



Lateral Economics



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Business  
Foundation

# **The BERD in the hand: Supporting Business Investment in Research and Development**

**Dr Nicholas Gruen**

**April 2011**



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## Occasional Paper Series

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# **THE BERD IN THE HAND: SUPPORTING BUSINESS INVESTMENT IN RESEARCH AND DEVELOPMENT**

**Dr Nicholas Gruen  
April 2011**



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# Foreword

The Australian Business Foundation is delighted to welcome Dr Nicholas Gruen of Lateral Economics as the latest thought leader to contribute to its Occasional Paper Series, providing expert analysis of contemporary issues in business innovation and competitiveness.

Dr Gruen's paper focuses on proposals for reform of the tax treatment of business research and development currently before Federal Parliament. His paper, *The BERD in the hand: Supporting Business Investment in Research and Development*, adds deep analysis to the business and public debate on these important changes. The Australian Business Foundation sought from Dr Gruen a dispassionate, informed analysis and commentary of the arguments behind the R&D legislation and its effectiveness, especially in fostering greater investment in R&D and innovation by smaller businesses.

Our aim is to promote informed public discourse on the best policy settings for R&D to promote the health and vibrancy of the Australian economy and innovative behaviour in business enterprises.

The Australian Business Foundation is a unique business-sponsored collaborative research body that partners with expert researchers and practitioners nationally and internationally. It develops its research to see further, delve deeper and make connections others don't, backed by a vibrant community of business, government and community leaders.

The Australian Business Foundation and Dr Nicholas Gruen as the author of this latest Occasional Paper invite you to think, consider and add your voice to the new ideas on business research and development canvassed here.

**Stephen Mills**  
Director  
Australian Business Foundation

April 2011

## ABOUT THE AUTHOR

### DR NICHOLAS GRUEN

Nicholas Gruen is trained in History, Statistics, Law and Economics.

He is CEO and founder of Lateral Economics and Peach Financial. He is Chairman of the Australian Centre for Social Innovation (TACSI), Online Opinion and Kaggle, a start-up global portal for data competitions which is doing remarkable things. He is Patron of the Australian Digital Alliance.



He is a regular newspaper columnist, most recently for the *Australian Financial Review* and has had his work featured in *Best Australian Essays* and *Best Political Writing*. He has published in international academic journals on a variety of topics and is a prolific blogger at a group blog Club Troppo.

Dr Gruen was a member of the Cutler Review into Australian Innovation leading the Review's deliberations on the importance improving information flows, innovation in government and improving the design of tax concessions for R&D and in 2010 he was the Commonwealth Department of Education, Employment and Workplace Relations (DEEWR) Thinker in Residence. Lateral Economics has been involved with the Commonwealth, Victorian, South Australian, NSW and Western Australian governments to improve innovation in government and with the World Bank on better regulation.

In 2009 Dr Gruen chaired the Federal Government's Government 2.0 Taskforce producing a report which garnered high praise from leading international figures. The Federal Government has essentially accepted its recommendations. Since the Taskforce Dr Gruen has spoken on Government 2.0 in every Australian State and internationally. He is recognised as a strong public advocate for economic reform, innovation and open government all in the context of grasping the extraordinary opportunities which burgeon online.

## ABOUT THE AUSTRALIAN BUSINESS FOUNDATION

The Australian Business Foundation is a collaborative research body at the centre of a vibrant community involving Australian and international business executives, scholars, policymakers and opinion-leaders.

For over a decade, the Foundation has nurtured evidence-based research into business innovation and sustainability, emerging models of business competitiveness and opportunities arising from a knowledge economy.

The Foundation is funded and backed by the business sector and has developed a distinctive model of collaborative and influential research, in partnership with expert scholars and practitioners from Australia and around the world. The Foundation's research strives for depth, rigor and practicality in its character, drawing out original content and insights and interpreting this for impact and use.

Working with our members, we deliver practical and tangible knowledge and findings through published reports, our web site, and a robust events program. In 2011 that range of activity will expand to incorporate broader and more diverse dialogue, access and participation in the Foundation's network of business executives, government and political representatives, researchers and academics.

# Executive Summary

**B**usiness investment in R&D generates high returns, but not all those returns accrue to the firm investing in the R&D. Other firms can copy aspects of any new commercial or technical know-how generated and/or poach knowledgeable employees from the original investor. For this reason, and to supplement tariff reform in the mid 1980s, Australia became an early leader in subsidising business R&D through tax concessions. Since then, this has become normal practice in developed countries.

Business R&D has risen strongly since, although the extent to which this has reflected the tax incentives is unclear. Exploiting the many changes in the tax concession since its inception as 'natural experiments', Thomson (2010) has been unable to find statistically robust evidence that large firms have been responsive to these concessions. However, it has been clear that smaller firms have been responsive to changes in the scheme, particularly where it improved their cash flow by making the concession 'refundable' in cash to tax loss firms that would otherwise have had to wait to access its benefits until they were in profit and paying tax.

For at least a decade, there has been concern over what has been called 'whole of mine' R&D claims. Here a legitimate but often not particularly large 'core' R&D project has taken place in the building of a mine to enable some technical issue to be addressed. It has emerged that in many cases, the legislation as currently interpreted permits a substantial proportion of the costs of the mine to also be claimed under the tax concession legislation as 'directly related' to the R&D project.

Because of confidentiality surrounding the scheme – itself a function of it being administered through the tax system – it is very difficult to understand the extent to which the increasing number and ambition of such claims may be driving the growth in the extent of claims under the R&D tax scheme. Nevertheless, it seems clear that they are a substantial driver of what has been surging and sustained growth throughout this century and correspondingly surging revenue costs.

Over the last four years, the average annual growth of costs claimed under the tax concession has been over twenty percent – a rate at which claims would more than double every five years and more than triple every seven years. Mining claims have expanded substantially faster than the expansion in mining investment. Indeed, in 2008-9 claims for R&D in mining exceeded the claims made in manufacturing for the first time. Further, Australian miners claim a dramatically higher share of R&D in their mining investment than their counterparts do in comparable countries like Canada.

In fact, this paper argues that ‘whole of mine’ claims should be considered as a subset of what can be called ‘whole of production’ claims. In ‘whole of production’ claims, there is an R&D project and there is a production process which is ‘directly related’ to the project. Yet the production process has its own costs and its own benefits to the firm in the form of production which then generates revenue. By drawing in the costs of this ‘business-as-usual’ production (but not its benefits in the form of revenue from business-as-usual production), the claim for eligible R&D can exceed, sometimes very substantially, the full incremental cost of the R&D project.

Since its introduction in the mid 1980s, reductions in the company tax rate and in the nominal level of the concession – from 150 to 125 per cent have seen its effective value reduced from 24.5 to 7.5 per cent. This has been the principle means by which the explosive growth of claims under the scheme has remained affordable to government.

Yet, it is self evident that with assistance rates as low as this, the scheme encourages very little *additional* R&D. There are also a number of schemes that reward increases in R&D with 175 per cent tax deductibility. The Cutler Report expressed scepticism about the extent to which the existing standard concession had fallen in value and agreed with many in the industry that they were complex and often capricious in the way they operate, which also undermined the extent to which they generated additional R&D.

The political equilibrium in which the cost of burgeoning claims has been met by an atrophy of the rate of assistance leaves us somewhere close to the worst of all worlds, with little additional R&D to show for all the costs in funding, administering and complying with the scheme. It is likely it would be more efficient to close it down.

A more appealing alternative was proposed in the Cutler Report which recommended that the base and incremental schemes be replaced with a tax credit which was paid at a substantially higher rate particularly for small firms which, if they were in tax loss, could also receive the benefit in ‘refundable’ form to augment their cash flow.

This approach is reflected in the Government's proposals which increase the rate of assistance from 7.5 per cent to 10 per cent for large firms (with turnover of over \$20 million) and from 7.5 to 15 per cent for smaller firms – together with 'refundability' so that tax loss firms can receive the assistance in cash rather than waiting until they come into profit. The Treasury advises that these rates of assistance can be achieved on a revenue neutral basis by abolishing the incremental schemes and tightening the definition of R&D to remove 'business-as-usual' production from R&D claims.

The proposed new scheme involves a new definition of R&D which is simpler than the old one. It will require some 'bedding down' with judicial decisions however the new definition recognisably borrows from the basic Frascati Manual concepts of what constitutes R&D. It simplifies the old definition, and it is possible that it will be interpreted somewhat more narrowly, but it is simpler and more compelling as a definition, and given the similar concepts and progeny of both approaches, it is unlikely to lead to substantial change.

Something similar could be said of the proposed new 'objects' clause<sup>1</sup> which specifies the legislative objective as stimulating R&D which would not otherwise take place. This is indeed the purpose of the scheme, but it offers no legislative attempt to operationalise such a test and, if it makes any difference at all, will do so very much at the margins of judicial interpretations of other parts of the legislation.

On the other hand, the 'dominant purpose' test will effect an important change. It renders all production activity as ineligible for the concession unless it is undertaken with the 'dominant purpose' of supporting the R&D. Further, if it has an overriding commercial purpose of producing saleable production, it will not meet this test. As illustrated in the cameos in the Explanatory Memorandum accompanying the Bill, this distinction neatly excludes from the concession activities which, though directly related to the R&D project, would take place with or without the R&D project and so are no part of the full incremental costs of the R&D project.

I have accordingly concluded that the basic architecture of what is proposed is well thought through. Nevertheless the new proposals involve uncertainty. The principle uncertainty is the extent to which existing claims involve 'business-as-usual' production that would be rendered ineligible by the 'dominant purpose' test. Treasury officials have testified to the Senate that the changes are likely to reduce eligible R&D by between 15 and 20 per cent.<sup>2</sup> However, neither the methodology behind the calculations nor the confidence we can have in them has been disclosed.

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<sup>1</sup> A clause specifying the objects of a piece of legislation or some section of it.

<sup>2</sup> Senate Committee, Transcript, Thursday, 20 May 2010, pp. E 46 ff.

Given the degree of delay already experienced it would be unfortunate for this to lead to further delay. If the new scheme is capable of eliciting new R&D spending, its absence will also be stalling spending that might otherwise take place. Right now, R&D investment will be stalling wherever the managers of small business think that they may do better by waiting for the new scheme to come into existence. Accordingly, a failure to pass the legislation is likely to actively suppress R&D spending.

There is, moreover, a constructive way through the uncertainty. The merits of what is being proposed do not depend on the magnitude of current activity that will become ineligible for assistance under the 'dominant purpose' test, but rather on the appropriateness of that test.

