

LONDON STOCK EXCHANGE

**IMPACT OF STAMP DUTY ON
THE COST OF CAPITAL OF
UK LISTED COMPANIES**

JULY 2ND 2001

OXERA

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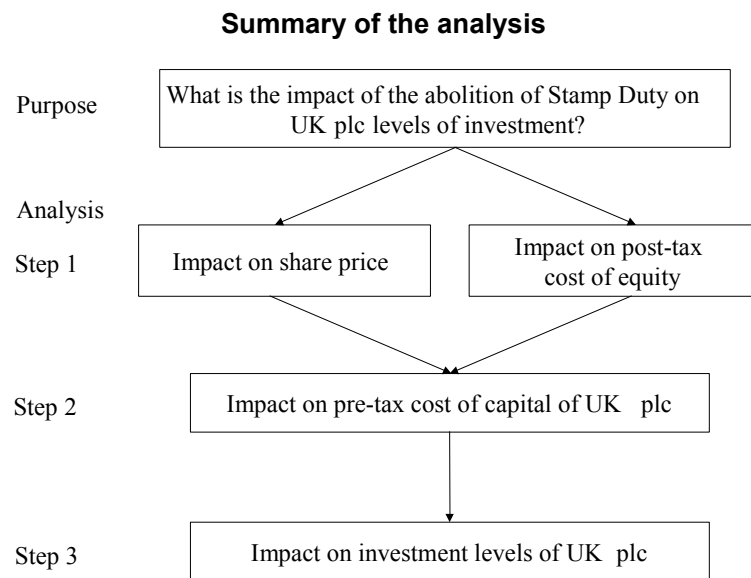
1. Introduction

The purpose of this research is to establish how the abolition of the UK Stamp Duty rate of 0.5% of transaction values would impact on the levels of investment of UK incorporated and publicly listed companies. This paper provides the technical analysis supporting the public policy statement, ‘The Impact on UK Investment and Productivity’, June 2001.

The paper draws on a variety of methodologies to estimate the potential impact of changes in stamp duty regime. In particular, it incorporates:

- all the available relevant academic literature to the best of our knowledge;
- new research conducted by OXERA on the impact of changes in Stamp Duty regime;
- knowledge acquired through interviewing a large number of practitioners. These interviews have served to inform, in particular, the importance of Stamp Duty in relation to costs of transacting and raising equity capital.

The methodology for determining the impact of Stamp Duty is set out in the figure below.



The report is structured as follows:

- section 2 defines the Stamp Duty regime in the UK and provides general data on Stamp Duty rates and revenues;
- section 3 estimates the relationship between the abolition of Stamp Duty, share prices and post-tax equity of UK listed companies, which is then translated into the change in pre-tax cost of capital;
- section 4 translates the change in the pre-tax cost of capital of UK listed companies as a result of the abolition of Stamp Duty into additional long-term fixed investment.

2. UK Stamp Duty

2.1 Description of Stamp Duty

Both Stamp Duty reserve tax (SDRT) and Stamp Duty are transfer taxes that apply to dealing in UK equities. They can also apply to dealings in certain other financial products. SDRT and Stamp Duty are alternative taxes; thus, if SDRT is paid on a sale of UK equities, for example, Stamp Duty will not be paid. The general rate of transfer chargeable securities is 0.5% of the purchase price, which is paid by the buyer of the securities. SDRT, rather than Stamp Duty, applies to dealings in UK equities which are settled in dematerialised form. In the following text, ‘Stamp Duty’ is used to refer to both SDRT and Stamp Duty.

Stamp Duty is applied on a global basis, whether the agreement which gives rise to the charge is made in the UK or elsewhere, and whether or not the parties are resident in the UK. This means that all purchase agreements relating to securities within the scope of the charge are potentially subject to Stamp Duty. For example, the charge will apply where both parties are non-UK residents and the agreement to transfer ownership of the UK incorporated shares traded on the London Stock Exchange (LSE) is made abroad.

Not all securities traded in the UK are subject to Stamp Duty—broadly speaking, only shares of companies incorporated in the UK must pay it. Securities issued by non-UK incorporated companies are exempt, except in very exceptional circumstances where the shares of a non-UK company have entered the UK register. Most debt and loan capital is excluded from the Stamp Duty charge. Futures, options and other derivatives are also almost fully exempt.

There are further exemptions from Stamp Duty payments on transactions in the securities subject to Stamp Duty. Since the introduction in October 1997 of the Stock Exchange Electronic Trading System, both market-makers and financial intermediaries trading at any UK-recognised exchange are exempt.¹

The Stamp Duty charge applies at a 0.5% rate on all purchases of UK equities unless a specific exemption applies. The charge does not generally apply where securities are issued, except in cases including when securities are issued into a depository receipt system. A higher rate (1.5%) applies when UK securities are converted into depository receipts, and when UK equities (or other securities subject to Stamp Duty) are transferred or issued into a depository receipt facility. The charge of 1.5% is intended to represent a higher ‘entry charge’ to compensate for the fact that subsequent dealings in the depository receipts themselves (which represent the underlying share held by the depository receipt issuer) are not subject to the Stamp Duty charge. There is normally no Stamp Duty charge on the re-conversion of depository receipts into the underlying UK equities.

¹ Before October 1997 only market makers were exempt from the stamp duty charges.

The rate of Stamp Duty has varied over the years. In August 1963 it was lowered from 2% to 1%, increasing to 2% in May 1974 and falling again to 1% in April 1984. In October 1986 the UK government reduced the rate to 0.5%. In comparison, there is no transaction tax in Germany and Japan. In Australia the 0.3% transaction tax will be abolished on July 1st 2001 and in USA, it is only 1/300 of 1%.²

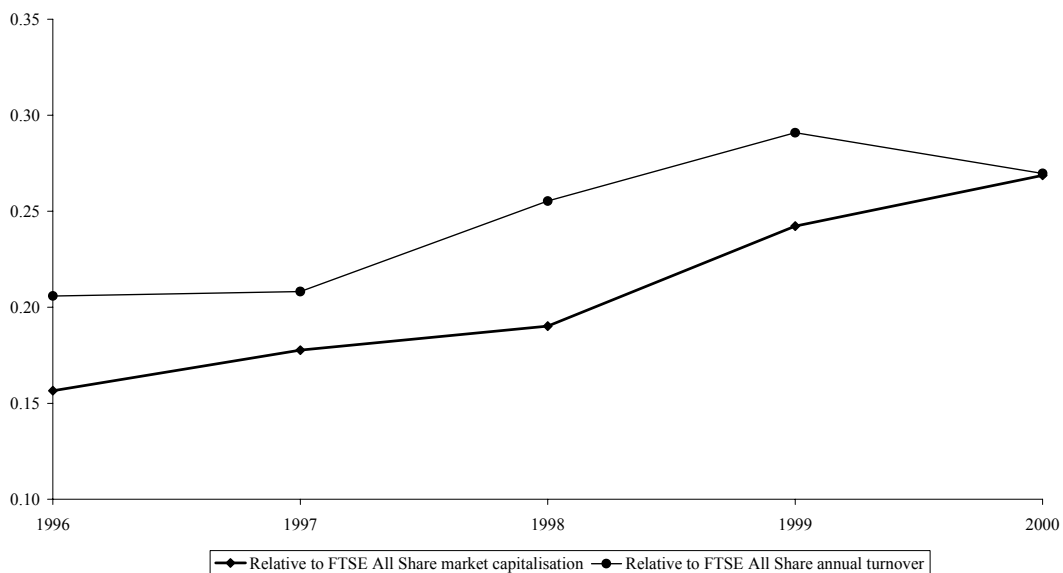
2.2 Recent trends in Stamp Duty revenues

Figure 2.1 shows two definitions of Stamp Duty charge, relative to:

- the market capitalisation of the FTSE All-share index—the ratio is defined as annual Stamp Duty receipts to the market capitalisation of the FTSE All-share index;
- the turnover of the FTSE All-share index—the ratio is defined as annual Stamp Duty receipts to the turnover of the FTSE All-share Index.

