Combining resource rent and income taxation for neutral impact

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Abstract

Income tax subsequent to a resource rent tax (RRT) in the production phase of petroleum resource projects where the risk of losing RRT deductions is low should, in order to maintain the RRT's neutral impact, be applied: first, to pre–taxes cash flow cut by the RRT tax rate; and, second, to the minimal–risk assets created by substitution of RRT loss carry–forward (with long–term government bond rate (LTBR) uplift) for immediate cash rebates for losses. Absent income tax on the minimal–risk assets, RRT loss uplift would be set at a post–income tax level. Leaving the minimal–risk assets embedded in aggregate post–RRT flows for income tax purposes, as under traditional RRT design, justifies uplift at pre–tax LTBR but, compared to ideal assimilation of RRT and income tax, imposes investment distortions and, potentially, greater income tax impost on investors.

Under ideal or traditional assimilation of RRT and income tax in projects' production phase, uplifted own–project exploration expenditure not previously transferred to profitable projects would be pooled and uplifted with production phase expenditures for RRT purposes. In the interests of simplicity, all RRT exploration expenditure would attract RRT uplift at least at pre–tax LTBR for a period and continue to attract the usual immediate write–off for income tax purposes.

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1. Introduction

Much energy has been expended over many years in Australia on design of imposts that tax the economic rent of mining and petroleum resource projects, leaving investment decisions unaffected. Such neutral tax design aims at providing a return to the community from the exploitation of its mineral resources while not impinging on commercial decisions to explore and develop those resources.

Little of that energy, however, has been devoted to proper assimilation of resource rent and income taxation, even though the neutrality benefits of well-designed rent taxation can be diminished considerably by a poorly devised interface with income taxation.

This article focuses on implications for sound, yet practical, design of the interface between rent and income taxation. In doing so, the rent taxes considered are project-based and applied before income taxation.[1]

Proper assimilation of rent and income taxation is clear when design of resource rent taxation is in the form of a cash flow tax (CFT) incorporating cash rebates for losses (negative cash flow) to provide immediate full loss offset ("pure CFT" or "Brown tax"[2] design). In this case, post-CFT cash flows of mineral resource projects comprise the tax base for income taxation.

Proper assimilation is also clear when resource rent taxation takes the form of a CFT with delayed government-guaranteed cash rebates for losses that are carried forward with annual uplift ("CFT with delayed full loss offset"). The assimilation sees income tax applied separately:

- first, to post-pure CFT cash flows as if a pure CFT applied — with CFT tax payments and delayed rebates ignored for income tax purposes; and
- second, to the risk-free asset (loan to government) created by delayed government-guaranteed loss offset.

Mayo[3] shows how this ideal assimilation with income tax operates with pure CFT and CFT with delayed full loss offset. The resource super profits tax (RSPT), based on

1 Applying a project-based rent tax after income tax would require income tax profit or loss to be attributed to each of an investor's projects subject to rent taxation year by year.

2 Pure CFT was first discussed in E Brown, "Business income taxation and investment incentives", in *Income, employment and public policy, essays in honor of Alvin H. Hansen*, Norton, 1948, pp 300-316.

3 W Mayo, *Taxing resource rent: concepts, misconceptions and practical design*, Kyscope Publishing, 2013. Available at www.kyscope.com.au.

design in the "Henry review"[4] and proposed in 2010 by the Australian Government,[5] is a form of CFT with delayed full loss offset. Nevertheless, the RSPT's interface with income tax was to attract what might be termed the traditional treatment whereby income tax was to apply to pre-tax cash flows with RSPT payments deductible, and delayed cash rebates assessable, for income tax purposes. Such treatment distorts investment and, potentially, adds to the income tax impost on investors.

In the event, the RSPT gave way to Australia's pre-existing project-based petroleum resource rent tax (PRRT). The PRRT was enacted in 1988 to apply to offshore greenfield petroleum (oil and gas) projects and was broadened in 2012 to include onshore projects.

With a traditional resource rent tax (RRT), like the PRRT, losses (again, negative cash flow) are carried forward with uplift similarly to a CFT with delayed loss offset.[6] Unlike a CFT with delayed full loss offset, however, cash rebates are not assured for uplifted and carried-forward RRT losses not absorbed by positive cash flow. That key design difference underlies the reason that both the Henry review and Mayo[7] put a wide distance between RRT design and CFT design with delayed full loss offset.

Consistent with that, Mayo[8] contends that, because of the risk under RRT design of losing RRT deductions, "income taxation cannot sensibly be applied to post-RRT project cash flows as if pure cash flow taxation were in place with accompanying full loss offset". That contention would suggest that ideal assimilation of income tax and CFT with delayed full loss offset could not be used as a model for RRT design.

Mayo[9] consequently suggests that income tax would logically be applied to pre-tax cash flows "with payment of RRT a deduction for income tax purposes". This is the income tax treatment which applies to the PRRT and which may be regarded as the traditional treatment for an RRT applied before income tax.

The "Callaghan review",[10] however, makes a crucial observation on the risk of losing RRT deductions. That review was announced by the Australian Government in

4 Australian Treasury, *Australia's future tax system*, *report to the Treasurer* (K Henry, Chairman) (Henry review), part two: detailed analysis, Australian Government, December 2009, vol 1, recommendation 45, pp 231-232. Available at http://taxreview.treasury.gov.au.

5 Australian Government, Australian Treasury, *The resource super profits tax: a fair return to the nation*, 2010. Available at https://catalogue.nla.gov.au/Record/4942197.

6 A feature espoused, along with the RRT name, in R Garnaut and A Clunies Ross, "Uncertainty, risk aversion and the taxing of natural resource projects", (1975) 85 *Economic Journal*, 272-287.

7 Mayo, above n 3.

8 Ibid, 192.

9 Ibid, 192.

10 M Callaghan, *Petroleum resource rent tax review: final report* (Callaghan review), Australian Government, April 2017. Available at https://treasury.gov.au/review/review-of-the-petroleum-resource-rent-tax/final-report.

November 2016 and included examination of the design and operation of the PRRT. The review points to the minimal risk of losing PRRT deductions in the production phase of PRRT projects.[11]

That practical observation provides the impetus for the central research question explored in this article. The observation first opens up the possibility of clear specification of the required uplift rate for RRT losses in the production phase of RRT projects (because the uplift rate depends on the risk of losing RRT deductions, not general project risk). The observation then raises the intriguing prospect of formulating RRT design that replaces traditional with ideal assimilation of RRT and income taxation (even though the Callaghan review did not consider the PRRT's interface with income taxation). Thus, the main research question examined in this article is:

> Could the ideal assimilation of income tax and CFT with delayed full loss offset (involving no risk of losing RRT deductions) be mirrored in RRT design in the production phase of RRT projects (involving minimal risk of losing RRT deductions) — resulting in more soundly based tax design with less impact on investment decision-making?

Analysis of this central research question logically leads to consideration of the following two associated RRT issues:

- the tax disadvantage associated with the traditional way of assimilating income tax and RRT versus ideal assimilation in the production phase of RRT projects; and
- the need to blend, for RRT and income tax purposes, an investor's exploration expenditure (with accompanying high risk of losing RRT deductions) and the production phases of the investor's RRT projects — taking into account the possibility of design that allows the transfer of RRT losses from exploration expenditure to profitable projects.

As a springboard to the central RRT research question and associated RRT issues, the article first spells out the proper assimilation of ideal (investment-neutral) income tax and CFT designs, along with the tax disadvantage associated with the traditional method of their assimilation.

Section 2 briefly recounts well-known pure CFT and income tax designs in order to confirm the less well-known proper assimilation of these two designs. Section 3 draws from the analysis in section 2 to explain the proper assimilation of CFT with delayed full loss offset and subsequent income tax and the accompanying requirement, perhaps not widely appreciated, to separate out for income tax consideration the

11 Ibid, 72.

risk-free asset created by delayed, government-guaranteed loss offset. Section 3 provides analytical rigour to both sound assimilation design and identification of the source of tax disadvantage with traditional assimilation.

From the analysis in section 3 involving CFT with delayed full loss offset, it is a relatively small analytical leap to the new insights in section 4 regarding assimilation of income tax and RRT in the production phase of RRT projects. The contention in section 4 is that, in practice, assimilation under RRT design can match that under CFT with delayed loss offset in the circumstances, observed by the Callaghan review, where there is minimal risk of losing RRT deductions.

Along with production phase issues, RRT design requires consideration of investors' exploration expenditure with its high risk of lost RRT deductions. Section 4 considers the practical blending of projects' exploration and production phases.

Section 4 draws directly from the PRRT experience regarding exploration expenditure covered in the Callaghan review. The Callaghan review explains clearly problems under current PRRT design associated with transferring PRRT losses from exploration expenditure to profitable projects, as well as blending uplifted and carried forward own-project exploration expenditures with production phase expenditures. The Australian Government, in its final response to the Callaghan review, foreshadows a series of changes to the PRRT legislation designed to address these problems.[12]

The practical RRT design devised in section 4 across projects' exploration and production phases has potential implications for Australia's PRRT. That practical design derives from: first, a clear separation being made between the very different exploration and development/production phases of RRT projects; and, second, the bridge that is provided between practical RRT design and the crucial theoretical analysis in section 3 by the Callaghan review's observation regarding the low risk of losing PRRT deductions in the production phase of PRRT projects.

In order to focus on RRT design within sound assimilation of RRT and income taxation, analysis in the article largely holds income tax design in pure form (including economic depreciation which tracks annual increase or decrease in asset value). With sound RRT design and proper assimilation of RRT and income tax established, the focus for policy can then be on improving the neutrality of income tax design.

Throughout this article, the research methodology is to judge the quality of design of rent and income taxes — both separately and when combined — on how neutral is the impact of the taxes on investment decision-making. Consistent with tax literature, the degree of neutrality of the taxes is determined primarily by their effect on the net present value (NPV) of cash flows of prospective investment projects.

12 Australian Government, "Government response to the petroleum resource rent tax review", 2 November 2018. Available at https://treasury.gov.au/publication/p2015-t339508.

There is therefore particular focus on NPV calculations in the worked examples in Attachment A to illustrate conceptual observations and conclusions made in the article regarding integration of rent and income taxes. A hypothetical, schematic petroleum project, shown in Table A1 and Figure A1 in Attachment A, is used as the basis for the worked examples in the attachment.

2. Assimilating income tax and cash flow tax with immediate full loss offset

2.1 Neutral rent tax design

A pure CFT taxes the economic rent of mineral (general mining and petroleum) resource projects perceived by prospective investors. Cash flow is gross project receipts less cash outlays (immediate expensing of both recurrent and capital costs).[13]

Annual positive cash flow is taxed under the CFT at a specified tax rate. Annual negative cash flow (loss) attracts an immediate government cash rebate (immediate full loss offset) equal to the loss times the tax rate.