If, as some accountants and consultants advise, the level of 'business-as-usual' claiming is greater than that expected by the Treasury, then the need for change is more rather than less compelling, though it would lead to a windfall revenue gain for the government. If this were to occur, it would be appropriate for the government to plough this back into the scheme in future years as increases in the rate of assistance and/or the threshold at which firms go from the small to the large company rate.

Another highly cost effective way of ramping up the scheme's efficacy in stimulating additional investment would be to enable refundable credits to be claimed at least quarterly in arrears for firms with a profile which enables them to be judged a good risk.

**Central Finding:** The proposed changes to the R&D tax concession are soundly based in policy. Further delay in passing them would not only delay the increases in R&D investment from small firms that could be expected from the changes, but could also retard investment in R&D by smaller firms, even if it were viable under the current regime.

**Recommendation One:** The Government's proposed new R&D tax credit scheme replacing the current one should be passed into law with or without some minor amendments suggested below.

**Recommendation Two:** Both the threshold defining small firms and the minimum amount eligible for reimbursement should be indexed for inflation and set to some rounded number every three years.

**Recommendation Three:** Although the concession is available through the tax system, normal tax confidentiality requirements should be waived to permit public scrutiny of individual claims on the scheme, both to maximise spillovers

and to enable better analysis and optimisation of the cost effectiveness of the scheme.

**Recommendation Four:** If a windfall to revenue should arise from narrowing the base of the scheme, this should be ploughed back into the scheme in future years. The most cost effective means of doing so would be to bring forward refundable payments to firms that were judged a good risk from an integrity perspective. Beyond this, additional funds should be ploughed back as increases in the rate of assistance and/or the threshold at which firms go from the small company to the large company rate.

# 1. Introduction and background

## THE CASE FOR R&D ASSISTANCE AND AUSTRALIA'S R&D TAX CONCESSION

**T**he case for assisting research and development (R&D) is straightforward. A variety of mechanisms enable firms to free ride on each others' investment in generating new knowledge which would lead to underinvestment in new knowledge without collective support. Intellectual property (IP) laws are rarely watertight so firms that have not invested in knowledge development may nevertheless be able to observe the fruits from the investments of others and benefit from them. Also as Hall and Lerner explain (2009, p. 5):

In practice fifty per cent or more of R&D spending is the wages and salaries of highly educated scientists and engineers. Their efforts create an intangible asset, the firm's knowledge base, from which profits in future years will be generated. To the extent that this knowledge is 'tacit' rather than codified, it is embedded in the human capital of the firm's employees, and is therefore lost if they leave or are fired.

Though economic studies leave much margin for error, they suggest that R&D generates high economy wide benefits compared with its cost. The Productivity Commission argues that the largest gains are from well-targeted government funded more basic research although there are also gains from business expenditure on R&D (BERD). For this reason most Western Governments have extensive programs of support for R&D. Australia is no exception and was in fact amongst the leading countries in subsidising R&D through the tax system. However, where the economic literature offers relatively robust answers to the question of whether R&D generates high returns, it gives us less confidence that we know what to do at the more detailed level of program design. Australia has pursued a range of programs to encourage R&D which have involved directly funding it, collaboratively co-funding it (as with the rural research boards and cooperative research centres) and more general business innovation and capability

programs. In this sense tax breaks for R&D are part of a larger mosaic and sometimes inadequacies in the tax concession may be offset elsewhere.

Introduced in 1985, the R&D tax concession enables firms to claim more than 100 per cent of their costs as a tax deduction. Abstracting from companies in tax loss and dividend imputation (both of which issues are briefly discussed below) the concession provides a level of assistance which was equal to the rate of concessionality times the tax rate. Thus, when it was introduced at the rate of 150 per cent (indicating concessionality of 50 per cent over the 100 per cent write-off) the concession was worth  $50\% \times 49\%$  or 24.5%. For each dollar's expenditure on R&D the concession entitled a firm to pay 24.5 cents less tax.

## AN INVIDIOUS AND TENACIOUS POLITICAL EQUILIBRIUM

Since the introduction of the concession, one can discern two trends. Firstly, R&D as rewarded by the scheme has grown so strongly that it seems clear that, to a substantial extent, it reflects firms' success in bringing activities that they might previously have classified differently within the definition of the concession. In particular, for at least a decade there has been concern over what has been called 'whole of mine' R&D claims. Here a legitimate but often not particularly large 'core' R&D project has taken place in the building of a mine to enable some technical issue to be addressed. It has emerged that in many cases, the legislation as currently interpreted permits a substantial proportion of the costs of the mine to also be claimed under the tax concession legislation as 'directly related' to the R&D project.

Because of the confidentiality surrounding the scheme – itself a function of its being administered through the tax system – it is very difficult to understand the extent to which the increasing number and ambition of such claims may be driving the growth in the extent of claims under the R&D tax scheme. Nevertheless it seems clear that they are a substantial driver of what has been surging and sustained growth throughout this century and correspondingly surging revenue costs.

This is not to imply wrongdoing. Those who are seeking to claim under the R&D scheme are not only doing what is legitimately their right. They are also engaged in legitimate R&D, and it is not surprising that they have an expansive view of what constitutes their R&D project. Nevertheless, it is clear that firms have been able to bring a substantial amount of 'business-as-usual production' within the definition of R&D under the existing scheme (see below).

As the value of R&D claims has surged the result may have been unaffordable were it not for a second, countervailing trend which is that the rate of assistance

has fallen. There have been ongoing 'nips and tucks' to the scheme to ensure integrity – including one major move in 1996 against the trading of tax losses via 'R&D syndication'. But the effective support provided by the concession has heavily atrophied since its inception. The company tax rate has fallen nearly 40 per cent since the concession's introduction, bringing the effective rate of assistance down by the same amount – from 24.5 per cent to 15 per cent. And the existing nominal rate of concessionality was halved from 50 to 25 per cent in 1996. The combined effect has been to reduce effective assistance from just shy of a quarter to a rate which is less than one in thirteen.

**TABLE 1:** Impact of the corporate tax rate on the value of the incentive

Financial Year(s)	Tax rate (%)	Incentive Rate (%)	After Tax Benefit (% or cents in the dollar)
87/88	49	150%	24.5
88/89 to 92/93	39	150%	19.5
93/94 to 94/95	33	150%	16.5
95/96 to Aug 96	36	150%	18.0
96/97 to July 2001	36	125%	9.0
Current	30	125%	7.5

Increasing claims complemented by lowering rates of assistance have become bound together in a tenacious and invidious political equilibrium. Governments have been concerned about the potential for the costs of the R&D tax concession to blow out for at least a decade. Yet, since 1996, action of any magnitude has not been politically possible. The result has in many ways delivered us the worst of all worlds. For as rates of effective assistance have fallen, the 'additionality' of the scheme – the extent to which it can stimulate genuinely new R&D that would not have occurred otherwise – must also have fallen almost certainly by more than the level of assistance has fallen (see below).

The benefits of the concession are also diluted in other ways. It is of immediate use only when firms are in tax profit and paying tax. For as long as firms are in tax loss they can only accumulate increased tax losses under the scheme, which will save the company tax when and if it moves into operating profit. Yet much of the most innovative work is done within start-up companies which can remain in tax loss for a substantial period, may never come into tax profit and are often constrained by cash flow in the amount of R&D they can perform.

A further problem is that under dividend imputation, to the extent that a firm is owned by Australian shareholders, much of the assistance available through the tax concession is ultimately 'clawed back' in the form of higher tax on shareholders. This is because for every dollar the firm saves in tax, it receives a

correspondingly lower value in franking credits to distribute to its shareholders. There is some evidence that this is not taken into account by managers of large firms to the extent that it should be (Business Council of Australia, 1997), however smaller firms may be more cognisant of it to the extent that the relations between managers and owners is closer. Thomas *et al* (2003) find that dividend imputation in a country dilutes the responsiveness of firms to tax incentives for R&D.

## THE PREVIOUS GOVERNMENT'S AUGMENTATION OF THE ORIGINAL TAX CONCESSION

The Howard Government introduced three schemes to supplement the tax concession in order to increase 'additionality' or the extent to which the scheme stimulated new R&D. The R&D Tax offset was introduced to enable small firms' entitlements to the concession to be paid in cash when they were in tax loss. However, the definition of 'small' was fairly restrictive, with firms missing out if their R&D annual investment was over \$1 million or their annual turnover was over \$5 million. By contrast the UK's small firms scheme defined small firms as those with turnovers under €50 million which has subsequently been increased to €100 million. Two additional schemes were established which paid higher rates of tax concession – 175 per cent – for increases in R&D.

The offset was very well received by smaller firms and a surge in small firm claims followed. The incremental schemes were less well received and have been complex to administer as incremental schemes tend to be – something which has led to a recent trend away from them (OECD, 2010).

## THE CURRENT PROPOSALS

The Cutler Review recommended that the base and incremental schemes be replaced with a tax credit which was paid at a substantially higher rate, particularly for small firms. This approach is reflected in the Government's proposals for tax credits to replace the tax concession. A tax credit of 35 per cent would be available to firms with an annual turnover of more than \$20 million. This would lift the rate of assistance from 7.5 to 10 per cent. Firms with annual turnover of less than \$20 million would receive a 45 per cent tax credit which would lift the rate of assistance they receive from 7.5 to 15 per cent. In addition, the credit would be 'refundable' so that where smaller firms were in tax loss they could receive the benefit in cash rather than waiting until they came into profit. The Treasury advises that these rates of assistance can be achieved on a revenue neutral basis by abolishing the incremental schemes and tightening the definition of R&D to remove 'business-as-usual' production from R&D claims.

The proposed new scheme involves a new definition of R&D, which is simpler than the old one and possibly marginally more demanding. It also renders all production activity as ineligible for the concession unless it is undertaken with the 'dominant purpose' of supporting the R&D. Moreover, if it has an overriding commercial purpose of producing saleable production it will not meet this test. This distinction neatly defines out of qualification activities which, though they are directly related to the R&D project, would take place with or without the R&D project and so are appropriately regarded as 'business-as-usual'.

Some business interests have applauded the new scheme whilst others are concerned that the new scheme introduces unacceptable uncertainties and is likely to disqualify a large amount of R&D. The view of the Government and its official advisors is that the changes are likely to disqualify around twenty per cent of claims which would otherwise qualify for 'business-as-usual' production and that this is justified by the fact that these changes can fund the higher rates of assistance necessary to restore adequate levels of additionality.

## THE TERMS OF THIS PROJECT

The Australian Business Foundation wishes to engage in the debate on the proposed changes to the R&D tax credit and has commissioned Lateral Economics for me, Nicholas Gruen to provide an expert report on the changes. I was a member of the Cutler Review into the Australian Innovation System which was the immediate prompt for the government to propose changes to the scheme. I was also on the tax sub-committee of the Review. Narelle Kennedy, CEO of the Australian Business Foundation was also a member of the Cutler Review Panel, but was not on the tax sub-committee.

