Measuring the Rate of Return for Competition Law

Paul A. Grout* and Anna Zalewska♣

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Abstract

This paper focuses on the application and interpretation of measures of rate of return for competition law. Amongst other results we analyse how outsourcing and similar arrangements impact on the rate of profitability and show that the measurement is more volatile the greater the rate of profit, suggesting that the measures are most problematic when they are most needed. We identify and interpret the outsourcing arrangements that provide the lowest rate of profit and show that these arrangements have a close relationship to net present value. Finally, we provide suggestions to make profitability measures more informative for competition law.
1. Introduction

In a business environment the desire to maximise profit is usually taken as given and, in the sphere of competition law, it is assumed that a higher profit is the primary payoff from abuse of a dominant position. Hence, one might reasonably expect that measurement of profitability would have played a straightforward and significant role in the application of competition law. However, in practice, this has not been the case and the use of profitability measures in competition law can at best be described as mixed. This paper focuses on the application and interpretation of measures of rate of return for competition law. In particular, we use empirical evidence and theoretical analysis to identify problems with standard use of the profitability measures and suggest how to make profitability measures more informative.

One reason why the use of profitability measures is mixed is that there is no general agreement as to the appropriate legal status of excessive pricing. Should it be seen as a standalone abuse or, in the absence of any exclusionary or exploitative action, should it be left to run its course?¹ The law differs between jurisdictions. The OECD identifies three categories. Those jurisdictions where monopoly profits are seen as “incentives that drive innovation and the development of business acumen”, those where charging a monopoly price is illegal but authorities “pick and choose” between cases and jurisdictions that actively prosecute such exploitative conduct (OECD, 2005). The U.S. is a good example of a jurisdiction where there is no formal concept of excessive pricing as an abuse in its own right.² The OECD places the U.K. in the middle category. However, despite the absence of universal enforcement, the U.K. has been more concerned with measuring profitability than almost any other jurisdiction (see Section 3.2). Indeed, this is explicitly stated in Office of Fair Trading publications: “The UK seems to be one of the few jurisdictions where the usefulness of profitability assessment has been explicitly recognized, and where it is regularly applied in investigations”.³ The South African Competition Authority is an example of a competition authority that has been vigorous in pursuing excessive pricing cases (notably against drug companies, e.g., GlaxoSmithKline and Boehringer Ingelheim).

¹ By standalone excessive pricing we mean that a court is not concerned with any additional abuse over and above the exploitation of market power through price.
There is limited case law on standalone excessive pricing at the European level, although the European Commission formally accepts that there is a concept of abuse based on pricing alone and the European Court of Justice has identified what it thinks excessive pricing might be: “Charging a price which is excessive because it has no reasonable relation to the economic value of the product supplied would be such an abuse.”⁴ However, the Commission’s decision that United Brands had charged unfair prices was not upheld by the Court, on the grounds that the Commission failed to produce “adequate legal proof”. In an earlier General Motors case, the Court again accepted that no abuse had been committed even though General Motors had been found to have sold documentation that was “cheap to produce” at a “high price”.⁵ In another well-cited excessive pricing case, British Leyland v the Commission, the case explicitly involved “excessive and discriminatory” pricing (our emphasis) and so cannot be seen as a standalone excessive pricing case.⁶ Furthermore, the European Commission have made it clear at certain times that excessive pricing cases should be a rarity: “However, the Commission in its decision making practice does not normally control or condemn high prices as such. Rather it examines the behaviour of the dominant company designed to preserve its dominance, usually directed against competitors or new entrants who would normally bring about effective competition and the price level associated with it.”⁷ This theme is maintained in the recent EC discussion paper on abuse of dominance, which focuses on exclusionary abuses.

So the potential role that the rate of profit can play differs between jurisdictions. Hence, in some cases profitability may be part of the evidence to prove excessive pricing and in others profitability analysis may be absent or used only as indicative of market power. Although our results have implications for this debate (see Sub-section 4.4), this is not the central theme of the paper. The primary focus of the paper is the conceptual and practical use of measures of the rate of profitability to inform competition law cases rather than the question of how to respond once there is evidence of excessive profitability.

⁴ Court of Justice, Case 27/76 United Brands v. Commission [1978] ECR 207, [1978] 1 CMLR 429. This terminology has caused confusion but given the rest of the judgement can loosely be interpreted as a price that has no relation the “competitive” level.
Historically, economists have disagreed about how to measure profitability. For example, Fisher and McGowan’s (1983) seminal paper, stating that “there is no way in which one can look at accounting rates of return and infer anything about economic profitability”, led to such strong responses that Fisher (1984) concluded “you would think that John McGowan and I had defaced a national monument”. However, there now seems consensus about the theoretical interrelationship between alternative approaches and what they imply. These are summarised in Section 2 of the paper. However, we argue, in Section 3.1, that these results are of very limited use in competition law. The reason is that the relationship between net present value and measures of the rate of profitability indicates whether a company’s rate of return is greater than the risk adjusted cost of capital. The standard measures have mainly been developed over the last century in the accounting, finance and economic literature for the purpose of project appraisal, and in such a context knowing whether a project increases or decreases shareholder value is important information. But competition law is not generally interested in this question.

The more relevant question is whether the return is excessive, i.e., it is useful to know how much the rate of profit exceeds the cost of capital. While we make no attempt to specifically identify what excessive might be in particular cases we use anecdotal evidence and detailed data from the U.K. (see, Section 3.2) to show that excessive is likely to involve a significant departure from the cost of capital, potentially several times the cost of capital. However, we show in Section 4.2 and 4.3, that the rate of profitability is more volatile the greater the rate of profit. Hence, measures of the rate of return are least reliable precisely when they are most needed.

