The calculation of returns during seasoned equity offers

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The paper analyses how the returns to a shareholder and the returns for an event study are calculated during the three types of seasoned equity offer in use in the UK, namely rights issues, open offers and placings. The calculations differ across the two types of return and the three types of offer. Evidence from a sample of SEOs shows the large impact that the choice of calculation method has on returns. An unresolved question is whether to use discount-adjusted returns in event studies of placings.

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1.   Introduction

It is common for seasoned equity offers (SEOs) in many countries to be made at a discount: the offer price of the new shares is below the market price of the existing shares when the offer is announced. The existence of a discount complicates the calculation of returns on the issuer's shares during the SEO. The purpose of the paper to analyse the calculation of returns during an SEO, and to provide evidence on the impact on event-study results of the choices made regarding the method of calculation. The paper discusses the case of the UK, which provides a rich field of study since there are three types of SEO currently in use, namely rights issues, open offers and placings. The typical discount in rights issues is in excess of 30% of the market price, and in open offers and placings it is around 10%. Discounts of this size mean that returns during SEOs are strongly affected by whether and in what way the returns are adjusted for the discount.[1]

In a *rights issue*, the rights to buy new shares are issued to the existing shareholders pro rata (in proportion) to the existing number of shares they own as at the day before the ex-rights day. The ex-rights day is the start of the offer period, which lasts for three weeks. During the offer period the existing shares trade ex-rights, which means that they cease to carry an entitlement to buy new shares, and the rights to the new shares can also be traded in the same way as existing shares. The right to buy a new share has value so long as the market price of the existing shares exceeds the offer price of the new shares. To buy a new share, the holder of a right must subscribe (pay the company) the offer price before the close of the offer period. The rights to any shares not subscribed for by the end of the offer period are sold to investors who will subscribe, or they are taken up by the underwriters if they cannot be sold, or they expire if they cannot be sold and the issue is not underwritten. The ex-rights day is the day after the offer is announced, if no extraordinary general meeting (EGM) of the company is required to authorise the increase in share capital. If there is an EGM, as is usually the case, it is held two or three weeks after the announcement. The ex-day is then the day after the EGM, because authorisation has to have been obtained before the rights can be issued.

In an *open offer*, the new shares are normally placed (sold) by private negotiation or private bookbuilding with a group of investors, known as placees, before the offer is publicly announced. The agreements to buy that are reached before the announcement are mainly verbal agreements; legally binding contracts are signed on the announcement day or shortly after. On the announcement day, the new shares are offered pro rata to the existing shareholders, and the offer period is two weeks. The ex-rights day is the announcement day or sometimes the day after, whether or not an EGM is necessary. An EGM need not be held

before offering the new shares because no tradable rights are issued. This means that the entitlements to the new shares cannot be sold, unlike in a rights issue, so the entitlements are worth nothing if the holders do not use them to buy shares by the end of the offer. If an EGM is required, as is usually the case, the issue of the shares will be conditional on gaining shareholder approval at the EGM, but it is very rare for an issue not to be approved at the EGM. If a placee has agreed to buy shares in excess of any shares to which they are entitled as a shareholder on a pro rata basis, the final number of shares the placee will receive depends on the number taken up by existing shareholders in the pro rata offer. The take-up by existing shareholders, and the final allocations of shares to placees, are not known until the end of the offer period.

The key differences between a rights issue and an open offer are as follows. First, an open offer is preceded by a placing, and the placees are not merely underwriters: they will expect to receive some shares over and above any entitlement they have to new shares by virtue of being shareholders. On average about half of the shares in open offers are not subscribed for by the existing shareholders on a pro rata basis (Armitage, 2002). Second, the rights cannot be traded in an open offer, and third, the ex-day is usually the announcement day. The name 'open offer' is potentially misleading, because this type of issue does not involve a public offer of shares to investors in general. The informal name 'placing with clawback' highlights the fact that the shares initially placed with the group of placees can be 'clawed back' by the existing shareholders on a pro rata basis.

In a *placing* or placement, the new shares are placed with one or more investors at a common offer price. The shares are not offered pro rata to the existing holders, and there is no ex-rights day; these are the crucial differences from a rights issue or open offer, from the perspective of calculating returns during the SEO. About ten per cent of rights issues and two thirds of open offers are accompanied by a placing of shares, known in this context as 'firm placing'. The shares in the firm placing are not offered pro rata, and so strictly they are not part of the rights issue or open offer itself, although there will be a common prospectus and a common offer price. We refer to such offers as combined offers. The presence of a firm placing in a combined offer means that the choice of method for calculating the return on announcement can have a large impact on the return, as we shall see.

The three types of offer and the two types of combined offer differ because they have different terms. The paper shows how such differences in terms across the types of offer affect the calculation of share returns, and discusses the choices that confront the researcher.

There is no one method of calculation that is applicable to all types of offer. As far as we are aware, no previous study explores comprehensively the calculation of returns during an SEO.

The primary question is the calculation of returns for an event study. Such returns are intended to measure the *information effect* of the SEO announcement, ie the change in the market value of the issuer's equity around the time of the announcement that is due to news of the SEO, as a percentage of the pre-announcement equity value. A change might be caused by news other than the SEO announcement in a particular case, but the event-study method assumes implicitly that the average of the returns that are due to other news is approximately zero across a given sample. The calculation of returns is not a problem in event studies of most types of event, but it is a problem with SEOs. A crucial decision is whether or not to calculate discount-adjusted returns, that is, returns that are gross of the value of the discount to buyers. We show that returns on the ex-day for an event study should be discount-adjusted for rights issues and open offers. The loss on the ex-day of the entitlement to buy shares at a discount entails a loss of value for the old shares which is not due to a change in the issuer's equity value, ie it is not due to the arrival of information. So the value of the discount should be added back when measuring the information effect.

Practice in previous UK event studies of rights issues and open offers has been to use returns adjusted for the theoretical ex-rights price (TERP) on the ex-day (for example, Armitage, 2002; Barnes & Walker, 2006). The TERP is the price which would obtain on the ex-day were there to be no change in equity value; it is lower than the share price before the ex-day, if the offer is at a discount. The TERP adjustment has the effect of increasing the measured return on the ex-day in offers at a discount, compared with the unadjusted return. We show that the return using the TERP adjustment measures some of the information effect, but not all of it. This is a new result. The use of discount-adjusted returns makes a material difference for open offers in particular, because the ex-day is usually the announcement day. As this is when the stock market is first informed of the offer, via the Regulatory News Service of the London Stock Exchange, it is the day on which much of the change in price in response to news of the offer normally occurs. Discount-adjusted returns make much less difference in rights issues, because the ex-day in a rights issue is usually at least two weeks after the announcement day.

There is an important distinction to be made about the impact of the discount on the share price. The size of the discount might be part of the information that affects equity value on announcement. For example, if the offer price is set lower than expected, this might be seen by investors as a negative sign about the company, and so it might be a reason for a fall

in the market value. The fall in market value, if there is one, is the information effect of the announcement. This is not the impact of the discount that is being adjusted for when using a discount-adjusted return on the ex-day. The impact that the discount-adjusted return allows for is the mechanical effect of selling new shares at less than market price. For example, suppose the share price is 100p and there are 100 shares in issue. The company announces an issue of 100 new shares at a price of 50p, and shareholders are entitled to buy the new shares on a pro rata basis. The ex-day is the same as the announcement day, as in most open offers. If there is *no change* in the market value of the equity on announcement, the share price will fall to 75p, not because news of the offer has changed the market's valuation of the firm - it has not, by assumption - but because the issue has caused the value per share (old plus new) to fall, and the existing shares no longer carry an entitlement to buy the 'cheap' new shares, because the shares have gone ex-rights.

The case for discount-adjusted returns for *placings* is less clear, for the following reason. The new shares are not offered pro rata to the existing shareholders, and this means that the value of the discount in a placing could be viewed as a predictable fee to buyers, one that is already reflected in the share price. If so, the size of the discount should not affect the share price when the offer price is announced, and the returns for an event study should be left unadjusted, because the unadjusted returns will measure the information effect correctly. In a rights issue or open offer, in contrast, the discount is not a fee at all, because the existing shareholders are entitled to benefit from the discount. The share price falls on the ex-day, other things being equal, because the old shares lose the entitlement to buy new shares at the discounted offer price, and not because the discount imposes a cost on the existing shareholders.

The 'no-adjustment view' for returns in a placing also requires an assumption that investors can anticipate, at least roughly, when the company will carry out SEOs and in what amounts, in which case the costs of such SEOs, including the discount, are among the predictable costs of the company. But if the discount is viewed as unexpected, the value of the discount to buyers is a cost to the existing shareholders, because they are not entitled to buy the new shares. So news of this cost will affect the share price on announcement. The 'adjustment view' for returns in a placing assumes that the share price falls by the cost of the discount, other things equal, and defines the information effect as the change in equity value on announcement excluding (gross of) the assumed impact of the cost of the discount. On this view, the information effect should be measured gross of the impact of the cost of the discount on the share price, and this calls for an adjustment to the returns.[2] As it is unclear

which view is correct, we suggest that the returns for placings are calculated both ways, as is the practice in several US event studies of private placements (for example, Hertzel et al, 2002; Krishnamurthy et al, 2005). We also propose a third method for calculating a discount-adjusted return which is in between the two extremes of no adjustment and full adjustment for the discount.