As requested, I have attempted to provide an independent review which is to say that my guiding purpose in reviewing the current proposals is not fidelity to the recommendations of the earlier Cutler Review or to any section of the Australian community including its business community, but rather the health and vibrancy of the Australian economy in general.

## 2. The issues

### THE RATE OF ASSISTANCE, ADDITIONALITY AND PROGRAM COST EFFECTIVENESS

**W**hen the government was paying 24.5 cents of each dollar invested in business R&D that subsidy would have had a far larger incentive effect in inducing more R&D than today when we pay just 7.5 cents in the dollar. A firm considering how much to spend on R&D will consider its after tax (and tax benefit) cost less the anticipated costs of compliance less any reduction in the expected value of the assistance arising from sovereign risk – the possibility that it will be changed before the firm can benefit from it.

These latter costs are likely to be of the order of 1-2 per cent though they will vary between firms. Thus, (abstracting from issues of tax loss and ‘clawback’ of assistance via dividend imputation) the level of assistance of the 125 per cent tax concession as assessed by firms in planning their level of R&D will be of the order of 6.5 to 5.5 per cent. Now estimates of the responsiveness of R&D to tax incentives suggest an ‘elasticity’<sup>3</sup> which ranges from 15 per cent in the short run to around 1 in the long run ((Bloom et al., 2002; Guellec & Van Pottelsberghe, 2003; Falk, 2006).

Even at the most optimistic end of this range – with R&D investment rising by one per cent for each one per cent of additional assistance – the implication is that around 95 per cent of the revenue foregone on the tax concession will nevertheless be paid on R&D that would have occurred in any event.

In this regard it is worth noting that, though it estimated the net benefit of the 125 per cent tax concession within a wide band, the median point of that band was slightly *negative* (See the final row of Table 2). It is surely a remarkable thing to persevere with a scheme which costs substantial government revenue with the median value in the range of expected outcomes suggesting that the scheme does more harm than good.

<sup>3</sup> Defined as the percentage response of R&D for each percentage change in R&D incentives. Thus if elasticity is 1 and the assistance provided is 5.5 per cent, one would expect R&D to expand by 5.5 per cent in response to the assistance.

**TABLE 2:** Benefit-cost analysis of the 125 per cent R&D tax concession (\$ million)

<b>Benefits</b>	
Transfer from government to companies <sup>a</sup>	22.4 – 112.0
Private benefit from induced R&D <sup>b</sup>	112.0 – 201.6
Spillover and flow-on benefits from induced R&D <sup>c</sup>	42.0 – 327.6
<b>Total benefit</b>	<b>176.4 – 641.2</b>
<b>Costs</b>	
Budget cost of scheme	280
Efficiency cost	85
Administrative cost	10
Compliance cost	35
<b>Total cost</b>	<b>410</b>
<b>Net benefit</b>	<b>-233.6 to +231.2</b>

Note: Benefit calculations are based on an estimated inducement rate between 0.5 and 0.9 and assumed spillover rate between 0.3 and 1.3. No account is made of clawback of the tax concession through the dividend imputation system, which would reduce (increase) the net social loss (benefit) from the program.

<sup>a</sup> This is the budget cost of the scheme x (1 – inducement rate) x (1 – leakage to foreign firms).

<sup>b</sup> This is the budget cost of the scheme x inducement rate x (1 – leakage to foreign firms).

<sup>c</sup> This is the budget cost of the scheme x inducement rate x spillover rate.

Source: Based on the methodology used in CIE (2003).

## ADDITIONALITY FOR SMALL AND LARGE FIRMS

Russell Thompson (2010) recently examined the changes to the R&D tax concession over its life treating them as ‘natural experiments’ to search for evidence of Australian firms’ responsiveness to changes in the scheme’s generosity. He finds as follows:

The principal result is that no evidence can be found that the user cost of R&D is an important determinant of firm R&D investment decisions. A corollary is that there is no evidence that tax incentives are an effective policy tool.

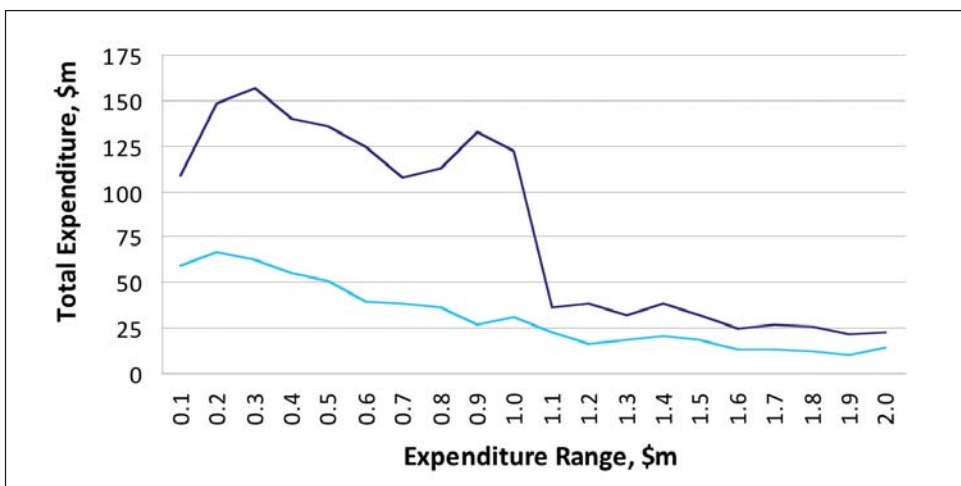
On the other hand, Thomas’s data set did not extend to smaller firms and there is quite persuasive evidence that smaller firms are substantially more responsive. Firstly, one of the key constraints for smaller firms, particularly start-ups, is cash flow and, there is relatively strong, though not unequivocal, support for the proposition that cash flow is a major constraint of firms’ appetite for R&D investment. And younger, smaller firms tend to be cash flow constrained.

In a fascinating paper James Brown and Bruce Petersen find that firm investment in fixed assets has been becoming much less cash flow sensitive in recent years – as physical investment has become less important – but that investment in R&D has

contrariwise grown in importance. They show that both cash flow and the issuance of public equity are very important in the funding of R&D for younger U.S. firms during the 1990-2004 period, but have little impact on mature firm R&D investment. Given that public equity is unavailable for most small firms, the sensitivity of their investment to cash flow is likely to be greater still.

Though these findings are from US data, they have been corroborated in Australia. One policy change and corresponding ‘natural experiment’ that Thomas does not examine occurred when the Howard Government introduced the R&D tax offset for small firms in 2002. Chart 1 below captures the difference between total firm expenditure on R&D before and after the introduction of the tax offset in 2002.

**CHART 1:** Impact of the R&D tax offset



Source: figures supplied by the Department of Innovation.

The sharpness of the response is striking, particularly given the modesty of the policy change. Firstly, the change made a material difference to only a subset, perhaps a relatively small subset, of small firms and yet the response is very visible at the aggregate level. The change only advantaged firms in tax loss who could not immediately benefit from the existing concession. Secondly, the rate of assistance did not change – but remained at a very modest 7.5 per cent rate. Accordingly, except for the few firms that expected never to achieve tax profit, the change involved merely an interest free loan from the time the tax offset was paid until the time when, having reached profitability, the firm would have been able to claim the same amount as a tax reduction once it came into profit and was required to pay tax. Thus, this is an excellent natural experiment to test the proposition that ‘cash flow’ is an important obstacle to higher R&D for small firms.

Given the modesty of this new benefit and the fact that it only improved things for a sub-set of firms, it has produced a remarkably strong effect particularly for firms with

annual R&D expenditure of around a quarter of a million dollars. Firms' responses indicate that improving cash flow is highly effective in stimulating R&D by small firms. This effect then dissipates somewhat as expenditure rises with a 'bunching' effect around \$1 million annual expenditure reflecting the threshold of R&D expenditure eligibility under the scheme and the highly distorting 'sudden death' nature of its administration. Firms qualified for the offset up to \$1 million dollar expenditure but an additional dollar's expenditure disqualified them from the offset.

Though there are some contrary findings in the research,<sup>4</sup> this pattern of effectiveness in stimulating innovation in small firms and ineffectiveness with large firms has been replicated in a number of other studies. Lach (2002), found that in Israel subsidies had been effective for small firms but not larger ones and more recently in Italy Bronzini and Iachini (2010) considered a regional innovation investment program in Emilia Romagna and found a positive effect only for small firms.

## THE DEMARCATION BETWEEN COMMERCIAL PRODUCTION AND R&D

Much R&D is not done by people in white coats in a laboratory but in a production environment where it will often be a matter of judgement as to what should be regarded as part of an R&D project and what should be regarded as a normal adjunct of running of the business. These issues bedevil questions such as what constitutes activity supporting R&D and the extent to which revenues from production should be taken into account in seeking to calibrate government support to the net, rather than the gross cost of R&D.

These concepts are well illustrated in the so called 'feedstock provisions'. Where research or development takes place in a production environment, continuing production in the presence of the R&D will often continue to generate value. Given this, one can distinguish between the net and the gross cost of R&D. Where a firm is seeking to optimise efficiency on a production line, perhaps trying some new technique on the line, running the production line is clearly in some sense part of the development process being undertaken. But if the firm continues to sell the produce from the development one could argue that the *net cost* of the development is all that should attract government support – in the same way that income taxation is imposed upon net, not gross income.

<sup>4</sup> By contrast de Blasio *et al* (2011), found no effectiveness for large or small firms, though it seems hard to believe that subsidies of the magnitude on offer (50 per cent for research costs and 25 per cent for development costs) would not have had some effect on some firms that might not otherwise have gone ahead. Given that the 'natural experiment' investigated involved the program being suspended for five years, it is possible that, like some US incentives, business had little confidence in the longevity of the scheme and so would only apply for programs that would proceed in any event.

Yet, if this is the approach, then, since much development activity will continue to be profitable in its own right – it has zero or negative net cost – and so, despite there being genuine development activity, there is no net cost base on which to apply the tax concession. Taken to its logical conclusion such a line of reasoning would lead one to deduct from the cost of development any subsequent profits generated from it. This could have policy appeal – particularly if the market failure leading to under-investment in R&D were risk aversion from potential R&D investors. However, it is also clear that this is not the intent of the R&D tax concession.

Similar considerations apply to how widely one draws the line around an R&D project and the associated industrial processes within which it may be embedded – which is where the new proposals have their most substantial effect. The facts of the 2000 Federal Court Case *Industry Research & Development Board (IR&D Board) v Coal & Allied Operations Pty Ltd* illustrate the issues well. There, Coal and Allied Operations was faced with technical issues in the construction of a mine. It claimed the following activities as qualifying under the concession.