Section 4.3 shows that the greater the rate of profitability, then the more susceptible the profitability measures are to trades such as outsourcing agreements. Given the growth of such arrangements in recent years this has implications for the interpretation of profitability measures. Some outsourcing arrangements increase the rate of return while other diminish it, so it becomes hard for competition authorities to interpret evidence. Section 4.3 also formalises the relationship between the minimum

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rate of return that can be achieved (a useful benchmark) and net present value, and Section 4.4 discusses how to use this information. Finally, Section 5 gives conclusions.

2. Basic Concepts

In this section we provide a statement of net present value, internal rate of return, accounting rate of profit and the cost of capital, and the basic relationship between them.

Shareholder and investor wealth is defined by the net present value (NPV) of all future cash flows discounted at the appropriate risk adjusted cost of capital. The NPV of an infinite project is calculated as

\[
\int_0^\infty R(s)e^{-rs}ds - \int_0^\infty C(s)e^{-rs}ds,
\]

where \( R(.) \) is a function denoting revenue cash flows, \( C(.) \) is a function denoting cash outflows (e.g., cost, or new investment acquired) over the same period of time, and \( r \) is the cost of capital. It is clearly sensible for investors to be primarily concerned with whether an action increases or decreases net present value, and, other things being equal, to adopt the alternative with the largest net present value. But competition authorities are likely to wish to know what the rate of profitability is. A difficulty with net present value, however, is that it measures absolute profitability and does not directly provide a rate of profitability. In particular, it does not provide a percentage measure to compare to the cost of capital.

The economic rate of profit, more generally referred to as the internal rate of return (IRR), is the discount rate that gives a net present value of zero when applied to a series of cash flows. That is, the IRR of the infinite project is the rate, denoted \( \rho \) throughout the paper, which satisfies:
The IRR is an extremely popular profitability measure. For example, Graham and Harvey (2001) state that more than three quarters of American and Canadian firms use IRR when making decisions on projects' potential profitability.\footnote{In some circumstances the IRR is not unique (see, for example, Brealey, Myers and Allen, 2006). In this paper we assume that all revenues and costs are such that there is a unique IRR. We also assume that that the term structure of interest rates is constant.} If the IRR is greater than the cost of capital, then the NPV of the project is positive. It is standard in finance and economics to use the terminology excess return to describe a situation where the rate of return in a period is greater than the cost of capital. It follows that if we know that the IRR is greater than the cost of capital, then the project must be making an excess return.

The accounting rate of return (ARR), or return on capital employed (ROCE), for a period is typically defined as the earnings of an investment during the period divided by the capital employed in the investment at that time.\footnote{For a formal definition of ARR in continuous time models see Kay (1976).} In contrast to the IRR, the ARR has many critics and there is a considerable literature both in economics and finance on its relevance as a profitability measure.\footnote{For example, van Breda (1984), Fisher and McGowan (1983), Horowitz (1984), Long and Ravenscraft (1984), and Martin (1984).} However, the ARR, calculated over a period of time, can be as relevant as the IRR providing asset value is calculated in a particular way. The asset definition that is necessary to provide consistent ARR figures is deprival value.\footnote{The deprival value is how much the entity loses if it is deprived of the asset. Formally, it is the minimum of (i) the replacement cost or (ii) the maximum of net present value or net realisable value. This is often referred to Hotelling valuation, following his seminal article on depreciation by Hotelling (1925).} In this case if the ARR is greater than the cost of capital, then the net present value is greater than replacement cost, i.e., there is an excess return. Furthermore, if the ARR is constant, then it is equal to the IRR and, when ARR is not constant, it can be shown that the IRR is a weighted average of ARRs.\footnote{For a detailed discussion of this literature see, for example, Edwards, Kay and Mayer (1987).} So the ARR can be seen as a simpler way of calculating IRR. Indeed, some competition authorities routinely look at ARR and about 30% of American and Canadian firms rely on the accounting rate of return as a measure of project profitability (see Graham and Harvey, 2001), although, in general, these do not adopt
the definitions that are necessary to bring a clear relationship between the ARR, the cost of capital and the net present value.

In summary, both the ARR and the IRR can be used to identify excess returns. In this sense these profitability measures may appear to have a straightforward role to play in “forensic economics”. However, we argue that these measures of profitability need handling carefully since we suggest that identification of excess profit, i.e., increase in NPV, is not particularly useful in a competition law context. For most potential abuses of a dominant position, e.g., bundling, excessive pricing, margin squeezes, etc., one is not interested in the fact that the firm is earning a return higher than the cost of capital, since a difference between IRR and the cost of capital can emerge for many reasons. The main interest is whether the difference is sufficiently “excessive” to be useful as an indicator that there may be a problem in a market or, in a jurisdiction where excessive pricing itself is considered an abuse, that profitability indicates that the pricing levels may themselves be excessive. The next section elaborates on this point and provides empirical evidence of what levels of profitability might be considered excessive.

3. Excessive versus excess returns

3.1 Excess returns and competition

An excess return arises when the IRR or ARR (calculated appropriately) is greater than the cost of capital. Economic theory indicates that the expected return on capital will be equal to the cost of capital, i.e., no excess return, if a company operates in a perfectly competitive market. A perfectly competitive market is one where there is an extremely large number of sellers, all producing homogeneous products, there is an extremely large number of buyers, consumers have perfect information about products, prices and market conditions, resources can flow freely from one area of economic activity to another, there are no barriers to entry, firms can lend and borrow in perfect capital markets and there are no barriers to exit. This degree of “perfection”
is generally, if not universally, absent and so for this reason alone identification of excess return is not very informative for competition law.\textsuperscript{14}

It is also helpful to recall how a standard cost of capital is derived and the precise question it answers. In competition law and regulation estimates of the cost of capital are typically derived from stock market returns (the Capital Asset Pricing Model is probably the most common formal approach). These estimates identify the return on an investment in share ownership. The share price implicitly values all assets that enable the company to earn its return. This may include difficult to measure intangible assets such as income forgone while learning cheaper ways to do something, specialist manpower, etc. It is the return on all these assets that the cost of capital applies to. In contrast the ARR and IRR are calculated from cash flows and valuations of physical assets. If the full set of assets in the business (i.e., everything that contributes to the return) is greater than the physical and financial assets, then the equilibrium required rate of return on physical and financial assets will be above the cost of capital derived from stock market data. This is a “missing assets” problem.

