DISCRETIONARY CAPITALISATION OF R&D EXPENDITURES IN CANADA AND AUSTRALIA

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ABSTRACT

DISCRETIONARY CAPITALISATION OF R&D EXPENDITURES

IN CANADA AND AUSTRALIA

The purpose of this thesis has been to provide evidence that the market is capable of determining value from the manager's selective capitalisation of deferred development costs. An existing model, the Feltham and Ohlson (1996) valuation model, is used to determine the association between market value, book value of equity, abnormal earnings and selected R&D variables. Research on value-relevance shows that the market is capable of valuing intangible assets, particularly R&D.

Empirical results are consistent with the voluntary disclosure hypothesis. Market value is positively associated with capitalised development costs when the sample has been partitioned on materiality. Materiality is defined as the ratio of capitalised development costs to total market value. Furthermore, the results are robust to numerous sensitivity checks.

Although other studies have examined the association between market value and R&D expenditures, this is one of the first studies to examine the association in a Canadian and Australian setting and to address the issue of manager's selective capitalisation of R&D related development costs. Previous U.S. studies investigate the association between market value and a researcher synthesised R&D asset. The United States standard, SFAS #2, mandates the immediate expensing of all R&D expenditures, other than certain software costs, in the current year. Researchers using U.S. data must therefore create the R&D asset.

This study should be useful in the ongoing debate on allowing managers choice in their selection of accounting policies, particularly on whether managers will use this discretion to engage in earnings manipulation. The positive association between market value and capitalised development costs tells regulators that despite the potential for manipulation the market values the asset placed on the balance sheet by the manager. Since regulatory bodies like the Ontario Securities Commission , the Australian Securities Commission, and the International Accounting Standards Committee and various users of financial information are interested in how R&D is accounted for and disclosed, research of this nature should be useful.

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DISCRETIONARY CAPITALISATION OF R&D EXPENDITURES
IN A FELTHAM & OHLSON FRAMEWORK

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CHAPTER 1

Introduction

1.1 Introduction

This study addresses the discretionary capitalisation of research and development (R&D)[1] costs, an intangible asset, and the related accounting treatment, using Canadian and Australian data in a Feltham & Ohlson (F&O) motivated empirical design.

When a firm's R&D project satisfies certain criteria, managers face a decision as to whether to capitalise or expense current period development expenditures. The decision to select the appropriate accounting policy is referred to as discretionary capitalisation. This study attempts to answer three questions: does the market place a value on capitalised development costs, does the market place a higher value on the current year capitalised development expenditures relative to the expensed research and development costs given that the firm is a capitaliser, and does the market place a higher value on the current year R&D expenditures of capitalisers than on those of expensers?

First, does the market place a value on the capitalised development costs? Value is defined as consistency with information used by the market. If the market does place a value on capitalised development costs a positive association between the asset and market value would be expected. Given that a subset of firms chooses to capitalise eligible costs, it would be useful to be able to determine whether the market agrees with this assessment. This is because, under Canadian and Australian generally accepted

[1] Though the literature refers to R&D in general, only development costs may be capitalised under Canadian GAAP. Australia allows for the capitalisation of development costs and, in limited cases applied research. See discussion in Chapter 3.

accounting principles (GAAP), an asset can be recognised only when it has future economic value. If the market does value the capitalised development costs, a plausible interpretation is that the act of capitalising provided information[2] to the market that it would not otherwise have had with respect to the expected future benefits of the capitalised project. This line of research is consistent with recent work (Sougiannis (1994), Lev and Sougiannis (1996), and Aboody and Lev (1998)).

Second, does the market place a higher value on the current year capitalised development costs relative to the expensed research and development costs given that the firm is a capitaliser? When a firm chooses to capitalise it will capitalise all outlays that meet the criteria set forth in the accounting standards. Those outlays that are expensed would have smaller future expected benefits, if any, relative to the capitalised outlays.

Third, does the market place a higher value on the current year R&D expenditures of capitalisers than those of expensers? Under a generalised signalling hypothesis, a firm that chooses to signal presumably does so because of the project's superior expected payoffs. As such, it is expected that (*ceteris paribus*) the coefficient on the current year R&D investment parameter would generally be greater than that of the expensers, the argument being that the higher future benefits related to current year expenditures would manifest itself in larger valuation coefficients per dollar of R&D outlay.

The signalling-related motivation for these research questions is to explore whether the market believes that managers do use their discretion to select accounting policies that convey their private information about firm value. Such a finding would

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[2] The information referred to is κ, the impact of date t cash investments on date $t+1$ cash receipts. This is discussed more fully in Chapter 5.

provide evidence that standards which allow for discretionary capitalisation may be effective in conveying private information to the market. The current direction of standard setting for intangibles in general is to permit discretionary capitalisation of all intangibles. Establishing value relevance would provide evidence to standard setters that, despite the subjectivity of estimates, managers are perceived as providing value-relevant information. This study examines a subset of intangibles, specifically R&D related development costs. Institutional differences between Canada and Australia (where discretionary capitalisation is permitted) and the United States (where immediate expensing is required) allows for the examination of issues that are not possible in a U. S. setting (the majority of previous studies utilise U. S. data - see section 1.2 and Chapter 3). A positive association between firm value and capitalised development costs suggests that the Canadian and Australian standard is appropriate for their respective capital markets.

1.2 Opportunity for discretionary capitalisation of development costs

Canadian and Australian GAAP allows for managers to capitalise development costs providing certain criteria have been met. This differs from GAAP in the United States. Statement of Financial Accounting Standard (SFAS) #2 requires firms to expense all R&D expenditures as incurred, except those relating to certain software costs which are covered under SFAS # 86. There is no scope, under U. S. standards, for the capitalisation of any non-software related R&D.

The majority of prior research on R&D utilised U. S. data. Recent studies by Sougiannis (1994) and Lev & Souginannis (1996), among others, show results that indicate that constructed R&D assets have value relevance to the market even though full

expensing is mandated under SFAS #2. The difference between the United States and Australian and Canadian standards gives researchers an opportunity to study and analyse the impact of various accounting treatments on management's choice of accounting policies and on capital markets. The research questions in this study are further motivated by two factors:

1) the increased awareness of intangibles in both the academic and professional communities; and
2) the emergence of the Feltham and Ohlson theoretical framework.

1.3 Increased awareness

The issues that this study addresses are relevant and important in today's accounting environment. Capitalised development cost is an "intangible asset". Research into intangibles has increased significantly over the last several years. Recent academic papers by Barth and Kasznik(1997), Barth, Kasznik and McNichols (1997) Ahmed, Morton and Schaefer (1997), Aboody and Lev (1998), Entwistle (1997) and Percy (1997) provide evidence of this increase. This study will contribute to the literature by examining how the market values development costs which have been capitalised at the discretion of the manager. An examination of R&D in this manner has not been previously undertaken due to the U. S. mandated standard of full expensing.

Aboody and Lev (1998) point out that, in addition, a number of professional bodies have begun to examine the proper accounting treatment of intangibles, including:

- the Financial Accounting Standards Board (FASB), which has recently established a Task Force on Business Combinations;

- the Accounting Standards Executive Committee of the AICPA (AcSEC), which released a Proposed Statement of Position (1996) on accounting for software in internal use; and
- the International Accounting Standards Committee (IASC), which is considering an exposure draft that calls for the capitalisation of internally developed intangibles with identifiable benefits.

1.4 Feltham and Ohlson Theoretical Framework

In recent years, Ohlson (1995) and Feltham and Ohlson (1995, 1996) have developed a theoretical valuation model utilising the firm's accounting data to explain its market value. Recent work by Ahmed, Morton, and Schaefer (1997), Stober (1996), and Myers (1996), has used the Feltham & Ohlson framework as a base for their empirical specification. The model is discussed in more detail in Chapter 5.

This thesis is intended to contribute to our understanding of the way accounting numbers can be used in determining firm value and how the market reacts to information conveyed by management concerning a firm's future R&D prospects.

1.5 Voluntary disclosure

Management faces a decision as to whether to capitalise qualifying development expenditures. This study *assumes* that management wishes to communicate the quality of their R&D projects.[3] Higher quality projects will (*ceteris paribus*) yield higher returns,

[3] It is assumed that when the expenditures have been capitalised, the decision is consistent with the requirements of the standard and that this consistency has been confirmed by the auditor.

and managers wish to credibly communicate this information to the market. Chapter 4 expands this discussion in a general framework. This study does not, however, propose a formal empirical test of a signalling equilibrium.

Based on the manager's disclosure of R&D expenditures, it is possible to determine how much of a firm's current period expense relates to past projects, how much relates to current projects and how much of current expenditures are being deferred (as they have met the criteria for selective capitalisation and management has chosen to do so). The market would be interested in the decisions made by management with respect to current period projects.

1.6 Outline

The remainder of the study is organised as follows: Chapter 2 discusses the current Canadian, Australian, U.S., and International standards; Chapter 3 reviews the previous research literature on R&D in general; Chapter 4 discusses the motivation for accounting disclosure, related research and hypothesis development; Chapter 5 provides an analysis of the Feltham & Ohlson framework and a reconciliation of the empirical specification with Sougiannis (1994); Chapter 6 describes the data and discusses the development of the empirical models; Chapter 7 presents the empirical results; and conclusions are reached in Chapter 8.

CHAPTER 2

Institutional Background

2.1 Introduction

Accounting standards are essential to the efficient functioning of the economy because decisions about the allocation of resources rely heavily on credible, concise, and understandable financial information. Financial information about the operations and financial position of individual entities also is used by the public in making various other kinds of decisions.

This chapter discusses the financial reporting standards and standard setting bodies in Canada (section 2.2) , Australia (section 2.3) the United States (section 2.4), and the International community, through the International Accounting Standard Committee (IASC) (section 2.5). Section 2.6 provides a chapter summary.

2.2 Financial reporting standards in Canada

The sources of regulation governing the financial reporting environment within Canada are:

i) The Canada Business Corporations Act[4]
ii) The Securities Commissions (primarily the Ontario Securities Commission)
iii) The Canadian Institute of Chartered Accountants (CICA)

Under the Canada Business Corporations Act, enacted by the federal government, the authority for establishing generally accepted accounting principles has been delegated to the Canadian Institute of Chartered Accountants (CICA). The Ontario Securities Act (OSA) requires financial statements filed with the Ontario Securities Commission to be

[4] Most provinces also have their own Provincial Companies Act (or Corporations Act).

prepared in accordance with generally accepted accounting principles (OSA S.78(1)). The regulations to the Act define GAAP as the recommendations set forth in the CICA *Handbook* (ON Reg. 1015:1(3)).

The Board of Governors of the CICA has authorised the Accounting Standards Board "the Board" to issue recommendations with respect to matters of accounting practice. The purpose of the Board is to:

> "establish and improve standards of financial accounting and reporting by profit oriented enterprises in the private and public sectors and by non-profit organisations...for the benefit of the public, including users, preparers and auditors of financial information. The Board issues, if satisfied as to need, usefulness and practicality:
> - Accounting Recommendations in the CICA Handbook, developed in accordance with a due process of consultation and debate.
> - Accounting Guidelines to provide interpretations of Recommendations or timely guidance on new or contentious issues." (CICA *Handbook*, p.12.)

The collection of Accounting Recommendations are contained in a loose leaf publication[5] called the CICA *Handbook*. The CICA *Handbook* is the authoritative source of GAAP in Canada.

The general disclosure requirements for Canadian financial statements of companies are contained in sections 1000 to 1800 of the CICA *Handbook*. Paragraph 1000.15 states:

> "the objective of financial statements is to communicate information that is useful to investors, members, contributors, creditors and other users ("users") in making their resource allocation decisions and/or assessing management stewardship. Consequently, financial statements provide information about:
> (a) an entity's economic resources, obligations and equity/net assets;
> (b) changes in an entity's economic resources, obligations and equity/net assets; and
> (c) the economic performance of the entity."

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[5] This is also available on CD-ROM.

As part of assessing the economic performance of the entity, *Handbook* section 1520.01 requires that: "The income statement should present fairly the results of operations for the period". Paragraph .03 outlines a list of items that the income statement should distinguish in arriving at the income or loss before discontinued operations and extraordinary items. One of the items listed is research and development costs (*Handbook* 1520.03(i)).

Section 3450 of the CICA *Handbook* is the relevant authority for Canadian GAAP with respect to R&D. Within the standard, scope exists for the capitalisation of certain *development* costs, provided that they meet the criteria as outlined in the *Handbook*.

Research, defined by the *Handbook* as " *...planned investigation undertaken with the hope of gaining new scientific or technical knowledge and understanding.*" (*Handbook* 3450.02) is generally thought to be an ongoing activity required to maintain a firm's business and competitive position. The timing and quantification of future benefits, if any, is problematic. The *Handbook* concludes that "*Research costs should be charged as an expense of the period in which they are incurred.*" (*Handbook* 3450.16).

Development costs, however, may be capitalised if stringent recovery tests are met. As a general rule, development costs should also be expensed in the period incurred unless the conditions set out in paragraph 3450.21 of the *Handbook* are met: *"Development costs should be deferred to future periods if all of the following criteria are satisfied:*

> *(a) the product or process is clearly defined and the costs attributable thereto can be identified;*

(b) the technical feasibility of the product or process has been established;
(c) the management of the enterprise has indicated its intention to produce and market, or use, the product or process;
(d) the future market for the product or process is clearly, defined or, if it is to be used internally rather than sold, its usefulness to the enterprise has been established; and
(e) adequate resources exist, or are expected to be available, to complete the project.

Though the *Handbook* states how the two components of R&D are to be accounted for, *management must still make the determination* of when a project has met the above criteria in order to capitalise. This determination is what gives Canadian managers discretionary decision-making power concerning development costs. This gives management the ability to communicate information to the market concerning the success of research efforts.

2.3 Financial reporting standards in Australia

The sources of regulation governing accounting principles and financial reporting within Australia are:

(i) The Australian Accounting Standards Board (AASB);
(ii) The Australian Securities Commission (ASC);
(iii) The Australian Stock Exchange (ASX);
(iv) The Australian professional accounting bodies which include
    (a) The Australian Society of Certified Practising Accountants (ASCPA); and
    (b) The Institute of Chartered Accountants in Australia (ICAA); and
(v) The Urgent Issues Group (UIG).

The power to make accounting standards is vested in the Australian Accounting Standard Board (AASB) which was established by virtue of Section 32 of the *Corporations Act (1989)*. According to Section 224 of *the Corporations Law (1991) as*

amended (hereafter *Corporations Law (1991)*), the major functions of the AASB are as follows:

(a) to develop a conceptual framework, not having the force of an accounting standard, for the purpose of evaluating proposed accounting standards;
(b) to review proposed accounting standards;
(c) to sponsor or undertake the development of possible accounting standards;
(d) to engage in such public consultation as may be necessary to decide whether or not it should make a proposed accounting standard; and
(e) to make changes to the form, and context of a proposed accounting standard.

The Board is an arm of the Australian Government and is responsible to the Commonwealth Treasury. The Director and members are appointed directly by the Commonwealth Treasurer from nominations made by a number of bodies, including the Business Council of Australia and the bodies listed above. Upon finalisation of an accounting standard by the AASB it is tabled in the Commonwealth Parliament to be passed as law. Once law, the standard, becomes an "applicable accounting standard" and is entrenched in the *Corporations Law (1991).*

The Australian Securities Commission (ASC) was also established January 1, 1991 by virtue of the *Australian Securities Act (1989)*. The role of the ASC in financial reporting includes the formulation and issuance of corporate and compliance requirements. The ASC is responsible for taking action in the event of non-compliance with an AASB Accounting Standards. Such action may include suspension from trading or legal action to enforce compliance.

The Australian Stock Exchange (ASX) is a non-profit private organisation formed on April 1, 1987. The ASX is the Australian domestic market for trading in securities. The objectives of the ASX are to:

(a) provide a fair and well-informed market for financial securities; and
(b) provide an internationally competitive market.

Firms that list with the ASX must comply with the ASX Listing Rules which are designed to protect the interests of the public. The Listing Rules are enforceable against listed companies under the *Corporations Law (1991)*. The ASX requires listed companies to provide various reports including audited annual and half-yearly financial statements. These reports must be prepared in accordance with AASB Accounting Standards.

The two major professional accounting bodies contribute to the development of accounting standards through the Australian Accounting Research Foundation (AARF), established in 1966. This privately funded body engages in technical research activities with the aim of improving the quality of financial reporting in Australia.

Prior to September 1988 the AARF was responsible for the promulgation of Australian Accounting Standards (AAS's). The AARF, however, had no role in the monitoring or enforcing of accounting standards and non-compliance was common. The extent of non-compliance eventually led in 1984, to the formation of the Accounting Standards Review Board (ASRB), the forerunner of the AASB, with power to issue mandatory standards. The Urgent Issues Group, established in October 1994, provides timely guidance on urgent financial reporting issues that have not been dealt with in accounting standards. Members are appointed by the Financial Board of Management of the AARF.

On September 8, 1997 the Commonwealth Treasurer announced the first initiative of the Federal Government's proposals under the Corporate Law Economic Reform Program (CLERP). Under the proposals, the Government plans to establish a new advisory board, the Financial Reporting Council (FRC). This board will set broad strategic direction for, and monitor the performance of, a new body responsible for setting

Accounting Standards, to be called the Australian Accounting Standards Committee (AASC). The AASC will replace the AASB and will have broad responsibility for preparing, approving and issuing accounting standards for both public and private sector entities required to prepare financial statements in accordance with Accounting Standards. At time of writing, the proposals have not yet come into effect.

2.3.1 Australian Accounting Standards[6]

The general disclosure requirements for Australian financial statements of companies are contained in two main AASB standards:

1) *AASB 1018: 'Profit and Loss Accounts'*, and
2) *AASB 1034: 'Information to be Disclosed in Financial Reports'. AASB 1034* was issued in December 1996 effective for companies with financial years ending on or after June 30, 1997. Prior to the release of *AASB 1034*, Australian companies were required to comply with section 297(1) of the *Corporations Law (1991)* which ensured companies comply with the disclosure requirement of Schedule 5 of the *Corporations Law (1991)*. Part 3 Division 2 of Schedule 5 provided guidance on the basic notes relating to the profit and loss account. Effective form May 1997, *AASB 1034* has replaced Schedule 5.

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[6] Australian Accounting Standards are divided into two categories sorted by either the AAS prefix or the AASB prefix. AAS standards apply to all non-corporate entities and Government institutions not covered under the *Corporations Law (1991)*. These include such entities as partnerships, trusts, superannuation funds, clubs and unincorporated associations. Although these standards do not have the force of law members of the professional accounting bodies are required to observe them. The standards are issue by the Public Sector Accounting Standards Board (PSASB), a board within the jurisdiction of the AARF. As at June 30, 1998, there were 34 AAS accounting standards on issue. All companies and other disclosing entities which fall under the jurisdiction of the *Corporations Law (1991)*, are required to prepare financial statements in accordance with Australian Accounting Standards Board (AASB) standards. As at June 10, 1998, there were 36 AASB accounting standards.

AASB 1018 was approved on October 30, 1989 and was effective for financial years ending on or after December 31, 1989. As the sample period in this study is for listed Australian companies from 1992 through 1997 inclusive, all firms were required to follow the standard. Technical amendments to the standard were made in both August 1992 and September 1995 but had no impact on the essence of the standard. The standard requires that all firms are to provide a profit or loss statement for the year disclosing the operating profit or loss before and after tax and the income tax expense.

The standard contains an appendix proving guidance on the layout of the profit and loss account. The standard in and of itself requires minimal disclosure. In addition to the above requirements, firms are required to report any abnormal and extraordinary items and their related tax effects. There is no requirement in *AASB 1018* to disclose individual revenue and expense components. This is left to the specific disclosure requirements of each individual AASB accounting standard and Schedule 5, prior to May 1997. As most observations are for firm years ending prior to the effective date of *AASB 1034*, the sample companies needed to comply with Schedule 5.

As previously mentioned, *AASB 1034* replaced Schedule 5 for reporting periods ending on or after June 30, 1997. No fundamental changes were made to the revenue and expense sections of Schedule 5 in the transition to an accounting standard. In contrast with Schedule 5, which required all items to be disclosed irrespective of materiality, *AASB 1034* requires disclosure only where the information is considered material in accordance with *AASB 1031: 'Materiality'*.

There is nothing in the two general standards that specifically require that research and development expenditures be disclosed. The *Corporations Law (1991)*, however,

places an onus on company directors to ensure that the financial statements present a "true and fair" view of the operations of the company. In particular, Section 292 requires the company's directors to: "...cause to be made out a profit and loss account for that accounting period that gives a true and fair view of the company's profit or loss for that accounting period." A similar provision is contained in section 293 relating to the balance sheet. While requiring directors to ensure that the company accounts are "true and fair", no statutory definition of "true and fair" exists in the *Corporations Law (1991)*. Section 298(1), however, specifically requires directors to ensure that the company's financial statements are made out in accordance with "applicable accounting standards". Section 9 of the *Corporations Law (1991)* defines an "applicable accounting standard" to be a standard as issued by the Australian Accounting Standards Board (AASB). Therefore, in order for the financial statements to portray a "true and fair" view, the accounts must be prepared in accordance with AASB standards. An important point to note is that the AASB standards only apply where the transaction or information is "material". If the information is not material, then the requirements of the standard do not apply.

AASB 1031: 'Materiality' governs the concept of materiality and explains the role of materiality in making judgements in the preparation and presentation of the financial reports. Clause 4.1.1 of states:

> The notion of materiality influences whether an item or an aggregate of items is required to be *recognised*, measured or disclosed in accordance with the requirements of an Accounting Standard. Where an item or an aggregate of items is not material, application of the materiality notion does not mean that those items would not be recognised, measured or disclosed, but rather that the entity would not be required to recognise, measure or disclose those items in accordance with the requirements of an Accounting Standard.

Further clause 4.1.6 of AASB 1031 states:

> ...Materiality is a matter of professional judgement influenced by the characteristics of the entity and the perceptions as to who are, or are likely to be, the users of the financial report, and their

> information needs. Materiality judgements can only be properly made by *those who have the facts (italics added).*

Therefore, implicit in the notion of presenting a "true and fair" view, directors must take into consideration the concept of materiality.

Consequently, when directors determine that expenditures on research and development are of a material nature, they are required under *AASB 1031* to apply the appropriate accounting standard, being *AASB 1011: 'Accounting for Research and Development Costs'*. The current standard was approved on May 29, 1987 and became operative for financial years ending on or after September 30, 1987. The standard applies to the accounting for research and development activities other than those conducted for others under contract or specialised activities.

The purpose of the standard is to require the application of a method of accounting whereby research and development costs are matched against related benefits when such benefits are expected beyond a reasonable doubt.

The standard requires that a disclosure be made in the notes detailing the amount of current year expenditures that were expensed, the amount deferred to future years, the closing book value of the capitalised asset and the basis for amortisation.

The disclosure requirements contained in the standard are in addition to the disclosure requirements of *AASB 1018* and are usually disclosed in the note to the financial statements. The commentary accompanying the standard provides discussion into the nature of research and development expenditure. The commentary, whilst not mandatory, provides a strong guidance on the application of the standard. Research is divided into two categories, basic and applied. Basic research is broadly defined as original investigation which results primarily in the advancement of knowledge. This research is

undertaken without a specific aim or application. There is usually no link between costs incurred and resulting future benefits if any. All costs associated with basic research are to be charged to the profit and loss account in the year incurred.

Applied research is defined as original investigation towards solving recognised practical problems. It is undertaken with a specific aim or application. Though a link may exist between current period expenditures and future benefits, at the time of expenditure any future benefits would be considered too uncertain to warrant deferral. Costs of applied research are normally charged to the profit and loss account in the year incurred. However, because applied research is undertaken with a specific aim or application, it may be possible that the costs be associated with identifiable projects. In these cases, if the costs meet the criteria of clause 31 of AASB 1011 they may be deferred until future financial periods.

Development activities are undertaken with specific commercial intent and involve the adaptation of basic and applied research knowledge into plans or designs for new products or significant improvements to existing products. These activities can be associated with identifiable projects and there may be a reasonable probability of future benefits. These costs may be deferred if the future benefits are "*beyond any reasonable doubt*" (AASB 1011.31) to be recoverable.

2.3.3 Recent Studies of Accounting Practice in Australia

In a study commissioned by the AARF, *Accounting Research Study No. 12*, Cantrick-Brooks (1993) examined the financial reports of the top 150 listed Australian companies in 1992. Of the 150 firms in the sample, 56 disclosed information about R&D.

Of these, 48 expensed their entire expenditure while 8 implemented a capitalisation policy. The ASC, in a review done in 1995, determined that companies did not supply enough information in regards to their choice of accounting policy nor provided justifications for the policy selection. Percy (1997) examines whether the investment opportunity set of high research intensive versus low research intensive firms is a factor that determines accounting policy and disclosure choice. She finds that high research intensive firms are more likely than low research intensive firms to choose selective capitalisation of R&D as their accounting policy.

These studies and an examination of the data indicate that significant variation exists in how R&D expenditures are accounted for and the level of disclosure. As Percy (1997) states: "A considerable number of firms whose principal activity is research and development *do not* [italics added] disclose the amounts of R&D capitalised or expensed, even though AASB 1011 requires material R&D expenditure to be disclosed (clause .60)." (Page 74).

2.4 Financial reporting standards in the United States

Since 1973, the Financial Accounting Standards Board (FASB) has been establishing standards of financial accounting and reporting. They are officially recognised as authoritative by the Securities and Exchange Commission (SEC) (Financial Reporting Release No. 1, Section 101) and the American Institute of Certified Public Accountants (Rule 203, Rules of Conduct, as amended May 1973 and May 1979). Though the SEC has statutory authority to establish financial accounting and reporting standards for publicly held companies under the Securities Exchange Act of 1934, it has been the Commission's policy to rely on the private sector for this function.

The FASB is an independent body separate from all other business and professional organisations. Before the present structure was created, financial accounting and reporting standards were established first by the Committee on Accounting Procedure of the American Institute of CPAs (1936-59) and then by the Accounting Principles Board, also an arm of the AICPA (1959-73). Pronouncements of those predecessor bodies remain in force unless amended or superseded by the FASB.

The Financial Accounting Foundation is responsible for selecting the members of the FASB and its Advisory Council, funding their activities, and for exercising general oversight (except with regard to the FASB's resolution of technical issues). The Foundation is also separate from all other organisations. Its Board of Trustees, however, is made up of nominees from sponsoring organisations whose members have special knowledge of, and interest in, financial reporting. They are:

i) American Accounting Association
ii) American Institute of Certified Public Accountants
iii) Association for Investment Management and Research
iv) Financial Executives Institute
v) Government Finance Officers Association
vi) Institute of Management Accountants
vii) National Association of State Auditors,
viii) Comptrollers and Treasurers
ix) Securities Industry Association

Accounting for R&D, in the U.S., is mandated by Statement of Financial Accounting Standards No.2 (SFAS #2). The statement established standards of financial accounting and reporting for research and development costs. The stated objectives of the standard is "reducing the number of alternative accounting and reporting practice presently[7] followed and providing useful financial information about research and development costs" (SFAS #2, 1). The statement mandates that "All research and development costs encompassed by this Statement shall be charged to expense when incurred" (SFAS #2, 6). An exception to the general rule is permitted for certain software costs which are covered under SFAS # 86. Under the standard, firms in the United States may not capitalise any non-software related research and development costs.

In concluding that all research and development costs should be expensed in the current period, The Board considered the following factors:

i) the uncertainty of future benefits
ii) lack of casual relationship between expenditures and benefits
iii) accounting recognition of economic resources
iv) expense recognition and matching
v) usefulness of resulting information
vi) capitalisation of all costs when incurred
vii) selective capitalisation
viii) accumulation of costs in a special category.

[7] October 1974

Of particular interest is the Board's discussion of points iii), v) and vii).

> The Board concluded, based on various submissions,
>
> "that the relationship between current research and development costs and the amount of resultant future benefits to an enterprise is so uncertain that capitalisation of any research and development costs is not useful in assessing the earnings potential of the enterprise. Therefore, it is unlikely that one's ability to predict the return on an investment and the variability of that return would be enhanced by capitalisation" (SFAS #2, 20).

The Board also states that, at the time, no empirical evidence existed which demonstrated a direct link between R&D costs and future revenue. It should be noted, however, "that FASB did not undertake a major research effort for the project. The FASB staff interviewed a *limited number* [italics added] of selected financial analysts and commercial bankers and reviewed a substantial number of published financial statements." (SFAS #2, 9). Recent work, as discussed in section 3.5, indicates that assumption of value irrelevance may no longer be warranted.

The Board also examined the following criteria that would have to be met before R&D costs could be capitalised:

a) Definition of product or process
b) Technological feasibility
c) Marketability/Usefulness
d) Economic feasibility
e) Management action
f) Distortion of net income comparisons

It is interesting to note the similarity between these factors and those discussed in section 2.2, relating to the Canadian standard. FASB concluded that "no set of conditions that might be established for capitalisation of costs could achieve the comparability among enterprises..." (SFAS #2, 22). Considerable judgement of managers is required to identify the point at which a research and development project satisfies the criteria, if any. As the

criteria, and the corresponding professional judgement are unobservable to the market and difficult to audit, this may explain why the requirement of full expensing of current R&D expenditures under U. S. GAAP still exists. As Lev and Sougiannis state, "...U. S. standard-setters are concerned with the reliability and objectivity of estimates required for R&D capitalisation, and with the associated audit risk. The specter of providing managers with additional opportunities for earnings management must also weigh heavily on regulators" (1996, 108).

2.5 International Standards

The International Accounting Standards Committee (IASC) was formed in 1973 through an agreement made by the professional accountancy bodies from Australia, Canada, France, Germany, Japan, Mexico, the Netherlands, the United Kingdom and Ireland, and the United States.

