables ρ_1 and ρ_2.

This confusion is easily avoided if we use the original notation of Schmalensee (1989). That is, if ρ_1 and ρ_2 stand for the one-period cost of capital and r_1 and r_2 stand for the allowed rate of return, then setting

$$\rho_1 = ke_{01}$$

$$\rho_2 = ke_{12}$$

$$r_1 = k_0$$

$$r_2 = k_1$$

$$I = A$$

$$D_1 = DEP_1$$

allows to combine equations (1) and (2) in Schmalensee (1989) as follows:

$$NPV = -A + \frac{k_0 A + DEP_1}{(1 + ke_{01})} + \frac{k_1(A - DEP_1) + A - DEP_1}{(1 + ke_{01})(1 + ke_{12})}$$

Then, the original statement of Schmalensee (1989) is consistent with Dr Lally's result: setting the allowed rates of return r_1 and r_2 (or k_0 and k_1 in Lally's notation) equal to ρ_1 and ρ_2 (or ke_{01} and ke_{12} in Lally's notation) will result in the NPV of zero.

To summarise:

- If we interpret ρ_1 and ρ_2 to be consistent with the original notation in Schmalensee (1989), then Lally's derivations are consistent with Schmalensee's (1989) Invariance Propostion.
- Schmalensee (2022) suggests equation (6) holds for any ρ_1 and ρ_2, including those equal to one-year costs of capital, therefore equation (6) does not invalidate Lally's derivations.

Schmalensee (2022) suggests that Lally 'does not explain why the r's, which do not appear in Schmalensee (1989), are the appropriate discount rates rather than, as in Schmalensee (1989) and equation (6), above, the estimated market costs of capital, the ρs' (p. 9).

There are a number of issues with this proposition:

- Taken literally, r's do appear in Schmalensee (1989) – they refer to the allowed rates of return.
- Lally does not use r's or ρs in his notation. He discounts by the one-year costs of equity, which is the same thing as 'market costs' of equity, which appears sensible and consistent with the standard practice in corporate finance. Further, given Schmalensee (2022) suggests that any values of ρs can be used for discounting, then using costs of capital for discounting should not be an issue.
- Schmalensee (1989) refers to the discount rates (denoted ρs) as the costs of capital, so, this appears consistent with Lally's use of discount rates. Schmalensee (2022), however, suggests that ρs can be determined 'in any way whatever' (p. 4 and p. 6), which appears inconsistent with the above statement (p. 9) that they ought to be the estimated costs of capital.

2.1.1.2 AER (2022)

Schmalensee (2022) offers two lines of criticism of the AER assumptions and mathematical derivations. The first one has to do with pages 103-104 of the Explanatory Statement:

> '[The first AER defense of Lally's proposition] essentially starts from the first equality in equation (8) and assumes an all-equity firm. It argues that the ρs should be set so that … NPV=0 is satisfied. It is being assumed, however that r_1, the expected return on equity in period 1, is unaffected by regulatory decisions and it may accordingly differ from the firm's market-determined cost of capital in that period. I have no idea how this assumption can be defended' (p. 9).

We have the following comments on the above criticism:

- We did start with an all-equity firm. However, we did not 'start with equation (8)' from Schmalensee (2022). We started with the standard corporate finance definition of the (expected) return and the assumption that the law of one price holds (that is, two identical cashflows or commodities must sell for the same price in a competitive market).
- Our equation, therefore, sought to demonstrate the relationship between the expected market value of a regulated asset, expected free cash flows, and the market determined cost of capital for an asset of similar risk.
- We did not start from Schmalensee's equation (8), we did not unpack the regulatory cash flows in our formula and we did not use ρs in our notation. Therefore we also did not seek to establish how ρs should be set so that NPV = 0 is satisfied.
- We did not assume r_1 to be unaffected by regulatory decisions. It is the opportunity cost of capital and, as such, reflects the risk associated with the asset. To the extent regulation affects this risk, it will be reflected in the expected return.

- We also did not assume that r_1 would differ from the firm's market determined cost of capital. If the law of one price holds (as we assumed), r_1 would reflect the market determined cost of capital for assets with similar risk.
- As we have not made the assumptions described in Schmalensee (2022), we consider we do need to establish whether they are reasonable.

