The economic consequences of taxation-related policy changes: empirical evidence from listed Australian companies

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This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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ABSTRACT

Prior research has documented the difficulty faced by small, early-stage R&D companies in financing their investments, due to the adverse selection problem that results from asymmetric information between investors and managers. Further, because these companies are generally cash constrained, they frequently make use of stock options to attract and retain employees, as the incentive effects of stock options are viewed as being more suited to firms undertaking risky projects with the possibility of large payoffs should they succeed. This thesis examines these issues in the context of two recent taxation-related policy changes in Australia. First, the 2011 reform of the R&D Tax Incentive ("R&DTI"), which allowed small, R&D-performing firms in a tax loss position to exchange a portion of their losses for a cash refund, and second, an unexpected change to the taxation of employee share schemes ("ESS") in 2009, which shifted the taxing point of employee stock options from exercise to vesting. Examining a sample of 322 ASX-listed mining exploration entities ("MEEs") that received R&D tax refunds between 2008 and 2015, this thesis finds that the number of firms accessing the R&DTI increased significantly after 2011, as did the average refund received. In a sample of 314 ASX-listed companies that adopted employee option plans between 2006 and 2017, this thesis also finds that the popularity of employee option plans declined after 2009. Of those companies that continued to grant options to employees after 2009, the value of options granted to employees decreased significantly, reducing the potential tax liability faced by employees on vesting. In addition, there is also evidence of a decline in stock option expense as a proportion of directors' total remuneration after 2009. This thesis also finds weak evidence of a negative market reaction to the announcement of the 2009 changes. The findings of this thesis shed new light on the financing decisions and compensation arrangements of early-stage R&D-performing firms.

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AASB	Australian Accounting Standards Board
AAT	Administrative Appeals Tribunal
ABS	Australian Bureau of Statistics
AGM	Annual General Meeting
ASC	Alternative Simplified Credit
ASX	Australian Stock Exchange
ATO	Australian Taxation Office
AUD	Australian dollars
BERD	Business expenditure on research and development
BHAR	Buy-and-hold abnormal return
CAR	Cumulative Abnormal Return
CGT	Capital Gains Tax
CP	Competent Person
CRD	SIRCA Core Research Data
E&E	Exploration and Evaluation
EOD	ASX End of Day Database
ESO	Executive Stock Option
EESO	Employee Stock Option
ESOP	Employee Stock Ownership Plan
ESS	Employee Share Scheme
FASB	Financial Accounting Standards Board
GAAP	Generally Accepted Accounting Principles
GDP	Gross Domestic Product
GICS	Global Industry Classification Standard
IFRS	International Financial Reporting Standards
IPO	Initial Public Offering
ISO	Incentive stock option
ITAA36	Income Tax Assessment Act 1936
ITAA97	Income Tax Assessment Act 1997
JORC	Joint Ore Reserves Committee
LP	Limited Partnership
MEE	Mining Exploration Entity
MTR	Marginal Tax Rate
NISA	National Innovation and Science Agenda
NPV	Net Present Value
NQO	Non-qualifying option
NRG	R&D National Reference Group
OECD	Organisation for Economic Co-operation and Development
PFS	Pre-feasibility study
R&D	Research & Development
RDFO	R&D Financing Organization
R&DTI	R&D Tax Incentive

RSPT	Resources Super Profits Tax
SEO	Seasoned Equity Offering
SIRCA	Securities Industry Research Centre of Asia-Pacific
SPP	Share Purchase Plan
SPPR	Australia Share Price & Price Relatives database
TRA69	Tax Reform Act of 1969
TSR	Total Shareholder Return
UK	United Kingdom
US	United States
USD	United States dollars

1. INTRODUCTION

1.1.Overview

The objective of this thesis is to examine the economic consequences of taxation-related policy changes in listed Australian firms.

This thesis adopts a microeconomic perspective in attempting to explain the effects of taxes on firms, by analysing settings in which taxes are likely to be important. In doing so, this thesis takes the view that the firm is a nexus of contracts among the various factors of production (Coase 1937; Jensen & Meckling 1976). In this framework, the taxing authority is an uninvited party to all contracts and brings to each of its “forced” ventures a standard set of contractual terms (tax rules) that taxpayers must accept (Scholes et al. 2016).

Chapter 2 examines the role of the R&D tax incentive in overcoming the impediments to capital raising faced by early-stage R&D-performing entities in Australia, who typically face adverse selection problems when seeking to raise equity due to the high information asymmetry inherent in their projects, which are typically high risk (Beatty, Berger & Magliolo 1995; Hall & Lerner 2010). The R&D tax incentive (R&DTI) provides a refundable tax offset (tax refund) to eligible firms in a tax loss position. This thesis examines the economic consequences of the R&D tax incentive in the context of Australian listed mining exploration entities (MEEs), who do not derive any revenue from their principal activities. The operating environment for MEEs is characterised by high information asymmetry due to the level of technical knowledge required to evaluate the economic potential of mineral resources and ore reserves (Ferguson & Crockett 2003). The presence of a large number of MEEs in a tax loss position, many of whom also perform R&D, makes this a potentially attractive setting to consider the economic consequences of R&D-related tax policy changes.

Chapter 3 examines the effect of taxes on employee stock option plans in Australia. The use of stock option grants to executives and employees is widespread and is frequently justified on the basis that it brings about improved incentive alignment between the managers of the firm and its shareholders (Scholes & Wolfson 1990; Smith & Watts 1992). Specifically, Chapter 3 aims to provide insight into the role played by taxes in compensation contracting, in the context of an unanticipated change to the taxation of employee share schemes in 2009, which saw the popularity of employee option plans decline due to the possibility of employees incurring a tax liability on the options vesting, but importantly, the change did not preclude high-growth firms from continuing to issue options to employees as a long-term incentive.

1.2.Motivation

This thesis aims to answer the call by Hanlon and Heitzman (2010) for tax researchers in accounting to consider research questions that will assist policy makers:

"As administrations propose changes to the tax rules, tax researchers in accounting should not sit on the sidelines. They should position their research and inquiry in a manner that can inform debates and inject much needed data with regard to firm behavior, real effects, and, to the extent possible, macroeconomic implications".

In this regard, Chapter 2 of this thesis is motivated by an expansion of the R&D tax incentive in 2011, which increased the rate of the refundable tax offset and expanded eligibility for the incentive by removing the cap on the amount of R&D expenditure that could be claimed. However, the 2011 changes to the incentive also introduced a narrower definition of R&D that was more closely aligned to the scientific method, and targeted activities where a hypothesis was being tested and that addressed a knowledge gap[1].

Prior research finds evidence that low-tax firms are more likely to make use of tax shelter structures such as R&D limited partnerships (RD LPs)[2], to enable them to transfer their unused tax losses to more highly taxed entities in exchange for financing (Shevlin 1987). However, Wolfson (1985) and Beatty et al. (1995) noted that these structures were characterised by agency conflicts, because the investors were effectively guaranteed a return in the form of the tax benefits transferred from the R&D performing entity regardless of whether the R&D succeeded or failed.

The mechanics of the current R&DTI are similar, in that the R&D firm gives up a portion of its tax losses in exchange for a tax refund. However, instead of transferring the tax losses to a more highly taxed entity, the R&D firm instead shares risk with the government. From an agency perspective, this arrangement would *prima facie* appear to be consistent with existing theories of the capital structure of the firm, which suggest that firms prefer to finance projects with internal funds, with equity used as a last resort (Myers & Majluf 1984). This is especially true in the case of high-risk investments such as R&D, where there is a 'lemons' problem due to not being able to distinguish good projects from bad (Akerlof 1970; Hall & Lerner 2010).

Chapter 2 therefore seeks to provide evidence regarding the characteristics of firms that receive refunds under the R&DTI. This research question is interesting in the context of the equity issuance literature, as the refunds issued under the R&DTI provide a unique source of financing that provides smaller firms with an alternative to issuing equity. This is particularly relevant in the case of MEEs, who have difficulty raising capital as a result of being subject to greater

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[1] The legislation is quite explicit in this regard, as eligible R&D activities must involve a systematic progression of work that proceeds from hypothesis to experiment, observation and evaluation, and leads to logical conclusions: refer section 355-25(1) of the ITAA97.
[2] Explained in Section 2.2.2.

information asymmetry (Prosser 2003). For example, Australian evidence finds that MEEs frequently raise funds by issuing share purchase plans ("SPPs"), a form of seasoned equity similar to a rights issue that allows existing shareholders to purchase up to $5,000 of additional shares without requiring the issue of a prospectus (Brown, Ferguson & Stone 2008). In this respect, R&D refunds and SPPs are both relatively cost-effective forms of financing.

Chapter 3 of this thesis examines an unexpected change to the taxation of employee share schemes ("ESS") in 2009, which amended the taxing point for employee options from exercise to vesting for certain options that were not at real risk of forfeiture (i.e., not subject to meaningful performance hurdles or a minimum term of employment). The real risk of forfeiture requirement was an attempt to ensure closer links between employee performance and the value of their remuneration.

Options are heavily used in small, early-stage start-up and R&D firms who undertake projects that are high risk, as these firms are initially cash constrained and rely on options to attract talented employees (Chang et al. 2015; Henrekson & Sanandaji 2018). Options are viewed as a more suitable compensation form in these companies because they provide employees of early-stage start-up firms with a share in the outcome of their actions should the firm succeed.

This thesis is of practical significance in that it examines the economic consequences of two policies that are argued to be vital in encouraging R&D and innovation in Australia. For example, a 2014 submission to Treasury by Employee Ownership Australia & New Zealand[3] highlighted the importance of a vibrant start-up sector in lifting productivity, competition, economic growth and employment. The accounting profession has also highlighted the importance of having a competitive taxation regime in place for the taxation of employee share

[3] Attached at Appendix J.

options in respect of start-up, research and development and speculative-type companies, as these companies often have limited access to cash, and their ability to offer equity as compensation in-lieu of paying higher cash remuneration is an important tool for attracting and retaining employees (Institute of Chartered Accountants in Australia 2009).

This investigation is also timely, as it comes at a time when Australia's current R&D spend of 1.8% of GDP has fallen well below the OECD average of 2.3% of GDP, and lags behind other countries such as Israel (4.8%), Korea (4.3%), Sweden (3.4%), Japan (3.3%), and the US (2.8%)[4]. In this regard, the accounting profession has argued that the R&D Tax Incentive is an important mechanism by which the Australian Government can promote business investment in innovation and R&D. In a recent submission to the Senate Standing Committee on Economics by Chartered Accountants Australia and New Zealand, it was suggested that the decline in Australia's R&D investment since 2008 (when R&D spend was 2.3% of GDP) is a result of the uncertainty surrounding the R&D Tax Incentive policy, which has been subject to numerous reviews and amendments in recent years (Chartered Accountants Australia & New Zealand 2018).

[4] OECD Research and Development Statistics (2018), available online: http://www.oecd.org/sti/rds [accessed 23 July 2018]

1.3.Research Questions

The objective of this thesis is to examine the economic consequences of two major taxation-related policy changes on Australian listed firms, namely, the reform of the R&D tax incentive in 2011, and the changes to the taxation of employee share schemes in 2009.

In relation to the R&DTI reforms, the following specific research questions are addressed in Chapter 2:

1. What are the characteristics of firms that claimed the refundable R&D tax offset?
2. How did the 2011 reforms affect: (i) the amount claimed; (ii) subsequent investment and equity raisings by MEEs; and (iii) growth opportunities?
3. How does the market value R&D refunds?
4. How does the long-run stock price performance of R&D-performing firms differ from comparable non-R&D firms?

Chapter 3 considers the following research questions in the context of the changes to the taxation of employee share schemes:

1. What are the characteristics of firms that adopt employee option plans?
2. What was the impact of the 2009 changes on employee stock option grants?
3. How did the market react to the surprise announcement of the 2009 changes?

1.4.Summary of major findings

Chapter 2 of this thesis finds that the number of MEEs claiming the refundable R&D tax offset increased after 2011, as did the average refund amount. The increase in refundable tax offset claims is concentrated in those firms that had previously disclosed a mineral resource or ore reserve and in projects with more technical risk, suggesting that the reform was effective in focusing the incentive on experimental, hypothesis-driven activities.

There is some evidence that R&D tax offset recipients spent more on exploration and evaluation, were more successful in raising equity, and had greater growth opportunities, relative to MEEs that did not claim the R&D tax offset. However, there was a negative association between receipt of an R&D tax offset during the year and firm market value.

There is significant long-run stock return underperformance in the MEE sector. This is attributed to the high failure rate of minerals exploration companies (Ferguson, Clinch & Kean 2011). In this regard, firms that receive the R&D tax offset fare no better than other MEEs, but R&D firms are generally less risky than non-R&D firms of comparable size. This is likely to be because companies engaged in greenfields exploration (the most high-risk form of exploration) typically do not invest significantly in R&D. R&D firms, by contrast, are more likely to conduct research around an existing mineral deposit.

Chapter 3 finds that the incidence of employee option plans declined after 2009. Younger firms and loss firms were found to be more likely to issue options to employees. Firms with employee option plans are more likely to be in the mining, oil and gas, information technology and pharmaceuticals industries.

Among the firms who continued to make use of employee option plans after 2009, there did not appear to be a decrease in the quantity of options granted. However, there was a significant decline in the value of options granted to employees, a result which appears to be driven by companies granting fewer higher-priced options (i.e., options that are deeper in the money at grant date) and more lower-priced options (i.e., options that are deeper out of the money at grant date) after 2009[5]. This is consistent with the employee's tax consequences being relevant in the option grant decision, as options that are deeper out of the money at grant date typically have no tax consequences for the employee at grant. There is also evidence that the compensation mix of companies granting options to directors changed after 2009, as a decline in stock option expense as a percentage of directors' total compensation was observed. Lastly, there is weak evidence that the stock prices of firms with employee share and option plans reacted negatively when the changes to the taxation of employee share schemes were announced in May 2009.

1.5.Structure of this thesis

The remainder of this thesis is structured as follows. Chapter 2 examines the economic consequences of the R&D tax incentive for listed MEEs. Chapter 3 examines the taxation of employee stock options in Australia. Chapter 4 outlines the contributions, limitations and opportunities for future research.

[5]Higher-priced here means that $P - X > 0$ by a greater amount, where X is the exercise price or strike price of the option and P is the firm's current share price. Lower-priced means $P - X < 0$ by a greater amount.

2. THE R&D TAX INCENTIVE AND MINERALS EXPLORATION IN AUSTRALIA

2.1. Introduction

Investment in research and development ("R&D") plays a major role in facilitating innovation within countries and regions. Many countries have turned to fiscal incentives for R&D in an effort to increase their level of innovation and improve their technological performance, often involving substantial sums of taxpayers' money (Bloom, Griffith & Van Reenen 2002). Government support for business R&D is typically justified based on the widely held view that R&D and innovative activities are difficult to finance in a freely competitive marketplace (Hall & Lerner 2010; Neubig, Galindo-Rueda & Appelt 2016). Scientific research is inherently risky, and it can be difficult to model the expected returns to R&D due to small probabilities of high future payoffs. As a result, small, new, innovative companies face a high cost of external capital when funding R&D projects, as they invariably must pay a lemons' premium when issuing new shares to fund R&D due to asymmetric information between new investors and management, increasing the required rate of return of this type of funding (Akerlof 1970; Fazzari, Hubbard & Petersen 1987; Hall 1992).

The chapter examines the economic impact of tax incentives for R&D in the context of the introduction of the R&D Tax Incentive ("R&DTI") in Australia on 1 July 2011, which replaced the previous R&D Tax Concession[6]. The new R&DTI differed from the previous tax concession in two main ways. First, it provided a 45% refundable tax offset (tax credit)[7] to firms with an annual turnover of less than $20 million, which was designed to improve cash flow for small, innovative and start-up firms in a tax loss position. These firms often endure losses for several years before becoming profitable and are thus unable to benefit from R&D deductions. Prior to 1

[6] Refer to the Tax Laws Amendment (Research and Development) Act 2011.
[7] The terms "tax offset" and "tax credit" are used interchangeably in this thesis.

July 2011, firms could only obtain a 30% refundable tax offset, and eligible R&D expenditure was capped at $2 million per year. Second, the R&DTI replaced the bonus tax deduction for R&D expenditure (then 125%) with a 40% non-refundable tax offset and abolished the 175% premium deduction for companies that increased their R&D expenditure above an average of the three previous years[8].

The focus of this chapter is on the economic impact of the refundable tax offset in a setting where firms with tax losses are prevalent, namely Australian mining exploration entities (MEEs). MEEs often undertake projects with a significant amount of geological and technical risk. R&D is undertaken by MEEs in order to bring about intellectual property acquisition around mineral deposits, which can result in certain sub-economic deposits becoming economically viable. Successful R&D may also accelerate the development of viable projects that are subject to long development life cycles.

The MEE setting has several advantages. First, the objectives of MEEs are relatively homogenous and are as follows: (1) find economic resources such as iron ore, base metals, precious metals and other minerals (i.e., exploration and prospecting); (2) define the extent of such resources; and (3) investigate the economics of extracting such resources with a view to project development (Ferguson & Pündrich 2015). This homogeneity of firm objectives is a strength of industry-based studies (Shevlin 1996).

Second, Australia is a resources-based economy. In 2016, the Metals & Mining GICS industry classification comprised 31.3% of all companies listed on the Australian Stock Exchange (ASX). The mining sector represents approximately 22% of business R&D investment in

[8] The rate of the refundable tax offset was subsequently lowered to 43.5% and the rate of the non-refundable tax offset was lowered to 38.5% for income years commencing on or after 1 July 2016.

Australia, spending around $4 billion each year on R&D, with over 700 mining companies currently registered for the R&D tax incentive (Ferris 2015).

Third, the Australian mining industry is comprised of a large number of early-stage exploration firms, a mid-sized number of middle-stage mine developers (i.e., successful explorers), and a small number of late-stage mine producers (Ferguson, Clinch & Kean 2011). The presence of a significant number of R&D performing MEEs who operate in a very competitive sector and are capital constrained make this an attractive setting in which to consider the economic implications of taxation related R&D policy changes.

This chapter makes several contributions. Firstly, data at the individual mine (project) level is utilised in order to provide descriptive evidence regarding the characteristics of MEEs who receive the refundable R&D tax offset. The speculative nature of minerals exploration, combined with the inherent uncertainty of scientific research, suggests that firms are unlikely to invest significant amounts in knowledge creation until a resource has been defined.

Second, the effect of the 2011 changes to the R&D tax incentive is examined by comparing the amount claimed under the 45% tax offset after 2011 to amounts claimed at the 30% rate before 2011, to determine whether the 2011 reforms achieved their stated objective of allowing smaller firms that have not yet reached the profit generating stage to access R&D tax concessions.

Third, a difference-in-difference research design is employed to examine the effect of the R&D tax incentive on exploration and evaluation expenditure, equity raisings and growth opportunities before and after the 2011 changes. If the R&D tax incentive has been successful in bringing about intellectual property acquisition around mineral deposits, it may lead to further brownfield exploration in neighbouring areas, as successful R&D efforts might result in more deposits becoming economically viable.

Fourth, this chapter contributes to the literature regarding the value relevance of non-financial information, which previous studies have highlighted in the context of fast-growing internet and telecommunications companies (Amir & Lev 1996). The information environment of MEEs resembles that of fast-growing technology companies in that it is characterised by high information asymmetry, and financial statement information is of limited use in valuing MEEs who derive no revenue from their principal operations. In the MEE setting, resource and reserve announcements have been found to be value relevant (Bird, Grosse & Yeung 2013). Capitalised R&D has been shown to be value relevant for Australian listed companies (Abrahams & Sidhu 1998). R&D in the MEE context may therefore be informative regarding the future mineral potential of previously reported resources and reserves.

Last, the performance implications of the R&D tax incentive are considered by examining the long-run performance of firms which receive the R&D incentive. Given the role of R&D refunds as a source of financing for cash constrained firms, pecking order theory predicts that firms facing a high cost of equity capital as a result of undertaking higher risk projects will prefer R&D refunds instead of issuing more equity (Hall & Lerner 2010; Myers & Majluf 1984). In the Australian setting, Ferguson and Crockett (2003) argue that mining companies are subject to greater information asymmetry due to the specialized and highly technical nature of geological information. This is likely to be especially true of mining companies that undertake R&D. In this regard, R&D refunds have some similarities to seasoned equity offerings (SEOs) such as share purchase plans (SPPs), which are often used when the company has insufficient funds to finance ongoing investment (Myers & Majluf 1984). Prior evidence suggests the SEO financing decision is seen as a negative signal, as it suggests an increase in the firm's underlying risk (Brown, Gallery & Goei 2006). Empirical evidence suggests Australian firms that implement SPPs are less profitable, have lower cash holdings relative to non-SPP issuers, and that the market reacts negatively to the announcement of an SPP (Brown, Ferguson & Stone 2008).

On the other hand, investors tend to view R&D expenditures as investments that are expected to produce future benefits. Prior research documents evidence of a positive relation between R&D investment and excess stock returns (Chambers, Jennings & Thompson 2002; Chan et al. 2007), with risk-based explanations most commonly advanced for this relation, as R&D projects typically involve significant technical uncertainty, which results in investors demanding higher returns as compensation for risk-bearing. Consistent with this explanation, Li (2011) finds that the R&D-return relation is strongest among financially constrained firms.

This chapter therefore hopes to shed new light on two well-documented share market anomalies, the SEO long-run underperformance anomaly first observed by Loughran and Ritter (1995) and Spiess and Affleck-Graves (1995), and the excess returns to R&D observed by Lev and Sougiannis (1996), Chambers et al. (2002), and others.

Prior research discusses the asymmetric impact of the taxation system on investments in risky R&D projects by firms with no taxable income, due to the uncertainty regarding whether the resulting tax loss carry forwards can in fact be utilised in the future, significantly reducing the value of the expected future tax benefits and hence the project's expected after-tax return (Scholes et al. 2016). The impact on after-tax returns is particularly severe for undiversified firms with "stand alone" projects where the project and the firm are the same, and it is often these firms that are the most innovative (Cutler 2008; Majd & Myers 1987). For profitable firms, on the other hand, any losses from risky investments such as R&D can be deducted against their other income, such that the project's expected after-tax return can exceed its expected pre-tax return after factoring in the benefit from the R&D tax credit[9].

Recent evidence suggests risk taking is sensitive to taxes, as higher taxes reduce expected profits more for risky projects than for safe ones (Ljungqvist, Zhang & Zuo 2017); further, the effect of taxes on risky investment appears to hinge on firm-specific expectations of future loss recovery. Langenmayr and Lester (2018) present evidence suggesting that risk taking is more attractive for firms that are more likely to use losses to offset future income, as the government shares in both the profit and loss related to the investment, decreasing the variance of returns.

Recent evidence suggests that firms increase their R&D when governments provide more generous R&D incentives (Finley, Lusch & Cook 2015). Among smaller firms, Agrawal et al. (2014) find evidence that Canadian firms that became eligible for a 35% tax credit (up from a 20% credit) increased their R&D spending by an average of 15%. In the Australian context, it has been suggested that the R&D tax incentive may generate additional investment of up to $1.90 for each dollar of tax revenue foregone (Thomson & Skali 2016). However, no published Australian study has explicitly considered the effect of the refundable R&D tax offset on investment by low-tax firms.

The evidence base in relation to Australia's R&D tax concessions is surprisingly limited for a scheme that has operated for the past 30 years. This is due in part to the inherent difficulty in measuring the effects of changes to a tax instrument, as well as the lack of open disclosure of taxation data (Cutler 2008), as well as the difficulty in measuring the outcomes of successful

[9] This was arguably a key driver of the use of R&D limited partnerships or syndicates, which were popular among start-up high technology companies in the 1980s, and generally involved the transfer of tax benefits to higher-taxed taxpayers in exchange for R&D funds (Shevlin 1987). The Australian Government introduced the R&D Syndication scheme in 1987 (Kestigian 1995) which operated in a similar fashion to the limited partnerships examined by Wolfson (1985) and Shevlin (1987); however, syndication was abolished in 1996 due to concerns about possible abuses of the scheme, such as excessive tax shelter activity (Cutler 2008).

R&D, which by nature involves small probabilities of large payoffs in the future. A further contribution of this chapter, then, is to contribute to the public policy debate on R&D in Australia.

Based on a sample of 846 mining exploration entities (MEEs) that were listed on the ASX between 2008 and 2015, the number of companies receiving R&D tax refunds after 2011 increased significantly, and the average refund received increased from $220,639 in 2008 to $1,022,677 in 2015. Firms are more likely to claim the R&D tax offset if they have existing mineral resources or ore reserves. The results also provide support for the scientific impetus of the R&D tax incentive program, as tax offset claims are less common in gold and silver projects, which tend to involve less scientific risk. There is also some evidence that firms receiving the R&D tax incentive spend more on subsequent exploration, and have greater growth opportunities.

The remainder of this chapter is structured as follows. The requirements of the R&D tax incentive are described in section 2.2. Section 2.3 provides an overview of the mining exploration sector in Australia, including the reporting requirements faced by firms in the sector. Section 2.4 contains a review of the relevant literature. Section 2.5 outlines the hypotheses. Section 2.6 describes the data and sample. Section 2.7 describes the research methodology. Section 2.8 presents the main results and section 2.9 concludes.

2.2.The R&D Tax Incentive

2.2.1. Background

Thirty OECD countries currently offer some form of R&D tax incentive and approximately 6.9% of all business R&D is directly funded by governments, with tax incentives accounting for 43% of all public funding for R&D (Neubig, Galindo-Rueda & Appelt 2016). Tax incentives for R&D can take various forms, ranging from volume-based R&D credits, where firms obtain a tax credit calculated as a fixed percentage of expenditure incurred; incremental R&D credits, where a tax credit is only obtained in respect of expenditure incurred above a base amount; bonus tax deductions beyond 100% of the cost incurred; accelerated depreciation on assets used in R&D; and patent box incentives which reduce the tax rate on qualifying income derived from certain types of intellectual property (Cutler et al. 2013).

The advantage of using tax incentives to support R&D is that they are often open-ended entitlements which reduce the scope for discretionary selection of individual firms or projects (Ferguson & Sherry 2017). Because qualified activities are defined in the relevant tax legislation, tax incentives do not involve the government 'picking winners'; rather, receipt of the tax rebate or refund follows the commercial decision to invest, so there is a mechanical relationship between the amount of the refund and the actual expenditure incurred, based on the percentage of the rebate (Adhikari 2015).

Australia has provided tax concessions for R&D spending since 1986. The form of these concessions has been modified from time to time, but the substantive purpose of the tax concession has not changed, namely, to encourage investment in R&D activities with the aim of making Australia internationally competitive (Sadiq 2014). The last significant reform of Australia's R&D tax concessions was in 2011, when the new R&D Tax Incentive ("R&DTI")

came into effect from 1 July[10]. This represented a unique design change in the history of the Australian R&D tax concession, as it replaced the existing bonus tax deduction for R&D expenditure (125% in 2010) with a tax offset system. The new R&D tax incentive was more generous than the previous system, as it provided for a 45% refundable tax offset, allowing many smaller firms with no taxable income to access the incentive (Crawford & Cunningham 2008; Crawford & Sawang 2011).

The R&D tax incentive is administered jointly by Innovation Australia (AusIndustry) and the Australian Taxation Office (ATO). Eligible entities must be registered with AusIndustry and be engaged in eligible R&D activities. Broadly, the activities conducted must be hypothesis-driven, experimental activities that are based on principles of established science and are conducted for the purposes of generating new knowledge. Eligibility of R&D activities is determined by AusIndustry, while the ATO determines the allowable tax offset when the entity submits its tax return. For more details about the core components of the R&D tax concession, refer to Table 2.1.

[TABLE 2.1 ABOUT HERE]

2.2.2. History of Australia's R&D concessions

The R&D Tax Concession ("the concession") was first introduced in Australia with the enactment of the former section 73B of the *Income Tax Assessment 1936* (1TAA36), applying from 1 July 1985. The concession was introduced as an important plank of the industry reform agenda under the then Hawke Government to overcome a shortfall of investment in new technologies (Michael Johnson Associates 2010). The concession provided for a bonus deduction of 150% of eligible R&D expenditure incurred by companies incorporated in Australia and

[10] Refer to the Tax Laws Amendment (Research and Development) Act 2011.

undertaking eligible Australian-owned R&D activities[11]. Based on the company tax rate at the time of 49%, the concession amounted to a non-refundable tax credit of 73.5% of all R&D expenditure and was viewed as a critical tool to overcome impediments facing businesses wishing to invest in R&D.

In 1987, the Commonwealth Government introduced the R&D Syndication program. The aim of the program was to attract investment into early-stage, high-risk R&D (Inspector-General of Taxation 2007). The program was designed to help start-up firms in a tax loss position (and therefore could not benefit from the 150% R&D concession) by allowing them to exchange their tax losses for R&D funds, and was effectively "an officially sanctioned mechanism for financing new R&D through the sale of tax losses" (Inspector-General of Taxation 2007, p. 3).

R&D syndicates involved establishing relationships between researchers, investors and financiers in the early stages of the arrangement. The syndicate investors would set up a tax benefit transfer arrangement between the parties and would provide funds to the syndicate to purchase a limited-term licence for a pre-existing core technology (usually developed in-house or purchased from other researchers) and also inject funds for the researcher to undertake new R&D based on the core technology. The investors received a 100% deduction for the cost of the investment and were guaranteed a rate of return regardless of whether the R&D project succeeded or failed. If the investor wished to discontinue the arrangement, it could exercise a put option, which would result in the researcher buying the investor out of the syndicate at a pre-agreed price.

A critical factor to the viability of R&D syndicates was the price of the eligible core technology at the heart of the research, as this was the mechanism that facilitated the transfer of tax losses. However, the design of the concession was such that it created an incentive for

[11] The rate was reduced to 125% for expenditure incurred on or after 20 August 1996.

researchers to inflate core technology valuations (hence enabling investors to buy more tax losses) in order to attract an investor (usually a highly taxed entity). While anti-avoidance provisions in the ITAA36 required the core technology to be valued at arm's length, valuations were highly subjective, as there was no established market for the core technology, which was usually novel and unique intellectual property. Syndication was ultimately abolished, due to concerns that the scheme was being exploited by means of inflated core technology values (Boreham 1995; Kestigian 1995)[12].

The first major change to the R&D tax concession was introduced in 2001 and allowed qualifying companies to take the concession as a refundable tax offset rather than a deduction, if their annual group turnover was less than $5 million and their R&D expenditure was below $1 million. This alternative concession was aimed at providing incentives to small, early stage companies making tax losses (Sadiq 2014). The second major change was the 175% premium concessional deduction for additional expenditure where annual expenditure exceeded a base level determined by the average R&D expenditure over the previous three years. For a summary of changes to the R&D tax concessions over time, refer to Table 2.2.

[TABLE 2.2 ABOUT HERE]

[12] For a discussion of these incentive problems in a similar context, refer to the work of Wolfson (1985) in relation to oil and gas limited partnerships.

2.2.3. The Cutler Review

In January 2008, the then Minister for Innovation, Industry, Science and Research commissioned a review of the National Innovation System. Informally known as the Cutler Report, the Review Panel's findings, released in August 2008, identified the R&D tax concession as requiring transformation and rationalization (Cutler 2008). In particular, the Cutler report commented that the R&D tax offset introduced in 2001 was too narrowly targeted and made it difficult for firms in a tax loss position to benefit from it, as many start-up firms were too large to qualify for the tax offset due to the $1 million cap on R&D expenditure. Further, the Cutler report observed that because many start-ups endure tax losses for the best part of a decade, bonus tax deductions for R&D would be of little commercial value for these entities.

The two main recommendations of the Cutler report were, firstly, that the existing R&D tax concession should be changed from a tax deduction to a tax offset, and secondly, that the tax offset be made refundable for smaller firms with a turnover of less than $50 million. In particular, the Cutler report highlighted the strong correlation between business research expenditure and the availability of the R&D concession over time (Ferguson & Sherry 2017). It is an open question as to whether causation can be imputed from this association, as some of the growth in R&D since the 1980s is likely to have been driven by the internationalisation of the Australian economy and the resulting need for Australian companies to innovate. Nevertheless, the Cutler report observed that Australia's R&D intensity declined sharply from 1996 to 2001 after bonus tax deductions for R&D were reduced from 150% to 125%, and only began to increase after 2001 when the 175% premium R&D concession and 30% refundable R&D tax offset were introduced. In addition, successive reductions in the company tax rate from 49% in 1987 to 30% in 2008 eroded the after-tax benefit of the R&D bonus deductions, such that the 150% concession was equivalent to a tax credit of 37.5%, compared to the original tax credit of 73.5% available under the original concession introduced in 1986.

2.2.4. The 2011 changes to the R&D tax incentive

Most of the Cutler Review recommendations were subsequently adopted by the Federal Government in its 2009 announcement of a new R&D tax offset to replace the existing R&D tax concessions effective 1 July 2011, with some modifications. For a timeline of key events relating to the introduction of the R&D tax incentive in 2011, refer to Table 2.3.

[TABLE 2.3 ABOUT HERE]

The main features of the new R&D regime were a 45% refundable tax offset for Australian owned firms with annual turnover of up to $20 million and a 40% non-refundable tax offset for all other firms. For most claimants, the new incentive increased the value of the program by applying a higher base rate to their R&D expenditure, which was no longer deductible under the program (Crawford & Sawang 2011). Based on the prevailing corporate tax rate of 30%, for a company with taxable income, the net additional benefit for a company claiming the 40% non-refundable offset would therefore be 10% of its eligible R&D expenditure; for a company claiming the 45% refundable offset, 15%. By contrast, the net additional benefit for a company previously claiming the 125% bonus deduction was 7.5%[13]. By making eligible R&D expenditure non-deductible, claimants in a tax loss position effectively sacrifice a portion of their unused tax losses in exchange for a refundable tax offset. The government will therefore claw back some of

[13] The new incentive was less generous for some large companies that were eligible for the 175% premium deduction. However, the 175% premium deduction was not seen as a key determinant of the investment decision-making process by most companies, as the quantum of eligible R&D spend is generally not determined until after year end. Further, complex grouping rules made it difficult to determine the value of the additional benefit, such that the premium concession was viewed as a windfall gain (Crawford & Cunningham 2008).

the tax benefits if the company later becomes profitable, in the form of higher tax revenues in later years[14]. The tax impact of the R&D incentive is summarised in Table 2.4.

[TABLE 2.4 ABOUT HERE]

Two other major changes were made, with the $1 million cap on R&D expenditure removed, and a more targeted definition of R&D introduced. While the distinction between core and supporting activities did not change, the eligibility test for core activities was made more stringent (Ferguson & Sherry 2017). Under the former R&D Tax Concession, core R&D activities had to involve 'innovation' (defined as involving an appreciable level of novelty) or high levels of 'technical risk' (defined in terms of applying the scientific method to close a knowledge gap)[15]. The definition of core R&D activities in the new section 355-25(1) of the *Income Tax Assessment Act 1997* ("ITAA97"), however, removed the concepts of innovation and technical risk and introduced new criteria based on the scientific method:

*"**Core R&D activities** are experimental activities:*

(a) whose outcome cannot be known or determined in advance on the basis of current knowledge, information or experience, but can only be determined by applying a systematic progression of work that:

(i) is based on principles of established science; and

(ii) proceeds from hypothesis to experiment, observation and evaluation, and leads to logical conclusions; and

[14] Further, because the R&D incentive is treated as a refund of income tax, it is treated as a debit in the company's franking account, so that a company that has received an R&D tax refund will not be able to pay a fully franked dividend to shareholders until such time as the refunds received from the R&D tax incentive are offset by the tax paid by the company; refer to section 205-30(1) of the ITAA97.
[15] Refer to paragraph 1.14 of the Explanatory Memorandum.

(b) that are conducted for the purpose of generating new knowledge (including new knowledge in the form of new or improved materials, products, devices, processes or services).”

The new definition represented a significant change and was justified on the basis that it would be “simpler” and “clearer”,[16] and that it would better align the Australian definition of R&D with international practice (Australian Government 2009). The revised eligibility criteria were based on the Frascati Manual guidelines developed by the OECD for collecting and reporting data on research and experimental development (OECD 2015). The Frascati manual published by the OECD provides internationally accepted definitions of R&D and classifications of its component activities. According to the Frascati manual, the definition of R&D covers three types of activities: basic research, applied research and experimental development, each of which are undertaken in order to produce additional knowledge, which is directed to producing new products or processes or improving existing products or processes.

However, the proposed changes were criticised by some advisers on the basis that the definition of R&D activities was too stringent. The definition of core R&D adopted in the legislation enacted was focused on the basic research and applied research aspects of the Frascati definition of R&D only, and not experimental development[17]. While some experimental development activities might still qualify, as the legislation still referred to activities undertaken in order to develop new and improved products or processes, it was argued that the removal of experimental development from the definition would narrow the range of activities that would qualify. Furthermore, the emphasis on basic and applied research was argued to be too limiting, as

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[16] Refer to the Explanatory Memorandum to the *Tax Laws Amendment (Research and Development) Bill 2010*
[17] Refer to Michael Johnson Associates Pty Ltd submission to Treasury, *The Tax Laws Amendment (Research and Development) Bill 2010 – Response to Second Exposure Draft*, 19 April 2010.

experimental development makes up the majority of business expenditure on research and development ("BERD").

2.2.5. Program administration

The Inspector-General of Taxation's review of the R&D syndication program in 2007 identified aspects of the program's administration and an absence of practical guidance from the ATO as two of the factors which contributed to that program's failure. Since the new R&D tax incentive commenced in 2011, both the ATO and AusIndustry have been more proactive in issuing guidance relating to the incentive. The ATO from time to time releases taxpayer alerts, rulings and determinations setting out its interpretation of the R&D legislation about which expenditures are eligible[18]. AusIndustry also encourages taxpayers to apply for advance findings in respect of activities that it intends to conduct, to provide companies with certainty about the eligibility of their activities prior to registering them[19]. AusIndustry also issues industry-specific guidance notes setting out its views regarding which activities are eligible for the incentive. For example, in November 2016 the Department of Industry, Innovation and Science published guidance on its website setting out its interpretation of the Mount Owen tribunal decision[20], where the taxpayer, a mining company, had its R&D tax offset claim disallowed on the basis that there was no evidence to support the taxpayer's claim that the activities being carried on contributed to new knowledge. In that case, the project on which the taxpayer sought to claim the R&D rebate involved some geological complexity, however, the activities conducted did not involve scientific

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[18] For an example, refer to Taxpayer Alert TA 2017/3, "Claiming the Research and Development Tax Incentive for ordinary business activities", available online: www.ato.gov.au [accessed 25 January 2018].
[19] Department of Industry, Innovation and Science, "Advance and Overseas Finding: Application Guidance", available online: www.business.gov.au [accessed 21 May 2019]
[20] Mt Owen Pty Limited (aka DBTL) v Innovation Australia [2013] AATA 573

or technical risk (i.e., no hypothesis was being tested, and the company applied existing knowledge and expertise to achieve its outcomes)[21].

2.2.6. Recent developments

Australia's R&D tax concessions have been subject to much debate in recent years as the actual cost of the R&D tax incentive has been greater than forecast, largely due to growth in the refundable tax offset. From 1 July 2016, the rate of the refundable tax offset was cut by 1.5% to 43.5%, with the non-refundable tax offset also cut by 1.5%, to 38.5%, as part of a number of savings measures designed to balance the Federal Budget[22]. This measure was criticized on the basis that it would undermine certainty and investor confidence in the incentive[23]. Rick Holliday-Smith, the Chairman of Cochlear Limited, noted the following in his address at Cochlear's 2016 AGM in response to the introduction into Parliament in August 2016 of the draft legislation to cut the R&D offset rate:

"Australia is now reducing these R&D incentives at a time when many other countries appear to be increasing incentives to attract R&D investment. Recent changes announced as part of the omnibus bill, as well as further proposed changes, will materially reduce the R&D tax benefits to Cochlear in Australia. Unfortunately, the impact of these decisions can only be fully understood over the longer term. There may be little or no apparent impact from changes to taxation policy in the first year, but over time we may see the loss of an increasing amount of research investments to overseas jurisdictions.[24]"

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[21] See "Getting mining R&D Tax Incentive Claims right", and "Mining projects to extract minerals", available online: https://www.business.gov.au/assistance/research-and-development-tax-incentive [accessed 19 February 2017].
[22] Refer to the Explanatory Memorandum of the Budget Savings (Omnibus) Bill 2016.
[23] Chartered Accountants Australia and New Zealand (2016), "Submission on R&D Tax Incentive Review Issues Paper", 29 February 2016.
[24] Cochlear Limited (2016). 2016 Annual General Meeting Chairman's Address, 18 October 2016.

On 7 December 2015, the Turnbull Government announced a commitment to conduct a review of the R&D tax incentive ("the Ferris review") as part of its National Innovation and Science Agenda. The review, which was completed in April 2016, made a number of recommendations, which included introducing an R&D intensity threshold so that only companies directing a specified percentage of their total business expenses to R&D would be able to claim the tax offset, and introducing a cap on the annual cash refund payable, with remaining offsets to be carried forward for use against future taxable income (Ferris, Finkel & Fraser 2016).

The Ferris review recommendations were criticized by several companies and industry bodies. In 2016, members of the R&D National Reference Group (NRG) urged the Minister to reconsider introducing an R&D intensity threshold as an eligibility criterion on the basis that it would pose a major barrier to companies obtaining R&D support and would be a "flawed" way of implementing the objective of increasing Australia's R&D intensity[25], with some manufacturing companies claiming that an R&D "intensity threshold" of 1-2% of total business expenses would drive their R&D tax offset claims to zero, as they have much higher operating costs relative to R&D than start-ups (Ferguson & Sherry 2017).

The accounting profession also argued strongly against making further changes to the R&D tax incentive. In its submission to the Ferris review, Chartered Accountants Australia & New Zealand cited a study by Thomson and Skali (2016) which found that firms registered for the R&D incentive invest around 40% more in R&D compared to similar firms which are not registered for the incentive. Further, their submission expressed surprise at reports in the financial

[25] Chartered Accountants Tax Team (2016). "CAANZ Taxation News", Edition 41, 24 October 2016.

press of fraudulent R&D claims[26], noting that compliance with the R&D tax incentive was believed to be "very high" based on AusIndustry's own statutory assessment and available data.

In the 2018 Budget, the Federal Government announced that it would introduce legislation to "improve the integrity of the R&DTI" and "refocus support for larger companies towards those undertaking additional, higher intensity R&D"[27]. The draft legislation and explanatory materials subsequently released in June 2018 incorporated several of the Ferris review recommendations, including an R&D premium to tie the rate of the non-refundable R&D tax offset to the incremental intensity of R&D expenditure as a proportion of total expenditure for the year[28]. With respect to the refundable R&D tax offset, the Government proposed a cap on refunds of $4 million per annum, in response to concerns that the previous uncapped refund was too generous as it did not place sufficient pressure on start-up companies to make decisions regarding the commercial viability of the funded R&D activities[29]. The proposals were unpopular, however, with a number of submissions to Treasury made through the consultation process highlighting the potential negative impact on projects whose funding is contingent on R&D tax refunds[30]. As a result, the Senate Economics Legislation Committee responsible for considering the draft legislation

[26] An article in *The Australian Financial Review* had suggested that the tax incentive system was being misused by some companies; see Mather et al. (2016). This may have been the result of companies seeking to claim the R&D tax offset in respect of activities that satisfied the requirements of the former concession because they were either innovative or involved technical risk, but did not qualify as eligible R&D under the new incentive, as the (by then well established) concepts of innovation and technical risk were abolished in favour of new criteria which required claimants to demonstrate evidence that a hypothesis was being tested.

[27] Australian Government (2018), "Budget 2018: Reforming the R&D Tax Incentive", available online: https://www.budget.gov.au/2018-19/content/factsheets/6-tax-integrity.html [accessed 28 November 2018]

[28] Australian Treasury (2018), "Consultation on the draft Treasury Laws Amendment (Research and Development Incentive) Bill 2018 and Explanatory Materials", Treasury consultation paper, June 2018.

[29] Gale, K. (2018). "The New R&D Tax Incentive: Refundable R&D Tax Offset – Some Value Trimming And A Fascinating Change", Michael Johnson & Associates, 10 May 2018, available online: http://mjassociates.com.au/the-new-rd-tax-incentive-refundable-rd-tax-offset-some-value-trimming-and-a-fascinating-change/ [accessed 17 July 2018]

[30] For example, refer to the submission by Northern Minerals Limited at Appendix B.

recommended deferring consideration of the Bill until further analysis of its impact could be taken[31].

In the meantime, R&D policy has been a source of ongoing uncertainty for program participants as a result of the complexity of the eligibility criteria. The ATO and AusIndustry have continued to target advisers that they believe have been too aggressive in the R&D claims that they have been submitting on behalf of clients. For example, the ATO recently rejected a R&D claim by the Commonwealth Bank (advised by Deloitte) in respect of a multi-year implementation of an internal software system (Tadros, Smith & Gillezeau 2018a), and accounting firm PwC recently cut more than 30 staff from its division advising companies on the R&D tax incentive after being told by the ATO that its R&D advice marketing was “too aggressive” and “risked breaching promoter penalty laws” (Tadros, Smith & Gillezeau 2018b). In response, a PwC spokeswoman said that the ATO and AusIndustry had taken a far more rigid interpretation of the R&D eligibility requirements than in the past. This view appears to be shared by a number of veteran advisers in the area, who have expressed concerns that the eligibility rules established by AusIndustry and the ATO are not suitable for some companies, such as those developing software, and need to be rewritten to accurately reflect the contents of the Frascati manual[32].

[31] Gale, K. (2019). “R&D Tax Bill Effectively Put On Hold By Senate Committee”, Michael Johnson & Associates, 12 February 2019, available online: http://mjassociates.com.au/the-new-rd-tax-incentive-refundable-rd-tax-offset-some-value-trimming-and-a-fascinating-change/ [accessed 22 May 2019]
[32] Gale, K. (2019). “Software R&D Tax Guidance: Talking Frascati, Time Travel and What Does It All Mean”, Michael Johnson & Associates, 28 February 2019, available online: https://mjassociates.com.au/software-rd-tax-guidance-talking-frascati-time-travel-and-what-does-it-all-mean/ [accessed 22 May 2019]

2.3. Mining exploration in Australia

2.3.1. Background

Australia is one of the world's leading resources nations. It has the world's largest reserves of lead, nickel, uranium and zinc, and in 2015 Australian minerals exports comprised around 45% of Australia's total exports of goods and services[33]. Australia's resources industry forms a significant portion of the listed firms on the ASX. As at March 2014, the "Materials" and "Energy" categories contained 1,028 listings on the ASX, which equates to 53.04% of total listings.

The Australian resources industry consists of the minerals sector and the petroleum sector. The minerals sector includes precious metals, such as gold, silver, platinum and palladium; base metals common in everyday use, such as iron ore, copper, nickel, zinc, lead and bauxite; other critical minerals such as lithium, tungsten, and rare earth elements; gemstones such as diamonds and zircon; and certain energy minerals including coal and uranium. The petroleum sector includes crude oil, natural gas, and liquefied petroleum gas (LPG) and liquefied natural gas (LNG). The objectives of participants in the minerals and petroleum sectors are straightforward, namely, to explore for natural resources and evaluate the economics of extracting such resources with a view to becoming a producer (Ferguson & Pündrich 2015).

The minerals and petroleum sectors have some similar characteristics in that what is being produced is a commodity in the strictest economic sense, i.e., a raw product that is used in the production of other goods and services and is uniform across all producers (Stewart 2017). However, the technical aspects of oil and gas projects are somewhat different from minerals

[33] Department of Industry, Innovation and Science, Resources and Energy, available online: http://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/Pages/Resources-and-energy-quarterly.aspx [accessed 2 November 2016]

exploration. For example, oil and gas projects involve the use of drilling techniques that are more suited to the nature of the rock sources where hydrocarbons are exploited, and drilling can occur either onshore or offshore (Zou 2017). Further, while Australia has significant mineral reserves, its petroleum reserves are very small by global standards (Prosser 2003). Therefore, the focus of this thesis will be on the mineral resources sector but will occasionally refer to the oil and gas sector where it aids understanding.

Minerals exploration involves searching for concentrations of naturally occurring metallic, non-metallic and industrial minerals, gemstones and certain energy minerals and includes activities that are intended to delineate or extend the limits of known deposits by geological, geophysical, geochemical, drilling or other means (Australian Bureau of Statistics 2019). Minerals exploration leads to the creation of an intellectual property asset, namely, the knowledge of subsoil deposits in specific locations for the purpose of their economic exploitation (OECD 2015).

There are two kinds of exploration activity: “greenfields” and “brownfields”. These terms were first coined by the petroleum sector, but in recent years the terms have been adopted by the minerals sector to differentiate high-risk remote exploration activity from near-mine exploration activity (Prosser 2003). Greenfields exploration refers to work undertaken in remote locations that are unexplored or underexplored and is speculative and extremely high risk. The probability of a greenfield geological target progressing to a profitable mine has been estimated to be about 1 in 1,000 (Del Real 2015). Further, discovery rates are falling, which some industry commentators believe is due to the increasing scarcity of mineral deposits as many of the world’s largest orebodies have already been discovered (Beaty 2010).

Brownfields exploration, on the other hand, is exploration undertaken close to an operating mine with the objective of extending its operating life and taking advantage of the established infrastructure. While brownfield targets are also high risk, Del Real (2015) notes that for some brownfield (and even some greenfield) targets, the most successful exploration companies can improve their odds of success significantly with the right geological expertise and by drilling efficiently (for example, by drilling early and knowing when to cut losses on bad targets)[34]. Technological advances also play a key role in facilitating discoveries (Beaty 2010). For example, advances in copper mining have allowed large, low-grade copper deposits to become economic.

There are four main stages in the life cycle of a resources company, which are exploration and evaluation; development and construction; production; and closure and rehabilitation (Stewart 2017). The mine life cycle is summarised briefly as follows. The exploration and evaluation stage involves searching for mineral deposits and evaluating their technical feasibility and commercial viability. In the development phase, access to the deposit is established, which usually involves applying for mining licences and environmental approvals, before construction of the mine can begin. The production phase involves activities aimed at obtaining saleable commodities from the deposit on a commercial scale. The final stage is the closure and rehabilitation phase, where various rehabilitation and regulatory costs are incurred to restore the mine site to its previous state. There is often a lengthy period between the initial exploration of an area and production. In Australia, the minerals sector is typified by a large number of early-stage exploration firms, a mid-size number of middle-stage mine developers (i.e., successful explorers), and a small number of late-stage mine producers (Ferguson, Clinch & Kean 2011).

2.3.2. The reporting environment

Because they do not derive any revenue from their principal operations, exploration companies are valued almost entirely on their ore reserves or their prospects of finding ore and have few tangible assets apart from working capital or equipment. As a result, non-financial

[34] Unpublished figures by mining analyst Richard Schodde suggest success rates can be as high as 1 in 200 for greenfield targets and 1 in 20 for brownfields.

disclosures such as resource and reserve announcements and geological reports are often highly value relevant for these companies (Bird, Grosse & Yeung 2013; Ferguson, Clinch & Kean 2011).

The main accounting choice relevant to exploration companies is how to account for costs incurred in the exploration and evaluation (E&E) phase. For most exploration companies, the capitalized E&E balance is the most significant asset on their balance sheet. In Australia, E&E costs are accounted for in accordance with AASB 6 *Exploration for and Evaluation of Mineral Resources*. Broadly, AASB 6 recognizes the uncertainty inherent in minerals exploration and permits the capitalisation of E&E costs in relation to an area of interest (defined in Aus7.3 as an individual geological area whereby the presence of a mineral deposit is considered favourable or has been proved to exist), where either the existence of an economically recoverable reserve has been proven, or exploration and evaluation activities are still continuing[35]. As a result of the requirements of AASB 6, decisions to capitalise or expense E&E costs are made on a project-by-project basis, with the capitalised E&E asset required to be impaired if the E&E costs are not expected to be recoverable (i.e., exploration efforts have not led to the discovery of a commercially viable resource). Empirical evidence suggests the majority of exploration companies choose to capitalize E&E costs and the decision to impair the E&E asset is generally viewed as an informative (negative) signal (Zhou, Birt & Rankin 2015). Further, empirical evidence suggests that E&E write-offs are associated with negative abnormal returns around the announcement date (Lam 2018).

Notwithstanding the high importance of non-financial information in valuing exploration companies, the content of such disclosures is often difficult to decipher. For example, announcements released by mining companies routinely include discussion of complex variables

[35]This is contrasted with the successful efforts approach permitted by IFRS 6, which only allows exploration and evaluation expenditures to be capitalized if it can be demonstrated that they will lead to commercially viable discoveries (Abdo 2016).

such as metal purity (the metallic grade in grams per tonne for precious metals, or percentage for base metals), the width of the drilling intercepts, and the depth below the surface where the intercept occurs. Highly technical factors also come into play when assessing the valuation implications of such disclosures. These include the geochemical composition of the mineralisation of the discovery, and the proximity of the discovery to mine infrastructure such as power and water supplies (Ferguson & Crockett 2003). Furthermore, as a result of this technical complexity, the best calculations of geologists may often be no better than approximations. For example, an unexpected intrusion of barren rock, unsuspected variations in grade, and metallurgical difficulties in ore treatment can significantly alter the calculations of a geological expert (Sykes 1978).

The public disclosures regarding outcomes of exploration activities can have a significant impact on stock prices (Gallery & Nelson 2008). As a result, the Australian resources sector is subject to additional reporting requirements which govern the disclosure of non-financial information. These are summarised below.

Mining exploration entities in Australia and New Zealand are bound by the Joint Ore Reserves Committee (JORC) Code (JORC 2012), a code of practice which sets minimum standards for public reporting in Australia and New Zealand of exploration results, mineral resources and ore reserves and provides a mandatory system for classification of tonnage and grade estimates. According to the JORC Code, a company must disclose any relevant information concerning a mineral deposit that could materially influence the value of that deposit. The JORC Code defines mineral resources and ore reserves as follows:

"A 'Mineral Resource' is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade (or quality), and quantity that there are reasonable prospects for eventual economic extraction…" (JORC 2012, paragraph 20)

"An 'Ore Reserve' is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level…" (JORC 2012, paragraph 29)

The key distinction between a mineral resource and an ore reserve is in terms of economic viability, which is typically established through the completion of a feasibility study. Further, the JORC code also requires that mineral resources and ore reserves be subdivided in categories in order of increasing geological confidence. The resource and reserve categories defined by the JORC code are *Inferred*, *Indicated* and *Measured* resources and *Probable* and *Proved* reserves. *Inferred* resources comprise the lowest confidence resources, *Indicated* resources are of higher confidence, and *Measured* resources are the highest confidence resource category. *Probable* reserves represent lower confidence reserves and *Proved* reserves are the higher confidence category. For a summary of the relationship between exploration results, mineral resources and ore reserves, refer to Figure 2.1.

[FIGURE 2.1 ABOUT HERE]

Assurance of JORC compliant resource and reserve disclosures is provided by a 'competent person' (CP). Broadly, a CP is a minerals industry professional who is a member of a recognized professional geological body and must comply with ethical and independence requirements. CPs must gather enough information, consider materiality, and document evidence supporting their public reports. In this respect, the assurance function of the CP with regard to resource and reserve disclosures bears some similarities to the assurance role of auditors in financial reporting in accordance with accounting standards (Ferguson & Pündrich 2015).

The JORC code operates in tandem with the ASX Listing Rules which apply to mining and exploration companies. ASX Listing Rule 5.3 requires all mining exploration entities

("MEEs") to issue quarterly activity and cash flow reports in accordance with the JORC code, which is reprinted in Appendix 5A of the ASX listing rules[36]. Except for commitments test entities,[37] MEEs and oil and gas exploration entities are the only companies in Australia required to provide quarterly reports in addition to their annual and semi-annual reporting requirements (Gallery & Nelson 2008). In addition, MEEs are also subject to the continuous disclosure requirements set out in ASX Listing Rule 3.1, which requires the immediate disclosure of any information or circumstances that are likely to materially affect the price of the entity's securities.

2.3.3. R&D in the mining exploration industry

Mineral exploration and evaluation activities are defined in the Frascati manual as activities that add to the knowledge of subsoil deposits in specific locations for the purpose of their economic exploitation (OECD 2015). The OECD acknowledges that it is difficult to frame a precise definition of R&D in the context of mineral exploration and evaluation. Minerals exploration and evaluation itself is not considered to be R&D under the Frascati manual; for example, surveying and prospecting activities and other exploitation-driven exploration efforts are generally not considered to be R&D. R&D may be undertaken to develop new test and drilling techniques that that the mining industry can draw on in its exploration and routine activities. R&D can also be used to develop advanced extraction techniques, as well as to improve the efficiency and reliability of processes employed to remove metals from the ore in the processing phase (Upstill & Hall 2006).

In the context of establishing eligibility for the R&DTI, the key to establishing the existence of a core R&D activity as defined in the ITAA97 is that a hypothesis is being tested, or, in other

[36] MEEs are defined as entities whose main undertaking consists of exploration for minerals.
[37] Commitments test entities are companies that are allowed to list on the ASX without a 'binding contract', provided they make commitments to spend their cash in accordance with their business objectives (Gallery & Nelson 2008).

words, a scientific approach to the activity can be demonstrated that will result in the creation of new knowledge. This means that if a mining developer is conducting a pre-feasibility study ("PFS") into a certain deposit, and through umbrella of the PFS, a viable hypothesis test can be demonstrated, then ground and airborne surveying, ground sampling, drilling, assaying and resource modelling costs may qualify for the R&D rebate as legitimate 'support' activities (Ferguson & Sherry 2017). Mining-related core R&D activities that may be eligible for the R&D tax incentive would include experiments necessary to develop new or improved processes such as new drilling and assaying techniques[38]. By contrast, activities that are not experimental, use existing technology, and are standard practice within the industry, will not qualify as core R&D activities as they do not generate new knowledge; rather, they are part of the inherent geological risk involved in undertaking mining projects (Ferguson & Sherry 2017).

An example of a project involving eligible R&D activities is the flagship Browns Range Heavy Rare Earths project of Northern Minerals Limited (ASX code: NTU)[39]. The Browns Range deposit, located in the East Kimberley region of Western Australia, contains reserves of high-grade dysprosium and terbium, two rare earth elements which are key components of the energy efficient permanent magnet motors used in electric vehicles, wind turbines and in other industrial applications. Demand for these and other critical minerals used in the technologies that produce low cost or renewable energy is expected to grow globally, as the supply of rare earths to world markets is currently dominated by China (Regional Development Australia 2018).

The Browns Range project has been heavily reliant on cash refunds from the R&DTI, as the project has faced reluctance from traditional lenders to provide finance due to its higher risk.

[38] Assaying refers to the chemical process by which the quality of ore is determined by analysing the proportion of metal, particularly precious metal, contained in the ore (Sykes 1978).
[39] Refer to the submission by Northern Minerals to the Senate Economics Legislation Committee Inquiry attached at Appendix B.

The project has received $26 million in funding from the R&DTI to date with a further $21 million budgeted from eligible R&D activities claimed. The funds from the R&DTI were used to finance the establishment of a pilot processing plant to enable the company to assess the economic and technical feasibility of the project, as hard rock mining processing of the type required by the project has not been done before. Approximately 25% of the planned project financing for the Browns Range project comes from the R&DTI, with the remainder of the funding coming from share placements and a share purchase plan. The funds from the R&DTI have enabled the company to maximise Australian ownership of the project.

2.3.4. Tax-related impediments to capital raising in the mining exploration sector

In 2003, the House of Representatives Standing Committee on Industry and Resources undertook an investigation into the impediments to increasing investment in minerals and petroleum exploration in Australia, with their findings published in the report "Exploring: Australia's Future" ("the Prosser Report"). The Prosser Report (2003, p. 35) noted that the corporate tax system creates impediments for juniors seeking to attract capital. In Australia, as in other countries, corporate profits are taxed at the statutory tax rate, while losses are carried forward and used as claimable deductions against future taxable gains (Kent 2011). There is no time limit for the utilisation of tax losses in Australia; however, the ability to deduct carried forward tax losses is subject to various integrity rules aimed at restricting the transfer of tax losses in order to preserve government revenue. The most important of these restrictions is the continuity of ownership (COT) test, which requires that the same persons maintain more than 50% of the company's voting power[40].

[40] Subdivision 165-A of the ITAA97.

Losses are widespread among Australian companies. From the ATO's Taxation Statistics[41], the total amount of tax losses deducted by all companies (private and public) in the fiscal year ended 30 June 2016 was $22 billion, and the total amount of tax losses carried forward to later income years was $348 billion, implying a loss utilisation rate of 6.33% (refer to Figure 2.2). Further, Figure 2.2 shows that the loss utilization rate has decreased over time, from almost 10% in 1996 to 6.33% in 2016. This indicates that a high percentage of losses become "trapped" and are never used.

[FIGURE 2.2 ABOUT HERE]

The loss utilization rate is even lower in exploration companies, which typically do not have any taxable income. In the exploration sub-grouping within the mining industry, total tax losses deducted in the year ended 30 June 2016 were $345 million, and total tax losses carried forward were $41 billion, implying a loss utilisation rate of 0.8% (Refer to Table 2.5). This indicates the high inherent risk associated with minerals exploration, where only very few explorers progress to become producers.

[TABLE 2.5 ABOUT HERE]

Many exploration companies, therefore, will have no opportunity to deduct exploration and other expenses immediately, or perhaps ever. This reduces the after-tax NPV of exploration projects. This problem does not affect large mining companies that have taxable income, as exploration and other expenses are immediately deductible for these companies.

This asymmetry results in distortion when comparing the returns of risky and riskless projects. The delay in being able to use losses, as well as the real possibility that losses will be trapped, can

[41] Australian Taxation Office (2018), "Taxation statistics 2015-16", available online: www.ato.gov.au [accessed 29 November 2018]

result in expected effective tax rates that are greater than the statutory tax rate. Freebairn (2012) considers the case of a project which has a 50:50 chance of a profit of $100 and a loss of $20, with an expected before-tax payoff of $40 (= [0.5 * 100] + [0.5 * -20]). With a 30% tax rate on a profit and a zero tax rate on a loss, the asymmetric treatment of losses means an expected tax payment of $15 (= 0.5 * 100 * 0.3) if the project is a success, but no refund if the project fails, since the loss would not be deductible. This results in an expected effective tax rate of 37.5% (= 15 / 40), which exceeds the statutory tax rate of 30%.

Further, the greater the project risk, for a given expected return, the higher the effective tax rate. For example, for the above 50:50 project, raising the return on success to $120 and increasing the loss on a failure to $40 leaves the expected before-tax return at $40, but with an even higher effective tax rate of 45% (= 0.5 * 120 * 0.3/40).

