# Observations on the *Review of Submissions on the Cost of Debt and the TAMRP for UCLL and UBA Services*

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## Contents

## 1. The author

1. The author of this report is Bruce Grundy. Bruce Grundy has a Ph.D. in Finance from the University of Chicago and 30 years' experience in Finance academia and consulting. My curriculum vitae is attached as Appendix 1.

## 2. Scope of this Report

2. This report examines issued raised by the 13 June 2014 review undertaken by Dr Martin Lally of submissions to the NZ Commerce Commission on the cost of debt and the TAMRP (the Lally Review).

## 3. Foreign Currency Denominated Bonds and the Estimation of the DRP

3. The Lally Review argues that the inclusion of foreign currency denominated bonds in a DRP estimate is problematic on a number of grounds. One ground given is that these bonds are not very liquid because the holders of them typically hold them till maturity. Accepting for the moment that bond illiquidity makes measuring bond yields problematic, Lally has not provided any evidence that suggests that the holders of foreign bonds are more likely to hold to maturity than are the holders of domestic bonds. To argue that one set of bonds should be excluded while another should be included because there is a potential problem with the first set requires establishing that the same potential problem is not present in the second set.

4. As to the question of how bond yields are affected by a tendency to hold to maturity, the answer will depend on whether owners hold to maturity by necessity given a dearth of buyers in the secondary market or actually prefer to hold to maturity. If owners prefer to hold to maturity and hence there are few willing sellers in the secondary market, would-be buyers in the secondary market will have to offer higher prices, i.e., secondary market yields on foreign bonds will actually be *below* what they would be if holders had been more willing to sell.

5. Footnote 1 of the Lally Review notes that even if foreign currency borrowing were more expensive, some level of foreign borrowing would occur if, for example, a firm were unable to issue long maturity bonds locally. The implication is not that apparently high-

cost foreign borrowing should be ignored. Rather the implication is the exact opposite. Short-term local borrowing rates may well be lower than foreign long-term rates. Furthermore, consistent with an inability to borrow locally over the desired long horizon, short-term local borrowing rates may be lower than what a firm would have to be pay if it were to try to borrow long-term locally. At the same time long-term borrowing may be cheaper if sourced from overseas.

6. A decision by a firm to source its long-term borrowing from overseas is consistent with the following relation between interest rates:

   short-term local rate < long-term foreign rate < long-term local rate.

   Rather than borrow everything locally and short-term, a firm can undertake some amount of long-term borrowing in order to reduce refinancing risk. When foreign long-term borrowing is cheaper than local long-term borrowing, foreign long-term borrowing will be part of the firm's optimal capital management strategy.

7. The true cost of financing if all the firm's borrowing were to be both local and short-term would not be the low rate on short-term domestic bonds. The true cost of borrowing would include the expected costs associated with the future refinancing risk of refinancing maturing short-term debt at times when rates turn out to be precipitously high. In order to correctly determine the cost of debt that a firm actually incurs, the rate paid on its cost-minimizing overseas borrowing must be recognized.

8. On this last point, page 7 of the Lally Review argues that if foreign data is used in order "to better reflect the average cost of a firm's debt finance, then this would raise contentious questions about whether to also include the cost of bank debt (the third primary source of debt finance) estimating the weights to be placed upon such sources of debt, and the issue of whether to apply the same weights to firms who may not have access to foreign borrowing."

9. There are a number of issues that arise with the claim that a contentious issue is raised. One issue is that while bank debt may well be the third source of debt finance, whether it is a non-trivial fraction of debt finance is a different matter. A second issue is that the Lally Review states that "I understand that the term for bank loans typically does not exceed five years." Short-term loans of less than one year are an important element of net working capital. Short-term bank debt allows a firm to meet outgoings like wages that are

not perfectly matched to incoming revenues from operations. If short-debt bank loans that fund working capital are to be included, then the assets of a regulated firm need to also include its working capital and the firm's weighted average cost of capital (WACC) needs to be applied to a larger base.

10. A third issue is that the bank providing loans to a firm will typically also provide a set of other services to the firm. Banks can choose to charge less on a loan in order to attract the firm as a client—a bank will offer a low-rate loan if the firm will then pay above cost for the other services the firm buys from the bank. Thus a further weakness in the claim that apparently low cost bank debt should be included in the determination of the cost of debt is that the true cost paid by a firm that enters a borrowing and services relationship with a bank is need not just the rate directly paid on its borrowing from the bank. The true cost is higher when the firm pays more for other services.

11. Now consider the Lally Review's claim that the question of what weights to apply to the various forms of debt is a contentious issue since there may be firms that do not have access to foreign borrowing. The cost of capital for firms that find it prohibitively expensive to borrow aboard will be higher than the cost of capital for those able to borrow abroad and therefore treating such restricted firms as if they were unrestricted (by applying the weights chosen by unrestricted firms) will actually produce a *conservative* estimate of their true WACC. While this can be characterized as a contentious issue, it is contentious because it would lead to an underestimate of the WACC of such firms.

12. The Lally Review contains an illustration in the second paragraph of its page 8 that is claimed to support the assertion that foreign bonds should be ignored in determining the cost of debt. The illustration assumes that a firm which could borrow at 7% locally instead chooses to pay over the odds and borrow overseas at 7.5%. The actual reason that a firm will borrow overseas at 7.5% is that if it were to try and replace that overseas borrowing with similarly long-term but locally issued bonds, the firm would find that the cost of borrowing long-term locally would be greater than 7.5%. The Lally Review's analysis here is flawed because it based on an assumption that firms do not seek out the cheapest form of financing; i.e., an assumption that firms do not seek to increase their owner's wealth.

## 4. The Target Credit Rating

13. Page 10 of the Lally Review claims that poor incentives would be put in place if Chorus' actual credit rating were used in determining the allowed DRP. It is alleged that "actions taken by Chorus … [that] lowered its credit rating, … would raise its regulatory cost of debt and weaken the incentive for Chorus to maintain its credit rating." But when the WACC increase simply reflects the risk increase, a firm has no incentive to weaken its credit rating or alter its hedging strategy.

