Attachment 7.28

NERA, Imputation credits and equity prices and returns

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NERA
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Imputation Credits and Equity Prices and Returns

A report for the Energy Networks Association

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Project Team

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Contents

List of Tables

List of Figures

Executive Summary

This report has been prepared for the Energy Networks Association (ENA) by NERA Economic Consulting (NERA). The ENA has asked NERA to provide and review evidence on the value that the market places on imputation credits distributed.

In particular, the ENA has asked NERA to:

- explain the methodology of Lajbcygier and Wheatley (2012) and of Siau, Sault and Warren (2013); [1]
- explain whether the results of these studies would be affected by higher-than-average trading volumes around ex-dividend dates;
- set out the advantages of the methodologies employed by Lajbcygier and Wheatley and of Siau, Sault and Warren relative to the use of aggregate tax statistics for the purposes of estimating the value of imputation credits; and
- update the results of the Lajbcygier and Wheatley study and explain their relevance to estimating the value of imputation credits.

NERA understands that the ENA intends to submit this report as part of its response to the draft *Rate of Return Guidelines* released by the Australian Energy Regulator (AER) in August 2013 under the recently revised National Electricity Rules (NER) and National Gas Rules (NGR).

The new NER and NGR require that the estimated cost of corporate income tax for a network service provider include a value for imputation credits, gamma.[2] Gamma represents the value that equity investors place on imputation credits created through the payment of company income tax and is generally estimated as the product of two elements:

- the *payout* ratio, being the proportion of created credits distributed by companies to their shareholders; and
- *theta*, the market value of distributed imputation credits as a proportion of their face value.

In the AER's post tax revenue model the value of gamma is used to determine the proportion of the assumed company income tax that does not need to be included in a regulated firm's annual revenue requirement.

The AER's framework presumes that imputation credits distributed lower the without-credit cost of equity. Put another way, the AER uses a framework that presumes that the market places a higher value on a firm that distributes imputation credits than on an otherwise

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[1] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[2] NER 6.5.3, 6A.6.4 and NGR 87A.

identical firm that distributes no credits. Lajbcygier and Wheatley (2012) test the proposition that imputation credits distributed lower the without-credit cost of equity while Siau, Sault and Warren (2013) test the proposition that the market places a higher value on a firm that distributes imputation credits than on an otherwise identical firm that distributes no credits. [3]

Imputation credits are of some use to domestic investors but are of little or no use to foreign investors. So the value that the market places on imputation credits distributed will largely depend on the impact that foreign investors have on equity prices.

Lajbcygier and Wheatley (2012)

The AER has in the past relied exclusively on Officer's (1994) version of the Sharpe-Lintner Capital Asset Pricing Model (CAPM) and has indicated that, going forward, it intends to make the model its 'foundation' model. [4] Officer's model predicts that a firm's cost of equity, inclusive of a value assigned to imputation credits distributed, will depend on the firm's equity beta. The model also predicts that there will be a negative relation, holding a firm's equity beta constant, between the firm's cost of equity, exclusive of a value assigned to imputation credits distributed, and the firm's credit yield. A firm's credit yield is the ratio of the credits that a share of the firm's equity delivers over a year to the share's price. Lajbcygier and Wheatley (2012) find, however, rather than a negative relation between a firm's without-credit cost of equity and its credit yield, holding the firm's equity beta constant, a positive relation. [6] Thus they find no evidence that the AER should place a positive value on credits distributed. In other words, their evidence suggests that the AER should set theta, and so also gamma, to zero.

Lajbcygier and Wheatley (2012) use data for individual equities and for portfolios formed on the basis of past credit yields from July 1987 to December 2009. [7] They also use a number of different asset pricing models. In this report, we update their results using data from July 1987 to December 2012, Officer's model and versions of the Black CAPM and Fama-French three-factor model that allow the market to place a value on imputation credits. [8] We find, like Lajbcygier and Wheatley, that:

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[3] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[4] Lintner, John, *The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets*, Review of Economics and Statistics 47, 1965, pages 13-37.

Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

Sharpe, William F., *Capital asset prices: A theory of market equilibrium under conditions of risk*, Journal of Finance 19, 1964, pages 425-442.

[6] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[7] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[8] Black, Fischer, *Capital market equilibrium with restricted borrowing*, Journal of Business 45, 1972, pages 444-454.

Fama, Eugene and Kenneth French, *Common risk factors in the returns to stocks and bonds*, Journal of Financial Economics 33, 1993, pages 3-56.

- there is a positive, rather than a negative relation, holding a firm's equity beta or betas constant, between the firm's without-credit cost of equity and its credit yield; and

- there is no evidence that the July 2000 change to the imputation system led to a significant increase in the value of a one-dollar credit – in contrast, the evidence typically points to a decline in the value rather than the increase that the documented rise in the fraction of credits redeemed after the change might suggest.

Siau, Sault and Warren (2013)

An alternative way of determining whether the market places a value on imputation credits is to examine whether equity prices reflect the discounted value of the credits that firms are expected to distribute. Siau, Sault and Warren (2013) use this alternative approach. [9] In particular, they employ two methods.

First, Siau, Sault and Warren (2013) use discounted cash flow valuation models to examine the relation between equity prices and the present values of the dividends and imputation credits that firms are expected to distribute. [10] Second, they regress earnings yields on credit yields and a range of control variables. If imputation credits are capitalised into equity prices, then, all else constant, earnings yields will be negatively related to credit yields.

Siau, Sault and Warren (2013) use a sample of 468 publicly listed equities and data from 1996 to 2011 and find that: [11]

- on balance, no substantial evidence exists that imputation credits have a significant impact on equity prices; and

- earnings yields, all else constant, are positively, not negatively, related to credit yields – that is, the relation between earnings yields and credit yields is the opposite of what one would expect to find were credits capitalised into equity prices.

Tax Statistics

The AER has in the past based estimates of the value of imputation credits distributed in part on the fraction of imputation credits redeemed computed from tax statistics. In its recently released *Explanatory Statement*, it indicates that it will use tax statistics going forward to estimate the value of credits distributed.

The market will place a value on imputation credits distributed if and only if the distribution of credits lowers the cost of equity, exclusive of a value assigned to credits distributed. We

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9 Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

10 Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

11 Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

emphasise that one cannot determine the difference between the cost of equity that will prevail when credits are distributed and the cost of equity that would prevail were no credits to be distributed simply by measuring the fraction of credits that are redeemed from tax statistics. This is because domestic investors who redeem credits would be likely to place a smaller fraction of their wealth in domestic equities were no credits to be distributed and because foreign investors would be likely to place a larger fraction of their wealth in domestic equities. Potential but not current holders of domestic equities can play an important role in determining what impact the distribution of credits will have on the cost of equity. The tax statistics compiled by the Australian Taxation Office do not, of course, provide information about the characteristics of potential holders of domestic equities.

To illustrate the role that potential holders of domestic equities can have on the impact of imputation credits on the cost of equity, Lajbcygier and Wheatley (2012) provide a simple analytical example. Their examples shows that the impact of imputation credits distributed on the market risk premium, exclusive of a value assigned to credits, can be negligible even when domestic investors redeem all credits distributed, that is, even when the utilisation rate is one. [12] This result suggests that redemption rates drawn from tax statistics may provide a very unreliable guide as to the value that the market places on imputation credits.

Implications

The tests that Lajbcygier and Wheatley (2012) and Siau, Sault and Warren (2013) conduct do not suffer from the problems associated with the use of tax statistics. [13] This is because these tests do not attempt to gauge the impact of imputation credits on the cost of equity by extrapolating what the impact might be from aggregate tax statistics. The tests instead compare directly the prices of and returns delivered by firms that do and do not distribute credits. Lajbcygier and Wheatley examine whether, holding risk constant, there is a negative relation between the return that a long-term investor would earn on an investment in a firm's equity and the firm's credit yield. Siau, Sault and Warren examine whether long-term investors place a higher value on a firm that distributes imputation credits than on an otherwise identical firm that distributes no credits. Both sets of authors conclude that there is no evidence to suggest that the market places a value on imputation credits distributed and the additional evidence that we provide in this report supports this conclusion.

Finally, neither the tests that Lajbcygier and Wheatley (2012) conduct and we update nor the tests that Siau, Sault and Warren (2013) conduct are affected in any way by higher-than-average trading volumes around ex-dividend dates. [14]

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[12] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[13] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[14] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

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1. Introduction

This report has been prepared for the Energy Networks Association (ENA) by NERA Economic Consulting (NERA). The ENA has asked NERA to provide and review evidence on the value that the market places on imputation credits distributed.

In particular, the ENA has asked NERA to:

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- set out the advantages of the methodologies employed by Lajbcygier and Wheatley and of Siau, Sault and Warren relative to the use of aggregate tax statistics for the purposes of estimating the value of imputation credits; and
- update the results of the Lajbcygier and Wheatley study and explain their relevance to estimating the value of imputation credits.

The remainder of this report is structured as follows:

- section 2 describes the framework that the Australian Energy Regulator (AER) uses in determining a rate of return for a regulated utility and the role that imputation credits play in the framework;
- section 3 describes the methodology that Lajbcygier and Wheatley (2012) use and provides an update of the results that they supply; [16]
- section 4 describes the methodology that Siau, Sault and Warren (2013) use and the results that they provide; [17] and
- section 5 offers conclusions.

In addition, Appendix A provides details of the estimation procedure that Lajbcygier and Wheatley (2012) and we use, Appendix B provides the terms of reference for this report, Appendix C provides a copy of the Federal Court of Australia's *Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia* and Appendix D provides the curricula vitae of the two authors of the report. [18]

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[15] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[16] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[17] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[18] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

1.1. Statement of Credentials

This report has been jointly prepared by **Simon Wheatley** and **Brendan Quach**.

Simon Wheatley is a Special Consultant with NERA, and was until 2008 a Professor of Finance at the University of Melbourne. Since 2008, Simon has applied his finance expertise in investment management and consulting outside the university sector. Simon's interests and expertise are in individual portfolio choice theory, testing asset-pricing models and determining the extent to which returns are predictable. Prior to joining the University of Melbourne, Simon taught finance at the Universities of British Columbia, Chicago, New South Wales, Rochester and Washington.

Brendan Quach is a Senior Consultant at NERA with eleven years experience as an economist, specialising in network economics and competition policy in Australia, New Zealand and the Asia Pacific. Since joining NERA in 2001, Brendan has advised a wide range of clients on regulatory finance matters, including approaches to estimating the cost of capital for regulated infrastructure businesses.

In preparing this report, the joint authors (herein after referred to as 'we' or 'our' or 'us') confirm that we have made all the inquiries that we believe are desirable and appropriate and that no matters of significance that we regard as relevant have, to our knowledge, been withheld from this report. We acknowledge that we have read, understood and complied with the Federal Court of Australia's *Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia*. We have been provided with a copy of the Federal Court of Australia's *Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia*, dated 4 June 2013, and our report has been prepared in accordance with those guidelines.

We have undertaken consultancy assignments for the Energy Networks Association in the past. However, we remain at arm's length, and as independent consultants.

2. Theory

Australia has had an imputation tax system since 1 July 1987. The idea behind the system is to avoid corporate profits being taxed twice. Under a classical tax system, corporate profits are taxed at the corporate level and may be taxed again at the personal level. Under an imputation system, an imputation credit is provided to individuals or institutions for tax paid at the corporate level. Imputation credits, therefore, can alter the rate at which individuals pay taxes at the personal level. An imputation credit can be used to offset Australian tax due on the dividend to which the credit is attached or tax due on other income. Since 1 July 2000 investors have also been able to use credits to produce a rebate from the Australian Tax Office (ATO).

In principle, imputation credits that can be used by investors to reduce the taxes that they pay at the personal level can affect the cost of equity, exclusive of a value assigned to credits, and so the values of companies. Officer (1994) examines what impact imputation credits should have on the way in which one assesses company values. He introduces a parameter he labels *gamma* that represents the 'value of personal tax credits' created, and he incorporates gamma into measures of the weighted average cost of capital (*WACC*).

The framework that the AER and other Australian regulators use is based on the perpetuity framework of Officer (1994). [19] So we begin by describing Officer's framework and the pricing model that he suggests that one can use to estimate the cost of equity.

2.1. Officer's Perpetuity Framework

Investors, besides the imputation credits that they may be able to redeem, face a wide array of taxes at the personal level on the dividends and interest that they receive. So an important question is: How should these credits and taxes affect the *WACC* formula that one should use for discounting cash flows conventionally defined? The answer is that, in a simple perpetuity framework, taxes levied at the personal level on income from equity and debt and credits distributed to equity holders will not affect the *WACC* formula that one should use. As Berk and DeMarzo make clear in their corporate finance text:[20]

> *'the WACC method does not change in the presence of investor taxes.'*

Personal taxes and credits distributed can affect the return that the market requires on equity and the return that the market requires on debt, but they do not, in a perpetuity framework, affect the *WACC* formula that one should use. If personal taxes on dividends are high, the market may require that the return to equity that pays dividends be high. If personal taxes on interest are high, the market may require that the return to holding debt be high. If imputation credits can be used to reduce personal taxes, the market may accept a lower return, exclusive of a value assigned to credits, to equity that delivers credits. So taxes at the

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[19] Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

[20] Note that the emphasis is theirs.

Berk, Jonathan and Peter DeMarzo, 2007, Corporate Finance, Pearson Addison-Wesley, Boston, MA, USA, page 606.

personal level and credits distributed can surely affect a company's *WACC* conventionally defined. Taxes at the personal level and credits distributed, though, will not affect the *WACC* formula that one should use for discounting cash flows conventionally defined. As Berk and DeMarzo (2007) emphasize, in the conventional *WACC* formula:[21]

> 'the equity and debt cost of capital in the market *already* reflects the effects of investor taxes.'

Suppose that a firm is expected to deliver an operating income before taxes of X_O in perpetuity, that it has perpetual risk-free debt with market value D outstanding that will pay interest at the rate of r_D per period, that the market value of its equity is E, the cost of equity, exclusive of personal taxes or credits received, is $\mathrm{E}(r_E)$ per period and that the corporate tax rate is T.

If the firm follows a policy of maintaining a constant leverage through time, the value of the firm will be given by:

$$V = \frac{X_O - T(X_O - r_D D)}{WACC}, \tag{1}$$

where

$$WACC = \frac{D}{V} r_D + \frac{E}{V} \mathrm{E}(r_E) \tag{2}$$

In words, the value of the firm will be the after-corporate-tax net cash flows that the market expects the firm to deliver in perpetuity discounted at the firm's *WACC* conventionally defined.

Officer (1994) provides an alternative way of valuing a firm when there are credits issued that lower personal taxes.[22] He provides a definition for the cost of equity for a firm that includes a portion of the imputation credits that the firm issues. In particular, he defines the cost of equity after company tax but before personal tax to be:

$$\mathrm{E}(\hat{r}_E) = \left(\frac{1 - (1 - \gamma)T}{1 - T} \right) \mathrm{E}(r_E), \tag{3}$$

where γ is the ratio of the value of imputation credits created to the face value of the credits. To be clear, $\mathrm{E}(r_E)$ represents the required return on equity excluding imputation credits and

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[21] Again, Berk and DeMarzo provide the emphasis

Berk, Jonathan and Peter DeMarzo, 2007, Corporate Finance, Pearson Addison-Wesley, Boston, MA, USA, page 606.

[22] Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

$\mathrm{E}(\hat{r}_E)$ represents the required return on equity including imputation credits.[23] Similarly, Officer defines the *WACC* after company tax but before personal tax (i.e., including the value of imputation credits) to be:

$$\hat{WACC} = \frac{D}{V} r_D + \frac{E}{V} \mathrm{E}(\hat{r}_E) \tag{4}$$

Officer (1994) shows that one can use this after-company-tax but before-personal-tax *WACC* to compute the value of the firm. One can do so if instead of discounting the after-corporate-tax net cash flows of $X_O - T(X_O - r_D D)$ at the *WACC* defined by (2), one discounts the after-corporate-tax but before-personal-tax net cash flows of $X_O - (1 - \gamma) T(X_O - r_D D)$ at the *WACC* defined by (4). In other words, one can compute the value of the firm as:

$$V = \frac{X_O - (1-\gamma)T(X_O - r_D D)}{\hat{WACC}} \tag{5}$$

Conditional on a choice for the cost of equity exclusive of credits, r_E, the value of the firm one derives by using the formula (5) will be independent of the value of gamma. This implies that Officer's framework is consistent with the conventional framework that Berk and DeMarzo (2007) describe because one can always set gamma to be zero.[24] The insertion of gamma into numerator of (5) is *necessitated* by defining the cost of equity in such a way that it too depends on gamma.