This taxation asymmetry has been noted by Freebairn (2012) as an impediment to risk-taking by junior exploration companies who, due to their capital constraints, typically only have one flagship project. This was also the problem faced by research-driven start-up firms described in section 2.2.2, who could not access the former R&D tax concession as they had been running at a loss. This was the basis for the Cutler Review recommendation that the R&D tax offset be made refundable for smaller firms (discussed in section 2.2.3 above). Prior research addressing this taxation asymmetry is discussed in Section 2.4.3.

2.4. Theory and Prior Literature

2.4.1. Introduction

This literature review is structured as follows. First, the various agency conflicts that can occur in firms undertaking riskier investments (such as minerals exploration) are discussed. Second, theory and evidence on the role of taxes in corporate risk-taking is considered. Third, a theory of the capital structure of the firm is presented, based on agency theory, as well as the implications that this has for the financing of R&D investment and the long-run performance of R&D-performing firms. Fourth, the literature considering the value relevance of non-financial information is discussed, as well as the extent to which this applies to R&D-performing MEEs. Finally, the previous literature on the effectiveness of R&D tax credits is briefly reviewed.

2.4.2. Agency costs and R&D

This thesis adopts the perspective of the firm as a nexus of contracts among the various factors of production, where contracts serve to mitigate agency conflicts between those parties (Armstrong, Guay & Weber 2010; Coase 1937; Jensen & Meckling 1976).

Jensen and Meckling (1976) define the agency relationship as a contract under which one or more parties (the principal(s)) engage another party (the agent) to perform some service on their behalf, which involves delegating some decision-making authority to the agent. The agency relationship has been recognised as a pervasive fact of economic life since Adam Smith's seminal 1776 work, *The Wealth of Nations* and is succinctly expressed thus: *"it cannot well be expected, that [managers] should watch over [other people's money] with the same anxious vigilance with which [they] watch over their own"*.

The typical problem analysed in the principal-agent literature is that of a risk-neutral principal attempting to induce a risk-averse agent to take the same action that the principal would take (Smith & Watts 1992). In empirical capital markets-based accounting research, one of the most frequently examined agency relationships is the relationship between shareholders and management (Jensen & Meckling 1976). In the Jensen and Meckling framework, agency costs arise whenever there is a divergence between the agent's decisions and the decisions that would maximize the principal's welfare. Agency costs are defined as the sum of monitoring expenditures by the principal, bonding expenditures by the agent, and the reduction in welfare experienced by the principal due to this divergence from the principal's interest (referred to as the residual loss).

For example, shareholders are generally considered risk-neutral, because they can diversify idiosyncratic (i.e., firm-specific) risk, and diversified shareholders want managers to adopt all positive net present value ("NPV") projects regardless of their idiosyncratic risk. Managers, however, may be more risk-averse, due to the disutility that they associate with risky investments, because the variance of the payoff is greater for a risky project than a safe one (Armstrong et al. 2019). If the manager is a utility maximiser, then he or she might be tempted to avoid risky projects, because the worst-case scenario would impact his or her future wages or job prospects. The agency cost in this scenario would be the reduction in welfare experienced by the shareholder that results from the manager rejecting a risky, but potentially lucrative, project.

The above example is relevant to MEEs, as small firms tend to yield excess returns relative to those predicted by traditional asset pricing models (Banz 1981; Brown et al. 1983). Because junior mining companies have high idiosyncratic risk and rarely pay dividends (Ball & Brown 1980), investors who trade in these companies are more likely to seek capital gains, because these stocks typically have higher variances of price changes and, therefore, larger probabilities of large price increases (and large price declines).

With respect to the potential agency conflict discussed above, this thesis adopts the efficient-markets perspective of Fama (1980) in viewing the separation of ownership and control as an efficient form of economic organisation within the 'set of contracts' called a firm. According to Fama, in a competitive market, the firm is disciplined by competition from other firms; this competition is the device for efficiently monitoring the performance of the team and its members. In addition, individual participants in the firm, and its managers, also face the discipline and opportunities provided by the markets for their services, both within and outside the firm, as the managerial labour market exerts direct pressure on the firm to sort and compensate managers according to their performance. Because the managerial labour market uses the performance of the firm to determine each manager's outside opportunity wage, each manager effectively has a stake in the performance of those above and below him. This perspective is especially relevant in the MEE setting in Australia, which is characterised by a large number of early-stage exploration companies who compete for a limited amount of capital (Ferguson, Clinch & Kean 2011).

However, it should be emphasised that one of the conditions for an efficient market (i.e., one in which prices always fully reflect available information on average) is that all available information is costlessly available to all market participants (Fama 1970). In the MEE setting, which is characterised by high information asymmetry due to the inherent complexity of geological information (Ferguson & Crockett 2003), information costs can result in agency problems such as adverse selection and moral hazard (Arrow 1985).

The adverse selection problem is best illustrated by the market for 'lemons' modelled by Akerlof (1970), where there are both good quality and bad quality used cars, but the buyer of the car does not know *ex ante* whether it is a good car or a lemon. As a result, the owner of a good car will be worse off and unable to sell their car for a fair price. The cost of adverse selection is larger for higher-variance (i.e., riskier) projects such as R&D, since the range of (unobservable) values between good and bad projects is greater (Beatty, Berger & Magliolo 1995). This is especially relevant for MEE firms operating in a high information asymmetry environment.

Moral hazard, on the other hand, arises when the agent has incentives to increase the project's riskiness *ex post* (also known as the hidden action problem). The term moral hazard originates from the practice of insurance (Arrow 1985); for example, fire insurance can dull incentives for caution and may even create incentives for arson. Health insurance creates similar problems, for it creates incentives to use excessive medical care if medical fees are paid for the insurer.

Beatty, Berger & Magliolo (1995) discuss moral hazard in the context of R&D financing organizations ("RDFOs"), which bear many similarities to the R&D syndicates discussed in section 2.2. They argue that moral hazard costs arise in RDFOs because of conflicts of interest between the sponsor (i.e., the entity undertaking the project research) and the investor (i.e., the entity receiving the benefit of the tax losses transferred by the sponsor). The investor in an RDFO is typically a highly taxed entity whose objective is to receive the use of tax losses from the sponsor in exchange for providing funding to the sponsor to conduct research; the RDFO is effectively a paper organization designed to facilitate the transfer of tax losses, and is totally dependent on the sponsor's decisions. Moral hazard arises if the RDFO sponsor can increase the project's riskiness *ex post* (referred to as the asset substitution problem, where managers are more risk-seeking than investors). Examining a sample of 166 RDFOs formed between 1978 and 1992, they find empirical evidence that such information costs restrict the use of RDFOs by R&D firms, as the RDFO is more likely to be used by small, young firms who are capital constrained.

The findings of Beatty et al. (1995) are relevant for this thesis, as their results show that taxation asymmetries such as those observed in R&D syndicates, where taxpayers have incentives to 'sell' tax losses to others to whom tax benefits are more valuable, have the potential to create agency conflicts. The next section of this literature review considers the relationship between taxes and firm risk-taking in more detail.

2.4.3. Taxes and corporate risk taking

This thesis adopts the framework developed by Scholes and Wolfson (Scholes et al. 2016) in order to explain the role of taxes in firms. The Scholes-Wolfson ("SW") paradigm does not advance new theories or methodology but adopts a microeconomic perspective in analysing settings where taxes are likely to be important (Shackelford & Shevlin 2001). In this respect, the SW paradigm has some similarities with the positive accounting literature which began with the publication of Watts & Zimmerman (1978) in that it draws on theories from economics and finance and employs empirical methods to explain the extent to which taxes affect firm decisions.

From the standpoint of taxpaying entities, interesting tax planning problems arise because the taxing authority is an uninvited party to all contracts, and brings to each of its "forced" ventures with taxpayers a set of contractual terms (tax rules) (Scholes et al. 2016). As Domar & Musgrave (1944) put it: "by imposing an income tax on the investor, the Treasury appoints itself as his partner". Unlike other contracting parties, however, the taxing authority generally does not negotiate these terms separately for each venture, as this would be prohibitively expensive. Instead, it announces a standard set of terms taxpayers must accept.

The SW conceptual framework is developed around three central themes they consider to be important for effective tax planning (known as all parties, all taxes and all costs). The SW paradigm asserts that effective tax planning requires the tax planner to consider all parties to a transaction, all taxes (i.e., both explicit and implicit taxes), and all costs (i.e., both tax costs and non-tax costs). Explicit taxes are tax dollars paid directly to taxing authorities; implicit taxes are taxes that are paid indirectly in the form of lower before-tax rates of return on tax-favoured investments.

For example, Edwards & Shevlin (2011) consider the role of implicit taxes in Canadian publicly traded income trusts, by examining the price change around the date of an unexpected announcement of a change in the tax law which reduced the tax advantages of investing in Canadian publicly traded income trusts. They found evidence of significant price declines in all but one of the actively traded income trusts examined, which they interpreted as evidence that investors in Canadian income trusts before the tax law change bore significant implicit taxes.

The SW framework also requires the tax planner to consider both tax and non-tax costs in making investment and financing decisions. In particular, SW asserts that agency costs are another non-tax cost that has the potential to influence tax planning decisions in the case of high-risk investments such as R&D.

Scholes et al. (2016, p. 144) consider the case of a firm who faces a choice between a riskless project yielding a certain profit, and a risky project which is expected to yield a profit half the time and a loss half the time. Assuming a risk-neutral manager, absent any taxes the firm would choose the project providing the higher expected pre-tax profit, which will often be the risky project. For a single project company with no other taxable income, there is a non-zero probability that if the project fails, the resulting tax losses will never be used, significantly reducing the project's after-tax return. Profitable companies, on the other hand, are not restricted in their ability to deduct tax losses.

Firms could respond to this asymmetry in several ways. Domar & Musgrave (1944) argue that without the ability to deduct tax losses, the compensation for risk-taking is reduced, making risky investments such as R&D less attractive so that firms will want to take less risk. However, they note that their analysis is based on a probability approach to risk theory and is merely indicative of the direction in which the firm is more likely to shift. While taxes reduce the expected return from risky investments, they reduce the variability of investment returns as well, which may encourage managers to take more risk (Gentry 2007).

The corporate income tax schedule is progressive for loss firms. Cooper & Knittel (2006) document that tax losses are pervasive, and up to 25-30% tax losses in the US economy are never deducted, because the firm never generates sufficient taxable income in order to utilize the loss.

The tax law is asymmetric in its treatment of gains and losses made by companies; income is taxed at statutory tax rates only when positive, with losses carried forward indefinitely to be credited against future profits (Majd & Myers 1985). This asymmetry can result in different after-tax rates of return on the same capital investment project depending on the tax position of the firm undertaking the project. For example, the tax system will be symmetrical for a profitable company, as it will be able to offset project losses against its other income. For a start-up company undertaking only one project, however, the after-tax return can decline significantly depending on the length of time before the project is expected to earn a profit, since the company has no income against which to deduct project expenditures; the longer the time period over which the tax loss is carried forward, the lower the present value of the tax benefit associated with the loss. This results in a less favourable tax treatment for single-project firms that invest in risky projects, such as R&D, where the payoff is uncertain.

In the 1970s and 1980s, firms with low marginal tax rates responded to this outcome by selling the tax benefits of investing in R&D to other, more highly taxed companies in a better position to benefit from the tax deductions. This was most commonly achieved by the creation of R&D limited partnerships (LPs) (similar to the R&D syndicates described in section 2.2.2) in which the limited partnership interests were sold to outside parties who could take advantage of the immediate deductibility of the R&D by contracting out the R&D work to an R&D contractor (usually a sponsor or affiliate), with payments to the R&D contractor being deductible to the LP. Shevlin (1987) found empirical evidence consistent with the tax motivation for forming R&D LPs, asfirms sponsoring R&D LPs were younger and had more tax loss carry forwards than firms conducting R&D in house.

Despite the tax advantages of the R&D LPs examined by Shevlin (1987), these partnerships suffered from numerous incentive problems. Wolfson (1985) details several agency costs in the context of oil and gas LPs. For example, the R&D firm may continue incurring expenses when it is no longer economically justified (overinvestment), or, if the project has a marginally positive NPV, the R&D firm may choose not to exploit the deposit commercially (undercompletion).

Undercompletion is a hidden-action (moral hazard) problem that occurs in LPs because the tax system encourages the limited partner to invest before the general partner. From a tax perspective, the value of an LP interest is maximized if the limited partners fund the initial drilling operations which can be immediately deducted, because the deductions are more valuable in the hands of the LP, the more highly taxed entity. (Recall that the motivation for establishing an LP was to enable a general partner with tax losses to 'sell' tax deductions in exchange for financing.) The undercompletion problem arises because the general partner alone knows the true status of the drilled hole. Because the general partner bears 100% of all completion costs if drilling succeeds but receives less than 100% of the resulting revenues under the sharing agreement with the LP, the general partner will abandon the well unless it is profitable from his perspective, not the LP's perspective. For example, if the general partner finds \$2 of oil after drilling and knows that it will cost \$1 to complete the well, he will only complete the well if his share of the revenues is greater than \$1. As a result, it will be in the general partner's best interest to abandon wells that only have a marginally positive NPV.

Wolfson shows empirically that the undercompletion problem is mitigated by drilling exploratory wells that have a lower probability of being marginal, i.e., exploratory projects where there is a low probability that a large amount of oil will be found and a high probability that nothing will be found. For example, if the general partner finds $10 of oil after drilling and the well costs $1 to complete, the well will obviously be profitable from the general partner's perspective as his share of the revenue will be greater than $1.

In his examination of oil and gas limited partnerships, Wolfson (1985) presents evidence suggesting that the hidden-action problems discussed above are priced by the market (but not completely eliminated). For example, general partners with a good reputation appear to command a price premium.

Beatty et al. (1995) observe that similar moral hazard costs exist in RDFOs. R&D LPs are one form of RDFO, but the intent is the same in both structures, namely, to allow low marginal tax rate (MTR) firms to effectively sell the benefits of immediate tax deductibility of R&D to high MTR investors who value the deductions more. Beatty et al. (1995) find mixed support for the tax motivation for forming RDFOs. While their evidence is consistent with the tax motivation observed by Shevlin (1987), as R&D firms have lower MTRs, they also find that some R&D firms with tax losses do not form RDFOs. They suggest that the information costs of using external funding (i.e., the moral hazard costs that arise when outside investors in high risk projects do not play an active role in the management of the firm) restrict the use of RDFOs by R&D firms in spite of the potential for tax benefits.

A similar incentive problem existed in the context of the R&D syndication program discussed in section 2.2.2, which provided incentives for the inflation of core technology values. The work of Wolfson (1985) and Shevlin (1987) remains relevant in the case of this thesis. In the context of the present day R&D tax incentive, the mechanics of the incentive work in a similar fashion, by allowing low marginal tax rate firms (e.g., start-ups and MEEs) to exchange their tax losses (which have a very low probability of being utilised) for a cash refund. However, the current R&D tax incentive differs from the previous R&D syndicates or the LPs examined by Wolfson and Shevlin, in that instead of tax benefits flowing to the limited partners, the taxing authority bears the risk.

Research addressing taxes and agency costs is less well developed than other strands of empirical tax research. Shackelford & Shevlin (2001) suggest that this is due to difficulties in quantifying incentive costs. On the other hand, the relationship between taxes and corporate risk-taking has been the subject of two recently published studies, suggesting that this is a fruitful area for future research. First, Ljungqvist, Zhang & Zuo (2017), using 113 staggered changes in corporate income tax rates across US states, find evidence that risk taking is sensitive to taxes asymmetrically, as they find that the average firm reduces risk in response to a tax increase (primarily by changing its operating cycle and reducing R&D risk, which is measured by the sensitivity of sales to the firm's R&D spend), but does not respond to a tax cut. They trace this asymmetry to constraints on risk taking imposed by creditors as well as the tax loss-offset rules, which moderate firms' sensitivity to taxes by allowing firms to partly share downside risk with the government. In a related analytical and empirical paper, Langenmayr & Lester (2018) show in a cross-country study of the US and major Western European countries that tax rates have a positive effect on risk-taking for firms that expect to use losses, and a weak negative effect for those that cannot. However, neither study considered the situation where firms can exchange their unused tax losses for a tax refund, as is the case with the current R&DTI.

Given recent reports that some Australian R&D advisers have been submitting aggressive R&D claims (Tadros, Smith & Gillezeau 2018a), a possible avenue for further research might be the extent to which the incentive problems associated with RD LPs and RDFOs are also present in the current R&DTI. In this regard, some features of the current R&DTI, such as the dual agency model, in which the R&DTI is jointly administered by the ATO and AusIndustry, might provide more effective monitoring than RDFOs or RD LPs. However, the extent to which the current R&DTI has been successful in mitigating these incentive problems is an empirical question.

Another branch of empirical tax research examines the role of corporate tax savings as a source of financing. For example, Edwards, Schwab & Shevlin (2016) find that firms facing more financial constraints exhibit increases in cash tax planning, suggesting that firms use cash savings generated through tax planning to increase internally generated funds. In this respect, the R&DTI can be viewed as a substitute for costly equity financing by small, financially constrained firms undertaking risky R&D projects. Because the refundable R&D tax offset results in a cash refund for the R&D firm that is not contingent on the outcome of the R&D (i.e., the government does not attempt to pick winners), the firm effectively shares the risk with the government. The R&D expenditure eligible for the refundable tax offset is non-deductible, which means that the government will claw back part of the R&D tax offset in future years through higher tax revenues if the project is successful. Because the government can consolidate risk within the collected sum of tax revenues on the returns from many investments by many different companies, the government's tax claim on risky assets can therefore be thought of as equivalent to a portfolio of call options (Majd & Myers 1985). This may reduce the adverse selection problem associated with high-variance investment projects such as R&D.

The next section of this literature review introduces theories and empirical evidence regarding the capital structure of the firm and the implications that this has for the financing of risky investments such as R&D.

2.4.4. Capital structure and the financing of R&D

The capital structure of a firm is the combination of debt and equity that the firm uses to raise capital. According to the capital structure irrelevancy theory advanced by Modigliani & Miller (1958), in complete and perfect capital markets the firm's market value should be independent of its capital structure. However, the existence of market imperfections such as taxes, information asymmetry, and transaction costs has led to the development of the trade-off theory of capital structure, which asserts that the firm's optimal capital structure is determined by a trade-off between the marginal costs and benefits of debt (Brigham & Houston 2018). The marginal costs of debt include direct and unanticipated bankruptcy costs (Kraus & Litzenberger 1973) and the costs of agency conflicts between shareholders and debtholders (Jensen & Meckling 1976). The marginal benefits of debt include the tax advantage to debt financing, since interest charges are tax deductible. The trade-off theory of capital structure asserts that an optimal capital structure does exist, and a firm's security issuance decisions will move its capital structure closer to this optimum.

The trade-off theory predicts a cross-sectional relation between average debt ratios and asset risk, profitability, tax status and asset type. Specifically, Bradley, Jarrell & Kim (1984) predict that firm leverage will be inversely related to the costs of financial distress, the level of non-debt tax shields and the variability of firm value. In Bradley, Jarrell and Kim's model, the costs of financial distress include bankruptcy costs and the agency costs of debt. To the extent that the variability of firm value reflects higher risk, this is likely to increase the probability of incurring costs of financial distress, as well increasing the probability that interest tax shields will be wasted due to the firm having insufficient income against which to offset deductions for interest charges. Non-debt tax shields include accelerated depreciation and investment tax credits (such as R&D tax credits) and unused tax losses carried forward from prior periods. Bradley, Jarrell and Kim's findings suggest that volatility of firm earnings and intensity of R&D are shown to be inversely associated with firm leverage. In their model, R&D expenditure is included as a non-debt tax shield, as R&D is historically been a tax-favoured form of investment, with most governments offering some form of tax credit for R&D expenditure.

An alternative model developed by Myers & Majluf (1984) argues that firms' capital structure decisions exhibit a pecking order; that is, firms finance new investments first with retained earnings (internally generated funds), then with safe debt, then with risky debt and finally (as a last resort), with outside equity. In contrast to the trade-off model, pecking order theory asserts that firms do not have a leverage target, but rather seek to maintain spare debt capacity. The underlying assumption of the pecking order model is that firm's capital structure decisions are driven by information asymmetry, as the lack of information possessed by market participants may lead to undervaluation of issued equity due to the adverse selection problem. As a result, debt is argued to be a preferred source of external funds.

If, as predicted by pecking order theory, firms tend to view equity financing as a last resort, then intuitively, smaller firms, less profitable firms and firms with greater growth opportunities are more likely to raise additional equity capital (Brown, Ferguson & Stone 2008). Information asymmetry is generally considered to be greater in small firms, who are viewed as providing poorer quality information and being subject to less external analysis, and as a result may find it more difficult to persuade shareholders to invest (Burton & Power 2003). Burton and Power also note that firms with greater growth opportunities are often associated with higher levels of intangible assets and may have difficulty supporting high gearing ratios.

Overall, the empirical evidence is more consistent with the pecking order theory. The decision to raise equity is generally seen as a negative signal, as it suggests an increase in the firm's underlying risk (Brown, Gallery & Goei 2006). For example, Asquith & Mullins (1986) report an average market reaction to the announcement of seasoned equity offerings (SEOs) by listed US companies that is negative and statistically significant. This is interpreted as providing support for the idea that firms issue equity only as a last resort, either because they do not have sufficient internal funds, or because they have insufficient debt capacity.

Empirical evidence from Australia is also consistent with the US findings. Share purchase plans (SPPs) are a form of SEO popular in Australia that offer shareholders the opportunity to subscribe for new shares. SPPs constitute a public issue but are often issued jointly with a private placement and are restricted to existing shareholders. The popularity of SPPs increased substantially after a regulatory change in 2002 which increased the maximum subscription amount per shareholder (Brown, Ferguson & Stone 2008). Examining a sample of 591 SPPs issued in Australia between 1991 to 2005, Brown et al. (2008) found that Australian firms implementing SPPs are less profitable, have lower cash holdings relative to non-SPP issuers, and that the market reacts negatively to the announcement of an SPP. These findings are interesting in that SPPs do not require the issue of a prospectus, indicating that issues can occur within a more asymmetric information environment than other public issues.

The pecking order theory of capital structure appears to be particularly relevant to the financing of R&D investment. The marketplace for financing the development of innovative ideas resembles the "lemons" market described by Akerlof (1970). The lemons' premium for R&D is higher than that for ordinary investment, because investors have more difficulty distinguishing good projects from bad (Hall & Lerner 2010). Further, reducing information asymmetry through fuller disclosure is argued to be of limited effectiveness in this arena, due to proprietary costs (the cost of revealing innovative ideas to the marketplace). The result of this is that firms prefer to finance their R&D with internal funds, due to the wedge between the rate of return required by an entrepreneur investing his own funds and that required by external investors (Brown & Petersen 2009, 2011; Lach & Schankerman 1989), in addition to the inherent moral hazard problems involved in transferring information from an entrepreneur to shareholders (Hall, Mairesse & Mohnen 2010). This line of reasoning has been frequently been used by policymakers to justify government support of R&D, particularly given that insufficient funding is often cited as a threat to the success and survival of potential R&D ventures (Li 2011).

Furthermore, investments in R&D have an option-like character as they typically proceed in stages and are characterised by long gestation periods (Bar-Ilan & Strange 1996). Bar-Ilan and Strange argue that investments with longer lags (due to time-to-build or time-to-complete considerations) create options for future growth and flexibility. As a result of the staged nature of such investments, the impact of bad news is capped by the closure of the project, but the impact of good news is not constrained in this way. This is equivalent to buying a call option with the worst outcome being the loss of the option price if it lapses without being exercised, but the best outcome being that the option is deeply in the money. This is contrasted with capital investments that are costly to undo (if not irreversible), such as major acquisitions, or the decision to construct a mine (Moel & Tufano 2002). This has implications for the valuation of R&D projects, as the value of a growth option increases with volatility. Kraft, Schwartz & Weiss (2018) find empirical evidence that Tobin's Q (defined as the market to book ratio, a measure of growth opportunities) increases with volatility, and that this relation comes mainly from R&D firms.

The section that follows will discuss the literature that examines the investment performance of firms that issue equity, and the implications that this has for R&D-performing firms.

2.4.5. Long run underperformance of equity issuing firms

Numerous studies in the US and internationally have documented an anomaly in the pricing of initial public offerings (“IPOs”) of equity issuing firms, with long-run (of up to five years) underperformance associated with equity (both IPO and SEO) issuing firms. Initially, Ritter (1991) examined the long-run performance of IPO issuing firms from 1975 to 1984. The results showed IPO firms underperform a matched firm’s stock returns for three years following the decision to go public.

Evidence from Australia suggests that SEO firms underperform common share market benchmarks for up to 5 years after the announcement (Brown, Gallery & Goei 2006). Significant underperformance is also documented for Australian firms issuing SPPs for some years after the event (Brown, Ferguson & Stone 2008). In the case of SPPs, the SPP-issuing firm does not perform as badly if audited by a large audit firm (larger auditors in the audit literature have become synonymous with audit quality) or if the issue was underwritten. This provides support for the ‘underwriter certification’ argument in the literature that underwriters convey reputational signals to markets (Beatty & Ritter 1986), as professionals, such as underwriters and auditors, are argued to reduce the effect of asymmetric information between firm insiders and outsiders. A substantial body of literature examines the effects of underwriter reputation on post-issue performance; a detailed review of this literature is beyond the scope of this thesis.

The literature has also identified auditor reputation as a factor affecting the post-offer returns of microcap IPOs, a segment of the market with poor long-run performance. In a microcap IPO, the auditor is often the sole (if any) expert present. Weber & Willenborg (2003) find evidence that the pre-IPO audit opinions of larger auditors are more predictive of post-IPO stock price performance.

It has been suggested that many of the studies on long-run returns suggest market inefficiency (i.e., long-term under-reaction to information), which is anomalous to the efficient markets hypothesis ("EMH"). However, as Fama (1998) observes, long-run return studies rarely test a specific alternative hypothesis to market efficiency. For example, in an efficient market, apparent under-reactions should be about as frequent as over-reactions; anomalous returns by themselves are not necessarily inconsistent with market efficiency. Ball (1994) argues that theory and empirical anomalies are expected, due to the 'bad model' problem described by Kuhn (1970), as we will never have a perfect model of expected returns. Like all models, market efficiency is an imperfect description of price formation due to the presence of market frictions which must be invoked to explain even the existence of firms (Ball & Brown 2019; Coase 1937). In the sciences, theories are formed as conjectures and put to the test with attempts at falsification (Feigin 2015; Popper 1968). In this respect, Ball (1994) and Fama (1998) argue that the alternative hypothesis to market efficiency, market inefficiency, is vague, and by implication, not falsifiable. Therefore, Fama argues that any test of long-run performance must be tested jointly with a model for expected (i.e., normal) returns.

In this regard, tests of long-run returns in the literature have often been shown to be sensitive to methodological choices. Barber & Lyon (1997), for example, find that in event studies designed to detect long-run (one- to five-year) abnormal returns, test statistics based on abnormal returns calculated using a reference portfolio are misspecified. They correct for this misspecification by matching sample firms to control firms of similar sizes and book-to-market ratios. Ang & Zhang (2004) find that this matched-firm approach shows the best performance in samples of small firms. This finding is particularly relevant when conducting tests of long-run performance in a sample containing many small firms, such as MEEs, that have high idiosyncratic risk and hence a higher variance of price changes.

2.4.6. Excess returns to R&D

Several studies have documented a positive association between R&D spending and future excess stock returns. The explanation advanced by Chambers, Jennings & Thompson (2002) is that shares of R&D-intensive firms are "mispriced" because investors fail to see through earnings distortions caused by conservative accounting for R&D costs (i.e., because R&D costs are expensed instead of capitalised). However, an alternative explanation is that the excess returns are just compensating for an R&D-specific risk factor (Ciftci, Lev & Radhakrishnan 2011). Li (2011), on the other hand, argues that the positive R&D-return relation is driven by financial constraints, as he finds that R&D predicts stock returns only among financially constrained firms.

Chambers, Jennings & Thompson (2002) investigate the risk explanation for excess returns by examining whether the returns persist over time and whether they are more highly variable than excess returns to firms that are not R&D-intensive. They find that the positive excess returns to high R&D firms persist for up to 10 years following their first investment date, which is consistent with a risk explanation. In addition, the cross-year standard deviation of "portfolio" excess returns for high-R&D firms is more than two-and-a-half times larger than that for either non-R&D firms or for low-R&D firms.

Ciftci, Lev & Radhakrishnan (2011) argue that if business risk is the reason investors demand a higher return for investing in R&D firms, then fiscal incentives (R&D subsidies) are likely to mitigate R&D risk. On the other hand, if information risk is the reason investors demand a higher rate of return for R&D firms, then this risk might be mitigated by improved disclosure. They find that high R&D intensity firms have larger average short-term excess returns than low R&D intensity firms. In the long run, however, they find no difference in the long-term excess returns of the high and low R&D intensity firms. They suggest that this is more consistent with a mispricing explanation for short-term excess returns.

Chan et al. (2007) provide evidence of the relation between R&D and stock returns for a large sample of Australian companies. They examine the impact of the accounting treatment of R&D on future stock returns. Under the former AASB 1011, Australian firms were permitted to capitalise R&D costs to the extent that such costs were expected "beyond any reasonable doubt" to be recoverable, otherwise R&D costs were required to be expensed[42]. They found evidence that firms with higher R&D intensity had higher future risk-adjusted returns regardless of the accounting method used, suggesting that the excess returns to R&D firms is more likely to be due to a risk premium rather than mispricing due to earnings distortions caused by conservative accounting.

2.4.7. Value relevance of non-financial information

The Ohlson (1995) valuation model states that the value of the firm is a function of forecasted earnings, book value, and discount rates. For firms in fast-changing, technology-based industries, such as telecommunications, biotechnology, and software, that invest heavily in intangibles, financial information has been argued to be of limited value to investors, as the earnings of these companies are often negative (Amir & Lev 1996). In these companies, Amir & Lev (1996) show that non-financial information is often highly value relevant. For example, the telecommunications industry relies on non-financial metrics such as customer churn rate, market penetration rate, and subscribers added per employee. Another example is Trueman, Wong &

[42] AASB 1011 was in force until 2005, when IFRS was adopted in Australia. The current accounting treatment for R&D is set out in AASB 138, which corresponds to IAS 38 "Intangible Assets". AASB 138 requires research expenditures to be expensed; expenditures relating to the development phase can be capitalised if they will generate probable future economic benefits.

Zhang (2001), who incorporate web usage statistics including unique visitors, page views, and minutes spent at a firm's website as 'other information' in valuing Internet stocks.

Non-financial information is equally important in the resources industry, with prior research having documented a relation between reserve disclosures, information asymmetry and firm value. Magliolo (1986), for example, finds that the information included in reserve disclosures made by oil and gas firms in the US is anticipated by the market, but when a firm drills a promising well that has no proved reserves, investors attach value to the unproved well. Further, Raman & Tripathy (1993) observe a decline in the bid-ask spreads of oil and gas firms following routine disclosures of the changes in the value of their oil and gas reserves, which is consistent with reserve disclosures reducing information asymmetry.

The balance sheets of MEEs frequently consist of a single asset, namely deferred exploration and evaluation (E&E) expenditure. For MEEs, current income (which is usually negative), provides little indication about future income, because GAAP does not match expenses with revenues due to the high level of uncertainty regarding future revenues[43]. As a result, non-financial disclosures by MEEs, such as resource and reserve announcements, are viewed by the market as being highly value relevant (Bird, Grosse & Yeung 2013).

Ferguson & Pündrich (2015) extend this literature by examining the value of assurance of non-financial information in the MEE setting, where the utility of non-financial technical information supersedes financial statement information in firm valuation. The information environment of MEEs is unique in that the assurance of public disclosures of resources and reserves made under the JORC Code is mandatory. Ferguson and Pündrich find some evidence

[43] See Barker & Penman (2017) for an in-depth discussion of how the IASB's Conceptual Framework accounts for uncertainty.

that the market values the assurance of resource and reserve disclosures when this assurance is provided by a specialist mining consultant.

2.4.8. The effectiveness of R&D tax incentives

The final section of this literature review provides an overview of the evidence regarding the effectiveness of tax credits for R&D in stimulating additional investment in R&D.

Traditionally, the economics literature has examined the effect of corporate taxes on investment using aggregate data, drawing inferences from time-series changes in tax rates or regimes (Hanlon & Heitzman 2010). However, the economics literature documents mixed evidence on the link between tax incentives and investment (Hassett & Hubbard 2002). Challenges in observing the effectiveness of tax incentives in stimulating investment arise for two main reasons. Firstly, because of the endogeneity of the investment decision, as the decision to invest can be considered as being determined by both idiosyncratic (firm-specific) and economy-wide factors (Lach & Schankerman 1989). Secondly, the difficulty in identifying policy changes that are both exogeneous and exhibit sufficient variation to identify the effect of that policy (Thomson 2010).

The results of prior research on the effectiveness of government incentives in stimulating R&D spending are mixed. An early R&D study by Tillinger (1991), examining a broad sample of US firms over the period 1981 through 1985, did not find any evidence that the R&D tax credit was cost effective. Berger (1993), on the other hand, examined the R&D spending of 263 US firms before and after the introduction of the R&D credit in 1981, and found on average, the R&D credit increased the R&D to sales ratio by 2.9% of pre-1981 median levels and induced \$1.74 of additional spending per revenue dollar foregone by US Treasury.

More recently, Finley, Lusch & Cook (2015) examined the behaviour of US firms before and after the introduction of the Alternative Simplified Credit (ASC) in 2007, which provides an alternative, less restrictive, method of calculating the R&D credit, resulting in more firms being eligible for the R&D credit. Using a sample consisting of all firm-year observations from the Compustat database with data available for the four years before (2003-2006) and the four years after (2007-2010) the enactment of the ASC, they found firms becoming eligible for the R&D credit after the policy change spent an additional $2.26 on R&D per dollar of tax revenue foregone by the IRS.

A key difference between Australia's R&D tax incentive and the US R&D tax credit regime is that the US R&D credit has always been an incremental credit, meaning that firms must spend more in the current year than some base amount (typically, average R&D spending in the previous three tax years) in order to claim the credit (Gupta, Hwang & Schmidt 2011). This policy has been criticised by academics, as prior research has suggested that the marginal incentive effect associated with incremental R&D credits is largely offset by the third year (Eisner, Albert & Sullivan 1984), at least prior to the introduction of the ASC (discussed above). By contrast, Canada, which like Australia also has a large resources sector, has introduced a 35% refundable tax credit for R&D undertaken by small Canadian-controlled private companies (Ernst & Young 2017) which more closely resembles Australia's R&D tax incentive.

There is a paucity of empirical evidence regarding Australia's R&D tax concessions. The economics literature typically evaluates programs such as the R&DTI by reference to their 'additionality'. The concept of additionality refers to the amount of R&D invested for every dollar of tax revenue foregone and is used as a measure of the effectiveness of a tax policy. Thomson (2010) found little evidence of additionality using a data set covering the period from 1992 to 2005. However, it should be noted that this is consistent with the 2008 Cutler Report findings that the R&D tax concession was not effective in stimulating investment and was one of the reasons for recommending changes to the R&D tax concessions.

Thomson & Skali (2016), using more recent company-level data obtained from the Australian Bureau of Statistics (ABS) and tax returns provided to the Australian Taxation Office (ATO), find R&D investment is positively associated with other government finance (e.g., grants), turnover, and wages. They observed an additionality of between 0.8 and 1.9, consistent with the international literature. However, they did not explicitly consider the impact of the introduction of the new R&D tax incentive in 2011.

There is very limited evidence looking specifically at the impact of tax incentives on the level of R&D investment by mining firms. Khindanova (2012) finds some evidence that tax incentives were effective in increasing the exploration spending of junior miners in Canada.

2.5.Hypotheses

2.5.1. The determinants of R&D tax offset claims

Theory predicts that undiversified firms, or firms with 'stand-alone' projects, are most disadvantaged by the asymmetric tax treatment of corporate gains and losses, because they are unable to fully exploit the tax benefits associated with their carry forward losses (Majd & Myers 1987; Scholes et al. 2016).

The Cutler review of Australia's innovation system, recognising this asymmetry in the tax system, recommended the introduction of a refundable tax offset in order to encourage small, research-intensive firms with tax losses to increase their R&D expenditure, by making immediate cash refunds available to these firms (Cutler 2008).

The Australian mining industry is characterised by a large number of small exploration and development companies that do not earn any revenue, often enduring losses for a number of years before they transition into successful producers. In this respect, minerals exploration has much in common with other forms of R&D, in that MEEs operate in a high information asymmetry environment and face a constant challenge to secure sufficient capital to progress their projects which are often high risk (Ferguson & Sherry 2017). In addition, MEEs have a high failure rate, with failure often due to the inability to attract sufficient financing for the project to proceed (Ferguson, Clinch & Kean 2011). In fact, very few mining exploration entities transition from explorers through to developers and then into production, so there is a low probability that their tax losses will be used.

In order to test whether the refundable R&D tax offset introduced in 2011 achieved one of its stated objectives of making cash refunds available to small, innovative loss firms, H1a is proposed as follows:

H1a. Mining exploration entities are more likely to claim the refundable R&D tax offset after 2011.

The nature of the mine life cycle gives rise to testable propositions regarding the stages at which the refundable R&D tax offset is likely to be most valuable to capital constrained mining firms. Significant R&D is not expected to take place at the grassroots exploration phase before a discovery has been made and a resource defined, because the nature of mineral exploration at the grassroots phase is often speculative and extremely high risk. For example, Bartrop & Guj (2009) estimate the probability of discovering an economic orebody in a greenfield exploration program irrespective of its size to be 0.9%. This means that it is more difficult to justify the process of scientific experimentation and knowledge creation at the grassroots exploration phase, given the very low probabilities of success. However, in contrast, it is much easier to justify knowledge building and hypothesis testing around an existing defined resource.

The relative tractability of resource and reserve disclosures is an advantage in this setting, since the quantity and classification of resources and reserves according to the JORC Code is an indicator of the firm's stage in the mine life cycle. Further, because disclosure of resource and reserve information is mandatory under the JORC Code and the ASX Listing Rules, resource and reserve disclosures can be identified with relative ease through the ASX announcement platform. H1b is therefore proposed as follows:

H1b. Mining exploration entities that have a defined resource or reserve are more likely to claim the refundable R&D tax offset.

Exploration and development companies can capitalise and defer exploration and evaluation (E&E) expenditure when the future of the project is uncertain under the Area of Interest method allowed under AASB 6 *Exploration for and Evaluation of Mineral Resources*.

Higher amounts of capitalised E&E expenditure may signal expectations of project success to the extent that the decision to capitalise reflects the existence of an economically recoverable reserve. On the other hand, lower amounts may reflect accounting conservatism, which may signal conservatism more broadly in terms of project development assumptions (Ferguson, Clinch & Kean 2011)[44]. H1c is proposed as follows:

H1c. Mining exploration entities with larger capitalised exploration balances are more likely to claim the refundable R&D tax offset.

2.5.2. Impact of the 2011 reforms

The introduction of the refundable R&D tax offset was argued to increase R&D expenditure in the following ways. The offset rate of 45% increased the value of the tax benefit for firms that were eligible for the previous 30% refundable tax offset; the $2 million R&D expenditure cap was removed; and the minimum turnover threshold for claiming the refundable R&D offset was increased from $5 million to $20 million. These changes were expected to increase the quantum of eligible R&D expenditure by small firms claiming the refundable offset, even though the definition of eligible R&D was tightened. H2 is therefore proposed as follows:

H2. Mining exploration entities eligible for the refundable R&D tax offset received larger R&D refunds after 2011.

High R&D firms and other firms investing in high risk projects face a wedge between the cost of capital required by entrepreneurs as opposed to that required by external investors due to the increased risk. The main source of capital for mining firms is the equity market, with junior

[44] For example, explorers may pursue a strategy of 'drill to kill', a philosophy whereby management aims to decide whether to drop an unviable project as quickly as possible and move on to other prospects (Fulp 2018). Such a strategy may result in more exploration and evaluation expenditure being written off, as the company is quicker to make an assessment of the existence or otherwise of an economically recoverable reserve as required by AASB 6.

explorers and mine developers using their market capitalization as collateral for additional equity raisings. However, due to the uncertainty surrounding whether these firms can in fact progress to the production stage, the market tends to view shares of junior explorers as out-of-the-money call options, which makes equity raising more difficult (Schodde 2015).

Prima facie, the receipt of a 45% rebate as a cash refund upfront regardless of project outcome increases the level of internal funds available for investment. Pecking order theory predicts that firms prefer to finance expenditures on risky projects with internal funds first, followed by debt, before turning to the equity markets. There is anecdotal evidence that some firms have been using their expected future R&D refunds as a form of collateral when entering into loan facility agreements with financiers. Broadly, the lender agrees to lend the firm an amount equal to the R&D refund expected to be received for the financial year, with the funds to be repaid once the entity's tax return for that financial year has been lodged and the refund paid by the ATO[45].

Notwithstanding the above, it is by no means certain that firms will increase their investment levels as a result of receiving the R&D rebate. Mining investment is to a large extent determined by commodity prices, discovery costs, and global GDP growth rates. Exploration investment peaked in 2012 before declining[46]; weaker economic conditions tend to depress investment levels. Remaining market participants, however, are expected to be even more reliant on the R&D rebate as a source of funding during a downturn, as the equity market is likely to have a reduced appetite for further capital raisings. Further, as deposits are deeper and discovery becomes more difficult over time, as explorers must drill more metres and deeper metres per discovery, input costs would be expected to rise. This suggests explorers become higher risk over

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[45] For example, refer to ASX announcement by Northern Minerals Limited (ASX code: NTU), "US$30m R&D Loan Facility executed with leading New York financier", 29 August 2017.

[46] Australian Bureau of Statistics (2017), "Mineral and Petroleum Exploration, Australia".

time, indicating that incentives such as the R&D tax rebate may become even more critical in the capital raising process.

It is an empirical question whether the R&D rebate resulted in increased expenditure on exploration and evaluation. There are no priors regarding how the funds from the R&D rebate are likely to be allocated to projects. Firms may either use the proceeds from the rebate towards evaluating the economic potential of previously discovered deposits; alternatively, the knowledge generated as a result of successful R&D could lead to further brownfields exploration in neighbouring areas. H3a is therefore expressed as follows:

H3a. Subsequent expenditure on exploration and evaluation after 2011 by mining exploration entities eligible for the refundable R&D tax offset was greater than that by ineligible firms in the same period.

Prior literature suggests that the equity issuance decision is generally seen as a negative signal, with IPO and SEO issuing firms exhibiting long-run underperformance for up to five years after the issue (Asquith & Mullins 1986; Brown, Gallery & Goei 2006). However, SEO issuances such as SPPs do not perform as badly if they are underwritten or are audited by a large audit firm (Brown, Ferguson & Stone 2008). Given that MEEs rely heavily on equity financing and compete with other firms for a limited amount of capital, the ATO and AusIndustry could be seen as performing a monitoring role in their joint administration of the R&DTI, reducing agency costs for MEEs that claim the R&D tax offset relative to other firms in the sector, such as greenfields explorers. As a result, firms that claim the R&D tax offset may be more successful in raising additional equity in subsequent periods. H3b is thus expressed as follows:

H3b. Equity raisings after 2011 by mining exploration entities eligible for the refundable R&D tax offset were greater than that by ineligible firms in the same period.

Investments in R&D projects have a growth options-like character in that they are typically characterised by long investment lags as they proceed in stages, such that their downside in the event of bad news is capped by closing the project, but the upside from good news has no upper bound (Bar-Ilan & Strange 1996). As a result, R&D investments are associated with greater growth opportunities (Kraft, Schwartz & Weiss 2018). A testable proposition, therefore, is whether firms that claimed the R&D tax offset had greater growth opportunities relative to firms that did not claim the offset. H3c is thus expressed as follows:

H3c. Mining exploration entities eligible for the refundable R&D tax offset had greater growth opportunities after 2011 relative to ineligible firms in the same period.

2.5.3. The market valuation of R&D

Prior research has examined the value relevance of non-financial information in companies in fast-changing, technology-based industries where financial information is often of limited value (Amir & Lev 1996). The information environment of MEEs is characterised by high information asymmetry, and non-financial disclosures are potentially more important in this setting. For example, resource and reserve disclosures by MEEs are viewed by the market as being highly value relevant (Bird, Grosse & Yeung 2013).

Appendix 5B disclosures are mandated by the ASX and resource and reserve disclosures are regulated by the JORC Code. However, the amount of detail provided by MEEs in Appendix 5Bs about their quarterly activities varies, with some firms providing extensive commentary and others merely completing a pro forma cash flow statement[47]. Further, in recent years a growing number of MEEs have announced receipt of an R&D refund in a separate news release when the refund is received. As Figure 2.3 shows, there were over 40 such market-sensitive announcements

[47] Refer to Appendix C for an example.

pertaining to the R&D tax incentive in 2015 alone. Receipt of an R&D refund may therefore provide a positive signal about the project's future prospects[48].

[FIGURE 2.3 ABOUT HERE]

If receipt of an R&D refund is viewed as an indicator of future income, then firms that receive R&D refunds should be valued more highly. H4 is therefore specified as follows:

H4. There is a positive association between receipt of an R&D tax refund and firm market value.

2.5.4. The long-run return performance of firms receiving R&D refunds

Prior evidence documents a positive relation between R&D investment and subsequent excess returns due to the higher risk of R&D-performing firms (Chambers, Jennings & Thompson 2002; Ciftci, Lev & Radhakrishnan 2011; Li 2011). Chan et al. (2007) document evidence of the positive R&D-return relation in Australia, and find that R&D-intensive firms earn positive risk-adjusted returns regardless of whether the firm capitalizes or expenses its R&D.

Expectations about the effect of the R&D rebate on subsequent returns are mixed. Minerals exploration and mine development, even without R&D, are high risk activities, so it is not clear how receipt of the R&D rebate will affect firm risk. One possibility is that the R&D being conducted could indicate greater technical risk associated with the deposit being mined. Alternatively, the financing provided by the rebate may lower risk relative to firms who do not claim the rebate, since claimant firms are effectively sharing some of the risk with the government.

[48] Refer to Appendix D for one such announcement by Impact Minerals Limited (ASX: IPT) on 22 December 2014, advising that it had received a $1.14 million R&D tax refund.

Pecking order theory predicts that outside equity will be used as a last resort by firms that face a high cost of equity capital as a result of undertaking higher risk projects (Hall & Lerner 2010; Myers & Majluf 1984). In the Australian setting, Ferguson & Crockett (2003) argue that mining companies are subject to greater information asymmetry due to the specialized and highly technical nature of geological information. This is likely to be especially true of mining companies that undertake R&D. In this regard, R&D refunds have some similarities to seasoned equity offerings (SEOs) such as share purchase plans (SPPs), which are often used when the company has insufficient funds to finance ongoing investment.

Most studies of the long-run return performance of IPOs and SEOs find evidence of long-term underperformance for up to five years after an equity offering (Ritter 1991; Spiess & Affleck-Graves 1995). Evidence from share purchase plans in Australia suggests that SPP-issuing firms are less profitable and have lower cash holdings (Brown, Ferguson & Stone 2008), which would be consistent with the view that firms issue equity as a last resort when their internal funds are insufficient. SPPs in Australia do not perform as badly if the issuer was audited by a large audit firm or if the issue was underwritten, supporting the 'underwriter certification' argument that the presence of outside experts can convey valuable information to investors (Weber & Willenborg 2003).

The predictions for the long-run performance of firms that receive the R&D tax offset are unclear. While firms that receive the R&D tax offset are unprofitable as well as being capital constrained, the monitoring role provided by the ATO and AusIndustry, who jointly administer the R&DTI program, might provide some form of certification. The certification argument is arguably weaker in the context of R&DTI, however, since the incentive operates on a self-assessment basis which is standard in the Australian tax system. Further, the role of the R&D consultants who prepare the R&D claims is unclear. While in some respects their role resembles that of an outside expert, this has not always been the case, as even large R&D advisory practices have been targeted by the ATO and AusIndustry for preparing aggressive R&D claims.

Since there are competing predictions regarding the effect of the R&D rebate on subsequent returns, H5 is expressed in the null form as follows:

H5. The long-run buy-and-hold abnormal returns of mining exploration entities eligible for the refundable R&D tax offset are not significantly different from the returns of ineligible firms.

2.6.Data and Sample

The first section of this thesis focuses on mining exploration entities (MEEs) due to their relatively homogenous nature. The sample for this study consists of all MEEs listed on the ASX between 2008 and 2015. The sample period includes the four years before and the four years after the introduction of the R&D Tax Incentive (R&DTI) in 2011.

A mining exploration entity is defined in Chapter 19 of the ASX Listing Rules as an entity whose main undertaking consists of exploration for minerals, or an entity which has been advised by the ASX that it is a mining exploration entity for the purposes of the ASX Listing Rules.

Details of refundable tax offset receipts are hand collected from quarterly Appendix 5B filings. ASX Listing Rule 5.5 requires all mining exploration entities listed on the ASX to complete a quarterly activities and cash flow report no later than one month after the end of the quarter.

Searching for all announcements in the categories “Quarterly Cash Flow Reports” and “Quarterly Activities Reports” between 2008 and 2015 available from the SIRCA Australian Company Announcements database yields a sample of 26,182 individual releases. Where a firm receives a tax refund relating to R&D, this is typically disclosed at item 1.7 on the face of the quarterly cash flow statement. Perceptive Workgroup Search is used to search for releases containing the words “R&D tax incentive”, “tax rebate”, “tax refund” or “concession”. 1,699 quarterly announcements are identified in which receipt of a R&D tax refund is disclosed. Most firms disclose the amount of the R&D tax refund received as a separate line item on the quarterly cash flow statement, though there are some disclosure idiosyncrasies as some firms may include the R&D refund received as part of other cash receipts. In very rare cases, a firm might disclose that it received an R&D refund in its Appendix 5B, but not disclose the amount. For these firms, the amount of the R&D refund is obtained from the Statement of Cash Flows in the firm's annual report, where this is available.

A selection bias is acknowledged, for two reasons. Firstly, the R&D tax offset is not only claimed by listed firms; many privately-owned companies are also registered for the R&D tax incentive. Secondly, firms are not required to disclose precisely when they receive a refund in relation to the R&D tax incentive. For the most part, however, it is possible to identify the name of the firm claiming the refund and the amount received. This is a strength of the present thesis, as this information would otherwise only be available from confidential company tax returns.

To validate the data collection procedure outlined above, the number of firms that disclosed receipt of the refundable R&D tax offset in the Appendix 5B is compared to the number of firms that claimed the refundable R&D tax offset according to the statistics that are published annually by the ATO on its website[49].

An excerpt from the ATO Taxation Statistics is reproduced in Table 2.6 (note that the ATO did not start publishing the number of companies claiming the refundable R&D tax offset until 2012). On average, 10.6% of all companies in the exploration industry group claimed the refundable tax offset between 2012 and 2017. The percentage of companies claiming the offset varies from year to year, ranging from 8.6% in 2017 to 12.4% in 2013. This is comparable to the sample of MEEs examined in this chapter, where 9.5% of firms claimed the offset (refer to Table 2.7 Panel B). Further, the average refund amount of $669,239 in Panel B of Table 2.7 is comparable to $607,838 in the statistics published by the ATO.

[49] Australian Taxation Office, "Taxation Statistics", available online: https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Taxation-statistics/ [accessed 22 May 2019]

It should be noted that there are more companies in the ATO sample, which includes both public and private companies, whereas the focus of this chapter is on ASX listed MEEs only. According to the ATO data, the amounts claimed by private companies would appear to be significantly smaller. For example, 99 ASX listed MEEs claimed the offset in 2015. The total amount claimed was $101.2 million and the average refund amount was $1.02 million. For the ATO sample, on the other hand, 243 companies claimed the refundable tax offset in 2015; the total amount claimed was $123.3 million and the average refund amount was $507,277[50]. Based on this, it would be reasonable to assume that any R&D tax refunds received by ASX listed MEEs that were not separately disclosed in either the Appendix 5B or annual report are not likely to be economically significant.

[TABLE 2.6 ABOUT HERE]

Mine project data and resource and reserve disclosures are obtained from SNL Metals and Mining and are current as at August 2016. Firm financial variables are obtained from DatAnalysis Premium. Industry membership, ASX listing dates and daily stock price data used in the calculation of return measures are obtained from SIRCA. Exchange rates are downloaded from the Reserve Bank of Australia website and commodity prices are obtained from Global Financial Data and Datastream.

The sample is drawn from all ASX-listed companies that lodged quarterly Appendix 5B reports between 2008 and 2015 and the composition of the final sample is set out in Table 2.7. Firms that had exited the mining industry were excluded from the sample, as some of these firms would have likely achieved listing status on the ASX via a "backdoor listing", i.e., using the corporate shell of a failed junior explorer (Lam & Chan 2016). Firms with no financial data were

[50] The ATO does not publish the amount claimed by each company, only the number of companies that claimed the offset each year and the total amount claimed.

also excluded. It might be the case that a firm did not have financial data because it was delisted or acquired before the end of the year, but the firm had issued an Appendix 5B earlier in the same year before being delisted. The final sample consists of 5,163 firm-years covering the period 2008 to 2015.

[TABLE 2.7 ABOUT HERE]

2.7. Research Design

2.7.1. Characteristics of firms that claim R&D refunds

To test H1, a logistic regression model is constructed to examine the characteristics of mining exploration entities who claim the refundable R&D tax offset. The model utilised for testing H1 is specified as follows:

$$RD_{i,t} = \alpha_0 + \beta_1 Post_t + \beta_2 Age_{i,t} + \beta_3 Size_{i,t} + \beta_4 MTR_{i,t} + \beta_5 Issuance_{i,t} + \beta_6 PriceMove_{i,t} + \beta_7 FXMove_t + \beta_8 CashBurn_{i,t} + \beta_9 DeferredAsset_{i,t} + \beta_{10} Top20_{i,t} + \beta_{11} ResourceValue_{i,t} + \beta_{12} ReserveValue_{i,t} + \beta_{13} Precious_i + \beta_{14} Base_i + \beta_{15} Bulks_i + \beta_{16} Other_i + \beta_{17} Foreign_i + \beta_{18} SingleProject_i + \varepsilon_{i,t} \quad (1)$$

Dependent variable

The dependent variable, *RD*, is an indicator variable set equal to 1 if firm *i* received an R&D tax refund during year *t*, and 0 otherwise. The procedure for identifying firms that received R&D tax refunds has been described in section 2.6.

Independent variables

The variables of interest are *Post*, an indicator variable set equal to 1 if the year is 2012 or later; *MTR*, a variable designed to capture the tax status of firm *i* in year *t*; *ResourceValue* and *ReserveValue*, which capture the value of the resources or reserves disclosed by firm *i* at the end of year *t*; and *DeferredAsset*, the capitalised exploration balance for firm *i* at the end of year *t*.

Eligibility for the R&D tax incentive was expanded in 2011, when the annual R&D expenditure threshold was raised to \$100 million and the tax offset rate was increased to 45% for income years beginning on or after 1 July 2011. Prior to 1 July 2011, eligible R&D expenditure had been capped at $2 million per year and the rate of the offset was 30%. The indicator variable *Post* is used to control for the post-2011 period. *Post* is set equal to 1 if the year is 2012 or later. 2012 is chosen as the cut-off year, as firms would not be expected to receive R&D refunds claimed under the expanded incentive until after they lodge their income tax returns for the year ended 30 June 2012. Most Australian companies with a June 30 year end would not be required to lodge their tax returns before the following January, and non-taxable companies may not be required to submit their tax returns until the following June. This means that R&D tax refunds for the year ended 30 June 2012 may not be received until 2013, although companies expecting substantial R&D refunds have an incentive to lodge sooner. The timeline for claiming the R&D tax offset is shown at Figure 2.4.

[FIGURE 2.4 ABOUT HERE]

MTR, a proxy for the firm's marginal tax rate (MTR), is used to control for the tax status of firm *i* in year *t*. According to theory, the marginal tax rate is the appropriate rate to use to evaluate incremental corporate decisions (Graham et al. 2017). Following Shevlin (1990), the marginal tax rate of firm *i* in year *t* is defined as the present value of the cash flow paid to (or recovered from) the tax authorities as a result of earning one extra dollar of taxable income in the current period. Estimating a firm's MTR therefore requires an estimate of the firm's future taxable income, which is difficult to forecast for a loss-making MEE who may never transition into being a successful producer. Plesko's (2003) trichotomous measure of a firm's MTR is therefore used. *MTR* is set equal to 0% if the firm has both accumulated losses and negative current period earnings, 15% if the firm has either accumulated losses or negative earnings (being half the Australian corporate tax rate of 30%), and 30% if the firm has positive earnings and no accumulated losses. This measure has been shown to perform well in estimating current year MTRs. Given most MEEs are loss-making, it is expected that most firms will have an MTR of 0%. The ASX Listing Rules, however, require all entities whose main undertaking consists of exploration for minerals to file Appendix 5B quarterly reports. This may mean that some diversified mining companies with a range of projects, including some that are revenue generating, may also be required to file an Appendix 5B.

To measure the dollar value of mineral resources and reserves disclosed by firm *i* in year *t*, following Ferguson & Pündrich (2015) two variables are constructed, *ResourceValue* and *ReserveValue*, respectively, calculated as the product as the resource or reserve estimate and the price of the primary deposit commodity on the last day of the year in which the resource or reserve estimate is disclosed, converted from USD to AUD using the exchange rate on the last day of the year. The resource and reserve values are scaled by the firm's closing market capitalisation. Companies with mineral deposits that are not publicly traded (such as mineral sands and rare earths) are excluded from the calculation of resource and reserve values; these companies are treated as having resource and reserve values of nil. To ensure the tests are not biased against those firms whose focus is in non-traded commodities, an indicator variable *Resources* is also created, which is set equal to 1 if the firm had at least one project with a defined resource or reserve.

Control variables

Age is included as a control variable to proxy for the stage in the mine life cycle. Grassroots exploration companies are unlikely to invest in significant R&D prior to having identified a defined resource, for instance, as they would not be in a position to exploit the resulting knowledge until they find an economically viable deposit. Age is measured as the natural logarithm of the number of days since Australian Stock Exchange (ASX) listing.

Size is also included as a control variable, as prior evidence suggests risk is inversely related to company size for Australian mining companies (Ball & Brown 1980). Size is defined as the natural logarithm of the firm's market capitalization on the last day of year *t*.

Exploration activity is strongly influenced by commodity prices (Schodde 2017), which in turn is likely to flow through to the amount of R&D that is conducted. *PriceMove* is measured as the percentage change in the spot price of the firm's primary deposit commodity over the previous 12 months. Where no commodity prices are available for the firm's primary deposit commodity, commodity price indices are obtained from the Reserve Bank of Australia website. *FXMove* measures the percentage change in the $A/USD exchange rate over the previous 12 months, to proxy for demand for commodities exports.

Mining companies in the exploration and development phase face a high cost of equity capital, owing to the high degree of uncertainty involved in the evaluation of mining and other natural resource projects, which are viewed as real options, and as a result, standard capital budgeting techniques are unlikely to be suited to estimating their present value (Brennan & Schwartz 1985; Moel & Tufano 2002). Often, mining exploration companies' only source of funds is the equity market, with companies using their market capitalisation as a form of collateral (Schodde 2015). Firms with greater annual cash requirements may therefore be more likely to seek R&D tax refunds as a source of funding if they are unable to issue further equity capital. The cash burn rate, *CashBurn*, is used as a measure of annual cash requirements, and is calculated as (*Cash* + *Current Receivables* + *Current Investments*)/ (*Total cash requirements*), following Ferguson, Clinch & Kean (2011). Total cash requirements are equal to the absolute value of cash from operations for firms with negative cash from operations, and zero otherwise.

The information environment for mining exploration companies is characterised by high information asymmetry (Ferguson, Feigin & Kean 2013). Receipt of an R&D tax refund may provide a signal of the entity's ability to obtain finance. Further, a willingness to invest in intellectual property building may signal the entity's expectations of project success, which may translate into increased equity raisings. On the other hand, fewer equity raisings may indicate more difficulty in obtaining finance, and an even greater reliance on R&D tax refunds as a source of financing. *Issuance* is therefore included in the model as a control variable and is defined as the natural logarithm of the value of equity issuances during the year obtained from the Aspect Financial database.

Exploration and development companies can capitalise and defer exploration expenditure when the future of the project is uncertain under the Area of Interest method allowed under AASB 6 *Exploration for and Evaluation of Mineral Resources*. Higher amounts of capitalised exploration expenditure may signal expectations of project success; on the other hand, lower amounts may reflect accounting conservatism, which may signal conservatism more broadly in terms of project development assumptions (Ferguson, Clinch & Kean 2011). *DeferredAsset* is defined the natural logarithm of the balance of capitalised exploration and evaluation expenditure for firm *i* in year *t* (Aspect item 458).

A measure of investor sophistication is included following Ferguson, Clinch & Kean (2011) based on the percentage of shares held by the top 20 shareholders (*Top20*), which also serves as a proxy for the extent of private information.

To control for cross-sectional variation within mining exploration firms, indicator variables *Precious*, *Base*, *Bulks*, and *Other* are set up based on the firm's primary commodity, to distinguish between the major commodity clusters, namely, precious metals, base metals, bulk commodities and other commodities, such as rare earths and energy metals. The main commodity groups are defined in Table 2.8.

[TABLE 2.8 ABOUT HERE]

Foreign is included as a dummy variable to capture firms with only overseas projects. Generally, only R&D activities conducted in Australia or its external territories qualify for the R&D tax incentive. However, certain R&D activities conducted overseas may qualify, to the extent that the activities have a "significant scientific link to one or more core R&D activities conducted in Australia"[51], and subject to various other conditions being met, including a requirement for the company to apply to Innovation Australia for an advance finding in respect of the activities occurring overseas.

Mining exploration entities that are loss-making are normally single project firms, since developing two projects simultaneously is less common due to deposit complexities, technical and financial limitations (Ferguson, Clinch & Kean 2011). Single project firms are less able to diversify project-specific risk and may therefore be more dependent on R&D tax refunds as a source of financing. *SingleProject* is included as an indicator variable which is set equal to 1 for firms with only one active project.

A positive coefficient on *Post*, β_1, would be observed if the number of firms claiming R&D refunds increased after 2011. If firms are more likely to claim the refundable R&D tax offset if they have a defined resource or reserve, then β_{11} and β_{12} will be positive. If MEEs with larger capitalised exploration balances are more likely to claim the R&D tax offset, then a positive coefficient would be observed on *DeferredAsset*, β_9.

