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THE USE OF CARR IN THE ASSESSMENT OF
PROFITABILITY BY COMPETITION AUTHORITIES

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The Use of CARR in the Assessment of Profitability By Competition Authorities¹

1. Introduction

The UK Office of Fair Trading (OFT) is now using the 'certainty equivalent accounting rate of return' or 'CARR', to assess company profitability. This new measure has been deployed in the OFT's recent review of the UK food retailing industry. In this paper I review the CARR measure in order to assess its credentials and its usefulness as a signal of excess profitability by competition authorities. This review is based on the paper by Graham and Steele (1997), OFT working paper No 10, henceforth G&S, which develops the CARR measure.

I show that CARR is essentially a reworking of the traditional accounting rate of return (ARR), with two distinctive features. CARR measures a company's return as a ratio of outputs to inputs, rather than as a ratio of profit to capital, and it attempts to control for the fact that different cash flow streams may have different risks by taking 'Certainty equivalents'. As a result, whatever its merits or demerits, because CARR is calibrated differently to ARR, its behaviour will need to be learned by users. The complete decomposition of the risk elements of a company's cash flows into certainty equivalents, while perhaps interesting in theory, would be extraordinarily hard for competition authorities to accomplish in practice. As a result, the implementation of CARR will require arbitrary simplifying assumptions to be made about the allocation of risk. The unfamiliarity of the measure, and arbitrary allocation of the risk premium in the cost of capital, both contain an unacceptable danger of prejudice in its application to companies.

One of the most difficult tasks facing competition authorities is to distinguish superior returns that are due to competition failure from those that are the result of sustained competitive advantage and the possession of superior resources and competences. Unless competition authorities can make this separation they are at risk of penalising successful companies. CARR has no apparent advantage over ARR in this.

¹ I am grateful to PricewaterhouseCoopers for providing financial support for this project.

Like any accounting-based measure of profitability, CARR depends on the data integrity of the accounting numbers that are used. Again, CARR has no innate advantage over ARR in this area. The way in which CARR appears likely to be implemented by competition authorities raises some specific concerns. There is little attention to estimating the replication cost of intangible assets. In the case of food retailing, off-balance sheet market-based intangible assets such as brand may be very important. Some food retailers have valuable reputational assets, built over long periods. The valuation of real estate, and the interpretation of property values, is also a key area of difficulty in food retailing where the owners of scarce property assets may be able to extract prices from retailers that effectively discount future profits. So revaluation surpluses, which are an output in CARR, may contain anticipated future profits. Further, like ARR, CARR does not readily distinguish marginal from average profitability. Finally, CARR will not reflect the company- or sector-specific incidence of corporate taxes.

The value-added of CARR for regulators, its weaknesses and vulnerabilities and its performance in revealing uncompetitive behaviour, are all largely unknown at this point. Competition authorities should be very cautious in using the CARR framework in earnest until it has been fully tested.

My discussion of CARR is contained in Section 4. Section 2 provides the foundations of the discussion by describing the conditions under which, in general, accounting measures of profitability will reliably measure excess returns. Section 3 provides a simple derivation of CARR in order to reveal its relationship to traditional accounting rates of return. Section 5 contains some final comments.

2. The use of profitability measures to reveal excess returns.

Profitability measurement is best understood by reference to capital budgeting theory.² An activity creates value when it is expected to produce a stream of cash flows with a higher value than if the resources were put to their next best use. Assume the resources being used are assets and that capital is not rationed so that the activity is not competing for funds against other projects within the company. Then the test of value creation is whether the value of the expected future cash flows from using the assets, discounted at the company's cost of capital, is greater than the cost of the assets. Equivalently, value is created when the

² For a fuller discussion of these issues, see Higson (1998)

expected cash flows net of the investment have a yield or internal rate of return (IRR) which is greater than the cost of capital.

