

ACCOUNTING FOR EMPLOYEE STOCK OPTIONS

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Declaration

I declare that this thesis is my own, unaided work. It is being submitted for the Degree of Doctor of Philosophy in the University of Cape Town. It has not been submitted before for any degree or examination in any other University.

27th day of January 2010

Abstract

The use of ESOs as a form of employee remuneration has grown dramatically in recent years, fuelling a significant amount of research. The current accounting standards (IFRS 2 and IAS 33) do not reference this research and as a result the accounting records do not accurately reflect the economic nature of these transactions. This study will:

1. Evaluate the requirements of IFRS 2 and IAS 33 by developing an accounting model for each standard and comparing the current rules with this theoretical benchmark.
2. Further examine any identified differences by means of empirical tests.

The objective is thus to establish a theoretically sound approach to ESO accounting that can be confirmed by empirical testing.

As a means of modelling the employee stock option expense, a hedge is derived for ESOs. ESOs are complex instruments and this complicates the development of an appropriate accounting model. Defining a hedge for the transaction is a technique often used to analyse ordinary options, and assists in analysing the economic substance of ESO transactions.

Assuming the validity of the Hull and White (2004b) valuation model, a hedge is derived for a typical ESO using a methodology described in Derman et al. (1994). The hedging transaction provides a model by which the current IFRS 2 requirements can be evaluated.

With regards to IAS 33, a benchmark model for calculating diluted earnings per share (DEPS) is derived by using the framework developed by Ohlson (1995). The method of calculating DEPS suggested by this model is named the earnings adjustment method (EAM). The EAM adjusts the earnings for the period to reflect the dilution resulting from ESOs. This differs from the method described in IAS 33, referred to as the treasury stock method (TSM). The TSM calculation is based on the intrinsic value of the options and adjusts the number of shares in issue (i.e. the denominator). Core et al. (2002) suggest that this method can be improved by replacing the intrinsic value with the fair value of the options (herein after referred to as the treasury option method, or TOM). The analysis indicates that the EAM has a stronger theoretical grounding than the other two methods. It also achieves accounting parity, at a DEPS level, between cash- and equity-settled options. Further analysis is performed by comparing the three different DEPS methods using a series of examples.

To validate the deficiencies identified by the models, certain of the findings are tested empirically. The empirical tests are conducted within a value relevance study framework. Cross sectional regressions are used to examine the value relevance of the various measures. The sample used is all firms in the Standard and Poors 500 index (S&P 500) from 1997 to 2006.

The findings confirm some of the theoretical weaknesses in the current accounting rules. In the case of IFRS 2, the hedge created to model the economic substance of ESOs provides some interesting insights. Notably, the optimum hedge is a static hedge. A static hedge is a single transaction on the ESO grant date which will hedge the ESO throughout its life. This supports the current IFRS 2 approach, which requires measurement of the ESO on the grant date, with no subsequent remeasurement. The hedge contradicts the IFRS 2 rules for ESO forfeiture, however. It would be prudent to hedge all ESOs granted, whilst the IFRS 2 expense is based on only those options that are expected to vest. If all ESOs are hedged, a portion of the hedge would be liquidated if any ESOs were subsequently forfeited. This would indicate that the correct accounting approach would be to expense all options granted, and if any options are subsequently forfeited, recognise a gain on forfeiture. This gain is equal to the fair value of the options on the date of forfeiture.

With regards to the calculation of DEPS, the examples confirm the superiority of the EAM. Assuming that the objective of DEPS is to describe the change in wealth of a shareholder holding one ordinary share, the EAM accurately describes the change in economic value of that shareholder in all the scenarios explored by the examples. An unexpected finding however is that the TOM seems to be more useful in predicting future profits. The TSM

does not provide any additional information to that contained in the other two measures.

The findings relating to the value of ESOs forfeited and the relative performance of the various DEPS measures are then further examined by means of empirical testing. In the first instance, the explanatory power of the value of ESOs forfeited is tested within a levels and returns specification. Both tests confirm that the value of ESOs forfeited is statistically significant and does represent a gain to the entity. Data availability precludes testing the other finding concerning the ESO expense, being that all ESOs should be expensed.

The empirical tests allow for further comparison of the three different DEPS methods. In this case the value relevance of DEPS calculated under the EAM is benchmarked against the other two methods. Changes in the share prices of the sample are regressed against DEPS calculated using the three different methods. The empirical tests confirm that the EAM does outperform the other methods in explaining share price changes. Tests are also performed to determine whether the TOM does better predict future earnings. This is done by regressing the share price on lagged values of DEPS calculated under the TOM. These results, however, do not permit any reliable conclusions to be made.

This research thus supports the overall approach of IFRS 2, but suggests that the manner of dealing with forfeitures needs revision. The requirements of IAS 33, however, seem to have little merit and this thesis describes a DEPS calculation which is consistent with the general progression towards fair value accounting. It also addresses a common criticism of the current accounting rules, in that it achieves parity at a DEPS level between equity-settled and cash-settled transactions.

This thesis is dedicated to my wife, Riëtte, and two children,
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1. Introduction

1.1. *Background*

Many people assume that derivatives are a modern invention, a by-product of 20th century finance. This is not true as derivatives are probably many centuries old. The first recorded instance of a derivative occurs in the Bible, which documents an arrangement between Jacob and Laban whereby Jacob would “acquire” Laban’s daughter, Rachel, as his wife after seven years of labour¹. The transaction thus has most of the elements of a modern day derivative, being a fixed price, a fixed future date of delivery and an underlying asset, being Rachel! The story also records the first example of a default of derivative contract, as Laban tricked Jacob into marrying his other daughter, Leah, and Jacob had to work for another seven years to earn the right to marry Rachel. Other early examples of derivatives include Thales the Milesian purchasing options on olive presses in about 580 B.C. and forward contracts on Dutch tulip bulbs in the 17th century. Modern day traded derivatives have their origin at the Chicago Board of Trade; the oldest derivatives exchange which started trading agricultural futures in 1865.

It is in the last 20 years, however, that derivatives have become a significant instrument in financial markets. Fuelled by advances in financial

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mathematics, and increasingly sophisticated financial institutions, derivatives now account for a substantial portion of global economic activity. The Financial Times estimated on 5 March 2007 that whilst outstanding derivative contracts across the globe totalled \$450 000 billion, total share trades at the 10 biggest stock exchanges were only \$60 000 billion. This growth in derivatives markets has also been accompanied by an increasing use of stock options as employee remuneration. In 1992 the top 500 US companies issued share options worth \$11 billion. This had grown to \$71 billion by 2002, with a peak of \$ 119 billion in 2000.

Accountants, however, have been slow to respond to these changes. The first accounting standards to deal extensively with derivatives were only released in the late 1990's. Statement of Financial Reporting Standard No. 133 – Accounting for Derivative Instruments and Hedging Activities (FASB 1998) and International Accounting Standard 39 – Financial Instruments: Recognition and Measurement (IASB 1999) introduced new accounting rules for derivatives which were in many cases radically different from prevailing practice at the time. Before the introduction of these standards there were little or no accounting rules for derivatives. Neither of these statements dealt with derivatives-based compensation, and the first accounting standard on employee stock options (ESOs) was only issued in 2003.

One of the reasons for the growth in stock option compensation in the late 20th century may have been the benign accounting treatment at the time. Stock-based compensation was not recorded in the income statement, which meant that companies could issue stock options without any affect on earnings. Ratliff (2005) reported that accounting for stock option expenses would have reduced the S&P 500 companies' earnings by an average of 9% in 2000. This was rectified with the introduction of International Financial Reporting Standard 2 – Share-based Payments (IFRS 2) (IASB 2003b) in

2003 and in the USA Statement of Financial Reporting Standard No. 123 (revised) (SFAS No. 123) (FASB 2004) in 2004. The original SFAS No. 123 was actually issued in 1995, but its introduction was accompanied by such controversy that application was made voluntary. Unusually for an accounting development, the debate on accounting for employee stock options even attracted the attention of politicians at the time. Pressure to introduce an accounting statement on ESOs originated from a US senator in the early 1990s, and the Financial Accounting Standards Board (FASB) was forced to make the application of the original SFAS No. 123 voluntary because it was threatened by legislation from another US senator². Most companies at the time chose not to apply the requirements of SFAS No. 123, because of the adverse consequences on income. In the early 2000s the mood of the business community and politicians had changed, largely as a result of various accounting scandals (e.g. Enron and WorldCom), and the introduction of IFRS 2 and SFAS No. 123 (revised) was generally welcomed.

1.2. Accounting for Employee Stock Options

IFRS 2 provides accounting rules for all transactions in which the entity uses its own shares to acquire goods or services. Despite this broad scope, most transactions accounted for under IFRS 2 are transactions with employees. In terms of IFRS 2, the value of the services rendered by the employees to earn the incentive must be expensed over the period in which the services are received. Transactions with employees pose unique challenges for the accountant as it is difficult to measure the value of the services received from employees, and so IFRS 2 requires that these services be measured indirectly by reference to the value of the instruments granted to the employees. This may seem like a simple exercise given the sophisticated

² For a detailed account of the process leading up to the introduction of the original SFAS No. 123 see Dechow et al. (1996).

techniques already developed for valuing options, but ESOs have certain features that make them difficult to value. The accounting and finance literature has provided various solutions to these problems, but this seems to be largely ignored in IFRS 2.

In most cases ESOs are granted subject to vesting conditions. Economically these conditions help to align the interests of the employee with that of the firm and ensure the employee delivers sufficient services to justify the award. These conditions would normally take the form of a vesting period linked to other performance conditions. The vesting period is the period over which the employee must remain in the employ of the firm before he becomes fully entitled to the award. Over that period the employee may also be expected to meet certain performance conditions, for example a revenue, profit or share price target.

It is at this point that IFRS 2 introduces some interesting requirements. The nature of the condition determines how it impacts the accounting. Market related vesting conditions, such as a target share price or performance relative to a market index, must be incorporated into the grant date valuation. For equity-settled awards this grant date value is not subsequently retested, so that changes in market variables post the grant date have no effect on the IFRS 2 expense. Non-market related conditions, for example the requirement to remain in the employ of the firm for a certain period or a profit or revenue target, are ignored in the initial grant date valuation, and then incorporated in the accounting calculation in a simplistic manner. The non-market related conditions are then also continuously retested during the vesting period and the estimate of the IFRS 2 expense adjusted accordingly. The total cumulative IFRS 2 expense over the vesting period is thus equal to the grant date value of all options that fulfil the non-market related vesting conditions. An analysis of the academic literature elicits various ways to

incorporate non-market related conditions into the initial valuation of the ESOs, and thus there is no obvious reason why the two types of conditions should be treated so differently.

The discussion above describes the treatment of ESOs that are settled by giving the employees shares in the company. IFRS 2 requires a different treatment if the final value of the option is settled in cash. Cash-settled awards are continuously remeasured for changes in market and non-market related conditions. Thus the total cumulative expense over the vesting period will equal the final cash settlement amount.

The difference in the treatment of cash-settled versus equity-settled awards stems from the distinction made between equity transactions and liabilities in the International Accounting Standards Board's Framework for the Preparation and Presentation of Financial Statements (Conceptual Framework) (IASB 1989). As equity is defined as the residual in the framework, it is never remeasured. Liabilities, however, are carried at the amount expected to be paid to discharge the obligation and are subject to regular remeasurement. The standard setters were thus obliged to follow these general principles when compiling IFRS 2, and thus the different treatment for equity-settled and cash-settled awards. This still does not explain why market related and non-market related conditions are treated differently in equity-settled awards. It also raises the question of why are equity-settled and cash-settled options treated so differently when they are economically similar.

The differences between the various requirements of IFRS 2 are best illustrated by means of an example, which can be seen in the box below.

Example illustrating application of IFRS 2

Assume a company grants options under the following conditions (CU refers to currency units):

Share price on grant date	CU 1
Exercise price	CU 1
Number of options granted	100
Time to maturity	3 years
Vesting period	3 years

The options are subject to the company achieving a profit in year 3 of CU 1 000 and the share price climbing to at least CU 1,20.

Assume further that the company makes the following estimates during the vesting period:

	Percentage of staff granted options that will leave before the end of year 3	Profit expected in year 3 (CU)
Year 1 (estimate)	20%	900
Year 2 (estimate)	25%	1 010
Year 3 (actual)	22%	1 020

The options must initially be valued taking the share price target into account, but ignoring the other vesting conditions. Assume that this results in a value of CU 0,30 per option.

The IFRS 2 expense of an equity-settled award will be:

Year 1	CU 0,00	$[(0,30 \times 80 \times 0) / 3]$
Year 2	CU 15,00	$[(0,30 \times 75 \times 1) \times 2 / 3] - 0$
Year 3	<u>CU 8,40</u>	$(0,30 \times 78 \times 1) - 15$
Total	CU 23,40	$(0,30 \times 78 \times 1)$

To compare this with the expense of a cash-settled award, assume further that the fair value of the options are CU 0,35 and CU 0,40 at the end of year 1 and 2 respectively and that the final settlement value of the options are CU 0,42 per option. The IFRS 2 expense would then be:

Year 1	CU 0,00	$[(0,35 \times 80 \times 0) / 3]$
Year 2	CU 20,00	$[(0,40 \times 75 \times 1) \times 2 / 3] - 0$
Year 3	<u>CU 12,76</u>	$(0,42 \times 78 \times 1) - 20$
Total	CU 32,76	$(0,42 \times 78 \times 1)$

Another key metric of interest to users trying to understand the economic effects of ESOs is diluted earnings per share (DEPS). The rules for the calculation of DEPS are contained in International Accounting Standard 33 – Earnings per Share (IAS 33) (IASB 1997). IAS 33 prescribes the use of the treasury stock method for determining the dilutive effect of ESOs. The treasury stock method was originally introduced in the 1960s, and it thus predates the many significant developments in option pricing theory since then. In simple terms, the treasury stock method translates the intrinsic value of the ESOs into an equivalent number of shares, and then adds these shares to the denominator in the DEPS calculation. The problem with this approach is immediately apparent as there is a wealth of literature dealing

with options that make it clear that the economic value, and thus the dilutive effect, of options is almost always greater than the intrinsic value. This is especially the case when the options are at-, or out-of-the-money. This would suggest that IAS 33 understates the dilutive effects of these options. In addition to the archaic treasury stock method, the current IAS 33 rules require adjustment of the exercise price of the options used in the calculation that is based on the unamortised ESO expense. There is no obvious conceptual reason for this adjustment.

This research will focus on these two facets of ESO accounting; the appropriate measurement ESOs in the determination of profit or loss for the period, and calculating the effect of ESOs on DEPS.

1.3. Problem statement, purpose and objectives of the study

The requirements of IFRS 2 do not reflect developments made in the finance and accounting literature and thus the prescribed accounting treatment does not properly reflect the economic substance of ESO transactions.

This thesis will link the theoretical and empirical research with the requirements of IFRS 2 and IAS 33, and provide support for, or criticism of, these requirements.

The objective is thus to establish a theoretically sound approach to ESO accounting that can be confirmed by empirical testing. This leads to the following objectives:

1. Develop a theoretical model which can be used to determine the appropriate accounting treatment of ESOs in the income statement.

2. Develop a theoretical model which can be used to calculate the effect of ESOs on diluted earnings per share.
3. Validate any findings by means of empirical tests.

1.4. *Delimitation and limitations*

The Conceptual Framework does not provide detailed guidance on the distinction between debt and equity. This has been a point of contention for many of the discussions on IFRS 2. There is thus currently no clarity in terms of the Conceptual Framework as to whether equity-settled ESOs are debt or equity. This distinction affects the accounting treatment of many different transactions, not just ESOs. As this study focuses on the specific accounting requirements for ESOs, it does not contribute to this broader conceptual debate. It also assumes that the broad accounting principles used in measuring debt and equity contained in the framework are correct; equity is never remeasured, but is the residual resulting from measuring assets and liabilities. Some of the findings however, especially those relating to DEPS, provide insight into the kinds of problems that arise from the current approach. IFRS 2 assumes that equity-settled ESOs should be classified and measured as equity, and this is the assumption made in this study.

The study will be limited to the accounting of employee stock options that are equity settled. Most ESOs issued are equity-settled, and many of the arguments raised against ESO accounting have focused on equity-settled options. The term ESO will be used to refer to equity-settled benefits throughout the thesis.

Whether share-based remuneration is an effective and efficient form of remuneration is a complex economic issue. The research that follows focuses on the accounting for these transactions, and will not consider the effectiveness of this type of remuneration.

1.5. *Research Methodology*

The approach used in the study will be a two stage process to address each of the research questions. Firstly, to use existing research to create a financial model that will be useful in defining accounting rules. The second step will be to test the validity of the models through empirical studies.

1.6. *Overview of the thesis*

The thesis is divided into six chapters, the content of which is summarised below.

- Chapter 2 – Literature review
Most of the prior literature focuses on how to value ESOs and whether ESOs should be classified as debt or equity. Whilst much of this research was conducted before the issue of IFRS 2, many of the requirements of IFRS 2 seem inconsistent with these studies.
- Chapter 3 – Employee stock option expense
Employee stock options (ESOs) contain several features that distinguish them from ordinary, market-traded options. This makes them difficult to price and hedge. A review of the ESO valuation literature suggests that the model described in Hull and White (2004) deals with most of the unique features of ESOs whilst still being feasible in a practical context. Using Hull and White as a base model,

Chapter 3 derives a static hedge using a methodology described in Derman et al. (1994). The chapter goes on to argue that this hedge can be used to construct an accounting model for recognising ESOs in the income statement. The accounting model provides support for the current IFRS 2 approach, which requires that the options be valued at grant date, and not revalued subsequently. However, the hedging strategy for compensating for forfeitures contradicts IFRS 2. The analysis suggests that the ESO expense should be based on all of the ESOs granted, and not only those that are expected to vest. This will result in the recognition of income if the employees leave pre-vesting. The measurement of this income should be based on the value of the options when the employee leaves, which will mirror the cash flow resulting from reducing the hedge portfolio.

- Chapter 4 – Diluted earnings per share

Three possible methods for calculating diluted earnings per share (DEPS) when a firm has outstanding ESOs are described and compared. The first is the current IAS 33 approach which is based on the intrinsic value of the ESOs. In terms of IAS 33 the intrinsic value is used to determine an equivalent number of ordinary shares, which is then added to the denominator in the DEPS calculation. The second method is similar to IAS 33 but instead of the intrinsic value uses the fair value of the outstanding options. This chapter derives a third method which adjusts the earnings for the year by year change in fair value of the outstanding ESOs, with no adjustment to the denominator in the DEPS calculation.

The three methods are compared using a series of examples. The examples allow for an analysis of the effects of issuing ESOs on the three different DEPS measures. The earnings adjustment method

best describes the change in economic value of the current shareholders, the fair value method is more useful in predicting future profits, and the intrinsic value method appears to provide no additional information to that already contained in the other two measures. The earnings adjustment method has a further advantage in that it provides an identical result at a DEPS level to that which would have been obtained if the ESOs were cash-settled and treated as liabilities in terms of IFRS 2. This method will thus improve comparability as cash-settled and equity-settled options have a similar economic effect on current shareholders.

An interesting ancillary finding emanating from the theoretical analysis and examples is that the future dilution of current shareholders' interests is a function of changes in the value of the ESO *after* the grant date, and not the grant date value. This finding suggests that the current IAS 33 requirement that the exercise price of the ESOs be adjusted by the unamortised ESO expense in the DEPS calculation is theoretically incorrect.

- Chapter 5 – Empirical tests
Four key findings emanate from the analytic research in chapters 3 and 4:
 - i. The ESO expense should be based on all ESOs granted, not just those that are expected to vest.
 - ii. Any ESOs forfeited should be reflected as a gain in the income statement measured as the fair value of the ESOs on the date of forfeiture.
 - iii. The earnings adjustment method of calculating DEPS better describes the change in equity of current ordinary shareholders.

iv. The fair value method of calculating DEPS better predicts future earnings.

The first finding cannot be verified empirically because of a lack of appropriate data. The second finding is tested by means of a value relevance study in which cross sectional regressions are used. ESO data is obtained from a database supplied by R.G. Associates, Inc., and other financial data is downloaded from Datastream. Two regression specifications are adopted; a price levels and price changes (returns) specification. Notably, the coefficient associated with the fair value of the ESOs forfeited is of the correct sign (positive) and is statistically significant in both specifications. This corroborates the findings of Chapter 3.

The different DEPS measures are compared within a returns regression model. The statistical tests performed confirm that the earnings adjustment method better reflects the change in current ordinary shareholders' equity. Mixed results are obtained, however, concerning the various DEPS measures abilities to predict future earnings.

- Chapter 6 – Conclusion

Chapter 6 reviews the findings, suggests directions for future research and concludes.

A diagrammatic representation of the thesis is given in Figure 1.1. Figure 1.2 shows the main findings of each chapter and the relationships between the chapters.

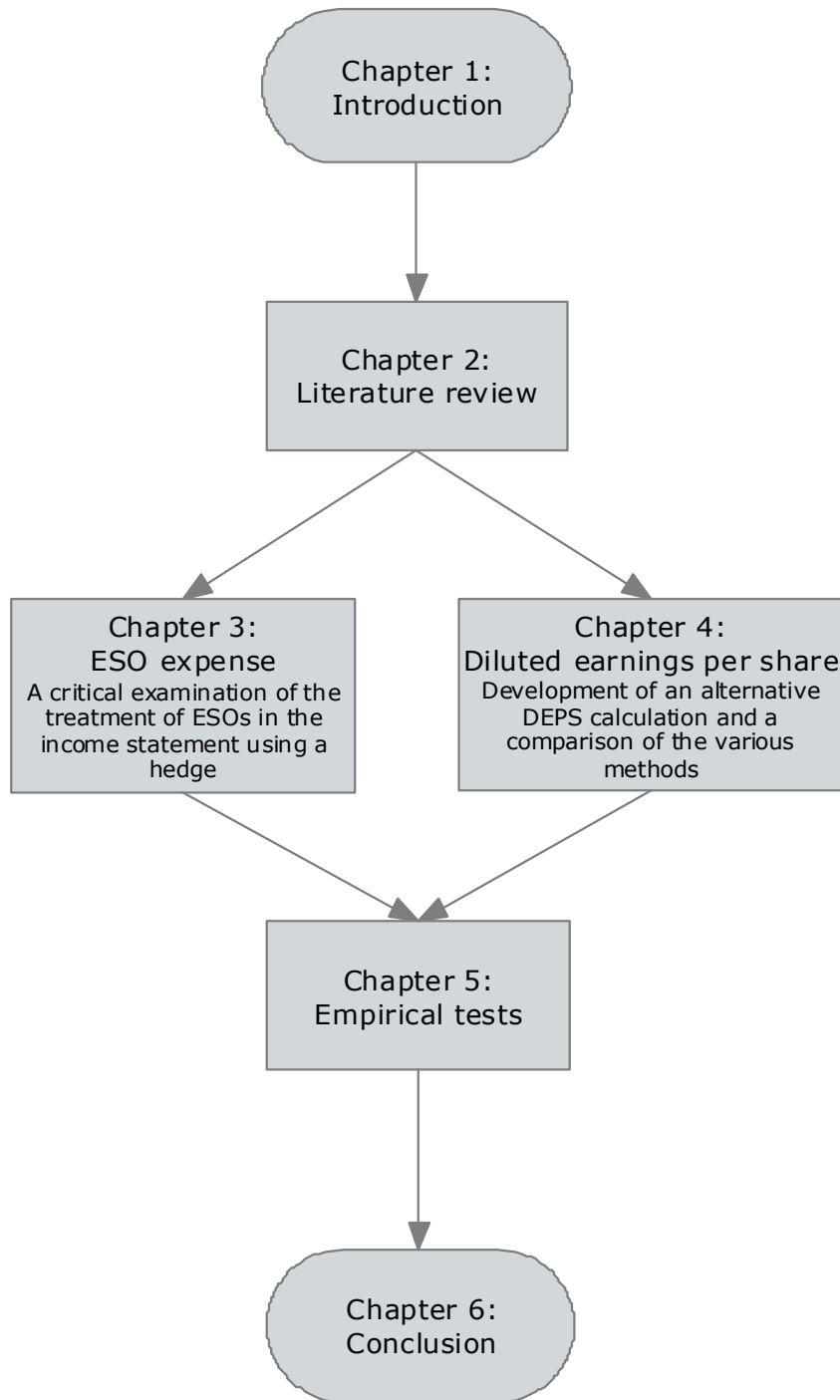


Figure 1.1 Schematic of thesis chapters

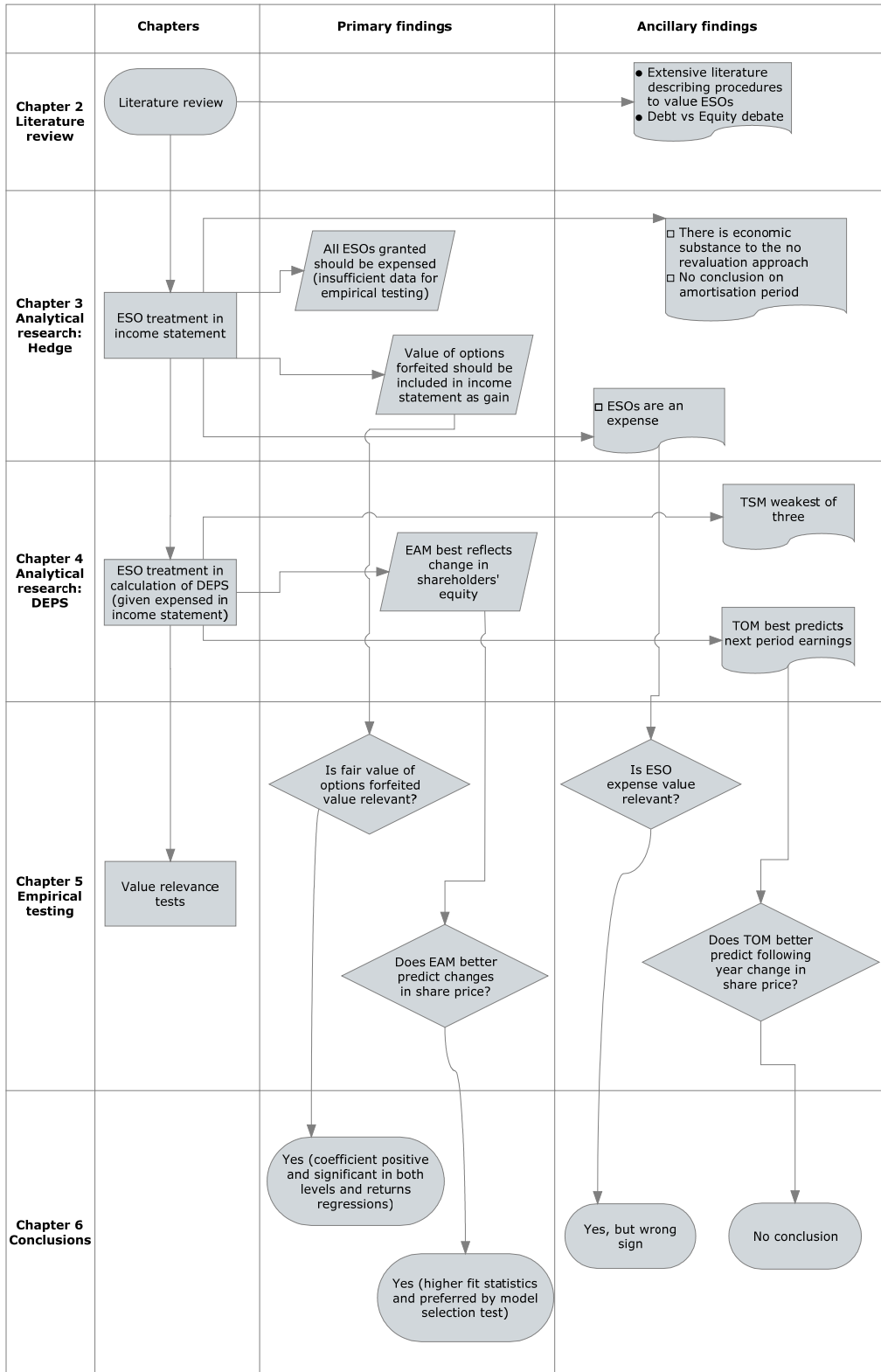


Figure 1.2 Diagrammatic overview of findings of each chapter and relationships between chapters

2. Literature review

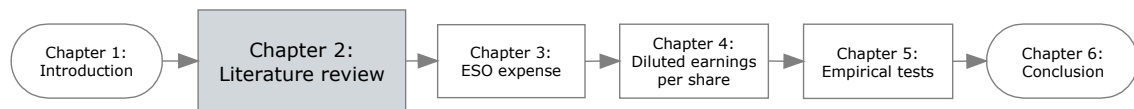


Figure 2.1 Role of chapter 2 within overall thesis structure

2.1. Introduction

This thesis considers the accounting of employee stock options. Analysing the accounting for any transaction normally involves two overarching questions:

- does the transaction result in an element (asset, liability, income or expense) that should be included in the accounting records, and
- at what amount should the element be valued?

These questions often lead to various subsidiary questions. For example, if a business purchases manufacturing plant, the accountant will probably ask the following questions:

- Is the plant an asset of the business?

- What is the cost of the plant?
- Should the plant be depreciated as it is used?
- What method of depreciation should be used and what are the appropriate inputs to the method?
- Should the plant be periodically revalued?

The answers to these questions have been debated for many years, and accountants continue to change their views on these issues from time to time. If one considers the accounting for ESOs, similar types of questions can be raised:

- Are ESOs an expense to the firm?
- Over what period should this expense be recognised?
- Should the expense recognised be adjusted as the value of the ESOs change?
- Do ESOs represent a liability of the firm, or should they be categorised as equity?
- Does the granting of ESOs result in an asset to the firm, being the future services that will be received from the employees?
- How should these ESOs be measured?
- How should ESOs be treated in the DEPS calculation?

These questions are far more complex than those relating to manufacturing plant, and the answers to these questions have been the source of much debate and research. This chapter analyses the prior literature relating to ESOs, and considers its relevance in answering each of the questions raised above.