The empirical section illustrates the impact on event-study results of the choice of calculation method for returns. We find that using discount-adjusted returns increases the estimated average abnormal return (AAR) on announcement of open offers and placings by about five percentage points, compared with the AAR from returns conventionally calculated from Datastream's prices adjusted for capital changes. In addition, there is a strong negative correlation between abnormal returns and discounts if conventional returns are used, but there is no significant correlation if discount-adjusted returns are used. So the choice of calculation method for returns matters considerably in practice. This is likely to be the case whatever choices are made with respect to other aspects of event-study methodology.

The paper also examines the calculation of the returns to shareholders during an SEO, ie the returns a shareholder actually receives. In an SEO, the returns to shareholders and the returns for an event study can differ: a discount-adjusted return is designed to measure the information effect, if an adjustment for the discount is thought to be appropriate, but it does not measure the return to shareholders. A point about calculating the return to shareholders arises with the return on the ex-rights day in rights issues and open offers. We show that the ex-day return with the TERP adjustment only measures the return to a shareholder if it is assumed that the shareholder subscribes immediately for all the shares to which they are entitled, so the shareholder is assumed to invest new cash. The return is different, and is less convenient to calculate, if the shareholder is assumed not to invest new cash.

The next section analyses how the returns to shareholders and returns for an event study are calculated for each type of offer, including combined offers. Section 3 provides evidence on the returns prior and subsequent to making an adjustment for the discount. Section 4 summarises the paper's discussion and findings.

2.   Adjustments for discounts in calculating returns

2.1   Purpose of adjustments

Returns to shareholders. It is standard practice for data providers to record share prices that have been adjusted for certain 'capital changes', including scrip issues, share consolidations, and rights issues and open offers.[3] The reason for the adjustments is so that

the adjusted prices can be used to calculate the correct returns to shareholders. Two conditions need to be met for a capital change to warrant an adjustment to prices.

(a) The capital change must in theory cause the unadjusted price of the existing shares to change, independently of any change in the equity value of the company at the same time, because the capital change creates new shares that give ownership of the equity on different terms from the old shares.

(b) The change in the unadjusted price that is caused by the capital change must not affect the value of a given shareholding, because each old share carries an entitlement to new shares that offsets the impact of the new shares on the value of the old shares.

If these two conditions are satisfied, and no adjustment to prices is made, then the unadjusted price series will produce a return to shareholders that is incorrect on the day the capital change takes effect.

Returns for an event study. The returns for an event study are intended to measure the information effect of the event. When new shares are to be issued at a price that differs from the market price of the old shares, the returns to shareholders around the announcement day may not measure the information effect correctly, depending on the type of offer. In these cases a different calculation needs to be made, and the returns to shareholders will differ from the returns for an event study.

2.2 Rights issue

Return to shareholders on the ex-day: the TERP adjustment. We now discuss the calculation of returns by type of issue, starting with a rights issue. In nearly all UK rights issues the offer price is below the share price as at day ex–1. The presence of this discount means that condition (a) in Section 2.1 is satisfied: the new shares give ownership of the equity on different (better) terms from the terms of the old shares. The capital change takes effect when the shares go ex-rights, because from that time the old shares cease to carry the entitlement to subscribe. Under certain assumptions, the entitlement attached to shares bought before the ex-day means that condition (b) is satisfied exactly: the fact that the old shares go ex-rights has no impact on the value of a given shareholding on the ex-day. The three assumptions are:

(i)   the equity value of the company does not change on the ex-day: $V_{ex-1} = V_{ex}$. In other words, no information arrives on the ex-day that affects the company's value;

(ii)   the offer is at a discount or at the market price: $P_{ex-1} \geq P_{offer}$;

(iii)   the proceeds $P_{offer}N_{new}$ are certain.

V_{ex-1} is the value of the equity as at day ex–1, the day before the ex-rights day, including the new cash to be invested as equity; P_{ex-1} is the unadjusted share price as at the close of day ex–1; P_{offer} is the offer price of the new shares; N_{new} is the number of new shares.

The company will not in fact receive the new cash until at least three weeks after the ex-day. But if the proceeds are certain, the company's market value from the AD will be the value as though the cash had been received. So we can write

$$V_{ex} \quad = \quad V_{ex-1} \quad = \quad P_{ex-1}N_{old} + P_{offer}N_{new} \tag{1}$$

where N_{old} is the number of existing shares.[4] After the old shares go ex-rights, they are the same as the new shares, and so they will have the same market price, given by V_{ex}/N, where $N = N_{old} + N_{new}$. It follows from this and from (1) that

$$P_{ex} \quad = \quad V_{ex}/N \quad = \quad V_{ex-1}/N \quad = \quad (P_{ex-1}N_{old} + P_{offer}N_{new})/N \tag{2}$$

Equation (2) says that, under assumptions (i), (ii) and (iii), the ex-rights price is given by the formula on the right-hand side. This is the standard TERP formula, to be found in some textbooks (eg Arnold, 2008, p. 384).[5]

In an offer at a discount, the price of the old shares falls when they go ex-rights, assuming no change in equity value (assumption (i)), because the old shares lose a valuable entitlement to buy new shares. But the value of an existing holding including the entitlement will be unchanged. The value per old share of the entitlement at the close of the ex-day, Ent_{ex}, is given by:[6,7]

$$Ent_{ex} \quad = \quad (P_{ex} - P_{offer})N_{new}/N_{old} \tag{3}$$

We have seen that, under the three assumptions, P_{ex} is given by the formula for *TERP* in (2). Using this, we can write

$$P_{ex-1} - Ent_{ex} \quad = \quad P_{ex-1} - (TERP - P_{offer})N_{new}/N_{old}$$

or $\qquad\qquad P_{ex-1} \quad = \quad TERP + Ent_{ex} \tag{4}$

So the value of a holding will be unchanged on the ex-day, and condition (b) is satisfied exactly.

The value of a holding on the ex-day is Ent_{ex}/P_{ex} per cent higher than the value measured using the ex-rights price alone, P_{ex}. This is why an adjustment is needed in order to calculate the correct return to a shareholder. With no change in equity value, the adjusted return, $R_{terpadj,ex}$, is given by

$$
\begin{aligned}
R_{terpadj,ex} \quad &= \quad (P_{ex} + Ent_{ex})/P_{ex-1} - 1 \\
&= \quad P_{ex}/[P_{ex-1} \times P_{ex}/(P_{ex} + Ent_{ex})] - 1 \\
&= \quad P_{ex}/[P_{ex-1} \times TERP/P_{ex-1}] - 1 \tag{5}
\end{aligned}
$$

The step to the last line uses (2) and (4). Equation (5) shows the *TERP adjustment*: the price before the ex-day, and all previous prices, are scaled down by multiplying them by an adjustment factor, *AF*, given by

$$AF \quad = \quad TERP/P_{ex-1}$$

We now examine the TERP adjustment further by relaxing in turn the assumptions used to derive it.

Assumption (i) does not hold: equity value changes on the ex-day. If the equity value changes, $P_{ex} \neq TERP$, and (4) will not hold exactly. There is now no unique ex-day return to shareholders. The return depends on the decision of the individual shareholder with regard to how much to subscribe. We show, first, that the TERP adjustment results in the return to a shareholder who subscribes for their full entitlement of shares at the start of the ex-day, the instant the shares go ex-rights. Such a subscriber invests $P_{offer}N_{new}/N_{old}$ per old share in the company, and so the shareholder's holding on which the return is calculated is larger. The assumption of immediate subscription is slightly unrealistic, in that the shareholder would normally wait until the offer close before subscribing, and would not subscribe unless $P_{ex,close} \geq P_{offer}$.

The ex-day return on the holding of a subscriber, including their new shares, is

$$
\begin{aligned}
R_{subscriber,ex} \quad &= \quad [P_{ex} + Ent_{ex} + P_{offer}N_{new}/N_{old} - (P_{ex-1} + P_{offer}N_{new}/N_{old})] \\
&\quad \div (P_{ex-1} + P_{offer}N_{new}/N_{old}) \\
&= \quad [P_{ex}N_{old} + (P_{ex} - P_{offer})N_{new} - P_{ex-1}N_{old}] \div (P_{ex-1}N_{old} + P_{offer}N_{new}) \\
&= \quad P_{ex}/TERP - 1
\end{aligned}
$$

which is the same as (5). Thus, the TERP adjustment is correct for an immediate subscriber, even if equity value changes. The reason is that the TERP is the price per share at the start of the ex-day of a holding of old shares plus new shares bought pro rata at the offer price. The return in (5) is not the exact return from a cash-neutral or buy-and-hold strategy of holding the old shares without investing or realising cash. The formula for the buy-and-hold return is derived in the Appendix.

Assumption (ii) does not hold: the offer is at a premium ($P_{ex-1} < P_{offer}$). In this case condition (b) for adjustment of the price series is not met. The entitlement to new shares has zero value on the ex-day because the entitlement cannot have a negative value. So there should be no adjustment to prices before the ex-day if the offer is at a premium. With no adjustment, the ex-day return to a shareholder is simply $P_{ex}/P_{ex-1} - 1$.