Financial reports can involve principles and procedures that can vary from country to country, and sometimes even within a country. Because of these differences, financial reports may not be comparable. This lack of comparability may lead to increased preparation costs in the case of a multinational company, as the company may have to prepare different reports on its operations for each country that it does business in. In addition, business would want to have a uniform system of assessment between operations in different countries.

Users of financial reports may incur extra costs of analysis when reports are prepared according to different standards in different countries. This may lead to a loss of credibility in accounting reports. The ISAC was formed to address these problems.

The objectives of IASC are two fold:

1) to formulate and publish accounting standards to be observed in the presentation of financial statements and to promote their worldwide acceptance and observance
2) to work generally for the improvement and harmonisation of regulations, accounting standards and procedures relating to the presentation of financial statements

International Accounting Standard No. 9 (*IAS9*) "Accounting for Research and Development Activities" was first issued in July 1978 by the International Accounting Standards Committee (IASC). It was revised in November 1993 to become operative for financial statements covering periods beginning on or after 1 January 1995. The original standard recommended the immediate write-off against earnings of research and development expenditures, with an exception in the case of the development costs of a project, which satisfied specified criteria. These criteria included the technical feasibility of the product, the separate identification of the costs involved, the existence of a future market or internal usefulness if it is to be used by the enterprise itself, the existence of adequate resources to develop the product and the expectation that the costs can be recovered from future revenues from the project. Disclosure of the total amount of R&D expenditures, including the amortisation of deferred costs, was also required by the original *IAS9*.

The new standard requires research costs to be recognised as an expense in the period in which they are incurred and not to be recognised as an asset in a subsequent period (paragraph 15). Development costs of a project are required to be recognised as an expense *in* the period in which they are incurred unless the criteria for asset recognition are met (paragraph 16). Development costs initially recognised as an expense should not

be recognised as an asset in a subsequent period (paragraph 16). Paragraph 17 specifies the criteria for when the development costs of a project should be recognised as an asset:

(a) the product or process is clearly defined and the costs attributable to the product or process can be separately identified and measured reliably;
(b) the technical feasibility of the product or process can be demonstrated;
(c) the enterprise intends to produce and market, or use, the product or process;
(d) the existence of a market for the product or process or, if it is to be used internally rather than sold, its usefulness to the enterprise, can be demonstrated; and
(e) adequate resources exist, or their availability can be demonstrated, to complete the project and market or use the product or process.

Additionally, paragraph 17 requires that the development costs of a project recognised as an asset not exceed the amount that is probable of being recovered from related future economic benefits, after deducting further development costs, related production costs, and selling and administrative costs directly incurred in marketing the product. Paragraph 21 requires that the amount of development costs recognised as an asset should be amortised and recognised as an expense on a systematic basis so as to reflect the pattern in which the related economic benefits are recognised.

The standard also discusses the impairment of development costs - the write-off, the write-down and also the subsequent re-instatement of these development costs. If, in reviewing the unamortised balance of development costs at the end of each period, it is decided that this balance, taken together with the other relevant costs, exceeds the related future economic benefits, the development costs should be written-off or written-down (paragraph 25). If circumstances and events that led to the write-off or write-down cease to exist and there is persuasive evidence that the new circumstances and events will persist

for the foreseeable future, the amount of development costs written-off or written-down are allowed to be re-instated. Paragraph 27 specifies that the amount written back should be reduced by the amount that would have been recognised as amortisation in accordance with paragraph 21 had the write-off or write-down not occurred.

The disclosure requirements are contained in paragraph 30, which requires the financial statements to disclose:

(a) the accounting policies adopted for research and development costs;
(b) the amount of research and development costs recognised as an expense in the period;
(c) the amortisation methods used;
(d) the useful lives or amortisation rates used; and
(e) a reconciliation of the balance of unamortised development costs at the beginning and end of the period showing:
    (i) development costs recognised as an asset;
    (ii) development costs recognised as an expense;
    (iii) development costs allocated to other asset accounts; and
    (iv) development costs written back.

At the IASC meeting in September 1996, an Exposure Draft incorporating revised proposals on intangibles and consequential changes to *IAS9* was considered.

2.6 Chapter summary

To summarise, Canadian and Australian reporting requirements offer considerable discretion in the accounting for R&D expenditure, especially when compared to the U.S. regulations, with selective capitalisation of development expenditures being permitted in Canada and development and applied research expenditure being permitted in Australia. Disclosure of information about R&D expenditures has become more important both in Canada and Australia.

CHAPTER 3

Literature Review - R&D

3.1 Introduction

A review of the literature indicates the diverse paradigms that have encompassed R&D in academic research. This chapter discusses literature relating to R&D. The R&D literature can be divided into the following topics: economic modelling (section 3.2), papers addressing economic consequences of mandatory adoption of SFAS #2 (section 3.3), voluntary choice of accounting policies (section 3.4), and value relevance studies (section 3.5). Section 3.6 then provides a chapter summary.

3.2 Economic Modelling

Early studies addressed research & development, not in relation to accounting, but in relation to the impact that R&D had on productive capacity and economic growth. Solow (1957) estimated that 90% of the per capita increase in output from 1909 to 1949 was attributable to technological development. Denison (1962) states that the Committee for Economic Development estimated that 36% of the increase in worker output from 1929 to 1957 was caused by R&D. By comparison, for the same period the increase in capital intensity was estimated at only 9%. Nix (1976) reports that, of the 182 research-intensive firms in his sample, 62% spent from 25 to 350 percent of profits on R&D. Griliches (1979), Mansfield (1980), and Scherer (1981) provided further evidence that industrial research and development was an important contributor to technological progress and productivity growth.

3.3 Papers addressing economic consequences of mandatory adoption of SFAS #2

With the introduction of SFAS #2 in 1975, U. S. firms were restricted in how they could account for R&D expenditures. From 1954 to the introduction of the current standard, firms were allowed to exercise choice between capitalisation and expensing. Prior to 1954 a firm's choice was restricted by its tax treatment. Tax law prior to 1954 allowed the current expensing of research and development expenditures only when the same procedure was followed in the financial statements. In 1954, the law was changed, allowing for immediate deduction of R&D costs as incurred regardless of the financial statement treatment.

With the introduction of SFAS #2, research focused on the economic consequences, if any, of the immediate expense requirement on R&D expenditures. Horwirtz and Kolodny (1980) concluded that in some cases the introduction of the standard did result in a decrease in R&D expenditures. Dukes, Dyckman and Elliott (1980) found that SFAS #2 did not have any effect on R&D expenditures. Wolfson (1980) and Vigeland (1981) found that there did not appear to be any market reaction to the announcement of adoption of SFAS #2. This suggested that the price of a company's stock did not decrease in response to the effect of SFAS #2 on reported earnings. As such, management would not be motivated to reduce R&D expenditures. A study by Elliott, Richardson, Dyckman and Dukes (1980) attempted to reconcile the Horwitz and Kolodny (1980) study and the Dukes et al (1980) study. Again, it was found that it could not be concluded that SFAS #2 caused changes in R&D expenditures. Further studies by Guerard, Bean and Andrews (1987) and Horwitz and Normolle (1988) failed to provide

any additional evidence that R&D expenditures were effected by SFAS #2. Ball (1980) and Marshall (1980) state that, at the time of these studies, no theory on the determination of R&D expenditures and accounting choice existed. Marshall states: "...the process of determining R&D expenditures, including the choice and role of accounting method is so complex that designs such as those used by Dukes, et al., and Horwitz and Kolodny are incapable of producing creditable results."

No conclusive results seemed to emerge from this line of research.

3.4 Voluntary choice of accounting policies

Three studies, in particular, that have addressed the issue of accounting choice with respect to R&D are Daley and Vigeland (1983), Shehata (1991), and Aboody and Lev (1998). The Daley and Vigeland and Shehata studies use pre-SFAS #2 data, when U. S. firms still had a choice about whether or not to capitalise or expense R&D expenditures. Daley and Vigeland test two opposing incentives which affect accounting choice. First, they examine leverage, dividend payments and interest coverage in relation to the debt covenant hypothesis. The debt covenant hypothesis states that firms will (*ceteris paribus*) tend to relax debt constraints (relative to expensing R&D costs) by increasing earnings, retained earnings, and total assets. The second incentive, the political cost hypothesis, states that larger firms will tend to expense rather than capitalise R&D. The rationale is that firms' reporting of higher earnings may attract more attention and regulators may be more likely to place tighter constraints on a firm's operations. Daley and Vigeland conclude that on average capitalisers were more highly levered, were closer

to dividend restrictions, used more public debt and were smaller in size than firms which expensed R&D costs.

Shehata (1991), consistent with Daley and Vigeland, finds leverage and firm size significant in explaining management's decision to capitalize. In addition, he finds volatility, materiality of R&D expenditures, and the volatility of R&D expenditures also to be significant.

Aboody and Lev (1998) use data from 1987 to 1995 to address the choice issue with respect to SFAS #86, which requires the capitalisation of software development costs meeting stringent recovery criteria. In practice, the standard affords considerable flexibility for management to exercise choice with respect to capitalisation. The authors find that capitalisers tend be smaller and less profitable (before capitalisation) than expensers. Of particular interest to this study, they find that software capitalisation is value relevant to investors and that software capitalisation is associated with future earnings. This is consistent with their hypothesis that capitalisation provides better information on the development activities of firms than immediate expensing.

3.5 Valuation relevance studies

A number of recent papers suggest that the market is capable of determining the value-relevance of research and development outlays.

Sougiannis (1994) examines whether reported accounting earnings reflect benefits from past R&D expenditures, and whether these benefits, if any, can then be used to estimate the investment value of R&D. He finds that reported earnings, adjusted for the

expensing of R&D, do reflect realised benefits from R&D, and modest evidence that R&D expenditures are directly valuation relevant.

Lev and Sougiannis (1996) estimate the R&D capital of a large sample of public companies using Almon lag technology. They find these estimates to be statistically reliable and economically meaningful. They then adjust the reported earnings and book values of sample firms based on capitalised R&D and find such adjustments are significantly associated with share price and returns. This association indicates that investors place a value on the R&D capitalisation process.

Healy, Myers and Howe (1997) examine the value-relevance of R&D outlays by using a Monte Carlo simulation model of a drug development program. The pharmaceutical industry is chosen as industry practices have been well documented and R&D is a critical driver of value for the industry. Their findings indicate that capitalisation of R&D can be more informative to market participants.

Aboody and Lev (1997) examine insider trading in the context of a specific source of information asymmetry. The current U.S. standard requires firms to immediately expense most investments in intangibles including current year outlays on research and development. This policy denies investors of timely and vital information on the success of the projects under development, the value of investment in the asset, and the rate of return on such investment. Managers have inside information unobservable to the market. Aboody and Lev hypothesise that managers of intangible-intensive firms will exploit the existing information asymmetry by trading in the stock of their firms, leading to gains from insider trading being positively associated with the intensity of corporate intangible

investment. They find strong evidence of such a relationship. This indicates that managers' inside information is value-relevant.

Chambers, Jennings and Thompson II (1998) examine the usefulness of capitalising and amortising research and development costs. They compare the extent to which financial statements that reflect alternative R&D accounting policies explain the cross-sectional distribution of share prices. They use a one-size-fits-all accounting rule under which R&D costs are capitalised and amortised over the same period by all firms. They find that adjusting reported earnings and book values to reflect capitalisation and amortisation of R&D costs results in a small but statistically significant increase in the extent to which those measures explain the distribution of share price. Their findings suggest that even a simple capitalisation and amortisation policy has the potential to increase the usefulness of accounting information as a basis for valuation. The study, however, uses a synthetic D created by the researchers. This synthetic D acts as a proxy as managers are not allowed to capitalise actual D. This approach may result in measurement error or the over capitalisation of development costs. The use of the actual D, as determined by managers, should provide incremental value as it reflects the market response to the true variable of interest and would not be subject to any measurement error.

Lev and Zarowin (1998) examine the apparent decrease in the usefulness, to investors, of reported earnings, cash flow and book (equity) values of financial information. They hypothesise that current accounting measurement and reporting systems do not adequately reflect the changes in a firm's economic environment. They

state that a major change is the innovative activity of business, taking the form of investment in intangible assets, including R&D. They provide evidence of a weakening association between capital markets and key financial variables and of an increase in the rate of change experienced by business over the same period. They link the increase in business change with the decrease in informativeness of financial information. They conclude that financial reporting must change in order to stop the deterioration in the usefulness of financial information. They provide two proposals - the capitalisation of intangible investments and a systematic restatement of financial reports. The first proposal, the capitalisation of intangible investments, is addressed in this study by examining the value-relevance of capitalised development costs.

Aboody and Lev (1998) examine the value-relevance of capitalised software development costs. Software capitalisation is the only exception in the U.S. to the full expensing rule of R&D mandated in SFAS #2. Their study allows a contrast to the general U.S. treatment of accounting for intangibles. They find that software capitalisation is positively and significantly associated with stock returns and the cumulative software asset on the balance sheet is associated with stock prices. They also find that software capitalisation figures are associated with subsequent reported earnings. This supports the notion that the prediction of a future benefit (earnings) is of considerable importance to investors.

Deng and Lev (1998) examine the valuation of acquired research and development. They analyse a sample of 375 cases where fair values of R&D-in-process were disclosed in the financial statements. The R&D projects were included in corporate acquisitions and were identified by the acquiring firms in the process of applying the

"purchase method", where a specific fair market value is assigned to R&D-in-process, distinct from other values assigned to tangible and intangible assets of the acquired company. The R&D-in-process is then fully expensed. This study allows a contrast to previous studies in that a fair value is determined and disclosed on the financial statements.

They then associate these values with the acquiring firms' stock price and returns. Their findings indicate that investors consider the estimate of R&D fair value to be highly value-relevant and that investors undo (reverse) the immediate expensing of acquired R&D, both in pricing earnings and asset values.

Barth and Clinch (1998) examine whether relevance, reliability, and timeliness of Australian asset revaluations differ across types of assets, including intangibles. They find that revalued intangible assets are consistently, significantly, and positively associated with share price. This provides evidence that such estimates are reliable.

3.6 Summary

Studies on research and development have examined issues related to economic modelling, economic consequences of mandatory adoption of accounting policies, voluntary choice of accounting policies and value-relevance. This thesis builds on the value-relevance paradigm by examining whether the Canadian and Australian capital markets value capitalised development costs. Value-relevance is determined by a positive association with share price. The more value-relevant a project is, the higher the association between market value and the project. The results of the papers, discussed in section 3.5, are important to this study as they provide evidence, primarily from the U.S. market, that markets are capable of determining value from research and development

expenditures. The next two chapters introduce a framework whereby managers wish to disclose their inside information regarding their R&D projects. Managers do so in the belief that the market is capable of determining value.

CHAPTER 4

Motivations for voluntary disclosure and hypothesis development

4.1 Introduction

This chapter discusses possible motivations for managers to choose to capitalise development costs. The usefulness of capitalised development costs in firm valuation depends on the factors influencing management's decision to capitalise. Section 4.2 discusses two potential broad factors for voluntary disclosure. These are efficient signalling and managerial opportunism. Section 4.3 sketches an argument in support of an efficient signalling[8] framework. Section 4.4 outlines three testable hypotheses under the assumption that managers voluntarily disclose inside information (capitalise development costs) in an attempt to reduce information asymmetry. Section 4.5 provides a chapter summary.

4.2.1 Efficient signalling

Canadian and Australian GAAP requires firms to capitalise development costs if certain criteria are met. Scope exists, however, for management to exercise discretion in making the determination of whether a particular test has been satisfied. For example, one of the criteria in Canada requires that "the management of the enterprise has indicated *its intention* [italics added] to produce and market, or use, the product or process;". Management will have inside information on its true intentions and expectations with respect to any R&D project that the firm has undertaken. These expectations are unobservable to the market.

Efficient signalling motivations arise out of management's desire to overcome these information problems. Providing management with some discretion in accounting treatments potentially facilitates the reduction of information asymmetries between management and investors. Managers argue that flexibility with respect to the manner in which these items are disclosed enables them to better disclose their superior (inside) information.

Research has addressed this issue. Gonedes and Dupuch (1974) emphasise that accounting choices may be a signal of manager's private information. Barnea, Ronen, and Sadan (1975, 1976) suggest that accounting choices are used by management to enhance user's predictions of future cash flows. Holthausen (1990) and Holthausen and Leftwich (1983) note that one rationale for accounting choices is information signalling, particularly when managers have a competitive advantage in providing information about the firm's future cash flows. Healy and Palepu state: " This research, which draws on "information models" in economics and finance, assumes that managers have superior information on their firms' current and future performance than outside investors. *Disclosure strategies then provide a potentially important means for corporate managers to impart their knowledge to outside investors* [italics added]..." (1993, 1).

It is often argued that the selection of an R&D capitalisation accounting policy is one mechanism used by managers seek to communicate their superior information about a firm's future potential to investors.

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[8] A formal signalling empirical model is not developed.

4.2.2 Managerial opportunism

Managers may also be opportunistic in their selection of accounting policies. Zeff raises the issue of "economic consequences" which he defines as "the impact of accounting reports on the decision-making behaviour of business, government and creditors" (1978, 57). The thrust of the definition is that the selection of accounting policies can affect the real decisions made by managers, rather than simply reflecting the results of those decisions. As the selection of an accounting policy may have an impact on the manager, it would be in the best interest of the manager to select the accounting policy that maximises his own utility.

Positive Accounting Theory (PAT) provides three hypotheses, formulated by Watts and Zimmerman (1986), that attempt to explain why economic consequences exist. These are:

1) The bonus plan hypothesis
2) The debt covenant hypothesis
3) The political cost hypothesis

The bonus plan and debt covenant hypothesis state that, *ceteris paribus*, managers will select income increasing accounting policies in order to maximise their current year bonus and/or reduce the probability of technical default on the firms' loans. The political cost hypothesis states that, *ceteris paribus*, the greater the political costs faced by a firm, the more likely the manager will select accounting procedures that defer reported earnings from current to future[9].

The choice of an accounting policy, so as to achieve some specific manager objective, is called earnings management. Earnings management can potentially reduce

the informativeness of accounting choices, and hence value-relevance, as investors would not be able to distinguish between earnings management and efficient signalling.

4.3 A sketch of a signalling argument

Akerlof (1970), using the market for used cars, showed that the unobservability of product quality can lead to adverse selection. With respect to R&D projects undertaken by the firm, product quality can be described as the net present value generated by the project. The higher the quality of the project, the greater the expected net present value per dollar invested. In the absence of a market mechanism to control for adverse selection, the market will value all firms and/or R&D projects at the average. While firms know the quality of their R&D projects, investors cannot distinguish among them. As a result, market value will reflect average project quality. Firms with superior projects are unable to get appropriate prices and hence do not enter the market. In the extreme, market failure may result.

Aumber of analytical models have been proposed which determine the necessary and/or sufficient conditions whereby a firm undertakes a costly action in order to credibly communicate inside information to investors. Spence (1973) examines signalling in the context of a job market. Leland and Pyle (1977) show that an entrepreneur's willingness to invest in his own project can serve as a signal of project quality. Hughes (1986) extends the Leland and Pyle (1977) model to include disclosure as a second signal of value. Titman and Trueman (1986) develop a model whereby auditor quality can rationally

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[9] These are very general summaries of the hypotheses and are not meant to be comprehensive. For a more detailed discussion see Watts and Zimmerman (1978).

be used by investors in valuing new security issues. The selection of the auditor is the signal communicated by the entrepreneur.

A number of empirical studies have addressed similar issues. Barth and Kasznik (1997) examine share repurchase decisions under conditions of accounting-related and general information asymmetry. Aboody and Lev (1998) examine SFAS #86, the standard relating to the capitalisation of certain software development costs. Given that software capitalisation is the only U. S. exception to full expensing, they feel that it provides "a laboratory experiment for a different accounting treatment of intangibles." Clearly, the issue of information asymmetry and accounting disclosures has gained the recent attention of academics.

A common theme underlying all the above studies is that the signalling action undertaken by the entrepreneur or firm is costly. Cost may comprise a number of factors, such as audit fees, the cost of false signalling, and the cost of converting Canadian GAAP to U.S. GAAP for those firms that are cross-listed. For a firm to voluntarily disclose its inside information (capitalise development costs), any benefits of capitalisation must be greater than the associated costs. A firm may directly communicate the quality of its R&D project but this communication may not be credible. The decision to capitalise requires not only that the project meet the criteria outlined in GAAP, but also satisfy an independent auditor that it has done so. The audit process, the regulatory environment (i.e, monitoring by the Ontario Securities Commission in Canada and the Australian Securities Commission), the firm's reputation, and the risk of litigation are factors that give credibility to the accounting signals.

In summary, a firm that chooses to capitalise its development costs may be sending a costly signal to the market attempting to differentiate its R&D project as one of high quality. A firm with a lower quality project would be unable to mimic the firm with the higher quality project (capitalise its development costs) as:

1) it would be unable to satisfy the *Handbook* criteria and hence cannot even attempt to capitalise; or
2) for a firm with a sufficient high quality project, the expected benefits of capitalising do not exceed the lump sum cost.

4.4 Testable hypotheses

A necessary condition for an asset to be placed, or remain, on the balance sheet is that the asset must have a future economic value. Paragraph 1000.29 of the CICA *Handbook*, for example, defines assets as "economic resources controlled by an entity as a result of past transactions or events and from *which future economic benefits may be obtained* [italics added]". Both the Australian and the United States standard has a similar definition.

The null of Hypothesis 1 can be supported by reference to SFAS #2. When FASB introduced SFAS #2 in 1974 a major factor in concluding that all R&D expenditures are to be expensed was that there was no causal relationship between expenditures and benefits.

> "A direct relationship between research and development costs and specific future revenue generally has not been demonstrated, even with the benefit of hindsight. ...generally failed to find a significant correlation between research and development expenditures and increased future benefits as measured by subsequent sales, earnings, or share of industry sales." (SFAS #2, 16).

FASB concluded that capitalisation should not be allowed because there were no direct future benefits. If this conjecture is true, the market would not value any capitalised R&D[10] asset since the market would be sceptical about any number placed on the balance sheet.

If the market believes, however, that an asset has a future economic benefit a positive association would be expected between market value and the asset. In the case of capitalised development costs, if the market places a value on the asset directly, the expected coefficient on capitalised development costs will be greater than 0. This leads to the following hypothesis (in alternate form):

$H1_A$: Capitalised development costs are positively associated with firm value.

When a firm chooses a capitalisation policy, managers do so as a means of signalling the cumulative quality of the firm's individual projects. In order to capitalise a project, the net present value of the expected benefit must be greater than or equal to the related cost. If it is assumed that firms undertake relatively homogenous projects and that each project costs, for example, $1 then firms that have a larger capitalised asset value have a larger number of successful projects. This assumption implies that capitalising firms differentiate themselves from one another by the value of the capitalised development costs. Under this assumption, the more successful projects the firm has the higher the quality of the firm.

[10] U.S. studies have used a researcher created synthetic R&D asset. Generally, however, only development costs meet the criteria for capitalisation in Canada and Australia.

For those projects where the cost was expensed two possibilities exist. The net present value of the expected benefit did not exceed the cost or the expected benefit, if any, may be to hard to quantify as the project may not be sufficiently developed. In either case, the recovery prospects would be inferior relative to the recovery prospects of capitalised development costs.

In order for the act of capitalisation to be a signal it must be credible (low quality firms must not be able to mimic the signal). The firm must submit its annual report for examination by its auditors. The audit report gives the signal its credibility. Any benefits associated with capitalising (i.e., an increase in share price) must exceed the related costs (increase in audit costs). Expensed costs would either not pass the audit inspection or the increase in audit costs associated with a more in-depth analysis of these outlays does not or would not offset any further increase in benefits.

Therefore managers signal as a means of communicating their inside information about their quality. Once managers have made the decision to capitalise they can only capitalise successful projects. Successful projects enjoy a higher recovery prospect than unsuccessful projects. The difference in the recovery prospects should manifest itself in a larger coefficient on the capitalised development outlays relative to the expensed outlays. This leads to the second hypotheses (in alternate form):

$H2_A$: Firms that capitalise development costs will have a higher valuation coefficient per $1 of capitalised development costs relative to a $1 of expensed research and development costs.

Under the signalling hypothesis, firms capitalise as a means of disclosing their inside information. Expensing firms, under the signalling hypothesis, do not have any projects for which the benefits exceed the costs. Firms that capitalise communicate their superior recovery prospects relative to firms that expense. Therefore, the expectation is that capitalisers will enjoy an incrementally higher association with firm value than expensers (who chose not to capitalise). This hypothesis differs from H_2 in that additional information is included. Specifically firms that capitalise none of their R&D are included in addition to firms that capitalise some or all. The addition of the expensing firms allows for the retest of the signalling hypothesis developed in H_2 by expanding the sample to include all firms engaged in R&D activity in a manner which relaxes the project by project assumption[11]. This leads to the third hypotheses (in alternate form):

$H3_A$: Firms that capitalise development costs have a higher valuation coefficient per $1 of R&D expenditures than firms that expense all development costs (ceteris paribus).

The null in the first two hypothesis states, in general, that there will not be a greater association between market value and the deferred development costs, either by itself or relative to expensed R&D outlays. The opportunistic behaviour argument

[11] The current specification, developed in Chapter 6, focuses on the information content of the total current year investment variable CI. A possible test is to compare the value-relevance of the current year expense component to determine whether it is valued contingent on the accounting policy choice.

discussed in section 4.2.3 can be used to support the null for all three hypotheses. Earnings management reduces the credibility of financial statements for investors and increases managers' communication costs. The possibility of earnings management was a concern to U.S. standard-setters and helps to explain the continued requirement of full expensing of current R&D expenditures. As Lev and Sougiannis state: "...U. S. standard-setters are concerned with the reliability and objectivity of estimates required for R&D capitalisation, and with the associated audit risk. The specter of providing managers with additional opportunities for *earnings management* [italics added] must also weigh heavily on regulators" (1996, 108).

If the act of signalling (capitalisation) results in an increase in share price, the market must have placed a value on the capitalised development asset. Alternatively, if the market uses other information beyond accounting disclosures, the above hypotheses will still apply if the capitalised development asset is associated with value-relevant information used by investors.

4.5 Chapter summary

This chapter presents an argument in support of an efficient signalling framework. The main hypotheses reflect the information signalling perspectives with respect to the selective capitalisation of deferred development costs. A link between market value and deferred development costs is suggested. Costs prevent firms with inferior inside information from mimicking the signalling behaviour of firms with superior inside information. The following chapters describe the Feltham and Ohlson framework (Chapter 5) and the data and research design (Chapter 6) that will operationalize the testing of the hypotheses.

CHAPTER 5

The Feltham & Ohlson Framework

5.1 Introduction

The empirical specifications used in this study are based on Feltham and Ohlson (1996). Section 5.2 discussed the different research avenues currently being addressed utilising the Feltham and Ohlson framework. Section 5.3 discusses the development of the Feltham and Ohlson theoretical model. A reconciliation to the empirical specification, developed in Chapter 6, is provided in section 5.4. The preliminary model is described in section 5.5. Section 5.6 provides a further reconciliation between the general model used in this study and a recent model used by Sougiannis (1994), where he addressed similar issues using U.S. data. Section 5.7 provides a chapter summary.

5.2 Research avenues

It must be recognised that two broad branches of research have arisen from the Feltham and Ohlson framework[12]. These may be considered as the relation between stock price and future earnings (the expectational branch) and the relation between financial statement data and firm value (the realisation of current accounting variables).

The Feltham and Ohlson model allows for earnings to be substituted for dividends in the classical finance model of firm valuation. Firm value is then expressed as the present value of future earnings. As future earnings are unknown it then becomes necessary to determine what those future earnings may be. Therefore, researchers must

[12] See Bernard (1995) for an excellence discussion of the Feltham and Ohlson implications for empirical research.

either forecast future earnings or find a suitable proxy. Researchers have used analyst forecasts as a proxy of forecasted earnings. Ultimately firm value is expressed as a function of forecasted earnings, book value, and discount rates.

The second avenue of research addresses the relation between current accounting variables and firm value. In particular, it addresses the idea of conservative versus unbiased accounting. Accounting is considered unbiased if the expected difference at date *t* between future price and future book value eventually becomes zero. Accounting is considered conservative when that difference is positive. Conservative accounting causes decreases in current book which means that book value is understated. The expensing of R&D, where there exists a future value, is clearly conservative. As such book value is understated by the exclusion of the present value of the revenues arising from the R&D projects undertaken by the firm.

While it is expected that analysts will address R&D implications in making their earnings forecasts, they will not necessarily have the inside information available to managers. Managerial disclosure of development costs potentially provide information to the market incremental to that contained in analyst forecasts. It is for this reason that this thesis addresses the capitalisation of deferred development costs.

5.3 Feltham & Ohlson (1996)

This study will initially utilise the theoretical specification of proposition number 2 (equation 3(a)) of Feltham and Ohlson (1996, 216), hereafter (F&O 96). F&O 96 show that under the assumptions of cash flow/information dynamics (CFD), the present value of

cash flows (PVCF) and the clean surplus relation (CSR), accounting information can be used to express firm value.

The first assumption (CFD) focuses on fundamental economic events. For any date *t*, a firm will receive cash (cr_t) and spend cash (ci_t). Cash receipts are influenced by prior period cash investments. In the F&O 96 analysis, current period cash receipts (cr_t) *do not* include any payback from current year investments (ci_t). This assumption appears to be reasonable. As Sougiannis (1994) points out in footnote 17, with respect to a current investment in R&D: "Note that the R&D lag structure ...does not allow for a contemporaneous effect of R&D on earnings....it is unlikely that a firm can initiate, complete, and derive benefits from an R&D project all within one year." (1994, 52)

Initially F&O 96 assume that current cash receipts and investments constitute the only relevant information for predicting future cash flows and hence value. Under these assumptions, their stochastic model is:

$$cr_{t+1} = \gamma cr_t + \kappa ci_t + \varepsilon_{1t+1} \qquad (1)$$

$$ci_{t+1} = \omega ci_t + \varepsilon_{2t+1} \qquad (2)$$

This assumes an auto-regressive function. The future period cash receipt (cr_{t+1}) is expressed as a portion ($\gamma < 1$) of the prior period cash receipt, representing the decay in the persistence of incoming cash flows, and as a function ($\kappa > 0$) of the current period investment outlay. κ represents the impact on date $t+1$ cash receipts (the initial cash return on investment) of the date t investment, while γ can be thought to represent the

length of the recovery period for investments made prior to date t. ε_{1t+1} and ε_{2t+1} are unpredictable zero mean disturbance terms.