Because each annual positive or negative cash flow is cut by the tax rate, neutrality of the CFT stems from:

- unchanged internal rate of return (IRR) of possible project outcomes (say, based on expected or forecast cash flow); and
- as shown in equation (1), pre-CFT net present value (NPV) of possible outcomes cut by the tax rate.

For a possible outcome of a particular project, with each annual positive or negative cash flow cut by the CFT rate and with investor discount rate unchanged by the CFT, the relationship between the NPV of the project's outcome after tax (NPV_a) and before tax (NPV_b) is given by:[14]

$$\mathrm{NPV}_a = P\,(1 - t) - N\,(1 - t) = (P - N)\,(1 - t) = \mathrm{NPV}_b\,(1 - t) \qquad (1)$$

where:

> P = sum of each annual positive cash flow of the project discounted to start of project;

13 The fungibility of debt in particular means there are advantages in excluding from the CFT base flows relating to debt finance, as is done with the PRRT.

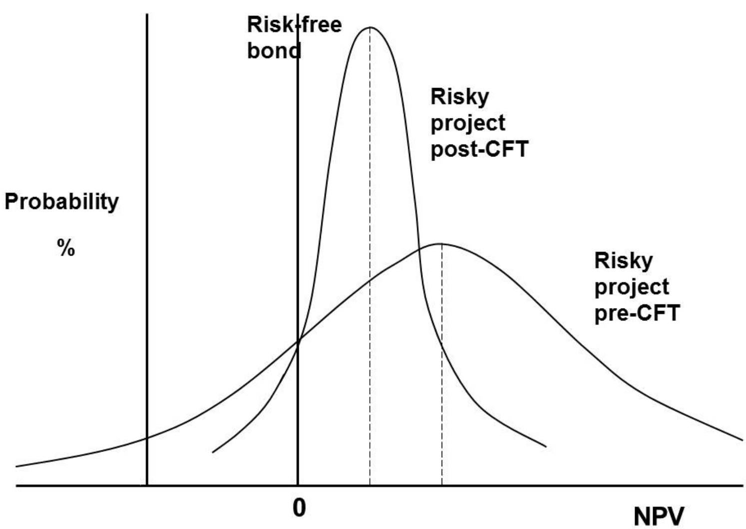
14 Equation (1) draws on similar notation in W Mayo, "Rent royalties", (1979) 55 *Economic Record*, 203 to produce the same result as P Swan, "Income taxes, profit taxes and neutrality of optimizing decisions", (1976) 52 *Economic Record*, 172.

N = sum of absolute value of each annual negative cash flow discounted to start of project; and

t = tax rate of CFT.

Figure 1 illustrates how the CFT effect on NPV shown in equation (1) applies across all possible project outcomes (with discounting at a risk-free rate to avoid double counting of risk). Neutral CFT impact — assuming linear trade-off between risk and return — arises from the CFT's symmetric and proportional cutting of the NPVs across the project's pre-CFT NPV probability distribution (at both profitable and loss-making ends of the spectrum of outcomes). Each possible pre-CFT outcome (including those with negative NPV) is cut in proportion to the CFT rate (assumed 50% in Figure 1).

Figure 1: Project's NPV probability distribution pre- and post-CFT[15]



When project viability is being assessed in practice, NPV is commonly determined just for a single central case (or a limited number of main cases) using a risk-weighted discount rate — as is done with the schematic project in Attachment A. Again, a pure CFT then reduces the NPV of expected/forecast cash flows of an investor's project

15 Sourced from Mayo (2013), above n 3, 27, refined from Mayo (1979), above n 14, 204. Mayo (2013), above n 3, 26 illustrates a project's NPV skewed probability distribution where the highest probability involves failure.

in proportion to the tax rate regardless of the discount, or hurdle, rate used by the investor to compute NPV.

Consequently, CFT only taxes a proportion of the economic rent of the project (positive NPV) perceived by the investor. A potentially viable proposition before tax should remain so after CFT — though the ranking for access to investment funds would be lowered relative to other prospective investments not subject to the CFT.[16]

Rent taxation in the form of pure CFT applying to a mineral resource project can be easily assimilated with subsequent income taxation without diluting the neutrality properties of the CFT. That is achieved by having project cash flows net of effect of CFT (that is, cash flows cut by the CFT rate) form the basis of income taxation. With CFT maintaining investment neutrality before income tax, overall tax neutrality would be achieved if post-CFT project cash flows fed into income tax design which itself had neutral impact on investment decisions.

In contrast to the effects of CFT, tax-neutral income tax design sees IRR cut in proportion to the income tax rate and NPV remain unaffected by the tax. Thus, CFT achieves neutrality by cutting NPV of project flows by the CFT rate; pure income taxation maintains overall neutrality by not changing the NPV of post-CFT flows.

It is therefore important to appreciate how such pure income tax design can have benign effect on investment decisions.

2.2 Neutral income tax design

Taxing the income from investing (from a tax perspective, the flip side of saving) imposes a distortion on consumption/saving decisions. Nevertheless, sound income tax structure means that investment decisions need not be distorted. Swan, for example, explains the "apparent paradox that a tax which distorts consumption-savings decisions does not also distort investment decisions".[17]

The tax base (taxable income) of neutral income taxation comprises net receipts (gross receipts less annual/recurrent expenses) plus annual change in value of assets:[18]

16 A CFT imposed unexpectedly on existing projects would impose a capital levy (reflected in the up-front loss in value of the project in Figure A1, Attachment A). The effect of the levy could be offset by allowing the pre-tax market value of such projects as a CFT deduction — with consequent expectation of nil net CFT revenue from those projects. See Swan, above n 14, 176 and Mayo (2013), above n 3, 37-42.

17 Swan, above n 14, 172.

18 Nominal income taxation is assumed here with nominal interest assessable/deductible. If only real interest is assessable/deductible, the investment-neutral income tax base then incorporates annual change in real value of investment assets/liabilities.

commercial profit or economic income.[19] Importantly, the ability of a taxpayer to write off economic losses from one activity against economic profits of the taxpayer's other activities enables the value of the losses to be captured.[20]

Absent economic profit to absorb a taxpayer's losses, government cash rebates for losses (or trading in losses) are required to achieve symmetric treatment across the risk spectrum[21] (taxing the upside and giving back to the downside), consistent with CFT design.

To help illustrate the impact of such income tax design on IRR and NPV, Figure 2 shows $100 of income produced at year end (Year i+1), representing a 10% return, from $1000 capital invested in an asset at start of the year (Year i).

That $100 income could come just from an increase in asset value (like a $1,000 bank account or block of land increasing in value to $1,100), shown as "$V_{i+1}$ (+)" in the figure. It could also come with an associated reduction in asset value — shown in the figure as "V_{i+1} (-)" — of, say, $150 resulting from $250 of net receipts received by the investor from the sale of product made from the asset (net receipts not available to a buyer of the asset at year end). The $250 of net receipts provides the $100 of income after covering the $150 loss in asset value.

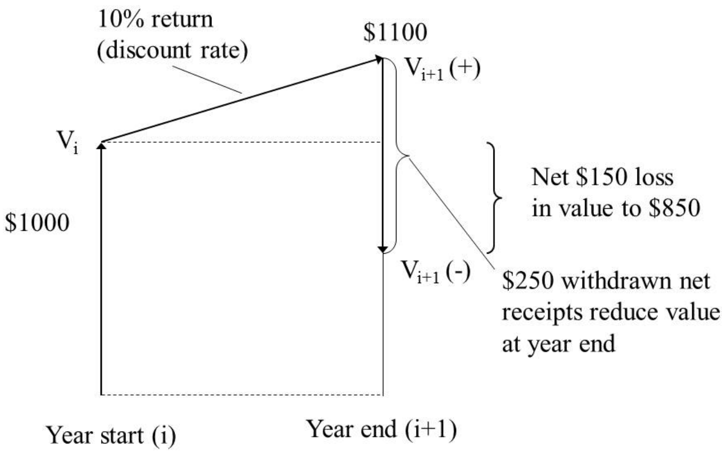
Alternatively, the $100 of income could come from a combination of these effects depending on the types of assets involved. The same considerations follow in each subsequent year.

19 Under current Australian income tax law, declining balance depreciation may align well with the annual reduction in value of a range of depreciating assets (see W Mayo, "(Tax) depreciation and inflation: some practical observations", (1984) 3(4) *Economic Papers*, 33-37). In contrast, taxation of annual accrued capital gains only applies to a limited range of appreciating assets (like deep discounted zero coupon bonds and trading stock or financial arrangements chosen to be valued on a market value basis).

20 "Negative gearing" of rental properties is therefore not a "tax break" as many claim. Anti-negative gearing measures cannot counteract the tax distortion arising from annual taxable income from rental properties not including annual accrued gains (which, if included, might turn a tax loss into a tax profit).

21 Absent general taxation of accrued capital gains in Australia, it is not surprising that such provisions to achieve full loss offset do not apply generally.

Figure 2: Annual income from, and associated change in value of, an asset



Equations (2) and (3) generalise change in asset value and $100 of economic income, income $_{i+1}$, depicted in Figure 2 when net receipts are involved:[22]

$$V_{i+1} = V_i \times (1 + \text{discount}) - \text{net receipts}_{i+1} \tag{2}$$

where:

V_i = value of project in Year i before income tax;

net receipts_i = net receipts in Year i; and

discount = investor's discount (hurdle) rate before tax.

Rearranging equation (2):

$$V_i \times \text{discount} = V_{i+1} - V_i + \text{net receipts}_{i+1} = \text{income}_{i+1} \tag{3}$$

22 Mayo (2013), above n 3, 239-243 reformulates equations (2) to (6) to accommodate ongoing capital expenditure of a mineral resource project by replacing "net receipts" with annual cash flow (gross receipts less both capital and recurrent expenses). Taxable income under such a formulation is consistent with that typically used in income tax law for trading stock: sales (gross receipts) – purchases of stock (regardless of when sold) + end value of stock – opening value of stock. For the investment in Figure 1, the $100 of income then comprises $250 net receipts – $1,000 capital expense + $850 end value – zero opening value.

Regardless of the make-up of the $100 of income, taxing it at, say, 30% results in $70 of after-tax income, producing a 7% post-tax return, the pre-tax 10% cut by the 30% tax rate.

With taxable income measured in the same way across the board, all the investor's marginal investment alternatives offering 10% per annum before tax offer 7% per annum after tax, keeping investment choices little affected (application across all investment income is a requirement of neutral income taxation, in contrast to rent taxation). That includes a reduction in 10% pre-tax to 7% post-tax per annum from investing in (or borrowing from) debt markets.

Thus, if the 30% tax rate investor is using a risk-adjusted 10% discount or hurdle rate before tax to assess pre-income tax flows and measure asset value, the investor's post-tax discount rate will be 7%. The investor's opportunity cost of borrowing to invest reduces from 10% pre-tax to 7% post-tax.