An accounting rate of return can proxy IRR in the sense that it can be meaningfully compared to the cost of capital. For a one-period project the IRR is:

$$\text{IRR} = (\text{cash flow} + \text{increase in assets}) / \text{opening assets}$$

View each year in the life of a company as an investment project. The company starts a year with a stock of assets, and has earnings during the year, some of which are distributed as dividend (= cash flow to investors) and some of which are retained and increase the stock of assets. Indeed *earnings* \Rightarrow *cash flow + increase in assets* is the fundamental accounting identity. So the accounting return for the period, measured on the opening assets of the company, will be identical to the IRR:

$$\text{IRR} = \text{ARR} = \text{earnings} / \text{opening assets}$$

But the reliability of an accounting measure of return as a proxy for IRR depends crucially on the accounting. To provide the data integrity of capital budgeting, three things are needed.

- Firstly, the accounting identity has actually to hold, so that all balance sheet changes pass through earnings; earnings must be 'comprehensive', 'all-inclusive' or in current parlance, 'clean-surplus'.
- Second, the balance sheet needs to be 'complete' in that it records all the assets and claims over which property rights have been established.
- Third, assets and claims need to be measured at their opportunity costs.

The opportunity cost of an asset can be measured in terms of the *deprival value* of the asset, which is the loss the firm would suffer if it was deprived of it. The deprival value is the lesser of the replacement cost of an asset and the value of possessing the asset. The latter is the 'recoverable amount', which is the greater of the asset's resale value and the present value of the cash flows it will generate. In the 'normal', profitable, case where assets are worth buying or replacing the opportunity cost is replacement cost.

Kay (1976) is usually attributed with establishing the link between economic and accounting returns, and Edwards, Kay and Mayer (1987) undertake a detailed analysis of the economic interpretation of accounting returns. They show that, if accounting has the characteristics identified above, then the accounting rate of return can reliably proxy the internal rate of return.

3. CARR

It has become common practice to use accounting rates of return such as return on capital employed as a proxy for internal rate of return, and thus to compare it with the company's risk adjusted cost of capital, r . In this section I derive CARR in a way which demonstrates its relationship to ARR.

The formulae used by G&S to derive CARR appear complicated. I produce a simpler version of their logic below, without any loss of generality. Assume that there is no incremental investment or disposal; ARR is a one-period (internal) rate of return,

$$1 + \text{ARR} = \frac{\text{Profit} + \text{Assets}_1}{\text{Assets}_0} \quad (1)$$

The subscripts on assets refer to the beginning (0) and end (1) of the period. If *profit* is *revenue* less *costs*, both of which are assumed to occur at the end of the period, this can be expanded to

$$1 + \text{ARR} = \frac{\text{Revenue} - \text{Costs} + \text{Assets}_1}{\text{Assets}_0} \quad (2)$$

For this purpose, CARR can be usefully seen as a response to two problems with traditional ARR measures:

- a. The limited concept of investment embodied in the denominator of traditional return of traditional capital employed.
- b. The fact that any IRR is a complex average of return streams of different risk.

CARR is essentially equation (2) transformed in two ways. First, in response to b., G&S decompose the return into its elements, and allocate risk to different constituents using 'certainty equivalents'. Second, in response to a., they rearrange ARR into a ration of outputs to inputs. I will describe these in turn.

3.1 *Certainty Equivalents.*

In some places the reader is unclear about the steps in the logic of the G&S paper, but the following probably captures the spirit of it. Suppose the elements of IRR and ARR are an excess rate of return, x , earned over the cost of capital or required return, r . The components of x are: inflation, i , a risk premium, p , and the riskless real interest rate, r_f . Then

$$1 + \text{ARR} = (1+r)(1+x) = (1+i)(1+p)(1+r_f)(1+x).$$

The 'Certainty equivalent' (CE) of a risky flow is found by dividing by $(1+P)$.