Where the firm has an investment opportunity set, growth in future period cash investments (ω) are expressed in relation to current period investment. This parameter represents projects not yet undertaken by the firm. If ω=0, the firm has no growth options. Future cash receipts will then depend on the persistence of current period investments and unexpected future period random shocks. Investments that a firm undertakes may include expenditures in research and development.

The second assumption (PVCF) is that firm value at time t (P_t) is the present value of expected net future cash flows. Net cash flows ($c_t = cr_t - ci_t$) are assumed to equal the net dividend at each date t. This assumption allows for net cash flows to substitute for dividends in the standard neoclassical "finance" model of security valuation, such that the value of firm equity can be expressed as:

$$P_t = \sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[\tilde{d}_{t+\tau}] = \sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[\tilde{c}_{t+\tau}] . \qquad (3)$$

Under the clean surplus assumption, CSR, all changes in book value are reported as either income or dividends. The assumption of CSR allows the replacement of dividends in the valuation formula with earnings and book value of equity.

Combining those assumptions yields their Proposition 2 (F&O equation (3a)) (1996, 216).

$$P_t = \omega a_t + \alpha_1 \omega x_t^a + \alpha_2 \omega a_{t-1} + \alpha_3 ci_t, \qquad (4)$$

where:

P_t = firm market value at time *t*,
oa_t = operating assets at time *t*,
α_1 = $\Phi\gamma$,
ox_t^a = abnormal operating earnings at time *t*,
α_2 = $\Phi R(\gamma - \delta)$,
oa_{t-1} = operating assets at time *t-1*,
α_3 = $[\Phi\kappa - 1] R / (R - \omega)$,
ci_t = cash investments at time *t*,
Φ = $[R - \gamma]^{-1}$
R = one plus the risk free interest rate,
κ > 0 represents the impact of date *t* cash investments on date *t+1* cash receipts (see Exhibit A),
γ ε [0,1) represents the persistence in cash receipts,
δ ε [0,1) is a policy parameter which determines the depreciation rate (1-δ), and
ω ε [0,R) represents one plus the expected growth in cash investments.

5.4 Reconciliation of F&O 96 to empirical specification

In Feltham and Ohlson (1995), it was shown that a firm's book value of equity (bv_t) can be segregated into two components, financial assets (fa_t) and operating assets (oa_t). Under their assumptions of the net interest relation (NIR) interest earned during the period (i_t) = $(R_f - 1)fa_{t-1}$ and the financial assets relation (FAR), $fa_t = fa_{t-1} + i_t - [d_t - c_t]$ the financial assets are accounted for so that book value equals market value for all *t*. NIR expresses the certain zero net present value economic return on the net financial position and imposes a flat non-stochastic term structure on interest rates. The modelling seems reasonable in terms of risk-free financial assets and liabilities or net financial assets marked-to-market. Financial assets and liabilities may be thought to be trading in perfect markets. In their analysis, it is also assumed that the model incorporates Modigliani and Miller's (1958, 1961) basic concept regarding debt. The firm's borrowing and lending activities yield zero net present value. Financing activities are separated from the firm's operating activities to ensure that a firm's equity value equals the value of the operating activities plus the value of the net financial assets. Because of the NIR and FAR

assumptions, the value of financial assets is assumed to equal book value. "Perfect" accounting is assumed to apply for the financial assets. Because of the above assumptions regarding fa_t, bv_t can be expressed in terms of oa_t alone.

Under Proposition 1 of their 1995 paper (page 698) F&O show that in valuing the firm's equity $\sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[\tilde{x}^a_{t+\tau}]$ is equal to $\sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[o\tilde{x}^a_{t+\tau}]$ under the assumptions of NIR, FAR, CSR and the present value relation (PVR). That is, in valuing a firm's equity, the present value of abnormal earnings ($\tilde{x}^a_{t+\tau}$) is equal to the present value of abnormal operating earnings ($o\tilde{x}^a_{t+\tau}$) when i_t is assumed to follow NIR. Under these assumptions, it is possible to model firm value P_t as a function of abnormal earnings instead of abnormal operating earnings. This assumption will be utilized in the empirical specification.

5.4.1 Persistence of cash flows

In equation (4), α_1 will have a positive weight if cash flows from prior investments are persistent (i.e., $\alpha_1 > 0$ if $\gamma > 0$). That is, current year abnormal operating earnings will include returns generated by prior period capital investments. An assumption of the model is that current year investments are *not* reflected in current earnings but will be reflected in future years' earnings. This is a reasonable assumption if current year investments have not yet come on line and therefore, are not producing income.

5.4.2 Conservatism

The weight on prior period operating assets (α_2) depends on the relative magnitudes of the earnings persistence (γ) and conservatism (δ) parameters. ($1-\delta$)

represents the accounting depreciation rate. If $\gamma < \delta$, economic depreciation (the decline in persistence) is less than accounting depreciation. This results in accounting assets being "over depreciated" in relation to their economic value. In particular, firms with high conservatism would have operating assets understated from an economic point of view and an expectation of positive loading on α_2. Stober (1996) and Ahmed, Morton and Schaefer (1997) find that their estimated coefficient, α_2, is both positive and significant, indicating that for their samples the operating assets are, on average, conservatively reported and the market compensates for the understatement of the operating assets. With firms engaged predominately in R&D, the expected major source of conservatism is in the expensing of the R&D expenditures if they have future economic value which the market recognises. In order to control for conservatism it is necessary to add back the current R&D expense to reported operating earnings to arrive at pre-R&D operating earnings. By doing so R&D conservatism is controlled for and α_2 is made redundant in the current specification. If conservatism no longer plays a role in the model, we would expect α_2 to be insignificant. As such, the variable can be dropped from our current model.

5.4.3 Current investment ci_t

Of particular interest to this study is α_3 in equation (4). When a firm makes a current period investment, it does so in the hope that it will lead to economic returns in subsequent periods. α_3 will have a positive weight if current and future capital investments have positive net value projects (i.e., $\alpha_3 > 0$ if $\Phi\kappa > 1$). Under the CFD assumption, a dollar of capital investment in time period *t* is expected to generate future cash receipts of $\kappa, \kappa\gamma, \kappa\gamma^2, \ldots$ for dates t+1, t+2, t+3..., the present value of this being $\kappa R^{-1} + \kappa\gamma R^{-2} + \kappa\gamma^2 R^{-}$

^{3} + ... = $\Phi\kappa$. In order for $\Phi\kappa$ to be > 1, the return on the capital investment must be greater than the discount rate R, indicating that the project has a positive NPV.

For firms engaged in R&D, this expenditure can be the largest component of current investment. In order to test the signalling aspects of R&D, it is necessary to separate out this expenditure. Any remaining current investment (in PP&E and goodwill for example) will be left in book value, since the market's valuation of these expenditures is not of interest in this study.

5.4.4 Omitted variables

An assumption of F&O 1996 Proposition 2 is that the model is well specified under the assumed conditions. It can be shown, however, that any empirical specification based on the parsimonious model $P_t = oa_t + \alpha_1 ox_t^a$ does not allow for the effect of other information on firm value and, therefore, may be subject to potential miss-specification. Omitted variables may include: accounting conservatism, the future investment opportunity set, delayed recognition of shocks to assets-in-place, and delayed recognition of shocks to future investment opportunities.

As discussed in section 5.3.2, accounting conservatism is controlled for in the empirical specification by adding back the R&D expense to earnings to arrive at a pre-R&D earnings number. Though R&D may be a major source of conservatism, other sources may still exist. Ahmed, Morton and Schaefer (1997) discuss the impact of conservatism on the valuation of accounting numbers. They analyse four conservatism proxies; accelerated depreciation, LIFO inventory, the ratio of R&D expenditures to sales

and the ratio of advertising expenditures to sales. Section 7.6.8 discusses and analyses these variables as a test of robustness.

Future investment opportunity sets are included in F&O 96 by the inclusion of a growth parameter (ω) on current investments. Though $\omega > 1$ implies positive expected growth in future investments, the technology does not exist to accurately measure a firm's future investment opportunity set. Therefore, this will be an omitted variable in the analysis.

Equation (4) above holds if there is no delayed recognition of shocks to the future cash returns from assets-in-place. This requires that impairment events (or events which are favourable) are given immediate accounting treatment when the events become known to the market. Under Canadian GAAP, permanent impairment of an asset results in the write down of that asset to some measure of fair or realisable value, but such measurements are typically delayed for several years. There is no opportunity, however, for the write-up of permanent favourable events. Therefore temporary reductions or permanent increases in value may not be included in accounting variables, resulting in a potentially relevant omitted variable due to delayed recognition.

In addition, the GAAP accounting model does not account for shocks to the investment opportunity set. Under the concepts of reliability and conservatism these future events are not recognised in the accounting system. Shocks to the investment opportunity set invariably constitute a relevant but omitted variable in the model.

5.5 Preliminary empirical model

Based on the above discussion, a preliminary empirical specification can be formulated. Book value of equity, however, is adjusted to deduct the capitalised development costs in order to value it separately in the empirical specification. The initial empirical model (ignoring scale[13]) can be estimated as:

$$MV_{it} = \alpha_0 CLBV^{t}_{it} + \alpha_1 D^{B}_{it} + \alpha_2 ABNI^{t}_{it} + \alpha_3 CI_{it} + e_{it} \qquad (5)$$

Where

MV_{it} = market value of the firm's stock measured three months after year end,
$CLBV^{t}_{it}$ = book value of equity less capitalised development costs at time t,
D^{B}_{it} = book value of capitalised development costs at time t, before any current year investment in R&D,
$ABNI^{t}_{it}$ = abnormal earnings before any R&D expense or amortisation in period $t+1,t$,
CI_{it} = current year investment in R&D in period $t+1,t$,
e_{it} = an unpredictable zero-mean disturbance term.

5.6 Reconciliation to Sougiannis (1994)

Sougiannis (1994) used a sample of U. S. R&D expensers and explored the valuation coefficients on CI in the above equation. The above specification can be reconciled with the direct model used by Sougiannis. The direct model effect applies to expected net R&D benefits not reflected in earnings and thus captured directly by the R&D variables. In order to test the direct effect, Sougiannis included current R&D outlays (V_{it}) and past R&D outlays (V_{it-l}, for various lagged periods) in his valuation equation. Launching from Ohlson (1989)[14], his direct empirical model is expressed as:

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[13] Discussed in section 6.4.2.
[14] Working paper later published as Ohlson (1995).

$$\left(\frac{P_{it}}{Y_{it}}\right) = \alpha \frac{1}{Y_{it}} + \beta_0 \frac{Y_{it}}{Y_{it}} + \beta_1 \frac{X_{it}^{a}(1-\tau_{it}) - rY_{it-1}}{Y_{it}} + \beta_2 \frac{V_{it}\tau_{it}}{Y_{it}} + \sum_{t=0}^{n} \beta_{3,t} \frac{V_{it-t}}{Y_{it}} + \mu_{it} \quad (6)$$

Where P_{it} = market value of the firm's stock at measured three months after year end,
Y_{it} = book value of equity at time t,
X_{it}^{a} = earnings before expensing R&D expenditures at time $t+1,t$,
τ_{it} = is the firm's tax rate at time t,
r = the risk free interest rate, and
V_{it} = current year investment in R&D in period $t+1,t$,
μ_{it} = an unpredictable zero-mean disturbance term.

As discussed earlier, there are no capitalisers in Souginannis' sample, so $CLBV_{it}^{a} = CLBV_{it}$. Abnormal earnings are defined to be the excess of after tax pre-R&D income $X_{it}^{a}(1-\tau_{it})$ over "normal" income (rY_{it-1}). One of the main research objectives of Sougiannis was to determine whether reported earnings reflect benefits from past R&D expenditures. An adjustment to earnings for the expensing of current R&D expenditures is necessary to avoid including them twice on the right hand side of the equation: as a component of earnings and as an independent variable. The variable $ABNI_{it}^{a}$ is equivalent to the Sougiannis variable $X_{it}^{a}(1-\tau_{it}) - rY_{it-1}$.

The variable $\beta_2 \frac{V_{it}\tau_{it}}{Y_{it}}$ in Sougiannis represents the impact on valuation of R&D tax shields. Citing Scholes and Wolfson (1992), the argument is made that prices of tax-favored assets increase by the present value of tax savings in excess of costs associated with increased demand. Sougiannis hypothesises that the R&D tax shield must be value relevant. Though β_2 is found to be statistically significant in all years, the difference between β_1 and β_2 is not found to be significant in 10 of the 11 years in the study, implying that the R&D tax shields are valued like earnings. An examination of the data indicate

that a significant number of firms do not disclose tax data. Firms that are in continual loss positions do not appear to be booking tax provisions.

Of particular interest is Sougiannis' coefficient $\beta_{3,l}$ which attempts to measure the direct effect of current and lagged R&D expenditures on market value. A significant $\beta_{3,l}$ would indicate that the market values information about expected R&D benefits not reflected in earnings. Utilising Almon lag technology he finds that for nine of the eleven-year period utilised in his study that the fitted polynomial was of degree zero meaning that there is no lag pattern in the data and implying that only the current R&D expenditure is value-relevant.

Sougiannis was unable to reject the null that $\beta_{3,0} = 0$ for his time series cross-sectional model. However, an inspection of equation (6) reveals that he includes V_{it} for the current period twice on the right hand side, first to capture the value of the R&D tax shield, and second to capture the value of the R&D itself. Including V_{it} twice in the regression equation potentially confounds inferences regarding the coefficient estimate, since β_2 in equation (6) above is positive and significant[15]. For this reason, and the lack of data, the tax shield will not be estimated separately.

While initially this study proposed to include the lagged R&D variable, the absence of a sufficient number of time series observations quickly became apparent in the data. The lack of observations prevents the replication of that portion of Sougiannis' study.

[15] Sougiannis finds β_3, the coefficient on the direct effect of R&D outlays on market value, to be positive and significant for 3 years in his study. The inclusion of the V_{it} variable twice need not necessarily result in multicollinearity if the tax shield is orthogonal to R&D outlay. Sougiannis reports tests for multicollinearity in note 24 indicating that it does not appear to be a problem. The primary reason for exclusion of the tax effects, in this study, is lack of data.

Sougiannis' results, however, provide empirical support for the inclusion of only the current year R&D investment variable, CI_{it}, in the model.

Referring to equation (5), a proposed hypothesis, under the alternate, is that $\alpha_1 > 0$. An important issue is whether D_{it}^{B} is informationally redundant given current earnings, $ABNI_{it}^{*}$. D_{it}^{B} relates entirely to past projects and Sougiannis found that current earnings make past R&D expenditures informationally redundant. There is, however, a potential signalling role for D_{it}^{B} regarding future earnings, a variable to which Sougiannis did not have access.

5.7 Chapter summary

This chapter presents the basic Feltham and Ohlson theoretical framework. This framework is used as the basis for developing the empirical models. Chapter 6 describes the data and research design. A reconciliation is provided between the F&O framework and the proposed research design. A further reconciliation is provided between the proposed research design and recent work by Sougiannis (1994).. These reconciliations provide support for the empirical model.

CHAPTER 6

Data Collection and Research Design

6.1 Introduction and overview

This chapter describes the empirical study undertaken. Data collection procedures utilised in obtaining the samples used in this study are discussed. The research design used in the testing of the hypotheses developed in the previous chapters is described. Potential threats to the empirical specifications are discussed and analysed.

The chapter is organised as follows: Section 6.2 describes the sample selection process and data sources. A total of 795 firm-year observations have been collected, representing 314 Canadian and 481 Australian public companies' annual reports. The sample is further divided into "capitalisers" and "expensers". Empirical tests are performed on each country's sample separately[16]. Tests of H_1 and H_2 are performed on the subsample of "capitalisers" only. Tests of H_3 and the Logit analysis are performed using each country's entire sample. Section 6.3 describes the econometric model. The main economic model is described for all three hypotheses. In general, the models use the coefficient on deferred development costs in a multiple regression model of market value on book value and abnormal earnings to assess the market's valuation. Deviations from the general model, where applicable, are described and discussed for each separate hypothesis. Section 6.4 discusses data problems and econometric specification issues such as influential observations, heteroscedaticity, scale, multicollinearity, and autocorrelation. Section 6.5 provides a chapter summary.

[16] A sensitivity test, discussed in Section 7.6.2, uses a combined sample of Canadian and Australian "Capitalisers".

6.2 Data collection

Empirical tests are carried out by regressing market value of common equity three months after fiscal year end on fiscal year end book value of equity, abnormal earnings and selected capitalisation variables of sample firms. In general, the sample selection process involved collecting as many company annual reports as possible where the companies were engaged in research and development activities.

6.2.1 Canadian sample

An initial sample was created by performing a key-word search of the 1995 Canadian Financial Infobase, utilising the search string "research" and "development". The list of potential sample firms was then cross-referenced to firm specific annual reports. The annual reports were then analysed to determine if the firm was engaged in R&D activity and, more importantly, if the firm had capitalised development costs as an asset on the balance sheet. The preliminary list was expanded by examining the additional following sources:

i) The 1996 and 1997 Canadian Financial Infobase published by Micromedia Inc
ii) An examination of the December 1995 TSE listing
iii) A list provided by the Canadian Advanced Technology Association (CATA)
iv) Compact Disclosure Canada CD-ROM
v) Internet searches of various technology associations

Firms were included only if all required data was available. Financial statement data was obtained for 1991 to 1996 from the Micromedia microfiche database and for 1997 from the Micromedia CD-ROM, both published by Micromedia Inc. The microfiche database located in the Ontario Security Commission (OSC) library was used in order to control for

missing statements. Information on share price, beta and the number of common shares outstanding was obtained from the Canadian Financial Markets Research Center (CFMRC) database[17] and the TSE monthly bulletin. The search resulted in a sample consisting of 324 firm year observations between 1991 and 1997 inclusive. Of the 324 observations, 103 are for firm years (generated by 29 firms) with capitalised development costs. The remaining 221 observations are firm years (generated by 54 firms) where all current period R&D outlays were expensed on a current basis.

6.2.2 Australian sample

The initial list of potential Australian firms was provided by Dr. Majella Percy, Senior Lecturer at Queensland University of Technology. The list was compiled in the completion of her PhD dissertation. Her dissertation examined the relationship between the investment opportunity sets of high research-intensive firms versus low-research intensive firms in an Australian setting. In order to find her thesis sample, Dr. Percy searched the 1993 Australian Stock Exchange (ASX) CD-ROM in order to identify firms that had a discussion of R&D, either in the director's report or in any notes to the financial statements. The annual reports of those firms identified were then examined. Conditions were placed on the data to ensure that all information was available. These procedures resulted in a sample of 153 firms for her original data set, with 68 firms being identified as "capitalisers" and the remaining 85 firms being identified as "expensers". This list was provided as the starting point of the Australian sample.

[17] This database is maintained by the Toronto Stock Exchange and the University of Western Ontario.

All 153 firms were contacted by fax and asked to provide annual reports for the period 1992-1997 inclusive. 84 firms responded. Including these reports with the 1993 annual reports originally obtained by Dr. Percy resulted in a total of 132 firms providing 495 annual reports.

6.3 Selection of econometric model

The framework developed by Ohlson (1995), Feltham and Ohlson (1995) and Feltham and Ohlson (1996) was used in developing the econometric specifications. In the framework, as discussed in Chapter 5, firm value can be expressed as a function of book value and abnormal earnings.

6.3.1 Econometric models for hypothesis one

The general hypothesis outlined in Chapter 4 states that capitalised development costs provide useful information to the market and, as such, are value relevant. The financial reporting and disclosure of R&D activities provides potentially important new information to the market regarding the future prospects of R&D activities undertaken by the firm. Information about future recovery prospects is communicated to the market through management's decision to capitalise or expense current period R&D expenditures. If the firm capitalises the expenditure, the closing book value of equity would be increased relative to the closing book value had the expenditure been expensed instead. The act of capitalising reduces the current year expense and thus increases net income (relative to net income had the expenditure been expensed). Increased net income results in higher retained earnings and therefore higher shareholders' equity. If the market does place a

value on capitalised development costs, a positive association between the asset and market value would be expected. Tests of H_1 are designed to test:

i) whether the accounting GAAP that allows for management discretion in the capitalisation of development costs is "more informative" than a set of GAAP that does not allow such discretion

ii) whether market value is positively associated with R&D variables.

6.3.1.1 Relative information content tests

The first test of H_1 uses the relative information content approach. It is expected that the correlation between "capitalising" GAAP book values and market value is greater than that between "expensing" GAAP book values and market value. Biddle, Seow and Siegel (1995) discuss the issue of relative information content. When faced with mutually exclusive alternate measures, the issue is which measure provides greater information content relative to the other. The comparison in this study is whether the book values associated with capitalised development costs provides greater information content relative to the book values associated with expensing. The relevant information content is examined by comparing the adjusted R^2 values of the two alternate forms of book value measures. This simple comparison, however, does not provide a statistically valid test. Vuong (1989) provides a test for model selection whereby the two competing specifications are compared to determine which measure has a greater association with the dependent variable[18].

[18] Dechow (1994) provides an excellent discussion of the Vuong test.

In order to facilitate relative information content test the first empirical specification utilises the general F&O 96 framework under both current Canadian and Australian GAAP, one which allows for the selective capitalisation of development costs.

$$MV_{it} = a_0 + a_1 CLBV_{it} + a_2 ABNI_{it} + a_3 NUMSHR_{it} + e_{it} \quad (7)$$

where:

MV_{it}	= firm market value of common equity three months after fiscal year end
$CLBV_{it}$	= book value of equity less preferred stock
$ABNI_{it}$	= abnormal net income = net income - [10% x (opening book value of equity)]
$NUMSHR_{it}$	= the number of common shares outstanding (scale proxy)
e_{it}	= residuals, assumed to be independently and identically distributed

The inclusion of the $NUMSHR_{it}$ variable in the above model, and all subsequent models, is a scale proxy introduced to control for heteroscedaticity. Section 6.4.2 discusses this issue.

The alternate form of GAAP represents a system where management does not have any discretion in the treatment of R&D expenditures. All expenditures must be expensed in the current fiscal period.[19] An "as if expensing" GAAP can be created by reversing the capitalisation process. In order to go from a capitalising firm to an expensing firm, the following adjustments need to be made:

1) If prior period expenditures on development had been expensed in prior periods, prior period net income would have been lower resulting in a lower closing retained earnings figure. It is therefore necessary to adjust closing retained earnings (and hence, closing book value) to reflect the lower prior period earnings. The adjustment to closing book value is to subtract the capitalised development costs (hereafter "D_{it}") that would not have existed under the expensing GAAP, $ADJCLBV_{it} = CLBV_{it} - D_{it}$.

2) The current fiscal impact of the capitalisation process has to be removed. An expensing firm would expense all development costs in the current period. This would reduce current period net income. The adjustment to go from reported net income to an "as if expensed" net income is to add back the current period amortisation of D_{it} (hereafter "$AMORT_{it}$"), as D_{it} would not exist, and to deduct the current year development costs (hereafter "DEF_{it}") that were capitalised. Under an "as if expensed" GAAP, the DEF_{it} expenditures would have been expensed in the current year. The adjustment can be expressed as $ADJ_{it} = AMORT_{it} - DEF_{it}$.

These adjustments result in the second empirical specification employed in the relative information content tests, an "as if expensing" GAAP specification:

$$MV_{it} = a_0 + a_1\, ADJCLBV_{it} + a_2\, ADJABNI_{it} + a_3\, NUMSHR_{it} + e_{it} \qquad (8)$$

where:

MV_{it}	= firm market value of common equity three months after fiscal year end
$ADJCLBV_{it}$	= "as if expensing" book value of common equity = book value of equity less deferred development costs
$ADJABNI_{it}$	= "as if expensing" abnormal income = (net income + current period amortisation of deferred development costs - current period expenditures on development costs that were capitalised) - (10 % x opening book value of equity))
$NUMSHR_{it}$	= the number of common shares outstanding (scale proxy)
e_{it}	= residuals, assumed to be independently and identically distributed

[19] This is similar to current GAAP in the U.S. as mandated by SFAS #2.

6.3.1.2 Incremental information content tests

Test two of H_1 examines the incremental information content of the "adjustments" between expensers and capitalisers. If the values associated with capitalisers are more highly associated with firm value than expensers, it is expected that the items giving rise to the difference would be valued by the market directly. Reported closing book value of shareholders' equity and reported net income of the capitalisers are decomposed into an "as if expensed" closing book value and an "as if expensed" net income as discussed above. Combining the "as if expensed" model with the adjustments to closing book value and net income reconciles up to the "capitalising" GAAP specification as $CLBV_{it}$ = $ADJCLBV_{it} + D_{it}$ and $ABNI_{it} = ADJABNI_{it} + ADJ_{it}$. The empirical model for H_2 is therefore:

$$MV_{it} = b_0 + b_1\ ADJCLBV_{it} + b_2\ D_{it} + b_3\ ADJABNI_{it} + b_4\ ADJ_{it} + b_5\ NUMSHR_{it} + e_{it} \quad (9)$$

where:

MV_{it}	= market value of common equity three months after fiscal year end
$ADLCBV_{it}$	= "as if expensed" book value of common equity = book value of common equity less closing deferred development costs
D_{it}	= closing deferred development costs (the balance sheet asset)
$ADJABNI_{it}$	= "as if expensed " abnormal income = (net income + current period amortisation of deferred development costs - current period expenditures on development costs that were capitalised) - (10 % x opening book value of equity))
ADJ_{it}	= current period amortisation of deferred development costs - current period expenditures on development costs that were capitalised.
$NUMSHR_{it}$	= the number of common shares outstanding (scale proxy)
e_{it}	= residuals, assumed to be independently and identically distributed

Under the hypothesis that the capitalisation of development costs is informative, a positive association would be expected between MV_{it} and D_{it} (the balance sheet development cost variable) and between MV_{it} and ADJ_{it} (the income statement impact of capitalised development costs).

6.3.2 Econometric model for testing H_2

H_2 examines, for a given capitaliser, whether there is a higher association between market value and the current year development expenditure that was capitalised, versus market value and the current year research expenditure that was expensed. An assumption of this model is that a firm will capitalise all projects that meet the criteria for capitalisation. Those expenditures that are expensed indicate that there is either (i) no future benefit associated with the expenditure or (ii) the future benefits cannot yet be quantified. Under this assumption, capitalised outlays are expected to have confirmed payoffs relative to expensed outlays. As such, it is expected that the coefficient on the current year "D" parameter would generally be greater than the coefficient on the expensed "R" parameter - the argument being that the higher future benefits (or less certainty about those benefits) related to current year capitalised expenditures would manifest themselves in a larger valuation coefficient per dollar of outlay.

The model is constructed in five steps to allow the reader to understand the model's development. The model starts as a simple regression of market value to book value of equity and is represented by equation (10).

$$MV_{it} = a_0 + a_1\, CLBV_{it} + a_7\, NUMSHR_{it} + e_{it} \qquad (10)$$

where:

MV_{it} = firm market value of common equity three months after fiscal year end
$CLBV_{it}$ = book value of equity less preferred stock
$NUMSHR_{it}$ = the number of common shares outstanding (scale proxy)
e_{it} = residuals, assumed to be independently and identically distributed

Equation (11) then separates closing book value into two components: the capitalised development asset and the remainder, $ADJCLBV_{it} = CLBV_{it} - D_{it}$. The disaggregation from book value is done in order to isolate the valuation impact of the capitalised development asset. The model becomes:

$$MV_{it} = a_0 + a_1 ADJCLBV_{it} + a_2 D_{it} + a_7 NUMSHR_{it} + e_{it} \quad (11)$$

where:

MV_{it} = firm market value of common equity three months after fiscal year end
$ADJCLBV_{it}$ = book value of equity less preferred stock less closing book value of the capitalised development asset
D_{it} = closing book value of the capitalised development asset
$NUMSHR_{it}$ = the number of common shares outstanding (scale proxy)
e_{it} = residuals, assumed to be independently and identically distributed

Equation (12) introduces abnormal income into the equation. This is the basic F&O specification in conjunction with a disaggregated capitalised development asset.. The model thus becomes:

$$MV_{it} = a_0 + a_1 ADJCLBV_{it} + a_2 D_{it} + a_4 ABNI_{it} + a_7 NUMSHR_{it} + e_{it} \quad (12)$$

where:

MV_{it} = firm market value of common equity three months after fiscal year end
$ADJCLBV_{it}$ = book value of equity less preferred stock less closing book value of the capitalised development asset
D_{it} = closing book value of the capitalised development asset
$ABNI_{it}$ = abnormal net income = net income - [10% x (opening book value of equity)]

$NUMSHR_{it}$ = the number of common shares outstanding (scale proxy)
e_{it} = residuals, assumed to be independently and identically distributed

Equation (13) builds on Equation (12) by segregating D_{it} into two balance sheet components. OPD_{it} (opening D) represents the closing period unamortised portion of deferred development costs that existed *at the beginning* of the fiscal period. DEF_{it} (deferred amounts) represents the capitalisation of current year expenditures of development costs. These are the current year additions to the balance sheet asset. Combined, the two components equal the closing book value of D_{it}, $D_{it} = OPD_{it} + DEF_{it}$. The model thus becomes:

$$MV_{it} = a_0 + a_1\, ADJCLBV_{it} + a_2\, OPD_{it} + a_3\, DEF_{it} + a_4\, ABNI_{it} + a_7\, NUMSHR_{it} + e_i \qquad (13)$$

where:

MV_{it} = firm market value of common equity three months after fiscal year end
$ADJCLBV_{it}$ = book value of equity less preferred stock less closing book value of the capitalised development asset
OPD_{it} = opening book value of deferred development costs
DEF_{it} = current year additions to the capitalised development asset
$ABNI_{it}$ = abnormal net income = net income - [10% x (opening book value of equity)]
$NUMSHR_{it}$ = the number of common shares outstanding (scale proxy)
e_{it} = residuals, assumed to be independently and identically distributed

Equation (14) represents the empirical model used to test H_2. It builds on Equation (13) by separating out of $ABNI_{it}$ variables relating to R&D activity. $AMORT_{it}$ is the expense that represents the current period amortisation and write off of deferred developments costs that had been previously capitalised. $CYEXP_{it}$ is the expense that represents current expenditures on research and development costs that did not meet the capitalisation criteria.

$$MV_{it} = a_0 + a_1\ ADJCLBV_{it} + a_2\ OPD_{it} + a_3\ DEF_{it} + a_4\ ABNI^*_{it} +$$

$$a_5\ AMORT_{it} + a_6\ CYEXP_{it} + a_7\ NUMSHR_{it} + e_{it} \qquad (14)$$

where:

MV_{it}	= firm market value of common equity three months after fiscal year end
$CLBV_{it}$	= book value of equity less preferred stock
OPD_{it}	= opening book value of deferred development costs
DEF_{it}	= current year additions to the capitalised development asset
$ABNI^*_{it}$	= abnormal income adjusted for the effects of R&D =(Net income + amortisation of opening deferred development asset + current year expense) - [10% x (opening book value of equity)]
$AMORT_{it}$	= current period amortisation of opening deferred development asset.
$CYEXP_{it}$	= current period expenditure on R&D that was not capitalised.
$NUMSHR_{it}$	= the number of common shares outstanding (scale proxy)
e_{it}	= residuals, assumed to be independently and identically distributed

If DEF_{it} represents expenditures that have superior future expected benefits relative to $CYEXP_{it}$, it is expected that the coefficient on DEF_{it} would have a larger association with the dependent variable, MV_{it}, relative to the coefficient on $CYEXP_{it}$. This assertion is tested using an F statistic. The F statistic is computed under the restriction $a_3\ (DEF_{it}) - a_6\ (CYEXP_{it}) > 0$. Rejection of the null would indicate that the coefficient a_3 is larger than coefficient a_6.