In addition to the measurement error associated with assets, the cost of capital itself is not identified with precision. In competition law we are likely to be concerned with showing that the rate of return is higher than a reasonable limit so we need to worry about the errors in measuring the cost of capital. The two most important errors are probably those related to CAPM beta and the equity risk premium. A typical example of a standard error for a beta estimate is in the order of 0.15. Errors surrounding the equity risk premium are even larger. For example, the arithmetic mean of the annual equity risk premium in Europe is around 6.7\%, and the standard error is approximately 21.4\%. The missing assets problems and the error surrounding the cost of capital indicates that the rate of return ought to be “significantly” above the cost of capital before it is reasonable to suspect there may be an abuse of dominance.

Furthermore, a wedge between the cost of capital and investment returns can also arise because of a general phenomenon known as real options (see, for example, Dixit

\textsuperscript{14} An example of the divergence between perfect competition and “acceptable” competition in a market can be seen by looking at the threshold Herfindahl-Hirschman index values that identify areas of concern in the US Department of Justice’s Merger Guidelines.
and Pindyck, 1995). Investing today closes down the option not to undertake the project. The flexibility often has value and so the additional return from starting the investment today instead of waiting has to be sufficiently greater than the cost of capital to justify giving up the option to wait. The return required to invest in physical assets may therefore be higher than the return necessary to be persuaded to buy a share that can be sold at any time. This drives a wedge between the cost of capital and the required rate of return on physical capital.

All these examples suggest that there are fundamental theoretical and measurement reasons why there should be “clear water” between a return that might be thought of as excessive and the cost of capital. Hence knowing that the rate of return is above the cost of capital is not particularly helpful. This problem is well recognised by competition authorities. For example, the Office of Fair Trading in the U.K. is explicit on this issue: “The Director General recognises that judgement is needed to estimate relevant rates of return and it may be difficult for an undertaking in a dominant position to know whether a particular rate indicates supra-normal profitability. There can be legitimate uncertainty in the estimation of the appropriate cost of capital, the valuation of net assets, and their attribution to the business. It is unlikely, however, that the Director General would conclude that an undertaking was abusing a dominant position solely on the evidence of supra-normal profit.”15 Oftel makes the same point in an indirect way: “Profit levels which consistently and substantially lie above the cost of capital can be considered excessive.”16

Even if the contribution of the above factors could be determined with reasonable accuracy, it is not obvious that any profit above this level should be deemed excessive in a legal sense or would be a good benchmark to indicate potential dominance. This is particularly true if one is trying to identify an excessive price, which constitutes an abuse under competition law. If earning the cost of capital is the minimum consistent with non-exit, then there ought to be a grey area before pricing becomes illegal even in a world of perfect measurement. This raises the question, what levels of return

15 2.15 of OFT Guidelines “Assessment of Individual Agreements and Conduct”
16 “Effective Competition Review of the UK Mobile Industry”, Oftel, February 2001 (italics added by the authors).
might be potential indicators of dominance or might be contenders to indicate excessive pricing. We discuss this in the next sub-section.

3.2 Is the difference material?

In this section we look at competition law evidence drawn from the UK. There are several reasons why empirical evidence from the U.K. Competition Commission (CC, formerly the Monopolies and Mergers Commission) is particularly relevant.\(^{17}\)

First, as indicated in the introduction, the U.K. competition authorities have been more concerned with measuring profitability than any other jurisdiction. Second, the CC cases are investigated in great detail; reports of several hundred pages are not unknown and a final report in the public domain will typically be over 100 pages. Finally, the profitability figures quoted in the reports are the result of careful analysis by teams of CC accountants. These are designed to give as good a reflection as possible of the true profitability of the activity under investigation. In particular, the figures normally relate to the relevant market and, hence, the part of the business that is under investigation. This is not usually the case with publicly available data, which tends to be based on the legal entity (e.g., the publicly quoted enterprise) or industry level.

The data we use is drawn from all monopoly situations investigated by the CC with submission date between 1973 and 2000 inclusive (i.e., until the introduction of the new 1998 Competition Act, which came into force in 2000). All investigations that published ARR (to be precise, historical cost return on capital employed) figures for companies are used. The data set where ARR figures are available has 43 cases and 119 company level data points. The ARR figures reported here are those from the year before investigation to avoid any window dressing of profitability that might have arisen as a result of the investigation. The ARR figures relate to earnings by the relevant part of the business under investigation.

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\(^{17}\) We use the terminology CC to refer both to the UK Competition Commission and the Monopolies and Mergers Commission.
The legal test during this period was one of public interest, i.e., the CC would investigate and report whether the activity operated against the public interest or not. Therefore, there is either an adverse finding or not for each company, hence there is no ambiguity regarding the verdict. The data are grouped in two forms. One is at company level. Here the ARR is collected for the relevant section of each company and market shares are for that company’s share of the market under investigation. The data is also collected at case level. Here an adverse finding is reported for the case if any company within the case is found to be acting against the public interest. The ARR for the case is the average ARR across all the companies within the case that were found guilty.

The cases in the dataset cover many potential abuses. A subset of these cases are concerned explicitly with excessive (or so called monopoly) pricing and we present results for these separately. Being designated a monopoly pricing case does not imply that there are no other concerns of abuse within the same case but merely that the level of pricing was explicitly one of the primary concerns.

Table 1 presents the results for the company level data set and Table 2 presents the results for the case level data set. We present the average ARR for all companies/cases and then break them down according to adverse and non-adverse finding.\textsuperscript{18} We also give the correlation between ARR and adverse finding for all cases.