This tax effect on discount rates is a crucial ingredient to understanding the investment neutrality of income taxation. This effect means that NPVs of possible outcomes of mineral resource projects need not be affected by such a tax — as shown, for example, by Samuelson.[23]

That result can be derived simply (ignoring second round effects) by first rearranging equation (2) to obtain the expression for V_i:

$$V_i = (V_{i+1} + \text{net receipts}_{i+1}) / (1 + \text{discount}) \tag{4}$$

Then, both add V_i to, and subtract V_i from, the numerator of the RHS of equation (4) and substitute ($V_i \times$ discount) for (V_{i+1} - V_i + net receipts$_{i+1}$) from equation (3) to obtain:

$$V_i = (V_i + V_i \times \text{discount}) / (1 + \text{discount}) \tag{5}$$

Now, impose income tax which reduces both income ($V_i \times$ discount) and discount rate in equation (5) in proportion to the income tax rate, t, to derive post-income tax asset value in Year i, V_i^t:

$$\begin{aligned} V_i^t &= [V_i + (V_i \times \text{discount})(1 - t)] / [1 + \text{discount}(1 - t)] \\ &= [V_i (1 + \text{discount}(1 - t)] / [1 + \text{discount}(1 - t)] = V_i \end{aligned} \tag{6}$$

Equation (6) shows value after tax on economic income is the same as value before tax. As explained by Swan, "Ultimately, the neutrality of the tax can be seen to arise

23 P Samuelson, "Tax deductibility of economic depreciation to insure invariant valuations", (1964) 72 *Journal of Political Economy*, 604-606.

from the fact that while returns are taxed the opportunity cost of funds is reduced in the same proportion".[24]

To put numbers on the results in equations (5) and (6), if a 30% tax rate investor uses a 10% hurdle rate, the investor will compute a zero NPV before tax and before investment for the project in Figure 2 where $1,000 is invested to achieve $1,100 over a year because the $1,000 up-front investment outlay plus $(1,000 + 100) / (1 + 0.1) from equation (5) equals zero. After tax, the investor will again compute zero NPV because $1,000 up-front outlay plus $[1,000 + 100 (1 - 0.3)] / [1 + 0.1 (1 - 0.3)] from equation (6) again equals zero. For this investor, the project marginal before tax remains so after tax.

2.3 Neutral assimilation of pure CFT and income tax

The equations in the last two sections explain how overall neutrality is achieved when a mineral resource project is subjected to pure CFT plus subsequent pure income taxation.

Overall tax neutrality is maintained if project cash flows net of neutral effect of CFT — that is, cash flows cut by the CFT rate as per equation (1) — are followed by neutral income tax applied to post-CFT flows as per equation (3). That is consistent with how, under goods and services tax (GST) design, costs and receipts net of GST refunds and tax payments feed into income taxation.

Table A2 in Attachment A illustrates this ideal way of combining pure CFT and income taxation. The table imposes pure CFT on the expected/forecast cash flows of the project in Table A1 followed by income tax applied to post-CFT flows on the basis of annual net receipts plus annual change in value.

Thus, in Table A2, the project's 10% per annum return pre- and post-CFT becomes 7% per annum after 30% income taxation — just as returns before income tax of the other marginal investments of the investor in this project (including risky or risk-free debt) would be cut in proportion to the 30% income tax rate.

In addition, for this investor, the project's zero NPV before all taxes remains at zero after CFT (with discounting at the investor's risk-weighted 10%) — zero cut by the CFT rate remains at zero — and also remains at zero after subsequent income tax (with discounting at 7%).[25]

24 Swan, above n 14, 172.

25 Mayo (2013), above n 3, 248 shows equivalent results to those in Table A2 for a more realistic, but similarly marginal, project (whose pre- and post-tax returns match the investor's pre- and post-tax risk-weighted discount rates).

Moreover, consistent with equation (6), post-all taxes value in column (h) in Table A2 matches post-CFT value (pre-all taxes value cut by the CFT rate) in column (d) in Table A1 year-by-year.

More generally, the project's complete pre-tax NPV probability distribution would be squeezed by the pure CFT symmetrically and in proportion to the CFT rate — as illustrated in Figure 1 — around the vertical zero NPV line in the figure representing a risk-free asset. Subsequent pure income taxation (with income tax losses offset against income tax profits from elsewhere[26]) need not change the squeezed post-CFT distribution.[27]

2.4 Alternative assimilation design

Were, instead, income tax simply applied to pre-tax project cash flows with cash rebates assessable and CFT payments deductible for income tax purposes, investors would be significantly disadvantaged.

Figure A1 in Attachment A helps explain such disadvantage in the context of pure CFT depicted in Table A2.[28] The figure shows that, over the life of the schematic project subject to pure CFT, under both ideal and disadvantaged income tax treatment, a net deduction of $600m is allowed for up-front capital expenditure:

- $600m being the opening value under the ideal treatment (based on post-CFT flows); and
- $1,000m opening (pre-CFT) value under the disadvantaged treatment (based on pre-tax flows) less the up-front assessment of $400m of cash rebates arising from the $1,000m of expenditure.

The difference in overall tax outcome arises, however, from the very different profile of the allowance of that net $600m deduction over the life of the project.

The disadvantaged treatment loads extra income tax up front in a vain attempt at offsetting the year-by-year effects of incorrect, higher annual values (pre-CFT

26 To reiterate, as with CFT, neutral income taxation requires the taxing of upside outcomes to be balanced by giving back to downside outcomes.

27 Mayo (2013), above n 3, 237 shows how a project's positive NPV can remain unchanged by income taxation if the difference between up-front value of the project's future cash flows and up-front net capital outlays (the difference matching the project's positive NPV) is not taxed. If that difference were taxed, the project's NPV after CFT would be reduced by income tax in proportion to the investor's income tax rate.

28 Mayo (2013), above n 3, 193-196 provides a detailed explanation of how this disadvantage arises with pure CFT; and Mayo (2013), above n 3, p 174 computes the disadvantage for the project in Attachment A in terms of an NPV of –$31.4m for post-all taxes cash flow with discounting at 7% pa compared to the zero NPV in Table A2.

schedule in column (b) of Table A1) being used for income tax purposes instead of post-CFT values (post-CFT schedule in column (d) of Table A1).

None of the resulting disadvantage comes from the inclusion of positive pre-tax annual net receipts in income tax assessment and allowing deductions for associated CFT payments. That is because that treatment is equivalent to including directly in assessable income annual net receipts less payment of CFT (net receipts cut by the CFT rate).[29]

3. Assimilating income tax and cash flow tax with delayed full loss offset

Alternative project-based CFT design has resource project losses (negative cash flows) carried forward, delaying any government cash rebates ultimately required for unutilised losses.

Such design may be financially equivalent to a pure CFT. Equivalence would be achieved if:

- first, it is certain that government will provide a rebate for losses of a project carried forward from prior years that are not absorbed by the subsequent positive cash flow of the project;[30] and
- second, losses carried forward from one year to the next are increased by a rate of interest (or uplift rate) equal to the long-term government bond rate (LTBR). Such design provides delayed full loss offset instead of immediate full loss offset.

This design of cash flow taxation incorporating delayed full loss offset was the basis of the bold design of resource rent taxation recommended by the Henry review and the little-understood and ill-fated RSPT subsequently proposed by the Australian Government.[31] Notable was a general misunderstanding of the justification for a LTBR loss uplift rate.

Uplifting losses at LTBR compensates the project for the time value of money over the period that the project has to wait for a rebate. It is as if the project provides the government with a loan (an asset to the project) equal to the rebate not paid up front

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29 With a 40% CFT and 30% income tax rate, $NR \times 0.3 - NR \times 0.4 \times 0.3 = [NR \times (1 - 0.4)] \times 0.3$, where NR are annual net receipts.

30 In practice, there might be the question whether government could default on rebates before defaulting on its own bonds — but practical tax design cannot be expected to accommodate all such nuances .

31 Australian Government (2010), above n 5. A feature of the RSPT in addition to loss uplift at LTBR was depreciation of capital expenditure with annual LTBR uplift applied to written-down value.

on an annual loss with the loan acquitted by subsequent reduced tax payments or, if necessary, delayed government rebate.

Thus, the cash flows of a project after application of CFT with delayed full loss offset are best viewed as representing, on the one hand, a risky asset comprising project cash flows as if a pure CFT applied and, on the other, a risk-free asset comprising loans to government of amounts of cash rebates not paid immediately in years of negative cash flow.

3.1 Ideal assimilation with income tax

The splitting of a prospective project's cash flows, after CFT with delayed full loss offset, into a risky post-pure CFT asset and a risk-free asset underlines a key feature of the assimilation with income tax required to maintain the tax neutrality properties of this form of rent taxation: ideal income tax treatment requires these two assets to be taxed separately — with change in annual asset value, and consequently annual taxable income, reflecting the very different risks associated with the two assets.

Consistent with income tax assimilation under pure CFT, the post-pure CFT flows of the risky project asset (pre-tax flows cut by the tax rate) are subject to income taxation. Thus, ideally, income tax consistent with equation (3) is applied to post-pure CFT flows of the risky project asset — in practice, often expected/forecast cash flows of the prospective investment — as if immediate cash rebates apply.

The risk-free asset then requires its own separate income tax assessment: ideally, on income measured consistent with equation (3) on the basis of net receipts (repayments on implicit loan to government) plus change in value each year.

In more general terms, again the complete pre-tax NPV probability distribution of the risky project asset would be squeezed by the CFT effect symmetrically and in proportion to the CFT rate — as illustrated in Figure 1 — around the vertical zero NPV line in the figure. That vertical NPV line can now be viewed as the project's very own risk-free asset. Subsequent pure income taxation need not change the squeezed post-CFT distribution of the risky asset or the zero NPV of the risk-free asset.

To illustrate such ideal assimilation, Table A3 in Attachment A provides for the separate income tax treatment of the risky and risk-free assets of our schematic petroleum project — with change in annual asset value determined by a 10% risk-weighted discount (hurdle) rate for the risky project asset and a 5% (LTBR) discount rate for the risk-free asset.[32]

32 The table substitutes "RRT" for "CFT" because of the equivalence between the two taxes in the circumstances shown.

Aggregate project flows after CFT with delayed loss offset, in column (e), are separated into:

- post-pure CFT cash flows of the risky project asset — column (f); and
- flows of the risk-free asset — column (g).

Annual income tax payable on the risky project asset, totalling $80.1m in aggregate, is shown in column (f) of Table A2.

Annual income tax payable on the risk-free asset, totalling $23.4m, is shown in column (j) of Table A3.

Consequently, in addition to the $100m of CFT payments shown in Year 5, column (d) of Table A3, the project pays $103.5m income tax.

Table A3 illustrates clearly why separation of the risky and risk-free asset is necessary for sound investment decision-making.

Before income tax, for example, the project should be viewed by our investor as marginal because NPV is zero for both the post-pure CFT risky project asset (column (f) of Table A3) and the risk-free asset (column (g) of Table A3) with discounting at 10% (risk-weighted) and 5% (LTBR), respectively.