6.3.3 Econometric model for testing H_3

H_3 examines whether the market places a higher value on the total current year R&D expenditures of capitalisers than on those of expensers, *ceteris paribus*. This hypothesis is predicated on the simple notion, that *ceteris paribus*, capitalisers signal their superior recovery prospects, relative to expensers. Of course, this ignores other motives for capitalising, a selection threat to be discussed shortly.

Section 6.3.3.1 discusses the general empirical model used to test H_3. Section 6.3.3.2 discusses self-selection bias and introduces a logit model. This model is used in an attempt to identify factors that may result in a self-selection bias. Section 6.3.3.3 outlines the empirical model used to test H_3 when it is augmented by including any significant variables that are discovered in the tests for self-selection bias.

6.3.3.1 Primary econometric model for testing H_3

Under the hypothesis that capitalising firms are doing so as a means of signalling superior quality, it is necessary to incorporate this difference into the general model. When differences are expected in the association between firm value and capital investments it is appropriate to use a slope shift to capture the expected variation. This is accomplished through the use of an indicator variable. A binary indicator variable (CAP_{it} =1 if the firm capitalises development costs, CAP_{it} = 0 otherwise) is introduced into the equation. This will be multiplied by CI_{it}, the firms total current year investment in R&D (expensed and capitalised). This variable is meant to capture the hypothesised increase in valuation that the market places on the current year R&D expenditures of capitalisers.

The relevant contrast between the valuation of the expensers (control group) and the capitalisers (treatment group) is represented by $(a_4 + a_5)$ vs a_4. Under the null hypothesis $(a_4 + a_5)$ is equal to a_4. The alternate is that $(a_4 + a_5) > a_4$ implying that $a_5 > 0$. The primary empirical model is for H_3 is:

$$MV_{it} = a_0 + a_1 CAP_{it} + a_2\, ADJCLBV_{it} + a_3\, ADJABNI_{it} + a_4\, CI_{it} + a_5\, (CAP_{it} \times CI_{it}) + a_6\, NUMSHR_{it} + e_{it} \quad (15)$$

where:

MV_{it}	= market value of common equity three months after fiscal year end
CAP_{it}	= 1 if the firm is a capitaliser, 0 otherwise
$ADJCLBV_{it}$	= book value of equity less preferred stock less deferred development costs
$ADJABNI_{it}$	= (net income + amortisation + current year expense) - (10% x opening book value of equity)
CI_{it}	= current year investment in $R\&D_{it}$ = $CYEXP_{it}$ and DEF_{it}
$(CAP_{it} \times CI_{it})$	= slope shift
$NUMSHR_{it}$	= the number of common shares outstanding (scale proxy)
e_{it}	= residuals, assumed to be independently and identically distributed

A positive and significant coefficient on the $(CAP_{it} \times CI_{it})$ variable would be consistent with capitalising firms having a larger association with MV_{it} relative to expensing firms.

6.3.3.2 Self-selection bias

Ideally, the only distinguishing factor between the capitalisers and expensers relates to the decision to capitalise as a result of a project's future expected benefit. It must be recognised, however, that firms may have different or additional motives to capitalise or expense. Managers do not choose at random, but do so on the basis of the firm's characteristics and the comparative advantages of each method.

The best experimental control can be achieved only if capitalisers and expensers are identical in every way except for accounting method choice. Using Cook and Campbell (1979) terminology, expensers (the control group) and capitalisers (the experimental group) are potential nonequivalent testing groups. The "treatment" is the decision to capitalise development costs. In an ideal setting, the "treatment" is assumed to be the sole cause of any expected difference between the two groups. When observations are not randomly assigned to the groups, another source of expected difference potentially exists, namely, selection differences associated with group nonequivalence. Equation (15) will not take these differences into account. Therefore, when selection factors are present that would lead to differences in posttest scores *even in the absence of a treatment*, the procedure is biased. Controls need to be introduced to compensate for potential self-selection bias.

One method of control used in nonequivalent group designs is to match observations on the basis of pretest scores after the groups have been formed. The treatment effect is then estimated from the posttest difference between groups within each matched pair (see Cook & Campbell (1979, 176). Industry classification and firm size are two variables that prior literature has used to match observations between the two nonequivalent groups see, for example, Collins and Salatka (1993, 130).

Tables 9 (Canadian sample) and 10 (Australian sample) compare capitalisers and expensers on size and industry classification. An inspection of the Tables indicates that there are large differences between the two groups, for each sample, in terms of size and

industry classification[20]. An analysis of the samples indicates that performing a matched pair procedure was not viable.

Another procedure to control for pre-test differences is the introduction of covariates. "Intuitively, the inclusion of multiple covariates produces an adjustment for initial group differences on each of the measured traits..." Cook and Campbell (1979, 171). A review of prior literature [Shehata (1991), Daley & Vigeland (1983) and Aboody and Lev (1997)] indicates that a number of potential covariates have been identified. Aboody and Lev (1997) identify the following independent variables as potential covariates impacting on the capitalisation decision:

(1) Firm size, measured by total assets (minus deferred development costs)
(2) Earnings, measured by net income plus the current period amortisation of deferred development costs, minus annually capitalised development costs, divided by sales
(3) Leverage, measured by long term debt divided by equity (minus the deferred development costs)
(4) Market to book ratio
(5) Systematic Risk, the β value of the firm's stock
(6) Return on equity, earnings (as adjusted in #2, above) divided by equity (minus d deferred development costs)
(7) Market value
(8) Firm age
(9) R&D intensity, current period expenditure on R&D divided by sales
(10) Volatility, measured by the firm's time-series variance of earnings.

Aboody and Lev (1997) perform a logit analysis and include significant variables as covariates in the regression equation. A similar analysis is performed in this study, as reported in Section 7.5.1. The small number of time-series observations in the Canadian sample did not allow for a meaningful volatility earnings variable to be calculated. This variable was dropped from the analysis[21]. Intuition indicates that another possible

[20] With respect to matching on industry, only 8 firms in the Canadian sample match at the 4 digit SIC level.
[21] The earnings volatility variable was not found to be significant in Aboody and Lev (1997).

covariate, primarily for the Canadian sample, would be firms that are cross-listed on a U.S. stock exchange. Firms raising capital in the U.S. are required to follow U.S. GAAP which calls for the immediate expensing of all R&D expenditures. Firms may find it costly to maintain two sets of GAAP and therefore choose to follow U.S. GAAP only.

6.3.3.3 Econometric model for testing H_3 using covariates

The variables found to be significant in the logit analysis (see Section 7.5.1) are introduced into the primary H_3 equation as covariates in an attempt to control for pretest differences. The resulting model is:

$$MV_{it} = a_1\, CAP_{it} + a_2\, ADJCLBV_{it} + a_3\, ADJABNI_{it} + a_4\, CI_{it} + a_5\, (CAP_{it} \times CI_{it}) + a_6\, NUMSHR_{it} + a_7\, COVAR_{it} + e_{it} \quad (16)$$

where:

MV_{it}	= market value of common equity three months after fiscal year end
CAP_{it}	= 1 if the firm is a capitaliser, 0 otherwise
$ADJCLBV_{it}$	= book value of equity less preferred stock less deferred development costs
$ADJABNI_{it}$	= (net income + amortisation + current year expense) - (10% x opening book value of equity)
CI_{it}	= current year investment in $R\&D_{it} = CYEXP_{it} + DEF_{it}$.
$(CAP_{it} \times CI_{it})$	= slope shift.
COVARit	= covariates
$NUMSHR_{it}$	= the number of common shares outstanding (scale proxy)
e_{it}	= residuals, assumed to be independently and identically distributed

6.4 Data Problems: Influential Observations, Multicollinearity, Autocorrelation and Scale Effects

This section addresses various threats to the econometric specification and discusses methods used to control or mitigate these threats. Subsection 6.4.1 discusses the issue of influential observations and the results of implementing tests to control for this problem. Subsection 6.4.2 discusses heteroscedasticity and scale, its impact on economic specification and the procedure used to mitigate its impact. Subsection 6.4.3 looks at the issue of multicollinearity and discusses tests used to assess its impact, if any. Subsection 6.4.4 discusses the issue of autocorrelation and proposes a sensitivity test to asses its impact.

6.4.1 Influential observations

An influential observation is one which, either individually or together with several other observations, has a demonstrably larger impact on the calculated values of various estimates (coefficients, standard errors, *t*-values, etc.) than is the case for most other observations. If uncontrolled, these influential observations can have a disproportionate influence on the estimated parameters. The estimates generated by the model may not be representative of the "true" underlying relationship due to the inclusion of outliers.

Influential observations were identified using the studentized residual (R-student) test (Belsley, Kuh and Welsch (1980)). The R-student test is a procedure that employs an absolute cutoff value. Observations generating R-student values greater than ± 3 in market

value to book value and net income regressions were deleted. This is consistent with Amir, Harris and Venuti (1992) and Bandyopadhyay, Dover and Richardson (1997).

Ten observations in the Canadian sample were identified as having R-student values greater than ± 3. Of these ten observations, four were capitalisers and six were expensers. This left a final Canadian sample consisting of 99 capitalisers and 215 expensers. Fourteen observations in the Australian sample were similarly identified. Of these fourteen, eight were capitalisers and six were expensers. Deleting these observations resulted in a final Australian sample of 253 capitalisers and 228 expensers.

6.4.2 Heteroscedasticity and scale effects

One of the primary assumptions of the classical linear regression model is that the variance of the regression residual is constant across observations, Var $[\varepsilon_i] = \sigma^2$. If the variance is not constant across observations, the regression is said to be heteroscedastic. Heteroscedasticity arises in numerous applications, primarily in the analysis of cross-section data. Failure to control for heteroscedasticity can result in biased standard error estimates and estimation inefficiency.

Scale differences can result in heteroscedastic regression error variances. Scale differences arise because large firms have larger values of many variables relative to small firms. Scale affects the values of observed variables. Variation in the dependent variable due to variation in scale is not of research interest. A properly designed empirical model will attempt to purge the scale factor's effect from the observed variables without purging the effect of the true independent variable. As scale is not observed, a proxy must be

selected. Barth and Kallapur (1996) identify a number of proxies that have been used in prior research including total assets, number of common shares outstanding, book value of equity, net income and sales.

A number of methods have been employed to control for scale-related problems. Barth and Kallapur (1996) examine and discuss three methods: deflating regression variables by a scale proxy, including a scale proxy as an independent variable, and using White (1980) heteroscedaticity-consistent standard error estimates[22].

Barth and Kallapur (1996) find that including a scale proxy as an independent variable is more effective than deflation for the purposes of mitigating coefficient bias. Further deflation does not noticeably reduce heteroscedasticity and can decrease estimation efficiency. They also find that White (1980) standard errors are closer than OLS estimated standard errors to the true undeflated standard errors. Their analysis shows that White standard errors approximate 88 percent of the true standard errors compared to 21 percent for the OLS standard errors. Based on their analysis, this study includes a scale proxy as an independent variable and reports inferences based on White (1980) standard errors.

Their analysis looks at a number of different variables as possible scale proxies. Total assets (TA), sales (SALES), book value of equity (BVE), net income (NI), number of shares outstanding (NUMSHR) and share price (PRICE) were examined. Preliminary tests (unreported) were run using TA, SALES, and NUMSHR as possible scale proxies. BVE, NI and PRICE were not selected as they are variables in the model. TA and SALES did not provide consistently plausible results. The proxy NUMSHR provided

[22] Section 7.6.1 discusses the results of using a different scaling methodology.

plausible results that were consistent between various model specifications and consequently was selected as the scale proxy. The use of NUMSHR as a scale proxy is consistent with prior literature (Barth and Clinch (1998)).

6.4.3 Multicollinearity

In the classical regression model, it is assumed that the matrix of independent variables has full rank. There is no exact linear relationship among the independent variables. This condition is necessary in order for the inverse matrix $(X'X)^{-1}$ to exist. The case of an exact linear relationship among the independent variables indicates a failure in the assumptions of the empirical model and not the data.

A more common case is where variables are highly, but not perfectly, correlated. In this instance, the empirical model would retain all of its assumptions but statistical problems would arise. The higher the correlation between the independent variables, the less precise the model estimates will be. Besley et al (1980) refer to this as "degrading" the regression estimates. The essential harm due to collinearity arises from the fact that a collinear relation can readily result in a situation in which some of the systematic influence of the independent variables on the dependent variable is swamped by the instability of coefficient estimates.

Tests for multicollinearity were performed using the condition index test described in Besley et al (1980). They suggest that condition indices of 30 to 100 represent moderate to strong relations among the independent variables. The largest condition indexes are 38.897 and 94.901, for the full Canadian and Australian samples respectively,

in the incremental information test of H_1 (see Panel C of Tables 1 and 2). These levels represent a modest to high amount of multicollinearity. The introduction of the ADJ variable into the equation results in the increase in multicollinearity and is expected.

Two sensitivity tests will be performed to assess the impact of the ADJ variable on overall results. The first eliminates ADJ from the general F&O empirical specification. The second uses the Barth (1994) specification, which is a balance sheet only model. These tests are reported in section 7.6.5.

6.4.4 Autocorrelation

Whenever time-series data is being used, the problem of serial correlation of the disturbances across periods may arise. In an OLS setting, the assumption that all observations are independent can lead to misspecification of the empirical model. As firms contribute multiple sequential annual observations, the risk of autocorrelation is present and must be addressed. Kmenta (1983) has devised a procedure which uses generalised least squares methodology in controlling for autocorrelation. The procedure uses the within company correlation coefficients as an estimate of the autoregressive parameter, rho, for each cross-sectional unit. A second procedure uses a pooled estimate of rho. Such analyses are used as robustness checks (see Section 7.6.3).

6.5 Chapter summary

This chapter has discussed both the research design and data collection procedures. Specific threats to econometric specification have been identified. The next chapter presents the results of the testing of the models.

CHAPTER 7

Empirical Analysis and Discussion

7.1 Introduction

Chapter 5 developed an argument in support of managers capitalising development costs in an attempt to communicate their inside information about future expected benefits. Information is value relevant when it can influence the decisions of users by helping them evaluate the impact of the future benefits. An association between share price and the communicated information would provide evidence of value relevance. Of course, the usual caveat applies. The association tests cannot infer that capitalised values convey incremental new information for investors. Causation is not inferred. Rather, one can only infer that the capitalised values are correlated with information used by investors to value the firm.

Overall, the results support the proposition that capitalised development costs are value relevant when the samples are partitioned on materiality. Partitioning is necessary to prevent the valuation impact of deferred development costs from being "swamped" by other information contained in the financial statements. The results are robust to alternative empirical specifications.

Discussion of the empirical results is divided into six sections. Section 7.2 discusses descriptive statistics. Section 7.3 provides the results of Hypotheses 1 for both test 1 (relative information content) and test 2 (incremental information content). Section 7.4 discusses the results of Hypothesis 2, while section 7.5 discusses the results of

Hypothesis 3. Sections are subdivided into Canadian and Australian results. Section 7.6 discusses checks for robustness and sensitivity analysis. Section 7.7 provides a chapter summary.

7.2 Descriptive statistics

Tables 1 (Canada) and 2 (Australia) provide summary descriptive statistics of the variables used in the empirical regressions for "Capitalisers". The tables are further divided into Panel A (Full Sample) and Panel B (Top 50% Based on Materiality of "D"). Panel C provides correlation matrices on variables used in the incremental information test of H_1 and on variables used in the testing of equation 14 of H_2.

7.2.1 Canadian sample

An analysis of Table 1 Panel A indicates that the means tend to be larger than the medians for most of the variables, indicating that the distributions are skewed. While the means are larger than the medians, most means fall within the second and third quartiles. A couple of notable exceptions exist. The mean of *Market capitalisation* ($360,113,000) is greater than the third quartile ($220,014,000) and the mean of *Net income after tax* ($8,005,000) is greater than the third quartile ($6,009,000). An inspection of the maximum value of *Market capitalisation* ($5,695,692,000) and *After tax net income* ($202,864,000) indicates that these are indeed large values. Though these observations were *not eliminated* in the test of influential observations, a risk exists that their inclusion may be driving the results. A sensitivity test is performed in section 7.6.6 to address this

issue. An inspection of the *Capitalised development costs/market capitalisation* ratio (mean 5.37%, median 2.79%) would indicate that capitalised costs are potentially material enough to warrant the market's attention.

Panel B provides the same descriptive statistics for the top 50% of the sample as partitioned on materiality of "D". A similar pattern exists. Means tend to be larger than medians, indicating that the sample is still skewed. The mean of *Market capitalisation* ($141,676,000) falls between the median ($49,580,000) and the third quartile ($183,112,000). The mean of *Net income after tax* ($225,000) falls between the first quartile ($-6,599,000) and the median ($575,000). Though the maximum values of *Market capitalisation* ($1,816,711,000) and *Net income after tax* ($126,550,000) are still large relative to their respective mean and median, the partitioned sample does not appear to suffer from any remaining large observations to the extent that the entire sample did. As expected, the *Capitalised development costs/market capitalisation* ratio (mean 9.54%, median 5.76%) has increased relative to the entire sample.

Panel C reports the Spearman rank correlation matrices for variables used in the incremental information test of H_1 and for variables used in equation 14 of H_2. Large (>.5) pairwise correlations are observed between the variables ADJCLBV and D (.533) and between the variables D and ADJ (.569) in the matrix for the variables used in the incremental test of H_1. An association between D and ADJ is expected. ADJ includes the amortisation of opening development costs, D. The larger D is the larger the expected amortisation. The main variables of interest in equation 14 are DEF and CYEXP. The pairwise correlation is .270 indicating that pairwise correlation does not appear to be a factor.

7.2.2 Australian sample

Panel A of Table 2 provides descriptive statistics for the entire Australian "capitalisers" sample. An inspection of Panel A indicates that the sample is skewed. The mean value of nearly all variables are greater than their third quartile value. Panel B also shows that means tend to be larger than the third quartile, indicating that the partitioned sample is still skewed. Partitioning the sample on materiality does not alter the skewness of the distribution.

In both samples, the *Capitalised development costs/market capitalisation* ratio (full sample - mean 9.06%, median 2.14% , partitioned sample - mean 17.55%, median 5.84%) appears to be potentially material.

Panel C reports the Spearman correlation matrices. Similar to the Canadian sample, the correlation between the variables D and ADJ in the incremental information test is large (.548) and expected. The correlation matrix for variables used in the testing of equation 14 of H_2 does not indicate any large correlations (>.5). The correlation of the primary variables of interest, DEF and CYEXP is .102 indicating that pairwise correlation does not appear to be a factor.

A comparison of the Australian sample to the Canadian sample indicates that the medians of *Capitalised development costs/market capitalisation* ratio are close (full sample - Canadian 2.79% vs. Australian 2.14%, partitioned sample - Canadian 5.76% vs. Australian 5.84%). While differences exist between the two countries (R&D Intensity appears to be quite different (Canadian median 9.16% vs. Australian median 1.22% for the full samples), an overall comparison of the other variables and their distribution would

indicate that a comparison between Canada and Australia as a general test of robustness is plausible.

7.3 Hypothesis one

Hypothesis one states, in alternative form, that capitalised development costs are positively associated with firm value. H_1 is examined by performing two tests. As explained in section 6.3.1.1, test one measures the relative information content. This test asks whether one accounting method provides greater information content than the other. Test two examines the incremental information content by directly testing the "adjustments" in going from one accounting method to the other.

7.3.1 Canadian results

Table 3 reports both the relative (Panel A) and incremental (Panel B) results for the entire Canadian capitalisation sample (99 firm year observations).

Examining the Adjusted R^2 between current GAAP and "as if expensing" GAAP for the full sample does not support H_1. From Table 3 Panel A, the current GAAP Adjusted R^2 is .791, compared to .788 for the "as if expensed" GAAP. The corresponding ratio is 1.004. The Vuong Z statistic is 0.810 ($p = .209$) which is not significant at conventional levels of statistical significance. Therefore current GAAP does *not* explain more of the variation in stock price compared to the "as if expensing" GAAP.

Panel B examines the incremental information content of the adjustments to closing book value of shareholders' equity and net income. The capitalised development

asset, b_2 = 19.123, is statistically significant at the 5% level (White's t = 2.105) while the coefficient on the adjustment to net income, b_4 = -24.739, is not (White's t = -1.327). Taking Panel A and B together, the preliminary evidence does not support H_1.

Aboody and Lev (1997) find similar results when their entire sample was used. In their study on the selective capitalisation of software development costs, they find that the coefficient on the capitalised software asset was negative (-0.037) and insignificant (White's t = -0.09). They argue, however, that the result may be due to the fact that many firms in their sample capitalise small amounts of software development costs relative to market value. They reran their tests on the 25 percent of the sample observations with the highest capitalisation intensity (the ratio of the capitalised development costs to total expenditures on development). After controlling for this "materiality" effect, they find that the coefficient is positive (0.789) and significant (White's t = 3.44).

A similar analysis is therefore employed. "Materiality" is defined[23] by the ratio of deferred development costs / market capitalisation. The sample is then sorted on this measure of materiality and partitioned in two. Table 1 Panel B provides summary statistics for the resulting top 50 observations (50%). A comparison of Panel B to Panel A indicates that the top 50 Canadian observations tend to be generated by firms which are smaller by any measure of size (mean market capitalisation is $141,676,000 versus $360,113,000), less profitable (mean unadjusted net income is $225,000 versus $8,005,000), have higher mean R&D assets ($7,143,000 versus $4,946,000) and, finally, higher mean net income adjustments (-$1,853,000 versus -$973,000). It is therefore plausible that the results become significant as the materiality of the adjustments increases.

After partitioning on materiality, the relative and incremental analysis is rerun for the top 50 observations (top half of the sample).[24] Table 4 reports the results for the partitioned sample. Panel A of Table 4 reports a much larger difference in the Adjusted R^2 between the two accounting methods, .599 versus .544, yielding a ratio of 1.101. This ratio indicates that, for the top 50 observations, current GAAP explains more of the variation in stock price relative to the "as if expensing" GAAP. The difference is statistically significant as indicated by the Vuong Z statistic of 2.651 (p = .004). Panel B indicates that the "adjustments" between capitalisers and expensers are now statistically significant at the 1% level. The capitalised development cost coefficient, $b_2 = 27.157$, is positive (White's $t = 3.098$), while the coefficient on the adjustment variable, $b_4 = -35.749$, (White's $t = -2.560$) is negative. The positive sign on b_2 is as expected, but the negative sign on b_4 is not and is hard to interpret[25].

7.3.2 Australian results

The same tests are run for the Australian sample. Table 5 reports the results for the entire Australian capitalisation sample (n = 253). Similar to the results for the entire Canadian sample, the full Australian sample does not provide evidence in support of H_1. Panel A indicates that the ratio of Adj R^2s is 1.001 (.968/.967). The Vuong Z statistic of 1.218 (p = .112) indicates that the difference is not statistically significant. Panel B indicates that only one of the "adjusting" variables is significant. The adjustment to

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[23] A number of different materiality definitions were examined as follows: D/TA, D/BVE, ADJ/MV, ADJ/TA and ADJ/BVE. All yielded similar results.

[24] Though Aboody and Lev (1997) use the top 25% of their sample, data limitations prevents the sample size from being decreased any further.

equity, b_2 = 1.471, is significant at the 5% level (White's t = 2.449) while the adjustment to income, b_4 = 1.735, is not (White's t = 0.956).

The Australian sample is also partitioned in two using the ratio of deferred development costs / market capitalisation as the partitioning variable. Comparing Panels A and B of Table 2, the top 50% of firm year observations tend to be smaller (mean market capitalisation is $133,192,000 versus $455,504,000), less profitable (mean unadjusted net income is $1,628,000 versus $ 13,202,000), have higher mean capitalised development costs ($10,815,000 versus $6,539,000) and, finally, have larger mean net income adjustments (-$2,274,000 versus -$600,000). This pattern is consistent with the Canadian sample.

Table 6 reports the results for the top 50% of Australian capitalisers. The ratio of Adj R^2 in Panel A has increased to 1.045 (.906/.867). The Vuong Z statistic of 3.081 (p = .001) indicates that the difference is statistically significant. Panel B indicates that both adjustments, b_2 = 1.108, (White's t = 5.987) and, b_4 = 2.246, (White's t = 2.323), are positive and significant at the 1% level, as predicted by H_1 under the alternate hypothesis.

7.3.3 Conclusion

The results on H_1 are as follows: for the full Canadian sample (99 firm year observations) and the full Australian sample (253 firm year observations), evidence does not support H_1. However, when the data is partitioned on the materiality of the capitalised development costs (i.e. the ratio of capitalised development costs to market value), the evidence does support H_1 for the top half (Canada n = 50, Australia n = 127) of the

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[25] The corresponding b_4 in the Australian sample is positive, as expected. Thus, the Canadian sample b_4

capitaliser sample. The results are consistent with "capitalisation" GAAP yielding reported balance sheet and income numbers that are more correlated with information used by investors relative to an "as if expensing" GAAP.

7.4 Hypothesis two

Hypothesis two examines, for a given capitaliser, whether there is a higher association between market value and the current year development cost expenditure which was capitalised versus market value and the current year research expenditure that was expensed.

Results for tests of H_2 are reported in Tables 7 and 8 as five separate equations for each sample. The equations segregate out the R&D variables in a step by step manner and allow the reader to articulate back up to a simple market to book value of equity model. The various R&D variables of interest are as follows: prior period D_{it-1} assets that still exist at year end ($OPDA_{it}$)[26], the current year build up in deferred development costs (DEF_{it}), the current period amortisation of prior period D_{it-1} assets ($AMORT_{it}$) and current year expenditures which did not meet the criteria for capitalisation and were expensed ($CYEXP_{it}$).

If H_2 holds, it is expected that DEF_{it} would be positive and significant. Further, it is expected that the coefficient on DEF_{it} would be larger than the coefficient on $CYEXP_{it}$, consistent with a larger valuation coefficient per dollar of outlay. An F statistic is computed to test this comparison. As these tests are entirely based on capitalisers, they

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result appears to be specific to that sample.

[26] These assets must still have future benefits otherwise GAAP would require that impaired assets be written down to their realisable value.

use each firm as its own control. This means that ceteris paribus assumptions are not confounding inferences, as is the case for tests of H_3 (to be discussed later).

7.4.1 Canadian results

Table 7 reports the results for both the full (n = 99) and partitioned (n = 50) Canadian sample. Panel A reports results for the entire Canadian sample, while Panel B reports the results for the top 50 firm year observations of the partitioned sample. The partitioning variable is the ratio of capitalised development costs to market value, similar to H_1.

Panel A indicates that the coefficient on OPD_{it} (27.554) in equation 14 is positive and significant at the 5% level (White's t = 2.062). The coefficient on DEF_{it} (-25.415) is negative and insignificant (White's t = -1.355). The F test statistic is 0.414 (p = .5217, 1 and 91 d.f.), indicating that the coefficient for DEF_{it} (-25.415) is not significantly different than the coefficient for $CYEXP_{it}$ (-15.353). Thus, the evidence for the full Canadian sample does not support H_2.

The sample is partitioned on materiality in a fashion similar to that employed for tests of H_1. Panel B reports the results for the top 50 firm year observations. The coefficient on OPD_{it} (56.595) in equation 14 is positive and significant at the 1% level (White's t = 4.730). The coefficient on DEF_{it} (22.381) is positive and significant at the 5% level (White's t = 1.884). The F statistic comparing the coefficient on DEF_{it} (22.381) and $CYEXP_{it}$ (-7.747), respectively, is 8.124 (p = .007, 1 and 42 d.f.), indicating that coefficients are statistically different from each other. The evidence on the partitioned Canadian sample (n = 50) supports H_2.