The claimed activities were as follows:

1. Investigation and design of a suitable ground and flood water protection system that comprised:
  - (a) Overseas investigation of alluvial valley floor mining in USA.
  - (b) Assessment of various options that led to the choice of pursuing a Cut off Wall type to control ground water and minimise seepage.
  - (c) Research and design of a soilbentonite cutoff wall.
  - (d) Investigations leading to a choice of levee bank design.
  - (e) Research and design of the levee bank and the interface join between the cut off wall and levee bank.
2. Construction of the cut off wall and levee bank which includes instrumentation to measure performance of the wall and bank.
3. Dewatering the alluvial mine site area to allow mining to commence.
4. Blasting and mining a technically determined section (about 1000 metres) of the alluvial area adjacent to the cutoff wall and levee bank.

The IR&D Board proposed to allow the claims corresponding to paragraphs 1(a) to (e) of the claim but challenged the claims corresponding to paragraphs 2, 3 and 4. The Administrative Appeals Tribunal (AAT) held in favour of the company reinstating the claim for the activities described in paragraphs 2, 3 and 4 and this was upheld by the Federal Court. Following the fall in R&D in the wake of its 1996 reduction the nominal rate of the tax concession and closure of the R&D syndication program, stimulating R&D became a high priority for the Howard Government. In 2001 it introduced measures to supplement the tax concession at the same time as seeking to address concerns about the breadth of activity that

might come to qualify for the R&D tax concession in the wake of the *Coal and Allied* case and similar cases in the AAT.<sup>5</sup>

Describing its “increasing frustration” in 2001, the IR&D Board had this to say:

There is a clear divergence between what experienced, private-sector people on the Board consider to be R&D and what the Courts/AAT have ruled to fall within the meaning of the legislative definition. To address this issue in the eyes of the Courts, the wording of the definition would need to be changed....

The Board advised the Government in 2000 that, if it planned to enhance the program, then the definition needed to be addressed in order to protect the integrity of the R&D Tax Concession....

The Board would give the same advice to whichever party was in government. This issue goes to the fundamental integrity of the R&D Tax Concession and the need to have a sound foundation upon which to base the current and any future enhancements to the program.

In 2001 the Howard Government attempted to tighten the definition of R&D under the scheme but was largely unsuccessful in getting its changes through the Senate. The veil of confidentiality of tax records makes it difficult to quantify and understand the issue in detail, but as we see in the following section the growth of claims under the scheme offers strong circumstantial evidence of a potentially serious problem.

In the course of researching this paper, credible sources described claims in manufacturing that are analogous to ‘whole of mine’ claims in mining. In the example provided, a new shape for a packaging container attracted all the costs of running the line and so all the costs of production, with the incremental cost of the R&D project (including incremental costs of the project on the line) being a small fraction of the ultimate claim. If so, then although manufacturing claims have not been growing at the rate that mining claims have been growing (see below), the issue is not simply a ‘whole of mine’ claims. Rather ‘whole of mine’ claims are a subset of ‘whole of production’ claims suggesting that the problem is systemic and requires a systemic solution rather than an *ad hoc* anti-avoidance response.

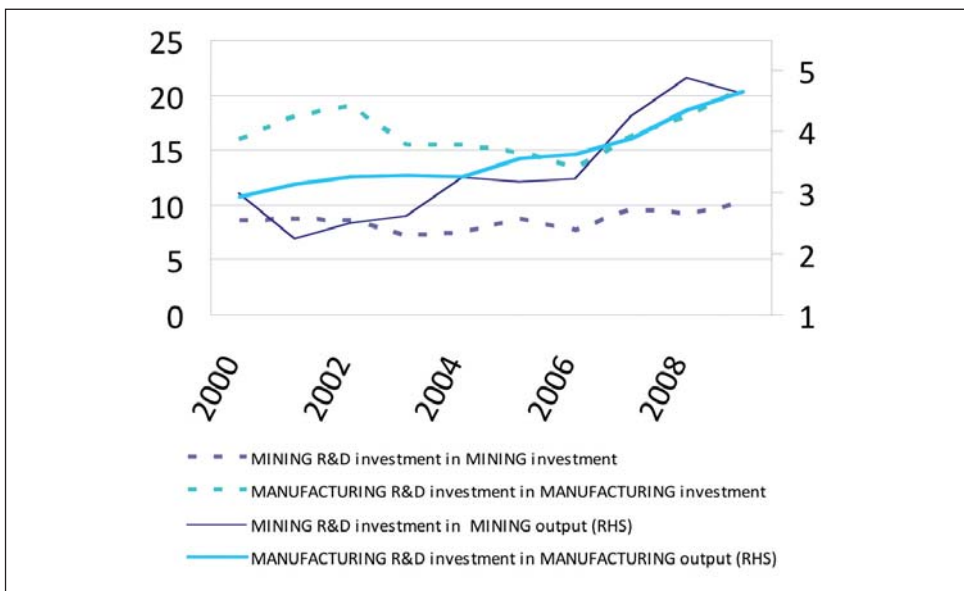
Further, given the surging cost of the R&D tax credit (see below) and the long delay in trends finding their way into official figures,<sup>6</sup> it is quite likely that the matter is growing urgent as progressively more firms find ways to move their claims further towards ‘whole of production’. We will not know how much the scheme is costing us this financial year until nearly two years from now.

<sup>5</sup> *Re “Fermenter” and “Distiller” v Industry Research and Development Board*, Administrative Appeals Tribunal. No N1998/1702, [2000] AATA 888.

<sup>6</sup> This is largely the result to the fact that claims are assessed in arrears as part of the income tax system.

However, the statistics on R&D tax claims do suggest gradual firm ‘learning’ from cases such as the *Coal and Allied* and *Distillers and Fermenters* cases in 2000. Chart 2 below maps R&D claim intensity of mining and manufacturing both against output and investment. It shows R&D claims fall quite markedly for both sectors following the relatively minor tightening of the scheme in 2001 but then mining heads from an R&D to output ratio of around 2.5 to 4.5 per cent between 2001-2 and 2008-9 whilst manufacturing rises slowly from a little under to a little over 3 per cent until around 2004 when it begins rising much more strongly rising to over 4.5 per cent by 2008-9. The corresponding figures for R&D investment as a proportion of investment (probably a better measure for mining as R&D would occur with the development of mines, but not necessarily for manufacturing) see mining R&D intensity rise from the early 2000s from around 7.5 per cent to over 10 per cent and manufacturing R&D to investment rise from 2005-6 to 2008-9 from 15 to 20 per cent.

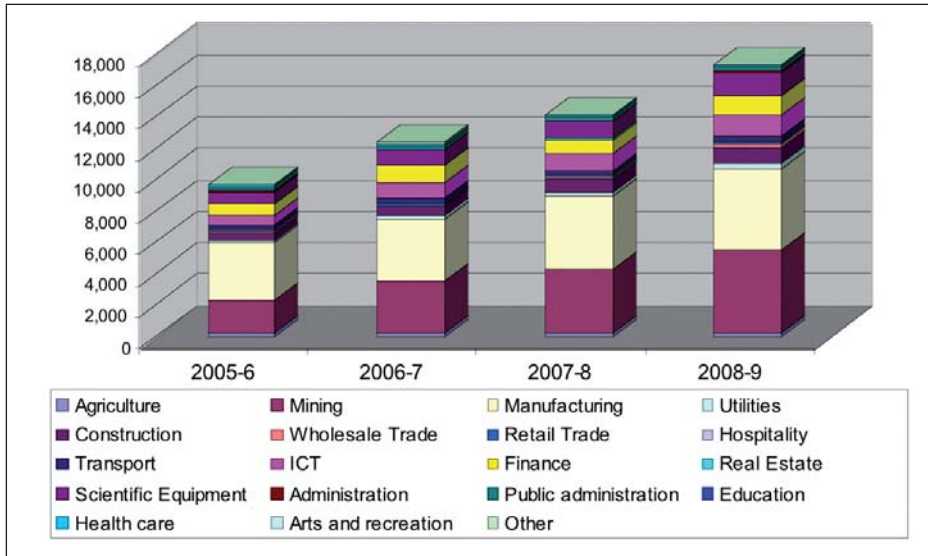
**CHART 2:** R&D intensity of manufacturing and mining: % of investment and % of output from 2000-1 to 2008-9.



Source: Data source: Australian System of National Accounts, Australian Bureau of Statistics and data provided by Department of Innovation, Industry, Science and Research.

## EXPENDITURE UNDER THE SCHEME

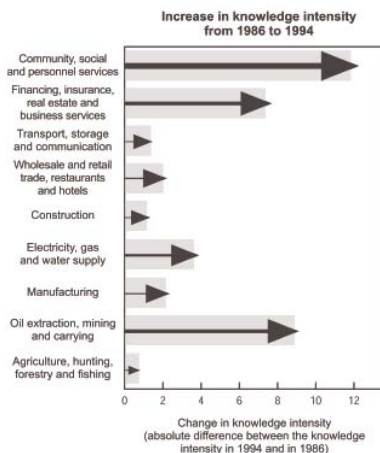
Over the last four years for which there is data – that is, the period covering 2005-6 to 2008-9, the average annual growth of costs claimed under the tax concession has been over twenty percent or a rate at which claims would more than double every five years and more than triple every seven years. At the same time mining claims have grown on average by 35 per cent per annum over the last four years, a rate which sees claims nearly double every three years and more than triple every five years.

**CHART 3: R&D investment claimed under the tax concession (\$ millions)**

Source: IR&D Board. 2008-9

Rising mining investment is helping to drive this process. Yet this can only explain part of the growth in mining R&D. Mining investment grew at an annual rate from 2005-6 to 2008-9 of 23 per cent or from \$27 billion to \$52 billion a growth of 93 per cent whereas mining R&D grew from \$2.2 billion to \$5.2 billion or by 136 per cent. There also seems to be a secular trend towards greater R&D in mining, which appears to be running at around 1 per cent per annum.<sup>7</sup> It is also likely that that, in responding to higher output prices, mining is moving towards more physically marginal production necessitating more R&D in investment.