Even though over the last five years the Stamp Duty rate has remained at 0.5% of the value of the transaction, the Stamp Duty charge per value of transaction has increased from 0.21% in 1996 to around 0.27% in 2000. This increase indicates that the share of transactions that are carried out by non Stamp Duty exempt market participants is increasing, and/or turnover of UK incorporated companies is increasing relatively faster than the turnover of non-UK incorporated companies. In terms of Stamp Duty in relation to market capitalisation, the rate increased from 0.16% in 1996 to 0.27% in 2000.

² Source: London Stock Exchange.

Figure 2.1: Stamp Duty charge (%)

Source: Inland Revenue Service, LSE, Datastream and OXERA calculations.

The higher Stamp Duty rate relative to turnover, combined with an acceleration in the velocity of turnover—ie, the value of transactions expressed as a proportion of market capitalisation, which increased from 76% in 1996 to 100% in 2000—has resulted in a sharp increase in Stamp Duty revenues over the last five years (see Table 2.1).

Table 2.1: Stamp Duty revenues

Year	Stamp Duty revenues (£m)
1993/94	1,035
1994/95	1,031
1995/96	1,298
1996/97	1,408
1997/98	1,960
1998/99	2,488
1999/00	3,719
12 months to December 2000	4,686

Source: Inland Revenue Service.

3. Impact of Stamp Duty on the Cost of Equity of UK Listed Companies

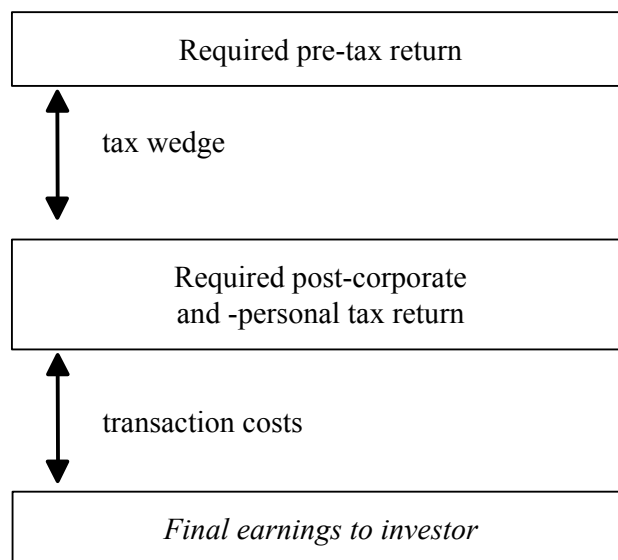
This section discusses a framework for analysing the impact of Stamp Duty on the cost of equity of UK firms. A summary of the empirical evidence on the issue then follows, based on existing academic literature and further empirical analysis conducted by OXERA.

3.1 Framework

For the purposes of this study, it is necessary to examine the extent to which equity transaction costs, such as Stamp Duty, can have a permanent impact on the cost of equity of companies (ie, the amount of profits that companies must earn in order to persuade investors to invest in that company).

A simple framework serves to illustrate this relationship. If it is assumed that investors require minimum rates of return, net of all taxes and other transaction costs, then there is a direct relationship between transaction costs and the required pre-tax return, set out in Figure 3.1 below. As illustrated in the figure, at any given year, investors receive a final return that is a function of the pre-tax earnings of the company, corporation and personal taxes, and transaction costs. In the mean-variance framework, assuming the riskiness of the security stays the same, investors will want to receive identical *final earnings*, independent of tax rates and transaction costs. Transaction costs that investors bear in any particular year will directly influence the post corporation-tax return that they require in this year, and hence the pre-tax return that firms need to earn.³ This framework applies to both direct and indirect transaction costs (see Appendix A1.1).

³ The above illustration is broadly consistent with the findings, for example, of Brennan and Subrahmanyam (1996), who report that there is a significant rate-of-return premium associated with both the fixed and variable elements of transaction costs. Therefore, transaction costs can play an important role in explaining the behaviour of the returns of assets. In such a framework, Stamp Duty is considered a direct transaction cost, in the same way as, for example, commissions and fees, are also direct costs that have an impact on the post-tax return to the investor.

Figure 3.1: Impact of transaction costs

Under an assumption that the current stamp duty of 0.5% is paid by investors on average once a year for any security they hold, abolition of this tax would reduce the required post-corporation tax annual return by 0.5% points.

Another simple example serves to illustrate the mechanics of the impact of transaction costs on share prices. Consider a stock that is traded once every year, with transaction costs of 1p per transaction. Assume that the value of a share of the stock traded without any transactions costs is £1. Assume, furthermore, that the present value of the transaction costs (discounted, say, at an 8% cost of capital), is 13.5p.⁴ In other words, the transaction costs reduce the stock price from £1 to £0.865. Now, if the trading cost declines by 0.25p to 0.75p per transaction, the present value of the costs of trading will decline to 10.1p, and the stock price will rise to £0.899, an increase of about 4%. Thus, as this example suggests, a seemingly small reduction in transaction costs can generate a substantial increase in stock prices.

It is not necessarily the case, however, that the permanent change in the share price of the company would have the same impact as the permanent reduction in the cost of equity. The permanent change of the share prices would directly influence companies' investment decisions if:

⁴ The present value (PV) of the trading costs is calculated as the discounted value of perpetual annual expected transaction costs: $PV = \sum_{i=0}^{\infty} \{E[TC_i]/(1+r)^i\}$, where t is the period, TC is transaction costs and r is the cost of capital.

- investment decisions, for example, mergers and acquisitions are made on a ‘price–earnings ratio’ basis; or
- if the marginal source of finance in the company is new equity—this is likely to be the case for high-growth companies, for example.

3.2 Empirical evidence

The results of the academic literature and further research can be split into two categories:

- studies on share-price reactions around the time of the changes in the Stamp Duty regime—a summary of the existing academic literature and the OXERA event study analysis in relation to the 1997 changes in Stamp Duty rules;
- studies on the impact on the cost of equity—a summary of the literature on the impact of changing transaction costs on the cost of equity.