14. What the Lally Review characterises as an undesirable cost-based determination of WACC (i.e., the determination of the firm's true WACC) is what underpins optimal investment incentives. If the regulatory WACC does not reflect the firm's true WACC that will have an effect on the firm's desire to invest—investment will be too high if the regulatory WACC exceeds the true WACC and too low when the regulatory WACC is below the true WACC. Deviating from the true WACC creates poor investment incentives.

15. Within any one regulatory cycle a regulated firm is incentivized to reduce its costs. A concern about incentive effects can only relate to implications of the firm's credit rating for the subsequent regulatory cycle.

16. There are two basic ways a firm could raise its credit rating (and reduce its regulatory cost of debt). First, the firm might become less levered. Second, the firm might alter its hedging strategies. Changing the level of leverage will not affect the WACC in a perfect capital market—if leverage is reduced, the resultant lower cost of debt will be accompanied by a lower weight on the cheaper source of financing provided by debt.

17. Second, if hedging is undertaken to reduce the volatility of the firm's net cash flows, then the WACC will be reduced since both the cost of debt and the sensitivity of equity payoffs to the return on the market will fall. But the value of the firm will not change. The hedged expected future net cash flows will be reduced by an amount commensurate with the reduction in the cost of capital. To see this, suppose a firm hedges out part of its exposure to general market conditions by selling stock index futures. The expected payoff to the party who is short a stock index futures is negative (this is the immediate result of

the fact that the market risk premium is positive) and the hedge will reduce not only the volatility of, but also the expected amount of, the firm's future payoffs.

18. In an imperfect capital market there are potential effects both on the costs of financial distress and on corporate taxes (associated with interest deductibility) when a firm issues debt or undertakes hedging. The balancing of these costs and benefits determines both the firm's optimal level of leverage and optimal hedging strategy. In determining allowed revenues regulators should recognize not only the expected benefit from the corporate tax saving associated with debt financing (as they do) but also the expected cost of financial distress (CFD). The firm's capital structure and hedging decisions determine its credit rating. The consideration of a target credit rating in a regulatory setting requires that CFD be explicitly recognized in the regulatory process. The following section discusses the CFD element of the cost of debt that has been overlooked in regulatory settings.

## 5 Costs of Financial Distress and the Cost of Debt Financing

19. The benefit of debt is the saving in corporate taxes. This benefit feeds into the net cash flow (NCF) element of the regulatory process. One cost of debt is the interest on the borrowing. This cost feeds into the WACC element of the regulatory process. But another important cost, namely the cost associated with the potential for financial distress, reduces future expected NCFs and is not recognized by existing regulatory processes. This overlooked cost of debt has been empirically estimated to be far from trivial.

20. The Miller-Modigliani (MM) theorem of capital structure irrelevance and its implication of hedging irrelevance is often described as applicable in a world without transactions costs, taxes or differences in information. The MM result is more general. The result applies so long as there is no *difference* in the transactions costs and informational asymmetries of firms with and without gearing or hedging. For a discussion of the generality and implications of the MM theorem see Grundy (2001) and Grundy (2002).

21. Increasing gearing makes equity more risky and therefore increases the cost of equity. Increasing gearing simultaneously decreases the weight put on the cost of equity (the higher cost source of funding) in the determination of a firm's WACC. More debt means a higher cost of equity but a lower weight on that source of finance with no net effect on the firm's cost of capital. Absent transactions costs and information asymmetries, not

only is the aggregate amount to be distributed to the owners of a firm unaffected by gearing, the firm's WACC is also unaffected.

22. In practice transactions costs and information asymmetries mean that a firm's gearing affects its value and its WACC. For example, corporate taxes paid reflect the firm's gearing since interest payments are tax deductible. There are in fact many ways in which the amount that can be distributed to the firm's owners is affected by gearing. Therefore forecasts of future payments to the owners of the firm must reflect the firm's gearing if those forecasts are to be unbiased. Regulators recognize this when, for example, they build an allowance for the costs of issuing future debt and equity securities into the determination of allowed revenues.

23. While gearing reduces corporate taxes, it is important to recognize that there are many ways in which gearing can reduce the payoff to a firm's owners. These negative effects of gearing are discussed in paragraphs 24 through 31 below.

24. One subtle influence of gearing on future payoffs is its effect on future investment incentives. Debt financing can make a firm less innovative in seeking out new investment opportunities. Consider a setting in which the payoff from a new project serves to make existing debtholders' claims on the firm safer and more valuable. Suppose the project requires an investment of $100 and that its future payoffs have a present value of $101; i.e., the project has a $1 positive net present value. Such a project would be attractive to an ungeared firm.

25. Suppose though the project were being considered by a firm that already had $1,000 worth of assets and had existing risky debt worth $600 in the absence of the project. The firm's equity is worth $400 in the absence of the project. If the firm does raise the $100 necessary to undertake the new project, doing so will increase the total firm value by $101. With more assets in the firm, the risky debt will become safer. Suppose the debt's value increases to $603. The value of the original shareholders' claim on the firm will actually decline by $2 to $398.

26. The post-investment value of the equity will be the difference between the new total value of the firm's assets and the sum of the value of the firm's debt and the value of the new claim issued to finance the project; i.e., $1,101 – ($603 + $100) = $398 < $400. The project will not be undertaken. The diminution in a firm's future investment incentives

and consequent reduction in firm value today is known as the debt overhang problem. An ungeared firm with access to the new project would be worth $1,001 (the sum of the $1,000 value of the existing assets plus the $1 value of the firm's positive NPV growth opportunity). An otherwise equivalent geared firm (which would, because of its gearing, reject the new project) would be worth only $1,000.

27. The debt overhang problem grows with the amount of existing risky debt relative to the size of the new investment opportunities (see Diamond and He (2014)). The reason no debt overhang problem arises in a Miller-Modigliani setting is that given no transactions costs, sufficiently complex terms could always be written into a debt contract so as to readjust the contract appropriately as future investment opportunities arose. But because in practice it is prohibitively costly to contract over every eventuality, debt overhang problems have a negative effect on the value of geared firms.

28. Another way in which gearing leads to a diminution in firm value is that if a firm has not been profitable and if meeting its debt obligations requires selling assets, the assets may have to be sold at "fire-sale" prices. Titman (1984) observes that firms that make products requiring specialized servicing and spare parts will find liquidation especially costly and concludes that firms manufacturing machines and equipment should optimally be less geared because of potential costs should asset sales be necessary to repay debt.