Assumption (iii) does not hold: the proceeds are not certain. The issue will almost certainly proceed so long as the share price is at or above the offer price at the offer close, ie $P_{close} \geq P_{offer}$. If $P_{close} < P_{offer}$, the issue will only proceed if it is underwritten. If it is not underwritten, the possibility that the issue will not proceed because $P_{close} < P_{offer}$ means that V_{ex-1} and V_{ex} are not given precisely by $P_{ex-1}N_{old} + P_{offer}N_{new}$, and equation (1) does not follow. However, the value of the entitlement that is lost on the ex-day is not affected by whether the issue is underwritten, because the value of the entitlement is zero at the offer close if $P_{close} < P_{offer}$, whether or not the issue is underwritten.

Returns for an event study. The 'capital change' in a rights issue occurs when the shares go ex-rights, which is after the announcement day (AD). As a result, no adjustment is needed for measuring the information effect on the AD so long as P_{ad}, the unadjusted share price as at the close of the AD, is above P_{offer}. Any change in the market's valuation of the company before the ex-day is captured in the return on the old shares, because they still carry entitlement to the new shares. The information effect (change in equity value) on the AD is given by $V_{ad} - P_{offer}N_{new} - V_{ad-1}$. V is the market value of the equity, including the new cash $P_{offer}N_{new}$ on the AD but not on AD–1, because the market does not know about the issue before the AD. Therefore, the information effect is $(P_{ad} - P_{ad-1})N_{old}$, which is the change in market value of the old shares. This shows that all of the information effect on announcement is captured by the old shares in a rights issue at a discount.

If $P_{ad} < P_{offer}$, and the offer is underwritten, then the fact that shares will be sold at a price exceeding the current market price is affecting the market price in a mechanical way, that is distinct from any information effect from news of P_{offer}. The underwriters are expected to be buying shares at a loss, assuming the best guess of the market price at the close of the offer is P_{ad}. The expected loss to the underwriters is a gain to the shareholders, which affects P_{ad}. Therefore an adjustment to the return for the AD is needed to measure the information effect, and the adjustment is explained in the next section.

The ex-date might be included in the event period; the ex-date in some rights issues is the day after the AD. In this case the ex-day return for an event study should be measured by the discount-adjusted return, given by (10) below, rather than by $R_{terpadj,ex}$ in (5). We shall see why in the context of open offers.

2.3   Open offer

Returns to shareholders. An open offer at a discount satisfies condition (a) for adjustment: the discount affects the price of the old shares when the shares go ex-rights. However, condition (b), that the change in price because of the discount does not affect the value of a given holding, is only satisfied if the shareholder subscribes. Otherwise the shareholder suffers a loss on the ex-day, equal to $P_{ex–1} – TERP$ assuming no change in equity value, and the loss cannot be offset by selling the rights. So it is less clear that condition (b) is satisfied in an open offer than in a rights issue. But all the shares carry the same entitlement as at day ex–1, giving the same opportunity to subscribe and to realise the value of the entitlement. It would be misleading for the price series not to reflect the existence of the entitlement.

The return with the TERP adjustment, $R_{terpadj,ex}$, measures the return per old and new share on the ex-day to a subscriber in an open offer, as in a rights issue. If $P_{ex–1} \leq P_{offer}$, no adjustment should be made and the return is $P_{ex}/P_{ex–1} – 1$. A cash-neutral strategy is also possible in an open offer via selling old shares and using the proceeds to buy new shares, assuming that $P_{ex} > P_{offer}$. The return obtained via this strategy is derived in the Appendix.

Returns for an event study. The calculation of the ex-day return is critical for open offers, because the ex-day is usually the same as the AD in an open offer, and much of the information effect occurs on the AD. The ex post value of the entitlement per old share is Ent_{ex} in (3). Since this value is available to any shareholder by subscribing, and since the purpose of an event study is to measure the change in equity value per old share, the ex-day return for a event study should include the value of the entitlement per old share.

The unadjusted price on announcement is

$$P_{ad} = P_{ex} = V_{ex}/N$$

and the unadjusted change in the total value of the old shares is

$$(V_{ex}/N)N_{old} − V_{ex–1} = (P_{ex} − P_{ex–1})N_{old} \tag{6}$$

It is clear that the unadjusted change in value does not measure the full change in value, and so it is not correct for an event study. The value captured by the new shares, $(P_{ex} − P_{offer})N_{new}$, is not included in (6). $(P_{ex} − P_{offer})N_{new}$ can be broken down into two components. First, $(TERP − P_{offer})N_{new}$ is the transfer of wealth to the new shares due to the discount the instant the shares go ex-rights. Since this is positive if the offer is at a discount, the unadjusted return is biased downwards. Second, $(P_{ex} − TERP)N_{new}$ is the information effect captured by the new shares.

The return under the TERP adjustment is the return on one old share valued at the TERP:

$$R_{terpadj,ex} \quad = \quad P_{ex}/TERP - 1$$

and so, using (5), the change in the value of the old shares, as measured under the TERP adjustment, is

$$
\begin{aligned}
R_{terpadj,ex}(TERP)N_{old} \quad &= \quad (P_{ex} - TERP)N_{old} \\
&= \quad (V_{ex}/N)N_{old} - [(P_{offer}N_{new} + P_{ex-1}N_{old})/N]N_{old} \\
&= \quad (V_{ex} - P_{offer}N_{new} - V_{ex-1})N_{old}/N \qquad (7)
\end{aligned}
$$

Equation (7) shows that the change in the value of the old shares measured under the TERP adjustment captures only the proportion N_{old}/N of the information effect. The component

$$(P_{ex} - TERP)N_{new} \quad = \quad (V_{ex} - P_{offer}N_{new} - V_{ex-1})N_{new}/N$$

is missing from the measured change in (7), ie the information effect captured by the new shares is missing. So $R_{terpadj,ex}$ is the return with only $(TERP - P_{offer})N_{new}$ added back, the value of the discount the instant the shares go ex-rights. Thus, the TERP-adjusted return understates the absolute value of the information effect, whether it is positive or negative.

If the information effect of an open offer is positive on average, as the existing evidence indicates, then the TERP-adjusted return will be biased downwards as a measure of the return for an event study. Furthermore the results of an event study will not be comparable between a rights issue and an open offer, even if the TERP adjustment is applied in both types of issue. As we have seen, all of the information effect on the AD is captured by the old shares in a rights issue at a discount, and is correctly measured by the unadjusted return for the AD (the TERP adjustment affects the return for the ex-day only). For the bulk of open offers, which have the ex-day on the AD, applying the TERP adjustment results in returns in which the information effect is understated.

If we wish to measure the full information effect as a return on the old shares, we must use an adjustment that assigns all of the information effect to the old shares. Such an adjustment has been developed by Bradley & Wakeman (1983) and Wruck (1989), and has been used in several subsequent studies to measure the market reaction to US private placements. The impact of the new information on the value of the old shares is measured as

$$
\begin{aligned}
\Delta V_{old} \quad &= \quad (P_{ex} - P_{ex-1})N_{old} + (P_{ex} - P_{offer})N_{new} \\
&= \quad V_{ex} - P_{offer}N_{new} - V_{ex-1} \qquad (8)
\end{aligned}
$$

(from Wruck, p. 26, equation A.5). Equation (8) says that the impact is the change in value of the old shares, $(P_{ex} - P_{ex-1})N_{old}$, plus all of the gain or loss for the new shares, $(P_{ex} -$

$P_{offer})N_{new}$. The return on each old share that measures the information effect is the *discount-adjusted return*, $R_{discadj,ex}$:

$$
\begin{aligned}
R_{discadj,ex} \;=\; & (\Delta V_{old}/N_{old})/P_{ex-1} \\
=\; & [N(P_{ex} - P_{ex-1})/P_{ex-1} + N_{new}(P_{ex-1} - P_{offer})/P_{ex-1}]/N_{old} \\
=\; & P_{ex}/P_{ex-1} - 1 + [(P_{ex} - P_{offer})N_{new}/N_{old}]/P_{ex-1} \qquad (9) \\
=\; & \%\text{ change in share price } + \%\text{ value of entitlement as at the ex-day} \\
& \text{per old share}
\end{aligned}
$$

The step to the second line uses a version of the first line of (8). In equation (9), all of the percentage change in equity value on announcement is divided among the old shares only, as is clear from line two.

The same analysis applies to the ex-day return for an event study in a rights issue. However, using the discount-adjusted return on the ex-day will make less difference to the returns for rights issues than for open offers, because the ex-day in a rights issue is usually two or three weeks after the AD.

$R_{discadj,ex}$ is not a return on the old shares that is available to a shareholder. If $P_{ex} > P_{offer}$, the entitlement has value, but to realise this value in an open offer, the shareholder has to subscribe. Then the return on the augmented holding is $R_{terpadj,ex}$, which has a smaller absolute value than $R_{discadj,ex}$, as can be seen by comparing equations (7) and (8). If $P_{ex} < P_{offer}$, the shareholder will not subscribe, and the return is $P_{ex}/P_{ex-1} - 1$. This is less negative than $R_{discadj,ex}$, as can be seen from the third line of equation (9). By not subscribing, the shareholder forces the placees/underwriters to buy the new shares at a loss, and this loss is not borne by the old shares. But under the discount-adjusted return, the loss is allocated to the old shares via the term $(P_{ex} - P_{offer})N_{new}/N_{old}$ in (9), which is negative when $P_{ex} < P_{offer}$. The discount-adjusted return should also be used to calculate the event-study return for the AD in an underwritten rights issue at a premium, ie with $P_{ad} < P_{offer}$, as previously noted.