2.2. Are ESOs an expense to the firm?

The first question is a basic one; does the issue of ESOs result in an expense? Despite the simplicity of the question, the answer is not that obvious. This is because, unlike most other expenses, granting ESOs never devolves into a cash outflow. ESOs also do not affect the business entity at all, but rather are an economic cost to the current shareholders. Many critics have thus argued that ESOs do not represent an expense to the firm. Clearly the problem with this view is that many companies use option-based and cash-based benefits interchangeably, and a company which chooses to give its employees ESOs rather than cash would present higher profits if it did not show the ESOs as expense. Indeed the benevolent accounting treatment of ESOs prior to the introduction of IFRS 2, whereby most companies did not record the cost of ESOs issued, may have been a cause of their popularity at the time.

This issue is addressed at length in Bodie et al. (2003) and the American Accounting Association's (AAA) Financial Accounting Standards Committee's (FASC) response to the FASB's exposure draft on "Accounting for Stock-based Compensation", and the same committee's comments on later changes to the same standard (AAA_FASC 1994, 2005). They all argued strongly that ESOs *do* represent an economic cost to the firm and must be shown in the income statement. Whilst this view was not generally held at one stage, most accountants now agree that ESOs should be expensed in the income statement.

The empirical research supports the recognition of an ESO expense, but also seems to suggest that there are other related issues that need to be addressed. Aboody (1996) and Aboody et al. (2004) found a negative relationship between the value of ESOs and a company's share price. In contrast, Bell et al. (2002) found a positive relationship between the ESO

expense and the share price. This was unexpected, and was possibly due to correlated omitted variables in their regression model. In particular, the findings of Bell et al. suggested that the granting of ESOs also created an intangible asset, being the future services to be received from employees. The value of this asset is correlated with the ESO expense, and most likely explains why the ESO expense was positively related to the share price. The research of Bell et al. was based on profitable firms in the computer software industry; an industry that is dependant on motivated and well-incentivised employees. Rees and Stott (2001) also found a positive relationship between disclosed ESO expense and firm value, and that this relationship was stronger for firms with more growth opportunities.

The theoretical arguments for recognising an ESO expense are thus strong, but the empirical research to date has presented confounding results. Chapter 3 provides further analysis on the nature of the ESO transaction. That chapter derives a hedge for a typical ESO, and then analyses this hedge in an attempt to better understand the ESO expense. The hedge is useful as it provides an economic transaction which mirrors the ESO. It thus allows a different perspective of the underlying economic nature of the ESO transaction.

2.3. Over what period should the expense be recognised?

Generally employees that receive ESOs are expected to render services over an extended timeframe. IFRS 2 requires that the ESO expense be recognised over the vesting period, the assumption being that the benefits are received over the vesting period. Very little research has considered this issue, perhaps because employees typically have no formal obligations with regards to the ESOs post the vesting date. Thus the period from grant date to vesting date seems to be the obvious time over which to recognise the

ESO expense. Interestingly Bell et al. (2002) suggested that in some cases the ESOs continue to generate benefits beyond the vesting date. The straight line recognition of the expense also ignores the fact that the incentive effects are probably correlated with the option's value and the incentive effects are stronger the longer the remaining time to maturity (Aboody 1996).

The most appropriate method for recognising the expense will depend on the incentive effects of the options. The expense should be recognised over the period over which the options act as an incentive to the employees. The proportion of the expense recognised in each period should match the services received in that period. This thesis does not consider the incentive effects of the options and except for some minor observations in Chapter 3 will not contribute to this issue.

2.4. Are ESOs liabilities or equity, and should the expense be adjusted as the value of the ESOs change?

The IFRS 2 treatment of cash-settled share-based payments is markedly different from equity-settled share-based payments. Equity-settled transactions are measured at grant date, and never thereafter remeasured. Cash-settled transactions are continuously remeasured, so that the total expense equals the cash actually paid in settlement of the obligation. This difference is because IFRS 2 categorises cash-settled transactions as liabilities, and equity-settled transactions as equity in terms of the Conceptual Framework. Liabilities are often restated for subsequent changes in value, for example the treatment of provisions in International Accounting Standard 37 – Provisions, Contingent Liabilities and Contingent Assets (IASB 1998). Equity is never restated.

The remeasurement debate is thus closely linked to the classification of ESOs as equity. Were they categorised as a liability, the case for remeasurement would be much stronger. Liabilities are defined in the Conceptual Framework as:

“... a present obligation of the entity arising from past events, the settlement of which is expected to result in an outflow from the entity of resources embodying economic benefits.”

IFRS 2 does not classify equity-settled transactions as liabilities because it does not consider the transfer of shares to be an “outflow of resources embodying economic benefits” (IFRS 2: BC98). Many writers have objected to this approach (AAA_FASC 2004; Balsam 1994; Kirschenheiter et al. 2004; Landsman et al. 2006; Ohlson and Penman 2005). The crux of their arguments is that ESOs are economically equivalent to cash-settled options. Cash-settled options are accounted for as liabilities because they are an obligation to transfer cash or other assets, and are therefore remeasured at each reporting period. The contention is that economically equivalent transactions should be accounted for in the same manner, and thus ESOs should be shown as a liability and remeasured. The AAA FASC (AAA_FASC 2004) went further to suggest that this problem indicates that the Conceptual Framework needs revision.

Empirical research supports the view that the ESO “liability” should be restated (Aboody 1996; Landsman et al. 2006). It is, however, difficult to draw conclusions from this work as the methodology follows that of most of the value-relevance studies, whereby the stock price is stated as a function of accounting data. This assumes that the objective of accounting is to provide information relating to the wealth of the current ordinary shareholders, rather than the equity holders as a whole (i.e. including option holders and other types of equity participants). If the dependant variable is

the value of an ordinary share, then the current value of the options *will* be more relevant than the historical value. The empirical work thus does not assist in answering the broader theoretical question of whether ESOs should be classified as a liability or equity.

The issue of liability vs. equity will be dealt with in more detail in Chapter 4 which considers the effect of this classification on the calculation of DEPS.

2.5. Does the granting of ESOs result in an asset to the firm?

The accounting treatment of manufacturing plant, as prescribed by International Accounting Standard 16 – Property, Plant and Equipment (IASB 1993), provides some useful parallels. If a liability is incurred as a direct result of installing a manufacturing plant, for example a decommissioning obligation, both a liability and an asset³ are recognised at the time of installation. The liability for future costs is initially offset in the balance sheet by an asset that reflects the additional benefits that will be generated by the plant. If the same logic was applied to ESOs, the full value of the ESOs should be credited to equity/liability on the grant date, and an asset recognised for the future benefits to be received from the employees.

The work of Bell et al. (2002) and Rees and Stott (2001) referred to earlier both suggested the existence of an unrecorded intangible asset due to ESOs. Aboody et al. (2004) also found a positive relationship between stock-based compensation expense and future earnings, supporting the contention that issuing ESOs results in future benefits for the firm. In an analysis of various different ways of accounting for ESOs, Landsman et al. (2006) concluded that the most appropriate accounting treatment is to record

³ This asset is included in the carrying amount of the plant. See paragraph 16 of IAS 16.

an ESO asset when the ESOs are granted, and also to recognise the outstanding ESOs as a liability. This liability should be restated for changes in the value of the ESOs to reflect the ESO holders' claims on the entity.

The reason why an ESO asset is not recognised on grant date is explained in the original SFAS No. 123 (FASB 1995: para. 92-96). Basically the contract to provide services in exchange for options is considered an executory contract. A fundamental rule of accounting is that no entries are processed in the accounting records until one of the parties to the contract has discharged its obligations. As both parties in an ESO transaction still need to "execute" their obligations, the transaction is not recorded on grant date. This is similar to entering into a contract to purchase stock; the asset and liability would only be recognised once the seller has delivered the stock.

There are, however, inconsistencies in the treatment of executory contracts in the current accounting standards. For example, International Accounting Standard 39 – Financial Instruments: Recognition and Measurement (IASB 1999) (IAS 39) requires recognition of contracts to deliver financial instruments on signature of the agreement. IAS 39 also requires that contracts to deliver commodities that will be settled net in cash must be accounted for from signature date (IAS 39: para. 5). The International Accounting Standards Board (IASB) plans to change current rules for leases so that all leases are accounted for as finance leases (IASB 2008a). Finance lease accounting involves recognising a liability for future lease payments and an asset for the rights under the lease when the lease is signed. Currently, operating, or short-term leases, would have been considered executory contracts and no accounting entries recorded until the lessee or lessor performs part of their obligations under the contract.

The issues surrounding executory contracts again point to some problems with the Conceptual Framework. The primary objective of this research is not to criticise the Conceptual Framework, but rather to explore the implications of existing accounting, finance and economic literature on the current accounting rules. Where this points to a potential conflict with the Conceptual Framework, this will be highlighted, but only within the context of ESO accounting.

2.6. How should the ESO expense be measured?

Another objection often raised is that ESOs cannot be valued. Whilst there is a well accepted practice and theory that has evolved for the valuation of other options, typical ESOs have several unique characteristics:

- The options may not be exercised during the “vesting period”. The employee must work for the company for a specified time before obtaining access to the option benefit.
- If the employee leaves the company (voluntarily or otherwise) during the vesting period, the options will be forfeited.
- The options are not tradable. Employees may thus be forced to exercise the options irrationally rather than selling them to liquidate their position. This will be more likely if the employee has immediate cash flow needs or the value of the options reflect a significant portion of their personal wealth.
- Those employees that leave the company after the vesting period, but before the maturity of the options, may forfeit out-of-the-money options or automatically exercise in-the-money options (regardless of whether the exercise makes financial sense).
- Possible stock dilution owing to the issue of new treasury stock in the event of exercise.

All of these features may induce the employee to act in a way that violates some of the assumptions used in standard option pricing methods. Whilst IFRS 2 acknowledges many of these problems in the comments accompanying the standard, it provides very little guidance as to how these issues should be dealt with. The guidance given seems clumsy and takes little cognisance of the large amounts of literature that deal directly with the valuation problems caused by ESOs. An example of this is the suggested solution in IFRS 2 of the potential for early exercise. IFRS 2 stipulates that the time to expiry used in the Black-Scholes-Merton (BSM) formula must be reduced to the expected life of the option, rather than the contract life (IFRS 2: para. B17). The expected life is the period of time from grant date to the date on which the option is expected to be exercised. It would be easy to prove that this approach is incorrect, as the expected value of the options cannot be calculated by simply using the expected life of the options in the BSM formula. This is because the value of the option is not a linear function of the time to maturity. Boyle and Scott (2006) detailed the potential errors that could be induced by using the expected life. The alternative approach suggested by IFRS 2 is that early exercise be modelled in a binomial pricing model. The binomial model is based on a tree or lattice-like visualisation of the potential paths the underlying share price can take over the life of the option. It is subject to the same assumptions as the BSM formula, but the lattice depiction makes it easier to understand. This model is also a lot more flexible, because it is easy to change the payoff tests through the life of the option and at various points in the share price paths by simply changing the tests at the various nodes on the tree. Thus the binomial model is more suitable for pricing non-standard options, and thus more suited to ESOs. IFRS 2, however, does not provide any guidance as to how the standard binomial model should be modified.

Unusually, IFRS 2 also requires that some of the features of the ESOs be ignored when they are valued on grant date. The ESO features are split into market and non-market related vesting conditions. Non-market related vesting conditions are conditions that the employee must satisfy before becoming entitled to the option benefit. These may include a requirement to remain in service with the employer for a specified amount of time, or performance conditions which require certain intra-firm financial or strategic targets to be met. Market related vesting conditions are conditions related to the market price of the entity's stock. Market conditions must be taken into account when estimating the value of the options. Non-market vesting conditions are ignored when valuing the options initially, and are then considered in the actual accounting process. For example, the number of options actually expensed must be reduced by the number of options expected to be forfeited prior to vesting. Forfeiture relates to a specific condition between the firm and the employee that has nothing to do with the firm's performance on the stock market, and thus relates to a non-market vesting condition. The estimate of the forfeiture rate is corrected annually so that the final expense is based on the number of options that actually vest. The result is that the two types of conditions are dealt with very differently; market conditions are included in the valuation process, while non-market conditions are dealt with in a simplistic way in the actual accounting. Market conditions are never revisited, but non-market conditions are revised so that the final expense is based on actual outcomes.

In an attempt to address both market and non-market conditions, many authors have provided alternative valuation methods to those prescribed by IFRS 2⁴. Huddart (1994) was one of the first to suggest solutions to the problems concerning early exercise. Huddart derived a utility-based

⁴ Most deal with the U.S. equivalent of IFRS 2, Statement of Financial Accounting Standards No. 123, Accounting for Stock-Based Compensation (FASB 1995). In all areas relevant to this thesis, the requirements of the two standards are the same.

economic model to describe an employee's exercise behaviour. The employee's decision is a function of his risk aversion, investment opportunities and wealth. His results suggested that employees' behaviour can be approximated by assuming that the options are exercised when the stock price reaches a critical multiple of the strike price.

Smith and Zimmerman (1976) provided initial boundaries on the option values. They argued that the lower bound for an ESO is $V \geq \text{Max}(0, S - XB)$, where V is the value of the option, S is the current stock price and XB is the exercise price of the option discounted over the life of the option⁵. Under the original version of SFAS 123, unlisted companies were allowed to value their options using this method. IFRS 2 and SFAS 123 (revised 2004) currently require options of unlisted companies (or more correctly, options that cannot be reliably measured) to be valued at intrinsic value. Whilst this will result in the options being undervalued, the two statements only allow the use of the intrinsic method in exceptional circumstances.

Rubinstein (1995) addressed many of the features of ESOs in an extension to the standard Cox-Ross-Rubinstein binomial model. His model included adjustments to account for longer maturity, delayed vesting, forfeiture, non-transferability, dilution and taxes. This revised model, however, required 16 input variables, as opposed to the normal six. Many of the variables will be difficult to estimate, for example employees' risk aversion and expected stock return. The complexity of this model, and in particular, the number of input variables, would make it very difficult to apply in practice.

In an effort to model both early exercise and ESO forfeiture, Carpenter (1998) and Jennergren and Naslund (1993) used a stochastic process to

⁵ Or X is the exercise price and $B = 1 / (1 + r)^T$ where r is the risk-free rate of return and T is the time until the option expires.

model employee behaviour. The stochastic process terminates the option according to a fixed probability. Carpenter demonstrated that these types of models work as well as more complex, utility-maximising models. The Carpenter and Jennergren and Naslund models require only one more parameter to those required by the standard option pricing models, the option termination rate. Option termination occurs when the employee exercises the option or leaves the company. Utility-maximising models typically require other inputs, such as risk aversion, outside wealth and potential gain from voluntary separation.

Other writers have dealt with some of the other features unique to ESOs. Jain and Subramanian (2004) described a more flexible model that allows for multi-period exercise, rather than a single exercise of all existing options. Most employees own more than one ESO, and often also own ESOs with different grant dates, and different terms. They are thus likely to exercise their options in tranches, rather than all at once. Multi-period exercise is thus more likely to reflect actual ESO exercise patterns. Another feature often encountered with ESOs is repricing, or a reload provision. The reload provision allows directors to reduce the exercise price of options if the stock price drops to a level where the initial options cease to have any real incentive effect. If the ESOs are issued with a reload provision, or even if repricing is likely, the value of the options will be significantly increased. Hemmer et al. (1998) and Corrado et al. (2001) derived models that can be used to value these types of options. Interestingly, the Hemmer et al. analysis indicates that optimal exercise strategy for reload options is independent of employee's personal preferences and circumstances.

Integrating many of the techniques suggested by previous authors and focusing on providing a practical solution to valuing ESOs, Hull and White (2004b) proposed a simple extension to the standard binomial model, which

dealt with most of the valuation problems associated with ESOs. Their model requires just three additional input variables as compared to standard option pricing models; employee exit rate pre- and post-vesting and an early exercise multiple (M). They essentially combined the model developed by Carpenter (1998) with the principles established in Huddart (1994). From Carpenter they carried forward the notion of a fixed proportion of the options being forfeited each period, but this portion only represents employees that have left during the period. As the employee exit rate may differ pre- and post-vesting, the model allows for different rates over the two periods. If the employee leaves during the vesting period, the option will pay out nothing. Departure after vesting will result in a payout of the option's intrinsic value. Huddart, referred to earlier, determined that risk-averse employees will exercise their options when the share price goes above a certain level. Hull and White translated this into an early exercise multiple. If the stock price reaches a price equal to KM , where K is the strike price and M is the early exercise multiple, the employee is assumed to exercise the option immediately.

Cvitanic et al. (2008) and Brisley and Anderson (2008) presented variations on HW's M early exercise barrier. HW's model is based on a lattice-type pricing model, whereas Cvitanic et al. derive an analytical formula which can be used to price ESOs. Their formula is complex, however, and not as easy to follow as the HW approach. Brisley and Anderson argue that instead of assuming that employees exercise when the share price reaches a fixed multiple of the exercise price, it should be assumed that the employee always exercises to realise a fixed proportion of the remaining Black-Scholes-Merton (BSM) value. This results in an exercise boundary that curves downwards as the option reaches maturity.

Empirical research on valuing employee stock options

The economic models presented to describe employee exercise behaviour (Hall and Murphy 2000; Huddart 1994; Kulatilaka and Marcus 1994) have been supported by empirical research. Employees do tend to exercise their ESOs well before expiry (Carpenter 1998; Hemmer et al. 1996; Huddart and Lang 1996). Hemmer et al. (1996) and Huddart and Lang (1996) found that the more risk associated with the ESO, the earlier it was exercised. This supports the notion that risk-aversion induces the employee to exercise the option early. In fact, conservative employees often sacrifice half of the Black-Scholes value by exercising early (Huddart and Lang 1996).

Huddart's (1994) theoretical work suggested that employees exercise their options when the share price to exercise price ratio reaches a certain level. Empirical findings suggest that employees do exercise options when the market-to-strike ratio is high (Huddart and Lang 1996). The average market-to-strike ratio on exercise ranges from 2,2 to 2,8 (Carpenter 1998; Huddart and Lang 1996). Heath et al. (1999) found that employees are much more likely to exercise their options if the market price of underlying shares has just exceeded a 12 month high.

Utilising an appropriate valuation model only addresses part of the measurement problem. The ESO expense may be more prone to manipulation than many other expenses. The value of ESOs is sensitive to the inputs used (Rubinstein 1995), which are often subjective and difficult to validate. Prior research also indicates that management can sometimes control the timing of the ESO grant or the release of information to maximise the value of the incentive (Aboody et al. 2006; Aboody and Kasznik 2000; Heron and Lie 2007; Yermack 1997). It is thus likely that the ESO expense will suffer from measurement error, and the general tendency seems to be to understate this expense.

The theoretical and empirical research concerning the valuation of ESOs is thus varied and extensive. This thesis considers the implications of this literature for the accounting of ESOs. In Chapter 3 some of the models described above are used to establish a hedging strategy for ESOs. This hedging strategy allows for some additional insights to be made into ESO accounting.

2.7. How should ESOs be treated in the DEPS calculation?

The current GAAP for measuring DEPS has been carried over largely unaltered from Accounting Principles Board (APB) Opinion 15 (AICPA 1969) which was issued in 1969. The introduction of this standard predated the development of option pricing models in the 1970's, which made the provisions of APB Opinion 15 seem archaic and redundant. These problems were soon identified in a number of research studies. Vigeland (1982) and Bierman (1986) pointed out that APB Opinion 15 ignores the probability of the option being exercised. Jerris (1992) used the probability of the instrument being converted or exercised to calculate his EPS numbers, which he found had a closer association with stock return residuals than the APB Opinion 15 figures. The APB Opinion 15 method also uses the exercise price rather than the present value of the exercise price, which understates the dilutive effects of the options (Smith and Zimmerman 1976). It also ignores the present value of the dividends foregone (Barlev 1984). All of these issues, probability of conversion, present value effects on the exercise price and dividends foregone are captured in the fair value of the options by the option pricing models. More recently, Caster et al. (2006) criticised the SFAS No. 128 approach on a more basic level:

“The current definition of diluted EPS describes a long, complex computational process, and it defines diluted EPS as being the

result that one obtains at the end of the computation. Using the jargon of current accounting debates, this definition is completely rule-bound and essentially lacks any conceptual basis. It also seems oddly out of step with the other definitions that FASB has provided for the accounting profession.”

Research into the information content of the various EPS figures has supported the view that the present requirements fail to capture the dilutive effects of potential future shares. Scott and Wier (2000) and Miller et al. (1987) found that DEPS had a weaker association with stock returns than basic EPS, suggesting measurement error in the calculation of DEPS. This was in contrast with the findings of Jennings et al. (1997) who found that DEPS explained more of the variation in stock prices than basic EPS. Rice (1978) analysed stock price patterns around the time DEPS⁶ figures were first disclosed, and found that the information contained in DEPS was value-relevant. Huson et al. (2001) compared earnings response coefficients for firms with varying numbers of dilutive instruments outstanding, and found that the coefficient was smaller for firms with large numbers of dilutive instruments. Their findings also suggested that current DEPS measures do not adequately reflect future dilution. Taken together, these studies indicate that the information contained in DEPS is useful, but is perhaps not correctly measured.

Core et al. (2002) directly addressed the issue of DEPS measurement in the presence of ESOs. They derived their DEPS calculation by assuming a simple linear relationship between share price and earnings. Their DEPS calculation is similar to the APB Opinion 15 method, except that they used the fair value of the options to calculate the adjustment to the denominator.

⁶ Rice actually tested the impact of fully diluted EPS information, but fully diluted EPS is substantially the same as the current diluted EPS figure.

Their findings suggested that the APB Opinion 15 method significantly understates the dilutive effects of the options.

The analysis of the literature thus leads to the following conclusions:

- DEPS information is useful, but appears to suffer from measurement error,
- the current DEPS calculation underestimates the dilutive effects of ESOs, and
- using the fair value of ESOs in the DEPS calculation would provide more useful information.

The most appropriate way to calculate DEPS when a firm has outstanding ESOs is the central issue in Chapter 4. This chapter explores alternative methods of calculating DEPS. The merits of each are considered and compared with the current IAS 33 approach.

2.8. Conclusion

IFRS 2 seems to raise more questions than it answers. This is not surprising given that it was issued as recently as 2004, and prior to that most accounting jurisdictions completely ignored the economic effects of ESOs in the accounting records. It has thus not had the benefit of a long iterative process of regulation and application. By way of contrast, accountants have been grappling with the accounting issues relating to plant for hundreds of years.

The significant themes emanating from the literature review are summarised in Figure 2.2. Many of these issues will be dealt with in the following two chapters on the ESO expense and DEPS, as indicated in the diagram. Chapter 3 focuses on the appropriate treatment of ESOs in the income

statement. Given the preferred treatment in Chapter 3, the next chapter will discuss the most appropriate way to reflect the future potential dilutive effects of ESOs on the earnings per share metric.

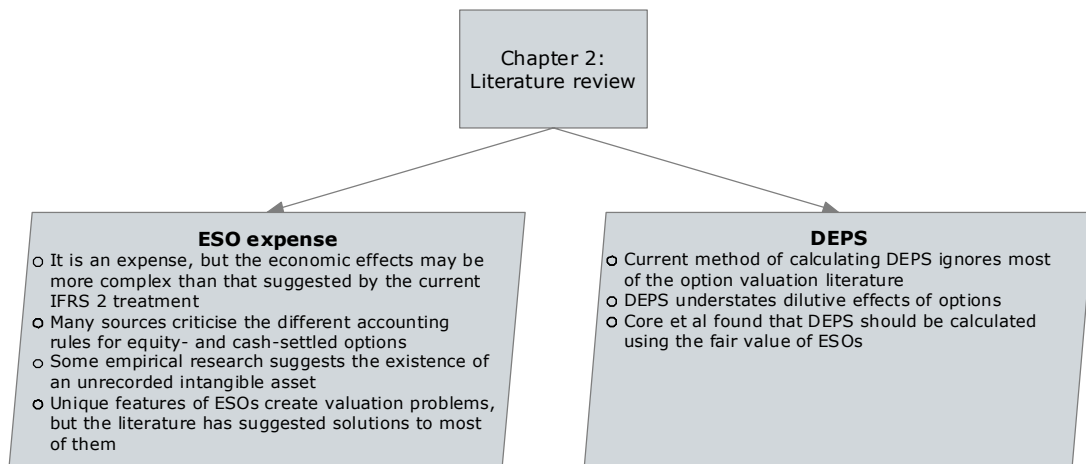


Figure 2.2 Significant themes emanating from the literature review

3. Employee stock option expense⁷

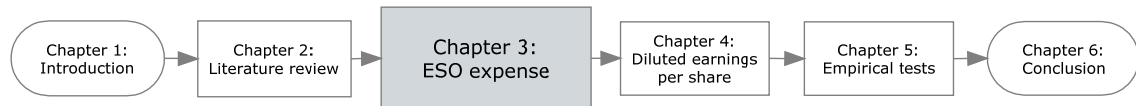


Figure 3.1 Role of chapter 3 within overall thesis structure

3.1. Introduction

The role of accounting is to provide economic information. It is thus imperative to determine the underlying economic nature of a transaction before deriving the appropriate accounting treatment. This leads to the well known accounting principle of economic substance over legal form; the economic substance of the transaction will always dominate the legal form from an accounting perspective. An often quoted example is the accounting for leases. Despite the fact that leases do not transfer legal ownership rights to lessees, International Accounting Standard 17 – Leases (IASB 1997)

⁷ I am indebted to Associate Professor David Taylor from the School of Computational and Applied Mathematics at the University of the Witwatersrand for his assistance with the technical aspects in this chapter. The findings of this chapter have been published in an article co-authored with Prof. Taylor titled “Hedging employee stock options and the implications for accounting standards” which appeared in the Investment Analysts Journal No. 67 of 2008.

requires the recognition of an asset if the economic substance of the arrangement is such that the lessee owns the asset.

Thus the first step in determining an accounting policy for ESOs is to understand the underlying economic substance. ESOs are complex; they are intangible rights created by contracts and sophisticated mathematical and statistical techniques are required to value them. Option theory has developed to such an extent in recent years that many of the usual characteristics of options and their economic effects are well understood, but ESOs have characteristics that violate some of the standard assumptions used in option analysis⁸. An additional complication from an accounting perspective is that ESOs never result in a cash outflow. Most other expenses can be traced back to a cash outflow at some stage in the firm's life, and any accounting treatment must balance back to this cash flow. The lack of a cash outflow has caused some accountants to conclude that there is no expense. This is clearly not the correct conclusion (see comments in Chapter 2), but does illustrate the significance of this feature of ESOs. All these problems tend to inhibit development of accounting rules for ESOs.

A technique used to understand ordinary options is to specify a hedge for the contract. The hedge acts as a mirror, and by looking at the hedge, it is possible to better understand the original. For example, Black and Scholes (1973) use a hedged position to derive their famous formula. Importantly, from an accounting perspective, creating and liquidating the hedge results in cash flows which allow for a better understanding of the underlying economic characteristics of the ESO. Whilst a hedge has often been used to analyse options in the finance literature, no other instances have been found that use hedging as a method of analysis in an accounting context. This chapter thus presents a new and atypical technique for assessing accounting

⁸ These characteristics were detailed in Chapter 2.

requirements.

In the paragraphs that follow, a hedge is derived for ESOs. The unusual characteristics of ESOs necessitate an unusual hedge. It will be argued that the optimal way to hedge ESOs is by way of a static portfolio. This is in contrast to the normal hedging strategy adopted for most other options, being dynamic hedging. Dynamic hedging requires continuous adjustment to the hedging portfolio in order to maintain its effectiveness as time passes and market conditions change. Static hedging, on the other hand, means that a hedging portfolio can be created that will mirror the cash flows of the option throughout its life, and without any subsequent changes to the hedging portfolio.

This allows for some interesting parallels to be drawn between the hedging portfolio and the current IFRS 2 requirements. Notably, IFRS 2 prescribes grant date accounting for ESOs, which means that the value of the ESOs are determined on grant date, and never thereafter adjusted. The static hedge thus provides a useful mirror which can be used to reflect on grant date accounting.

3.2. Accounting for Employee Stock Options

The income statement treatment of ESOs is determined by IFRS 2. IFRS 2 prescribes a two-stage approach to accounting for employee stock options: firstly, value the options on grant date by using an appropriate valuation model; and secondly, recognise the value of the options as an accounting expense over the vesting period.

IFRS 2 provides brief guidance on the valuation of ESOs. As mentioned earlier, options are generally subject to vesting conditions. IFRS 2

distinguishes between market related and non-market related vesting conditions. The stock options must then be valued using an accepted valuation model. The valuation model should only consider market related vesting conditions. Non-market related conditions are considered when the options are expensed in the accounting records. The discussion that follows focuses on only one vesting condition, the time that the employee must remain in the service of the employer before becoming entitled to the option. This period is often referred to as the “vesting period”.

Over the vesting period, the accountant is required to continuously assess the likelihood of the options actually vesting, such that the final cumulative option expense is equal to the grant date value of the options that ultimately vest. Thus IFRS 2 only expenses those options that are expected to ultimately vest. The advantage of this approach is that only options that ultimately vest are expensed, but it fails to recognise the fact that a valuable benefit was offered to those employees that have left during the vesting period, and that they chose to forgo this benefit some time after the grant date⁹.

3.3. Definition of ESO

Before exploring the economic characteristics and deriving an appropriate hedge it will be useful to define an ESO. Most of the literature¹⁰ describes an ESO as:

- a call option,
- with a strike price equal to the share price on grant date,
- which cannot be exercised for the first few years of its life, typically two to five years (known as the vesting period),

⁹ In fact, this may be contributing to the positive ESO coefficient in prior empirical research. This issue is discussed further in the empirical tests in Chapter 5.

¹⁰ For example see Hemmer et al. (1994), Hull and White (2004b) and Mozes (1998).

- the options are forfeited if the employee leaves the firm during the vesting period,
- a long time to maturity (normally between five to ten years),
- employees may not sell their options,
- the options may be exercised at any time from the vesting date to the final expiry date,
- if employees leave the firm after the vesting period they must exercise the options immediately, and
- the options are settled by the firm issuing new shares to the employees.