7.4.2 Australian results

Table 8 reports the Australian results. Panel A indicates the coefficient on OPD (1.653) is significant at the 5% level (White's t = 2.440). The coefficient on DEF_{it} (-1.120) is not significant (White's t = -0.453) for the entire Australian capitaliser sample (n = 253). The F statistic is .002 (p = 0.966), indicating that the coefficient for DEF_{it} (-1.120) and the coefficient for $CYEXP_{it}$ (-1.000) are not significantly different. After partitioning on materiality, Panel B shows that OPD (0.948) is significant at the 1% level (White's t = 4.667). The coefficient on DEF (4.329) is positive and significant, at the 1% level (White's t = 3.567), as expected. The F statistic between the coefficient for DEF_{it} (4.329) and the coefficient for $CYEXP_{it}$ (-3.602) is significant ($p<.001$), indicating that DEF_{it} has a statistically larger coefficient than $CYEXP_{it}$. This is consistent with H_2.

7.4.3 Conclusion

The results on H_2 are as follows: for the full Canadian sample (99 firm year observations) and the full Australian sample (253 firm year observations), evidence does not support H_2. However, when the data is partitioned on the materiality of the deferred development costs (i.e. the ratio of deferred development costs to market value), the evidence does support H_2 for the top half (Canada n = 50, Australia n = 127) of the capitaliser sample. The results are consistent with capitalised current period development cost outlays receiving higher valuation coefficients than current period expensed research outlays by the same firm. One interpretation is that the "ceiling" test aspect of "capitalisation" GAAP conveys useful information to investors.

7.5 Hypothesis three

Hypothesis three examines whether the market places a higher value on the total current year R&D expenditures of capitalisers than on those of expensers, *ceteris paribus*. Results are discussed in two subsections. Subsection 7.5.1 discusses the results of the logit analysis performed and identifies potential covariates. Subsection 7.5.2 discusses the results of H_3 both without any covariates and also after the introduction of covariates identified above.

7.5.1 Logit analysis

Ideally, the only distinguishing factor between the capitalisers and expensers relates to the decision to capitalise as a result of a project's future expected benefit. It must be recognised, however, that firms may have different or additional motives to capitalise or expense. Accordingly, it is necessary to implement control procedures to account for these possible selection-related differences. The main objective of the empirical logit analysis is to identify, from the list of independent variables discussed in section 6.3.3.2, potential covariates. The independent variables were selected from a list compiled by Aboody and Lev (1997). Their list is consistent with variables identified in other research (Daley and Vigeland 1983; Shehata 1991). Since some of the independent variables are highly correlated (i.e., market value and total assets), the logit analysis is performed with various combinations of the independent variables, to reduce multicollinearity. The reported model represents the best combination of independent variables.

The logit model is based on the assumption that the dependent variable represents the probability than an observation belongs in one of two groups:

$$\text{Prob } [CAP_{it} = 1] = F(x,\beta), \tag{17}$$

$$\text{Prob } [CAP_{it} = 0] = 1 - F(x,\beta) \tag{18}$$

and that this probability has a logistic distribution

$$\text{Prob } [CAP_{it} = 1] = \frac{e^{\beta' x}}{1+e^{\beta' x}} \tag{19}$$

The set of parameters β reflect the impact of changes in the independent variables on the probability. The combination of variables chosen for the model and their predictions are:

1) Firm size (LNMV), measured as the log of market value of equity three months after fiscal year end. The political cost hypothesis states that large firms will adopt income-decreasing accounting policies items in an attempt to reduce net income and avoid media or consumer attention . Consequently, large firms can be expected to expense development costs more frequently than smaller firms. A negative sign is expected. This expectation is consistent with Aboody and Lev (1997) and Shehata (1991) who find firm size to be significant.
2) Earning (EARN), measured by net income converted to full expensing (i.e., net income plus amortisation minus current year capitalised development costs) divided by sales. The lower the earnings the likelier a firm is to capitalise in order to protect earnings. A negative sign is expected. This expectation is consistent with Aboody and Lev (1997). They find that less profitable firms are more likely to capitalise.
3) Leverage (LEV), measured by long-term debt divided by book equity (minus the deferred development costs). This variable acts as a proxy for the restrictiveness of

loan covenants. A positive sign is expected. This expectation is consistent with Daley and Vigeland (1983) and Shehata (1991). They find that the more highly levered a firm is the more likely the firm is to capitalise.

4) Market to book ratio (RATIO), measures the growth potential. Economic studies have shown that R&D expenditures lead to an increase in productive capacity and economic growth (see section 3.2). This increased economic growth would manifest itself in higher future expected benefits. The larger the future expected benefits the larger the associated market value *ceteris paribus*. The higher the expected future benefits the more likely the benefits will exceed the costs for a particular project. Benefits exceeding costs is one criterion for capitalisation to take place. A positive sign is expected. This expectation is consistent with Aboody and Lev (1997).

5) R&D Intensity (R&D INT), measured by the ratio of annual R&D costs to sales. The more R&D a firm undertakes the higher the potential materiality of the capitalised costs. A positive sign is expected. This expectation is consistent with Shehata (1991). He found that firms that spent a significant portion of their income on R&D activities were more likely to capitalise.

6) Systematic Risk (BETA), the β value of the firm's stock. The riskier a firm is, the more volatile its earnings stream. A firm would want to increase earnings in order to reduce the risk that the earnings will fall below a certain threshold. A lower earnings number may cause the violation of debt covenants, if applicable, or may result in managers not qualifying for bonuses. A positive sign is expected. This expectation is consistent with Shehata (1991). He found that firms with more variable earnings were more likely to capitalise.

7) Cross-listing (XLIST for Canadian sample only). If a firm is cross-listed on a U.S. exchange XLIST =1 , otherwise XLSIT = 0. For firms obtaining financing in the U.S., U.S. GAAP must be followed which mandates immediate expensing of all R&D costs. Cost considerations would encourage the firm to select one accounting policy for both jurisdictions. A negative sign is expected indicating that a cross-listing firm is more likely to expense R&D outlays.

Rearranging equation (19) and substituting the variables into equation (19) yields the logit model:

$$Log\ \frac{F_i}{1-F_i} = \alpha + \beta_1 \text{LNMV}_i + \beta_2 \text{EARN}_i + \beta_3 \text{LEV}_i + \beta_4 \text{RATIO}_i + \beta_5 \text{R\&D INT}_i + \beta_6 \text{BETA}_i + \beta_7 \text{XLIST}_i + \varepsilon_1 \quad (20)$$

Table 11 (Canada) and Table 13 (Australia) presents the mean and median of the main variables used in the logit analysis. Furthermore, a comparison of the capitaliser and expenser sample is performed using a standard two-sample t test and a non-parametric Wilcoxon Z test. More specifically, the t test evaluates the hypothesis that the true means of the two samples are the same. The non-parametric Wilcoxon test is also used to test whether the two samples are drawn from the same population.

Results in Table 11 (Canada) show that the mean and median of a number of variables are significantly different. The *t* test rejects the null that the mean value of LN(ADJTA) ($p<0.01$), LN(MV) ($p<0.01$), and R&D INT ($p<0.10$) are the same between capitalisers and expensers. The Wilcoxon Z test rejects the null for each variable indicating that the samples are not drawn from the same population.

Table 13 reports the results for the Australian sample. Similar to the Canadian sample, the *t* test rejects the null that the mean value of LN(ADJTA) ($p<0.01$) and LN(MV) ($p<0.01$) are the same between capitalisers and expensers. The null of that the mean is the same for BETA ($p<0.05$) is also rejected. The Wilcoxon Z statistic on LN (ADJTA), LN(MV), EARN, LEV, and R&D INT is significant. This indicates that the samples do not appear to have been drawn from the same population. Significant differences exist between the capitaliser and expenser samples.

7.5.1.1 Canadian results

The results of the logit analysis for the Canadian sample are presented in Table 12. The variables LNMV, LEV and RATIO are significant at the 0.005, 0.025, and 0.100 level, respectively, with one tail *t* tests. The signs of the coefficients on LNMV and RATIO are consistent with predictions. The sign on LEV is opposite to expectations. The significance of the overall model is reflected in the likelihood ratio test, which is below the 0.005 significance level ($\chi 2 = 20.28$ for $\alpha = 0.005$ with 7 d.f.). The model has a 70.3% prediction accuracy . Overall the model is significant.

7.5.1.2 Australian results

Table 14 reports the results of the logit analysis for the Australian sample. The model is the same as for the Canadian sample (minus XLIST). The variable LNMV is significant at the 0.005 level. BETA is significant at the 0.025 level. LEV and RATIO are significant at the 0.100 level. The signs on the coefficients of LNMV, RATIO and BETA

are consistent with predictions. Similar to Canada, the sign of LEV is opposite to what was expected.

The significance of the overall model is reflected in the likelihood ratio test, which is below the 0.005 significance level ($\chi 2 = 18.55$ for $\alpha = 0.005$ with 6 d.f.). The model has a 68.6% prediction accuracy.

7.5.1.3 Conclusion

Overall the logit model in both countries is significant. The results, in general, are consistent with prior literature. The significant finding on size is consistent with all three cited studies. The significance of BETA is consistent with the variability of earnings found by Shehata, both variables being a measure of firm risk. The sign of LEV is counter to all prior studies. Overall, both models are significant as their respective χ^2 statistic is below the 0.005 significance level. The percentage of right predictions, for both models, is approximately 70%. These results and the consistent findings with prior research indicate that the models are plausible.

7.5.2 Tests of H_3

Under the hypothesis that capitalising firms are doing so as a means of signalling superior quality, differences are expected in the association between firm value and R&D outlay. If H_3 holds, we would expect a positive significant coefficient on a_5. As discussed, in section 6.3.3.2, a matched pair procedure cannot be implemented. Industry membership can not be controlled for. The regression results may be picking up the fact that different industries have different R&D recovery prospects since the capitalise /

expense accounting choice is correlated with industry membership. Lev and Sougiannis (1996) examined the different recovery and amortisation periods for different industries. Readers are therefore cautioned as to the interpretation of H_3 results.

7.5.2.1 Canadian results

Table 15 reports the results of H_3 for the Canadian sample. Two equations are reported in both Panel A and Panel B as follows[27]:

$$MV_{it} = a_0 + a_1\, CAP_{it} + a_2\, ADJCLBV_{it} + a_3\, ADJABNI_{it} + a_4\, CI_{it} + a_5\, (CAP_{it} \times CI_{it}) + a_6\, NUMSHR_{it} + e_{it} \quad (21)$$

$$MV_{it} = a_0 + a_1 CAP_{it} + a_2\, ADJCLBV_{it} + a_3\, ADJABNI_{it} + a_4\, CI_{it} + a_5\, (CAP_{it} \times CI_{it}) + a_6\, NUMSHR_{it} + a_7\, BETA + a_8\, LEV + a_9\, LNADJTA + e_{it} \quad (22)$$

where:

MV_{it}	= market value of common equity three months after fiscal year end
CAP_{it}	= 1 if the firm is a capitaliser, 0 otherwise
$ADJCLBV_{it}$	= book value of equity less preferred stock less deferred development costs
$ADJABNI_{it}$	= (net income + amortisation + current year expense) - (10% x Opening book value of equity)
CI_{it}	= current year investment in $R\&D_{it} = CYEXP_{it} + DEF_{it}$.
$(CAP_{it} \times CI_{it})$	= slope shift.
$NUMSHR_{it}$	= the number of common shares outstanding (scale proxy)
$BETA_{is}$	= systematic Risk, the β value of the firm's stock
LEV_{it}	= leverage, measured by long-term debt divided by book equity (minus the deferred development costs)

[27] Equation 21 measures the incremental information content of capitalisers relative to expensers. The variable CI_{it} represents the current year outlay on R&D for expensers. The variable $(CAP_{it} \times CI_{it})$ represents the current year outlay on R&D for capitalisers. If a there is a greater association for capitalsers relative to expensers a positive and significant coefficient on a_5 is expected.

$LNADJTA_{it}$ = firm size, measured as the log of adjusted total assets (total assets minus the deferred development costs)

e_{it} = residuals, assumed to be independently and identically distributed

LNMV and RATIO could not be used in the above specification as they are functions of MV, the dependant variable. Tests show (unreported) that the loading on the coefficient for LNADJTA variable is comparable in significance to the coefficient on the LNMV variable. Due to the linear correlation between the dependent variable, MV, and the independent variable, LNMV, it was necessary to substitute LNADJTA for LNMV in the above empirical specification.

The first equation reports the primary H_3 equation without covariates. The second equation adds variables, identified in the logit analysis, as covariates in an attempt to control for pretest differences. Panel A reports the results for the entire sample (n = 314). The coefficient on CI_{it} , $a_4 = 2.513$, in the no control equation, is positive and significant at the 5% level (White's t = 2.177) indicating that the market values current period R&D investment for expensing firms. The coefficient on the slope shift variable, (CAP_{it} x CI_{it}), a_5 = 19.334, is positive and significant at the 1% level (White's t = 4.497), as predicted by H_3. This indicates that, for the Canadian sample, capitalising firms appear to have a higher valuation coefficient per $1 of R&D expenditures than expensers. Introducing control covariates does not appear to alter the results. No new variables become significant. The significance levels for CI_{it} and (CAP_{it} x CI_{it}) do not change.

A further test is performed to determine if total current year expenditures on R&D for capitalisers have a direct effect on market value. This assertion is tested using an F statistic. The F statistic is computed under the restriction that CI_{it} + (CAP_{it} x CI_{it}) = 0.

The F statistic testing that assertion that the coefficients $a_4 + a_5 = 0$ are 10.872 ($p = .001$, 1 and 307 d.f.) for the no control equation and 8.289 ($p = 0.004$, 1 and 304 d.f.) for the equation with control variables. The significance of these results rejects the null in favour of the alternate that current year investment in R&D is valued directly by the market.

Panel B partitions the sample based on R&D intensity (current period investment / market value) and reports the results for the top 50% of the sample. CI_{it} is positive, $a_4 = 7.740$ and significant at the 1% level (White's $t = 3.604$). The coefficient on the slope shift variable (CAP_{it} x CI_{it}), is negative, $a_5 = -5.817$ and significant at the 10% level (White's $t = -1.871$). Further, the F statistic on the assertion that the coefficients $a_4 + a_5 = 0$ is 0.034 ($p = 0.854$ with 1 and 150 d.f.) for the no control equation and 0.007 ($p = 0.932$ with 1 and 147 d.f.) for the control equation. The F statistic, in each, case fails to reject the null. The inclusion of covariates does not alter the overall significance of results.

The results imply, however, that R&D is valued for expensers. The coefficient on the expensers R&D outlay, $a_4 = 2.512$, in the no control full sample, is significant at the 5% level (White's $t = 2.177$). The coefficient in the control equation, $a_4 = 2.606$, is also significant at the 5% level (White's $t = 2.206$). The partitioned sample reports stronger inferences. The coefficient on the expensers R&D outlay , $a_4 = 7.740$, in the no control equation is significant at the 1% level (White's $t = 3.664$). A similar result is reported for the control equation.

7.5.2.2 Australian results

Table 16 reports the results for the Australian sample. Procedures performed on the Canadian sample where performed identically for the Australian sample.

In the primary equation in Panel A, the coefficients on total current year expenditures (CI_{it}), $a_4 = -4.524$, and the slope shift variable (CI_{it} x CAP_{it}), $a_5 = 4.146$ are insignificant (White's $t = -0.574$ and 0.651 respectively). The inclusion of the covariates does not alter the significance of the variables. Both CI_{it} and (CAP_{it} x CI_{it}) are still insignificant and maintain the signs of the primary equation. The F statistic computing the assertion that the coefficients $a_4 + a_5 = 0$ are 0.017 ($p = .895$, 1 and 474 d.f.) for the no control equation and 0.283 ($p = .595$, 1 and 471 d.f.) for the equation with control variables. The significance of these results does not reject the null. For the full Australian sample, current year investment in R&D is not valued directly by the market.

Identical to the Canadian sample, the sample was partitioned based on the ratio of R&D intensity. The results are reported in Panel B of Table 16. The coefficient on CI_{it} in the no control equation is positive, $a_4 = 28.890$ and significant at the 1% level (White's $t = 4.143$), indicating that the market values current period investment in R&D for expensers. The slope shift variable (CAP x CI) , $a_5 = -11.867$ is negative and significant at the 5% level (White's $t = -2.069$). This would indicate that capitalisers appear to have a lower valuation coefficient per $1 of R&D expenditures, relative to expensers. This is counter to H_3. The F statistic computing the assertion that the coefficients $a_4 + a_5 = 0$ are 76.411 ($p < .001$, 1 and 233 d.f.) for the no control equation and 89.075 ($p < .001$, 1 and 230 d.f.) for the equation with control variables. Thus, for the partitioned Australian sample,

7.5.2.3 Conclusion

Overall, the evidence generally fails to support H_3. While the full Canadian sample (314 firm year observations) provides evidence in support of H_3, partitioning the Canadian sample on R&D intensity (n = 157) results in a negative slope shift variable, which does not support H_3.

The evidence from the full Australian sample (n = 481) does not support H_3. The coefficients on CI_{it} and (CAP_{it} x CI_{it}) are not significant. Partitioning the sample on R&D intensity (n = 240), results in the coefficient on CI_{it} for expensers becoming positive and significant. The coefficient on (CAP_{it} x CI_{it}) becomes negative and significant which is inconsistent with H_3. As stated earlier, these results may be confounded by omitted variables relating to self-selection bias. Thus, unlike tests of H_1 and H_2, the tests of H_3 in this study are inconclusive. The ceteris paribus assumption underlying H_3 is problematic.

An interesting result is observed, however. For the full and partitioned Canadian sample and the partitioned Australian sample, results indicate that the a dollar of R&D outlay incurred by expensers is valued directly by the market. The findings provide an interesting contrast with Sougiannis (1994) who did not find an overall significant direct effect for R&D expenditures. It should be pointer out, however, that Sougiannis used a different empirical specification and did not partition his sample on R&D intensity.

7.6 Tests of robustness and sensitivity

A number of supplementary tests were performed to assess the sensitivity of the results to alternate specifications. Tests included: running tests of H_1 on an alternative

method of scale (deflation) and raw (section 7.6.1), running tests of H_1 on a combined Canadian and Australian sample (section 7.6.2), comparing OLS and POOL procedures in SHAZAM as a test of autocorrelation (section 7.6.3), applying different discount rates in determining abnormal earnings (section 7.6.4), applying a Barth (1994) motivated specification (section 7.6.5), eliminating potential remaining large firms in the Canadian sample (section 7.6.6) and introducing the covariate BETA in an interactive fashion.

7.6.1. Scale issues

The empirical tests performed in this study used the procedure outlined by Barth and Kallapur (1996) as a means of controlling for scale. Deflation by the scale proxy has also been used as a control technique. Tables A.1 through A.4 of Appendix A report the H_1 results for the partitioned sample *Top 50% Based on Materiality of "D"* for Canada and Australia. Tables A.1 (Canada) and A.3 (Australia) report the results of the raw models while Tables A.2 (Canada) and A.4 (Australia) report the deflated models using the number of common shares outstanding as the deflator. Tables A.14 and A.15 report the H_2 results for the *Top 50% Based on Materiality of "D"* sample for Australia and Canada, respectively when deflated by the number of common shares outstanding.

Table A.1 reports a significant difference between the Adjusted R^2 of the two sets of GAAP. The Vuong Z statistic of 2.556 ($p = .005$) indicates that the difference is statistically significant. Consistent with H_1, the "Capitalising" GAAP is found to be more informative than the "As if expensed" GAAP. The coefficients on D_{it}, $b_2 = 29.613$ (White's $t = 3.196$), and ADJ_{it}, $b_4 = -46.113$ (White's $t = -2.173$), are of the same sign and

significance level as the general model. The deflated model, reported in A.2 indicates similar results. There is no change in the overall significance of the results.

Results reported for Australia in Table A.3 (raw) indicate that the coefficients on D_{it}, $b_2 = 1.363$ (White's $t = 8.000$), and ADJ_{it}, $b_4 = 2.194$ (White's $t = 2.214$), are positive and significant at the 1% and 5% level, respectively. The "Capitalising" GAAP is, once more, found to be "more informative" as indicated by the Vuong Z statistic of 3.736 ($p<.001$). Table A.4 reports similar findings for the deflated model.

Table A.14 indicates that, for the Canadian sample, the coefficient on OPD_{it} (40.633) remains significant at the 1% level. The coefficient on DEF_{it} (20.638), however, is no longer significant. The F statistic of 4.608 ($p = 0.038$, 1 and 43 d.f.) indicates that the difference between the coefficients on DEF_{it} and $CYEXP_{it}$ is still statistically significant. Table A.15 exhibits similar results for the Australian sample. The coefficient on DEF_{it} (5.053) remains significant at the 1% level. The F statistic of 2.917 ($p = 0.089$, 1 and 120 d.f.) is still significant though the significance level has decreased from 1% to 10%.

Overall the results appear to be robust to scaling choices. While individual coefficients are subject to variations in significance, the selection of alternative methods to control for scale appear to have no impact on the overall significance of the models.

7.6.2 Joint Canadian and Australian sample

Combining samples allows for the creation of a larger sample. The degrees of freedom will increase, relative to the individual samples[28]. The number of degrees of

[28] This assumes that autocorrelation is not significant enough to impact overall results (see section 7.6.3).

freedom impacts on the precision of the test statistics. Table A.5 of Appendix A reports the results of the full combined sample. Table A.6 reports the results of the partitioned sample. The sample was partitioned in a manner similar to that used for the individual company samples.

Consistent with the general empirical model, evidence from the full sample does not support H_1. There does not appear to be any separation in the Adjusted R^2 of the two sets of GAAP as indicated by the Vuong Z statistic of 1.046 (p =.148). The coefficient on, b_3 = 5.069, is positive and significant at the 5% level (White's t = 2.406). The coefficient on, b_5 = 1.106, is not significant (White's t = 0.319). Partitioning on the materiality of "D" results in a separation of the Adjusted R^2. The Vuong statistic of 4.207 ($p<.001$) indicates that the separation is statistically significant. The coefficient on, b_3 = 3.008, is significant at the 10% level (White's t = 1.827). The coefficient on, b_5 = 4.131, has become significant at the 10% level (White's t = 1.905). In both samples, the country coefficient is positive and significant. Overall the results are consistent with the individual country results.

7.6.3 Panel Data

A concern, as discussed in section 6.4.4, is that the number of degrees of freedom may be overstated if the observations are not independent. The number of degrees of freedom impacts on the precision of the standard error and, therefore, the t statistic. The significance being asserted by an inflated t statistic would not be warranted.

SHAZAM provides a POOL procedure that controls for serial correlation using a procedure developed by Kmenta (1986). In order to use the POOL procedure it is

necessary that the data be in panels (each firm has an equal number of time-series observations). In order to satisfy this data requirement, only a subset of the samples could be used. The Australian sample has 36 firms with 5 years of data resulting in a sample size of 180. A similar sample could *not be* created for the Canadian sample due to the small number of observations. A pooled regression, however, was performed on a sample of Canadian expensers to determine if serial correlation may be a factor in the Canadian population. Two comparisons are run for each sample. The first comparison allows the autoregressive parameter, rho, to be firm specific. That is, the disturbances between cross-sectional units are uncorrelated. Rho represents the autocorrelation between firm observations in time. Autoregressions are structured so that the influence of a given disturbance fades as it recedes into the more distant past but vanishes only asymptotically. The second comparison restricts rho to be the same across all observations in the entire sample. That is, cross-sectional correlation across units is allowed.

Table A.7 of Appendix A reports the results for the "Full" Australian sample with a firm specific rho. Each cross-sectional unit has a firm specific parameter. A comparison of the OLS procedure and the POOL procedure indicates that POOL inferences tend to be sharper than OLS. Panel A indicates that both procedures fail to distinguish between the Adjusted R^2 and Buse R^2 of the two sets of GAAP (OLS - .951 vs. .952, POOL - .879 vs. .881). Panel B indicates that those variables found to be significant in OLS are also significant in POOL.

Table A.8 of Appendix A reports the results for the "Top 50% sorted by Average Firm Materiality"[29]. Panel A indicates that partitioning on a materiality variable has the same impact on the POOL procedure as it does on the OLS procedure. The difference in the Buse R^2 (.845 vs. .715) is larger relative to the difference in the Adjusted R^2 in OLS (.880 vs. .822). Panel B indicates that no new variables become significant using the POOL procedure.

A similar analysis (unreported) was performed with the autoregressive parameter, rho, constrained to be the same across all observations in the POOL procedure. Similar to the above analysis, the results for the full sample do not indicate that there is a difference in the R^2 between the two sets of GAAP for either the OLS procedure or the POOL procedure. For the partitioned sample, a separation in the R^2 appears for both the OLS and POOL procedure. Coefficients that are significant in the OLS procedure are also significant in the POOL procedure. The results are consistent with the prior OLS-POOL comparison.

Table A.9 runs the OLS - POOL comparison on a sample of Canadian expensers. This model is a variation of the model used to test for the direct valuation effect in H_3 and is used to test whether the R&D outlay of expensers is valued by the market. The only adjustment required is to segregate the current year expenditure on R&D. This is done by adding the current year expense (CYEXP) back to net income and including it separately in the empirical specification. There is no need to adjust the closing book value of equity as expensers do not have a capitalised development asset. Consistent with the above

[29] In order to maintain the panel format it is necessary to implement a different sorting criterion. A 5 year average of firm materiality based on the deferred development cost / market capitalisation ratio was computed.

Australian comparisons, using the POOL procedure does not result in any OLS variable becoming insignificant and does not change inferences. Overall the POOL procedure gives better results than the OLS procedure. Restricting the autoregressive parameter, rho, to be the same across all cross-sectional units results in no increase in the Buse R^2 but results in the intercept coefficient, a_0 = -2.716, and the coefficient on CLBV, a_1 = 0.654, becoming significant at the 1% level (asymptotic *t*-ratio = 4.630 and 4.525 respectively). An interesting observation is that the coefficient on CYEXP, a_3, is positive and significant in all 3 models. A positive and significant coefficient provides evidence that market value is associated with direct R&D expenditures for expensers even though no amounts are capitalised.

The evidence would indicate that serial correlation is not driving the results. The inferences generated by OLS do not appear to be the result of serial correlation and appear to be plausible. Relying on the OLS estimates does not appear to invalidate inferences.

7.6.4 Alternate discount rates

The empirical specification used a common discount rate of 10%. Empirical tests were rerun (results unreported) using different discount rates ranging from 9% to 13%. For the Canadian sample only the tests were rerun using a firm specific cost of capital. The results (unreported) indicate that the overall significance of the models were not effected. The use of a single discount rate does not appear to invalidate the inferences of the model.

7.6.5 "Reduced" F&O and Barth (1994) specification

The condition index tests, discussed in section 6.4.3, indicated that a modest level of multicollinearity was present between some of the variables. The largest pairwise correlation occurs between D and ADJ in both the Canadian and Australian samples. The sensitivity tests, performed in this section, eliminate the ADJ variable from the F&O general model. In addition, a Barth (1994) motivated specification is used as an alternate procedure.

The "reduced" F&O model is as follows:

$$MV_{it} = a_0 + a_1 ADJCLBV_{it} + a_2 D_{it} + a_3 ABNI_{it} + a_4 NUMSHR_{it} + e \qquad (23)$$

MV_{it} = firm market value of common equity three months after fiscal year end
$ADJCLBV_{it}$ = book value of equity less preferred stock less closing book value of the capitalised development asset
D_{it} = closing book value of the capitalised development asset
$ABNI_{it}$ = abnormal net income = net income - [10% x (opening book value of equity)]
$NUMSHR_{it}$ = the number of common shares outstanding (scale proxy)
e_{it} = residuals, assumed to be independently and identically distributed

The results of the "reduced" models are reported in Table A.10. For the top 50% of firms, the coefficient on D, $a_2 = 17.215$, is significant at the 5% level (White's $t = 2.313$).

The Barth (1994) motivated specification utilises a balance sheet approach only. Any potential multicollinearity between D_{it} and ADJ_{it} is eliminated. The Barth[30] specification is as follows:

$$MV_{it} = a_0 + a_1 ADJCLBV_{it} + a_3 D_{it} + a_4 NUMSHR_{it} + e_{it} \qquad (24)$$

where:

MV_{it} = firm market value of common equity three months after fiscal year end

[30] Barth (1994) deflates the variables. To be consistent with results reported in this study, the scale proxy is included as a right hand side independent variable.

$ADJCLBV_{it}$ = closing book value of equity less preferred stock less closing book value of the capitalised development asset
D_{it} = closing book value of the capitalised development asset
$NUMSHR_{it}$ = the number of common shares outstanding (scale proxy)
e_{it} = residuals, assumed to be independently and identically distributed

Table A.10 reports the results for the Canadian sample. In the "reduced" full model, the coefficient on the capitalised development asset, a_2 = 11.422, is not significant (White's t = 1.335). The coefficient on the capitalised development asset in the partitioned model, a_2 = 17.215, is positive and significant at the 5% level (White's t = 2.313). The Barth (1994) specification shows similar results. In the full sample, the coefficient on the capitalised development asset, a_2 = 9.147, is insignificant (White's t = 1.189). In the partitioned sample, the coefficient on the capitalised development asset, a_2 = 14.827, is significant at the 5% level (White's t = 2.198).

Table A.11 reports the Australian results. For the "reduced" full model, the coefficient on the capitalised development asset, a_2 = 1.327, is significant at the 5% level (White's t = 2.116). For the partitioned sampled, the coefficient on the capitalised development asset, a_2 = 1.168, is also significant at the 5% level (White's t = 6.519). For the Barth (1994) specification, the coefficient on the capitalised development asset, a_2 = 0.783, is insignificant (White's t = 0.868). For the partitioned sample, the coefficient on the capitalised development asset, a_2 = 1.122 is significant at the 1% level (White's t = 6.660).

Overall, the results support the general findings. Capitalised development costs are value relevant when the sample is partitioned on materiality.