[51] Refer to AusIndustry, "R&D Tax Incentive: Overseas R&D Information Sheet".

2.7.2. Tests of H2

For tests of H2, the sample is restricted to firms that were eligible for the R&D tax incentive. Because eligibility for the incentive is based on the firm first registering its R&D activities with AusIndustry, a record of which is not publicly available, a firm is treated as being eligible for the incentive if it received at least one R&D tax refund between 2008 and 2015. In order to examine whether mining exploration entities eligible for the refundable R&D tax offset received larger R&D refunds after 2011, the following OLS regression model is estimated:

$$Refund_{i,t} = \propto_0 + \beta_1 Post_t + \beta_2 Age_{i,t} + \beta_3 Size_{i,t} + \beta_4 MTR_{i,t} + \beta_5 Issuance_{i,t} + \beta_6 PriceMove_{i,t} + \beta_7 FXMove_t + \beta_8 CashBurn_{i,t} + \beta_9 DeferredAsset_{i,t} + \beta_{10} Top20_{i,t} + \beta_{11} ResourceValue_{i,t} + \beta_{12} ReserveValue_{i,t} + \beta_{13} Precious_i + \beta_{14} Base_i + \beta_{15} Bulks_i + \beta_{16} Other_i + \beta_{17} Foreign_i + \beta_{18} SingleProject_i + \varepsilon_{i,t} \quad (2)$$

The dependent variable in equation (2), *Refund*, is the dollar amount of the R&D tax refund received by firm *i* in year *t*, scaled by total assets, and all other variables are as defined in Equation (1). The log transformation of the refund amount is also used as a dependent variable.

An alternative specification of the model in Equation (2) is estimated, in which the *Post* dummy is replaced with indicator variables *New*, *Existing,* and *Repeat.* The expansion of the R&D tax incentive in 2011 was expected to result in a significant increase in the number of firms eligible for the incentive, as the removal of the R&D expenditure cap was designed to improve the ability of firms in a tax loss position to access cash refunds. *New* is coded 1 if the firm first disclosed receipt of an R&D tax refund after 2011 and 0 otherwise; *Existing* is coded 1 if the firm disclosed receipt of at least one R&D tax refund before 2011 (claimed under the previous R&D tax concession) and also disclosed receipt of at least one R&D tax refund after 2011, and 0 otherwise.

Investment in R&D tends to be "sticky", since R&D is the result of the efforts of highly educated scientists and engineers (or, more likely, external consultants in the case of MEEs), and takes place over several years (Hall & Lerner 2010). A dummy variable *Repeat* is therefore set up to capture repeat claimers (i.e., firms that receive R&D refunds over several years). *Repeat* is coded 1 if the firm disclosed receipt of an R&D tax refund in a previous year, and 0 otherwise.

If firms received larger R&D refunds after 2011, a positive coefficient on β_1 would be observed.

2.7.3. Tests of H3

For tests of H3, a difference-in-difference ("DD") research design is used to examine the outcomes of the R&D tax incentive for eligible firms relative to ineligible firms. The OLS regression model used to test H3 is specified at Equation (3) using a number of alternative dependent variables, which are intended to measure various outcomes of the expansion of the R&D tax incentive in 2011, including: (i) subsequent exploration expenditure; (ii) subsequent equity raisings; and (iii) the market to book ratio, to proxy for the firm's growth opportunities.

$$DepVar_{i,t+1} = \propto_0 + \beta_1 Post_t + \beta_2 RD_i + \beta_3 RD_i \times Post_t + \beta_4 Age_{i,t} + \beta_5 Size_{i,t} + \beta_6 MTR_{i,t} + \beta_7 PriceMove_{i,t} + \beta_8 FXMove_t + \beta_9 CashBurn_{i,t} + \beta_{10} DeferredAsset_{i,t} + \beta_{11} Top20_{i,t} + \beta_{12} ResourceValue_{i,t} + \beta_{13} ReserveValue_{i,t} + \beta_{14} Precious_i + \beta_{15} Base_i + \beta_{16} Bulks_i + \beta_{17} Other_i + \beta_{18} Foreign_i + \beta_{19} SingleProject_i + \varepsilon_{i,t} \tag{3}$$

The dependent variable in Equation (3), *DepVar*, is replaced by the alternative outcome variables *Exploration*, *Issuance* and *MTB*.

Exploration is defined as payments for exploration and evaluation (Aspect item 814) made by firm *i* in the year following receipt of an R&D tax refund. Exploration expenditure is obtained from the cash flow statement, since the accounting treatment of exploration expenditure is not uniform across the entire sample. Since firms may choose to capitalise or expense exploration and evaluation costs, exploration expenditure can be reported either as an operating cash flow or an investing cash flow on the cash flow statement. Both operating and investing cash flows are included.

Issuance is defined in Equation (1) and refers to the proceeds from equity raisings in year $t + 1$.

MTB is calculated as the market value of equity divided by the book value of equity at the end of year *t*.

The variable of interest, *RD*, is set equal to 1 if firm *i* was eligible for the incentive, and 0 otherwise. As described above, an eligible firm is defined as one that received at least one R&D tax refund during the period 2008 to 2015.

A potential limitation of this approach is that the proxy for eligibility is based on a choice of the firm, as some firms may receive an R&D refund but not disclose it. For example, if the rebate amount was not material, it may be included in cash from operating activities rather than as a separate line item in its Appendix 5B report. It would appear that most firms do separately disclose the amount of the rebate received, as the smallest R&D tax refund disclosed in the sample was $8,000. The pro forma Appendix 5B supplied by the ASX on its website includes the line item "Research and Development refunds" at item 1.7, though some firms also show GST, fuel tax credits, government grants and other miscellaneous receipts at this item.

All other variables are as defined in Equations (1) and (2).

The difference-in-difference estimator is the interaction of RD_i with the *Post* variable. If the changes to the R&D tax incentive resulted in increased exploration expenditure and equity issuances and higher market-to-book ratios for eligible firms relative to ineligible firms after 2011, a positive coefficient should be observed on the interaction term, β_3.

2.7.4. Valuation of R&D

To examine the value relevance of the R&D tax incentive in tests of H4, the end-of-period market value of equity (*MVE*) is regressed on an indicator variable coded 1 if the firm received an R&D tax refund in year *t*, controlling for resource and reserve value estimates and the end-of-period book value of equity in equation (8), as follows:

$$MVE_{i,t} = \propto_0 + \beta_1 ResourceValue_{i,t} + \beta_2 ReserveValue_{i,t} + \beta_3 RD_{i,t} + \beta_4 BVE_{i,t} + \beta_5 RD_{i,t} \times ResourceValue_{i,t} + \beta_6 RD_{i,t} \times ReserveValue_{i,t} + \varepsilon_{i,t} \tag{8}$$

ResourceValue and *ReserveValue* are defined in Equation (1); *RD* is an indicator variable coded 1 if firm *i* received an R&D tax refund in year *t* and 0 otherwise; *BVE* represents the book value of equity at the end of year *t*.

If disclosure of receipt of an R&D tax refund is informative about the firm's future income, then a positive coefficient would be observed on β_3.

Alternatively, *RD* may be a moderating variable that influences the value relevance of resource and reserve disclosures, as the economic viability of a deposit may depend on whether the R&D is successful. *RD* is therefore interacted with each of *ResourceValue* and *ReserveValue*. If this is the case, positive coefficients would be observed on β_5 and β_6.

2.7.5. Long-run buy-and-hold abnormal returns

In order to measure the subsequent performance of firms that are eligible for the R&D tax incentive for tests of H5, long-term buy-and-hold abnormal returns (BHARs) of eligible firms are examined. Following Barber & Lyon (1997), Ritter (1991), Lam & Chan (2016) and others in the literature, monthly BHARs are calculated for each eligible firm for up to 60 months after the release date of the Appendix 5B which disclosed receipt of the R&D tax refund. The monthly BHAR of firm *i*, denoted as AR_{it}, is calculated as follows:

$$AR_{it} = R_{it} - BR_{it}, \tag{6}$$

where R_{it} is the buy-and-hold return of firm *i* in month *t*, and BR_{it} is the buy-and-hold return for a benchmark of firm *i* in month *t*. The cumulative BHAR of firm *i* over the τ months following receipt of an R&D tax refund is calculated as the cumulative return on a buy-and-hold investment in the sample firm less the cumulative return on a buy-and-hold investment in an asset or portfolio with an appropriate expected return, as follows:

$$BHAR_{i\tau} = \prod_{t=1}^{\tau} R_{it} - \prod_{t=1}^{\tau} E(R_{it}) \tag{7}$$

where R_{it} is the buy-and-hold return for firm *i* in month *t*.

For each eligible firm *i*, the buy-and-hold return for each month following receipt of an R&D tax refund, R_{it}, is calculated as $\frac{P_{i,t}}{P_{i,t-1}}$, where $P_{i,t}$ is the closing stock price of firm *i* in month *t*. If a firm disclosed receipt of an R&D tax refund during the month, the buy-and-hold return for that month is calculated as the closing stock price for that month divided by the closing stock price on the release date of the Appendix 5B.

Some firms separately announce when they receive an R&D tax refund. For firms that announced receipt of an R&D tax refund during the month, the buy-and-hold return for that month is calculated as the closing stock price for that month divided by the closing stock price on the date of the announcement.

Choice of benchmark firm

There are several methods of arriving at the expected return $E(R_{it})$ for each sample firm. In particular, testing for long-term abnormal returns in small growth firms can be problematic, since the volatility of abnormal returns among small firms is much higher than that of randomly selected firms, and the extent of overestimation by using a reference portfolio as the benchmark, as is common in the literature, is higher for small firms (Ang & Zhang 2004). For example, Fama & French (1993) report that their three-factor model has problems explaining the prices of small growth firms. Barber & Lyon (1997) document that the misspecification of test statistics for abnormal returns calculated using a reference portfolio, such as a market index, can be overcome by matching sample firms to control firms of similar sizes and book-to-market ratios. In particular, Ang and Zhang (2004) find that the use of a single firm benchmark is better suited to estimating long-run abnormal returns in samples of small firms.

Following Ang & Zhang (2004), therefore, a two-factor single firm benchmark is used, by identifying the benchmark firm that is most similar to the eligible firm in both size and book-to-market. Specifically, for each eligible firm that receives at least one R&D tax refund during the period from 2008 to 2015, a benchmark firm from the sample of MEEs that do not disclose receipt of an R&D tax refund is identified.

The procedure for choosing the benchmark firm for each firm that claims the R&D tax offset is based on Spiess & Affleck-Graves (1995) and is described here. All listed MEEs are segmented by their commodity focus (precious metals, base metals, bulk commodities, others, and diversified). The firm's commodity focus is obtained from the SNL Metals & Mining database, which identifies the primary commodity for each project. The benchmark firm is identified by first identifying all non-claiming firms in the same commodity group whose market value at the end of the previous year is within 70% to 130% of the eligible firm's market value, and then choosing the firm that has the book-to-market ratio closest to that of the eligible firm (also measured at the end of the previous year).

To ascertain if the long-run return performance of firms that are eligible for the R&D tax incentive differ from the matched control firms in terms of their buy-and-hold returns, a test of whether the cumulative BHARs in each month from month $t + 1$ to month $t + 60$ are significantly different from zero is performed, where month t = the month in which the R&D refund was received. Cumulative buy-and-hold returns are calculated for both the claiming firms and the matched control firms over the 60 months following each R&D refund received by the claiming firm.

2.8. Results

2.8.1. Descriptive statistics and univariate analysis

Panel B of Table 2.7 sets out the number of firms claiming the R&D tax rebate and the total amount claimed each year. Overall, there were 489 firm-years in which receipt of the R&D tax rebate was disclosed between 2008 and 2015, representing 9.5% of the final sample of 5,163 firm-year observations. Most firms disclose receipt of the rebate at item 1.7 of the Appendix 5B quarterly cash flow statement. Some firms disclosed other receipts at item 1.7, such as GST refunds and fuel tax rebates received. These receipts are excluded from the R&D rebate amount. A small number of firms disclose R&D refunds at "Receipts from product sales and related debtors" at Item 1.1.

[TABLE 2.7 ABOUT HERE]

The number of firms claiming the rebate increased dramatically from just 11 in 2008 to 99 by 2015. The biggest increase is observed between 2012 and 2013 when the number of firms claiming the rebate increased from 66 to 107, reflecting the spike in the number of firms that became eligible for the refundable tax offset after 2011.

The effect of the rebate was not reflected in more R&D claims immediately. Because the R&D tax incentive is based on entities self-assessing their eligibility and then lodging a claim with the ATO when they complete their tax return, the process of applying for the incentive and determining the amount of eligible expenditure *ex post* is likely to take time. In this regard, R&D performing entities have up to 10 months after the end of their tax year to register their R&D activities with AusIndustry. Most companies with a June 30 financial year end would not be required to submit their tax returns until the following January, or May if they are not in a tax payable position. This means that the first R&D claims for the year ended 30 June 2012 would not be expected to be received until late 2012 at the earliest.

The size of the average R&D refund received increased as well, from $220,639 in 2008 to $1,332,471 in 2013, reflecting the removal of the R&D expenditure cap after 2011. Interestingly, the average R&D refund received declined from $1,332,471 in 2013 to $1,022,677 in 2015. This may have occurred for two reasons. First, minerals exploration in Australia declined sharply after the peak of the commodities boom in 2011, with commodities prices falling over the same period (refer to Figure 2.5 and Figure 2.6). With less exploration being conducted, R&D activity may have declined as well. For a graphical depiction of the data in Table 2.7, refer to Figure 2.6.

[FIGURE 2.5 ABOUT HERE]

[FIGURE 2.6 ABOUT HERE]

[FIGURE 2.7 ABOUT HERE]

Second, a number of Administrative Appeals Tribunal (AAT) decisions such as *Mt Owen Pty Limited (aka DBTL) v Innovation Australia*[52] provided additional guidance for companies regarding which activities are eligible. The *Mt Owen* decision was particularly significant as it re-affirmed the approach taken by AusIndustry and Innovation Australia with regard to the administration of the R&D tax incentive, particularly in relation to the requirement to have a specific hypothesis which forms the basis for specific experimental activities, and, of most relevance to claimants in the mining industry, the distinction between geological risk and technical or scientific risk. The taxpayer in *Mt Owen* provided evidence that the activities conducted involved numerous risks around geology, operations and other commercial risks; however, any uncertainty was found to be intrinsic to the geological or other characteristics of the

[52] [2013] AATA 573

deposit, so the activities claimed were not eligible R&D[53]. Many of the principles set out in that case were subsequently adopted by AusIndustry in guidance issued to taxpayers setting out their interpretation of what constitutes "hypothesis-driven" activities[54]. This is likely to have had the result of narrowing the range of expenditure that could be claimable as eligible R&D.

Table 2.8 provides a breakdown of active mining properties (projects) held by ASX listed mining exploration entities. Projects are grouped into four main commodity clusters, precious metals, base metals, bulk commodities and others. Precious metals are the largest commodity cluster (representing 37.48% of active projects) due to the large number of gold explorers listed on the ASX. Not all commodities have price data available; this mostly affects projects in the 'other' group (i.e., heavy mineral sands and rare earths). Just under 40% of the projects in the sample are located outside Australia, with most of these being in Africa (13.58% of all projects), Asia and the Middle East (8.11% of all projects) and South America (6.61% of all projects).

[TABLE 2.8 ABOUT HERE]

Table 2.9 compares the characteristics of firms that claim the R&D tax rebate (claimants) to firms that do not (non-claimants). As defined in Equation (3), a firm is defined as a claimer if it received at least one R&D tax refund during the period 2008 to 2015. This is designed to proxy for rebate eligibility. This results in a larger number of firm-years being included in the claimant group (1,631 compared to 3,668 in the non-claimant group), since all observations in the time series for a claiming firm will be assigned to the claimant group. In sensitivity analysis conducted in a later section, alternative definitions of the claimant and non-claimant group are considered,

[53] See "Administrative Appeals Tribunal decision – Mt Owen v Innovation Australia" (2017), https://www.business.gov.au/assistance/research-and-development-tax-incentive/guidance-and-information/administrative-appeals-tribunal-decisions/aat-decision-mt-owen-v-innovation-australia (accessed 29 January 2018).
[54] See e.g. Department of Industry, Innovation and Science (2016). "R&D Tax Incentive: applying the law – Finding 2016/01 – Mining projects to extract minerals".

including whether a firm received at least one R&D tax refund after 2011, and whether a firm received more than one R&D tax refund during the period 2008 to 2015 (i.e., repeat claimers).

Because the sample is comprised solely of firms that are required to lodge the Appendix 5B (i.e., firms engaged in exploration), with producers largely excluded, the two groups share a number of similar characteristics. For example, the two groups are similar in terms of their age (average 4 years), both groups are loss-making, and are reliant on equity capital to fund their cash requirements. On average, R&D claimants are significantly smaller (market capitalisation of $44.9 million versus $165 million for non-claimants) and have more accumulated losses ($31.4 million versus $1.9 million for non-claimants). This is consistent with the profile of the typical R&D-performing firm at which the R&D tax incentive was targeted (i.e., small-cap mining firms that have not yet reached the revenue generating stage and have substantial accumulated losses). The right-tailed distribution of the firm size variable is evident, as the median market capitalization for the claimants and non-claimants respectively is $13 million and $14.2 million, both significantly less than the mean.

The median resource and reserve values of both groups are zero. For the non-claimer group, this is likely indicative of the number of junior exploration companies undertaking greenfield exploration. For the claimer group, this may also reflect companies with primary deposit commodities where the price is unavailable. The resource and reserve value estimates for the bulk commodities group may be subject to some measurement error, as the values are obtained by multiplying the reported tonnage by the iron ore spot price, regardless of grade. This will lead to the values of some low-grade iron ore deposits being overstated. As a result, the resource and reserve value measures used as control variables are winsorized at the 97th percentile to reduce the impact of extremely large values[55].

[TABLE 2.9 ABOUT HERE]

Due to the influence of outliers on many of the variables in Table 2.9, a Wilcoxon-Mann-Whitney test of the equality of the distributions of key variables across claimants and non-claimants is also conducted (refer to Table 2.10). This test compares the number of observations that are less than or equal to the median, and greater than the median, across the two groups, to test whether there is a statistically significant difference between the two distributions. For example, Table 2.9 reveals that there is no significant difference in the average deferred exploration balance between the two groups; however, Table 2.10 shows a significant difference in the distributions (Pearson chi-squared statistic 30.08; significant at the 1% level). In the non-claimer group, 1,927 firm-year observations had a capitalized exploration balance less than or equal to the median, while only 1,741 observations had a balance greater than the median. This is reversed in the claimer group, with 723 observations having a capitalized exploration balance less than the median, and 908 greater than the median. The median balance for the non-claimer group was $4.35 million, and $6.4 million for the claimer group. Taken together, this suggests that firms claiming the R&D offset are more likely to capitalize exploration expenditure, which is interpreted as preliminary support for H1c.

The marginal tax rate of both the median claimant firm and the median non-claimant firm is nil, reflective of the high inherent risk associated with minerals exploration, as for many companies in the sample, there is a high probability that they will not be able to use their tax losses. However, the marginal tax rate is not zero in either group (the mean MTR is 3.47% for

[55] In untabulated results, log transformations are applied to selected variables as well as winsorization (discussed at section 2.8.2), but this does not change the conclusions of this chapter.

non-claimants and 1.12% for claimants), indicating the presence of some companies in the sample who are earning revenues. The number of firms with positive MTRs is significantly lower in the claimant group (89 firm-years compared to 531 in the non-claimant group, with a chi-squared statistic of 88.034 which is significant at the 1% level).

[TABLE 2.10 ABOUT HERE]

Descriptive statistics and correlations between key variables are reported at Table 2.11 and Table 2.12, respectively. Overall, most of the correlation coefficients in Table 2.12 are less than 0.5. There are strong positive correlations between *Size*, *DeferredAsset* and *Exploration*, suggesting that the presence of a small number of larger companies in the sample is likely causing the distributions of these variables to be skewed. As a result, log transformations as well as winsorization (generally at the 97^{th} percentile) are employed for selected variables. *ResourceValue* and *ReserveValue* are positively correlated (correlation 0.308); ore reserves have a greater probability of being economically viable relative to mineral resources. *DeferredAsset* is also positively correlated with *Exploration* (correlation coefficient 0.4782), which is consistent with the discretion allowed by AASB 6 which permits capitalisation of exploration expenditure when the future of a project is uncertain.

[TABLE 2.11 ABOUT HERE]

[TABLE 2.12 ABOUT HERE]

2.8.2. Characteristics of claiming firms

In Panel (1) of Table 2.13, the coefficient on *Post* is positive and significant, providing *prima facie* evidence that R&D expenditure increased after the introduction of the new R&D tax incentive, consistent with H1a[56].

The coefficient on *MTR* is negative and significant, suggesting that the demand for the refundable tax offset is greatest among firms that are the least likely to be able to use their tax losses.

There is a negative coefficient on *Foreign*, consistent with expectations, as only R&D activities that have a significant scientific link to Australia are eligible for the R&D tax incentive.

The results are also consistent with H1b, as *ResourceValue* and *ReserveValue* are both positively and significantly associated with the probability that a given firm received an R&D tax refund in year *t*. The positive and significant coefficient on *Age* is also consistent with H1b, as junior (grassroots) explorers are not expected to conduct R&D until they have successfully identified a mineral resource.

The importance of the R&D tax incentive varies depending on the firm's primary deposit commodity. Firms whose exploration focus is in precious metals (i.e., gold, silver and platinum) are less likely to claim the R&D tax offset, as the coefficient on *Precious* is negative and significant (-0.2774, t-statistic = 1.83). By contrast, there are positive coefficients on both *Base* and *Other*. Taken together, these findings support the scientific impetus of the R&D tax incentive

[56] One explanation for the results in Table 2.13 is that new firms entering the sample could be affecting the results. To investigate whether the increase in the number of firms claiming the R&D tax offset after 2011 is due to more firms becoming eligible, or the R&D incentive leading to new firms being established, the sample used in tests of H1 is restricted to only those firms that were in existence at the beginning of 2008. This does not change the conclusion; i.e., firms are still more likely to claim the refundable R&D tax offset after 2011, regardless of whether newly established firms are included in the sample.

program. Extraction and processing of gold and silver is generally undertaken using industry-standard methods and involves little scientific or technical risk[57]. By contrast, commodities in the *Base* and *Other* groups include copper, rare earths, lithium, cobalt, graphite and nickel, which are used in the manufacture of battery materials for electric vehicles (EVs) (Regional Development Australia 2018). The market for the supply of EV batteries is highly competitive. While the supply of some of the commodities used in EV batteries, such as lithium and graphite, is relatively abundant, production of these materials involves more technical risk. For example, impure graphite in anodes has been shown to lead to performance and safety issues. This may be one of the factors driving R&D efforts in the minerals exploration sector.

As noted, the measures of resource and reserve value are biased towards those primary deposit commodities for which prices are publicly available[58]. An alternative model specification is used with an indicator variable, *Resources*, which is coded 1 if the firm had a defined resource or reserve, and 0 otherwise. The results are shown in Panel (2) of Table 2.13 and are consistent with H1b, as the coefficient on *Resources* of 0.5649 is significant at the 1% level (*t*-statistic 4.28). When *Resources* is used in place of *ResourceValue* and *ReserveValue*, the coefficient on *Precious* remains negative and significant, but the coefficients on *Base* and *Others* lose their significance (but still have the correct sign). One explanation for this that *Resources* is capturing firms that reported a defined resource or reserve but are missing commodity prices. Table 2.8 shows that more commodities in the base metals and other commodities groups are affected by the

[57]This is not to say that firms with a precious metals focus do not undertake R&D. While firms in the precious metals space are less likely to claim the R&D tax offset on average (this is likely due to the large number of junior gold explorers listed on the ASX), some firms with a precious metals focus do conduct R&D. For example, Aruma Resources Limited (ASX code: AAJ), a gold and base metal exploration company, disclosed in its 2015 annual report that it was eligible for the R&D tax offset as it was drilling based on new methodologies; while Gascoyne Resources Limited (ASX Code: GCY) received R&D refunds in respect of its Glenburgh and Dalgaranga gold projects.
[58]Commodity prices are available on Datastream for gold, silver, platinum, iron ore, coal, copper, nickel, zinc, uranium, tin, tungsten, molybdenum, vanadium, cobalt, titanium, lead, and palladium.

unavailability of commodity prices. Nevertheless, the results in Panel (2) of Table 2.13 do not contradict the conclusions of Panel (1).

While the positive coefficient on *DeferredAsset* is statistically significant, consistent with H1c, the small magnitude of the coefficient (i.e., less than 0.0001) suggests that accounting attributes are less important in determining the likelihood that a given firm will claim the rebate than project-specific characteristics such as the existence of a resource or reserve and the nature of the firm's primary deposit commodity. This finding is consistent with the discretion permitted by AASB 6, which allows the capitalisation of exploration expenditure in relation to an area of interest where exploration is ongoing and the outcome of that exploration is uncertain. Thus the capitalisation of exploration expenditure may not always reflect expectations regarding the economic viability of the firm's mineral deposits.

[TABLE 2.13 ABOUT HERE]

Some of the hypothesised determinants may also be outcomes of claiming the R&D rebate. For example, if successful R&D increases the economic potential of previously identified deposits, it may lead to further resource and reserve upgrades and further equity raisings. To control for this possibility, an alternative specification of Equation (1) is used to test H1, using the values of the hypothesised determinants at time $t - 1$ instead of time t. Results are qualitatively similar and are reported in Table 2.14.

[TABLE 2.14 ABOUT HERE]

As an alternative test of H1, the firm dummy *Claimer* is used in place of *RD*. This is defined such that if a firm received an R&D tax refund in any given year, all observations for that firm during the sample period 2008 to 2015 are assigned the value of 1. This test is designed to examine differences in characteristics of claimant firms and non-claimant firms over time. The results are reported in Table 2.15. *Post* is not significant in this model, due to the dependent variable being a firm dummy, rather than a firm-year dummy. In all other respects, results are qualitatively similar to those reported in Table 2.13. One notable difference is that the effect of the *SingleProject* dummy is stronger, suggesting that firms that have a single "flagship" project are more likely to claim the R&D rebate.

[TABLE 2.15 ABOUT HERE]

As discussed above, the distributions of some of the variables are skewed, particularly the resource and reserve value measures, which are defined as "in ground" values (i.e., quantity of the commodity multiplied by the spot price of the commodity). (Projects may have large "in ground" values, but this is not necessarily indicative of their economic viability.) Thus, in untabulated results, log transformations were applied to selected variables as well as winsorization, to reduce the impact of outliers. The use of log transformed variables does not change the conclusion; MEEs are still more likely to claim the refundable R&D tax offset if they have a defined resource or reserve.

2.8.3. Impact of the 2011 changes

The results from tests of H2 are reported in Table 2.16. The dependent variable, *Refund,* is the natural logarithm of the R&D tax refund received in the current year. The results are consistent with H2, that is, not only are firms more likely to claim the refundable R&D tax offset after 2011, but the amount claimed increased after 2011 as well, as evidenced by the positive and significant coefficient on *Post* (0.9907, t-statistic = 5.88). In contrast to the tests of H1, *Size* is positive and significant, as larger firms spend more on R&D in dollar terms. In order to examine the extent to which the increase in the amount claimed is driven by newly eligible firms who first started claiming the R&D rebate after 2011, the *Post* variable is replaced by indicator variables

New, *Existing* and *Repeat*. *New* and *Existing* both exhibit positive and significant coefficients; while a significant number of firms began claiming the R&D tax offset after 2011, firms that claimed the R&D tax offset before 2011 also received larger refunds after 2011. Prior to 2011, firms in a tax loss position could receive R&D refunds, but the maximum refund that could be received in any given year was $600,000, due to the annual expenditure cap of $2 million. These results would appear to validate the concern raised in the Cutler review of the R&D tax concession that the expenditure cap was too low.

An indicator variable *Repeat* is added to the model in Equation (2). This is designed to capture the "persistent" component of R&D over time. Berger (1993) highlights the autoregressive nature of R&D investment, where firms that have undertaken R&D in the past are expected to do so in the future. In this regard, R&D tends to be "stickier" than other expenses as it is generally performed by highly qualified scientists and engineers over several years. Interestingly, the coefficient on *Repeat* is negative and significant (-0.3645, t-statistic 2.67) after controlling for *New* and *Existing*. One explanation for this finding is that the repeat claimers tend to smooth their R&D expenditure over time. Another possibility may lie in the compliance requirements laid out by AusIndustry for successful R&D claims. Successful R&D claims require contemporaneous documentation to be kept documenting the nature of the activities conducted, how they result in the creation of new knowledge, and also linking the activities to actual expenditure incurred, in other words, an activity-based costing approach to recording R&D expenditure. Smaller firms with a limited number of accounting and administrative staff may require more time to prepare the documentation required in order to claim the R&D tax offset in their tax return; thus, some firms may register their activities with AusIndustry when required, and amend their tax return in a later year to include their entitlement to the R&D tax offset when it is known. This could result in multiple refunds being received in the same year.

[TABLE 2.16 ABOUT HERE]

Equation (2) is also estimated with the dependent variable, the amount of the refund received in a given year, scaled by total assets, as a measure of the firm's R&D intensity. The results are reported in Table 2.17. To demonstrate the effect of scaling the dependent variable on the interpretation of the results, the coefficient on *Size* is now negative and significant in Panel (1) of Table 2.17, suggesting smaller firms are more R&D-intensive. This is consistent with economic intuition, as smaller firms are likely to have fewer assets, so those firms that do conduct R&D in the early stages of their development life cycle will naturally have a higher ratio of R&D to total assets. Otherwise, the main result in Table 2.16 still holds, as the coefficient on *Post* is still positive and significant (0.0495, t-statistic 3.07), suggesting that R&D intensity increased after 2011.

[TABLE 2.17 ABOUT HERE]

2.8.4. Difference-in-difference tests

The objective of H3 is to compare the outcomes of the 2011 changes to the R&D tax incentive for the claimant and non-claimant groups. To do this, a difference-in-difference research design is employed, which uses the interaction term $Post \times RD_i$ to compare the pre- and post-period outcomes between the two groups. Before conducting difference-in-difference ("DD") tests, however, it is first necessary to establish that the parallel trends assumption is not violated. Briefly, the parallel trend assumption is the key identifying assumption for DD, and requires a comparison of the average outcomes for the treatment and control groups during the pre- and post-treatment periods (Whited & Roberts 2013). Here, the treatment group is the claimant group and the control group is the non-claimant group. The treatment is the introduction of the changes to the R&D tax incentive in 2011.

As observed in Figure 2.6 above, the period after 2012 saw a decline in exploration expenditure following the peak of a commodities boom in Australia. However, this does not necessarily preclude the use of the DD estimator; what is of interest for the purposes of the test of H3a is whether there were any differences in exploration trends between the two groups after 2011.

Average exploration and evaluation expenditure for both the claimant and non-claimant groups over the period from 2008 to 2015 is depicted graphically in Figure 2.8. As can be seen from Figure 2.8, exploration activity declined in both the claimant and non-claimant groups, which is consistent with the trend observed in Figure 2.6. This would suggest that exploration expenditure by firms eligible for the R&D tax offset did not increase after 2011, which is contrary to H3a. However, looking at the trend over the entire sample period from 2008 to 2015 in Figure 2.8, average exploration declined more sharply in the non-claimant group relative to 2008 levels. This would suggest that exploration activity by firms that do not claim the R&D tax offset is more sensitive to commodity prices, as these firms rely on the equity markets to fund their exploration activities. Further, it is possible that changes to the then 30% refundable R&D tax offset in 2009, which saw the R&D expenditure cap lifted to $2 million, may have contributed to the increase in exploration and evaluation expenditure in the claimer group from 2009 to 2012, as the number of firms claiming the R&D tax offset increased steadily from 2009 to 2012 (refer to Table 2.7), though the biggest increase in the number of firms claiming the R&D tax offset occurred after 2012.

[FIGURE 2.8 ABOUT HERE]

The regression results for the tests of H3a are reported in Table 2.18. The dependent variable is the natural logarithm of total payments for exploration and evaluation. The results when current period exploration is used as the dependent variable are reported in Panel (1) of

Table 2.18; exploration in the following period is used an alternative dependent variable in Panel (2), to reduce the likelihood of reverse causality driving the results.

[TABLE 2.18 ABOUT HERE]

The interaction of *Post* × RD_i (i.e., the DD estimator) is not significant, which is not consistent with H3a. This would suggest that the 2011 changes to the R&D tax incentive did not result in increased exploration activity in the claimant group relative to the non-claimant group. Interestingly, however, the coefficient on RD_i is positive and significant in Panels (1) and (2) of Table 2.18, while there is a negative and significant coefficient on *Post* in Panel (2) of Table 2.18 (-0.5063, t-statistic = 2.29). This finding is attributed to the distribution of the log transformed dependent variable, but could also point to the role of the refundable tax offset as a source of financing for cash constrained MEEs, in light of the 2009 changes to the R&D tax offset which saw the R&D expenditure cap lifted to $2 million, which may have helped R&D-performing MEEs maintain their cash holdings. The importance of cash flow to MEEs is also illustrated by the positive and significant coefficient on *CashBurn* in Panel (2) (0.0665, t-statistic = 3.11), suggesting that firms with greater cash holdings were able to spend more on exploration in the following period.

Table 2.19 reports the results when subsequent period equity raisings and the market-to-book ratio (as a measure of growth opportunities) are adopted as alternative dependent variables. As with exploration expense, the log transformation of the amount of equity raised is used as the dependent variable in Panel (1) of Table 18. The coefficient on *Post* in Panel (1) is negative and significant (-1.5374, t-statistic = 3.93), which, like in Table 2.18 can be attributed to the end of the commodities boom, but H3b is not supported, as the coefficient on *Post* × RD_i is not significant. While the results suggest that the average claimant issued more than the average non-claimant (i.e., there is a difference in equity raisings between the two groups), there does not appear to be a difference between pre-period and post-period outcomes for the claimant group.

The results for the tests of H3c are reported in Panel (2) of Table 2.19. There is weak evidence that firms claiming the R&D tax offset had greater growth opportunities after 2011, as the *Post* × RD_i interaction is statistically significant (albeit only at the 10% level) when *MTB* is used as the dependent variable.

[TABLE 2.19 ABOUT HERE]

2.8.5. Valuation of R&D firms

The results for tests of H4 are reported at Table 2.20. Consistent with prior literature, the value of reserves is significantly and positively associated with firm value. H4 is not supported, however, as there is a negative association between receiving an R&D tax offset in the current year and firm value. This is likely to be for the following reasons. First, if R&D is undertaken in relation to a previously reported resource or reserve, receipt of an R&D refund may not be viewed by the market as providing new information. For example, Magliolo (1986) finds that disclosures of additional information regarding proven and probable oil and gas reserves are not associated with market values, as the market anticipates information on the reserves disclosures. Second, information costs may affect the value that investors attach to R&D. As discussed in section 2.4.2 above, the cost of adverse selection is larger for higher-variance (i.e., riskier) projects such as R&D, since the range of (unobservable) values between good and bad projects is greater (Beatty, Berger & Magliolo 1995). If investors do not have enough information to be able to evaluate the quality of R&D projects, they will find it difficult to attach value to the R&D.

[TABLE 2.20 ABOUT HERE]

2.8.6. Long-run performance

The results for the long-run returns analysis are presented in Table 2.21. The final sample used to calculate the average cumulative buy-and-hold abnormal returns in Table 2.21 consisted of 404 R&D refunds that were received by 157 claiming firms between 2008 and 2015 for which a suitable benchmark firm could be identified for each claiming firm.

There is significant long-run underperformance in both the claimer and non-claimer groups; the median firm in the claimer sample declined by 76.2% over the 60 months following receipt of an R&D refund, and the median firm in the non-claimer sample declined by 88.1% over the same period. This is reflective of the high risk involved in minerals exploration, where very few explorers are successful.

The return series for the non-claimer sample is significantly more volatile than the claimer sample. The average standard deviation of the monthly returns in the claimer sample is 2.7, compared with 9.4 for the non-claimer sample[59]. This is likely due to the high-risk nature of greenfield exploration, where less R&D is undertaken. By contrast, as discussed in section 2.8.2, R&D is more likely to be conducted in conjunction with an existing mineral deposit. As a result, the returns for the non-claimer sample are more strongly impacted by commodity prices, particularly the gold price, given the large number of gold explorers listed on the ASX[60]. For example, the gold price reached a peak of US$1,899/oz in September 2011 before declining to US$1,060/oz by December 2015. As can be seen from Figure 2.9, this resulted in the non-claimer group significantly outperforming the claimer group on average for the majority of the 60-month

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[59] MEEs in general trade at very low share prices and have more volatile return series. It is not uncommon for the share prices of exploration companies to increase by 100% or more following the announcement of favourable drilling results. For example, on 14 July 2014 Crater Gold Mining Limited (ASX code: CGN) announced the commissioning of a gold mining plant following favourable high grade drilling results, which saw the share price increase from $0.092 to $0.155 in a single day (an increase of 168%).

[60] The economic viability of mineral deposits is in general strongly linked to commodity prices, as higher commodity prices can result in previously sub-economic deposits becoming economically viable.

period before the peak of the commodity price boom. Towards the end of the 60-month period, however, the average performance of the non-claimer group declines significantly relative to the claimer group, as depicted in Panels B and C of Figure 2.9. This suggests that the share prices of R&D-performing MEEs are less sensitive to commodity price movements relative to MEEs that do not perform R&D, perhaps as a result of the nature of the projects they undertake.

The results in Table 2.21 may also point to the resilience of R&D tax offset recipients during downturns, providing evidence in support of the role of the R&D tax incentive as an alternative source of financing to the equity markets. This is more evident when cumulative abnormal buy-and-hold abnormal returns are calculated for the claimer sample by subtracting the return for a matched firm of comparable size. The mean cumulative abnormal return reaches a low of -325% in month 33 following receipt of an R&D refund. Subsequently, however, the claimer sample begins to outperform the non-claimer sample, as the average cumulative abnormal return reaches a high of 4.1% in month 58 of the 60-month period. The median firm in the claimer sample begins to earn more positive abnormal returns (of up to 21.7%) towards the end of the 60-month period as well, relative to a non-claimer firm of comparable size.

However, the results in the later months of the time series are not statistically significant, as the sample size is reduced, due to the smaller number of firms with sufficient data available to estimate returns over a 60-month window, which also satisfy the criterion of being in the same primary commodity group as the claimant firm, due to the requirement to have at least five years of price data following receipt of an R&D refund. The first R&D refunds issued under the new R&D tax incentive were received in the second half of 2012. At the time of writing this thesis, daily stock price data was only available from SIRCA until December 2016. Most of the firms for which there is enough data to calculate cumulative abnormal returns over the entire 60 months, therefore, would be firms who were eligible for the 30% refundable tax offset under the former R&D tax concession scheme which operated until 2011.

Survivorship bias can also not be ruled out as a possible driver of the results, as some firms may be delisted, acquired or otherwise exit the industry (for example, firms which are acquired in "reverse takeover" transactions as part of a backdoor listing). If MEEs rely on the R&D tax incentive as a substitute for equity financing during downturns, then one would *prima facie* expect relatively fewer firms in the claimer group to be delisted[61].

It should be stressed that while there is some evidence (albeit not statistically significant, due to the small sample size) that MEEs claiming the R&D tax offset earn excess returns relative to non-claimant firms towards the end of the five-year return period, there is still significant underperformance in both the claimant and non-claimant groups. In both groups, the number of stocks earning negative returns exceeds the number of stocks earning positive returns for most of the five-year return period. In addition, the percentage of stocks earning positive returns decreases over time in both groups, such that by the end of the five-year return period, only 22.1% of claimant firms and 18.1% of non-claimant firms earn positive returns.

While this is reflective of the high failure rate of minerals exploration as discussed above, the persistent underperformance of the claimant group might suggest that some of the concerns expressed by industry professionals about the new R&D tax incentive introduced in 2011 (discussed in Section 2.2.2) may be justified. While the redesigned R&D tax incentive was more generous in the sense that it increased the tax benefit provided in respect of eligible R&D by increasing the rate of the tax offset and removing the expenditure cap, the revised definition of eligible R&D effectively limited the program to the "basic research" and "applied research" parts

[61] In untabulated results, claimant firms are three times less likely to be delisted than non-claimant firms, which would also be consistent with non-claimant firms having higher risk than claimant firms.

of the OECD definition of R&D (i.e., the Frascati definition), and excluded much experimental development, which has been argued to be one of the most critical aspects of business R&D. Notwithstanding the importance of the incentive as a source of financing for capital constrained MEEs, one explanation for the persistent underperformance is that as a result of the more restrictive definition of eligible R&D, the incentive has failed to encourage the kinds of R&D that result in projects becoming economically viable.

[TABLE 2.21 ABOUT HERE]

One limitation of the long-run returns analysis conducted in this section is that because some firms received multiple R&D refunds during the period 2008 to 2015, some of the cumulative return periods will be partially overlapping in calendar time. As each R&D refund receipt is treated as a distinct event, some firms will have multiple R&D refund events. The cumulative buy-and-hold returns are calculated over the five years following each R&D refund received by the claiming firm, i.e., each 5-year return period commences after each R&D refund event, resulting in cross-sectional correlation in the return series.

The event study literature has proposed a number of solutions to the problem of cross-sectional correlation in cumulative abnormal returns where there are partially overlapping event windows, including adjusted *t*-statistics (Kolari & Pynonnen 2010); portfolio test statistics by Jaffe (1974); non-parametric rank-based tests (Kolari & Pynonnen 2011); and sign tests (Cowan 1992). However, accounting for cross-sectional correlation is more complicated when the return windows are partially overlapping in calendar time. At the time of writing this thesis, there does not exist a well-established solution in the literature to account for this (Kolari, Pynonnen & Pape 2018).

Therefore, as a robustness test, the sample used in the long-run returns analysis is restricted to R&D refunds that were received in 2012 only, to overcome the problem of overlapping return windows. (2012 was chosen as it was the first year in which firms began claiming the 45% refundable tax offset.) This resulted in a significantly smaller sample of 41 R&D refunds. Due to the return periods for each event commencing in 2012, returns were only calculated for the four years following receipt of each R&D refund. While the *p*-values were not statistically significant due to the smaller sample size, the main result of Table 2.21 was unchanged, i.e., the claimant group is still lower risk than the non-claimant group (the return series of the claimant group had an average standard deviation of 2.08, compared with 3.72 for the non-claimant group).

2.9.Conclusions

The results of this chapter show that MEEs are more likely to access the R&D incentive after 2011, suggesting that the incentive has achieved its objective of making cash refunds available to capital constrained firms that are also loss-making. In addition, MEEs are more likely to conduct R&D around an existing mineral deposit. The results also support the scientific impetus of the R&D tax incentive program, as R&D claims are less common among firms with a precious metals focus, while firms whose focus is in base and industrial metals and other minerals, such as lithium, graphite and rare earths, are more likely to claim the R&D tax offset. This result suggests that R&D claims are more common in respect of projects involving more scientific and technical risk.

One acknowledged limitation is that actual R&D expenditure is not observed directly. Very few of the firms in the sample have this data available in the Aspect Financial database, as this is typically included in the capitalised exploration balance or expensed if the firm chooses to expense exploration costs. Having said that, the fact that the removal of the R&D expenditure cap resulted in larger R&D refund claims after 2011 can be interpreted as *prima facie* evidence that the incentive is achieving at least part of its stated objective.

For further discussion of the contributions, implications and limitations of this chapter, refer to Chapter 4.

3. TAXATION OF EMPLOYEE OPTION PLANS IN AUSTRALIA

3.1.Introduction

Employee stock ownership is widely viewed as aligning the interests of employees and managers more closely with the overall goals of the firm's owners (Scholes & Wolfson 1990). The tax treatment of stock-based compensation is typically more favourable than cash-based compensation such as salary and wages, due to the ability of employees to defer taxation to some future date, for example, the vesting date of stock option grants, or the date on which the stock is subsequently sold. If the stock is held for a long period of time, the lower tax rates on long-term capital gains can make stock-based compensation more attractive.

The purpose of this chapter is to examine the effect of taxes on employee stock option plans in the context of an unanticipated change to the taxation of employee share schemes ("ESS") in Australia that was announced in the 2009-10 Federal Budget on 12 May 2009. The most significant impact of the 2009 changes was to alter the deferred taxing point for employee shares and options ("ESS interests") issued on or after 1 July 2009 at a discount to market value. Prior to July 2009, the ESS discount was typically subject to taxation at the time of vesting for employee shares and on the exercise date for options, unless an election was made by the employee to tax the discount upfront. For options with no disposal restrictions or other forfeiture conditions, the earliest possible taxing point was on exercise. The 2009 changes, however, amended the taxing point for employee options such that the discount could be taxed prior to being exercised for certain options that did not have a real risk of forfeiture[62]. This meant that employees would potentially be required to pay tax prior to realising a gain, which *prima facie*

[62] The "real risk of forfeiture" requirement was the most controversial aspect of the 2009 changes and was aimed at tightening the existing ESS deferral rules which were seen as being too generous. Broadly, an ESS interest acquired by an employee is said to be at real risk of forfeiture if retention of the interest is subject to genuine performance hurdles or a minimum term of employment.

made employee stock options less attractive. Although an earlier taxing point typically results in less tax being paid overall, as any subsequent appreciation in the value of the employee's equity is generally taxed at lower long-term capital gains tax rates, this was argued to be of little consequence for employees receiving a relatively low fixed salary who are "topped up" with substantial option-based incentives, as they would generally only be able to afford to pay the tax on their equity benefits when they sell their shares (Day & Fitton 2009). For options remaining "out of the money"[63], the employee could be required to pay tax on a gain that may never be realised.

Existing evidence from the US suggests that tax changes affect the popularity of employee stock option plans (Austin, Gaver & Gaver 1998; Balsam, Halperin & Mozes 1997; Hite & Long 1982), and firms appear to consider both tax and employee incentive factors when designing a compensation package (Madeo & Omer 1994). The incentive alignment effects of stock-based compensation is argued to be particularly important for small, early stage start-up and R&D firms, as these firms are initially cash constrained and rely on non-cash compensation to attract and retain talent (Core & Guay 2001; Henrekson & Sanandaji 2018; Ittner, Lambert & Larcker 2003). A paucity of data exists in relation to employee option plans in Australia, as most of the compensation contracting literature to date has been focused on executive stock options (Brown & Szimayer 2008; Qu et al. 2018; Shan & Walter 2016).

Notwithstanding the potential adverse tax consequences of the 2009 ESS changes, the non-tax benefits of equity-based compensation may outweigh the tax costs. Market-based equity incentives can be used as a governance mechanism where more direct monitoring is too costly or infeasible, as tying the wealth of employees and managers to the value of the firm can mitigate

[63] An option is said to be "out of the money" if $P - X < 0$, where X is the exercise price or strike price of the option and P is the current share price.

agency costs (Demsetz & Lehn 1985). For example, the asymmetric payoff structure of stock options can be used to incentivize employees of start-up and R&D firms by rewarding them with unlimited upside should the firm succeed, while limiting their losses when innovation fails (Chang et al. 2015). Evidence from Australian mining exploration entities (MEEs), which are typically small, cash constrained and high risk, usually do not have the funds, or the need, for large boards with diverse skills, nor do they have the cash for large executive salaries, and as a result are more likely to rely on equity based compensation as a bonding mechanism (Featherstone 2010; Ferguson et al. 2011).

If employee tax considerations are important, a decline in employee stock option grants after 2009 would be expected. To test this prediction, an option issuance model similar to that employed by Core & Guay (2001) is utilised, to examine whether ASX listed firms granted fewer options after 2009, controlling for economic determinants of employee stock option grants established in prior literature, including financial constraints, current and prior period stock price performance, and growth opportunities. Details of stock options issued to employees are obtained directly from Appendix 3B filings which require listed companies to disclose details of any changes in issued capital to the ASX.

The announcement of the ESS changes in May 2009 was seen as a shock to the market. Numerous industry and professional bodies expressed vocal opposition to the changes, on the basis that forcing employees to sell their shares in order to pay tax on them would remove any incentive for employees to participate in employee share schemes[64]. Further, several companies froze their employee share schemes following the initial announcement[65]. An event study approach similar to that used by Noreen & Sepe (1981) is followed to examine the stock price

[64] Cunningham, L. "Swan must rethink share scheme call", The Australian Financial Review, 21 May 2009.
[65] Durkin, P., Hepworth, A. and Anderson, F. "PM lashed on share scheme debacle", The Australian Financial Review, 15 May 2009.

reaction to accounting policy changes. The timing of any market reaction in this case is somewhat easier to predict *ex ante*, since the announcement was an exogeneous taxation shock. If the market values the incentive alignment effects of stock-based compensation and employee tax considerations are seen as being important in compensation plan design, firms issuing employee options would be expected to experience lower abnormal returns around the announcement of the 2009 changes relative to firms that did not issue employee options.

Examining a sample of 314 ASX-listed companies that disclosed the existence of an employee option plan between 2006 and 2017, this chapter finds that the incidence of employee option plans declined after 2009. Younger firms and loss firms are more likely to issue options to employees. In addition, firms with employee option plans are significantly more likely to be in the mining industry. As observed in Chapter 2, the mining industry is comprised of a significant number of early-stage MEEs. This is consistent with the incentive contracting literature which predicts that firms with greater growth opportunities and higher idiosyncratic risk make greater use of employee stock options.

Among the firms who continued to make use of employee option plans after 2009, there did not appear to be a decrease in the quantity of options granted. However, there was a significant decline in the value of options granted to employees, a result which is largely driven by companies granting fewer higher-priced options (i.e., options that were deeper in the money at grant date) and more lower-priced options (i.e., options that were deeper out of the money at grant date) after 2009. This is consistent with employee tax considerations being relevant in the option grant decision, as options that are deeper out of the money at grant date typically have no tax consequences for the employee at grant or at vesting.

There is also evidence that the compensation mix of companies granting options to directors changed after 2009, as a decline in stock option expense as a percentage of directors' total compensation was observed. There is weak evidence that firms with employee share and option plans reacted negatively to the May 2009 Budget announcement.

The remainder of this chapter is structured as follows. Section 3.2 provides a brief overview of the taxation of employee share and option plans in Australia. Section 3.3 reviews the extant literature. Section 3.4 sets out the hypotheses. Section 3.5 describes the data and sample construction. Section 3.6 describes the empirical tests to be conducted. Section 3.7 discusses the results and section 3.8 concludes.

3.2.Employee Share and Option Plans in Australia

3.2.1. A brief history of employee share ownership

Employee share ownership plans are a form of shared capitalism that have been argued to reduce wealth inequality and improve firm and aggregate economic outcomes (Blasi & Kruse 2006). Worker ownership first appeared in the United States during the Colonial period of the late 1700s, in the form of worker co-operatives (Blasi & Kruse 2006). However, employee ownership was largely wiped out by the Great Depression and did not begin to grow again until the second half of the twentieth century, when workers were encouraged to buy stock in their own companies, sometimes at discounts, as part of their pension and savings plans. This was followed by the development of the Employee Stock Ownership Plan ("ESOP") by investment banker Louis Kelso (Wallace 1975). A typical ESOP would involve the company taking out a loan to buy shares from an owner which would be then held by an ESOP trust on behalf of employees.

Broad-based employee share ownership in Australia has traditionally enjoyed bipartisan political support. In 1999, the then Coalition Government directed the House of Representatives Standing Committee on Employment, Education and Workplace Relations to conduct an inquiry (entitled *Shared Endeavours*) into the extent of employee share ownership in Australia and its resulting effects (O'Connell, Ramsay & Landau 2010). The Shared Endeavours inquiry produced two reports in 2000, a Majority Report and a Dissenting Report from the Labor committee members (Commonwealth of Australia 2000). Both reports were in favour of promoting broad-based employee share ownership, however Australia has been relatively slow in adopting employee share schemes relative to the US and the UK, partly due to disagreement over key issues surrounding their regulation and a lack of evidence regarding their effectiveness.

From an industrial relations perspective, support for employee share ownership has been more muted. The Australian Council of Trade Unions (ACTU), for example, is generally supportive of employee share ownership when introduced in a manner consistent with ACTU policy (i.e., wage levels and employment conditions independent of share ownership; plans must be non-discriminatory and should minimize financial risk to the employee; administered via a democratically controlled employee share trust; plans must be part of a comprehensive approach to greater employee participation) (Australian Council of Trade Unions 1999).

There have been very few quantitative studies regarding the precise incidence, nature and economic value of employee share schemes in Australia. A 2004 survey carried out by the Employee Share Ownership Developmental Unit ("ESODU") indicated that approximately 10% of Australian businesses had some form of employee share ownership plan (O'Connell 2011).

3.2.2. Types of employee ownership plans

The following section will provide an overview of the most popular forms of employee ownership. While the focus of this chapter is on employee share options, a brief review of the main kinds of employee ownership plans is included here by way of background. The advantages and disadvantages of each of the main types of employee ownership plans are summarised in Table 3.1.

[TABLE 3.1 ABOUT HERE]

3.2.2.1. Options

Options give the employee the right, but not the obligation, to buy shares in the employer company at some future date (Brown & Howieson 1994). An option agreement will spell out the exercise or strike price, X, which is the cost to the employee of converting the option to a share. Suppose the exercise price is the market price of the shares, P, on the date the option is granted. If the share price rises over time, the option will be "in the money", and the employee will make a gain equal to $(P - X)$ when the option is exercised, because the shares can be bought for less than their market value. However, if the share price falls, the employee does not have to buy the shares for more than they are worth, and so avoids the loss. In this case, the option will be "out of the money" (i.e., $P - X < 0$). For this reason, options are valuable from the date they are granted, as there will generally be some probability that the share price will rise in the future. The value of an option increases with the volatility of the share price, because the expected payoff is greater, given there is no downside; the value of an option also increases with the time to expiry.

Employee stock options are more complex than exchange-traded options, due to their unique features which are designed to align employees' interests with the shareholders', for example, by giving them incentives to take actions which increase shareholder value, and inducing employees to seek greater returns by taking bigger risks. Employees may be required to complete a specified period of service before the options vest (options cannot be exercised until they are vested; vesting periods are thus often used to increase employees' commitment to the firm). In addition, employee option agreements may also include performance hurdles, where vesting is linked to the achievement of predetermined targets, such as sales or earnings growth, or total shareholder return. Such performance hurdles are more commonly used when granting options to senior executives, whose decisions affect the value of the firm, but performance hurdles are sometimes used when granting options to non-executive employees (Brown & Szimayer 2008).

Options have become the dominant compensation form for start-up and innovative companies. Options are preferred by technology start-ups because they provide a share of future growth in value without diluting existing ownership (Employee Ownership Australia & New Zealand 2014).

3.2.2.2. Restricted Shares

Grants of restricted shares to employees typically restrict the employee from selling the shares until some future date (the vesting date). Restricted shares are a form of compensation that is subject to the risk of forfeiture (i.e., contingent upon continued employment) (Blouin & Carter 2010). Irving et al. (2011), Abudy & Benninga (2016) and others have documented a shift away from employee stock options towards restricted stock in US firms, as restricted shares are viewed as being more valuable to employees because they will always be "in the money" as long as the firm's share price is positive. Restricted shares also have the advantage of being dividend-protected, i.e., employees can receive dividends on restricted shares and do not have to refund them if the shares do not vest. Some practitioners have observed a trend towards restricted shares in Australia as well (Basker 2013).

3.2.2.3. Performance and retention rights

Also known as zero exercise price options ("zepos"), performance and retention rights are options that do not have an exercise price (i.e., $X = 0$). Typically, they will vest at the end of a specified period. Because the options do not have an exercise price, they will always have an intrinsic value at the time of vesting, because $P - X$ will always be positive as long as the firm has a positive share price. The employee will not have to pay any money to acquire the shares, but they will have to sell the shares to pay the tax that arises on vesting. One drawback of zepos is that they do not provide a long-term incentive, as the employee receives shares regardless of whether the share price goes up or down (Day & Fitton 2009).

3.2.2.4. Loan funded share plans

A loan-based employee share plan will typically involve the employer (or a related entity) making a loan to a participating employee, who then uses the loan funds to acquire shares in the employer (Chang 2011). Dividends generated by the shares are used to fund loan repayments, with repayment of the loan ultimately funded by the proceeds of the sale of the shares. Such loans are "limited recourse", such that the employer's recourse against the employee for repayment of the loan is limited to the value of the shares. This has the effect of ensuring that the employee will benefit from any appreciation in the value of the company's shares, while being protected from falls in the company's share price.

Additional features may be built into the plan rules, such as restrictions on sale or other vesting conditions. In practice, the shares will be held by an employee share trust with the employees as beneficiaries, and the shares are transferred to employees when they vest.

In Australia, because the shares are typically granted at market value, they operate outside the employee share scheme rules contained in Division 83A of the ITAA97. An attractive feature of these plans is that they do not require any cash outlay by the employee, as the acquisition of the shares is entirely funded by the loan, and any dividends are set off against the employee's obligation to make loan repayments. Notwithstanding the fact that dividends are still assessable to the employee on the basis they were constructively received by the employee, the employee should be entitled to a deduction in respect of the interest expense on the loan, such that dividend and interest flows have the potential to result in no net tax liability to the employee (Chang 2011), with the only taxing point arising on the ultimate sale of the shares.

In Australia, these plans fell out of favour with shareholders in the 1990s, but since the 2009 changes to the employee share scheme rules, there is anecdotal evidence that the popularity of these plans has increased (Basker 2013).

3.2.2.5. Share appreciation rights

Share appreciation rights are a special kind of option where the employee's entitlement to shares on vesting of the rights is determined based on the extent of share price appreciation from the grant date to the vesting date. For each right, the employee will be entitled to (A – B)/A shares, where A is the share price on vesting date and B is the share price on issue date. If (A – B) is less than or equal to zero, the rights will not vest. For example, if the employee is granted 1,000 rights and the share price appreciates by 10% from the grant date to the vesting date, then the employee would receive 1,100 shares on vesting. If the share price drops, then the rights do not vest. Share appreciation rights can also be settled in cash as well as equity[66].

3.2.3. Division 13A

Employee share schemes (ESS) in Australia have traditionally been regulated through the tax system, and first became the subject of federal legislation in 1974 (O'Connell, Ramsay & Landau 2010). The general principle is that that the issuing of shares or rights to an employee in respect of their employment is treated as a substitute for cash income, with tax imposed on the difference between the market value of the share or right and any consideration provided by the employee, that is, the amount of the discount provided to the employee. Prior to 1995, the default position was that no tax would be imposed on employee shares or options until an option was exercised or any restrictions on shares were lifted. For a brief history of the tax treatment of ESS in Australia, refer to Table 3.2.

[TABLE 3.2 ABOUT HERE]

Division 13A of the ITAA 1936 was introduced in 1995, ostensibly to reduce the exploitation of the existing legislation and ensure that the tax concessions available were directed at share schemes which encourage employees to own shares in the company in which they are employed (Kelly 1996). Division 13A shifted the default taxing point to acquisition but permitted deferral of tax until exercise or sale (the deferral concession) if there were no disposal restrictions or forfeiture conditions. The basic principle of Division 13A was that any discount given in

[66] AASB 2 "Share-based Payment" provides an example of this.

relation to a share or right acquired by an employee was included in their assessable income in the income year in which the share or right was acquired (O'Connell, Ramsay & Landau 2010). Tax concessions were available for ESS arrangements which allowed either a reduced amount to be assessable to the taxpayer, or a deferral of the taxing point in relation to the discount. However, in order to access the concessions, the shares or rights issued were required to satisfy a list of requirements, including, that participation in the scheme was widely available to employees, and that concessions could not be accessed by shareholders who were in a position to exert control over the company's operations (Board of Taxation 2010).

3.2.4. The 2009 Budget Proposals and Division 83A

The Treasurer, Wayne Swan, announced significant changes to the taxation of employee share schemes in the 2009 Federal Budget[67]. The first major change was to limit access to the upfront $1,000 per annum tax exemption to employees with adjusted taxable incomes of less than $60,000 per annum. The final policy increased the taxable income threshold for the $1,000 tax exemption to $180,000, as the $60,000 limit was seen as being too low, being little more than the average full-time weekly earnings at the time of $1,243.50 (Australian Bureau of Statistics 2009).

The second major change was the introduction of a new deferred taxing point for discounts on shares and options where there is a "genuine risk of forfeiture" and restrictions on disposal for up to 7 years[68].

The "genuine risk of forfeiture" requirement was an attempt by the Government and Treasury to ensure closer links between employee performance and the value of their equity-based remuneration. Specifically, it was argued that employee share scheme arrangements under which

[67] Commonwealth of Australia (2009), "Budget Paper No. 2, Budget Measures 2009-10". Available online: www.budget.gov.au [accessed 28 November 2017]
[68] Commonwealth of Australia (2009), "Reform of the taxation of employee share schemes", Treasury consultation paper. Available online: archive.treasury.gov.au [accessed 28 November 2017]

the employee's remuneration would be genuinely "at risk" until the employee's performance could be validated were more consistent with the purpose of concessionally taxing employee share schemes, namely to align the interests of employee and employers[69]. In this regard, the "real risk of forfeiture" requirement was intended to deny deferral of tax where schemes were contrived to present a nominal risk of forfeiture in order to achieve deferral of tax for the employee or executive. For example, a forfeiture condition specifying that "your shares are forfeited if the company's value falls by 95% during the next 12 months" would be an example of a contrived risk[70].

Broadly, a real risk of forfeiture would be present if vesting of the shares or options was subject to meeting meaningful sales targets, a minimum term of employment, or performance hurdles based on the company achieving a certain level of market share or total shareholder return targets. These performance hurdles need not be accounting based; in the MEE context, for example, performance hurdles are more likely to be based on project milestones or share price hurdles[71].

However, because the "real risk of forfeiture" requirement is a principle-based test, whether a real risk of forfeiture is present will be a question of fact and circumstance. This is especially true of performance hurdles based on earnings, market share or share price hurdles. For example, the Explanatory Memorandum gives an example of options that vest if the company's share price increases by 10% in two years' time. This might indicate a real risk of forfeiture if the company's share price over the past 12 months has been steady or declining. However, if the company has outperformed the market in recent years and is forecasting continuing strong

[69] Paragraph 1.153 of the Explanatory Memorandum.
[70] For more information regarding the "real risk of forfeiture" requirement, refer to Appendix E.
[71] Refer to Appendix F for examples of performance hurdles commonly used by MEEs.

performance, then a reasonable person might conclude that the specified performance hurdle would be too low for there to be a real risk of forfeiture.