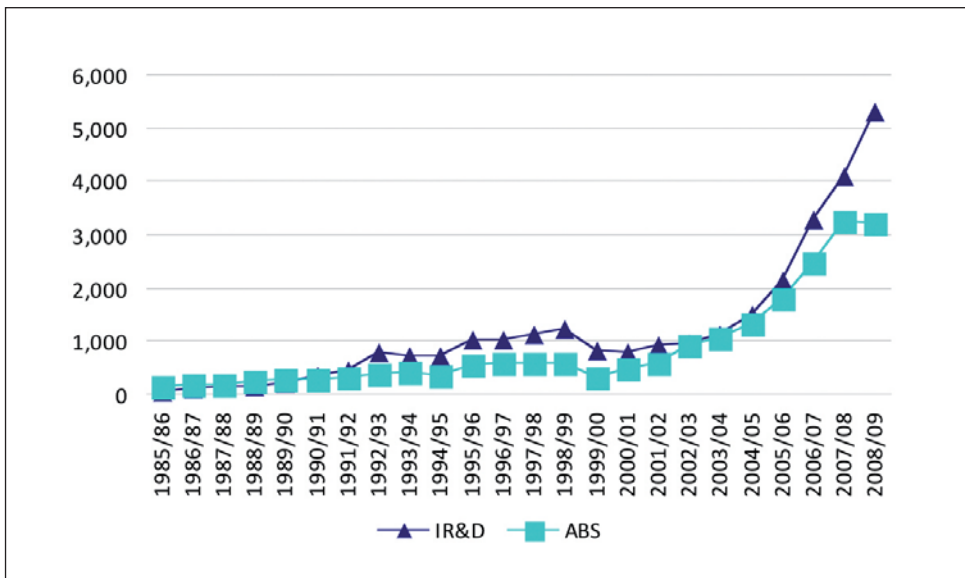
7



Source: OECD, 1999, p. 17 citing Smith 1996.

It seems likely, however, that a substantial part of the explanation is also that so called ‘whole-of-mine’ claims have expanded – those like that outlined in the *Coal and Allied* case where policy makers would regard much of the expenditure which is brought within the program as being relatively normal production activity, albeit activity which has a direct relationship with an R&D project. It is unclear if this is the reason but it is also notable that the statistical series on R&D maintained by the Australian Bureau of Statistics has mining investment in R&D tailing off whereas the series generated from claims on the tax concession has surged in recent years.

**CHART 4:** Deviation between ABS measure of R&D and R&D Claims (\$ millions)



Data source: Australian System of National Accounts, Australian Bureau of Statistics and the Department of Innovation, Industry, Science and Research

Indeed, the increased growth rate of mining R&D claims saw these claims exceed those of manufacturing for the first time in the latest data available for this study which was in 2008-9. If these claims are to be believed then the R&D intensity of mining investment is around ten per cent.<sup>8</sup> The corresponding figure from Statistics Canada is less than one tenth of this.<sup>9</sup>

<sup>8</sup> The ABS has gross fixed capital formation in mining at \$52,362 billion in the year ending June 2009 (Series A3348050V) which corresponds to R&D concession claims corresponding to \$5.3 billion of R&D.

<sup>9</sup> In Canada by contrast, despite Canada’s larger size, its statistical agency recorded mining R&D in 2008 at CAD \$449 from mining investment of CAD \$64 billion (Series Catalogue nos. 88-202-X and 61-205-X respectively). This is less than one tenth the both the amount of R&D and the proportion of R&D to mining investment than is claimed in our sector.

## POLICY EXPERIENCE AND POLICY ADVICE SHAPING CURRENT THINKING

When introducing the offset and premium schemes in 2001 the Howard Government sought to redirect the scheme by tightening the definition of R&D in a range of ways which would have disadvantaged certain activities particularly at the 'development' end of the R&D spectrum including limiting the kinds of activities that were claimed for the concession in the *Coal and Allied* case and similar cases. The Opposition supported the extensions but opposed the most significant aspects of tightening the scheme. The actions of today's Government and Opposition have been consistent with their actions in 2001 though with a change of government the parties' roles have reversed. Yet, with the cost of the scheme and the growth in expenditure now both substantially higher than before, the situation looks more urgent.

In addition, today's situation is characterised by two important pieces of policy advice before the government– the Productivity Commission (PC) report into Public Support for Science and Innovation (2007) and the report of the Review of the Australian Innovation System or the Cutler Report (2008).<sup>10</sup> Both reports were sceptical of the complexity of the existing arrangements and also of the extent to which the 125 per cent tax concession could be stimulating additional R&D.

The reports took somewhat different tacks. The Review of the Australian Innovation System was particularly concerned about the way in which the tax concession failed to provide assistance to firms until they were making sufficient profits to be taxed. This was anomalous when many of the most innovative and highest risk companies – and those most likely to respond to the assistance by increasing R&D – were relatively small start up research companies, for instance in biotechnology which were cash flow constrained and, if they were to find their way into profit would do so in many years' time. Where they were too large to qualify for the tax offset, the 125 per cent tax concession seemed almost perfectly designed *not* to assist them.

The Review recommended that the panoply of tax concession programs be rolled into a single program to be offered in two different forms. The concession should be transformed into a tax credit which was offered at both a higher level and in a refundable form for smaller firms. Where the existing refundable offset scheme was available for very small companies – with R&D of less than \$1 million<sup>11</sup> and turnover of less than \$5 million<sup>12</sup> the Review proposed its replacement with a

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<sup>10</sup> The author is a past Associate Commissioner of the Productivity Commission from 1993 to 1997 and was also a member of the Review Panel of Australia's Innovation System in 2008.

<sup>11</sup> This figure has been extended to \$2 million since the Review for years after 2009.

<sup>12</sup> See <http://www.ato.gov.au/businesses/content.asp?doc=/content/34652.htm>.

more generous refundable 50 per cent offset to be paid to firms up to \$50 million in turnover (being 20 percentage points higher than the company rate, this represented a 20 per cent rate of assistance). Less convinced of their responsiveness, it recommended a non refundable tax credit of 40 per cent (with an effective assistance rate of 10 per cent) for larger firms. The Review also recommended that action be taken to prevent so-called 'whole-of-mine' claims as illustrated in the *Coal and Allied Case*.

The Productivity Commission focused more single-mindedly on the question of 'additionality' arguing for an expansion of concessions which rewarded firms' *expansions* in R&D. It also argued that, just as there was a greater case for funding more innovative and more basic research within government, so with BERD there was a case for focusing assistance towards more innovative R&D and removing 'business as usual' activities from the scheme.

Kris Gale from Michael Johnson and Associates has argued the Government's response has embraced critical elements of both the PC's and the later Cutler Report. When commencing this project Gale's description seemed like an accurate description of what had happened. But as the project has proceeded I have come to think that the Government's report is much more squarely an attempt to implement the Cutler Report than the PC's approach. While the revisions to the definition of R&D are likely to advantage research somewhat more than development, closer inspection suggests this effect will be marginal if there is any effect at all. On the other hand, there is no debate between those arguing for and against the proposed changes that, in addressing what the Review saw as the crucial 'whole of mine' problem, the proposed changes will have a substantial impact on some R&D claims, constraining them by removing a substantial amount of production which is currently claimed under the concession. It is to these matters that we now turn.

# 3. The proposed changes

## THE OBJECTS OF THE ACT

The proposed new scheme sets out the objects of the scheme and provides a new definition of R&D. Some in industry have objected to the objects clause of the legislation for describing the legislative intention of the scheme as encouraging R&D that might not otherwise take place. The clause also speaks of the need for R&D to involve scientific experimentation in pursuit of 'new knowledge'. If it were possible to devise an administrative procedure to determine what R&D would proceed without assistance it would be valuable to governments in minimising their spending. Unfortunately however the incentives of the firms that have this information are to claim that projects would not go ahead without assistance even if this is not true. In recognition of that attempts are rarely made to directly target 'additionality' by excluding projects that would proceed without assistance and the R&D regime envisaged in the proposals for change is no exception.

Accordingly, although the objects clause sets out the motivating economic purpose of the scheme, it will have a marginal impact on the way the scheme operates because it is not a definition of eligible R&D and does not operationalise any test that R&D being claimed under the scheme must meet. Rather it is something to which judges may turn to understand the broad intent of the scheme when interpreting clauses – such as the definition of core and supporting R&D to which we will turn. Judges are in the same position as others in the policy process regarding R&D that would go ahead anyway. They are not in a position to know whether any specific R&D project would have gone ahead without the scheme and the bill as drafted does not seek to get them to deliberate on that in any direct way. The new scheme is likely to have substantially higher levels of 'additionality' than the current scheme, but even so, in the absence of huge increases in the scale of the scheme the bulk of assistance will continue to go to activity that would have occurred in any event. Nothing in the objects clause will change that in any but the most marginal way.

## THE DEFINITION OF R&D

As currently proposed, the new definition is simpler than the old one. It emphasises that R&D must involve the systematic application of the scientific method to the production of new knowledge. In the existing arrangements R&D is defined as

- “systematic, investigative and experimental work” involving
- innovation or high levels of technical risk, and which is done
- for the purpose of acquiring new knowledge or creating new or improved materials, products, devices, processes or services.

R&D also includes all directly related activities which are those other activities that have been undertaken for a purpose which is directly related to the systematic, investigative and experimental work. The new bill takes greater pains to focus on experimental work, though it is also clear that it includes development. The bill as currently drafted defines core R&D to be assisted under the new arrangements (s355-25) as:

- (1) 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
  - (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).

Sub-clause (2) of the same section then exempts a number of activities, though fewer than the current scheme.

It is clear that this definition is similar to the definitions in numerous similar provisions in other countries. Though there are a wide variety of different linguistic formulations, all use the fundamental concepts of the Frascati Manual defining R&D as the application of scientific and systematic investigation to acquire new knowledge in projects which involve technical risk. (See Appendix). It is also clear that all these definitions include what is called ‘experimental development’ in the Frascati Manual.

It is possible that the new language in the proposed system will be taken by judges to be somewhat less expansive than the current definitions. The fear that this

could disqualify a substantial amount of development is no doubt genuine, but it is hard to see it making much difference in determining whether most projects are qualifying development or not. In the case of both the existing and the proposed definition of qualifying R&D, the emphasis is on the systematic application of scientific method – which one can also describe as an experimental method – to discriminate between ‘business as usual’ development and continual improvement on the one hand and what the Frascati manual describes as ‘experimental development’ on the other. The latter concept implies the creation of new knowledge and the creation of new knowledge is always uncertain and so, presumably involves the bearing of some technical risk. Confining development to ‘experimental activities’ and to the discovery of ‘new knowledge’ seems unlikely to have a major effect given the existing requirement for “systematic, investigative *and* experimental work” (emphasis added) and the clear elaboration in the proposed scheme that new knowledge can be in the form of “new or improved materials, products, devices, processes or services”.

## DELINEATING AN R&D PROJECT FROM THE REST OF A FIRM’S ACTIVITIES

Also, in certain circumstances, undertaking a manufacturing process could fall within the scope of R&D for tax purposes, if it is being undertaken solely in order to resolve scientific or technological uncertainty to seek the advance in science or technology, and not also to produce goods for supply to a customer. An example might be operating a new process incorporating a new technology, which the company has been developing in its R&D project, where any output from the process will only be used for testing purposes or as scrap. (But, if the process is also being undertaken as production activity, with a view to producing goods for sale, then the activity is excluded from the scope of R&D for tax purposes.)