29. More generally, higher gearing increases the probability of incurring costs associated with financial distress and bankruptcy. These costs are real and significant. If a business faces a financial crisis the existing value of the company can be 'eaten up' in short-term management decisions (e.g., through a failure to invest in otherwise valuable capital maintenance), fractured management decisions (driven by different stakeholders' interests), selling assets at "fire-sale" prices in order to raise cash, and the legal fees of bankruptcy and/or restructuring.

30. The set of future costs associated with debt financing are known in the finance literature as the costs of financial distress (CFD). The future expected benefit from debt financing is treated in regulatory determinations of allowed revenues as the product of the corporate tax rate and promised future interest payments. The existence of non-debt tax shields and the realizations of levels of earnings before interest that are less than promised interest payments mean that promised interest payments do not always give rise to tax savings.

The difference between the potential tax savings and actual tax savings is then another cost that must be included in the set of CFD in order to offset the overstatement of the tax benefits from debt financing that arises when all interest payments are assumed to reduce corporate taxes.

31. Allowed revenues must be set at a level such that the firm's owners actually expect to earn the cost of capital, not at a level where at best they do so. The actual expected corporate taxes payable given the firm's gearing should be reflected in allowed revenues. If the benefit of debt financing is overstated because expected corporate tax payments are understated because all promised interest payments are treated as tax deductible, the expected difference between the potential tax saving and the actual tax saving associated with interest payments must then be recognized as a cost of debt financing.

32. Similarly overlooked in regulatory determinations of allowed revenues, are the other components of CFD inherent in even an optimal capital structure. An optimal capital structure is not the level of gearing at which there are zero CFD. Regulatory determinations of allowed revenues that overlook CFD effectively assume that at an optimal capital structure the CFD is zero. If in fact the CFD were really zero, then firms should be much more highly geared than they are in order to capture more of the potential tax savings associated with interest deductibility.

33. Nor is it the case that an optimal capital structure minimizes CFD – that would require not issuing any debt. An optimal capital structure trades off the marginal benefit (of the tax saving) associated with substituting a dollar of debt financing for a dollar of equity financing with the marginal CFD.

34. At an optimal level of gearing the marginal benefit and marginal cost of financing with debt rather than equity are equal. If the (annual) marginal benefit is the product of the corporate tax rate and the (annual) interest on a dollar of debt financing, i.e., $\tau_c \times r_d$, then the marginal CFD on the last dollar of debt in an optimal capital stricture must also equal $\tau_c \times r_d$. At higher levels of gearing the marginal CFD will be higher and would exceed the marginal tax saving from debt financing. Conversely, if the firm used less than the optimal amount of debt its marginal CFD would be less than the marginal tax saving.

35. Regulatory regimes do not allow realized CFD to be passed on in higher revenues at the time of an insolvency event (which seems sensible and consistent with giving businesses

an incentive to avoid these costs). But a regulatory regime should make an allowance for the actuarially expected level of these costs in determining allowed annual revenues. Ignoring CFD will mean allowed revenues are set at a level whereby the firm is actually worth less than the cost of efficiently reproducing its capital.

36. One can get a rough figure for the annual CFD that should be built into allowed revenues by assuming that the marginal CFD is zero on the first dollar of debt financing and increases linearly as debt increases to the optimal level. The annual CFD is then $[(0 + \tau_c \times r_d)/2] \times$ Optimal Gearing Ratio $\times$ firm assets. Given $\tau_c = 28\%$ and an Optimal Gearing Ratio of 0.44, the annual CFD that needs to incorporated within the building blocks of allowed revenue is $r_d \times 6.16\% \times$ firm assets.

37. But we need not rely on this rough estimate of $r_d \times 6.16\% \times$ firm assets. Empirical investigations of CFD have been undertaken in recent years and published as Korteweg (2007), Almeida and Philippon (2007) and van Binsbergen, Graham and Yang (2010).

38. From an examination of 269 US firms between 1994 and 2004, Korteweg (2007) estimates that the present value of the expected future CFD is equal to 5% of firm value for a typical non-bankrupt firm, and equal to 31% for firms in bankruptcy. It is the high cost of financial distress that inhibits firms from using higher gearing to minimise their corporate tax liabilities. Korteweg's analysis leads him to conclude that CFD are primarily the result of debt overhang problems and distressed asset fire-sales.

39. Korteweg estimates the costs of financial distress by examining firms in the same industry and relating differences in their values to differences in their size and their gearing. Korteweg examines 23 different industries. Firms within an industry are assumed to have the same optimal level of gearing. Firms deviate temporarily from that optimum because of firm-specific relatively good or bad performance. Firms that have done well (poorly) will tend to have become under-geared (over-geared) relative to the industry optimum. Because of the costs of recapitalizing a business, firms do not immediately move back to their optimal gearing levels.

40. The observed value of a levered firm is then the value of an otherwise unlevered firm, plus the present value of the tax saving that would be enjoyed if coupon payments were to always give rise to a saving in corporate taxes, less the present value of CFD including

the tax benefits not received when the firm's otherwise taxable income turns out to be less than its coupon payments.

41. By relating the observed values of levered firms to their gearing levels, Korteweg is able to back out the present value of this measure of CFD. Korteweg's estimate is an estimate of the present value of the reduction in firm value due to debt financing relative to a situation where debt were to always lead to a tax deduction and were never to lead to other costs of financial distress. When Korteweg refers to his estimate as an upper bound on CFD he means the reduction in the value of a business associated with debt financing relative to the valuation when promised coupons are assumed to always reduce corporate taxes (just as regulatory determinations of allowed revenues assume) and all other components of CFD are zero.

42. Korteweg estimates that the present value of CFD as equal to 5% of the market value of the average firm. If the present value of future CFD is equal to 5% of the value of an optimally-levered firm, then ignoring these costs when determining the allowed revenues of a regulated firm will mean that the firm's true value will be 5% below the cost of efficiently reproducing its optimal physical and human capital.