But Table A3 shows that, if the investor simply aggregated project flows after CFT with delayed loss offset — as shown in in column (e) — and discounted these flows at 10%, NPV of –$62m would be obtained, suggesting spuriously that the project is unviable even before income tax. Column (g) of Table A3 shows that this –$62m result arises solely because the flows of the excised risk-free asset shown in this column are being discounted at 10% rather that 5%.

The practical difficulties of imposing income tax on a project's risk-free asset in line with equation (3) are made clear in Table A3. The mechanics of that imposition are described in the table's notes (h) to (j).[33]

Tax assessments of a project's risk-free loans would be made year by year. That would require annual measurement of implicit loans to government for immediate cash rebates for losses not provided (negative cash flow times CFT rate) plus implicit repayments of those loans. Those implicit repayments would comprise the project's:

- annual post-CFT cash flow; less
- annual pre-taxes cash flow reduced by the CFT rate.

33 The income tax treatment of trading stock (above n 22) could be applied to deal with a sequence of years of negative flow rather than the single year of negative cash flow in Table A3.

The complications of separately subjecting a project's risk-free assets to income taxation could be avoided completely by uplifting losses not at LTBR but at post-tax LTBR to provide the same post-tax outcome.

In the hypothetical example in Attachment A, uplift at 5% pre-tax LTBR would then be replaced by uplift at 3.5% post-income tax LTBR (5% LTBR reduced by the investor's 30% income tax rate). The risky project asset would still be subject to income tax as per Table A2. And the excised risk-free asset, now not subject to income tax, would have a post-all taxes return of 3.5% per annum[34] — matching that of the risk-free asset in Table A3 subject to income tax with a 5% per annum pre-tax return (driven by the pre-tax LTBR uplift).

Fane[35] and Mayo[36] make this same point regarding uplift at post-tax LTBR. Nevertheless, the challenging task would remain of explaining to investors that the LTBR uplift rate (no doubt itself contentious) is being reduced because their risk-free assets, assets that they did not ask for, are not being subjected to income taxation.

3.2 Alternative assimilation design

As noted, the RSPT is a form of CFT with delayed full loss offset. Nevertheless, RSPT design did not apply income tax to post-pure CFT flows of the risky project asset coupled with separate consideration of tax treatment of risk-free flows.[37]

The RSPT design simply applied income taxation to pre-tax project cash flows with delayed cash rebates assessable and RSPT payments deductible for income tax purposes. As in the case of pure CFT, there is the question of how much investors would be disadvantaged by such alternative treatment.

In contrast to pure CFT, up-front cash rebates are not involved with CFT incorporating delayed full loss offset (as illustrated for the hypothetical project in Table A3). Nevertheless, similarly to the situation with pure CFT, income tax disadvantage for investors arises from the differing profiles of income tax deductions under the ideal versus alternative treatment.

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34 Investors would still separate out the risk-free asset from risky project flows for purposes of investment analysis. Similarly, if the CFT with delayed loss offset applied after, rather than before, income tax separation of the risk-free asset (likely not subject to income tax and driven by post-tax LTBR uplift) would be required for sound investment assessment.

35 G Fane, "The taxation of rents from mineral resources", seminar given at Crawford School of Economics & Government, Australian National University, August 2010, Canberra.

36 Mayo (2013), above n 3, 203.

37 This may have been a result of the lack of discussion of neutral income tax design in the Henry review.

The same aggregate amount of income tax should be payable under both the ideal and alternative (traditional) treatment. Whether or not post-CFT flows are split into risky and risk-free assets (ideal) or left aggregated (alternative), all assets have zero value at the end of a project's life. Consequently, total asset depreciation over a project's life remains the same under either treatment, as does the total of annual recurrent net receipts.

Thus, the hypothetical project in Attachment A would pay, under the alternative treatment, the same $103.5 of total income tax as it does in Tables A2 and A3 under ideal treatment (section 3.1).

The profile of income tax payments will differ, however, between ideal and alternative treatment. With economic depreciation applying, the alternative treatment (which has the cash flows of the risk-free asset embedded in aggregate post-CFT flows) will unambiguously result in front-loaded income tax payments relative to the ideal treatment. Economic depreciation (annual change in asset value) is a feature of neutral income taxation in section 2.2 (and is applied in Tables A2 and A3).

This front-loading of income tax payments arises for the same reason that spurious NPV measures of prospective projects arose in section 3.1: discounting aggregate post-CFT flows by a risk-adjusted hurdle rate.

Thus, applying income tax to aggregate post-CFT flows removes the possibility of a tax-neutral outcome, despite economic depreciation being applied for income tax purposes. That is because the risk-free asset, with LTBR annual return (driven by soundly based pre-tax LTBR uplift rate), is embedded within aggregate post-CFT flows. As a result, the risk-free asset is taxed as if it were providing annual income consistent with the risk-adjusted annual return of the risky project asset.

Equation (3) and Figure 2 enable the impact of this non-neutral design to be generalised when income tax incorporates economic depreciation.

The equation and figure make clear that if, say, a risk-adjusted hurdle rate rather than a risk-free discount is being applied to compute taxable income for the risk-free asset, taxable income will always be higher in the early years after capital outlays.

The year-by-year "net receipts" of the risk-free asset remain fixed in equation (3) and Figure 2. Consequently, the use of an excessive discount rate either increases early gains in value of the risk-free asset ("V_{i+1} (+)" in Figure 2) or cuts early reductions in value of the risk-free asset ("V_{i+1} (-)" in Figure 2) included in taxable income.

To illustrate, take the alternative treatment applied to the schematic mining project with economic depreciation operating (as it does with the ideal treatment in Tables A2 and A3). The alternative treatment simply applies income tax to aggregate post-CFT flows, or pre-tax cash flows with CFT payments deductible (column (e) of Table A3).

The resulting annual tax payments (totalling $103.5m as expected) are shown in column (b) of Table A4 (Attachment A). Compared with year-by-year income tax payable under the ideal treatment (column (c) of Table A4), the alternative treatment suffers from a $3.6m relative disadvantage in discounted terms (shown in column (d) of Table A4).

In practice, capital expenditure on mineral resource projects is likely to attract write-off over fixed periods or over the life of the project rather than economic depreciation. In recognition of that, computations equivalent to those for economic depreciation in Table A4 are shown in columns (e) to (j) of Table A4 with economic depreciation replaced by 20% straight line depreciation starting when the schematic project commences production in Year 3. With this change to income tax depreciation arrangements:

- income tax payments under ideal assimilation design are shown in columns (g) to (i) of Table A4 where the risk-free asset is unchanged and still separated and taxed as in Table A3; and
- the discounted relative disadvantage of income tax payments under the alternative treatment in columns (e) and (f) of Table A4 is then shown to be reduced marginally to $2.9m (column (j) of Table A4).

Arrangements that move the stream of fixed depreciation deductions further up front would see this measure of relative disadvantage being reduced further.

The disadvantage could even be reversed should the up-front write-off applying to the embedded risk-free asset under the alternative treatment offset the advantage of applying economic depreciation separately to that asset under the ideal treatment. How such a trade-off would play out in practice would vary depending on the profile of deductions and the characteristics of the associated project.

But, the more the depreciation deductions were loaded up front and out of kilter with economic depreciation, the greater the distortive effect on investment decision-making under either income tax treatment.

Overall, the preferred tax strategy under CFT with delayed full loss offset is clearly, first, to assimilate CFT and income tax as per the ideal treatment and, second, to improve the neutrality of income tax treatment of mineral resource operations.

4. Assimilating income and resource rent taxes

An RRT has similarities with a CFT which allows immediate expensing of all costs and has losses carried forward with LTBR uplift because of delayed, but government-guaranteed, full loss offset (discussed in section 3 and illustrated in Table A3 in Attachment A).

A traditional RRT[38] also allows immediate expensing of all costs and applies an uplift ("threshold") rate to losses carried forward. But, unlike a CFT with delayed full loss offset, an RRT does not provide government-guaranteed cash rebates for unutilised carried-forward losses.

Thus, while Australia's PRRT does provide rebates for losses arising from eligible closing-down expenses (limited by the amount of prior PRRT paid), other unutilised losses are lost.[39] Implicit government-guaranteed loans under CFT with delayed full loss offset become risky loans under RRT design.

Nevertheless, debate in 2010 over RSPT design[40] suggests that the possibility of lost RRT deductions does not detract from the acceptability of RRT-style design by the community at large. The RSPT came in for much criticism over its provision of rebates for cash flow losses realised by risk-preferring investors. While to some, full loss offset offers the prospect of tax neutrality, to others it represents wasted community expenditure.

There is now clear consensus that RRT uplift rate should match LTBR when there is no risk of losing RRT deductions.[41] This consensus translates into the more general observation that RRT uplift rates should be set on the basis of the risk of losing RRT deductions, not on the basis of project risk.

The Callaghan review summarises well the difference between project risk and risk of losing RRT deductions.[42]

Project risk stems from a wide range of influences that affect commercial outcomes. The risk of losing RRT deductions, while affected by these same influences, is very different. Highly profitable projects with significant project risk might have virtually no risk of losing RRT deductions, particularly if cash rebates for closing-down expenditure are allowed:[43]

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38 Like that of Garnaut and Clunies Ross, above n 6.

39 The unutilised losses are likely to leave unaffected pre-tax NPVs of unprofitable outcomes in projects' NPV probability distributions, like those shown in Figure 1, consequently skewing their post-PRRT distributions negatively — see Mayo (1979), above n 14, 207; and Mayo (1984), above n 19, 44.

40 Australian Government, above n 5.

41 See Australian Government, *Discussion paper on resource rent tax in the petroleum sector*, December 1983, p 4; Mayo (1984), above n 19, p 44; G Fane, "Neutral taxation under uncertainty", (1987) 33(1) *Journal of Public Economics,* 103; Henry review, above n 4, p 223; and Callaghan review, above n 10, p 65.

42 Callaghan review, above n 10, 71-72.

43 Ibid, 72.

> "Successful exploration programs may point to the prospect of highly profitable projects with a wide spread of possible outcomes (high project risk), none of which have any significant prospect of losing carried forward losses (low risk of losing deductions)".

Moreover, the risk of losing RRT deductions is only relevant at the loss-making end of the spread of a project's possible outcomes:[44]

> "But this risk is only reflected in the spread of possible outcomes where uplifted expenditures exceed revenue. Irrelevant to that spread are outcomes where revenues exceed expenditures – though these outcomes are a vital part of a project's overall risk spectrum".

Resource rent tax uplift rate higher that LTBR can be viewed as a rough offset, via increased returns to possible profitable outcomes, for possible unprofitable outcomes where carried-forward and uplifted losses are never utilised.[45] Given the wide range of varying circumstances of different projects, however, the setting of generally applicable loadings on LTBR for RRT loss uplift is, as noted by the Callaghan review, "necessarily arbitrary".[46]

There is, nevertheless, the enticing prospect of avoiding arbitrarily-set RRT uplift rates with loadings above LTBR — at least in the development/production phase of petroleum resource projects — as well as achieving better assimilation of RRT and income taxation in projects' production phase.