In addition to the subjectivity involved in establishing whether a real risk of forfeiture was present, the new rules were also criticised as it resulted in a taxing point which did not correspond with the point at which the employee had realised a gain (Day & Fitton 2009). The Government at the time was of the view that the previous law was overly concessionary in allowing tax to be deferred, but this overlooked the fact that the reason for deferred taxation was so as not to tax the employee until the gain had materialised (i.e., when they sell their shares) in accordance with the ordinary concept of income in Australian tax law.

For employee shares, there was little change to the tax treatment in practice. Previously, the taxing point was deferred until the earliest 'cessation time'. Under Division 13A, the cessation time would typically be when any disposal or forfeiture conditions ceased to have effect. For options, however, there was a negative impact, since the taxing point could now be before the options were exercised for options that vest and are not exercised because they have no intrinsic value (i.e., the share price is less than the exercise or strike price). This placed Australia out of step with other countries and was argued to particularly disadvantage employees of start-up and R&D companies, due to the higher risk that employee options would be out of the money on the vesting date. For these companies, the ability to provide employees with a share of the company's wealth in the event of a "monetisation event" (i.e., sale, takeover or IPO) is argued to be vital to their ability to attract and retain staff (Day & Fitton 2009).

According to Computershare, 95% of its ASX 100 clients suspended their employee share schemes after the initial 2009 announcements (Schwab 2009).

3.2.5. 2015 Amendments to Division 83A

Employee share schemes returned to the government's radar following the announcement of the Federal Government's National Industry Investment and Competitiveness Agenda on 14 October 2014, which included plans to make it easier for employers to provide incentives to their employees using ESS (Coorey 2014). Subsequently, the Government passed legislation in June 2015 that included tax concessions for employee shares and options issued by eligible start-up companies (Kantor 2015). However, disclosure requirements in the Corporations Act were argued to discourage those start-ups from implementing ESS, since this may result in the release of commercially sensitive information. The Government has since opened a consultation process around these disclosure requirements to make ESS easier to implement (Australian Government 2019).

The 2015 changes also reversed some of the changes made in 2009 for other corporate tax entities. While the real risk of forfeiture requirement was retained, the 2015 amendments allowed deferred taxation where there was no real risk of forfeiture, but where the scheme genuinely restricted an employee from immediately disposing of the right. This effectively restored the taxing point on options from vesting to exercise (i.e., the pre-2009 position). For a summary of the current ESS rules, refer to Table 3.3.

[TABLE 3.3 ABOUT HERE]

3.2.6. Illustration of option taxation

The example set out in Table 3.4 compares the taxation treatment of options before and after the 2009 Budget Announcements.

[TABLE 3.4 ABOUT HERE]

The example assumes that the employee receives a relatively low fixed remuneration, with equity incentives comprising a significant percentage of his or her pay. Options are issued for nil consideration and vest after three years, with the exercise price set equal to the share price at the grant date. Because these options are not subject to any further forfeiture conditions after they vest, and there are no disposal restrictions on shares acquired as a result of their exercise, it is assumed that the shares will be sold following exercise, in order to pay both the exercise price and the tax on the shares.

This particular investment is risky, as there is a 90% chance that the company's flagship project will not be successful, and a 10% chance that the company's shares will be worth $2 in three years' time.

Under the former Division 13A, the employee could make an election under section 139E to be taxed on the taxable value of the option at grant date. Making the election would therefore result in an upfront tax cost on grant date regardless of whether the option is ultimately exercised. As a result, this election was rarely made in practice unless the employee had the expectation of significant share price appreciation in the future (Day & Fitton 2009), for example, an employee of an unlisted technology start-up anticipating a monetization event such as an IPO or acquisition. In this situation, it would be advantageous to make the election and be taxed upfront on a much lower value, as any subsequent appreciation would be taxed at lower long-term capital gains tax rates. However, this strategy shifts more risk to the employee, and would only be made if the company is able to compensate the employee for the tax paid[72]. In the example in Table 3.4, the tax paid will be the same regardless of whether the election is made, since the shares are sold upon exercise, so would not be eligible for the 50% CGT discount for long-term capital gains.

[72] Refer Blouin & Carter (2010) for an example of this.

According to the statutory valuation rules prescribed by the income tax regulations, the option's taxable value at the grant date is $0.058[73]. The statutory valuation factors are derived using the Black Scholes option pricing formula. The assumed risk-free rates, dividend yields, and implied volatilities used as inputs to the Black Scholes model will generally underestimate the market value of the option. This is by design, as the valuation factors were intended to be concessional, in recognition of the fact that the vesting of employee options is commonly subject to performance and service conditions[74]. In this example, if the election were made pursuant to section 139E of Division 13A, the employee would have an upfront tax liability of $47,000. If the options were subsequently exercised, the employee would make a capital gain when selling the shares acquired following exercise. The discount of $0.058 per option is included in the CGT cost base of the shares, because it has already been taxed upfront. This example assumes that the shares were sold immediately after exercise, but if the employee were to hold the shares for a longer period, the CGT discount for long-term capital gains may apply. By contrast, if the Division 13A election were not made, the employee's entire before-tax profit from the exercise of the options and subsequent sale of the shares ($1.50 per share in this case) would be taxed as ordinary income.

Under Division 83A, which replaced Division 13A for income years beginning on or after 1 July 2009, the section 139E election was removed, and the default taxing point for employee stock options was brought forward from exercise to vesting. As can be seen from Panel B and

[73] The statutory valuation factors are reproduced at Appendix G. The taxable value percentage of an option with a calculation percentage of 100% and an exercise period of 5 years, according to Table 1 of the regulations, is 11.6%. The taxable value of the option is the taxable value percentage multiplied by the share price at grant date. The statutory valuation rules are also designed to assign a higher taxable value to higher priced options (i.e., options that are more deeply in the money), as an additional percentage is applied to options with a calculation percentage of greater than 110%.

[74] Refer to the Board of Taxation review attached at Appendix H.

Panel C, there is no change to the net after-tax proceeds under Division 83A in a scenario where the options are 'in the money' when they vest.

However, the impact of Division 83A can be seen in Panel D, where the employee will have an income tax liability on vesting even if the options remain 'out of the money' at this time. Assume that the share price on the vesting date falls to $0.45, implying a calculation percentage of 90%. The taxable value percentage on the vesting date would be 1.0%, based on the remaining exercise period of 24 months, reflecting the fact that the value of the option has fallen. However, the employee still faces a tax liability on vesting of $3,647, even if the options are out of the money at that time. If the option did not have a vesting period, which is often the case for options granted by start-up, R&D and speculative-type companies such as MEEs who tend to grant options as a substitute for a higher cash salary, the employee would face an upfront tax liability of $47,000 (i.e., equivalent to the tax position under Division 13A if an election were made). Further, the refund provisions in the former Division 13A were amended in 2009, such that a tax refund would no longer be available merely because an employee loses a right without having exercised it. While the option will have a lower taxable value on vesting date than on grant date (in recognition of the shorter period before the options expire), this would nevertheless be expected to make options less attractive for employees, particularly considering the increased risk, since the employee could be required to pay tax on a gain that may never be realised. Notably, the statutory valuation factors were amended in 2015 to reduce the possibility of this scenario occurring.

3.3. Theory and Prior Literature

3.3.1. Introduction

This literature review is structured as follows. First, hypotheses regarding the determinants of firms' compensation policies and the forms that they take will be developed based on contracting and tax-based theories. This will be followed by a review of the literature examining the determinants of employee stock option plans, including financial reporting and governance considerations. Second, the tax motivation for adopting employee stock option plans will be discussed, including the interaction between tax and non-tax factors in the design of employee compensation plans. Third, the capital market consequences of employee stock option plans will be considered.

3.3.2. Contracting explanations for compensation policy

Like Section 2 of this thesis, this section adopts the perspective that the firm is a nexus of contracts as articulated by Coase (1937) and Alchian & Demsetz (1972). According to this view, the optimal organizational structure of the firm depends on whether productive activities are carried out more efficiently by markets or by firms (Watts & Zimmerman 1990). For example, if the costs of constant recontracting with another party are high relative to the cost of signing a long-term contract with an employee in which the employee agrees to carry out the commands of the employer, Coase suggests that it is more likely that activities will be carried out in the firm.

However, as Grossman & Hart (1986) observe, it is extremely costly to write a complete contract between two parties that specifies all possible contingencies. This applies not only to contracts between separately owned buyers and sellers, but also to contracts between employees and employers. In this regard, the employment relationship is an example of the principal-agent problem discussed in Chapter 2, as the actions of employees (the agents) collectively affect the value of the firm, but the actions of individual employees are largely unobservable to shareholders (the principals).

The use of equity incentives such as stock options to remunerate employees, therefore, must be considered in the context of the agency problem discussed by Jensen & Meckling (1976), whereby the owner of a firm (the principal) delegates some decision making authority to managers and employees (the agents). If both parties to the relationship are utility maximizers, then the agent may not always act in the best interests of the principal if the contract between the principal and the agent does not give the agent a share in the outcome of his actions (which is usually the case if the agent is paid a fixed wage).

In the context of explaining the decision to use incentive compensation, the typical problem analysed in the principal-agent literature is that of a risk-neutral principal establishing appropriate incentives for the agent, and incurring monitoring and bonding costs designed to reduce the probability that the agent will take actions that are suboptimal from the principal's point of view. In most agency relationships, the principal and agent will incur positive monitoring and bonding costs; however, the principal is unlikely to be able to eliminate divergences from his or her interest completely, due to the costly contracting problem described by Grossman & Hart (1986) above.

It is the existence of such contracting costs that is crucial to predicting and explaining corporate policies such as the use of incentive compensation (Watts & Zimmerman 1990). For example, Smith & Watts (1982) suggest that the popularity of executive compensation plans which formally tie the executive's compensation to some measure of firm performance (e.g., earnings, stock prices) is at least partially explained by the agency problem discussed by Jensen and Meckling, as such compensation plans are argued to incentivize corporate executives to make decisions that maximize firm value.

Executive compensation plans such as bonus plans and stock options are far from a panacea, however. If not structured appropriately, they can lead to horizon problems such as those described by Smith & Watts (1982), whereby managers whose horizons are short because they are considering leaving the firm may have incentives to make decisions that maximize their compensation in the short-term at the expense of long-term firm value. In addition, Watts & Zimmerman (1990) point out that executive compensation plans that use accounting numbers will not be effective in aligning managers' and contracting parties' interests if managers have complete discretion over the reported accounting numbers.

In this regard, Smith & Watts (1982) view the emergence of compensation arrangements such as bonus plans, stock options, stock appreciation rights, restricted stock plans and performance rights as being consistent with a desire to establish appropriate incentives for managers and limit divergences from the principals' interests. For example, bonus plans frequently include deferment provisions which defer a portion of the manager's compensation to the retirement period in order to reduce the horizon problem; further, stock option plans and restricted stock plans often carry the threat of forfeiture if the executive leaves the firm before the completion of a minimum term of employment. Smith and Watts suggest that deferral of compensation combined with the threat of forfeiture reduces the probability that the manager will cheat or steal from the firm or otherwise take actions that are suboptimal from the point of view of the principal.

While the discussion in Smith & Watts (1982) concerns the incentive effects of executive compensation plans, the objectives of non-executive employee compensation plans are similar, namely, to align the interests of the employee more closely with the overall goals of the shareholders, by linking the employee's wealth to the value of the firm (Scholes & Wolfson 1990).

The use of incentive compensation for non-executive employees is discussed in more detail in section 3.3.3, with an emphasis on the determinants of employee stock option plans.

3.3.3. Determinants of employee stock option plans

Employee stock options provide a form of employee ownership in the firm. As discussed above, employee ownership is viewed as a potential solution to the agency conflict that exists between employees and owners and is argued to promote a greater commonality of interests between employees and owners relative to straight salary contracts (Scholes & Wolfson 1990). The use and effectiveness of employee stock option plans, however, depends on several factors, including the extent of monitoring costs, the importance of human capital to the firm, the firm's investment opportunity set, taxes, and regulations, all of which may vary across firms (Demsetz & Lehn 1985; Smith & Watts 1982, 1992).

The tax motivation for employee stock options has been researched extensively in the US, partly due to the tax advantages that have historically been available to US companies granting equity (stock as well as options) to employees (Hall & Liebman 2000). This literature is reviewed in more detail in section 3.3.3.4.

3.3.3.1. Investment opportunities

In making investment and employment decisions, firms invest in specialized physical and human capital (Smith & Watts 1992). These firm-specific investments result in variation in firms' investment opportunities. Thus, Smith and Watts argue that the investment opportunity set offers the potential to explain cross-sectional variation in firms' compensation policies.

A large body of literature uses real options theory to explain corporate investment decisions. Broadly, real options refer to investment projects that are irreversible or costly to undo, typically because they require substantial capital investment and involve large sunk costs. For example, a well-known real option is the decision to open a gold mine (Moel & Tufano 2002). Under uncertainty, bad news has a negative effect on investment because of the higher rate of return required to invest. This is referred to by Bernanke (1983) as the "bad news principle". Growth options, on the other hand, refer to investments where the downside of bad news is capped, because the project takes longer to complete (Bar-Ilan & Strange 1996). As discussed in section 2 of this thesis, two such examples are mining and R&D projects, both of which are potentially irreversible, but typically proceed in stages, and take several years to complete. For example, consider a mining exploration company that secures an opportunity to explore for minerals in a particular location. If drilling results turn out to be unsatisfactory, the firm's losses are limited to the exploration costs incurred during drilling. Should drilling results be positive, on the other hand, the good news is not constrained in this way, as the best outcome looks even more profitable. Under uncertainty, good news is predicted to have a positive effect on investment as it increases the potential payoff.

Contracting theory, therefore, predicts that firms with greater investment opportunities in the form of growth options will make greater use of incentive compensation (Smith & Watts 1992). This is because managers' actions are less readily observable if the firm has more investment opportunities, because shareholders do not have the knowledge to observe all the investment opportunities from which the manager chooses[75]. As a result, the optimal contract would give the agent a share in the outcome of his or her actions. Smith and Watts therefore hypothesise that the larger the proportion of firm value represented by growth options, the more likely that the firm will tie compensation to the effect of the manager's actions on firm value. Consistent with the contracting prediction, Smith and Watts find that the existence of a stock

[75] This is especially true of the MEE sector, where a significant amount of geological and technical expertise is required to evaluate the economic potential of mineral deposits.

option plan is more likely if the firm has greater investment opportunities, as measured by the ratio of the book value of assets to market value.

Because the value of an option increases with both stock price and volatility, stock options positively relate employee wealth to stock return volatility. Further, the asymmetric payoff structure of stock options rewards employees with unlimited upside potential when projects are successful but protects them with limited downside loss when projects fail (Chang et al. 2015). Options are therefore seen as a suitable compensation form for firms with more growth options and other firms that undertake high risk investments. As a result, employee stock option grants are widely used by start-up and R&D-intensive companies, who undertake projects that are characterised by high uncertainty, technological complexity, and longer investment lags (Henrekson & Sanandaji 2018). For example, Hall & Murphy (2003) note that the increase in employee stock options in the US since the 1990s was especially pronounced in so-called "new economy" firms related to computers, software, the Internet, telecommunications and networking. Stock options are also argued to allow companies to attract highly motivated and entrepreneurial employees, as these employees are more likely to be attracted to incentive schemes that tolerate early failure and reward long-term success (Chang et al. 2015; Hall & Murphy 2003).

Further, when most of a firm's value is represented by investment opportunities, the impact of managers' actions on those opportunities is unlikely to be accurately measured by accounting numbers (Smith & Watts 1992). As a result, this is likely to result in a preference for grants of stock options whose value is linked to the achievement of certain project milestones, share price hurdles, or some exit event such as a sale or IPO[76].

[76] This is often the case in the MEE sector, where performance hurdles are unlikely to be accounting based, but are frequently linked to milestones such as exploration success, completion of a feasibility study, and successfully obtaining finance (see Appendix F for examples). In technology start-ups, employee stock options crystallise only at exit or IPO, with the most obvious recent examples of this being Facebook and Google.

Rajgopal & Shevlin (2002) present evidence that executive stock options (ESO) can mitigate risk-related incentives in a sample of oil and gas producing firms. The risk of uncertain success is an important factor in exploring for new oil and gas reserves (exploration risk). The risk-related incentive problem is that of risk-averse managers passing up positive, but risky, net present value (NPV) projects. Risk-neutral shareholders, by contrast, would prefer managers to undertake all positive NPV projects (hence firm value increasing) regardless of their risk, since this risk is diversifiable (Armstrong et al. 2019).

Examining a sample of 160 CEOs of publicly traded US oil and gas firms, Rajgopal and Shevlin find that ESO risk incentives (measured as the sensitivity of the change in the option value to a 1% change in stock return volatility) are positively related with future exploration risk taking (measured as the coefficient of variation in estimated discounted future operating cash flows from exploration activities in period $t + 1$). This result is obtained after controlling for the endogeneous determination of both ESO risk incentives and exploration risk taking and is consistent with the idea that the use of incentive compensation is effective in mitigating risk-related incentive problems.

Brown & Szimayer (2008) develop a model for accurately valuing executive and employee stock options focusing on performance hurdles, early exercise and uncertain volatility, and show that the inclusion of performance hurdles can significantly alter the valuations of executive and employee stock options. Specifically, they find that the main factors driving the valuation of executive and employee options are the probability that the performance hurdle will be met, and the probability of the employee leaving the firm. They show that performance hurdles can be set ‘almost at ground level’ to maximise the option valuation, even though such hurdles present at best a “mediocre” (in the authors’ words) challenge.

To illustrate how performance hurdles can affect the valuation of employee options, Brown and Szimayer consider the case of Amcor, a global packaging company listed on the ASX with a market capitalisation of $A5.9bn in 2005, that granted 5,588,200 options to employees on 2 August 2004. The options had a vesting condition that was based on measuring the stock price performance of Amcor against a specified group of 46 ASX 100 companies. At the vesting date (2 August 2007), if Amcor's stock price outperformed at least half the stocks in the comparator group by reference to their prices on 1 July 2004, then the options vest. If not, then the hurdle can be retested each month for 2 years following the vesting date (i.e., until 2 August 2009). When taking into account the probability of the options not vesting due to the performance hurdle not being achieved (including the retesting feature), Brown and Szimayer found that the performance hurdle had little impact (only 2%) on the option value. When they included a more challenging performance hurdle that required Amcor to outperform 75% of the stocks in the comparator group, the value reduction due to the performance hurdle increased sharply, from 2% to 60%.

The implication of the above result is that performance hurdles can be structured in such a way so that they have relatively little impact on the option value. However, Brown and Szimayer argue that this comes at the expense of the pay-for-performance sensitivity of executive stock option grants, and consequently the incentive capacity of stock options.

The findings of Brown and Szimayer are highly relevant in the case of this thesis, as it appears that the scenario outlined above was one of the factors which led to the introduction of the 'real risk of forfeiture' test in Division 83A, which was intended to deny deferral of tax where employee share schemes contrive to present a nominal risk of forfeiture,[77] given that the 50%

[77] See paragraph 1.158 of the Explanatory Memorandum to the *Tax Laws Amendment (2009 Budget Measures No. 2) Bill 2009.*

performance hurdle in the Amcor illustration resulted in a relatively high probability of the options vesting.

Notwithstanding the above, stock options may not be a suitable compensation form in all companies. As Scholes & Wolfson (1990) observe, where employees are risk-averse relative to shareholders, efficient risk sharing requires that employees bear little risk of change in the value of the firm. Where employees' activities affect the value of the firm, however, it may be desirable to require employees to bear some risk of changes in the value of the firm for incentive reasons, provided that the employees are adequately compensated for being exposed to risks that are beyond their control. For example, in mature, diversified firms, stock prices are likely to be a noisier monitor of employee inputs than accounting measures of performance, such as divisional profits, or physical output measures. Further, stock options may not be the most efficient way of providing employees with incentives to remain with the company. Hall & Murphy (2003) argue that retention incentives can be created by any compensation mechanism that encourages them to stay with their current employer and need not be linked to share prices. Efficient incentive contracting, therefore, requires a trading-off of risk sharing and incentives[78].

3.3.3.2. Financial constraints

In contrast to salary and most forms of annual bonus, compensating employees using stock options does not require a current outlay of cash by the firm (Ittner, Lambert & Larcker 2003). As a result, cash constrained firms, such as firms in the early stages of their life cycle, are expected to make greater use of options to conserve cash (Core & Guay 1999; Yermack 1995) as the cash saved by not paying a current salary can be invested.

[78] Holmstrom (1989) provides a concise overview of this trade-off.

Core & Guay (2001) find that options are granted extensively to non-executive employees (defined as all employees other than the five most highly compensated executives), and that options are granted to non-executive employees more intensively when firms have greater financing constraints.

3.3.3.3. Financial reporting considerations

Accounting for stock-based compensation has been a controversial topic in both Australia and the US. A detailed review of the literature considering the financial reporting implications of stock-based compensation (including employee share options) is beyond the scope of this thesis. The purpose of this section is to provide a brief overview of some of the issues associated with accounting for stock options insofar as they are relevant to the research questions being examined in this thesis.

For many years, accounting standards did not require any expense to be recognised in the financial statements in respect of stock options granted to employees and executives unless and until they were exercised (Brown & Howieson 1994; Coulton & Taylor 2002). The main arguments against recognising stock option expense at the time of grant were the "no cost, no charge" argument, based on the claim that since the granting of options did not require the firm to sacrifice cash or other assets, there was no cost; and that the value of stock option grants that may never vest could not be reliably estimated (Coulton & Taylor 2002).

However, these arguments did not consider the nature of an option, in that it is valuable from the very date that it is granted. Suppose an option is granted with an exercise price equal to the market price of the shares on the grant date. If there is some probability that the share price will rise above its grant date value, the option will always have some value (Brown & Howieson 1994). Further, Brown and Howieson explain, if the stock's historical volatility can be estimated, an estimate of the value of an option can be computed using an option pricing model, such as the Black-Scholes (1973) model. In this respect, while valuing options does present some measurement difficulties, options are arguably no different from other financial statement items where significant estimates are involved, such as employee benefits provisions and allowances for loan losses (Rodgers et al. 1994). As a result, investors argued that the lack of option expensing did not reflect the true economic cost of stock-based compensation (Brown & Lee 2011). Further, the favourable accounting treatment was argued to be a contributing factor to the explosion in executive stock option grants in the 1990s, as it allowed companies to report higher earnings (Hall & Murphy 2003).

The lack of stock option expensing came under renewed attack in the US following Enron, WorldCom and other major accounting scandals. To address investors' concerns, the FASB responded by issuing SFAS 123R in December 2004, which mandated expensing of employee stock options based on their grant date fair values, effectively bringing the FASB requirements into line with the IASB issued standard on share-based payments (Brown & Lee 2011).

Similarly, since 2005 Australian firms have been required to expense the fair value of stock options granted to employees over the vesting period, according to AASB 2 *Share-based Payment*, which is based on the corresponding IFRS standard. A feature of AASB 2 is that it directly links the vesting conditions of employee stock options to recognised compensation expense (Qu et al. 2018). In particular, the calculation of compensation expense must consider the number of options that are expected to eventually vest (AASB 2, para 19). This aspect of accounting for stock-based compensation under AASB 2 is relevant in the case of this thesis. To the extent that the introduction of the real risk of forfeiture requirement in Division 83A of the ITAA97 caused firms to amend their compensation plans (i.e., by incorporating meaningful performance hurdles or service conditions), this would also affect the compensation expense recognised in the financial statements. An option with a real risk of forfeiture, for example, would have a lower probability of not vesting than an option with no real risk of forfeiture. This would affect estimates of the number of options expected to eventually vest.

3.3.3.4. Governance contracting

Equity incentives are important governance mechanisms that are, in part, aimed at mitigating agency problems (Armstrong et al. 2015). For example, Core, Holthausen & Larcker (1999) suggest that the compensation mix (i.e., the combination of cash pay, equity pay, short- and long-term incentives that is adopted by the board) is a function of the firm's governance characteristics.

In a recently published study examining executive stock option grants by the 250 largest Australian firms, Qu et al. (2018) find evidence that stronger corporate governance is positively associated with the length of the vesting period and the use of performance hurdles, suggesting that these contractual features of stock option grants can restrict opportunistic managerial behaviour. Specifically, they find that firms with well-structured remuneration committees, more independent directors on the board and separation of the roles of CEO and board chair are more likely to grant executive stock options with longer time-vesting features and performance hurdles (i.e., on terms that are more favourable to the firm). Conversely, poorly governed firms with more powerful CEOs were found to grant executive stock options with less restrictive vesting conditions (i.e., on terms that are more favourable to executives).

Notwithstanding the findings of Rajgopal and Shevlin discussed above, stock options are not always granted efficiently to employees and executives. Some argue that the escalation in executive pay, driven by options, reflects inefficient transfers of wealth to shareholders to executives (Bebchuk, Fried & Walker 2002), however, a detailed discussion of this topic is beyond the scope of this thesis.

3.3.4. The tax motivation for employee stock options

Employee compensation arrangements are argued to be influenced by the joint tax consequences of both the employer and the employee (Scholes et al. 2016). As discussed in Chapter 2, Scholes et al. (2016) provide a framework under which firms trade off tax benefits with non-tax costs in their organizational form, investment, financing and compensation choices.

From the employee's perspective, if the employee's tax rate is expected to be lower in the future, then the employee tends to prefer deferred compensation, as the income will be recognized in a period in which his or her tax rate is lower. This is one reason why employee stock and option plans have often been structured in order to enable the employee to treat any gains arising from the acquired stock as long-term capital gains, which are typically taxed at lower rates than ordinary income. However, the potential for tax benefits is balanced against the employee's preferences. If options result in a greater share of the employee's remuneration being "at risk", then a risk-averse employee may prefer a cash salary.

From the point of view of the employer, paying a salary is tax preferred relative to deferred compensation when the employer's current period marginal tax rate is high, as the immediate tax deduction from paying a salary is more valuable.

Start-up, R&D and high technology firms often endure losses for several years before becoming profitable, and as a result often have significant carried forward tax losses. The corporate income tax is progressive for these firms, as their marginal tax rate is linked to the probability that their carried forward tax losses can be utilised in the future. The marginal tax rate in the current period is defined as the change in the present value of the cash flow paid to (or recovered from) the tax authorities as a result of earning one extra dollar of income (Shevlin 1990).

Consider the example of a firm with $10 million in carried forward tax losses. If the firm expects to use up all its losses in five years' time, assuming a corporate tax rate of 30% and a 7% discount rate, this equates to a marginal tax rate of 21.4%, or $\frac{30\%}{(1.07)^5}$. For a firm undertaking a risky project with only a 10% chance of becoming profitable, however, the expected marginal tax rate would be just 2.14% $\left(\frac{30\%}{(1.07)^5} \times 10\%\right)$. Thus, as discussed in Chapter 2, the tax benefits of immediate deductibility are likely to be insignificant for R&D and other high technology companies and MEEs undertaking risky investments. Austin, Gaver & Gaver (1998), for example, find that firms with carried forward tax losses pay less cash compensation than firms without losses.

Several US-based papers have examined the role of taxes in the choice between firms issuing incentive (or qualified) stock options (ISOs) to employees, and non-qualified employee stock options (NQOs). ISOs must satisfy several criteria (Scholes et al. 2016). For example, stock obtained under an ISO cannot be disposed of within two years of the grant date nor within 12 months after exercise, otherwise the ISO is "disqualified". Further, ISOs cannot be granted with an exercise price below the stock price at grant date, and the aggregate stock value covered by the ISOs (the number of options multiplied by the grant date stock price) is limited to $100,000 per year per employee. If a stock option plan satisfies all the criteria, no tax consequences arise for the employee until the stock acquired from exercising ISOs is sold, with any gains on the acquired stock treated as long-term capital gains of the employee. The tax treatment of an ISO, therefore, is broadly similar to that of employee options with a real risk of forfeiture under Division 83A, where the employee can defer tax beyond exercise.

NQOs, by contrast, are taxed at the point of exercise, with the difference between the exercise price and the stock price at exercise date treated as ordinary income of the employee and taxed at his or her marginal tax rate. At the corporate (employer) level, ISOs are not deductible, but NQOs are deductible as compensation expense.

On an aggregate level, the relative use of ISOs and NQOs has changed over time, consistent with changes in the tax laws favouring one or the other option type (Shackelford & Shevlin 2001). This led to the development of the hypothesis that tax considerations play an important role in explaining the form of compensation contracts (the “tax hypothesis”). One of the earliest studies to consider the tax hypothesis was conducted by Hite & Long (1982), who documented evidence of firms switching from ISOs to NQOs after the top individual tax rates were lowered in the US Tax Reform Act of 1969 (TRA69). Specifically, the TRA69 gradually lowered the tax rate on compensation including NQOs from 70% to 50%, which reduced the tax advantage of ISOs, such that the corporate tax savings from issuing NQOs swamped the personal tax advantages of ISOs. Examining the executive compensation plans of the top 100 industrial firms, Hite and Long found that of the 86 firms which found ISOs to be optimal in 1968, 94% had switched to NQOs by the end of 1975 even though they could have continued to issue ISOs. This was interpreted as being consistent with the tax hypothesis.

Madeo & Omer (1994), on the other hand, present evidence suggesting that the importance of the tax hypothesis in explaining the choice of stock option plan may be overstated. They argue that firms consider both tax and employee incentive factors when designing the compensation package. They test the tax hypothesis in a setting that for many firms should have induced a change in stock option plans. They find that low-tax firms also switched from qualified to non-qualified stock option plans after the introduction of the TRA 1969. However, this research only considered the tax consequences from the employer’s perspective.

Blouin & Carter (2010) examine the interplay between tax benefits and employee incentives in the context of restricted stock grants. Ordinarily, grants of restricted stock to employees are only subject to tax when the restrictions on transfer lapse. Section 83(b) of the US tax code allows the employee to make an election to accelerate the recognition of the restricted stock grant into income. Once the employee makes the election, the post-grant appreciation (or decline) in value of the stock is capital, rather than ordinary, in nature. The evidence suggests that firms prohibit the election in order to minimize taxes, whereas they require the election for incentive purposes. This is consistent with the theory of the section 83(b) election. By subjecting any appreciation over the restricted stock grant's vesting period to capital gains tax rates, the 83(b) election will result in an employee making the election receiving a greater after-tax payout for each $1 increase in stock price. The tax treatment of employee shares and options under Division 83A is therefore comparable to the tax treatment for an employee making the 83(b) election, with the crucial difference that under Division 83A, the employee does not have the ability to elect to be taxed upfront, an option which was previously available to them under the former Division 13A.

3.3.5. Capital market consequences

The event study methodology pioneered by Ball & Brown (1968), Fama et al. (1969) ("FFJR") and others, which seeks to measure the impact of economic events on the value of firms, is commonly used to examine the market reactions, and hence wealth effects, of regulatory changes, including proposed changes to accounting standards (Collins & Dent 1979); accounting policy deliberations by standard setters (Noreen & Sepe 1981); changes in oil price regulations (Smith, Bradley & Jarrell 1986), and tax-related court rulings (Dhaliwal & Erickson 1998).

The use of the event study methodology to examine market reactions to accounting policy deliberations was developed by Noreen & Sepe (1981), who examined a series of sequential events relating to a proposal by the FASB to require disclosure of the effects of inflation on financial statements, including the initial proposal mandating disclosure, the postponement of a decision and the announcement of a revised Exposure Draft. Specifically, Noreen and Sepe found evidence that stock returns were affected by each of the FASB's deliberations. They concluded that their methodology would be useful in other settings where policy makers where deliberating or vacillating over time.

A challenge with regulatory event studies is that regulatory announcements are often anticipated well in advance of the announcement (Binder 1985). As a result, the methodology adopted by Noreen and Sepe is likely to be most useful when the dates on which market expectations change are known, for example, by reference to standard sources such as the Wall Street Journal, or, for Australian readers, the Australian Financial Review. Binder therefore advocates examining major news and business publications to find events believed to contain major new information regarding a new regulation, starting from the first news item concerning the regulatory change.

Dechow, Hutton & Sloan (1996), for example, employed an event study methodology to examine the stock price reactions to key events surrounding the release of a 1993 FASB exposure draft that required the mandatory expensing of stock options. Consistent with the approach suggested by Binder (1985), Dechow, Hutton & Sloan (1996) isolated the event dates for which they had particularly strong priors that investors' expectations regarding the probability of mandatory expensing were revised, i.e., the announcement of the formal FASB vote to move forward with the standard (Event 1), the date of release of the exposure draft (Event 2), and the date the FASB announced the vote to drop its proposal (Event 3). Events 1 & 2 were hypothesised to increase the probability of mandatory expensing, while event 3 was hypothesised to reduce the probability of mandatory expensing. However, they did not find any evidence that investors reacted to news concerning the mandatory expensing of stock options. One possible explanation for this finding is that the probability of mandatory expensing never rose much above zero.

The event study methodology has been used in the Australian setting to examine the wealth effects of regulatory changes such as the proposed Resources Super Profits Tax ("RSPT") in 2010 (Brown, Clout & Ferguson 2013), and the announcement of the Australian Carbon Pricing Scheme (the "carbon tax") in 2011 (Han et al. 2019). In particular, the announcement of the RSPT was an exogeneous taxation shock to the mining industry, with anecdotal reports suggesting that approximately $9 billion was wiped off the value of Australian resources companies in the aftermath of the RSPT announcement (Burrell 2010). The surprise nature of the RSPT announcement made it particularly suited to the regulatory event study methodology suggested by Binder (1985), given the relative ease in identifying the dates on which market expectations were revised. Specifically, Brown, Clout & Ferguson (2013) found evidence that bulk commodity firms such as iron ore and coal firms experienced negative cumulative abnormal returns (CARs) in response to the RSPT announcement. The findings of Brown, Clout & Ferguson (2013) are relevant to this thesis in that the surprise nature of the changes to the taxation of employee share schemes announced in the 2009 Federal Budget suggests the existence of a readily identifiable date on which market expectations changed.

3.4 Hypotheses

3.4.1 The determinants of employee stock option plans

The first hypothesis examines the economic determinants of employee option plan adoptions in Australia.

Prior research has generally emphasized three potential benefits of equity-based compensation: (1) incentive effects; (2) tax considerations; and (3) cash flow considerations (Ittner, Lambert & Larcker 2003).

Specifically, firms that grant options to employees typically have greater growth opportunities and higher idiosyncratic risk (Chang et al. 2015; Henrekson & Sanandaji 2018; Smith & Watts 1992), lower marginal tax rates (Austin, Gaver & Gaver 1998; Core & Guay 2001), and greater financing constraints (Core & Guay 2001; Ittner, Lambert & Larcker 2003).

Unlike in the US, stock option expense is not deductible in Australia. This means that employee stock option plans in Australia do not provide employers with the same level of tax advantages as option plans in other countries where stock option expense is deductible. In Australia, therefore, the tax advantages of stock options mainly apply to the employee, not to the employer. Thus, in examining the determinants of employee option plan adoptions in Australia, this chapter will focus on the incentive effects and cash flow considerations.

H1 is therefore proposed as follows:

H1a. Firms that adopt employee option plans have greater growth opportunities and higher idiosyncratic risk.

H1b. Firms that adopt employee option plans are more likely to be cash constrained.

3.4.2 Impact of the 2009 changes on option grants

The 2009 changes to the taxation of employee share schemes in Australia altered the taxing point of the discount on employee options granted for no consideration, such that for certain options that did not have a real risk of forfeiture, the discount could be taxed on vesting, rather than on exercise. This meant that employees would potentially be required to pay tax on options that are out of the money on the vesting date (i.e., a tax liability could arise even if the options were not exercised)[79].

The impact was expected to be particularly severe for employees of start-up, speculative and R&D companies that are cash constrained, as these employees typically receive a relatively low fixed salary and are "topped up" with substantial option-based incentives. Although the earlier taxing point would likely result in less tax being paid overall should the employee ultimately realise a gain, as any subsequent appreciation in the value of the employee's equity would be taxed at lower long-term capital gains tax rates, these employees would generally not be able to afford to pay the tax on their equity benefits if taxed upfront.

This differs from the case of restricted shares, where firms often require employees to make a voluntary election to be taxed upfront when restricted stock is granted, by increasing their cash remuneration to compensate them for the tax burden (Blouin & Carter 2010). This option is often not available to start-up firms due to their cash constrained status.

Empirical evidence regarding the importance of tax considerations in explaining changes to the form of compensation contracts is mixed. Consistent with the 'tax hypothesis', Hite & Long

[79] As noted in Section 3.2.6, the valuation factors prescribed by the income tax regulations were intended to be concessional (i.e., they will generally underestimate the market value of the option), to take into account the lower probability of vesting due to the use of performance hurdles. This would reduce the likelihood of a tax liability arising on the vesting date. Having said that, the prospect of the employee having to pay tax on vesting would arguably still discourage the use of stock options in firms undertaking high risk projects that also grant options intensively to employees, such as MEEs.

(1982) find that firms replaced their tax qualified incentive stock option (ISO) plans with non-qualified stock option plans (NQO) after the Tax Reform Act of 1969, which reduced the personal tax advantages of the qualified plan, such that the corporate tax savings from NQOs swamped the personal tax advantages of the qualified plan. Madeo & Omer (1994), however, suggest that the effect of taxes of plan switches may have been overstated, as low-tax firms also switched to NQOs after the Tax Reform Act of 1969.

H2 is therefore proposed as follows:

H2. Stock option grants to employees declined after 2009.

3.4.3 Impact of the 2009 changes on compensation mix

One of the stated objectives of the 2009 changes to the taxation of employee shares and options, apart from a desire to tax the value of benefits received by employees consistently regardless of the forms of remuneration they receive, was to improve the alignment of employee and employer interests. In particular, the introduction of the "real risk of forfeiture" requirement appears to have been at least in part aimed at improving the pay-for-performance sensitivity of employee stock options, seemingly in response to the trend observed by Brown & Szimayer (2008), whereby some firms had been issuing stock options to senior executives with performance hurdles set 'almost at ground level', i.e. implying a level of performance that would be relatively easy to achieve, in order to maximise the value of the fair value of the options granted.

The 2009 changes to the taxation of employee share schemes, therefore, could plausibly affect the compensation mix in two ways. First, option grants would be expected to decline as a result of the default taxing point being shifted from exercise to vesting, as described above. Second, the introduction of the requirement that options and shares must have a real risk of forfeiture for tax to be deferred would be expected to result in firms restructuring their option plans to comply with the new requirements. Both outcomes would reduce the amount of option expense recognised for accounting purposes, in the following ways. First, firms could issue fewer options. Second, as discussed in Ittner, Lambert & Larcker (2003), young, high-growth firms pursuing riskier projects might grant options based on more forward-looking stock price measures, in order to provide a longer-term incentive to employees. In this regard, small-cap stocks frequently include performance hurdles based on total shareholder return (TSR) performance measured against a larger group of companies (Brown & Szimayer 2008). This might lead to firms granting options to employees that are more deeply out of the money at grant date, in order to lower their valuations for tax purposes. Third, as AASB 2 requires performance hurdles and vesting conditions to be taken into account by estimating the number of employee options expected to vest each year, issuing more options with a real risk of forfeiture would also be expected to lower the amount of stock option expense recognised under AASB 2, as a greater proportion of the individual's compensation would be 'at risk', therefore affecting the number of options expected to vest. This would be the case for options granted to executives as well as lower-level employees. H3 is therefore specified as follows:

H3. Options and shares comprised a smaller percentage of directors' and executives' total remuneration after 2009.

3.4.4 Market reactions to ESS-related policy announcements

A large body of literature uses an event study methodology similar to that pioneered by Ball & Brown (1968) and Fama et al. (1969) to examine the wealth effects of regulatory changes, including tax policy changes (Dhaliwal & Erickson 1998; Noreen & Sepe 1981; Smith, Bradley & Jarrell 1986).

The May 2009 announcement of the proposed changes to the taxation of ESS took the market by surprise and can therefore be interpreted as an exogeneous taxation shock. This overcomes one of the limitations inherent in the study of market reactions to regulatory changes, in that regulatory announcements are often anticipated by the market, and the dates on which market expectations change are not always known (Binder 1985).

The surprise nature of the May 2009 announcement arguably lends itself to the regulatory event study methodology suggested by Binder (1985), given the relative ease in identifying the dates on which market expectations were revised. Examining another exogeneous taxation shock in the form of the announcement of the Resources Super Profits Tax ("RSPT") in 2010, Brown, Clout & Ferguson (2013) find evidence that bulk commodity firms such as iron ore and coal firms experienced negative cumulative abnormal returns (CARs) in response to the RSPT announcement.

A negative market reaction is predicted in response to the May 2009 announcement for firms with employee share and option plans, as the removal of the ability of employees to defer tax on shares or options was widely expected to reduce incentives for employees to participate in employee share or option plans (Cunningham 2009). Start-up, research and development and speculative-type companies were expected to be the most adversely affected by the changes to the taxation of employee options, as these companies are more dependent upon the capacity to provide equity through incentive schemes in order to attract and reward staff, as they do not have the same levels of cash resources to pay salaries at the level offered by larger firms (Association of Mining Exploration Companies 2009). Prior studies have found evidence consistent with firms using options to attract and retain certain types of employees as well as to create incentives to increase firm value (Core & Guay 2001). Thus, a reduction in incentives for employees to participate in option plans would *ceteris paribus* be expected to reduce firm value.

Alternatively, firms could respond to the 2009 changes by issuing deeper out of the money options in order to avoid the tax that would otherwise arise on vesting, as options that are deeply out of the money will not have a taxable value.[80] This could offset the reduced incentives for employees to participate in option plans, as employees of start-up, research and development and speculative-type companies (such as MEEs) are typically risk seeking. Thus, issuing deeper out of the money options could incentivize employees to take more risk in the innovation process (Chang et al. 2015). In practice, however, options are often provided by companies in start-up mode in-lieu of paying higher upfront cash remuneration, because these companies have limited access to cash (Institute of Chartered Accountants in Australia 2009). As a result of this, practitioners argued strongly against the 2009 changes on the basis that they would make Australia's taxation regime for employee options uncompetitive relative to other countries such as the UK and Singapore, which provide special tax rules for the taxation of employee options provided by small and start-up type entities.

A negative market reaction is also predicted for firms with employee share plans. While broad-based employee share plans in Australia are typically provided by larger firms, the 2009 changes were expected to result in costly restructuring of existing plans to comply with the new rules (Durkin, Hepworth & Anderson 2009), for example, by providing more cash compensation

[80] Refer to the discussion in section 3.2.6.

to compensate employees for the reduced incentives, since the removal of the ability of employees to defer tax would have the effect of lowering the after-tax value of the employee's total remuneration. The 2009 changes were thus expected to impose real costs on firms, notwithstanding the fact that the employer's tax consequences did not change. H4 is therefore proposed as follows:

H4. Firms with employee share and option plans experienced more negative abnormal returns around the May 2009 announcement relative to firms without employee share and option plans.

3.5 Data and Sample

The continuous disclosure requirements that apply to ASX listed companies require the ASX to be notified immediately of any changes to issued capital. When a new issue of securities (including shares and rights) has been made, a listed entity must lodge a completed Appendix 3B with the ASX which sets out the number and class of the securities issued, the principal terms of the securities, and the issue price or consideration[81]. A sample of firms with employee option plans is therefore obtained from a search of firms' Appendix 3B filings on the SIRCA Australian Company Announcements database. Because many Appendix 3B filings pertain to changes in issued capital that do not relate to grants of employee stock or options, the sample is restricted to those filings which mention the word "employee" in the announcement header.

The sample covers the period from 1 January 2006 to 31 December 2017, as this encompasses the two most significant changes to the taxation of employee share options in 2009 and 2015. A total of 1,790 individual Appendix 3B announcements which satisfy the above-mentioned search criteria are identified. A breakdown of the number of individual announcements by year is presented at Figure 3.1. The number of employee-related Appendix 3B announcements has declined over time, consistent with statistics provided by Link Market Services Limited and Computershare Limited documenting a decline in employee option plan usage after the 2009 reforms[82].

[FIGURE 3.1 ABOUT HERE]

While the amount of detail provided in respect of employee option grants in the Appendix 3B varies considerably between firms, most firms disclose, at a minimum, the option grant date,

[81] An example of an Appendix 3B filing is attached at Appendix I.
[82] Refer to the submission to Treasury prepared by Employee Ownership Australia & New Zealand attached at Appendix J.

the quantity of options issued, the exercise price, the expiry date, and whether there are any vesting hurdles. These details are hand-collected from the Appendix 3B filings. For option exercises, the details collected include the quantity of shares purchased as a result of the options being exercised, the price at which the options were exercised, and the date exercised.

A firm is identified as having an active employee option plan in place during the year if it issued at least one Appendix 3B during the year relating to either a grant of employee options, or to the exercise, cancellation, forfeiture or expiry of employee options that were previously granted. A total of 680 firm-years, or 375 unique companies, were identified that satisfied this requirement. A breakdown of the sample of firms with employee option plans by year and plan characteristics is presented at Table 3.5.

[TABLE 3.5 ABOUT HERE]

Table 3.5 shows that within the sample of firms who grant options to employees, option grants with time-based vesting conditions are the most common (25.1% of all firm-years), followed by zero exercise price options or zepos (14.1%) and performance hurdles (10.7%). The performance hurdles may be either market-based (i.e., options vest upon a target share price being reached) or linked to certain performance milestones. For example, a minerals exploration company that does not derive any revenue from its principal operations might specify that options will vest upon certification of a specified quantity of mineral resources or ore reserves, the granting of a mining licence, completion of a feasibility study, or finalisation of project finance. Examples of common vesting conditions are set out in Appendix F.

It should be noted that 47.9% of firms in the sample do not specify the plan vesting conditions in detail, but simply state that the options granted are subject to vesting conditions, without specifying the terms. This may be due to proprietary costs. To the extent that performance hurdles are based on project milestones, firms may not wish to reveal the specific performance hurdles used, in order to avoid giving away firm-specific knowledge.

Interestingly, the use of zepos increased after 2009. As discussed in section 3.2.2.3, zepos are options that do not have an exercise price. The tax treatment of zepos under Division 83A was the same as for options with an exercise price (i.e., they were taxed on vesting), but because they always have an intrinsic value (since $P - X$ will always be positive as long as the firm has a positive share price), some have conjectured that companies looked at zepos after 2009 as an alternative to options, in order to avoid the situation that arose under Division 83A whereby options could be taxed on vesting even if they were not exercised (Basker 2013). This would be *prima facie* evidence of tax being an important consideration in employee compensation plan design.

The search described above likely understates the number of firms with employee option plans, for two reasons. First, not all firms refer to the content of the announcement in the header. Second, there may be differences in the naming of option plans in companies where the directors and the employees are largely the same. For example, many junior exploration companies typically only have a few employees apart from the CEO, and it would not be uncommon for the employees of a junior explorer to consist of an executive chairman, managing director, an exploration manager, a geologist, and an engineer with a technical background. To the extent that these option plans are referred to as director options rather than employee options, the number of firms granting options to employees will be understated.

As an alternative data source, therefore, directors' and executives' compensation details are also obtained from the Connect 4 Boardroom database, which provides details of cash and non-cash remuneration paid to directors and executives, including options and shares. One limitation of using the Connect 4 database as a primary data source, however, is that it is extremely common for directors' and executives' remuneration to include an equity component, which can be made up of options, shares or a combination of both. As a result, the characteristics of firms that grant options to lower-level employees will differ from those of firms granting options to directors and executives only[83]. However, Core & Guay (2001) find that firms that grant options to non-executive employees are also more likely to grant options more intensively to executives.

Monthy share price price relatives, market capitalisation and industry membership are obtained from the SIRCA Share Price Price Relative (SPPR) database. Daily share prices are obtained from the SIRCA Core Research Data (CRD) and ASX End of Day (EOD) databases. Financial variables are obtained from Morningstar's DatAnalysis Premium database. A list of events relevant to the passage of the employee share schemes legislation through Parliament is obtained through a Factiva search for news articles relating to employee share schemes. Details of the composition of the final sample are shown at Table 3.6.

[TABLE 3.6 ABOUT HERE]

[83] For example, Ittner, Lambert & Larcker (2003) show empirically that the determinants of equity grants to lower-level employees and senior-level executives are significantly different in "new economy" and "old economy" firms.

3.6 Research Design

3.6.1 Option determinants model

A logistic regression model is used to predict the characteristics of firms that grant options to employees as set out in H1. The primary dependent variable, *EESO*, is a dichotomous variable which is coded 1 to denote the existence of an active employee option plan in year *t*, and 0 otherwise[84]. The model specification as follows:

$$EESO_{it} = \alpha_0 + \beta_1 Size_{it} + \beta_2 MTR_{it} + \beta_3 Volatility_{it} + \beta_4 MTB_{it} + \beta_5 Intangibles_{it} + \beta_6 CashBurn_{it} + \beta_7 Top5_{it} + \beta_8 Age_{it} + \beta_9 Top20_{it} + \beta_{10} Lev_{it} + Industry_i + Year_t + \varepsilon \quad (1)$$

The main variables of interest in Equation (1) are stock return volatility (*Volatility*) as a proxy for idiosyncratic risk; the market-to-book ratio (*MTB*) as a proxy for the firm's investment opportunity set; intangible assets (*Intangibles*) as a proxy for the importance of human capital; and cash constraints (*CashBurn*), as these characteristics are typically associated with grants of stock options to lower-level employees. Specifically, firms which grant stock options more intensively to non-executive employees are predicted to have higher idiosyncratic risk, greater growth opportunities and greater cash constraints (Core & Guay 2001; Demsetz & Lehn 1985; Smith & Watts 1992). In addition, non-executive employees are predicted to receive more options in firms where human capital is relatively more important, such as R&D-intensive firms (Chang et al. 2015) as it is argued that the importance of retaining employees is greatest in in these firms.

[84] The abbreviation *ESO* is commonly used in the literature to refer to executive stock options. Therefore, to avoid confusion, the abbreviation *EESO* is adopted in this thesis to refer to employee stock options.

Volatility is the standard deviation of monthly stock returns measured over the previous 12 months, and is used as a proxy for idiosyncratic risk, as the incentive effects of stock options are predicted to be more important for firms that are pursuing unproven, riskier strategies (Ittner, Lambert & Larcker 2003). Since the value of the option increases with the implied volatility of the underlying stock, stock options have been argued to motivate higher degrees of risk taking (Rajgopal & Shevlin 2002).

The market-to-book ratio (*MTB*) is used to proxy for the growth opportunities of firm *i* following Chang et al. (2015), as firms with more growth options (i.e., greater access to positive NPV projects) also make greater use of stock option plans (Smith & Watts 1992).

Intangibles is defined as the ratio of intangible assets to total assets and is used to proxy for the importance of human capital (Chang et al. 2015). Australian companies are permitted to capitalise both exploration expenditure and R&D if asset recognition requirements are met. Accordingly, the definition of intangible assets includes both capitalised exploration expenditure as well as capitalised R&D.

CashBurn is calculated as the ratio of current holdings of cash and cash equivalents divided by annual cash requirements: (*Cash* + *Current Receivables* + *Current Investments*)/*Total Cash Requirements*. Total cash requirements are equal to the absolute value of cash from operations for firms with negative cash from operations, and zero otherwise. A lower ratio of cash on hand to annual cash requirements would be expected for firms with employee option plans if cash constrained firms use stock option grants in place of cash compensation.

The marginal tax rate (*MTR*) is also included as a control variable in Equation (1), as prior studies have shown that firms which grant stock options more intensively to non-executive employees have lower marginal tax rates (Core & Guay 2001). *MTR* is a trichotomous variable designed to proxy for the tax-paying status of firm *i* in year *t* based on Plesko (2003). *MTR* is set equal to the statutory corporate tax rate (i.e., 30%) if a firm has positive current period earnings and no accumulated losses, 50% of the corporate tax rate (i.e., 15%) if a firm has either accumulated losses or negative current earnings, or 0% if a firm has both accumulated losses and negative current earnings. While the employer's tax-paying status is less likely to be a determinant of the decision to grant stock options to employees in Australia, where stock option expense is not deductible (unlike in the US), *MTR* is nevertheless included in the model as a proxy for loss firms (such as MEEs), which are also likely to have higher idiosyncratic risk. A negative coefficient is thus expected on *MTR*.

In addition to the economic determinants of options use described above, a measure of the intensity with which firms use options for their top executives (*Top5*) is also included, to control for firm-specific determinants of options use, since firms are likely to use options more intensively for lower-level employees in situations where options are more useful in monitoring top management (Core & Guay 2001). *Top5* is defined as stock option compensation for the firm's five most highly paid executives, expressed as a percentage of their total compensation. Stock option expense and total compensation are both sourced from the Connect 4 Boardroom database. The firm's five most highly paid executives are determined by reference to their total compensation (cash and equity) for the year. The coefficient on *Top5*, i.e., β_7, is predicted to be positive.

To control for the effect of the firm's life cycle, the natural logarithm of the firm's age (*Age*), where age is measured as the number of days since the firm's listing on the ASX, is also employed. *Age* is predicted to be negatively associated with stock option use for lower-level employees.

Size is defined as the natural logarithm of the market capitalisation of firm *i* at the end of year *t*. Core & Guay (2001) note that the expected relation between firm size and the use of stock options to provide incentives is ambiguous. Theory predicts that firms will provide equity incentives more intensively to lower-level employees when direct monitoring of employees is more costly, i.e., when the firm has greater growth opportunities, and when the firm is larger and more decentralized (Demsetz & Lehn 1985; Smith & Watts 1992). However, lower-level employees in larger firms are less likely to be able to influence stock prices directly.

Following Ittner, Lambert & Larcker (2003), two proxies for alternative monitoring mechanisms are employed. The percentage of shares owned by the company's top 20 shareholders (*Top20*) is used to proxy for monitoring by shareholders (e.g., institutional investors). Leverage (*Lev*) is used to proxy for monitoring by debt holders and is defined as the ratio of long-term debt to total assets. Stronger monitoring by shareholders and debtholders would *prima facie* be expected to reduce the demand for employee option plans. Thus, both *Lev* and *Top20* are predicted to be negatively related to option plan usage. In the case of *Top20*, however, it is also possible that high information asymmetry, as is the case for many junior exploration companies, may lead to less effective monitoring, as large blockholders may be able to expropriate wealth from smaller shareholders (Ferguson, Clinch & Kean 2011).

Industry and year fixed effects are also included in Equation (1), since it is hypothesised that option plan usage declined after 2009. In addition, the determinants of employee option plans are measured at both the end of year *t* and at the end of year $t-1$.

3.6.2 Option issuance model

For tests of H2, an OLS regression model is used to examine the effect of the 2009 changes on subsequent employee option grants. The analysis is conducted only on firms with employee option plans. As with the tests of H1, a firm is defined as having an employee option plan in the current year if it made at least one announcement relating to either a grant of options to employees, or to the exercise, cancellation, forfeiture or expiry of previously granted options. The resulting sample consists of 680 firm-years between 2006 and 2017. The model specification adopted for tests of H2 is set out at Equation (2) below:

$$\begin{aligned} Grants_{it} = {} & \alpha_0 + \beta_1 Div83A_t + \beta_2 Div83A\_amended_t + \beta_3 Size_{it} + \beta_4 MTR_{it} + \beta_5 Volatility_{it} \\ & + \beta_6 MTB_{it} + \beta_7 Intangibles_{it} + \beta_8 CashBurn_{it} + \beta_9 Top5_{it} + \beta_{10} Age_{it} \\ & + \beta_{11} Top20_{it} + \beta_{12} Lev_{it} + \beta_{13} Exercises_{it} + \beta_{14} Performance_{it} \\ & + \beta_{15} Performance_{it-1} + \varepsilon \end{aligned} \tag{2}$$

Dependent variable

The dependent variable, *Grants*, is defined, alternatively, as the natural logarithm of the quantity of options granted to employees during the year, and as the natural logarithm of the value of options granted to employees during the year.

Options are valued in accordance with the valuation rules set out in the regulations to Division 83A of the *Income Tax Assessment Act 1997*. Essentially, the regulations provide a 'safe harbour' for valuing unlisted rights such as employee stock options. The statutory valuation factors contained in the regulations are derived using the Black-Scholes option pricing method, using assumptions that are considered to be more appropriate for valuing employee share options in light of their unique features, i.e., vesting periods, performance hurdles, disposal restrictions (since they cannot be sold) and the ability of employees to exercise options early[85]. For example,

[85] See Brown & Szimayer (2008) for a discussion of these issues.

the inclusion of performance hurdles such as earnings or share price targets can enhance the incentive capacity of employee share options, but also detract from their value, particularly if the performance hurdles result in an increased risk of forfeiture. As a result, the tax valuations of employee share options are typically significantly lower than the Black-Scholes values[86].

The valuation of employee share options for taxation purposes is contrasted to their accounting treatment under AASB 2 *Share-based Payments*, where vesting conditions are not taken into account when estimating the fair value of the options at grant date. Rather, AASB 2 provides that vesting conditions are taken into account by estimating the number of options that are expected to vest at the end of each period. The tax valuation factors implicitly take into account the effect of vesting conditions on the valuation of employee options by modifying the assumptions used as the Black-Scholes model inputs. For example, the implied volatility underlying the statutory valuation factors is assumed to be 10%, when the volatility of exchange traded Australian options is generally higher than this (Board of Taxation 2010).

The tax valuations themselves are obtained by calculating the ratio of the market value of the underlying share divided by the option exercise price (referred to as the calculation percentage) and finding the valuation factor that corresponds to the calculation percentage and the option exercise period. For more details regarding how the tax valuations are derived, refer to Appendix G.

In addition to the tax valuations, options are also valued at the date of grant using the Black-Scholes option pricing model, based on the information contained in the Appendix 3B filings. A minority of option grant announcements do not disclose all the key terms required to

[86] For an example of how the statutory valuation factors are applied in practice, refer to Board of Taxation (2010), "Review into elements of the taxation of employee share scheme arrangements: a report to the Assistant Treasurer", attached at Appendix H.

determine the Black-Scholes model inputs; thus, options are also valued at 25% of their exercise price following Core, Holthausen & Larcker (1999), as more sophisticated option pricing models typically produce values in this range.

Independent variables

The main variable of interest, *Div83A*, is an indicator variable set equal to 1 to capture the period between 2009 and 2015, when Division 83A of the *Income Tax Assessment Act 1997* was enacted to replace the previous legislation setting out the tax treatment of employee share options, and 0 otherwise. If option grants declined following the May 2009 Budget announcement, a negative coefficient on *Div83A* would be expected.

Div83A_amended is a dummy for the period 2015 and later and is designed to capture the effect of the amendments to Division 83A applicable from 1 July 2015, which saw the tax treatment of employee share options largely restored to the pre-2009 position. If the 2015 amendments resulted in an increase in employee option grants, a positive coefficient would be expected on *Div83A_amended*.

Grants of options are expected to be determined by option exercises during the year, for two reasons. First, option exercises decrease the level of option incentives outstanding (Core & Guay 2001). If firms manage option grants around a target level, then greater grants of options might be made during years when exercises are greater, to replace the reduced incentives after the options are exercised. On the other hand, option exercises by employees of firms undertaking higher-risk projects might reduce the need for further option grants. The value of options exercised during the year is calculated by multiplying the quantity of options exercised by the market price of the underlying shares on the exercise date.

Current year and previous year stock returns are used as proxies for firm performance, as empirical examinations of option grants tend to find a positive association between option grant levels and firm performance (Core & Guay 1999). The stock return is calculated as the cumulative price relative over the previous 12 months. All other variables are as defined in Equation (1).

3.6.3 Compensation mix model

For tests of H3, an OLS regression model is used to examine whether the compensation mix changed after 2009. In contrast to tests of H2, the objective of H3 is to examine the effect of the 2009 changes to the taxation of employee options on the level of option incentives provided to directors and executives in a sample based on all ASX listed companies with director compensation data available. The model specification is set out at Equation (3) below:

$$\begin{aligned} CompMix_{it} = {} & \alpha_0 + \beta_1 Div83A_t + \beta_2 Div83A\_amended_t + \beta_3 Size_{it} + \beta_4 MTR_{it} \\ & + \beta_5 Volatility_{it} + \beta_6 MTB_{it} + \beta_7 Intangibles_{it} + \beta_8 CashBurn_{it} + \beta_9 Age_{it} \\ & + \beta_{10} Top20_{it} + \beta_{11} Lev_{it} + Industry_i + \varepsilon \end{aligned} \tag{3}$$

Dependent Variable

The dependent variable, *CompMix*, is defined, alternatively, as *OptionMix* and *EquityMix*. *OptionMix* is defined as the level of option incentives for all directors and executives of firm *i* in year *t*, as a percentage of their total compensation. To measure the level of option incentives, the amount of stock option expense and total compensation reported for each director is obtained from the Connect 4 Boardroom database. *EquityMix* is defined similarly to *OptionMix*, with the only difference being that *EquityMix* is measured as the value of options and shares provided to the director, expressed as a percentage of the value of their total compensation.

Independent variables

As in Equation (2), the main variables of interest are *Div83A* and *Div83A_amended.* If the level of equity incentives declined after 2009, a negative coefficient would be observed on *Div83A*. Similarly, if the level of equity incentives increased after 2015, a positive coefficient would be observed on *Div83A_amended*. All other variables are as defined in Equations (1) and (2).

3.6.4 Event study

To examine the shareholder wealth effects of the changes to the tax treatment of employee share and option plans, an event study methodology is adopted similar to the approach developed by Noreen & Sepe (1981) to examine the market reactions to accounting policy deliberations by the FASB. While the Noreen and Sepe ("NS") approach was used in the context of examining a series of events relating to inflation adjusted accounting, they concluded that their methodology would be useful in other settings where policy makers were deliberating or vacillating over time, or where there was some uncertainty around the government's proposals. In the Australian setting, the NS approach has been used to examine the market reactions to the proposed introduction of the Resources Super Profits Tax (RSPT), the announcement of which took the mining industry by surprise, and was followed by vocal opposition and a lengthy negotiation process between the government and affected companies (Brown, Clout & Ferguson 2013).

The process for legislating tax-related policy changes mirrors that of accounting policy deliberations, in that it typically involves an initial announcement by the Federal Government which is accompanied by a policy statement; the release of a discussion paper, usually accompanied by draft legislation and an explanatory memorandum, which marks the beginning of a public consultation period in which interested parties can lodge submissions with Treasury; the introduction of a bill into Parliament, at which stage the bill is debated, and may be referred to a sub-committee for review before being sent back to Parliament for a final vote; and receipt of Royal Assent once the legislation passes both Houses of Parliament.

Following Noreen & Sepe (1981), a search of the Factiva database is conducted for relevant press articles referring to events relating to the proposed changes to the taxation of employee share and option plans announced by the Government in the 2009 Budget. The events selected are those that *ex ante* would be expected to exhibit the largest market reactions (i.e., the events expected to give rise to the greatest changes in the probability that the proposed changes would be legislated). A similar procedure is followed to identify events relating to the proposed amendments to the taxation of employee option plans announced by the Government in late 2014. A summary of the relevant events and their predicted market reactions is shown at Table 3.7.