43. This 5% undervaluation occurs when a regulated firm employs its value-maximizing gearing level. If the regulatory regime correctly assumes the optimal gearing level then the regulatory regime will tend to capture, and pass onto customers, all of the benefits of higher gearing in the form of lower corporate taxes. However, if the regulatory regime does not also compensate for the higher costs of gearing (i.e., for the actuarially expected level of CFD) then the firm's total compensation will be lower than its total costs (other things equal). Based on the Korteweg (2007) results for the average firm, the value of this under-compensation would be around 5% of firm value.

44. How should allowed revenues be adjusted so that there is not a 5% diminution in the value of a regulated business? The future annual allowed revenues need to be increased by such an amount that the present value of the future annual allowed revenues is increased by 5%. Treating the annual increase as a perpetuity, the allowed revenues should be increased by WACC × 5% × firm assets.

45. van Binsbergen, Graham and Yang (2010) examine panel data from 1980 to 2007 to estimate firm's marginal CFD functions. By integrating and discounting the marginal cost

functions the authors obtain an estimate of the present value of future CFD for the average firm of 6.9% of asset value. While the econometric technique is quite different from that employed in Korteweg (2007), the resultant estimates of the present value of CFD are quite similar.

46. van Binsbergen, Graham and Yang estimate that the default costs associated with debt financing are approximately one half the total CFD, implying that agency costs and other non-default costs (e.g., poor investment incentives associated with a debt overhang problem and short-term decision making in times of financial stress such as the failure to invest in otherwise valuable capital maintenance) contribute the other half of the total ex-ante CFD.

47. Almeida and Philippon (2007) estimate the present value the direct legal fees of bankruptcy and/or restructuring and the losses associated with selling assets at "fire-sale" prices in the event of a debt default as a percentage of the pre-distress value of a firm. Column 2 of Panel B of Table IV of Almeida and Philippon (2007) reports the author's estimates of the present value of this component of CFD. The estimates are 0.32% for AAA-rated bonds; 1.84% for AA bonds; 3.83% for A; 4.53% for BBB; 6.81% for BB; and 9.54% for B-rated bonds.

48. Because debt default is more likely to occur in bad times, the default costs examined by Almeida and Philippon are borne in states of the world in which an additional dollar has a particularly high value (relative to the value of an additional dollar to be received in a future boom). Almeida and Philippon show that a simplistic valuation that ignored the fact the costs borne in bad times should be discounted at very low rates would have given an incorrect under-valuation of the present value of these costs as only 1.4% (as opposed to 4.53%) of the pre-distress value of a BBB-rated firm.

49. Almeida and Philippon conclude that even the default cost component of CFD can be high and that this helps explain why firms appear to use debt conservatively. Absent any CFD, firms would optimally minimize corporate taxes payable by financing almost entirely with debt and thereby maximizing interest deductions and minimizing taxes.[1]

[1] Recall that van Binsbergen, Graham and Yang estimate that the default costs of debt as examined by Almeida and Philippon amount to approximately half the total CFD. Thus it is not surprising that the Almeida and Philippon (2007) estimate of the present value of a portion of CFD for investment grade firms is less than the

50. The level of revenues allowed in a regulatory setting should include compensation for all expected costs and benefits associated with gearing. This includes the relatively easily explicitly measured benefit due to the reduction in corporate tax liabilities associated with interest payments on debt. It also includes the more difficult to measure expected CFD. While difficult to measure, this cost can be large.

51. In his review of submissions on the cost of debt Lally overlooks the component of the cost of debt due to CFD. This is not a failing unique to Lally. Regulatory regimes invariably overlook CFD. It is my opinion that the published estimates of just how large CFD are in practice mean that the CFD should be included as a building block in the regulatory process.

## 6. Estimating the DRP

52. The Lally Review treats each of Chorus' two credit ratings of BBB and BBB- as equally valid. Cantor, Packer and Cole (1997) examine the relation between split ratings and the DRP and conclude that for investment grade bonds (i.e., for bonds with rating above BB+) the market prices split rated bonds between the yield implied by the lower rating and the average of the yields applying to each rating; i.e., the market requires a return from split rated bonds that is *above* the average of the two yields. Thus the empirical evidence is that the market prices split rated bonds like those of Chorus as more like a BBB- bond than like a BBB bond.

53. The Lally Review makes a number of flawed claims about the concavity of yields and biases in estimates of the cost of debt. The Lally Review consider a setting where firms issue bonds with lives of, say, $T - 2\Delta$, $T$ and $T + 2\Delta$ years. The lives of the bonds that the firm issues are dispersed around an average of $T$-years.

54. Suppose a regulator seeks an estimate of the average cost of the firm's debt. If the regulator estimates the DRP component of the average cost of a firm's debt by averaging over the DRPs observed on a set of bonds with times to maturity that are *less* dispersed than the times to maturity of the bonds that the firm actually issues (e.g. over a set of

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Korteweg (2007) and van Binsbergen, Graham and Yang (2010) estimates of the present value of total CFD for the typical firm.

bonds with times to maturity of $T - \Delta$, $T$ and $T + \Delta$ years) then *if the DRP is a concave function of the time to maturity* the regulator will overestimate the average DRP on the bonds the firm actually issues.

55. The observation in the preceding paragraph can be easily illustrated with a simple numerical example. Suppose a firm has two bonds outstanding with equal market values and maturity dates of 8 and 12 years. The average maturity is 10 years. Suppose also that the DRPs on the bonds are 2% and 3.6% respectively. The average DRP on the firm's debt is therefore 2.8%.

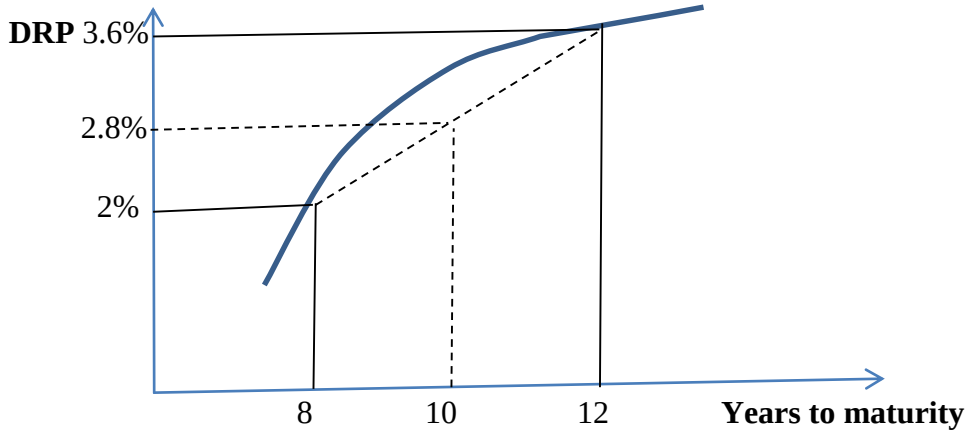


**Figure 1: DRPs on a firm's two bonds. Average life = 10 years**

56. Suppose also that the DRP is a concave function of a bond's maturity as in the figure above. DRPs for 9-year and 11-year bonds of 2.95% and 3.3% are consistent with this concave shape.