CARR is a real risk adjusted return, so,

$$1+CARR = (1 + x)(1 + r_f) = \frac{CE(Revenue - Costs + Assets_1)/(1+i)}{Assets_0} \quad (3)$$

3.1.1 Approximations

G&S also produce a number of ‘approximations’ of their full CARR measure. It appears there are two motives in this. One driver is intellectual curiosity, and certainly some of their approximations are mathematically skilful restatements. However, the authors also recognize that a complete allocation of risk to the elements of CARR would be extraordinarily difficult to implement in practical situations. This necessitates simpler, implementable, measures. The derivation of these approximations necessarily requires increasingly arbitrary assumptions.

The first approximation (equation 22) estimates end of year balance sheet values with opening values and accrual charges. This is a minor change in terms of simplification since the numerator in any case includes the clean surplus growth in assets. The main innovation is to assume that all risk is attributable to volume, and thus to sales revenue and to variable costs. Their certainty equivalent adjustment allocates all of the risk in the cost of capital to these flows. This is implemented in two ways. The certainty equivalent adjustment scales down revenues and variable costs to an extent, which is increasing in the risk premium in the business, $\frac{(1+r)}{(1+r_f)(1+i)}$. It scales down revenues and variable costs to an extent which

is increasing in the ratio of net margin to gross margin, reflecting the extent to which the cost base is fixed rather than variable.

3.2 Output / input ratio.

G&S's second step is to restate this as a ratio of outputs to inputs by taking costs to the bottom. Manipulating (3), you get

$$(1+CARR) Assets_0 - CE (Costs)/(1+i) = CE (Revenue + Assets_1)/(1+i) \quad (4)$$

So,

$$1 + CARR = \frac{CE(revenue + Assets_1)/(1+i)}{Assets_0 + CE(Costs)/(1+i)(1+r_f)(1+x)} \quad (5)$$

In fact G&S's version is slightly different:

$$1 + CARR = \frac{CE(revenue + Assets_1)/(1+i)}{Assets_0 + CE(Costs)/(1+i)(1+r_f)}$$

CARR omits the $(1 + x)$ term on costs and will, therefore, report a larger excess return than ARR. This is possibly an improvement on ARR, since it may effectively correct the classic 'reinvestment' fallacy in IRRs.

I suggested in this section that CARR is best understood by rearranging ARR. As such, it is unlikely to add new insights but, because it is differently calibrated, it will require familiarization from users.

4. Review

We can now assess CARR. There are two focuses of this discussion. Does CARR provide a better measure of profitability for competition authorities, as the authors suggest? What are the limitations of the measure from the perspective of companies to which it is being applied? G&S provide a nice review of the limitations of traditional ARR measures, such as Return of Capital Employed, as a signal of excess profitability. They imply or claim that CARR performs better. I now examine whether this is likely to be the case.

G&S identify (pp21-32) three problems with traditional ARR measures:

- a. The limited concept of investment embodied in the denominator of traditional measures of return on capital employed.
- b. The fact that any IRR is a complex average of return streams of different riskiness.
- c. The fact that ARR is an ex post measure, whereas ex ante, there must be some likelihood of failure.

They also extensively discuss a fourth problem:

- d. The difficulty of determining whether excess returns reflect competitive advantage or failure in competition.

This provides a framework for reviewing CARR.

4.1 Accounting.

4.1.1 Integrity of the accounting data

The authors assert (paragraph 1.5) that in measuring excess profitability, traditional measures such as Return on Capital Employed (RoCE) have 'little merit'. Similarly, a comparison of the current cost ARR with the risk adjusted cost of capital 'is also shown to

be seriously flawed'. At issue here is the question of data integrity, which I discussed in section 2. Does the accounting give comprehensive income, and a complete balance sheet valued at opportunity cost?

The authors package a discussion of some these issues with their advocacy of CARR. This is potentially misleading since the onerous requirements of data integrity will apply equally to any measure of profitability. This is not an area in which CARR has any inherent advantage relative to other measures. Certainly, whatever the practice of competition authorities, commercial users of RoCE now almost invariably make some adjustments to accounting to meet criticisms of the sort made by G&S.