3.2.1 Literature on share-price reaction

Jackson and O’Donnell (1985)

Econometric studies estimating the elasticity of share prices with respect to Stamp Duty find evidence supporting the arguments presented above. The original work was conducted by Jackson and O’Donnell in 1985. The authors argue that investors take into account the expected transactions costs as well as the expected return when deciding whether to invest in equities rather than an alternative asset. In their framework changes in transaction costs have a direct and indirect impact:

The future stream of transaction cost payments is taken into account in the price which an investor expects to receive when the equities are sold.

The effect of a reduction in transaction costs on market liquidity would also have an effect on the relative attractiveness of equities.

In order to calculate the likely size of the increase in share prices as a result of the reduction in Stamp Duty, the authors calculate the present value of the saving in transactions costs as a result of a given tax change using the present value model:

$$PV = (t' - t) \times P_0 \times \sum_{i=1}^{\infty} \{1 / (1 + d / s)^i\} \quad (3.1)$$

where $(t' - t)$ is the change in the tax rate, P_0 is the original price of the share, d is the annual discount rate minus the nominal growth rate of share prices and s is the level of turnover for the share each year.

The authors then try to predict the abnormal share-price reaction as a result of the UK Stamp Duty reduction in 1984 from 2% to 1%. They calculate the present value of

savings assuming that the nominal discount rate is 3% greater than the nominal growth of share prices, and that velocity of turnover is 0.18. These assumptions imply that a reduction in Stamp Duty from 2% to 1% would raise prices by around 7%. Alternatively, assuming that the discount rate is only 2% higher than the growth of share prices, the authors predicted that the appreciation of share prices would be 10%.

However, the model assumes 0.18 velocity.⁵ If current velocity numbers were used then results could be more significant. For example, an average UK pension fund trades its UK equities once every two years (*activity*⁶ in the UK equities = 0.51, Source: Philips and Drew (2000)), which gives a velocity of turnover of around 0.5 subject to the current stamp duty rate. Applying velocity of turnover of 0.5 to the equation (3.1), a reduction of Stamp Duty from 2% to 1% would give a predicted share price increase of 18% in the case of 3% difference between discount rate and the growth in the share prices and 26% in the case of 2% difference.

Empirical tests of Jackson and O'Donnell are based on the quarterly data over a period from 1963 Q2 to 1984 Q3. The change in the real share price is modelled as a function of the change in yield of a risk-free bond and the change in transaction costs:

$$\Delta \ln(P_{st} / P_{ct}) = c_1 + c_2 \times \Delta r - c_3 \times \Delta \ln(TC) \quad (3.2)$$

where P_{st} is the share price at time t, P_{ct} is the consumer price deflator, r is taken to be the par yield on a 20-year gilt and TC denotes transaction costs.

Equation 3.2 estimated over a full period suggests that a Stamp Duty reduction from 2% to 1% would lead to a share-price increase of 10.35%.

To summarise, on the basis of the results of the research conducted by Jackson and O'Donnell (1985), under the simplifying assumption that the velocity of turnover subject to Stamp Duty now is similar to that in the original study, the abolition of the current Stamp Duty in the UK of 0.5% would lead to a share-price appreciation of around 5%. In terms of the impact on the cost of equity, this could mean that the abolition of the Stamp Duty would lead to a reduction in the post-tax cost of equity of between 0.21 and 0.33%.⁷

Nevertheless, this impact may be underestimated because current levels of velocity of turnover are higher than the levels prevailing at the time when the Jackson and O'Donnell research was carried out. The theoretical prediction under the assumption of current levels of velocity could be as much as twice the original

⁵ Note that this is not the total velocity of turnover, but rather a ratio of turnover of FTSE All-share UK incorporated companies subject to stamp duty (ie, trades by non-market makers and non-financial intermediaries) and market capitalisation FTSE All-share UK incorporated companies.

⁶ Activity is defined as the lesser of purchases and sales divided by the mean value of a fund's holdings in the sector.

⁷ Appendix A1.2 explains how to convert share-price changes into cost of equity changes.

Jackson and O'Donnell result—ie, 0.5–0.8% reduction of the post-tax cost of equity as a result of an abolition of the 0.5% stamp duty rate.

Umlauf (1993)

In a similar study, Umlauf (1993) analyses the impact of Stamp Duty on the level of share prices and trading volume on the Stockholm Stock Exchange (SSE). In particular, the author explores the impact of the announcement of transaction tax changes that took place in Sweden in October 1983 (introduction of a round-trip tax of 1% of the value of exchanged securities) and March 1986 (increase in the tax to 2%).

The author first estimates the theoretical impact of introduction of 1% tax in 1984 and 1% tax increase in 1986. Under the assumptions that the future annual turnover rate is 27%, a perpetual dividend yield of 4% per annum, and the Gordon growth model holds,⁸ Umlauf (1993) estimates that the expected stock market index decline is 6.75% [that is, $(27\% \times 1\%)/4\% = 6.75\%$], as a result of a 1% increase in transaction tax. To bring into the context of the UK stamp duty and current levels of turnover, the prediction under this simple framework would be that the abolition of the UK rate of 0.5% would increase the stock market index by 5.6% [that is, $(50\% \times 0.5\%)/4.5\% = 5.6\%$].

The author went on to estimate empirically the theoretical predictions. The data used by Umlauf consists of continuously compounded daily and weekly Swedish All-share equity index returns for the 1980–87 sampling period. The index comprised all listed SSE stocks except those traded over the counter. The index is identical to a standard value-weighted index with the exception that in the calculation of an individual company's market capitalisation, only the price of its most recently traded share class is used. As the data on daily and weekly index dividend yields were not available to the author, the return series consisting solely of capital gains was used.

Table 3.1 (taken from Umlauf, 1993) describes the index reactions to the changes in transaction tax in Sweden. On the day of introduction of the transaction tax, the index fell by –2.2%. A test for equality of this decline with the mean daily return of the 1980–87 sampling period of 0.09% yields a t-statistic of 101, thus strongly rejecting the hypothesis that the introduction of the transaction tax had no impact on share prices. The estimated decline of –0.8% on the day when the 1986 tax increase was announced is smaller, although still substantial. The test for equality of this decline with the mean return of the sampling period yields a t-statistic of 39.

⁸ See Appendix A1.2 for an explanation of such model.

Table 3.1: Reaction of the Swedish All-share equity index to announcements of transaction tax increases (t-statistic in parentheses)

Date	Event	Index return on the day of announcement	Index return over the period of 30 days prior to announcement and announcement date
October 24th 1983	1% transaction tax announced	-2.2% (101)	-5.3% (n/a)
March 11th 1986	Transaction tax increase to 2% announced	-0.8% (39)	n/a (n/a)

Source: Umlauf (1993).

Umlauf argues, however, that the cumulative return on the index for the 30-day period up to, and including, the day of the announcement of the introduction of a 1% transaction tax in Sweden was actually -5.3%. This compares to the abnormal return of -2.2% on the day of the announcement of the introduction of a 1% Stamp Duty. The author suggests that the abnormal decline in share prices prior to the announcement was most likely a result of leakage of information, and thus constituted a part of the impact of Stamp Duty introduction. It should be noted that the author did not estimate the cumulative return over a period comprising the 20 days after the date of the announcement, as it is usually analysed (see, for example, Campbell, Lo and MacKinley, 1997). This could have therefore underestimated the impact of the transaction tax.