2.4   Placing

In a placing the old shares do not carry an entitlement to the new shares. This means that condition (b) for adjustment to the price series is not satisfied. The return to a shareholder on the AD is

$$
R_{ad} \;=\; P_{ad}/P_{ad-1} - 1
$$

To measure the return for an event study, the ex post value of the discount can be ascribed to the old shares by calculating $R_{discadj,ad}$ as in (9), with P_{ad-1} and P_{ad} substituted for P_{ex-1} and P_{ex}. However, the literature is ambivalent about whether this is the best approach.

Several event studies of private placements measure returns with no adjustment for the discount (Kang & Stulz, 1996; Allen & Phillips, 2000; Cronqvist & Nilsson, 2005; Wu & Wang, 2005; Barclay, Holderness & Sheehan, 2007; Maynes & Pandes, 2008; Wruck & Wu, 2009). Previous event studies of UK placings also make no adjustment for discounts (Slovin, Sushka & Lai, 2000; Barnes & Walker, 2006; Balachandran et al, 2009). Other studies of placements provide results using both approaches (Wruck, 1989; Hertzel & Smith, 1993; Goh et al, 1999; Hertzel et al, 2002; Eckbo & Norli, 2005; Krishnamurthy et al, 2005; Marciukaityte et al, 2005). Several of these latter studies argue that the discount-adjusted return provides the better measure of the information effect. For example, Krishnamurthy et al (2005, p. 221) write that 'since the positive abnormal returns of 2.21 percent around private placements are despite the discount offered to investors, the true abnormal returns (ie the total information effect of the placements) are actually higher.'

In a rights issue or open offer, whether to use the TERP-adjusted return or the discount-adjusted return for the ex-day depends on the type of return one wishes to calculate, as we have seen. But both adjustments are warranted: both the return to shareholders and the return for an event study should incorporate the value of the entitlement to subscribe at the discounted price that the shares lose on the ex-day, because all existing shareholders are entitled to subscribe. The loss of the entitlement on the ex-day entails a loss of value for the old shares which is not the result of a fall in the value of the company's equity.

The discount in a placing provides a reward or fee to buyers that existing shareholders are compelled to pay, unless they have been invited into the placing. This difference makes it questionable whether to measure the event-study return gross of the value of the discount. If no adjustment for the discount is made, the value of the discount is ignored, and the fee for buyers via the discount is thereby treated in the same way as the fee for the investment bank. In a rights issue, open offer or placing, the fee for the investment bank is paid in cash and is usually recorded in the prospectus. In US firm-commitment offers, the fee takes the form of the underwriter's spread, plus out-of-pocket (cash) expenses of the issue. The underwriter's spread is the difference between the offer price, paid to the underwriter by investors, and the price per share paid to the issuer by the underwriter. Both the cash fees in UK SEOs and the underwriter spread in US firm commitments are typically several percent of the issue proceeds. But almost no event study measures returns gross of the fee to the investment bank.[8]

The argument is presumably that the investment bank's fee for an SEO is largely predictable, and that investors can predict at least roughly when the company will be making

SEOs and in what amounts. In this case the predicted fees in future SEOs are already reflected in the share price, and the payment of the fee for a given issue should not affect the share price on announcement, unless the fee is unexpectedly high or low.[9] If the fee is unexpected, however, the share price should fall in line with the fee.

The view that the offer price has no impact on the share price when announced implies that the market and the company can predict the post-announcement share price, and that the company sets the offer price to provide the predicted fee for buyers. This is illustrated in Example 1 below. In an environment in which companies choose between a rights issue or open offer on the one hand, and a placing on the other, the no-impact view also requires the market to have predicted the company's choice of a placing.

Should the discounts in placings be viewed as predictable, and hence already 'in the price' before the announcement, as the investment bank's fee is assumed to be? If so, then the returns for an event study should be calculated using prices with no adjustment, because news of the discount should not in itself cause the share price to change. If a discount is not expected, the discount-adjusted return should be calculated, in order to measure the information effect gross of the negative impact of the cost of the discount on the market price.

A further question is the extent to which the issue itself is a surprise. If investors are not expecting an SEO from a company in the foreseeable future, and it announces a placing at a discount, then both the investment bank's fee and the discount are costs that have not been anticipated, and the announcement-day return should be measured gross of both costs, in order to measure the information effect.

There is a strong correlation between announcement abnormal returns and discounts in UK placings, found in previous studies and in Section 3 below. Price changes on announcement are affected by the depth of the discount to the pre-announcement price. This is consistent with the view that the wealth transfer caused by the discount is not already in the pre-announcement price. But there is another interpretation, which is that a deeper discount conveys negative information about the company; it indicates that the pre-announcement market price was more likely to have been overvalued.

No adjustment for the discount implies an assumption that *all* of the ex post transfer to buyers via the discount is viewed as an expected fee. In practice this results in some implausibly large ex post fees, and also some negative fees (when the market price on the AD is below the offer price). Instead, the existing share price could be used to estimate the expected share price post announcement, the assumption here being that no fall in price is expected despite the discount. Then the estimated expected fee per old share via the discount

would be $(P_{ad-1} - P_{offer})N_{new}/N_{old}$, and the return for an event study assuming this fee was already in the price, R_{event}, would be

$$
\begin{aligned}
R_{event} &= R_{discadj,ad} - (P_{ad-1} - P_{offer})N_{new}/N_{old}, \\
&= [(P_{ad} - P_{ad-1})/P_{ad-1}]N/N_{old} \quad\quad\quad (10)
\end{aligned}
$$

We suggest that this return, which is net of an ex ante estimate of the value of the discount, would provide a more accurate measure of the information effect in a placing than does either the discount-adjusted return or the return with no adjustment. However, in the remainder of the paper we assume that the choice for an event study is between these latter two returns.[10]

2.5   Combined offers

A final complication is that the majority of open offers, and some rights issues, are accompanied by a placing made at the same time as the pro rata issue, and at the same offer price. To calculate returns to shareholders during these combined offers, no adjustment should be made with respect to the shares in the placing; N_{new} in the TERP adjustment should include the pro rata shares only. This is because the old shares do not carry an entitlement to participate in a placing.

The return on the AD for an event study depends on whether we adjust for the discount of the shares in the placing. The return should be measured by (9) if we adjust, and the figure for N_{new} in (9) depends on the type of offer. An open offer with the ex-day on the AD is treated the same way as a placing, so N_{new} is the total number of new shares. In a rights issue, or in an open offer with the ex-day on day AD+1, the return on the AD is measured by (9) with N_{new} the number of shares in the placing only. On the ex-day the return is measured by (9) with N_{new} the number of shares in the rights issue or open offer. But if $P_{ad} < P_{offer}$, N_{new} in (9) is always the total number of new shares for the return on the AD.

If we do not adjust for the discount of the placing shares, then the presence of an accompanying placing makes no difference to the returns for an event study. The returns are unadjusted except for the ex-day, for which the discount-adjusted return is calculated, with N_{new} equal to the number of shares in the rights issue or open offer only.

2.6   Summary and numerical example

Table 1 summarises our conclusions about how to calculate the returns on the AD and ex-day, assuming that discount-adjusted returns are calculated. Some of the calculations of the returns on the AD are illustrated in Example 1. This shows the returns on the AD in an equivalent rights issue, open offer (with ex-day on the AD), and placing, given three different

changes in equity value on the AD. The example illustrates what happens with and without the adjustment for the discount in a placing, and spells out what is implied by the view that the discount is a predictable fee.

Table 1 and Example 1 around here

3. Effect of adjustments on abnormal returns

3.1 Sample and method

We now measure the impact of the adjustments on abnormal returns (ARs) on announcement, using a sample of 261 UK SEOs made during 2002-06. The purpose is to illustrate the impact of the choice of method of calculating returns on actual event-study results. The event-study method used is simple; other methods could equally well be used, and we would not expect the findings to be especially sensitive to the choices made with respect to aspects of event-study method that are separate from the method of calculating the share returns. In particular, the choice of model of expected returns makes little difference to the results of short-horizon studies, as Fama (1998) observes. We shall see, however, that the way the share returns are calculated can make a large difference.

The sample consists of 47 rights issues, 134 open offers and 80 placings. To be included, an SEO had to have a prospectus and the requisite price data in Datastream, with trading in the shares not suspended. Datastream, owned by Thomson Reuters, is widely used for research that calls for UK price and accounting data. Nine of the open offers and nine of the placings were made at the pre-announcement midpoint market price or at a small premium. In the 244 offers made at a discount to the price at AD–1, the mean (median) discounts are 36.0% (34.9%) in the rights issues, 17.1% (9.8%) in the open offers, and 15.1% (10.1%) in the placings. The source of the information about each issue is the prospectus, except that the ex-dates are from the London Share Price Database (LSPD), which is maintained by London Business School. Details regarding ex-dates and accompanying placings are shown in Table 2. Two thirds of the open offers are accompanied by a 'firm' (non pro rata) placing, and on average these firm placings are approximately the same size as the open offers they accompany.