Many of these characteristics result in ESOs violating some of the assumptions underlying standard option pricing models, and the constraints placed on the employee mean that an ESO has a lower value than a normal option. For example, if a normal option holder needed to liquidate his position, he would sell the options rather than exercise them before expiry. The selling price is almost always higher than the exercise value. Many writers have suggested solutions to these problems, as discussed in Chapter 2. As a means of revising and summarising this discussion, the ESO features and the papers that have addressed these issues are listed in the table below:

Table 3.1 ESO features and the valuation literature

Standard option features	ESO features	Relevant literature
Not subject to ongoing employment.	If the employee leaves the company (voluntarily or otherwise) during the vesting period, the options will be forfeited.	Carpenter (1998), Hull & White (2004b), Jennergren and Naslund (1993), Rubinstein (1995).
Risk-averse option holders can hedge the option or sell it and realise the full economic value.	The options are not tradable. Risk-averse employees will exercise the option and only realise the intrinsic value. Employees tend to exercise when the market-to-strike ratio is high.	Carpenter (1998), Huddart (1994), Hull & White (2004b), Jennergren and Naslund (1993), Rubinstein (1995).
Option exercised when holder believes it is optimal to do so. Option theory indicates that this is at, or near to, maturity.	Those employees that leave the company after the vesting period must exercise the options immediately.	Carpenter (1998), Hull & White (2004b), Jennergren and Naslund (1993), Rubinstein (1995).
Generally short time to maturity.	Long time to maturity.	Brown & Szimayer (2008) [ESOs], Hull & White (1987), Heston (1993) and Heston & Nandi (2000) [General].
Not issued by the company and thus exercise does not affect the shares in issue.	Stock dilution owing to the issue of new treasury stock in the event of exercise.	Li & Wong (2005)

It is clear from the table above that Carpenter (1998), Hull & White (2004b), Jennergren and Naslund (1993), Rubinstein (1995) deal with most of the unique features of ESOs. The Rubinstein model, however, is complex and requires many more input parameters than the others. In particular, the employees' risk aversion, outside wealth and marginal tax rate would be difficult to measure. The Carpenter and Jennergren and Naslund models allow for employee forfeiture or early exercise according to a fixed probability per period. Their model thus only requires one additional input as compared to standard option pricing models, being the employee stopping rate. This does seem to be an overly simplistic solution to the problem of early exercise, though, as early exercise is likely to be highly correlated with the option's value. As mentioned earlier, employees tend to exercise their options when the share price exceeds a multiple of 2 to 3 times the exercise price (Carpenter 1998; Huddart and Lang 1996).

The Hull & White (HW) model takes the principles of Carpenter and Jennergren and Naslund a step further. It retains the fixed stopping rate of Carpenter and Jennergren and Naslund to model employee forfeiture during the vesting period, or departure in the post-vesting period. To cater for the fact that the employee may exercise early in order to liquidate his position, the HW model assumes immediate exercise when the share price reaches a certain multiple of the strike price. The HW model thus requires one additional input to Carpenter and Jennergren and Naslund, the early exercise multiple (M). Technically, as demonstrated by Huddart (1994), M will be a function of the employees' risk aversion and outside wealth. M has the advantage, however, of being easier to understand and can be based on observations of historical voluntary early exercise decisions of employees¹¹.

¹¹ See Hull and White (2004a) for a discussion on estimating M .

Only Rubinstein attempts to capture the relationship that is likely to exist between the value of the option and the employee's decision to leave the firm. The more valuable the option, the less likely the employee is to leave the firm before the option matures. This relationship is difficult to model. Rubinstein includes an adjustment to his option value that requires two additional parameters, a minimum forfeiture rate multiplier and a maximum forfeiture rate multiplier. Rubinstein does not, however, provide any substantiation for the adjustment he has chosen, or describe how the parameters could be measured. Therefore, until a feasible solution is suggested, the fixed stopping rate suggested by Carpenter and Jennergren and Naslund appears to be the most practical solution to the early termination phenomenon.

The standard option pricing models assume constant volatility and constant interest rates throughout the life of the option. Over a short period these assumptions are unlikely to undermine the validity of the model. Over a long period, however, these assumptions become questionable, as volatility and interest rates are likely to change over an extended time frame. As ESOs generally have a long time to expiry, they are susceptible to this weakness in the standard pricing models. Some authors have presented pricing models that allow for stochastic volatility and interest rates for standard options, notably Hull and White (1987) and Heston (1993). Only Brown and Szimayer (2008) have suggest an ESO model that incorporates stochastic volatility, utilising the method suggested by Heston. These models continue to be developed, but are complex and require parameters that are difficult to estimate.

The final characteristic of ESOs that could complicate their valuation is the fact that they are settled by the company issuing new shares. Most traded options are settled in cash, or in shares held by one of the parties. The

settlement has no effect on the equity of the underlying firm. When the employer firm settles ESOs, however, the additional shares have a dilutive effect which is not captured by the standard option pricing models. Li and Wong (2005) present an adjustment to the standard BSM model based on the work of Galai and Schneller (1978) and Black and Scholes (1973). Simplistically, their model multiplies the normal BSM solution by $n / (n + m)$, where n is the number of shares outstanding before the options are settled, and m is the number of options. In addition, the estimate of volatility must be based on the volatility of total equity, not just the ordinary shares.

HW address this issue in their paper and argue that the possible dilution caused by settling the ESOs will be incorporated in the share price as soon as investors become aware of the ESOs. It is thus not necessary to adjust the model further, provided the valuation is based on the share price post the ESO announcement. The Li and Wong adjustment is also not likely to be significant if the number of ESOs is small relative to the shares outstanding. Either way, this does not seem to be a material deficiency in the HW model.

3.4. The Hull and White model

The HW model thus appears to deal with most of the complications inherent in ESOs in a practical and simple manner. Table 3.2 repeats the ESO features listed in Table 3.1 and describes how they are dealt with in the Hull and White model.

Table 3.2 Hull and White approach to ESOs

ESO feature	Hull and White model
If the employee leaves the company (voluntarily or otherwise) during the vesting period, the options will be forfeited.	Fixed exit rate resulting in zero payout.
The options are not tradable.	Early exercise multiple resulting in payout of intrinsic value.
Those employees that leave the company after the vesting period must exercise the options immediately.	Fixed exit rate post-vesting resulting in payout of intrinsic value.
Long time to maturity.	Not addressed.
Stock dilution owing to the issue of new treasury stock in the event of exercise.	Not addressed (see earlier comments).

It would be useful at this point to analyse this model further. Figure 3.2 below presents a graphical interpretation of the model.

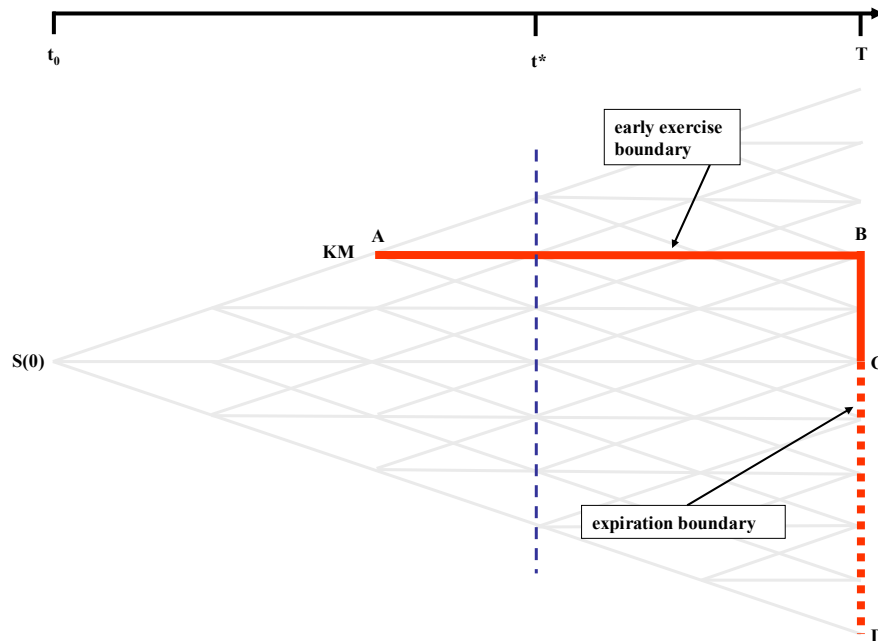


Figure 3.2 Graphical depiction of Hull & White Employee Stock Option

Reading from left to right the diagram presents the possible stock price evolution over the life of the ESO, each node representing a different stock price. The diagram starts at the share price on the grant date ($S(0)$), which is typically also the strike price, and ends on the maturity date (T). If the employee leaves the firm during the vesting period, t_0 to t^* , the ESO is forfeited. The HW model assumes that during each period from t_0 to t^* a fixed proportion of the employees leave the firm and forfeit their options. The payout for ESOs forfeited is zero. Thus at each node on the diagram, a fixed percentage of the options terminate. In a similar manner, a fixed proportion of the employees leave the firm during the period post-vesting, t^* to T . Departure here, however, results in a payout of the option's intrinsic value if the share price is above the strike price, or zero otherwise.

The line AB represents the barrier first described by Huddart (1994). This barrier lies at a share price of KM , where K is the strike price and M the early

exercise multiple. The option terminates at this barrier, and pays out $KM - K$. The final expiration boundary, BD, represents the normal termination of the option on expiry, and the option will pay out the intrinsic value if expiry occurs on the line BC, or zero if it occurs on the line CD.

In technical terms, the HW ESO can be described as a Bermudan style barrier option¹², with an up-and-out barrier at KM and a rebate of $KM - K$. The barrier has been referred to already, and an up-and-out barrier option terminates when the share price exceeds the barrier. In the case of an ESO, the option pays out $KM - K$, which is referred to as the rebate.

3.5. The hedging strategy

The conventional way of hedging options is delta-neutral hedging. A sufficient number of the underlying asset is purchased or shorted so that the change in the value of the hedge over a short period of time will exactly offset the change in value of the option over the same period¹³. Delta-neutral hedging is a dynamic hedging strategy, in that the hedge must be regularly adjusted, or rebalanced. The more often the hedge is rebalanced, the more efficient it is. The trade off is that transaction costs are incurred every time the hedge is changed. The alternative to a dynamic hedging strategy is some sort of static hedge, whereby a portfolio of instruments is acquired when the option is initially written, and that portfolio continues to provide an effective hedge throughout the life of the option.

¹² ESOs are typically American style options, in that they can be exercised at any time up to the expiry date. ESOs cannot, however, be exercised during the vesting period, and in this they are similar to European style options which can only be exercised on the expiry date. In the middle of the Atlantic lies Bermuda, and so options with both American and European features are generally referred to as Bermudan options.

¹³ Delta refers to the rate of change of the option value with respect to the underlying asset price.

Static hedging is sometimes preferable to delta-neutral hedging, particularly in the case of barrier options. This is because barrier options often have a high gamma, being the rate of change of the delta with respect to the underlying asset price. This makes delta hedging difficult (Hull 2009: 563). Stochastic volatility on longer term options is also likely to affect the performance of delta hedging (Hull 2009: 590). The logical alternative for barrier options is static hedging, and Derman et al. (1994) (DEK) describe a method for devising a static hedge, called static options replication. ESOs, being a kind of barrier option, are a likely candidate for a static hedge. The flexible nature of the static options replication method also means that it is readily adaptable to ESOs. Static hedging is also useful from an accounting perspective, as the cost of the hedge will define a once off, upfront expense which can be recognised in the accounting records. This is consistent with the principles in IFRS 2, which require recognition of the initial value of the ESOs.

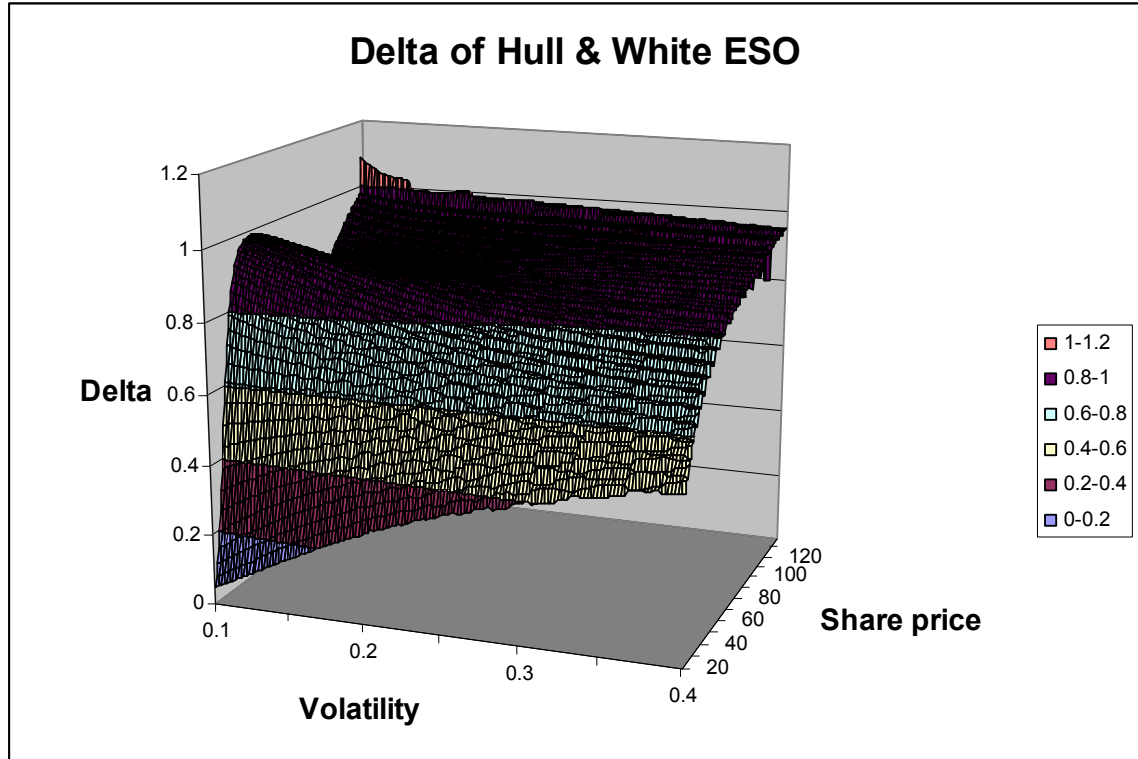


Figure 3.3 Delta of Hull & White ESO.

The graph shows the delta of an ESO with volatility from 10% to 40% and a share price of 20 to 139. The strike price is 50, risk-free interest rate 10%, dividend yield 0%, the time to maturity 5 years, the vesting period 2 years, exit rate 0% and the early exercise multiple 2,8.

3.6. The DEK hedge

The DEK procedure is based on the *binomial* tree that is often used to value options. Barrier options are more appropriately valued by using a *trinomial* tree (Hull 2009: 598), and this is the method used in HW for ESOs. The DEK approach is easily adapted to trinomial trees. In the paragraphs that follow, the DEK procedure will be used to hedge a fictitious ESO.

Assume an ESO has the following characteristics and valuation parameters:

- initial share price 50
- strike price 50

- risk free interest rate 10%
- dividend yield 0%
- stock volatility 30%
- time to maturity 5 years
- time to vest 2 years
- exercise multiple $2,8^{14}$

Hull (2009: 599) describes the procedure to be followed to construct a trinomial tree for a barrier option. The tree begins at the initial share price of 50. In each time interval the share price can either move up, down or stay the same. Using the parameters given above, an upwards movement is then calculated as always being 1,29 times the previous price, and a downwards movement always 0,77 times the previous price. This stock price evolution can be seen in Figure 3.4. The tree given is based on a tree with 20 steps, but only every fourth node is shown on Figure 3.4. As the tree covers five years, these are also the annual nodes. For example, four successive upwards movements would give a share price of $50 \times 1,29^4 = 140$ (ignoring rounding errors), which is the value at the upper node at $t = 1$.

¹⁴ This is the average value of the Carpenter (1998) sample.

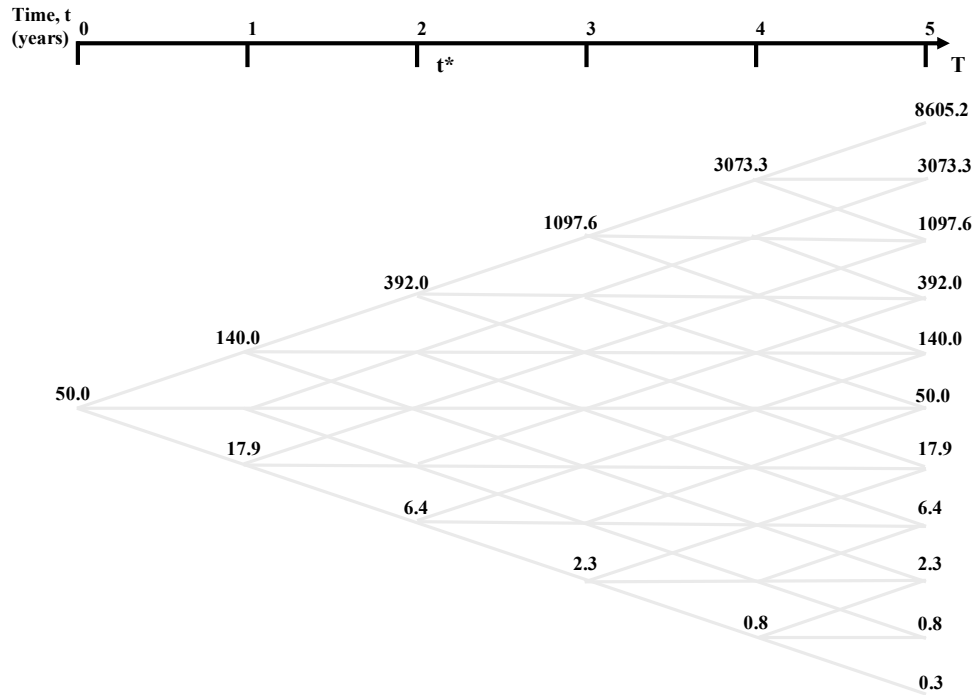


Figure 3.4 A trinomial tree of stock prices. Only the annual nodes are shown.

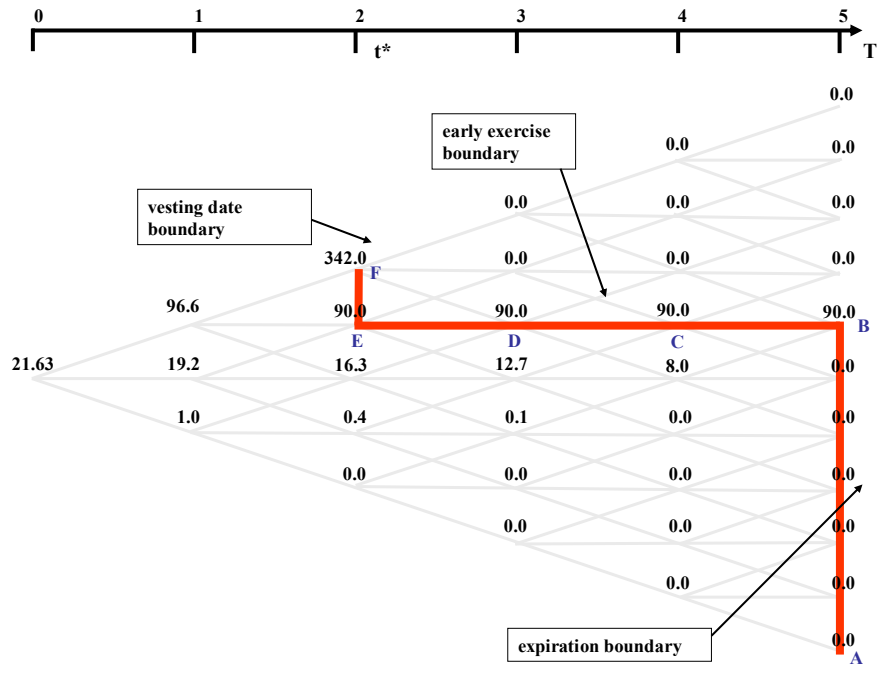


Figure 3.5 A trinomial tree of ESO values corresponding to the nodes in Figure 3.4.

This tree can then be used to value the ESO. The values shown in Figure 3.5 are the values of the ESO corresponding to the tree of stock prices in Figure 3.4. Only the annual nodes are shown, but the full trees can be viewed in appendix A. Figure 3.5 indicates a value of 21,6 for the ESO on grant date. The bold line marks the exercise boundary. For reasons that will be explained later, the pre- and post-vesting exit rates are set at 0%.

Following DEK, the boundary payoffs are matched by using normal European call options, starting with the expiration boundary. A call option with a strike price of 50 and a maturity of five years will match the payoff on line A – B. The payoffs are then matched at the 2, 3, 4 and 5 year nodes on

the barrier¹⁵. The number of hedging options required in each case is determined by matching the payoff of the hedging portfolio with the payoff of the ESO at that node. For example, to match node C we need to short a European call with a strike of 140 and a maturity of five years. To give a payoff of 90 (140 - 50) at point C, we need to short 0,21 calls.

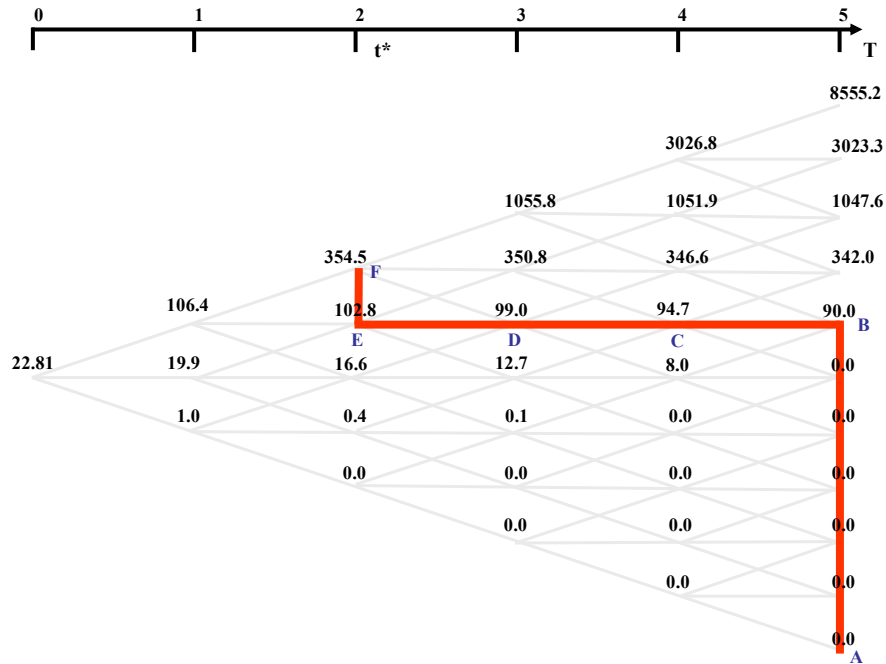


Figure 3.6 Trinomial tree of European call values with a strike of 50 and maturity of five years.

Figure 3.6 shows the value of a European call struck at 50 and Figure 3.7 the value of a European call struck at 140, both with a maturity of five years. The second option must be added to the portfolio so that value at node C, which is the next node to be matched, is 90. To achieve this, a short position of 0,21 European calls struck at 140 is required. The combined effect of the two options is shown in Figure 3.8, and it can be seen that a value of 90 at node C has been achieved.

¹⁵ Five nodes are considered sufficient for illustrative purposes. The more nodes matched, the more efficient the hedge.

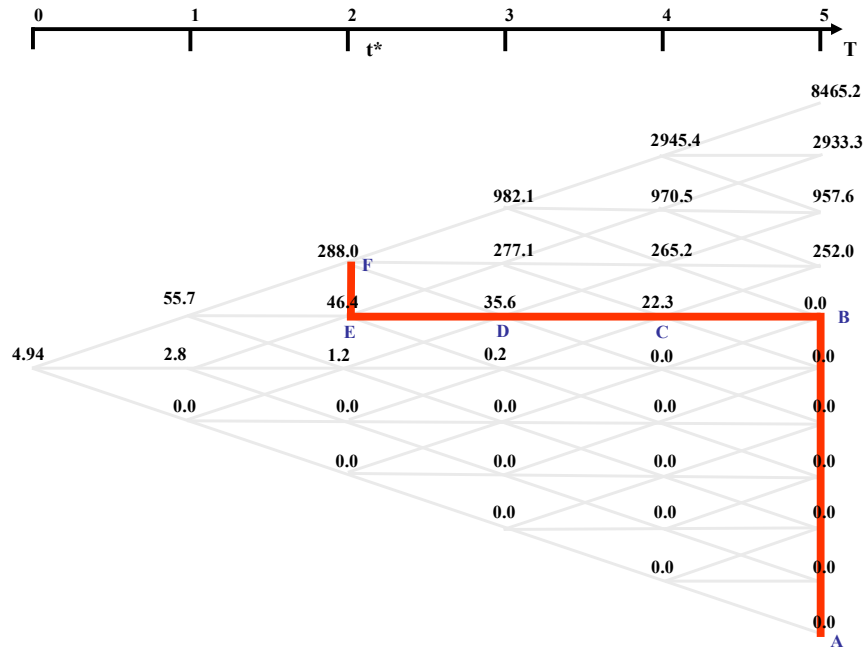


Figure 3.7 Trinomial tree of European call values with a strike of 140 and a maturity of five years.

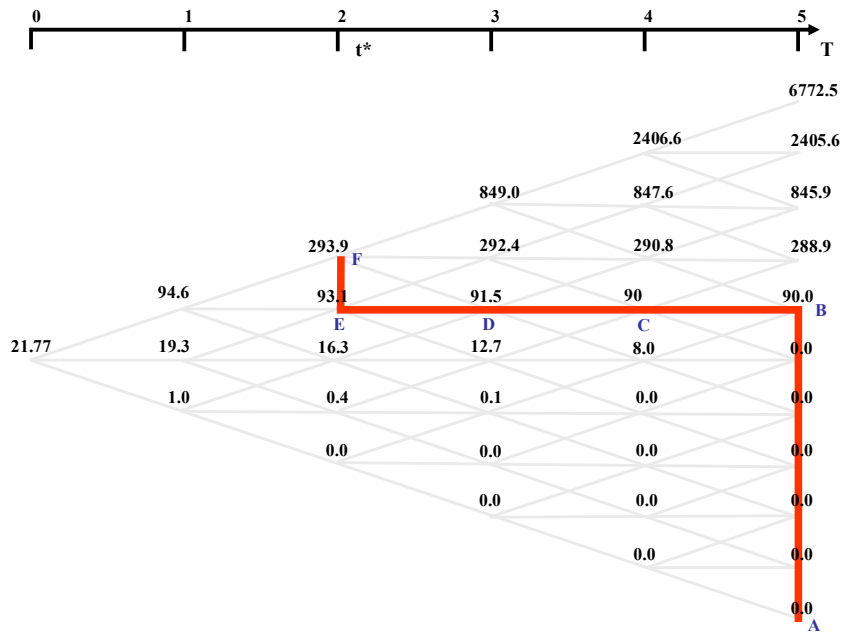


Figure 3.8 Trinomial tree showing combined value of European call options with a maturity of five years, one long with a strike of 50 and 0,21 short with a strike of 140.

The same process is followed at nodes D – F. The detailed trees for each stage of the procedure are available in appendix A. This results in the following hedging portfolio:

Table 3.3 Static hedging portfolio for illustrative ESO.

Node	Position	Size	Strike	Maturity	Tree Value	BS value
AB	long European call	1.00	50	5	22.81	23.02
C	short European call	0.21	140	5	-1.04	-1.09
D	short European call	0.07	140	4	-0.19	-0.20
E	short European call	0.03	140	3	-0.04	-0.04
F	long European call	0.30	140	2	0.07	0.09
Total					21.61	21.77

The value shown in the column headed "Tree Value" is calculated using the trinomial trees. The total tree value compares favourably with the ESO value of 21,63 shown in Figure 3.5. The last column indicates the value of the options using the Black and Scholes model. This value is also close to the value of the ESO calculated using the Hull and White calculator¹⁶, being 21,80. The fact that the ESO value is similar to the portfolio value in both instances provides an initial indication that the hedge is effective.

Figure A 5 in appendix A shows the mismatch between the hedging portfolio and the ESO, using the trinomial tree. The ESO tree is superimposed on the tree describing the total hedge portfolio, and the ESO value subtracted from the hedge value at each node. The value at each node in Figure A 5 thus describes the hedging gap at each possible state realisation depicted on the tree. The largest difference is 1,50, which represents 7% of the initial ESO value. The mean error over the possible exercise region (including the early exercise barrier) is 0,00 and the standard deviation of the errors is 0,29. The standard deviation represents 1% of the initial ESO value. Thus, given constant interest rates and volatility, the hedge is effective over the various state realisations reflected in the tree.

The effectiveness testing can be extended by introducing different interest rates and volatilities. Similar to Figure A 5 the ESO tree is superimposed on the hedging portfolio tree to determine the hedging gap. However, the interest rate and volatility inputs for both trees are changed to test the effects of these changes on the hedging gap. The constituents of the hedging portfolio are those shown in Table 3.3 throughout. The resulting hedging errors are reported in Table 3.4.

¹⁶ This calculator is available from <http://www.rotman.utoronto.ca/~hull/>.

Table 3.4 Measures of hedge effectiveness.

The values in the table indicate the largest absolute error, the mean error and the standard deviation, all expressed as a percentage of the initial ESO value of 21,63.

Hedge sensitivity		Volatility			
		20%	30%	40%	
Interest rate	5%	Largest absolute value	5%	15%	23%
		Mean error	0%	-3%	-6%
		Error standard deviation	1%	4%	7%
	10%	Largest absolute value	11%	7%	9%
		Mean error	2%	0%	-2%
		Error standard deviation	3%	1%	3%
	15%	Largest absolute value	18%	13%	8%
		Mean error	4%	2%	0%
		Error standard deviation	6%	3%	2%

Table 3.4 shows the largest absolute error calculated on any of the nodes in the feasible exercise region. The mean error and error standard deviation is also given for all the nodes in the exercise region. The detailed error trees are shown in Figure A 6 to A 14. For example, the largest error shown in the exercise region of the tree in Figure A 6 is -0,98, which is -5% of the original ESO value of 21,63.

Table 3.4 provides an extreme case sensitivity analysis, because each change shown is quite large, and the calculation assumes that the change occurs immediately after setting up the initial hedge. Despite this, the hedge remains reasonable effective, with a mean error ranging from -6% to 4%, and the standard deviation from 1% to 7%. It can thus be seen that even though a small hedging portfolio has been used, the hedge is reasonably effective across a wide range of scenarios.