That prospect arises from the observation that, as the risk of losing RRT deductions diminishes, an RRT approaches a CFT incorporating delayed full loss offset which requires uplift at LTBR — and the ideal way of assimilating RRT with subsequent income taxation approaches that is described in section 3.1 (and illustrated in Tables A2 and A3 in Attachment A).

A full appreciation of that prospect first requires a clear understanding of the marked difference in project risk and the risk of losing RRT deductions between exploration and production phases of a mineral resource project (section 4.1). That understanding is of central importance to the setting of the RRT uplift rate and design of RRT's assimilation with income taxation in a project's development/production phase (sections 4.2 and 4.3).

44 Ibid, 72.

45 Again, however, no level of uplift will change such negative pre-tax NPV outcomes in projects' NPV probability distributions, like such outcomes depicted in Figure 1 — see Mayo (2013), above n 3, 77-83; and Callaghan review, above n 10, 66. For a typical central-case positive NPV of a planned project using a risk-weighted discount (hurdle) rate, higher uplift would simply increase post-RRT NPV.

46 Ibid, 67.

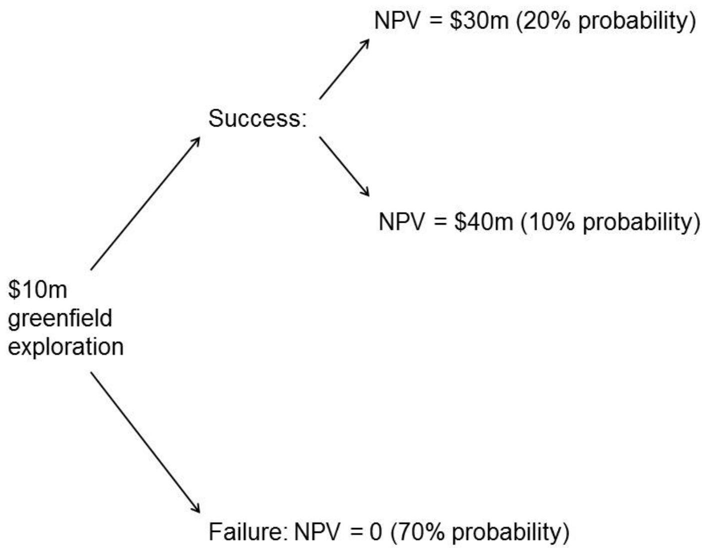
To round out overall RRT design, sound design is required for RRT and income tax in the blending of the development/production phase of an investor's RRT projects and the investor's RRT exploration expenditure with its high risk of unutilised RRT deductions (section 4.4).

4.1 Project risk and risk of losing RRT deductions in exploration and production phases

Typically, the chances of success of greenfield exploration activity are very low. Moreover, if this exploration is unsuccessful, there will be no ensuing production phase and the overall project is worthless.

It is important, however, that the high project risk at the exploration phase not be reflected in the discount rate used to determine the NPV of possible production phase outcomes in the event of successful exploration. Figure 3 illustrates this.

Figure 3: Possible outcomes of mineral resource exploration[47]



47 Sourced from Mayo (2013), above n 3, 22. A similar example, in the context of pilot production and test marketing, is in R Brealey and S Myers, *Principles of corporate finance*, 3rd Edition, McGraw-Hill, 1988, 196.

Figure 3 illustrates the specification of the overall NPV computation that might be used to decide whether to proceed with \$10m of greenfield exploration expenditure in search of a commercial mineral resource body. The figure shows how high exploration risk is accommodated in NPV computation by quantifying the high chance that the exploration will not be successful.

Figure 3 puts probabilities on each of the limited range of possible NPV outcomes associated with the \$10m of exploration activity:

- 70% chance that the exploration expenditure will be unsuccessful with no resulting pay-off;
- 20% chance that the greenfield exploration activity will be successful with NPV of associated post-exploration project (future development expenditure and ensuing stream of net receipts) coming in at \$30m with discounting at the investor's post-exploration discount rate; and
- a 10% chance that the exploration activity will be successful with NPV of associated post-exploration project coming in at \$40m.

Absent taxation, on the basis of the numbers in Figure 3, the NPV of the overall project (exploration plus post-exploration phases) is as follows.

Before tax NPV (\$m)

$$= -10 + (70\% \times 0) + (20\% \times 30) + (10\% \times 40) = -10 + 0 + 6 + 4 = \text{zero} \qquad (7)$$

For the investor concerned, the overall project is of marginal viability.[48]

The high degree of risk involved at the exploration stage is dealt with by the 70:30 chance of failure over success. Were the investor to discount possible project flows using a discount rate commensurate with exploration risk, the NPV would be wrongly assessed as negative. Thus, if a more normal level of risk is not applied to expected cash flows from production in the event of success, the wrong exploration decisions are likely to be made.

Consistent with the more normal level of project risk in the production phase, the Callaghan review observes that:[49]

> "…. once developed, rare would be the (still risky) project that could not utilise PRRT deductions uplifted at LTBR."

48 Were another investor to assess the overall project using a lower discount rate on post-exploration cash flow, the project might be assessed as viable with a positive pre-tax NPV.

49 Callaghan review, above n 10, 72.

That crucial observation immediately points to desirable design features in the production phase for both level of uplift rate and form of assimilation of RRT with subsequent income taxation.

4.2 Production phase uplift rate and ideal RRT assimilation with income tax

In relation to assimilation of RRT and income taxation in the production phase of mineral resource projects generally, Mayo considers[50] that RRT with its possibility of lost deductions does not lend itself to ideal design. If investors faced little prospect of offsetting RRT expenditure against RRT receipts, for example, they would not appreciate having these expenditures cut by the RRT rate for income tax purposes. Such circumstances would support design that simply applies income tax to pre-RRT flows with RRT payment deductible for income tax purposes.

However, the findings of the Callaghan review point to, at least for petroleum resource projects, a low risk of losing RRT deductions in projects' development/production phase. The findings suggest that this risk is likely so low that, if the RRT uplift rate in this phase were LTBR, it would invariably be just a matter of time before early RRT losses (years of negative cash flow) — uplifted annually at LTBR — were completely absorbed by subsequent positive cash flow.[51]

Expressed in terms of the spread of future possible NPV outcomes (with discounting at LTBR), as illustrated in Figure 1, the findings suggest that, once a final decision has been made to proceed to production, loss-making outcomes in the spread would be rare. That matches the situation under CFT with delayed full loss offset (losses carried forward with LTBR uplift). The only difference here is that CFT design would guarantee ultimate cash rebates if losses carried forward were not, in the rare event, fully absorbed, whereas RRT design would not.

Risk-free implicit loans to government under CFT with delayed full loss offset become minimal-risk loans under RRT design in projects' production phase.

Failure of petroleum projects during their production phase with accompanying lost RRT deductions remains a possibility (though the risk of lost RRT deductions would be reduced even further were project-based design replaced by taxpayer-based design).

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50 Mayo (2013), above n 3, 192.

51 From government's perspective, uplift at more than LTBR would cost more in terms of reduced RRT revenue than LTBR interest payments on government bonds issued to cover cash rebates on production phase RRT losses (with minimal accompanying risk of RRT payments not matching those interest payments).

Nevertheless, uplift at LTBR in the production phase of petroleum projects can be viewed as a sound compromise on unachievable perfection of RRT design.

Attempts at improving that compromise via an uplift rate higher than LTBR can be counterproductive, resulting in distortions (like delayed production or gold plating[52]) and reduced tax revenue collections (identified in the Callaghan review). General design focus is best devoted to achieving a sound RRT base (breadth of allowable deductions) and a tax rate that is not excessive (recognising also that non-cash costs and benefits are not included in the RRT net).

Most importantly, accepting the sound basis for uplift at LTBR during the production phase of petroleum resource projects brings into focus the main research question being examined by this article.[53]

Ignoring the exploration phase for now, such acceptance of the low risk of losing RRT deductions with associated uplift at LTBR brings into play ideal design that assimilates RRT and income taxation in line with that specified in section 3.1 — and portrayed in Tables A2 and A3 in Attachment A.[54] The risk of losing RRT deductions, rather than investor hurdle rates, always provides the basis for setting RRT uplift rate. But, soundly based uplift at LTBR also allows ideal assimilation of RRT and income tax. Thus, in such circumstances, ideally:

- pre-tax cash flows cut by the RRT rate would feed into income taxation as if pure CFT applied to those pre-tax flows — consistent with column (f) of Table A3 and associated income tax treatment in Table A2 — though no doubt with regular income tax depreciation arrangements replacing economic depreciation; and
- if practicable, income tax would be applied separately to the minimal-risk (rather than completely risk-free) asset, created by RRT uplift at LTBR substituting for immediate cash rebates of pure CFT. A realistic representation of the minimal-risk asset remains the single zero NPV outcome of the "risk-free bond" depicted in Figure 1 — regardless of whether the prospective production phase is considered marginal or highly profitable.

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52 Henry review, above n 4, 229.

53 Such acceptance with accompanying more neutral tax design also provides support for primacy being given to the first pricing point for determining RRT taxing point with integrated gas-to-liquefied gas operations, so avoiding a range of complexities and uncertainties associated with methodologies that seek to price gas feedstock for RRT purposes close to the wellhead — see Mayo (2013), above n 3, 111-113; and Australian Government, Australian Treasury, *Review of PRRT gas pricing arrangements*, consultation paper, April 2019. Available at www.treasury.gov.au/consultation/c2019-t364690.

54 Under ideal assimilation (section 3.1), the prospect of successful operations avoiding the potential income tax disadvantage of traditional assimilation may offset the prospect of reduced income tax deductions for expenditures preceding *rare* failure in the production phase.

The annual income of the minimal-risk asset subject separately to income tax would align with that in equation (3) (with overall income tax treatment of the asset illustrated in columns (g) to (k) of Table A3).[55]

Under this design, the RRT component of Table A3 in Attachment A (with 5% LTBR and investor hurdle rate of 10%) aligns with the PRRT treatment of the simple two-year project used by the Callaghan review also with uplift at 5% and investor hurdle rate 10%.[56]

It may be superficially appealing to suggest that RRT uplift rate should match the investor's hurdle rate (assumed 10% in Table A3 and in the Callaghan review's two-year project). After all, a 10% uplift rate used in Table A3 would mean no RRT payable at all, again preserving the marginal status of the project. However, beyond wide variability in hurdle rates, such design has major implications for RRT revenue across all projects (as illustrated in the Callaghan review).

Were the segregated minimal-risk asset not subject to income taxation, RRT uplift would be set at post-income tax LTBR level (again, as in the case of CFT with delayed full loss offset in section 3.1).

4.3 Alternative production phase RRT assimilation design

Consistent with traditional assimilation of RRT and income tax, alternative assimilation would have pre-tax flows feeding into income taxation with RRT payments deductible. As described in section 3.2, this traditional treatment applies income tax to the minimal-risk asset embedded in post-RRT cash flows — justifying pre-tax LTBR uplift but imposing potential tax disadvantage which is assured should income tax apply to annual commercial profit, or economic income, of petroleum resource projects.