UK Customs and Revenue on the UK R&D Tax Credit .<sup>13</sup>

By contrast to the changes to the objects and definition, it is clear that the distinction between core and supporting R&D is the most important change in the new arrangements (s355 30). Here the new scheme seeks to logically determine a means of distinguishing between an R&D project and other activities which, though they may be directly related to it and support it, are nevertheless conducted for other purposes – most particularly continued production.

<sup>13</sup> Accessed at <http://www.hmrc.gov.uk/manuals/cirdmanual/cird81350.htm> on 20<sup>th</sup> February, 2011.

### Supporting R&D activities

(1) Supporting R&D activities are activities directly related to \*core R&D activities.

(2) However, if an activity:

- (a) is an activity referred to in subsection 35525(2); or
- (b) produces goods or services; or
- (c) is directly related to producing goods or services;

the activity is a supporting R&D activity only if it is undertaken for the dominant purpose of supporting core R&D activities.

The purpose of the distinction is to *disqualify* development where it draws in the costs of production which, though the production may be integral to the experimental development it is nevertheless undertaken also for (and very often predominantly for) production itself. The cameos in the Explanatory Memorandum circulated by the Government explain compellingly how the new arrangements deal with ‘whole-of-mine’ claims (See Box 1).

#### BOX 1: Boulevard Mining cameos from the Explanatory Memorandum

Boulevard Mining uses a new fork in an existing mine to undertake R&D aimed at allowing it to use wider tunnels. It uses existing knowledge about a new truss design developed elsewhere for cantilevered stadium roofs along with existing knowledge about safe tunnel widths for black coal. Boulevard will mine and sell the produce of the seam regardless of the outcome of the experiments.

This is legitimate development work addressing the uncertainty over applying knowledge in one situation to another thereby acquiring new knowledge and it qualifies as ‘core R&D’. The truss will be subject to different forces to those in its previous applications and it will interact with tunnel widths and shapes in ways that cannot readily be determined using existing knowledge of the properties of trusses and tunnels.

In order for the experiments with the truss to take place, tunnelling of various widths and shapes needs to be undertaken into the coal seam. This tunnelling has a direct, close and relatively immediate relationship with the actual experimental activities. Accordingly, it is a directly related activity and could well qualify under existing arrangements.

However, the tunnelling is also a production activity – it produces coal – and so the dominant purpose test applies. Here the dominant purpose of undertaking the tunnelling activities is to allow the seam to be mined, rather than to support experimental activities. Accordingly, the tunnelling activity does not qualify as a supporting R&D activity.

In another cameo it is explained that if a disused mine were used to conduct the experiments and the tunnelling did not produce coal for sale or for other value to the firm, it would qualify as a supporting activity. The example is used for illustrative purposes as it would be very rare for such experiments not to take place *in situ* within an existing production environment.

Source: Explanatory Memorandum, 2001, Boulevard Mining I to IV (précised)

In a range of discussions with industry it was clear that claimants regard what they are claiming as R&D and in a sense, even ‘whole-of-mine’ claims are R&D within the definition of the existing act as the investments that are claimed have elements of novelty and technical risk or at least a direct relation to a project which has. Likewise, if production is part of an R&D project, one can argue that there is no purely logical reason for clawing back revenue from production where that production is part of a legitimate R&D project. For process innovation is as important as product innovation, and process innovation must often be done on ‘live’ production which therefore produces output that can be sold.

Further, if one were to deduct all the proceeds of production from production that was directly related to an R&D project then it would often be impossible to identify *any* net cost to R&D wherever the revenue from production exceeded the costs of the R&D. And yet R&D is generally undertaken to *ultimately* generate revenue which exceeds the cost of the R&D project. Accordingly, taken to its logical conclusion all successful R&D would not be subsidised. In fact, if the risk of failure were a major driver of inadequate R&D such an outcome could improve the efficiency of policy – by increasing the risk appetite of R&D investors. But it is not clear that this is the case, and even if it were, it is evident that the scheme is *not* intended to assist only unsuccessful R&D.<sup>14</sup>

Even so, the cost of production activities can dwarf the cost of an R&D project as subsequent cameos in boxes 2 and 3 make clear. Just as the construction and testing of a new truss structure could cost a million dollars whilst the establishment of the production environment of a whole mine within the new truss might be deployed could cost \$50 million or more,<sup>15</sup> so one might be testing a new paint on a production line with the costs of doing so a very small proportion of the costs of running a production line when scaling up the new technology. In these circumstances one might argue that the *incremental* costs of any R&D in running the line are a legitimate part of the R&D project. But these costs will often

<sup>14</sup> See also Treasury Submission to the Senate Committee, p. 13.

<sup>15</sup> The R&D deduction in the Coal and Allied case was \$24 million over two years though the judgement in the case does not give detail on the breakdown of the claim between what might have been called the ‘core’ of the project (item 1) and the supporting activities – items 2-4).

be captured in the core R&D project and where they are not they will often be a very small fraction of the total costs of production.

Further, ruling out production is common in overseas schemes and seems well crafted to address the practical matter of ensuring that R&D assistance is focused as the Productivity Commission has suggested it should be (2007, p. 385).

While the Commission acknowledges that the nature of (and incentives to perform) R&D will vary across industries due to differences in both technical demands and market characteristics, the rationale for public support is to target activities that have two features: they generate high spillovers and they would not take place in the absence of that support. As such, activity is likely to involve higher levels of novelty and technical risk, eligibility criteria determining access to support should, to the extent practicable, reflect those features.

Quarantining 'core R&D' from the often much more costly production activities ancillary to it in the normal production environment seems to meet the PC's proposed criteria. Further, as with R&D towards IT systems for internal administration, it seems overwhelmingly likely that the vast bulk of supporting activity would occur in any event.

### BOX 2: Summary of the new approach

New law	Current law
A distinction is made between core R&D activities and supporting R&D activities.	A distinction is made between core R&D activities (without that term being used) and supporting R&D activities (for a directly related purpose).
The definition of 'core R&D activities' focuses on the requirement for an experiment that is conducted using the scientific method in order to address a significant knowledge gap.	Core R&D activities are defined in terms of multiple overlapping and interrelated tests relating to experimentation, innovation, technical risk, purpose and scientific approach.
Supporting R&D must be directly related to core R&D activities.	Supporting R&D must be carried on for a purpose directly related to the carrying on of core R&D activities.
Production activities can be supporting R&D activities only if undertaken for the dominant purpose of supporting core R&D activities.	Production activities can be supporting R&D activities.

The list of activities specifically excluded from being core R&D activities has been rationalised.

Activities on the exclusions list can qualify as supporting R&D activities if undertaken for the dominant purpose of supporting core R&D activities.

Developing, modifying or customising software for the internal administration of business functions is excluded from being core R&D activity.

Listed activities are specifically excluded from being core R&D activities.

Activities on the exclusions list can qualify as supporting R&D activities.

In-house software is excluded from being a core R&D activity by a requirement that software development activities be for the purpose of supply to at least two other entities.

Source: Explanatory Memorandum, 2010.

### BOX 3: Matryosh-Koala comes from the Explanatory Memorandum

Matryosh-Koala (MK) operates a factory manufacturing wooden koala-shaped dolls in sets of seven nesting sizes. MK conducts R&D to investigate whether a new fast drying permeable polymer glaze can be used to speed up the line. The experiments will also investigate the maximum thickness of glaze that will be permeable enough to allow the paint beneath to dry.

A production line diversion is fitted with a spare glazing unit and glaze tank, to allow several sets of test doll to be coated with the permeable glaze in various formulations and thicknesses in conjunction with a normal production run. The diversion also contains a spare nesting machine to allow the test doll halves to be nested at an earlier than usual stage of the production line and set aside for examination.

The test dolls will not be sold because their quality will be inconsistent with the firm's standard dolls. The experimental activities seek to acquire new knowledge about the drying and permeability properties of the glaze for varying formulations and thicknesses of glaze. The hypothesis can only be tested by replicating how the materials would be handled in a production line context and so the production line diversion is core R&D.

Operating the diversionary stage of the production line where the test dolls are coated with the glaze and assembled would form part of the experiment. The

*(Continued)*

less formal manual trial prior to the experiments proper would also form part of the core R&D activities.

MK's experiment can only be done on a production line, so running the line has a direct and relatively immediate relationship with core R&D. In addition because it is a production activity, the dominant purpose test applies. Given that the dominant purpose of running the main line is not to support the experiment but to generate production its operation fails the 'dominant purpose' test and is not claimable under the credit. However, producing the painted doll halves used in the glazing experiment would be eligible as a supporting activity (as would acquiring the painted doll halves were they sourced externally). Normal cost attribution rules would be used to determine the cost of producing the test dolls.

However, if aspects of the whole line were under test (for instance, the glazing of all dolls on the line) in ways which threatened to degrade the likely quality of the output for instance necessitating its disposal separate to the factory's normal produce the firm could legitimately self-assess the dominant purpose of the whole run to have the dominant purpose of supporting the R&D project.

Source: Explanatory Memorandum, 2001, Matryosh-Koala I and II (précised)

Similar principles apply in manufacturing. Running the production line in the first MK cameo is necessitated by the R&D project, but the main expenses involved are likely to be dominated by the business-as-usual expenses of running the line. And, as in the case of 'whole of mine' claims, those expenses which may directly support the development but which also support normal production may be hugely in excess of the incremental costs of the whole of the rest of the development that is conducted on the line.

Given the choice between the two options, especially in a time of impending fiscal austerity, narrowly defining R&D projects is the superior approach from a policy perspective. In many, if not almost all cases, the costs of running the line will largely recoup themselves from sales of production. And many, if not all, of the direct costs of any experiment run on the normal production line would be eligible for the concession as made clear in the first MK cameo where the Explanatory Memorandum explains that:

the production of the painted doll halves used in the glazing experiment run on the production line would be eligible as a supporting activity (as would acquiring the painted doll halves were they sourced externally). Normal cost attribution rules would be used to determine the cost of producing the test dolls.

**BOX 4: The UK's R&D Tax Credit**

Under the UK tax credit, assistance to larger firms is comparable to Australia's scheme. For smaller firms it is much more generous. The UK tax credit provides substantially higher assistance to SMEs than the existing or proposed Australian scheme. Qualifying R&D expenditure can be deducted at 175 per cent. On a 27 per cent company rate this provides refundable assistance of 20.25 per cent. UK SME assistance is available to firms with turnover up to €100 million as opposed to \$5 million today or \$20 million under the proposed new Australian arrangements.