The share-price reaction on the day of announcement of Stamp Duty changes in Sweden suggests a modest share-price reaction to the abolition of Stamp Duty in the UK. As the author notes, however, the real impact is significantly higher, as illustrated by the abnormal returns prior to the announcement.

To summarise, according to Umlauf (1993), if the 30-day period up to the date of the announcement is considered, an increase in the transaction tax of 1% could lead to a negative share-price reaction (-5.3%). According to this research, therefore, under the simplifying assumption that the velocity of turnover subject to Stamp Duty now is similar to that in Umlauf's study, the abolition of the current rate of UK Stamp Duty of 0.5% could lead to an increase of at least 2.65% in share prices of UK incorporated companies. The resulting change in the post-tax cost of equity could be at least 0.18%.⁹

Nevertheless, using current levels of turnover in the UK, the theoretical prediction from Umlauf's model is that the abolition of the UK stamp duty of 0.5% would lead to an increase in share prices of 5.6%. This would translate into a reduction in the post-tax cost of equity of between 0.24% and 0.37%.

⁹ Appendix A1.2 explains how to convert share-price changes into cost of equity changes.

3.2.2 OXERA's analysis of the impact of the introduction of 1997 Intermediary Relief

The introduction of Intermediary Relief in the Finance Bill 1997 constitutes an important event for analysing the share-price reaction to the change in the UK Stamp Duty regime. Even though the Stamp Duty rate of 0.5% remained the same, the Relief granted tax exemption to a large number of market participants. In addition, because Stamp Duty is, in general, only applicable to transactions involving UK-registered shares, it is possible to observe the differential impact on different types of shares being transacted by, approximately, the same group of market participants using the same market mechanisms and infrastructure. This makes it easier to isolate the impact of the change in the Stamp Duty regime from other changes taking place simultaneously.

This sub-section proceeds by testing the hypothesis that the change in Stamp Duty regime resulting from the introduction of Intermediary Relief had a permanent impact on the share prices of UK incorporated companies relative to foreign companies listed in the London system.

The first step in studying the impact of the introduction of Intermediary Relief is to define the date of the announcement. Extensive literature and press search suggest that Chancellor Kenneth Clarke's statement on July 25th 1996 was the first public release of information concerning the planned change in Stamp Duty regime in October 1997. In particular, the former Chancellor stated that:

A new relief on transactions is to be introduced to replace the existing Stamp Duty exemptions for market makers and broker dealers. Key features of the new Stamp Duty exemption are:

- (i) Stamp Duty exemption will be available to intermediaries on any UK recognised investment exchange or European Economic Area regulated market;
- (ii) Relief will be limited to transactions conducted on exchange.¹⁰

This is therefore the relevant date for the purposes of the event study conducted in this analysis.

Replicating Umlauf (1993)

The first approach adopted to estimate the impact of the October 1997 change in Stamp Duty is to replicate the methodology employed by Umlauf (1993). This is used to assess the impact on share prices of the July 25th 1996 announcement of Intermediary Relief. The data for this part of the study consist of continuously compounded daily FTSE All-share equity index returns for a period from January 1st 1994 to January 1st 1998.¹¹ The daily returns include both capital gains and dividend yields of companies included in these indices.

¹⁰ HM Treasury press release, 124/96.

¹¹ Data taken from Datastream.

Table 3.2 lists announcement effects for the introduction of Intermediary Relief in 1997, but announced in 1996. The FTSE All-share index surged 0.44%. A test of equality of this increase with the mean of daily return of the 1994–98 sampling period of 0.050% and volatility of 0.0077 yields a t-statistic of 18.3 (sample size is 1,303). As a result, the hypothesis that the change in Stamp Duty regime had no impact on share prices of UK companies can be rejected with high statistical significance.

Table 3.2: Effect of change in Stamp Duty regime on the day of the announcement

Index	Event	Index returns	t-statistic
FTSE All-share	Announcement of introduction of Intermediary Relief (July 25th 1996)	+0.44%	18.3

Source: Datastream and OXERA calculations.

Using a ‘control group’

The figures presented in Table 3.2 probably underestimate the impact of change in Stamp Duty regime as market participants were arguably aware of the possibility of the change before the announcement date. Umlauf (1993), for example, found that there are clear signs that markets expect these announcements, so these numbers underestimate true cumulative abnormal returns (see Section 3.2.1). Another potential concern in relation to the methodology applied above is the extent to which changes in the Stamp Duty regime were announced in isolation of other events.

In order to account for these shortcomings, the approach taken in this study is to:

- increase the length of the event window—including the pre- and post-event period ensures that abnormal returns resulting from information leakage before the date of the announcement are considered and allows a longer period for information to be incorporated into the share prices; and
- introduce a ‘control group’—in order to control for other events around the time of the announcement, it is necessary to design a control group that would arguably capture most effects of all events influencing companies trading on the LSE except for the change in Stamp Duty regime. The differential between abnormal returns of the control group and the group of UK incorporated companies traded on the Exchange around the time of the announcement of the introduction of Intermediary Relief is likely to capture only the effect of the change in Stamp Duty regime.

The choice of the length of event window is based on Campbell, Lo and MacKinley (1997) study of abnormal returns for an event study of the information content of earning announcements. In this study, the authors use several event windows consisting of 20 pre-event days, event day and 20 post-event days.

The choice of the control group is implicit in the definition of companies that are subject to Stamp Duty:

The securities subject to Stamp Duty are referred to as ‘chargeable securities’. These are, broadly, securities issued by companies incorporated in the UK. ‘Chargeable securities’ do not include securities which are issued by non-UK incorporated companies except in very exceptional circumstances (e.g. where shares of a non-UK company are paired with the share of a UK company).¹²

The hypothesis is that, as non-UK incorporated companies traded on the LSE were not subject to Stamp Duty, the change in the Stamp Duty regime should not have had any effect on their share prices. At the same time, the sample of non-UK incorporated companies captured the general sentiment of the UK stock market around the time of the announcement.

In July 1996 there were around 448 stocks of non-UK incorporated companies on the LSE’s official list. In principle, the full sample of non-UK incorporated companies could be used for the purposes of controlling for other events influencing prices of UK companies listed on the LSE. It is, however, possible to increase the accuracy of the control group by excluding non-UK incorporated companies that had very small annual share turnover on the LSE prior to the date of announcement (ie, those that were effectively not traded on the LSE).

The criteria applied to filter non-UK incorporated companies out of the control sample are as follows:

- the company’s ordinary shares or depository receipts were listed on the LSE in July 1996;
- the one-year share turnover in London prior to July 1996 was at least 10% of the total number of shares of the company; and
- the average number of trades per day in London one-year prior to July 1996 was at least 20.

On the basis of these criteria, the sample was 41 non-UK incorporated companies.

Before proceeding with the testing of abnormal returns resulting from the change in Stamp Duty regime, it is necessary to assess the performance of the control sample prior to the announcement date. The difference between cumulative total returns of the FTSE All-share index¹³ and the sample of non-UK incorporated companies over the 12 months prior to the date of announcement was -0.6% . The hypothesis that returns of the two samples are driven by the same factors cannot be statistically rejected (t-statistic is equal

¹² LSE (1999), ‘Stamp Duty Reserve Tax Case Book’, September 13th.