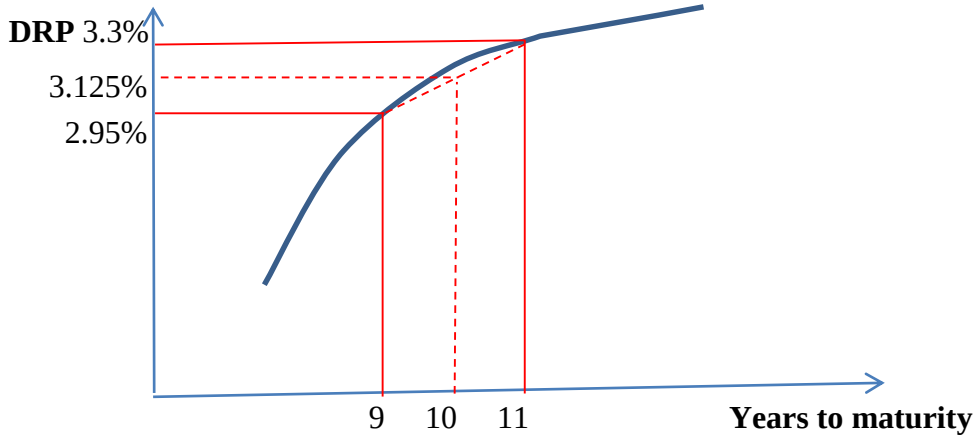


**Figure 2: DRPs on two bonds examined by a regulator. Average life = 10 years**

57. Now suppose that a regulator estimates the DRP on the firm's portfolio of 8-year and 12-year bonds by averaging the DRPs of the two bonds with 9 and 11 year lives. Note that the average maturity of both sets of bonds is 10 years. The regulator's estimated average DRP of 3.125% will be an overestimate of the true 2.8% average DRP of the firm's debt. This can be easily seen by comparing Figures 1 and 2.

58. The question that arises is what implication should be drawn from an example like that above. First, Lally provides no evidence that regulators do, or will, average over the DRPs of a set of bonds with times to maturity that are less dispersed than the times to maturity of the bonds that regulated firms actually issue. If in fact the DRP was a concave function of time to maturity and a regulator averaged over the DRPs of sets of bonds with *more* dispersed times to maturity than the bonds that the regulated firms actually issued, the regulator would obtain an *underestimate* of the average DRP on the regulated firm's bonds.

59. More importantly, Lally provides no evidence that the DRP is a concave function of the time to maturity over the relevant range of bond lives. It is taken as given that since bond yields are typically a concave function of time to maturity, the DRP will be similarly concave.

60. Risk-free yields and yields on risky bonds can both be concave functions of the time to maturity and yet the DRP can be a convex function of the time to maturity. A function is concave (convex) in the time to maturity if the second derivative of the function with respect to time to maturity is negative (positive).

$$\begin{aligned} t &\equiv \textit{time to maturity}. \\ DRP &\equiv \textit{bond yield} - \textit{risk-free yield}. \\ \frac{\partial DRP}{\partial t} &= \frac{\partial \textit{bond yield}}{\partial t} - \frac{\partial \textit{risk-free yield}}{\partial t}. \\ \frac{\partial^2 DRP}{\partial t^2} &= \frac{\partial^2 \textit{bond yield}}{\partial t^2} - \frac{\partial^2 \textit{risk-free yield}}{\partial t^2}. \end{aligned} \qquad (1)$$

61. When both bond yields and the risk-free rate are concave, the DRP will be concave provided that bond yields are *more* concave than are risk-free yields; i.e., provided that the second term on the right hand-hand-side of (1) is less negative than the first term on the right-hand-side of (1). But when the opposite is true, the DRP will be a convex function of time to maturity.

62. The RBA publishes monthly values of the DRP on 5-year, 7-year and 10-year BBB Australian bonds for the period January 2005 through June 2014 on its website: http://www.rba.gov.au/statistics/tables/index.html#interest-rates No data is provided for bonds with more than 10 years to maturity. For a set of 5, 7 and 10 year bonds the DRP will be a concave function of the time to maturity if the 7-year DRP exceeds 3/5 of the 5-year DRP plus 2/5 of the 10 year DRP; i.e., the 'middle' bond has a higher DRP than a weighted average of the DRPs of the two bonds with shorter and longer lives. Figure 1 and 2 illustrate this feature of concavity—note how the DRP of the bond with 10 years to maturity exceeds a weighted average of the DRPs of the shorter- and longer-lived bonds.

63. Consider the set of Australian BBB bond DRPs observed in December 2013. The 5-year, 7-year and 10-year DRP was 2.2775%, 2.5986% and 3.2177% respectively. The weighted average of the 5-year and 10-year DRPs is 2.6536%. This average is greater than the 7-year DRP; i.e., in December 2013 the DRP was a *convex* function of the time to maturity. In fact, in 46 of the 114 months covered by the RBA dataset, the DRP was a convex function of time to maturity.

64. When the DRP is a convex function of time to maturity, the bias that the Lally Review considers goes in the opposite direction. When a regulator averages over the DRPs of a set of bonds with times to maturity that are less dispersed than the times to maturity of the bonds that regulated firms actually issue and the DRP is a convex function of the time to maturity, regulators will *underestimate* the average DRP of the bonds that regulated firms issue.