[TABLE 3.7 ABOUT HERE]

The abnormal returns for firm *i* over the 3-day event window (-1,1) are estimated using the formula in Equation (4) below (i.e., the 'normal' return for firm *i* over the 3-day event window is assumed to be the market return),

$$AR_{it} = \ln\left[\frac{P_{it}}{P_{it-1}}\right] - \ln\left[\frac{P_{mt}}{P_{mt-1}}\right] \tag{4}$$

where P_{it} is the closing share price of firm *i* on day *t*, P_{it-1} is the closing share price of firm *i* on day $t-1$, P_{mt} is the level of the All Ordinaries index on day *t*, and P_{mt-1} is the level of the All Ordinaries index on day $t-1$.

Abnormal returns are then summarised over the event window (-1,1) for each event as follows:

$$CAR_{it}(-1,1) = \sum_{t=-1}^{1} AR_{it}$$

(5)

The hypothesis that firms with employee share and option plans were negatively affected by the 2009 Budget announcement is tested by examining whether the average 3-day cumulative abnormal returns (CARs) for the firms with employee option and share plans around each event date were significantly different from the average 3-day CARs for all other firms over the same event window. If firms with employee option and share plans were negatively affected, then these firms should exhibit significantly lower CARs in the 3-day event window around 2009 Budget night (Event I in Table 3.7). Because the 2009 Budget was handed down on the evening of 12 May 2009, day 0 for Event I is 13 May 2009.

Following the initial Budget announcement, the Rudd government did announce changes to some of the measures originally proposed. For example, the taxable income threshold for the upfront tax concession in respect of employee shares was raised to $180,000, and the deferral of tax was allowed for shares acquired under certain broad-based salary sacrifice employee share plans. For firms with employee share plans, these changes were viewed as a softening of the measures announced in the Budget. However, the enacted legislation still disadvantaged smaller, high-growth firms reliant on options to attract and retain staff, as a result of the taxing point for options being shifted from exercise to vesting. Therefore, firms with employee share plans, but not firms with employee option plans, might be expected to exhibit positive abnormal returns around Events II, III and IV, reflecting the revision in expectations regarding the effects of the proposed changes.

With respect to the amendments to the taxation of employee options that applied from 1 July 2015, the changes may have been anticipated as early as August 2014, when the Abbott Government announced that it was considering reversing some of the 2009 changes to the taxation of employee share schemes for start-up companies and small to medium businesses. The amendments applied to employee options granted from 1 July 2015, and not shares. Firms with employee option plans, but not firms with employee share plans, would therefore be expected to exhibit positive abnormal returns around Events I, II and III.

3.7 Results

3.7.1 Descriptive statistics and univariate analysis

Descriptive statistics for employee option grants and option exercises are reported at Panels B & C of Table 3.5. Of the 649 firm-years with employee option plans between 2006 and 2016, there were 439 firm-years in which options were granted, and 208 firm-years in which options were exercised[87]. This is likely indicative of the number of options that are granted out of the money and that do not vest; from Panel D of Table 3.5, options tend to be granted to employees out of the money, on average. Over the period 2006 to 2016, the mean (median) share price at grant date was \$0.936 (\$0.345), and the mean (median) exercise price was \$0.988 (\$0.43), implying a mean (median) taxable value of just \$0.079 (\$0.009) per option.

Panel B of Table 3.5 confirms that options valued based on the statutory valuation factors produce significantly lower valuations than options valued using the traditional Black-Scholes option-pricing method, demonstrating the concessionality embedded into the valuation factors, which recognise that the use of vesting periods and performance hurdles have the potential to significantly affect the probability of exercise. In general, the average taxable value of options granted has declined since 2009, and this appears to be due to a greater percentage of options being issued out of the money, which may be due to employers seeking to reduce the likelihood of employees incurring an upfront tax liability on vesting as a result of the 2009 changes. Supporting this view, the average calculation percentage in Panel B (the ratio of share price on grant date to exercise price) declined from 92.1% in 2006 to 63.3% in 2016, indicating that since 2009, options are being issued further out of the money.

[87] The year 2017 is omitted from the option grant and exercise samples as at the time of writing, daily share price data was only available from SIRCA until 31 December 2016.

Overall, the descriptives reported in Panel B are consistent with the findings of Brown & Szimayer (2008), who show that properly computed fair values of employee stock options are significantly lower than traditional Black-Scholes values, due to the greater risk of the options not vesting as a result of using performance hurdles. On average, the tax valuations (which do take into account the risk of options not vesting) are 68% lower than the Black-Scholes values.

3.7.2 Characteristics of firms with employee option plans

Table 3.8 provides a comparison between the sample of firms with employee option plans and all other ASX-listed firms. On average, firms with employee option plans are significantly younger, and have lower marginal tax rates, more growth opportunities, and have more intangible assets relative to all other ASX-listed firms, consistent with the economic determinants of option grants to lower-level employees based on prior research. Correlations between the key variables are reported at Table 3.9.

[TABLE 3.8 ABOUT HERE]

[TABLE 3.9 ABOUT HERE]

The results for the economic determinants of employee option plan adoptions in Australia are presented at Table 3.10. Firms with employee option plans are more likely to have lower marginal tax rates, are younger, issue less debt, and grant options more intensively to top executives. They are also more likely to be in the metals and mining, energy, information technology and pharmaceutical industries, consistent with options being granted more intensively to employees of growth companies.

Interestingly, there is a positive association between firm size and the likelihood of having an employee option plan. This provides support for the Core & Guay (2001) prediction that firms provide equity incentives more intensively to lower-level employees when monitoring is more costly. This will be true of small firms with greater growth opportunities (who have few resources and little need for large boards), as well as some larger, more decentralized firms. In very large firms, however, stock options are less likely to be granted to lower-level employees because the ability of individual employees to influence stock prices through their actions is limited. Another explanation for the positive coefficient on the size variable is that other explanatory variables may also be proxying for size. For example, many small, high-growth companies that do not have any revenue (e.g., mining exploration companies), will also have low marginal tax rates as they have no taxable income. In addition, the positive coefficient on *Size* may also be a result of the large number of small firms listed on the ASX, many of whom do not have employee option plans. Other studies of non-executive employee compensation plans, by contrast, have tended to focus on larger industrial firms such as the S&P 1500, as in Chang et al. (2015).

Cash constraints do not appear to be a determinant of employee option plan usage. This contrasts with Core & Guay (2001) who predict and find that cash constrained firms make greater use of stock option grants to non-executive employees, but is more consistent with Ittner, Lambert & Larcker (2003), who find no evidence that cash constrained new economy firms make greater use of equity-based compensation to conserve cash. It may be the case that the incentive effects of stock options are more important for these firms, for example, by attracting less risk-averse employees.

[TABLE 3.10 ABOUT HERE]

In summary, the results are consistent with H1a (volatility and market-to-book, which proxy for risk and growth opportunities respectively, are not statistically significant when industry fixed effects are included in the model, though firms in riskier industries are more likely to use employee option plans), but are not consistent with H1b, as the cash burn variable is not statistically significant. Having said that, however, given the negative and significant coefficient on *MTR*, it is possible that the *MTR* variable could be proxying for loss firms and may also be capturing EESO usage by cash constrained firms. The *MTR* variable may also be proxying for risk, since riskier firms tend to be loss-making, particularly in the MEE sector, where the failure rate is extremely high. This may explain why the risk proxy, *Volatility*, and to a lesser extent, *CashBurn*, are not significant in Table 3.10. This would suggest that the determinants of employee option plan adoptions in Australia are broadly consistent with economic theory.

3.7.3 Determinants of option grants before and after 2009

The results for the determinants of employee option grants are set out in Table 3.11. Firms that do not issue options to employees are excluded from the sample (i.e., only firms where *EESO* = 1 are included). When *LnQuantityGrants* is used as the dependent variable in Panel 1 of Table 3.11, there is no association between the *Div83A* indicator variable and the number of options granted, indicating that the quantity of options granted to employees did not decline after 2009, which is not consistent with H2. However, when the value of options granted is adopted as the dependent variable, the *Div83A* indicator is negative and significant, indicating that the value of options granted to employees has decreased since 2009. This result is robust to the valuation method used.

[TABLE 3.11 ABOUT HERE]

When read in conjunction with the descriptive statistics for employee option grants and exercises shown at Table 3.5, the results suggests that firms may be issuing lower-priced options to employees that are more deeply out of the money at the time of grant, to avoid subjecting employees to a potential tax liability on vesting. This would be consistent with both a tax motivation, as well as an incentive alignment motivation, as high-growth firms and firms that are pursuing riskier investment opportunities are more likely to use market-based performance conditions and more forward-looking share price hurdles in order to lengthen employees' decision-making horizons and attract employees who are less risk-averse (Brown & Szimayer 2008; Ittner, Lambert & Larcker 2003).

To test this conjecture, two alternative dependent variables are adopted, *LnNilValueGrants*, and *LnTaxableGrants*, to ascertain whether there are any differences in option grant activity between low-priced options which do not have a taxable value, and higher-priced options. If the 2009 changes did result in more options being issued to employees that were out of the money at the time of grant, then there should be a positive coefficient on *Div83A* when *LnNilValueGrants* is adopted as the dependent variable, and a negative coefficient on *Div83A* when *LnTaxableGrants* is the dependent variable. This exploits a unique feature of the statutory valuation factors contained in the regulations to the income tax legislation, where options are assigned a taxable value of zero where the calculation percentage is below 50%. In other words, where the exercise price is set significantly higher than the share price at grant date and the exercise period is sufficiently short (since option value increases with the exercise period), the option will not have a taxable value. This is by design, as the Board of Taxation considered that the valuation concessions provided in the regulations would significantly reduce the costs associated with high growth companies such as start-up and R&D companies issuing options to employees[88].

The empirical results reported at Table 3.12 support this prediction. The number of options granted that did not have a taxable value increased after 2009, as evidenced by the positive and

[88] The Board notes at paragraph 6.70 of its review of the taxation of employee share scheme arrangements that "the prescribed valuation techniques for companies that issue unlisted rights to their employees operate with a 'safe harbour' valuation methodology that will continue to be concessional if the Board's recommendations are accepted."

significant coefficient on *Div83A* in Panel (2), while there was a decrease in the number of taxable options granted after 2009.

An indicator variable *NilValue* is also created, which is set equal to 1 if the firm issued options with no taxable value during the year, and 0 otherwise. When the original option grant model specified in Equation (2) is augmented with the *NilValue* indicator and *LnQuantityGrants* is used as the dependent variable, the coefficient on *NilValue* is positive and significant, indicating that low-priced options are commonly granted to employees. However, when *NilValue* is interacted with the *Div83A* indicator, the coefficient is not statistically significant. This suggests that the *quantity* of low-priced options did not necessarily increase after 2009, at least relative to pre-2009 levels, but low-priced options appear to make up a larger proportion of all option grants after 2009, which would be consistent with a tax motivation, thus providing partial support for H2.

Notably, option exercises are significantly and negatively correlated with option grants in Table 3.12. This contrasts with the findings of Core & Guay (2001), who suggest that companies grant more options in years when more options are exercised, in order to top up the level of option plan incentives provided to employees (since option exercises reduce the level of option incentives). However, in the case of high growth firms, option exercises are expected to be less frequent, reflective of the higher risk that options may not vest due to share price targets not being met. As a result, when options do vest, they are likely to be more deeply in the money, which would usually result in the employee realising a large gain. This appears to be the case, as option exercises in Panel C of Table 3.5 are much less frequent than option grants.

There is no association between current or prior year stock price performance and the quantity of options granted. However, when *LnNilValueGrants* is employed as the dependent variable, there is a negative and significant association between both current and prior year stock returns and option grants. This may be indicative of higher firm-specific risk, as firms may grant lower-priced options to employees to replace previously granted options that did not vest due to the company's poor stock price performance.

The results for *Div83A_amended* are not as expected. The coefficients on *Div83A_amended* are statistically significant in both Table 3.11 and Table 3.12, but they have the same sign as the coefficients on *Div83A*, which is contrary to expectations. This suggests that the 2015 changes to the taxation of employee options did not encourage option use. This may be a result of lower commodity prices leading to lower demand for employee share options in the extractive industries context. Lower share prices would not only make options less attractive, but would also result in lower tax values (since the formula used to derive the tax valuation factors is based on the Black-Scholes option pricing model). This may explain why the coefficient on *Div83A_amended* in Table 3.12 is positive and significant when *LnNilValueGrants* is used as the dependent variable, but negative and significant when *LnTaxableGrants* is used as the dependent variable.

3.7.4 Compensation mix before and after 2009

The results for the determinants of the mix of compensation between cash and equity are presented at Table 3.13. The stock option component of total compensation paid to directors and executives declined after 2009, supporting H3. Economically, the significant coefficient on *Div83A* implies a 10% decline in the option expense component of total compensation. This is likely to be for two reasons. First, if the popularity of stock options declined after 2009, this would affect the stock option expense recorded in the accounts. Second, AASB 2 requires employee share options to be valued at their fair values at grant date, and an estimate made each year regarding how many options are expected to vest. Granting lower-priced options would result in lower fair values. In addition, the 'real risk of forfeiture' requirement would also be expected to affect assessments of the number of options that are likely to vest. The economic determinants of the compensation mix are largely consistent with prior literature. Loss firms, younger firms, firms with greater growth opportunities, lower leverage, and a greater percentage of intangible assets are all associated with higher stock option expense as a percentage of total compensation. This result is robust to the inclusion of industry fixed effects. As was the case for the economic determinants of employee option plans, firms in the metals and mining, energy, pharmaceuticals and information technology industries are all associated with higher stock option expense.

[TABLE 3.13 ABOUT HERE]

3.7.5 Market reactions

The cumulative abnormal returns for firms with employee share and option plans around each event date are reported at Table 3.14. The average 3-day CARs around event I (in Panel A) for firms with employee share and option plans are positive, which contradicts H4. The average 3-day CAR for the firms with employee option (share) plans is 1.1% (1.5%) lower than the average 3-day CAR for firms that do not have employee share or option plans. In each case, the difference is statistically significant at the 10% level on a one-tailed test, providing weak evidence in support of H4. There is some evidence that firms with employee share plans reacted positively to the 25 May 2009 announcement by the Rudd government that it was reconsidering some of the previously announced changes, as the mean 3-day CAR around event II for firms with employee share plans was 1.4% higher than the mean 3-day CAR for all other firms (though only statistically significant at the 10% level).

With respect to the 2015 changes, the average 3-day CARs are reported in Panel B of Table 3.14. There is no evidence that firms with employee option plans reacted positively to the Abbott government's announcement that it was considering reversing some of the 2009 changes. While the employee share plan firms exhibited significantly higher returns relative to the non-event firms around event I, the abnormal returns for the employee option plan firms around event I were significantly lower than the non-event firms, contrary to expectations. It appears that the 2015 amendments to Division 83A did little to affect the popularity of employee option plans. The most significant change was the removal of the taxing point for stock options on vesting, but given the trend towards issuing lower-priced options, even if the taxing point had stayed the same, the potential tax liability that employees would have faced may well have been minimal, given the concessionality embedded in the statutory valuation factors[89].

[TABLE 3.14 ABOUT HERE]

[89] The valuation factors were reduced even further from 1 July 2015 to reflect the increased risk borne by employees as a result of the 2009 changes; this would have the effect of further lowering the potential tax liability for the employee.

3.8 Conclusion

This chapter contributes to the compensation contracting literature by considering both valuation and taxation issues associated with stock option grants to employees. It does so in the context of an unanticipated change to the employee taxation of stock options in Australia in 2009 which saw the popularity of employee option plans decline due to the possibility of employees incurring a tax liability on vesting, but importantly, the change did not preclude firms from continuing to issue options to employees as a long-term incentive.

The economic determinants of employee stock option grants in Australia are largely consistent with those documented in prior research, namely, firms with more growth opportunities and firms with a greater reliance on human capital are more likely to grant options to employees.

This chapter documents a decline in both the number of firms issuing options to employees and the value of options issued to employees after 2009, providing evidence in support of the tax motivation for employee stock option grants identified in prior literature.

While selection bias cannot be completely ruled out due to an inability to identify a definitive sample of firms with employee option plans, there is also evidence of a decline of plausible economic magnitude in the level of option incentives in a broad sample of ASX-listed firms who grant options to directors and executives. However, it is not clear whether this reflects a decrease in option grants, or simply a lower stock option expense figure being recognised for accounting purposes, as the real risk of forfeiture requirement would *prima facie* be expected to result in a higher probability of options not vesting, in turn affecting reported compensation expense. While a more detailed examination of this question is beyond the scope of this chapter, this would provide an interesting avenue for future research.

For further discussion of the contributions, implications and limitations of this chapter, refer to Chapter 4.

4 SUMMARY AND CONCLUSIONS

4.1 Summary

This thesis provides evidence regarding the economic consequences of two significant tax-related policy changes in Australia, namely, the 2011 reforms to the R&D tax incentive (R&DTI) (refer Chapter 2), and the 2009 changes to the taxation of employee share schemes (refer Chapter 3).

In Chapter 2, evidence from a hand-collected sample of mining exploration entities ("MEEs") that disclosed receipt of R&D tax refunds in their quarterly cash flow reports between 2008 and 2015 reveals that the number of MEEs claiming the refundable tax offset increased from just 11 in 2008 to 99 in 2015. Over the same period, the average refund amount increased from $220,639 to $1,022,677. In addition, refundable tax offset recipients were smaller, had more accumulated losses, were more likely to have a single flagship project, less likely to have projects located overseas, and more likely to have previously reported a JORC compliant mineral resource or ore reserve.

There was also some evidence that R&D tax offset recipients spent more on exploration and evaluation, were more successful in raising equity, and had greater growth opportunities, relative to MEEs that did not claim the R&D tax offset. However, there was a negative association between receipt of an R&D tax offset during the year and firm market value.

There is significant long-run stock return underperformance in the MEE sector. This is attributed to the high failure rate of minerals exploration companies. In this regard, firms that receive the R&D tax offset fare no better than other MEEs. The standard deviation of monthly stock returns among non-R&D firms is higher than that of R&D firms. This may reflect the fact that there are more greenfields exploration companies in this group that do not typically invest significantly in R&D. Greenfields explorers would be expected to have higher risk than R&D-performing MEEs, who are more likely to conduct R&D around an existing mineral deposit. In addition, greenfields explorers may have better stock market performance during periods of rising commodity prices, as investors in MEEs are risk seeking. This may account for the relative performance attributes of the R&D tax offset recipients.

In general, the results in Chapter 2 support the scientific impetus of the R&DTI program. Because MEEs are more likely to claim the refundable tax offset if they have previously announced a JORC compliant mineral resource or ore reserve, this suggests that the increase in R&D claims is more likely to be driven by expenditure incurred in order to evaluate the economic potential of existing mineral deposits, rather than exploring in new areas (which is not eligible for the R&D offset). Further, MEEs whose focus is on base metals or other minerals (such as lithium, graphite and rare earth elements) are more likely to claim the R&D tax offset, with R&D claims occurring less in MEEs focused on precious metals and bulk commodities, where extraction and processing typically involves less scientific and technical risk. This suggests that the tightening of the definition of eligible R&D after 2011 resulted in more R&D effort aimed at addressing a knowledge gap, consistent with the objectives of the R&DTI program.

In Chapter 3, details of firms with employee option plans are hand-collected from Appendix 3B filings. The incidence of employee option plans in Australia declined after 2009. Younger firms and loss firms are more likely to issue options to employees, as are firms in industries with greater growth opportunities. Specifically, firms with employee option plans are more likely to be in the mining, oil and gas, information technology and pharmaceuticals industries.

Among the firms who continued to make use of employee option plans after 2009, there did not appear to be a decrease in the quantity of options granted. However, there was a significant decline in the value of options granted to employees, a result which is largely driven by companies granting fewer higher-priced options and more lower-priced options after 2009. This is consistent with the employee's tax considerations being relevant in the option grant decision, as lower priced options (i.e., options that are further out of the money at grant date) typically have no taxable value in accordance with the valuation factors set out in the regulations to the ITAA97.

There is also evidence that the compensation mix of companies granting options to directors changed after 2009, as a decline in stock option expense as a percentage of directors' total compensation was observed. Further, firms that grant options more intensively to directors are also more likely to grant options to lower-level employees.

There is weak evidence that firms with employee share and option plans reacted negatively to the 12 May 2009 Budget announcement, with the average 3-day CAR around the Budget announcement approximately 1.1% to 1.5% lower than firms without employee share or option plans.

4.2 Contributions and implications

Chapter 2 of this thesis provides the first empirical evidence in relation to the Australian R&D tax incentive that considers the effect of the incentive on individual firms. While a number of studies have considered the economic implications of the incentive (Thomson 2010; Thomson & Skali 2016), these have focused more on the additionality of the incentive, i.e., the extent to which R&D investment in Australia is responsive to tax subsidies.

The MEE setting is also an advantage of the present study, in that it represents a relatively homogeneous sample of loss-making firms who undertake projects with a high level of technical complexity. The asymmetric treatment of corporate profits and losses, and the extent to which this affects corporate risk-taking, has been well documented (Langenmayr & Lester 2018; Ljungqvist, Zhang & Zuo 2017), but this study differs from prior studies in that it focuses exclusively on those firms predicted to be most disadvantaged by this tax asymmetry, i.e., loss firms. It is hoped that this will stimulate further research in this area in other similar settings, such as Canada, which like Australia is also home to a large cluster of minerals exploration companies.[90]

Further, Chapter 2 also provides support for the pecking order theory of capital structure (Myers & Majluf 1984), as the increase in refundable R&D tax offset claims after 2011 appears to be consistent with the literature suggesting that firms making risky investments such as R&D prefer to finance those investments with internal funds, due to the adverse selection problems associated with equity finance.

This study also contributes to the literature examining the value relevance of non-financial disclosures. The negative association between receipt of an R&D tax refund and concurrent firm value is consistent with the information in resource and reserve disclosures being factored in to market prices, unless they contain new information (Magliolo 1986). Disclosing receipt of an R&D tax refund in either the quarterly activities report or in a standalone announcement may not necessarily result in a change in the market's expectations if the R&D relates to existing deposits.

In the context of the long-run returns literature, the long-run underperformance of both R&D firms and non-R&D firms in this setting is more likely to be attributable to the low probability of success in the mining exploration sector, and is arguably more consistent with the efficient-markets perspective espoused by Fama (1998). Since information asymmetry is typically high in the MEE setting, a more volatile return series is expected, and this appears to be the case here, for two reasons. First, Panel C of Figure 2.9 shows that the cumulative buy-and-hold returns for the R&D sample generally underperform the non-R&D sample, but over time the performance of the R&D sample gradually recovers. In an efficient market, apparent underreaction should be about as frequent as overreaction when returns are examined over long horizons (Fama 1998).

[90] Government of Canada (2017). "Canadian Mineral Exploration", available online: https://www.nrcan.gc.ca/mining-materials/exploration/8290 [accessed 23 May 2019]

Second, Fama stresses that any test of long-run performance must be tested jointly with a model of expected (i.e., normal) returns. In this regard, referring again to Panel C of Figure 2.9, the abnormal returns for the median R&D firm relative to its matched non-R&D firm measured over a 60-month window never deviate much from zero. This suggests that the single-firm benchmark proposed by Ang & Zhang (2004) provides a reasonable model of the R&D firm's "normal" return.

Further, a plausible explanation for the significant differences between the abnormal returns for R&D firms when matched with similar non-R&D firms may simply reflect the fact that investors want exposure to both greenfields and brownfields projects. Greenfields projects are likely to be higher risk than R&D projects that are undertaken in connection with an existing mineral deposit, and significant R&D is unlikely to occur at the greenfields exploration stage before a resource has been defined. A feature of stocks with high idiosyncratic risk is the higher probability of large price rises and large price declines (Ball & Brown 1980). This may be a driver of the trend observed in Panel C of Figure 2.9.

Chapter 3 addresses a paucity of data in relation to employee share and option plans in Australia by providing evidence regarding the determinants of employee option plans. Specifically, Chapter 3 contributes to the incentive contracting literature by showing that the determinants of employee option plans are consistent with prior studies, i.e., following Smith & Watts (1992), firms in industries with greater growth opportunities e.g., minerals exploration, are more likely to grant options to lower-level employees.

Chapter 3 also contributes to the compensation contracting literature by providing evidence regarding the mechanisms by which taxes are likely to affect stock option grants. Tax minimization is not the only objective when designing compensation plans, as the literature suggests employers trade off tax benefits with incentives, in keeping with the Scholes-Wolfson framework, under which companies consider both tax and non-tax costs in their tax planning

(Blouin & Carter 2010; Madeo & Omer 1994; Scholes & Wolfson 1990). This study is distinguished from prior studies in that the 2009 changes to the taxation of employee share options did not affect the tax consequences of the employer, only the employee. Further, the ability to classify option grants into taxable grants and non-taxable grants based on the statutory valuation factors provided in the legislation, arguably provides a cleaner test of the effect of taxes on stock option grants. In this respect, the finding that grants of taxable options decreased after 2009, while grants of non-taxable options increased, is more suggestive of a tax motivation.

4.3 Potential limitations

One limitation of this thesis is that actual R&D expenditure is not directly observed, so the tests in Chapter 2 do not directly examine whether R&D expenditure increased after 2011. Very few of the firms in the sample have this data available in the Aspect Financial database, as most firms include R&D expenditure in their capitalised exploration balance (if they choose to capitalise E&E costs), or as part of exploration expense (if they choose to expense exploration costs), and do not break down these amounts further into their components. The tests of H2 only document companies received larger R&D refunds after 2011. While this would be consistent with R&D expenditure increasing, it is not clear how much of the increase in R&D refunds was due to the removal of the R&D expenditure cap. Before 2011, firms could only claim a maximum refundable R&D tax offset of $600,000 regardless of their R&D spend. Because the quantum of R&D spend that was not eligible for the tax offset before 2011 is not observed directly, Chapter 2 does not address whether the 2011 changes to the R&D tax incentive resulted in firms spending more on R&D. Having said that, the fact that the removal of the R&D expenditure cap resulted in larger R&D refunds after 2011 can be interpreted as *prima facie* evidence that the incentive is achieving at least part of its stated objective, by making cash refunds available to more firms.

Because the primary means of identifying firms that received an R&D tax refund is through disclosures in the quarterly cash flow statement, this may inadvertently exclude some firms that did not disclose the R&D refund received as a separate line item in the Appendix 5B. It is not possible to establish a definitive sample of R&D tax offset recipients without obtaining the names of individual applicants for the R&D tax incentive, which are confidential. However, many firms do appear to disclose the R&D refund separately in the Appendix 5B even if the amount received is small, as the smallest refund amount disclosed was $8,000, suggesting a high level of compliance with the ASX requirements.

In addition, some commodities that are not actively traded, such as lithium, graphite and rare earth elements (REEs), have a wide variety of applications, from battery manufacture to electronics. As a result, the measures of resource value and reserve value used in Chapter 2 of this thesis will not include the value of these commodities. To the extent that R&D is undertaken to investigate potential applications for commodities for which there is not necessarily an active market, this will bias against finding an association between resource and reserve values and receipt of an R&D tax refund. Despite this limitation, the results still show a positive relationship between receiving an R&D tax refund and the value of the firm's resources and reserves.

As noted in Chapter 2, the choice of the MEE setting is a strength of this thesis, given the homogeneity of firm objectives and the presence of a large number of small firms with tax losses, who also perform R&D. One drawback of this setting is a possible lack of generalizability to other important R&D settings, such as technology and pharmaceuticals. Having said that, however, these settings do have some similarities with the MEE sector, as R&D projects can take a number of years from conception to commercialisation, with the result that R&D firms may endure losses for a long period of time.

A limitation of the long-run returns analysis in Chapter 2 is that at the time of conducting the relevant return analyses, daily share price data was only available from SIRCA until December 2016. Given that the new R&D tax incentive commenced in 2011 and the first refunds issued under the new incentive would not have been received until late 2012 or early 2013, this limits the sample size for the long-run returns analysis. For example, only 68 firms had daily price data available for the full 60-month window over which the cumulative BHARs were calculated. These would have been firms that claimed the 30% refundable tax offset under the previous R&D concession that existed prior to 2011.

As discussed in Section 3.5, the procedure followed to identify firms with employee option plans in Chapter 3 may understate the number of firms that issue options to employees. Due to variations in disclosure quality across firms, it is not possible to establish a definitive sample of firms with employee share and option plans. The procedure used to identify firms with employee share and option plans for the purposes of this thesis involved filtering firms based on the announcement header, as the majority of Appendix 3B filings relate to changes in issued capital that do not pertain to employee equity plans. It was envisaged that the criteria for selecting Appendix 3Bs would be expanded from header queries to screening the entire document using text search software. However, this task was beyond the scope of this thesis, given the difficulty in coming up with an exhaustive list of text strings to search for, as a result of the sheer variety of employee share and option plans offered, each having different terms. Despite this limitation, however, the general trend observed in Chapter 3, whereby the number of option plans decreased since 2009, is broadly consistent with data from Link Market Services which indicated a decline in the popularity of option plans after 2009[91].

[91] Refer to page 7 of the February 2014 submission to Treasury by Employee Ownership Australia, attached at Appendix J.

Alternative explanations for the findings in Chapter 3 cannot be ruled out. For example, there may be other reasons why options have become less popular. During the past decade, there has been evidence of a shift away from employee stock options towards restricted shares (Abudy & Benninga 2016). Irving, Landsman & Lindsey (2011) suggest that restricted shares are more valuable to employees than stock options, because they will always be in the money when vesting conditions are met if the firm has a positive share price. It is also possible that lower share prices following the global financial crisis in 2008 resulted in reduced demand for employee options. Lower commodity prices may also lead to lower demand for stock options in the extractive industries context.

4.4 Suggestions for future research

Prior studies have considered the role of expert informational intermediaries such as auditors and underwriters in conveying information to investors to aid them in security valuation. For example, Weber & Willenborg (2003) consider the role of the auditor in small, "microcap" IPOs, a segment of the market where it can be difficult to assess project quality, and an extensive body of literature has considered the role of underwriters in conveying reputational signals to markets (Beatty & Ritter 1986). In the Australian setting, Brown, Ferguson & Stone (2008) find that share purchase plans do not perform as badly if they are underwritten, or if the issuing firm is audited by a large audit firm. In the MEE context, Ferguson & Pündrich (2015) consider the role of specialist mining consultants in helping investors assess the valuation implications of resource and reserve disclosures.

The 'underwriter certification' argument is not examined in this thesis, as the role of outside experts is less clear in the case of the R&DTI. Because the R&DTI operates on a self-assessment basis, the monitoring role played by ATO and AusIndustry in administering the program is limited. For example, while program registrants do have the ability to request an advance finding from AusIndustry to provide certainty regarding the eligibility of their proposed R&D activities, this is not mandatory. Further, AusIndustry's role in preparing advance findings is largely to confirm the eligibility of the proposed activities; the government does not attempt to pick winners.

A pertinent question, therefore, is who are the outside experts involved in the R&DTI? It could be argued that some specialist R&D advisers who assist in the preparation of R&D claims provide a certification role, similar to the role of specialist mining consultants who assist in the preparation of resource and reserve estimates. This is not tested in this thesis, as R&D advisers are generally not named when the company announces receipt of an R&D tax refund. Further, there are competing predictions regarding the role of R&D advisers, given recent reports that the ATO has been targeting R&D claims prepared by advisers that it believes have been too aggressive in claiming activities that are not pure R&D (Smith & Gillezeau 2018).

Given the highly technical nature of geological information, one might conjecture that certification in the context of R&D-performing MEEs might come from alternative sources. For example, in recent years, State and Territory governments have invested in several initiatives to encourage exploration and development in the resources sector. Most of these initiatives involve the award of grants to support exploration and drilling, such as the South Australian Government's Plan for Accelerating Exploration (PACE) program (Economics Consulting Services 2014). These initiatives are competitive schemes which allocate seed funding for exploration to participants undertaking innovative drilling projects, based on the technical merit of their applications. Applications are typically ranked according to a set of criteria, which include, *inter alia*, whether the proposal addresses a significant knowledge gap or critical uncertainties in underexplored areas. Because these grants are competitive, success in being allocated funding could plausibly provide a signal of project quality in an environment of high information asymmetry. This may be a fruitful area for further research.

As a result of the long investment lags typically seen in the MEE sector (where projects take several years to complete) and the fact that very few MEEs progress to become producers, this thesis does not directly address the success of the R&D tax incentive, as the quality and success of the R&D is unobservable. Therefore, this thesis does not provide an answer to the question of whether the increased cost to Treasury of expanding the R&D incentive is likely to result in increased tax revenues. Accordingly, this question is left for future research.

Given the findings of Chapter 3, which are consistent with taxes being an important factor in employee compensation plan design, an open empirical question is the extent to which the change in option grant patterns observed after 2009 reflects a desire for tax minimisation on the part of the employee, or an incentive alignment motivation. While the tendency of firms to issue more non-taxable options after 2009 suggests a tax motivation, firms with more growth opportunities may also be inclined to issue more lower-priced options (i.e., those that are more deeply out of the money at the time of grant), as a long-term incentive. While this would lower the option value (and hence the employee's potential tax liability) because of the lower probability of vesting, this might also be used by small, high-risk companies to attract less risk-averse (i.e., risk-seeking) employees who are more likely to choose employers based on the prospect of realising large future gains should the company succeed. This leads to the following unanswered question: how did the changes to the taxation of employee stock options in 2009 affect employee risk-taking? As this question is beyond the scope of this thesis, it is left for future research.

Another avenue for future research might be the increasing popularity of non-Division 83A employee share plans, such as loan-funded share plans which operate outside the employee share scheme rules in the ITAA97. Who is likely to choose these plans, and why? For example, these plans typically involve contributions by the employer into an employee share trust, which then acquires shares in the employer company for the benefit of the employees (Basker 2013). Because contributions to employee share trusts are generally tax-deductible, they might be more attractive from the point of view of an employer who has sufficient taxable income and therefore can benefit from the tax deductions.

Lastly, the changes to the employee share scheme rules may offer a fruitful setting in which to examine the effect of taxes on the pay-performance relation of equity-based compensation. The introduction of the real risk of forfeiture requirement effectively meant that only those employee share and option plans with meaningful performance hurdles would qualify for deferred income tax treatment. In this way, the tax rules *prima facie* provided an incentive for firms to make greater use of performance-based pay. This may be another avenue for future research.

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6 TABLES AND FIGURES

Table 2.1: Core Features of the R&D Tax Incentive[92]

Program component	Features
Tax offset	• Refundable tax offset of 43.5% (45% for income years commencing before 1 July 2016) for eligible entities with annual turnover of less than $20m • Non-refundable tax offset of 38.5% (40% for income years commencing before 1 July 2016) for all other eligible entities
Eligible entities	Entities that are: • Incorporated under an Australian law; • Incorporated under foreign law and resident in Australia for tax purposes; • Incorporated under foreign law and resident of a foreign country with a DTA with Australia that carries on business through a permanent establishment in Australia; and • Public trading trusts with a corporate trustee.
Accessing the programme	Entities self-assess whether they are eligible and must register with AusIndustry up to 10 months after the end of their income year. They then lodge a claim with the ATO when they complete their tax return.
Eligible R&D Activities	The R&D tax offset applies to core and supporting R&D activities undertaken in Australia. Some overseas activities may be eligible (subject to an advance finding first being sought from AusIndustry), if they cannot be conducted in Australia and they have a significant scientific link to core R&D activities carried on in Australia.
Core R&D activities	Experimental activities whose outcome cannot be known or determined in advance on the basis of current knowledge, information or experience, but can only be determined by applying a systematic progression of work, that: • is based on principles of established science; and • proceeds from hypothesis to experiment, observation and evaluation and leads to logical conclusions; and • is conducted for the purpose of generating new knowledge (including new knowledge in the form of new or improved materials, products, devices, processes or services).
Supporting R&D activities	Activities directly related to core R&D activities that are undertaken for the dominant purpose of supporting core R&D activities.
Expenditure cap	Annual R&D expenditure threshold of $100 million. Expenditure over $100 million is subject to a reduced tax offset rate of 30%.
Notional deductions	Expenditure eligible for the R&D tax offset for which a deduction would normally be available is treated as non-deductible when the entity completes it tax return.
Unused tax offsets	For the non-refundable tax offset, unused tax offsets can be carried forward for use in a later income year.

[92] Source: Department of Industry, Innovation and Science (2016), "The R&D Tax Incentive: A Guide to Interpretation", business.gov.au/taxincentive

Table 2.2: History of R&D tax concessions in Australia

Date	Details
1985	Bonus tax deduction of 150% on eligible R&D expenditure.
1989	The 150% tax concession scheme was expanded to allow Syndication. This permitted projects that were carried out by a group of companies.
1996	Concerns about possible abuses of syndication through some of the financing schemes deployed led to the scheme being dropped.
	Bonus tax deduction for R&D was cut from 150% to 125%; scope of eligible expenditure was narrowed to exclude interest on debt.
2001	Incremental tax concession (175% premium deduction) introduced, allowing firms to claim an additional 50% deduction on the portion of eligible R&D expenditure exceeding the average nominal expenditure over the past 3 years.
	Firms incorporated in Australia with R&D group turnover[93] of less than $5 million could claim a refundable tax offset of 30% for eligible R&D expenditure between $20,000 and $1 million.
2007	The 175% premium deduction was extended to Australian incorporated companies belonging to multinational enterprise groups.
2009	Expenditure cap for the 30% refundable tax offset increased to $2 million. All other eligibility criteria unchanged.
2011	45% refundable tax offset for eligible entities (including companies incorporated overseas that are resident in Australia) with an aggregated turnover[94] of less than $20 million and R&D expenditure greater than $20,000.
	40% non-refundable tax offset for all other eligible entities. Unused tax offsets can be carried forward for use in a later income year, provided that the tax offset carry-forward rules in Division 65 are satisfied.
2014	Reduced tax offset for entities with R&D notional deductions exceeding $100 million.
2016	The rates of the refundable tax offset and the non-refundable tax offset were lowered from 45% to 43.5% and from 40% to 38.5%, respectively.

[93] "R&D group turnover" is based on the GST-exclusive value of supplies made by the company during the income year in the ordinary course of carrying on a business. Refer to s 73K of the ITAA1936 (repealed). "Supplies" have the same meaning as in the GST Act.
[94] "Aggregated turnover" is defined as the total ordinary income derived by the taxpayer in the ordinary course of carrying on a business. Refer to section 328-115 of the ITAA 1997.

Table 2.3: Timeline of Key Events in the Development of the R&D Tax Incentive

Date	Description of Event
22 January 2008	The then Federal Minister for Innovation, Industry Science and Research commissions a review of the national innovation system, including the R&D concessional regime.
29 August 2008	The Review Panel releases its findings and recommendations in respect of the current national innovation system in the Cutler Report, specifically identifying problems with the R&D concession regime.
12 May 2009	Changes to the R&D tax concession announced as part of the Australian Government's innovation policy agenda
18 September 2009	Treasury releases a consultation paper 'The New Research and Development Tax Incentive'
18 December 2009	Draft legislation for the new R&D tax incentive released
15 June 2011	R&D tax incentive legislation passes Parliament
1 July 2011	Start date for the new R&D tax incentive
8 September 2011	R&D tax incentive legislation receives Royal Assent
13 May 2014	The Australian Federal Government announced that the rates for the R&D tax incentives would be reduced.
7 December 2015	Government launches National Innovation and Science Agenda, including a commitment to review the R&D tax incentive program.
10 February 2016	The government releases an issues paper to assist in the review of the Research and Development (R&D) tax incentive.
4 April 2016	Finkel Review report released
31 August 2016	Budget Savings (Omnibus) Bill 2016 introduced into Parliament, including provisions for the reduction of the rates of the R&D tax offset

Table 2.4: Tax benefits provided by the R&D tax incentive

	Former R&D Tax Concession		Non-Refundable Tax Offset		Refundable Tax Offset	
	Tax Profit Example	**Tax Loss Example**	**Tax Profit Example**	**Tax Loss Example**	**Tax Profit Example**	**Tax Loss Example**
Assessable income	$10,000,000	-	$10,000,000	-	$10,000,000	-
Allowable deductions including eligible R&D	$6,000,000	$6,000,000	$6,000,000	$6,000,000	$6,000,000	$6,000,000
Eligible R&D expenditure (non-deductible)	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
R&D tax concession bonus deduction @ 125%	$1,250,000	$1,250,000	-	-	-	-
Taxable income	$3,750,000	-	$5,000,000	-	$5,000,000	-
Tax liability @ 30%	$1,125,000	-	$1,500,000	-	$1,500,000	-
Non-refundable tax offset @ 38.5%	-	-	$385,000	-	-	-
Refundable tax offset @ 43.5%	-	-	-	-	$435,000	$435,000
Tax payable / (refundable)	$1,125,000	-	$1,115,000	-	$1,065,000	($435,000)
Unused tax losses carried forward	-	$6,250,000	-	$5,000,000	-	$5,000,000
Unused tax offsets carried forward	-	-	-	$385,000	-	-
Net tax benefit of R&D incentives	$75,000		$85,000		$135,000	
Net value of assistance provided	7.5%		8.5%		13.5%	

Table 2.5: Tax losses deducted in 2015-16, mining industry, all companies

Mining industry sub-groups	Tax losses deducted ($)	Tax losses carried forward ($)	Tax losses deducted as a percentage of tax loss carry forwards
Coal Mining	292,607,813	23,591,428,500	1.2%
Oil and Gas Extraction	167,258,993	30,943,328,503	0.5%
Metal Ore Mining	858,983,706	25,581,172,737	3.4%
Construction Material Mining	22,240,989	193,217,441	11.5%
Other Non-Metallic Mineral Mining and Quarrying	140,587,686	6,331,520,168	2.2%
Exploration	344,932,099	40,994,638,877	0.8%
Other Mining Support Services	266,022,127	1,955,844,328	13.6%
Total	**2,092,633,413**	**129,591,150,554**	**1.6%**

Source: ATO Taxation Statistics 2015-16

Table 2.6: Excerpt from ATO Taxation Statistics (Broad Industry Classification: Mining; Fine Industry Classification: Exploration)

Year	Total companies	Number of companies claiming the refundable R&D tax offset	% of total companies	Total amount claimed ($)	Average amount claimed ($)
2012	2,005	200	10.0%	175,301,816	876,509
2013	2,145	265	12.4%	168,524,391	635,941
2014	2,060	223	10.8%	132,283,748	593,201
2015	2,138	243	11.4%	123,268,400	507,277
2016	1,971	201	10.2%	108,844,131	541,513
2017	2,098	180	8.6%	88,665,921	492,588
	12,417	**1,312**	**10.6%**	**796,888,407**	**607,838**

Table 2.7: Sample construction

Panel A: Full sample

	Firms	Firm-years
All ASX-listed companies that lodged quarterly Appendix 5B reports between 2008 to 2015	1,135	6,742
Less: Firms not covered by the Aspect Financial database	237	777
Less: Non-mining firms	52	802
Final sample, 2008 to 2015	846	5,163

Panel B: Firms claiming the R&D tax offset only

	Number of firms claiming offset	Total claimed ($)	Average refund ($)
2008	11	2,427,025	220,639
2009	26	7,294,297	280,550
2010	27	6,125,000	226,852
2011	48	19,545,179	407,191
2012	66	61,671,291	934,414
2013	107	142,574,365	1,332,471
2014	105	97,557,817	929,122
2015	99	101,245,000	1,022,677
	489	**438,439,974**	**669,239**

Table 2.8: Breakdown of active projects by commodity type and location

Panel A – Primary commodities

	Precious Metals	**Base Metals**	**Bulk Commodities**	**Other**	**Total**
	Gold	Aluminium	Coal	Lithium	
	Platinum	Bauxite	Iron Ore	Graphite	
	Silver	Cobalt		Heavy Mineral Sands	
		Copper		Ilmenite	
		Lead		Lanthanides	
		Manganese		Phosphate	
		Molybdenum		Scandium	
		Nickel		Tantalum	
		Tin		Tungsten	
		Vanadium		U3O8	
No. of active projects	425	293	227	189	1,134
% of total	37.48%	25.84%	20.02%	16.67%	
Less: Projects with commodity prices unavailable	-	40	-	137	177
Final sample	425	253	227	52	957
% of total	44.41%	26.44%	23.72%	5.43%	

Panel B – Project Location

Region	Projects	% of Total
Africa	154	13.58%
Asia & Middle East	92	8.11%
Australia & Oceania	702	61.90%
Central America	7	0.62%
Europe	40	3.53%
North America	64	5.64%
South America	75	6.61%
Total	1,134	

Table 2.9: Characteristics of R&D tax offset claimants and non-claimants

	(1) Non-claimers (3,668)					(2) Claimers (1,631)					*t*-test for difference in means (1) - (2)
Variable	Mean	Median	S.D.	Min	Max	Mean	Median	S.D.	Min	Max	
Age	1,837.13	1,431	1,743.44	-	16,260.0	1,815.25	1,559	1322.97	4.0	8,377	0.4521
Size	165.0	14.2	1,310.0	0.0182	39,800.0	44.9	13.0	144.0	0.0160	3,080.0	3.71***
TotalAssets	259.0	15.2	2,320.0	0.0115	54,600.0	38.1	13.3	121.0	0.0068	2,260.0	3.85***
MTR	0.0347	0.00	0.0888	0.00	0.30	0.0112	0.00	0.05	0.00	0.3	9.99***
RetEarnings	-1.86	-15.6	637.0	-3,790.0	17,900.0	-31.4	-14.8	68.2	-1,810.0	97.2	1.87*
Issuance	12.2	1.36	65.5	-	2,490.00	6.33	1.67	15.5	-	213.0	3.562***
CashBurn	4.53	0.4822	91.32	-	5,440.75	2.27	0.5861	6.75	-	126.9	1.000
DeferredAsset	18.1	4.35	66.3	-	1,870.0	15.9	6.40	29.4	-	335.0	1.304
Top20	0.6120	0.6076	0.1713	0.0686	1.00	0.5725	0.5715	0.1668	0.0881	1.00	7.741***
Exploration	10.8	1.39	112.0	-	5,930.0	4.56	1.91	11.5	-	247.0	2.23**
MTB	2.6662	1.11	11.06	0.0008	402.74	2.49	1.09	8.39	0.0579	202.5	0.568
Mining	0.7369	1.00	0.44	0.00	1.00	0.7915	1.00	0.41	0.00	1.00	-4.267***
Energy	0.2631	0.00	0.44	0.00	1.00	0.2085	0.00	0.41	0.00	1.00	4.267***
ResourceValue	10,000	-	68.1	-	1,660,000	6,020.00	-	30,600.0	-	698,000	2.27**
ReserveValue	2,030	-	16.6	-	381,000	981.0	-	8,690.0	-	204,000	2.42**
SingleProject	0.171	0.00	0.3763	0.00	1.00	0.2728	0.00	0.4456	0.00	1.00	-8.61***
Foreign	0.165	0.00	0.3709	0.00	1.00	0.0846	0.00	0.2784	0.00	1.00	7.79***
Precious	0.206	0.00	0.4042	0.00	1.00	0.1521	0.00	0.3592	0.00	1.00	4.60***
Base	0.108	0.00	0.3104	0.00	1.00	0.1680	0.00	0.3740	0.00	1.00	-6.09***
Bulks	0.067	0.00	0.2502	0.00	1.00	0.0656	0.00	0.2477	0.00	1.00	0.197
Others	0.068	0.00	0.2511	0.00	1.00	0.1122	0.00	0.3157	0.00	1.00	-5.50***

Table 2.9: Characteristics of R&D tax offset claimants and non-claimants (continued)

The above table compares characteristics of firms that received the R&D tax offset and firms that did not. T-statistics are used to compare the means of each group. The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels.

Age = the number of days since ASX listing; *Size* = end of year market capitalisation; *TotalAssets* = closing total assets; *MTR* = Plesko's (2003) trichotomous measure of marginal tax rate; *RetEarnings* = balance of retained earnings; *Issuance* = value of equity issued during the year; *CashBurn* = ratio of cash holdings to annual cash requirements; *DeferredAsset* = capitalised exploration balance; *Top20* = percentage of shares held by top 20 shareholders; *Exploration* = total payments for exploration and evaluation; *MTB* = market to book ratio; *Mining* = dummy coded 1 for mining firms and 0 otherwise; *Energy* = dummy coded 1 for oil and gas firms and 0 otherwise; *ResourceValue* = value of resources measured at the end of the year; *ReserveValue* = value of reserves measured at the end of the year; *SingleProject* = dummy coded 1 if the firm only has one active (flagship) project and 0 otherwise; *Foreign* = dummy coded 1 if the firm does not have any Australian projects and 0 otherwise; *Precious*, *Base*, *Bulks* and *Others* are indicator variables based on the firm's primary deposit commodity to distinguish between companies that are focused on precious metals, base metals, bulk commodities and other minerals. The 'other' category includes rare earths and energy metals such as uranium. *Size*, *TotalAssets*, *RetEarnings*, *Issuance*, *DeferredAsset*, *Exploration*, *ResourceValue* and *ReserveValue* are in millions of dollars.

Table 2.10: Non-parametric Mann-Whitney test for equality of the distributions of key variables across claimants and non-claimants

Variable	Non-claimers (3,668 firm years)		Claimers (1,631 firm years)		Pearson chi-squared statistic	*p*-value
	Less than or equal to the median	Greater than the median	Less than or equal to the median	Greater than the median		
Age	1,879	1,789	773	858	6.481	0.011**
Size	1,804	1,864	846	785	3.156	0.076*
TotalAssets	1,794	1,874	856	775	5.625	0.018**
MTR	3,137	531	1,542	89	88.034	<0.001***
RetEarnings	1,854	1,814	796	835	1.30	0.254
Issuance	1,870	1,798	780	851	4.378	0.034**
CashBurn	1,880	1,788	770	861	7.224	0.007***
DeferredAsset	1,927	1,741	723	908	30.083	<0.001***
Top20	1,677	1,871	908	710	34.481	<0.001***
Exploration	1,917	1,751	733	898	23.913	<0.001***
MTB	1,746	1,763	802	784	0.255	0.614
Mining	3,668	-	1,631	-		
Energy	2,703	965	1,291	340	17.856	<0.001***
ResourceValue	2,610	1,058	1,030	601	33.264	<0.001***
ReserveValue	3,228	440	1,454	177	1.3257	0.250
SingleProject	3,042	626	1,186	445	72.453	<0.001***
Foreign	3,064	604	1,493	138	59.425	<0.001***
Precious	2,914	754	1,383	248	20.733	<0.001***
Base	3,272	396	1,357	274	36.298	<0.001***
Bulks	3,422	246	1,524	107	0.0189	0.891
Others	3,420	248	1,448	183	29.447	<0.001***

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. All variables as defined in Table 2.9.

Table 2.11: Descriptive Statistics

Variable	Obs	Mean	Median	SD	Min	Max
RD	5,163	0.0941	0.000	0.2920	0.000	1.0000
Claimer	5,163	0.3134	0.000	0.4639	0.000	1.0000
New	5,163	0.2101	0.000	0.4075	0.000	1.0000
Existing	5,163	0.0699	0.000	0.2550	0.000	1.0000
Repeat	5,163	0.1927	0.000	0.3945	0.000	1.0000
LnRefund	486	12.8976	12.8479	1.1952	8.854	16.9307
ScaledRefund	486	0.0674	0.0274	0.1090	0.000	0.5234
Age	5,163	7.0946	7.2889	1.0597	1.000	9.6965
Size	5,163	16.5940	16.407	1.6657	9.682	24.2308
MTR	5,163	0.0266	0.000	0.0786	0.000	0.3000
Issuance	5,163	6,584,237	1,479,000	13,100,000.0	-	60,600,000.0
PriceMove	5,163	0.0186	-0.0944	0.2045	-0.221	0.3650
FXMove	5,163	0.0019	-0.0489	0.1458	-0.188	0.2836
CashBurn	5,163	1.9164	0.528	3.5285	-	16.7754
DeferredAsset	5,163	13,100,000	5,130,256	20,500,000	-	89,000,000
Top20	5,163	0.5997	0.5965	0.1709	0.069	1.0000
Exploration	5,163	4,615,034	1,575,856	7,765,754	-	34,800,000
MTB	4,984	1.9630	1.106	2.3532	0.001	11.4851
ResourceValue	5,163	116.0031	-	352.6355	-	1,658.799
ReserveValue	5,163	4.2319	-	16.1764	-	82.248
SingleProject	5,163	0.2034	0.000	0.4025	0.000	1.0000
Foreign	5,163	0.1408	0.000	0.3479	0.000	1.0000
Precious	5,163	0.1904	0.000	0.3926	0.000	1.0000
Base	5,163	0.1259	0.000	0.3318	0.000	1.0000
Bulks	5,163	0.0682	0.000	0.2521	0.000	1.0000
Others	5,163	0.0784	0.000	0.2689	0.000	1.0000

RD = dummy variable coded 1 if the firm received an R&D tax refund during the year and 0 otherwise;
Claimer = dummy coded 1 if the firm received at least one R&D tax refund between 2008 and 2015;
New = dummy coded 1 if the firm first disclosed receipt of an R&D tax refund after 2011 and 0 otherwise;
Existing = dummy coded 1 if the firm disclosed receipt of an R&D tax refund before 2011 and also disclosed receipt of at least one R&D tax refund after 2011, and 0 otherwise;
Repeat = dummy coded 1 if the firm disclosed receipt of more than one R&D tax refund between 2008 and 2015 and 0 otherwise;
LnRefund = natural logarithm of the R&D tax refund received during the year;
ScaledRefund = the R&D tax refund received during the year, scaled by total assets;
Age = natural logarithm of the number of days since ASX listing;
Size = natural logarithm of end of year market capitalisation;
MTR = Plesko's (2003) trichotomous measure of marginal tax rate;
Issuance = value of equity issued during the year;
PriceMove = the percentage change in the spot price of the firm's primary deposit commodity over the previous 12 months;
FXMove = the percentage change in the \$A/\$USD exchange rate over the previous 12 months;
CashBurn = ratio of cash holdings to annual cash requirements;
DeferredAsset = capitalised exploration balance;

Table 2.11: Descriptive Statistics (continued)

Top20 = percentage of shares held by top 20 shareholders;
Exploration = total payments for exploration and evaluation;
MTB = market to book ratio;
ResourceValue = value of resources measured at the end of the year, scaled by market capitalization;
ReserveValue = value of reserves measured at the end of the year, scaled by market capitalization;
SingleProject = dummy coded 1 if the firm only has one active (flagship) project and 0 otherwise;
Foreign = dummy coded 1 if the firm does not have any Australian projects and 0 otherwise;
Precious, *Base*, *Bulks* and *Others* are dummy variables based on the firm's primary deposit commodity to distinguish between companies that are focused on precious metals, base metals, bulk commodities and other minerals. The 'other' category includes rare earths and energy metals such as uranium.
CashBurn, *DeferredAsset*, *Equity, ResourceValue, ReserveValue, Exploration*, *MTB,* and *Equity* are winsorized at the 97th percentile to minimize the impact of outliers.

Table 2.12: Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	1												
(2)	0.0828	1											
(3)	-0.04	0.1257	1										
(4)	-0.0675	0.1246	0.3748	1									
(5)	-0.0443	-0.0217	0.5352	0.1072	1								
(6)	-0.1076	-0.1376	0.1606	0.0157	0.154	1							
(7)	-0.0775	-0.1272	0.1943	0.0353	0.1641	0.6164	1						
(8)	-0.0363	-0.1062	0.0855	-0.005	0.1252	0.0775	0.0753	1					
(9)	0.0554	0.1103	0.4652	0.1714	0.2845	-0.0337	0.0001	-0.0038	1				
(10)	-0.0545	-0.0381	0.1228	0.1107	0.0904	-0.0772	-0.0649	0.0101	0.0955	1			
(11)	0.0471	0.0563	-0.0414	-0.0386	-0.0473	-0.0568	-0.0361	-0.0425	0.0516	0.0048	1		
(12)	0.038	0.0779	0.0934	0.0839	0.0193	-0.05	-0.0458	-0.0587	0.1113	0.0612	0.308	1	
(13)	-0.0187	0.1035	0.6012	0.3353	0.4143	0.0191	0.0444	0.0314	0.4782	0.0445	-0.0324	0.101	1

Variables: (1) *RD*; (2) *Age*; (3) *Size*; (4) *MTR*; (5) *Issuance*; (6) *PriceMove*; (7) *FXMove*; (8) *CashBurn*; (9) *DeferredAsset*; (10) *Top20*; (11) *ResourceValue*; (12) *ReserveValue*; (13) *Exploration*. All variables defined in Table 2.11.

Table 2.13: Tests of H1 – determinants of refundable R&D tax offset claims

Variables	Pred. Sign	(1) Dep. var. RD_{it}		(2) Dep. var. RD_{it} with *Resources* dummy	
		Coefficient	Z-stat.	Coefficient	Z-stat.
Constant		-3.6296	-4.56***	-3.6325	-4.55***
$Post_t$	+	1.1457	7.32***	1.1649	7.42***
Age_{it}	+	0.1809	3.30***	0.1715	3.12***
$Size_{it}$	-	0.0023	0.05	-0.0035	-0.08
MTR_{it}	-	-4.8227	-4.71***	-4.7604	-4.67***
$Issuance_{it}$	+	-0.0000	-1.39	-0.0000	-1.37
$PriceMove_t$	?	-0.6843	-1.61	-0.6913	-1.62
$FXMove_t$	?	0.8764	1.79*	0.8983	1.84*
$CashBurn_i$	-	-0.0171	-1.01	-0.0154	-0.92
$DeferredAsset_{it}$	+	0.0000	4.27***	0.0000	4.47***
$Top20_{it}$	?	-1.3870	-4.64***	-1.3560	-4.52***
$ResourceValue_{it}$	+	0.0002	1.78*		
$ReserveValue_{it}$	+	0.0059	2.11**		
$Resources_i$	+			0.5649	4.28***
$Precious_i$	-	-0.2773	-1.83*	-0.4977	-3.1***
$Base_i$	+	0.4551	3.20***	0.2332	1.54
$Bulks_i$	-	-0.1349	-0.63	-0.2146	-0.95
$Others_i$	+	0.5227	3.01***	0.2533	1.39
$Foreign_i$	-	-0.7967	-4.5***	-0.7725	-4.47***
$SingleProject_i$	+	0.3098	2.49**	0.0743	0.57
Observations		5,163		5,163	
Chi-squared statistic		302.11***		310.59***	
Pseudo R^2		9.38%		9.64%	
Log likelihood		-1459.7675		-1455.5268	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. *RD* = a dummy variable coded 1 if the firm received an R&D tax refund during the year and 0 otherwise; *Post* = dummy variable coded 1 for years 2012 and later; *Age* = natural logarithm of the number of days since ASX listing; *Size* = natural logarithm of end of year market capitalisation; *MTR* = Plesko's (2003) trichotomous measure of marginal tax rate; *Issuance* = value of equity issued during the year; *PriceMove* = the percentage change in the spot price of the firm's primary deposit commodity over the previous 12 months; *FXMove* = the percentage change in the $A/$USD exchange rate over the previous 12 months; *CashBurn* = ratio of cash holdings to annual cash requirements; *DeferredAsset* = capitalised exploration balance; *Top20* = percentage of shares held by top 20 shareholders; *ResourceValue* = value of resources measured at the end of the year, scaled by market capitalization; *ReserveValue* = value of reserves measured at the end of the year, scaled by market capitalization; *Resources* = dummy coded 1 if the firm has reported a mineral resource or ore reserve; *SingleProject* = dummy coded 1 if the firm only has one active (flagship) project and 0 otherwise; *Foreign* = dummy coded 1 if the firm does not have any Australian projects and 0 otherwise; *Precious*, *Base*, *Bulks* and *Others* are dummy variables based on the firm's primary deposit commodity to distinguish between companies that are focused on precious metals, base metals, bulk commodities and other minerals. The 'other' category includes rare earths and energy metals such as uranium. *CashBurn*, *DeferredAsset*, *Issuance, ResourceValue,* and *ReserveValue* are winsorized at the 97th percentile to minimize the impact of outliers.

Table 2.14: Tests of H1 by regressing RD_{it} on its hypothesised determinants in year $t - 1$

Variables	Pred. Sign	(1) Dep. var. RD_{it}		(2) Dep. var. RD_{it} with *Resources* dummy	
		Coefficient	**Z-stat.**	**Coefficient**	**Z-stat.**
Constant		-4.6239	-12.54***	-4.7028	-12.96***
$Post_t$	+	1.3360	9.53***	1.3695	9.76***
Age_{it-1}	+	0.1231	2.56**	0.1240	2.58**
$Size_{it-1}$	-	0.0617	2.24**	0.0564	2.07**
MTR_{it-1}	-	-6.7013	-6.04***	-6.7554	-6.11***
$Issuance_{it-1}$	+	-0.0000	-0.74	-0.0000	-0.84
$PriceMove_{t-1}$	?	1.1292	2.75***	1.1710	2.85***
$FXMove_{t-1}$	?	-2.0311	-4.22***	-2.1363	-4.43***
$CashBurn_{it-1}$	-	-0.0247	-1.54	-0.0222	-1.39
$DeferredAsset_{it-1}$	+	0.0000	3.94***	0.0000	4.09***
$Top20_{it-1}$	?	-0.6743	-2.54**	-0.6552	-2.45**
$ResourceValue_{it-1}$	+	0.0004	3.17***		
$ReserveValue_{it-1}$	+	0.0036	1.22		
$Resources_i$	+			0.6027	4.52***
$Precious_i$	-	-0.2642	-1.75*	-0.5169	-3.21***
$Base_i$	+	0.4738	3.34***	0.2283	1.5
$Bulks_i$	-	-0.2398	-1.03	-0.2973	-1.3
$Others_i$	+	0.4105	2.40**	0.1127	0.63
$Foreign_i$	-	-0.8123	-4.67***	-0.7961	-4.63***
$SingleProject_i$	+	0.3662	3.00***	0.1199	0.93
Observations		5,299		5,299	
Chi-squared statistic		337.0***		344.45***	
Pseudo R^2		10.33%		10.56%	
Log likelihood		-1462.46		-1458.73	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. Variables are defined in Table 2.13.