As with most attempts to achieve data integrity in accounting based measures of return, the measure described by Graham and Steele is incomplete. They do use clean surplus accounting, hence the numerator of their measure includes the revaluation surplus, R. They do revalue the balance sheet to replacement cost. However, although they refer to the need to do so, there is a limited attempt to *complete* the balance sheet for missing intangibles, including R&D and market-based assets such as brands. IN the food retailing industry some companies possess very strong reputational assets, built over very long periods of time. Full data integrity would require some attempt to estimate the replication cost of this reputational asset. Short of this, reputation can be seen as a resource that confers competitive advantage, and the ability to earn excess returns, on some firms.

There are further profound difficulties with this methodology, as applied to food retailing, which are not discussed by G&S (and have received little discussion elsewhere). The logic of replacement cost revaluation is that replacement cost is measuring the opportunity cost of the capital stock. Correspondingly, the revaluation credit, R, in CARR recognises that the cost of using the capital stock may be overstated by the depreciation charge. However, this logic runs into difficulties when, rather than replicable assets in competitive supply, the firm uses specific assets such as prime retail sites which are in limited or unique supply. Here the vendor or landlord may be able to extract all or most of the surplus in the price of the real estate, or as rent. The consequence would be that property values will be economic values, at the margin, and R may involve a significant element of anticipation of future income.

A further difficulty is the 'windfall' element in R when retail property values are set by prices in marginal transactions. In this case there may be a significant difference between

the marginal and average cost of stores. Competition authorities should be concerned with marginal returns. Neither ARR nor CARR readily provide this.

4.1.2 *Investment treated as revenue.*

G&S say that 'The measure is intended to overcome (the weakness arising from) investment like properties of revenue expenditure.' There are two quite distinct issues here. One is whether the accounting data is complete. I discussed some aspects of this question in the previous section. It is well-known that, observed over a long period, ARR's are robust to the capitalisation or non-capitalisation of asset-creating expenditures such as R&D, and advertising. The second is presentational, rearranging the ARR as a ratio of outputs to inputs. This is a novelty of the CARR approach. What insight does this add? To the extent that CARR is a rearrangement of ARR, it cannot contain new information about the existence of excess profitability. So when ARR is above the risk adjusted cost of capital, CARR should be above the risk free cost of capital, and vice versa. A troublesome feature of ARR's is that they can take extreme values when firms are very efficient in balance sheet management, or firms pursue financial policies designed to understate capital employed by keeping key assets off the balance sheet or by undervaluing assets. But bringing costs to the bottom of the ratio will have a dampening effect. CARR is less likely to show extreme outliers that ARR measures such as ROCE. G&S conduct a preliminary study of food retailing in the appendix to their paper. It is no surprise that CARR is 'better behaved'. However, whether CARR provides a more reliable ranking than ARR *within* a group of profitable companies remains unclear.

4.1.4 *Accruals*

The paper (paragraph 1.3) suggests that politically visible companies are likely to make income decreasing accounting choices, in other words to use accrual accounting creatively. The authors suggest that discretionary accruals are the most important area of accounting discretion from a regulatory perspective. They quote a case study, that of W.T. Grant in the US where, between 1996-75, a company was apparently able to report operating profits that diverged from operating cash flows for many years. However G&S do not provide convincing evidence on the importance of accrual under current GAAP and auditing practices. Discretionary accruals, which are dominantly short-term and self-correcting are arguable *not* an issue for regulators who are tracking the profitability of companies over a number of years.