65. The Lally Review makes a further claim in relation to the estimation of the DRP, namely that "[g]iven the need for a wider range of maturities, the temptation to loosen standards (by admitting lower quality data) will be strong and the result of this is likely to be a biased estimate of the DRP of concern." Suppose there does exist some data that is lower quality in the sense that it involves larger measurement error. The Lally Review's claim that using that data is likely to result in a biased estimate of the DRP is false in the absence of further assumptions about the additional data. Measurement error per se does not induce a bias.

66. The average of a set of independent noisy unbiased observations is not a biased estimate. Further, the law of large numbers guarantees that the average of the errors will diversify

away as the sample size grows and thus it is often the case that the average of a larger set of more noisy estimates gives a more accurate estimate than the average of a smaller set of individually more accurate estimates.

## 7. Debt Management Strategies

67. Footnote 8 of the Lally Review makes the claim that the recognition in paragraph 229 of the CEG Report (2014) of the importance of a minimal divergence between the true cost of debt and the cost of debt allowed by a regulator is "covered by the ability of firms to replicate the regulator's strategy." The ability to replicate the regulator's strategy is not sufficient to guarantee that the regulatory cost of debt matches the firm's true cost of debt. The two will differ if the transactions costs of implementing the replicating strategy are not fully recognized in determining the regulatory cost of debt.

68. Issuing longer term debt will mean that the refinancing risk borne by equity-holders is decreased; e.g., the risk associated with refinancing in the same high interest rate environment that precipitates a major stock market correction is reduced. Reducing the likelihood of incurring increased interest costs when the stock market is crashing will reduce the firm's equity beta and hence will reduce the firm's cost of equity. While the DRP component of the cost of debt may be increased by issuing long-term debt, the cost of equity will be reduced. Firms will wish to issue some long-term debt whenever the combined effect on the costs of debt and equity is a reduction in their WACC. Only when the regulatory cost of debt appropriately recognizes that the DRP will vary with the actual maturity of the bonds optimally issued by a firm, will firms have the incentive to minimize their WACC.

## 8. The TAMRP

69. Lally Review dismisses (on its page 22) evaluating a methodology on the basis of its predictive power because markets might be inefficient and the greater predictive power might reflect an ability to predict the effects of mispricing on future returns. It is worthwhile thinking through the implications of such a view.

70. Suppose a regulated entity were considering an investment with an asset beta of one. Potential investors would require from that investment a return at least equal to what they

expected to get by investing in a broad stock market index. Suppose that some methodology predicts that the return on the market will on average by 15% and suppose that the methodology has good power to predict what the actual return on the market will be; i.e., when the methodology predicts a 15% return, the market on average delivers a 15% return. Whatever individual investors happen to think (some individuals may be optimistic and others pessimistic), the aggregate supply and demand for stocks is such that the equity market is priced at a level that on average produces a return of 15%.

71. Suppose a regulator who is worried that the market may be inefficient ignores the methodology that has good predictive ability and looks instead at say the historical average return on the market. Assume this historic average is 10%. Suppose though that the usually accurate estimate of 15% is in fact the correct prediction. Based on a flawed belief the regulator will set the WACC at 10%. If the typical potential investor has the same expectation as the usually accurate methodology and he/she expects to earn a 15% from the stock market, the typical potential investor will not supply capital to the regulated firm.

72. For a regulator to deviate from a methodology that has good predictive ability requires that the regulator to be able to identify those times when the methodology is not accurate. The regulator would have to believe that he/she was more skilled than professional money managers.

## 9. Consistent implementation of the Brennan-Lally CAPM

73. The Brennan-Lally CAPM is designed to give the cost of equity capital in a closed economy when the cost of equity is defined as the sum of the dividend yield and the capital gain return on equity. The economy is closed in the sense that there are no overseas suppliers of equity capital. This cost of equity then feeds into the WACC to be applied when discounting future after-corporate-tax net cash flows (NCF) when the NCF is not adjusted to recognize franking credits as an additional source of income to shareholders.

74. The Brennan-Lally CAPM for the cost of equity as applied by regulators has taken the form:

$$E\{R_i\} = R_f\left(1-\tau_c\right) + \beta_i\left(E\{R_m\} - R_f\left(1-\tau_c\right)\right). \qquad (2)$$

Note that the tax rate in the formula is the corporate tax rate $\tau_c$. For a stock with a beta of 1 the expected return is naturally the same as that on the market. Consider a stock with a beta of 0. According to the above application of the Brennan-Lally CAPM the expected return on such a stock is equal to $R_f\left(1-\tau_c\right)$.

75. If there were no difference in the taxation of debt and equity the expected return on a zero-beta stock would equal the risk-free rate $R_f$, just as in the familiar Sharpe-Linter variant of the CAPM. But under an imputation system when the total return on zero-beta equity comes in the form of dividends and those dividends are always accompanied by franking credits, the dividend income from stock is tax-advantaged relative to interest income. Investors will therefore be willing to accept a lower dividend yield on zero-beta equity than the interest rate they require from riskless debt. This is so because interest payments are not accompanied by any personal tax offsets; i.e., there is no such thing as an 'interest franking credit'.

76. If all dividends were fully franked, the supply of debt versus equity in the closed economy would adjust until in equilibrium the tax rate of the marginal investor just indifferent between investing in debt and zero-beta equity was equal to the corporate tax rate. This investor would pay no personal taxes on dividends from zero beta equity but would be taxed on interest income. The return this investor will require from zero beta equity would equal $R_f\left(1-\tau_c\right)$ since this is the after-personal-tax return she could instead earn by investing in interest-paying riskless bonds. This required return is equal to the expected return on zero-beta equity implied by the application of the Brennan-Lally CAPM in equation (2), namely $R_f\left(1-\tau_c\right)$.

77. But not all dividends are fully franked and an internally consistent implementation of the Brennan-Lally CAPM requires that this be consistently recognized. On its pages 26 and 27, the Lally Review's estimation of the $E\{R_m\}$ component of the TAMRP is quite explicit in its use of a *Q* factor to recognize that only 80% of dividends are accompanied by franking credits. To consistently recognize that not all dividends are accompanied by franking credits it must also be recognized that not all dividends paid by zero-beta equity are accompanied by franking credits.