7.6.6 "Reduced" Canadian sample

The discussion of the Canadian descriptive statistics, in section 6.4.1, indicates that a number of potential outliers remain in the Canadian sample. An analysis of the Australian sample does not indicate that potential outliers remains a problem. Reported results are plausible. Therefore this sensitivity test was not run on the Australian sample. The top and bottom 5% of the sample was removed (10 observations in total) in an attempt to purge their influence. The maximum observation of *Market capitalisation* of the "reduced" distribution has decreased to $545,000,000 from the maximum observation of $5,695,692,000 in the full model. The maximum observation of *After tax net income* has also decreased from $202,864,000 to $126,550,000.

The results of the H_1 tests on the "Reduced" model before partitioning, though not reported, do not significantly change from the results reported on Table 3. Results of the H_1 tests on the "Reduced" partitioned sample are reported in Table A.12. Consistent with the model reported on Table 4, there is a significant separation in the Adjusted R^2 between the two sets of GAAP. In Panel B, the coefficient on D_{it}, $b_2 = 9.754$ (White's $t = 4.789$), has decreased dramatically from the result reported on Table 4 where $b_2 = 27.157$ (White's $t = 3.098$). In both tests, however, the coefficient is significant at the 1% level. The coefficient on ADJ_{it}, $b_4 = 3.004$ (White's $t = 0.648$), is insignificant. This coefficient has also changed dramatically from the result reported on Table 4 where $b_4 = -35.749$ (White's $t = -2.560$) where it was significant at the 1% level.

The H_2 tests were rerun on the "Reduced" sample as the coefficients in the original test seemed unusually high. Though not reported, results for tests of H_2 before partitioning are qualitatively the same as in Table 7 Panel A. Table A.13 reports the

results for H_2 of the "Reduced" partitioned sample. The coefficient on DEF, a_3 = 12.312 (White's t = 3.129) is smaller that the coefficient reported in Panel B of Table 7 where, a_3 = 22.381 (White's t = 1.884). The significance level has changed from the 5% to the 1% level. The coefficient on CYEXP, a_6 = -0.040 (White's t = -0.036) has decreased from the result reported in Panel B of Table 7 where a_6 = -7.746 (White's t = -1.322). In both tests the coefficient is insignificant. The F test, in the reduced sample, has increase to 25.914 ($p<0.001$ with 1 and 37 d.f.) from 8.125 ($p<0.007$ with 1 and 42 d.f.) in the original partitioned sample. An analysis of the condition indexes (not reported) indicates that the maximum condition index has decreased to 28.940 from 79.025. Further, the Spearman pairwise correlation (unreported) between DEF and CYEXP has decreased to .127 from .270 in the original test.

The results of the partitioned "Reduced" sample are consistent with deferred development costs being positively associated with market value. The elimination of the top 5% and bottom 5% of observations indicates that, though the original test observations passed the Belsley, Kuh and Welsch (1980) filtering procedure, one or a number of large observations still exist. The elimination of these observations has resulted in more plausible coefficients being reported. The overall conclusions of H_1 and H_2, however, remain unchanged.

7.6.7 Interactive BETA covariate

Section 7.5.1 identified a number of variables that may impact on a firm's decision to capitalise or expense development costs. It appears that capitalising and expensing firms differ in terms of risk, leverage and size. These variables were included in empirical

tests as covariates in order isolate these effects on the capitalisation decision. Equation 20 adds the covariates in a linear manner. An alternate approach would be to introduce the covariates into the model in an interactive fashion, consistent with Bandyophadhyay (1994). The results of equation 20 (not reported) when BETA enters the model interactively do not alter the inferences for the Canadian (Australian) samples reported on Table A.13 (Table A.14).

7.6.8 Other sources of conservatism

Ahmed, Morton and Schaefer (1997) analyse the impact of four conservatism proxies on the valuation of accounting numbers. This study assumes that R&D is the largest source of conservatism and that most of the accounting conservatism is controlled for by adding back the R&D expense to earnings to arrive at a pre-R&D earnings number. Other forms of conservatism, however, may still exist.

The proxy variables; ratio of R&D expenditures to sales, ratio of advertising expense to sales and LIFO inventory valuation were not analysed. As discussed above, conservatism relating to R&D was controlled for by added the R&D expenditure back to earnings. All the Canadian financial reports were examined and not one firm disclosed advertising expenses making it impossible to examine the ratio of advertising expense to sales proxy variable. LIFO inventory valuation is not allowed under the Canadian Income Tax Act making it unlikely that any firms would adopt this policy. An examination of the financial statements did not find any firms that disclosed the use of this valuation method. Therefore the accelerated depreciation proxy was the only additional conservatism proxy that could be examined.

Accelerated depreciation understates current earnings and asset values and thus result in more conservatively reported operating assets relative to alternate methods. The accounting policy note of the Canadian financial statements were examined to determine a firm's depreciation policy. Of the 29 Canadian firms in the sample, 15 reported an accelerated depreciation policy. The remaining 14 firms reported depreciation on a straight line basis.

Equation 9 was rerun, for the Canadian sample, including the dummy variable DEP. DEP = 1 if the firm uses an accelerated depreciation policy, otherwise DEP = 0. Table A.16 reports the results of equation 9 with and without DEP for the Top 50% of the sample. The coefficient on DEP (-2.480), though not of the expected sign, is negative and significant at the 5% level (White's t = -1.435). More importantly, however, is that the variables of interest, D and ADJ, still remain significant. The coefficient on b_4 increases in significance from the 5% level to the 1% level. The analysis shows that even though other sources of conservatism may still be present and significant, these sources do not appear to be driving the results.

7.7 Chapter summary

Overall the multivariate results indicate that the selective capitalisation of development costs is value-relevant. Empirical results are consistent with the hypothesis that deferred development costs are associated with market value and with the hypothesis that, for capitalisers, the market values a dollar of deferred outlay more than a dollar of expensed outlay. The evidence supports H_1 and H_2 only when the samples are partitioned

on materiality. This indicates that for some firms, the capitalised amounts must be material enough to capture the market's attention. The evidence is consistent between Canada and Australia. Furthermore, the results are robust to numerous sensitivity checks.

Overall, the results do not support H_3. H_3 predicts that the valuation coefficient will be larger for capitalisers than expensers. The data do not support this prediction. For the full Canadian sample the coefficient is larger (as hypothesised) but the result is not robust to the partitioned Canadian sample. For the Australian sample, the coefficient is either not significant (full sample) or significant but lower than the corresponding coefficient for Australian expensers. As discussed earlier, inferences may be confounded by the inability to control for industry membership which results in the violation of the *ceteris paribus* assumption.

The results on the full Canadian and the partitioned Australian sample do indicate, however, that the market values the current year R&D outlay of expensers. These results provide evidence that the R&D outlays of expensers are valued by the market even though the amounts are immediately expensed in the year. Though this specification is not comparable to that of Sougiannis (1994) it does provide interesting additional evidence and calls into question the current U.S. policy of immediate expensing of all R&D outlays (consistent with similar conclusions of Lev and Sougiannis (1996)).

CHAPTER 8

Summary and Conclusions

8.1 Summary

The purpose of this thesis has been to provide evidence that the market is capable of determining value from the manager's selective capitalisation of deferred development costs. An existing model, the Feltham and Ohlson (1996) valuation model, is used to determine the association between market value, book value of equity, abnormal earnings and selected R&D variables. Research on value-relevance shows that the market is capable of valuing intangible assets, particularly R&D (Lev and Sougiannis 1994; Sougiannis 1996; Aboody and Lev 1998; Chambers, Jennings and Thompson II 1998; Deng and Lev 1998).

Two views as to the association between market value and capitalised development costs are opposed. The voluntary disclosure or efficient signalling perspective suggests that managers capitalise development costs in an effort to reduce information asymmetry. Managers have inside information as to the expected future benefits of R&D projects undertaken by the firm and wish to communicate this information to the market. The managerial opportunism perspective suggests that there will be no association between market value and capitalised development costs if the market perceives that managers capitalise development costs in order to maximise their own utility or for opportunistic earnings management purposes.

Empirical results are consistent with the voluntary disclosure hypothesis. Market value is positively associated with capitalised development costs when the sample has been partitioned on materiality. Materiality is defined as the ratio of capitalised development costs to total market value. Furthermore, the results are robust to numerous sensitivity checks.

The findings also confirm previous results of a number of U.S. studies. Results are consistent with Aboody and Lev (1998) who examine the value-relevance of capitalised software development costs. Lev and Sougiannis (1996), Sougiannis (1994) and Chambers et al (1998), using a synthesised R&D asset, find the asset to be value-relevant. This finding further supports the assertion that capitalised development costs can be and are valued by the market.

Although other studies have examined the association between market value and R&D expenditures, this is one of the first studies to examine the association in a Canadian and Australian setting and to address the issue of manager's selective capitalisation of R&D related development costs. Previous U.S. studies investigate the association between market value and a researcher synthesised R&D asset. The United States standard, SFAS #2, mandates the immediate expensing of all R&D expenditures, other than certain software costs, in the current year. Researchers using U.S. data must therefore create the R&D asset. This study provides incremental value to the Chambers et al study as it incorporates the actual D, as determined by managers, as opposed to the synthetic D created by the researchers. The use of a synthetic D may not accurately reflect the markets response to managerial actions as it is a proxy subject to measurment

error. Only one U.S. study, Aboody and Lev (1998), examines the value relevance of development costs which have been capitalised by the manager. Furthermore, the theory and methodology suggested in this study are not limited to the selective capitalisation of development costs. The approach adopted can be applied to the selective capitalisation of various intangibles that affect market value.

This study should be useful in the ongoing debate on allowing managers choice in their selection of accounting policies, particularly on whether managers will use this discretion to engage in earnings manipulation. The rejection of the H_1 and H_2 null hypotheses tells regulators that despite the potential for manipulation the market values the asset placed on the balance sheet by the manager. Since regulatory bodies like the Ontario Securities Commission , the Australian Securities Commission, and the International Accounting Standards Committee and various users of financial information are interested in how R&D is accounted for and disclosed, research of this nature should be useful.

This study has employed a two sample design in order to enhance external validity. With a relatively small sample size for both Canada and Australia, uncertainty arises as to whether reported results reflect the underlying economic conditions or whether they reflect the limited number of observations. Therefore, to generalise either the Canadian or Australian results by themselves across different populations may not be warranted. It was a point of research design to include two independent samples to mitigate the problems caused by small samples. The use of two independent samples allows for stronger inferences for results that are robust across both samples.

8.2 Limitations

As in any type of empirical study, there are limitations to take into account when interpreting the results. One limitation relates to the validity of causal inferences. The theory states that managers capitalise development costs as a means of disclosing their inside information. If the capitalisation is the source of new information and there will be an *association* between share price and capitalised development costs. However, *causation* cannot be inferred as this study does not employ event study methodology. If there is no new information to the market from the capitalisation of deferred development costs, there can still be an association between share price and capitalised development costs. This is because capitalised development costs may be correlated with information already being used by investors. It cannot be inferred, from association tests, that that the capitalisation of deferred development costs *is the source* of new information to the market. Results for H_1 and H_2, however, are generally supportive of the arguments developed in this study.

8.3 Directions for future research

A most interesting area of research suggested by this study is pertaining to information already used by the market in determining value. Test one of hypothesis one examines the relative information content of two alternate sets of GAAP, one which allow for selective capitalisation and the other which mandates the immediate expensing of all current period outlays. As discussed in section 8.2, a limitation of this study recognises that the positive association may be caused by the capitalised development costs being associated with other information already being used by investors. Future research could identify what other sources of information the market uses in determining value. A synthetic asset could be created based on this other information. The relative comparison would then be between the actual capitalised development costs and the synthetic asset.

Table 1

Canadian Capitalisers

Panel A - Full Sample

Summary statistics on distribution of variables used

Number of observations (firm year) = 99

Variables	Mean (000's)	Std. Dev (000's)	1st Quartile (000's)	Median (000's)	3rd Quartile (000's)	Max (000's)	Min (000's)
Total assets	119,393	168,411	25,186	52,049	148,128	1,093,417	2,329
Capitalized development costs	4,946	8,414	515	2,125	6,840	69,069	86
Adjusted total assets (Total assets less capitalised development costs)	114,447	163,812	21,923	46,498	140,122	1,075,132	2,229
Market capitalization	360,113	970,730	31,835	55,906	220,014	5,695,692	1,829
Capitalized development costs as a percentage of market capitalization	5.37%	9.46%	1.17%	2.79%	5.76%	75.47%	0.03%
Book value of equity (Shareholder's equity less book value of pref)	68,346	124,025	13,460	34,442	75,863	902,686	19
Adjusted book value of equity (Book value of equity less deferred development costs)	63,400	121,214	11,686	31,894	65,817	884,401	-517
Leverage (Long term debt / adjusted book value of equity)	19.25%	122.93%	0.00%	5.77%	33.92%	919.47%	0.00%
Beta (Monthly)	0.7123	0.9369	0.6880	1.2690	1.7330	4.3920	-1.3660
R&D intensity (Current year investment in R&D / Sales)	23.61%	51.39%	3.01%	9.16%	16.07%	296.66%	0.00%
Net income after tax (Before extraordinary items)	8,005	39,186	-3,239	542	6,009	202,864	-71,109
Net income adjustment (Amortization less current year build up)	-973	2,967	-1,685	-492	2	7,835	-12,532
Adjusted net income (As if an expenser)	7,032	38,933	-4,479	-118	5,644	199,111	-60,436

Table 1

Canadian Capitalisers

Panel B - Top 50% Based on Materiality of "D"

Summary statistics on distribution of variables used

Number of observations (firm year) = 50

Variables	Mean (000's)	Std. Dev (000's)	1st Quartile (000's)	Median (000's)	3rd Quartile (000's)	Max (000's)	Min (000's)
Total assets	105,913	113,154	32,356	72,770	125,876	579,391	2,329
Capitalized development costs	7,143	10,654	1,715	5,378	7,651	69,069	100
Adjusted total assets (Total assets less capitalised development costs)	98,770	105,351	27,813	69,485	118,170	510,332	2,229
Market capitalization	141,676	274,399	35,148	49,580	183,112	1,816,711	1,829
Capitalized development costs as a percentage of market capitalization	9.54%	11.96%	3.78%	5.76%	9.19%	75.47%	2.79%
Book value of equity (Shareholder's equity less book value of pref)	48,289	43,661	17,704	35,243	58,304	167,518	19
Adjusted book value of equity (Book value of equity less deferred development costs)	40,822	39,329	14,120	27,707	50,762	156,358	-517
Leverage (Long term debt / adjusted book value of equity)	20.89%	170.75%	0.00%	10.66%	37.51%	919.47%	0.00%
Beta (Monthly)	0.6089	0.7675	0.2630	1.1025	1.4868	2.4610	-1.3660
R&D intensity (Current year investment in R&D / Sales)	18.30%	42.45%	3.29%	10.10%	14.66%	296.67%	0.00%
Net income after tax (Before extraordinary items)	225	25,546	-6,599	575	5,060	128,550	-71,109
Net income adjustment (Amortization less current year build up)	-1,653	3,158	-2,756	-1,198	-380	4,590	-12,532
Adjusted net income (As if an expenser)	-1,628	25,379	-7,500	-643	3,251	126,681	-80,436

Table 1

Canadian Capitalisers

Panel C - Correlation Matrices

Variables used in the incremental test of H_1

	ADJCLBV	D	ADJABNI	ADJ
ADJCLBV	1.000			
D	0.533	1.000		
ADJABNI	0.103	0.034	1.000	
ADJ	0.071	0.569	0.064	1.000
Condition Indexes	1.000	12.942	23.857	94.901

ADJCLBV = *Closing book value of equity less preferred shares less closing deferred development costs*

D = *Closing deferred development costs*

ADJABNI = *(Net income + current period amortisation of deferred development costs - current period expenditures on development costs that were capitalised) - (10% x opening book value of equity)*

ADJ = *Current period amortisation of deferred development costs - current period expenditures on development costs that were capitalised*

Variables used in the testing of H_2

	ADJCLBV	OPD	DEF	ADJABNI*	CYEXP	AMORT
ADJCLBV	1.000					
OPD	0.514	1.000				
DEF	0.250	0.243	1.000			
ADJABNI*	0.532	0.338	0.361	1.000		
CYEXP	0.619	0.479	0.270	0.324	1.000	
AMORT	0.269	0.285	0.573	0.262	0.432	1.000
Condition Indexes	1.000	6.699	17.348	23.578	49.573	79.025

ADJCLBV = *Closing book value of equity less preferred shares less capitalised development costs*

OPD = *Capitalised development costs that remain at the end of the fiscal period*

DEF = *Current year expenditures on development costs that have been capitalised*

*ADJABNI** = *(Net income + CYEXP + AMORT) - (10% x opening book value of equity)*

CYEXP = *Current year expenditures of R&D that were expensed in the current period*

AMORT = *Current year amortisation of opening capitalised development costs*

Table 2

Australian Capitalisers

Panel A - Full Sample

Summary statistics on distribution of variables used

Number of observations (firm year) = 253

Variables	Mean (000's)	Std. Dev (000's)	1st Quartile (000's)	Median (000's)	3rd Quartile (000's)	Max (000's)	Min (000's)
Total Assets	487,970	326,744	16,820	58,470	224,297	7,669,900	345
Capitalised development costs	6,539	99	148	651	3,059	221,225	0
Adjusted total assets (Total assets less capitalised development costs)	481,582	326,844	15,680	56,595	217,536	7,659,500	204
Market capitalisation	455,504	350,343	11,844	38,610	181,738	9,604,515	28
Capitalized development costs as a percentage of market capitalisation	9.06%	359.68%	0.14%	2.14%	5.84%	508.67%	0.00%
Book value of equity (Shareholder's equity less book value of pref)	239,221	176,906	9,289	28,518	118,534	4,474,300	748
Adjusted book value of equity (Book value of equity less deferred development costs)	233,729	177,005	8,420	26,422	111,083	4,463,900	-126,682
Leverage (Long term debt / adjusted book value of equity)	24.62%	79.92%	0.00%	8.03%	34.73%	393.15%	-327.39%
Beta (Monthly)	0.9193	0.4420	0.5088	0.9038	1.2758	2.9872	-0.4651
R&D Intensity (Current year investment in R&D / Sales)	10.00%	22.32%	0.29%	1.22%	7.94%	279.03%	0.00%
Net income after tax (Before extraordinary items)	13,202	17,375	-860	1,276	6,493	389,900	-144,094
Net income adjustment (Amortization less current year build up)	-600	83	-549	-21	81	194,612	-41,527
Adjusted net income (As if an expense)	12,349	17,457	-1,343	586	5,192	383,600	-144,094

Table 2

Australian Capitalisers

Panel B - Top 50% Based on Materiality of "D"

Summary statistics on distribution of variables used

Number of observations (firm year) = 127

Variables	Mean (000's)	Std. Dev (000's)	1st Quartile (000's)	Median (000's)	3rd Quartile (000's)	Max (000's)	Min (000's)
Total Assets	180,323	10,209	14,306	28,982	79,580	6,744,805	345
Closing capitalised development costs	10,815	98	500	1,289	5,620	221,225	23
Adjusted total assets (Total assets less closing capitalised development costs)	169,508	10,111	11,928	26,074	75,227	6,616,739	204
Market capitalisation	133,192	9,184	8,555	18,737	49,329	5,111,950	28
Closing capitalized development costs as a percentage of market capitalisation	17.55%	358.1685	3.40%	5.84%	13.66%	508.67%	2.14%
Closing book value of equity (Shareholder's equity less book value of pref)	82,559	4,452	8,166	15,459	43,271	2,368,696	748
Adjusted book value of equity (Book value of equity less deferred development costs)	71,743	4,354	6,623	13,860	35,504	2,240,630	-126,682
Leverage (Long term debt / adjusted book value of equity)	17.46%	71.98%	0.00%	5.09%	20.45%	272.03%	-94.72%
Beta (Monthly)	0.9020	0.0398	0.3511	0.8780	1.3008	2.9872	-0.3886
Development Intensity (Current year investment in R&D / Sales)	16.46%	22.87%	0.77%	3.31%	15.32%	279.03%	0.00%
Net income after tax (Before extraordinary items)	1,628	1,534	-933	396	2,146	303,494	-144,094
Net income adjustment (Amortization less current year build up)	-2,274	34	-929	-160	57	29,202	-41,527
Adjusted net income (As if an expenser)	-695	1,500	-1,840	77	1,104	282,007	-144,094

Table 2

Australian Capitalisers

Panel C - Correlation Matrices

Variables used in the incremental test of H_1

	ADJCLBV	D	ADJABNI	ADJ
ADJCLBV	1.000			
D	0.293	1.000		
ADJABNI	-0.112	-0.132	1.000	
ADJ	0.189	0.548	-0.085	1.000
Condition Indexes	1.000	12.942	23.857	94.901

ADJCLBV = *Closing book value of equity less preferred shares less closing deferred development costs*

D = *Closing deferred development costs*

ADJABNI = *(Net income + current period amortisation of deferred development costs - current period expenditures on development costs that were capitalised) - (10% x opening book value of equity)*

ADJ = *Current period amortisation of deferred development costs - current period expenditures on development costs that were capitalised*

Variables used in the testing of H_2

	ADJCLBV	OPD	DEF	ADJABNI*	CYEXP	AMORT
ADJCLBV	1.000					
OPD	0.161	1.000				
DEF	0.177	0.294	1.000			
ADJABNI*	0.077	0.093	0.074	1.000		
CYEXP	0.442	0.068	0.102	0.135	1.000	
AMORT	0.022	0.241	0.374	0.141	0.028	1.000
Condition Indexes	1.000	13.898	23.269	70.795	113.100	134.060

ADJCLBV = *Closing book value of equity less preferred shares less capitalised development costs*

OPD = *Capitalised development costs that remain at the end of the fiscal period*

DEF = *Current year expenditures on development costs that have been capitalised*

*ADJABNI** = *(Net income + CYEXP + AMORT) - (10% x opening book value of equity)*

CYEXP = *Current year expenditures of R&D that were expensed in the current period*

AMORT = *Current year amortisation of opening capitalised development costs*

Table 3

Relative and Incremental Information Tests
Canadian Capitalisers: Full Sample

Raw data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

Panel A: Comparison of alternative GAAP

$$Markvet\ value = a_0 + a_1\ CLBV + a_2\ ABNI + a_3\ NUMSHR + e_i$$

n = 99		a_0	a_1	a_2	a_3	Adj. R^2
Current GAAP	coefficient[a]	-4.291 ***	1.818	4.188	38.275 ***	0.791
"D" capitalised	White's t-statistic[b]	(-3.867)	(1.559)	(1.315)	(3.101)	
"As if" GAAP	coefficient[a]	-4.423 ***	2.409	3.657	39.028 ***	0.788
All R&D expensed	White's t-statistic[b]	(-3.794)	(1.483)	(1.153)	(3.197)	

Ratio of Adj R_2 = 1.004
Vuong's Z statistic **0.810** p= **0.209**

Current GAAP - "D" capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (10% x opening book value of equity)
NUMSHR	= Number of common shares outstanding (scale proxy)

"As if" GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares (scale proxy)

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1 ADJCLBV + b_2\ D\ + b_3\ ADJABNI + b_4\ ADJ + b_5\ NUMSHR + e_i$$

n = 99	b_0	b_1	b_2	b_3	b_4	b_5	Adj. R^2
coefficient[a]	-4.389 ***	1.683	19.123 **	5.849 *	-24.739	36.801 ***	0.796
White's t-statistic[b]	(-3.779)	(1.029)	(2.105)	(1.816)	(-1.327)	(3.086)	

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Current period capitalised development costs - amortisation of opening development costs
NUMSHR	= Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0 and b_0 are divided by 10^6.
b) Significance levels (two-tailed): *** <0.01, **<0.05, *<0.10.

Table 4

Relative and Incremental Information Tests
Canadian Capitalisers: Top 50% Based on Materiality of "D"

Raw data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)
Top 50 firm year observations sorted by the ratio - Capitalised development costs / Market capitalization

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + +a_3\ NUMSHR + e_i$$

n = 50		a_0	a_1	a_2	a_3	Adj. R^2
Current GAAP	coefficient[a]	-2.854 ***	5.921 ***	1.872	16.305 ***	0.599
"D" capitalised	White's *t*-statistic[b]	(-3.193)	(3.266)	(0.386)	(3.009)	
"As if" GAAP	coefficient[a]	-2.918 ***	6.440 ***	0.345	16.961 ***	0.544
All R&D expensed	White's *t*-statistic[b]	(-3.093)	(3.501)	(0.052)	(3.263)	

Ratio of Adj R_2 = 1.101
Vuong's Z statistic = 2.651 **p = 0.004**

Current GAAP - "D" capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
ABNI	= Net income - (10% x opening book value of equity)
NUMSHR	= Number of common shares outstanding (scale proxy)

"As if" GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less capitalised R&D asset
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding (scale proxy)

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1 ADJCLBV + b_2 D + b_3\ ADJABNI + b_4\ ADJ + b_5\ NUMSHR + e_i$$

n = 50	b_0	b_1	b_2	b_3	b_4	b_5	Adj. R^2
coefficient[a]	-1.977 ***	3.095 **	27.157 ***	8.447 **	-35.749 **	15.411 ***	0.687
White's *t*-statistic[b]	(-3.099)	(2.421)	(3.098)	(2.090)	(-2.560)	(4.124)	

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Current period capitalised development costs - amortisation of opening development costs
NUMSHR	= Number of common shares outstanding (Scale proxy)

a) For the sake of presentation, a_0 and b_0 is divided by 10^5.
b) Significance levels (two-tailed): *** <0.01, **<0.05, *<0.10.