3.7. Implications for IFRS 2

What implications does this hedge have for IFRS 2? The IFRS 2 valuation approach has been criticised as having no sound theoretical basis¹⁷.

Empirical research indicates that this may be evident in practice. Bell et al. (2002) find a significant positive relationship between an intangible asset related to employee stock options and share price in the computer software industry. This would imply that an ESO intangible asset should be recognised when the ESOs are issued to employees. Their findings also suggest that the option expense should be recognised over a longer period than the vesting period. This view is supported by Rubenstein (1995) who argues that the non-transferability of the options means that employees are forced to work beyond the vesting period in order to realise the full benefit of the options (assuming that the options mature some time after the vesting period). Aboody's (1996) results suggest that the stock option expense should be adjusted each year for changes in stock price, dividend yield, risk-free interest rate and stock price volatility.

The hedging strategy provides a theoretically sound approach to determining the stock option expense. The DEK static hedge provides an upfront cost that can be recognised over a period. The hedge supports the approach followed by IFRS 2 with regard to re-measuring the option value. The static hedge will not need adjustment through the life of the option, which suggests that the ESO should not be revalued.

This approach can be justified by applying a similar logic to the risk-neutral approach used in valuing options. Assume a company issues stock options to its employees. If the company hedges those options, the risks and cash flows of the business will be exactly the same as before the issue of the

¹⁷ See, for example, Hull and White (2004b).

options. The cost to hedge those options must thus represent the loss to the company on the issue of those options. If a company chooses not to hedge the options, the hedging costs must represent the best valuation of the additional risks to which the company is now exposed. As a static hedge can be devised, it is not necessary to account for subsequent changes in the option values.

One aspect of IFRS 2 that is contradicted by the hedge is the treatment of the ESO expense over the vesting period. As illustrated previously, IFRS 2 requires that only those options that are expected to vest be expensed, and that the estimate of the proportion that will vest must be revised each year. Once the options have vested, the full value of these options must have been expensed. A prudent hedging approach, however, would dictate that all the options issued be hedged, and not just those that are expected to vest. This strategy is supported by the fact that there is likely to be a negative correlation between the value of the options and the employee exit rate (i.e. less employees are likely to leave as the option value increases)¹⁸. This suggests that the company will be exposing itself to considerable risk if it does not hedge all the options issued. If any employees leave, a portion of the hedge can be liquidated. Thus, in contrast to the current IFRS 2 requirements, *all* the options granted should be expensed and income recognised when employees leave. The income should be measured at the fair value of the options on the departure date. At this point, any unrecognised ESO value should also be expensed.

Table 3.5 compares the two accounting methods, the current IFRS 2 method and the method advocated above (headed "Alternative method"). Using the

¹⁸ Ammann and Seiz (2004) propose an adjustment to the ESO valuation model to recognise this correlation. See also the comments in Rubinstein (1995).

same scenario as the example in section 3.2, the accounting expense under the two methods is shown below:

Table 3.5 ESO expense under the two methods.

Grant date value is CU 100 and vesting period is two years with anticipated vesting of 80% at the end of year 1 and actual vesting at the end of the two year period of 85%.

	IFRS 2	Alternative method
	<u>CU</u>	<u>CU</u>
ESO expense		
- year 1	40	50
- year 2	45	50
ESO forfeiture ¹⁹		(5)
Total	85	95

The alternative method thus focuses on the two economic events, the grant of the ESOs, and the forfeiture in year 2. They are two independent events and are thus accounted for separately.

This accounting treatment can be linked back to the objectives of IFRS 2. The primary purpose of IFRS 2 is to account for the services received from employees, not the consideration given. The options given as consideration need only be valued if the services received cannot be valued. Whilst this is likely to be the case with most share-based compensation schemes, it should not detract from the fact that we are trying to measure the services rendered by the employees. In the case of ESOs, the expense recognised should mirror the services rendered by the employees. When the ESOs are granted, all the eligible employees will be working towards earning and maximising the ESO benefit. This implies that the full ESO value should be

¹⁹ Assuming the forfeiture only occurred in year 2 and that the options were worth 5 at forfeiture.

expensed, not just the portion that is ultimately expected to vest. When the employee leaves the company, he generally foregoes any future potential benefits from the ESOs. This is a direct consequence of him leaving the company. This should not affect expenses already recognised, but may result in a net gain in that period. The net gain will represent the obligations now cancelled, less any unrecognised ESO expense. During the vesting period, the gain will be the full value of the ESO on the exit date, and during the post-vesting period, it will be the remaining time value of the ESO (assuming the employee exercises the ESO on leaving). The gain will thus equal the cash flow that will result if the ESOs are fully hedged.

This accounting approach corresponds with the “advance view” explained in Mozes (1998). This view describes the issue of ESOs as an advance in lieu of future services rendered. The ESOs must be valued at grant date as this is the amount the employees receive when they enter into the contract with the firm. Recognition of the ESO expense (and the corresponding increase in equity) would occur as the services are rendered. All ESOs issued must be expensed, as this is the advance the employees have received. If the employees forfeit the benefit for any reason, the firm would not reverse out previously recognised expense, but rather account for the direct economic consequences of the forfeiture.

The model does contradict Aboody’s suggestion that the options should be revalued for changes in value post grant date. Aboody’s approach could be justified by arguing that the motivation effects of the ESOs are related to their current value. If the options are well out-of-the-money, they are less likely to motivate employees, and the services received will be less. Options that are in-the-money will encourage employees to work harder to enhance the value of the options. The hedging strategy clearly indicates that the options need not be revalued at fair value, and no more arguments are

offered in this regard²⁰. It is concerning to note, however, that the requirements of IFRS 2 change dramatically if the options are cash-settled, rather than settled by selling or issuing the underlying shares to the employee. Cash-settled options must be revalued at fair value in each reporting period. Thus a relatively small economic change results in a materially different accounting treatment.

The hedging model does not provide any clear answer with regard to the period over which the option cost should be expensed. Normal accounting principles would dictate that the expense be recognised over the periods in which the benefits are received. IFRS 2 indicates that this is the vesting period. As referred to previously, some of the research suggests that the recognition period should be longer than the vesting period. As the hedging model is not directly related to the benefits received from the employees, it cannot contribute further to this question. It is important to note, however, that recognising the expense over a period that is longer than the vesting period may result in undesirable accounting consequences. If an employee leaves the organisation before the full ESO expense has been recognised, his departure will result in an immediate recognition of the remaining ESO expense. This could possibly cause a sudden and large expenditure that is beyond the control of management, and has no real economic justification. Recognition over the vesting period overcomes this problem because the employee's departure during this period will result in him losing the ESO benefit altogether. As discussed previously, the employee's loss must be the employer's gain, and the suggested accounting approach will result in recognition of income at this point. The vesting period is also a clear and verifiable time period which will enhance the reliability and comparability of the ESO expense.

²⁰ For a radically different approach to valuing and expensing ESOs see Bulow and Shoven (2005) and Hancock et al. (2005).

3.8. Conclusion

The abundance of research into the valuation of ESOs has allowed for a better understanding of the mechanics of these options. It has also allowed for the derivation in this chapter of a hedging strategy for ESOs. Notably, a static hedge is possible and preferable. The static hedge allows for a deeper understanding of the economic characteristics of ESOs. This has important implications for financial accounting, and appears to be the first time that hedging has been used to assess accounting rules. This may seem surprising given that hedging has been used many times in the development of option theory, but must be viewed in the context that the development of detailed accounting standards for options is a recent event.

The static hedge provides economic substance for the accounting approach prescribed by IFRS 2. This standard requires recognition of the grant date value of the ESOs; subsequent changes in the value of ESOs are not recognised. This corresponds with the static hedge. Unlike IFRS 2, however, this chapter argues that the full value of the ESOs should be expensed, and not just the portion that vests. The model then suggests that income should be recognised if the employee forfeits the options, and that this income should be the fair value of the options foregone.

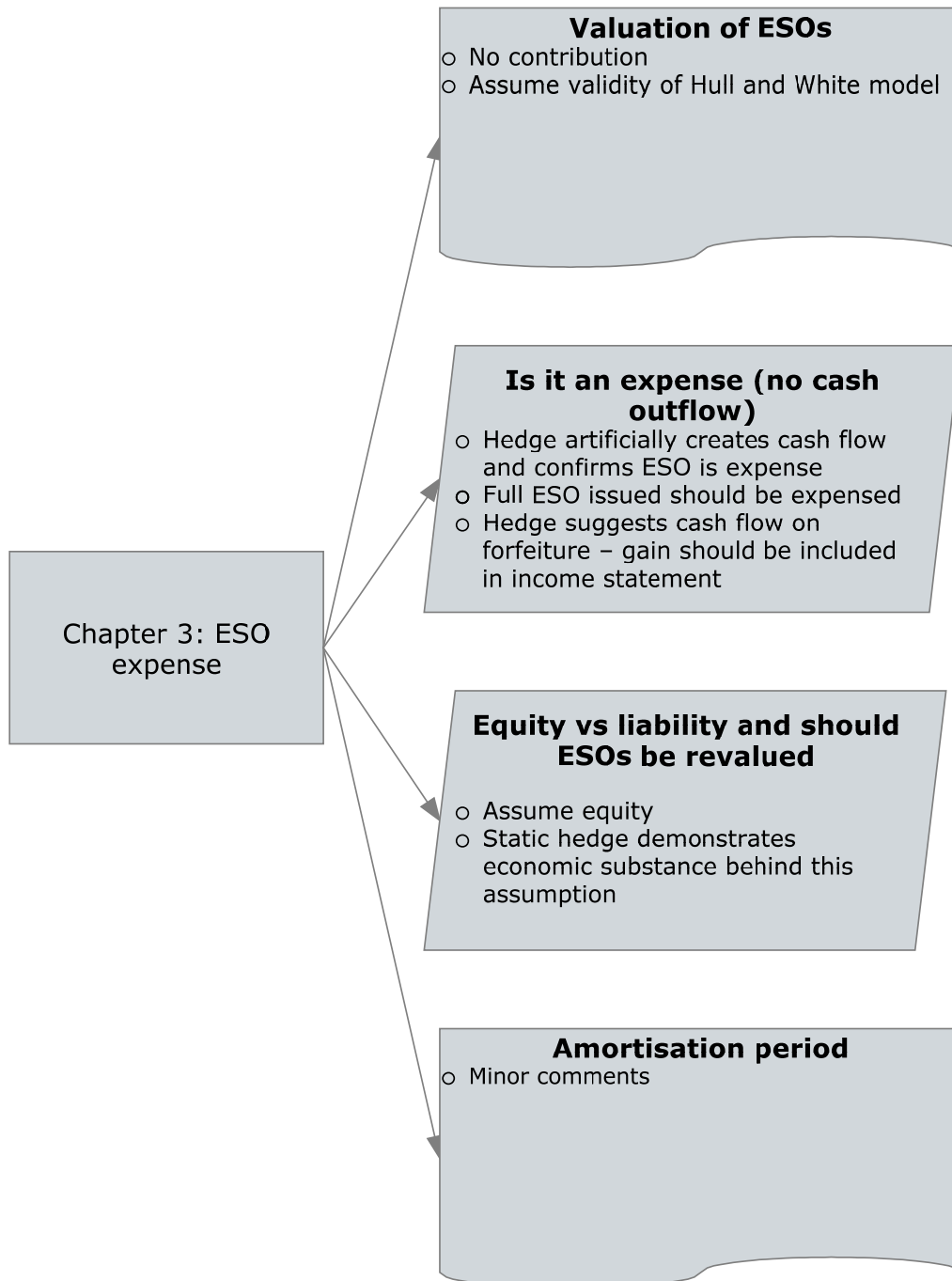


Figure 3.9 Primary and ancillary findings of Chapter 3

4. Diluted earnings per share

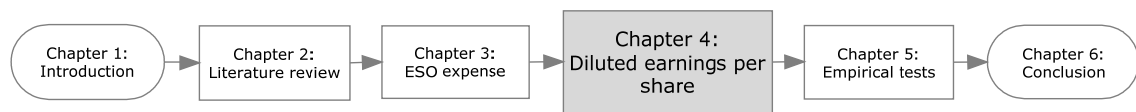


Figure 4.1 Role of chapter 4 within overall thesis structure

4.1. Introduction

IFRS 2 provided detailed rules for determining the appropriate expense for stock based remuneration. These rules marked a significant improvement in the accounting for ESOs, but seemed to neglect an equally important issue, being the measurement of diluted earnings per share (DEPS). IFRS 2 made minor amendments to the accounting standard on DEPS, International Accounting Standard 33 – Earnings per Share (IAS 33) (IASB 1997), but left the old methods of calculating the dilutive effects of options largely intact. These rules for calculating DEPS were formulated in the 1960s, long before derivatives and derivative-based compensation began to play a significant

role in financial markets and the business environment. In fact, the rules predate the work of Black and Scholes (1973), which revolutionised the derivatives industry.

This chapter focuses on this issue; what is the best way to calculate DEPS when a firm has outstanding ESOs? The current IAS 33 approach is to make an adjustment to the number of shares in issue based on the intrinsic value of the outstanding ESOs. The intrinsic value ignores the time value of the options, and the IAS 33 method is thus likely to understate the dilutive effects of the options. Core et al. (2002) have suggested using the full fair value of the options to adjust the number of shares in issue. Whilst an improvement to the current IAS 33 approach, this method still creates difficulties when comparing the accounting treatment of ESOs with their cash-settled equivalents. This chapter develops a third method that adjusts the *earnings* for the period to account for the dilutive effects of the outstanding options. This method is grounded in the work of Ohlson (1995), who provides a framework which links finance theory to accounting information. Adjusting earnings for the change in the fair value of the ESOs has the dual advantage of giving proper recognition to the full fair value of the options as well as achieving parity at a DEPS level between equity-settled and cash-settled options.

By using a series of examples, the three methods are compared to determine the relative merits of each. The examples clearly indicate that adjusting the earnings for the period results in a DEPS figure which best reflects the change in economic value of the current shareholders. Interestingly, the Core et al. method provides the best indication of future DEPS. The current IAS 33 method appears to be the weakest of the three.

An interesting ancillary finding emanating from the theoretical analysis is that the present IAS 33 requirement that the exercise price of the ESOs be adjusted by the unamortised ESO expense in the DEPS calculation has no justification.

4.2. Current accounting rules for employee stock options

IFRS 2 introduced accounting rules in an area that was largely unregulated before. Whilst IFRS 2 covers all types of share-based transactions, it is ESOs that attract most of the attention and will be the most affected by the new standard. ESOs were largely ignored in the accounting records of most companies, especially if those ESOs were issued with a strike or exercise price that was below or equal to the current share price. IFRS 2 requires that all share-based payments be accounted for initially at fair value. The standard then distinguishes between cash-settled and equity-settled transactions. The obligation incurred in cash-settled transactions is reflected as a liability in the balance sheet, and remeasured at each reporting date to reflect changes in the value of the underlying shares. Equity-settled transactions are simply recorded against reserves and not remeasured. This requirement is anomalous, as it results in different accounting treatments for transactions that are economically identical.

In the case of employee stock options the initial grant date fair value of options that are equity-settled is recognised as an expense in the income statement over the vesting period of the options. The initial grant date fair value of cash-settled options is also recognised over the vesting period as an expense, but the cumulative expense is adjusted to reflect changes in the value of the expected settlement amount due to changes in the underlying share price. This means that the total expense recognised for equity-settled options will be the initial grant date value, whereas for cash-settled options it

will be the final amount paid in settlement of the option obligation. For the remainder of this chapter the term ESO will refer to equity-settled employee stock options and share appreciation rights (SARs) will refer to cash-settled employee stock options.

One of the issues highlighted by the objections to IFRS 2 is the relationship between ESOs and DEPS. The rules for calculating DEPS are contained in IAS 33. IAS 33 requires use of the treasury stock method. The treasury stock method calculates the dilutive effects of the outstanding options on the current ordinary shareholders by increasing the number of shares used in the earnings per share (EPS) calculation. The additional number of shares is determined by assuming immediate exercise of the options and that the firm uses the exercise proceeds to repurchase its own stock. The difference between the shares issued and the shares repurchased is added to the denominator in the EPS calculation. In the case of ESOs, the unamortised expense must be added to the exercise price before the treasury stock calculation is performed.

Many critics maintained that recognising an ESO expense and adjusting DEPS for the same ESOs would be double accounting (Bodie et al. 2003; Michaels and Waters 2004). There is actually a double effect on shareholders; this is well known and is simply explained by Bodie et al. (2003) and in the examples that follow later in this chapter. It does, however, emphasise that the two issues need to be considered together. Minor changes were made to IAS 33 when IFRS 2 was issued, but in essence the treasury stock method was retained. In comparison to IFRS 2, the provisions of IAS 33 seem archaic and in need of revision:

- The treasury stock method assumes immediate exercise of the options at the reporting date, whilst finance theory indicates that it is rarely optimal to exercise options before expiry.

- The IAS 33 calculation uses the difference between exercise price and the current share price, which is normally referred to as the intrinsic value. It is well accepted that the economic value of an option is almost always greater than its intrinsic value, and is often considerably greater than its intrinsic value.
- The exercise price of the option and the value of employee services still to be rendered relate to completely different economic concepts, but IAS 33 sums these values together to obtain an adjusted strike price.
- IAS 33 assumes that the dilutive effects of options are best captured by adjusting the number of shares in issue. There is no conceptual justification for this assumption, and it is feasible that the dilution could be better calculated by adjusting the earnings figure.

By reference to finance and accounting theory, this chapter will address these issues, and evaluate the current GAAP approach to accounting for the effects of ESOs on DEPS. The specific question raised in this chapter is thus how best to calculate diluted earnings per share for a firm which has outstanding ESOs.

4.3. Debt vs. Equity

An important assumption made thus far is that equity-settled ESOs form part of the firm's equity, and are not liabilities. This is the approach taken by IFRS 2, which follows from the Conceptual Framework definition of a liability. Liabilities are defined as:

“... a present obligation of the entity arising from past events, the settlement of which is expected to result in an outflow from the entity of resources embodying economic benefits.”

IFRS 2 does not classify equity-settled transactions as liabilities because it does not consider the transfer of shares to be an “outflow of resources embodying economic benefits” (IFRS 2: BC98). Many writers have objected to this approach (AAA_FASC 2004; Balsam 1994; Kirschenheiter et al. 2004; Landsman et al. 2006; Ohlson and Penman 2005). The crux of their arguments is that ESOs are economically equivalent to SARs. SARs are accounted for as liabilities because they are an obligation to transfer cash or other assets, and are therefore remeasured at each reporting period. The argument is that economically equivalent transactions should be accounted for in the same manner, and thus ESOs should be shown as a liability and remeasured. The American Accounting Association’s (AAA) Financial Accounting Standards Committee (FASC) (AAA_FASC 2004) goes further to suggest that this problem indicates that the Conceptual Framework needs revision.

The fact that ESOs are economically similar to SARs while the accounting is quite different certainly does suggest problems with the current accounting rules, but it does not follow that ESOs should be accounted for in the same manner as SARs. In fact, while there are many similarities there is one important economic difference between the two. The obligation to deliver cash or other income generating assets of the business *is* different to the obligation to deliver shares. Transferring cash or other assets reduces the entity’s ability to generate future economic benefits, and at worse may compromise the existence of the entity if it results in liquidity or solvency problems. This is not the case with the obligation to deliver shares. Issuing more shares obviously dilutes the interests of current shareholders, but this may be offset by other benefits received and should not result in the demise of the entire firm. This is one of the reasons why accountants are careful to distinguish liabilities from equity on the balance sheet.

Classifying ESOs as a liability suggests a proprietary rather than entity view. The proprietary view assumes that the objective of accounting is to present the financial position and performance of the current shareholders, whereas the entity perspective focuses on the organisation. The Conceptual Framework is based on the entity concept and defines equity as the difference between assets and liabilities, rather than the economic interests accruing to a particular type of proprietary holding. This is also consistent with the current general approach of financial reporting, which is to provide financial information on the performance of the entity, rather than focus on particular stakeholders.

It does not hold, however, that the entity perspective is suitable for the calculation of DEPS. IAS 33 requires disclosure of the DEPS for ordinary shareholders only (IAS 33: 9). It goes further to state that:

“The objective of basic earnings per share information is to provide a measure of the interests of each ordinary share of a parent entity in the performance of the entity over the reporting period.”

The application of this objective necessitates a proprietary perspective. If the accounting records are drawn up using the entity view, adjustments will be necessary before DEPS can be calculated. It may be appropriate to use the entity perspective at a balance sheet and income statement level, but only the proprietary perspective is valid at a DEPS level. Thus while there may be differences in the accounting for ESOs and SARs in the income statement and balance sheet, they should be treated in exactly the same manner in the DEPS calculation.

4.4. Current rules for diluted earnings per share

The requirements regarding the dilutive effects of options are contained in IAS 33 para. 45, which states;

“For the purpose of calculating diluted earnings per share, an entity shall assume the exercise of dilutive options and warrants of the entity. The assumed proceeds from these instruments shall be regarded as having been received from the issue of ordinary shares at the average market price of ordinary shares during the period. The difference between the number of ordinary shares issued and the number of ordinary shares that would have been issued at the average market price of ordinary shares during the period shall be treated as an issue of ordinary shares for no consideration.”

In other words, $DEPS = \text{Earnings} / (\text{Number of ordinary shares} + D)$, where

$$D = n_o - \frac{n_o X}{P} \quad (1)$$

and D = dilutive effect of options which must be added to the denominator in calculating diluted EPS

n_o = number of options outstanding

X = exercise price of the options

P = average market price of the existing ordinary shares

equation 1 can be rewritten as

$$D = \frac{1}{P}(Pn_o - n_o X) \quad (2)$$

this can be simplified to

$$D = \frac{n_o}{P}(P - X) \quad (3)$$

D thus represents the total intrinsic value of the options expressed as a proportion of the current market price of the ordinary shares. The options are reduced to an equivalent number of ordinary shares, which is added to the existing ordinary shares to calculate the DEPS. Options out-of-the-money are ignored.

This approach is based on the treasury stock method, first advocated by APB Opinion No. 15. This method stipulated that the dilutive effect of the options can best be described by calculating the effect on EPS of the following dummy transaction; assume the exercise of the options at year end and use the proceeds from the exercise to repurchase ordinary shares on the market. The net increase in the number of shares in issue must be used to adjust the denominator in the DEPS calculation.

Option valuation theory describes an option value as consisting of an intrinsic value and a time value. The time value component primarily captures the possibility that the option value could increase significantly before the option matures. The value of an option is thus always greater than the intrinsic value, except when the option is about to expire. Thus assuming that the option holders will exercise their options before maturity, which is what the treasury stock method does, assumes that the option holders will act irrationally, as they will lose the time value of the options. A better application of the treasury stock method may be to assume repurchase of the options at fair value (intrinsic value plus time value), and assume that the company issues shares at market value to generate the

cash needed to purchase the options. This approach is more realistic as the option holders will recover the full market value of their options. This will result in $n_o F/P$ shares being issued, where F is the fair value per option, and n_o and P are defined as above. This method will hereinafter be referred to as the treasury *option* method.

Formally the dilutive effect of the treasury option method can be expressed as

$$D = \frac{n_o F}{P}. \quad (4)$$

The treasury option method replaces the intrinsic value of the options, $P - X$, with F , the current fair value. When the treasury stock method was first advocated fair value information was not commonly used in financial reporting. This has changed in recent years and it thus makes sense to introduce fair value information into the calculation of DEPS as well. Not only will the current fair value better reflect the dilutive effects of the options than the intrinsic value, it will also recognise the dilutive effects when they are out-of-the-money.

Interestingly, Core et al. (2002) derive a DEPS calculation which is the same as the treasury option method described here. They derive their model by using a formal, theoretical approach which assumes that the total firm value is a function of economic earnings and that this value must be allocated between current shareholders and outstanding options. This chapter adds to the work of Core et al. by deriving an alternative way to adjust the earnings per share calculation for the dilutive effects of ESOs. It will be argued that

this method has theoretical and practical advantages over the Core et al. method.

4.5. Alternative approach to calculating DEPS

The two methods discussed above both attempt to adjust the denominator in the DEPS calculation, so as to reflect an “equivalent” number of shares. The analysis that follows suggests that it may be more appropriate to adjust the numerator, or earnings, instead. Adjusting the earnings rather than the number of shares has two important advantages:

- the assumptions made in the theoretical analysis are less restrictive than those of Core et al., and
- the DEPS will be the same regardless of whether the options are cash- or equity-settled.

Ohlson (1995) provides a theoretical framework which can be used to link equity values to accounting information:

$$P_t = b_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t(x_{t+\tau}^a) \quad (5)$$

where P_t = Total market value of equity at date t

b_t = Book value of equity at date t

r = cost of equity

$R = 1 + r$

E_t = The expectation operator conditional on date t information

x_t = Earnings for the period $(t-1, t)$

$x^a = x_t - rb_{t-1}$ (generally referred to as residual or abnormal income)

EPS can be considered a measurement of change in value of equity. Thus calculating $P_t - P_{t-1}$ gives

$$\Delta P_t = b_t - b_{t-1} - E_{t-1}(x_t^a) + \sum_{\tau=1}^{\infty} R^{-\tau} [E_t(x_{t+\tau}^a) - E_{t-1}(x_{t+\tau}^a)]. \quad (6)$$

Assuming

$$b_t - b_{t-1} = x_t - d_t \quad (7)$$

(generally referred to as the clean surplus assumption), where d_t is the net dividends at date t , equation 6 can be combined with 7 to give

$$\Delta P_t = x_t - d_t - E_{t-1}(x_t^a) + \sum_{\tau=1}^{\infty} R^{-\tau} [E_t(x_{t+\tau}^a) - E_{t-1}(x_{t+\tau}^a)] \quad (8)$$

The term

$$- E_{t-1}(x_t^a) + \sum_{\tau=1}^{\infty} R^{-\tau} [E_t(x_{t+\tau}^a) - E_{t-1}(x_{t+\tau}^a)]$$

describes the change in expectations of future abnormal earnings from the previous period to the current period. Earnings expectations will be based on various sources of information, including accounting data, and will depend on the market's analysis of the interaction between these various data sources. This research focuses on the information conveyed by accounting data only, and in particular the information conveyed by the current year ESO expense. To restrict the analysis to accounting data only,

this term is assumed to be equal to zero. Narrowing the analysis to accounting data only means that equation 8 becomes

$$\therefore \Delta P_t = x_t - d_t . \quad (9)$$

Equation 9 assumes that in the absence of any change in other information the change in the market value of the firm will be equal to the accounting earnings less any dividends paid.

To reduce this to per share information, each side must be divided by the number of shares in issue (n_s).

$$\frac{\Delta P_t}{n_s} = \frac{x_t - d_t}{n_s} \quad (10)$$

Equation 10 thus provides a model which relates the market value per share to accounting data. There are two problems which must be overcome before using this model:

- i) The clean surplus restriction, which underpins the Ohlson model, will not normally be met on a per share basis.
- ii) The model will also only work on a total value basis if the issue and buying of shares are value-irrelevant transactions and GAAP measures equity contributions at market value (Ohlson 2005).

The first problem can be overcome by defining

$$EPS \equiv \Delta BVPS + DPS \quad (\text{Ohlson 2005})$$

where $BVPS$ = Book value per share

DPS = Dividends per share

Whilst this relationship will not always hold under current GAAP, it facilitates the analysis that follows, as the objective is to determine the *correct* way to calculate EPS in the presence of ESOs.

The second problem can be overcome by restricting the analysis to ESOs and assuming that the issue of ESOs are value-irrelevant transactions. This is a fair assumption in an efficient market. Current GAAP for ESOs requires that the issue of ESOs be recorded at grant date fair value. The clean surplus relationship on a per share level should thus hold in the context of ESOs.

If the company issues options on its own shares the Ohlson relationship becomes

$$S_t + O_t = b_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t(x_{t+\tau}^{aa}) \quad (\text{Hess and Lüders 2001}). \quad (11)$$

This formula differs from the Ohlson (1995) model in that i) the total value of the firm is described as the value of current shareholders (S_t) plus the value of outstanding ESOs (O_t), and ii) x^{aa} is the abnormal earnings after accounting for the issue of ESOs as an expense based on the fair value on grant date (which is what IFRS 2 does).

Following the same devolution as before we have

$$\frac{\Delta S_t + \Delta O_t}{n_s} = \frac{x_t - d_t}{n_s} \quad (12)$$

To calculate the DEPS, as it relates to the ordinary shares currently outstanding, we must transform the equation as follows:

$$\frac{\Delta S_t}{n_s} = \frac{x_t - d_t - \Delta O_t}{n_s} \quad (13)$$

Thus to calculate the change in value of one share, the earnings must be adjusted by the dividends paid and the change in the value of the outstanding ESOs, and divided by the number of shares currently in issue. Importantly, and in contrast to IAS 33, this indicates that *earnings* must be adjusted by the change in the value of the ESOs. This approach is no more complicated than the treasury option method and requires no additional estimates. In a sense, the change in the value of the ESOs represents a shift of value from the current shareholders to the future shareholders. This transfer in value is captured by reducing the earnings attributable to the current shareholders by the change in value of the ESOs.

This will result in a DEPS figure that is similar to that which would be obtained if the options were cash-settled. The only difference is that the accounting for SARs would only reflect a part of the change in fair value of the options. Current GAAP for SARs only requires that a portion of the change in fair value be recognised in the current period. This portion is equal to the proportion of SARs expensed versus the total value of SARs to be expensed. The two treatments can be made identical by including the unrecognised change in SARs value in the earnings figure used for the DEPS calculation. This will better describe the transfer in value from the current shareholders to the SARs recipients.

The method of calculating DEPS described above, by which earnings is reduced by the change in the fair value of the outstanding options, rather

than any adjustment to the denominator, will hereinafter be referred to as the *earnings adjustment* method. The analyses that follow will compare the three methods described thus far; the treasury stock method (TSM), the treasury option method (TOM) and the earnings adjustment method (EAM).