Table 2.15: Alternative model specifications for tests of H1

Variables	Pred. Sign	(1) Dep. var. *Claimer$_i$*		(2) Dep. var. *Claimer$_i$* with *Resources* dummy	
		Coefficient	Z-stat.	Coefficient	Z-stat.
Constant		0.0274	0.06	0.1375	0.30
Post$_t$	+	0.0583	0.69	0.0785	0.92
Age$_{it}$	+	0.0699	2.18**	0.0546	1.70*
Size$_{it}$	-	-0.0408	-1.59	-0.0525	-2.04**
MTR$_{it}$	-	-4.8632	-8.52***	-4.9615	-8.67***
Issuance$_{it}$	+	-0.0000	-3.19***	-0.0000	-3.34***
PriceMove$_t$	?	-0.0468	-0.22	-0.0692	-0.32
FXMove$_t$	?	0.2380	0.83	0.2905	1.00
CashBurn$_i$	-	-0.0019	-0.21	-0.0001	-0.01
DeferredAsset$_{it}$	+	0.0000	6.41***	0.0000	6.66***
Top20$_{it}$	?	-1.4066	-7.13***	-1.3830	-6.93***
ResourceValue$_{it}$	+	0.0004	4.32***		
ReserveValue$_{it}$	+	0.0005	0.23		
Resources$_i$	+			0.7640	8.93***
Precious$_i$	-	-0.1203	-1.31	-0.4742	-4.74***
Base$_i$	+	0.5644	5.80***	0.2348	2.24**
Bulks$_i$	-	0.1141	0.81	-0.1100	-0.78
Others$_i$	+	0.7678	6.52***	0.3965	3.20***
Foreign$_i$	-	-1.1631	-10.53***	-1.1663	-10.7***
SingleProject$_i$	+	0.6202	7.71***	0.3032	3.51***
Observations		5,163		5,163	
Chi-squared statistic		473.02***		532.98***	
Pseudo R^2		7.37%		8.3%	
Log likelihood		-2973.748		-2943.77	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. The dependent variable, *Claimer*, is a dummy variable coded 1 if the firm received at least one R&D tax refund between 2008 and 2015; all other variables are defined in Table 2.13 and Table 2.14.

Table 2.16: Tests of H2

Variables	Pred. Sign	(1) Dep. var. $Refund_{it}$			(2) Dep. var. $Refund_{it}$ with *New, Existing* and *Repeat* dummies		
		Coeff.	t-stat.	VIF	Coeff.	t-stat.	VIF
Constant		7.2821	8.61***		6.9312	7.97***	
$Post_t$	+	0.9907	5.88***	2.16			
New_i	+				1.1256	5.39***	4.69
$Existing_i$	+				0.6994	3.34***	4.43
$Repeat_i$	+				-0.3645	-2.67***	1.24
Age_{it}	+	0.0221	0.36	1.11	0.0597	0.99	1.10
$Size_{it}$	-	0.3154	6.96***	1.50	0.3266	7.21***	1.52
MTR_{it}	-	-0.3075	-0.3	1.06	-0.4645	-0.45	1.06
$Issuance_{it}$	+	-0.0000	-2.05**	1.08	-0.0000	-1.57	1.08
$PriceMove_t$	?	0.0679	0.15	1.76	-0.4787	-1.12	1.52
$FXMove_t$	?	0.0737	0.16	1.71	-0.5314	-1.21	1.51
$CashBurn_{it}$	-	-0.0197	-1.17	1.07	-0.0239	-1.42	1.07
$DeferredAsset_{it}$	+	0.0000	2.33***	1.32	0.0000	2.61***	1.32
$Top20_{it}$	?	-0.8350	-2.6***	1.13	-0.8130	-2.54**	1.14
$ResourceValue_{it}$	+	0.0002	1.1	1.38	0.0002	1.08	1.40
$ReserveValue_{it}$	+	-0.0062	-2.3**	1.18	-0.0068	-2.53**	1.17
$Precious_i$	-	0.1181	0.76	1.25	0.0301	0.19	1.28
$Base_i$	+	0.0589	0.44	1.19	0.0761	0.56	1.21
$Bulks_i$	-	-0.1008	-0.44	1.28	-0.1611	-0.7	1.29
$Others_i$	+	-0.2059	-1.21	1.23	-0.2390	-1.4	1.26
$Foreign_i$	-	-0.1072	-0.61	1.13	-0.0621	-0.35	1.16
$SingleProject_i$	+	0.0873	0.72	1.20	0.0954	0.79	1.20
Observations		486			486		
F-statistic		8.23***			2.71***		
Adjusted R^2		21.16%			6.58%		
Root MSE		1.0612			0.2140		

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. The dependent variable, *Refund*, is the natural logarithm of the R&D tax refund received during the year. *Post* = dummy variable coded 1 for years 2012 and later; *New* = dummy coded 1 if the firm first disclosed receipt of an R&D tax refund after 2011 and 0 otherwise; *Existing* = dummy coded 1 if the firm disclosed receipt of an R&D tax refund before 2011 and also disclosed receipt of at least one R&D tax refund after 2011, and 0 otherwise; *Repeat* = dummy coded 1 if the firm disclosed receipt of more than one R&D tax refund between 2008 and 2015 and 0 otherwise; all other variables defined in table 2.13.

Table 2.17: Tests of H2 (dependent variable scaled by total assets)

Variables	Pred. Sign	(1) Dep. var. *Refund*$_{it}$			(2) Dep. var. *Refund*$_{it}$ with *New, Existing* and *Repeat* dummies		
		Coeff.	**t-stat.**	**VIF**	**Coeff.**	**t-stat.**	**VIF**
Constant		0.2051	2.53**		0.1625	1.96*	
Post$_t$	+	0.0495	3.07***	2.16			
New$_i$	+				0.0593	2.98***	4.69
Existing$_i$	+				0.0131	0.65	4.43
Repeat$_i$	+				0.0018	0.14	1.24
Age$_{it}$	+	-0.0020	-0.34	1.11	0.0002	0.04	1.1
Size$_{it}$	-	-0.0077	-1.78*	1.50	-0.0065	-1.51	1.52
MTR$_{it}$	-	-0.0499	-0.5	1.06	-0.0493	-0.5	1.06
Equity$_{it}$	+	-0.0000	-1.09	1.08	-0.0000	-0.66	1.08
PriceMove$_t$	?	0.0029	0.07	1.76	-0.0124	-0.31	1.52
FXMove$_t$	?	0.0013	0.03	1.71	-0.0156	-0.37	1.51
CashBurn$_{it}$	-	-0.0042	-2.58**	1.07	-0.0044	-2.77***	1.07
DeferredAsset$_{it}$	+	-0.0000	-4.93***	1.32	-0.0000	-4.73***	1.32
Top20$_{it}$	?	-0.0048	-0.16	1.13	0.0016	0.05	1.14
ResourceValue$_{it}$	+	-0.0000	-0.98	1.38	-0.0000	-0.73	1.40
ReserveValue$_{it}$	+	-0.0003	-1.17	1.18	-0.0003	-1.29	1.17
Precious$_i$	-	0.0123	0.83	1.25	0.0048	0.32	1.28
Base$_i$	+	0.0164	1.27	1.19	0.0159	1.23	1.21
Bulks$_i$	-	0.0378	1.72*	1.28	0.0306	1.4	1.29
Others$_i$	+	0.0140	0.86	1.23	0.0130	0.8	1.26
Foreign$_i$	-	-0.0113	-0.67	1.13	-0.0146	-0.86	1.16
SingleProject$_i$	+	-0.0238	-2.05	1.2	-0.0225	-1.96*	1.20
Observations		486			486		
F-statistic		5.14***			5.24***		
Adjusted R^2		13.32%			14.87%		
Root MSE		0.1015			0.1006		

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. The dependent variable, *Refund*, is the R&D tax refund received during the year scaled by total assets; the dependent variable therefore captures the intensity of the entity's R&D. *Post* = dummy variable coded 1 for years 2012 and later; *New* = dummy coded 1 if the firm first disclosed receipt of an R&D tax refund after 2011 and 0 otherwise; *Existing* = dummy coded 1 if the firm disclosed receipt of an R&D tax refund before 2011 and also disclosed receipt of at least one R&D tax refund after 2011, and 0 otherwise; *Repeat* = dummy coded 1 if the firm disclosed receipt of more than one R&D tax refund between 2008 and 2015 and 0 otherwise; all other variables defined in table 2.13.

Table 2.18: Tests of H3 with $Exploration_{it}$ and $Exploration_{it+1}$

Variables	Pred. Sign	(1) Dep. var. $Exploration_{it}$		(2) Dep. var. $Exploration_{it+1}$	
		Coeff.	t-stat.	Coeff.	t-stat.
Constant		4.8248	5.15***	6.1773	5.91***
$Post_t$	?	0.0991	0.50	-0.5063	-2.29**
RD_i	+	0.3617	1.70*	0.8172	3.45***
$Post_t \times RD_i$	+	0.0035	0.01	-0.1412	-0.44
Age_{it}	-	0.0532	0.80	-0.0850	-1.15
$Size_{it}$	+	0.5500	10.64***	0.5116	8.87***
MTR_{it}	-	-0.7402	-0.79	1.1726	1.12
$Issuance_{it}$	+	-0.0000	-2.69***	-0.0000	-0.37
$PriceMove_t$	+	0.0008	0.00	0.0584	0.12
$FXMove_t$	-	-0.3994	-0.66	-0.4019	-0.59
$CashBurn_{it}$	+	0.0215	1.12	0.0665	3.11***
$DeferredAsset_{it}$	-	0.0000	15.58***	0.0000	9.92***
$Top20_{it}$	?	-4.7207	-11.47***	-5.7436	-12.51***
$ResourceValue_{it}$	-	-0.0004	-2.15**	-0.0000	-0.21
$ReserveValue_{it}$	-	-0.0033	-0.75	-0.0023	-0.47
$Precious_i$	+	0.7480	4.01***	1.5567	7.48***
$Base_i$	+	0.7153	3.30***	1.4721	6.09***
$Bulks_i$	-	-0.2630	-0.90	0.2094	0.64
$Others_i$	+	-0.0432	-0.16	0.3582	1.22
$Foreign_i$	+	0.3574	1.73*	0.5069	2.20**
$SingleProject_i$	+	0.3294	1.86*	0.5316	2.69***
Observations		5,163		5,163	
F-statistic		40.04***		32.13***	
Adjusted R^2		13.14%		10.76%	
Root MSE		4.7596		5.3106	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. The dependent variable, *Exploration*, is the natural logarithm of total payments for exploration and evaluation. *Post* = dummy variable coded 1 for years 2012 and later; *RD* = dummy coded 1 if the firm received at least one R&D tax refund between 2008 and 2015; all other variables defined in table 2.13.

Table 2.19: Tests of H3 with $Issuance_{it+1}$ (log transformed) and MTB_{it}

Variables	Pred. Sign	(1) Dep. var. $Issuance_{it+1}$		Pred. Sign	(2) Dep. var. MTB_{it}	
		Coeff.	t-stat.		Coeff.	t-stat.
Constant		22.238	12.01***		-8.3277	-19.39***
$Post_t$	?	-1.5374	-3.93***	?	-0.1930	-2.14**
RD_i	+	0.8256	1.98**	+	-0.0677	-0.71
$Post_t \times RD_i$	+	0.0308	0.05	+	0.2254	1.73*
Age_{it}	-	-0.0758	-0.58	-	0.0203	0.67
$Size_{it}$	+	-0.4246	-4.18***	+	0.6531	27.38***
MTR_{it}	-	-14.0859	-7.59***	-	-5.2434	-12.46***
$Issuance_{it}$	+	0.2056	15.03***	+	0.0000	1.49
$PriceMove_t$	+	1.2402	1.40	+	0.0905	0.45
$FXMove_t$	-	-3.0780	-2.58**	-	0.1352	0.49
$CashBurn_{it}$	-	-0.2134	-5.67***	+	-0.0615	-7.16***
$DeferredAsset_{it}$	-	0.0000	0.46	+	-0.0000	-22.42***
$Top20_{it}$	?	-7.9857	-9.98***	?	0.2709	1.43
$ResourceValue_{it}$	-	0.0001	0.13	-	-0.0001	-1.17
$ReserveValue_{it}$	-	-0.0034	-0.40	+	-0.0055	-2.72***
$Precious_i$	+	0.8678	2.36**	+	-0.1662	-1.95*
$Base_i$	+	0.6220	1.46	+	-0.0517	-0.53
$Bulks_i$	-	-0.4303	-0.75	-	0.1262	0.96
$Others_i$	+	1.3934	2.69***	+	0.0655	0.55
$Foreign_i$	+	1.3685	3.36***	+	-0.0055	-0.06
$SingleProject_i$	+	0.4336	1.24	+	0.0742	0.92
Observations		5,163			4,984	
F-statistic		40.8***			56.71***	
Adjusted R^2		13.36%			18.27%	
Root MSE		9.367			2.127	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. The dependent variable in Panel (1), *Issuance,* is the natural logarithm of the value of equity issued during the year. The dependent variable in Panel (2), *MTB*, is the market-to-book ratio. *Post* = dummy variable coded 1 for years 2012 and later; *RD* = dummy coded 1 if the firm received at least one R&D tax refund between 2008 and 2015; all other variables defined in table 2.13.

Table 2.20: Tests of H4 – valuation of R&D

Variables	Pred. Sign	Dep. var. MVE_{it}	
		Coeff.	t-stat.
Constant		0.3431	18.25***
$ResourceValue_{it}$	-	0.0000	0.58
$ReserveValue_{it}$	+	0.0014	5.63***
RD_{it}	+	-0.2123	-3.40***
BVE_{it}	+	0.0069	17.69***
$ResourceValue_{it} \times RD_{it}$	+	0.0000	0.10
$ReserveValue_{it} \times RD_{it}$	+	0.0005	0.34
Observations		5,299	
F-statistic		70.88***	
Adjusted R^2		7.33%	
Root MSE		1.2912	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. The dependent variable, *MVE*, is the end of period market value of equity. *ResourceValue* = value of resources at the end of the year; *ReserveValue* = value of reserves at the end of the year; *RD* = dummy coded 1 if the firm received an R&D tax refund during the year; *BVE* = end of period book value of equity. All continuous variables used in table 2.20 are scaled by the number of shares outstanding.

Table 2.21: Long-run cumulative buy-and-hold returns of R&D firms and non-R&D firms calculated over rolling 60-month windows from month *t* + 1 to month *t* + 60, where month *t* = the month in which the R&D firm received an R&D tax refund

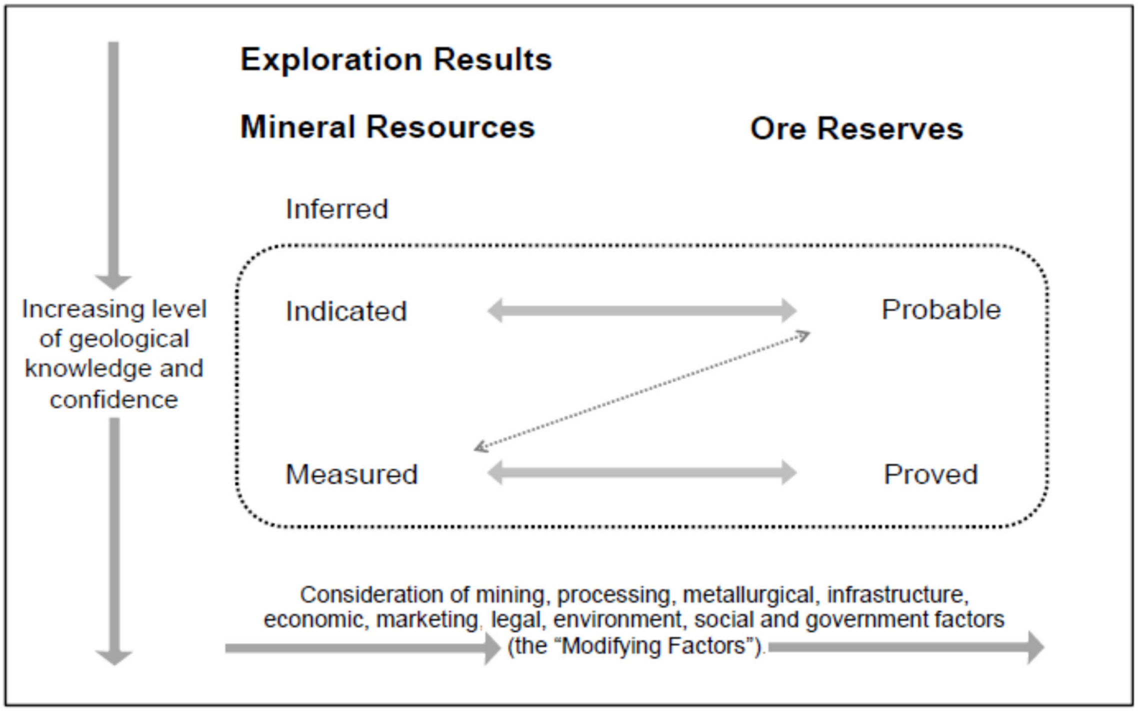
		(1): R&D sample		(2): Non-R&D sample		(3): R&D firms matched to non-R&D firms, i.e., (1) – (2)			
Holding period (months)	N	Mean	Median	Mean	Median	Mean	Median	*t*-statistic	p-value
1	404	.015	0	.084	0	-.07	-.021	-2.147**	.033
2	404	-.005	-.079	.061	0	-.066	-.02	-1.831*	.068
3	404	-.019	-.104	.108	-.033	-.127	-.027	-1.667*	.097
4	404	.022	-.098	.165	-.029	-.141	-.015	-1.82*	.07
5	404	.067	-.109	.098	-.087	-.03	.007	-.355	.723
6	404	.19	-.143	.122	-.108	.071	-.014	.528	.598
7	404	.261	-.144	.746	-.1	-.481	-.008	-1.456	.146
8	404	.274	-.174	.716	-.154	-.439	-.012	-1.345	.179
9	404	.216	-.212	.916	-.167	-.694	0	-2.018**	.044
10	403	.304	-.197	.938	-.154	-.632	-.018	-1.899*	.059
11	403	.318	-.186	.818	-.136	-.5	.024	-1.689*	.092
12	403	.263	-.2	.992	-.144	-.727	.005	-2.222**	.027
13	381	.248	-.213	.989	-.158	-.739	-.005	-2.403**	.017
14	381	.182	-.253	.946	-.228	-.764	-.064	-2.647***	.009
15	378	.329	-.277	1.32	-.269	-.975	.02	-2.253**	.025
16	358	.342	-.279	1.514	-.265	-1.18	.025	-2.442**	.015
17	357	.333	-.317	1.378	-.276	-1.043	.002	-2.401**	.017
18	355	.25	-.325	1.384	-.354	-1.143	.014	-2.667***	.008
19	326	.158	-.333	1.527	-.344	-1.387	-.011	-2.632***	.009
20	325	.103	-.34	1.53	-.333	-1.447	.001	-2.987***	.003
21	325	.061	-.384	1.905	-.375	-1.86	-.026	-3.347***	.001
22	296	.146	-.36	1.753	-.326	-1.615	.025	-2.812***	.005
23	295	.122	-.357	1.59	-.362	-1.479	-.007	-2.815***	.005
24	294	.084	-.414	1.722	-.409	-1.63	.011	-3.281***	.001
25	280	.14	-.378	1.899	-.381	-1.723	-.015	-2.106**	.036
26	280	.089	-.421	1.771	-.424	-1.659	.024	-2.316**	.022
27	279	.069	-.441	2.131	-.475	-1.976	.063	-2.516**	.013
28	250	.154	-.494	2.741	-.498	-2.508	.062	-2.23**	.026
29	250	.136	-.486	2.465	-.458	-2.251	-.003	-2.292**	.022
30	250	.245	-.487	2.729	-.455	-2.36	-.004	-2.373**	.018
31	232	.24	-.486	3.374	-.478	-2.965	.043	-2.039**	.043
32	232	.043	-.51	3.137	-.5	-2.891	.049	-2.313**	.022
33	232	-.018	-.553	3.368	-.557	-3.251	.025	-2.581**	.011
34	209	.063	-.519	2.931	-.549	-2.665	.053	-2.416**	.017
35	207	.035	-.529	2.956	-.559	-2.702	.028	-2.464**	.015
36	206	.144	-.518	2.826	-.592	-2.465	.013	-2.538**	.012
37	181	.19	-.511	2.621	-.609	-2.243	-.015	-1.794*	.074
38	180	.202	-.53	2.403	-.617	-2.05	.006	-1.965*	.051
39	180	.124	-.581	2.584	-.601	-2.329	-.015	-2.123**	.035
40	153	.263	-.573	3.218	-.673	-2.99	.053	-2.097**	.037

Table 2.21 (Continued)

		(1): R&D sample		(2): Non-R&D sample		(3): R&D firms matched to non-R&D firms, i.e., (1) – (2)			
Holding period (months)	N	Mean	Median	Mean	Median	Mean	Median	*t*-statistic	p-value
41	153	.106	-.6	2.982	-.667	-2.815	.079	-2.144**	.034
42	153	.069	-.606	2.915	-.665	-2.809	.055	-2.288**	.024
43	132	-.056	-.599	2.087	-.692	-2.279	.048	-1.973*	.051
44	131	-.051	-.589	1.954	-.751	-2.167	.087	-2.018**	.045
45	131	-.067	-.602	2.052	-.747	-2.288	.081	-2.228**	.028
46	115	.037	-.6	2.031	-.764	-2.204	.158	-1.79*	.076
47	115	-.098	-.591	1.699	-.748	-1.957	.14	-1.864*	.065
48	115	.034	-.571	1.827	-.75	-2.034	.139	-1.955*	.053
49	102	.142	-.58	2.165	-.787	-2.337	.129	-1.751*	.083
50	101	.193	-.591	1.958	-.789	-2.078	.142	-1.717*	.089
51	101	.122	-.605	1.828	-.819	-1.981	.124	-1.693*	.093
52	80	.292	-.58	1.148	-.841	-1.1	.187	-1.027	.307
53	80	.178	-.612	1.046	-.842	-1.156	.217	-1.12	.267
54	80	.069	-.702	1.192	-.862	-1.466	.12	-1.61	.112
55	71	.133	-.687	.401	-.84	-.57	.215	-1.058	.293
56	71	-.012	-.723	.322	-.84	-.568	.119	-1.097	.277
57	71	.198	-.685	.118	-.861	-.109	.129	-.207	.837
58	68	.324	-.697	.116	-.873	.041	.146	.072	.943
59	68	.252	-.738	.049	-.88	.007	.139	.013	.99
60	68	.213	-.762	.132	-.881	-.093	.088	-.172	.864

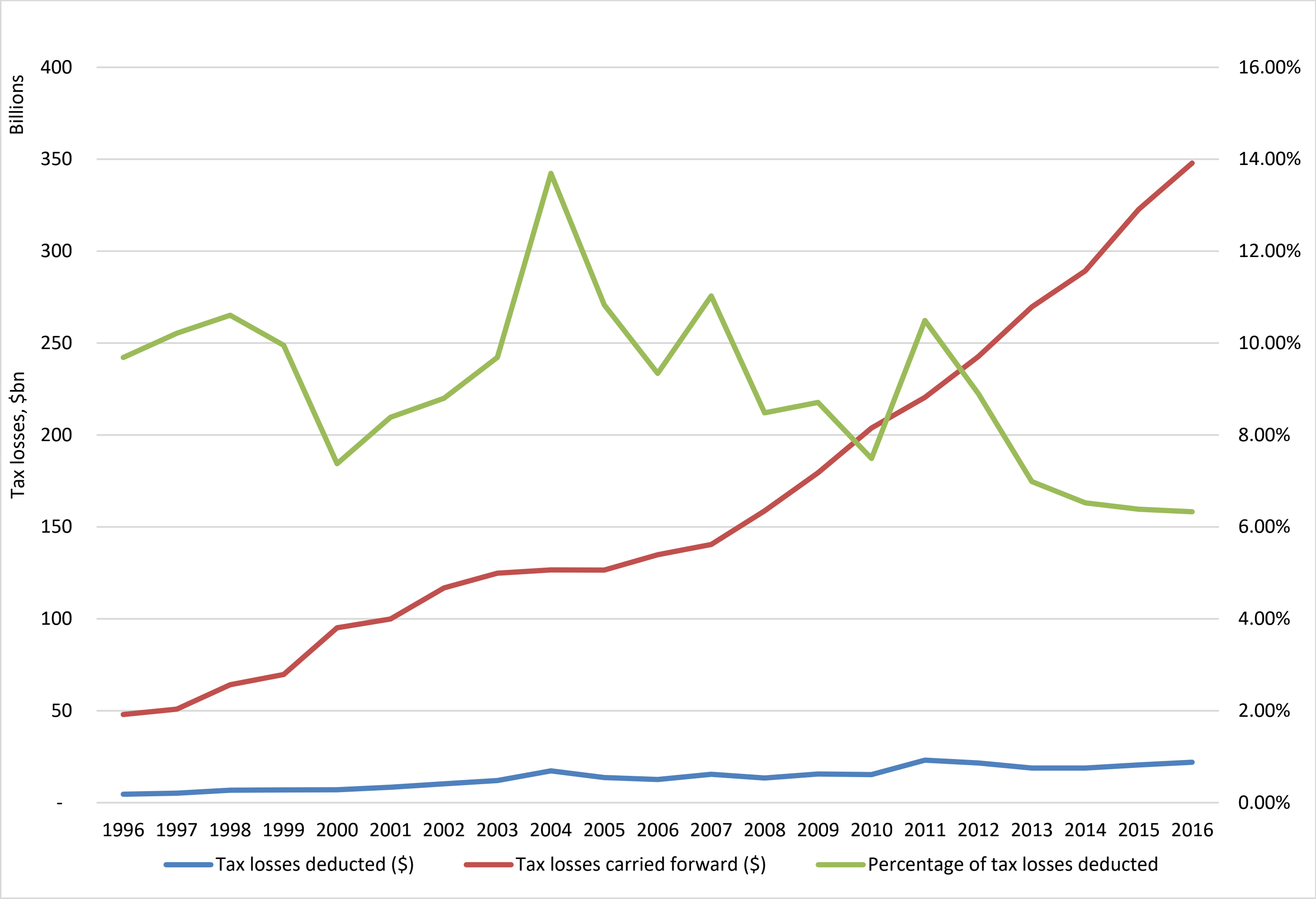
Panel (1) of Table 2.21 reports cumulative buy-and-hold returns for companies claiming the R&D tax offset for up to 60 months following receipt of an R&D refund. The mean return is reported in the first column of panel (1) and the median is reported in the second column. Cumulative buy-and-hold returns are also calculated over the same 60-month window for companies that do not claim the R&D tax offset in panel (2). In panel (3), cumulative buy-and-hold abnormal returns are calculated for the R&D sample, where each company claiming the R&D tax offset is matched to a company in the non-R&D sample based on size, book-to-market and commodity focus. The abnormal return is calculated as the cumulative buy-and-hold return for the R&D company, expressed as a percentage return, less the cumulative buy-and-hold return for the matched non-R&D company. A significant t-statistic indicates that the mean buy-and-hold abnormal return is significantly different from zero. *** denotes significance at the 1% level; ** at the 5% level and * at the 10% level.

Figure 2.1: Relationship between exploration results, mineral resources and ore reserves



Source: JORC Code (2012)

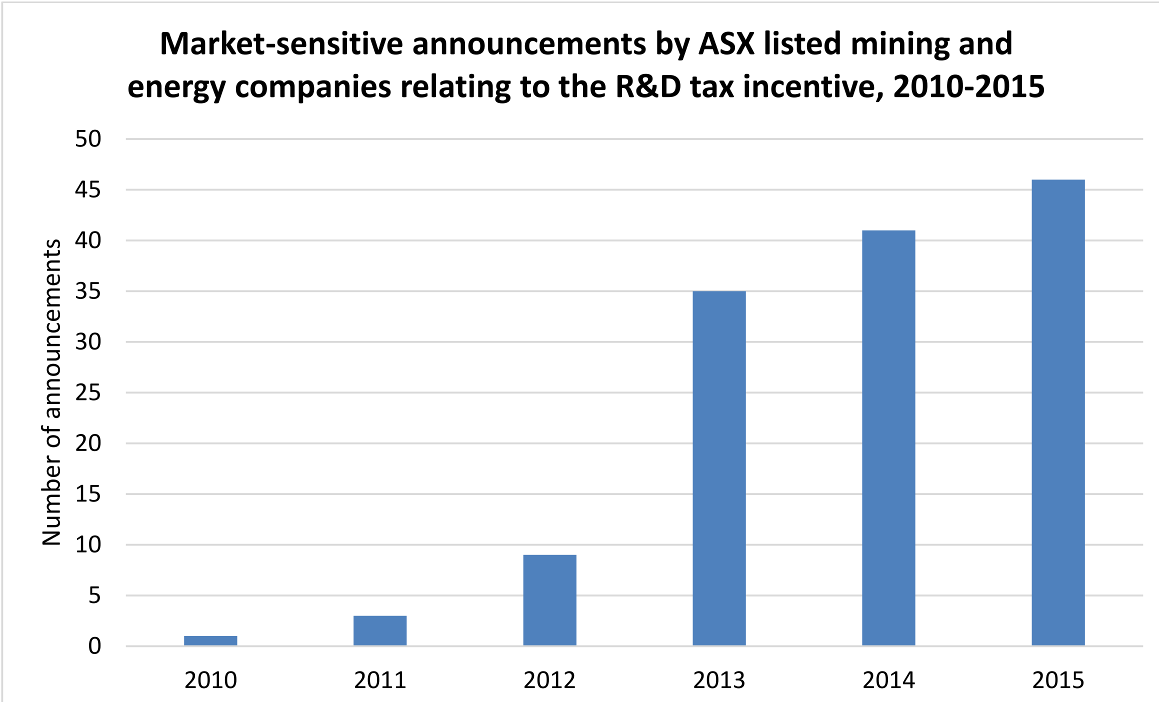
Figure 2.2: Tax losses carried forward ($bn), all Australian companies, 1996-2016



Source: ATO Taxation Statistics 2015-16

Figure 2.3: Market-sensitive announcements relating to the R&D tax incentive

Panel A – Total number of announcements by year

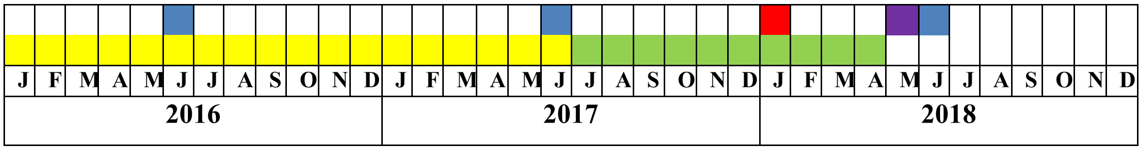


Source: Morningstar DatAnalysis

Panel B – Examples of announcements

Company	Date	Announcement Header
Aura Energy Ltd	07-Jun-13	Aura receives research tax rebate for groundbreaking metallurgical testwork
Argent Minerals Limited	29-Jul-13	$1.0 Million Research and Development Claim
Altech Chemicals Ltd	30-Mar-15	Altech Receives $815,000 from R&D Advance Loan Facility
Carbon Energy Limited	02-Jul-14	CNX Secures $1.5m R&D Tax Offset Financing Facility
Dampier Gold Limited	19-Dec-12	Dampier Receives $934k Tax Refund for R&D Activities
Dart Mining NL	02-Apr-14	Dart Mining Receives $1.1M further R & D Grant
Gascoyne Resources Limited	27-Jun-13	$1.52 Million Research and Development Tax Refund Received
Latrobe Magnesium Limited	18-Oct-16	LMG Receives $560K R&D Tax Incentive Funding
Northern Minerals Limited	29-Aug-17	US$30 million R&D Loan Facility with New York financier
Strike Energy Limited	15-Nov-16	R&D facility established with CBA
White Cliff Minerals Limited	24-Jul-14	WCN Receives $352,962 Research and Development Rebate

Figure 2.4: Timeline for claiming the R&D tax offset



Period during which the eligible R&D activities must be undertaken

Tax year end (30 June for most companies)

Period during which companies can register R&D activities with AusIndustry

Tax return due date for taxable large and medium companies

Tax return due date for companies not required to lodge earlier, including non-taxable companies

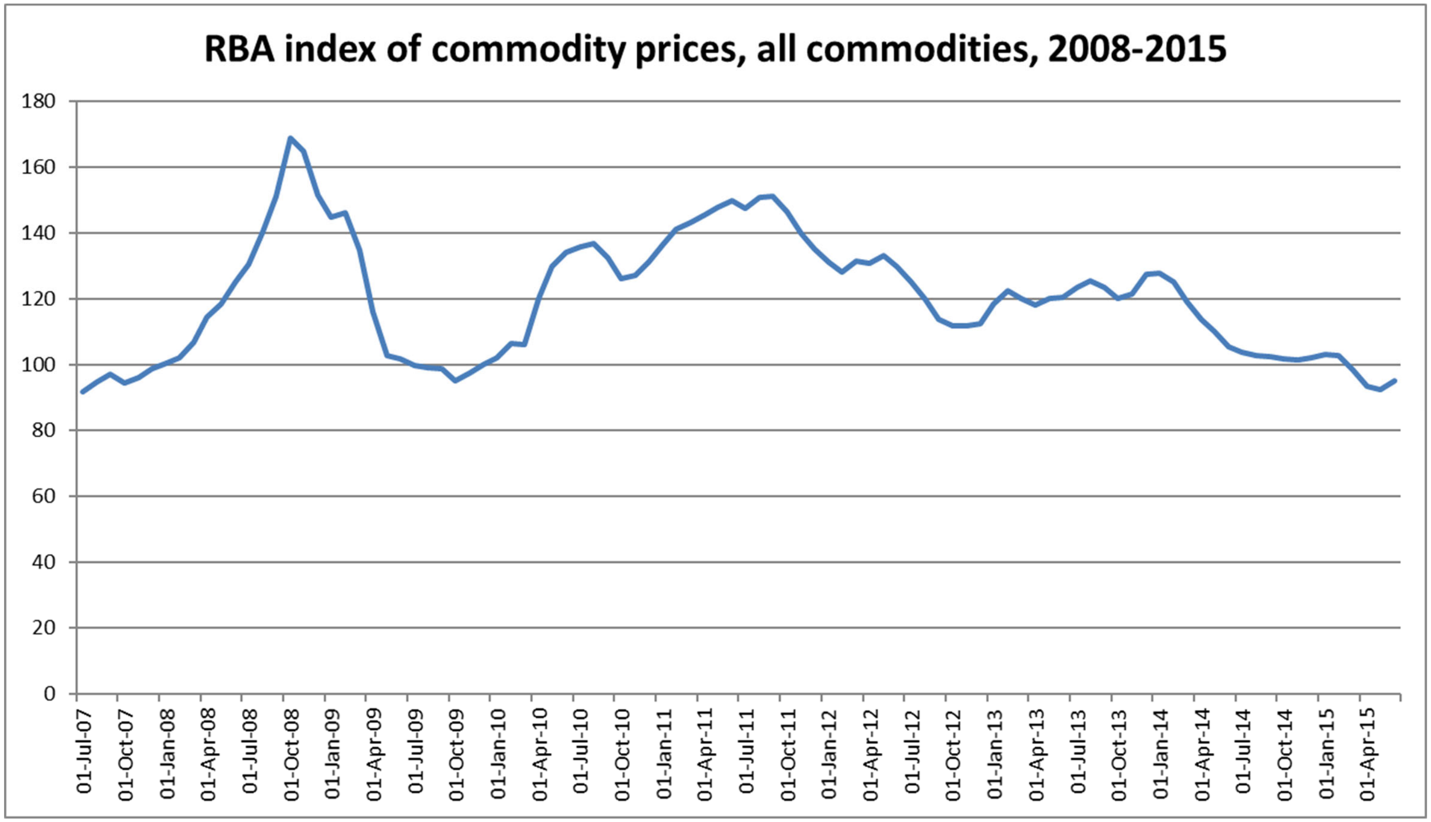
Companies must register their R&D activities with AusIndustry (on behalf of Innovation and Science Australia) before claiming the R&D tax offset.

Registration takes place in the income year after the R&D activities are undertaken. Registration applications are due annually, within 10 months of the end of the company's income year.

A precondition of eligibility is that the activities must have been conducted in the previous income year. In some circumstances, companies may be able to claim expenditure on eligible R&D activities that were undertaken in an earlier income year, if those activities had previously been registered before the applicable due date, subject to the time limit on amending a company income tax return (generally 4 years). Late registration applications are not normally accepted, unless the reason for lodging the application late was not the fault of the company (or its advisors) and not within its control.

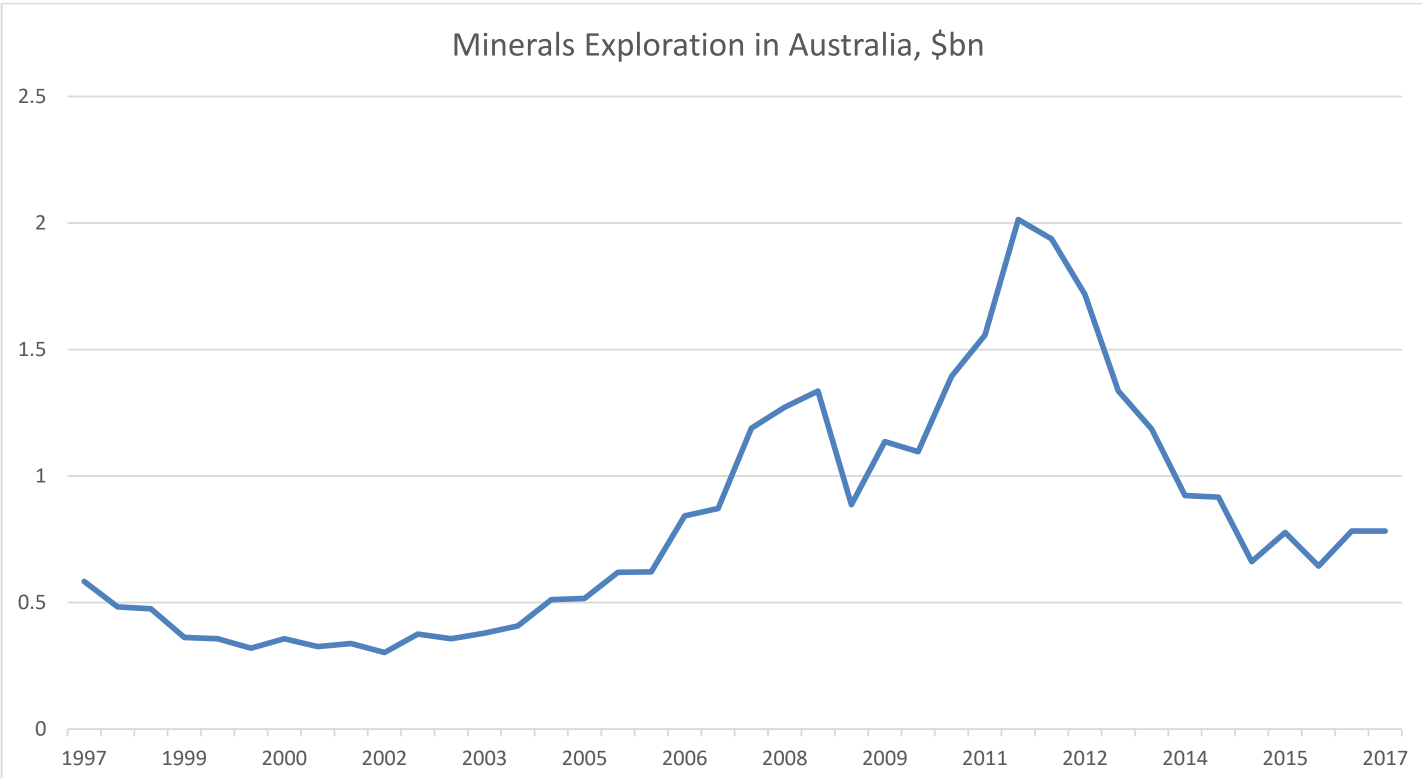
Once R&D activities have been registered, the company can claim the R&D tax offset in its income tax return for the income year in which eligible R&D expenditure is incurred.

Figure 2.5: RBA commodity price index, all commodities, 2008-2015



Source: Reserve Bank of Australia (RBA) website

Figure 2.6: Minerals exploration in Australia, 1997-2017



Source: Australian Bureau of Statistics (2017).

Figure 2.7: R&D claims by listed mining exploration entities, 2008-2015

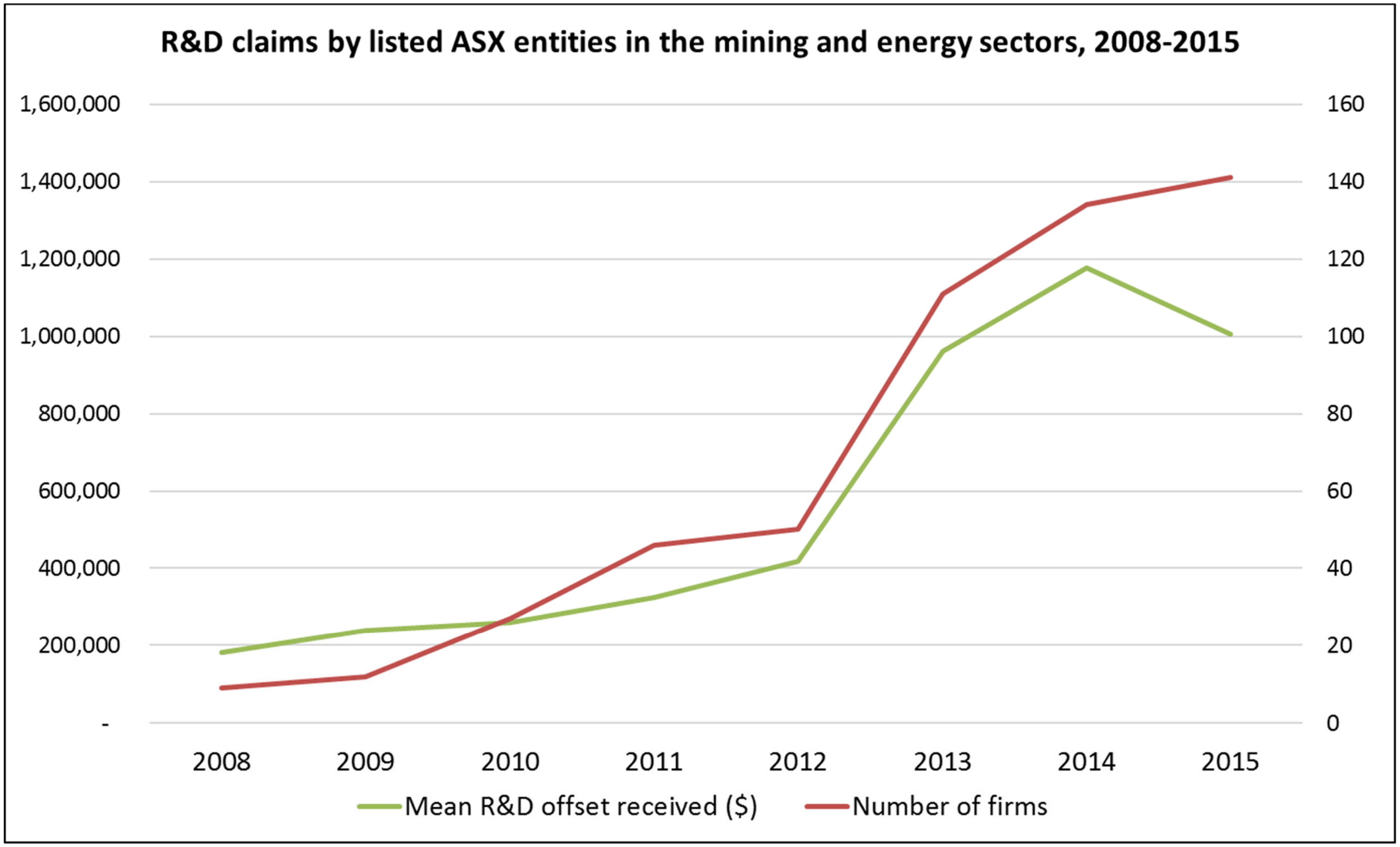


Figure 2.8: Average exploration and evaluation expenditure by listed MEEs, $m, 2008-2015

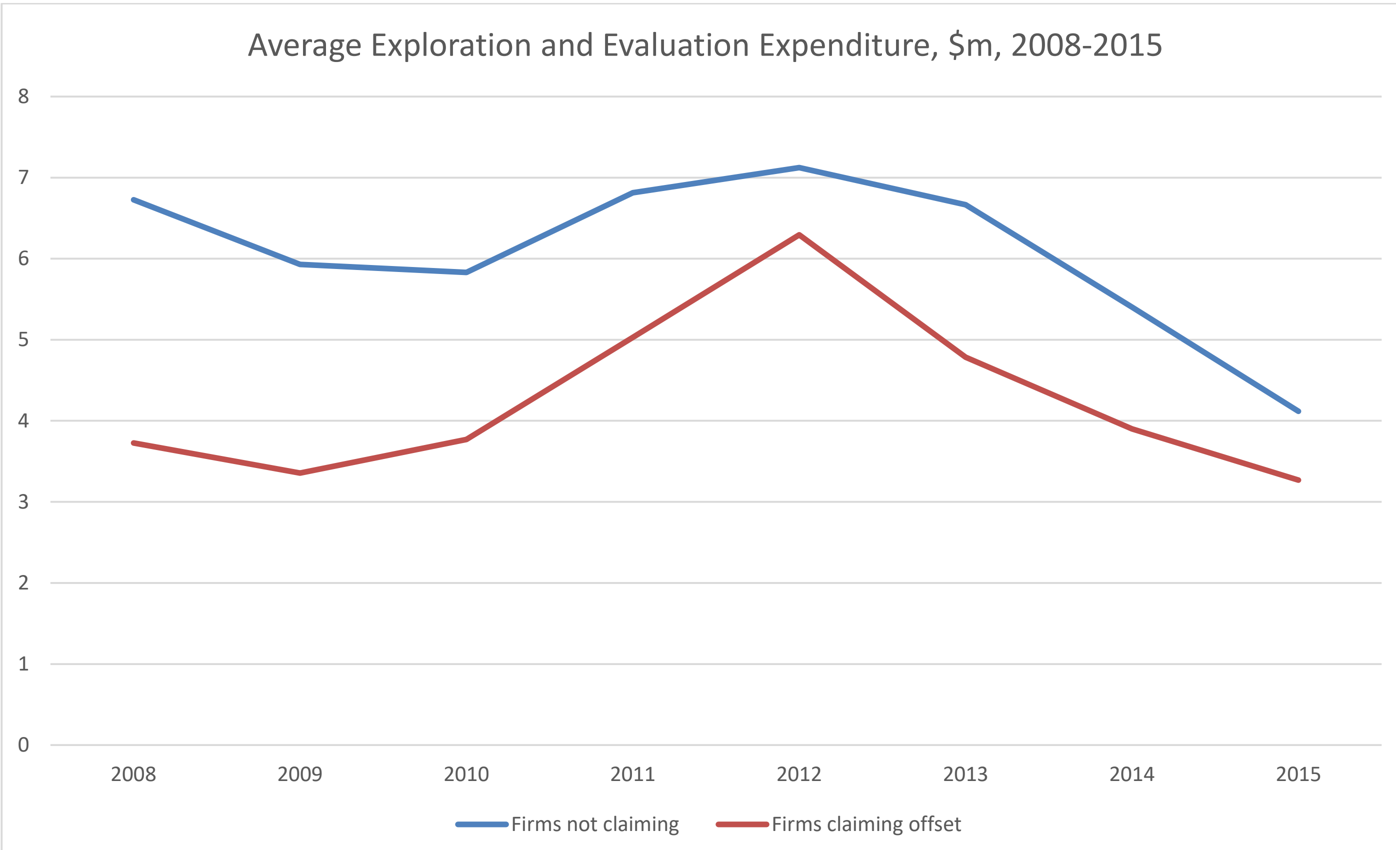
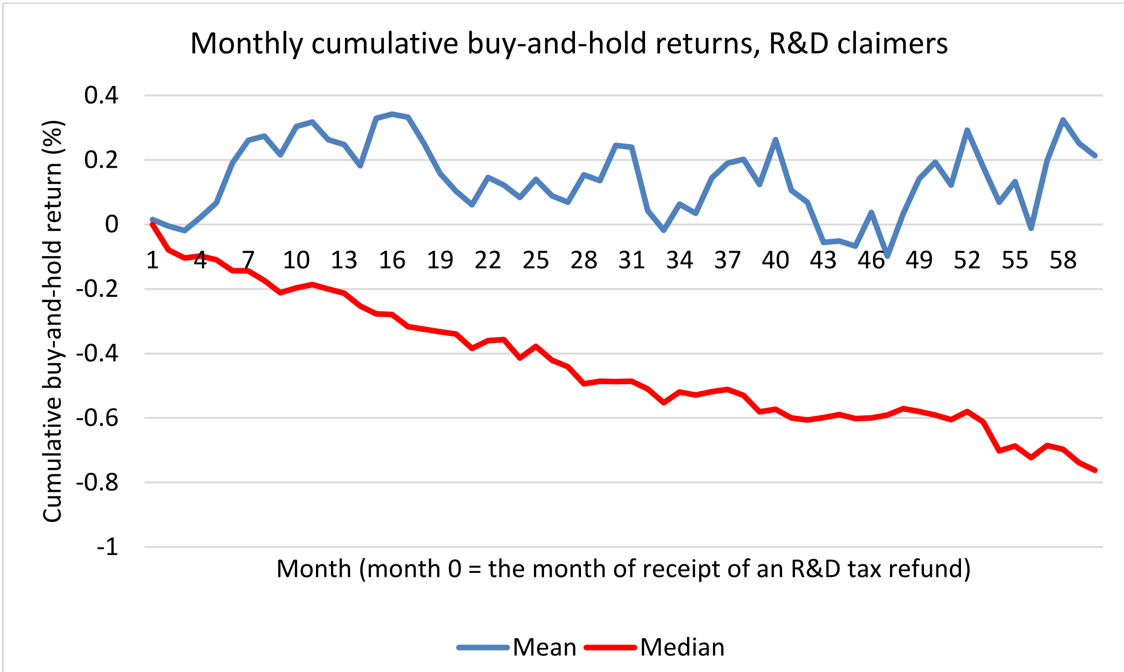
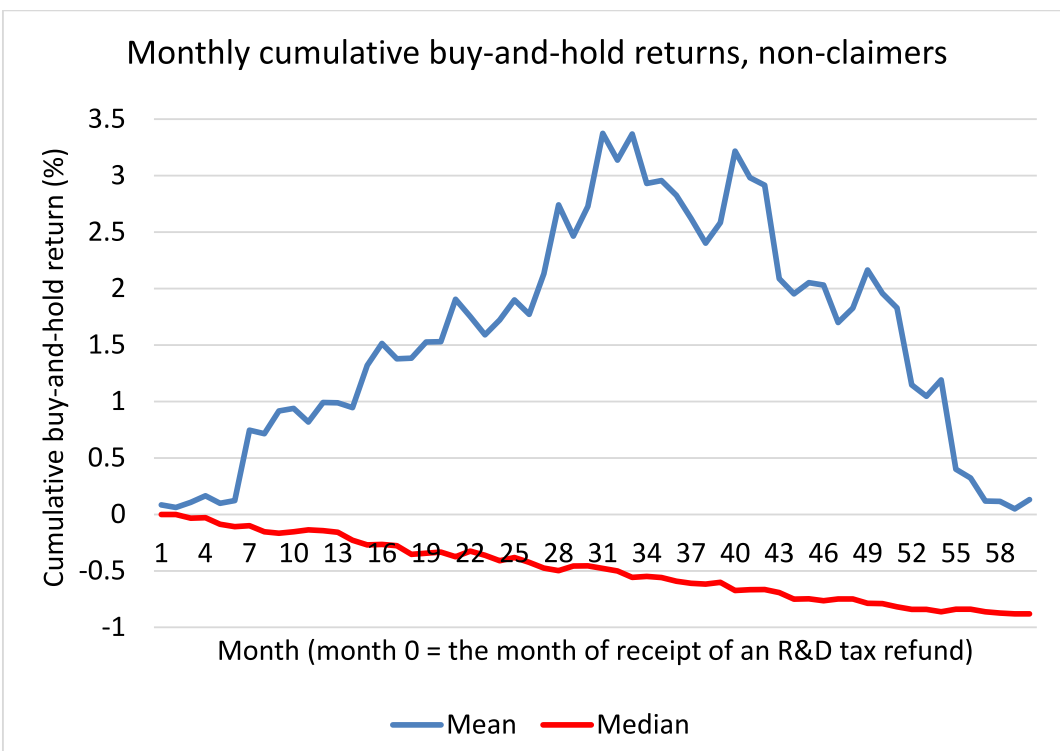


Figure 2.9: Monthly cumulative buy-and-hold returns, R&D claimers and non-claimers

Panel A – Claimers



Panel B – Non-claimers



Panel C – Abnormal returns for R&D firms matched with non-R&D firms

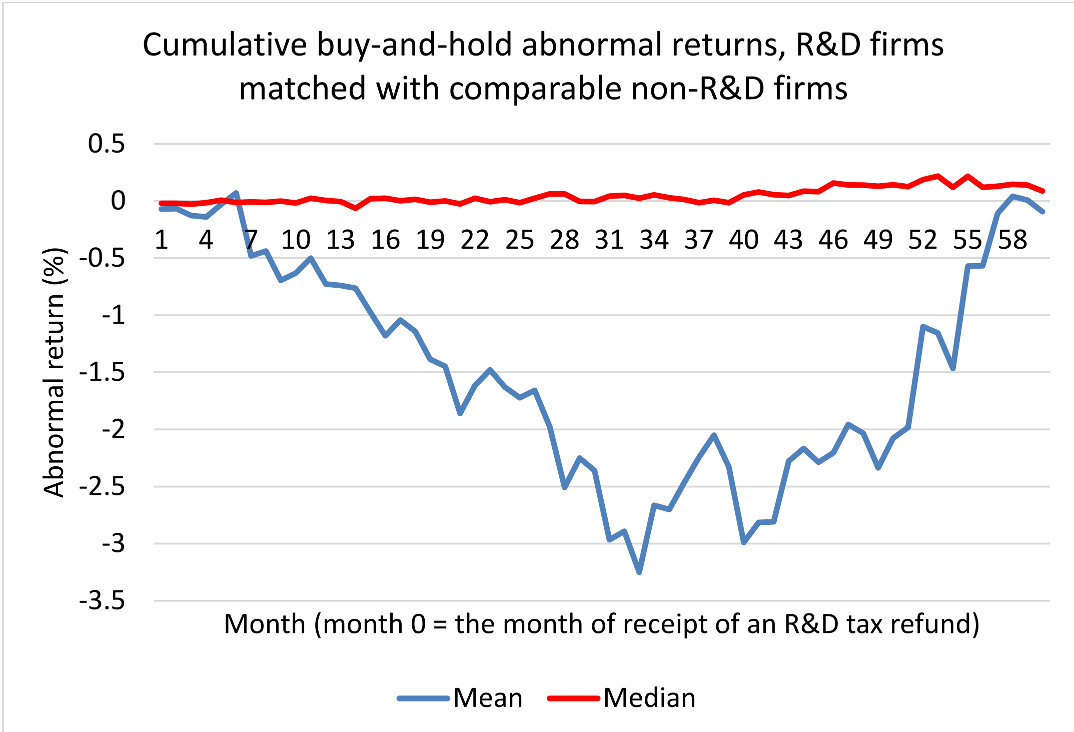


Table 3.1: Types of employee share schemes

Plan Type	Key Features	Advantages	Disadvantages
Options	• Typically offered to employees for nil consideration, and exercisable on satisfaction of certain vesting conditions, which can be time-based or performance-based.	• Substitute for cash compensation for start-up companies. • The value of the option is increasing in the volatility of the underlying stock, so can be used to encourage risk-taking.	• No tax deduction available to the employer • Only options with performance-based vesting conditions qualify for deferred tax treatment. For other types of options, the employee will generally have to sell the shares after exercise, in order to pay the tax that arises.
Restricted shares	• The employer issues shares to the employee that are subject to a risk of forfeiture (i.e. contingent on continued employment). • The restriction typically ends after the employee achieves some performance goal or minimum term of employment.	• The employee receives the full value for each share that vests, versus only the increase over the exercise price in the case of stock options. • May result in a greater pay-performance sensitivity relative to options.	• No tax deduction available to the employer
Performance rights (zero exercise price options, or zepos)	• Similar to options, except there is no exercise price to pay when they vest. • They can be issued with performance targets built in, by specifying that the rights will only vest if the share price reaches a certain level.	• Because there is no exercise price, zepos will always have an intrinsic value, so they can protect the employee from downside market risk.	• While the employee does not need to pay anything to acquire the shares, the employee will still need to sell the shares in order to pay the tax that arises on vesting. • No tax deduction available to the employer
Loan funded share plans	• The employer lends money to the employee to acquire shares in the employer; • The repayment of the loan is funded from the proceeds of the sale of the shares; • The loan is "limited recourse"; that is, the employer's recourse against the employee is limited to the value of the shares.	• Operate outside the employee share scheme rules, as the shares are issued at market value, so there is no discount. • The limited recourse nature of the loan means that employees only realise a gain if the share price on the loan maturity date exceeds the value of the shares on the date the loan was made. • A tax deduction may be available to the employer for interest on funds borrowed to purchase the shares.	• Complex to set up, as generally require the shares to be held by an employee share trust • Companies must loan the funds to the employee; so not an option for start-ups and R&D companies who face a high cost of capital and are cash constrained.

Table 3.2: History of employee share schemes (ESS) in Australia

Date	Event
1974	Section 26AAC inserted into the ITAA1936 to provide for the taxation of ESS benefits, replacing the old s 26(e) which only dealt in general terms with "benefits" provided to employees.
1986	Two concessions introduced: deferral of tax on ESS benefits, or an exemption of up to $200, but access was limited to taxpayers who were employees or directors of the employer company.
1988	Provisions of Section 26AAC amended to include directors as well as employees and their associates.
1995	The Division 13A regime (ITAA36) introduced in response to the government's view that ESS had been open to tax minimisation abuse by corporate executives of established companies. Division 13A was based on upfront taxation, i.e. to tax the discount given in relation to an ESS interest in the year the interest was acquired. If the interest was a "qualifying" interest, the liability could be deferred for up to 10 years if the rights were subject to disposal restrictions, or the recipient could elect to pay tax upfront on the discount (less a $1,000 exemption).
1997	Amendment to Division 13A which increased the initial $500 exemption to $1,000 and amended the thresholds to make it easier for an ESS to qualify for concessional treatment under Division 13A.
2000	Shared Endeavours report into employee share ownership tabled in the House of Representatives.
2003	Federal Government introduces limited measures in response to Shared Endeavours report.
2006	Government extended tax provisions governing employee share plans to ASX listed stapled securities.
2009	Amount of the discount became taxable in the year in which the shares and options were issued, unless they were at a "real risk of forfeiture" or obtained under a salary sacrifice arrangement. The $1,000 exemption was available in limited circumstances. If tax on the discount was able to be deferred, tax became payable at the earliest of a series of trigger events (but no later than 7 years after issue). The foundation principle was taxation of the discount on ESS interests.

Table 3.3: Australia's current ESS legislation

Employee share scheme	• Acquired in respect of employment or services provided • Acquired for less than the market value of the share or the right
Qualifying shares or rights	• Acquired under an ESS • Shares must be in the employer company of the taxpayer • Ordinary shares/rights to acquire ordinary shares • 75% of permanent employees entitled to participate • Legal/beneficial interest and voting power cannot exceed 5% immediately after acquisition.
Taxing point – shares	If no disposal restrictions or forfeiture conditions, on acquisition; otherwise, the earliest of the following: • Disposal; • When disposal or forfeiture conditions lifted; • When employment ceases.
Maximum deferral period – shares	10 years
Taxing point – rights	The earliest of the following: • Disposal other than by exercise; • When employment ceases; • If exercised, when disposal or forfeiture conditions lifted; • Taxpayer disposes of the share.
Maximum deferral period – rights	10 years
Calculation of discount – taxed upfront schemes	Market value at acquisition time less consideration paid
Calculation of discount – deferred taxation	If disposed: consideration received less consideration paid If not disposed: market value at deferred taxing point less consideration paid
Upfront concession	Maximum of $1,000 per eligible employee, if the employee makes an election and the exemption conditions are satisfied.
Exemption conditions for upfront concession	• No conditions that could result in forfeiture • Disposal of shares prohibited for 3 years or until cessation of employment. • ESS must operate on a non-discriminatory basis.
Availability of deduction for employer	Only if providing money or other property in exchange for shares. Maximum deduction of $1,000 available if employee claims the upfront concession (lesser of $1,000 or the actual amount of the discount). Deduction only available when share or right acquired.
Market value of share or right – listed	If the share or right is quoted on a stock market of an approved stock exchange, last market price or weighted average price (if share not traded frequently).
Market value of share or right – unlisted	Shares valued at arm's length valuation according to a report prepared by a qualified person, or other approved methodology. Rights valued at the greater of the following: • Market value of the share that would be acquired by exercising the right, less lowest exercise price • Taxable value of the right worked out based on the calculation percentage and exercise period in accordance with the regulations. For rights with no exercise price, the market value of the right is the market value of the share on the same day.
Capital gains/losses on ESS interests	Disregarded during the period in which Division 83A applies to them.

Table 3.4: Comparison of the taxation of options under Division 13A and Division 83A

Panel A: Assumptions	
Grant Date	1/07/2009
Vesting Date	30/06/2012
Option Expiry Date	30/06/2014
Consideration Paid	-
Market price at grant date	$0.50
Exercise price	$0.50
Forecast share price at vesting date	$2.00
Probability of the option being in the money at vesting date	10%
Exercise date	30/06/2012
Sale date	30/06/2012
Employee marginal tax rate	47.00%
Value of remuneration	$100,000
Number of options issued	1,724,138

Panel B: Comparison of after-tax proceeds if options are in the money at vesting date			
	Division 13A		**Division 83A**
	Upfront election	**No election**	
Discount per option[95]	$0.058	$1.50	$1.50
Income tax payable per option	$0.027	$0.71	$0.71
CGT cost base of share	$0.558	$2.00	$2.00
Net capital gain on sale of shares	$1.44	-	-
CGT payable per share	$0.68	-	-
Total tax payable per share	$0.71	$0.71	$0.71
Net after-tax proceeds per share	$0.80	$0.80	$0.80

Panel C: Summary of cash flows if options are in the money at vesting date					
	Year 0	**Year 1**	**Year 2**	**Year 3**	**Net cash flow**
Division 13A with election	-47,000	-	-	1,417,690	1,370,690
Division 13A without election	-	-	-	1,370,690	1,370,690
Division 83A	-	-	-	1,370,690	1,370,690

Panel D: Summary of cash flows if options are out of the money at vesting date[96]					
	Year 0	**Year 1**	**Year 2**	**Year 3**	**Net cash flow**
Division 13A with election	-47,000	-	-	-	-47,000
Division 13A without election	-	-	-	-	-
Division 83A	-	-	-	-3,647	-3,647

95 Worked out using the statutory valuation rules set out in the income tax regulations.
96 Assumes a share price of $0.45 on the vesting date, implying a calculation percentage of 90%.