¹³ The returns of UK incorporated companies listed on the LSE are approximated by returns of the FTSE All-share equity index. The fact that the FTSE All-share index includes both UK incorporated and non-UK incorporated companies can be ignored as only a very few non-UK incorporated companies have ‘a reasonable turnover’.

to -0.08).¹⁴ The very small difference in annual cumulative returns and statistically significant similarities of daily returns suggests that the returns of the non-UK incorporated companies in the control group may be driven by factors similar to those of UK incorporated companies.

To appraise the event's impact, it is necessary to measure the difference between the abnormal return of UK incorporated companies and the sample of non-UK incorporated companies. The abnormal return is the actual *ex-post* return of the security over the event window, minus the normal return of the firm over the same period. The normal return is defined as the return that would be expected if the event did not take place. There are two common choices for modelling the normal return: the *constant-mean-return model* and the *market model*. For the purposes of this study, abnormal returns are calculated using a market model with $\alpha = 0$ and $\beta = 1$ —ie, the normal returns are equal to the equity risk premium (ERP). The size of the ERP remains one of the most controversial areas of normal-returns calculations. For the purposes of this study, an ERP of 4% is chosen, which translates into a daily normal return of around 0.016%.

Cumulative abnormal returns of both the FTSE All-share index and the sample of non-UK incorporated companies are documented in Table 3.3. The cumulative abnormal return for the FTSE All-share index over the whole event window is 3.62%, while for the sample of non-UK companies, it is -4.59% . The difference between the cumulative abnormal returns clearly suggests that the change in the Stamp Duty regime has had a substantial positive impact on UK incorporated companies. The hypothesis of similarity of daily returns of both groups over the event window can be rejected with high statistical significance (t-statistic is equal to 2.94).

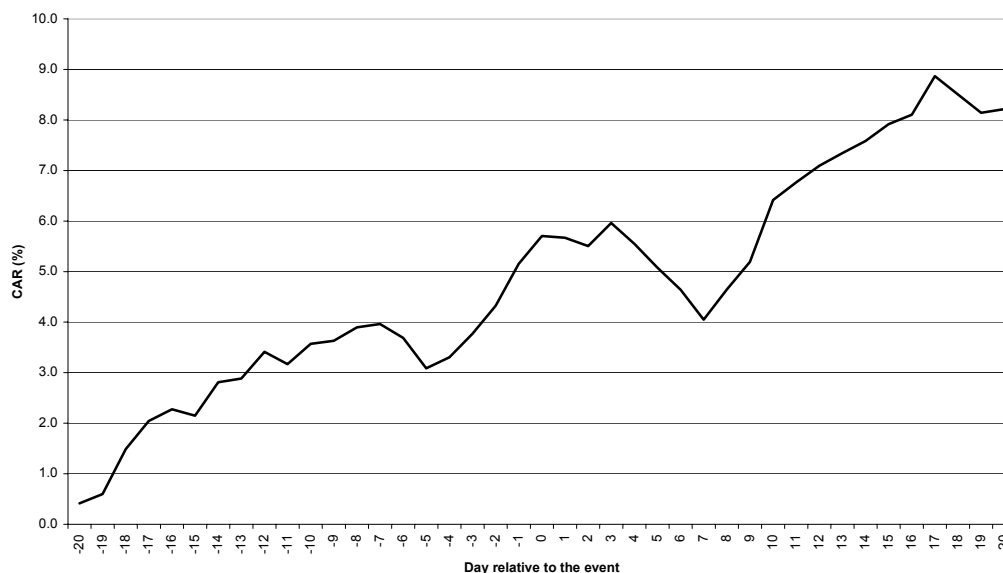
The results suggest that the total impact of the introduction of the Intermediary Relief on the share prices of UK incorporated relative to non-UK incorporated companies could have been as high as 8.21%. As with the results described in Umlauf (1993), there has been a substantial impact on the share prices of UK incorporated companies prior to the announcement of the changes in Stamp Duty regime, which can be explained by leakage of information about the announcement. The impact of the Intermediary Relief announcement (defined as the difference between the cumulative abnormal returns of UK incorporated and non-UK incorporated companies) is shown in Table 3.3 and Figure 3.2 below.

¹⁴ Null hypothesis—the difference between the mean daily return of the FTSE All-share index and the sample of non-UK incorporated companies is equal to zero (assuming 41 matched daily observation).

Table 3.3: Cumulative abnormal returns (%)

	FTSE All-share	Non-UK sample	Difference
20 days before the event (including)	-1.67	-7.37	5.70
event (not including) to 20 days after the event	5.29	2.78	2.51
20 days before the event to 20 days after it	3.62	-4.59	8.21

Source: Datastream and OXERA calculations.

Figure 3.2: Difference between cumulative abnormal returns of FTSE All-share index and the sample of non-UK companies

Source: Datastream and OXERA calculations.

Summary

The null hypothesis that the announcement in July 1996 of the change in the Stamp Duty regime has no impact on the price of the relevant securities can be confidentially rejected. Indeed, the divergence of the performance of the two groups is wide, at 8% of share prices. However, the detailed interpretation deserves a careful discussion.

The change in the taxation base rather than the tax rate means that the reduction in transaction costs arising directly from the tax change cannot be measured directly. The average decrease in direct per-transaction costs may not have been particularly large. However, there may have been additional impacts on liquidity independent of direct cost changes as more market intermediaries were brought into the tax exemption.

Given the likely decrease in transaction costs, the observed share-price impact is large. There are a number of potential reasons for this. In particular, the velocity of circulation of equities had increased significantly between the earlier event studies and 1996, which implies that the same change in Stamp Duty would have a greater impact on share prices.

Although a general reduction in Stamp Duty would not have exactly the same impact on trading as the removal of intermediaries from the tax base, **this event does still indicate that there would be a significant impact on the share price of UK companies, and that this impact would be larger than a simple scaling of the previous events when that tax rate has been changed.**

3.2.3 Existing literature on impact on cost of equity

Domovitz and Steil (2001)

Domovitz and Steil (2001) examine the impact of technological innovation in securities' trading structures on the cost of equity trading and the cost of corporate equity capital. The study covers the USA and a range of European and Latin American countries. For the purposes of this study, only the results relating to the USA and European countries are considered, as it can be argued that it is unlikely that the sensitivity in Latin American countries would be similar to that prevailing in the UK.

The transaction costs in the study are defined as the end-to-end transactions, including the sum of the explicit costs, such as brokerage fees, and implicit costs, such as the price impact of the trade.¹⁵ The post-tax cost of equity in a given market is estimated based on expectations of the future stream of dividends, expressed in the following form:

$$r = Div_1 / P_0 + g \quad (3.3)$$

where r is the post tax cost of equity, Div_1 is the expected dividend in the coming year, P_0 is the current price of a stock or an index, and g is the long-term growth rate of the dividend.

The authors first carry out a simple test on the correlation between the post-tax cost of equity and transaction costs in the USA and 12 European countries. They find that the correlation of trading cost with the cost of capital is positive and economically significant, regardless of the time period. The resulting correlation estimate from the sample that is pooled over time is around 0.28.