The first point to notice is the level of the ARRs. The mean ARR is 39.4\% for companies and 47.7\% at the case level. Obviously, if attention is focused on monopoly pricing cases, then one would expect to see higher ARRs. This is indeed the case. The equivalent averages are 65.5\% and 82.4\%.

Focusing on companies/cases where there was not an adverse finding, the average for all companies is 30.5\% and for all cases is 31.7\%. These are 28.3\% and 50.1\% in the case of monopoly pricing. These are ARRs for markets with acceptable behaviour by

\textsuperscript{18} The averages are equally weighted, i.e., no account is taken of different size of markets.
participants. This is quantitative evidence of the point outlined in detail in the previous sub-section, namely, that it is perfectly reasonable to have an ARR well in excess of the cost of capital and for there to be no abusive behaviour by the companies involved.

Table 1. Company level data

<table>
<thead>
<tr>
<th></th>
<th>All companies</th>
<th>Monopoly pricing cases only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average ARR</td>
<td>39.4%</td>
<td>65.5%</td>
</tr>
<tr>
<td>Average ARR where adverse finding</td>
<td>51.0%</td>
<td>102.6%</td>
</tr>
<tr>
<td>Average ARR where no adverse finding</td>
<td>30.5%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Average addition to ARR for adverse finding</td>
<td>20.5%</td>
<td>74.3%</td>
</tr>
<tr>
<td>Correlation between ARR and adverse finding</td>
<td>0.18</td>
<td>0.49</td>
</tr>
</tbody>
</table>

Table 2. Case level data

<table>
<thead>
<tr>
<th></th>
<th>All companies</th>
<th>Monopoly pricing cases only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average ARR</td>
<td>47.7%</td>
<td>82.4%</td>
</tr>
<tr>
<td>Average ARR where adverse finding</td>
<td>53.8%</td>
<td>92.1%</td>
</tr>
<tr>
<td>Average ARR where no adverse finding</td>
<td>31.7%</td>
<td>50.1%</td>
</tr>
<tr>
<td>Average addition to ARR for adverse finding</td>
<td>22.1%</td>
<td>42.0%</td>
</tr>
<tr>
<td>Correlation between ARR and adverse finding</td>
<td>0.11</td>
<td>0.23</td>
</tr>
</tbody>
</table>

The difference between the adverse and non-adverse findings is relevant to help inform how high the ARR levels typically are above an acceptable range to warrant a finding of illegal action or at least to indicate dominance. The difference ranges from 20.5% at the lowest to 74.3% at the highest. That is, on average the CC has looked for a significant increase (at least over 20%) above the reasonable range before opting for an adverse finding.
Finally, it is interesting to look across all the companies in our data set to identify the lowest ARR that appears in any adverse finding in monopoly pricing cases. This is 29%, and arose in two separate cases. In one of these two there were three other firms also found guilty and these had ARRs of 43.5%, 76.1% and 83.5%.

Figure 1. Comparison of market share and ARR for companies investigated by the Competition Commission in the period 1973 – 2000 where ARR data is publicly available.

Market share is often taken as a crude measure of monopoly power. It is interesting to see the relationship between ARR and market share (using company level data). This is given in Fig. 1, which shows that there is little relationship between these. There is a slight positive correlation, 0.25, but it is clear from Fig. 1 that this is almost totally driven by a few outliers.

Summarising, this evidence suggests that the difference between a reasonable ARR for a market without any adverse activity and those where the CC have decided to make an adverse finding is around 20%, and over 40% where the abuse has involved monopoly pricing. This evidence is confirmation of the general point made in the paper, namely that profitability measures need to be extremely high before they can be taken as reliable evidence of excessive pricing. The implications for the measurement of IRR and ARR are discussed in the next section.
4. Measuring an excessive rate of return

4.1 Background

The previous section indicated that, for competition law purposes, we are interested in assessing how far the rate of profitability is above the cost of capital, and that we are likely to be concerned with figures that are several times greater than the cost of capital. This section of the paper shows that the measures of profitability do not perform this task well and discusses ways to address the problem.

The IRR suffers from a well-known problem sometimes referred to as the reinvestment rate assumption. Essentially, the IRR calculation has a single interest rate, the IRR number, and implicitly assumes that investors can reinvest their money at the IRR. So if a project has an IRR of 20% it is equivalent to assuming that the project is able to move money about at 20% rate of interest. The effect of the reinvestment rate assumption is that, even when comparing projects that have the same initial set-up cost, one project can have a higher IRR than another but have a lower NPV. That is, the ranking of projects by NPV and IRR are not the same.

There is an immediate consequence of the reinvestment rate assumption which receives less attention but is of considerable relevance for competition law. Namely, that if a firm that is earning an excess return enters into a trade in a competitive market, then the IRR of the firm is almost certain to change. At best, this is a potential complication if IRR and ARR are to be used as measures of the rate of return for competition law purposes. Furthermore, the issue is becoming of greater significance as outsourcing develops.

An immediate question is whether the differences in IRRs are significant. The following sub-section provides two plausible types of examples that show the change in IRR may be large. Sub-section 4.3 then provides formal results that inform the application of rate of return measures in competition law.

19 See for example, Copeland, Weston and Shastri (2005).
4.2 Two examples

In the first example we show that a series of different arrangements with an outsourced third party delivers different rates of return, even though the NPV, and, hence, the quantity the shareholders take from the market is constant. Suppose a company invests €1m today to buy a piece of capital (that decays after one year). One year after purchase the capital provides an output that can be sold at an (uncertain) price, which gives an average expected revenue of €1.1m. Let the appropriate risk adjusted annual cost of capital for the revenue be 8%. The annualized IRR of this simple project is 10%, i.e., there is a “small” excess return. Think of this as the “in-house” process.