Table 3.5

Panel A: Employee option plan characteristics by year

Year	Firm years with option plans[97]	Immediate vesting	Time-based vesting	Hurdles	Zero exercise price ("zepos")	Other / not specified
2006	114	11.4%	27.2%	8.8%	4.4%	54.4%
2007	87	2.3%	29.9%	5.7%	3.4%	60.9%
2008	78	2.6%	42.3%	11.5%	5.1%	41.0%
2009	59	6.8%	27.1%	15.3%	6.8%	49.2%
2010	52	3.8%	13.5%	17.3%	9.6%	59.6%
2011	53	7.5%	22.6%	9.4%	20.8%	41.5%
2012	57	5.3%	24.6%	7.0%	21.1%	47.4%
2013	41	4.9%	14.6%	17.1%	24.4%	39.0%
2014	38	5.3%	15.8%	5.3%	34.2%	42.1%
2015	32	3.1%	12.5%	12.5%	31.3%	43.8%
2016	38	2.6%	23.7%	7.9%	28.9%	36.8%
2017	31	-	22.6%	19.4%	25.8%	32.3%
Full sample	680	5.3%	25.1%	10.7%	14.1%	47.9%

Panel B: Employee option grants by year[98]

Year	Firm years	Option Grants				Average Vesting Period (months)	Average Exercise Period (months)	Average Calculation Percentage
		Average Quantity Granted	Average Taxable Value ($)	Average Black-Scholes Value ($)	Average CHL Value ($)[99]			
2006	78	796,112	29,970	124,517	74,905	16	49	92.1%
2007	56	1,412,218	86,210	219,148	246,187	18	53	102.6%
2008	66	2,093,787	18,291	95,766	186,912	18	56	78.0%
2009	41	1,863,559	28,660	108,421	193,209	18	52	83.5%
2010	35	1,846,530	54,453	178,721	308,353	19	48	71.7%
2011	36	1,815,755	25,470	54,182	171,630	16	45	118.7%
2012	37	1,691,527	9,893	19,154	44,534	14	41	71.1%
2013	24	1,170,792	25,465	62,509	137,226	20	52	72.5%
2014	19	3,584,077	70,898	126,604	209,685	21	47	63.7%
2015	18	3,281,473	28,300	72,523	98,635	21	48	69.2%
2016	29	2,327,134	12,288	62,559	196,724	21	52	63.3%
Full sample[100]	439	1,756,081 *350,000*	37,568 *2,250*	116,555 *16,541*	168,650 *37,500*	18 *17*	51 *48*	85.2% *83.8%*

[97] A firm is identified as having an employee option plan if it issued at least one Appendix 3B during the year where the header contained the word "employee", and the announcement related to either a grant of options, or to the exercise, cancellation, forfeiture or expiry of options that were previously granted.
[98] Daily share prices which are used to estimate option values are only available from SIRCA until 31 December 2016. The figures reported in this table are the average values for each year.
[99] Options are also valued at 25% of their exercise price following Core, Holthausen and Larcker (1999), who note that this heuristic produces similar valuations to more sophisticated option pricing models.
[100] The first reported figure is the sample mean; the second reported figure is the median.

Table 3.5 (continued)

Panel C: Employee option exercises by year

Year	Firm years	Average Quantity Exercised	Average Value Exercised ($)
2006	47	104,407	252,456
2007	38	175,040	624,496
2008	14	167,063	669,258
2009	19	155,291	403,481
2010	16	89,856	410,668
2011	13	197,969	144,464
2012	16	138,459	232,365
2013	16	408,858	1,077,863
2014	14	199,060	361,949
2015	9	305,828	266,612
2016	6	550,653	420,414
Full sample	208	182,471 *45,000*	418,301 *87,875*

Panel D: Average share price at grant date, exercise price, and taxable value per option by year, employee option grants sample

Year	Firm years	Share price at grant date ($)		Exercise price ($)		Taxable value per option ($)	
		Mean	Median	Mean	Median	Mean	Median
2006	78	0.992	0.335	1.070	0.460	0.098	0.013
2007	56	1.525	1.160	1.471	1.035	0.159	0.057
2008	66	1.138	0.480	1.422	0.600	0.073	0.011
2009	41	0.921	0.643	1.131	0.750	0.078	0.013
2010	35	0.870	0.280	0.923	0.425	0.059	0.0003
2011	36	1.083	0.380	0.859	0.400	0.062	0.015
2012	37	0.431	0.198	0.432	0.250	0.030	-
2013	24	0.496	0.160	0.613	0.430	0.037	0.0002
2014	19	0.323	0.100	0.365	0.217	0.019	-
2015	18	0.345	0.125	0.139	0.035	0.012	0.0002
2016	29	0.407	0.185	0.515	0.248	0.010	0.0002
Full sample	439	0.936	0.345	0.988	0.430	0.079	0.009

Table 3.6

Panel A: Sample Construction – Full Sample, 2006-2017

	Firms	Firm-years
Number of ASX-listed firms with compensation data available, all years	2,686	20,734
Less: Observations with insufficient price data to calculate market-based variables (i.e. stock return volatility and market capitalisation)	167	1,641
Less: Observations with missing financial statement data in Aspect Financial	118	1,596
Final sample used to estimate employee option plan determinants model	2,401	17,497

Panel B: Sample Construction – Employee Option Plan Sample, 2006-2017

	Firms	Firm-years
Number of firms disclosing details of employee option plans in Appendix 3Bs, all years	375	680
Less: Observations with insufficient price data to calculate market-based variables (i.e. stock return volatility, market capitalisation, and contemporaneous and lagged performance measures)	48	86
Less: Observations where compensation data is not available from Connect4 Boardroom	5	8
Less: Observations with missing financial statement data in Aspect Financial	8	22
Final sample used to estimate model of employee option grants	314	564

Panel C: Breakdown of employee option plan sample by industry

Industry	Firm years	% of total	Taxable value of option grants ($)	Option % of total remuneration	Equity % of total remuneration
Consumer Discretionary	16	2.5%	203,915	4.2%	6.1%
Consumer Staple	17	2.6%	46,023	5.2%	7.6%
Energy	103	15.9%	15,775	11.6%	14.5%
Financials	26	4.0%	30,671	5.0%	7.6%
Health Care	20	3.1%	24,123	8.2%	10.6%
Industrials	49	7.6%	53,164	5.3%	7.0%
Information Technology	55	8.5%	49,890	7.4%	9.4%
Materials	6	0.9%	91,686	7.6%	11.2%
Metals & Mining	303	46.9%	55,687	11.1%	13.8%
Pharmaceuticals	42	6.5%	43,734	9.6%	12.2%
Real Estate	1	0.2%	-	3.6%	4.7%
Telecommunications	3	0.5%	156,784	6.0%	8.2%
Utilities	5	0.8%	45,260	9.1%	11.2%
Full Sample	676		49,931	8.4%	10.9%

Table 3.7

Panel A: Timeline of Events and Predicted Market Reactions (2009 Budget Announcement)

Event	**Date**	**Details**	**Source**	**Predicted market reaction**
I	12 May 2009	Treasurer Wayne Swan delivers his sixth Federal Budget, which includes the surprise announcement of a measure requiring employees earning more than $60,000 to pay tax upfront on discounts provided on shares and options from 1 July 2009. The Australian Financial Review (AFR) reports that some companies are reviewing and considering suspending their employee share schemes as a result of the Treasurer's announcement.	2009-10 Budget Papers; AFR	-
II	25 May 2009	AFR reports that following pressure from businesses and unions, the Rudd government is considering backing down on some of the proposed changes to employee share schemes, and will fast-track the consultation process.	AFR	+
III	5 June 2009	Treasury releases a consultation paper on the taxation of employee share schemes canvassing a number of options, including a limited deferral of tax for schemes where there is a genuine risk of forfeiture, to prevent employees from being taxed on shares or rights that may not vest. AFR reports that while the exposure draft represented a softening of the measure announced in the Budget, the proposed changes would still disadvantage smaller start-ups who rely heavily on shares and options to attract staff.	Treasury website; AFR	+
IV	1 July 2009	Assistant Treasurer issues policy statement confirming the 1 July 2009 start date and making some concessions, including increasing the taxable income threshold for the upfront tax concession to $180,000 and allowing the deferral of tax for shares acquired under certain salary sacrifice based employee share schemes. AFR reports that while the modifications were welcomed by employers, the proposed changes would still greatly restrict the way in which options could be offered to employees, as options would be taxed when they vest.	Treasury website; AFR	+
V	14 August 2009	Treasury releases an exposure draft and explanatory materials based on the 1 July 2009 policy statement.	Treasury website	*
VI	21 October 2009	Legislation introduced into Parliament substantively similar to the 1 July 2009 policy statement.	Parliament of Australia website	*

Event	Date	Details	Source	Predicted market reaction
VII	2 December 2009	Legislation passes Parliament without further amendment.	Parliament of Australia website; AFR	*

Panel B: Timeline of Events and Predicted Market Reactions (2015 Changes)

Event	Date	Details	Source	Predicted market reaction
I	1 August 2014	AFR first reports on the Abbott Government's plans to reverse some of the 2009 changes to the taxation of employee share schemes for start-ups and small to medium businesses as part of its National Industry Innovation and Competitiveness Agenda	AFR	+
II	14 October 2014	Federal Government releases National Industry Innovation and Competitiveness Agenda, announcing in general terms the previously reported changes to the tax treatment of options offered to employees, with the legislation proposed to come into effect on 1 July 2015.	Department of the Prime Minister and Cabinet; AFR	+
III	14 January 2015	Exposure draft legislation released confirming the policy announced in October 2014; AFR reports that the proposed changes to the tax treatment of employee share options were positively received and that the legislation was expected to have bipartisan support.	Treasury website; AFR	+
IV	25 March 2015	Legislation introduced into Parliament based on the October 2014 policy announcement.	Parliament of Australia website	*
V	25 June 2015	Legislation passes Parliament without amendment.	Parliament of Australia website	*

Table 3.8: Comparison of employee option plan sample with firms without option plans, all years

	(1) All ASX-listed companies (excluding option plan sample)						(2) Employee option plan sample						t-test of difference in means (1) – (2)
	N	Mean	Median	SD	Min	Max	N	Mean	Median	SD	Min	Max	
Size_mktcap	24,704	825.0	25.8	7.48	1.6	421.0	647	917.0	62.2	4,830.0	0.9	47.7	-0.314
Ln_mkcap	24,704	17.38	17.07	2.21	7.38	26.77	647	18.09	17.95	1.90	13.72	24.59	-8.137***
Size_ta	25,883	2,450.0	25.6	31.4	-	976.0	653	1,370.0	41.7	13,400	0.5	300.0	0.870
Ln_ta	25,883	17.33	17.06	2.64	-	27.61	653	17.72	17.54	1.91	13.08	26.43	-3.730***
Age	24,166	14.59	9.21	17.94	-	135.58	646	12.79	7.91	16.52	0.03	115.57	2.521**
Ln_age	24,166	7.97	8.12	1.26	-	10.81	646	7.91	7.97	1.10	2.48	10.65	1.278
Volatility	21,853	18.6%	15.6%	13.1%	0.06%	75.7%	640	19.4%	17.0%	11.1%	3.3%	75.7%	-1.481
MTR	25,904	10.8%	0.00%	13.4%	0.00%	30.0%	653	8.6%	0.0%	12.4%	0.0%	30.0%	4.290***
MTB	23,332	3.043	1.601	3.897	0.000	18.062	635	3.588	2.225	3.984	0.104	18.062	-3.475***
Intangibles	25,832	0.158	-	0.284	-	1.000	653	0.230	0.055	0.294	-	0.984	-6.382***
Cash_burn	25,904	1.564	0.119	3.489	-	16.457	653	1.870	0.231	3.903	-	16.457	-2.212**
Equitymix_top5	21,650	11.09%	1.51%	17.58%	0.00%	100.00%	636	18.47%	10.61%	20.03%	0.00%	88.50%	-10.390***
Top20	24,442	64.46%	65.62%	19.08%	0.42%	100.00%	634	60.91%	61.76%	16.14%	17.60%	94.56%	4.643***
Lev	25,832	0.07	-	0.14	-	0.77	653	0.0514	-	0.1139	-	0.7714	2.743***
Totalcomp	22,672	0.34	0.12	12.1	-	1,240.0	637	0.217	0.165	0.207	-	1.834	0.254
Options	22,672	0.025	-	0.15	-	17.9	637	0.040	0.010	0.079	-	0.901	-2.632***
Shares	22,672	0.009	-	0.06	-	2.01	637	0.011	-	0.046	-	0.503	-0.701
Optionplan	22,672	43.82%	0.00%	49.62%	0.00%	100.00%	637	74.4%	100.0%	43.7%	0.0%	100.0%	-15.391***

Size_mktcap = Market cap ($m). *Ln_mktcap* = natural log of market cap. *Size_ta* = Total assets ($m). *Ln_ta* = natural log of total assets. *Age* = Firm age in years. *Ln_age* = Natural log of the firm's age in days. *MTR* = Estimated marginal tax rate. *Volatility* = standard deviation of monthly stock returns over the previous 12 months. *MTB* = Market to book ratio. *Intangibles* = Intangible assets as a percentage of total assets. *CashBurn* = Ratio of cash holdings to cash used in operations. *Equitymix_top5* = Equity-based compensation for the top 5 executives as a percentage of total compensation. *Top20* = % of shares owned by top 20 shareholders. *Lev* = Ratio of long-term debt to total assets. *Totalcomp* = Average total remuneration paid to each director and executive ($m). *Options* = Average option-based remuneration paid to each director and executive ($m) *Shares* = Average equity-based remuneration paid to each director and executive ($m). *Optionplan* = Percentage of firms using option-based compensation for directors and executives.

Table 3.9: Correlation matrix[101]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1)	1																	
(2)	0.661	1																
(3)	0.852	0.838	1															
(4)	0.985	0.710	0.884	1														
(5)	0.093	0.128	0.158	0.119	1													
(6)	0.087	0.137	0.169	0.115	0.893	1												
(7)	-0.411	-0.099	-0.262	-0.366	-0.003	0.024	1											
(8)	-0.118	0.061	-0.013	-0.102	-0.022	0.002	0.212	1										
(9)	-0.286	0.098	-0.065	-0.201	0.108	0.170	0.435	0.387	1									
(10)	-0.292	-0.056	-0.163	-0.248	-0.152	-0.161	0.321	0.064	0.443	1								
(11)	0.159	0.021	0.146	0.124	0.064	0.086	-0.170	0.211	-0.314	-0.333	1							
(12)	0.093	-0.073	-0.012	0.052	0.089	0.046	-0.217	-0.088	-0.310	-0.410	0.238	1						
(13)	-0.048	0.102	0.052	-0.016	0.055	0.055	0.229	0.501	0.334	-0.082	0.085	-0.185	1					
(14)	0.093	0.163	0.118	0.098	0.088	0.112	-0.029	0.080	0.045	-0.174	0.123	-0.002	-0.062	1				
(15)	0.086	0.130	0.157	0.114	0.991	0.884	0.001	-0.024	0.129	-0.128	0.047	0.076	0.047	0.086	1			
(16)	-0.201	-0.097	-0.176	-0.201	-0.053	-0.032	0.269	0.022	0.341	0.384	-0.209	-0.198	-0.100	-0.089	-0.047	1		
(17)	-0.072	0.101	0.041	-0.025	-0.029	0.011	0.159	0.106	0.312	0.244	-0.176	-0.262	0.109	0.106	-0.017	0.099	1	
(18)	-0.167	-0.063	-0.126	-0.147	0.010	0.007	0.238	0.045	0.365	0.247	-0.193	-0.235	0.124	-0.093	0.023	0.158	0.167	1

[101] Variables: (1) *OptionGrants* = natural logarithm of the number of options granted in the current year. (2) *TaxableValue* = natural logarithm of the taxable value of options granted during the year. (3) *BlackScholesValue* = natural logarithm of the value of options granted, using the Black-Scholes option pricing model. (4) *CHLValue* = value of option grants using a heuristic of 25% of the exercise price. (5) *OptionMix* = Stock option compensation as a percentage of total compensation. (6) *EquityMix* = Equity based compensation (shares + options) as a percentage of total compensation. (7) *Exercises* = Value of options exercised during the year. (8) *Performance* = Cumulative price relative measured over the previous 12 months. (9) *Size* = Market capitalisation. (10) *MTR* = Estimated marginal tax rate. (11) *Volatility* = standard deviation of monthly stock returns over the previous 12 months. (12) *Intangibles* = Intangible assets as a percentage of total assets. (13) *MTB* = Market to book ratio. (14) *CashBurn* = Ratio of cash holdings to cash used in operations. (15) *Optionmix_top5* = Stock option compensation for the top 5 executives as a percentage of total compensation. (16) *Age* = Number of days since listing date. (17) *Top 20* = % of shares owned by top 20 shareholders. (18) *Lev* = Ratio of long term debt to total assets.

Table 3.10: Results for tests of H1 – Determinants of employee option plan adoptions

		DV = Employee option plan dummy (EESO)			
		(1) Control variables in year *t*		(2) Control variables in year *t* - 1	
	Predicted sign	Coefficient	Z-stat.	Coefficient	Z-stat.
Size	-	0.269	9.43***	0.262	8.77***
MTR	-	-1.302	-2.62***	-1.490	-2.83***
Volatility	+	-0.359	-0.87	-0.169	-0.4
MTB	+	-0.002	-0.18	0.020	1.73*
Intangibles	+	0.085	0.50	0.208	1.18
CashBurn	-	0.011	0.98	0.014	1.13
OptionMix_Top5	+	0.879	4.12***	0.701	3.12***
Age	-	-0.109	-2.60***	-0.127	-2.98***
Top20	-	-0.006	-2.55**	-0.006	-2.24**
Lev	-	-1.251	-2.63***	-0.958	-2.02**
Fixed effects:					
Industry		Yes		Yes	
Year		Yes		Yes	
Metals & Mining	+	0.289	5.48***	0.283	5.02***
Energy	+	0.301	4.73***	0.295	4.43***
Information Technology	+	0.310	4.52***	0.307	3.81***
Pharmaceuticals	+	0.328	5.17***	0.324	4.63***
Observations		17,497		16,588	
Chi-squared statistic		423.7		407.59	
Pseudo R^2		8.08%		8.29%	
Log likelihood		-2,411.46		-2,254.26	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. The dependent variable, *EESO*, is an indicator variable coded 1 if the firm disclosed the existence of an employee option plan in year *t*. *Size* = natural log of market capitalisation. *MTR* = Estimated marginal tax rate. *Volatility* = standard deviation of monthly stock returns over the previous 12 months. *MTB* = Market to book ratio. *Intangibles* = Intangible assets as a percentage of total assets. *CashBurn* = Ratio of cash holdings to cash used in operations. *Optionmix_top5* = Stock option compensation for the top 5 executives as a percentage of total compensation. *Age* = Number of days since listing date. *Top 20* = % of shares owned by top 20 shareholders. *Lev* = Ratio of long-term debt to total assets.

Table 3.11: Results for tests of H2 – Determinants of employee option grants before and after 2009

		DV = Option Grants (only firms where EESO =1)							
		(1) Quantity granted		(2) Black Scholes		(3) CHL Heuristic		(4) Tax Value	
	Pred. sign	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
constant		16.326	3.88***	3.396	1.00	10.032	2.71***		
Div83A	-	-0.539	-0.9	-1.820	-3.77***	-1.302	-2.46**	-2.150	-4.7***
Div83A_amended	+	0.072	0.09	-3.338	-4.31***	-2.560	-3.43***	-4.679	-7.27***
Size	-	-0.330	-1.58	0.183	1.07	-0.041	-0.22	0.355	2.23**
MTR	-	-9.192	-3.31***	-2.919	-1.28	-4.395	-1.8*	-0.966	-0.46
Volatility	+	2.237	0.83	5.424	2.46**	1.999	0.84	1.624	0.79
MTB	+	0.088	1.01	0.035	0.49	0.106	1.38	0.028	0.43
Intangibles	+	-2.297	-2.3**	-1.717	-2.06**	-1.557	-1.77*	-0.671	-0.88
CashBurn	-	0.068	0.95	0.048	0.84	0.095	1.52	0.123	2.27**
OptionMix_Top5	+	2.289	1.61	3.104	2.73***	2.535	2.03**	1.639	1.52
Age	-	-0.009	-0.03	-0.176	-0.67	-0.167	-0.59	-0.181	-0.74
Top20	-	0.014	0.82	0.032	2.25**	0.017	1.12	0.030	2.24**
Lev	-	-1.345	-0.51	-4.453	-2.1**	-3.651	-1.58	-4.253	-2.14**
Exercises	-	-0.353	-7.12***	-0.251	-6.22***	-0.329	-7.54***	-0.155	-4.11***
Performance$_t$	?	-0.461	-1.09	0.075	0.21	-0.249	-0.67	0.380	1.18
Performance$_{t-1}$	?	-0.080	-0.21	0.231	0.75	-0.043	-0.13	0.247	0.85
Observations		564		517		564		564	
F-statistic		10.06***		7.89***		8.7***		7.74***	
Adj-R2		19.44%		16.68%		17.02%		15.23%	
Root MSE		6.116		4.78		5.3868		4.6516	

Div83A = indicator variable coded 1 for years between 2009 and 2014 and 0 otherwise. *Div83A_amended* = indicator variable coded 1 for 2015 and later years and 0 otherwise. *Exercises* = natural log of option exercises. *Performance* = cumulative stock return over the previous 12 months. Dependent variables: (1) *OptionGrants* = natural logarithm of the number of options granted in the current year. (2) *BlackScholesValue* = natural logarithm of the value of options granted, using the Black-Scholes option pricing model. (3) *CHLValue* = value of option grants using a heuristic of 25% of the exercise price. (4) *TaxableValue* = natural logarithm of the taxable value of options granted during the year. Log transformations applied to dependent variables. All other variables as defined previously.

Table 3.12: Option Grants Model with alternative dependent variables

		All observations with *EESO* = 1		Option grants sub-sample			
		(1) *DV = LnQuantityGrants*		(2) *DV = LnNilValueGrants*		*DV = LnTaxableGrants*	
	Exp Sign	Coefficient	t-stat.	Coefficient	t-stat.	Coefficient	t-stat.
constant		11.865	2.94***	14.888	2.46**	-8.316	-1.49
Div83A	-	-1.412	-2.25**	3.693	4.76***	-2.439	-3.42***
Div83A_amended	+	-0.444	-0.53	5.232	4.02***	-4.504	-3.75***
NilValue	+	3.644	3.28***				
*Post*NilValue*	+	2.059	1.59				
Size	-	-0.114	-0.57	-0.843	-2.73***	1.077	3.78***
MTR	-	-8.030	-3.05***	-8.365	-2.09**	3.506	0.95
Volatility	+	1.852	0.72	-0.118	-0.04	3.580	1.2
MTB	+	0.047	0.56	0.137	1.2	-0.134	-1.28
Intangibles	+	-2.499	-2.63***	0.266	0.2	-0.674	-0.56
CashBurn	-	0.053	0.78	-0.015	-0.17	0.128	1.58
OptionMix_Top5	+	1.662	1.23	0.591	0.34	-0.579	-0.36
Age	-	-0.061	-0.2	0.619	1.47	-0.086	-0.22
Top20	-	0.020	1.22	-0.025	-1.1	0.018	0.83
Lev	-	-1.981	-0.8	4.979	1.14	-4.377	-1.09
Exercises	-	-0.294	-6.15***	-0.117	-1.52	0.030	0.43
$Performance_t$	?	-0.189	-0.47	-1.444	-2.49**	0.971	1.82*
$Performance_{t-1}$	?	0.177	0.49	-1.019	-2.13**	0.482	1.09
Observations		564		322		322	
F-statistic		13.64***		7.52***		6.1***	
Adj-R2		27.63%		23.35%		19.24%	
Root MSE		5.797		6.104		5.624	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. *NilValueGrants* = Quantity of options granted during the year that did not have a taxable value. *TaxableGrants* = Quantity of options granted during the year that did have a taxable value. *NilValue* = Indicator variable coded 1 if the firm granted options without a taxable value during the year.

Table 3.13: Results for tests of H3 – compensation mix before and after 2009

		(1) DV = *OptionMix*		(2) DV = *EquityMix*	
	Predicted sign	Coefficient	t-stat.	Coefficient	t-stat.
constant		-0.182	-11.87***	-0.282	-16.92***
Div83A	-	-0.022	-7.81***	-0.020	-6.53***
Div83A_amended	+	-0.021	-6.46***	-0.016	-4.4***
Size	-	0.021	30.04***	0.028	36.17***
MTR	-	-0.219	-17.41***	-0.280	-20.51***
Volatility	+	0.007	0.72	0.022	1.93**
MTB	+	0.001	2.24**	0.001	3.54***
Intangibles	+	0.015	3.06***	0.015	2.86***
CashBurn	-	0.002	4.64***	0.002	4.31***
Age	-	-0.010	-8.8***	-0.009	-7.59***
Top20	-	-0.000	-4.89***	-0.000	-4.71***
Lev	-	-0.031	-2.85***	-0.019	-1.58
Industry FE		Yes		Yes	
Metals & Mining		0.051	10.57***	0.059	11.25***
Energy		0.053	9.62***	0.060	10.01***
Information Technology		0.031	5.49***	0.034	5.67***
Pharmaceuticals		0.007	3.79***	0.031	3.94***
Observations		17,490		17,490	
F-statistic		87.18***		109.95***	
Adj-R2		10.18%		12.53%	
Root MSE		0.1488		0.1616	

The superscripts ***, ** and * denote significance at 1%, 5%, and 10% confidence levels. *OptionMix* = stock options as a percentage of total compensation paid to directors and executives, based on stock option expense in the company's financial statements. *EquityMix* = equity-based pay as a percentage of total compensation paid to directors and executives.

Table 3.14: Results for tests of H4 – Market Reactions

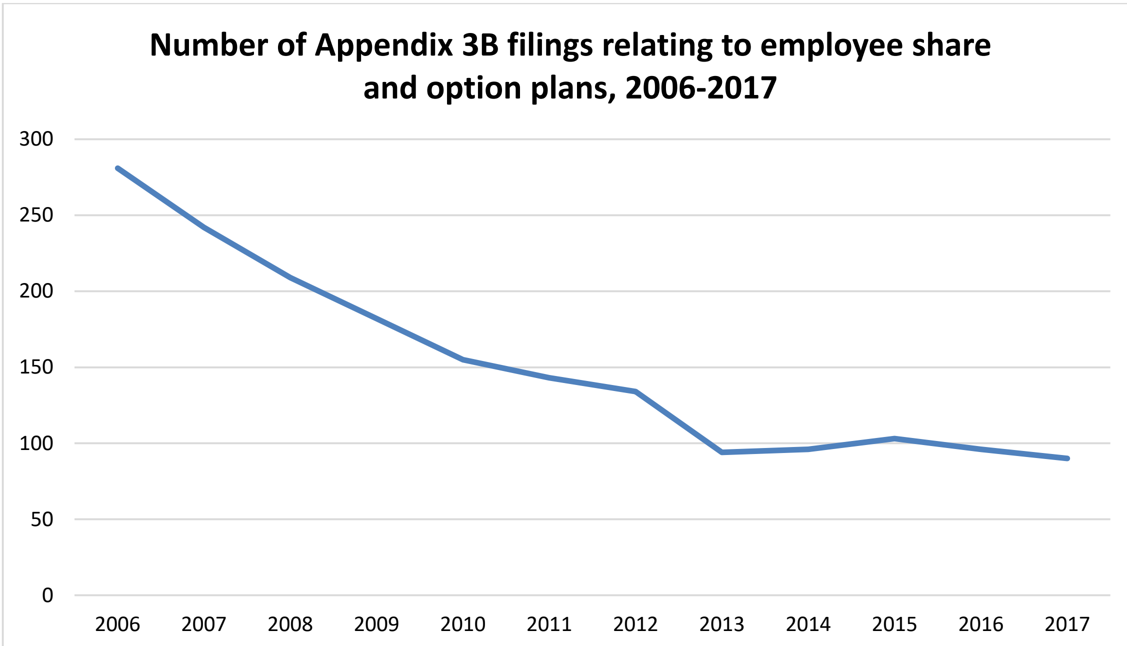
Panel A: 2009

			3-day CARs, option plan sample			3-day CARs, ESS sample		
			(1)	(2)	(1) – (2)	(3)	(4)	(3) – (4)
Event	Date	Pred. reaction	Option plan firms	All other firms	Difference	ESS firms	All other firms	Difference
I	12 May 2009	-	0.033	0.044	-0.011*	0.028	0.044	-0.015*
II	25 May 2009	+	-0.006	0.006	-0.012	0.017	0.003	0.014*
III	5 June 2009	+	0.031	0.019	0.012**	0.017	0.021	-0.004
IV	1 July 2009	+	0.021	0.012	0.008*	0.016	0.013	0.003
V	14 August 2009	*	0.010	0.009	0.001	0.026	0.008	0.018*
VI	21 October 2009	*	-0.004	0.004	0.008	0.005	0.002	0.003
VII	2 December 2009	*	0.013	0.008	0.005	0.006	0.009	-0.003

Panel B: 2015

			3-day CARs, option plan sample			3-day CARs, ESS sample		
			(1)	(2)	(1) – (2)	(3)	(4)	(3) – (4)
Event	Date	Pred. reaction	Option plan firms	All other firms	Difference	ESS firms	All other firms	Difference
I	1 August 2014	+	-0.003	0.009	-0.012**	0.032	0.007	0.026*
II	14 October 2014	+	-0.024	-0.029	0.005	-0.020	-0.028	0.009
III	14 January 2015	+	0.006	0.012	-0.006	0.006	0.012	-0.006
IV	25 March 2015	*	0.006	0.011	-0.005	-0.003	0.011	-0.014**
V	25 June 2015	*	0.017	0.017	-0.000	0.004	0.018	-0.014**

Figure 3.1: Number of announcements relating to employee share and option plans, 2006-2017



Source: Australian Company Announcements Library, SIRCA

7 APPENDICES

APPENDIX A: DESCRIPTION OF DATA COLLECTED

Appendix 5B Data

- Announcement date
- Company name
- Ticker – the historical 3-letter ASX code of the company as at the date of the announcement (used for linking observations to other databases).
- Quarter – The quarter to which the Appendix 5B related. The quarterly report is usually released to the ASX within 30 days of the quarter end.
- The amount of the R&D tax offset received during the quarter, in AUD.
- The description given to the R&D tax offset refund in the Appendix 5B, e.g., "R&D tax incentive", "R&D refund", or "R&D rebate".

Metals & Mining Properties Data

- Company name
- Ticker – The historical 3-letter ASX code of the company as at August 2016 (used for linking observations to other databases).
- Property – The name of the project. This tracks the project for which the company is disclosing resource and reserve updates.
- Property ID – A 5-digit number that uniquely identifies each project in the SNL Metals & Mining database.
- Controlling interest – The company's percentage controlling interest in the project as at August 2016.
- Country – The country in which the project is located.
- Development stage – The stage of the project as at August 2016, i.e., grassroots; advanced exploration; feasibility; development; construction; production.
- Activity status – The status of the project as at August 2016, i.e., active/inactive
- The primary commodity (the lead product) being explored.
- Other (by-product or secondary) commodities being explored.

- Primary reserves and resources (quantity) – Total quantity of reserves and resources measured in tonnes, based on the company's most recently disclosed estimate.
- Primary reserves and resources (value) – Total in-situ value of the resource or reserve in $millions, based on the company's most recently disclosed estimate.
- Primary reserves and resources as of date – Date of the company's most recently disclosed resource or reserve estimate.

Resource and Reserve Disclosures

- Property – The name of the project. This tracks the project for which the company is disclosing resource and reserve updates.
- Property ID – A 5-digit number that uniquely identifies each project in the SNL Metals & Mining database.
- The date that the resource or reserve estimate was disclosed.
- The primary commodity (the lead product) being explored.
- Whether the estimate is a mineral resource or an ore reserve.
- Tonnage – The total representation of the mineral resource or reserve in tonnes without considering the grade or density of the mineral.
- Grade – Shows how much mineral is being extracted per rock, expressed as a percentage.
- Contained resource or reserve – An estimate of the net quantity of the commodity that can be extracted from the mine after considering the grade or density.
- The year-end spot price of the primary deposit commodity in $AUD.
- Value of resource or reserve – The quantity of the resource or reserve multiplied by the year-end spot price.

Appendix 3B Data

- Announcement date
- Announcement header
- Company name
- Ticker – The historical 3-letter ASX code of the company as at the date of the announcement (used for linking observations to other databases).

- Report code – The code used by the ASX to classify the announcement. Each announcement has a primary report code and a sub report code, which are combined to form the report code. For example, the report code for an Appendix 3B filing is 6013. The primary report code, 06, is used to identify the announcement as pertaining to changes in issued capital, and the sub report code, 013, identifies the announcement as an Appendix 3B.
- The class of securities issued – e.g. ordinary shares, options, performance rights or retention rights.
- The quantity of securities issued.
- The date of the issue.
- Action – The reason for the Appendix 3B announcement, e.g., issue or exercise of employee options, issue or vesting of employee shares, issue or vesting of performance rights.
- Terms – The principal terms of the securities issued (if disclosed), including performance hurdles, vesting or forfeiture conditions, or disposal restrictions.
- Exercise price for employee options.
- Vesting date for employee options, restricted shares or performance/retention rights.
- Expiry date for employee options.
- Number of shares outstanding as at the date of the announcement.
- Employee options outstanding as at the date of the announcement (not always disclosed).
- Employee shares outstanding as at the date of the announcement (not always disclosed).

APPENDIX B: NOVEMBER 2018 SUBMISSION BY NORTHERN MINERALS LIMITED TO THE SENATE ECONOMICS LEGISLATION COMMITTEE INQUIRY ON THE R&D TAX INCENTIVE

NORTHERN MINERALS

05 November 2018

Dear Chair and Members of the Senate Economics Legislation Committee,

RE: Submission to the Senate Economics Legislation Committee Inquiry on the Treasury Laws Amendment (Making Sure Multinationals Pay Their Fair Share of Tax in Australia and Other Measures) Bill 2018.

This submission explains Northern Mineral's concern at changes to the Research and Development Tax Incentive Scheme given effect under this Bill, and specifically with the $4million cap on research and development (R&D) cash refunds for expenditure on eligible R&D for companies with an aggregated annual turnover below $20 million.

It details:

1. The immediate negative financial impact of the Bill on Northern Minerals and its heavy rare earths Project.
2. The potential of this ground-breaking Australian Project.
3. The Project's geopolitical significance.
4. Economic and social benefits to Australia and the Government from the Project.
5. Why uncapped cash refunds for eligible R&D were essential to developing the Project.
6. Three approaches to amending the Bill to ameliorate the negative impact on Northern Minerals, including two which would also support the development of the critical minerals industry over the long term.

1. Immediate financial impact on Northern Minerals and the Browns Range Heavy Rare Earths Project

The Browns Range Heavy Rare Earths Project has been planned, financed and constructed relying on access to uncapped R&D cash refunds under the Government's long-established Tax Incentive Scheme over an eight-year period (2012/13 to 2018/19). In an opaque global heavy rare earths market, Northern Minerals has leveraged the cash refunds for money spent on eligible R&D to gain finance for a project that faced reluctance from traditional banks to provide finance.

If the Bill is passed in its current form, it will apply retrospectively to this current financial year. This retrospective effect will create a $12,361,470 million shortfall in the financing of the Project in 2018/19, the final year of the planned R&D program. This immediate and retrospective change by the Australian Government brings new and unexpected financial risk to the Project.

Northern Mineral made its Final Investment Decision on the Project in April 2017 based on a business case which anticipated 2018/19 would be the final year of the planned R&D program at Browns Range. All indicators are that this timeframe will be met.

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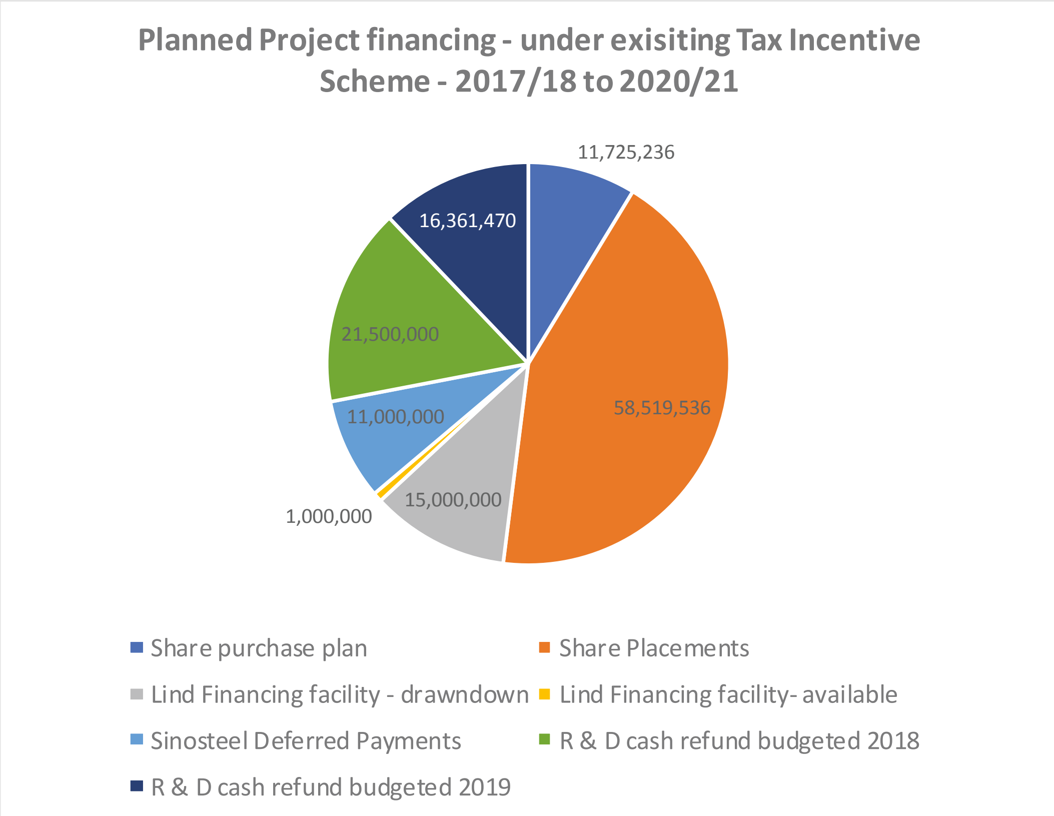
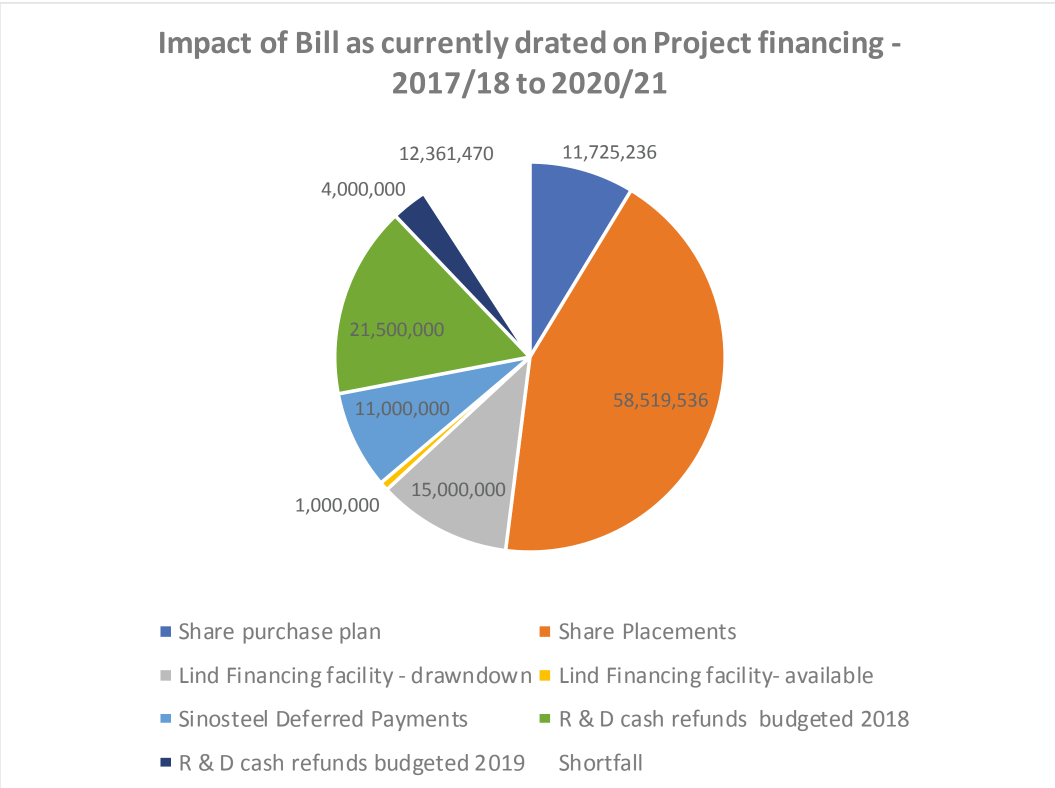
NORTHERN MINERALS





NORTHERN MINERALS

Year	Cash Refund on Eligible R&D Received
2011/12	$1,809,074
2012/13	$6,025,492
2013/14	$8,992,296
2014/15	$4,985,413
2015/16	$1,763,771
2016/17	$2,672,972
Total Received to date	**$26,249,018**

Year	Expected Cash Refund on Eligible R&D Claimed (not yet Received)
2017/18	$21,562,688

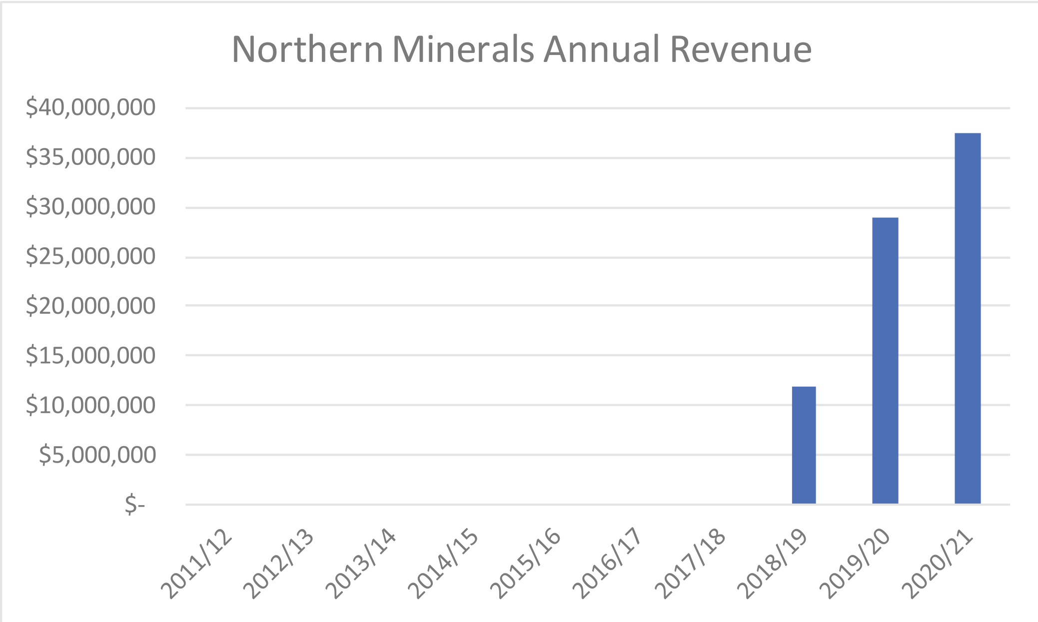
Year	Budgeted Cash Refund on Eligible R&D
2018/19	$16,361,470 – current Tax Incentive Scheme

Year	Capped Cash Refund on Eligible R&D under new Bill as drafted
2018/19	$4,000,000

If R&D cash refunds are now, as a result of this Bill, to be capped at $4million in this current financial year, Northern Minerals will be forced to raise replacement funding from an alternative source. While the majority of shares in Northern Minerals are currently held by Australian investors, the most significant debt and equity investments in the Project have been made by Chinese companies with experience in rare earths processing and understanding of the market potential. Ideally, we would like to maximise Australian equity and debt in the project, however if this is not possible, the most likely source of funding to replace the R&D cash refund shortfall is from China – which would result in diluted Australian ownership.

In 2018/19, Northern Minerals will generate its first revenue and in 2019/20 is not expected to be eligible for the R&D cash refund program when its aggregated annual turnover is expected to exceed $20 million. See graph below. The uncapped R&D cash refunds have been vital to financing and developing this innovative Project, which has created a new export opportunity for Australia.

NORTHERN MINERALS

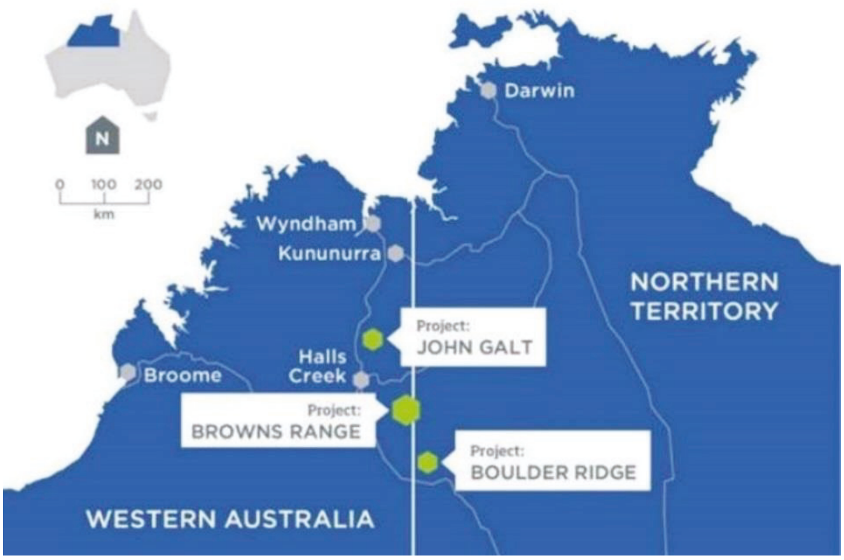


Note: graph shows actual and projected revenue over the 2011/12 to 2020/21 period

2. A ground-breaking world-first project

The pilot stage of the Project produced its first rare earths carbonate in October 2018 and will commence export this year.

The Project is producing a commodity vital to current technological development while creating jobs in one of the most remote parts of Australia. It is located 160 kilometers south-east of Halls Creek and 50 kilometers south east of the Yaruman Community at Ringer Soak in the East Kimberley. See map below.



Northern Minerals has invested more than $190 million in the Project to date. It produces a mixed rare earth carbonate which includes a high grade of Dysprosium and Terbium which are key components of the highly energy efficient permanent magnet motors used in electric vehicles, wind turbines, air conditioning, industrial robots and defence applications.

Beyond producing a mixed rare earth carbonate, Northern Minerals is actively pursuing plans for downstream processing to increase the value of exports. In 2018 and 2019 the company is focused on establishing ore sorting and moving towards producing separated oxides which will allow products to be sold to a greater range of markets globally.

Size of resource

Northern Minerals has spent $35 million on exploration to date at Browns Range. The Browns Range dome is a massive geological feature covering 1,500km2 and stretching 60km x 30km, most of which hasn't been effectively explored. Northern Minerals believes there is huge, long term potential for production from Browns Range and the surrounding region. Northern Minerals also holds tenements for nearby Boulder Ridge and John Galt.

To date, Northern Minerals has drilled 15 targets at Browns Range, six of which have been converted to resources compliant with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code). These are open at depth and along strike (length) which indicates upside potential. This compares to industry average conversion rates of 10,000 prospects drilled producing one mine. A current drilling program is showing extremely promising results with two new high-grade discoveries.

3. Geopolitical importance of product

Browns Range is now globally the only producer of heavy rare earths outside of China.

There is growing global demand for the critical minerals used in the technologies that save energy and produce low cost or renewable energy – including Dysprosium and Terbium. Governments and companies in the US and Europe are increasingly focused on ensuring reliable supplies of such minerals. Geoscience Australia maintains a list of those minerals it has identified as of critical significance. The list includes Rare Earth Elements – see Appendix A.

China has long dominated the supply of rare earths to world markets. This has been achieved by utilising its significant deposits of rare earths and also with focused investment in developing the facilities to process (beneficiate) ore into the high-grade oxides required by manufacturers throughout the world. The lack of beneficiation facilities outside of China currently means almost all ore mined outside China must be exported to the country for processing before it can be used by manufacturers throughout the world. This investment in processing has given China monopolistic control over the global rare earth market.

In 1992, Chinese Premier, Deng Xiaoping stated: "Saudi Arabia has oil, but China has rare earths."

In 2011, China reacted to nations critical of its South China Sea activities by cutting rare earths exports. This resulted in global prices skyrocketing to historic highs. The price of Dysprosium peaked at US$1,508 per kg in 2011. Prices subsequently fell when China resumed controlled export.

In 2017, China commenced a program of closing illegal heavy rare earths mines which use highly polluting leach mining techniques. This policy remains in place with mines continuing to close. Prices for heavy rare earths have risen as production in China has fallen.

In December 2017, the United States Geological Survey published its first critical minerals assessment since 1973. The report flagged the lack of US domestic and secure sources of a range of minerals that are expected to be used increasingly in critical technology. Later that month US President Donald Trump signed the 'Presidential Executive Order on a Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals'. The order states: *"It shall be the policy of the Federal Government to reduce the Nation's vulnerability to disruptions in the supply of critical minerals, which constitutes a strategic vulnerability for the security and prosperity of the United States."*

In February 2018, the US Department of the Interior released a draft list of 35 minerals deemed 'critical' to US national security. A following report by the Centre on Sustainable Investment at Columbia University noted that of the six minerals "most critical for the transition to the green economy", the US only has domestic supplies of two – Tellurium and Indium. According to the Centre of Sustainable Investment – the remaining minerals are: Lithium, Cobalt, Neodymium and Dysprosium. Australia has deposits of all four of these minerals. Also in February, President Trump met with then Australian Prime Minister Malcolm Turnbull where the countries agreed to form a partnership on critical minerals. This work is being led by Senator the Hon. Matthew Canavan, Minister for Resources and Northern Australia and the Department of Industry, Innovation and Science.

In May 2018, the Western Australian State Government announced the appointment of a Task force to develop a Lithium and Energy Materials Strategy for WA. The strategy aims to maximize opportunities for the State from the global interest in its critical minerals and downstream processing and manufacturing potential. I am a member of the Industry Reference Group advising the Taskforce.

In July 2018 US Secretary of State Michael Pompeo, US Defense Secretary James Mattis, then Australian Foreign Minister the Hon Julie Bishop, and then Australian Defence Minister (now Foreign Affairs Minister) Senator the Hon Marise Payne met for the 2018 Australia-U.S. Ministerial Consultations (AUSMIN). They agreed to hold a critical minerals dialogue, with planning now underway for the meeting to be tentatively held in the first quarter of 2019.

In August 2018, the President of the United States signed into law legislation which prohibits the US Department of Defense from acquiring rare earth magnets from China, Russia, North Korea and Iran. While there are some provisos related to reliability and cost, the legislation is significant given over 90 per cent of rare earth magnets consumed by the US Military are currently produced by China alone.

In October 2018, the Australian Government's Resources 2030 Taskforce released its report on Australia's mineral commodity future. This report includes many references to the importance of well-funded and targeted Australian Government R&D programs and the importance of this to future economic activity.

Also in October, the US Geological Survey sent two geologists to visit and gather information on the Browns Range Heavy Rare Earths Project and Lynas Corporation's Mount Weld light rare earths processing facility.

4. Economic and social benefits to Australia and the Government from cash refunds on eligible R&D

Under the current R&D Tax Incentive Scheme, the Australian Government effectively makes seed funding investments in innovative and promising projects which have the prospect of delivering returns – both to the Government Treasury and the Nation.

It is important to note that cash refunds to companies on eligible R&D expenditure can result in a benefit to the Australian Government later in the form of increased company tax collections. Projects that receive cash refunds for eligible R&D, reduce the company tax losses which would otherwise have been carried forward and used to reduce tax payable. Receiving R&D cash refunds also results in the company losing future franking credits that would otherwise have been attached to future dividends paid to shareholders. Any cash refunds received as a result of the R&D Tax Incentive Scheme are effectively treated as a debit to the company's franking account in the future. This means that a company that has received a cash refund on eligible R&D expenditure will not be able to pay a fully franked dividend to shareholders until such a time that the refunds received from R&D are offset by the tax paid.

Limiting R&D cash refunds to $4 million potentially slows down important work leading to commercialization, the ultimate outcome of R&D.

The current pilot processing plant at Browns Range is budgeted to process 60,000 tonnes of ore per annum (full capacity is 72,000 tonnes). The pilot is a preliminary stage towards full-scale production which will process 585,000 tonnes of ore per annum. Analysis by Deloitte Access Economics[1] indicates the pilot stage will boost the Gross Regional Product of the Kimberley region over its three-year operation by $33 million, and provide mining, construction and service contracts to Western Australian businesses worth $74 million.

During construction in 2017 the pilot stage of the Project provided an additional 90 FTE jobs (at peak there were 120 people employed) and now in operation employs 50 FTEs.

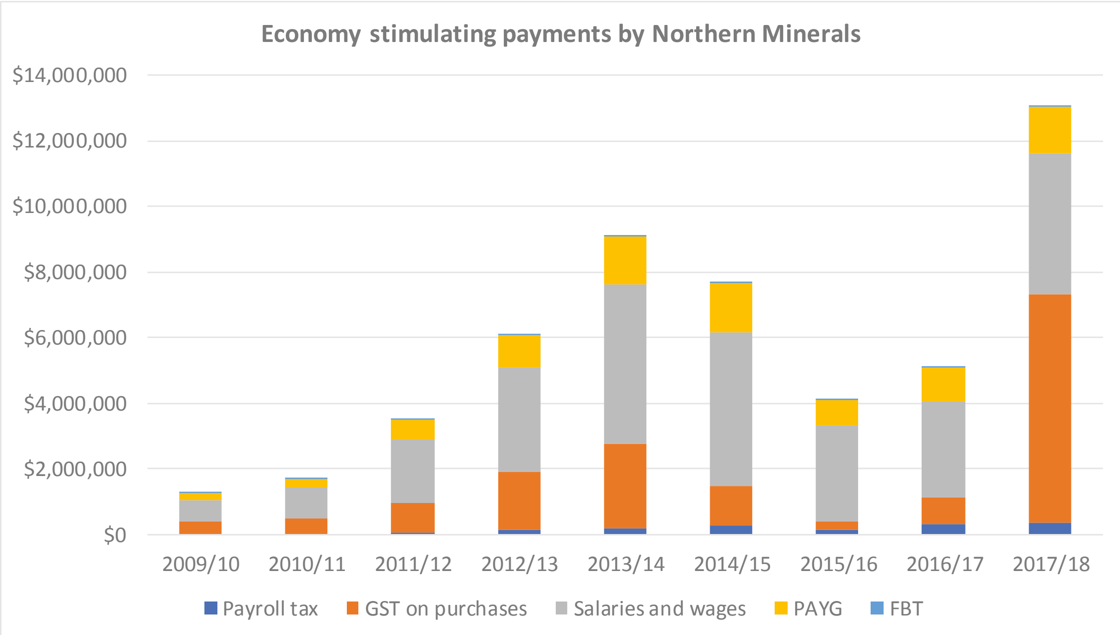
Other benefits of the pilot stage of the Project include:

- $8.1 million training to work program and on-site infrastructure providing trainee positions for local Aboriginal people. These traineeships will be run continuously to build capacity in nearby communities. The training program received $4.8 million in funding from the Australian Government's Building Better Regions Fund.
- Rare earth exports worth approx. $19 million per annum (based on current rare earth prices).
- Mineral royalties of approximately $500,000 to the WA State Government per year.
- Payroll tax of approximately $500,000 to the WA State Government per year.
- GST and company tax paid to the Commonwealth Government.
- The purchase of goods and services – with preference given to local suppliers where possible.

Once at full scale production, Deloitte Access Economics[2] predict the Project will boost the Gross Regional Product of the Kimberley region over a 13-year period by $393 million, create 406 FTE jobs during construction and an average of 135 FTEs during operation, and provide mining, construction and services contracts to Western Australian businesses worth $773 million. At full-scale production, the Project will generate between $270 million and $310 million per year of economic activity across Australia; approximately 80% of this economic activity is expected to benefit Western Australia, and up to $10 million of this will directly benefit the local area.

At full-scale production, the Project will also contribute significantly increased royalties and payroll tax to the State Government and GST and company tax to the Australian Government.

[1] Deloitte Access Economics, economic impact study of the Browns Range Heavy Rare Earths Project, 2016.
[2] Deloitte Access Economics, economic impact study of the Browns Range Heavy Rare Earths Project, 2016.



Note: the above graph doesn't include the significant sums paid to businesses for goods and services.

5. Uncapped cash refunds for eligible R&D were essential to developing Browns Range

The Browns Range deposit is found in hard rock whereas Chinese deposits are mined from ionic clays. Hard rock mining processing of this type has not been done before.

Given the product specifications and market for Australian Dysprosium and Terbium are yet to be proved, financing for the pilot stage of this project presented many technical challenges and has been achieved through a number of sources. The R&D cash refunds have been a vital part of financing the establishment of the pilot stage of the Project.

The pilot processing plant provides the opportunity for Northern Minerals to assess the economic and technical feasibility of the full-scale production stage of the Project and to conduct further research and development on the process. The full-scale plant, if economically and technically feasible as we aim to demonstrate by the pilot plant, will be the first commercial scale source of heavy rare earths outside China. The cash refunds on eligible R&D expenditure have been a vital component in funding the development of what is now a new export industry for Australia.

The funds accessed by Northern Minerals through the R&D cash refund have added to the company's confidence in undertaking detailed studies into hard rock heavy rare earths mining and processing. This has resulted in innovative enhancement initiatives as the Project has progressed through its development phases.

Eligible R&D expenditure

Innovation and Science Australia (ISA) is the body responsible for determining whether activities qualify as eligible R&D expenditure under the Tax Incentive Scheme. In recent years, the approval process has become significantly more rigorous. Northern Minerals has met the eligibility requirements of the Scheme throughout its R&D program. Below is a description of eligible R&D activities from the ATO's website[3]:

[3] https://www.ato.gov.au/business/research-and-development-tax-incentive/eligibility/eligible-activities/

"Core R&D activities are experimental activities:

- *whose outcome cannot be known or determined in advance on the basis of current knowledge, information or experience, but can only be determined by applying a systematic progression of work that*
  - *is based on principles of established science; and*
  - *proceeds from hypothesis to experiment, observation and evaluation, and leads to logical conclusions*
- *that are conducted for the purpose of generating new knowledge (including about creating new knowledge or improved materials, products, devices, processes or services)."*

6. Suggested amendments to the Bill to protect the Critical Minerals Industry

Option 1: Allow existing projects, where the current R&D arrangements have been used to finance the project, to be grandfathered in the 2018-19 financial year. This would allow projects such as Northern Minerals to be completed according to their planned financing structure and protected from the retrospective nature of the Bill. This option would support advanced existing projects but not future projects.

This amendment would acknowledge the risk posed to advanced projects which have made investments and proceeded in reliance on the established R&D Tax Incentive Scheme.

Northern Minerals understands that the Government has costed this potential amendment.

Option 2: Amend the Bill to exempt projects that support the development of critical minerals and those associated with energy production and efficiency from the $4million cap on cash refunds for eligible R&D expenditure for companies with an aggregated annual turnover below $20 million.

Under the Bill as drafted, clinical trials have been scoped out of the $4million cap on cash refunds in this way. Innovation and Science Australia (ISA) is the body responsible for determining whether eligible R&D expenditure satisfies the definition of a clinical trial. The Bill could be amended to make ISA also responsible for determining whether eligible R&D expenditure satisfies the definition of a critical mineral project. Geoscience Australia maintains a list of minerals deemed as critical commodities to Australia and could provide the definitions. See Appendix A.

This approach is supported by the WA State Government, the WA Liberal Opposition, the WA Nationals and the Chamber of Minerals and Energy WA (see Appendix B, C, D and E).

According to advice provided by Advisers to the Minister for Industry, Science and Technology, the Hon. Karen Andrews and key staff from the Department of Industry, Innovation and Science, the main rationale for the carve out on capped cash refunds on eligible R&D expenditure for clinical trials is that this is a key focus of interest to the Government and the long lead times in developing and bringing such products to market. Northern Minerals believes that both these points should also apply to critical mineral production and processing, given the long-term contribution to the national interest.

Like clinical trials, the critical minerals sector has been identified by the Prime Minister and the Government as of national and international importance. The Australian Government's Resources 2030 Taskforce has reported that a well-funded and targeted Australian Government R&D program is vital to the development of the nation's resource industry.

Northern Minerals is firmly of the view that the proposed cash refund cap will have a negative impact on the development of innovative critical minerals projects in Australia. The proposed cap will force projects, such as Browns Range, to develop very slowly, if at all, and result in missed opportunities for the nation.

Option 3: Amend the Bill to remove the $4 million cap on cash refunds on eligible R&D expenditure for companies with an aggregated annual turnover below $20 million.

Northern Minerals has been advised by the Department of Industry, Innovation and Science that in 2015/16 twenty companies that benefited from R&D cash refunds claimed more than $4million.

In conclusion

Northern Minerals has been actively involved in all stages of consultation on these changes and has met with many Ministers, Shadow Ministers, and MPs from all political parties. We understand the issues and have serious concerns about the impact of the proposed cap on refunds on, not only our business but Australia's emerging critical minerals industry as a whole. Many of the MPs we have met with understand and share our concerns. See one example at Appendix F.