Table 5

Relative and Incremental Information Tests
Australian Capitalisers: Full Sample

Raw data with scale proxy as independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + a_3\ NUMSHR + e_i$$

n = 253		a_0	a_1	a_2	a_3	Adj. R^2
Current GAAP	coefficient	-1.909 **	1.991 *	3.704 *	0.261	0.968
"D" capitalised	White's *t* statistic	(-2.167)	(15.8500)	(4.7270)	(1.6270)	
As if GAAP	coefficient	-1.515 **	1.935 *	3.578 *	0.436 *	0.967
All R&D expensed	White's *t* statistic	(-1.751)	(14.940)	(4.491)	(2.699)	

Ratio of Adj R_2 =	1.001		
Vuong's Z statistic	**1.218**	**p =**	**0.112**

Current GAAP - "D" capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (10% x opening book value of equity)
NUMSHR	= Number of common shares outstanding

As if GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1 ADJCLBV + b_2\ D + b_3\ ADJABNI + b_4\ ADJ + b_5\ NUMSHR + e_i$$

n=253	b_0	b_1	b_2	b_3	b_4	b_5	Adj. R^2
coefficient	-1.744 ***	1.978 *	1.471 **	3.703 *	1.735	0.311 **	0.968
White's *t* statistic	(-1.959)	(15.430)	(2.449)	(4.652)	(0.956)	(1.970)	

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding

a) For the sake of presentation, a_0 and b_0 are divided by 10^7.
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 6

Relative and Incremental Information Tests
Australian Capitalisers: Top 50% Based on Materiality of "D"

Raw data with scale proxy as independent variable
Sacle proxy - the number of common shares outstanding (NUMSHR)
Top 127 firm year observations (50%) sorted by the ratio - Capitalised development costs / market capitalisation

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + a_3\ NUMSHR + e_i$$

n = 127		a_0	a_1	a_2	a_3	Adj. R^2
Current GAAP	coefficient[a]	-0.630	1.198 ***	0.701 *	0.264 ***	0.906
"D" capitalised	White's *t* statistic[b]	(-1.629)	(8.413)	(1.861)	(3.855)	
"As if" GAAP	coefficient[a]	-1.097 **	1.117 ***	0.406	0.562 ***	0.867
All R&D expensed	White's *t* statistic[b]	(-2.294)	-4.751	-1.390	-2.916	

Ratio of Adj R^2 = 1.045
Vuong's Z statistic = 3.081 **p = .001**

Current GAAP - "D" capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (10% x Opening book value of equity)
NUMSHR	= Number of common shares outstanding

As if GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less capitalised development asset
ADJABNI	= (Net income + ADJ) - (10% x opening book value)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding

Panel B: Incremental Analysis

$$Market\ Value = b_0 + b_1 ADJCLBV + b_2\ D + b_3\ ADJABNI + b_4\ ADJ + b_5\ NUMSHR + e_i$$

n= 127	b_0	b_1	b_2	b_3	b_4	b_5	Adj. R^2
coefficient[a]	-0.678 *	1.152 ***	1.108 ***	0.581	2.246 **	0.249 ***	0.911
White's *t* statistic[b]	(-1.710)	(7.828)	(5.987)	(1.579)	(2.323)	(3.277)	

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding

a) For the sake of presentation, a_0 and b_0 are divided by 10^7.
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 7

Tests of H_2
Canadian Capitalisers: Full Sample

Rawa data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

Panel A		*n* = 99							**Adj R^2**
Eq. 10	*CONSTANT*	*CLBV*						*NUMSHR*	0.811
coefficients[a]	-4.214 ***	3.254 ***						31.880***	
White's t statistic[b]	(-3.557)	(3.553)						(2.766)	
Eq. 11	*CONSTANT*	*ADJCLBV*	*D*					*NUMSHR*	0.811
coefficients[a]	-4.360 ***	3.155 ***	9.1469					31.407**	
White's t statistic[b]	(-3.715)	(3.489)	(1.189)					(2.697)	
Eq. 12	*CONSTANT*	*ADJCLBV*	*D*		*ABNI*			*NUMSHR*	0.812
coefficients[a]	-4.194 ***	2.542 **	11.422		2.6492			31.632***	
White's t statistic[b]	(-3.657)	(2.462)	(1.335)		(1.067)			(2.744)	
Eq. 13	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI*			*NUMSHR*	0.812
coefficients[a]	-4.111 ***	2.464 **	22.395	-1.426	2.9254			32.033***	
White's t statistic[b]	(-3.645)	(2.311)	(1.647)	(-0.098)	(1.050)			(2.767)	
Eq. 14	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI**	*AMORT*	*CYEXP*	*NUMSHR*	0.819
coefficients[a]	-3.853 ***	3.647 ***	27.554 **	-25.415	2.9502	42.074 **	-15.353	30.482***	
White's t statistic[b]	(-3.890)	(3.682)	(2.062)	(-1.355)	(1.080)	(2.414)	(-1.571)	(2.709)	

F test = 0.414 p = 0.522 with 1 and 91 D.F.
F test is on the restriction a_3 (DEF) - a_6 (CYEXP) > 0

CLBV — *Closing book value of equity less book value of preferred stock*
ADJCLBV - *Closing book value of equity less book value of preferred stock less deferred development costs*
D - *Closing book value of deferred development costs*
OPD - *Unamortised closing book value of deferred development costs which existed at the beginning of the period*
DEF - *Current period capitalised expenditures (deferred development costs)*
NUMSHR - *Number of common shares outstanding (scale proxy)*
ABNI - *Abnormal income unadjusted for effects of R&D = Net income - (10% x opening book value of equity)*
*ABNI** - *Abnormal income adjusted for effects of R&D*
AMORT - *Current period amortisation expense*
CYEXP - *Current period expenditures not capitalised*

Abnormal income = Net income - (10% x opening book value of equity)

a) For the sake of presentation, a_0 is divided by 10^5
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 7

Tests of H_2

Canadian Capitalisers: Top 50% Based on the Materiality of "D"

Rawa data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

Panel B	*n=50*								**Adj R^2**
Eq. 10	*CONSTANT*	*CLBV*						*NUMSHR*	0.499
coefficients[a]	-2.483 ***	3.846 ***						17.036**	
White's t statistic[b]	(-2.746)	(4.434)						(2.666)	
Eq. 11	*CONSTANT*	*ADJCLBV*	*D*					*NUMSHR*	0.560
coefficients[a]	-2.326 **	2.496 **	14.827 **					16.294**	
White's t statistic[b]	(-2.369)	(1.922)	(2.198)					(2.425)	
Eq. 12	*CONSTANT*	*ADJCLBV*	*D*		*ABNI*			*NUMSHR*	0.583
coefficients[a]	-2.162 **	1.502	17.215 **		3.187			17.998 **	
White's t statistic[b]	(-2.643)	(1.254)	(2.313)		(0.800)			(2.463)	
Eq. 13	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI*			*NUMSHR*	0.696
coefficients[a]	-1.722 **	2.629 **	61.171 ***	29.286 **	6.546 **			16.277 ***	
White's t statistic[b]	(-2.614)	(2.080)	(4.596)	(1.929)	(1.840)			(2.938)	
Eq. 14	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI**	*AMORT*	*CYEXP*	*NUMSHR*	0.755
coefficients[a]	-1.477 ***	1.0345	56.595 ***	22.381 **	9.692 **	-8.728	-7.746	11.954 ***	
White's t statistic[b]	(-2.870)	(0.751)	(4.730)	(1.884)	(2.646)	(-0.6593)	(-1.322)	(2.873)	

F test = 8.125 p = 0.007 with 1 and 42 d.f.
F test is on the restriction a_3 (DEF) - a_8 (CYEXP) > 0

CLBV — *Closing book value of equity less book value of preferred stock*
ADJCLBV - *Closing book value of equity less book value of preferred stock less deferred development costs*
D - *Closing book value of deferred development costs*
OPD - *Unamortised closing book value of deferred development costs which existed at the beginning of the period*
DEF - *Current period capitalised expenditures (deferred development costs)*
NUMSHR - *Number of common shares outstanding (scale proxy)*
ABNI - *Abnormal income unadjusted for effects of R&D*
*ABNI** - *Abnormal income adjusted for effects of R&D*
AMORT - *Current period amortisation expense*
CYEXP - *Current period expenditures not capitalised*

Abnormal income = *Net income - (10% x opening book value of equity)*

a) For the sake of presentation, a_0 is divided by 10^5
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 8

Tests of H_2
Australian Capitalisers: Full Sample

Raw data with scale proxy as independent variabe
Scale proxy - number of common shares outstanding (NUMSHR)

Panel A	***n =253***								**Adj R^2**
Eq. 10	*CONSTANT*	*CLBV*						*NUMSHR*	
coefficients[a]	-0.249	1.993 ***						-0.254	0.950
White's t statistic[b]	(-0.158)	(9.764)						(-0.761)	
Eq. 11	*CONSTANT*	*ADJCLBV*	*D*					*NUMSHR*	0.950
coefficients[a]	-0.095	1.969 ***	0.783					-0.168	
White's t statistic[b]	(-0.062)	(9.451)	(0.868)					(-0.470)	
Eq. 12	*CONSTANT*	*ADJCLBV*	*D*		*ABNI*			*NUMSHR*	0.968
coefficients[a]	-1.811 **	1.977 ***	1.327 **		3.672 ***			0.303 **	
White's t statistic[b]	(-2.046)	(15.420)	(2.116)		(4.623)			(1.914)	
Eq. 13	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI*			*NUMSHR*	0.968
coefficients[a]	-1.614 **	1.979 ***	1.636 **	-1.203	3.689 ***			0.316 **	
White's t statistic[b]	(-1.666)	(15.370)	(2.407)	(-0.4391)	(4.686)			(1.999)	
Eq. 14	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI**	*AMORT*	*CYEXP*	*NUMSHR*	0.968
coefficients[a]	-1.699 **	1.993 ***	1.653 **	-1.123	3.850 ***	-2.874	-0.999	0.254 **	
White's t statistic[b]	(-1.724)	(15.860)	(2.440)	(-0.453)	(4.597)	(-1.094)	(-0.579)	(1.753)	

F test = 0.002 p= 0.966 with 1 and 245 d.f.

F test is on a_3 (coefficient on DEF) - a_6 (coefficient on CYEXP) > 0

CLBV - *Closing book value of equity less book value of preferred stock*
ADJCLBV - *Closing book value of equity less book value of preferred stock less deferred development costs*
D - *Closing book value of deferred development costs*
OPD - *Unamortised closing book value of deferred development costs which existed at the beginning of the period*
DEF - *Current period capitalised expenditures (deferred development costs)*
NUMSHR - *Number of common shares outstanding (scale proxy)*
ABNI - *Abnormal income unadjusted for effects of R&D*
*ABNI** - *Abnormal income adjusted for effects of R&D*
AMORT - *Current period amortisation expense*
CYEXP - *Current period expenditures not capitalised*

Abnormal income = *Net income - (10% x opening book value of equity)*

a) For the sake of presentation, a_0 is divided by 10^7

b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 8

Tests of H_2

Australian Capitalisers: Top 50% Based on Materiality of "D"

Raw data with scale proxy as independent variabe
Scale proxy - number of common shares outstanding (NUMSHR)

Panel B	***n =127***								Adj R^2
Eq. 10	*CONSTANT*	*CLBV*						*NUMSHR*	0.894
coefficients[a]	-0.383	1.196 ***						0.131 *	
White's t statistic[b]	(-1.002)	(7.750)						(1.680)	
Eq. 11	*CONSTANT*	*ADJCLBV*	*D*					*NUMSHR*	0.894
coefficients[a]	-0.413	1.203 ***	1.122 ***					0.143 **	
White's t statistic[b]	(-1.027)	(7.382)	(6.660)					(2.035)	
Eq. 12	*CONSTANT*	*ADJCLBV*	*D*		*ABNI*			*NUMSHR*	0.905
coefficients[a]	-0.641	1.200 ***	1.168 ***		0.699 **			0.269 ***	
White's t statistic[b]	(-1.579)	(8.097)	(6.519)		(1.880)			(3.521)	
Eq. 13	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI*			*NUMSHR*	0.914
coefficients[a]	-0.810 **	1.099 ***	0.902 ***	4.165 ***	0.463			0.234 ***	
White's t statistic[b]	(-2.010)	(6.825)	(4.276)	(3.091)	(1.267)			(2.950)	
Eq. 14	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI**	*AMORT*	*CYEXP*	*NUMSHR*	0.915
coefficients[a]	-0.666 **	1.095 ***	0.948 ***	4.329 ***	0.419	-0.619	-3.602	0.258 ***	
White's t statistic[b]	(-1.933)	(7.158)	(4.667)	(3.567)	(1.267)	(-0.5799)	(-1.014)	(2.939)	

F test = 17.535 p < 0.001 with 1 and 119 d.f.
F test is on a_3 (coefficient on DEF) - a_6 (coefficient on CYEXP) > 0

CLBV - *Closing book value of equity less book value of preferred stock*
ADJCLBV - *Closing book value of equity less book value of preferred stock less deferred development costs*
D - *Closing book value of deferred development costs*
OPD - *Unamortised closing book value of deferred development costs which existed at the beginning of the period*
DEF - *Current period capitalised expenditures (deferred development costs)*
NUMSHR - *Number of common shares outstanding (scale proxy)*
ABNI - *Abnormal income unadjusted for effects of R&D*
*ABNI** - *Abnormal income adjusted for effects of R&D*
AMORT - *Current period amortisation expense*
CYEXP - *Current period expenditures not capitalised*

Abnormal income = Net income - (10% x opening book value of equity)

a) For the sake of presentation, a_0 is divided by 10^7
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 9

Canadian Sample

Panel A - Comparison of Selective Descriptive Statistics

	Capitalisers		*Expensers*
	Full	*Top 50%*	
Number of observations (firm year)	99	50	215
Number of firms in sample	29		54
Mean total assets (000's)	119,393	105,913	2,166,438
Median total assets (000's)	55,096	72,770	169,001
Standard deviation (000's)	970,730	113,154	6,599,290
Mean market value (000's)	360,113	141,676	1,740,620
Median market value (000's)	52,049	49,580	241,826
Standard deviation (000's)	168,411	274,399	1,924,514
Mean book value of equity (000's)	68,346	48,289	813,521
Median book value of equity (000's)	34,442	35,243	106,321
Standard deviation (000's)	124,025	43,661	1,924,514
Mean net income after tax (000's)	8,005	225	60,608
Median net income after tax (000's)	542	575	8,110
Standard deviation (000's)	39,186	25,546	213,060

Panel B - Comparison of Industry Concentration

	Capitalisers			*Expensers*		
Industry	Obs.	Firms	% of sample	Obs.	Firms	% of sample
Natural resources	0	0	0.0%	28	6	13.0%
Manufacturing of basic products	7	2	7.1%	52	13	24.2%
Manufacturing of specialised products	39	10	39.4%	94	22	43.7%
Transportation and public utilities	0	0	0.0%	5	2	2.3%
Durable and nondurable goods	0	0	0.0%	3	1	1.4%
Finance, insurance and real estate	2	1	2.0%	0	0	0.0%
Services - private	36	12	36.4%	7	3	3.3%
Services - public	15	4	15.2%	26	7	12.1%
	99	29	100.00%	215	54	100.00%

Table 10

Australian Sample

Panel A - Comparison of Selective Descriptive Statistics

	Capitalisers		*Expensers*
	Full	*Top 50%*	
Number of observations (firm year)	253	127	228
Number of firms in sample	63		45
Mean total assets (000's)	487,970	180,323	1,525,960
Median total assets (000's)	58,470	28,982	244,783
Standard deviation (000's)	326,744	10,209	4,445,078
Mean market value (000's)	455,504	133,192	1,166,290
Median market value (000's)	38,610	18,737	100,632
Standard deviation (000's)	350,343	9,184	4,048,854
Mean book value of equity (000's)	239,221	82,559	447,654
Median book value of equity (000's)	28,518	15,459	7,291
Standard deviation (000's)	176,906	4,452	1,682,577
Mean after tax net income (000's)	13,202	1,628	48,440
Median after tax net income (000's)	1,276	396	9,926
Standard deviation (000's)	17,375	1,534	178,848

Panel B - Comparison of Industry Concentration

	Capitalisers			Expensers		
	Obs.	Firms	% of sample	Obs.	Firms	% of sample
Gold	6	2	2.37%	0	0	0.00%
Other metal	18	5	7.11%	17	3	7.46%
Solid Fuels	0	0	0.00%	6	1	2.63%
Diversified Resources	0	0	0.00%	6	1	2.63%
Developers & Contractors	0	0	0.00%	3	1	1.32%
Building Materials	4	2	1.58%	20	4	8.77%
Alcohol & Tobacco	0	0	0.00%	8	2	3.51%
Food & Household	0	0	0.00%	33	6	14.47%
Chemicals	0	0	0.00%	13	2	5.70%
Engineering	39	9	15.42%	19	4	8.33%
Paper & Packaging	0	0	0.00%	12	2	5.26%
Transport	5	1	1.98%	0	0	0.00%
Investment & Financial Services	4	3	1.58%	9	2	3.95%
Miscellaneous Services	80	16	31.62%	6	1	2.63%
Miscellaneous Industrials	91	22	35.97%	53	11	23.25%
Diversified Industrial	6	3	2.37%	23	5	10.09%
	253	63	100.00%	228	45	100.00%

Table 11

Descriptive Statistics on Logit Variables
Canadian Sample

	Firm years of observations	BETA		LN(ADJTA)		LN(MV)		EARN		LEV		R&D INT		RATIO	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Capitalisers	99	1.253	1.269	4.711	4.667	7.918	7.747	-0.215	-0.004	0.153	0.051	0.292	0.099	3.587	2.640
Expensers	215	6.649	0.940	5.372	5.209	8.456	8.384	-1.865	0.033	0.370	0.122	1.580	0.020	3.610	1.972
t - statistics		-0.952		-7.226 ***		-5.797 ***		1.552		-1.647		-1.724 *		-0.016	
Wilcoxon 2-sample test		2.451 **		-5.691 ***		-4.939 ***		-3.345 ***		-1.947 *		4.531 ***		2.656 ***	

BETA = *The firm's systematic risk*
LN(ADJTA) = *The natural log of (total assets minus deferred development costs)*
LN(MV) = *The natural log of market value*
EARN = *(Net income plus the current period amortisation of deferred development costs minus annually capitalised development costs) / sales*
LEV = *Long term debt / (equity minus the deferred development costs)*
R&D INT = *Current period expenditure on R&D divided by sales*
RATIO = *Market to book ratio*

a) Significance levels (two tailed): ***<0.01, **<0.05, *<0.10.

Table 12

Results of Logit Analysis (Canadian Sample)

Variable Name	Estimated Coefficient	Asymptotic Standard Error	Asymptotic T-Ratio	Elasticity At Mean	Weighted Aggregate Elasticity	Prediction
Ln (MV)	-0.395	0.084	-4.712 *	-5.634	-4.364	-
Earn	0.148	0.278	0.532	-0.157	-0.014	-
Lev	-0.599	0.225	-2.665**	-0.135	-0.093	+
Ratio	0.000	0.000	2.303***	0.121	0.091	+
R&D Int	-0.076	0.309	-0.247	-0.067	-0.015	+
Beta	-0.004	0.013	-0.345	-0.011	-0.002	+
X-List	0.204	0.371	0.549	0.038	0.024	-
Constant	6.721	1.528	4.3991*	5.026	3.992	

LOG-LIKELIHOOD FUNCTION	=	-171.82	
LOG-LIKELIHOOD (0)	=	-194.55	
LIKELIHOOD RATIO TEST	=	45.4577*	WITH 7 D.F.

MADDALA R-SQUARE	0.14
CRAGG-UHLER R-SQUARE	0.19
MCFADDEN R-SQUARE	0.12
ADJUSTED FOR DEGREES OF FREEDOM	0.10
CHOW R-SQUARE	0.13
PERCENTAGE OF RIGHT PREDICTIONS	70.29%

* < 0.005 significance level (one tail)
** < 0.025 significance level (one tail)
*** < 0.100 significance level (one tail)

LN(MV) = *The natural log of market value*
EARN = *(Net income plus the current period amortisation of deferred development costs minus annually capitalised development costs) / sales*
LEV = *Long term debt / (equity minus the deferred development costs)*
RATIO = *Market to book ratio*
R&D INT = *Current period expenditure on R&D divided by sales*
BETA = *The firm's systematic risk*
X-LIST = *1 if firm is cross-listed on U.S. stock exhange, 0 otherwise*

Table 13

Descriptive Statistics on Logit Variables
Australian Sample

	Firm years of observations	BETA		LN(ADJTA)		LN(MV)		EARN		LEV		R&D INT		RATIO	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Capitalisers	253	0.899	0.872	7.774	7.736	7.656	7.571	-0.403	0.019	0.190	0.049	0.102	0.014	2.164	1.566
Expensers	228	0.807	0.861	8.411	8.576	8.310	8.525	-0.357	0.037	0.242	0.111	0.148	0.005	1.920	1.607
t - statistics		1.775 *		-7.817 ***		-7.632 ***		-0.198		-0.908		-0.624		1.081	
Wilcoxon 2-sample test		-1.096		7.135 ***		7.049 ***		2.292 **		3.018 ***		-4.608 ***		0.076	

BETA = *The firm's systematic risk*
LN(ADJTA) = *The natural log of (total assets minus deferred development costs)*
LN(MV) = *The natural log of market value*
EARN = *(Net income plus the current period amortisation of deferred development costs minus annually capitalised development costs) / sales*
LEV = *Long term debt / (equity minus The deferred development costs)*
R&D INT = *Current period expenditure on R&D divided by sales*
RATIO = *Market to book ratio*

a) Significance levels (two tailed): ***<0.01, **<0.05, *<0.10.

Table 14

Results of Logit Analysis (Australian Sample)

Variable Name	Estimated Coefficient	Asymptotic Standard Error	Asymptotic T-Ratio	Elasticity At Mean	Weighted Aggregate Elasticity	Prediction
Ln (MV)	-0.391	0.052	-7.489*	-2.712	-2.834	-
Earn	0.015	0.078	0.197	-0.002	-0.001	-
Lev	-0.456	0.187	-2.440***	-0.070	-0.060	+
Ratio	0.110	0.059	1.866***	0.089	0.085	+
R&D Int	-0.361	0.358	-1.009	-0.018	-0.012	+
Beta	0.633	0.194	3.268**	0.209	0.199	+
Constant	6.764	0.920	7.349*	2.672	2.662	

LOG-LIKELIHOOD FUNCTION	=	-290.22	
LOG-LIKELIHOOD (0)	=	-332.53	
LIKELIHOOD RATIO TEST	=	84.621*	WITH 6 D.F.

MADDALA R-SQUARE	0.16
CRAGG-UHLER R-SQUARE	0.22
MCFADDEN R-SQUARE	0.13
ADJUSTED FOR DEGREES OF FREEDOM	0.12
CHOW R-SQUARE	0.17
PERCENTAGE OF RIGHT PREDICTIONS	68.6%

* < 0.005 significance level (one tail)
** < 0.025 significance level (one tail)
*** < 0.100 significance level (one tail)

LN(MV) = *The natural log of market value*
EARN = *(Net income plus the current period amortisation of deferred development costs minus annually capitalised development costs) / sales*
LEV = *Long term debt / (equity minus The deferred development costs)*
RATIO = *market to book ratio*
R&D INT = *Current period expenditure on R&D divided by sales*
BETA = *The firm's systematic risk*

Table 15

Tests of H_3
Canadian Sample

Panel A - Full sample

Raw data with scale proxy as an independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)

No control variables
Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + *e*

With control variables
Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + a_7 *BETA* + a_8 *LEV* + a_9 *LNADJTA* + *e*

n = 314	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	Adj R^2
coefficient	-2.731 ***	-1.001 *	0.454 **	1.036	2.513 **	19.334 ***	0.026 ***				0.9156
White's t - statistic	(-4.360)	(-1.743)	(1.869)	(1.464)	(2.177)	(4.466)	(7.118)				
	F test =	**10.872**	**p=**	**0.001**	**with 1 and 307 D.F.**						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										
coefficient	8.622 **	-0.482	0.432 **	1.026	2.606 **	17.122 ***	0.025 ***	-354.190 ***	856.890	0.536	0.9149
White's t - statistic	(-2.321)	(-0.964)	(1.754)	(1.455)	(2.206)	(3.519)	(7.170)	(-4.048)	(1.604)	(1.518)	
	F test =	**8.289**	**p=**	**0.004**	**with 1 and 304 D.F.**						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										

CAP	*= 1 if capitaliser, 0 otherwise*
ADJEQUITY	*= Closing book value of equity less preferred stock less deferred development costs*
ADJABNI	*= (Net income + amortisation + current year expense) - (10% x opening book value of equity)*
CI	*= Current year investment in R&D*
NUMSHR	*= Number of common shares outstanding (scale proxy)*
BETA	*= Beta - firm's systematic risk*
LEV	*= Long term debt / revenue*
LNADJTA	*= Natural log of (total assets less deferred development costs)*

a) For the sake of presentation, a_0,a_1 and a_9 are divided by 10^5.
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 15

Tests of H_3
Canadian Sample

Panel B - Top 50% Based on Intensity of "R&D"

Raw data with scale proxy as an independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)
Partitioned by the variable - Total current year R&D Expenditure / Market Value

No control variables
Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + e

With control variables
Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + a_7 *BETA* + a_8 *LEV* + a_9 *LNADJTA* + e

70 Capitalisers
87 Expensers

n = 157	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	Adj R^2
coefficient	-3.009 ***	1.660 ***	-0.507 *	0.134	7.740 ***	-5.817 *	0.025 ***				0.9629
White's t - statistic	(-4.429)	(2.868)	(-1.774)	(0.117)	(3.664)	(-1.871)	(4.098)				
	F test =	0.034	p=	0.854	with 1 and 150 D.F.						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										
coefficient	-5.074	1.775 ***	-0.509 **	0.137	7.738 ***	-6.770	0.025 ***	146.410	1068.000 **	0.109	0.9622
White's t - statistic	(-1.391)	(3.086)	(-1.775)	(0.119)	(3.652)	(-1.456)	(4.183)	(0.980)	(2.354)	(0.321)	
	F test =	0.007	p=	0.932	with 1 and 147 D.F.						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										

CAP	*= 1 if capitaliser, 0 otherwise*
ADJEQUITY	*= Closing book value of equity less preferred stock less deferred development costs*
ADJABNI	*= (Net income + amortisation + current year expense) - (10% x opening book value of equity)*
CI	*= Current year investment in R&D*
NUMSHR	*= Number of common shares outstanding (scale proxy)*
BETA	*= Beta - firm's systematic risk*
LEV	*= Long term debt / revenue*
LNADJTA	*= Natural log of (total assets less deferred development costs)*

a) For the sake of presentation, a_0,a_1 and a_9 are divided by 10^6.
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 16

Tests of H_3

Australian Sample

Panel A - Full Sample

Raw data with scale proxy included as an independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)

No control variables

Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + e

With control variables

Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + a_7 *BETA* + a_8 *LEV* + a_9 *LNADJTA* + e

n = 481	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	Adj R^2
coefficient[a]	-5.648	7.224	2.513 ***	2.248 **	-4.524	4.146	-1.151 ***				0.9796
White's t - statistic[b]	(-1.336)	(1.521)	(19.360)	(2.353)	(-0.574)	(0.651)	(-4.952)				
	F test =	0.017	p=	0.895	with 1 and 474 D.F.						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										
coefficient[a]	117.520 ***	2.079	2.506 ***	2.390 ***	-3.792	5.305	-0.849 ***	0.496	-0.460	-6.882 ***	0.9802
White's t - statistic[b]	(3.548)	(0.476)	(19.930)	(2.338)	(-0.481)	(0.772)	(-3.340)	(-0.387)	(0.227)	(-3.483)	
	F test =	0.283	p=	0.595	with 1 and 471 D.F.						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										

CAP	*= 1 if capitaliser, 0 otherwise*
ADJEQUITY	*= Closing book value of equity less preferred stock less deferred development costs*
ADJABNI	*= (Net income + amortisation + current year expense) - (10% x opening book value of equity)*
CI	*= Current year investment in R&D*
NUMSHR	*= Number of common shares outstanding (scale proxy)*
BETA	*= Beta - firm's systematic risk*
LEV	*= Long term debt / revenue*
LNADJTA	*= Natural log of (total assets less deferred development costs)*

a) For the sake of presentation, a_0, a_1, a_7, a_8 and a_9 are divided by 10^7
b) Significance level (two-tailed): ***<0.01, **<0.05, *<0.10.

Table 16

Tests of H_3
Australian Sample

Panel B - Top 50% Based on Intensity of "R&D"

Raw data with scale proxy included as an independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)
Partitioned by the variable - Total Current year R&D Expenditure / Market Value

No control variables

Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + e

With control variables

Market Value = $a_0 + a_1$ *CAP* + a_2 *ADJEQUITY* + a_3 *ADJABNI* + a_4 *CI* + a_5 *(CAP x CI)* + a_6 *NUMSHR* + a_7 *BETA* + a_8 *LEV* + a_9 *LNADJTA* + e

153 Capitalisers
87 Expensers

n = 240	a_0	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	Adj R^2
coefficient[a]	-5.319 **	2.883	1.367 ***	0.430	28.890 ***	-11.867 **	-0.538 **				0.9422
White's t - statistic[b]	(-2.241)	(1.1840)	(5.6710)	(0.9312)	(4.1430)	(-2.069)	(-2.251)				
	F test =	76.4111	p<	0.001	with 1 and 233 D.F.						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										
coefficient[a]	56.588 ***	2.200	1.382 ***	0.350	32.021 ***	-13.274 **	-0.455 **	-2.469 *	-1.018	-3.463 ***	0.9341
White's t - statistic[b]	(3.5790)	(0.9024)	(5.7910)	(0.7643)	(4.4760)	(-2.362)	(-1.839)	(-1.682)	(-1.229)	(-3.574)	
	F test =	89.075	p<	0.001	with 1 and 230 D.F.						
	F test is on the restriction: a_4 (CI) + a_5 (CAP x CI) = 0.										

CAP	*= 1 if capitaliser, 0 otherwise*
ADJEQUITY	*= Closing book value of equity less preferred stock less deferred development costs*
ADJABNI	*= (Net income + amortisation + current year expense) - (10% x opening book value of equity)*
CI	*= Current year investment in R&D*
NUMSHR	*= Number of common shares outstanding (scale proxy)*
BETA	*= Beta - firm's systematic risk*
LEV	*= Long term debt / revenue*
LNADJTA	*= Natural log of (total assets less deferred development costs)*

a) For the sake of presentation, a_0,a_1,a_7,a_8 and a_9 are divided by 10^7
b) Significance level (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.1

Relative and Incremental Information Tests
Canadian Capitalisers: Top 50% Based on Materiality of "D"

Raw data - no scale proxy

Panel A: Comparison of alternative GAAP

$$Market\ Value = a_0 + a_1\ CLBV + a_2\ ABNI + e_i$$

n = 50		a_0	a_1	a_2	Adj. R^2
Current GAAP	coefficient[a]	-9.719	8.003 ***	0.791	0.4647
"D" capitalised	White's *t*-statistic[b]	(-1.519)	(4.095)	(0.176)	
"As if" GAAP	coefficient[a]	-10.812	9.160 ***	-1.039	0.4010
All R&D expensed	White's *t*-statistic[b]	(-1.427)	(3.663)	(-0.162)	

Ratio of Adj R_2 = 1.159
Vuong's Z statistic = 2.556 p= 0.005

Current GAAP - "D" capitalisation permitted

CLBV = Closing book value of equity less book value of preferred stock
ABNI = Net income - (10% x opening book value of equity)

"As if" GAAP - All R&D expenditures must be expensed

ADJCLBV = Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI = (Net income before + ADJ) - (10% x opening book value of equity)
ADJ = Amortisation of opening development costs - current period capitalised development costs

Panel B: Incremental Analysis

$$Market\ Value = b_0 + b_1 ADJCLBV + b_2\ D + b_3\ ADJABNI + b_4\ ADJ + e_i$$

n = 50	b_0	b_1	b_2	b_3	b_4	Adj. R^2
coefficient[a]	-2.722	5.519 ***	29.613 ***	7.830 **	-46.113 ***	0.5673
White's *t*-statistic[b]	(-0.676)	(2.903)	(3.196)	(1.646)	(-2.173)	

ADJCLBV = Closing book value of equity less book value of preferred stock less deferred development costs
D = Closing book value of deferred development costs
ADJABNI = (Net income + ADJ) - (10% x opening book value of equity)
ADJ = Current period capitalised development costs - amortisation of opening development costs

a) For the sake of presentation, a_0 and b_0 are divided by 10^4.
b) Significance levels (two-tailed): *** <0.01, ** <0.05, * <0.10.

Table A.2

Relative and Incremental Information Tests
Canadian Capitalisers: Top 50% Based on Materiality of "D"

Deflated by number of common shares outstanding

Panel A: Comparison of alternative GAAP

$$Market\ Value = a_0 + a_1\ CLBV + a_2\ ABNI + e_i$$

n = 50		a_0	a_1	a_2	Adj. R^2
Current GAAP	coefficient	4.449	2.545 ***	1.791	0.1270
"D" capitalised	White's *t*-statistic[a]	(1.319)	(2.719)	(0.297)	
"As if" GAAP	coefficient	5.571 *	2.392 ***	1.287	0.0754
All R&D expensed	White's *t*-statistic[a]	(1.851)	(3.256)	(0.171)	

Ratio of Adj R^2 = 1.684
Vuong's Z statistic = 2.258 **p = 0.005**

Current GAAP - "D" capitalisation permitted

CLBV = Closing book value of equity less book value of preferred stock
ABNI = Net income - (10% x opening book value of equity)

"As if" GAAP - All R&D expenditures must be expensed

ADJCLBV = Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI = (Net income before + ADJ) - (10% x opening book value of equity)
ADJ = Amortisation of opening development costs - current period capitalised development costs

Panel B: Incremental Analysis

$$Market\ Value = b_0 + b_1 ADJCLBV + b_2\ D\ + b_3\ ADJABNI + b_4\ ADJ + e_i$$

n = 50	b_0	b_1	b_2	b_3	b_4	Adj. R^2
coefficient	5.117 **	1.291	22.683 **	7.198 *	-20.248	0.2923
White's *t*-statistic[a]	(2.189)	(1.585)	(2.656)	(1.865)	(-1.494)	

ADJCLBV = Closing book value of equity less book value of preferred stock less deferred development costs
D = Closing book value of deferred development costs
ADJABNI = (Net income + ADJ) - (10% x opening book value of equity)
ADJ = Amortisation of opening development costs - current period capitalised development costs

a) Significance levels (two-tailed): *** <0.01, **<0.05, *<0.10.