Sound investment decision-making would still require separation of the minimal-risk asset from risky project flows.

In addition, clear explanation would still be required to ensure general understanding that an LTBR rate of uplift at production stage is designed to align with the risk of losing RRT deductions and is necessarily quite different from investors' hurdle rates driven by project risk.

55 This design would see numerical RRT case studies in Mayo, above n 3, reworked to show RRT treatment equivalent to that of a CFT with delayed full loss offset.

56 Callaghan review, above n 10, 73 (Box 4.1).

4.4 Exploration phase RRT assimilation with income tax

4.4.1 Ideal exploration phase RRT assimilation with income tax

On the basis of the numbers in Figure 3, the NPV of the overall project illustrated there (exploration plus post-exploration phases) after a 50% pure CFT is as follows.[57]

After tax NPV ($m)

$$= -10(1 - 0.5) + 0 + [20\% \times 30(1 - 0.5)] + [10\% \times 40(1 - 0.5)]$$
$$= -5 + 0 + 3 + 2 = \text{zero} \qquad (8)$$

Equation (8) shows how the conceptual ideal of immediate cash rebates (or financially equivalent delayed cash rebates) for RRT losses out of exploration expenditure (whether successful or not) and other project expenditures would ensure sound exploration decisions.

Exploration expenditure itself ($10m in equation (8)) and the NPV of each possible outcome resulting from the exploration are cut by the RRT rate. That should leave exploration decisions unaffected, with a subsequent separate investment decision to be made — drawing on, say, cash flow analyses like that shown in Table A3 — as to whether or not to proceed to the development/production stage on the basis of future cash flow possibilities revealed by the exploration activity.

Continuing with the conceptual ideal would see post-rebate exploration expenditure immediately deductible for income tax purposes if unsuccessful (not producing an asset of any value). If successful, post-rebate exploration expenditure would feed into an income tax base comprising annual cash flow (cut in proportion to RRT rate) of the resulting commercial project plus the project's annual change in post-RRT value. Value of successful projects would likely increase prior to production commencing, as shown in Figure A1 in Attachment A, and fall subsequently as the mineral resource is depleted.

Such ideal overall tax treatment (using pure CFT instead of a financially equivalent RRT) is shown by Mayo[58] for an above-marginal project and by Mayo[59] for a marginal project with pre- and post-taxes returns matching the project investor's pre- and post-taxes discount rates, respectively.

Discussion of ideal income tax and RRT treatment is overshadowed, however, by practicalities in relation to both income tax and RRT.

57 A similar example is used in Australian Government, "Effects on exploration of resource rent tax with full loss offset", February 1984.

58 Mayo (2013), above n 3, 237.

59 Ibid, 248.

Despite conceptual arguments to the contrary, a taxpayer's successful and unsuccessful exploration expenditure typically attracts immediate write-off for income tax purposes (as it does in Australia) — and against the taxpayer's assessable income from any source. In practice, therefore, successful exploration expenditure does not have to be separated from unsuccessful expenditure in the face of, for example, the potential for many stages of exploration activity and much delay before success or otherwise is determined.

From the RRT perspective, prior RSPT experience shows community aversion to immediate cash rebates for RRT losses. Again, enter project-based RRT design with its loss carry-forward without any guarantee that the value of losses will be recouped.

4.4.2 Practical treatment of RRT exploration phase losses and related PRRT design

Equation (8) might suggest that, under traditional RRT design, *successful* petroleum exploration expenditure could be carried forward to the development/production phase with the same LTBR uplift that applies in the production phase. With a project-based RRT, according to PRRT definitions, successful exploration expenditure would be own-project expenditure undertaken "within the original exploration permit area from which the associated production licence(s) is drawn".[60]

Resource rent tax deductions for *unsuccessful* greenfield exploration expenditure would, however, be lost completely under a pure project-based RRT.

Practical difficulties of earmarking exploration expenditure successful or unsuccessful aside, equations (7) and (8) show how such treatment of unsuccessful exploration expenditure under pure project-based design would adversely affect exploration decisions.

If exploration expenditure were not successful, the $10m exploration expenditure in equation (8) would not be cut by the RRT rate. Given the 70% chance of failure underlying the figures in equation (8), what was a marginally viable exploration program before tax in equation (7) would become unviable post-RRT. Even so, such RRT design would provide more soundly based post-exploration decisions than provided under ad valorem or production-based royalties (which ignore successful, as well as unsuccessful, exploration expenditure). Specification of RRT design does not stop there, however.

The prospect of stranded RRT exploration expenditure logically calls for uplift above LTBR for RRT losses from exploration expenditure. Australia's PRRT started with

60 The Hon. Paul Keating, Treasurer, and the Hon. Peter Walsh, Minister for Resources and Energy, "Resource rent tax on "greenfields" offshore petroleum projects", 27 June 1984, 7.

an uplift of LTBR plus 15 percentage points for both eligible exploration and general project (development/production) expenditure.[61]

But no level of uplift can compensate for lost RRT deductions from stand-alone unsuccessful exploration activity in a project-based system.[62] This, in turn, logically leads to design where an investor's unsuccessful exploration expenditure can be transferred and written off against positive cash flows of that investor's successful RRT projects.

Such transfers directly reduce RRT otherwise payable, providing the effect of immediate or delayed cash rebates. They consequently reduce the risk of lost PRRT deductions from stranded exploration expenditure, pushing RRT design some way towards company-based (or, more generally, taxpayer-based) RRT design.

Australia's PRRT allows transferability of exploration expenditure. However, problems have arisen from the PRRT's current transferability arrangements, as well as the PRRT's current treatment of the interface between exploration and production phases of PRRT projects.

The PRRT experience is therefore a useful case study on which to base design that assimilates RRT and income tax across exploration and production phases of mineral resource activities.

4.4.3 PRRT lessons for RRT treatment of exploration expenditure

Australia's PRRT is essentially project-based but since 1991, transfer of RRT exploration losses is required against positive cash flow (after allowing for uplifted and carried-forward own-project losses) of the taxpayer's other PRRT projects.

Despite the resulting reduced risk of losing PRRT exploration losses, the uplift rate of LTBR plus 15 percentage points for eligible exploration expenditure was not reduced; instead, the uplift rate for general project (development/production) expenditure was reduced to LTBR plus five percentage points.

A complex set of specific rules apply to the PRRT transfer rules, like transfer of the oldest expenditures first to the project with the most recent production licence. The

61 While multiplicative loadings on LTBR would be more attuned to the LTBR floor, PRRT loadings are formulated on an additive basis. The PRRT uplift of LTBR + 15 percentage points corresponded to about 2 × LTBR when first designed in 1984 but, in mid-2019, corresponds to more than 10 × LTBR.

62 A market in PRRT losses out of exploration expenditure is logically not applicable in a project-based system.

Callaghan review highlights the wide range of variable and arbitrary outcomes that can arise from these PRRT transfer arrangements.[63]

A key source of variability in outcomes is the differing uplift rates that apply to exploration expenditure depending on the timing of that expenditure. Uplift of LTBR plus 15 percentage points applies to exploration expenditure undertaken within five years of the associated production licence and uplift of GDP deflator if undertaken prior to then. Transferred exploration expenditure attracts an uplift rate determined by reference to how many years before the receiving project's production licence the expenditure occurred.

Compulsory transfer means that a taxpayer's required treatment of exploration expenditure (including undeducted own-project exploration expenditure of an established PRRT project) can suddenly change if, say, a particular project of the taxpayer becomes liable for PRRT. Moreover, different treatment can apply to each share of the same exploration expenditure of different participants of the same project.

In addition, major implications for PRRT revenue stem from current design of the interface between exploration and development/production phases of PRRT operations, in particular, the combination of:

- PRRT losses out of exploration expenditure (within five years of associated production licence) continuing to attract uplift at LTBR plus 15 percentage points during a project's development/production phase despite the sharp reduction in risk of losing PRRT deductions in that phase — rather than, say, being folded into a common pool of losses attracting the uplift rate for general project expenditure; and
- incongruous rules for the sequencing of PRRT deductions which allow general project expenditure with its lower uplift rate (LTBR plus five percentage points) to be deducted before exploration expenditure attracting uplift at LTBR plus 15 percentage points.

Reflecting on the revenue impact of these design features, the Callaghan review observes: "This is particularly so for gas projects with moderate profitability, and long lead times before production begins and very high levels of general project expenditure".[64]

Changes to the PRRT proposed to be legislated in 2019 by the Australian Government in its response to the Callaghan review are designed to address problems with the ordering of expenditure deductions and the variability of treatment of transferred

63 Callaghan review, above n 10, 75-76 and 136-137.

64 Ibid, 77. Exploration expenditure within five years of production licence being granted continues to attract uplift of LTBR + 15 percentage points regardless of length of production lead time.

exploration expenditure under the PRRT.[65] Essentially, the changes, as well as removing onshore projects from the PRRT regime, would:

- reintroduce a uniform uplift rate for both exploration and general (development/production) expenditure, set at LTBR plus five percentage points[66] — though with the uplift rate reduced after 10 years to GDP deflator and LTBR for exploration expenditure (starting from date of expenditure) and general expenditure (starting from year of first assessable PRRT receipts), respectively; and
- implement a fixed treatment of transferred exploration expenditure matching that of own-project exploration expenditure (uplift at LTBR plus five percentage points for 10 years, reverting then to GDP deflator), regardless of when the receiving project's production licence was granted.

This background from the PRRT experience helps with practical design that better assimilates RRT and income tax across the exploration and production phases of RRT operations.

Absent cash rebates or their equivalent for all exploration expenditure (section 4.4.1), how are the exploration and production phases to be blended soundly for both RRT and income tax purposes?

4.4.4 Blending RRT and income tax treatment across exploration and production phases

Practical design that blends RRT and income tax treatment across exploration and production phases of mineral resource operations need not be affected by the policy choice between ideal RRT/income tax assimilation design for the production phase (section 4.2) and traditional design (section 4.3).

Production phase assimilation. To reiterate, ideal assimilation design for projects' production phase (with low risk of losing RRT deductions) would involve (section 4.2, drawing from section 3.1):

- cutting all production phase RRT receipts and costs by the RRT rate before income taxation;
- excluding RRT payments from the income tax base; and
- setting the RRT uplift rate in projects' production phase at post-income tax LTBR, assuming that this phase's minimal-risk assets are not separately subject to income tax.

65 Australian Government (2018), above n 12.

66 A structure more sympathetic both to the much-reduced levels of LTBR since 1984 and to the reduced risk of losing exploration expenditure deductions given transfer arrangements and rebates for eligible closing-down expenditure.