Yet, the UK scheme costs less than the current or planned Australian scheme both as a share of GDP and as a share of the budget. How can this be? The central reason seems to be the UK scheme's tighter definition of R&D so as to exclude 'whole of production' claims. Their guidelines<sup>16</sup> define eligible R&D in a way that is more heavily weighted towards the research end of the research and development spectrum and the creation of new knowledge than the current or proposed system.

R&D is defined as activity which seeks "an advance in science or technology". This means "an advance in overall knowledge or capability in a field of science or technology (not a company's own state of knowledge or capability alone)<sup>17</sup> . . . Work which uses science or technology but which does not advance scientific or technological capability as a whole is not an advance in science or technology.

The guidelines make it clear that "It is important to get the boundaries of the project correct" and go on to specify that work that 'directly contributes' to an R&D project is eligible for the tax credit, but that "the production and distribution of goods and services" are deemed *not* to directly contribute to the project. (See also the head quote to this section).

The Canadian Government's R&D tax concession likewise excludes production.<sup>18</sup>

As a matter of logic, the 'dominant purpose' test almost perfectly separates the 'business-as-usual' activities (running the production line) from the R&D activities with each treated separately under the concession. Put another way, like whole-of-mine claims, the current concession conflates activity which,

<sup>16</sup> Accessed at <http://www.dius.gov.uk/policies/innovation/business-support/rd-tax-credits/tax-guidelines> on 20th February, 2011.

<sup>17</sup> Note however the guidance goes on that "This includes the adaptation of knowledge or capability from another field of science or technology in order to make such an advance where this adaptation was not readily deductible".

<sup>18</sup> Accessed on 20<sup>th</sup> Feb 2011 <http://www.cra-arc.gc.ca/txcrdt/sred-rsde/bts-eng.html#whatkind>

though it is associated with development is not development. It is production. Where development involves production, 'the costs of development' are best thought of as the incremental costs incurred by the development project. This would be costs (or reductions in revenue) incurred by the firm that are in addition to the normal costs and revenue that would normally be generated in running the line.

Within the activity based scheme under which the concession operates, the MK cameos indicate that the 'dominant purpose' test captures this distinction creditably. It is possible that in some cases, because of its binary operation – ruling the costs associated with production in or out – the dominant purpose test may exclude legitimate incremental development expenses on the production line. A more precise delineation of the legitimate costs of development under the concession with the ordinary expenses of running the business would impose the dominant purpose test on production activity, but explicitly allow any *incremental costs of development* as defined in the previous paragraph in conducting a production activity associated with the development project. It is possible that this would avoid the compliance costs associated with firms need under the proposed scheme to document core and supporting activity, though it could also prejudice the activity based nature of the way the system works at present.

## THE PROPOSED ARRANGEMENTS FOR LARGE AND SMALL FIRMS

Early in this paper doubt was cast regarding the extent to which a 7.5 per cent effective rate of assistance would lead to net economic benefits when applied to large firms. Common sense tells us that where the responsiveness to this subsidy is unlikely to be greater than one, that the assistance will overwhelmingly assist activity that would take place in any event. The proposed scheme increases the rate of assistance from 7.5 per cent to ten per cent which is not a large increase. And since the Review of the Innovation System which recommended this rate of assistance Russell (2010) has found no statistically robust evidence of the scheme having any appreciable effect even when it was provided at a substantially higher level. And it has found no appreciable effect of the success of the 'premium' scheme.

Though it is unlikely to be a politically viable option, in these circumstances and in straightened fiscal circumstances, it is hard to argue that either the existing or the proposed scheme is likely to be cost effective for large firms. It is possible, perhaps probable, with sufficiently aggressive approaches to supporting innovation and durable R&D support for large firms could see them thinking of Australia as a worthwhile location for substantial R&D investments. We make some observations about how that might be afforded in one possible more radical scenario below.

On the other hand growing experience with the tax offset provides strong evidence that R&D in small firms is often cash flow constrained and that schemes which relieve that constraint can unlock substantial R&D growth. We have not done an econometric analysis of the tax offset but it seems clear that if it was done, and if the offset were modelled as a loan rather than a grant as it is in many, if not most cases, the tax offset would be strongly welfare enhancing. Further, if the constraint is cash flow, then a substantial proportion of the increase in the level of assistance under the scheme – in this case boosting its value from 7.5 cents to fifteen cents in each dollar spent on R&D – should find its way into additional R&D.

**Central Finding:** The proposed changes to the R&D tax concession are soundly based in policy. Further delay in passing them would not only delay the increases in R&D investment from small firms that could be expected from the changes, but could also retard investment in R&D by smaller firms, even if it were viable under the current regime.

**Recommendation One:** The Government's proposed new R&D tax credit scheme replacing the current one should be passed into law with or without some minor amendments suggested below.

## 4. Some issues that have not been prominent in the debate

The previous sections have been written with the prominent themes of the debate over the new proposals in mind. This section explores some further areas and possibilities for improvements that have received less attention.

### INDEXING

Both the existing and the proposed new R&D tax concessions operate with a number of thresholds that will gradually lose their currency as low levels of inflation undermine their real value. This lack of indexing will pull various thresholds within the proposed scheme in different directions. For administrative simplicity the R&D tax credit is not paid until firms' R&D expenditure reaches \$20,000. This has been the case for a considerable period under the old tax concession. If the figure were indexed to the CPI from the time of its inception it would be more appropriate and would save money. By the same token, the \$20 million figure governing the threshold between the refundable and non-refundable offset will gradually reduce the reach of the more generous scheme and should also be indexed.

**Recommendation Two: Both the threshold defining small firms and the minimum amount eligible for reimbursement should be indexed for inflation and set to some rounded number every three years.**

### PRIVACY

It has been amply demonstrated in the course of this study how the high level of confidentiality firms are given in making tax claims is inimical to understanding the cost drivers in the scheme and in evaluating its cost effectiveness. In just the same way that one of the rationales for the patent scheme is to improve returns to innovators *in return for greater transparency* about their innovations it would make sense to apply a similar principle to the tax credit.

Though each firm would rather not disclose its claims, it is defensive of its claims because other firms are not giving their information away either. Yet, if firms could make a collective decision to make greater disclosures of what they were doing, most firms would benefit from the additional information available to all firms as a public good. This would generate private gains for many innovators whilst contributing to the public good of enabling much better analysis of the scheme's effectiveness and of how to optimise it.

**Recommendation Three: Although the concession is available through the tax system, normal tax confidentiality requirements should be waived to permit public scrutiny of individual claims on the scheme, both to maximise spillovers and to enable better analysis and optimisation of the cost effectiveness of the scheme.**

## ADJUSTMENTS FOR REVENUE

Given the 'dominant purpose' test, much of the existing regime for limiting production claims via the feedstock rules is likely to be rendered redundant. Nevertheless, it is hard to understand why the feedstock provisions should operate differently in the small and large firm tax credits. Yet, as the explanatory memorandum explains:

For simplicity, the feedstock adjustment only seeks to recover 10 percentage points of the R&D tax incentive enjoyed on the feedstock expenditure claim. This means that a firm receiving the 45 per cent refundable tax offset (rather than the standard 40 per cent non-refundable tax offset) on the feedstock expenditure will effectively retain at least 5 percentage points of incentive on all feedstock expenditure.

It is hard to understand why this contributes to simplicity. In the elaborate calculations made to institute the netting off of feedstock revenue, it is true that this procedure would use a different number for firms receiving the 40 per cent non-refundable offset and those receiving the 45 per cent refundable offset, but for each firm the arrangement is simple – and involves a single number.

## A MORE AMBITIOUS SCHEME

Even though the refundable tax credit for smaller firms is likely to stimulate R&D, it is likely that it should be more generously funded. It would be appropriate to have it at a higher rate. It would also be appropriate to set the threshold higher. Indeed, the Cutler Review Panel recommended that the tax credit be set five percentage points higher at 50 per cent (producing a 20 per cent rate of assistance) and that it be available to firms with turnover of up to \$50 million rather than \$20 million per annum.

But at a time of fiscal stringency – and indeed, even when the purse-strings are not as tight as they are now – there is never a shortage of worthy and/or politically compelling causes on which to lavish government resources. If we are to achieve a step change in funding business R&D in Australia, it would require a new source of funding. Since the rationale for R&D support is that firms which fund R&D cannot recover all the benefits their spillovers confer on other firms, one could argue that business R&D incentives should be funded by a general levy on business.

This would have the following attractions.

1. It would produce a new and substantial source of funding.
2. The winners from the R&D (those firms performing less R&D but which stood nevertheless to benefit from spillovers) would fund those who generated those spillovers.
3. It may be possible to get business to ‘own’ the scheme so that business has as much of a stake in ensuring that the credit is well targeted as the rest of the community. By contrast, when the last major effort was made to coral R&D assistance into R&D and not on associated production, the political failure of that endeavour was widely seen as a ‘win’ for business.<sup>19</sup>

Indeed, there are two activities firms undertake which economists widely see as conferring benefits to firms other than those that undertake the investment. R&D is one such area and so, too, is training. And spillovers from training were the central motivation behind the Training Guarantee Levy (TGL) introduced in the 1980s. Though it was marred by design and implementation faults,<sup>20</sup> the TGL was at least soundly conceived in principle. It would accordingly be possible to fund a more generous R&D support scheme around similar architecture which could itself be extended to training as a general scheme to better internalise the costs and benefits of both training and R&D.

Although it does not use the kind of levy proposed, Canada foregoes more than twice the revenue Australia does both absolutely and as a share of GDP (OECD, 2010, p. 11) in what appears to be R&D tax concessions which are both better targeted (being largely unavailable on production costs), and substantially more generous on those activities that qualify.

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<sup>19</sup> See for example “Business cheers R&D Tax Concessions”, AFR, 27<sup>th</sup> Sep, 2001.

<sup>20</sup> It is natural in the economy for some firms to train more than others. Unfortunately, the scheme sought to force all firms to undertake a minimum amount of training and did so by facing them with a government levy which was equivalent to the cost of the level of training the government was seeking to get them to undertake. This meant that it was still in firms’ interest to place their employees in formal training programs even if they conferred virtually no benefit on the firm. This and lax accreditation of training agencies virtually ensured an avalanche of golf days and other excesses which discredited the scheme, leading to its early removal.

# Conclusion: A way through the uncertainty

This report is supportive of the basic logic of what government – at both political and official levels – is seeking to achieve with the new package. The current scheme is sufficiently underpowered and so would induce so little R&D that would not occur in any event that, with the likely exception of the small firm tax offset, if one had the choice between the 125 per cent tax concession and nothing at all, nothing at all would probably be the superior policy. For that reason the rates of assistance should be increased to give the scheme some chance of increasing sufficient R&D to outweigh its administrative, compliance and revenue costs.