Table 2 around here

We calculate the AR for a given share as the market-adjusted return over three days centred on the AD:

$$AR_\tau = R_\tau - R_{M,\tau} \tag{11}$$

where $\tau = $ AD–1 to AD+1 and the market return is given by

$$R_{M,\tau} = \ln(M_{ad+1}/M_{ad-2})$$

where M_t is the value of the FT-SE All-Share Index at the close of day t. The AD is when the issue is first announced in the Regulatory News Service, which is occasionally before the date of the prospectus. The calculation of the three-day share return, R_τ, depends on the type of return. The return using Datastream's adjusted prices (code P), $R_{DS,\tau}$, is

$$R_{DS,\tau} = \ln(P_{DS,ad+1}/P_{DS,ad-2}) \tag{12}$$

where $P_{DS,t}$ is the adjusted price for day t. The adjusted prices are supposed to incorporate the TERP adjustment, for the shares in rights issues and open offers at a discount to P_{ex-1}. There is no adjustment for placings, nor for the shares in the firm-placing component of combined offers. To check Datastream's adjustments, we calculate our own return under the TERP adjustment, $R_{terpadj,\tau}$:

$$R_{terpadj,\tau} = \ln[P_{ad+1}/(P_{ad-2} \times TERP/P_{ex-1})] \tag{13, from eq. (5)}$$

where P_t is the unadjusted price from Datastream (code UP). If the ex-day is after AD+1, or there is no ex-day because the offer is a placing, the return to shareholders is

$$R_\tau = \ln(P_{ad+1}/(P_{ad-2})$$

The discount-adjusted return is

$$R_{discadj,\tau} = \ln[P_{ad+1} + (P_{ad+1} - P_{offer})N_{new}/N_{old}]/P_{ad-2} \tag{14, from eq. (9)}$$

for placings, open offers, and for rights issues with the ex-day on AD+1 or accompanied by a placing. N_{new} in (14) is the total number of shares in the issue except in the case of a rights issue accompanied by a placing, with the ex-day after AD+1, in which case N_{new} is the number of shares in the accompanying placing. For rights issues and open offers with the ex-day after AD+1, the return for an event study is

$$R_\tau = \ln(P_{ad+1}/P_{ad-2})$$

In several cases the company implemented a share consolidation between the announcement and the date when the new shares were issued. In these cases the unadjusted prices are multiplied by the consolidation factor (for example, 100 times if one share replaces 100 pre-consolidation shares), so that the unadjusted but consolidated market prices are on the same scale as the offer price.

Table 3 around here

17

3.2   Market reaction by type of offer

Table 3 shows the three-day average abnormal returns (AARs) by type of offer. In order to reduce the influence of outlying observations, the absolute value of ARs is capped at 30%. There are 31 discount-adjusted ARs with absolute values in excess of 30%. The results are qualitatively similar without the cap.[11]

The most striking finding is that the AARs for open offers and placings are approximately zero using Datastream's adjusted prices, whereas they exceed +5% using discount-adjusted returns. The differences are economically and statistically significant. The reason for the differences is that there is a positive information effect (equity value rises) in the majority of cases, some of which is captured by the new shares. The information effect is fully incorporated in the discount-adjusted return of the old shares, but not in either the unadjusted or TERP-adjusted return.

In addition, the returns for open offers are slightly biased downwards using Datastream's adjusted prices. The AAR for open offers using the TERP adjustment is 1.8%, compared with 1.0% using Datastream's adjusted prices, though the difference is not significant. Datastream should and usually does make the TERP adjustment, but in some cases the adjustment is missing or incorrect, given our information on the ex-dates and terms of offers. 125 of the open offers were made at a discount to the pre-announcement price. Datastream makes no adjustment for ten of them and for a further 18 the adjustment factor is at least 1.005 times higher (nearer to one) than we calculate the correct factor to be. Both errors cause downward bias in the ARs. In seven cases the adjustment factor is below 0.995 times what it should be, which causes upward bias in the ARs. The overall effect is the downward bias in the AAR for open offers of 0.8 percentage points that we have noted. This problem has also been identified by Armitage & Capstaff (2009) and Espenlaub, Iqbal & Strong (2009). The latter note that the LSPD records the correct TERP adjustment factor in open offers. In their sample of open offers, from 1991-95, the AAR increases by 4.2% when returns are calculated using the LSPD adjustment factors. This increase is much larger than in our sample, probably because Datastream's adjusted prices do not incorporate adjustments for *any* open offers before 2002.[12]

The AAR for rights issues is –3.0% using Datastream's adjusted prices, and –0.4% using discount-adjusted returns; neither is significantly different from zero at the 10% level. Much of the difference is due to the presence of five rights issues that were accompanied by placings, at very large discounts. The discounts appeared to cause large falls in price on

announcement, which did not reflect a fall in equity value gross of the value of the discount for the shares in the placing. If these five issues are excluded, the discount-adjusted AAR for rights issues is –2.0%. The discount-adjusted abnormal returns are only different for the minority of rights issues with an ex-day on AD+1.

Datastream's adjustment before the ex-day in rights issues was also checked. In six of the 47 rights issues the adjustment factor is at least 1.005 times higher than we calculate it should be, and in five it is below 0.995 times what it should be. The impact on the average ex-day return is –0.5%. So there is less error and less bias in Datastream's TERP adjustments for rights issues than for open offers. The effect of Datastream's apparent errors on the announcement AAR for rights issues turns out to be miniscule (<0.1%). This is because only 12 of the 47 rights issues have the ex-day on AD+1, and so they are included in our event period, and only one of these 12 has a (slightly) incorrect TERP adjustment. Errors of adjustment if the ex-day is after the event period make no difference to the announcement AR, because both of the prices in (12) have been multiplied by the adjustment factor, and so any error is cancelled out.

The results of previous event studies of UK SEOs are summarised in Table 4. All use TERP-adjusted prices from Extel[13] or Datastream, with no further adjustment, except for Espenlaub et al (2009) who apply the TERP adjustment from LSPD to Datastream's unadjusted prices. A general finding is that the AAR for open offers and placings is higher than for rights issues, and the results in the current paper support that finding. However, the announcement AARs for open offers and placings in previous studies are not adjusted for discounts. So the contrast in market reaction between these offers and rights issues is greater than has previously been thought, if the reaction is calculated gross of the value of the discount. Slovin et al (2000) argue that the contrast exists because the certification of issuer value by the underwriters is less effective in rights issues than in placings, because the underwriting bank in rights issues bears less risk of loss. Another possibility is that the AAR is positive for open offers and placings because the market knows that, by the time the issue is announced, the shares have been placed with investors with private information about the issuer, who are willing to buy at the offer price. So in effect there is certification by the placees (Armitage, 2002, 2010).

Table 4 around here

Our finding of a significant AAR for open offers of 1.8% using the TERP adjustment tallies approximately with the significant AARs of 2.0% for open offers reported in Armitage (2002), and 4.0% in Korteweg & Renneboog (2003). Armitage used adjusted prices from Extel rather than Datastream, and Korteweg & Renneboog may also have used Extel. So it appears that the TERP adjustments in Extel were less biased than those in Datastream, as Armitage and Capstaff (2008) conjecture. However, the Extel database is no longer available.

Our results suggest that, if returns are adjusted for discounts, about five percentage points should be added to the AARs for placings and open offers in previous studies (three points if the AAR for open offers was calculated using Extel prices). The addition would be about ten percentage points if our abnormal returns were not capped at 30% (previous studies apparently do not exclude small shares or outlying ARs, except Espenlaub et al, 2009). Against this, the discounts in our sample are somewhat deeper than those in earlier samples. The addition means that the discount-adjusted AARs for open offers and placings are in the range 4% to 9%, rather than –1% to 4%. The ARs for samples of rights issues that include issues accompanied by a placing are also likely to be biased downwards.

4.3   An example of the impact of adjustment: ARs and discounts

The choice of method for calculating event-study ARs can affect the results of correlation and regression analyses, as well as the size and sign of AARs, especially when the discount is an explanatory variable. Table 5 reports correlation coefficients between ARs and discounts to the pre-announcement market price. Using Datastream's adjusted prices, there is a significant negative correlation for all three types of offer; a larger (deeper) discount is associated with a lower AR on announcement. The correlations are especially negative for open offers (–0.38) and placings (–0.43). Datastream's adjusted prices incorporate the TERP adjustment for shares in open offers, and no adjustment for shares in placings. It appears that some of the negative correlation for open offers is due to apparent errors in Datastream's TERP adjustments. The correlation between AR and discount using our own TERP-adjusted returns is –0.22 (still significant at the 1% level), compared with –0.38 using Datastream's TERP-adjusted returns.

Using discount-adjusted ARs, the correlation is positive for open offers and placings, and less negative for rights issues, though it is not significantly different from zero at the 10% level for any type of offer. For rights issues the less negative correlation using discount-adjusted returns is due mainly to the substantial change in the returns for the five issues accompanied by a placing.