2.2. Officer's Pricing Model

Officer (1994) also provides a model that one can use to estimate the cost of equity after company tax but before personal tax.[25] He assumes implicitly that:

(i) risk-averse investors choose between portfolios on the basis of the mean and variance of each portfolio's return, inclusive of a value assigned to credits received, measured over a single period;

(ii) share the same investment horizon and beliefs about the distribution of returns;

(iii) face the same rate of tax on all forms of income and no transaction costs; and

(iv) can borrow or lend freely at a single risk-free rate.

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[23] Note that Officer assumes that a firm is expected to deliver an operating income before taxes of X_O in perpetuity. If instead the operating income before taxes that a firm is expected to deliver will grow through time, then the expression (3) will no longer represent the required return on equity including imputation credits.

[24] Again, Berk and DeMarzo provide the emphasis

Berk, Jonathan and Peter DeMarzo, 2007, Corporate Finance, Pearson Addison-Wesley, Boston, MA, USA, page 606.

[25] Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

With these assumptions, the market portfolio of all risky assets must be mean-variance efficient on a with-a portion-of-credits basis. A portfolio that is mean-variance efficient is a portfolio that has the highest mean return for a given level of risk, measured by variance of return.

If the market portfolio is mean-variance efficient on a with-a portion-of-credits basis, the following condition will hold: [26]

$$\mathrm{E}(\hat{r}_j) = r_f + \beta_j[\mathrm{E}(\hat{r}_m) - r_f], \tag{6}$$

where:

$\mathrm{E}(\hat{r}_j)$ = the mean return on asset *j* inclusive of a value assigned to credits;

r_f = the risk-free rate;

β_j = asset *j*'s beta; and

$\mathrm{E}(\hat{r}_m)$ = the mean return to the market portfolio of risky assets inclusive of a value assigned to credits.

Officer's model makes two predictions:

- the cost of equity for a firm, inclusive of a value assigned to imputation credits, will be a positive linear function of its beta; and
- if the market places a value on credits distributed, then there will be a negative relation, holding beta constant, between the cost of equity for a firm, exclusive of a value assigned to credits, and the firm's credit yield. Moreover, the relation will be stronger the greater is *theta*, that is, the value that the market places on a one-dollar credit distributed.

To see that the second prediction must hold, consider the following simple example. Let there be two firms, A and B. Suppose that A distributes credits but B, for some unspecified reason, never distributes credits. Assume that the two firms are otherwise identical. Then if Officer's model is true, it must be the case that, in equilibrium, the costs of equity for the two firms, inclusive of a value assigned to imputation credits, are equal. That is, it must be the case that:

$$\mathrm{E}(\hat{r}_A) = \mathrm{E}(\hat{r}_B) \tag{7}$$

Since A distributes credits while B does not, however, it must also be the case that the cost of equity for A, exclusive of a value assigned to credits, must lie below the cost of equity for B, exclusive of a value assigned to credits. That is, it must also be true that:

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[26] Note that the left-hand side of (6) will in general only match the right-hand side of (3) for a firm whose operating income before taxes is a perpetuity.

$$\mathrm{E}(r_A) < \mathrm{E}(r_B) \tag{8}$$

Moreover, the difference between the cost of equity for A, exclusive of a value assigned to credits, and the cost of equity for B, exclusive of a value assigned to credits will be greater the larger is theta. In simple terms, holding the with-credit required return on equity constant, a greater return from imputation credits means that the balance of the required return is lower.

Lajbcygier and Wheatley (2012) test the proposition there will be a negative relation, all else constant, between the cost of equity for a firm, exclusive of a value assigned to credits, and the firm's credit yield and we update their results. [27] The tests that Lajbcygier and Wheatley conduct and that we update are not affected in any way by higher-than-average trading volumes around ex-dividend dates.

2.3. The Value of Imputation Credits

If the cost of equity, exclusive of a value assigned to credits, for a firm that distributes credits lies below the cost of equity, exclusive of a value assigned to credits, for a firm that distributes no credits, then distributing credits must add value to the firm. To see this, assume once more that there are two firms, A and B. Assume also that A distributes credits but B does not. Finally, assume that the two firms are otherwise identical, perpetual and, for simplicity, unlevered.

In equilibrium, the cost of equity for A, inclusive of a value for credits, must match the cost of equity for B, inclusive of a value for credits. B, however, distributes no credits, so from (3), it must be the case that:

$$\mathrm{E}(r_B) = \mathrm{E}(\hat{r}_B) = \mathrm{E}(\hat{r}_A) = \left(\frac{1-(1-\gamma)T}{1-T}\right)\mathrm{E}(r_A)\,, \tag{9}$$

It follows, from (1), that the value of firm A will be:

$$V_A = \frac{X_O(1-T)}{\mathrm{E}(r_A)} = \frac{X_O(1-(1-\gamma)T)}{\mathrm{E}(r_B)} = V_B + \frac{\gamma TX_O}{\mathrm{E}(r_B)} > V_B\,, \tag{10}$$

where V_B is the value of firm B. Thus the value of the imputation credits that A will provide will be:

$$\frac{\gamma TX_O}{\mathrm{E}(r_B)} = \frac{\gamma TX_O}{\mathrm{E}(\hat{r}_A)} \tag{11}$$

In words, the value of the imputation credits that A will provide is the value of the credits that A will deliver each period in perpetuity discounted at A's with-credit cost of equity. Siau, Sault and Warren (2013) conduct tests of the proposition that equity prices reflect the

[27] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

discounted value of the credits that firms are expected to distribute.[28] The tests that Siau, Sault and Warren conduct are not affected in any way by higher-than-average trading volumes around ex-dividend dates.

2.4. Taxation Statistics

The AER has in the past based estimates of the value of imputation credits distributed in part on the fraction of imputation credits redeemed computed from tax statistics. In its recently released *Explanatory Statement*, it indicates that it will use tax statistics going forward to estimate the value of credits distributed. We briefly examine here some of the problems associated with the use of tax statistics.

There is almost uniform agreement that imputation credits are of some use to domestic investors and are of little or no use to foreign investors. Since imputation credits are of some use to domestic investors, domestic investors will rationally harvest credits up to the point where the costs of harvesting credits match the benefits of doing so. The ATO places limits on the extent to which domestic investors can harvest imputation credits without being exposed to the risks associated with holding domestic equities. So harvesting credits necessarily requires domestic investors place a larger fraction of their wealth in domestic equities than they would in the absence of an imputation system. Put another way, the harvesting of credits by domestic investors necessarily requires foreign investors place a smaller fraction of their wealth in domestic equities than they would in the absence of an imputation system. The additional risk that domestic investors must bear by placing a larger fraction of their wealth in domestic equities is one of the costs that they face in harvesting imputation credits.

The question that a regulator must answer is what impact the distribution of credits by a company will have on the company's cost of equity and what impact the distribution of credits by companies in general will have on the cost of equity for the domestic market as a whole. To answer this question requires one compare the cost of equity that will prevail when credits are distributed to the cost of equity that would prevail were no credits to be distributed. One cannot, however, determine the difference between the cost of equity that will prevail when credits are distributed and the cost of equity that would prevail were no credits to be distributed simply by measuring the fraction of credits that are redeemed from tax statistics. This is because domestic investors who redeem credits would be likely to place a smaller fraction of their wealth in domestic equities were no credits to be distributed and because foreign investors would be likely to place a larger fraction of their wealth in domestic equities.

This analysis suggests that even if all credits were currently redeemed by domestic investors, one could still not determine the difference between the cost of equity that will prevail when credits are distributed to the cost of equity that would prevail were no credits to be distributed from tax statistics. This is because foreign investors who may not hold domestic equities when credits are distributed might well hold domestic equities were no credits to be

[28] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

distributed. The tax statistics compiled by the ATO do not provide information about the characteristics of potential holders of domestic equities. These potential holders of domestic equities, however, can play an important role in determining what impact the distribution of credits will have on the cost of equity.

Lajbcygier and Wheatley (2012) provide a simple general-equilibrium example that illustrates the points that we make here. [29] In their example, aside from an inability of foreign investors to redeem imputation credits, there are no barriers to international investment. There is a single domestic risky asset, a single foreign risky asset and a risk-free asset in zero net supply. Imputation credits are financed by a tax on dividends and interest and aggregate foreign wealth exceeds aggregate domestic wealth. When credits are distributed, only domestic investors hold the domestic risky asset and so all credits are redeemed. On the other hand, when no credits are distributed, foreign investors also hold the domestic risky asset. As a result, foreign investors play an important role in determining the impact that credits will have on the domestic cost of equity. This is true even though under an imputation system they do not hold the domestic risky asset.

Table 2.1 shows how, in the model, domestic investors respond to the distribution of imputation credits. The table shows that the domestic without-credit market risk premium is barely affected by the introduction of an imputation system when aggregate domestic wealth is a small fraction of world wealth – as is true of Australia. For example, if the ratio of domestic to foreign wealth is around two per cent, then in Lajbcygier and Wheatley's (2012) model, introducing a credit yield of three per cent lowers the domestic without-credit equity premium by just 6 basis points. [30] The domestic without-credit market risk premium is barely affected even though, in the model, domestic investors redeem all the imputation credits that are distributed, that is, even though the utilisation rate is one.

Table 2.1
Impact of imputation credits on domestic without-credit market risk premium

Ratio of domestic wealth to world wealth	Credit yield	Share of domestic market held by domestic investors	Domestic without-credit market risk premium
1.96	0.00	1.96	6.06
1.96	3.00	100.00	6.00
9.09	0.00	9.09	6.29
9.09	3.00	100.00	6.00
33.33	0.00	33.33	7.04
33.33	3.00	100.00	6.00

Source: Lajbcygier, P. and S.M. Wheatley, Imputation credits and equity returns, Economic Record, 2012, page 494.

[29] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[30] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

To summarise, the use of redemption rates drawn from tax statistics will not provide a reliable guide as to the value of imputation credits distributed, that is, theta. Potential holders of domestic equities can play an important role in determining what impact the distribution of credits will have on the cost of equity. The tax statistics compiled by the ATO, though, do not provide information about the characteristics of these investors.

2.5. Equity Ownership

Measuring the proportion of the value of domestic equities held by domestic investors is just an indirect way of estimating the average redemption rate. So the arguments that we provide here also indicate that one cannot determine the impact of imputation credits distributed on the cost of equity from an analysis of domestic equity ownership prevailing under an imputation system. This is because equity ownership in the absence of an imputation system is likely to differ and ownership in the absence of an imputation system will play an important role in determining the impact of credits on the cost of equity.

3. Imputation Credits and Equity Returns

The AER's framework presumes that imputation credits distributed lower the without-credit cost of equity. Lajbcygier and Wheatley (2012) test this proposition and in this section we update the results of their tests. [31]

Lajbcygier and Wheatley (2012) use data for individual equities and for portfolios formed on the basis of past credit yields from July 1987 to December 2009. [32] They also use a number of different asset pricing models. Here, we update their results using data from July 1987 to December 2012, Officer's (1994) model and versions of the Black CAPM and Fama-French three-factor model that allow the market to place a value on imputation credits. [33]

We find, like Lajbcygier and Wheatley (2012), that: [34]

- there is a positive, rather than a negative relation, holding a firm's equity beta or betas constant, between the firm's without-credit cost of equity and its credit yield; and

- there is no evidence that the July 2000 change to the imputation system led to a significant increase in the value of a one-dollar credit – in contrast, the evidence typically points to a decline in the value rather than the increase that the documented rise in the fraction of credits redeemed after the change might suggest.

Like the tests that Siau, Sault and Warren (2013) conduct, the tests that Lajbcygier and Wheatley (2012) conduct and that we update are not affected in any way by higher-than-average trading volumes around ex-dividend dates. [35]

3.1. Methodology

We use three models to examine the relation between credit yields and equity returns. We use the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French three-factor model. [36]

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[31] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[32] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[33] Black, Fischer, *Capital market equilibrium with restricted borrowing*, Journal of Business 45, 1972, pages 444-454.

Fama, Eugene and Kenneth French, *Common risk factors in the returns to stocks and bonds*, Journal of Financial Economics 33, 1993, pages 3-56.

Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

[34] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[35] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[36] Black, Fischer, *Capital market equilibrium with restricted borrowing*, Journal of Business 45, 1972, pages 444-454.

Fama, Eugene and Kenneth French, *Common risk factors in the returns to stocks and bonds*, Journal of Financial Economics 33, 1993, pages 3-56.

Lintner, John, *The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets*, Review of Economics and Statistics 47, 1965, pages 13-37.

The original versions of the models assume that imputation credits either do not exist or have no impact on the cross-section of mean returns. Officer (1994) modifies the Sharpe-Lintner CAPM to allow credits distributed to have an impact and we modify the other two models in a similar manner.[37] Also, with each model, we examine the impact on estimates of the market value of credits distributed of allowing for a tax penalty on dividends. The modified versions of the CAPM predict that the market portfolio will be after-tax mean-variance efficient, that is, it has maximum mean after-tax return for a given variance of after-tax return. The modified version of the Fama-French three-factor model predicts that the market portfolio will be after-tax multifactor efficient, that is, it has maximum mean after-tax return for a given variance of after-tax return and given betas relative to a number of factors.[38]

Like Black and Scholes (1974) and Kalay and Michaely (2000), we compute a stock's dividend yield as the sum of the dividends paid over the previous year divided by the end-of-year price of the stock and we compute the stock's credit yield in a similar manner.[39] We do not, like Litzenberger and Ramaswamy (1979), classify stocks as dividend-paying stocks only in months in which the stocks go ex-dividend.[40] We do not do so because we wish to test for a cross-sectional relation between risk-adjusted credit yields and long-run risk-adjusted returns. As Kalay and Michaely show, most of the return variation that Litzenberger and Ramaswamy attribute to dividends can be traced to time-series variation between dividend-paying months and non-dividend paying months rather than to cross-sectional variation in returns.

To estimate the parameters of each model, we, like Lajbcygier and Wheatley (2012), use the two-pass methodology of Fama and MacBeth (1973) and Litzenberger and Ramaswamy (1979).[41] Appendix A provides a detailed description of the approach that Lajbcygier and Wheatley and we use. Here we provide only a brief outline.

In the first pass, for each stock and month least squares estimates are computed of the beta or betas that each pricing model employs using the last 60 months of data.

Sharpe, William F., *Capital asset prices: A theory of market equilibrium under conditions of risk*, Journal of Finance 19, 1964, pages 425-442.

[37] Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

[38] Fama (1996) explains what it means for a portfolio to be multifactor efficient.

[39] Black, F. and M. Scholes, *The effects of dividend yield and dividend policy on common stock prices and returns*, Journal of Financial Economics, 1974, pages 1-22.

Kalay, A. and R. Michaely, *Dividends and taxes: A reexamination*, Financial Management 29, 2000, pages 55-75.

[40] Litzenberger, R. and K. Ramaswamy, *The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence*, Journal of Financial Economics, 1979, pages 163-195.

[41] Fama, E. F. and J. D. Macbeth, *Risk, return and equilibrium: Empirical tests*, Journal of Political Economy, 1973, pages 607-636.

Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Litzenberger, R. and K. Ramaswamy, *The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence*, Journal of Financial Economics, 1979, pages 163-195.

In the second pass, for each month and pricing model estimates are computed of the parameters of a cross-sectional regression that relates risk-adjusted returns to risk-adjusted credit yields and, in some specifications that we use, risk-adjusted dividend yields. The output from the second pass includes a time series of estimates of the value that the market attaches to a one-dollar credit distributed and, in some specifications, a time series of estimates of the additional dollar with-dividend return that the market requires on a stock for each additional dollar of dividends paid.

To test hypotheses about the mean over time of each series of estimates we compare the sample mean of the series of estimates to its standard error computed in the usual way, that is, under the assumption that the series of estimates is independently and identically distributed over time.