78. The expected return on zero-beta equity in the assumed closed economy will therefore be equal $R_f\left(1-\hat{\tau}\right)$ where $\hat{\tau} \neq \tau_c$. The investor in a tax bracket equal to the corporate rate who in the equilibrium is just indifferent between investing in riskless bonds and buying zero beta equity (the fraction *Q* of whose return will be accompanied by franking credits and hence tax-free while the remaining fraction is fully taxable) will require the same after-personal-tax return from the two alternate investments; i.e.,

$$\begin{aligned} R_f\left(1-\tau_c\right) &= E\left\{R_{\text{zero beta equity}}\right\}\times Q + E\left\{R_{\text{zero beta equity}}\right\}\times\left(1-Q\right)\times\left(1-\tau_c\right) \\ &= E\left\{R_{\text{zero beta equity}}\right\}\times\left[Q+\left(1-Q\right)\left(1-\tau_c\right)\right]. \end{aligned}$$

Thus $E\left\{R_{\text{zero beta equity}}\right\} = R_f\,\dfrac{1-\tau_c}{Q+\left(1-Q\right)\left(1-\tau_c\right)} = R_f\left(1-\hat{\tau}\right)$, where $\hat{\tau}$ is given by the solution of $1-\hat{\tau} \equiv \dfrac{1-\tau_c}{Q+\left(1-Q\right)\left(1-\tau_c\right)}$.

79. Thus an internally consistent application of the Brennan-Lally CAPM takes the form:

$$E\left\{R_i\right\} = R_f\left(1-\hat{\tau}\right) + \beta_i\left(E\left\{R_m\right\} - R_f\left(1-\hat{\tau}\right)\right). \tag{3}$$

80. The implementation of the Brennan-Lally CAPM (assuming a closed economy) applied by regulators and in the Lally Review is inconsistent in its treatment of unfranked dividends. For beta one equity, regulators and Lally assume that only the fraction (1 – *Q*) of dividends are accompanied by franking credits, while regulators and Lally assume that all dividends on zero beta equity are accompanied by franking credits.

81. For zero-beta equity the error in the misapplication of the Brennan-Lally CAPM can be large. The misapplied Brennan-Lally CAPM will understate the required return on zero-beta equity by $R_f\left(\tau_c-\hat{\tau}\right) = R_f\left(1-\tau_c\right)\left(\dfrac{1}{Q+\left(1-Q\right)\left(1-\tau_c\right)}-1\right)$.

82. Given a risk-free rate of 5%, a *Q* value of 80% and a corporate tax rate of 28%, the misapplied Brennan-Lally CAPM will understate the required return on zero-beta stock by 0.2136%.

83. To consistently implement the Brennan-Lally CAPM (in a closed economy) requires that the term $R_f\left(1-\tau_c\right)$ be replaced by $R_f\left(1-\hat{\tau}\right)$ thereby increasing the expected return on

zero-beta equity and decreasing the TAMRP by an equivalent amount. The correct implementation of the Brennan-Lally CAPM yields a higher (lower) cost of equity for stocks with betas below (above) one than does the implementation that has been applied by regulators in the past. (The correction does not change the cost of equity for a stock with a beta of 1.)

84. Just as it is necessary to recognize the actual source of funds when determining the cost of debt, it should also be recognized that equity capital is provided by non-New Zealand investors. Non-New Zealand investors do not qualify for franking credits. The implementation of the Brennan-Lally CAPM given in equation (3) above is only correct in the assumed closed economy.

85. When a fraction of equity capital is provided by non-New Zealand investors a further decrease in the tax rate that should be applied when implementing the Brennan-Lally CAPM is required. To see this most clearly, suppose that all equity capital is raised overseas and no franking credits can be enjoyed by those who actually buy shares in New Zealand firms. The required return on zero-beta equity would be the same as the risk-free rate since the buyers of the equity would receive no tax advantage from dividend income relative to interest income. In effect, the tax adjustment component of the $R_f\left(1-\hat{\tau}\right)$ term in the Brennan-Lally CAPM would involve $\hat{\tau}=0$. (This is equivalent to setting $Q$ = 1 in the formulae for $\hat{\tau}$.)

86. When in equilibrium overseas investors provide a portion of the equity capital raised by New Zealand firms (i.e., the economy is not closed), the required return on zero-beta equity is increased and the TAMRP is reduced by an equivalent amount. The effect is to further increase (decrease) the cost of equity for stocks with betas below (above) one.

## 10. Empirical Analysis in Lally Appendix 1: Bankruptcy Risk

87. Appendix 1 of the Lally Review considers how the choice between two options for setting the allowed cost of debt affects the bankruptcy risk of a firm. Option A sets the cost of debt as the sum of a risk-free rate and a DRP both observed at the beginning of the regulatory interval. It is assumed, but not demonstrated, that it is possible to enter interest rate swaps that align the risk-free rate component of the firm's actual debt issues with the maturity of the riskless bonds used in defining the risk-free rate for the purposes of setting

the cost of debt. Option B sets the cost of debt as the sum of a risk-free rate observed at the beginning of the regulatory interval and a 7-year trailing average of the DRP.

88. The net cash flows (NCF) are compared under options A and B for the years 2007 to 2014. One reason the NCF will vary through time is because of a difference between the allowed cost of debt and the actual cost incurred. A second reason the NCF will vary through time is that the risk-free rate enters the determination of the cost of equity and in turn the cost of equity varies across regulatory cycles. To limit the scope of its analysis, the Lally Review focuses on these two reasons for time variation in the NCF.

89. The Lally Review concludes that the largest annual shortfall between the allowed DRP and the actual DRP given the data it analyses is only $0.14 per $100 of RAB and this shortfall represents only 2.5% of the NCF. The implication drawn is that relying on Option A rather than Option B would not have given rise to any material bankruptcy risk since 2006.

90. Before reaching such a conclusion it is important to better understand the data that the Lally Review uses in analysing the 2007 to 2014 period. The data set examined that gives rise to the conclusion that the bankruptcy risk is not material has two flaws. The first flaw is that the Lally Review gives a single annual value for the DRP and takes that value from Commission decisions during those years. Possibly if there was more than one decision in a year, the various values were averaged to obtain a yearly number. But the commission's allowed DRP is not necessarily equal to the DRP on the firm's debt.