In order to control for high correlation between the trading costs and turnover, the authors then estimate the relative contributions of trading costs and turnover to the cost of capital. For this purpose, they use the following (fixed-effects) panel data estimation model:

$$y_{it} = \alpha_i + \beta_1 \times TC_{it} + \beta_2 \times T_{it} + \varepsilon_{it} \quad (3.4)$$

where y , TC and T are post-tax cost of equity capital, trading costs, and turnover, respectively, all measured in logs; i and t denotes the country and time; and α_i is a country-specific effect. Based on the cross-country data for a period of 1996–98,

¹⁵ The 'market' or 'price' impact of the transaction is the deviation of the transaction price from the 'unperturbed price' that would have prevailed had the trade not occurred.

estimates of the post-tax cost of equity elasticity to the trading costs from this specification range from 0.14 to 0.17 depending on the specification of the cost of equity estimate.¹⁶ In other words, a 10% increase in transaction costs would lead to a 1.4–1.7% increase in the post-tax cost of equity.

This study can be used to try to estimate the impact of the abolition of the current UK Stamp Duty rate of 0.5% on the cost of equity capital of UK companies, as follows. The authors estimate that the total (ie, the sum of direct and indirect) one-way equity trading costs in the UK are 55 basis points.¹⁷ Therefore, if Stamp Duty were abolished, then this would correspond to a reduction of 46% in transaction costs for the UK. Such a reduction would then lead to a 6.4–7.8% fall in the post-tax cost of equity.

Therefore, assuming that the nominal post-tax cost of equity in the UK is currently around 9.5%,¹⁸ the empirical findings of Domovitz and Steil suggest that abolishing the 0.5% Stamp Duty would lead to a fall in the post-tax cost of equity of UK companies of 0.61–0.74%.

3.2.4 The impact of liquidity Amihud and Mendelson (1986)

There is a vast literature assessing the direct impact of share liquidity on share prices and the cost of equity capital. Amihud and Mendelson (1986) attempt to examine whether changes in stock liquidity bring about changes in stock prices. They show that when transferring stock from the call to the continuous trading method (in the context of the Tel Aviv Stock Exchange), the average trading volume as a percentage of total market volume increased from 0.266% to 0.475%. More importantly, they show that this increase in liquidity resulted in the cumulative abnormal return of at least 5.5% during the period from five days before the announcement to 30 days after the actual transfer. Moreover, the actual increases in value attributable to the trading changes were almost certainly larger than this, since some stocks that were expected to be transferred experienced significant price increases prior to the announcement. Numerous subsequent contributions have confirmed the findings of this paper,¹⁹ which show a strong correlation between indirect trading costs, such as reduction in liquidity, and the cost of equity financing.

¹⁶ The authors estimate the impact under two assumptions on the dividend growth: in the first case, it is assumed that the current year's dividend is an unbiased estimate of the following year's dividend; in the second, it is assumed that the market's expectation of the following year's dividend, which is unobservable, is, on average over time, approximately equal to the actual dividend paid in the following year.

¹⁷ The authors base their transaction costs on Elkins/McSherry, who define trading costs as the cost incurred while the particular equity change hands from one investor to another. Under this approach, intermediary and market-makers' trading costs are not directly captured in the calculations of average trading costs in the market.

¹⁸ See Appendix 1.3 for underlying assumptions

¹⁹ For example, Brennan M.J. and Subrahmanyam A. (1996); Botosan, C. A. (2000); and Amihud, Y. and Mendelson H. (2000).

The Amihud and Mendelson (1986) study therefore suggests that factors that reduce the liquidity of stocks, such as transaction taxes, could lead to increases in the cost of equity of firms. **Therefore, indirect transaction costs lead to higher costs of equity for firms.**

3.3 Conclusions

The table below summarises the impact of the abolition of the 0.5 Stamp Duty rate on the post-tax cost of equity and the pre-tax cost of capital of UK incorporated firms.

Table 3.4: Summary table of the potential impact on UK companies of the abolition of the 0.5% Stamp Duty

Source	Change in the post-tax cost of equity (%)	Change in the pre-tax cost of capital (%) ¹
Cost of equity impact study		
Domovitz and Steil (2001)	0.61–0.74	0.72–0.87
Share-price impact studies		
Jackson and O'Donnell (1985), empirical estimate, velocity of 0.18	0.21–0.33	0.25–0.39
Jackson and O'Donnell (1985), theoretical prediction, velocity of 0.50 ²	0.52–0.81	0.61–0.94
Umlauf (1993), empirical estimate, velocity of 0.27	0.18	0.21
Umlauf (1993), theoretical prediction, velocity of 0.5 ²	0.24–0.37	0.28–0.44
OXERA event study	At least as high as the result predicted by Jackson and O'Donnell (1985), at current levels of velocity	At least as high as the result predicted by Jackson and O'Donnell (1985), at current levels of velocity

Note: ¹ Appendix 1.3 sets out the methodology of transformation from the post-tax cost of equity to the pre-tax cost of capital. ² OXERA calculations on the basis that velocity at current or prospective levels of trading leads to a higher impact relative to earlier studies.

- Empirical studies of Jackson and O'Donnell (1985) and Umlauf (1993) suggest that the abolition of the current Stamp Duty rate in the UK is likely to result in share-price appreciation of at least 5%, provided the similarity of expected velocity of turnover and expected growth of turnover. As the velocity of turnover subject to Stamp Duty in the UK is currently higher than in the two above studies, this result is likely to underestimate the true impact of the abolition of Stamp Duty.
- For example, applying current velocity of domestic equity assets of UK pension funds to the theoretical model of Jackson and O'Donnell (1985), the predicted share-price reaction as a result of the abolition of the 0.5% Stamp Duty is as high as 9–13%. The OXERA study confirmed that the most recent changes in the Stamp Duty regime appear to have a more significant impact than previous studies have estimated.
- A 5% share appreciation would result in a reduction in the post-tax cost of equity of 0.33% according to the perpetuity model, and 0.21% according to the Gordon

growth model.²⁰ Using current levels of velocity, the reduction on the post-tax cost of equity could be as much as 0.5–0.8%. The changes are subject to the assumption that the main marginal source of finance in the UK is external equity, which is certainly the case for high-growth companies, which have low levels of retained earnings and are seeking outside equity.

- Empirical tests by Domovitz and Steil (2001) would suggest a reduction in the post-tax cost of equity of around 0.61–0.74% as a *direct* result of Stamp Duty abolition. The positive relationship between the direct and indirect cost of trading (as described in Appendix 1.1) in this case suggests that the effect of the Stamp Duty abolition could be over and above the direct impact, as it is likely to lead to lower indirect costs of trading (eg, higher liquidity).
- **On the basis of all the available evidence from Table 3.4, and current levels of velocity in the UK market, the resulting change in the pre-tax cost of capital is likely to be within a reasonable range of 0.72–0.87%.**

²⁰ See section A1.2 for an explanation of these two models.

4. Potential Impact on the Level of Investment

4.1 Theory

Investment involves the formation of capital: fixed (or tangible) capital, such as machinery or factories; intangible capital, such as reputations or technical knowledge; or human capital, such as skills or education. This study is concerned mainly with the first—investment in fixed capital. In order to assess the impact of Stamp Duty on the level of fixed capital, it is necessary to consider factors that managers take into account in investment decisions.