4.6. Comparison with Core et al. and Landsman et al.

It would be useful at this stage to compare the methodology used to derive the EAM with those of Core et al. (2002) and Landsman et al. (2006). Core et al. derive their DEPS calculation by equating total firm value to the sum of current ordinary shares value and outstanding options value. They then transpose their equation to express the per share value of ordinary shares as a function of total firm value, the number of ordinary shares outstanding, the number of options outstanding and the fair value of the options and the ordinary shares. Firm value is subsequently assumed to be a multiple of accounting earnings, which allows them to express per share diluted earnings as a function of accounting earnings in terms of the following formula:

$$DEPS = \frac{E}{[n_s + n_o(F/P)]} \quad (14)$$

where E = accounting earnings

n_s = number of shares outstanding

n_o = number of options outstanding

F = fair value of the outstanding options

P = market price of the existing ordinary shares.

This is similar to the approach used to derive the EAM above, except that Core et al. reduce their equation to per share information at a much earlier

stage in the derivation process, which forces them to assume a simple linear relationship between earnings and share price. The approach used here allows for a more complex, albeit still linear, relationship between earnings and share value as described by Ohlson (1995). Core et al. also focus on allocating earnings between the various equity participants; this may be more useful in predicting future attributable earnings whereas the EAM describes the shifts in value between the various equity participants, and should mirror changes in the share price. The Core et al. method has the advantage of being relatively simple and easy to understand. Changing IAS 33 to require this method would correspond with other shifts in accounting standards that require the use of fair value information.

Landsman et al. (2006), as with others, have suggested that ESOs should be treated as liabilities. They argue, also by using the Ohlson (1995) model, that the only way to correctly reflect the economic dilution effects of ESOs is to recognise an asset and liability on grant date. The asset represents those future services that will be received from the employees. The liability represents the future claims the ESO holders have against the firm, which must reduce the firm value attributable to the ordinary shareholders. The ESO asset would probably be amortised over the vesting period of the ESOs, which will give an identical result to the IFRS 2 method *from an income statement perspective*. The ESO asset and ESO liability would also perfectly offset each other on grant date, which will also give the same net asset value as the IFRS 2 method. The two will differ post grant date as the ESO liability under Landsman et al. must be adjusted for changes in the fair value of the outstanding ESOs. This will also result in a similar effect to net asset value to that which would be obtained if the options were cash-settled

rather than equity-settled²¹. In effect, Landsman et al. are suggesting that the accounting should follow the proprietary view, and thus ESOs should be accounted for in the same manner as SARs. Whilst this can be debated, this chapter has argued that there should be parity between the treatment of SARs and ESOs *at a DEPS level*.

It is interesting to note that none of the analyses indicate that the DEPS needs to be adjusted for the unexpensed ESO grant date value. The current IAS 33 method of accounting for ESOs requires that the unrecognised ESO expense be added to the exercise price when calculating DEPS (IAS 33: 47A). It is assumed that the standard setters believed that the employees pay more than the exercise price for their option, being the exercise price plus their future services (Bonham et al. 2004: 1783). None of the theoretical analyses suggest that this is necessary (Core et al. 2002; Hess and Lüders 2001; Landsman et al. 2006; Ohlson and Penman 2005). The Landsman et al. (2006) approach facilitates an explanation for this. Their method requires recognition of the total grant date value of the ESOs granted as an asset, which must subsequently be amortised. This asset is offset by the recognition of a liability. This is essentially what IFRS 2 does, except that it does not actually show the asset and liability on the balance sheet. Provided the economic value of the asset is equal to the value of the liability, which it should be in an efficient market, there is no dilution of current ordinary shareholders interests on grant date. The interests of ordinary shareholders may be diluted at a later stage if the value of the liability increases, which will occur if the value of the ESOs increase. The dilution is thus not caused by the initial grant date value of the options, but rather by subsequent changes in that value. Thus the total grant date value

²¹ As is the case with the DEPS calculation derived in this paper, the result will not be exactly the same as SARs accounting because under IFRS 2 only a portion of the change in the fair value of the outstanding SARs is accounted for.

need not play any role in the calculation of DEPS and IAS 33 seems to err in this respect. The examples that follow will also emphasise this point.

Table 4.1 Summary of three DEPS methods

Method	Treasury stock	Treasury option	Earnings adjustment
Source	IAS 33	Core et al. (2002)	This chapter
Adjusts	denominator (no. of shares)	denominator (no. of shares)	numerator (earnings)
Adjustment based on	intrinsic value	fair value	changes in fair value
Adjustment for future services	Strike adjusted by the unamortised expense	No adjustment mentioned	No adjustment

4.7. Examples

The differences between the three approaches to accounting for the dilutive effects of ESOs can best be understood by means of a series of simple examples. The following assumptions are used throughout:

- All transactions with employees are economically irrelevant from the existing shareholders' perspective. Any share-based benefits granted to employees will be perfectly offset by additional income generated by the employees.
- The additional income generated by employees is independent of any subsequent changes in value of the share-based benefits.
- Interest rates remain constant at 10% p.a.
- Investors are risk neutral.
- No employees forfeit their share-based benefits.

The first assumption is consistent with efficient markets and is necessary to show the economic effects of the ESOs on the simple firm. In addition, assuming that the ESO transactions have no economic effect on the current shareholders makes it easier to demonstrate which of the three DEPS methods is optimal. The other assumptions are necessary to make the examples more tractable. Relaxing any of these assumptions would make the mechanics of the example firm much more complicated. For example, relaxing the second assumption would require the inclusion of a function determining the relationship between the value generated by the employees and changes in the value of the ESOs. There is currently no accepted way of modelling this relationship, and an appropriate model is likely to be complex.

The first example sets the scene and describes a simple firm with known future income. The firm then issues shares as compensation to employees to create additional income which is exactly equal to the economic value of the shares issued. The examples begin with shares rather than options to help establish a base case scenario, and introduce the complications associated with options and uncertainty in the subsequent examples. This first example also addresses an issue raised by many critics of IFRS 2, being that reflecting the issue of shares as a cost in the income statement and reducing the earnings per share by increasing the number of shares in the denominator results in “double-counting”. As can be seen in the example there *is* a twin effect; to accurately reflect the economic position of the entity the value of the shares must be shown in the income statement, and the earnings per share must be reduced by increasing the number of shares used in the calculation.

The second example illustrates a similar transaction, except that the firm issues options rather than shares to its employees. The third example increases the complexity by reviewing the transaction over two periods, which highlights the tendency of the TSM to understate the dilutive effects of the options. To illustrate the differences between the TOM and the EAM, the fourth example introduces uncertainty at the end of year 1. The EAM is the only method that correctly reflects the shift in value from the existing shareholders to the option holders due to the introduction of uncertainty. Example five completes the examples by showing that if the uncertainty is present from the beginning of year 1, and remains unchanged during the life of the options, the earnings adjustment and the TOM give the same answer at the end of the first period.

Example 1

Firm A begins with ten shareholders, no liabilities and an asset of currency units (CU) 100 cash.

No. of shares in issue	10
Cash asset	100
Return on cash deposit	10%

It is clear that, in the absence of any other transactions, the value of the shares will be CU 10 each at the beginning of year 1, and that the earnings per share for year 1 will be CU 1. Assume then that at the beginning of year 1, Firm A issues two shares to employees, in return for which they will provide services to the firm. The expense recognised in terms of IFRS 2 will be the fair value of the shares at the grant date, being CU 20. Assume that the transaction with the employees is economically irrelevant from the existing shareholders perspective, thus in this case the firm will earn additional benefits of CU 22 in year 1. This is CU 20 to compensate for the value of the shares at grant date, plus CU 2 to compensate for the fact that had the shares been issued for cash of CU 20 at the beginning of year 1 CU 2 interest would have been earned on this cash. Stated differently, the benefits must equal the end of year value of the shares. Assume further that the benefits of CU 22 are realised in cash.

Thus the income statement of Firm A will reflect:

	<u>CU</u>
Interest received (100 x 10%)	10
Income from services	22
IFRS 2 expense	(20)
Net income	<u>12</u>
 EPS (12/12)	 1

Note that the original shareholders are no better or worse off than they would have been had the transaction with the employees not occurred. Their DEPS is CU 1 and NAV per share at the end of year 1 is CU 11²² regardless. This result is achieved only because the cost of the services is reflected in the earnings *and* the dilutive effect of the new shares is incorporated into DEPS.

²² [(110 + 22) / 12] with the transaction with the employees and (110 / 10) without.

Example 2

Amending example 1, Firm A now issues two options to employees (instead of shares) at the beginning of year 1 in return for which they will provide services to the firm. The options entitle the employees to purchase shares in the business at the end of year 1 for CU 10 per share. Assume once more that the transaction with employees is value-irrelevant, thus the employees will generate benefits of CU 2. As Firm A is a simple business, the payouts from the options are known with certainty at the beginning of year 1. The value of the options on expiry would thus be CU 1 per option $([(110 + 20 + 2) / 12] - 10)$. Discounted back to the beginning of the year, the grant date value of the two options is CU 1,82 $(2/1,1)$. As in the first example, it can be seen that the benefits derived from the employees must equal the end of year fair value of the options received.

Thus the income statement of Firm A will reflect:

	<u>CU</u>
Interest received	10,00
Income from services	2,00
IFRS 2 expense	(1,82)
Net income	<u>10,18</u>

Calculating the DEPS by using the EAM gives:

$$DEPS = \frac{10,18 - 0,18}{10}$$

$$= 1$$

The 0,18 is the change in value of the options over the year $(2 - 1,82)$. Because this example deals with a single period the DEPS figure for the other two methods is the same, i.e. CU 1²³.

²³ On maturity the fair value and the intrinsic value of the options will be the same, and the

Example 3

By extending the examples to multiple periods, some of the differences between the methods will become clearer. If we assume that the options vest and expire after two years, the equilibrium occurs where each option is initially worth CU 1,74. If the transaction with employees is economically irrelevant to the existing shareholders, the value of the shares must be CU 12,10 ($10 \times 1,1^2$) at the end of year 2 with or without the transaction with the employees. This gives a value of the option of CU 2,10 at the end of year 2 ($12,10 - 10$). Discounted back over two years gives CU 1,74 ($2,10 / 1,1^2$). For the transaction with employees to remain economically irrelevant the employees must generate additional income over the two years sufficient to cover the up front cost of the option and the opportunity cost of the firm not receiving the initial value of the option in cash. This results in additional income of CU 2,08 in the first year [$1,74 + (1,74 \times 2 \times 10\%)$] and CU 1,91 in the second year [$1,74 + (1,74 \times 10\%)$]. The interest received in year 2 will increase to CU 11,21 as a result of the additional cash generated from services in year 1. The IFRS 2 expense is simply the initial value of the two options, being CU 3,48, recognised over the two year vesting period, which gives an expense of CU 1,74 each year.

DEPS is $10,18 / [10 + (2 / 11)]$.

	Y1	Y2
	<u>CU</u>	<u>CU</u>
Interest received	10,00	11,21
Income from services	2,08	1,91
IFRS 2 expense	(1,74)	(1,74)
Net income	<u>10,35</u>	<u>11,38</u>
 DEPS		
Earnings adjustment method	1,00	1,10
Treasury stock method	1,02	1,10
Treasury option method	1,00	1,10
 Share price	 11,00	 12,10
Option value	1,91	2,10

The EAM and the TOM both give the same DEPS figures, whilst the TSM understates the dilutive effects in the first year because it uses the intrinsic value rather than the fair value of the options.

Example 4

Example 4 uses the same information as Example 3, but introduces uncertainty. It is assumed that investors are risk neutral so that the expected rate of return does not change from the previous examples. Circumstances change at the end of year 1 such that the interest received for year 2 is equally likely to be CU -18,79 or CU 41,21. These values are simply the original interest received plus or minus 30, so that the expected interest received remains CU 11,21 which is the interest received in the previous example.

	Y1	Y2(1)	Y2(2)	E(Y2)
	<u>CU</u>	<u>CU</u>	<u>CU</u>	<u>CU</u>
Interest received	10,00	(18,79)	41,21	11,21
Income from services	2,08	1,91	1,91	1,91
IFRS 2 expense	(1,74)	(1,74)	(1,74)	(1,74)
Net income	10,35	(18,62)	41,38	11,38
DEPS				
EAM	0,964	(1,444)	3,636	1,096
TSM	1,017	(1,862)	3,893	1,016
TOM	0,997	(1,862)	3,893	1,016
Share price	10,96	9,52	14,60	12,06
Change in share price	0,96	(1,44)	3,64	1,10
Option value	2,09	-	4,60	2,30

Y2(1) and Y2(2) represent the two possible state realisations, and E(Y2) is the expected outcome for year 2. The IFRS 2 expense is unaffected by the introduction of uncertainty at the end of year 1 as the expense is determined

when the options are granted. The share price at the end of year 2 if the first state is realised is $(100 + 10 + 2,08 - 18,79 + 1,91) / 10 = 9,52$. As this is below the strike price of the options, the options will not be exercised and thus have no value. If the second state is realised the option holders will exercise their options as the shares received will be worth $(100 + 10 + 2,08 + 41,21 + 1,91 + 20) / 12 = 14,60$ each, for which they only need to pay CU 10. The shares will be worth CU 14,60 each and the options CU 4,60 just before exercise. The value of the option at the end of year 1 can be calculated as CU 2,09 $([(\frac{1}{2} \times 0) + (\frac{1}{2} \times 4,60)] / 1,1)$. This is higher than the value in example 3, as the introduction of uncertainty has increased the value of the option. The share price at the end of year 1 can be calculated by determining the expected share price at the end of year 2 $[(\frac{1}{2} \times 9,52) + (\frac{1}{2} \times 14,60)] = 12,06$ and discounting that for one year $12,06 / 1,1 = 10,96$.

The results of year 1 are as before, except that the earnings per share figures have dropped to reflect the shift in value from the ordinary shareholders to the option holders. The change in value of one share is 0,96 $(10,96 - 10)$. It can be seen that the EAM exactly captures the increase in wealth of the ordinary shareholders, which neither of the other two methods do. Interestingly, however, the TOM gives the best predictor of year 2 earnings, because $CU 0,997 \times 1,1$ is exactly the expected DEPS under the EAM in year 2. Thus it seems that the EAM better reflects the change in economic wealth of the current ordinary shareholders, whilst the TOM is more useful in determining future earnings. The TSM continues to understate the dilutive effects of the options and does not appear to contain any useful information beyond that already reflected in the other two figures.

Example 5

Example 5 changes Example 4 slightly by introducing the uncertainty at the beginning of year 1 rather than at the end. This will change the initial grant date option value, and the benefits derived from the employees are adjusted so that the transaction continues to be economically irrelevant at the grant date.

	Y1	Y2(1)	Y2(2)	E(Y2)
	<u>CU</u>	<u>CU</u>	<u>CU</u>	<u>CU</u>
Interest received	10,00	(18,77)	41,23	11,23
Income from services	2,30	2,11	2,11	2,11
IFRS2 expense	(1,92)	(1,92)	(1,92)	(1,92)
Net income	<u>10,38</u>	<u>(18,58)</u>	<u>41,42</u>	<u>11,42</u>
EPS				
EAM	1,000	(1,436)	3,636	1,100
TSM	1,020	(1,858)	3,895	1,019
TOM	1,000	(1,858)	3,895	1,019
Share price	11,00	9,56	14,64	12,10
Change in share price	1,00	(1,44)	3,64	1,10
Option value	2,11	-	4,64	2,32

As there is no shock to the system as in Example 4, both the earnings adjustment and the TOM provide the same information in year 1, and accurately convey the change in economic wealth of the ordinary shareholders. The TSM continues to overstate the DEPS in year 1. Only the EAM presents the correct change in the value of ordinary shareholders' equity in year 2.

4.8. Predicting future earnings

Example 4 indicates that the TOM is the best predictor of future earnings per share. That this is in fact so, given the narrow assumptions listed above, can be proved by the use of simple algebra.

As indicated previously, earnings under the TOM for the period t (e_o) can be calculated by the following formula:

$$e_o = \frac{E_t}{[n_s + n_o(F_t / P_t)]} \quad (15)$$

where the symbols are defined as before, except that the subscript t indicates the earnings for period t and the share price and option value at the end of period t . By multiplying both the numerator and denominator on the right hand side by P_t one obtains:

$$e_o = \frac{P_t E_t}{n_s P_t + n_o F_t} \quad (16)$$

Manipulating this equation gives:

$$n_s P_t + n_o F_t = \frac{P_t E_t}{e_o} \quad (17)$$

The left hand side of the equation equals the total equity value of the firm. Given the assumptions, and utilising principles from finance theory, the value of the firm must be equal to the next period's earnings divided by the rate of return. For the simple firm described above, the next period's earnings

must equal the current period's earnings (E) multiplied by $(1 + r)$, where r is the rate of return in the system (10% in the examples above). Thus

$$n_s P_t + n_o F_t = \frac{(1+r)E_t}{r} \quad (18)$$

Substituting equation 18 into 17 gives

$$\frac{(1+r)E_t}{r} = \frac{P_t E_t}{e_o} \quad (19)$$

This can be simplified to

$$e_o = \frac{P_t r}{(1+r)} \quad (20)$$

The DEPS using the TOM multiplied by $(1 + r)$, which is the object of this proof, is thus

$$e_o(1+r) = P_t r \quad (21)$$

or the share price at the end of the period t multiplied by the rate of return.

To prove that this is equal to DEPS for the following period calculated using the EAM, the equity value of the firm at the end of period t is again stated as a function of period t earnings:

$$n_s P_t + n_o F_t = \frac{(1+r)E_t}{r} \quad (22)$$

Multiplying throughout by r gives

$$n_s P_t r + n_o F_t r = (1 + r) E_t . \quad (23)$$

Isolating the term $n_s P_t r$ and dividing throughout by n_s

$$P_t r = \frac{(1 + r) E_t - n_o F_t r}{n_s} . \quad (24)$$

The DEPS for period $t + 1$ using the EAM (e_a) can be calculated by the following formula:

$$e_a = \frac{E_{t+1} - n_o (F_{t+1} - F_t)}{n_s} \quad (25)$$

Given the assumptions listed and that no further shocks to the system occur²⁴, F_{t+1} must be equal to $(1 + r)F_t$. Thus

$$\begin{aligned} F_{t+1} - F_t &= (1 + r)F_t - F_t \\ &= F_t r \end{aligned} \quad (26)$$

As stated before, the earnings for period $t + 1$ must be $(1 + r)E_t$. Equation 25 thus becomes

$$e_a = \frac{(1 + r)E_t - n_o F_t r}{n_s}$$

²⁴ Which is the scenario at the end of year 1 for all the multi-period examples.

which is the same as the right hand side of equation 24, proving that the DEPS for period t calculated using the TOM multiplied by $1 + r$ is equal to the DEPS for period $t + 1$ calculated using the EAM, given that no further shocks to the system occur.

4.9. Which is the best method?

Reviewing the examples above, it is clear that the only method which captures the change in economic value of one share is the EAM. If one assumes that the purpose of an income statement is to describe the change in economic value of the business entity, it seems natural to assume that DEPS should describe the change in economic value of one share. The EAM is then the most appropriate way to calculate DEPS.

An alternative view is that the income statement and DEPS should be presented in a manner that best facilitates the prediction of future earnings. The TOM provides the most useful information on future DEPS. The TSM is in a sense a partial application of the TOM, but will always be inferior to the TOM as it captures only part of the dilutive effects of the options.

The TSM is thus the least useful of the three methods, and there appears to be no convincing reason as to why it should be retained in IAS 33.

4.10. Conclusion

This chapter describes and compares three alternative methods for calculating DEPS when the firm has outstanding ESOs. The first method, that currently required by IAS 33, adjusts the denominator in the DEPS calculation by an amount of shares equivalent in value to the intrinsic value of the outstanding options. The second method is similar to that used in IAS 33, except that the adjustment to the denominator is based on the fair value of the options. This chapter advocates the use of a third method, which adjusts the earnings for the period by the change in the fair value of the options.

The theoretical analysis and examples that follow suggest that the EAM described in this chapter better reflects the changes in economic value attributable to ordinary shareholders. The EAM has the added advantage of giving a similar result to that of cash-settled options at a DEPS level, which should go some way to appeasing those critics that believe that equity-settled employee stock options should be treated as liabilities and remeasured at each reporting period.

Notably, the theoretical analysis and the examples indicate that future dilution of current shareholders' interests is a function of changes in the value of the ESO after the grant date, and not the grant date value. This is because one would assume that the initial grant date value is fully compensated for in the form of future services from employees in an efficient market. Granting the ESOs thus does not dilute current shareholders' interests, but subsequent increases in the value of the ESOs would cause a dilution. This finding suggests that the current IAS 33 requirement that the exercise price of the ESOs be adjusted by the unamortised ESO expense in the DEPS calculation is theoretically incorrect.

The examples used to illustrate the effects of the different methods are simple and based on a number of assumptions. Thus the relationship between the EAM DEPS and the current year's change in shareholders' equity is further tested in the next chapter. In addition, the ancillary finding that the TOM better predicts next period's earnings will also be tested. These tests will be conducted within an empirical framework using a value relevance study.

The findings of Chapter 4 are summarised in Figure 4.2.

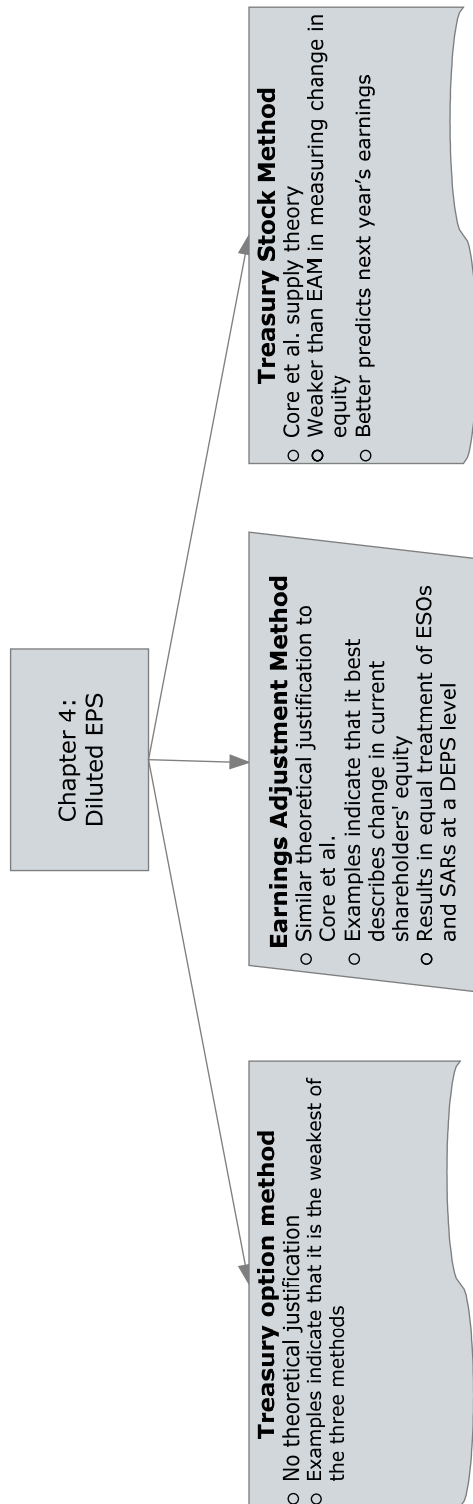


Figure 4.2 Summary of findings of Chapter 4

5. Empirical Tests

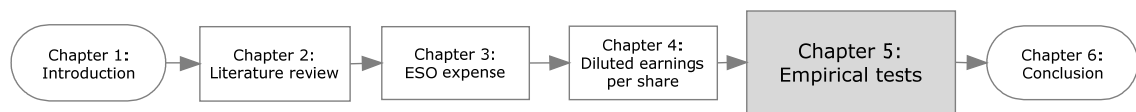


Figure 5.1 Role of chapter 5 within overall thesis structure

5.1. Introduction

The analytical results of chapters 3 and 4 propose some amendments to the current accounting standards for ESOs. This chapter presents empirical evidence concerning the issues raised. Specifically, Chapter 3 suggests that the current fair value of options forfeited should be included as a gain in the income statement. Using a value relevance study framework, this finding will be investigated by cross sectional regressions of share price against valuation parameters, including the value of ESOs forfeited. The sample is all firms in the Standard and Poors 500 index (S&P 500) for 1997 to 2006. The results reported indicate that the value of ESOs forfeited is indeed relevant.

Chapter 3 also concludes that all the ESOs granted should be expensed; not just those that are expected to vest, as under the current IFRS 2. Data availability precludes testing this finding, as the databases used do not record the proportion of ESOs expected to vest used in the calculation of the ESO expense.

The analysis in Chapter 4 indicates that the current method of calculating DEPS is the weakest of the three methods described in that chapter, and that the earnings adjustment method better captures the change in value of current shareholders' equity. This is tested by regressing changes in the share prices of the sample on DEPS calculated using the earnings adjustment method (EAM). This relationship is benchmarked against the two other methods described in Chapter 4, the treasury stock method (TSM) and the treasury option method (TOM). The findings of Chapter 4 also suggest that the TOM better predicts future earnings. Tests are performed by regressing the share price on lagged values of DEPS calculated under this method.

The findings tested in this chapter are summarised in Figure 5.2.

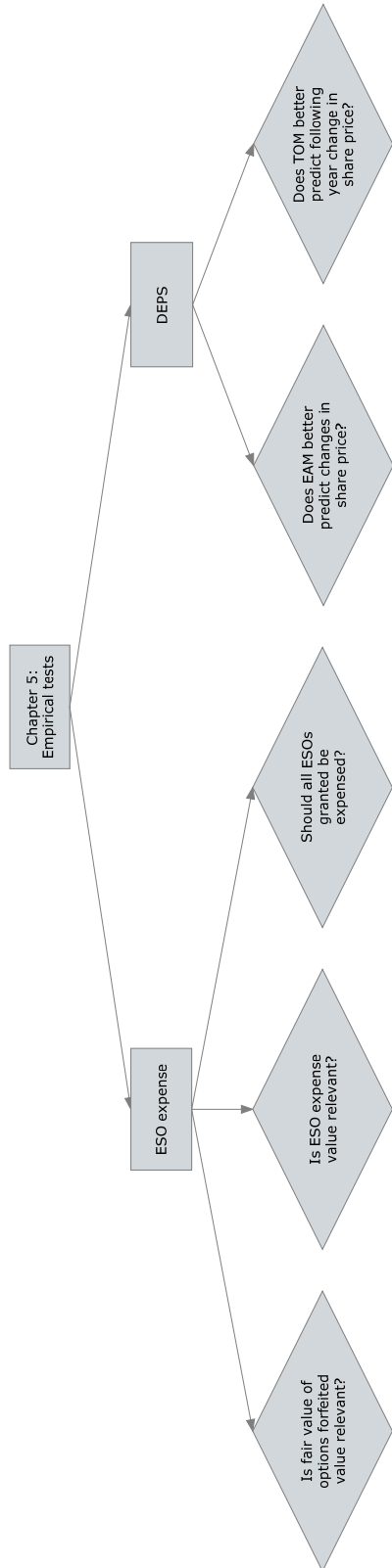


Figure 5.2 Findings tested in Chapter 5

The empirical study provides evidence that the EAM does outperform the other methods in explaining share price changes. The results do not, however, permit any reliable conclusions to be made regarding the abilities of the various methods to predict subsequent year's stock returns.

5.2. Research design

5.2.1. Fair value of ESOs forfeited

The design of these tests is typical of the various value relevance studies (see for example Barth (1994), Barth et al. (1996), Ahmed and Takeda (1995), Venkatachalam (1996), Aboody et al. (2004), Landsman et al. (2006) and Kumar and Krishnan (2008)). Financial information is defined as value-relevant if the information helps financial statement users assess firm value (Barth and Landsman 1995). Value relevance research thus looks to changes in equity values to determine if financial information should be disclosed and how it should be disclosed. A central role of accounting is to provide information for equity valuation. Thus the value of the accounting information can be examined by investigating the relationship between share prices and movements in share prices with the accounting data.

The value relevance research has been criticised, notably by Holthausen and Watts (2001). They question the role of value relevance research in accounting standard setting as it only considers the needs of equity investors, and ignores other users of financial information. While there are many other users of accounting information besides equity investors, equity investors are certainly important users, if not the most important user group. Certainly no firm would be sustainable if it did not meet the information needs of its equity investors. Thus determining whether information is useful to equity investors must be a key consideration for standard setters. This

would suggest that value relevance research is worthwhile, a view espoused by Barth et al. (2001) in response to Holthausen and Watts' comments.

Chapter 3 proposes that the fair value of options forfeited be included in net income. To support this proposition this chapter examines the association between share prices and the value of options forfeited. Specifically, does the inclusion of options forfeited in a valuation model improve that model's description of the share price? The base model used is that of Ohlson (1995), which defines equity value as a function of accounting book value, abnormal earnings and other information:

$$P_t = y_t + \alpha_1 x_t^a + \alpha_2 v_t \quad (1)$$

where P = market value of the firm's equity at date t

y_t = net book value at date t

$x_t^a = x_t - r y_{t-1}$ ²⁵

v_t = other information

x_t = earnings for the period $(t-1, t)$

r = risk-free rate

α_1 and α_2 are coefficients that describe the persistence of abnormal earnings and other information (refer to Ohlson (1995)).

The Ohlson model holds for any set of accounting methods provided that clean surplus accounting (closing firm equity is equal to opening firm equity plus earnings less dividends) is applied. This model has been used in various forms in value relevance research (for example Aboody (1996),

²⁵ x_t^a is often referred to as "abnormal earnings" or "residual income".

Aboody et al. (2004), Graham et al. (2003), Hann et al. (2007), Landsman et al. (2006) and Mozes (2002)). Using the Ohlson model to determine the most correct accounting policy may seem at odds with the fact that the model is valid under any accounting method, but the value relevance literature does not use the model itself to answer the question of which is the most appropriate accounting method, but rather uses the model as a basis with which to initially describe the relationship between accounting information and equity values. The researchers then ask whether the addition, or alternative presentation, of some or other accounting data enriches the model's description of the share price. In the case of ESOs, however, the Ohlson model can be used to some extent to determine the most appropriate accounting policy, as done in Landsman et al. (2006) and Hess and Lüders (2001). Implicit in the Landsman et al. analysis, although, is the additional assumption that the role of accounting is purely to describe the value of existing shareholders; an assumption already criticised in Chapter 4.