Table A. 3

Relative and Incremental Information Tests
Australian Capitalisers: Top 50% Based on Materiality of "D"

Raw data - no scale proxy

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + e_i$$

n = 127		a_0	a_1	a_2	Adj. R^2
Current GAAP	coefficient[a]	-0.319	1.361 *	0.510	0.900
D capitalised	White's *t* statistic[b]	(-0.092)	(10.110)	(1.235)	
As if GAAP	coefficient[a]	2.989	1.449 *	-0.190	0.830
All R&D expensed	White's *t* statistic[b]	(0.527)	(6.789)	(-0.434)	

Ratio of Adj R^2 =	1.085		
Vuong's Z statistic =	**3.736**	**p <**	**0.001**

Current GAAP - "D" capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (10% x opening book value)

As if GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less capitalised development asset
ADJABNI	= (Net income + ADJ) - (10% x opening book value)
ADJ	= Amortisation of opening development costs - current period capitalised development costs

Panel B: Incremental Analysis

$$Market\ Value = b_0 + b_1 ADJCLBV + b_2\ D + b_3\ ADJABNI + b_4\ ADJ + e_i$$

n = 127	b_0	b_1	b_2	b_3	b_4	Adj. R^2
coefficient[a]	-1.165	1.280 *	1.363 *	0.416	2.194 **	0.906
White's *t* statistic[b]	(-0.354)	(8.422)	(8.000)	(1.037)	(2.214)	

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value)
ADJ	= Amortisation of opening development costs - current period capitalised development costs

a) For the sake of presentation, a_0 and b_0 are divided by 10^6.

b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.4

Relative and Incremental Information Tests
Australian Capitalisers: Top 50% Based on Materiality of "D"

Deflated by number of common shares outstanding

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + e_i$$

n = 127		a_0		a_1		a_2	Adj. R^2
Current GAAP	coefficient	0.381	*	0.845	*	0.170	0.526
"D" capitalised	White's *t* statistic[a]	(5.356)		(14.850)		(0.324)	
As if GAAP	coefficient	0.433	*	0.846	*	-0.335	0.455
All R&D expensed	White's *t* statistic[a]	(6.015)		(16.670)		(-0.950)	

Ratio of Adj R^2 = 1.156
Vuong's Z statistic = 1.992 p= 0.023

Current GAAP - "D" capitalisation permitted

CLBV = Closing book value of equity less book value of preferred stock
ABNI = Net income - (10% x opening book value)

As if GAAP - All R&D expenditures must be expensed

ADJCLBV = Closing book value of equity less book value of preferred stock less capitalised development asset
ADJABNI = (Net income + ADJ) - (10% x opening book value)
ADJ = Amortisation of opening development costs - current period capitalised development costs

Panel B: Incremental Analysis

$$Market\ Value = b_0 + b_1 ADJCLBV + b_2\ D + b_3\ ADJABNI + b_4\ ADJ + e_i$$

n= 127	b_0		b_1		b_2		b_3		b_4		Adj. R^2
coefficient	0.425	*	0.602	*	1.235	*	0.557	***	4.138	**	0.602
White's *t* statistic[a]	(4.746)		(5.999)		(2.692)		(1.702)		(2.595)		

ADJCLBV = Closing book value of equity less book value of preferred stock less deferred development costs
D = Closing book value of deferred development costs
ADJABNI = (Net income + ADJ) - (10% x opening book value)
ADJ = Amortisation of opening development costs - current period capitalised development costs

a) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.5

Relative and Incremental Information Tests
Joint Sample: Full

Raw data with scale proxy as independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ COUNTRY + a_2\ CLBV + a_3\ ABNI + a_4\ NUMSHR + e$$

n=352		a_0		a_1		a_2		a_3		a_4	Adj. R^2
Current GAAP	coefficient[a]	1.920	***	-2.217	***	2.167	***	6.022	***	0.239	0.8085
"D" capitalised	White's *t* statistic[b]	(3.174)		(-3.293)		(15.020)		(3.585)		(0.811)	
"As if" GAAP	coefficient[a]	2.092	***	-2.351	***	2.091	***	5.955	***	0.489	0.8026
All R&D expensed	White's *t* statistic[b]	(3.331)		(-3.3920)		(14.700)		(3.456)		(1.581)	

Ratio of Adj R^2 = 1.007
Vuong's Z statistic = 1.046 p = 0.148

Current GAAP - "D" capitalisation permitted

COUNTRY	= 1 if Australian, 0 otherwise
CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (10% x opening book value of equity)
NUMSHR	= Number of common shares outstanding (scale proxy)

"As if" GAAP - All R&D expenditures must be expensed

COUNTRY	= 1 if Australian, 0 otherwise
ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI	= Net income + ADJ - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUSMHR	= Number of common shares outstanding (scale proxy)

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1\ COUNTRY + b_2\ ADJCLBV + b_3\ D + b_4\ ADJABNI + b_5\ ADJ + b_6\ NUMSHR + e$$

n=352	b_0		b_1		b_2		b_3		b_4		b_5	b_6	Adj R^2
coefficient[a]	1.820	***	-2.141	***	2.207	***	5.089	**	6.134	***	1.106	0.106	0.8099
White's *t* statistic[b]	(3.237)		(-3.322)		(14.440)		(2.406)		(3.618)		(0.287)	(0.319)	

ADJCLBV	= Book value of equity less book value of preferred stock less deferred development costs
D	= Book value of deferred development costs
ADJABNI	= Abnormal net income + ADJ - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUSMHR	= Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0, a_1, b_5 and b_1 are divided by 10^5
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.6

Relative and Incremental Information Tests
Joint Sample:Top 50% - Partitioned on the materiality of "D"

Raw data with scale proxy as independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ COUNTRY + a_2\ CLBV + a_3\ ABNI + a_4\ NUMSHR + e$$

n=176		a_0		a_1		a_2		a_3	a_4	Adj. R^2
Current GAAP	coefficient[a]	6.381	**	-6.287	***	1.652	***	-0.915	-0.433	0.4518
"D" capitalised	White's *t* statistic[b]	(2.441)		(-2.844)		(6.180)		(-0.6037)	(-0.8846)	
"As if" GAAP	coefficient[a]	7.811	**	-8.541	***	1.340	***	-1.264	0.092	0.3960
All R&D expensed	White's *t* statistic[b]	(2.336)		(-2.692)		(5.202)		(-0.7567)	(0.235)	

Ratio of Adj R^2 =	1.141		
Vuong's Z statistic	4.207	p <	0.001

Current GAAP - "D" capitalisation permitted

COUNTRY	= 1 if Australian, 0 otherwise
CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (10% x opening book value of equity)
NUMSHR	= Number of common shares outstanding (scale proxy)

"As if" GAAP - All R&D expenditures must be expensed

COUNTRY	= 1 if Australian, 0 otherwise
ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI	= Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUSMHR	= Number of common shares outstanding (scale proxy)

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1\ COUNTRY + b_2\ ADJCLBV + b_3\ D + b_4\ ADJABNI + b_5\ ADJ + b_6\ NUMSHR + e$$

n=176	b_0		b_1		b_2		b_3		b_4	b_5		b_6	Adj R^2
coefficient[a]	6.099	***	-5.644	***	1.372	***	3.008	*	-0.923	4.131	*	-0.893	0.4932
White's *t* statistic[b]	(2.602)		(-3.244)		(5.563)		(1.827)		(-0.883)	(1.905)		(-1.060)	

COUNTRY	= 1 if Australian, 0 otherwise
ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0, a_1, b_0 and b_1 are divided by 10^6
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.7

Relative and Incremental Information Tests
Australian Capitalisers: Comparison of OLS and POOL Procedures
Full Sample

Raw data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + a_3\ NUMSHR + e,$$

OLS PROCEDURE

n = 180		a_0	a_1	a_2	a_3	Adj. R^2
Current GAAP	coefficient[a]	-3.308	1.869 ***	2.437 **	0.493	0.9507
"D" capitalised	White's *t* statistic[b]	(-1.471)	(9.0190)	(2.4150)	(1.1530)	
"As if" GAAP	coefficient[a]	-3.126	1.807 ***	2.752 ***	0.763 *	0.9522
All R&D expensed	White's *t* statistic[b]	(-1.423)	(8.993)	(2.753)	(1.931)	

Ratio of Adj R^2 = 0.9984

POOLED PROCEDURE

n = 180		a_0	a_1	a_2	a_3	Buse R^2
Current GAAP	coefficient[a]	-2.105 ***	1.813 ***	1.872 ***	0.305 ***	0.8880
"D" capitalised	asymptotic *t*-ratio[b]	(-5.901)	(31.660)	(6.937)	(5.520)	
"As if" GAAP	coefficient[a]	-1.559 ***	1.812 ***	2.278 ***	0.525 ***	0.8891
All R&D expensed	asymptotic *t*-ratio[b]	(-4.364)	(26.420)	(6.830)	(5.619)	

Ratio of Buse R^2 = 0.9988

Current GAAP - "D" capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (.10 * opening book value of common equity)
NUMSHR	= Number of common shares outstanding (scale proxy)

As if GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less capitalised development costs
ADJABNI	= (Net income + ADJ) - (.10 * opening book value of common equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding (scale proxy)

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1 ADJCLBV + b_2 D + b_3\ ADJABNI + b_4\ ADJ + b_5\ NUMSHR + e,$$

OLS PROCEDURE

n = 180	b_0	b_1	b_2	b_3	b_4	b_5	Adj. R^2
coefficient[a]	-3.116	1.802 ***	-0.064	2.776 ***	-0.626	0.806 *	0.9517
White's *t* statistic[b]	(-1.433)	(9.034)	(-.050)	(2.984)	(-0.139)	(1.715)	

POOLED PROCEDURE

n = 180	b_0	b_1	b_2	b_3	b_4	b_5	Buse R^2
coefficient[a]	-1.545 **	1.760 ***	0.249	2.718 ***	-0.667	0.654 **	0.8931
asymptotic *t*-ratio[b]	(-3.846)	(23.620)	(0.468)	(7.570)	(-0.562)	(5.785)	

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= Abnormal net income before extraordinary items plus GAAP adjustment
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUSMHR	= Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0 and b_0 are divided by 10^7
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.8

Relative and Incremental Information Tests
Australian Capitalisers: Comparison of OLS and POOL Procedures
Top 50% sorted by Average Firm Materiality

Raw data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + + a_3\ NUMSHR + e,$$

OLS PROCEDURE

n = 90		a_0	a_1		a_2		a_3		Adj. R^2
Current GAAP	coefficient[a]	4.702	1.124	***	0.339		0.153	***	0.8796
"D" capitalised	White's *t* statistic[b]	(0.940)	(9.934)		(1.249)		(2.091)		
"As if" GAAP	coefficient[a]	0.830	1.081	***	0.052		0.384	***	0.8223
All R&D expensed	White's *t* statistic[b]	(0.140)	(4.772)		(0.190)		(2.094)		

Ratio of Adj R^2 = 1.0697

POOLED PROCEDURE

n = 90		a_0	a_1		a_2		a_3		Buse R^2
Current GAAP	coefficient[a]	-0.742	1.047	***	0.368	**	0.234	***	0.8451
"D" capitalised	asymptotic *t*-ratio[b]	(-0.406)	(13.480)		(1.937)		(4.649)		
"As if" GAAP	coefficient[a]	0.713	0.799	***	0.129		0.470	***	0.7146
All R&D expensed	asymptotic *t*-ratio[b]	(0.596)	(6.780)		(0.692)		(5.033)		

Ratio of Buse R^2 = 1.1826

Current GAAP - "D" capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Abnormal net income before extraordinary items = Net income - (.10 * opening book value of common equity)
NUMSHR	= Number of common shares outstanding (scale proxy)

As if GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI	= Abnormal net income before extraordinary items plus ADJ
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding (scale proxy)

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1 ADJCLBV + b_2 D + b_3\ ADJABNI + b_4\ ADJ + b_5\ NUMSHR + e,$$

OLS PROCEDURE

n = 90	b_0	b_1		b_2		b_3	b_4		b_5		Adj. R^2
coefficient[a]	3.718	1.075	***	1.096	***	0.230	1.946	**	0.135	**	0.8869
White's *t* statistic[b]	(0.756)	(9.462)		(7.224)		(0.790)	(1.962)		(1.683)		

POOLED PROCEDURE

n = 90	b_0	b_1		b_2		b_3	b_4		b_5		Buse R^2
coefficient[a]	-2.063	0.969	***	0.994	***	0.201	2.062	***	0.201	***	0.8848
asymptotic *t*-ratio[b]	(-0.1436)	(13.110)		(6.889)		(1.181)	(3.320)		(4.649)		

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= Abnormal net income before extraordinary items plus GAAP adjustment - (10% x Opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0 and b_0 are divided by 10^7
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.9

Canadian Expensers: Comparison of OLS and POOL Procedures

Raw data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ADJABNI + a_3\ CYEXP + a_4\ NUMSHR + e_i$$

OLS PROCEDURE

n = 120	a_0	a_1	a_2	a_3		a_4		Adj. R^2
coefficient[a]	-12.224	0.288	0.846	3.136	**	0.027	***	0.9086
White's *t* statistic[b]	(-1.305)	(1.096)	(0.934)	(1.991)		(6.432)		

POOLED PROCEDURE - RHO firm specific

n = 120	a_0	a_1	a_2	a_3		a_4		Buse R^2
coefficient[a]	-8.152	0.284	0.026	3.877	***	0.021	***	0.7808
asymptotic *t*-ratio[b]	(-1.543)	(1.469)	(0.060)	(3.407)		(9.168)		

POOLED PROCEDURE - RHO same for entire sample

n = 120	a_0		a_1		a_2	a_3		a_4		Buse R^2
coefficient[a]	-2.716	***	0.654	***	0.609	3.253	***	0.014	***	0.7814
asymptotic *t*-ratio[b]	(-4.630)		(4.525)		(0.912)	(2.773)		(7.134)		

CLBV	= Closing book value of equity less book value of preferred stock
ADJABNI	= (Net income + CYEXP) - (10% x opening book value of equity)
CYEXP	= Current year investment in R&D
NUMSHR	= Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0 is divided by 10^4
b) Significance leves (two-tailed) : ***<0.01, **<0.05, *<0.10.

Table A.10

Relative and Incremental Information Tests
Canadian Capitalisers

"Reduced" F&O specification

$$\textit{Market value} = a_0 + a_1\ ADJCLBV + a_2\ D + a_3\ ABNI + a_4\ NUMSHR + e$$

Panel A - Full Sample

n = 99	a_0		a_1		a_2	a_3		a_4		Adj R^2
coefficient[a]	-4.194	***	2.542	**	11.422	2.649	*	31.632	***	0.812
White's *t* statistic[b]	(-3.657)		(2.462)		(1.335)	(1.067)		(2.744)		

Panel B - Top 50% as partitioned on the materiality of "D"

n = 50	a_0		a_1	a_2		a_3	a_4		Adj R^2
coefficient[a]	-2.162	**	1.502	17.215	**	3.187	17.998	**	0.583
White's *t* statistic[b]	(-2.643)		(1.254)	(2.313)		(0.600)	(2.463)		

Barth (1994) specification

$$\textit{Market value} = a_0 + a_1 ADJCLBV + a_2\ D + a_3\ NUMSHR + e$$

Panel A - Full Sample

n = 99	a_0		a_1		a_2	a_3		Adj R^2
coefficient[a]	-4.360	***	3.155	***	9.147	31.407	***	0.811
White's *t* statistic[b]	(-3.715)		(3.489)		(1.189)	(2.697)		

Panel B - Top 50% as partitioned on the materiality of "D"

n = 50	a_0		a_1		a_2		a_3		Adj R^2
coefficient[a]	-2.326	**	2.496	**	14.627	**	16.294	**	0.580
White's *t* statistic[b]	(-2.369)		(1.922)		(2.198)		(2.425)		

MV = Market value of common equity
ABNI = Net income - (10% x opening book value of equity)
ADCLBV = Closing book value of equity less preferred stock less deferred development costs
D = Deferred development costs
NUMSHR = Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a0 is divided by 10^5
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.11

Relative and Incremental Information Tests
Australian Capitalisers

"Reduced" F&O specification

$$Market\ value = a_0 + a_1\ ADJCLBV + a_2\ D + a_3\ ABNI + a_4\ NUMSHR + e$$

Panel A - Full Sample

n = 253	a_0		a_1		a_2		a_3		a_4		Adj R^2
coefficient[a]	-1.811	**	1.977	***	1.327	**	3.672	***	0.303	**	0.968
White's *t* statistic[b]	(-2.046)		(15.420)		(2.116)		(4.823)		(1.914)		

Panel B - Top 50% as partitioned on the materiality of "D"

n = 127	a_0		a_1		a_2		a_3		a_4		Adj R^2
coefficient[a]	-0.641		1.200	***	1.168	***	0.699	**	0.269	***	0.905
White's *t* statistic[b]	(-1.579)		(8.097)		(6.519)		(1.880)		(3.521)		

Barth (1994) specification

$$Market\ value = a_0 + a_1 ADJCLBV + a_2\ D + a_3\ NUMSHR + e$$

Panel A - Full Sample

n=253	a_0		a_1		a_2		a_3		Adj R^2
coefficient[a]	-0.095		1.989	***	0.783		-0.168		0.950
White's *t* statistic[b]	(-0.062)		(9.451)		(0.867)		(-0.470)		

Panel B - Top 50% as partitioned on the materiality of "D"

n=127	a_0		a_1		a_2		a_3		Adj R^2
coefficient[a]	-0.413		1.203	***	1.122	***	0.143	**	0.894
White's *t* statistic[b]	(-1.027)		(7.382)		(6.660)		(2.035)		

MV = Market value of common equity
ABNI = Net income - (10% x opening book value of equity)
ADCLBV = Closing book value of equity less preferred stock less deferred development costs
D = Deferred development costs
NUMSHR = Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0 is divided by 10^7
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.12

Relative and Incremental Information Tests
Canadian Capitalisers: Top 50% as partitioned on "D"
"Reduced Sample"

Raw data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

Panel A: Comparison of alternative GAAP

$$Market\ value = a_0 + a_1\ CLBV + a_2\ ABNI + a_3\ NUMSHR + e_i$$

n = 46		a_0		a_1		a_2		a_3		Adj. R^2
Current GAAP	coefficient[a]	-4.696	**	2.015	***	1.330	**	4.551	**	0.772
"D" capitalised	White's *t*-statistic[b]	(-2.155)		(6.758)		(1.921)		(2.320)		
"As if" GAAP	coefficient[a]	-4.432	*	2.073	***	1.238	**	5.188	**	0.641
All R&D expensed	White's *t*-statistic[b]	(1.800)		(6.237)		(1.782)		(2.245)		

Ratio of Adj R_2 = 1.205
Vuong's Z statistic = 6.1950 $p <$ 0.001

Current GAAP - D capitalisation permitted

CLBV	= Closing book value of equity less book value of preferred stock
ABNI	= Net income - (.10 * opening book value of equity)
NUMSHR	= Number of common shares outstanding (scale proxy)

"As if" GAAP - All R&D expenditures must be expensed

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
ADJABNI	= (Net income + ADJ) - (.10 * opening book value of equity)
ADJ	= Amortization of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding (scale proxy)

Panel B: Incremental Analysis

$$Market\ value = b_0 + b_1 ADJCLBV + b_2\ D + b_3\ ADJABNI + b_4\ ADJ + b_5\ NUMSHR + e_i$$

n = 46	b_0		b_1		b_2		b_3		b_4	b_5		Adj. R^2
coefficient[a]	-4.384	***	1.232	***	9.754	***	0.909	***	3.004	2.741	**	0.831
White's *t*-statistic[b]	(-2.883)		(5.441)		(4.789)		(4.138)		(0.648)	(2.047)		

"Reduced F&O"

$$Market\ value = b_0 + b_1 ADJCLBV + b_2\ D + b_3\ ADJABNI + b_5\ NUMSHR + e_i$$

n = 46	b_0		b_1		b_2		b_3		b_5		Adj. R^2
coefficient[a]	-4.373	***	1.119	***	11.190	***	0.917	***	2.790	*	0.833
White's *t*-statistic[b]	(-2.827)		(4.935)		(4.777)		(3.977)		(1.995)		

ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (.10 * opening book value of equity)
ADJ	= Current year deferred development costs less amortization
NUMSHR	= Number of common shares outstanding (scale proxy)

a) For the sake of presentation, a_0 is divided by 10^4
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.13

Tests of H_2
Canadian Capitalisers: Top 50% Based on the Materiality of "D" ("Reduced") Sample

Rawa data with scale proxy as independent variable
Scale proxy - number of common shares outstanding (NUMSHR)

Panel B	*n =45*								**Adj R^2**
Eq. 10	*CONSTANT*	*CLBV*						*NUMSHR*	0.791
coefficients[a]	-5.642***	2.216***						3.555**	
White's t statistic[b]	(-2.831)	(6.913)						(2.412)	
Eq. 11	*CONSTANT*	*ADJCLBV*	*D*					*NUMSHR*	0.857
coefficients[a]	-5.128 ***	1.448 ***	9.439 ***					2.395**	
White's t statistic[b]	(-3.516)	(5.897)	(4.141)					(2.139)	
Eq. 12	*CONSTANT*	*ADJCLBV*	*D*		*ABNI*			*NUMSHR*	0.856
coefficients[a]	-4.921 ***	1.389 ***	9.460 ***		0.234			2.460 **	
White's t statistic[b]	(-3.474)	(5.083)	(4.148)		(1.081)			(2.101)	
Eq. 13	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI*			*NUMSHR*	0.870
coefficients[a]	-5.608 ***	1.915 ***	2.527	11.784 ***	0.059			2.029 **	
White's t statistic[b]	(-4.038)	(5.670)	(0.866)	(4.358)	(0.286)			(2.180)	
Eq. 14	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI**	*AMORT*	*CYEXP*	*NUMSHR*	0.863
coefficients[a]	-5.604 ***	1.948 ***	2.147	12.312 ***	0.028	-1.170	-0.040	2.008 **	
White's t statistic[b]	(-4.086)	(4.153)	(0.641)	(3.129)	(0.108)	(-0.361)	(-0.036)	(2.144)	

F test = 25.914 $p <$ 0.001 with 1 and 37d.f.
F test is on the restriction a_3 (DEF) - a_6 (CYEXP) > 0

CLBV - *Closing book value of equity less book value of preferred stock*
ADJCLBV - *Closing book value of equity less book value of preferred stock less deferred development costs*
D - *Closing book value of deferred development costs*
OPD - *Unamortised closing book value of deferred development costs which existed at the beginning of the period*
DEF - *Current period capitalised expenditures (deferred development costs)*
NUMSHR - *Number of common shares outstanding (scale proxy)*
ABNI - *Abnormal income unadjusted for effects of R&D*
ABNI -* *Abnormal income adjusted for effects of R&D*
AMORT - *Current period amortisation expense*
CYEXP - *Current period expenditures not capitalised*

Abnormal income = *Net income - (10% x opening book value of equity)*

a) For the sake of presentation, a_0 is divided by 10^5
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.14

Tests of H_2
Canadian Capitalisers: Top 50% Based on the Materiality of "D"

Deflated by the Scale proxy
Scale proxy - number of common shares outstanding (NUMSHR)

	n=50							**Adj R^2**
Eq. 10	*CONSTANT*	*CLBV*						0.220
coefficients	2.419	2.673 ***						
White's t statistic[a]	(1.1220)	(3.969)						
Eq. 11	*CONSTANT*	*ADJCLBV*	*D*					0.307
coefficients	1.230	2.010 *	13.140					
White's t statistic[a]	(0.610)	(1.866)	(1.642)					
Eq. 12	*CONSTANT*	*ADJCLBV*	*D*		*ABNI*			0.303
coefficients	2.454	1.615	14.517 *		2.264			
White's t statistic[a]	(0.860)	(1.602)	(1.896)		(0.811)			
Eq. 13	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI*			0.391
coefficients	2.810	2.457**	41.106**	13.291	4.277			
White's t statistic[a]	(1.070)	(2.407)	(2.491)	(0.924)	(1.549)			
Eq. 14	*CONSTANT*	*ADJCLBV*	*OPD*	*DEF*	*ABNI**	*AMORT*	*CYEXP*	0.421
coefficients	2.287	1.938*	40.633**	20.638	6.961	-15.951	5.723	
White's t statistic[a]	(0.968)	(1.739)	(2.455)	(1.313)	(2.104)	(-1.605)	(1.310)	

F test = 4.608 p = 0.038 with 1 and 43 d.f.
F test is on the restriction a_3 (DEF) - a_6 (CYEXP) > 0

CLBV - *Closing book value of equity less book value of preferred stock*
ADJCLBV - *Closing book value of equity less book value of preferred stock less deferred development costs*
D - *Closing book value of deferred development costs*
OPD - *Unamortised closing book value of deferred development costs which existed at the beginning of the period*
DEF - *Current period capitalised expenditures (deferred development costs)*
NUMSHR - *Number of common shares outstanding (scale proxy)*
ABNI - *Abnormal income unadjusted for effects of R&D*
*ABNI** - *Abnormal income adjusted for effects of R&D*
AMORT - *Current period amortisation expense*
CYEXP - *Current period expenditures not capitalised*

Abnormal income = *Net income - (10% x opening book value of equity)*

a) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.15

Tests of H2
Australian Capitalisers: Top 50% Based on the Materiality of "D"

Deflated by the Scale proxy
Scale proxy - number of common shares outstanding (NUMSHR)

																Adj R^2
	n=128															
Eq. 10	*ONSTANT*		*CLBV*													
coefficients	0.357	***	0.860	***												0.537
White's t statistic[a]	(4.519)		(12.780)													
Eq. 11	*ONSTANT*		*ADJCLBV*		RDA											0.568
coefficients	0.285	***	0.767	***	1.934	***										
White's t statistic[a]	(4.688)		(10.990)		(4.293)											
Eq. 12	*ONSTANT*		*ADJCLBV*		RDA				ABNI*							0.569
coefficients	0.325	***	0.747	***	1.985	***			0.335							
White's t statistic[a]	(5.247)		(11.160)		(4.303)				(0.730)							
Eq. 13	*ONSTANT*		*ADJCLBV*		OPRDA		DEF		ABNI*							0.630
coefficients	0.427	***	0.575	***	0.337		5.221	***	0.517							
White's t statistic[a]	(4.559)		(5.268)		(0.707)		(4.313)		(1.773)							
Eq. 14	*ONSTANT*		*ADJCLBV*		*OPD*		*DEF*		*ABNI*		*AMORT*		*CYEXP*			0.652
coefficients	0.394	***	0.549	***	-0.279		5.053	***	0.709	**	-0.698		4.706	***		
White's t statistic[a]	(4.915)		(5.356)		(-0.075)		(4.351)		(2.174)		(-0.334)		(3.832)			

F test = 2.9173 **p= 0.0889**

F test is on the restriction a_3 (DEF) - a_6 (CYEXP) > 0

CLBV - *Closing book value of equity less book value of preferred stock*
ADJCLBV - *Closing book value of equity less book value of preferred stock less deferred development costs*
D - *Closing book value of deferred development costs*
OPD - *Unamortised closing book value of deferred development costs which existed at the beginning of the period*
DEF - *Current period capitalised expenditures (deferred development costs)*
NUMSHR - *Number of common shares outstanding (scale proxy)*
ABNI - *Abnormal income unadjusted for effects of R&D*
*ABNI** - *Abnormal income adjusted for effects of R&D*
AMORT - *Current period amortisation expense*
CYEXP - *Current period expenditures not capitalised*

Abnormal income = *Net income - (10% x opening book value of equity)*

a) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

Table A.16

Canadian Capitalisers
Incremental Information Tests: Top 50% Based on Materiality of "D"
Comparison of With/Without DEP variable

Raw data with scale proxy as independent variable
Scale proxy - the number of common shares outstanding (NUMSHR)

$$Market\ value = b_0 + b_1 ADJCLBV + b_2 D + b_3 ADJABNI + b_4 ADJ + b_5 NUMSHR + b_6 DEP + e_i$$

n =50

No DEP	b_0		b_1		b_2		b_3		b_4		b_5		b_6	Adj. R^2
coefficient[a]	-1.977	***	3.095	**	27.157	***	8.447	**	-35.749	**	15.411	***		0.687
White's *t* statistic[b]	(-3.099)		(2.421)		(3.098)		(2.090)		(-2.560)		(4.124)			

With DEP	b_0		b_1		b_2		b_3		b_4		b_5		b_6		Adj. R^2
coefficient[a]	-4.290		-0.079		26.423	***	0.405		-13.816	***	25.670		-2.480	**	0.910
White's *t* statistic[b]	(-1.639)		(0.230)		(10.730)		(0.902)		(-2.850)		(1.666)		(-1.435)		

DEP	= 1 if the firm used accelerated depreciation, otherwise 0
ADJCLBV	= Closing book value of equity less book value of preferred stock less deferred development costs
D	= Closing book value of deferred development costs
ADJABNI	= (Net income + ADJ) - (10% x opening book value of equity)
ADJ	= Amortisation of opening development costs - current period capitalised development costs
NUMSHR	= Number of common shares outstanding

a) For the sake of presentation, a0 and b0 is divided by 105.
b) Significance levels (two-tailed): ***<0.01, **<0.05, *<0.10.

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