We see that whether a deeper discount is viewed as a negative signal, ie has a negative impact on equity value, depends on the view taken about how the information effect should be measured. Previous studies have found that a deeper discount in open offers and placings is associated with a lower AR on announcement (Slovin et al, 2000; Armitage; 2002; Korteweg & Renneboog, 2003; Balachandran et al, 2009). But they do not calculate discount-adjusted returns. We find that the significant negative correlation disappears when discount-adjusted returns are used.

Table 5 around here

5. Summary and conclusion

The calculation of returns during SEOs requires care if the offers are made at a price which differs from the market price. The paper examines the calculations for the three types of offer currently in use in the UK, together with combined offers (rights issue plus placing; open offer plus placing), and sets out formulae for the returns to shareholders and returns for an event study. Returns for an event study are designed to measure the information effect (change in equity value) per old share resulting from the announcement of the SEO. When new shares are about to be issued, the returns to shareholders may not measure correctly the change in the value of the issuer's equity. So the calculation of the return for an event study can be different from the calculation of the return to shareholders. Whether the calculation is different depends on the type of offer, and on how the researcher believes that the information effect should be measured.

Use of a discount-adjusted return (equation (9)) assumes that the information effect should be measured gross of the transfer of wealth to buyers caused by the discount. We argue that the return on the ex-rights day for an event study in a rights issue or open offer should be the discounted-adjusted return, rather than the conventional TERP-adjusted return (equation (5)). This is because the shares lose on the ex-day their valuable entitlement to buy new shares at a discount, and any given shareholder can capture all of the value of the discount by subscribing to the shares to which they are entitled; the discount is not a fee to buyers that shareholders are forced to pay. So the value of the entitlement per old share should be included in the ex-day return for an event study. We show that the TERP-adjusted return does not measure correctly the value of the entitlement per old share, whereas the discount-adjusted return does measure this correctly.

The position is less clear in the case of placings, because shareholders do not have the right to subscribe in a placing. The choice between using the unadjusted return in an event study, or the discount-adjusted return, depends on whether the discount is viewed as providing a predictable fee to buyers. If the fee is predicted, its value is already reflected in the pre-announcement share price. Then if the discount in relation to the post-announcement price in a given offer is as predicted, and the offer itself is not a surprise, the discount should not affect the share price on announcement and no adjustment to returns is warranted. If the discount is unexpected, the share price should be lower when the discount is announced, and the discount-adjusted return should be used to measure the information effect. The presence of a discount which is a fee is possibly less predictable when there are alternative offer methods in use in which the discount is not a fee. We suggest that, even if the discount is viewed as a predictable fee, an ex ante estimate of its value should be used rather than the ex post value which implicitly is used when returns are not adjusted. Such an ex post estimate of the discount is very variable in practice, and will be negative if $P_{ad} < P_{offer}$. An adjusted return that measures the information effect using an ex ante estimate of the discount is given by equation (10).

The paper also studies the ex-day return to shareholders in rights issues and open offers. This is a different calculation from the return for an event study. We show that the ex-day return to a shareholder depends on whether the holder invests new cash to subscribe for all the new shares to which they are entitled, or does not invest but sells rights or old shares. The TERP-adjusted return on the ex-day is exactly correct either if there is no change in equity value on the ex-day, which is a special case, or if the shareholder subscribes immediately to the new shares to which they are entitled. It is not the return from a buy-and-hold strategy, in which no new cash is invested. We present the buy-and-hold return in the Appendix but we note that it is less convenient to calculate than the TERP-adjusted return.

The paper shows empirically that the choice made about the method of calculating returns makes a substantial difference to the average returns and cross-section of returns during an SEO. We find in our sample that using discount-adjusted returns results in average abnormal returns on the announcement of open offers and placings that are about five percentage points higher than returns from Datastream's prices adjusted for capital changes, after capping the impact of outlying abnormal returns. In addition, which calculation of returns is used is likely to have an impact on the results of cross-sectional analyses with the announcement abnormal return as the dependant variable, especially when the discount is an explanatory variable. There is a strong negative correlation in open offers and placings

between the abnormal return and the size (depth) of the discount when TERP-adjusted prices are used, as is standard practice in previous studies. TERP-adjusted prices incorporate the TERP adjustment for shares in an open offer, and no adjustment for shares in a placing. The negative correlation between abnormal return and discount disappears when using discount-adjusted returns.

No previous event study of UK SEOs has used discount-adjusted returns. There is a case for following the practice of several US studies, and calculating returns both with and without adjustment for the discount, as detailed in Table 1. The case is especially strong for open offers. We argue that adjustment for the discount of shares in an open offer or rights issue is clearly warranted when calculating the ex-day return, and the adjustment is likely to make a material difference to event-study results for open offers, since the ex-day is usually the announcement day.

The same or similar considerations will arise in the calculation of returns during SEOs in other countries. Researchers should take due account of the terms of the offers in their samples when calculating returns, and should check the adjustments for discounts, if any, that have been made in the price data they are using. They need to decide which type of returns they wish to calculate. For open offers and placings, and for rights issues accompanied by a placing, how the wealth transfer to buyers is treated is likely to make a substantial difference to the results.

Appendix: alternatives to the TERP adjustment in rights issues and open offers

In a rights issue the shareholder can sell rights on the market during the offer period. The return to a nonsubscriber, who sells all their rights at the end of the ex-day, is

$$R_{nonsubscriber,ex} \quad = \quad (P_{ex} + Ent_{ex})/P_{ex-1} \; - \; 1 \qquad\qquad (A1)$$

This differs from $R_{terpadj,ex}$ in (5); the return in (A1) exceeds (5) when $P_{ex} > TERP$, ie when equity value rises, and is lower than (5) when equity value falls.[14] So an alternative to the TERP adjustment would be to use (A1); that is, to make no adjustment to prices before the ex-day, and to add Ent_{ex} to P_{ex} when calculating the ex-day return.[15]

A further possibility is that the shareholder neither invests nor realises cash, but sells rights and uses the proceeds to subscribe for new shares at the end of the ex-day. It turns out that this results in the same ex-day return as the return for a nonsubscriber. Let $f_{neutral}^{rightsissue}$ be the fraction of a new share obtained per old share via a cash-neutral strategy in which the holder sells the proportion of their rights that enables all the remaining rights to be taken up with the proceeds:

$$f_{neutral}^{rightsissue} \quad = \quad (1 - P_{offer}/P_{ex})N_{new}/N_{old}$$

P_{offer}/P_{ex} is the proportion of the rights required to be sold to implement the strategy.[16] So the return on a shareholding under the cash-neutral strategy, $R_{neutral}^{rightsissue}$, is

$$R_{neutral}^{rightsissue} \quad = \quad P_{ex}(1 + f_{neutral}^{rightsissue})/P_{ex-1} - 1$$
$$= \quad (P_{ex} + Ent_{ex})/P_{ex-1} - 1 \qquad\qquad (A1)$$

So the return in (A1) is the buy-and-hold return. The difference between the two choices is that selling all the rights results in the shareholder realising cash and owning fewer shares than they end up owning under the cash-neutral strategy.

A drawback of (A1) is that it involves a special calculation for the ex-day. Returns using the TERP adjustment are easier to calculate; once the prices before the ex-day have been adjusted, the return calculation for the ex-day is no different from that for other days. Another worry about (A1) is that it ignores the transaction cost of selling rights. Armitage (2007) presents evidence that the cost of selling very large blocks of rights is at least 50% of the rights' value, in order to provide the buyers of the new shares with an acceptable discount to the price of the old shares. In view of these concerns, it seems preferable for the ex-day return to a shareholder to be calculated by $R_{terpadj,ex}$.

In an open offer the shareholder must sell shares rather then rights in order to obtain a cash-neutral subscription. The entitlements attached to shares sold on the ex-date can be

subscribed for (but not sold) by the selling shareholder. The number of new shares bought per old share in the original holding is

$$f_{neutral}^{openoffer} \quad = \quad N_{new}/N_{old}, \text{ or } P_{ex}/P_{offer} \text{ if selling all the old shares does not raise}$$

enough cash to enable the purchase of all the holder's entitlement shares.

The ex-day return on each old share, ignoring the extra return from buying new shares, is $P_{ex}/P_{ex-1} - 1$, whether or not the share is sold. Each new share bought provides an additional return of $(P_{ex} - P_{offer})/P_{ex-1}$. So the return to a shareholder from the cash-neutral strategy is given by

$$R_{neutral}^{openoffer} \quad = \quad [P_{ex} + f_{neutral}^{openoffer} (P_{ex} - P_{offer})]/P_{ex-1} - 1$$

This is the same as (A1) if selling old shares raises enough raises enough for purchase of all the shareholder's entitlement. $R_{neutral}^{openoffer}$, like $R_{neutral}^{rightsissue}$, is inconvenient to calculate compared with $R_{terpadj,ex}$.

Footnotes

1.   The focus of the paper is on the calculation of returns, not on why researchers are interested in SEO announcements. See Eckbo, Masulis and Norli (2007) for a comprehensive review of research on SEOs that includes both event-study evidence and research on the determinants of offer-price discounts.