Now suppose that output and the prices charged remain identical but instead of paying €1m for the capital, the company only purchases a quarter of the capital at the start of the project and chooses to enter into an outsourcing agreement with a third party. Assume further, that the instantaneous risk free rate is 5%. The agreement is that in $Y$ months time the third party will be paid a guaranteed price of $€750,000 \times e^{0.05Y/12}$, and will deliver to the company in month twelve the same output that the company would have made with the other three quarters of the capital. The delivered output will be combined with the company’s own output and then the company will sell it on the market. For example, if the time of entering the outsourcing contract is $Y = six$ months, the amount the company agrees to pay to the third-party subcontractor is €768,986. Note that depositing €750,000 in the bank today yields exactly €768,986 in six months, hence shareholders are totally indifferent between the alternatives. The only difference between the in-house and outsourced case is in the profile of the cash flows. However, the IRR figures differ significantly. Table 3 which provides the IRRs for different $Y$.

<table>
<thead>
<tr>
<th>Second payment date</th>
<th>IRR, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate payment</td>
<td>10.00</td>
</tr>
<tr>
<td>$Y = three months</td>
<td>11.15</td>
</tr>
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</table>

\[20\] This type of investment is reminiscent of typical simple investment models given in introductory textbooks.
The second example consists of a company that rents out equipment. Supplying a
customer has an upfront cost of €100 for the company to buy and deliver the
equipment to the customer and then a small ongoing cost. Expected net revenues are
€68 a year. Assuming that the cost of capital is 5% and using the IRR as the measure
of profitability, we can calculate that the company earns 68.0% on a customer that
retains the item for 15 years. This is the IRR for the in-house process. Now consider
what happens if the company decides to outsource its rental collection. For this
purpose let us assume that all money collected is invested in an asset of similar risk to
the rental revenues, i.e., at the cost of capital, and paid to the company at the point of
termination. Then, the company’s IRR is 18.1%. That is, the IRR could be
significantly less than four times the cost of capital with outsourcing yet with the in-
house process the IRR is almost 14 times the cost of capital. Both of these
alternatives have the same present value for the company.

Table 4

<table>
<thead>
<tr>
<th>Contract life</th>
<th>“Outsourced” IRR</th>
<th>“In-house” IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>17.9%</td>
<td>32.5%</td>
</tr>
<tr>
<td>4</td>
<td>27.0%</td>
<td>65.4%</td>
</tr>
<tr>
<td>7</td>
<td>24.9%</td>
<td>67.4%</td>
</tr>
<tr>
<td>15</td>
<td>18.1%</td>
<td>68.0%</td>
</tr>
</tbody>
</table>

Table 4 gives the equivalent of the outsourced and in-house examples for different
contract lengths. This highlights two interesting points. First, a contract that has small
present value does not display much change in IRR between the outsourcing and in-
house arrangements. In contrast, as the present value taken from the market rises we
find that the measure of profitability becomes far more sensitive to the alternative
ways of operating in the market. Second, as the contract length increases, the
outsourced IRR and the in-house IRR can move in opposite directions. That is,
although the present value of a contract rises as the contract length is extended, the
outsourced IRR can actually fall.

21 The quoted IRR is the solution to $6.8 \times \frac{1-e^{-TIRR}}{IRR} = 10$, where $T=15$. 

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These examples suggest that the changes in IRR that can arise from outsourcing and business trades can have a sufficient effect on IRR, both in terms of magnitude and complexity, to warrant investigation. The following sub-section provides more formal analysis of results relating to the use measures of profitability in competition law. Section 4.4 then discusses the implications of results given in Sub-section 4.3 and the examples presented in this section.

4.3 Relevant properties of profitability in competition law

If we compare two companies that have assets with identical replacement cost and the same cost profiles in the time interval between $t$ and $T$, then it is reasonable to think of a difference in the companies’ present values over the interval as an indication of the difference in the amount of money that the companies are “taking out of the market”. However, the examples in the previous section have shown that entering into outsourcing arrangements with companies that are operating in a competitive outsourcing market can have significant impact on the IRR. This means that the two companies can take the same amount out of the market and have very different IRRs.

Given that a competition authority may wish to use a measure of profitability as an indication of dominance or as part of a case for excessive pricing, then the change in IRR as a result of outsourcing is a fundamental problem. A company may appear far more profitable than another simply because it has entered, for good business reasons, into a particular outsourcing (or for that matter any other financial) arrangement that has had a small impact on its total profits in present value terms. If the competition authority is concerned about excessive pricing, then the outsourcing agreement should not make the company more prone to be found guilty. Similarly, if a company’s IRR falls significantly by a competitive outsourcing arrangement, then there is a problem if this is the deciding factor in one company being found guilty and another not.

The above suggests that it might be interesting to identify the lowest IRR that could be achieved through a competitive outsourcing arrangement. However, there is a problem with this approach. Theoretically, a company earning an excess return could enter into an infinitely large outsourcing agreement that would swamp the company’s
core activity and hence bring its IRR down to the risk adjusted cost of capital. Clearly, this does not help to inform the competition authority. An alternative is to take the costs and revenues for project, as observed by the competition authority, as a given. Then calculate the minimum IRR that is achievable amongst the limited set of possible arrangements that involve moving these costs and revenues around within the relevant interval of time. We now show how this minimum IRR is achieved.

First we formalise the restriction on the financial arrangements that we allow. Consider a project between 0 and $T$ that has revenue cash flows $R(t)$ and cost cash flows $C(t)$. By definition $R(t)$ and $C(t)$ are non-negative for all $t$. Assume the revenue and cash flows have similar risk and let $r$ denote the relevant cost of capital for these cash flows. The IRR, i.e., $\rho$, for this project satisfies:

$$\int_0^T R(t)e^{-\rho t}dt - \int_0^T C(t)e^{-\rho t}dt = 0. \tag{1}$$

Let $(\tilde{R}(t), \tilde{C}(t))$ be alternative revenue and cost cash flows such that (i) they have the same present value as $(R(t), C(t))$ over the interval 0 to $T$ and (ii) $\tilde{R}(t)$ and $\tilde{C}(t)$ are non-negative for all $t$. We use the terminology “the set of equivalent outsourced projects” to denote the set of all $(\tilde{R}(t), \tilde{C}(t))$ that satisfy these conditions.