There are two potential problems with the two-pass procedure. The first problem is that since the least squares estimate of the vector of betas measures the vector with error, the second-pass estimates will be biased. There are two ways of addressing this problem and we use both ways. The first way is to place stocks into portfolios, like Fama and MacBeth (1973), so as to diversify away much of the measurement error but to do so in such a manner as to retain as much of the cross-sectional variation in the second-pass regressors as possible.[42] The second way is to modify the second-pass estimator, as Litzenberger and Ramaswamy (1979) do, to take into account the errors-in-variables problem.[43]

The second problem with the two-pass procedure is that the Fama-MacBeth method of computing the standard errors attached to the second-pass estimates does not properly take into account the measurement error associated with the beta estimates. Shanken (1992) shows that if, conditional on the factors, returns are homoskedastic, Fama-MacBeth standard errors will be downwardly biased.[44] He notes, though, that for models in which the factors are portfolio returns the bias is likely to be small. Jagannathan and Wang (1998), on the other hand, show that if, conditional on the factors, returns are heteroskedastic, Fama-MacBeth standard errors can be upwardly biased.[45]

To examine the extent to which Fama-MacBeth standard errors are biased, Lajbcygier and Wheatley (2012) conduct bootstrap simulations that allow for heteroskedasticity and are calibrated to the portfolio data that they construct.[46] The simulations examine the properties of estimates that use the domestic version of the Sharpe-Lintner CAPM in which it is assumed there is no tax penalty associated with dividends. The results of their simulations indicate that the extent to which Fama-MacBeth standard errors mislead is negligible and that it is safe to rely on the standard errors to conduct inference. The results also show that the

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42 Fama, E. F. and J. D. Macbeth, *Risk, return and equilibrium: Empirical tests*, Journal of Political Economy, 1973, pages 607-636.

43 Litzenberger, R. and K. Ramaswamy, *The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence*, Journal of Financial Economics, 1979, pages 163-195.

44 Shanken, J., *On the estimation of beta pricing models*, Review of Financial Studies 5, 1992, pages 1-33.

45 Jagannathan, R. and Z. Wang, *An asymptotic theory for estimating beta-pricing models using cross-sectional regression*, Journal of Finance 53, 1998, pages 1285-1309.

46 Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

second pass-estimates are close to unbiased. We update their simulations to allow for the slightly larger sample that we use and, not surprisingly, we draw the same conclusions. So, like Kalay and Michaely (2000), in our empirical work, we use Fama-MacBeth standard errors and do not adjust the standard errors for the measurement error associated with the beta estimates. [47]

3.2. Data

We extract monthly returns from July 1983 to December 2012 for individual stocks and the imputation credits and dividends that the stocks deliver from SIRCA's Share Price and Price Relative Data Base (SPPR).[48] We exclude foreign stocks listed in Australia and also, to minimise the impact of market microstructure effects, stocks in each year that at the end of the previous year fell outside the top 500 by market capitalisation.[49] From the stocks remaining, we form a number of portfolios.

First, we form a value-weighted portfolio of the 500 stocks and use the portfolio as a proxy for the Australian market portfolio. Second, we form a value-weighted portfolio of small firms from the bottom 30 percent of firms and a value-weighted portfolio of big firms from the top 30 percent. We use the difference between the returns to these portfolios as the *SMB* (small minus big) factor in the Fama-French three-factor model and rebalance the portfolios at the end of each year. We form the *SMB* factor in this way because we take the *HML* (high minus low) factor from Ken French's web site and French constructs the *HML* factor in this way.[50]

Third, we form portfolios on the basis of credit yield. At the end of June each year we compute the credit yield for each stock as the sum of the imputation credits distributed over the previous 12 months divided by the price of the stock at the end of June, and we compute the dividend yield for each stock in a similar manner. We place stocks that paid no dividends over the 12 months and so delivered no credits in one portfolio, stocks that paid dividends but delivered no credits in another and stocks that delivered credits into five portfolios on the basis of their credit yields. So we form portfolios in a way that is similar to the manner in which Fama and French (1993) form portfolios on the basis of dividend yield – except that we compute yields by dividing by end-of-financial-year price while they compute yields by dividing by start-of-financial-year price. [51] We conduct tests that use these seven portfolios but also, separately, tests that use individual stocks.[52] Thus our results do not rely solely on

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47 Kalay, A. and R. Michaely, *Dividends and taxes: A reexamination*, Financial Management 29, 2000, pages 55-75.

48 The imputation system was introduced in July 1987 and we compute credit yields using 12 months of data and beta estimates using 60 months of data. So we extract data starting in July 1983.

49 We choose the top 500 because the All Ordinaries Index is constructed from the top 500 stocks.

50 See Fama and French (1998) for a detailed description of how they construct the *HML* factors that we use.

51 Fama, Eugene and Kenneth French, *Common risk factors in the returns to stocks and bonds*, Journal of Financial Economics 33, 1993, pages 3-56.

52 To ensure that extreme values do not heavily influence tests that use individual stocks, like Fama and French (1992), we winsorise the data that we use in the tests. In particular, we shrink extreme credit and dividend yields to their 99th percentiles. We do not, on the other hand, winsorise the data that we use in tests that employ portfolios.

the behaviour of a small number of large stocks or solely on the behaviour of a large number of small stocks. We use both portfolio and individual stock data.

Finally, we extract the one-month risk-free rate from the SPPR, the returns to growth and value portfolios from Ken French's web site and the yield to a 10-year Commonwealth Government Security (CGS) from the Reserve Bank. Since we use monthly data, we use as a proxy for the risk-free rate the one-month risk-free rate taken from the SPPR. We also examine, however, the sensitivity of our results to replacing this rate with the yield on a monthly basis to a 10-year CGS.

3.3. Summary Statistics

We use three models to test whether, holding risk constant, equity returns are related to credit yields. Table 3.1 provides summary statistics computed using monthly data from July 1988 to December 2012 for the three factors that the models employ. The means of the factors, aside from the *SMB* factor, take on the same signs that others have typically found, but none of the means differs significantly from zero at conventional levels. The imprecision with which we estimate the factor means suggests that our tests may lack power. We find, though, in what follows that, despite this imprecision, our tests have sufficient power that we are able to reject a number of important hypotheses. Table 3.1 also shows that there are some interesting differences between the credit yields and dividend yields of value stocks and growth stocks and between the credit yields and dividend yields of large-caps and small-caps. Value stocks tend to have higher credit yields and dividend yields than growth stocks. Similarly, large-caps tend to have higher credit yields and dividend yields than small-caps.

Table 3.1
Summary statistics for the three factors

	MMF	*HML*	*SMB*
Mean	3.38	4.14	-0.18
Standard deviation	13.21	12.67	13.48
Credit yield	1.54	0.52	-0.42
Dividend yield	4.13	1.42	-0.89

*Note: Estimates are computed using data from July 1988 to December 2012. Each factor is the return to a zero-investment portfolio and so returns and yields are the differences between the returns to and yields of two portfolios. The factor MMF is the difference between the return to the market portfolio and the risk-free rate. HML is the difference between the returns to portfolios of high and low book-to-market stocks and SMB is the difference between the returns to portfolios of low and high market-capitalisation stocks. All statistics are in per cent per annum. Sample means have been annualised by multiplying the monthly data by 1200 and standard deviations have been annualised by multiplying the standard deviations of the monthly data by $100 \times \sqrt{12}$. * indicates significantly different from zero at the 5 percent level.*

Our tests use individual stocks and seven value-weighted portfolios formed on the basis of past credit yields. Table 3.2 provides summary statistics for the seven portfolios computed using data from July 1988 through December 2012. Portfolio 1 contains stocks that paid no dividends and so delivered no credits over the previous year, portfolio 2 contains stocks that

paid dividends over the previous year but delivered no credits while portfolios 3 through 7 contain stocks that paid dividends over the previous year and delivered credits. The table shows that the mean returns in excess of the risk-free rate to portfolios 1 and 2, the two portfolios containing stocks that delivered no credits over the previous year, are unusually low. On the other hand, the table shows that the CAPM betas of the two portfolios computed relative to the domestic market portfolio are not, on average through time, substantially lower than the CAPM betas of the other five portfolios. Indeed, the beta of portfolio 1 is, on average, higher than the betas of the other portfolios. Thus the table suggests that a model that predicts that, holding beta constant, there should be a negative relation between mean returns and credit yields will have difficulty in explaining the data.

Table 3.2 also shows that portfolio 1 has on average a high *SMB* beta while portfolio 2 has on average an *HML* beta that is higher than most of the other portfolios. Table 3.1 indicates that the sample mean of the *SMB* factor is approximately zero while the sample mean of the *HML* factor is positive. Thus one would not expect the higher exposure to the *SMB* factor of portfolio 1 to have much impact on its return. The higher exposure to the *HML* factor of portfolio 2, on the other hand, suggests that it should have earned a higher not lower return on average over the sample period than the other portfolios. Thus the table suggests that a model that predicts that, holding the three Fama-French betas constant, there should be a negative relation between mean returns and credit yields will also have difficulty in explaining the data.

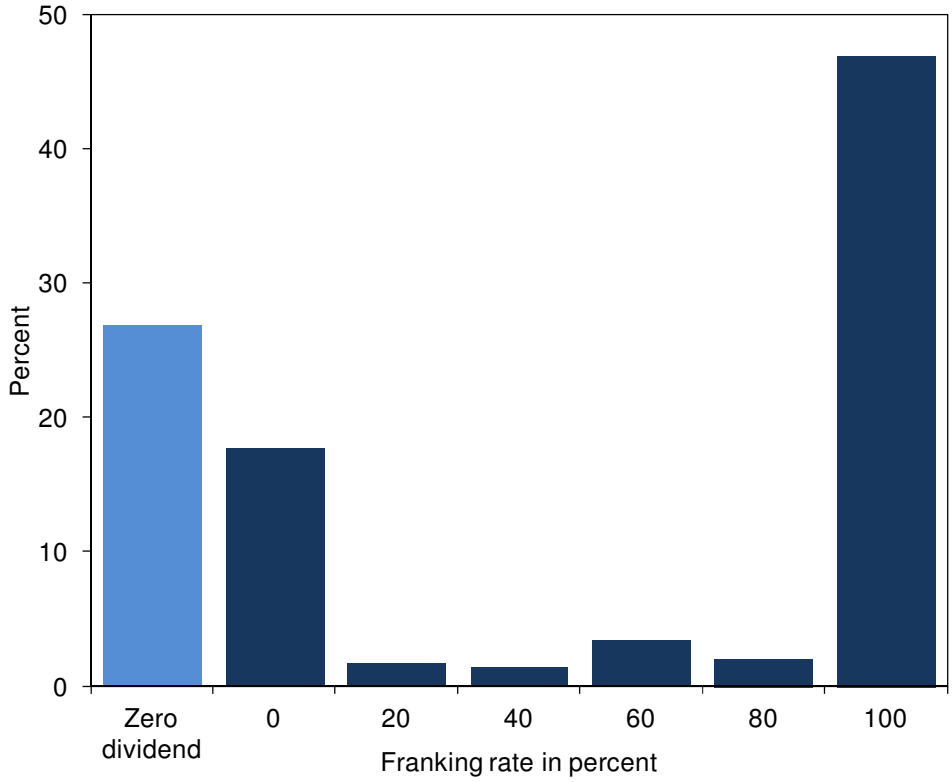
Table 3.2
Summary statistics for portfolios formed on the basis of past credit yields

					CAPM	Fama-French beta		
Portfolio	Number of stocks	Credit yield	Dividend yield	Mean excess return	Beta	Market	*HML*	*SMB*
1	75.37	0.30	0.93	-0.20	1.42	1.37	-0.19	0.84
2	48.97	0.17	5.21	-0.32	0.86	0.89	0.13	0.05
3	31.98	1.11	3.12	3.39	1.11	1.11	-0.10	0.01
4	32.37	1.71	3.58	5.25	1.01	1.01	-0.06	-0.08
5	32.29	2.21	4.49	5.96	0.93	0.94	0.07	-0.11
6	32.51	2.59	5.31	5.54	0.90	0.92	0.13	-0.11
7	31.93	3.35	6.50	4.56	0.82	0.82	0.07	-0.03

Note: The statistics are computed using data from July 1988 to December 2012. Portfolio 1 consists of stocks that paid no dividends in the previous year while portfolio 2 consists of stocks that paid a dividend in the previous year to which no credits were attached. Portfolios 3 through 7 consist of stocks that paid dividends to which credits were attached. The portfolios are value weighted and so all statistics, other than the average number of stocks in each portfolio in each month, are value-weighted averages. Betas are the value-weighted averages across time of estimates computed using the previous 60 months of data. Yields are in percent per annum and sample mean excess returns, which have been annualised by multiplying the means of the monthly data by 1200, are also in percent per annum.

Table 3.2 indicates that stocks that have not in the recent past delivered credits are likely to play an important role in tests for a relation between equity returns and credit yields. An examination of the distribution of the rates at which dividends are franked shows that stocks that pay dividends but deliver no credits must also play an important role in drop-off studies. Figure 3.1 shows the distribution of franking rates for the top 500 stocks from 1988 to 2012. 27 percent of the stocks do not pay a dividend, 18 percent pay a dividend but do not deliver a credit, 9 percent pay partially franked dividends while 47 percent pay fully franked dividends. [53] Credit yields and dividend yields are perfectly positively correlated across stocks that pay fully franked dividends. So were drop-off studies to use solely stocks paying fully franked dividends, the studies would be able to value only the package that is a one-dollar dividend and the credit attached to the dividend. The studies would be unable to value separately the dividend and credit. Drop-off studies therefore rely on stocks that do not pay fully franked dividends to determine separately the market value of a one-dollar dividend and the credit attached to the dividend.[54] As Figure 3.1 shows, 67 percent of these stocks are stocks that pay dividends but deliver no credits. [55]

Figure 3.1
Distribution of franking rates



[53] These percentages do not sum to 100 per cent because they are rounded.

[54] Drop-off studies do not use stocks that do not pay dividends. In contrast, our tests use these stocks.

[55] 18 percent of stocks pay a dividend but do not deliver a credit while 9 percent of stocks deliver credits but do not pay fully franked dividends. Thus 18/(18+9) = 67 percent of stocks that are not fully franked deliver no credit.

3.4. Credit Yields and Returns

The pricing model that is used by the AER to set the cost of equity assumes that the market places a value on imputation credits but does not impose a tax penalty on dividends.[56] So we start by examining models in which, holding risk constant, equity returns may be related to credit yields but, holding credit yields also constant, they are unrelated to dividend yields. Table 3.3 provides estimates of the value that the market places on a one-dollar credit computed using the three pricing models, individual stocks and the seven portfolios formed on the basis of past credit yields. The estimates of the value that the market places on a one-dollar credit are uniformly negative.[57] Tests that use the Sharpe-Lintner and Fama-French models reject the null that a nonpositive relation exists between equity returns and credit yields, holding risk constant, irrespective of whether the tests use individual stocks or portfolios formed on the basis of past credit yields. On the other hand, tests of the null that use the Black model do not reject the null – while estimates of the value that the market places on a one-dollar distributed that use the model do not differ significantly from zero, however, the estimates do differ significantly at the five per cent level from the value of 0.70 that the AER states that it plans to adopt in its *Explanatory Statement*.

Table 3.3
Estimates of the value that the market places on imputation credits

	Portfolios		Securities	
Model	Zero-beta excess return	Credit value	Zero-beta excess return	Credit value
Sharpe-Lintner		-1.74†		-1.21†
		(0.78)		(0.42)
Black	-2.51	-1.12	5.59*	-0.33
	(6.53)	(0.78)	(2.09)	(0.39)
Fama-French		-1.50†		-1.22†
		(0.75)		(0.41)

*Note: Estimates of the mean excess return to a zero-beta portfolio that delivers no credits, which have been annualised by multiplying the means of the monthly data by 1200, are in percent per annum. Credit value estimates are estimates of the dollar value that the market places on a one-dollar imputation credit. Standard errors are in parentheses. * indicates significantly greater than zero at the 5 percent level. † indicates significantly less than zero at the 5 percent level.*

The AER uses the 10-year CGS yield as a proxy for the risk-free rate. Replacing the one-month risk-free rate with the yield on a monthly basis on a 10-year CGS has little impact on our results. For example, estimates of the value that the market places on a one-dollar credit

[56] Whether there is a tax penalty on dividends will be determined by whether the tax rate that a representative investor faces on capital gains matches the rate that the investor faces on income.

[57] The value that the market places on a one-dollar credit cannot be truly negative because the receipt of a credit can never make an investor worse off.

that use the Sharpe-Lintner CAPM and portfolio and security data are -1.64 and -1.31 and the standard errors attached to the estimates are 0.77 and 0.44.