2.   If the SEO itself is a complete surprise, then arguably the returns should be gross of the impact of both the fees for the issue and the discount, since both are unexpected costs for the company. This is discussed further in Section 2.4

3.   In a scrip issue, the number of shares in issue is increased by giving shareholders n new shares for each existing share, where n exceeds zero. In a share consolidation, the number of shares in issue is reduced by replacing n existing shares with one new share, where n exceeds one.

4.   This ignores for simplicity the fact that the present value of the new cash as at day ex–1 is slightly less than $P_{offer}N_{new}$.

5.   It is sometimes the case that the new shares are not entitled to the next dividend, *Div*. Then the TERP formula is $[(P_{ex–1}N_{old} + (P_{offer} + Div)N_{new})/N]/P_{ex–1}$.

6.   Rights are call options in which the exercise price is the offer price and the expiry date is the offer close. So in theory a right should be worth slightly more than $P_{ex} - P_{offer}$. We ignore this for simplicity.

7.   If the new shares are not entitled to the next dividend, *Div*, the value of the entitlement will be $Ent_{ex} = [P_{ex} - (P_{offer} + Div)]N_{new}/N_{old}$.

8.   An exception is Hull & Kerchner (1996), who argue that a large part of the negative average abnormal return on announcement of US firm-commitments represents the costs of issue. They measure the information effect of the SEO announcement by adding the costs of issue per old share to the prevailing share price at the end of the event window. Eckbo & Masulis (1992, p. 322) also present some results with the costs of issue added back.

9.   For example, consider a project with cash in hand of £50 and cash flows of –£50 at date 1 and +£120 at date 2. Assume a discount rate of zero. The project's value at date 0 is £120. At date 1 the £50 cash is paid out, but its value remains at £120.

10.   US firm-commitment offers, not used in the UK, are different again. There is no pro rata offer to existing shareholders. The offer price is set the day before the shares are issued, about one month *after* the AD. The offer price used to be set at or very close to the market price the day before the issue day, but discounts of a few per cent have become normal in the

USA since the 1990s. Adler & Shea (2010) discuss returns during firm commitments. They include the value of the discount in their two-day return for the issue date.

11. Twenty-one of the 31 shares with a discount-adjusted AR with an absolute value in excess of 30% are very small, with a market capitalisation as at AD–1 of less than £10m. It could be argued that for such small, infrequently traded shares, the share price is a rather rough guide to the market's valuation. In some cases the issue is extremely large in relation to the pre-issue size of the company, and so the discount-adjusted AR is very sensitive to the difference $P_{ad+1} - P_{offer}$ (see eq. (14)).

12. Other errors in Datastream (and CRSP) prices are documented by Ince & Porter (2006).

13. The Extel Financial database was established as an electronic database in the mid-1980s, originally to contain the company information recorded on hard-copy Extel cards, which had been published since 1922. In the early 1990s the database was expanded to include share price data. Extel was eventually acquired by Thomson Reuters, who ceased to make the database available in 2005.

14. It is easy to show that the derivative of (A1) with respect to P_{ex}, $(1 + N_{new}/N_{old})/P_{ex-1}$, exceeds the derivative of (5) with respect to P_{ex}, $1/TERP$. With no change in equity value, P_{ex} = $TERP$ and (A1) = (5) = 0. Both (5) and (A1) switch sign at this value for P_{ex}.

15. What if the shareholder sells their rights at the start of the ex-day, the instant the shares go ex-rights? The return for day ex–1 would then be $(P_{ex}^* + Ent_{ex}^*)/P_{ex-2} - 1$, where P_{ex}^* is the ex-rights price at the start of the ex-day, and $Ent_{ex}^* = (P_{ex}^* - P_{offer})N_{new}/N_{old}$. The return for the ex-day would be $P_{ex}/P_{ex}^* - 1$. If $P_{ex}^* = TERP$, the TERP adjustment is correct; otherwise the analysis is similar to that in the text.

16. Let N_j be the number of rights owned by holder j and x be the required proportion of the rights to be sold. x is found by solving

$$N_j(1 - x) = N_j x[(P_{ex} - P_{offer})/P_{offer}]$$

The left hand side is the number of rights that is retained and subscribed for if the proportion x is sold, and the right hand side is the number of new shares that can be bought from the proceeds of selling proportion x.

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Example 1
Returns on the announcement date (AD) in a rights issue, open offer, and placing

The example compares the returns in an equivalent rights issue, open offer (with ex-day on the AD), and placing, underwritten in each case, assuming three different changes in equity value (= information effect) on the AD. The formulae for the returns are summarised in Table 1 and explained in Section 3.

Assumptions

Number of old shares: N_{old}	100
Number of new shares: N_{new}	100
Equity value on AD–1: V_{ad-1}	£200
Share price before ex-date or AD: $P_{ad-1} = V_{ad-1}/N_{old}$	£2.00
Offer price: P_{offer}	£1.80
Proceeds of share issue: $P_{offer}N_{new}$	£180

Alternative equity values on ex-day or AD	*Case A*	*Case B*	*Case C*
Equity value on AD, including new cash: V_{ad}	£300	£380	£500
Change in value: $V_{ad} - P_{offer}N_{new} - V_{ad-1}$	–£80	£0	£120

Rights issue (ex-day is after AD)

	Case A	*Case B*	*Case C*
Price on AD: P_{ad-1} + change in value/N_{old} if change on AD $\geq$ –£20; V_{ad}/N if change $<$ –£20[1]	£1.50	£2.00	£3.20
Return to shareholder: $P_{ad}/P_{ad-1} - 1$	–25.0%	0.0%	60.0%
Discount-adjusted return: $P_{ad}/P_{ad-1} - 1$; $[(P_{ad} - P_{ad-1}) + (P_{ad} - P_{offer})N_{new}/N_{old}]/P_{ad-1}$ if $P_{ad} < P_{offer}$	–40.0%	0.0%	60.0%

Open offer (ex-day is same as AD)

	Case A	*Case B*	*Case C*
Price on AD: $P_{ad} = P_{ex} = V_{ex}/N$	£1.50	£1.90	£2.50
TERP: $(P_{ex-1}N_{old} + P_{offer}N_{new})/N$	£1.90	£1.90	£1.90
Return to shareholder (subscriber): $P_{ex}/TERP - 1$; $P_{ex}/P_{ex-1} - 1$ if $P_{ex} < P_{offer}$	–25.0%	0.0%	31.6%

Placing (no ex-day)

	Case A	*Case B*	*Case C*
Price on AD: $P_{ad} = V_{ad}/N$	£1.50	£1.90	£2.50
Return to shareholder (nonsubscriber): $P_{ad}/P_{ad-1} - 1$	–25.0%	–5.0%	25.0%
Discount-adjusted return in an open offer or placing: $[(P_{ad} - P_{ad-1}) + (P_{ad} - P_{offer})N_{new}/N_{old}]/P_{ad-1}$	–40.0%	0.0%	60.0%

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[1]If the change in value is below –£20, $P_{ad} < P_{offer}$, and the relationship between V_{ad} and P_{ad} changes. See Section 2.2.   Continued...

Example 1 continued

Discussion. The pre-announcement value is £200, the new cash raised is £180, and the discount to the pre-announcement price is 10%. The change in equity value on the AD is –£80 in Case A, £0 in Case B, and £120 in Case C. The discount-adjusted returns are, respectively, –40.0%, 0.0% and +60.0%, ie they are the change in equity value as a percentage of the pre-announcement value. The returns to shareholders depend on the type of offer, as we now explain.

Case A. The change in equity value is –40%. The share price on the AD falls 25% to £1.50 in all three types of offer, which is below the offer price. Shareholders are assumed not to subscribe, and the return to a (nonsubscribing) shareholder is –25% in each offer. The underwriters or placees share some of the loss in value, since they are assumed to have to buy new shares at the offer price. Had the offer not been underwritten, the share price might have fallen by as much as 40%, reflecting the underlying percentage fall in equity value, and reflecting the likelihood that no new shares would be issued.

Case B. There is no change in equity value. The return to a shareholder is 0% in the rights issue and 0% in the open offer (for a subscriber). It is –5% in the placing, because shareholders do not have the right to subscribe, and with no change in equity value the share price falls by the value per old share of the discount.

Case C. The gain in equity value is 60%. This is also the return to a shareholder in the rights issue; all the information effect on the AD is captured by the old shares, because the AD is before the ex-day. The return to a subscriber in the open offer is only 32%, and the shortfall compared with 60% arises because, under the TERP adjustment, the measured gain per old share is only $P_{ex} - TERP = 60p$, rather than 120p when the full gain in value is assigned to the old shares via the discount-adjusted return. The cost of an old share is the TERP (= £1.90) under the TERP adjustment, rather than P_{ex-1} (= £2.00). We are comparing 120p/200p = 60% with 60p/190p = 32%. The return to a shareholder in the placing is lower still, at 25%. Not only does the non-purchasing shareholder miss 60p per old share of the gain in value on announcement, but the discount transfers $(TERP - P_{offer})N_{new}/N_{old} = 10p$ per old share to the new shares. So the return is lower by 70p/200p = 35 percentage points than the discount-adjusted return.

Alternative view for placings: the discount as a predictable fee. Suppose now that the ex post value of the discount in a placing is viewed as a fee that is already reflected in the share price. The company is assumed to anticipate the change in share price on announcement, and to set the offer price to provide the predicted fee. This implies that the return for an event study does not involve adjustment for the discount, and that the changes in equity value are measured net of the value of the discount.