It is relatively intuitive to understand which $(\tilde{R}(t), \tilde{C}(t))$ give the lowest IRR from the set of equivalent outsourced projects. For example, note that if cost occurring at any time $t$ is brought forward (at constant present value) to time $\hat{t}$ $(t > \hat{t})$, then the discount factor attached to this cost changes from $e^{-\rho t}$ to $e^{-\rho \hat{t}} e^{-\rho(t-\hat{t})}$. \footnote{We are being slightly informal here since we should be referring to cost over a small interval.} As long as $\rho$ is greater than $r$, then the latter is larger than the former. The effect is that the “present value” of the new cash flows discounted using $\rho$ will be negative, i.e., the IRR will have to fall when the cost is brought forward. Of course, we cannot bring costs further forward than time zero. This intuition shows that bringing forward (at constant present value) any cost to the start of the project reduces the IRR.
A similar argument relates to revenue flows but since revenues enter equation (1) with the opposite sign to the costs they have to be moved in the opposite direction to reduce the IRR. Moving revenues from \( t \) to \( \tilde{t} \), where \( \tilde{t} > t \), changes the discount factor attached to that revenue from \( e^{-\rho t} \) to \( e^{-\rho \tilde{t}} e^{(\tilde{t}-t)} \). If \( r < \rho \) the latter is smaller than the former and the present value of the new cash flows discounted using \( \rho \) is negative. Therefore, the IRR associated with the new cash flows is lower than the IRR before revenues were changed. Of course, within the interval of time \([0, T]\), revenues cannot be postponed beyond \( T \). This intuition shows that postponing any positive revenue at constant present value to period \( T \) reduces the IRR.

The above is the rough intuition behind Proposition 1 (see Appendix for a more formal proof).

**Proposition 1.** Amongst the set of equivalent-outsourced projects operating on a time interval \([0, T]\) the minimum IRR is unique and arises when all revenues are postponed to time \( T \) and all costs are brought forward to time 0.

As indicated in Sub-section 4.1, a major problem with the IRR is that it provides a different profitability ranking of alternatives than NPV. Consequently, an IRR measure may imply company A is more profitable than B while the NPV rule may indicate B is more profitable than A. Of course, part of the problem is that NPV measures the absolute amount of profit while IRR measures the rate of profit. That is, if a project is doubled in size, i.e., all costs and revenues are doubled, the rate of profit will not change but the absolute profit, NPV, will double. The NPV can be converted into a relative NPV by dividing the NPV by the present value of all costs. The relative NPV now gives a rate of profit measure and does not double when the project’s cash flows are doubled. However, it is still the case that the relative NPV and the IRR will rank companies differently.\(^{23}\)

Proposition 1, suggests that NPV and the minimum IRR must have a much closer relationship than NPV and IRR. Using the notation \( \rho_{\text{min}} \) to denote the minimum IRR,

\(^{23}\) We do formally show this but it follows from Proposition 1.
the relationship is shown in the following proposition (the Appendix contains a proof).

**Proposition 2**: Relative Net Present Value is equal to \( e^{T(p_{\text{max}} - r)} - 1 \).

There is an obvious but interesting corollary of Proposition 2.

**Corollary**. For any set of investigations over a finite time interval of companies with the same cost of capital, the profitability ranking of companies by minimum IRR is identical to the profitability ranking by relative NPV.

An attraction of Proposition 2 and its corollary is that it shows that the answers to two natural but separate approaches arrive at identical orderings. That is, if we convert NPV into a rate of profitability we achieve exactly the same ranking as when we find the lowest IRR amongst the set of equivalent financial transactions and then rank companies. Furthermore, identifying the lowest possible IRR amongst the set of equivalent outsourced projects can be found immediately from net present value calculations. The intuition behind both these results is relatively straightforward. Proposition 1 shows that the minimum IRR is found when all revenues are grouped together at the end of the time interval at constant present value (which is what would happen if the transaction took place with a third party in a competitive market) and costs are all grouped at the start of the time interval while NPV groups all revenues and costs at the start of the period. Therefore, it is not surprising that there is a close relationship between the rankings given that both approaches group activities.\(^{24}\)

Finally, the second example in the previous sub-section suggests that the IRR is more prone to larger changes when the in-house IRR is larger. This can be formalised easily for certain cases. In particular, we focus on basic investments (defined here as those that have a revenue stream over an interval \([0, T]\) and a single set-up investment cost).

\(^{24}\) Of course, the minimum IRR still gives a different rate of profitability than the relative NPV.
Proposition 3. Take any set of basic investments that differ only by their set-up costs. Within the set, the higher an investment’s IRR, then the greater is the difference between its IRR and its $\rho_{\text{min}}$.

The appendix gives a proof but there is a clear intuition for the result that can be seen from the preliminary discussion preceding Proposition 1. In the preliminary discussion an example was considered with revenue moved from $t$ to $\tilde{t}$, where $\tilde{t} > t$. As a result the discount factor attached to that revenue fell from $e^{-\rho t}$ to $e^{-\rho \tilde{t}} e^{r(\tilde{t} - t)}$ and the IRR needed to fall to compensate. It is clear that the greater the difference between the IRR and the cost of capital, then the greater the difference between $e^{-\rho t}$ and $e^{-\rho \tilde{t}} e^{r(\tilde{t} - t)}$. Therefore, it is not surprising that there is also a formal relationship between the required adjustment to the IRR and the difference between IRR and the cost of capital.

4.4 Implications for competition law

The preceding sub-sections indicate that the measuring the rate of profitability is potentially most problematic when the rate of return is excessive. Given that identifying when profitability might be or is excessive is one of the key objectives this suggests that measuring the rate of profitability for competition law is extremely complex. Here we discuss some of the implications of the results presented in Sub-sections 4.2 and 4.3.