Thank you for considering this submission. I look forward to appearing at the Inquiry hearing on 16 November, 2018. I can be contacted on [redacted]

Yours sincerely

Production Note:
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George Bauk
Managing Director/CEO

Apendices

Appendix A	Geoscience Australia: critical commodity notes for Dept.Industry, Innovation and Science, 17 July 2018
Appendix B	Letter from WA Premier to George Bauk, Northern Minerals, 13 September 2018
Appendix C	Letter from Leader of WA Liberal Opposition to George Bauk, Northern Minerals, 1 November 2018
Appendix D	Letter from Leader of WA Nationals and second Opposition party to George Bauk, Northern Minerals, 1 November 2018
Appendix E	Letter from CEO of Chamber of Minerals and Energy (WA) to Prime Minister Morrission, 3 October 2018
Appendix F	Letter from Senator the Hon. Matthew Canavan, Minister for Resources and Northern Australia to George Bauk, Northern Minerals, 13 September 2018

APPENDIX A

Commodity
Antimony
Arsenic
Barite
Bauxite (alumina and aluminium)
Beryllium
Bismuth
Cesium and Rubidium
Chromium
Cobalt
Fluorspar
Gallium
Germanium
Graphite
Helium
Indium
Lithium
Magnesium
Manganese
Niobium
Platinum Group Elements
Potash
Rare Earth Elements
Rhenium
Scandium
Strontium
Tantalum
Tin
Titanium
Tungsten
Uranium
Vanadium
Zirconium and Hafnium

Geoscience Australia: critical commodity notes for DIIS, 17 July 2018

APPENDIX B

RECEIVED
DATE 21/9/18 BY

Premier of Western Australia

Our Reference: 59-068228

Mr George Bauk
Managing Director/CEO
Northern Minerals
PO Box 669
WEST PERTH WA 6872

Dear ~~Mr Bauk~~ George

Thank you for your letter dated 23 May 2018 regarding the Federal Government's proposed amendments to the *Research and Development Tax Incentive Scheme*.

The Western Australian Government is committed to facilitating the development of the State's energy and battery materials industry. A ministerial taskforce chaired by the Hon Bill Johnston MLA, has been established to develop a lithium and energy materials strategy. I understand that you are contributing to this as a member of the industry reference group.

Minister Johnston has written to the Commonwealth Treasurer, the Hon Josh Frydenberg MP, expressing concern that the proposed changes to the *Research and Development Tax Incentive Scheme* will affect negatively investment in the energy and battery materials industry.

Minister Johnston has requested that Treasurer Frydenberg extend to the energy and battery materials industry the same annual cap exemption proposed for clinical trials. This will send a positive signal to potential investors and support the development of the industry.

Thank you for your efforts in promoting the development of this important new industry for Western Australia.

Yours sincerely

Production Note:
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Mark McGowan MLA
PREMIER

13 SEP 2018

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APPENDIX C

Hon Mike Nahan MLA
Leader of the Opposition

Mr George Bauk
Managing Director/CEO
Northern Minerals
PO Box 669
WEST PERTH WA 6872
BY EMAIL

Dear George,

RE: The Treasury Laws Amendment (Making Sure Multinationals Pay Their Fair Share of Tax in Australia and Other Measures) Bill 2018

This letter is to provide my support for the amendments you have outlined in your submission to the Senate Economics Legislation Committee Inquiry on the above Bill.

Northern Minerals should be applauded as a small, first project company developing a pioneering heavy rare earths project and creating a new export industry for Australia.

Innovative and difficult to finance projects like Browns Range are exactly the type of initiatives which should receive a high level of support from the Australian Government's Research and Development Tax Incentive Scheme.

There is global interest in critical minerals and their downstream manufacturing potential. Western Australia is home to almost all of these minerals. R&D funding is crucial to the development of cutting-edge methods to extract and process thes minerals and manufacture from them.

I note the Australian Government's Resources 2030 Taskforce recently released its report on Australia's mineral commodity future. This report includes many references to the importance of well-funded and targeted Australian Government R&D programs and the importance of this to future economic activity.

The R&D cash refunds are an investment in our Nation's future prosperity. Along with providing jobs and generating economic activity, companies that receive the cash refunds on eligible R&D and are successful, will pay significant company tax and GST as well as providing greater taxation on dividends. Such companies are not able to pay a fully franked dividend to shareholders until the value of R&D refunds are offset by tax paid.

I trust the Senate Economics Committee will consider and act on your suggested amendments to the Bill.

Yours sincerely

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prior to publication.

Hon. Dr Mike Nahan MLA
Leader of the Western Australian Opposition

- 1 NOV 2018

APPENDIX D

Parliamentary National Party of Australia (WA)

Our ref: 181101/MD

Senator the Hon Matthew Canavan
Minister for Resources
PO Box 6100
Senate
Parliament House
Canberra ACT 2600

Dear ~~Senator Canavan~~ Matt

RESEARCH AND DEVELOPMENT TAX INCENTIVE SCHEME CHANGES

I write in relation to the proposed changes to the Research and Development (R&D) Tax Incentive Scheme (the Scheme), in particular the impact these changes may have on the fledgling rare earths sector here in Western Australia.

We have recently met with Mr George Bauk of Northern Minerals. Mr Bauk provided a briefing on the Browns Range Heavy Rare Earths Project, the pilot stage of which produced its first rare earths carbonate in October 2018. Browns Range is currently the only producer of heavy rare earths outside of China and is producing a critical commodity vital to current technological development, as well as creating jobs in one of the most remote parts of Australia.

Northern Minerals have invested $180 million on the project to date – they are producing a mixed rare earths carbonate which contains a high grade of Dysprosium and Terbium, key components of energy efficient permanent magnet motors used in electric vehicles, wind turbines, air conditioning and industrial robots.

Given the product specifications and market for Australian Dysprosium and Terbium are yet to be proved, financing for the pilot stage of the project presented many technical challenges and was achieved through a number of sources. The R&D rebate was a vital part of financing the establishment of the project – allowing the company to undertake detailed studies into hard rock, heavy rare earths mining and processing. This has resulted in innovative enhancement initiatives as the project has progressed.

Northern Minerals has spent $35 million on exploration to date at Browns Range. They have drilled 14 targets, six of which have been converted to compliant resources. This compares to industry average conversion rates of 10,000 prospects drilled producing one mine.

The Executive at Northern Minerals are concerned that the amendments to the Scheme will have a negative impact on projects like the Browns Range Heavy Rare Earths Project. They have advised that without access to the uncapped R&D rebate, Northern Minerals may not have been able to construct the pilot stage of their project, or it would have been delayed so significantly that they would have missed the window of opportunity to position Australia to supply this important commodity.

Parliament House, Perth, Western Australia 6000 **ph** (08) 9222 7296 **fax** (08) 9222 7812

The company has suggested the following in relation to the changes proposed:

(1) Removing the proposed $4 million cap on R&D rebates or scoping out projects that support the development of critical minerals; or
(2) Allowing existing projects, where the current R&D arrangements have been used to finance the project, to be grandfathered in 2018-19 (this option would support advanced existing projects but not future projects).

You have shown a keen interest in this emerging and important resource, and our team in Western Australia has appreciated the time you've spent with representatives from the sector, including Northern Minerals.

Your advice on how the impact of the proposed amendments could be minimised to ensure this fledgling and very important sector can continue to grow would be appreciated.

If you wish to discuss this matter further please contact my Chief of Staff Josh Nyman on (08) 9222 7277 or email josh.nyman@losp.wa.gov.au.

Yours sincerely

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prior to publication.

Hon Mia Davies MLA
LEADER

Thank you for attending our Conference and making time to meet with business from WA - very much appreciated. Mia

APPENDIX E

CME

3 October 2018

The Hon. Scott Morrison MP
Prime Minister
Parliament House
CANBERRA ACT 2600

Via email: Scott.Morrison.MP@aph.gov.au

Dear Prime Minister,

It was good to see you on Tuesday and thank you for taking the time to discuss changes to the Research and Development Tax Incentive Scheme with me and George Bauk, CME WA Vice-President and Managing Director of Northern Minerals.

The emerging critical and energy minerals sector is of vital importance to Australia. There is growing global demand for these minerals, primarily used in the technologies that save energy and produce low cost or renewable technology. If encouraged, the emerging critical and energy minerals market could generate hundreds of billions of dollars in revenue in coming decades and underpin the new wave of clean energy technology being adopted around the world.

However, the proposed $4million cap to the Research and Development Tax Incentive Scheme will force innovative critical and energy minerals projects to develop very slowly or not at all, and will result in missed opportunities for Australia. We note that clinical trials have been exempted from the proposed changes, due to their national and international importance.

Given the recognised importance of the critical and energy minerals sector, CME WA asks the Federal Government to amend the Treasury Laws Amendment *(Making Sure Multinationals Pay Their Fair Share of Tax in Australia and Other Measures)* Bill 2018 to exempt projects that support the development of critical minerals and those associated with energy production and efficiency from the cap. The granting of this exemption would be a significant contributor to the successful establishment of this sector in Western Australia.

On behalf of the Western Australian Government, the Minister for Mines and Petroleum, the Hon. Bill Johnston MLA has written to the Federal Treasurer, the Hon. Josh Frydenberg to ask the Commonwealth Government to exempt the energy and battery materials industry from the cap. We support this call and would be pleased to provide additional information to your office on this emerging sector if required.

Yours faithfully,

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prior to publication.

Paul Everingham
Chief Executive Officer
The Chamber of Minerals and Energy of Western Australia

Cc: Senator the Hon. Matthew Canavan; Minister for Resources and Northern Australia, Hon. Karen Andrews MP; Minister for Industry, Science and Technology, Hon. Josh Frydenberg MP; Treasurer, Hon. Julie Bishop MP, Hon. Melissa Price MP, Hon. Christian Porter MP, Hon. Michael Keenan MP, Hon. Ken Wyatt MP, Senator the Hon. Mathias Cormann, Senator the Hon. Michaela Cash, Senator the Hon. Linda Reynolds, Ian Goodenough MP, Andrew Hastie MP, Steve Irons MP, Nola Marino MP, Rick Wilson MP, Ben Morton MP, Senator Dean Smith, Senator Slade Brockman

The Chamber of Minerals and Energy of Western Australia Level 10, 2 Mill Street, Perth, Western Australia 6000
Locked Bag N984, Perth WA 6844 p +61 8 9220 8500 f +61 8 9221 3701 e chamber@cmewa.com w cmewa.com ABN 82 738 249 529

APPENDIX F

RECEIVED
DATE 18/9/18 BY

Senator the Hon Matthew Canavan

Minister for Resources and Northern Australia

MC18-002458

13 SEP 2018

Mr George Bauk
Managing Director/Chief Executive Officer
Northern Minerals
PO Box 669
WEST PERTH WA 6872

gbauk@northernminerals.com.au

Dear ~~Mr Bauk~~ George,

Thank you for your letter of 2 August 2018 concerning the proposed amendments to the Research and Development Tax Incentive (R&DTI).

I have reviewed your submission to the Department of the Treasury on the Exposure Draft Treasury Laws Amendment (Research and Development Incentive) Bill 2018 and understand your concern relating to the proposed cap of $4 million per annum on rebates under the program.

The Australian Government supports a strong and sustainable resources sector and recognises the importance of diversifying the rare earths market. In particular, I am keenly aware of the growing demand for products like those which will be produced at your Browns Range project.

I would like to discuss your proposals regarding the proposed cap and have asked my office to contact you to arrange a time for us to meet.

Thank you for writing on this matter. I look forward to speaking with you soon.

Yours sincerely

Production Note:
Signature removed prior to publication.

Matthew Canavan

Parliament House, Canberra ACT 2600 Telephone (02) 6277 7180

APPENDIX C: EXAMPLE APPENDIX 5B

Mining exploration entity and oil and gas exploration entity quarterly report

Introduced 01/07/96 Origin Appendix 8 Amended 01/07/97, 01/07/98, 30/09/01, 01/06/10, 17/12/10, 01/05/13, 01/09/16

Name of entity

Archer Exploration Limited

ABN	**Quarter ended ("current quarter")**
64 123 993 233	30 Sept 2017

Consolidated statement of cash flows		**Current quarter $A'000**	**Year to date (3 months) $A'000**
1.	**Cash flows from operating activities**		
1.1	Receipts from customers	9	9
1.2	Payments for		
	(a) exploration & evaluation	(353)	(353)
	(b) development	-	-
	(c) production	-	-
	(d) staff costs (net of capitalised costs)	(196)	(196)
	(e) administration and corporate costs *[amount here includes consolidated group GST receivable/(payable)]*	(99)	(99)
1.3	Dividends received (see note 3)	-	-
1.4	Interest received	8	8
1.5	Interest and other costs of finance paid	-	-
1.6	Income taxes paid	-	-
1.7	Research and development refunds	158	158
1.8	Other (provide details if material)	-	-
1.9	**Net cash from / (used in) operating activities**	**(473)**	**(473)**

APPENDIX D: EXAMPLE OF A STANDALONE R&D ANNOUNCEMENT

ASX ANNOUNCEMENT

Date: 22 December 2014
Number: 384/221214

IMPACT RECEIVES $1.14 Million REBATE AND $150,000 GRANT FOR THE MULGA TANK Ni-Cu-PGE Project, WA

Impact Minerals Limited (ASX:IPT) is pleased to announce that it has received a rebate of $1.14 million from the Australian Tax Office for its Research and Development Activities during the 2014 Financial Year.

In addition the company has also been awarded a grant of $150,000 by the Western Australian Government's Exploration Incentive Scheme (EIS) for drilling at the Mulga Tank Ni-Cu-PGE Project. The EIS, a co-funding initiative for exploration in under explored areas and awarded on a dollar-for-dollar basis for direct drilling costs, has been designed to encourage innovative exploration and prioritised high quality, technically sound proposals that demonstrated new exploration concepts.

Impact's Managing Director, Dr Mike Jones, said "The receipt of the R and D rebate and our fifth co-funding award in as many years is an early Christmas present for the company and its shareholders. We have had a very successful year on all three of our key projects, starting with the first discovery of high grade nickel at the greenfields Mulga Tank Project in WA, the discovery of bonanza grade gold at the Commonwealth Project in New South Wales and finishing with the recent announcement of one of the highest grade drill intercepts of PGE ever reported in Australia together with copper and nickel from our maiden drill programme at the Broken Hill Project."

"With these funds we can continue with our very active exploration programme well into 2015 and our shareholders can look forward to very strong news flow in the New Year" he said.

APPENDIX E: REAL RISK OF FORFEITURE

Real Risk of Forfeiture[102]

Whether or not a real risk of forfeiture is present will depend on the facts and circumstances of each scheme and the individual circumstances of the employee.

An ESS interest acquired by an employee is at real risk of forfeiture if a reasonable person would consider that there is a real risk that the employee may forfeit or lose the ESS interest, other than by intentionally taking no action to realise the benefit.

The meaning of 'real' is something more than a mere possibility. An ESS interest will not be at real risk of forfeiture if a reasonable person would disregard the risk as highly unlikely to occur or as nothing more than a rare eventuality or possibility.

Real risks of forfeiture in a scheme may include conditions where retention of the ESS interests is subject to:

- performance hurdles
- a minimum term of employment.

There is no real risk of forfeiture where a scheme simply includes a condition which:

- restricts an employee from disposing of an ESS interest for a specified time
- allows an employee to request that the ESS interest be forfeited
- provides for an employee to forfeit an ESS interest if they are dismissed for fraud or gross misconduct.

[102] Source: ATO website https://www.ato.gov.au/General/Employee-share-schemes/In-detail/Restrictions-and-forfeiture/ESS---Real-risk-of-forfeiture/

APPENDIX F: EXAMPLES OF STOCK OPTION GRANTS WITH VARIOUS VESTING CONDITIONS

1. Options with immediate vesting, minerals exploration company

Issue of unlisted employee options by A1 Minerals Limited (ASX code: AAM) on 23 February 2009:

The Directors have resolved to issue 2,800,000 unlisted options to acquire ordinary shares in A1 Minerals Limited to employees and contractors. The issue has been made pursuant to the A1 Minerals Directors, Employees and Other Permitted Persons Option Plan which was last approved at the Company's Annual General Meeting held on 30th October 2008.

The Directors continue to use the policy of issuing options as a reasonable basis for rewarding employees and contractors and providing an incentive to remain with the Company.

The options vest immediately and are exercisable at 20 cents each on or before 23 February 2012, being 3 years from the date of grant.

The Directors reserve the right to cancel the options if an employee or contractor resigns from their employment or ceases their engagement with the Company.

No Director or Director related entity will participate in this issue.

2. Options with time-based vesting conditions, oil and gas exploration company

Issue of 250,000 unlisted employee options, exercisable at 25 cents, by Innamincka Petroleum Limited (ASX code: INP) on 21 January 2009, with the following exercise dates:

- 83,333 after 29 January 2010 and before 29 January 2012
- 83,333 after 29 January 2011 and before 29 January 2013
- 83,334 after 29 January 2012 and before 29 January 2014

3. Options with share price-based performance hurdles with real risk of forfeiture, software company

Issue of 250,000 unlisted employee options by Infomedia Ltd (ASX code: IFM) on 21 November 2010, exercisable at 24.5 cents and expiring on 20 December 2013.

The options shall be exercisable in three equal tranches as follows:

- One third on or after 21 November 2011;
- One third on or after 21 November 2012; and
- One third on or after 21 November 2013.

The options cannot be exercised unless the average volume weighted price for the Company's shares for the 5 trading days immediately prior to the exercise of each tranche exceeds the exercise price by the following percentages:

- For the 21 November 2011 tranche: 25%
- For the 21 November 2012 tranche: 46%
- For the 21 November 2013 tranche: 66%

4. Options with project-based performance hurdles with real risk of forfeiture, junior gold exploration company

Issue of 5,300,000 unlisted options to senior employees and key management support staff by Phoenix Gold Limited (ASX code: PXG) on 11 June 2013, with an exercise price of $0.33 and expiring on 10 June 2016. The exercise price is at an approximate 100% premium to Phoenix's recent share price.

The options will vest in four equal tranches when the Company achieves the following vesting milestones:

Key performance area	Vesting criteria
Exploration Success (1 million options)	• 25% subject to Phoenix Gold achieving a Resource position of at least 4 million ounces by end of 2013. • 25% subject to Phoenix Gold achieving a Reserve position of at least 1.5 million ounces by end of 2013. • 25% subject to Phoenix Gold achieving a market capitalization of A$80 million and the employee achieving 12 months service. • 25% subject to Phoenix Gold achieving a market capitalization of A$120 million and the employee achieving 24 months service.
Definitive Feasibility Study ("DFS") (2 million options)	• 25% on delivery of a DFS planning document outlining deliverables, critical dates and budget costs. • 25% on completion of a full mining schedule with capital and operating costs before end of 2013. • 25% on successful completion of an independently verified DFS and associated physical and financial models before the end of 2013. • 25% subject to Phoenix Gold achieving a market capitalisation of A$80 million and the employee achieving 12 months service.
Corporate Finance (2 million options)	• 25% on delivery of the financial model supporting the DFS suitable for debt funding considerations by banks before November 2013. • 25% on delivery to the Board of a recommended financing package for the project before end of 2013. • 25% on successful completion of project funding solution with first drawdown notice fulfilled before February 2014. • 25% subject to Phoenix Gold achieving a market capitalisation of A$80 million and the employee achieving 12 months service.

The remaining 300,000 options have been issued, with similar vesting hurdles, to management positions supporting the senior executives.

5. Issue of zero exercise price options ("zepos"), minerals exploration company

Employee performance rights with share price-based hurdles

Issue of 1,592,948 employee performance rights (being options without a strike price or exercise price) by Centrex Metals Limited (ASX code: CXM) on 30 November 2012, vesting on 30 June 2015. The performance rights will be convertible to fully paid ordinary shares on the vesting date if the 5-day volume weighted average share price (VWAP) exceeds $0.50.

Employee retention rights

Issue of 938,001 employee retention rights (being options without a strike price or exercise price) by Centrex Metals Limited (ASX code: CXM) on 30 November 2012, vesting on 30 June 2015. The retention rights will be convertible to fully paid ordinary shares on the vesting date.

Earliest possible taxing point

	Pre 2009	**2009-2015**	**Post 2015**
Examples 1 & 2	Exercise	Vesting	Exercise
Examples 3, 4 and 5*	Exercise	Exercise	Exercise

*Because the options in example 5 do not have an exercise price, the exercise date and vesting date will be the same.

APPENDIX G: STATUTORY VALUATION FACTORS FOR UNLISTED RIGHTS

The statutory valuation tables used to value unlisted rights for taxation purposes in Division 13A of the ITAA 1936 are derived using the Black Scholes method for valuing options.

The statutory (taxable) value of an unlisted option is worked out using Tables 1 and 2 in the regulations.

The formula used to derive the statutory valuation factors is set out below:

$$C(S,T) = e^{-rT}\left(FN(d_1) - KN(d_2)\right)$$

where:

$$F = Se^{(r-q)T}$$

$$d_1 = \frac{\ln(F/K) + (\sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

C(S, T) is the price of a European call option

S is the spot price of the underlying stock

K is the strike price of the underlying stock

N(•) is the cumulative distribution function of the standard normal distribution

T is the time to maturity

r is the risk free rate (annual rate, expressed in terms of continuous compounding)

q is the dividend yield (annual rate, expressed in terms of continuous compounding)

σ is the volatility of the underlying stock

Table 1 percentages applicable before 1 July 2015

Table 1 percentages for calculation percentages of 50% to 92.5%							
Calculation percentage up to and including							
Exercise period up to and including (months)	**60.0%**	**70.0%**	**75.0%**	**80.0%**	**85.0%**	**90.0%**	**92.5%**
120	0.6%	2.1%	4.8%	6.7%	8.9%	11.4%	14.1%
108	0.4%	1.5%	4.0%	5.8%	7.9%	10.3%	13.0%
96	0.2%	1.1%	3.2%	4.8%	6.8%	9.2%	11.8%
84	0.1%	0.7%	2.4%	3.8%	5.6%	7.9%	10.5%
72	0.0%	0.4%	1.6%	2.8%	4.4%	6.5%	9.0%
60	0.0%	0.1%	0.9%	1.8%	3.1%	4.9%	7.3%
48	0.0%	0.0%	0.3%	0.9%	1.9%	3.3%	5.4%
36	0.0%	0.0%	0.1%	0.3%	0.8%	1.8%	3.4%
24	0.0%	0.0%	0.0%	0.1%	0.4%	1.0%	2.3%
18	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%	1.3%
12	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.8%
9	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%
6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 1 percentages for calculation percentages of 92.5% to 110%							
Calculation percentage up to and including							
Exercise period up to and including (months)	**95.0%**	**97.5%**	**100.0%**	**102.5%**	**105.0%**	**107.5%**	**110.0%**
120	15.5%	16.9%	18.4%	20.0%	21.5%	23.1%	24.7%
108	14.5%	15.9%	17.5%	19.0%	20.6%	22.2%	23.9%
96	13.3%	14.8%	16.3%	17.9%	19.5%	21.2%	22.9%
84	11.9%	13.4%	15.0%	16.6%	18.2%	19.9%	21.7%
72	10.4%	11.8%	13.4%	15.0%	16.7%	18.5%	20.3%
60	8.6%	10.1%	11.6%	13.2%	14.9%	16.7%	18.6%
48	6.6%	8.0%	9.5%	11.1%	12.9%	14.7%	16.5%
36	4.4%	5.7%	7.1%	8.7%	10.4%	12.2%	14.1%
24	3.2%	4.4%	5.7%	7.2%	8.9%	10.8%	12.7%
18	2.0%	2.9%	4.1%	5.6%	7.3%	9.1%	11.2%
12	1.3%	2.2%	3.3%	4.7%	6.3%	8.2%	10.3%
9	0.7%	1.4%	2.3%	3.6%	5.3%	7.2%	9.4%
6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 2

Table 2 - for calculation percentages of 110% or more		
Exercise period up to and including (months)	**Base percentage**	**Additional percentage**
120	24.7%	0.6%
108	23.9%	0.6%
96	22.9%	0.7%
84	21.7%	0.7%
72	20.3%	0.7%
60	18.6%	0.7%
48	16.5%	0.8%
36	14.1%	0.8%
24	12.7%	0.8%
18	11.2%	0.9%
12	10.3%	0.9%
9	9.4%	0.9%
6	8.4%	0.9%
3	7.8%	1.0%

1. Calculate the calculation percentage according to the following formula:

$$\frac{\text{Market value of the underlying share}}{\text{Lowest exercise price}} \times 100\%$$

If the calculation percentage is…	…then the market value of the unlisted right is…
Less than 50%	Nil
50% or more but less than 110%	Determined using Table 1
110% or more	Determined using Table 2

2. Calculate the excess according to the following formula:

$$100\ \times [\text{Calculation percentage} - 110\%]$$

3. The value of the right:

$$\text{Exercise price} \times [\text{Base percentage} + (\text{Excess} \times \text{Additional percentage})]$$

Table 1 percentages applicable from 1 July 2015

Table 1 percentages for calculation percentages of 50% to 92.5%							
Calculation percentage up to and including							
Exercise period up to and including (months)	**60.0%**	**70.0%**	**75.0%**	**80.0%**	**85.0%**	**90.0%**	**92.5%**
180	0.50%	1.30%	2.60%	3.50%	4.60%	5.80%	7.10%
168	0.40%	1.20%	2.50%	3.40%	4.40%	5.70%	7.10%
156	0.40%	1.00%	2.30%	3.20%	4.30%	5.50%	7.00%
144	0.30%	0.90%	2.20%	3.00%	4.10%	5.40%	6.80%
132	0.20%	0.80%	2.00%	2.80%	3.90%	5.20%	6.60%
120	0.20%	0.70%	1.80%	2.60%	3.70%	4.90%	6.40%
108	0.10%	0.60%	1.60%	2.40%	3.40%	4.60%	6.10%
96	0.10%	0.40%	1.30%	2.10%	3.00%	4.30%	5.80%
84	0.10%	0.30%	1.10%	1.70%	2.70%	3.90%	5.40%
72	0.00%	0.20%	0.80%	1.40%	2.20%	3.40%	4.90%
60	0.00%	0.10%	0.50%	1.00%	1.70%	2.80%	4.20%
48	0.00%	0.00%	0.30%	0.60%	1.20%	2.10%	3.40%
36	0.00%	0.00%	0.10%	0.30%	0.60%	1.30%	2.40%
24	0.00%	0.00%	0.00%	0.10%	0.30%	0.90%	1.80%
18	0.00%	0.00%	0.00%	0.00%	0.10%	0.40%	1.10%
12	0.00%	0.00%	0.00%	0.00%	0.10%	0.20%	0.80%
9	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%	0.40%
6	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.10%
3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 1 percentages applicable from 1 July 2015 (continued)

Table 1 percentages for calculation percentages of 92.5% to 110%							
Calculation percentage up to and including							
Exercise period up to and including (months)	**95.0%**	**97.5%**	**100.0%**	**102.5%**	**105.0%**	**107.5%**	**110.0%**
180	7.90%	8.60%	9.40%	10.30%	11.20%	12.20%	13.30%
168	7.80%	8.60%	9.40%	10.30%	11.20%	12.20%	13.30%
156	7.70%	8.50%	9.40%	10.30%	11.20%	12.20%	13.30%
144	7.60%	8.40%	9.30%	10.20%	11.20%	12.20%	13.30%
132	7.50%	8.30%	9.20%	10.20%	11.20%	12.20%	13.30%
120	7.20%	8.10%	9.10%	10.00%	11.10%	12.10%	13.30%
108	7.00%	7.90%	8.80%	9.80%	10.90%	12.00%	13.20%
96	6.60%	7.60%	8.50%	9.60%	10.70%	11.80%	13.00%
84	6.20%	7.20%	8.20%	9.20%	10.40%	11.60%	12.80%
72	5.70%	6.70%	7.70%	8.80%	9.90%	11.20%	12.50%
60	5.10%	6.00%	7.00%	8.20%	9.40%	10.70%	12.10%
48	4.20%	5.20%	6.20%	7.40%	8.60%	10.00%	11.40%
36	3.20%	4.10%	5.10%	6.30%	7.60%	9.00%	10.50%
24	2.50%	3.40%	4.40%	5.50%	6.80%	8.30%	9.90%
18	1.70%	2.50%	3.40%	4.60%	6.00%	7.50%	9.20%
12	1.30%	2.00%	2.90%	4.00%	5.40%	7.00%	8.80%
9	0.80%	1.40%	2.20%	3.30%	4.70%	6.40%	8.30%
6	0.30%	0.60%	1.30%	2.40%	3.80%	5.70%	7.80%
3	0.00%	0.10%	0.50%	1.40%	3.00%	5.10%	7.50%

Table 2 percentages applicable from 1 July 2015

Table 2 - for calculation percentages of 110% or more		
Exercise period up to and including (months)	**Base percentage**	**Additional percentage**
180	13.30%	0.50%
168	13.30%	0.50%
156	13.30%	0.50%
144	13.30%	0.60%
132	13.30%	0.60%
120	13.30%	0.60%
108	13.20%	0.60%
96	13.00%	0.60%
84	12.80%	0.70%
72	12.50%	0.70%
60	12.10%	0.70%
48	11.40%	0.80%
36	10.50%	0.80%
24	9.90%	0.80%
18	9.20%	0.90%
12	8.80%	0.90%
9	8.30%	0.90%
6	7.80%	0.90%
3	7.50%	1.00%

APPENDIX H: BOARD OF TAXATION REVIEW INTO ELEMENTS OF THE TAXATION OF EMPLOYEE SHARE SCHEME ARRANGEMENTS, FEBRUARY 2010

Australian Government

The Board of Taxation

REVIEW INTO ELEMENTS OF THE TAXATION OF EMPLOYEE SHARE SCHEME ARRANGEMENTS

A report to the Assistant Treasurer

the board of taxation

www.taxboard.gov.au

Board of Taxation

February 2010

APPENDIX A: AUSTRALIAN GOVERNMENT ACTUARY REPORT ON THE VALUATION TABLES OF UNLISTED RIGHTS

INTRODUCTION

Australian Government Actuary (AGA) has been asked by the Board of Taxation to provide some background on the statutory valuation factors contained in Division 13A of the ITAA 1936 which are used, for taxation purposes, to value certain options provided to employees as part of their overall remuneration package.

The Board is considering whether the factors remain relevant today, given that they were developed about 15 years ago.

The statutory valuation factors are based on the Black Scholes method for valuing options. The Board has asked AGA to:

- outline briefly the Black Scholes method;
- comment, if possible, on why the Black Scholes method was preferred to other methods such as Monte Carlo simulation and Binomial;
- comment on the parameters that underpin the statutory valuation factors, including on whether those parameters remain valid today; and
- comment briefly on the results of the tax valuation method in practice.

This note is intended only to provide some very brief background to, and commentary on, the issue. It does not, for example, make any recommendations.

Finally, the Board has asked us to prepare an alternative set of statutory valuation factors. This is dealt with in the Appendix to this report.

CALL OPTIONS

A call option gives the employee the right to purchase a share on or before a specified date in the future at a specified price (exercise or strike price).

Volatility

Share prices exhibit volatility. Volatility in the price of a share means that call options can have real economic value, even if they are currently 'out-of-the-money'.

For example, at the time these numbers were prepared, BHP was trading at $36.62[54]. Options were available to buy BHP (expiry date 17 December 2009) at $37.00. If there was no movement in share prices, then this option would have been worthless. However, since share prices can move in unpredictable ways (that is, they exhibit volatility), the right to buy BHP at $37.00 before 17 December 2009 was worth something, even though BHP was then trading at $36.62. This is because there was a chance that BHP would have been trading above $37.00 by 17 December 2009. In fact, this option was trading for $1.63 on 29 October 2009.

That is, the market had valued the right to buy BHP on or before 17 December 2009 for $37.00 at $1.63, even though BHP was trading at only $36.62.

As a general rule, the higher the volatility in a share's price, the higher the value of an option to buy that share, all else being equal.

To value or price an option reliably, it is necessary to know what the future volatility of the price of the underlying share will be. However, this is unknowable. At best, estimates of future volatility can be obtained using a variety of means, such as examining historical volatility.

For options that are traded, it is reasonably possible to derive the option's 'implied volatility'. This is the volatility that is implied by the option price on the assumption that the Black Scholes (see below) method for pricing options holds.

54 As at 29 October 2009

BLACK SCHOLES METHOD - BACKGROUND

The statutory valuation tables contained in Division 13A of the ITAA 1936 were derived using the Black Scholes method for valuing options. The Black Scholes method is a well known method for valuing options.

The Board has asked us why the Black Scholes method was preferred to other methods, including the Binomial method and Monte Carlo simulation. We have not found any discussion in the working papers on these other methods. According to our reading, at one stage, a very simple Net Present Value method was considered but this was disregarded because its performance was considered too poor.

We are not experts in option pricing. However, the following comments might help explain the (implicit) preference for Black Scholes over Binomial or Monte Carlo.

Under the Binomial model, the future path of a share's price is broken down into intervals. At each interval, the share price is assumed to either go up or down at a particular rate. Also, the probabilities of going up and down are prescribed. A tree of possible ultimate prices and therefore ultimate call values (at the time of exercise of the option) can be determined. Then, working backwards one time interval at a time, it is possible to derive the theoretical value of a call option on the share at each intermediate step, taking account of the probabilities of the share going up or down and of the risk free rate of interest. Finally, the call price at the beginning can be determined as the sum of the discounted, probability-weighted, intermediate call prices.

The Black Scholes method represents the limit of a version of the binomial method, as the number of time intervals approaches infinity. In particular, if the binomial method assumes that returns are normally distributed and that the probabilities of going up or down at each step are consistent with the return process assumed by the Black Scholes method, then the binomial result will converge to the Black Scholes result. A possible advantage of Binomial is that it is not, in theory, restricted to the (Black Scholes) assumption that returns are normally distributed.

Somewhat similarly, Monte Carlo can be used to simulate share prices (and therefore call values) at expiry. The estimated price of the call is the discounted present value of the average call value at expiry. If the Monte Carlo simulation is based on the same share price model as the Black Scholes method (returns are normally distributed), then the result of a Monte Carlo simulation is an approximation to the Black Scholes result.

In summary, Black Scholes may have been (implicitly) preferred because:

- it is relatively easy to codify relative to Binomial or Monte Carlo;
- it is reasonably widely used; and

- under certain assumptions, the three methods converge anyway.

The Black Scholes method works very approximately as set out below. This is highly simplified and should not be taken as a reliable description of the model. It is intended merely to give a very broad overview of the model.

- A probability distribution of the share price at the time of exercise is determined based on certain assumptions – that returns are distributed normally and that the expected (simply compounded) return is the risk free rate. That is, an underlying assumption is that investors do not demand a risk premium on risky assets.

- From this a probability distribution of the value of the option at the time of exercise can be obtained

- From this an expected value of the option at the time of exercise can be determined

- The expected value of the option at the time of exercise is then discounted to obtain a current value of the option

The Black Scholes method is limited in a number of ways. In particular, it relies on a number of assumptions which are unlikely to be borne out in practice. For example, the Black Scholes method assumes that volatility in a share's price will be constant from time to time and can be reliably estimated. Historically, however, volatility has varied from share to share and from time to time. Implied volatility in an option price typically might vary from exercise price to exercise price (for options in the same share with the same expiry date).

Despite its shortcomings, however, the Black Scholes method is not necessarily unsuitable for certain purposes. For example, it should not be concluded that the Black Scholes method is unsuitable as a valuation model for tax purposes, simply because of its theoretical limitations.

However, it is appropriate to have an appreciation of any limitations of the model, in order to (subjectively, at least) adjust for these in light of the particular context in which the model is being used.

The basic Black Scholes model assumes that no dividends are payable. However, the statutory valuation factors were derived using an adjusted Black Scholes model, with some allowance for future dividends. This adjustment was needed to ensure that the valuation factors were not penal, to reflect the fact that it is quite common for listed Australian equities to pay dividends.

For reference, the formula used to derive the statutory valuation factors is set out below.

$$C(S,T) = e^{-rT}\left(FN(d_1) - KN(d_2)\right)$$

where:

$$F = Se^{(r-q)T}$$

$$d_1 = \frac{\ln(F/K) + (\sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

C(S, T) is the price of a European call option

S is the spot price of the underlying stock

K is the strike price of the underlying stock

N(•) is the cumulative distribution function of the standard normal distribution

T is the time to maturity

r is the risk free rate (annual rate, expressed in terms of continuous compounding)

q is the dividend yield (annual rate, expressed in terms of continuous compounding)

σ is the volatility of the underlying stock

PARAMETERS REQUIRED IN THE BLACK SCHOLES METHOD

The Black Scholes method, as adjusted for dividends, requires a number of inputs. The table below sets out the required inputs, together with brief commentary on the 'current validity' of the actual inputs that were adopted.

Required Input	Status	Comment
Relationship between exercise price and current share price	Known	Since this input is known in any individual case, it is valid.
Time to expiry	Known	Since this input is known in any individual case, it is valid.
Risk free interest rate	Broadly observable but changes over time	The rate underlying the statutory valuation factors is 7.6% (7.33% continuously compounded). At the time the factors were developed, 7.6% was the yield on 3 year Commonwealth bonds. This might be considered too high in the current environment. This assumption has most impact on the valuation of options which have a long time to expiry. The higher the interest rate, the <u>higher</u> the assessed value of the option.
Dividend yield	Varies from share to share and over time	The rate underlying the statutory valuation factors is 4% (3.92% paid continuously). This might continue to be considered broadly reasonable in the current environment. This assumption has most impact on the valuation of options which have a long time to expiry. The higher the dividend yield assumed, the <u>lower</u> the assessed value of the option.
Volatility	Unobservable. Historically, volatility has varied from share to share and from time to time. Implied volatility has varied from exercise price to exercise price (for options in the same share with the same expiry date).	The rate underlying the statutory valuation factors is 10%. In general, the implied volatility on exchange traded Australian options appears higher than this.

THE STATUTORY VALUATION FACTORS IN PRACTICE

The Board has asked us to compare the valuation result that is derived using the statutory valuation factors with the actual market price of a number of options.

The table below sets out the results for a number of BHP call options all maturing in September 2010.

Australian Government Actuary

Share (actual price[55])	Expiry	Exercise	'Market' price	Tax Valuation
BHP ($36.71)	23/9/2010	$37.00	$4.80	$1.22
BHP ($36.71)	23/9/2010	$34.00	$6.41	$3.50
BHP ($36.71)	23/9/2010	$52.00	$0.93	$0.00

The concessionality of the factors is evident. For example, the at-the-money option is trading for $4.80, compared to an assessed valuation for tax purposes of $1.22. Increasing the assumed volatility will have an impact on the assessed value, particularly of short term options. For example, increasing volatility from 10% to, say, 25% would lead to an assessed value on that option of around $3, compared to a market value of $4.80.

The table below sets out the results for a longer dated BHP call option, maturing in September 2014.

Share (actual price)[55]	Expiry	Exercise	'Market' price	Tax Valuation
BHP ($36.71)	25/9/2014	$45.00	$10.10	$1.40

Again, the valuation factors underestimate the market value of the option (although note that trading volumes are limited leading to uncertainty around market value). This is despite the relatively high underlying risk free interest rate assumption. The tax valuation implies a required rate of growth on BHP shares of 5% per annum to break even. In other words, for an investor who believes that BHP will grow at more than 5% pa, the tax value of the option represents good value. On the other hand, the estimated market value implies a required rate of growth of 10% pa to break even.

If the objective is to approximate market value, then there might be some room to strengthen the basis used in the valuation factors. However, care would be needed for a number of reasons. For example, it can be the case that employee options are subject to some restrictions – for example, exercisability might be conditional on employment status or performance. In other words the value of the option to the employee might be less than a comparable 'market value', which in turn would suggest that some concessionality in the parameters is not necessarily inappropriate. Furthermore, market values in the current climate might not be a good yardstick, given recent high levels of volatility.

55 As at 2 November 2009

Production Note:
Signature removed
prior to publication.

Peter Martin

Australian Government Actuary
11 February 2009

APPENDIX I: EXAMPLE APPENDIX 3B

Appendix 3B

New issue announcement,
application for quotation of additional securities and agreement

Information or documents not available now must be given to ASX as soon as available. Information and documents given to ASX become ASX's property and may be made public.

Introduced 1/7/96. Origin: Appendix 5. Amended 1/7/98, 1/9/99, 1/7/2000, 30/9/2001, 11/3/2002, 1/1/2003.

Name of entity

BANNERMAN RESOURCES LIMITED

ABN

34 113 017 128

We (the entity) give ASX the following information.

Part 1 - All issues

You must complete the relevant sections (attach sheets if there is not enough space).

1	+Class of +securities issued or to be issued	Unlisted Employee Options
2	Number of +securities issued or to be issued (if known) or maximum number which may be issued	1,500,000 Unlisted Employee Options - pursuant to the terms of the Employee Share Option Plan (ESOP) as approved by shareholders on 24 November 2009.

+ See chapter 19 for defined terms.

3	Principal terms of the +securities (eg, if options, exercise price and expiry date; if partly paid +securities, the amount outstanding and due dates for payment; if +convertible securities, the conversion price and dates for conversion)	The 1,500,000 Employee Options will be granted on the following key terms: (a) The Exercise Price for 500,000 Employee Options will be A$1.45 per share (being approximately 1.25 times the 20 Business Day VWAP of A$1.16 per Bannerman share at the close of trade on 24 November 2009). The Employee Options are subject to a vesting hurdle of 24 November 2010 and receipt of a mining licence (as defined) for the Etango Project. The Employee Options expire on 25 November 2013 **("Tranche 1")**; (b) The Exercise Price for 500,000 Employee Options will be A$1.81 per share (being approximately 1.25 times the exercise price of Tranche 1 Options). The Employee Options are subject to a vesting hurdle of 24 November 2011 and finalisation of Project Finance for the Etango Project. The Employee Options expire on 25 November 2014 **("Tranche 2")**; and (c) The Exercise Price for 500,000 Employee Options will be A$2.26 per share (being approximately 1.25 times the exercise price of Tranche 2 Options). The Employee Options are subject to a vesting hurdle of 24 November 2012 and commissioning of the Etango Project. The Employee Options expire on 25 November 2015 **("Tranche 3").**

4	Do the +securities rank equally in all respects from the date of allotment with an existing +class of quoted +securities? If the additional securities do not rank equally, please state: • the date from which they do • the extent to which they participate for the next dividend, (in the case of a trust, distribution) or interest payment • the extent to which they do not rank equally, other than in relation to the next dividend, distribution or interest payment	No – Upon exercise of the Options into ordinary fully paid shares, the allotted and issued shares will rank equally in all respects with an existing class of quoted ordinary fully paid shares.
5	Issue price or consideration	Nil

6	Purpose of the issue (If issued as consideration for the acquisition of assets, clearly identify those assets)	Employee Options issued as part of an executive remuneration package.

7	Dates of entering +securities into uncertificated holdings or despatch of certificates	On 30 November 2009.

		Number	+Class
8	Number and +class of all +securities quoted on ASX (*including* the securities in clause 2 if applicable)	201,710,934* Notes: *This number does not include 4,000,000 shares to be issued to Savanna Marble CC on grant of a mining licence for the Etango Project (as approved by shareholders on 16 April 2009).	Ordinary Fully Paid Shares (ASX:BMN)

	Number	ASX Code	+Class
9 Number and +class of all +securities not quoted on ASX (*including* the securities in clause 2 if applicable)	200,000	BMNAW	A$2.40 Options expiring 27 December 2011.
	2,250,000	BMNAA	A$6.50 Options expiring 30 November 2010.
	2,250,000	BMNAB	A$7.50 Options expiring 30 November 2011.
	2,725,000	BMNAC	A$0.20 Options expiring 28 May 2010.
	100,000	BMNAD	C$4.12 Options expiring 1 November 2012.
	200,000	BMNAE	A$3.64 Options expiring 28 January 2013.
	250,000	BMNAM	A$2.80 Options expiring 3 June 2013.
	250,000	BMNAF	A$2.44 Options expiring 1 September 2011
	1,000,000	BMNAG	A$2.51 Options expiring 1 September 2011.
	1,000,000	BMNAH	A$3.00 Options expiring 1 September 2012.
	250,000	BMNAL	A$4.00 Options expiring 1 September 2012.
	600,000	BMNAQ	A$0.91 Options expiring 2 February 2013.
	600,000	BMNAS	A$1.14 Options expiring 2 February 2014.
	600,000	BMNAU	A$1.43 Options expiring 2 February 2015.
	2,500,000	BMNAY	A$0.434 Options expiring 17 November 2012.
	1,500,000	BMNAAI	A$0.543 Options expiring 17 November 2013.
	1,500,000	BMNAAK	A$0.678 Options expiring 17 November 2014.
	600,000	BMNAAM	A$0.83 Options expiring 16 February 2013.
	250,000	BMNAZ	A$1.51 Options expiring 20 August 2014.
	250,000	BMNAAN	A$1.89 Options expiring 20 August 2015.
	600,000	BMNAI	A$1.46 Options expiring 31 August 2013.
	600,000	BMNAK	A$1.82 Options expiring 31 August 2014.
	600,000	BMNAJ	A$2.28 Options expiring 31 August 2015.
	500,000	-	A$1.45 Options expiring 25 November 2013.
	500,000	-	A$1.81 Options expiring 25 November 2014.
	500,000	-	A$2.26 Options expiring 25 November 2015.
	1	BMNAO	Convertible Note (convertible into 16,339,869 ordinary fully paid shares).

10 Dividend policy (in the case of a trust, distribution policy) on the increased capital (interests)		No change.

APPENDIX J: EMPLOYEE OWNERSHIP AUSTRALIA AND NEW ZEALAND (EOA) SUBMISSION TO TREASURY, FEBRUARY 2014

Employee Ownership
Australia & New Zealand
Making it your business

Employee Ownership
Australia & New Zealand
Making it your business

Employee Share Schemes and Start-up Companies: Administrative and Taxation Arrangements

**Employee Ownership Australia and New Zealand's (EOA)
Expert Panel's Reply to Treasury's Consultation**

February 2014

Introduction

This reply has been was created to provide a reply to the Treasury's Invitation to comment dated 21 January 2014. EOA has not provided answers to every question in relation to the invitation to comment but has provided focussed strategic areas of concern that sit within the discussion topics and questions raised.

The Importance of Start-Up Companies in Australia

As recognised in the consultation groups, start-ups have a significant role in the Australian economy. They are critical to lift productivity, competition, economic growth, and employment through the creation of, and access to, new markets and the invigoration of established markets.

Innovation-active companies are also significantly more engaged in the digital economy, earning over $144 billion in internet commerce in 2010-11 collectively, more than three times that of non-innovators. Innovation also encourages a more connected and skilled economy with greater market diversity and consumer choice. [1]

Google recently commissioned a PwC report, " The start-up economy, How to support tech start-ups and accelerate Australian innovation, in April 2013 that highlighted some key facts:

- Starts ups are likely to contribute $109 billion and 540,000 jobs to the Australian economy by 2033.
- There are 1,500 start-ups in Australia with the key hubs in Sydney and Melbourne.
- There are many sectors for growth that are untapped and there are good support systems already in place. In some ways there is no better time for an entrepreneur.
- The growth of the Australian technology sector is essential to the future success of the economy. It enhances productivity, creates global reach and improves customer experience.
- The changes to the taxation of options, however, has significantly impacted this sector's ability to attract and retain quality employees.

Yet, the recent report, *Silicon Beach: A Study of the Australian Start-up Ecosystem*, found that 4.8 per cent of Australian companies successfully scale up to sustainable businesses compared with 8 per cent in the Silicon Valley and 6.7 per cent in New York. [2]

When start-ups succeed, they invariable go on to reinvest in a new start-up venture. So helping the sector succeed helps grow the economy further. The current usage of plans has declined so significantly or has been adapted to ensure that the plans are taxed at gain that the potential revenue gain is likely to be greater rather than smaller by any change. This is added to additional company taxes which will occur when companies are successful. These factors should offset any revenue concerns that Treasury may have.

1 Australian Innovation Systems Report 2012, http://www.innovation.gov.au/Innovation/Policy/Pages/AustralianInnovationSystemReport.aspx. Please note that the text is taken directly from the discussion paper.

2 Silicon Beach Building Momentum: A Study of the Australian Start-up Ecosystem http://www.deloitte.com/au/siliconbeach.

Start-ups are critical to lift productivity, competition, economic growth, and employment. Starts ups are likely to contribute $109 billion and 540,000 jobs to the Australian economy by 2033.

The Key Focus for Australia is Being Globally Competitive

The current taxation regime does not allow Australian start-up companies to compete for talent globally. The current regime has inhibited companies from being able to attract staff because the equity plans offered can be complex, cost prohibitive and difficult for companies to implement.

In comparison to other countries like the UK and US this tax regime has impacted option plans which are most predominantly used in the US and UK.

Any reform should have as its key principles the desire to create a more even playing field for Australian start-ups. Unless we can match the conditions available in e.g. the Silicon Valley Australia will lose the battle for start-up companies and start-up talent. We must be on at least a level playing field with the US and the UK. This means tax should be paid only at realisation.

THE CURRENCY OF SILICON VALLEY

Almost without exception US technology start-ups use option plans. Options are granted to employees because they provide a share of future growth in value without diluting existing ownership. They are also less complex than shares (no trust is required, they crystallise only at exit or IPO, there is no minority shareholder concerns, no need to claw back existing issued shares with no requirements to create a market for employees to dispose of the shares and most companies do not have a dividend stream so there is no advantage in using shares). Most importantly in the US there is no tax to pay until the options are exercised and the shares are realised by the employee and any gain is on the capital account. The most obvious recent examples of the use of this model are Facebook and Google.

In the US and UK they recognise that in the life cycle of a start-up company everything is geared towards an exit event. Employees' tax is aligned to that event. There is no tax to pay until employee can realise the equity value.

THE UK MODEL – DRIVING THE START-UP ECONOMY

As set out in the Discussion Paper, in 2000 the UK Government introduced a plan called the EMI (Enterprise Management Incentive Plan) which was specifically created for start-up companies. EMIs are tax advantaged share options. They are designed to help small, higher risk companies recruit and retain employees who have the skills to help them grow and succeed. They are also a way of rewarding employees for taking a risk by investing their time and skills to help small companies achieve their potential[3].

[3] This wording is taken directly from HMRC site, http://www.hmrc.gov.uk/shareschemes/emi-new-guidance.htm

Tax advantaged share options with a market value of up to £250,000 from 16 June 2012 (£120,000 prior to 16 June 2012) may be granted to a qualifying employee[4] of a qualifying company, subject to a total share value of £3 million under EMI options to all employees.

For companies to qualify they must have maximum gross assets of no more than £30 million; for groups, this applies to the assets of the group as a whole. The company whose shares are the subject of the option must be independent, and the company or group must be trading. From 21 July 2008, there is a requirement that a company has to have fewer than 250 employees in order to grant EMI options. There is also a requirement that the company trades wholly or mainly in the UK.

The grant of the option is tax-free and there will normally be no tax or National Insurance contributions (employer withholding tax) for the employee to pay when the option is exercised (unless the option is granted with an exercise price that is less than the market value of the underlying share at the date of the grant). Capital Gains Tax is only payable on sale of the share.

The Barriers for Start-up Companies and the Impacts of the 2009 Taxation Changes -

The six key barriers for start-up companies are:

1. The ability to attract and retain staff in Australia and from overseas

Start-up companies commonly do not necessarily have the cash flow to attract key staff needed to start and grow the business. The salaries offered to attract staff are generally not as generous as the salaries offered by larger entities within Australia and overseas. Employees are also likely to face greater risk and uncertainty in a start-up organization. To counter this many companies would offer significant equity stakes in the business to staff. These equity stakes can be high risk but have large potential upside that allows start-up companies to attract and retain staff. Most commonly start-up companies would use options. Option plans have been significantly impacted by the 2009 changes (see below).

2. The changes to the taxation of options plans that happened in 2009, in conjunction with the refund rules

The use of employee share option plans has significantly declined. This is largely because of the introduction in Division 83A of taxation at vesting rather than the taxable event being on realisation of shares, in the case of options with a market value exercise price, or in any event not before exercise of options (as applied to options prior to the introduction of Division 83A). In addition, the elimination of tax refunds for vested but “out of the money” options has also exacerbated the situation.

Employee share option plans were formerly widely used in small to medium, privately owned enterprises including start-up companies, in particular because of the potential for upside that such plans deliver. From a practical perspective, more options are typically awarded than shares or performance rights (because the option plan has an exercise price and hence a lower intrinsic value). This could lead to larger gains for employees in start-ups who rely on this type of plan to offset the lower initial salary and higher risks inherent in a start-up company. The change in taxation of option plans has severely impacted the ability of many such companies to effectively remunerate their

[4] An employee must spend at least 25 hours a week working for the company or the group. If his hours are shorter, he must spend at least 75 per cent of his working time working as an employee for the company or group.

employees through employee share options and retain key talent in their businesses during the early period of growth.

Further, the change to the time of taxation of employee share options from exercise to vesting is one of a number of reasons that has forced listed Australian companies to expend considerable time and financial costs in restructuring employee equity plans.

Finally, the new tax refund rules unfairly impact option awards. For options awarded since 1 July 2009 the income tax liability typically arises at vesting, and this is the case even if the options are "out of the money" (i.e. the option exercise price exceeds the market value of the underlying shares at the vesting date). Further, this income tax liability cannot be refunded under the new rules even if the options lapse unexercised. The reasoning behind it is that the employee "chooses" not to exercise their options and therefore should not be allowed to access the tax refund provisions.

3. The cap on an individual owning legally or beneficially more than 5% of the company

The current and previous taxation rules do not allow tax deferral for an individual where they own legally or beneficially more than 5% of the company. This often prevents initial employees/founders from using equity to top up salary because the 5% is prohibitive in a company that has limited issued capital and provides a majority of the share capital to its employees to top up salary.

4. The current exemptions from prospectus filing that prevent more than 20 non senior employees being granted equity in any 12 month period

For an unlisted company the largest consideration at the outset is the disclosure filing requirements. If rights/options or shares are issued, any offer will be subject to the disclosure filing requirements (prospectus, short form prospectus and offer information statement) under Chapter 6D of the Corporations Act 2001, specifically section 706. There are limited exemptions that can be relied upon to exempt a company from these disclosure filing requirements. There is some cost and complexity in producing a disclosure document so this can inhibit a company's ability to offer the ESS plan broadly.

There is a prospectus filing requirements within the Australian Securities and Investment Commission (ASIC) Class Order for employee share and option plans CO 03/184. However the only exemption for unlisted companies is for options, with the requirement that a prospectus is lodged prior to exercise. This exemption is only effective for companies that are considering an IPO in the next 3 – 5 years.

The other common exemptions are:

Exemption 1 - Section 708(1) allows a company to make offers to 20 individuals in any twelve month period up to a certain dollar cap ($2,000,000).

Exemption 2 – Section 708(12) exempts offers that are made to senior managers. The definition of 'senior manager' for the purpose of this section is a person:

(a) who makes, or participates in making, decisions that affect the whole, or a substantial part, of the business of the corporation; or

(b) has the capacity to affect significantly the corporation's financial standing.

An individual falls into the exemption if either (a) or (b) are met.

The current exemptions by their nature allow grants only to limited employees or companies that are close to an IPO.

Recommendation:

Any review of the taxation regime should be made in conjunction with other regulatory reviews to ensure consistency, simplicity and certainty. If the tax legislation changes without the prospectus filing barriers being lifted then the impact of the changes will be marginalised.

5. The valuation process for ESS plans can be prohibitive

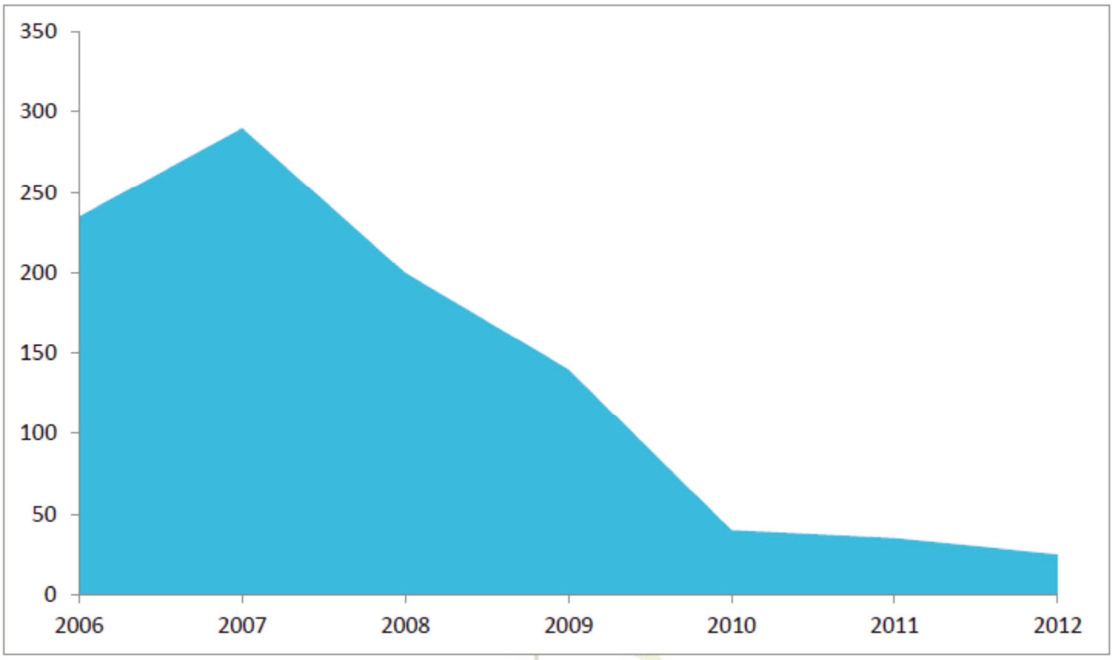
The Market Value of the shares of an unlisted company is needed for the purposes of option valuation, income tax and the operation of the plan. There are no accepted methodologies that can be used by an unlisted company and no means to validate the methodology that a company uses by the ATO. Companies as a result tend to use external parties to value their shares and for some start-ups this can be cost prohibitive. The changes that removed the requirement for the an external party such as an accountant to provide a valuation are welcomed but further steps can be taken to minimize costs. The only complete solution to this problem is taxation only at the point of realization.

Impacts of 2009 Changes

The decline in option plans has been highlighted in Employee Ownership Australia and New Zealand's previous report in April 2013, The Changing ESS Landscape since 1 July 2009.

Division 83A has significantly reduced participation in ESS option plans.

Figure 5: Decline in Option Plan Usage after the 1 July 2009 changes



Note: Employer population based on 500 employers.

The statistics from Link's private client database show that since 2009 most companies now use a non-Division 83A plan:

	Loan Plan	Non 83A Option Plan	Division 83A Plan	Other (cash)
% use	56%	23%	6%	5%

Pre 2009 85% of companies used Division 13A option plans. There has also been a 20% decline in companies seeking plan advice since the changes.

Proposed Definition for Start-ups

It is imperative that any definition of start-up is not so restrictive that it applies to only very limited and exceptional situations. In our opinion employees and years that the company has been incorporated are poor indicators because some business are employee intensive and have large employee numbers quickly because of the nature of their businesses, for example technology companies, whilst others have low employees numbers but take many years to shift from the start-up phase, for example Bio Med companies.

Ideally the definition should be based on a simple and easy identifiable figure that does not require further cost for the company, e.g. figures from financial accounts such as million profit, assets or turnover. What this figure should be considered further and there should be consultation with industry to make sure it is wide enough to be useable for a majority of start-up companies. If there are specific concerns about certain sectors or industries these sectors should be excluded. The requirement that a majority of the company's employees and assets are based in Australia is important if defined correctly and simply.

The important element of any definition is that it can be understood and applied easily and does not require any onerous calculations outside the normal course of business.

The key thing is to ensure that the definition captures the target market. If we are to stop the losses of our start-ups to Silicon Valley and other markets we must ensure that our definition is broad enough to capture most start-ups. Whilst the definition must be simple, it must also be appropriately targeted.

The EMI plan gives a good example of how it could be quantified by using a simple measure that any company would readily disclose in its accounts and which is regulated through accepted accounting principles and providing clear guidance about the other elements of the plan.

Taxation and Plan Design Recommendations

A key discussion of any reform should be about the design of the plans. It should have the same or greater focus as the definition of what is a start-up. To really maximise the aim of the review, which is to super charge the Australia's start-up sector and place Australia in a competitive position globally there are some key design recommendations that EOA has set out below:

Immediate Recommendations

1. Remove vesting as a taxation point for options and replace it with the previous position of exercise as one of the potential taxation points. If this change came into effective the issue with the refund rules would be overcome.

This change should be applied across the board to all companies and should not be restricted to start-up companies. Without exception globally options plans have exercise, not vesting, as the primary taxation point.

2. Create a regime that is specific to start-up companies that:

- **Remove the 5% cap.** In practice this rule is largely only an issue for start-up and SME companies. In the UK the EMI has a 30% cap limit.
- **Remove the need for valuations by taxing the options at the point of realization, i.e. when the employee disposes of the shares.** ***The start-up plan should be crafted so that when the disposal event happens they are taxed on the value at that date, less any costs (exercise or otherwise). The tax applied is a concessional marginal rate of 50% of the individual's marginal rate. There is no need for valuations prior to the disposal event (which would usually be a sale or listing) and at this point a valuation will be known, there is no need for the complexity of considering whether the 12 month concessional CGT period has occurred or whether the amount should be income tax or capital gains tax. This regime should not have a limited or fixed life but is triggered by the realisation event.***

If the plan is taxed at realization at a concessional marginal rate then it makes it simple for everyone to understand, track and pay the correct tax on.

- **Extend the prospectus filing exemptions to include those employees included by the plan.** In most overseas jurisdictions there is a carve from the prospectus filing requirements for employee plans up to a certain dollar limit, this principle should be replicated in Australia. Alternatively, any review of the taxation regime should be made in conjunction with any other regulatory reviews to ensure consistency, simplicity and certainty. If the tax legislation changes without the prospectus filing barriers being lifted then the impact of the changes will be marginalised.

- **Consider using options as the preferred vehicle.** These plans are by far the most common type of vehicle used in start-ups, they reflect the US and UK practise, they create simplicity for start-ups as there is no need for a trust, there is no dividend stream, there no need to buy back shares if a company leaves. Additionally the ASIC Class Order relief as it currently stands has a carve out exemption for options, that if broaden would overcome the prospectus filing issue.

- **Any definition of start-ups should be simple and indicative of the actual market -** A Good example of this may be the R&D definition that is easily understood. However, the review needs to also consider carefully other models, for example the EMI definition in the UK, to ensure that we capture our target market. The current definition is too limited in terms of employee numbers – it misses the target by a big margin.

- **To reduce costs and complexity the creation of standard documents would be welcomed** – part of the difficulties that companies face is the cost of implementation. This is partly due to the taxation and legislative complexity that a company must navigate through to implement an employee equity plan. If this regulation could be simplified and certain standard documents could be approved with a simple guide on how to use them. This would significantly reduce costs for start-up companies. As noted in the Nuttall Review of Employee Ownership - Sharing Success this would need to be complemented by greater awareness of the use of employee ownership.