One way to represent this is to imagine that the buyers pay the full post-announcement share price, and at the same time receive a cash payment from the company equal to the value of the discount. The cash payment is predicted and therefore does not affect the share price. The three cases would then look as follows.

	Case A	*Case B*	*Case C*
Price on AD	£1.50	£1.90	£2.50
Offer price	£1.80	£1.80	£1.80
Equity value on AD, including new cash	£300	£380	£500
Less new cash assuming 100 shares bought at price on AD	£150	£190	£250
Less equity value on AD–1	£200	£200	£200
Equals measured change in equity value	–£50	–£10	£50
As a percentage of equity value on AD–1 (= unadjusted return)	–25%	–5%	25%
Assumed cash payment to buyers (= value of discount)	£–30	£10	£70

In Case C, for example, the new shares have a market value of £250, although the new investors only contribute £180. So the value of the discount is £70. The equity value will not fall by £70 on announcement, in the absence of any information effect, because the market is assumed to expect a discount worth £70. To capture this, the change in equity value is measured as £50 rather than £120. In Case A the offer is at a premium ex post; £30 is paid by buyers to the company. The change in equity value is measured as –£50 rather than –£80. In this case the pre-announcement share price is assumed, perhaps implausibly, to incorporate an expected sum paid to the company.

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Table 1
Returns to shareholders and returns for an event study

The table summarises the methods presented in Sections 2.2 to 2.5 of calculating the percentage returns on the AD and ex-day in rights issues, open offers, placings, and rights and open offers combined with a placing. The returns are defined as follows: unadjusted return on the AD: $R_{ad} = P_{ad}/P_{ad-1} - 1$; unadjusted return on the ex-day: $R_{ex} = P_{ex}/P_{ex-1} - 1$; return to shareholders on the ex-day with TERP adjustment: $R_{terpadj,ex} = P_{ex}/TERP - 1$ (eq. (5)); discount-adjusted return on the ex-day: $R_{discadj,ex} = [(P_{ex} - P_{ex-1}) + (P_{ex} - P_{offer})N_{new}/N_{old}]/P_{ex-1}$ (eq. (9)). $R_{discadj,ad}$ is the same as $R_{discadj,ex}$, but with P_{ad} and P_{ad-1} substituted for P_{ex} and P_{ex-1}. All the prices used in the formulae are unadjusted prices.

	Return to shareholder	Return for an event study
Rights issue: AD	Unadjusted return: R_{ad}	Unadjusted return: R_{ad}, or $R_{discadj,ad}$ if $P_{ad} < P_{offer}$
Rights issue with placing: AD	Unadjusted return: R_{ad}	$R_{discadj,ad}$ with N_{new} = no. of shares in placing or with N_{new} = total no. of new shares if $P_{ad} < P_{offer}$[1]
Rights issue: ex-day (ex-day is after AD)	TERP adjustment: $R_{terpadj}$ or R_{ex} if $P_{ex-1} \leq P_{offer}$	$R_{discadj,ex}$[2]
Rights issue with placing: ex-day (ex-day is after AD)	TERP adjustment with N_{new} in $TERP$ = no. of shares issued pro rata	$R_{discadj,ex}$[2] with N_{new} = no. of shares in rights issue
Open offer: ex-day (ex-day is same as AD)	TERP adjustment: $R_{terpadj}$, or R_{ex} if $P_{ex-1} \leq P_{offer}$	$R_{discadj,ex}$
Open offer with placing: ex-day (ex-day is same as AD)	TERP adjustment: $R_{terpadj}$, or R_{ex} if $P_{ex-1} \leq P_{offer}$	$R_{discadj,ex}$[1]
Placing: AD (no ex-day)	Unadjusted return: R_{ad}	$R_{discadj,ad}$[3]

[1]Assumes adjustment is made for the discount of shares in the placing. N_{new} = number of shares in the rights issue or open offer only, if no adjustment is made.
[2]Assumes the event period includes the ex-day.
[3]Unadjusted return if no adjustment is made for the discount of shares in the placing.

Table 2
Details of types of issue

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Rights issues	47
of which	
ex date on AD+1	*12*
ex date after AD+1	*35*
accompanied by a firm placing[1]	*5*
Open offers	134
of which	
ex date on AD[2]	*110*
ex date on AD+1	*22*
ex date after AD+1	*2*
accompanied by a firm placing[1]	*89*
Placings	80
Full sample	261

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Notes

[1] A firm placing is a placing of shares that have not been offered pro rata to existing shareholders. Some rights issues and open offers include shares which have been pre-renounced; they were offered pro rata but renounced by the relevant shareholder(s) and privately placed with other investors before the offer was publicly announced. For the purposes of the current paper, pre-renounced shares are counted as part of the rights issue or open offer.

[2] The source of the ex-dates is the London Share Price Database. The ex-date or expected ex-date is only recorded in 31 of the open offer prospectuses. In seven cases the ex-dates in the prospectus and LSPD differ, and in these cases we use the LSPD date. 'The data is collected from a number of recognised sources, including the Stock Exchange Daily Official List, the Financial Times and Extel's EXSHARE service. Where possible, data is taken from more than one independent source to provide checks on its accuracy' (LSPD Reference Manual, 2009, p. 5).

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Table 3
Average abnormal returns on announcement by type of offer and by adjustment for discount

The table shows average abnormal returns (AARs) for three types of SEO made by UK companies during 2003-06, using the three methods of calculating share returns given by equations (12) to (14). The ARs are market-adjusted ARs, as in equation (12), for the period AD–1 to AD+1. The proportion positive is the proportion of ARs of at least zero. The t-statistic in italics below the AARs is $\sqrt{n}(AAR)/\text{stdev}(AR)$, and the t for the difference between two AARs is $(AAR_1 - AAR_2)/\sqrt{[\text{var}(AR_1)/n_1 + \text{var}(AR_2)/n_2]}$, where n_1 is the number of issues in the first sample.

Method of calculating returns	Rights issues AAR (%)	Prop'n positive	Open offers AAR (%)	Prop'n positive	Placings AAR (%)	Prop'n positive	Open offers less rights issues	Placings less rights issues	Placings less open offers
(i) Rtns using Datastream's adjusted prices (eq. (12))	–2.97 *–1.62*	.38	0.95 *1.01*	.54	–1.08 *–0.81*	.56	*1.90*	*0.83*	*–1.24*
(ii) Rtns using TERP adjustment (eq. (13))	–2.98 *–1.63*	.38	1.79 *2.24*	.59	na	na	*2.31*	*na*	*na*
(iii) Discount-adjusted rtns (eq. (14))	–0.39 *–0.20*	.43	4.98 *4.31*	.65	5.04 *3.26*	.69	*2.61*	*2.39*	*0.04*
t-statistic for (ii) – (i)	*0.00*		*0.68*		*na*				
t-statistic for (iii) – (i)	*0.97*		*2.70*		*2.99*				
Number in sample	47		134		80				

Table 4
Average abnormal returns in previous event studies of UK rights issues, open offers and placings

The data provider's adjusted prices were used, or are assumed to have been used, in all the papers except Espenlaub et al (2009). *** (**) (*) = significant at the 1% (5%) (10%) level, as reported by the relevant authors.

	Sample period	Event period (AD is 0)	Rights issues AAR	Open offers AAR	Placings AAR	Data provider
Burton, Lonie & Power (1999)	1989-91	–1 to 0	–7.8%**	–0.6% (non-rights issues)		Not stated
Slovin, Sushka & Lai (2000)	1986-94	–1 to 0	–3.1%***		3.3%***	Extel
Armitage (2002)	1985-96	–1 to 0	–2.2%***	2.0%***		Extel
Korteweg & Renneboog (2003)	1992-99	–1 to +1	–1.8%*	4.1%***	1.6%	Datastream & Extel
Barnes & Walker (2006)	1989-98	–1 to +1	–1.0%		0.6%	Datastream
Iqbal, Espenlaub & Strong (2009)	1991-95	–1 to 0		–1.1%		Datastream
Espenlaub, Iqbal & Strong (2009)	1991-95	–1 to 0		2.95% 'significant'	Datastream's unadjusted prices with separate TERP adjustment	
Balachandran et al (2009)	1996-05	–1 to +1	–1.6%***		–0.2%	Datastream

Table 5
Correlations between abnormal returns and discounts

The table shows correlation coefficients between announcement ARs in our sample calculated using the returns in equations (12) to (14), and discounts or premiums given by $(P_{ad-1} - P_{offer})/P_{ad-1}$. The t-statistic is $correl\sqrt{[(n-2)/(1 - correl^2)]}$, where n is the number of paired observations and $correl$ is the correlation coefficient.

ARs using	Rights issues	Open offers	Placings
Datastream's adjusted prices:			
equation (12)	–0.28	–0.38	–0.43
t-statistic	*–1.95*	*–4.68*	*–4.24*
TERP adjustment:			
equation (13)	–0.28	–0.22	na
t-statistic	*–1.95*	*–2.62*	*na*
Adjustment for discount:			
equation (14)	–0.08	0.12	0.11
t-statistic	*–0.52*	*1.33*	*1.02*