It is obvious from the Ohlson model that equity value depends on both accounting information and other information sources (v_t). Thus in a sense accounting information competes with other information in equity valuation. The relative importance of each will depend on the quantity and quality of information supplied by that source. To the extent that accounting's contribution can be increased, its competitive position will be improved with respect to other information sources. Thus indirectly the prominence of the accounting profession depends on the standard setters' ability to increase the contribution of accounting to the equity valuation equation. Ideally standard setters will anticipate future information needs and roles, but the value relevance research will at least identify existing gaps and measure the standards' past success.

The Ohlson model forms the basis of a regression model used by Aboody et al. (Aboody et al. 2004):

$$P_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 NI_{it} + \alpha_3 LTG_{it} + \alpha_4 ESO_{it} + \varepsilon_{1it} \quad (2)$$

where P = share price
 BV = book value of equity
 NI = net income, excluding ESO expense
 LTG = mean analyst I/B/E/S earnings growth forecast
 ESO = ESO expense
 ε = error term
 i denotes the different firms and t denotes years.

BV , NI and ESO are deflated by number of shares outstanding. In comparison with Ohlson's model, Aboody et al. use LTG as a proxy for other information, they use net income rather than abnormal earnings, the coefficient on BV is allowed to differ from one which compensates for using net income rather than abnormal earnings and also measures other information correlated with BV but not reflected in LTG . As most firms chose not to account for the ESO expense under SFAS 123, but rather to disclose a *pro forma* net income number which did include the expense, ESO is calculated by subtracting net income from *pro forma* net income.

The model used in this research to test the value relevance of ESOs forfeited differs from Aboody et al. in two respects. Firstly, consistent with the original Ohlson model, residual income rather than net income is used as a regressor. Residual income is calculated as $NI - 0.12BV_{t-1}$ (Landsman et

al. 2006). 12% is the long-term return on US equities²⁶. Secondly, gross values of the various variables are used rather than per share amounts. Barth and Kallapur (1996) find that using an inappropriate deflator can result in coefficient bias and does not mitigate heteroscedasticity. Many different deflators have been used as proxies for scale in past empirical research; sales, number of shares, market value (opening and closing) and closing book value²⁷. As none of these has been proven to be superior to the others, and given the risk associated with using the wrong deflator, gross values are used in the levels regression. This is consistent with Landsman et al. (2006) and allows for comparison with their research. Barth and Kallapur conclude that using robust standard errors are the best way of dealing with heteroscedasticity in cross-sectional valuation models and Gujarati (2003:417) notes that statistical inferences can be made in the presence of heteroscedasticity if the sample size is large and robust variances and standard errors are used. Heteroscedasticity and scale effects are thus managed by eliminating unduly influential observations by use of Cook's D statistic and by reporting robust standard errors.

The Aboody et al. model is thus changed to

$$MVE_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + \alpha_4 ESO_{it} + \varepsilon_{it} \quad (3)$$

where *MVE* equals total market value of outstanding shares and *RI* equals residual income and none of the variables are deflated.

²⁶ This is the assumption made by Landsman et al. (2006). It is also the average common stock return from 1926 to 1990 noted by Ross et al. (1993:350).

²⁷ For examples of these see Akbar and Stark (2003).

Consistent with other value relevance research in this area, no consideration is given to survivorship bias as a relatively short period is examined in these tests and a cross-sectional analysis is used rather than a time series analysis. In addition, the sample has not been stratified by size as there has been no significant size effects noted in previous ESO research.

To test the proposition that fair value of ESOs forfeited should be included in net income, the fair value of ESOs forfeited during the period is included in the model. The number of options forfeited is calculated as the number of ESOs outstanding at the beginning of the year, plus ESOs granted during the year, less ESOs exercised and less the number of ESOs outstanding at the end of the year. A negative result is most likely caused by measurement error, and is replaced with zero²⁸. The value of ESOs forfeited is calculated using the Black-Scholes model with volatility, interest rate and dividend yield taken from the figures reported for options granted during the year. The time to expiry is taken to be the expected time to expiry reported for ESOs granted divided by 2, which assumes that option grants are consistent from one period to the next so that at any point in time the average remaining life of the outstanding options is the expected life at grant date divided by two²⁹. The exercise price of the options forfeited is assumed to be the weighted average exercise price of the ESOs outstanding at the end of the previous year. The Black-Scholes value is then multiplied by the number of ESOs forfeited to give the total fair value of ESOs forfeited during the year. This variable has been named *FVFOR* in the regression models. As this reflects

²⁸ Recording the number of options forfeited as zero if a negative value results from the calculation effectively removes this observation from the determination of the *FVFOR* coefficient, whilst leaving the observation in the sample to form part of the overall estimation process for the other variables. Completely omitting these observations from the sample has a negligible effect on the regression results.

²⁹ Landsman et al. (2006) make similar assumptions when calculating the total value of ESOs outstanding.

a gain to existing shareholders, the coefficient of this variable should be positive. This leads to the following hypothesis, stated in alternate form:

H1: The coefficient of *FVFOR* is significant and positive.

With regards to the other variables in the model, *BV*, *RI* and *LTG* should have positive coefficients, and if *ESO* does reflect an expense, its coefficient should be negative.

ESO and *FVFOR* are likely to be endogenous regressors. Both are calculated using option pricing models, which all use the share price as an input. Thus they are a function of the share price, but the regression model assumes that they are independent variables. An instrumental variables approach is thus used to adjust these variables (Aboody 1996; Aboody et al. 2004). Using a two-stage least squares approach *ESO* and *FVFOR* will be regressed on all the independent variables in equation 3 as well as the number of options granted (*OPTGRANT*), number of options forfeited (*OPTFOR*), volatility (*VOL*), risk-free interest rate (*R*), dividend yield (*DIV*), expected time to maturity (*T*) and weighted average exercise price of outstanding options at the end of the previous fiscal year (*WAEXER_{t-1}*). These instruments are all inputs into the calculation of the *ESO* expense and *FVFOR*, and so correlated with *ESO* and *FVFOR*, but should be uncorrelated with *MVE*.

$$\begin{aligned}
 ESO_{it}, FVFOR_{it} = & \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + OPTGRANT_{it} \\
 & + OPTFOR_{it} + VOL_{it}^2 + RT_{it} + DIVT_{it} + WAEXER_{it-1} + \varepsilon_{it}
 \end{aligned}
 \tag{4}$$

Volatility is squared and the risk-free interest rate and the dividend yield are multiplied by *T* because that is how these variables enter the Black-Scholes

formula. The predicted values from equation 4 then replace *ESO* and *FVFOR* in equation 3.

Following Aboody (1996) and Aboody et al. (2004) a returns specification is also estimated. This will be useful in determining if there are any particular timing issues associated with the ESO expense and ESOs forfeited. The returns specification is also less sensitive to correlated omitted variables and inherently controls for scale effects and heteroscedasticity³⁰. The model is taken from Aboody et al. (2004):

$$RET_{it} = \gamma_1 NI_{it} + \gamma_2 \Delta NI_{it} + \gamma_3 \Delta LTG_{it} + \gamma_4 \Delta ESO_{it} + v_{it} \quad (5)$$

where RET_{it} denotes the annual share return of firm i for year t , and Δ denotes annual change. As the gain from ESOs forfeited is unlikely to contain enduring information, the full gain is included in the model (*FVFOR*). NI , ESO and $FVFOR$ are all per share amounts in this specification and are deflated by share price at the beginning of the year. This reduces any scale effects as all variables are stated as a proportion of the opening share price. It is predicted that all coefficients will be positive, except for a negative coefficient for ΔESO .

5.2.2. Diluted earnings per share calculated under the three different methods

The tests performed to assess the three different DEPS methods follow a similar approach to those already described. In the case of DEPS, only a returns specification is used, as this specification is likely to be more relevant to the research question. The analysis of Chapter 4 focuses on the change

³⁰ A detailed discussion on the pros and cons of a levels specification versus a returns specification is outside the scope of this thesis.

in existing shareholders equity which is assumed to be the primary objective of the DEPS metric. The most appropriate DEPS method will be the method that best describes the change in equity. The changes (returns) specification thus directly addresses this issue.

The same returns specification will be used as that detailed above, namely

$$RET_{it} = \gamma_1 DEPS_{it} + \gamma_2 \Delta DEPS_{it} + \gamma_3 \Delta LTG_{it} + v_{it} . \quad (6)$$

In each case the share return is regressed on DEPS, changes in DEPS and changes in *LTG*. Three regressions are performed; one for the TSM, TOM and EAM. ΔESO has been dropped from the model as it is the overall income measure and how the ESO expense has been captured within that income measure that is of interest here.

As DEPS is reported using the TSM only, DEPS must be calculated for the other two methods. The fair value of ESOs outstanding is calculated using the Black-Scholes model and the SFAS 123 disclosures. The volatility, risk-free interest rate and dividend yield disclosed for ESOs granted during the year are used as a proxy for the parameters needed to calculate the value of ESOs outstanding. As before, the remaining option life is taken to be half that of the ESOs granted. The number and the weighted average exercise price of ESOs outstanding are disclosed under SFAS 123. DEPS using the TOM is then easily calculated by dividing net income by the number of shares used in the basic EPS calculation adjusted by the total fair value of the ESOs divided by the end of year share price. This is summarised in the following formula:

$$DEPS_{TOM} = \frac{E}{[n_s + n_o (F/P)]} \quad (7)$$

where E = net income

n_s = number of shares outstanding used in the basic EPS calculation

n_o = number of options outstanding at the end of the year

F = fair value of the outstanding options at the end of the year

P = market price of the existing ordinary shares at the end of the year.

Given the total value of ESOs outstanding calculated above, DEPS under the EAM is calculated by adjusting the earnings with the change in the value of the outstanding ESOs, and dividing by the same number of shares as is used in the basic EPS calculation.

The calculations above, however, assume that there are no other dilutive instruments in issue, which may not be the case. To compensate for this, the DEPS is recalculated for the TSM so that the three methods are comparable. This is done by calculating the total intrinsic value of the ESOs outstanding using the SFAS 123 disclosures, and then calculating the DEPS by using the following formula:

$$DEPS_{TSM} = \frac{E}{\left[n_s + \frac{n_o}{P} (P - X) \right]} \quad (8)$$

where X = weighted average exercise price of the outstanding options and the other variables are as defined above.

The analysis in Chapter 4 suggests that the EAM best explains changes in equity, followed by the TOM. The TSM is the weakest of the three. The

examples also indicate that the TOM best predicts the next year's earnings. As the TSM is similar to the TOM it should also outperform the EAM in this regard. This leads to the following hypotheses:

H2a: The regression which includes $DEPS_{EAM}$ as regressors better explains stock returns than that using $DEPS_{TOM}$ as regressors.

H2b: The regression which includes $DEPS_{TOM}$ as regressors better explains stock returns than that using $DEPS_{TSM}$ as regressors.

H3a: The regression which includes lagged $DEPS_{TOM}$ as regressors better explains stock returns than that using lagged $DEPS_{TSM}$ as regressors.

H3b: The regression which includes the lagged $DEPS_{TSM}$ as regressors better explains stock returns than that using lagged $DEPS_{EAM}$ as regressors.

To test H3 RET_{it} is replaced in equation 6 with RET_{it+1} . No predictions are made as to the signs of the coefficients in these regressions, given that it is difficult to determine how a change in earnings this year will affect next year's return.

The hypotheses H2 and H3 require comparing the predictive ability of various models. As none of the models are nested within any of the other models, the usual F test cannot be employed. The relative performance of the three measures under H2 and H3 is thus assessed by comparing the R^2 and F statistics and Akaike's Information Criteria. While the R^2 and F statistics are measures of the explanatory power of the model, they can be misleading when comparing modes with different numbers of regressors or a different regressand. As all of the models tested under H2 and H3 have identical regressands and identical numbers of regressors, the analysis is

not subject to this weakness. Regardless, Akaike's Information Criterion (AIC) is also reported. AIC also measures explanatory power; in a sense the average residual value. Thus the lowest score is preferred. Unlike R^2 , however, it imposes a penalty for additional regressors. It can be used for comparing both nested and non-nested models, and can assess the in-sample and out-of-sample forecasting performance of a model (Gujarati 2003:537).

These statistics allow one to conclude which is the best model, given the data used. They cannot, however, determine if one model is *significantly* better than another. For this type of statistical inference testing the Davidson-MacKinnon J Test (Davidson and MacKinnon 1981) and Cox-Pesaran test (Cox 1961, 1962; Pesaran 1974) are used. These tests are more powerful than the non-nested F test when there is more than one non-overlapping variable in the two models, which is the case here (Pesaran 1982). These tests are only suitable for large samples, and given the exceptionally large samples used in this study they are considered appropriate.

5.3. Sample and data

The sample comprises the S&P 500 firms from 1997 to 2006. The S&P 500 firms are chosen as they are significant issuers of ESOs. The S&P 500 are also likely to be some of the most traded and liquid shares in the world. This increases the power of the value relevance tests, which assume an efficient market. In addition, data is readily available for the necessary tests. Share prices, equity book value and I/B/E/S analysts' growth forecast are obtained from Datastream. Income statement and ESO data is drawn from a database obtained from R.G. Associates, Inc, which is the same source

used by Landsman et al. (2006)³¹. As a number of the variables are based on lagged data (for example *RI* and *FVFOR*), the sample period is restricted to 1998 to 2006³². The potential sample is thus 4 500 observations (9 years x 500 firms). There are, however, differences in the constituents of the S&P 500 between the two databases. There are 47 firms which are not on both lists. The names of these firms are given in Appendix B. This reduces the potential sample to 4 077 (9 x 453). Some of the firms would have entered the S&P 500 midway through the sample period, and data is not available for the period before their entry. This, along with various other missing data items reduces the sample to 3 562 observations in the case of the levels regression, and 3 515 for the returns regression.

Table 5.1 presents descriptive statistics and Table 5.2 correlation coefficients for the sample. The means for *MVE*, *BV*, *RI* and *ESO* are similar but in all cases slightly higher than those reported by Landsman et al. (2006). Landsman et al. also sample the S&P 500, but for the period 1997 to 2001. The inclusion of later years probably accounts for the increased values, due to inflation and general economic growth. Aboody et al. (2004) report statistics for volatility, interest rate, option life and dividend yield which are all similar to those reported here. The large standard deviations and some extreme maximum and minimum values suggest the existence of significant outliers which could distort the regression results.

Table 5.2 indicates significant correlations between *MVE* and *BV* and *RI*, as is expected. There is also a strong correlation between *MVE* and *ESO*. This could be ascribed to two causes; the fact that ESOs are likely to be better incentives for companies with a larger market value and so are more likely to be granted, and, secondly, share price is an input into the calculation of

³¹ I am indebted to Jack Cielski at R.G. Associates, Inc. for supplying this data. R.G. Associates provides accounting research services to investment institutions.

³² In the case of the lagged DEPS measures, this is further restricted to 1998 to 2005.

ESO. Both point to *ESO* being endogenous to the regression model. The large correlation between *FVFOR* and *MVE* is also probably due to share price being included in the calculation of this variable.

The weak correlations between *ESO* and *VOL*, *R*, *T* and *DIV* are a cause for concern, as these are all inputs to the Black-Scholes model. A poor fit in the first stage regression is likely to undermine the efficacy of the instrumental variables method. The signs for the coefficients for *R* and *T* also contradict the Black-Scholes model. Similar relationships are evident for *FVFOR*. The correlations reported by Aboody et al. also exhibit some relationships that contradict those predicted by the Black-Scholes model.

Table 5.1 Descriptive statistics

Variable	Mean	Std. Dev	Min	Max
<i>MVE</i>	21,686.64	43,455.71	88.98	587,019.00
<i>BV</i>	6,035.69	11,500.23	-7,465.84	152,068.70
<i>RI</i>	246.94	2,094.16	-60,319.70	26,635.23
<i>LTG</i>	14.35	7.84	-5.80	183.25
<i>ESO</i>	46.60	123.87	-614.63	2,243.43
<i>FVFOR</i>	36.28	167.39	0.00	4,178.12
<i>OPTGRANT</i>	9.92	25.04	0.00	608.00
<i>OPTFOR</i>	3.02	10.21	0.00	404.00
<i>VOL</i>	0.36	0.17	0.00	4.14
<i>R</i>	0.05	0.01	0.00	0.08
<i>T</i>	5.35	1.55	0.00	12.00
<i>DIV</i>	0.02	0.02	0.00	0.13
<i>WAEXER</i>	26.03	16.77	0.00	318.92

Variable definitions (in \$ million):

- MVE* = market value of ordinary shares outstanding at fiscal year end
BV = book value of ordinary shareholders' equity at fiscal year end
RI = residual income calculated by net income from continuing operations minus 0.12 multiplied by BV_{t-1}
LTG = year end I/B/E/S mean analyst earnings growth forecast
ESO = net income minus *pro forma* net income disclosed under SFAS 123
FVFOR = *OPTFOR* multiplied by the Black-Scholes value calculated using the SFAS 123 disclosures
OPTGRANT = number of options granted
OPTFOR = number of ESOs forfeited calculated as opening ESOs outstanding plus ESOs granted less ESOs exercised less ESOs outstanding at the end of the year (limited to ≥ 0)
VOL = expected share price volatility
R = expected risk-free interest rate
T = expected option life
DIV = expected dividend yield
WAEXER = the weighted average exercise price for the ESOs outstanding at the end of the previous fiscal year.

Table 5.2 Pearson (Spearman) correlations in lower (upper) triangle (3562 observations)

	<i>MVE</i>	<i>BV</i>	<i>RI</i>	<i>LTG</i>	<i>ESO</i>	<i>FVFOR</i>	<i>OPTGRANT</i>	<i>OPTFOR</i>	<i>VOL</i>	<i>R</i>	<i>T</i>	<i>DIV</i>	<i>WAEXER</i>
<i>MVE</i>	1.00	0.79	0.46	*-0.01	0.32	0.47	0.48	0.28	-0.23	-0.06	0.05	0.12	0.26
<i>BV</i>	0.74	1.00	0.23	-0.23	0.21	0.25	0.35	0.19	-0.27	-0.11	0.09	0.25	0.37
<i>RI</i>	0.39	0.26	1.00	-0.05	*0.02	0.17	0.11	*0.00	-0.28	*0.01	0.03	0.15	0.12
<i>LTG</i>	*0.01	-0.11	-0.08	1.00	0.25	0.31	0.23	0.19	0.51	0.12	-0.22	-0.68	-0.44
<i>ESO</i>	0.44	0.33	*0.02	0.13	1.00	0.38	0.61	0.42	0.29	*-0.03	-0.13	-0.21	*-0.03
<i>FVFOR</i>	0.49	0.20	0.08	0.16	0.31	1.00	0.53	0.83	0.24	-0.08	-0.07	-0.29	-0.10
<i>OPTGRANT</i>	0.52	0.37	0.09	0.15	0.72	0.46	1.00	0.61	0.20	0.04	-0.14	-0.18	-0.16
<i>OPTFOR</i>	0.36	0.31	*-0.01	0.07	0.41	0.54	0.54	1.00	0.30	-0.09	-0.11	-0.23	-0.09
<i>VOL</i>	-0.12	-0.15	-0.20	0.50	0.18	0.10	0.12	0.13	1.00	-0.13	-0.25	-0.61	-0.38
<i>R</i>	*0.03	-0.05	*0.02	0.12	*-0.03	0.03	0.05	-0.04	-0.10	1.00	0.18	0.04	-0.21
<i>T</i>	*0.02	0.04	*-0.00	-0.24	-0.08	-0.04	-0.09	-0.06	-0.25	0.20	1.00	0.23	0.11
<i>DIV</i>	*0.01	0.11	0.09	-0.49	-0.12	-0.11	-0.11	-0.10	-0.47	0.05	0.22	1.00	0.44
<i>WAEXER</i>	0.09	0.16	-0.08	-0.26	0.08	-0.08	-0.09	-0.04	-0.19	-0.18	0.05	0.24	1.00

Refer to Table 5.1 for definitions of variables. * indicates all those correlations that are not significant at a 5% level.

Table 5.3 Initial regression results

Regression of market value on book value of equity, residual income and analyst earnings growth forecast.

$$MVE_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + \varepsilon_{it}$$

							Number of obs =	3804
							F(3, 3800) =	182.50
							Prob > F	= 0.0000
							R-squared	= 0.6275
							Root MSE	= 27479
	Predicted	Robust Std.						
<i>MVE</i>	sign	Coef.	Err.	t	P> t	[95% Conf. Interval]		
<i>BV</i>	+	2.71	0.15	18.64	0.000	2.42	2.99	
<i>RI</i>	+	4.28	1.19	3.59	0.000	1.94	6.61	
<i>LTG</i>	+	594.57	105.33	5.64	0.000	388.06	801.08	
CONS		-4,238.68	1,672.18	-2.53	0.011	-7,517.14	-960.21	

Variables are as defined in Table 5.1.

Table 5.3 presents results for an initial regression of market value of equity on book value of equity, residual income and analysts' mean earnings growth forecast (the number of observations is higher than mentioned before as fewer variables are used for this particular regression reducing the effects of missing data items). The negative constant is consistent with the notion that the market value will be asymptotic with the x – axis as the share price cannot be less than zero. Figure 5.3 indicates the existence of some outliers with high leverage. To counteract the effect of the outliers Cook's D is calculated for all observations and observations with Cook's D > 0,01³³ are

³³ The conventional cut off point is $4/n$ (*Stata Web Books* 2008). This gives a value of approximately 0,001. The threshold used of 0,01 is considered more conservative. Using Cook's D is a more sophisticated method of identifying outliers than the more traditional,

removed from the sample. The results of this revised regression are reported in Table 5.4. 69 (or 65 in the main sample) observations have been rejected. Most of the statistics are similar to those in Table 5.3, except for R^2 and the coefficient of RI , both of which have increased significantly. All of the standard errors have decreased. The coefficients of BV and RI are similar to those obtained by Landsman et al. who report on a similar specification.

With regards to the distribution of the residuals, the Breusch-Pagan / Cook-Weisberg and White tests all reject the null hypothesis of constant variance at a p value of < 0.00005 . Thus robust standard errors are reported throughout. Table 5.2 does not indicate any correlations amongst the regressors that may result in multicollinearity. Time-based autocorrelation does not seem to be a problem, as including year fixed effect dummy variables does not materially change the results. The time interval between observations, one year, is also quite long, which reduces the likelihood of autocorrelation (Gujarati 2003:441). No further tests concerning the distribution of the residuals are conducted as any violations from the normal regression assumptions will be mitigated by the large sample size. In addition, Theil (1971:615) notes that

“... tests which concern first moments (such as t tests for elements of the parameter vector β of the expectation $X\beta$ in the standard linear model) are relatively insensitive to departures from normality, whereas tests concerning second moments such as F tests are much less robust; ...”.

and arbitrary, approach of removing the top and bottom one percentile as it identifies those observations with large residuals and large leverage.

As these tests are primarily concerned with the coefficients of the independent variables, and thus t tests, any departures from normality should not affect the results.

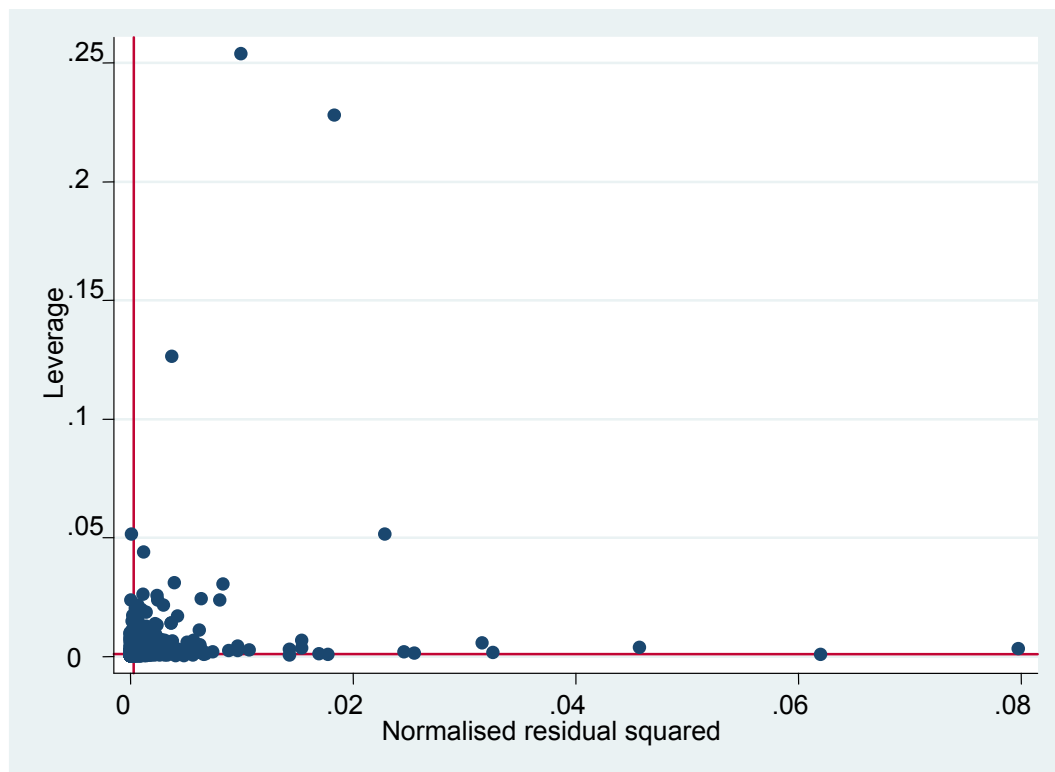


Figure 5.3 Graph of leverage vs. normalised residuals squared of regression

$$MVE_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + \varepsilon_{it} .$$

Table 5.4 Results of initial regression excluding all observations with Cook's D > 0,01

Regression of market value on book value of equity, residual income and analyst earnings growth forecast excluding observations with Cook's D > 0,01

$$MVE_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + \varepsilon_{it}$$

							Number of obs =	3735
							F(3, 3731) =	614.37
							Prob > F =	0.0000
							R-squared =	0.7324
							Root MSE =	16311
Predicted		Robust Std.						
<i>MVE</i>	sign	Coef.	Err.	t	P> t	[95% Conf. Interval]		
<i>BV</i>	+	2.64	0.07	36.57	0.000	2.50	2.78	
<i>RI</i>	+	7.17	0.64	11.14	0.000	5.91	8.43	
<i>LTG</i>	+	517.75	46.14	11.22	0.000	427.28	608.21	
<i>CONS</i>		-4609.87	704.07	-6.55	0.000	-5990.26	-3229.47	

Variables are as defined in Table 5.1.

The high R^2 and similarity to prior research suggests that the regression is well specified.

The descriptive statistics for the various DEPS measures are shown in Table 5.5. As expected, the standard deviation for the EAM is larger than the other methods, as this method will result in more volatile earnings. The other statistics are similar.

Table 5.5 Descriptive statistics for DEPS calculated under the treasury stock, treasury option and earnings adjustment methods

Variable	Mean	Std. Dev.	Min	Max
Treasury stock method	1.45	6.91	-411.20	27.11
Treasury option method	1.44	6.87	-400.32	27.06
Earnings adjustment method	1.42	7.67	-386.88	27.41
Reported DEPS	1.41	6.52	-411.20	26.85

5.4. Results

5.4.1. Levels regression

The results of the two-stage instrument variables regression are presented in Table 5.6. The signs of the coefficients of *ESO* and *FVFOR* are of the opposite signs to those predicted, and the coefficient of *FVFOR* is not significantly different from zero. The results are not materially affected by including year fixed effects, so all results are reported as simple pooled regressions.

The positive coefficient of *ESO* is contrary to theory and contradicts the results of Aboody et al. (2004), but is consistent with the results of Bell et al. (2002) and Landsman et al. (2006). Bell et al. ascribe the positive coefficient to a correlated intangible *ESO* asset. The introduction of *FVFOR* into the model does reduce the positive coefficient on *ESO*, suggesting it may have been one of the correlated omitted variables in prior research. Much of the literature referred to in earlier chapters indicates that the option pricing models generally used under SFAS No. 123 do not value ESOs correctly, suggesting that the ESO expense is subject to significant measurement

error. Despite this, the *ESO* coefficient is significant in all the models tested. As this *ESO* expense is not the focus of this research, these issues are not pursued further.

The results relating to *FVFOR* are of concern, however, as there are no obvious other correlated variables. An inspection of the first stage regression for *FVFOR* reveals a low R^2 , which suggests weak instruments. This is confirmed by Shea's adjusted R^2 which is much lower for *FVFOR* than *ESO* (0,11 vs. 0,19). To explore this possibility, the instrument variables regression is repeated with just *FVFOR* as an endogenous variable and temporarily ignoring *ESO*. *OPTGRANT* is removed from the instruments as it relates to *ESO* only. In this two-stage regression both Wooldridge's (1995) robust score test and a robust version of the Wu-Hausman regression test fail to reject the null hypothesis that *FVFOR* is exogenous with a p value of 0,34 and 0,31 respectively. Thus the instrument variables regression was reperformed with only *ESO* as an endogenous regressor. *OPTFOR* and *WAEXER* are removed from the instruments as they are not relevant to *ESO*.