Table 3.3 also provides estimates that use the Black model of the mean excess return to a zero-beta portfolio. Since we form portfolios on the basis of past credit yields and not, in addition, on the basis of past estimates of risk, we do not expect estimates of the mean excess return to a zero-beta portfolio that use the seven portfolios to be precise.[58] Table 3.3 indicates that this expectation is borne out and so we focus on the individual stock estimate.[59] The estimate of the mean excess return on a zero-beta portfolio that uses individual stocks is large and positive and significant at the five percent level. The estimate of the mean excess return to a zero-beta portfolio is sufficiently large, for example, that the estimate exceeds the estimate of the mean excess return to the market portfolio that appears in Table 3.1.

3.5. Credit Yields, Dividends and Returns

A potential explanation for the positive relation that we document, holding risk constant, between equity returns and credit yields is that the relation arises from an omitted variables bias. In particular, a potential explanation is that the relation arises from a positive relation, generated by the impact of taxes, between equity returns and dividend yields, holding credit yields and risk constant, and a positive relation between credit yields and dividend yields. To determine whether this explanation is consistent with the data, we test whether equity returns are related, holding risk constant, to both credit yields and dividend yields. Table 3.4 provides estimates of the additional dollar with-dividend return that the market requires for each additional dollar of dividends paid using the three pricing models, individual stocks and the seven portfolios formed on the basis of past credit yields. The estimates of the additional dollar with-dividend return that the market requires for each additional dollar of dividends paid do not differ significantly from zero. On the other hand, as before, tests that use the Sharpe-Lintner and Fama-French models reject the null that a non-positive relation exists between equity returns and credit yields, holding risk constant, irrespective of whether the tests use individual stocks or portfolios formed on the basis of past credit yields.

Tests of the null that use the Black model and portfolios reject but tests that use the Black model and individual securities do not reject. While an estimate of the value that the market places on a one-dollar credit distributed that uses the Black CAPM and individual securities does not differ significantly from zero, however, the estimate does differ significantly at the five per cent level from the value of 0.70 that the AER states that it plans to adopt in its *Explanatory Statement*.

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[58] We do not sort stocks into portfolios on the basis of past credit yields and past estimates of risk because with up to three different measures of risk each portfolio would end up containing relatively few stocks.

[59] Each month the tests that use individual stocks employ around 500 stocks and there is likely to be a substantial variation in risk across these stocks. Thus it is not surprising that the estimates of the zero-beta rate and the value that investors place on a one-dollar credit that we produce using individual stocks are more precise than their portfolio counterparts. Estimates of the risks of individual stocks, however, will be imprecise and this lack of precision, as we explain above, can create an errors-in-variables problem. The modified second-pass estimator of Litzenberger and Ramaswamy (1979) that we employ is designed to take this problem into account.

Litzenberger, R. and K. Ramaswamy, *The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence*, Journal of Financial Economics, 1979, pages 163-195.

Table 3.4
Estimates of the penalty that the market attaches to dividends and value that the market places on imputation credits

	Portfolios			Securities		
Model	Zero-beta excess return	Dividend penalty	Credit value	Zero-beta excess return	Dividend penalty	Credit value
SL		-0.05	-1.50†		0.22	-0.89†
		(0.76)	(0.87)		(0.23)	(0.45)
Black	0.17	-1.12	-1.65†	0.32*	-0.20	-0.37
	(0.66)	(0.90)	(0.90)	(0.18)	(0.23)	(0.42)
FF		0.12	-1.43†		0.15	-1.04†
		(0.74)	(0.87)		(0.21)	(0.44)

*Note: SL stands for Sharpe-Lintner while FF stands for Fama-French. Estimates of the mean excess return to a zero-beta portfolio that delivers no credits and pays no dividends, which have been annualised by multiplying the monthly excess returns by 1200, are in percent per annum. Dividend penalty estimates are estimates of the additional dollar with-dividend return that the market requires on a stock for each additional dollar of dividends paid. Credit value estimates are estimates of the dollar value that the market places on a one-dollar imputation credit. Standard errors are in parentheses. * indicates significantly greater than zero at the 5 percent level. † indicates significantly less than zero at the 5 percent level.*

3.6. Impact of Tax Regime Changes

There have been a number of changes to Australia's imputation system since its introduction in July 1987. The most recent change of July 2000 has made it easier for domestic investors to redeem imputation credits. Before July 2000, the tax rebate received by a domestic investor could not exceed the investor's tax liability. Since July 2000, however, a domestic investor has typically been able to redeem all credits received, regardless of the investor's liability. Handley and Maheswaran (2008) find that the July 2000 change had a significant impact on the fraction of credits redeemed.[60] They report that '67 per cent of distributed imputation credits were used to reduce personal taxes during 1990-2000, but this has increased to 81 per cent over 2001-2004.' Although the July 2000 change may have had an impact on the fraction of credits redeemed, however, it does not follow that the change will necessarily have had an impact on the returns required on equity. If equity markets are segmented, a change to the imputation system that raises the fraction of credits redeemed should lower the returns required on equity. If equity markets are – aside from an inability of foreign investors to redeem credits – integrated, a change to the imputation system, even though it may raise the fraction of credits redeemed, should have little impact on the returns that the market requires on equity.

[60] Handley, J. and K. Maheswaran, *A measure of the efficacy of the Australian imputation tax system*, Economic Record 84, 2008, pages 82-94.

To examine whether the July 2000 change had an impact on the returns that the market requires on equity, we test whether in July 2000 a structural break occurred in the relation between risk-adjusted returns and risk-adjusted credit yields. We test for a single structural break in July 2000 because tests for more than one break lack power and because of the importance that Handley and Maheswaran (2008) place on the July 2000 change to the imputation system.[61] We test for a structural break by computing an estimate of the value of a one-dollar credit distributed using data that begin in July 2000, computing an estimate using data from before July 2000 and testing whether the two estimates differ significantly.[62] The pricing model that the AER uses to set the cost of equity assumes that the market places a value on imputation credits but does not impose a tax penalty on firms that pay dividends. So we restrict our attention here to models in which, holding credit yields and risk constant, equity returns are unrelated to dividend yields.

Table 3.5 provides estimates of the value that the market places on a one-dollar credit computed using data from before July 2000 and estimates computed using data that begin in July 2000. Estimates of the value of a one-dollar credit computed using data either from before July 2000 or that begin in July 2000 are typically negative while, as was true in Table 3.3 and Table 3.4, estimates that use individual stocks tend to be more precise than those that use portfolios. Despite the lack of precision associated with the estimates, however, tests that use the Sharpe-Lintner and Fama-French models and data that begin in July 2000 reject the null that a nonpositive relation exists, holding risk constant, between equity returns and credit yields regardless of whether the tests use portfolios or individual securities.

Table 3.5 also provides estimates of the difference between the value of a one-dollar credit from July 2000 onwards and the value before July 2000. These estimates provide no evidence that the July 2000 change to the imputation system led to a significant increase in the value of a one-dollar credit. In contrast, the estimates typically point to a decline in the value rather than the increase that the documented rise in the fraction of credits redeemed after the change might suggest.

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[61] Handley, J. and K. Maheswaran, *A measure of the efficacy of the Australian imputation tax system*, Economic Record 84, 2008, pages 82-94.

[62] If the July 2000 change lowered the returns required on equity, an announcement of the change before July 2000 would have raised equity prices. Thus the impact of an announcement of the change before July 2000 should be to make any impact of the change on the returns required on equity easier to detect.

Table 3.5
Stability of estimates of the value that the market places on imputation credits

	Credit value estimates					
	Portfolios			Securities		
Model	Before July 2000	July 2000 – December 2012	Difference	Before July 2000	July 2000 – December 2012	Difference
Sharpe-Lintner	-1.57	-1.90†	-0.33	-0.46	-1.93†	-1.47†
	(1.03)	(1.17)	(1.55)	(0.49)	(0.68)	(0.84)
Black	-1.76†	-0.56	1.20	0.09	-0.74	-0.84
	(0.99)	(1.18)	(1.54)	(0.46)	(0.63)	(0.78)
Fama-French	-0.78	-2.13†	-1.35	-0.29	-2.11†	-1.81†
	(1.01)	(1.09)	(1.48)	(0.50)	(0.64)	(0.82)

Note: Credit value estimates are estimates of the dollar value that the market places on a one-dollar imputation credit. Standard errors are in parentheses. The significance of the difference between estimates computed using data from July 2000 to December 2012 and estimates computed using data from before July 2000 is determined using the Smith-Satterthwaite test described by Miller and Freund (1965).[63] ** indicates significantly greater than zero at the 5 percent level. † indicates significantly less than zero at the 5 percent level.*

[63] Miller, I. and J. E. Freund, *Probability and statistics for engineers*, Prentice-Hall, Englewood Cliffs, NJ, 1965.

4. Imputation Credits and Equity Prices

The AER's framework presumes that the market places a higher value on a firm that distributes imputation credits than on an otherwise identical firm that distributes no credits. Siau, Sault and Warren (2013) test this proposition and in this section we review the results of their tests. [64]

Siau, Sault and Warren (2013) employ two methods. [65] First, they use discounted cash flow valuation models to examine the relation between equity prices and the present values of the dividends and imputation credits that firms are expected to distribute. Second, they regress earnings yields on credit yields and a range of control variables. If imputation credits are capitalised into equity prices, then, all else constant, earnings yields should be negatively related to credit yields.

Siau, Sault and Warren (2013) use a sample of 468 publicly listed equities and data from 1996 to 2011 and find that: [66]

- on balance, no substantial evidence exists that imputation credits have a significant impact on equity prices; and
- earnings yields, all else constant, are positively, not negatively, related to credit yields – that is, the relation between earnings yields and credit yields is the opposite of what one would expect to find were credits capitalised into equity prices.

Like the tests that Lajbcygier and Wheatley (2012) conduct, the tests that Siau, Sault and Warren (2013) conduct are not affected in any way by higher-than-average trading volumes around ex-dividend dates. [67]

4.1. Methodology

4.1.1. Valuation models

To examine the relation between equity prices and the present values of the dividends and imputation credits that firms are expected to distribute, Siau, Sault and Warren (2013) first

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64 Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

65 Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

66 Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

67 Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

compute estimates of these present values. [68] They estimate the present value of the dividends that a share is expected to deliver as the sum of:

- the discounted value of the dividends analysts forecast will be paid over the remainder of the current fiscal year on the share;
- the discounted value of the dividends analysts forecast will be paid over the next fiscal year on the share; and
- the discounted value of the earnings analysts forecast will be paid over the year following the next fiscal year on the share, capitalised at the real cost of equity.

Thus Siau, Sault and Warren assume from the year following the next fiscal year that:

- a good proxy for dividends per share is earnings per share; and
- earnings per share are forecast to grow at the forecast rate of inflation, which they set at 2.5 per cent per annum.

Siau, Sault and Warren (2013) estimate the present value of the imputation credits that a share is expected to deliver as the product of the present value of dividends and the current credits delivered per dollar of dividends distributed. [69]

Armed with estimates of the present values of the dividends and imputation credits that firms are expected to distribute, Siau, Sault and Warren (2013) run the following regression: [70]

$$P_{jt} = \alpha + \beta PVD_{jt} + \gamma PVC_{jt} + \varepsilon_{jt} \quad (12)$$

where P_{jt} is the price of equity j at time t, PVD_{jt} is an estimate at time t of the present value of the dividends that a share of equity j is expected to deliver, PVC_{jt} is an estimate at time t of the present value of the imputation credits that a share of equity j is expected to deliver, ε_{jt} is a disturbance and α, β and γ are regression parameters. Siau, Sault and Warren use estimates of the cost of equity, inclusive of a value assigned to credits, generated by Officer's (1994) CAPM to estimate the present values of the dividends and imputation credits that firms are expected to distribute. [71] They assume that the market risk premium, inclusive of a value assigned to imputation credits is six per cent per annum, but they also examine the sensitivity of their results to changes in this value.

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[68] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[69] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[70] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[71] Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

If the present values of dividends and credits were estimated without error, then, in the regression (12), α would be zero, β would be one, and γ would be the value of a one-dollar credit distributed.

Just as estimates of the cost of equity for a portfolio are likely to be more precise than estimates of the cost of equity for an individual security, estimates of the present values of the dividends and imputation credits that firms are expected to distribute are also likely to be more precise for portfolios than for individual securities. So, in addition, Siau, Sault and Warren (2013) examine the ratio of price to an estimate of the present value of dividends for portfolios sorted on the basis of credit yields and dividend yields. [72] If the present values of dividends and credits were estimated without error and the market were to value credits distributed, then the ratio would exceed one and would be positively related to the credits that the portfolio delivers per dollar of dividends that it distributes.

To examine the sensitivity of their results to their choice of a valuation model, Siau, Sault and Warren (2013) also regress a stock's price on its book value, trailing and forward measures of earnings per share and the stock's credit yield. [73] This regression is motivated by the residual income valuation model of Ohlson (1995). [74]

4.1.2. Earnings yields

If imputation credits are capitalised into equity prices, then, all else constant, earnings yields should be negatively related to credit yields. Siau, Sault and Warren test this hypothesis by regressing a firm's one-year forward earnings yield on its imputation credit yield and a range of control variables that include an estimate of the firm's equity beta, the logarithm of the market capitalisation of its equity, the book-to-market ratio of its equity, forecasts of the growth in earnings per share for the firm, the firm's dividend yield and its leverage.

4.2. Evidence

4.2.1. Valuation models

Siau, Sault and Warren (2013) use a sample of 468 publicly listed equities and data from 1996 to 2011. [75] In regressions of price on estimates of the present value of the dividends and imputation credits that firms are expected to distribute that use individual equities, they estimate the value of a one-dollar credit distributed to be around 30 cents. This result, however, can be treated with some caution as estimates of the present values of the dividends

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[72] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[73] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

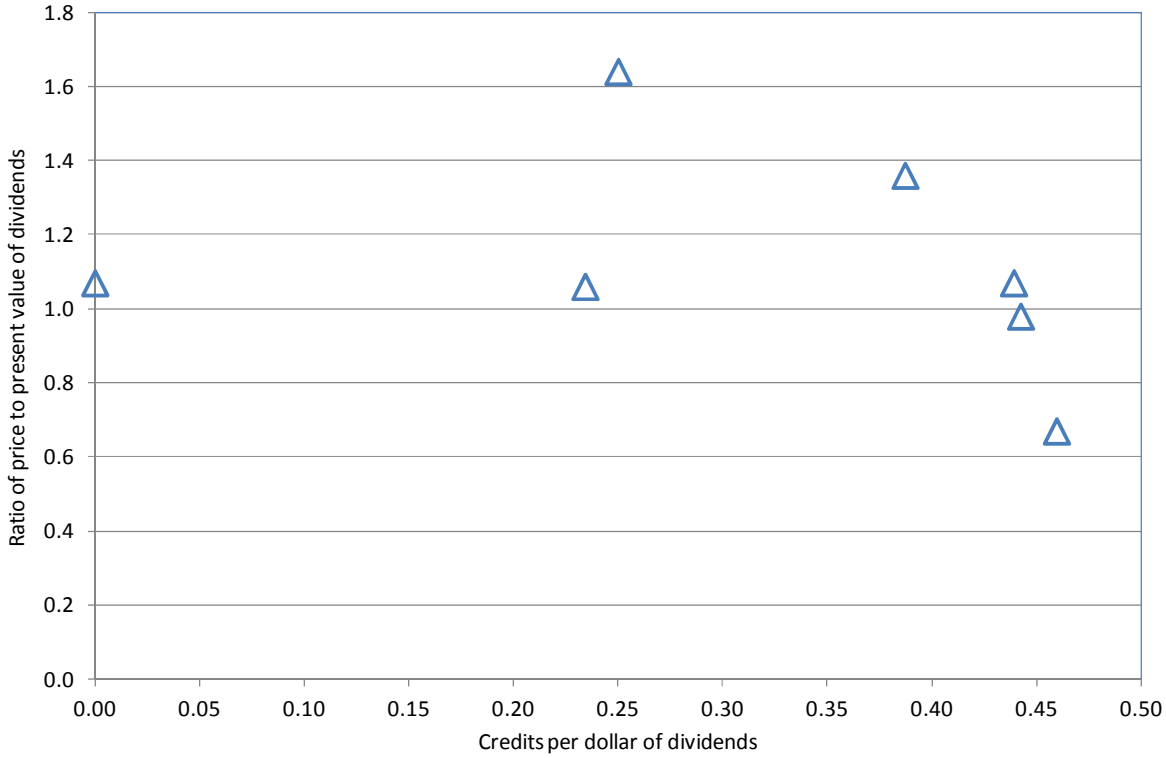
[74] Ohlson, J. A., *Earnings, Book values and dividends in equity valuation*, Contemporary Accounting Research, 1995, pages 661-687.