Several factors are likely to influence the level of investment. Other things being equal, the higher the price at which firms expect to be able to sell additional output resulting from the investment project, the higher the stream of future net revenues yielded by the investment. On the cost side, the higher the cost of capital, the higher the discount rates applied to future profits, and the lower the present value of any given stream of future profits.

This effect of the cost of capital on the profitability of investment can also be considered in terms of the opportunity cost of having wealth tied up in the project. Funds that are used to purchase capital equipment could alternatively have been invested in another project or safe asset. The investment project will have to generate a stream of net revenues that at least compensate investors for the loss of these forgone alternative net revenues. Higher opportunity costs will therefore be associated with higher required rates of return on investment projects.

For the purposes of this study, it is important to establish the sensitivity of the investment level to companies' costs of capital. The literature is reviewed below, together with an examination of the evidence on the potential impact of the cost of capital reduction on the level of UK investment.

4.2 Empirical evidence

Quantifying the impact of the higher cost of capital on the levels of corporate investment is very difficult, as noted by Bond and Jenkinson (1996). However, the premise that taxes do not have any impact on investment was destroyed by the change in investment as a response to the large tax reforms in the 1980s, both in Britain and elsewhere. Bond, Devereux and Gammie (1996) suggest that tax reforms often lead to variations in the cost of capital significant enough to overtake most other influences on investment. Based on the analysis produced in Bond, Denny and Devereux (1993), Bond et al. (1996) argue that:

Large changes in the cost of capital occurred temporarily in the UK in 1984-6, as a result of the 1984 corporation tax reform. In 1984 and 1985, a sharply lower cost of capital was associated with a noticeable surge in company investment, which then fell in 1986 as the cost of capital returned to more normal levels. Based on the 1984-6 experience, we estimate that a tax system which leaves the cost of capital permanently higher by 1-2 percentage points is likely to depress the level of company investment by up to 5 per cent' (p.111)

The long-run elasticity of investment with respect to the cost of capital, at around -0.5, as suggested by Bond et al. (1993) is similar to that found by Cummins, Hassett and

Hubbard (1994) in an analysis of US tax reforms (-0.66). For the purpose of this study, it is assumed that the sensitivity of the investment levels to the cost of capital in the UK is around -0.5 as (Cummins et al.), Bond et al. (1993) have based their calculation on UK data.

The first step is to translate the Stamp Duty abolition impact on the cost of capital into the change in gross investment in the economy. Taking into account results from the previous section, the long-run investment sensitivity to the cost of capital of -0.5 and the nominal pre-tax cost of capital of 12.3%,²¹ **abolition of Stamp Duty is likely to result in a 2.9–3.5% long-run increase in the capital stock.**²² **The adjustment to the new capital stock would mean that net investment is higher than it would otherwise have been over a period lasting several years. In the long run, higher replacement investment implies that gross investment would be permanently higher by 2.9-3.5%.**

The next step is to translate the estimated increase in the annual gross investment of UK listed companies into the permanent long-run extra investment. The methodology applied in this study is as follows:

- this year's investment in fixed assets is defined as the difference between this year's net fixed assets and the previous year's net fixed assets, plus fixed asset depreciation over the year;
- last year's net investment in fixed assets for FTSE 100, FTSE 250 Mid Cap and FTSE All-small companies is calculated using data obtained from Datastream;
- the increase in gross investment predicted above is used to calculate the extra investment that would be expected were Stamp Duty to be abolished.

As suggested by Table 4.1, in the previous year, UK listed companies made a gross fixed investment of around £97.3 billion. Based on this result, a 2.9% permanent increase in the gross investment translates into permanent extra annual investment of £2,821 million, while a 3.5% increase would translated into £3,406 million permanent extra annual investment. The table also suggests that relatively substantial amounts of extra investment would be generated within the smaller companies listed on the LSE. FTSE All-small Capitalisation companies (companies with market capitalisation below £3 billion) would have £197m–£238m extra annual investment.

²¹ Appendix A 1.3 sets out calculation of the nominal pre tax cost of capital

²² This is calculated as follows. The long-run elasticity of investment with respect to pre-tax cost of capital is defined as (change in long-term gross fixed investment/stock of gross fixed investment)/(change in the cost of capital/cost of capital). If elasticity is assumed to be -0.5, the current pre-tax cost of capital is 12.3%, then a change in the pre-tax cost of capital of 0.72% to 0.87% (see section 3.3) leads to a long-run permanent increase in the annual level of investment of between 2.9% and 3.5%.

Table 4.1: Long-term permanent impact on fixed investment resulting from the abolition of Stamp Duty

Index	Number of companies	Aggregate fixed investment over the last year (£ billion)	2.9% increment in annual gross investment (£m)	3.5% increment in annual gross investment (£m)	Mid increment in annual gross investment (£m)
FTSE 100	100	74.7	2,166	2,615	2,390
FTSE 250 Mid Cap	250	15.8	458	553	506
FTSE All-small Cap	1,039	6.8	197	238	218
Aggregate for the market ¹		97.3	2,821	3,406	3,114

Notes: ¹ The sum of the investment by companies in these three indices is approximately equal to the aggregate investment by listed UK companies.

Source: Datastream and OXERA calculations

Appendix

A1.1 Relationship between direct and indirect transaction costs

The illustration of the impact of the abolition of Stamp Duty on share prices, given in section 3.1, was set out on the basis of the net present value of the future value of Stamp Duty payments. This simplified framework does not take into account the impact of the Stamp Duty abolition on indirect costs, such as reduction in the liquidity of shares, and thus a further impact on share prices. Indirect costs, when quantified in a comparable way, may have the same impact as direct costs on the required returns by investors.

There is a strong evidence to suggest that direct transaction costs are positively related to indirect costs. Domovitz, Glen and Madhavan (2000) find that indirect costs²³ are positively correlated with direct trading costs, estimating the sample correlation between these costs in the range from 0.09 to 0.31 for each year across the sample period. This positive relationship can mainly be explained by the impact of the direct trading costs on the level of turnover activity of equity securities. There are a number of studies suggesting the negative relationship between the Stamp Duty and turnover in the respective stock market. For instance, Jackson and O'Donnell (1985) suggest that a 1% decrease in Stamp Duty could lead to a 70% increase in equity turnover. In similar studies, Lindgren and Westlund (1990) and Ericsson and Lindgren (1992) use Swedish and international panel data respectively, and find that, in the long run, a 1 percentage point increase in Stamp Duty leads to a decrease in turnover of between 50% and 70%. The negative relationship between direct transaction costs and share turnover suggests that Stamp Duty abolition is likely to lead to the reduction in total transaction costs of investors (that are not Stamp Duty exempt) by more than 0.5%.

A1.2 Translating share-price changes into changes in the cost of equity

For the studies where the impact of Stamp Duty is addressed in relation to share prices, there is a further step, which consists of translating this change in share price into a change in the cost of equity. The relationship between the change in share prices and that in the cost of equity can be established in the framework of two simple models:²⁴

- the perpetuity model; and
- the Gordon growth model.