The policy choice is then between this somewhat more complex but more investment-neutral assimilation design[67] and simpler traditional assimilation design, like that of Australia's PRRT, with its accompanying investment distortions and potential investor tax disadvantage (section 4.3, drawing from section 3.2). Traditional design would:

- impose income tax on pre-taxes costs and receipts;
- allow RRT payments to be deductible for income tax purposes; and
- set the RRT uplift rate in projects' production phase at pre-income tax LTBR.

Practical treatment of exploration expenditure for RRT and income tax purposes is not affected by the choice made between these two designs for RRT/income tax assimilation in projects' production phase.

Exploration expenditure and RRT. Regardless of uplift rate and RRT/income tax assimilation design applying in projects' production phase, practical RRT design dictates that the uplift rate for all exploration expenditure be set on a pre-income tax basis, likely above LTBR (preferably in multiplicative form) at least for a specified period (sections 4.4.2 and 4.4.3).

In line with proposed changes to PRRT design, the specified length of time that LTBR-related uplift rate applies to exploration expenditure would be linked to the timing of the expenditure. And, to ensure consistent RRT treatment of exploration expenditure, that design would apply equally to both own-project (non-stranded) exploration expenditure and to transferred exploration expenditure (then also non-stranded expenditure) regardless of when the profitable project receiving the transfer was established.

Exploration expenditure and income tax. As mentioned (section 4.4.1), practical design would simply maintain the usual immediate write-off of all exploration expenditure for income tax purposes regardless of whether or not the exploration is successful.

To be strictly consistent with ideal production-phase design where costs are cut by the RRT rate for income tax purposes, all exploration expenditure, also initially cut by RRT rate, would be immediately deductible for income tax purposes. Subsequent top-up deductions would be allowed for exploration expenditure stranded for RRT purposes.[68]

67 Given investment-neutral design, achieving what is commonly termed an "appropriate" return to the community is left to the selection of the RRT rate.

68 Once it was established (perhaps at the instigation of investors) that particular exploration expenditure was stranded and would not feed into the production phase of any RRT project — either as own-project expenditure or transferred expenditure — the remainder of the initial

Consequently, exchanging such clumsy income tax design for simple, universal immediate expensing of all exploration expenditure would provide tax-preferred treatment of non-stranded (own-project or transferred) exploration expenditure. RRT losses out of non-stranded exploration expenditures, like own-project development/production costs, would almost certainly be absorbed by future positive cash flow (reducing RRT payments to provide the equivalence of up-front cash rebates for losses). But the non-stranded exploration expenditure would not be cut by the RRT rate for income tax purposes while own-project development/production costs would be.

Nevertheless, such tax-preferred treatment of non-stranded exploration expenditure could be viewed as another offset to the risk of RRT exploration expenditure being stranded — along with the uplift rate on all exploration expenditure for RRT purpose being set on a pre-tax basis and above LTBR at least for a period.

Blending RRT across exploration/production phases. Independent of the policy choice over design of RRT/income tax assimilation in projects' production phase, sound blending for RRT purposes is required of an investor's exploration expenditures (stranded and non-stranded) and the production phases of the investor's established projects. Sound blending design would address the wide range of problems identified by the Callaghan review caused by differences in RRT uplift rates for exploration and production expenditures in projects' production phase (section 4.4.3).

Another policy choice is involved in deciding the shape of such blending design.

The first policy option is to apply a common standard RRT uplift rate for expenditures in both exploration and production phases. That design is in line with proposed changes to Australia's PRRT (section 4.4.3). It is, however, at odds with both the difference in the risk of losing RRT deductions in the these phases and likely to be at odds with the Callaghan review's finding of low risk of losing PRRT deductions in PRRT projects' production phase.

Under the alternative policy option, once a project is established (production licence granted), all prior uplifted, own-project (now non-stranded) exploration and other expenditure, as well as any subsequently transferred exploration expenditure, is pooled with the production phase cash flows of the RRT project. That pooling of expenditures applies regardless of uplift rates applying to prior own-project expenditure and transferred exploration expenditure.

On project establishment, therefore, the uplift rate of own-project exploration expenditure reverts to the common uplift rate applying to the production-phase pool,

exploration expenditure would be deductible for income tax purposes. An interest component could be included on the delayed write-off.

a rate that is aligned with the risk of losing RRT deductions: under ideal assimilation, post-tax LTBR assuming income tax is not imposed on the associated minimal-risk assets; and, under traditional assimilation, pre-tax LTBR.

In addition to the investment-neutrality and simplicity benefits of this design:

- unnecessary tax revenue loss and problems with the ordering of deductions in projects' production phase (section 4.4.3) are avoided, regardless of any differences in uplift rates across own-project expenditures prior to project establishment; and
- own-project exploration expenditure is not transferable to other projects once a project is established (consolidating consistent treatment of exploration expenditure, particularly across different investors with interests in the same RRT project, regardless of design of transfer arrangements).

Post-production phase, cash rebates could deal directly with losses arising from closing-down expenditures.[69]

5. Conclusion

Pure CFT with its immediate cash rebates for CFT losses (negative cash flow) is the foundation of neutral rent tax design applicable to mineral resource projects. These cash rebates apply to losses both out of high-risk exploration expenditure and out of relatively low-risk development/production expenditure consequent on successful exploration activity.

The neutrality properties of pure CFT can be maintained in the presence of subsequent income taxation simply by reducing project costs and gross receipts by the CFT rate for income tax purposes. Overall tax neutrality then depends solely on income tax design.

A project-based RRT that replaces immediate cash rebates for losses with uplifted loss carry-forward can be similarly assimilated with subsequent income tax during a project's development/production phase when there is low risk of losing RRT deductions in this phase. In these circumstances, uplifted loss carry-forward substituting for cash rebates during a project's production phase creates minimal-risk assets separate from the risky mineral resource project. The minimal-risk assets are implicit loans to government for unpaid immediate cash rebates for losses plus repayment of those loans via later reductions in RRT payments resulting from the loss uplift.

69 As explained (above n 29), income tax treatment could be either: deduction for expenditure net of rebate; or deduction for pre-tax expenditure plus cash rebate assessable.

The 2017 Callaghan review of Australia's PRRT found that the risk of losing PRRT deductions is so low in the production phase of petroleum resource projects that it would be rare for deductions, uplifted at LTBR, not to be fully utilised.

Such findings provide the opportunity for both soundly based setting of RRT uplift rate (which always depends on the risk of losing RRT deductions, not on investor hurdle rates) and investment-neutral assimilation of RRT and income tax. Thus, in the production phase of at least petroleum mineral resource projects, ideally:

- the RRT uplift rate for losses would be aligned with LTBR;
- pre-tax costs and gross receipts would be reduced by the RRT rate, and RRT payments would not be deductible, for income tax purposes — as if pure CFT applied; and
- the minimal-risk assets would be separately subject to income tax.

In the likely event that the minimal-risk assets are not separately subject to income tax, the LTBR uplift rate would ideally be set on an after-income tax basis.

Such design seeks tax-neutral assimilation of RRT and income tax in projects' production phase, with the RRT rate determining the return to the community from the RRT.

Leaving the minimal-risk assets embedded for income tax purposes in aggregate production phase post-RRT flows, consistent with traditional RRT design, justifies uplift at pre-tax LTBR. But, compared to ideal treatment of the production phase, the traditional treatment imposes investment distortions and higher income tax impost on investors (with that extra impost reduced the greater the generosity of income tax design).

Absent RRT cash rebates for exploration expenditure and differential income tax treatment for successful versus unsuccessful exploration activity, practical design is required of the interface between an investor's exploration expenditure and the development/production phase of the investor's established RRT projects. Formulating such design is helped by lessons from Australia's experience with its PRRT, which incorporates transfers of exploration expenditure to the investor's profitable projects.

This practical design would ideally minimise investment distortions, variable outcomes and unnecessary reductions in tax revenue, regardless of whether ideal or traditional RRT/income tax assimilation is chosen for projects' production phase.

In such practical design, the usual immediate write-off for income tax purposes for all exploration expenditure would apply.

The RRT treatment of an investor's exploration expenditure transferred to profitable RRT projects of that investor would also be consistent with that of own-project exploration expenditure: RRT uplift rate for all exploration expenditure set on a pre-tax basis and likely higher than LTBR at least over some specified period linked to the timing of the expenditure (in line with proposed PRRT changes). That would ensure consistent RRT treatment of transferred exploration expenditure.

In addition, once an RRT project is established, all prior uplifted, own-project exploration and other expenditure, as well as any transferred exploration expenditure, would be collapsed into a single production-phase pool with common uplift rate reflecting the risk of losing RRT deductions in this phase. This common pool would:

- remove the possibility of transfers of that project's remaining own-project exploration expenditure (promoting simplicity and consolidating consistent treatment of exploration expenditure);
- remove the possibility of investment distortions, variable outcomes and reduced tax revenue arising in circumstances where expenditures attract different RRT uplift rates in projects' production phase (like under current PRRT design); and
- accommodate RRT uplift rate for exploration expenditure set higher than the uplift rate for development/production phase expenditures in an attempt to counter the risk of stranded exploration expenditure (contrasting proposed PRRT changes where exploration and production expenditures would attract the same standard uplift rate).

Attachment A

Schematic petroleum project subject to rent and income taxation

Table A1 shows the cash flows and year-by-year values for the planned development/production phase of a schematic petroleum project before and after a 40% cash flow tax (CFT).

Table A1: Cash flows of a stylised petroleum project before and after 40% CFT ($m)

Year	Pre-CFT cash flow (a)	Value of pre-CFT net receipts (b)	Cash flow after CFT (c)	Value of post-CFT net receipts (d)
0	–1,000	1,000	–600	600
1		1,100 (e)		660 (e)
2		1,210 (e)		726 (e)
3	562	769	337	462
4	477	369	286	222
5	406	0	244	0
NPV@10%	Zero		Zero	
IRR%	10.0		10.0	

(a) All planned capital expenditure to develop project is undertaken in Year 0, followed by a three-year delay before production commences resulting in forecast net receipts (gross receipts from sales less operating costs) in Years 3, 4 and 5.

(b) Future stream of expected net receipts discounted at risk-adjusted 10% pa. Annual change in value is therefore driven by investor's 10% discount rate applied to project cash flows. Because $1,000m Year 0 capital expenditure is needed to produce net receipts stream, project is marginal to this investor (mining right has zero value to this investor). Year 0 value just after capital expenditure is undertaken is $1,000m pre-CFT or $600m post-CFT.

(c) Pre-tax cash flows reduced by 40% via either cash rebates (for negative cash flow) or tax payments (on positive cash flow).

(d) Future post-CFT net receipts in Years 3, 4 and 5 of column (c) discounted at 10% pa. In each year, equal to 60% of pre-tax value of project in column (b).

(e) With no net receipts produced in Years 1 or 2, the value of future cash flows discounted to end Year 1 and end Year 2 increases 10% each year above up-front value as delay before positive cash declines.

Figure A1 shows project value before and after CFT.