Table 5.6 Instrumental variables regression – *ESO* and *FVFOR* are instrumented

Instrument variables regression of market value of equity on book value of equity, residual income, analysts' earnings growth forecast, ESO expense and fair value of ESOs forfeited (*ESO* and *FVFOR* are instrumented)

Panel A: First stage regression of ESO expense on instrument variables

$$ESO_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + OPTGRANT_{it} + OPTFOR_{it} + VOL_{it}^2 + RT_{it} + DIVT_{it} + WAEXER_{it-1} + \varepsilon_{it}$$

Number of obs = 3497
 F(9, 3487) = 49.01
 Prob > F = 0.0000
 R-squared = 0.5432
 Adj R-squared = 0.5420
 Root MSE = 82.3102

<i>ESO</i>	Robust					
	Coef.	Std. Err.	T	P> t	[95% Conf. Interval]	
<i>BV</i>	0.002	0.001	3.440	0.001	0.001	0.003
<i>RI</i>	-0.003	0.003	-1.230	0.219	-0.008	0.002
<i>LTG</i>	0.091	0.391	0.230	0.816	-0.676	0.858
<i>OPTGRANT</i>	3.092	0.514	6.010	0.000	2.084	4.100
<i>OPTFOR</i>	1.658	0.966	1.720	0.086	-0.236	3.552
<i>VOL</i> ²	90.448	15.475	5.840	0.000	60.107	120.788
<i>RT</i>	9.527	12.727	0.750	0.454	-15.426	34.481
<i>DIVT</i>	-49.141	15.131	-3.250	0.001	-78.807	-19.475
<i>WAEXER</i>	1.041	0.214	4.870	0.000	0.622	1.459
CONS	-35.586	9.026	-3.940	0.000	-53.282	-17.889

Panel B: First stage regression of fair value of ESOs forfeited on instrument variables

$$FVFOR_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + OPTGRANT_{it} + OPTFOR_{it} + VOL_{it}^2 + RT_{it} + DIVT_{it} + WAEXER_{it-1} + \varepsilon_{it}$$

Number of obs = 3497
 F(9, 3487) = 33.29
 Prob > F = 0.0000
 R-squared = 0.3145
 Adj R-squared = 0.3127
 Root MSE = 89.3110

<i>FVFOR</i>	Robust					
	Coef.	Std. Err.	T	P> t	[95% Conf. Interval]	
<i>BV</i>	0.000	0.000	0.180	0.854	-0.001	0.001
<i>RI</i>	0.008	0.002	3.870	0.000	0.004	0.013
<i>LTG</i>	1.648	0.626	2.630	0.009	0.420	2.875
<i>OPTGRANT</i>	0.303	0.417	0.730	0.468	-0.515	1.121
<i>OPTFOR</i>	6.858	1.815	3.780	0.000	3.299	10.417
<i>VOL</i> ²	-18.629	17.459	-1.070	0.286	-52.860	15.602
<i>RT</i>	37.695	15.748	2.390	0.017	6.819	68.570
<i>DIVT</i>	-27.778	11.431	-2.430	0.015	-50.190	-5.365
<i>WAEXER</i>	-0.064	0.074	-0.860	0.392	-0.209	0.082
CONS	-22.249	10.095	-2.200	0.028	-42.043	-2.456

Panel C: Second stage regression of market value of equity on exogenous and instrumented variables

$$MVE_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + \alpha_4 ESO_{it} + FVFOR_{it} + \varepsilon_{it}$$

(ESO_{it} and $FVFOR_{it}$ are the predicted values from the first stage regressions)

Number of obs = 3497
 Wald chi2(5) = 1605.41
 Prob > chi2 = 0.0000
 R-squared = 0.7151
 Root MSE = 16241

<i>MVE</i>	Pred	Robust					
		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
<i>ESO</i>	-	77.92	12.28	6.35	0.000	53.86	101.99
<i>FVFOR</i>	+	-7.19	14.55	-0.49	0.621	-35.70	21.33
<i>BV</i>	+	2.19	0.10	22.23	0.000	1.99	2.38
<i>RI</i>	+	8.09	0.74	10.98	0.000	6.65	9.54
<i>LTG</i>	+	293.78	50.68	5.80	0.000	194.44	393.11
CONS		-2752.91	743.28	-3.70	0.000	-4209.72	-1296.10

Variables are as defined in Table 5.1.

The results of the two stage regression where only *ESO* is treated as endogenous are shown in Table 5.7. The first stage regression results report a reasonable R^2 , but Wooldridge's (1995) robust score test and the robust Wu-Hausman regression test produce p values of 0,11 and 0,12 respectively (the null hypothesis is that *ESO* is exogenous). Discarding the two stage regression procedure and treating *ESO* as exogenous does not affect the results. The high correlation coefficients between *ESO* and

OPTGRANT suggest that replacing *ESO* with a single instrument, *OPTGRANT*, may suffice. Again, this has no affect on the inferences made.

Table 5.7 indicates that the coefficient for *FVFOR* is now positive and significant. The large coefficient is difficult to explain, however. This coupled with a sizable standard error may suggest the existence of correlated omitted variables, but there are no obvious candidates. As the returns specification is less susceptible to correlated omitted variables (Landsman and Magliolo 1988), it will provide further evidence concerning this conjecture.

Table 5.7 Instrumental variables regression – *ESO* is instrumented

Instrument variables regression of market value of equity on book value of equity, residual income, analysts' earnings growth forecast, *ESO* expense and fair value of *ESOs* forfeited (only *ESO* is instrumented)

Panel A: First stage regression of ESO expense on instrument variables

$$ESO_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + OPTGRANT_{it} + VOL_{it}^2 + RT_{it} + DIVT_{it} + \varepsilon_{it}$$

Number of obs = 3497
 F(8, 3488) = 53.12
 Prob > F = 0.0000
 R-squared = 0.5203
 Adj R-squared = 0.5192
 Root MSE = 84.3340

<i>ESO</i>	Robust					
	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
<i>BV</i>	0.003	0.001	4.750	0.000	0.002	0.004
<i>RI</i>	-0.005	0.003	-1.720	0.086	-0.010	0.001
<i>LTG</i>	-0.484	0.402	-1.200	0.229	-1.272	0.304
<i>FVFOR</i>	-0.008	0.029	-0.280	0.779	-0.065	0.049
<i>OPTGRANT</i>	3.361	0.451	7.450	0.000	2.477	4.245
<i>VOL</i> ²	103.043	15.632	6.590	0.000	72.393	133.693
<i>RT</i>	-19.760	13.306	-1.480	0.138	-45.849	6.329
<i>DIVT</i>	-26.396	14.147	-1.870	0.062	-54.134	1.342
CONS	1.625	6.266	0.260	0.795	-10.660	13.909

Panel B: Second stage regression of market value of equity on exogenous and instrumented variables

$$MVE_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 RI_{it} + \alpha_3 LTG_{it} + \alpha_4 ESO_{it} + FVFOR_{it} + \varepsilon_{it}$$

(ESO_{it} are the predicted values from the first stage regression)

Number of obs = 3497

Wald chi2(5) = 1877.52

Prob > chi2 = 0.0000

R-squared = 0.7527

Root MSE = 15130

		Robust					
<i>MVE</i>	Pred	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
<i>ESO</i>	-	50.91	9.76	5.21	0.000	31.78	70.05
<i>BV</i>	+	2.22	0.09	24.70	0.000	2.04	2.40
<i>RI</i>	+	7.75	0.71	10.93	0.000	6.36	9.14
<i>LTG</i>	+	237.44	43.57	5.45	0.000	152.04	322.83
<i>FVFOR</i>	+	41.70	13.18	3.17	0.002	15.88	67.53
CONS		-2060.05	674.64	-3.05	0.002	-3382.33	-737.77

Variables are as defined in Table 5.1.

5.4.2. Returns regression

Table 5.8 presents the results of the initial returns regression. This specification is more likely to benefit from year fixed effects, and in fact including fixed effects improves the R^2 from around 0,05 to 0,13. The statistics for the year dummies are not reported, but all the dummies are significant at a p value of 0,001 or less, except for 1999, 2000 and 2004 with a value of 0,717 0,723 and 0,043 respectively. As before all observations with a Cook's D exceeding 0,01 are eliminated. This results in the

elimination of 15 observations in the initial regression (and 13 in the main regression). Whilst the overall R^2 is low, the coefficients are all significant with the correct signs, and the F score is significant at a p value of $< 0,00005$. The Breusch-Pagan / Cook-Weisberg test for heteroscedasticity rejects the null of constant variance and so robust standard errors are reported.

Table 5.8 Initial returns regression

Regression of annual stock return on net income, change in net income and change in analysts' earnings growth forecast

$$RET_{it} = \gamma_1 NI_{it} + \gamma_2 \Delta NI_{it} + \gamma_3 \Delta LTG_{it} + v_{it}$$

							Number of obs =	3716
							F(11, 3704) =	69.06
							Prob > F =	0.0000
							R-squared =	0.1278
							Root MSE =	.42382
Robust								
<i>RET</i>	Pred	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]		
<i>NI</i>	+	0.54	0.11	4.96	0.000	0.33	0.76	
ΔNI	+	0.29	0.07	4.12	0.000	0.15	0.43	
ΔLTG	+	0.13	0.05	2.84	0.004	0.04	0.22	

Year dummy coefficients are not reported.

Variable definitions:

RET = annual stock return

NI = net income (deflated by market value of equity at the beginning of the year)

LTG = I/B/E/S mean analyst earnings growth forecast

Including the variables under investigation gives the regression results shown in Table 5.9. The signs of the coefficients are as predicted, except for ΔESO which is again positive. The coefficient of ΔESO is not significantly different from zero though. Replacing ΔESO with ESO results in a significant positive coefficient, but then the coefficient of ΔNI becomes insignificant. It is thus difficult to make any conclusions regarding ESO .

The coefficient of $FVFOR$ is significant and positive under both specifications, confirming the results of the levels regression. As the returns specification is less sensitive to correlated omitted variables, thus does not seem a likely explanation. Taken together the results provide strong support for the hypothesis that the fair value of ESOs forfeited is value relevant and represents a gain to the entity.

Table 5.9 Returns regression including change in ESO expense and fair value of ESOs forfeited

Regression of annual stock return on net income, change in net income, change in analysts' earnings growth forecast, change in ESO expense and fair value of ESOs forfeited

$$RET_{it} = \gamma_1 NI_{it} + \gamma_2 \Delta NI_{it} + \gamma_3 \Delta LTG_{it} + \Delta ESO + FVFOR + v_{it}$$

Number of obs = 3502
 F(13, 3488) = 63.45
 Prob > F = 0.0000
 R-squared = 0.2459
 Root MSE = .39954

<i>RET</i>	Pred	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
<i>NI</i>	+	0.77	0.11	7.05	0.000	0.55	0.98
ΔNI	+	0.14	0.06	2.26	0.024	0.02	0.27
ΔLTG	+	0.14	0.05	3.15	0.002	0.05	0.23
ΔESO	-	0.23	3.02	0.08	0.940	-5.69	6.15
<i>FVFOR</i>	+	19.15	4.25	4.51	0.000	10.82	27.48

Year dummy coefficients are not reported.

Variable definitions:

RET = annual stock return

NI = net income

LTG = I/B/E/S mean analyst earnings growth forecast

ESO = ESO expense

FVFOR = fair value of ESOs forfeited during the year

NI, *ESO* and *FVFOR* are deflated by market value of equity at the beginning of the year.

5.4.3. Comparison of DEPS methods

The testing now moves on to consider the conclusions reached in Chapter 4. That chapter suggests that the EAM better captures the change in value of current shareholders' equity, and that the TOM better predicts future earnings. These findings are tested by comparing regression results using the basic returns specification described in the previous section, but in each case the earnings variables are calculated using the three different DEPS methods examined in Chapter 4. The regression results from the three different DEPS methods are summarised in Table 5.10. The regressions are all performed with year fixed effects, and all observations with a Cook's D from the initial regression reported in section 5.4.2 greater than 0,01 are excluded. The sample sizes differ as calculating the different DEPS measures requires different data items. The EAM requires more data than the TOM, which in turn requires more data than the TSM. The sample sizes decrease as more data is required due to the affect of missing data items.

The R^2 statistics indicate that the earnings adjustment method best explains stock returns, followed by the treasury option method, as predicted by the analysis in Chapter 4. The F statistics suggest exactly the opposite result, but this is probably due to the decrease in sample sizes. This is confirmed by Akaike's Information Criteria (AIC), which indicates a preference for EAM over TOM over TSM (a lower score indicates a better fit). The scores also suggest a material advantage for the EAM, whilst the difference between the TOM and the TSM is marginal. The signs of the coefficients of $DEPS$ and $\Delta DEPS$ under the EAM are contrary to theory, however. All the t statistics are significant at a p value of 0,01 or less. These statistics allow us to conclude that, given the data in this sample, the EAM, and then the TOM, best describes changes in the share price.

Table 5.10 Summary statistics from regression of stock return on the various DEPS measures, changes in those measures and change in analysts' earnings growth forecast

$$RET_{it} = \gamma_1 DEPS_{it} + \gamma_2 \Delta DEPS_{it} + \gamma_3 \Delta LTG_{it} + v_{it}$$

	Treasury stock	Treasury option	Earnings adjustment
Observations	3667	3467	3377
<i>F</i>	68.99	66.66	58.64
<i>R</i> ²	0.1275	0.1310	0.1591
AIC	4131.00	3922.73	3533.10
<i>t</i> statistics			
<i>DEPS</i>	4.83	4.75	-3.60
$\Delta DEPS$	4.06	4.24	-2.52
ΔLTG	2.84	2.83	2.84

The table shows, from top to bottom, the number of observations, the *F* and *R*² statistics, Akaike's Information Criteria (AIC), and the *t*-statistic (using robust standard errors) for the DEPS measure, change in that measure and change in analysts' earnings growth forecast resulting from a regression of stock return on *DEPS* and $\Delta DEPS$ calculated under the three different methods. ΔLTG is included as a regressor in each case. *DEPS* and $\Delta DEPS$ are deflated by the share price at the beginning of the year. All regressions are performed using year fixed effects and excluding observations with Cook's *D* > 0,01.

To determine if the models are significantly different, or in other words make statistical inferences regarding the differences between the three methods, the *J* and Cox-Pesaran tests are performed. These tests require that the regressions be based on the same number of observations. Thus only the observations available to the EAM regressions are used (3377

observations). The results of the J test and Cox-Pesaran test for the H2a and H2b hypothesis are shown in Table 5.11. Starting with Panel B, TOM vs. TSM, the J test and the Cox-Pesaran test provide inconclusive answers. This is not surprising given the closeness of the R^2 and AIC statistics in Table 5.10 and the similarity between the two methods. The J test is also inconclusive in Panel A, but the Cox-Pesaran test rejects the null hypothesis of model 2 being better specified than model 1, and is unable to reject the null of model 1 being better specified than model 2. The J test does tend to overreject H_0 when the model does not fit well and when the number of regressors in H_1 that do not appear in H_0 is large (Davidson and MacKinnon 2004:668), as is the case here. The Cox-Pesaran test is also a more direct comparison of the two models, whereas the J test compares the two models against an artificially constructed general model (Pesaran and Weeks 2003:288). The Cox-Pesaran test is thus more likely to distinguish between the two models, whereas a rejection of both models in the J test points to some other, more general, model being applicable.

Thus the results of the Cox-Pesaran test, combined with the results in Table 5.10, leads to the conclusion that the EAM better describes share price returns than the TOM, confirming H2a. Whilst the TOM seems to be preferable to the TSM, the statistics are not conclusive in this regard.

Table 5.11 Results of *J* test and Cox-Pesaran test for the three different regression models

$$RET_{it} = \gamma_1 DEPS_{it} + \gamma_2 \Delta DEPS_{it} + \gamma_3 \Delta LTG_{it} + v_{it}$$

Panel A: EAM vs. TOM	Panel B: TOM vs. TSM
M1 : Y = a + Xb with X = [EAM ΔEAM ΔLTG]	M1 : Y = a + Xb with X = [TOM ΔTOM ΔLTG]
M2 : Y = a + Zg with Z = [TOM ΔTOM ΔLTG]	M2 : Y = a + Zg with Z = [TSM ΔTSM ΔLTG]
<hr/>	
J test for non-nested models	J test for non-nested models
H0 : M1 t(3372) 59.352	H0 : M1 t(3372) -3.000
H1 : M2 p-val 0.000	H1 : M2 p-val 0.003
H0 : M2 t(3372) 74.051	H0 : M2 t(3372) 3.226
H1 : M1 p-val 0.000	H1 : M1 p-val 0.001
<hr/>	
Cox-Pesaran test for non-nested models	Cox-Pesaran test for non-nested models
H0 : M1 N(0,1) 0.278	H0 : M1 N(0,1) 2.991
H1 : M2 p-val 0.390	H1 : M2 p-val 0.001
H0 : M2 N(0,1) -8.098	H0 : M2 N(0,1) -3.232
H1 : M1 p-val 0.000	H1 : M1 p-val 0.001

Moving on to the H3 hypothesis, the statistics in Table 5.12 indicate that it is difficult to rank the predictive powers of the three different DEPS measures. All three models have very low explanatory power. This is to be expected as it is unlikely that such a simple specification can predict future returns in an

efficient market. The AIC statistic suggests that the TOM has more explanatory power than the TSM, supporting H3a. But, contrary to prediction, the EAM appears to have the best fit. This may suggest that the EAM has more predictive power than initially anticipated.

The non-nested models tests in Table 5.13 Panel A are inconclusive as to which of the two models is better specified. The results in Panel B provide weak evidence to support the hypothesis that the TSM better predicts future returns than the EAM. The p values in the second stage of both the J and the Cox-Pesaran tests are approximately half those of the first stage, suggesting that the first model (TSM) has higher explanatory power.

Table 5.12 Summary statistics from regression of next year's stock return on the various DEPS measures, changes in those measures and change in analysts' earnings growth forecast

$$RET_{it+1} = \gamma_1 DEPS_{it} + \gamma_2 \Delta DEPS_{it} + \gamma_3 \Delta LTG_{it} + v_{it}$$

	Treasury stock	Treasury option	Earnings adjustment
Observations	3258.00	3110.00	3023.00
<i>F</i>	2.84	2.42	1.53
<i>R</i> ²	0.008	0.008	0.009
AIC	6451.25	6259.51	6113.17
<i>t</i> statistics			
<i>DEPS</i>	-2.03	-1.78	-1.39
$\Delta DEPS$	1.56	1.50	1.39
ΔLTG	-0.94	-0.88	-1.17

The table shows, from top to bottom, the number of observations, the *F* and *R*² statistics, Akaike's Information Criteria (AIC), and the *t*-statistic (using robust standard errors) for the DEPS measure, change in that measure and change in analysts' earnings growth forecast resulting from a regression of stock return for *t*+1 on *DEPS* and $\Delta DEPS$ calculated under the three different methods. ΔLTG is included as a regressor in each case. *DEPS* and $\Delta DEPS$ are deflated by the share price at the beginning of the year.

Table 5.13 Results of *J* test and Cox-Pesaran test for the three different regression models

$$RET_{it+1} = \gamma_1 DEPS_{it} + \gamma_2 \Delta DEPS_{it} + \gamma_3 \Delta LTG_{it} + v_{it}$$

Panel A: TOM vs. TSM				Panel B: TSM vs. EAM					
M1 : Y = a + Xb with X = [TOM ΔTOM ΔLTG]				M1 : Y = a + Xb with X = [TSM ΔTSM ΔLTG]					
M2 : Y = a + Zg with Z = [TSM ΔTSM ΔLTG]				M2 : Y = a + Zg with Z = [EAM ΔEAM ΔLTG]					
J test for non-nested models				J test for non-nested models					
H0	:	M1	t(3017)	4.059	H0	:	M1	t(3017)	0.241
H1	:	M2	p-val	0.000	H1	:	M2	p-val	0.809
H0	:	M2	t(3017)	-3.948	H0	:	M2	t(3017)	0.765
H1	:	M1	p-val	0.000	H1	:	M1	p-val	0.444
Cox-Pesaran test for non-nested models				Cox-Pesaran test for non-nested models					
H0	:	M1	N(0,1)	-4.083	H0	:	M1	N(0,1)	-0.235
H1	:	M2	p-val	0.000	H1	:	M2	p-val	0.407
H0	:	M2	N(0,1)	3.913	H0	:	M2	N(0,1)	-0.810
H1	:	M1	p-val	0.000	H1	:	M1	p-val	0.209

5.5. Conclusion

The results of the empirical tests are summarised in

Figure 5.4. In general the empirical results reported in section 5.4 support the analytical findings of the previous chapters. The primary finding of Chapter 3 was that the fair value of ESOs forfeited should be included in the net income for the period. Both the levels and returns regressions find a significant positive effect for *FVFOR*, the estimate of the value of ESOs forfeited, providing strong evidence to support this hypothesis.

Corroborating evidence is found for the primary conclusion in Chapter 4 that the EAM better describes changes in equity. The various statistics reported indicate that DEPS calculated under the EAM better predicts current year stock returns. This is supported by the Cox-Pesaran test which concludes that the EAM has the higher explanatory power. The findings relating to the secondary finding in Chapter 4 are less conclusive, however. The regressions of next year's stock return on the current year DEPS have very little predictive ability. The conflicting evidence inhibits making any definite conclusions regarding the ability of the different methods to predict the following year's stock return.

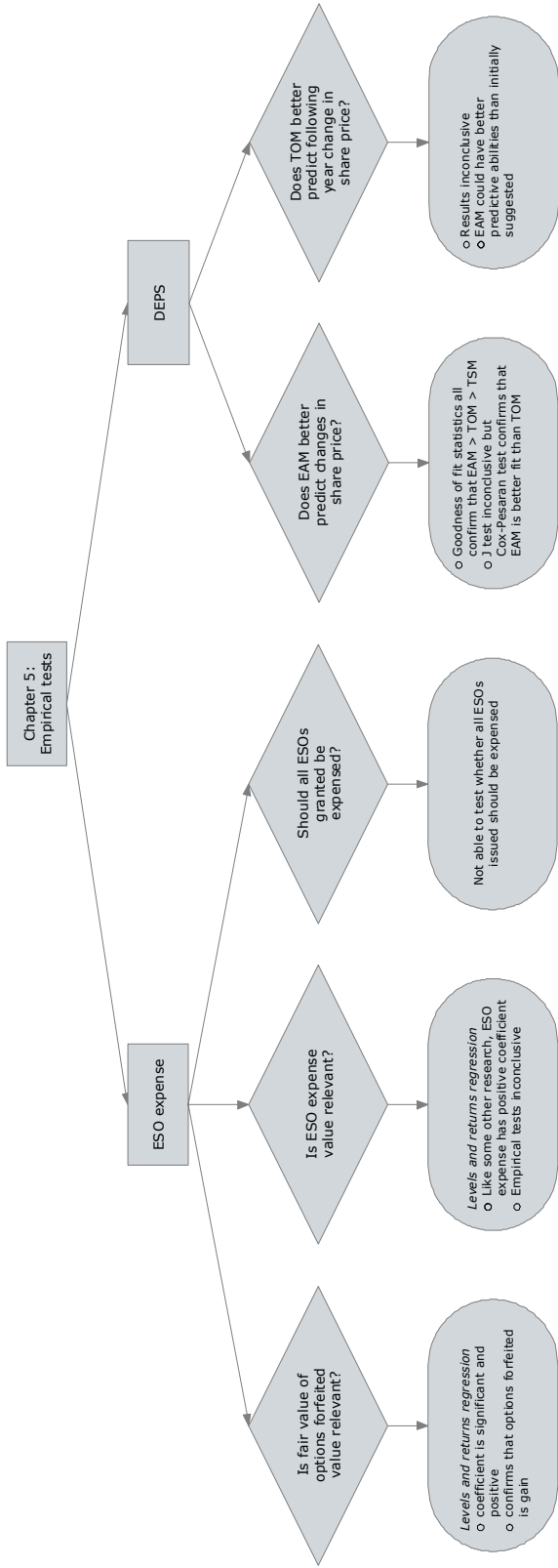


Figure 5.4 Summary of results of empirical tests

6. Conclusion

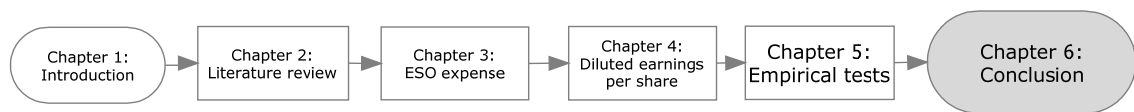


Figure 6.1 Role of chapter 6 within overall thesis structure

6.1. Overview

This thesis explores the current accounting standards for ESOs. Accounting for the cost of ESOs granted has been a contentious topic in the past, and as a result ESO standards have only recently been issued. Probably as a result of their short lives, these standards exhibit a number of weaknesses. In particular, the abundant research in this area over the last ten years has not been reflected in the accounting standards.

6.2. Research objectives

This research has sought to integrate the accounting and finance research on ESOs into the accounting rules. This lead to the following objectives:

1. Develop a theoretical model which can be used to determine the appropriate accounting treatment of ESOs in the income statement.
2. Develop a theoretical model which can be used to calculate the effect of ESOs on diluted earnings per share.
3. Validate any findings by means of empirical tests.

No analysis of ESO accounting would be complete without considering both the income statement and the DEPS treatment of these transactions. This is evident from some of the early criticisms of IFRS 2 and the ongoing debt vs. equity debate. This is the first research to deal with both issues simultaneously. This dual approach has allowed for some interesting conclusions; primarily that the concerns over the different accounting treatment for equity vs. cash-settled options do not need to be solved at an income statement level, but may be, and should be, addressed in the DEPS measure.

Complementing the analytical research with empirical testing has also allowed for a more practical perspective on the issues. Whilst some of the concerns with the current accounting requirements for ESOs may seem significant at a theoretical level, the problems may not be apparent in a practical context. The empirical study has thus highlighted certain issues that are likely to be relevant to the standard setting process.

6.3. Review of research methods and findings

6.3.1. ESO expense

The first objective is addressed in Chapter 3. One of the difficulties in understanding ESO transactions is that there is never any cash outflow. This is unlike most other expenses which do result in a cash outflow at some or other stage in the firm's lifecycle. This problem is addressed in Chapter 3 by constructing a hedge for the ESO. The hedge is useful as it does reduce the ESO to cash flows, being the costs to create and liquidate the hedge. Analysing the hedge rather than the actual transaction is a technique often used in option analysis, but has never been used in an accounting context. A hedge is derived for a typical ESO following a technique described by Derman et al. (1994) for hedging exotic options. The hedge allows a different perspective of the ESO and provides some useful insights. Importantly, Chapter 3 concludes that all ESOs granted should be expensed. This is because the firm issuing ESOs would need to hedge all ESOs granted to eliminate the risk, not just those that are expected to vest. This finding is strengthened by the fact that employees' forfeiture decisions are likely to be affected by the value of the ESOs; employees are less likely to leave the firm if the ESO is valuable, increasing the risk associated with any unhedged contracts. The second finding in Chapter 3 is that ESOs forfeited should be shown as a gain in the income statement measured at the fair value of the ESOs on the date of forfeiture. This is consistent with the finding that all ESOs should initially be expensed, and stems from the fact that forfeiture would result in the firm liquidating the hedge relating to the departing employee. This will result in a cash inflow to the value of the hedge. These findings are in contrast to the current IFRS 2 requirements, which specify that only those options that are expected to ultimately vest be expensed, and that forfeiture be ignored except to the extent that it may affect the original estimate of total expected forfeitures.

6.3.2. Diluted earnings per share

Chapter 4 shifts focus to the calculation of DEPS when a firm has outstanding ESOs. This chapter reviews the current standard on DEPS, IAS 33, which requires use of the treasury stock method (TSM). Two other methods are suggested, the treasury option method (TOM) and the earnings adjustment method (EAM). The TOM is a simple extension of the TSM; instead of using the intrinsic value of the options in the calculation, the fair value of the options is used. This is also the method advocated by Core et al. (2002). A new method, the EAM is derived in this chapter using the basic relationship between share prices and accounting information described by Ohlson (1995). The derivation is similar to that employed by Core et al., but uses less restrictive assumptions. As there is no obvious conceptual basis for the TSM, the TOM and EAM appear to have a stronger theoretical grounding than the TSM. The EAM has the added advantage of achieving parity between cash-settled and equity-settled options at a DEPS level.

The EPS figures generated by the three methods are then compared in a series of examples. The examples compare the results of the three methods under five different scenarios, with each scenario increasing in complexity from the previous one. The examples suggest that the EAM best reflects the change in current shareholders' equity. As expected, the TSM continuously understates the dilutive effects of the ESOs and seems inferior to the other methods in all respects. Tentative findings suggest that the TOM better predicts next period earnings.

An interesting secondary finding emanating from the theoretical analysis and examples in Chapter 4 concerns the current IAS 33 adjustment to the strike price of outstanding ESOs when calculating DEPS. IAS 33 requires that the

strike price of the ESOs be increased by the unamortised ESO expense in the TSM. None of the theoretical analyses support this adjustment, and a review of the findings of Landsman et al. (2006) suggest that this adjustment is incorrect.

6.3.3. Empirical tests

The three key results of Chapters 3 and 4 are then tested within an empirical framework. These findings are:

- ESOs forfeited should be included as a gain on forfeiture,
- The EAM better reflects change in current shareholders' equity, and
- The TOM better predicts next period earnings.

In addition, the ancillary finding that ESOs are in fact an expense to the firm is included within these tests. Chapter 3 also finds that all ESOs granted should be expensed, and not just those expected to vest. This finding has not been included in the empirical tests as the necessary data is not available in the databases used.

The empirical tests are conducted by using ordinary least squares regressions. This is similar to the approach used in many of the value relevance studies. The value relevance studies assess the usefulness of an item of accounting data by determining whether there is a significant causal relationship between the accounting information and the firm's share price. Thus changes in relevant data will be reflected in the share price.

Combining this approach with the findings of the previous chapters led to the following hypotheses:

H1: The coefficient associated with the fair value of ESOs forfeited is significant and positive.

H2a: The regression which includes $DEPS_{EAM}$ as regressors better explains stock returns than that using $DEPS_{TOM}$ as regressors.

H2b: The regression which includes $DEPS_{TOM}$ as regressors better explains stock returns than that using $DEPS_{TSM}$ as regressors.

H3a: The regression which includes lagged $DEPS_{TOM}$ as regressors better explains stock returns than that using lagged $DEPS_{TSM}$ as regressors.

H3b: The regression which includes the lagged $DEPS_{TSM}$ as regressors better explains stock returns than that using lagged $DEPS_{EAM}$ as regressors.

Hypothesis H1 is tested using both a levels and returns specification. Both sets of regression results exhibit a significant positive coefficient for the fair value of ESOs forfeited. This confirms that the gain should be reflected in the income statement. Contrary to theory, but consistent with some prior work, the coefficient of ESO expense has a positive coefficient using either specification. This issue is not explored further as it is not of primary concern to this work.

H2 and H3 are only tested using a returns specification, as these hypotheses specifically deal with the relationships between the earnings measures and share price return. With regards to H2a the explanatory statistics and model specification tests confirm that the EAM better describes changes in the firms' equity than the TOM. The statistics do not suggest a significant difference between the TOM and TSM in this regard (H2b).

Concerning H3a and H3b, the regressions of next periods' equity returns against this year's DEPS calculated using the three different methods have weak explanatory power. It is not possible to conclude as to which DEPS method better predicts next year's returns.

Figure 6.2 summarises the findings of the various chapters and the results of the empirical tests.