The perpetuity model calculates the value of the firm as the discounted value of its future earnings. Assuming a constant real earning equal to C and a constant post-tax cost of equity, denoted r , the model estimates that the current value of the share P_0 is:

²³ Indirect costs in this study are defined as the market impact of the trade, which is the deviation of the transaction price from the 'unperturbed price' that would have prevailed had the trade not occurred.

²⁴ An excellent overview of these simple models can be found in Brealey and Myers (1996).

$$P_0 = C / r \quad (\text{A1.1})$$

The Gordon model is based around the fact that the cash payoff to owners of common stocks comes in two forms: cash dividends and capital gains. Suppose that the current price of a share is P_0 , the expected price at the end of year is P_1 , the expected dividend per share is Div_1 , and the expected post-tax return in period one is r_1 . The rate of return that investors expect from this share over the next year is defined as the expected dividend per share Div_1 plus the expected price appreciation per share $P_1 - P_0$, all divided by the price at the start of the year P_0 :

$$r_1 = (Div_1 + P_1 - P_0) / P_0 \quad (\text{A1.2})$$

From equation (A1.2), the price of the share today can be rewritten as:

$$P_0 = (Div_1 + P_1) / (1 + r_1) \quad (\text{A1.3})$$

In the same manner, the price of the share in period one depends on the expected dividend and expected share price in the period two. Substituting for the share price up to the period infinity leads to the following price model:

$$P_0 = \sum_{i=1}^{\infty} \{Div_i / (1 + r_i)^i\} \quad (\text{A1.4})$$

Assuming that the dividends grow at a constant rate, g , and the post-tax cost of equity is constant and equal to r , equation A1.4 simplifies to:

$$P_0 = Div_1 / (r - g) \quad (\text{A1.5})$$

This formulation can also be expressed in terms of the post-tax cost of equity, r :

$$r = Div_1 / P_0 + g \quad (\text{A1.6})$$

Throughout this report, the real post-tax cost of equity, r , is assumed to be 7% (Appendix 1.3 sets out underlying assumptions), while g , in the long run, converges to the real long-term growth in GDP, which is assumed here to be 2.5%. In other words, using the above assumptions, the dividend yield is 4.5% for the UK stock market.

A1.3 Transformation of the cost equity estimate into the cost of capital

Investment decisions of companies are based on the pre-tax cost of capital (ie, also taking into consideration tax liabilities and alternative forms of financing, such as debt). The treatment of taxation and the relationship between the change in the post-tax cost of equity and changes in the pre-tax cost of capital are considered below.

Brealey and Myers (1996) suggest that a company's overall pre-tax cost of capital can be calculated as a weighted average pre-tax cost of debt finance and equity finance. The weighted average cost of capital (WACC) can be written as:

$$WACC = g \times r_d + (1 - g) \times r_e \quad (\text{A1.7})$$

where g is the gearing level (net debt / total value), r_d is the pre-tax return required on debt investments, and r_e is the pre-tax return required on equity investments (ie, the cost of equity).

The pre-tax cost of equity finance can be obtained from the post-tax equity finance and level of personal and corporate taxes:

$$coc_{pre-tax} = coe_{post-tax} \times tw \quad (A1.8)$$

where coc is the cost of capital, coe is the cost of equity and tw is the tax wedge.

The size of the tax wedge has been a subject of considerable discussion among practitioners and academics alike. There are two main approaches to taxation: a ‘traditional’ approach, in which new investors bear in mind the dividend tax system when choosing whether to invest; and the ‘tax capitalisation’ approach, in which changes to dividend taxes have no impact on the cost of capital (although they do affect the value of the company). In addition, it is worth recalling that the traditional approach assumes that the marginal source of finance is new share issues and that the marginal use of profits is dividends.

Table A1.1 summarises tax wedges for marginal investors under both approaches using simplifying assumptions on dividend payout ratio (equal to 1) and capital gains tax (equal to 0). According to the table, average pension-fund and basic-rate individuals bear the tax wedge of 1.43.

Table A1.1: Tax wedge of a marginal UK investor

Marginal investor	Traditional view	Capitalisation view
Pension fund	1.43	1.43
Basic rate individual	1.43	1.43

Source: Inland Revenue Service and OXERA calculations.

The conventional way of calculating financial gearing is to estimate the ratio of the market value of net debt to the sum of market value of net debt and of equity. Typically, market values of net debt are not available, so book value figures are used. The weighted average financial gearing of FTSE All-share index companies based on the latest available figures (December 31st 2000 or March 31st 2001 for net debt and respective figure for market value of equity) is 18%.²⁵

For the purposes of this paper, it is assumed that the average tax wedge of UK companies is equal to 1.43 and average financial gearing is equal to 18%. Under these assumptions, the pre-tax cost of capital can be defined as:

²⁵ Source: Datastream.

$$coc_{pre-tax} = (1.43 \times coe_{post-tax}) \times (1 - 0.18) + cod \times 0.18 \quad (A1.9)$$

As it is assumed that the abolition of the Stamp Duty has no impact on the cost of debt, the reaction of the pre-tax cost of capital as a result of the change in the post-tax cost of equity can be written as follows:

$$\Delta coc_{pre-tax} = \Delta coe_{post-tax} \times 1.43 \times (1 - 0.18) \quad (A1.10)$$

In order to estimate the relative impact of the change in the cost of capital, it is necessary to make assumptions on all components of the cost of capital. Table A1.2 sets out assumed values and methodologies for estimating parameters underlying both real and nominal cost of capital.

Table A1.2: Assumptions on the components of the cost of capital

Parameter	Estimate	Methodology/reference
Real risk-free rate	3%	Latest Competition Commission's assumption
Inflation	2.5%	Assumption
Nominal risk-free rate	5.5%	Sum of real risk-free rate and inflation
Equity risk premium	4%	Latest Competition Commission assumption
Debt premium	1%	Assumption on the average debt premium in the stock market
Tax wedge	1.43	Calculation of tax wedge is set out above
Gearing	0.18	Calculation is described above
<i>Real rates</i>		
Real post-tax cost of equity	7%	Post-tax cost of equity is calculated applying the capital asset pricing model (CAPM) for the market as a whole (ie, Beta = 1). It is also equivalent to the sum of assumed dividend yield of 4.5% and assumed dividend growth (g) of 2.5%.
Real pre-tax cost of equity	10%	Formula is set out in equation A1.8 above
Real pre-tax cost of debt	4%	Pre-tax cost of debt is calculated as a sum of the real risk-free rate and debt premium
Real pre-tax cost of capital	8.9%	Formula is set out in equation A1.7 above
<i>Nominal rates</i>		
Nominal post-tax cost of equity	9.5%	Post-tax cost of equity is calculated applying the CAPM for the market as a whole (ie, Beta = 1)
Nominal pre-tax cost of equity	13.6%	Formula is set out in equation A1.8 above
Nominal pre-tax cost of debt	6.5%	Pre-tax cost of debt is calculated as a sum of the nominal risk-free rate and debt premium
Nominal pre-tax cost of capital	12.3%	Formula is set out in equation A1.7 above

Source: Competition Commission (2000), Datastream and OXERA assumptions and calculations

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