[75] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

and imputation credits that firms are expected to distribute are likely to be imprecise for individual securities.

In contrast, Siau, Sault and Warren (2013) find little evidence from the behaviour of the ratio of price to the present value of dividends, for portfolios formed on the basis of credit yields, to support the proposition that the market places a positive value on credits distributed.[76] Figure 4.1 below plots the ratio of price to the present value of dividends against credits delivered per dollar of dividends distributed. If the present values of dividends and credits were estimated without error and the market were to value credits distributed, then this ratio would on average exceed one. Testing this proposition is problematic because the result will hinge on the assumption one makes about the market risk premium, inclusive of a value assigned to credits. If the market were to place a value on credits distributed, however, the ratio would also be positively related to credits delivered per dollar of dividends distributed. The results of a test of this proposition do not hinge on the assumption one makes about the market risk premium.

Figure 4.1
Relation between ratio of price to present value of dividends and credits per dollar of dividends for portfolios formed on the basis of credit yields



Note: The market risk premium, inclusive of a value assigned to imputation credits, is assumed to be six per cent per annum. The graph uses results drawn from Table 5 of Siau, K-W., S. Sault and G.J. Warren, Are imputation credits capitalised in stock prices? Working paper, ANU, June 2013.

[76] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

Figure 4.1 is based on an assumption that the market risk premium is six per cent per annum and provides little evidence of a positive relation between the ratio of price to the present value of dividends and credits delivered per dollar of dividends distributed. An estimate of the correlation between the two quantities is -0.28.

Using a regression of stock price on book value, trailing and forward earnings per share and credit yield inspired by the residual income valuation model of Ohlson (1995), Siau, Sault and Warren do find some evidence that the market values credits distributed. [77] Unfortunately, however, because of the way in which the regression is set up it is not possible to extract an estimate from the results of the value that the market places on credits distributed. One can only conclude that the results of the regression provide evidence that the market values credits distributed.

4.2.2. Earnings yields

If imputation credits are capitalised into equity prices, then, all else constant, earnings yields should be negatively related to credit yields. Siau, Sault and Warren (2013) test this hypothesis by regressing a firm's one-year forward earnings yield on its credit yield and a range of control variables. [78] They find instead of a negative relation between earnings yields and credit yields, conditional on the control variables, a statistically significant positive relation. This evidence is not consistent with the proposition that imputation credits are capitalised into equity prices.

[77] Ohlson, J. A., *Earnings, Book values and dividends in equity valuation*, Contemporary Accounting Research, 1995, pages 661-687.

[78] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

5. Conclusions

This report has been prepared for the Energy Networks Association (ENA) by NERA Economic Consulting (NERA). The ENA has asked NERA to provide and review evidence on the value that the market places on imputation credits distributed.

In particular, the ENA has asked NERA to:

- explain the methodology of Lajbcygier and Wheatley (2012) and of Siau, Sault and Warren (2013); [79]
- explain whether the results of these studies would be affected by higher-than-average trading volumes around ex-dividend dates;
- set out the advantages of the methodologies employed by Lajbcygier and Wheatley and of Siau, Sault and Warren relative to the use of aggregate tax statistics for the purposes of estimating the value of imputation credits; and
- update the results of the Lajbcygier and Wheatley study and explain their relevance to estimating the value of imputation credits.

NERA understands that the ENA intends to submit this report as part of its response to the draft *Rate of Return Guidelines* released by the Australian Energy Regulator (AER) in August 2013 under the recently revised National Electricity Rules (NER) and National Gas Rules (NGR).

The new NER and NGR require that the estimated cost of corporate income tax for a network service provider include a value for imputation credits, gamma.[80] Gamma represents the value that equity investors place on imputation credits created through the payment of company income tax and is generally estimated as the product of two elements:

- the *payout* ratio, being the proportion of created credits distributed by companies to their shareholders; and
- *theta*, the market value of distributed imputation credits as a proportion of their face value.

In the AER's post tax revenue model the value of gamma is used to determine the proportion of the assumed company income tax that does not need to be included in a regulated firm's annual revenue requirement.

The AER's framework presumes that imputation credits distributed lower the without-credit cost of equity. Put another way, the AER uses a framework that presumes that the market places a higher value on a firm that distributes imputation credits than on an otherwise

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[79] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[80] NER 6.5.3, 6A.6.4 and NGR 87A.

identical firm that distributes no credits. Lajbcygier and Wheatley (2012) test the proposition that imputation credits distributed lower the without-credit cost of equity while Siau, Sault and Warren (2013) test the proposition that the market places a higher value on a firm that distributes imputation credits than on an otherwise identical firm that distributes no credits. [81]

Imputation credits are of some use to domestic investors but are of little or no use to foreign investors. So the value that the market places on imputation credits distributed will largely depend on the impact that foreign investors have on equity prices.

Lajbcygier and Wheatley (2012)

The AER has in the past relied exclusively on Officer's (1994) version of the Sharpe-Lintner Capital Asset Pricing Model (CAPM) and has indicated that, going forward, it intends to make the model its 'foundation' model. [82] Officer's model predicts that a firm's cost of equity, inclusive of a value assigned to imputation credits distributed, will depend on the firm's equity beta. The model also predicts that there will be a negative relation, holding a firm's equity beta constant, between the firm's cost of equity, exclusive of a value assigned to imputation credits distributed, and the firm's credit yield. A firm's credit yield is the ratio of the credits that a share of the firm's equity delivers over a year to the share's price. Lajbcygier and Wheatley (2012) find, however, rather than a negative relation between a firm's without-credit cost of equity and its credit yield, holding the firm's equity beta constant, a positive relation. [83] Thus they find no evidence that the AER should place a positive value on credits distributed. In other words, their evidence suggests that the AER should set theta, and so also gamma, to zero.

Lajbcygier and Wheatley (2012) use data for individual equities and for portfolios formed on the basis of past credit yields from July 1987 to December 2009. [84] They also use a number of different asset pricing models. In this report, we update their results using data from July 1987 to December 2012, Officer's model and versions of the Black CAPM and Fama-French three-factor model that allow the market to place a value on imputation credits. [85] We find, like Lajbcygier and Wheatley, that:

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[81] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[82] Lintner, John, *The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets*, Review of Economics and Statistics 47, 1965, pages 13-37.

Officer, Robert R., *The cost of capital of a company under an imputation tax system*, Accounting and Finance, 1994, pages 1-17.

Sharpe, William F., *Capital asset prices: A theory of market equilibrium under conditions of risk*, Journal of Finance 19, 1964, pages 425-442.

[83] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[84] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[85] Black, Fischer, *Capital market equilibrium with restricted borrowing*, Journal of Business 45, 1972, pages 444-454.

Fama, Eugene and Kenneth French, *Common risk factors in the returns to stocks and bonds*, Journal of Financial Economics 33, 1993, pages 3-56.

- there is a positive, rather than a negative relation, holding a firm's equity beta or betas constant, between the firm's without-credit cost of equity and its credit yield; and

- there is no evidence that the July 2000 change to the imputation system led to a significant increase in the value of a one-dollar credit – in contrast, the evidence typically points to a decline in the value rather than the increase that the documented rise in the fraction of credits redeemed after the change might suggest.

Siau, Sault and Warren (2013)

An alternative way of determining whether the market places a value on imputation credits is to examine whether equity prices reflect the discounted value of the credits that firms are expected to distribute. Siau, Sault and Warren (2013) use this alternative approach. [86] In particular, they employ two methods.

First, Siau, Sault and Warren (2013) use discounted cash flow valuation models to examine the relation between equity prices and the present values of the dividends and imputation credits that firms are expected to distribute. [87] Second, they regress earnings yields on credit yields and a range of control variables. If imputation credits are capitalised into equity prices, then, all else constant, earnings yields will be negatively related to credit yields.

Siau, Sault and Warren (2013) use a sample of 468 publicly listed equities and data from 1996 to 2011 and find that: [88]

- on balance, no substantial evidence exists that imputation credits have a significant impact on equity prices; and

- earnings yields, all else constant, are positively, not negatively, related to credit yields – that is, the relation between earnings yields and credit yields is the opposite of what one would expect to find were credits capitalised into equity prices.

Tax Statistics

The AER has in the past based estimates of the value of imputation credits distributed in part on the fraction of imputation credits redeemed computed from tax statistics. In its recently released *Explanatory Statement*, it indicates that it will use tax statistics going forward to estimate the value of credits distributed.

The market will place a value on imputation credits distributed if and only if the distribution of credits lowers the cost of equity, exclusive of a value assigned to credits distributed. We

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[86] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[87] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[88] Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

emphasise that one cannot determine the difference between the cost of equity that will prevail when credits are distributed and the cost of equity that would prevail were no credits to be distributed simply by measuring the fraction of credits that are redeemed from tax statistics. This is because domestic investors who redeem credits would be likely to place a smaller fraction of their wealth in domestic equities were no credits to be distributed and because foreign investors would be likely to place a larger fraction of their wealth in domestic equities. Potential but not current holders of domestic equities can play an important role in determining what impact the distribution of credits will have on the cost of equity. The tax statistics compiled by the Australian Taxation Office do not, of course, provide information about the characteristics of potential holders of domestic equities.

To illustrate the role that potential holders of domestic equities can have on the impact of imputation credits on the cost of equity, Lajbcygier and Wheatley (2012) provide a simple analytical example. Their examples shows that the impact of imputation credits distributed on the market risk premium, exclusive of a value assigned to credits, can be negligible even when domestic investors redeem all credits distributed, that is, even when the utilisation rate is one. [89] This result suggests that redemption rates drawn from tax statistics may provide a very unreliable guide as to the value that the market places on imputation credits.

Implications

The tests that Lajbcygier and Wheatley (2012) and Siau, Sault and Warren (2013) conduct do not suffer from the problems associated with the use of tax statistics. [90] This is because these tests do not attempt to gauge the impact of imputation credits on the cost of equity by extrapolating what the impact might be from aggregate tax statistics. The tests instead compare directly the prices of and returns delivered by firms that do and do not distribute credits. Lajbcygier and Wheatley examine whether, holding risk constant, there is a negative relation between the return that a long-term investor would earn on an investment in a firm's equity and the firm's credit yield. Siau, Sault and Warren examine whether long-term investors place a higher value on a firm that distributes imputation credits than on an otherwise identical firm that distributes no credits. Both sets of authors conclude that there is no evidence to suggest that the market places a value on imputation credits distributed and the additional evidence that we provide in this report supports this conclusion.

Finally, neither the tests that Lajbcygier and Wheatley (2012) conduct and we update nor the tests that Siau, Sault and Warren (2013) conduct are affected in any way by higher-than-average trading volumes around ex-dividend dates. [91]

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[89] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

[90] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

[91] Lajbcygier , P. and S. M. Wheatley, *Imputation credits and equity returns*, Economic Record, 2012, pages 476-494.

Siau, K-W., S. Sault and G.J. Warren, *Are imputation credits capitalised in stock prices?* Working paper, ANU, June 2013.

Appendix A. Two-Pass Methodology

Each model that we use imposes a restriction of the form:

$$\mathrm{E}\left(z_{jt} - \gamma_{0t} + \gamma_{1t} c_{jt} - \gamma_{2t} d_{jt}\right) = \beta_{jt} \mathrm{E}\left(z_{pt} - \gamma_{0t} \iota_k + \gamma_{1t} c_{pt} - \gamma_{2t} d_{pt}\right), \qquad \text{(A.1)}$$

where z_{jt} is the return on stock j in excess of the risk-free rate from month t-1 to month t, c_{jt} is the stock's credit yield, d_{jt} is the stock's dividend yield in excess of the risk-free rate, z_{pt} is a $k \times 1$ vector of factors whose first element is the return to a zero-investment strategy that is long the market portfolio and short the risk-free asset and whose other elements, if any, are the returns to other zero-investment strategies, c_{pt} is a $k \times 1$ vector of factor credit yields, d_{pt} is a $k \times 1$ vector whose first element is the market portfolio's dividend yield in excess of the risk-free rate and whose other elements, if any, are factor dividend yields, β_{jt} is a $1 \times k$ vector of betas, ι_k is a $k \times 1$ vector whose first element is one and whose remaining elements, if any, are zeroes, γ_{0t} is the mean return on a zero-beta portfolio in excess of the risk-free rate, γ_{1t} is the dollar value that the market places on a one-dollar credit distributed and γ_{2t} is the additional dollar with-dividend return that the market requires on a stock for each additional dollar of dividends paid.[118] If $k = 1$ and $\gamma_{0t} = \gamma_{2t} = 0$, then (A.1) collapses to Officer's CAPM in which credits distributed can lower the without-credit cost of equity. If, on the other hand, $k = 1$ and $\gamma_{1t} = 0$, then (A.1) collapses to the version of the CAPM that Litzenberger and Ramaswamy (1979) test in which dividends distributed can raise required returns. [119]

To estimate the parameters of each model, we use the two-pass methodology of Fama and MacBeth (1973) and Litzenberger and Ramaswamy (1979). [120]

In the first pass, for each stock j and month t least squares estimates are computed of the parameters of the time-series regression

$$z_{jt-s} = \alpha_{jt} + \beta_{jt} z_{pt-s} + \varepsilon_{jt-s}, \qquad s = 1,2,...,S, \qquad \text{(A.2)}$$

where α_{jt} and ε_{jt-s} are the regression intercept and disturbance. Like Litzenberger and Ramaswamy and Kalay and Michaely (2000), we choose the number of months S used to compute the estimates to be 60. [121]

In the second pass, for each month t weighted least squares estimates are computed of the parameters of the cross-sectional regression

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[118] The factors that we use are the returns to zero-investment strategies and so their credit yields and dividend yields are the differences between the credit yields and dividend yields of two sets of portfolios.

[119] Litzenberger, R. and K. Ramaswamy, *The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence*, Journal of Financial Economics, 1979, pages 163-195.

[120] Fama, E. F. and J. D. Macbeth, *Risk, return and equilibrium: Empirical tests*, Journal of Political Economy, 1973, pages 607-636.

Litzenberger, R. and K. Ramaswamy, *The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence*, Journal of Financial Economics, 1979, pages 163-195.

[121] Kalay, A. and R. Michaely, *Dividends and taxes: A reexamination*, Financial Management 29, 2000, pages 55-75.

$$\hat{y}_{jt} = \hat{x}_{jt}\Gamma_t + \eta_{jt}, \qquad j = 1,2,...,N_t, \quad t = 1,2,...,T, \tag{A.3}$$

where $\hat{y}_{jt} = z_{jt} - \hat{\beta}_{jt} z_{pt}$, $\hat{\beta}_{jt}$ is the least squares estimate of β_{jt} computed using data from *t*-*S* to *t*-1, $\hat{x}_{jt}$ is the 1 × 3 vector

$$\left[\; (1 - \hat{\beta}_{jt}\iota_k) \qquad (\hat{\beta}_{jt} c_{pt} - c_{jt}) \qquad (d_{jt} - \hat{\beta}_{jt} d_{pt}) \right] \tag{A.4}$$

or, depending on the model, a row vector containing a subset of the elements of (A.4) and Γ_t is the 3 × 1 vector

$$[\gamma_{0t} \qquad \gamma_{1t} \qquad \gamma_{2t}]' \tag{A.5}$$

or, again depending on the model, a column vector containing a subset of the elements of (A.5).

The weighted least squares estimator for Γ_t is given by

$$\hat{\Gamma}_t = \left(\sum_{j=1}^{N_t} \hat{x}_{jt}' \hat{\sigma}_{jt}^{-2} \hat{x}_{jt} \right)^{-1} \sum_{j=1}^{N_t} \hat{x}_{jt}' \hat{\sigma}_{jt}^{-2} \hat{y}_{jt}, \tag{A.6}$$

where $\hat{\sigma}_{jt}^2$ is an unbiased estimate of the variance of the regression disturbance ε_{jt-s} computed using data from months *t*-*S* through *t*-1.