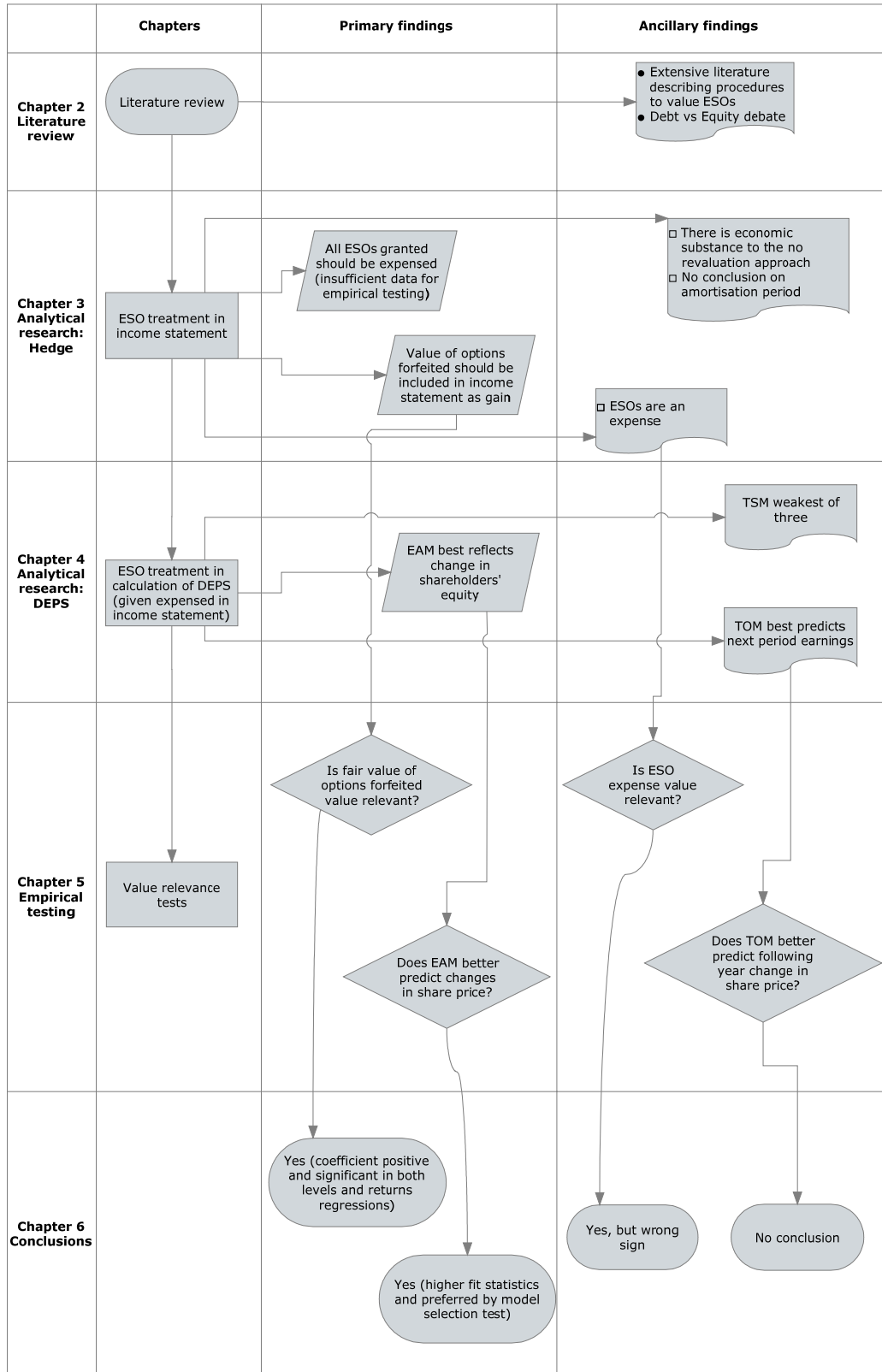


Figure 6.2 Diagrammatic overview of thesis

6.4. *Suggestions for further research*

Most prior research in this area has focused on valuing ESOs. Thus any further work which addresses the accounting issues is likely to be fruitful.

Some specific suggestions include:

- Extending the empirical tests to examine whether all ESOs, not just those expected to vest, should be expensed.
- Additional analytical and empirical research around the debt vs. equity debate. This should probably be considered within the context of the development of the conceptual framework.
- The coefficient of ESO expense continues to provide confusing results. Both positive and negative significant coefficients have been found in prior research. This may be as a result of econometric issues and it warrants further investigation.
- The examples used to compare the three different DEPS methods in Chapter 4 are based on relatively restrictive assumptions. A more complex analysis where some of these assumptions are relaxed may provide further insights.
- In addition, some other empirical approaches to comparing the three different DEPS measures may provide additional information on the dynamics of each method.

6.5. *The research in context*

The more significant recent developments in accounting standard setting have focused on the use of fair value information. Notably, the introduction of International Accounting Standard 39 – Financial Instruments: Recognition and Measurement (IAS 39) (IASB 1999) in 1999 forced fair value accounting for many financial instruments. IAS 39 has not been favourably received in some quarters, and continues to be controversial. Recent evidence of this is

the changes made to IAS 39 in October 2008 when certain rules concerning the classification of financial instruments were passed by the IASB without following the normal standard setting process (IASB 2008b). This was in an attempt to mitigate the accounting effects of the credit crisis in the financial services industry; some commentators had suggested that IAS 39 was partly to blame for the crisis (for example Davies (2008)).

IAS 39 is only one example of the recent trends towards fair value accounting. Other recent standards that have included fair value accounting in varying degrees include International Accounting Standard 40 – Investment Property (IAS 40) (IASB 2003a), International Financial Reporting Standard 3 – Business Combinations (IFRS 3) (IASB 2004) and International Accounting Standard 41 – Agriculture (IAS 41) (IASB 2002). IFRS 2 also introduces fair value accounting for share-based payments. Many of these transactions would have previously been accounted for using a historical cost philosophy. IFRS 2 now requires that all share-based payments be initially measured at fair value, and cash-settled transactions are to be continuously remeasured to fair value until settlement. However, fair value accounting is not required for the subsequent measurement of equity-settled transactions. This different treatment for similar transactions has resulted in criticism, just like the selective use of fair value accounting in IAS 39 has been criticised. Whilst the different accounting requirements in IAS 39 are probably due to practical considerations, the divergent treatments in IFRS 2 stem from the Conceptual Framework. Previous research has suggested that this framework needs revision as a result, but this thesis has attempted to explore the accounting issues within the parameters of the current conceptual framework. Thus Chapter 3 has tried to explore the economic nature of ESOs within a historical cost framework, consistent with the approach in IFRS 2. Chapter 4 addresses the issue of the divergent treatments directly, and derives a method which at a DEPS level will give

consistent results regardless of the type of settlement or IFRS 2 classification.

No doubt, as the recent changes to IAS 39 confirm, fair value accounting will remain a contentious issue. The role of fair value accounting is difficult to discern because of the competing interests of the various stakeholders. Future research should thus attempt to support the standard setters' attempts to more clearly define the contribution of fair value information.

The accounting for ESOs continues to be an area for fruitful research. This research has analysed the current accounting rules for ESOs. The results have both confirmed some of the current requirements, and suggested improvements in other areas. The size of ESO grants and their importance from a governance perspective mean that it is an area that warrants examination and reflection. No doubt the standard setters will continue to make significant improvements in the accounting of these transactions. Hopefully current and future research will provide information useful to this process.

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Appendix A



Figure A 1 Trinomial tree of stock prices and ESO values.

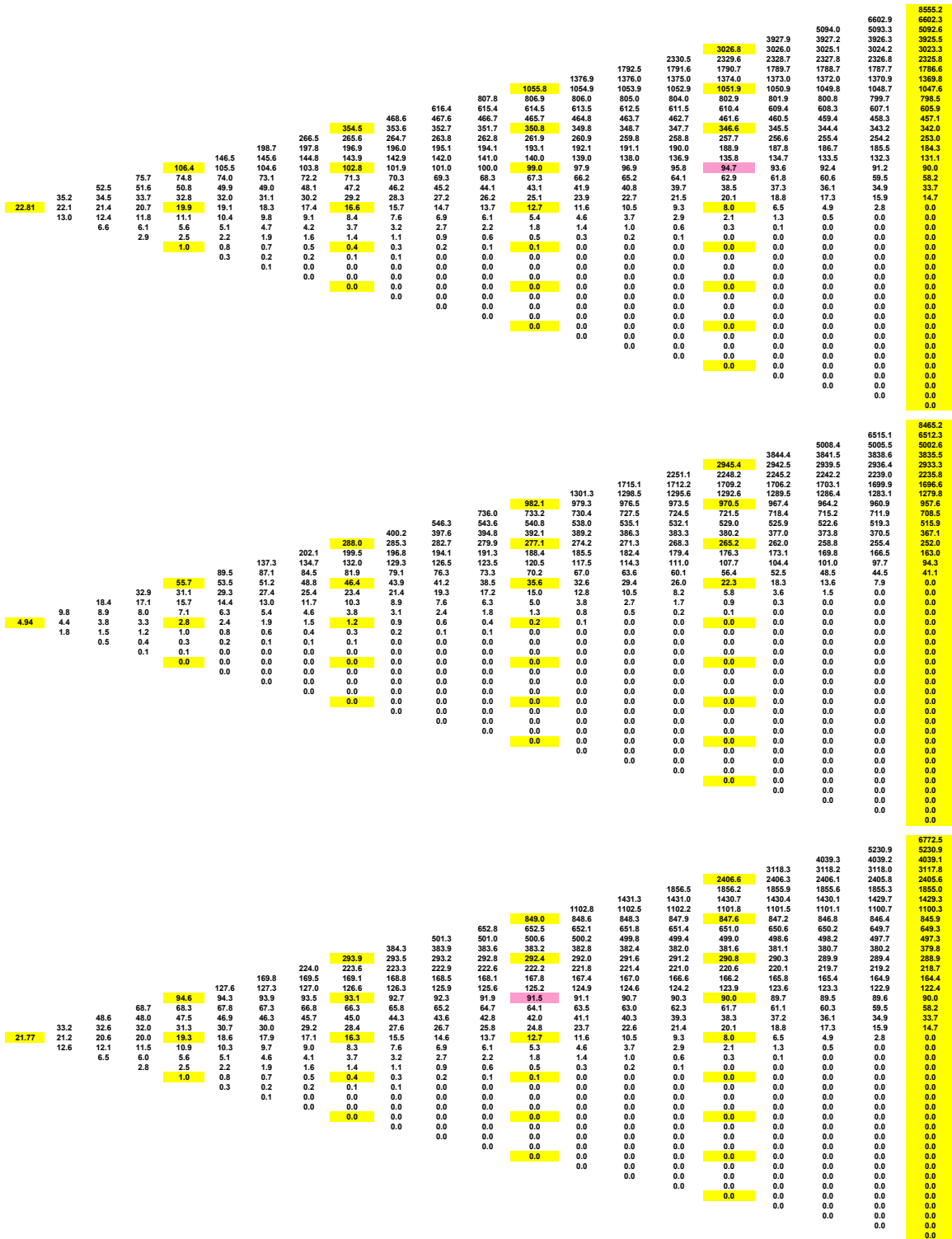


Figure A 2 Trinomial trees showing European call option value with strike 50 and strike 140.

The last tree shows the combined effect of the two options, with a weighting of 1 and short 0,21 for the first and second respectively.

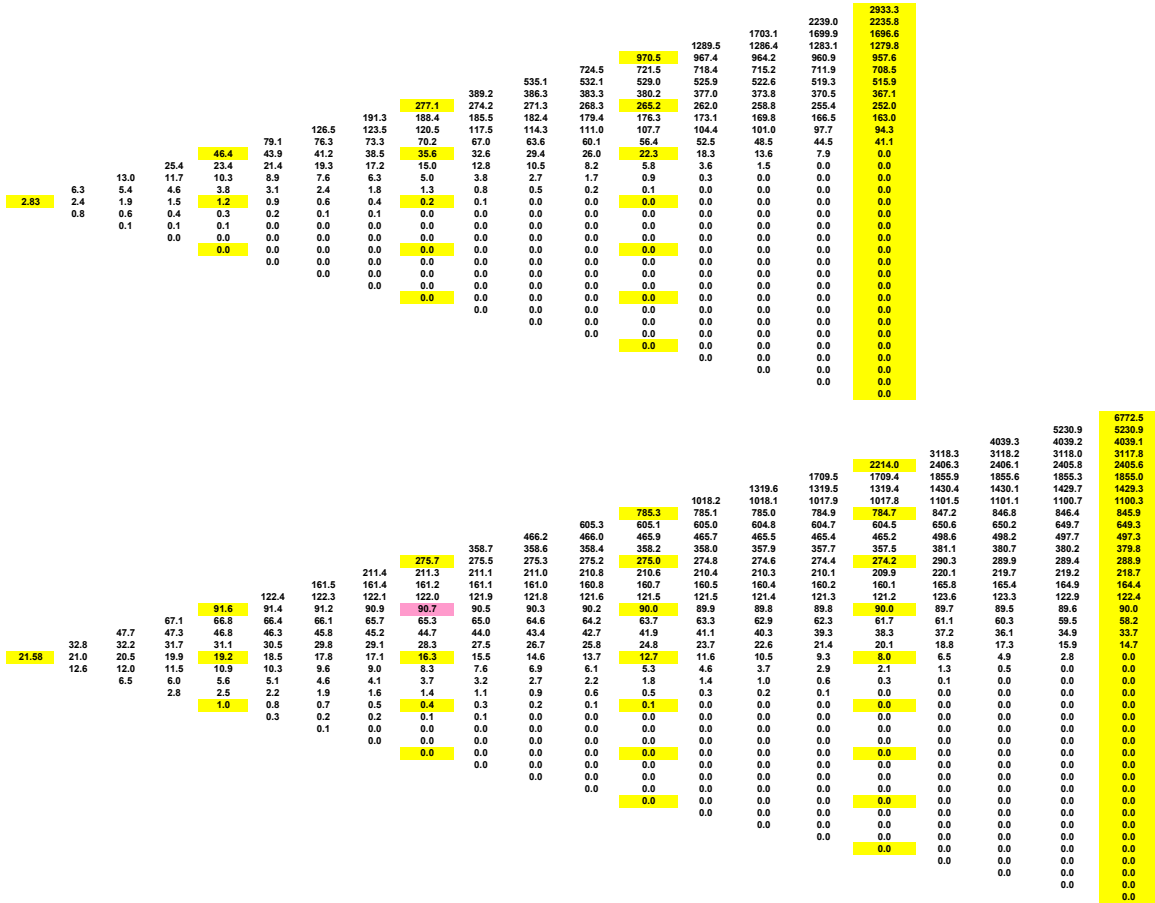


Figure A 3 Trinomial tree showing value of European call option with strike 140 and maturity 4.

The second tree shows the effect adding this option to the hedging portfolio with a weighing of short 0,07.

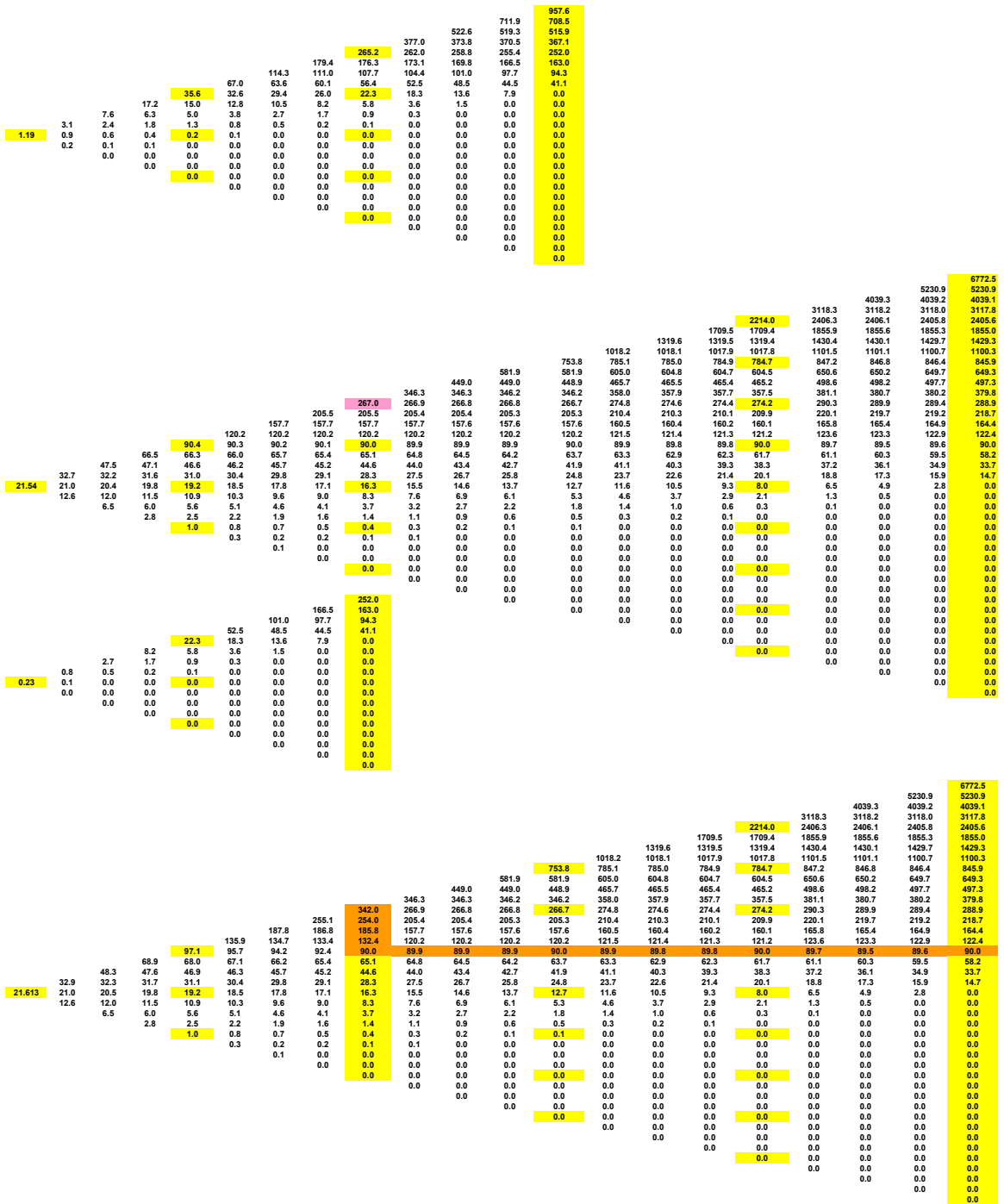


Figure A 4 Trinomial trees for hedging portfolio.

The first and third trees show the value of European call options with strike of 140 and maturity of 3 and 2 respectively. The second tree shows the effect of adding the option with a maturity of 3 to the hedging portfolio. The last tree shows the combined effect of all five options in the hedge portfolio.

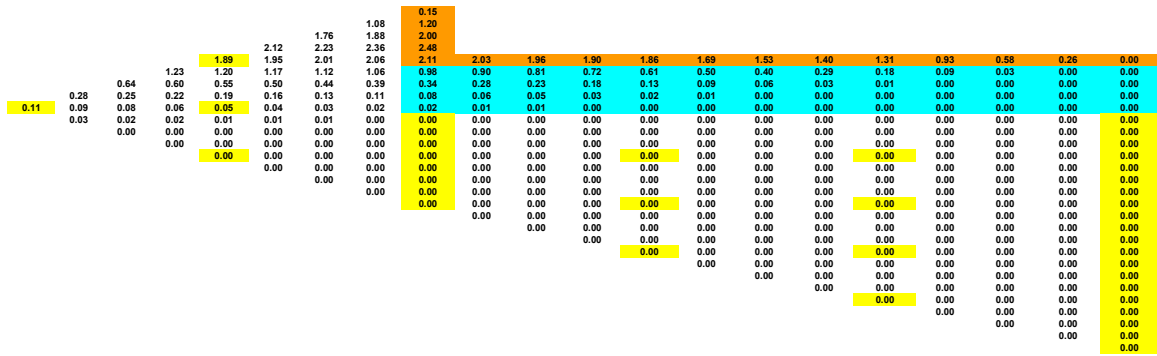


Figure A 9 Trinomial tree showing hedging portfolio minus ESO for interest rate = 10% and volatility = 20%.

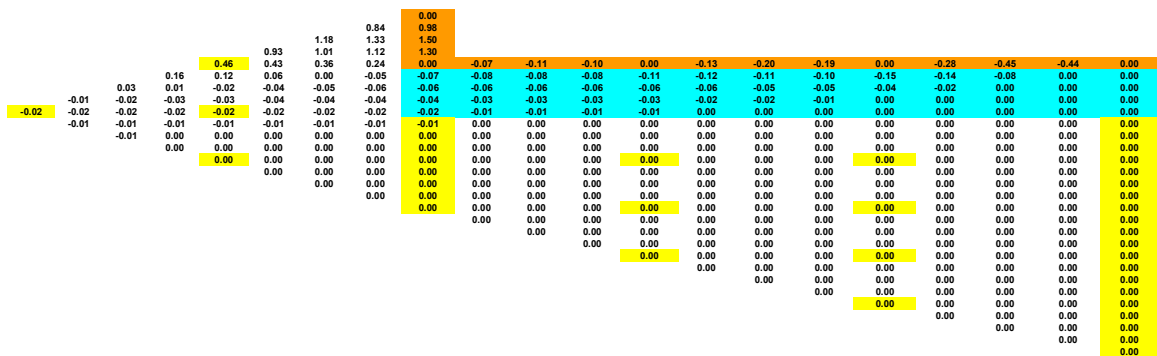


Figure A 10 Trinomial tree showing hedging portfolio minus ESO for interest rate = 10% and volatility = 30%.

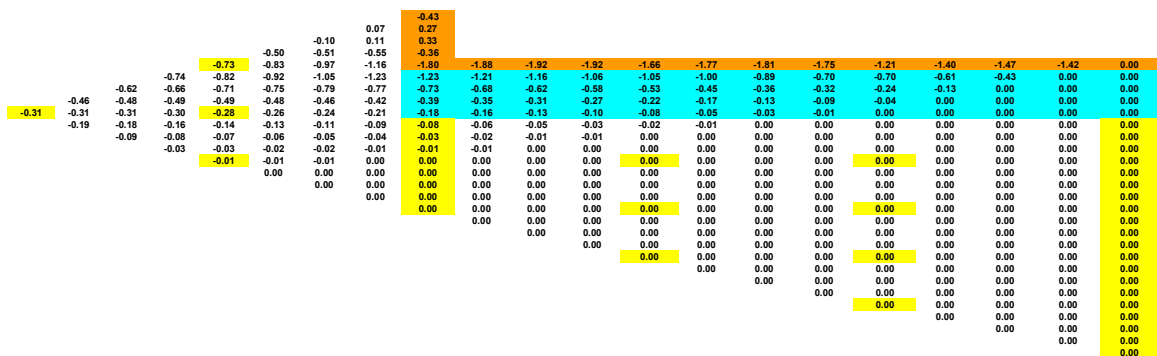


Figure A 11 Trinomial tree showing hedging portfolio minus ESO for interest rate = 10% and volatility = 40%.

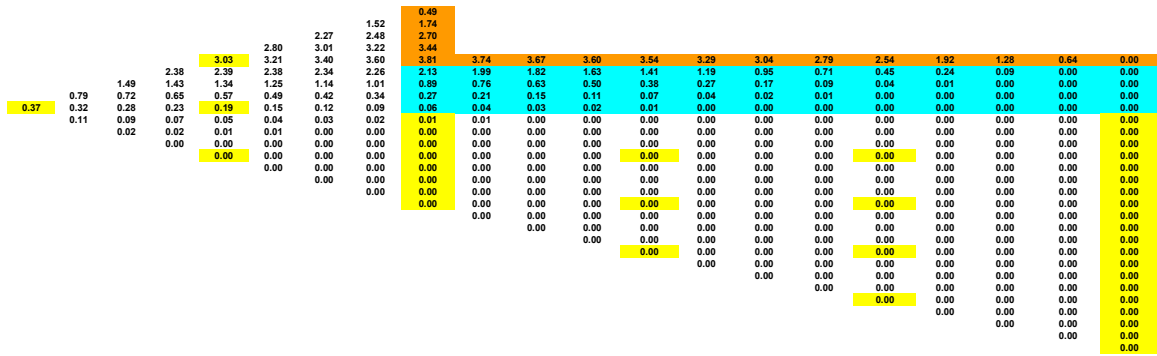


Figure A 12 Trinomial tree showing hedging portfolio minus ESO for interest rate = 15% and volatility = 20%.

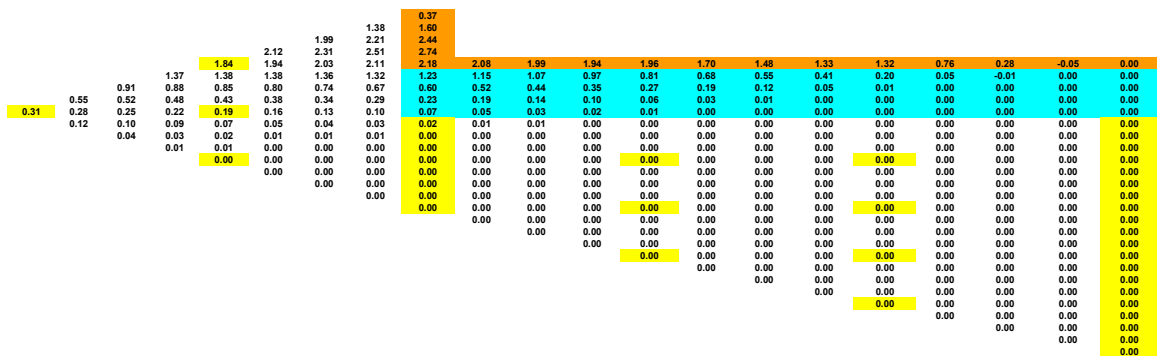


Figure A 13 Trinomial tree showing hedging portfolio minus ESO for interest rate = 15% and volatility = 30%.

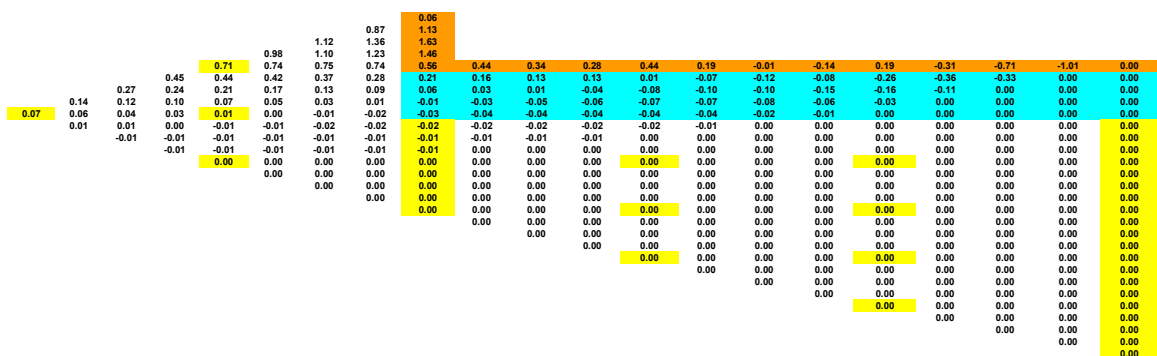


Figure A 14 Trinomial tree showing hedging portfolio minus ESO for interest rate = 15% and volatility = 40%.}

Appendix B

Table B 11 List of firms not appearing as constituents of S&P 500 on both Datastream and R.G. Associates (RGA) databases

Additional firms on Datastream list	Additional firms on RGA list
ABERCROMBIE & FITCH	ACE LIMITED
AK STEEL HLDG.	ADC TELECOMMUNICATIONS
AKAMAI TECHS.	ALLTEL
AMERICAN CAPITAL	AMBAC FINANCIAL
AMERICAN TOWER 'A'	AMERICAN STANDARD
APPLIED BIOSYSTEMS	APPLERA
ASSURANT	ARCHSTONE-SMITH TRUST
CABOT OIL & GAS 'A'	AVAYA
CAMERON INTERNATIONAL	BAUSCH & LOMB
CF INDUSTRIES HDG.	BEAR STEARNS
COVIDIEN	BIOMET
DAVITA	BRUNSWICK
DEVELOPERS DIVR.REAL.	CAREMARK RX
DISCOVER FINANCIAL SVS.	CIRCUIT CITY
EXPEDIA	CITIZENS COMMUNICATION
EXPEDITOR INTL.	CLEAR CHANNEL
FRONTIER COMMUNICATIONS	COMMERCE BANCORP
GAMESTOP	COMPASS BANCSHARES
GENERAL GW.PROPS.	COUNTRYWIDE FINANCIAL
HCP	DOLLAR GENERAL
HOST HOTELS & RESORTS	DOW JONES
INTERCONTINENTAL EX.	ELECTRONIC DATA SYSTEMS

INTUITIVE SURGICAL	EW SCRIPPS
INVESCO	FIRST DATA
JACOBS ENGR.	HARRAH'S
KRAFT FOODS	HILTON HOTELS
LEUCADIA NATIONAL	IAC/INTERACTIVE
LORILLARD	KEYSPAN
MANITOWOC	KINDER MORGAN
MASSEY EN.	MANOR CARE
MASTERCARD	MAXIM INTEGRATED
MEMC ELT.MATERIALS	MEDIMMUNE
MICROCHIP TECH.	MELLON FINANCIAL
NOBLE ENERGY	NCR
NYSE EURONEXT	OFFICEMAX
PEPCO HOLDINGS	PHELPS DODGE
PHILIP MORRIS INTL.	PMC-SIERRA
PREC.CASTPARTS	REALOGY
RANGE RES.	SABRE HOLDINGS
SCRIPPS NETWORKS INTACT	SANMINA
SOUTHWESTERN ENERGY	SOLECTRON
TERADATA	SYNOVUS FINANCIAL
TESORO	TEKTRONIX
TITANIUM METALS	TEMPLE INLAND
TOTAL SYSTEM SERVICES	TRIBUNE CO.
TYCO ELECTRONICS	TXU
WASHINGTON PST.'B'	UNIVISION COMMUNICATIONS