Because the IRR is least volatile when there are almost no excess returns and most volatile when returns are large it is difficult to disagree with the view that measures of the rate of profitability are least reliable for competition law purposes precisely when they are most needed. As indicated in the introduction, there are many jurisdictions where there is no attempt to consider excessive pricing as a stand-alone abuse of dominance. Furthermore, in those jurisdictions where it does have a formal status there are many who argue against it. For example, Gual et al. (2005) explicitly suggest that “in most circumstances, the competition authority ought to refrain from intervening against monopoly pricing and instead see to it that there is room for competition to open up”. Their argument is partly based on allowing the competitive
process to work and partly because of the problem of identifying what is excessive. Whish (2001) also argues that proving an excessive price is a formidable task: “To compare a monopolist’s price with a hypothetical ‘competitive’ price is unscientific; alternatively to establish what would be a ‘reasonable’ price by adding an acceptable profit margin to the actual cost of producing goods or providing services is fraught with difficulty.”

The results of the paper appear to bolster arguments that it makes no sense to envisage excessive pricing as a standalone abuse. The fact that profitability measures become more unreliable when they are most needed does add some credence to the view the rate of profitability ought to be restricted to use as an indicator of abuse and as evidence of the effect of a primary abuse, rather than being part of the evidence for excessive pricing as a standalone abuse. This eases the requirements on measuring the rate of return since the notion of excessive profitability itself can be far more loosely defined if it is not being used as a definition of a primary abuse.

Another implication is that the analysis of the rate of profitability for competition law cases is far more of an art form and far less of a statistical procedure than, say, deriving the cost of capital. Anyone who has estimated cost of capital figures for competition law cases will immediately realize how much judgment is therefore required to bring insight to whether profits are excessive or not. At a practical level we would suggest that it is useful to calculate several profitability measures, rather than simply estimate a single IRR or the equivalent ARR figures.

A major problem with the IRR is its volatility and sensitivity to relatively simple financial transactions and activities such as outsourcing. The results suggest that it is useful to calculate the minimum IRR since this gives a lower bound on what the IRR could have been with the company “taking no less out of the market” and allows companies to be ranked and compared on a less random basis. However, it is necessary for the competition authority to observe costs and revenues separately and for these to have been arrived at in good faith. Put another way, the basic figures that the competition authority deal with must not have already been manipulated to

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massage the IRR to a lower figure. In practice, this should not be a problem since a company is unlikely to involve itself in considerable outsourcing arrangements simply to reduce its rate of profitability in front of a competition authority. Indeed, if anything the problem is more likely to be the opposite. Most outsourcing agreements take the form of a company buying externally and paying costs later in the production process. As our results show this increases the rate of profitability even though it may not increase net present value. Managers are more likely to wish to display high rate of profitability for senior managers and shareholders than worry about bringing the rate of profitability down to impress competition authorities. Of course, after the event the situation may change once an investigation is under way but then the competition authority has the cost and revenue data to conduct the type of analysis we outline.

We suggest that the minimum rate of profit should be considered but care is needed when interpreting this figure. The type of financial arrangement that would be necessary for the company to achieve the minimum IRR needs consideration. In some cases totally plausible alternative arrangements might have moved the company’s return close to a minimum IRR and in others the arrangements might be a totally unrealistic way to do business. Similarly, if a company engages in significant outsourcing and other financial arrangements, then it is useful to calculate what the profitability would have looked like had the company chosen more of an in-house policy.

A final point we raise here concerns the difference between industry regulation and competition law. The international wave of privatisation has moved many activities from the public to the private sector. Recent estimates suggest this is more than $3.24 of assets (accounting for 39% of non-U.S. stock markets). This policy, along with liberalisation and non-state aid laws, has created many large companies that face sector specific, and often company specific, regulation over and above generic competition law. Frequently the prices of these companies are closely regulated and as a result the companies are very sensitive to changes in the regulatory structure. If these companies are regulated in a way that ties their returns quite closely to the cost

26 Megginson (2005). These figures only measure those privatisations that have stock markets listings.
of capital, then the results of this paper suggest that measures of profitability are likely to be more reliable for regulatory purposes than generic competition law purposes. This may help explain why profitability measures are frequently at the heart of sector specific regulation and play such a limited role in general competition law. In this context, our results add weight to the view that excessive pricing makes most sense in essential facilities cases (Gual et al., 2005) or in cases where power is due to special rights (Motta and de Steel, 2006).

5. Conclusions

The paper draws the formal distinction between excess return and excessive return, argues that competition policy is interested in the latter and uses evidence to suggest that the return is only likely to be thought to be a candidate for excessive if the difference between the rate of profit and the cost of capital is material. Using detailed U.K. evidence as a benchmark, this difference could potentially be several times the cost of capital. However, we show that measures of the rate of profitability are more volatile the larger the return. Hence, unfortunately, the measures are most problematic when they are most needed. Consequently, when looking at measures of profitability, it is dangerous to simply calculate one number and take this as the measure of profitability. It may provide a misleading picture as to whether the company is earning an excessive return. For example, the measured rate of profitability may be the consequence of the particular way that the company does business, e.g., a consequence of outsourcing arrangements, and that other equally plausible arrangements may provide a very different rate of return.

We identify the arrangements that provide the minimum rate of profitability and relate this to present value. We suggest that it makes sense to calculate this minimum, if only to identify how low the company’s rate of profitability could have been (consistent with the company “taking no less out of the market”). Furthermore, we show that this approach allows companies to be ranked and compared on a less random basis. However, it does not make sense to view this minimum as a sole alternative figure. Rather the authority should address the plausibility of alternative financial arrangements and their effect on profitability.
The analysis of the paper can clearly be interpreted as bolstering the arguments of those who believe that excessive pricing should not be a standalone abuse, and provides further evidence that it makes more sense for essential facility cases than general competition law (although in the paper we do not take a position on whether excessive profitability should be an abuse or merely a signal of abusive behaviour).