Since the least squares estimate of the vector of betas measures the vector with error, the second-pass estimator of Γ_t will be biased. Litzenberger and Ramaswamy (1979) suggest that to address this issue, one use a modified estimator to take into account the errors-in-variables problem. [122] The modified estimator that we use is:

$$\hat{\Gamma}_t = \left(\sum_{j=1}^{N_t} \left(\hat{x}_{jt}' \hat{\sigma}_{jt}^{-2} \hat{x}_{jt} - \lambda w_{jt}' \hat{\Omega}_{jt}^{-1} w_{jt} \right) \right)^{-1} \sum_{j=1}^{N_t} \left(\hat{x}_{jt}' \hat{\sigma}_{jt}^{-2} \hat{y}_{jt} - \lambda \, w_{jt}' \hat{\Omega}_{jt}^{-1} v_{jt} \right), \tag{A.7}$$

where $\hat{\Omega}_{jt}$ is an unbiased estimate of the covariance matrix of the vector of factors z_{pt-s} computed using data from months *t*-*S* through *t*-1, $\lambda = (S-k-1)/((S-1)(S-k-3))$, $v_{jt} = -z_{pt}$, and

$$w_{jt} = [\, -\iota_k \qquad c_{pt} \qquad -d_{pt} \,] \tag{A.8}$$

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[122] Litzenberger, R. and K. Ramaswamy, *The effects of personal taxes and dividends on capital asset prices: Theory and empirical evidence*, Journal of Financial Economics, 1979, pages 163-195.

or, depending on the model, a matrix containing a subset of the columns of (A.8). [123]

[123] To see how the modification arises, note that if $\varepsilon_{jt-s} \sim \text{NID}(0, \sigma^2_{jt})$, then, conditional on the factors, $(S-k-1)\hat{\sigma}^2_{jt} / \sigma^2_{jt} \sim \chi^2_{S-k-1}$, $\text{E}(\hat{\sigma}^{-2}_{jt} \sigma^2_{jt} / (S-k-1)) = 1/(S-k-3)$ and

$$\text{E}(\hat{x}_{jt}' \hat{\sigma}^{-2}_{jt} \hat{x}_{jt}) = (S-1)\lambda x_{jt}' \sigma^{-2}_{jt} x_{jt} + \lambda w_{jt}' \hat{\Omega}^{-1}_{jt} w_{jt},$$

$$\text{E}(\hat{x}_{jt}' \hat{\sigma}^{-2}_{jt} \hat{y}_{jt}) = (S-1)\lambda x_{jt}' \sigma^{-2}_{jt} y_{jt} + \lambda w_{jt}' \hat{\Omega}^{-1}_{jt} v_{jt}$$

For further details, see Shanken (1992).

Shanken, J., *On the estimation of beta pricing models*, Review of Financial Studies 5, 1992, pages 1-33.

Appendix B. Terms of Reference

TERMS OF REFERENCE – GAMMA

Background

The Australian Energy Regulator (AER) is developing *Rate of Return Guidelines* that will form the basis of the regulated rate of return applied in energy network decisions. The AER published an issues paper in late December 2012, a formal consultation paper in early May 2013 and released its draft *Rate of Return Guidelines* in August 2013 under the recently revised National Electricity Rules (NER) and National Gas Rules (NGR).

The AER undertook its last review of the weighted average cost of capital (WACC) in 2009 under a previous version of the NER.

The new NER and NGR require the AER, when determining the rate of return, to consider (amongst other things):

- Relevant estimation methods, financial models, market data and other evidence for determining the rate of return[124].

Additionally, the new NER and NGR require that the estimated cost of corporate income tax for a network service provider include a value of imputation credits (gamma)[125].

Gamma represents the value that equity investors place on the franking credits created through the payment of company income tax and is generally estimated as the product of two elements:

- The *pay-out* ratio, being the proportion of created credits distributed by companies to their shareholders; and
- *Theta*, the market value of distributed imputation credits as a proportion of their face value.

In the AER's post tax revenue model (PTRM) the value of gamma is used to determine the proportion of the assumed company income tax that does not need to be included in a regulated firm's annual revenue requirement. In its May 2009 Statement of Regulatory Intent, the AER departed from standard regulatory practice to set gamma to 0.5 (with a range of 0.3-0.5) and set a value of gamma of 0.65. On appeal to the Australian Competition Tribunal[126], the AER's determination of gamma value was adjusted down to 0.25. In its draft *Rate of Return Guidelines*, the AER considers, based on current evidence, to set a value of gamma of 0.5.

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[124] NER 6.5.2 (e)(1), 6A.6.2 (e)(1) and NGR 87 (5)(a).
[125] NER 6.5.3, 6A.6.4 and NGR 87A.
[126] Application by Energex Limited (Distribution Ratio (Gamma)) (No 3) [2010] ACompT 9 (24 December 2010).

As further detailed below, the Energy Network Association (ENA) would like to engage you to provide your opinion on the estimation of the value of imputation credits (gamma) within the scope of the *allowed rate of return objective*[127]:

> "[t]*he rate of return for a [Service Provider] is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applied to the [Service Provider] in respect of the provision of [services].*"

Scope of work

Having read the AER's draft *Rate of Return Guidelines* and *Explanatory Statement* on gamma, the ENA requests your opinion on the value of gamma for energy regulatory purposes covering the following points:

- Explain the methodology of Lajbcygier and Wheatley and of Siau, Sault and Warren (the ANU paper).
- Explain whether the results of these studies would be affected by higher-than-average trading volumes around ex-dividend dates (as suggested by the *Explanatory Statement*).
- Set out the advantages of the methodologies employed by Lajbcygier and Wheatley and of Siau, Sault and Warren relative to the use of aggregate tax statistics for the purposes of estimating the value of imputation credits (as the *Explanatory Statement* proposes to do). .
- Update the results of the Lajbcygier and Wheatley study and explain their relevance to estimating the value of imputation credits.

The ENA requests the consultant to provide a report which must:

- Attach these terms of reference;
- Attach the qualifications (in the form of a curriculum vitae) of the person(s) preparing the report;
- Identify any current or future potential conflicts;
- Comprehensively set out the bases for any conclusions made;
- Only rely on information or data that is fully referenced and could be made reasonably available to the AER or others;
- Document the methods, data, adjustments, equations, statistical package

[127] NER 6.5.2(c), 6A.6.2(c) and NGR 87 (3).

specifications/printouts and assumptions used in preparing your opinion[5];

- Include specified wording at the beginning of the report stating that "[the person(s)] acknowledge(s) that [the person(s)] has read, understood and complied with the Federal Court of Australia's *Practice Note CM 7, Expert Witnesses in Proceedings in the Federal Court of Australia*" as if your brief was in the context of litigation;
- Include specified wording at the end of the report to declare that "[the person(s)] has made all the inquiries that [the person(s)] believes are desirable and appropriate and that no matters of significance that [the person(s)] regards as relevant have, to [the person(s)] knowledge, been withheld"; and
- State that the person(s) have been provided with a copy of the Federal Court of Australia's "Guidelines for Expert Witnesses in Proceeding in the Federal Court of Australia" and that the Report has been prepared in accordance with those Guidelines, refer to Annexure A to these Terms of Reference or alternatively online at *<http://www.federalcourt.gov.au/law-and-practice/practice-documents/practice-notes/cm7>*.

The ENA intends to submit the consultant report to the AER in response to the draft *Rate of Return Guidelines*. Accordingly the report will become a public report.

Timeframe

The consultant is to provide a report by 30 September 2013.

Fees

The consultant is requested to:

- Propose a fixed total cost of the project and hourly rates for the proposed project team should additional work be required;
- Advise which staff who will provide the strategic analysis and opinion; and
- Identify any current or future potential conflicts in undertaking the project.

Miscellaneous costs such as travel and accommodation will be reimbursed, provided that they are agreed with the ENA beforehand.

[5] Note: this requires you to reveal information that you might otherwise regard as proprietary or confidential and if this causes you commercial concern, please consult us on a legal framework which can be put in place to protect your proprietary material while enabling your work to be adequately transparent and replicable.

Contacts

Any questions regarding this terms of reference should be directed to:

Nick Taylor (Jones Day)

Email: njtaylor@jonesday.com

Phone: 02 8272 0500

Appendix C. Federal Court Guidelines

FEDERAL COURT OF AUSTRALIA

Practice Note CM 7

EXPERT WITNESSES IN PROCEEDINGS IN THE FEDERAL COURT OF AUSTRALIA

Practice Note CM 7 issued on 1 August 2011 is revoked with effect from midnight on 3 June 2013 and the following Practice Note is substituted.

Commencement

1. This Practice Note commences on 4 June 2013.

Introduction

2. Rule 23.12 of the Federal Court Rules 2011 requires a party to give a copy of the following guidelines to any witness they propose to retain for the purpose of preparing a report or giving evidence in a proceeding as to an opinion held by the witness that is wholly or substantially based on the specialised knowledge of the witness (see **Part 3.3 - Opinion** of the *Evidence Act 1995* (Cth)).

3. The guidelines are not intended to address all aspects of an expert witness's duties, but are intended to facilitate the admission of opinion evidence[128], and to assist experts to understand in general terms what the Court expects of them. Additionally, it is hoped that the guidelines will assist individual expert witnesses to avoid the criticism that is sometimes made (whether rightly or wrongly) that expert witnesses lack objectivity, or have coloured their evidence in favour of the party calling them.

Guidelines

1. General Duty to the Court[129]

1.1 An expert witness has an overriding duty to assist the Court on matters relevant to the expert's area of expertise.

1.2 An expert witness is not an advocate for a party even when giving testimony that is necessarily evaluative rather than inferential.

1.3 An expert witness's paramount duty is to the Court and not to the person retaining the expert.

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[128] As to the distinction between expert opinion evidence and expert assistance see *Evans Deakin Pty Ltd v Sebel Furniture Ltd* [2003] FCA 171 per Allsop J at [676].

[129] The "*Ikarian Reefer*" (1993) 20 FSR 563 at 565-566.

2. The Form of the Expert's Report[130]

2.1 An expert's written report must comply with Rule 23.13 and therefore must

(a) be signed by the expert who prepared the report; and

(b) contain an acknowledgement at the beginning of the report that the expert has read, understood and complied with the Practice Note; and

(c) contain particulars of the training, study or experience by which the expert has acquired specialised knowledge; and

(d) identify the questions that the expert was asked to address; and

(e) set out separately each of the factual findings or assumptions on which the expert's opinion is based; and

(f) set out separately from the factual findings or assumptions each of the expert's opinions; and

(g) set out the reasons for each of the expert's opinions; and

(ga) contain an acknowledgment that the expert's opinions are based wholly or substantially on the specialised knowledge mentioned in paragraph (c) above[131]; and

(h) comply with the Practice Note.

2.2 At the end of the report the expert should declare that "[the expert] has *made all the inquiries that* [the expert] *believes are desirable and appropriate and that no matters of significance that* [the expert] *regards as relevant have, to* [the expert's] *knowledge, been withheld from the Court*."

2.3 There should be included in or attached to the report the documents and other materials that the expert has been instructed to consider.

2.4 If, after exchange of reports or at any other stage, an expert witness changes the expert's opinion, having read another expert's report or for any other reason, the change should be communicated as soon as practicable (through the party's lawyers) to each party to whom the expert witness's report has been provided and, when appropriate, to the Court[132].

2.5 If an expert's opinion is not fully researched because the expert considers that insufficient data are available, or for any other reason, this must be stated with an indication that the opinion is no more than a provisional one. Where an expert witness who has prepared a report believes that it may be incomplete or inaccurate without some qualification, that qualification must be stated in the report.

2.6 The expert should make it clear if a particular question or issue falls outside the relevant field of expertise.

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[130] Rule 23.13.

[131] See also *Dasreef Pty Limited v Nawaf Hawchar* [2011] HCA 21.

[132] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565

2.7 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the opposite party at the same time as the exchange of reports[133].

3. Experts' Conference

3.1 If experts retained by the parties meet at the direction of the Court, it would be improper for an expert to be given, or to accept, instructions not to reach agreement. If, at a meeting directed by the Court, the experts cannot reach agreement about matters of expert opinion, they should specify their reasons for being unable to do so.

J L B ALLSOP
Chief Justice
4 June 2013

[133] The *"Ikarian Reefer"* [1993] 20 FSR 563 at 565-566. See also Ormrod *"Scientific Evidence in Court"* [1968] Crim LR 240

Appendix D. Curricula Vitae

Simon M. Wheatley

5 Maple Street
Blackburn VIC 3130
Tel: +61 3 9878 7985
E-mail: swhe4155@bigpond.net.au

Overview

Simon is a consultant and was until 2008 a Professor of Finance at the University of Melbourne. Since 2008, Simon has applied his finance expertise in investment management and consulting outside the university sector. Simon's interests and expertise are in individual portfolio choice theory, testing asset-pricing models and determining the extent to which returns are predictable. Prior to joining the University of Melbourne, Simon taught finance at the Universities of British Columbia, Chicago, New South Wales, Rochester and Washington.

Personal

Nationalities:	U.K. and U.S.
Permanent residency:	Australia

Employment

- Special Consultant, NERA Economic Consulting, 2009-present
- External Consultant, NERA Economic Consulting, 2008-2009
- Quantitative Analyst, Victorian Funds Management Corporation, 2008-2009
- Adjunct, Melbourne Business School, 2008
- Professor, Department of Finance, University of Melbourne, 2001-2008
- Associate Professor, Department of Finance, University of Melbourne, 1999-2001
- Associate Professor, Australian Graduate School of Management, 1994-1999
- Visiting Assistant Professor, Graduate School of Business, University of Chicago, 1993-1994
- Visiting Assistant Professor, Faculty of Commerce, University of British Columbia, 1986

- Assistant Professor, Graduate School of Business, University of Washington, 1984-1993

Education

- Ph.D., University of Rochester, USA, 1986; Major area: Finance; Minor area: Applied statistics; Thesis topic: Some tests of international equity market integration; Dissertation committee: Charles I. Plosser (chairman), Peter Garber, Clifford W. Smith, Rene M. Stulz
- M.A., Economics, Simon Fraser University, Canada, 1979
- M.A., Economics, Aberdeen University, Scotland, 1977

Publicly Available Reports

The Market, Size and Value Premiums: A report for the Energy Networks Association, June 2013, http://www.aer.gov.au/sites/default/files/Report%2015%20-%20ENAMRPReport28062013%20Final.pdf

Estimates of the Zero-Beta Premium: A report for the Energy Networks Association, June 2013, http://www.aer.gov.au/sites/default/files/Report%202%20-%20Black%20CAPM%20Zero%20Beta%20Estimate%20(Final)%20-%2027%20June..pdf

The Payout Ratio: A report for the Energy Networks Association, June 2013, http://www.aer.gov.au/sites/default/files/Report%2012%20-%20Payout%20Ratio%20(Final)%20-%20June%202013.pdf

Review of Cost of Equity Models: A report for the Energy Networks Association, June 2013, http://www.aer.gov.au/sites/default/files/Report%201%20-%20Alternative%20Cost%20of%20Equity%20Models%20(Final)%20-%2026%20June.pdf

The Cost of Equity for a Regulated Energy Utility: A Response to the QCA Discussion Paper on the Risk-Free Rate and the MRP: A report for United Energy and Multinet Gas, March 2013, http://www.qca.org.au/files/CI-UEM-SubNERA-CCR1213-0413.pdf

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Prevailing Conditions and the Market Risk Premium: A report for APA Group, Envestra,

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The Market Risk Premium: A report for CitiPower, Jemena, Powercor, SP AusNet and United Energy, 20 February 2012,
http://www.aer.gov.au/content/item.phtml?itemId=752660&nodeId=fe0280e7e2113c467dfc4b3b076e1623&fn=Vic%20DNSPs%20(NERA)%20-%2020%20February%202012.pdf

Cost of Equity in the ERA DBNGP Draft Decision: A report for DBNGP, 17 May 2011,
http://www.erawa.com.au/cproot/9669/2/20110620%20-%20DBNGP%20(WA)%20%20-%20Sub%2055%20-%20Att%207%20-%20NERA%20Economic%20Consulting%20Cost%20of%20equity%20in%20the%20draft%20decision.pdf

The Market Risk Premium: A report for Multinet Gas and SP AusNet, 29 April 2011,
http://www.aer.gov.au/content/index.phtml/itemId/745782

Cost of Capital for Water Infrastructure Company Report for the Queensland Competition Authority, 28 March 2011,
http://www.qca.org.au/files/W-NERA-EconomicConsulting-FinalReport-WACC-0411.pdf

The Cost of Equity: A report for Orion, 2 September 2010,
http://www.comcom.govt.nz/assets/Pan-Industry/Input-Methodologies/Draft-Reasons-Papers/Draft-Reasons-EDBs/Draft-Determination-X-Sub/Orion-Cross-Submission-Attachment-on-EDBs-and-GPBs-Input-Methodologies-Draft-Determination-and-Reasons-Paper-NERA-Report-2-September-2010.pdf

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http://www.erawa.com.au/cproot/8512/2/20100503%20D29252%20DBNGP%20-%20Submission%208%20-%20Annexure%201%20-%20The%20Required%20Rate%20of%20Return%20on%20Equity%20for%20a%20Gas%20Transmission%20Pipeline.pdf

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http://www.aer.gov.au/content/item.phtml?itemId=735229&nodeId=4dc041cfe6e30a2c2b91e833cad31191&fn=Appendix%205.1%20-%20NERA%20-%20FAMA%20French%20Report.pdf

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Cost Of Equity - Fama-French Three-Factor Model Jemena Gas Networks (NSW), 12 August 2009, http://www.aer.gov.au/content/item.phtml?itemId=730699&nodeId=4fcc57398775fe84685434e0b749d76a&fn=Appendix%209.1%20-%20NERA%20-%20Cost%20of%20equity%20-%20Fama-French%20Model.pdf

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AER's Proposed WACC Statement – Gamma: A report for the Joint Industry Associations, 30 January 2009, http://www.aer.gov.au/content/item.phtml?itemId=726698&nodeId=80cf978278d317e99c34ae1878525573&fn=JIA%20Appendix%20Q%20-%20NERA%20-%20AER's%20proposed%20WACC%20statement-Gamma.pdf

The Value of Imputation Credits: A report for the ENA, Grid Australia and APIA, 11 September 2008, http://www.ena.asn.au/udocs/24092008aersub/Appendix%20K%20-%20The%20value%20of%20imputation%20credits%20-%20NERA.pdf

Consulting Experience

NERA, 2008-present

Lumina Foundation, Indianapolis, 2009

Industry Funds Management, 2010

Academic Publications

Imputation credits and equity returns, (with Paul Lajbcygier), 2012, *Economic Record* 88, 476-494.