The second criticism of the AER 'defenses of Lally's proposition' refers to our example on pages 109 – 110 of the Explanatory Statement. Prof Schmalensee states: 'the cost of capital as assessed in period 1 is assumed by the AER to discount cash flows during period 2 even though, by hypothesis it has changed between the two periods. I have no idea how this assumption can be defended…' (p. 10).

We note that the example in the Explanatory Statement referred to by Schmalensee sought to demonstrate that setting the benchmark equity term to 10 years would not result in zero NPV even if we were to adopt the modelling assumptions consistent with the submissions in support of the 10 year equity term. On page 110 of the Explanatory Statement we noted (emphasis added):

> 'The above example is **not based** on Dr Lally's modelling approach **and instead assumes the modelling assumptions consistent with the** valuation practices described in stakeholder **submissions**.'

The submissions to the AER in support of the 10 year benchmark equity term suggested the following:

- Regardless of the reset frequency of the allowed return on equity (typically 5 years), we should set the allowed rate of return consistent with the market-determined required rate of return investor expect to receive over a 10-year (or longer) investment horizon.
- When valuing investment projects, the standard practice of valuation professionals and market practitioners is to use a 10-year (or longer) risk-free rate.

Our example, therefore, seeks to reflect those propositions. That is why we set the two-period (i.e., long-term) cost of capital as a discount rate, even though we adjust the allowed rate of return every period to equal the prevailing two-period cost of capital. We consider that Schmalensee's criticism, therefore, points to an inconsistency in the propositions put to us in support of the 10-year benchmark equity term.

2.1.1.3 Does Schmalensee (1989) say anything about the term of the allowed rate of return?

Schmalensee (2022) notes:

> 'It is a general principle that the allowed cost of capital should be an estimate of the relevant efficient expected return demanded by investors. I have no idea why Dr Lally thinks that Schmalensee (1989) implies that this estimate must depend precisely on how often it is computed. Schmalensee (1989) is agnostic about how investors might go about determining their required return. Schmalensee (1989) certainly does not "show" that the term of the allowed return must match the term of the regulatory cycle.' (pp. 7-8)

The AER analysis in the Explanatory Statement does not directly rely on whether or not Schmalensee (1989) has anything conclusive to say about the benchmark term. However, we note the following:

- What is central to the notion of the benchmark term of return on equity – as used by both the AER and Lally – is not how often it is computed, but over what time horizion the investors expect to recover the corresponding allowed return.
- Schmalensee (1989) explicitly refers to ρ_t as 'one-period cost of capital', 'one-period rate of return' or (under certainty) 'one period interest rate' in period *t* that is allowed to vary over time. The Invariance Proposition then considers the case when the allowed rate of return is 'adjusted each period to equal the current one-period interest rate' (p. 296). This context appears to suggest that 'one-period' refers to the term of the rate or return.
- Schmalensee (1989) further suggests that '[f]or a single project, fairness would also be ensured for any depreciation schedule if the rate of return were set equal, once and for all, to the *T*-period long rate' (emphasis added, 296). This would appear to us to be suggesting that if the allowed rate of return is set once and never reset, then an interest rate of term *T* ('long return') should be used to set the allowance. However, we welcome alternative interpretations of what '*T*-period long rate' as opposed to a 'one-period' or 'short-term' rate could be referring to.

References

AER, 2022, Draft Rate of Return Instrument Explanatory Statement, https://www.aer.gov.au/system/files/Draft%202022%20Rate%20of%20Return%20Instrument%20-%20Explanatory%20Statement%20-%2016%20June%202022.pdf.

Lally, M., 2021, "The Appropriate Term for the Allowed Cost of Capital", report prepared for the AER, https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/term-of-the-rate-of-return-pathway-to-rate-of-return-2022.

Schmalensee, R., 1989, "An Expository Note on Depreciation and Profitability Under Rate-of-Return Regulation', *Journal of Regulatory Economics*, vol. 1, pp. 293-298.

Schmalensee, R., 2022, "Statement of Richard Schmalensee, Ph.D. to the Australian Energy Regulator".