Where profitability is relevant to a case what are our overall implications for the use of rates of return? It is clear from the results and discussion in the paper that the analysis of the rate of profitability for competition law cases is far more of an art form and far less of a statistical procedure than, say, deriving the cost of capital. However, we believe that measuring the rate of return is a useful component of the economists “toolkit” in competition law cases providing it is recognized that what can be achieved with the information is inevitably case specific.

References:


OECD, 2005, Abuse of Dominance in Regulated Sectors, DAF/COMP/GF(205)3


Appendix

Proof of Proposition 1

Consider an investment defined over the time interval \([0, T]\) and denote by \(\rho\) the IRR of the investment. Consider an alternative investment, denote this \(I'\), in the set of equivalent outsourced projects that is defined by bringing forward all costs to time 0 whilst retaining their present value, i.e., discounting costs at the cost of capital, and moving all revenues to the end of the period whilst retaining their present value. Let \(\rho'\) denote the IRR of this alternative investment. \(\rho'\) is defined by:

\[
e^{-\rho'T} \int_0^T R(t)e^{\rho'(T-t)} dt - \int_0^T C(t)e^{-\rho't} dt = 0.
\]

The heuristic arguments given in the main text show that \(\rho'\) will be less than \(\rho\). Now, assume that \(\rho'\) is not the minimum IRR in the set of all outsourced projects. In this case another project, call this \(I''\), which by definition cannot group all revenues at \(T\) and all costs at 0, must have the minimum IRR in the set of all equivalent outsourced projects. Denote this IRR by \(\rho''\). However, an alternative project, \(I'''\), that “moves” the revenues in project \(I''\) to \(T\) and brings the costs forward to 0 must have an IRR, \(\rho'''\), that is less than \(\rho''\). This implies that, \(I'\) and \(I'''\) are identical so \(\rho''\) must equal \(\rho'''\), rejecting the assumption that \(\rho''\) was less than \(\rho'\). Therefore, there can be no \(\rho''\) that is less than \(\rho'\), i.e., \(\rho'\) is \(\rho_{\text{min}}\). \(\rho_{\text{min}}\) solves the equation:

\[
e^{-\rho_{\text{min}}T} \int_0^T R(t)e^{\rho_{\text{min}}(T-t)} dt - \int_0^T C(t)e^{-\rho_{\text{min}}t} dt = 0.
\]

A simple rearrangement gives

\[
\rho_{\text{min}} = r + \frac{1}{T} \left( \ln \int_0^T R(t)e^{-\rho_{\text{min}}t} dt - \ln \int_0^T C(t)e^{-\rho_{\text{min}}t} dt \right).
\]  \hspace{1cm} (A1)

It is clear from (A.1) that \(\rho_{\text{min}}\) is unique.
Proof of Proposition 2.

The relative NPV (RNPV) of an investment is defined as

\[
\text{RNPV} = \frac{\int_0^T R(t)e^{-rt} dt - \int_0^T C(t)e^{-rt} dt}{\int_0^T C(t)e^{-rt} dt} = \frac{\int_0^T R(t)e^{-rt} dt}{\int_0^T C(t)e^{-rt} dt} - 1. \quad (A2)
\]

Combining Eqs. (A1) and (A2) gives

\[
\rho_{\text{min}} = r + \frac{1}{T} \ln(\text{RNPV} + 1)
\]

or:

\[
\text{RNPV} = e^{(\rho_{\text{min}} - r)T} - 1.
\]

\[\blacksquare\]

Proof of Proposition 3.

Consider any set of projects (each project indexed by a project specific parameter \(\gamma\)) that are defined on the \([0, T]\) time interval, have identical revenue streams and initial costs \(\gamma C\), where costs arise at time 0 only. Let \(r\) denotes the cost of capital and \(\rho\) denotes the IRR of a project, i.e., \(\rho\) satisfies\(^{28}\)

\[
\int_0^T R(t)e^{-\rho t} dt = \gamma C. \quad (A3)
\]

The minimum IRR, \(\rho_{\text{min}}\), associated with project \(\gamma\) is given by:

\[
e^{-\rho_{\text{min}} T} \int_0^T R(t)e^{(\gamma - r)(T - t)} dt = \gamma C. \quad (A4)
\]

Subtracting Eqs. (A3) and (A4) allows us to define function \(Z\) such that

\[
Z = \int_0^T R(t)e^{-\rho t} dt - e^{-\rho_{\text{min}} T} \int_0^T R(t)e^{(\gamma - r)(T - t)} dt = 0.
\]

Since \(Z\) is an implicit function of \(\rho\) and \(\rho_{\text{min}}\), the relationship between changes in \(\rho_{\text{min}}\) and \(\rho\) can be calculated as:

\(^{28}\)To avoid multilevel subscripting/superscripting we do not attach any symbol to \(\rho\) to indicate that \(\rho\) is a function of \(\gamma\).
\[ \frac{\partial \rho_{\text{min}}}{\partial \rho} = -\frac{\partial Z}{\partial \rho_{\text{min}}}. \]

Therefore,

\[ \frac{\partial \rho_{\text{min}}}{\partial \rho} = -\frac{\int_0^t t R(t) e^{-\rho t} dt}{\int_0^T TR(t) e^{\rho(T-t)} e^{-\rho_{\text{min}} t} dt} = -\frac{\int_0^t R(t) e^{-\rho t} dt}{\int_0^T R(t) e^{\rho(T-t)} e^{-\rho_{\text{min}} t} dt} \cdot \frac{T}{\gamma C}. \]

From Eq. (A3) and the fact that \( \frac{t}{T} < 1 \) for any \( t \in [0, T] \) we conclude that

\[ \int_0^T R(t) e^{-\rho t} dt < \gamma C, \]

and that

\[ \frac{\partial \rho_{\text{min}}}{\partial \rho} < 1, \]

i.e., a decrease in \( \gamma \) will lead to a larger increase in \( \rho \) than \( \rho_{\text{min}}. \)