Do measures of investor sentiment predict returns? (with Robert Neal), 1998, *Journal of Financial and Quantitative Analysis* 33, 523-547.

Adverse selection and bid-ask spreads: Evidence from closed-end funds (with Robert Neal), 1998, *Journal of Financial Markets* 1, 121-149.

Shifts in the interest-rate response to money announcements: What can we say about when they occur? (with V. Vance Roley), 1996, *Journal of Business and Economic Statistics* 14, 135-138.

International investment restrictions and closed-end country fund prices, (with Catherine Bonser-Neal, Greggory Brauer, and Robert Neal), 1990, *Journal of Finance* 45, 523-547 (reprinted in International Capital Markets Volume III, 2003, G. Andrew Karolyi and Rene M. Stulz, editors, Edward Elgar Publishing, Cheltenham, Glos).

A critique of latent variable tests of asset pricing models, 1989, *Journal of Financial Economics* 21, 177-212.

Some tests of international equity market integration, 1988, *Journal of Financial Economics* 21, 177-212 (reprinted in International Capital Markets Volume I, 2003, G. Andrew Karolyi and Rene M. Stulz, editors, Edward Elgar Publishing, Cheltenham, Glos).

Some tests of the consumption-based asset pricing model, 1988, *Journal of Monetary Economics* 22, 193-215.

Working Papers

An evaluation of some alternative models for pricing Australian stocks (with Paul Lajbcygier), 2009.

Intertemporal substitution, small-sample bias, and the behaviour of U.S. household consumption (with Kogulakrishnan Maheswaran and Robert Porter), 2007.

Keeping up with the Joneses, human capital, and the home-equity bias (with En Te Chen), 2003.

Evaluating asset pricing models, 1998.

Time-non-separable preferences or artifact of temporal aggregation? (with Robert Porter), 2002.

Testing asset pricing models with infrequently measured factors, 1989.

Refereeing Experience

Referee for Accounting and Finance, the Australian Journal of Management, Economic Letters, Financial Analysts Journal, Financial Management, Journal of Accounting and Economics, Journal of Business, Journal of Empirical Finance, Journal of Finance, Journal of Financial and Quantitative Analysis, Journal of Financial Economics, Journal of Futures Markets, Journal of International Economics, Journal of International Money and Finance, Journal of Money, Credit, and Banking, Journal of Monetary Economics, Management Science, National Science Foundation, Pacific-Basin Finance Journal, and the Review of Financial Studies.

Program Committee for the Western Finance Association in 1989 and 2000.

Teaching Experience

International Finance, Melbourne Business School, 2008

Corporate Finance, International Finance, Investments, University of Melbourne, 1999-2008

Corporate Finance, International Finance, Investments, Australian Graduate School of Management, 1994-1999

Investments, University of Chicago, 1993-1994

Investments, University of British Columbia, 1986

International Finance, Investments, University of Washington, 1984-1993

Investments, Macroeconomics, Statistics, University of Rochester, 1982

Accounting, 1981, Australian Graduate School of Management, 1981

Teaching Awards

MBA Professor of the Quarter, Summer 1991, University of Washington

Computing Skills

User of SAS since 1980. EViews, Excel, EXP, LaTex, Matlab, Powerpoint, Visual Basic. Familiar with the Australian School of Business, Compustat and CRSP databases. Some familiarity with Bloomberg, FactSet and IRESS.

Board Membership

Anglican Funds Committee, Melbourne, 2008-2011

Honours

Elected a member of Beta Gamma Sigma, June 1986.

Fellowships

Earhart Foundation Award, 1982-1983

University of Rochester Fellowship, 1979-1984

Simon Fraser University Fellowship, 1979

Inner London Education Authority Award, 1973-1977

Brendan Quach

Senior Consultant

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Website: www.nera.com

Overview

Brendan Quach has eleven years' experience as an economist, specialising in network economics, and competition policy in Australia, New Zealand and Asia Pacific. Since joining NERA in 2001, Brendan has advised clients on the application of competition policy in Australia, in such industries as aviation, airports, electricity, rail and natural gas. Brendan specialises in regulatory and financial modelling and the cost of capital for network businesses. Prior to joining NERA, Brendan worked at the Australian Chamber of Commerce and Industry, advising on a number of business issues including tax policy, national wage claims and small business reforms.

Qualifications

1991-1995 **AUSTRALIAN NATIONAL UNIVERSITY**
Bachelor of Economics.
(High Second Class Honours)

1991-1997 **AUSTRALIAN NATIONAL UNIVERSITY**
Bachelor of Laws.

Career Details

2001 - **NERA ECONOMIC CONSULTING**
Economist, Sydney

1998-1999 **AUSTRALIAN CHAMBER OF COMMERCE AND INDUSTRY**
Economist, Canberra

1996 **AUSTRALIAN BUREAU OF STATISTICS**
Research Officer, Canberra

Project Experience

Industry Analysis

2011 **Energy Networks Association**
Review of the regulatory frameworks for energy networks
Brendan is currently advising the ENA on the Australian Energy Regulator's (AER's) potential Rule change proposal. Advice currently focuses on a range of issues including the propose-respond framework, expenditure incentives, the cost of capital and the potential role of judicial reviews.

2011 **MSAR Office for the Development of the Energy Sector**
Development of a New Tariff Structure
Brendan is currently leading a team reviewing Macau's current electricity tariffs. This requires NERA to model and analyse long- and short-run marginal costs, sunk costs and generation dispatch. Our work for the Macau Government will be incorporated into the potential development of new tariffs for residential, commercial and casino customers.

2010 **Industry Funds Management/Queensland Investment Corporation**
Due diligence, Port of Brisbane
Brendan was retained to advise on various regulatory and competition matters likely to affect the future financial and business performance of the Port of Brisbane, in the context of its sale by the Queensland government.

2010-2011 **Minter Ellison /UNELCO**
Review of regulatory decision by the Vanuatu regulator
Assisted in the development of an expert report on a range of matters arising from the Vanuatu regulator's decision to reset electricity prices under four concession contracts held by UNELCO. The matters considered included the methodology employed to calculate the new base price, the appropriateness of the rate of return, the decision by the regulator to reset future prices having regard to past gains/losses.

2010 **Gilbert + Tobin/Confidential – Telecommunications**
Incentive Arrangements for Regulated Telecommunications Services
Brendan provided strategic advice to Gilbert + Tobin on possible regulatory arrangements that allow for the efficient delivery of fixed line telecommunications services in the context of the government mandated roll out the National Broadband Network.

2009-10 **EnergyAustralia – NSW Electricity Distribution**
Review of Public Lighting Services
Brendan provided advice to EnergyAustralia during its electricity distribution price review on the provision of public lighting services. Our work provided strategic and regulatory advice to EnergyAustralia during the appeal of the AER's revenue determination for the 2009-2014 period.

2009 **CitiPower/Powercor**
Efficiency carryover mechanisms
Assisted in the development of an expert report submitted to the AER on the consistency of carrying-forward accrued negative amounts arising from the application of the ESC's efficiency carryover mechanism with the National Electricity Law and the National Electricity Rules.

2009 **Prime Infrastructure**
Sale of Dalrymple Bay Coal Terminal (DBCT)
Brendan provided regulatory advice to a number of potential bidders for the assets of DBCT. Advice included an assessment of the rate of return parameters, depreciation, regulatory modelling and the regulatory arrangements in Queensland.

2008-09 **MSAR Office for the Development of the Energy Sector**
Review of Electricity Cost and Tariff Structures
Review of current and projected costs of electricity provision in Macau, including modelling and analysis of marginal costs and sunk cost attribution to various consumer classes. Our work for the Macau Government has incorporated the development of potential tariff structures (specifically rising block tariff structures) and scenarios, including modelling revenue recovery and cross subsidies.

2008 **Singaporean Ministry for Trade and Industry**
Electricity Industry Review
NERA was retained by the Singaporean Ministry for Trade and Industry (MTI) to provide a comprehensive review of the Singaporean electricity market. Brendan was involved in the analysis of the costs and benefits arising from the restructuring and reform of the Singaporean electricity industry since the mid 1990's, the estimated costs and benefits of future security of supply and energy diversification approaches. The project required NERA to undertake quantitative dispatch modelling of the Singaporean electricity market.

2008 **Ministerial Council Energy**
Retailer of Last Resort
Assisted in the development of a joint expert report with Allens Arthur Robinson (AAR) that: reviewed the existing jurisdictional retailer of last resort (RoLR) frameworks; advised the MCE on the development of an appropriate national policy framework for RoLR and developed a suggested base set of proposals for a national RoLR scheme.

2005-06 **Freehills/South Australian Gas Producers, NSW and South Australia**
Gas supply agreement arbitration
Assisted in the development of an economic expert report in the arbitration of the price to apply following review of a major gas supply agreement between the South Australian gas producers and a large retailer in NSW and South Australia.

2005-2006 **Australian Energy Market Commission (AEMC), Australia**
Advised the AEMC on its review of the Electricity Rules relating to transmission revenue determination and pricing, which included providing briefing papers to the Commission on specific issues raised by the review.

2005-2006 **Minter Ellison/ South West Queensland Gas Producers, Queensland**
Gas supply agreement arbitration
Advised Minter Ellison and the Producers in an arbitration of the price to apply following review of a major gas supply agreement between the South West Queensland gas producers and a large industrial customer.

2005 **International Utility, Queensland**
Generator sale, due diligence
Part of the due diligence team acting on behalf of a large international utility in the purchase of two coal fired generators in Queensland, Australia. Provided advice on the features of the Australian electricity market and regulatory environment.

2003 **Auckland City Council, New Zealand**
Rationalisation Options Study
Conducting a rationalisation options study to examine alternative business models for Metrowater. Our report assessed different vertical and horizontal integration options for Metrowater.

2003 **Metrowater, New Zealand**
Institutional Restructuring
Prepared advice for the board of the Auckland City Water and wastewater service provider, Metrowater on options for institutional and regulatory reform of the entire Auckland regional water sector.

2002 - 2003 **Rail Infrastructure Corporation, Australia**
Research to RIC on their proposed access undertaking.
Provided research and advice into various components of RICs proposed access undertaking with the ACCC including the cost of capital, asset valuation and pricing principles.

2002 **Argus Telecommunications, Australia**
Critique of CIE's bandwidth pricing principles.
Provided a critique of a CIE report on bandwidth pricing principles for the fibre optic networked run owned by Argus Telecommunications.

2001 **Screenrights, Australia**
Advice on valuing retransmission of local TV
A review and analysis of different methodologies in valuing retransmission of local television on pay TV services.

Regulatory and Financial Analysis

2012 **Queensland Competition Authority**
Review of the retail water regulatory models
Brendan undertook an independent quality assurance assessment of the financial models relied on by the QCA to set the regulated revenues of SunWater. The review considered: SunWater's Financial model, a model used by SunWater to calculate future electricity prices, an renewals annuity model, as well as the QCA's regulatory model. These models established a set of recommended prices for each of the 30 irrigation schemes operated by SunWater for the period 2014 to 2019.

2011 **Queensland Competition Authority**
Review of the retail water regulatory models
Undertook an independent quality assurance assessment of the models used to calculate regulated revenues for Queensland Urban Utilities, Allconnex Water, and Unitywater. The review considered: the formulation of the WACC; the intra year timing of cashflows; and the structural, computational and economic integrity of the models.

2011 **Queensland Competition Authority**
Review of the wholesale water regulatory models
Undertook an independent quality assurance assessment of the models used to calculate regulated revenues for LinkWater, Seqwater; and

WaterSecure. The review considered: the formulation of the WACC; the intra year timing of cashflows; and the structural, computational and economic integrity of the models.

2011 **Multinet Gas and SP AusNet - Gas Distribution**
Report on the market risk premium
Co-authored a report that examined a number of issues arising from the draft decision on Envestra's access proposal for the SA gas network. The report considered whether: the historical evidence supported the use of a long term average of 6 per cent; there is any evidence to warrant a MRP at it long term average; and the evidence relied on by the AER to justify its return to a MRP of 6 per cent.

2011 **Dampier to Bunbury Natural Gas Pipeline - Gas Transmission**
Cost of Equity
Co-authored two reports that updated the cost of equity for a gas transmission business and responded to issues raised by the regulator in its draft decision. The report re-estimated the cost of equity of a gas distribution business using the Sharpe Lintner CAPM, Black CAPM, Fama-French three-factor model and a zero beta version of the Fama-French three-factor model.

2010-2011 **Queensland Competition Authority**
Weighted Average Cost of Capital (WACC) for SunWater
Retained to provide two expert reports on the WACC for SunWater a Queensland rural infrastructure business. The first report considered issues pertaining to whether a single or multiple rates of return can be applied across SunWater's network segments. The second report focuses market evidence on the appropriate rate of return for SunWater.

2011 **Mallesons Stephens Jaques, on behalf of ActewAGL Distribution**
Determining the averaging period
Assisted in the development of an expert report that considered the economic and financial matters arising from the Australian Energy Regulator's decision to reject ActewAGL's proposed risk free rate averaging period.

2010 **Orion Energy, New Zealand**
Information disclosure regime
Provided advice and assistance in preparing submissions by Orion to the New Zealand Commerce Commission, in relation to the Commission's proposed weighted average cost of capital for an electricity lines businesses. Issues addressed included the financial model used to calculate the required return on equity, the appropriate term for the risk free rate and the WACC parameter values proposed by the Commission.

2010 **Ministerial Council on Energy, Smart Meter Working Group, The costs and benefits of electricity smart metering infrastructure in rural and remote communities**

This report extends NERA's earlier analysis of the costs and benefits of a mandatory roll out of smart meters, by consider the implications of a roll out in rural and remote communities in the Northern Territory, Western Australia and Queensland. The project has focused on eight case study communities and has examined the implications of prepayment metering and remoteness on the overall costs and benefits of a roll out.

2010 **Grid Australia, Submission to the AER on the proposed amendments to the transmission revenue and asset value models**

Developed and drafted a submission to the AER on the proposed amendments to the AER's post-tax revenue model (PTRM) and roll forward model (RFM). The proposal focused on a number of suggestions to simplify and increase the usability of the existing models.