4.1.4 *Taxes*

It is the company's return net of corporate taxes that will be subject to competitive equalisation. Taxes consume a large proportion of company cash flows, and the effective rate of corporation tax varies significantly across companies. This reflects both company behaviour in response to taxes, and government policy in providing differential incentives to capital formation. Equity analysts who compare company profitability measure to the cost of capital now almost universally use an after-tax accounting rate of return that fully reflects fully the company's particular tax position. Though the treatment of tax receives little explicit attention in the G&S paper, it appears that CARR will be measured pre-tax, and benchmarked against a riskless interest rate grossed-up by the statutory corporate tax rate. If company and sector-level tax characteristics are excluded, the interpretation of the resulting excess return becomes ambiguous.

4.2 *Risk Adjustment*

The authors argue that an accounting rate of return is a complex average when it is constructed from elements of return with different levels of risk. Their response is to discount individual elements of return for risk, that is, to take certainty equivalents, so that the resulting return can be benchmarked against the riskless interest rate. This procedure is intellectually interesting. It is also, and G&S do not make this clear, an unavoidable consequence of implementing an output/input approach to profitability, since it is now no longer the case that all risky flows are in the numerator and that the denominator contains only riskless, current flows.

It is customary, since an ARR is analogous to IRR, to use the company's market-based cost of capital as the benchmark for the accounting rate of return. The costs of capital which analysts use to benchmark ARR can be seen as complex weighted averages, appropriate to the risk profile of the elements of the firms' cash flows.

To fully implement the certainty equivalent approach the analyst would need to know precisely how to decompose this cost of capital to apply it to each cash flow element. This would be extraordinarily challenging in practice, which is presumably why it is rarely attempted.

So the certainty equivalence approach, if it could be fully implemented, would make the task of measuring return considerably more complicated. Perhaps understandably, G&S seek to mitigate the problem by assuming only one source of risk, volume or quantity sold,

and allocating the equity risk premium in proportion to this. This is an arbitrary allocation. Whether this simplification works tolerably well in practice is an empirical question that requires empirical research before the measure can be safely used. Forced to compromise in this way, in the key area in which CARR claims to improve returns measurement, it is far from clear that the measure offers an advance on traditional returns measurement processes.

4.3 *Identification of competition failure*

Competition authorities need to be able to distinguish excess profitability which is due to the possession of competitive advantage from that due to failures of competition. Graham and Steel recognise the importance of this (paragraph 1.2), and they discuss an approach to it in section 6. Clearly, it is no easier to make this separation with CARR than with ARR. This is, again, an observation which gets lost in the general advocacy of CARR in the G&S paper.

In section 6 of the paper, G&S assert that competitive advantage is inherently transitory, so, 'when CARR exceeds the risk free rate for a number of years, it is consistent with market failure and the exploitation of market power by the firm.' (paragraph 1.7). This assertion, that competitive advantage is necessarily transitory, is dangerous, and is not, I believe, supported from a thorough reading of the research. Rather, strategy research sees the company as possessing resources and competences which confer advantage. Viewed this way, firms with excess profitability are deploying hidden assets. Some companies sustain competitive advantage for significant periods of time.

However, though not discussed by G&S, the distribution of excess returns across a previously identified group of companies may help distinguish competition failure from competitive advantage. Assume excess profitability *can* be reliably measured, using CARR, ARR, or some other measure. If a group of companies is believed to be protected by competition failure, or believed to be practising a complex monopoly, we would expect to observe excess returns across all members of the group. Excess returns in some companies, but not in others, would suggest competitive advantage, that is, the possession of firm specific resources.

5. Final comments

The Graham and Steele paper is an interesting addition to the literature on regulation. I believe that the authors have received comments on it from colleagues, and that it has been presented at a conference. I believe that the OFT have privately run CARR on a number of firms. However, it is essential that the central ideas, including those I have commented on in this paper, are subjected to full and open debate, and that CARR be fully empirically tested. As I noted above, the fullest version of the model is essentially a restatement of ARR, and approximations or simplifications are needed to implement the model. The value-added of CARR for regulators, its weaknesses and vulnerabilities, and its performance in revealing uncompetitive behaviour, are not fully understood at this point.

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