Further, the basic architecture of what is proposed is well thought through. Currently, there is a substantial cost drag on the system which is an artefact of the way R&D has hitherto been defined within the scheme. The result is that the scheme assists R&D as it is intended to do *plus* whatever production costs that can be brought within the purview of the scheme *even if they exceed the incremental costs of R&D*. Though it is unclear how large those costs are, it is clear they are substantial and Treasury is of the view that they are of the order of fifteen to twenty per cent of costs claimed under the scheme (see below).

There are several sources of uncertainty in considering the policy options. One is that, as a legislated scheme, a new definition will require some ‘bedding down’ with judicial decisions. Nevertheless, the new definition of R&D recognisably borrows from the basic Frascati Manual concepts of what constitutes R&D. It simplifies the old definition, and it is possible that it will be interpreted somewhat more narrowly, but it is simpler and more compelling as a definition, and given the similar concepts and progeny of both approaches, it is unlikely to lead to substantial change.

There is also potential uncertainty as to how the ‘dominant purpose’ test will be applied. But it is inevitable that there be such bedding down with any new definition, and the basic logic of what is being attempted is both clearly expressed and coherently elaborated in the series of cameos in the Explanatory

Memorandum. And those cameos – with their compelling logic – will have their own weight in guiding administrative and judicial determination of the intent and ultimate meaning of the legislated words.<sup>21</sup> Given this the degree of uncertainty in all these matters is relatively low.

There is clearly a lot more uncertainty around the question of the revenue impact of the changes and, the cognate question of how much currently eligible expenditure the new test will render ineligible. This has been handled in a way which, though it conforms to long established practice is not particularly satisfactory. Costings were conducted by a costings unit within Government with access to ATO data. Treasury officials have given evidence to the Senate Committee that a judgement has been formed that the changes are likely to reduce eligible R&D by between 15 and 20 per cent.<sup>22</sup> However, neither the methodology behind the calculations nor the confidence we can have in them has been disclosed. The result has been that more than an ideal amount of policy design has occurred behind closed doors.

Against this it can be said that there have been two exposure drafts, and more importantly, the basic design of the proposals being put to the Parliament emerged as a development of a public inquiry – the Cutler Report – is soundly conceived, and indeed compelling.

Further substantial delay would be unfortunate. This is not simply because impatience naturally rises as delay lengthens. There is a fundamental economic reason. The new arrangements seek to double the rate of assistance to small firms and the only reason for doing so is to encourage R&D that might not otherwise be performed. And if the new scheme is capable of eliciting new R&D spending, its absence is now doubly powerful. Not only will the absence of the new program be stalling R&D that would go ahead once the changes are secured, but there will also be some R&D that would be going ahead now in the absence of any proposals for change which get put ‘on ice’ until they can benefit from the higher level of assistance under the new program. This could be a substantial sum as there would be a substantial body of R&D by tax loss firms that are ineligible for the current tax offset but which will be eligible for the new small firm tax credit.<sup>23</sup> Right now R&D investment, particularly within small firms, will be stalling wherever the managers of small business think that they may do better by waiting for the new scheme to come into existence. Accordingly a failure to pass the legislation is likely to actively suppress R&D spending.

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<sup>21</sup> S 15AB of the *Acts Interpretation Act*. See [http://www.austlii.edu.au/au/legis/cth/consolact/aia19012\\_30/s15ab.html](http://www.austlii.edu.au/au/legis/cth/consolact/aia19012_30/s15ab.html)

<sup>22</sup> Senate Committee, Transcript, Thursday, 20 May 2010, pp. E 46 ff.

<sup>23</sup> In particular those firms with annual turnover between \$5 and \$20 million.

It is unfortunate that there is such uncertainty. If the process by which the costings were made were a more transparent one, we might at least understand the level of uncertainty we are facing. Nevertheless, there is a constructive way through that uncertainty. The merits of what is being proposed do not turn on the magnitude of current activity that will become ineligible for assistance under the 'dominant purpose' test. For the dominant purpose test has been designed to remove from assistance production activity for which there is very little policy rationale for assisting. It is overwhelmingly activity which would take place in any event because it would take place without the R&D project being undertaken. If this activity currently comprises around 15-20 per cent of activity currently benefiting from the scheme as government officials have suggested, then the new scheme will be broadly revenue neutral as they forecast.<sup>24</sup>

If the real figure is substantially higher – as some accountants believe based on their own clients' circumstances – then the need for change becomes more not less compelling. But in this case the change will be revenue positive for the government leading to the following recommendation. For this reason, if a windfall to revenue should arise from narrowing the base of the scheme, it would be appropriate for the government to plough this back into the scheme in future years as increases in the rate of assistance, the threshold at which firms go from the small company to the large company rate and/or the alacrity with which firms can access the assistance once claimed.

While there is nothing sacrosanct or particularly scientific about any particular figure, the proposed 45 per cent credit is still not particularly generous and, apart from its effect on cash flow will still be limited in its inducement of new R&D. The UK small firm scheme provides 20.55 per cent assistance and the Canadian scheme offers substantially more assistance again. These schemes are more likely to generate substantial additionality than the 15 per cent rate of assistance in our own scheme for smaller firms, particularly given the potential for dividend imputation to dilute the value of the assistance especially to smaller stocks where owners are more likely to have direct involvement in management.

Our experience with the tax offset gives us a clue as to the most cost effective way of ploughing that money back into the scheme. Recall that simply lending firms the tax benefit that they expect to ultimately qualify for once in tax profit produced a strong response from small firms. This suggests that one of the most effective ways to target R&D assistance to smaller firms is to do so in a way that augments their cash flow. Increasing the speed with which small firms receive refundable tax credits will impose very low costs on governments given their low

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<sup>24</sup> Note however that the growth of R&D we have seen in recent years may slow to the extent that it has reflected firms' increasing success in claiming production as part of R&D.

cost of capital, but if the experience with the tax offset is anything to go by, it can have a substantial effect in stimulating R&D within small firms.

However to protect tax integrity, the R&D tax offset operates in arrears on an annual cycle and this is how the intended refundable tax credit is intended to operate. This contrasts with the concession for firms in tax profit that can vary their tax as it is paid and so access the benefit almost contemporaneously with undertaking the expenditure. The Review of the Australian Innovation System considered options for bringing R&D Tax Offset payments forward. The Tax Office indicated that paying offset payments in advance or even quarterly as of right would introduce administrative difficulties into the current administration of the tax offset if integrity were to be maintained. However, the prospective benefits are of sufficient effectiveness in maximising the efficiency of the scheme that some regime should be developed where the refundable credit can be claimed at least quarterly in arrears for firms with a profile which enables them to be judged a good risk.

**Recommendation Four: If a windfall to revenue should arise from narrowing the base of the scheme, this should be ploughed back into the scheme in future years. The most cost effective means of doing so would be to bring forward refundable payments to firms that were judged a good risk from an integrity perspective. Beyond this, additional funds should be ploughed back as increases in the rate of assistance and/or the threshold at which firms go from the small company to the large company rate.**

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# Appendix: Eligible R&D Expenditures in other Countries

This appendix presents the definitions of eligible R&D from a range of countries.

## CANADA<sup>25</sup>

- Experimental development to achieve technological advancement to create new materials, devices, products, or processes, or improve existing ones;
- Applied research to advance scientific knowledge with a specific practical application in view;
- Basic research to advance scientific knowledge without a specific practical application in view; and
- Support work in engineering, design, operations research, mathematical analysis, computer programming, data collection, testing, or psychological research, but only if the work is commensurate with, and directly supports, the eligible experimental development, or applied or basic research.

## IRELAND<sup>26</sup>

- Systematic, investigative or experimental activities
- In a field of science or technology
- One or more of the following categories of research and development:  
Basic research, Applied research, or Experimental development.

In addition they must:

- Seek to achieve scientific or technological advancement, and
- Involve the resolution of scientific or technological uncertainty.

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<sup>25</sup> Canada Revenue Agency, Accessed March 2011 from <http://www.cra-arc.gc.ca/txcrdt/sred-rsde/bts-eng.html#whatkind>

<sup>26</sup> Irish Tax and Customs, Accessed March 2011 from <http://www.revenue.ie/en/tax/ct/research-development.html>.

## NEW ZEALAND<sup>27</sup>

Activities must:

- Be directed at acquiring new knowledge or creating new or improved materials, products, devices, processes or services, and
- Include systematic, investigative and experimental (SIE) activities, and
- Either seek to advance science or technology by resolving scientific or technological uncertainty, OR involve an appreciable element of novelty.

## SINGAPORE<sup>28</sup>

- Any systematic, investigative and experimental study that involves novelty or technical risk carried out in the field of science or technology with the object of acquiring new knowledge or using the results of the study for the production or improvement of materials, devices, products, produce, or processes.

## UK<sup>29</sup>

- R&D for tax purposes takes place when a project seeks to achieve an advance in science or technology.
- The activities which directly contribute to achieving this advance in science or technology through the resolution of scientific or technological uncertainty are R&D.
- Certain qualifying indirect activities related to the project are also R&D. Activities other than qualifying indirect activities which do not directly contribute to the resolution of the project's scientific or technological uncertainty are not R&D.

## US<sup>30</sup>

- The expenditures of Research and Development ("R&D") are reasonable costs you incur in your trade or business for activities intended to provide information to help eliminate uncertainty about the development or improvement of a product. Uncertainty exists if the information available to you does not establish how to develop or improve a product or the appropriate design of a product.
- Whether expenditures qualify as R&D expenditures depends on the nature of the activity to which the expenditures relate. Neither the nature of the product (or improvement) being developed, nor the level of technological advancement matters when making this determination.
- R&D expenditures generally include all expenditures incident to the development or improvement of a product. R&D expenditures include the expenditures of obtaining a patent, such as attorney's fees expended in making and perfecting a patent application.

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<sup>27</sup> New Zealand Inland Revenue, Accessed March 2011 from <http://www.ird.govt.nz/rd-tax-credit/about/overview/>.

<sup>28</sup> Inland Revenue Authority of Singapore, Accessed March 2011 from [http://www.iras.gov.sg/irasHome/page04.aspx?id=614#Research\\_&\\_development\\_expenses](http://www.iras.gov.sg/irasHome/page04.aspx?id=614#Research_&_development_expenses).

<sup>29</sup> UK Department for Business Innovation & Skills, Accessed March 2011 from <http://www.bis.gov.uk/policies/innovation/business-support/rd-tax-credits/tax-guidelines>.

<sup>30</sup> Internal Revenue Service, Accessed March 2011 from <http://www.irs.gov/businesses/small/industries/article/0,,id=97640,00.html>