2010 **Dampier to Bunbury Natural Gas Pipeline (DBNGP) - Gas Transmission**

Cost of Equity

Co-authored a report that examined four well accepted financial models to estimate the cost of equity for a gas transmission business. The report of estimating the cost of equity of a gas distribution business using the Sharpe Lintner CAPM, Black CAPM, Fama-French three-factor model and a zero beta version of the Fama-French three-factor model.

2009-10 **Jemena - Gas Distribution**

Cost of Equity

Co-authored two reports on the use of the Fama-French three-factor model to estimate the cost of equity for regulated gas distribution business. The report examined whether the Fama-French three-factor model met the dual requirements of the National Gas Code to provide an accurate estimate of the cost of equity and be a well accepted financial model. Using Australian financial data the report also provided a current estimate of the cost of equity for Jemena.

2009 **WA Gas Networks - Gas Distribution**

Cost of Equity

Co-authored a report that examined a range of financial models that could be used to estimate the cost of equity for a gas distribution business. The report of estimating the cost of equity of a gas distribution business using the Sharpe Lintner CAPM, Black CAPM, Fama-French three-factor model and Fama-French two-factor model. The report examined both the domestic and international data.

2009 **CitiPower and Powercor – Victorian Electricity Distribution Network Reliability Incentive Mechanism (S-factor)**

Brendan provided advice to CitiPower and Powercor on the proposed changes to the operation of the reliability incentive mechanism. The advice considered the effects of the proposed changes to the operation of the two distribution network service providers. Specifically, how the 'S-factors' would be changed and implications this has to the revenue streams of the two businesses. A comparison was also made with the current ESC arrangements to highlight the changes to the mechanism.

2009 **CitiPower and Powercor – Victorian Electricity Distribution Network Reliability Incentive Mechanism (S-factor)**

Brendan provided advice to CitiPower and Powercor on the proposed changes to the operation of the reliability incentive mechanism. The advice considered the effects of the new arrangements on the business case for undertaking a series of reliability projects. Specifically, the project estimated the net benefit to the businesses of three reliability programs.

2009 **Jemena and ActewAGL - Gas Distribution Cost of Equity**

Co-authored a report on alternative financial models for estimating the cost of equity. The report examined the implication of estimating the cost of equity of a gas distribution business using the Sharpe Lintner CAPM, Black CAPM and Fama-French models. The report examined both the domestic and international data.

2008 **Joint Industry Associations - APIA, ENA and Grid Australia Weighted Average Cost of Capital**

Assisted in the drafting of the Joint Industry Associations submission to the Australian Energy Regulator's weighted average cost of capital review. The submission examined the current market evidence of the cost of capital for Australian regulated electricity transmission and distribution businesses.

2008 **Joint Industry Associations - APIA, ENA and Grid Australia Weighted Average Cost of Capital**

Expert report for the Joint Industry Associations on the value of imputation credits. The expert report was attached to their submission to the Australian Energy Regulator's weighted average cost of capital review. The report examined the current evidence of the market value of imputation credits (gamma) created by Australian regulated electricity transmission and distribution businesses.

2007-2008 **Smart Meter Working Group, Ministerial Council on Energy – Assessment of the costs and benefits of a national mandated rollout of smart metering and direct load control**

Part of a project team that considered the costs and benefits of a national mandated rollout of electricity smart meters. Brendan was primarily responsible for the collection of data and the modelling of the overall costs and benefits of smart metering functions and scenarios. The analysis also considering the likely costs and benefits associated with the likely demand responses from consumers and impacts on vulnerable customers.

2007 **Electricity Transmission Network Owners Forum (ETNOF), Submission to the AER on the proposed transmission revenue and asset value models**

Developed and drafted a submission to the AER on the proposed post-tax revenue model (PTRM) and roll forward model (RFM) that would apply to all electricity transmission network service providers (TNSPs). The proposal focused ensuring that the regulatory models gave effect to the AER's regulatory decisions and insures that TNSPs have a reasonable opportunity to recover their efficient costs.

2007 **Victorian Electricity Distribution Business**
Review of Smart Meter model

Reviewed the smart meter model developed by a Victorian distributor and submitted to the Victorian Essential Service Commission (ESC). The smart meter model supported the business' regulatory proposal that quantified the revenue required to meet the mandated roll out of smart meters in Victoria. The smart meter model the quantified the expected, meter, installation, communications, IT and project management costs associated with the introduction of smart meters. Further, the estimated the expected change in the business' meter reading and other ongoing costs attributed with the introduction of smart meter infrastructure.

2007 **Energy Trade Associations - APIA, ENA and Grid Australia**
Weighted Average Cost of Capital

Expert reports submitted to the Victorian Essential Services Commission evaluating its draft decision to set the equity beta at 0.7, and its methodology for determining the appropriate real risk free rate of interest, for the purpose of determining the allowed rate of return for gas distribution businesses.

2007 **Babcock and Brown Infrastructure, Qld**
Review of Regulatory Modelling

Provided advice to Babcock and Brown Infrastructure on the regulatory modelling of revenues and asset values of the Dalrymple Bay Coal Terminal (DBCT). DBCT has undertaken a substantial

capital investment to increase the capacity of the port. Brendan's role was to advise DBCT on variety of issues including the calculation of interest during construction, appropriate finance charges, cost of capital and regulatory revenues which were submitted to the Queensland Competition Authority (QCA).

2007- **ActewAGL, ACT**
Transition to National Electricity Regulation
Providing on-going advice to ActewAGL, the ACT electricity distribution network service provider, on its move to the national energy regulation. The advice covers the revenue and asset modelling, the development of a tax asset base, the new incentives for efficient operating and capital expenditure and processes for compliance, monitoring and reporting of its regulatory activities.

2007 - 2008 **Smart Meter Working Group, Ministerial Council on Energy – Assessment of the costs and benefits of a national mandated rollout of smart metering and direct load control**
Brendan was a member of NERA team that investigated the costs and benefits of a national mandated rollout of electricity smart meters. Brendan's prime responsibility was to undertake the modelling of the costs and benefits of smart metering. NERA's assignment required an assessment of smart metering functions and scenarios, and also considering the likely demand responses from consumers and impacts on vulnerable customers.

2005- **TransGrid, NSW**
Review of Regulatory Systems
Providing strategic advice to TransGrid, the NSW electricity transmission network service provider, on its current regulatory processes. The advice covers TransGrid's internal systems and processes for compliance, monitoring and reporting of its regulatory activities.

2006 **Grid Australia, National**
Submission to application by Stanwell to change the national Electricity Rules (Replacement and Reconfiguration investments)
Developed and drafted a submission to the AEMC on the appropriateness of the draft Rule change that extended the application of the regulatory test to replacement and reconfiguration investments.

2006 **Grid Australia, National**
Submission to application by MCE to change the national Electricity Rules (Regulatory Test)
Developed and drafted a submission to the AEMC on the appropriateness of the draft Rule change which changed the

Regulatory Test as it applies to investments made under the market benefits limb.

2006 **Office of the Tasmanian Energy Regulator**
Implications of the pre-tax or post-tax WACC
Provided a report to OTTER on the potential implications of changing from a pre-tax to a post-tax regulatory framework.

2006 **Babcock Brown Infrastructure**
Regulatory Modelling of Dalrymple Bay Coal Terminal
Developed the economic model used to determine revenues at Dalrymple Bay Coal Terminal. This included updating the model for capital expenditure to upgrade capacity at the terminal, account for intra-year cash flows, and the proper formulation of the weighted average cost of capital and inflation.

2006 **Queensland Competition Authority, Queensland**
Review of Regulatory Revenue Models
Advised the QCA on the financial and economic logic of its revenue building block model that projects the required revenue for the Queensland gas distribution businesses and tariffs for the next 5 years.

2006 **Envestra, South Australia**
Review of RAB Roll Forward Approach
Assisted Envestra in responding to the Essential Services Commission of South Australia's consultation paper on Envestra's 2006/07 to 2010/11 gas access proposal. This involved reviewing Envestra's RAB roll forward modelling and the Allen Consulting Group's critique thereof.

2006 **Transpower, New Zealand**
Review of Regulatory Systems
Provided assistance to Transpower, the sole electricity company in New Zealand, in responding to the New Zealand Commerce Commission's announcement of its intention to declare control of Transpower. This involved developing an expert report commenting on the Commission's methodology for analysing whether Transpower's has earned excess profits in the context of New Zealand's "threshold and control" regime.

2006 **Pacific National**
Rail industry structure and efficiency
Assisted with the development of a report which examined options for addressing issues arising in vertically-separated rail industries. This involved examining a number of case study countries including the UK, US and Canada.

2005 **Australian Energy Markets Commission, Australia**
Transmission pricing regime
Advisor to the AEMC's review of the transmission revenue and pricing rules as required by the new National Electricity Law.

2005 **Queensland Rail, Australia**
Weighted Average Cost of Capital
Provided a report for Queensland Rail on the appropriate weighted average cost of capital for its regulated below rail activities.

2004-2005 **ETSA Utilities**
Review of Regulatory Modelling
Advised ETSA Utilities on the financial and economic logic of ESCOSA's regulatory models used to determine the regulatory asset base, the weighted average cost of capital, regulatory revenues and distribution prices.

2003- 2005 **TransGrid, NSW**
Review of Regulatory Revenues
Assisted TransGrid in relation to its application to the ACCC for the forthcoming regulatory review which focused on asset valuation and roll forward, cost of capital and financial/regulatory modelling.

2004 **Prime Infrastructure, Australia**
Weighted Average Cost of Capital
Provided a report for Prime Infrastructure on the appropriate weighted average cost of capital for its regulated activities (coal shipping terminal).

2004 **PowerGas, Singapore**
Review of Transmission Tariff Model
Advised the Singaporean gas transmission network owner on the financial and economic logic of its revenue building block model that projects PowerGas' revenue requirements and tariffs for the next 5 years.

2003 **ActewAGL, ACT**
Review of Regulatory Revenues
Provided strategic advice to ActewAGL in developing cost of capital principles, asset valuation and incentive mechanisms as part of their current pricing reviews for their electricity and water businesses.

2003 **Orion Energy, New Zealand**
Threshold and Control Regime in the Electricity Sector
Provided advice and assistance in preparing submissions by Orion to the Commerce Commission, in relation to the Commission's proposed

changes to the regulatory regime for electricity lines businesses. Issues addressed included asset valuation, and the form of regulatory control.

2003 **EnergyAustralia, NSW**
Pricing Strategy Under a Price Cap
Advised EnergyAustralia on IPART's financial modelling of both regulated revenues and the weighted average price cap.

2002-03 **TransGrid, NSW,**
Advice in Relation to the Regulatory Test
Modelled the net present value of a range of investment options aimed at addressing a potential reliability issue in the Western Area of New South Wales. This work was undertaken in the context of the application of the ACCC's "regulatory test" which is intended to ensure only *efficient* investment projects are included in the regulatory asset base.

2002 **Rail Infrastructure Corporation (RIC), Australia**
Review of the Cost of Capital Model
Provided advice to RIC and assisted in drafting RIC's submission to the Australian Competition and Consumer Commission (ACCC) on the appropriate cost of capital. This included building a post-tax revenue model of RIC's revenues in the regulatory period.

2002 **PowerGrid, Singapore**
Review of Transmission Tariff Model
Advised the Singaporean electricity transmission network owner on the financial and economic logic of its revenue building block model that projects PowerGrid's revenue requirements and tariffs for the next 10 years.

2002 **EnergyAustralia, Australia**
Review of IPART's Distribution Tariff Model
Advised EnergyAustralia, a NSW distribution service provider, on the economic logic of the revenue model that projects EnergyAustralia's revenue requirements and tariffs for the 2004-2009 regulatory period.

2002 **Essential Services Commission of South Australia**
Review Model to Estimating Energy Costs
Reviewed and critiqued a model for estimating retail electricity costs for retail customers in South Australia for 2002-2003.

2002 **National Competition Council (NCC), Australia**
Exploitation of Market Power by a Gas Pipeline
Provided a report to the NCC in which we developed a number of tests for whether current transmission prices were evidence of the

exploitation of market power by a gas transmission pipeline. Also provided a separate report that applied each of the tests developed. This analysis was relied on by the NCC in determining whether to recommend the pipeline in question be subject to regulation under the Australian Gas Code.

2002 **Australian Gas and Lighting, Australia**
Report on South Australian Retail Tariffs
An independent assessment on the cost components of regulated retail tariffs in South Australia that will be used by AGL in the next review.

2002 **New Zealand Telecom, New Zealand**
Report on the application of wholesale benchmarks in NZ
A report on the application of international benchmarks of wholesale discounts to New Zealand Telecom.

2002 **ENEL, Italy**
Survey of Retailer of Last Resort in NSW
Provided research into the retailer of last resort provisions in the NSW gas sector of an international review for the Italian incumbent utility.

2002 **ENEL, Italy**
Survey of Quality of Service provisions in Victoria and South Australia
Provided research into quality of service regulation for electricity distribution businesses in Victoria and South Australia of an international review for the Italian incumbent utility.

2002 **Integral Energy, Australia**
Provided Advice on the Cost of Capital for the 2004 – 2008 Distribution Network Review
Provided analysis and strategic advice to Integral Energy on the possible methodologies that IPART may use to calculate the cost of capital in the next regulatory period.

2001 **IPART, Australia**
Minimum Standards in Regulation of Gas and Electricity Distribution
Advised the NSW regulator on the appropriate role of minimum standards in regulatory regimes and how this could be practically implemented in NSW.

2001 **TransGrid, Australia**
Advice on ACCC's Powerlink WACC decision
Provided a report critically appraising the ACCC's decision regarding Powerlink's weighted average cost of capital (WACC).

Competition Policy

2005 **Confidential, Australia**
Merger Analysis
Provided expert opinion as well as strategic guidance to the merging firms on the competitive implications of that merger.

2004 **Mallesons Stephen Jaques / Sydney Airports Corporation, Australia**
Appeal to declare under Part IIIA
Provided strategic and economic advice on aspects of Virgin Blue's appeal for the declaration of airside facilities at Sydney Airport under Part IIIA of the Trade Practices Act. This cumulated in the production of an expert witness statement by Gregory Houston.

2003 **Sydney Airports Corporation, Australia**
Application to declare under Part IIIA
Expert report to the National Competition Council in connection with the application by Virgin Blue to declare airside facilities at Sydney Airport under Part IIIA of the Trade Practices Act, and the potential impact on competition in the market for air travel to and from Sydney.

2002 - 2003 **Blake Dawson Waldron/ Qantas Airways, Australia**
Alleged predatory conduct
NERA was commissioned to provide advice in relation to potential allegations of anticompetitive behaviour. Developed a paper examining the economic theory behind predation and the way courts in various jurisdictions determine whether a firm has breached competition law.

2002 **Phillips Fox and AWB Limited**
Declaration of the Victorian Intra-State Rail Network
Advised law firm Phillips Fox (and AWB Limited) in its preparation for an appeal (in the Australian Competition Tribunal) of the Minister's decision not to declare the Victorian intra-state rail network, pursuant to Part IIIA of the Trade Practices Act. This included assisting in the preparation of testimony relating to pricing arrangements for third party access to the rail network and their likely impact on competition in related markets, including the bulk freight transportation services market.

2002 **Singapore Power International (SPI)**
Impact of acquisition of a Victorian distributor on competition
Provided analysis to a company interested in acquiring CitiPower (a Victorian electricity distribution/retail business). Including an assessment of the extent to which the acquisition of CitiPower would

lead to a 'substantial lessening of competition' in a relevant energy markets, given the company's existing Australian electricity sector assets. The NERA report was submitted to the ACCC as part of the pre-bid acquisition clearance process.

Other

1999-2000 **Australian Chamber of Commerce and Industry, Australia**
Alienation of Personal Service Income
Involved in analysing the effects of the proposed business tax reform package had on a number of industries which advocated a number of recommendations to the Federal Government. The package also included the provisions to change the definition of personal service income.

1998-2000 **Australian Chamber of Commerce and Industry, Australia**
Various economic policy issues
Provided analysis on economic trends and Government policies to business groups. This covered issues such as industrial relations reform, taxation changes, business initiatives, and fiscal and monetary settings. Also compiled ACCI surveys on business conditions and expectations.

1996 **Australian Bureau of Statistics, Australia**
Productivity Measures in the Public Health Sector
Involved in a team that reported on the current methods used to measure output in the public health sector and analysed alternative methods used internationally. This was in response to the ABS investigating the inclusion of productivity changes in the public health sector.

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