Figure A1: Value of project's future net receipts before and after 40% CFT

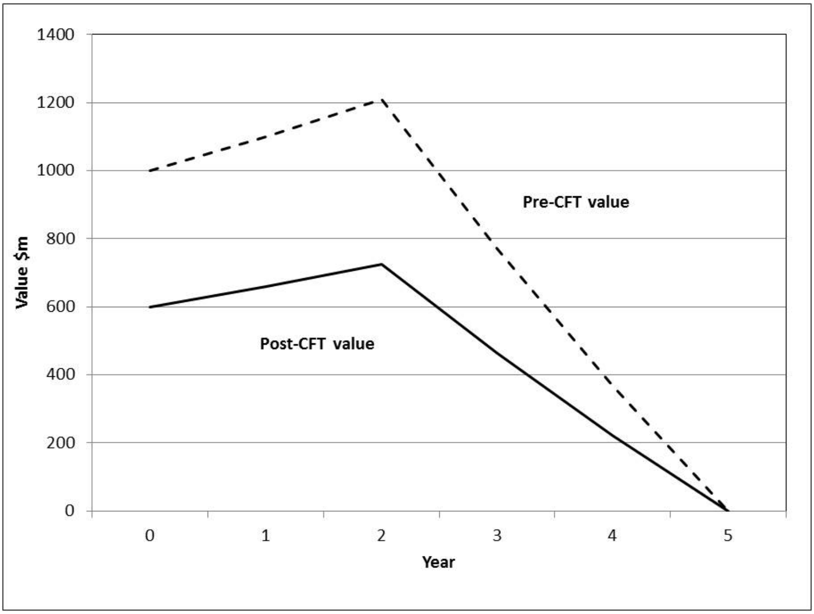

Table A2 shows the ideal way to combine 40% CFT and 30% income taxation.

Table A2: 30% income taxation with economic depreciation and taxable income based on cash flow after 40% CFT ($m)

Year	Pre-CFT cash flow (a)	CFT rebates/tax payments (b)	Cash flow post-CFT (c)	Income tax depreciation (d)	Taxable income (e)	Income tax payments (f)	Post-all taxes cash flow (g)	Post-CFT and all taxes value (h)
0	–1,000	–400	–600				–600	600
1				–60	60	18	–18	660
2				–66	66	20	–20	726
3	562	225	337	264	73	22	315	462
4	477	191	286	240	43	14	273	222
5	406	162	244	221	22	7	237	0
NPV	Zero[i]	Zero[i]	Zero[i]				Zero[j]	
IRR %	10.0	10.0	10.0				7.0	

(a) As in Table A1.

(b) Pre-tax cash flow — column (a) — times 40% tax rate. Negative number represents cash rebate and positive numbers tax payments.

(c) Column (a) less column (b).

(d) Economic depreciation, or annual change in the year-by-year values, shown in column (d) in Table A1, of net receipts after CFT. Negative values represent assessable accrued capital gains, positive values deductible accrued capital losses.

(e) Net receipts after CFT — Years 3, 4 and 5 of column (c) — less economic depreciation of net receipts after CFT in column (d). CFT cash rebates/tax payments are *not* part of income tax base.

(f) Column (e) times 30% income tax rate. Sum of income tax payments is $80m.

(g) Cash flow after CFT in column (c) less income tax payments.

(h) Future post-all taxes cash flow in Years 1 to 5, discounted at the investor's post-income tax discount rate of 7% pa — that is, 10x(1–0.3)% pa. Value each year matches post-CFT value in column (d) of Table A1 (where discounting is at 10% pa).

(i) Discounting at 10% pa pre-all taxes (and post-CFT) discount rate.

(j) Discounting at the investor's post-income tax discount rate of 7% pa.

Table A3 shows pure income taxation combined with CFT incorporating delayed full loss offset.

Table A3: Cash flows of stylised petroleum project subject to 40% RRT[a] ($m)

	Pre- and post-RRT				Risky flows	Minimal-risk asset (loan to govt)				
Year	Pre-tax cash flow (b)	Base after loss uplift (c)	RRT paid (d)	Post-RRT cash flow (e)	Cash flow after pure CFT (f)	Col (e) less col (f) (g)	Income tax value change (h)	Taxable income (i)	Income tax (j)	Post-tax cash flow (k)
0	–1,000	–1,000		–1,000	–600	–400				–400
1	0	–1,050		0	0	0	20	20	6.0	–6.0
2	0	–1,103		0	0	0	21	21	6.3	–6.3
3	562	–596		562	337	225	–203	22	6.6	218.4
4	477	–148		477	286	191	–179	12	3.6	187.4
5	406	250	100	306	244	62	–59	3	0.9	61.1
NPV@10%	Zero			–62[l]	Zero[m]	–62[l]				
NPV@5%	196[n]			118[n]	118[m]	Zero[n]				
IRR% pa	10			8.1[o]	10[o]	5[o]				3.5[p]

(a) Immediate expensing of all costs, tax losses (negative cash flow) compounded forward with 5% (LTBR) uplift. Thus, CFT with delayed loss offset is equated here with RRT incorporating LTBR uplift.

(b) As in column (a) of Table A1.

(c) Prior year negative cash flow uplifted by 5% (LTBR) plus pre-tax cash flow each year.

(d) 40% times any positive tax base after loss uplift (column (c)).

(e) Pre-tax cash flow in column (b) less RRT payments in column (d).

(f) Pre-tax cash flow in column (b) times 60% or the cash flow that would have resulted from a 40% pure CFT cutting all positive and negative cash flows immediately by 40% (see column (c) of Table A1). These cash flows are the component of the project's aggregate post-RRT cash flows in column (e) that reflect project risk.

(g) Post-RRT cash flow less post-RRT cash flow if a pure cash flow tax were applying — that is, column (e) less column (f). These cash flows comprise the minimal-risk component of the project's aggregate post-RRT cash flows in column (e).

(h) Change in value ("capital" component) of implicit $400m loan to government and government's implicit repayments in column (g). Value in a year equals value in prior year ($400m in Year 0) increased by 5% annual uplift less cash flow in that year (for example, value in Year 3 is $(441 × 1.05 – 225) m, or $238m, a reduction of $203m from Year 2 value of $441m).

(i) Cash flow in Years 1 to 5 of implicit loan repayments in column (g) plus annual change in value of loan in column (h). Represents "income" component of $400m implicit loan and associated repayments.

(j) Taxable income in column (i) associated with minimal-risk asset times 30% income tax rate.

(k) Pre-income tax cash flow of minimal-risk asset in column (g) less income tax paid on it in column (j).

(l) Aggregate post-RRT cash flow in column (e) has negative NPV with discounting at 10%. However, this is seen to arise solely from discounting the minimal-risk component in column (g) at 10% instead of 5% LTBR.

(m) NPV (at any discount rate) of the project's risky post-pure CFT flows is 60% of pre-tax NPV (at unchanged discount rate), matching effect in Table A1 under immediate full loss offset.

(n) With discounting at 5% LTBR, NPV of post-RRT cash flow is also 60% of pre-tax NPV. That is because the minimal-risk component in column (g) of post-RRT cash flows has zero NPV at this discount rate (discount rate matches loss uplift rate).

(o) The internal rate of return (IRR) of aggregate post-RRT cash flow is reduced below pre-tax return. As with NPV, however, separating aggregate post-RRT cash flows into those related to project risk (column (f)) and those with minimal-risk (column (g)) results in the IRR of the risky project component being equal to pre-tax IRR (effect of pure CFT) and IRR of minimal-risk component being equal to the 5% uplift rate.

(p) Return of post-income tax cash flow of minimal-risk asset is 3.5%, matching investor's post-income tax risk-free discount rate of 3.5% pa — that is, 5 × (1–0.3)% pa — which means NPV of minimal-risk asset is zero with discounting at 3.5%.

Table A4 illustrates the potential tax disadvantage under RRT design from imposing income tax on pre-tax cash flows with RRT payment deductible (and so on the embedded minimal-risk asset) versus ideal income tax treatment.

Table A4: Disadvantage of income tax on pre-tax flows with RRT payments deductible for income tax purposes versus income tax on pre-tax flows cut by RRT rate and separately on minimal-risk asset ($m)

	Economic depreciation (pre-tax values)				Straight line write-off of $1,000m from Year 3					
	Alternative		Ideal	Diff	Alternative		Ideal			Diff
Year	Annual depreciation (a)	Income tax (b)	Income tax (Tables A2 & A3) (c)	Annual disadvantage (d)	St line write-off (e)	Income tax (f)	Tax on cut pre-tax flows (g)	Income tax on min-risk asset (h)	Total income tax (i)	Annual disadvantage (j)
0	0	0								
1	–100	30	24	6		0		6	6	–6
2	–110	33	26.1	6.9		0		6.3	6.3	-6.3
3	441	36.3	28.4	7.9	200	108.6	65.2	6.6	71.8	36.8
4	400	23.1	17.4	5.7	200	83.1	49.9	3.6	53.5	29.6
5	369	–18.9	7.5	–26.4	600	–88.2	–34.9	0.9	–34	-54.2
Sum	1,000	103.5	103.5	0	1,000	103.5	80.1	23.4	103.5	0
NPV@7%				3.6[k]						2.9[k]

(a) Annual reduction in pre-tax values from column (b) of Table A1. Negative numbers show increase in value (as positive cash flow gets closer).

(b) 30% income tax rate applied to taxable income comprising aggregate post-RRT net receipts from column (e) of Table A3 less economic depreciation in column (a). Income tax losses are able to be written off immediately against taxpayer's other income.

(c) Column (f) of Table A2 (income tax on risky project asset with cash flows cut by RRT rate) plus column (j) of Table A3 (income tax on minimal-risk asset).

(d) Column (b) less column (c) showing for economic depreciation the yearly extra income tax paid using pre-tax flows with RRT deductible versus using pre-tax flows cut by RRT rate (Table A2) plus separate income taxation of minimal-risk asset (Table A3).

(e) 20% straight line write-off of $1,000m expenditure starting year of first production (Year 3).

(f) 30% income tax rate applied to taxable income comprising post-RRT net receipts from column (e) of Table A3 less straight line write-off in column (e). Income tax losses are able to be written off immediately against taxpayer's other income.

(g) Pre-tax net receipts cut by RRT rate (in column (c) of Table A2) less 60% of write-off deductions in column (e) — reflecting write-off of $1,000m Year 0 expenditure being cut by the RRT rate — times 30% income tax rate. Income tax losses are able to be written off immediately against taxpayer's other income. Sum of income tax payments/tax savings is $80.1m (same as in column (f) of Table A2).

(h) Column (j) of Table A3. As in Table A3, minimal-risk is separated from risky project asset and separately subjected to income tax.

(i) Column (g) plus column (h).

(j) Column (f) less column (i) showing for straight line depreciation the yearly extra income tax paid using pre-tax flows with RRT deductible versus using pre-tax flows cut by RRT rate plus separate income taxation of minimal-risk asset (Table A3).

(k) NPV of extra income tax payable with discounting at the investor's post-income tax discount rate of 7% pa — that is, 10 × (1–0.3)% pa.