91. The 2008 and 2009 DRP numbers given in Appendix 1 of the Lally Review are 1.6% and 1.8% respectively. These numbers are from Commission decisions. These numbers do not reflect the spike in risk associated with the GFC. The DRP on US BBB-rated bonds rose above 6% in late 2008 and early 2009, a level not seen since 1931 and the Great Crash. By the end of 2009 the US DRP had fallen back below 3%.

92. It would be interesting to know if any of the regulatory DRP values that underlie the Lally Review's 2008 and 2009 DRP numbers attempted to reflect the conditions of the GFC– perhaps the decisions occurred in early 2008 and late 2009 (ie, before and after the spike in risk), or perhaps the regulator by chance or by design considered it was better to use an estimate less affected by the GFC than the contemporaneous value of the DRP in setting the allowed DRP. If the market DRP that applied in late 2008 and early 2008 had been

fully reflected in the DRP values used for those years by the Lally Review, the results would have been quite different.

93. The second reason that the data used in Appendix 1 of the Lally Review is flawed is that the Lally Review states that it interpolates from its DRP values of 1.3%, 1.6% and 1.8% in the years 2007, 2008 and 2009 to conclude that the DRP was a constant value of 1.3% in the years 2001 through 2007. How one interpolates an increasing series backwards in time to obtain a constant series at the earlier dates is not explained. The effect of this creation of a constant data series is that in 2007 the trailing DRP taken as the true value of the DRP is identical to the Option A allowed DRP by construction. But this is not because the allowed DRP of Option A will equal the true DRP at the start of a regulatory cycle. Rather, a constant series of DRP numbers is created (by "interpolation") so that this appears to be the case.

94. It is not just in 2007 that the creation of a constant time series leads to an understatement of the difference between the true and the allowed DRP. Consider 2008. The allowed DRP under Option A is still 1.3% in 2008. The time series that feeds into the trailing average of Option B involves the true 2207 and 2008 values of 1.3% and 1.6% respectively and five created values all equal to 1.3%. Five of the seven numbers in the average are created. Consider 2011, the final year of the first regulatory cycle, The Option A allowed DRP remains at 1.3%. The Option B trailing average still reflects two years of created values of 1.3%.

95. The difference between the allowed DRP of Option A and the trailing DRP of Option B is understated by the analysis in Appendix 1. In consequence the estimate of the bankruptcy risk associated with relying on Option A is understated.

## 11. Empirical Analysis in Lally Appendix 2: Variation in Output Prices

96. Appendix 2 examines the variability of allowed revenues under Options A, B and C. Options A and B are largely as discussed in Section 9 above. But on page 47 of Appendix 2 the trailing average DRP is described as a 10-year trailing average and the reader is referred to the Table 6 of the Lally Review for the values. The values actually used in Appendix 2 are taken from Table 6 but these are seven-year, not 10-year, trailing averages. Under Option C the allowed cost of debt is the 5-year trailing average of the

market cost of debt. In Appendix 2 the market cost of debt is proxied by the sum of the 5-year risk-free rate and the seven-year trailing average of the DRP.

97. In what follows I ignore the confusion in Appendix 2 between 5-year, 7-year and 10-year averaging. Option A uses the sum of the risk-free rate and the DRP at the start of the regulatory cycle; i.e., Option A uses a proxy for the cost of debt at the start of the regulatory cycle. Option B uses the sum of the risk-free rate at the start of the regulatory cycle and a trailing average of the DRP. Option C uses the sum of a trailing average of the risk-free rate and a trailing average of the DRP; i.e., Option C uses a proxy for a trailing average of the cost of debt.

98. By the nature of averaging, Option C is such that the expected value of the variability of the associated revenue stream must be less than that associated with Option B which in turn must be less than that associated with Option A. How much less variable depends upon the degree of autocorrelation in the risk-free rate, the DRP and the sum of the two. But if the goal is to reduce variability in output prices, Option C dominates Option B and in turn Option B dominates Option A.

99. The measure of variability calculated in Appendix 2 is flawed for four reasons. First, as discussed in relation to Appendix 1 the DRP numbers analysed are not market DRP values but are instead a set of allowed DRP values. Second, also as discussed in relation to Appendix 1, six of the 14 DRP values underlying the analysis are the result of an "interpolation" such that they are constant and equal to the seventh value in the series; i.e., the created series simply lacks variability.

100. Third, the standard deviation number reported in Appendix 2 in part reflects variability that might have arisen if the starting year of the set of 5-year regulatory cycles was itself a random variable. This form of variability exists only in a thought experiment. The regulatory cycle is given and output prices faced by consumers do not become more variable because in a parallel world a different starting year might have been chosen.

101. Fourth, ignoring the preceding three flaws, the number of observations is very small. The population property, that Option C dominates Option B which in turn dominates Option A, need not always be observed in such a small sample.

102. In a large sample of data without the flaws inherent in the data underlying Appendix 2, Option C would exhibit lower variability of output prices than Option B which in turn would produce less variable output prices than Option A.

## 12. Conclusions

103. The Lally Report contains a number of flaws. First, The Lally Review fails to recognize that the bonds a firm chooses to issue are the set that the firm believes will maximize its value. It is not correct to allege that firms systematically err by failing to borrow locally and that their WACC should then be set so as to reflect a capital structure they did not choose.

104. Second, the Lally Review is incorrect in its claim that firms will have poor incentives if their actual credit rating is used in determining their DRP for regulatory purposes. Third, in considering the cost of debt the Lally Review overlooks a large and critical component thereof, namely the costs of financial distress. The Lally Review focuses only on the interest rate component of the cost of debt.

105. A fourth flaw in the Lally Review is that it claims that a regulator's estimate of the average DRP of a firm's debt will have an upward bias. This claim is unjustified. The claim rests on two assumptions: (i) an unsupported assumption about the dispersion in the time to maturity of the bonds a regulator will consider in estimating the DRP relative to the dispersion in the time to maturity of the bonds that a firm actually issues, and (ii) an assumption that the DRP is a concave function of time when in fact the DRP is often a convex function of time.

106. A fifth flaw in the Lally Report is in its implementation of the Brennan-Lally CAPM via the tax-adjusted risk-free rate and the TAMRP used therein. The implementation assumes that 20% of dividends are not accompanied by franking credits but inconsistently treats all dividends on zero beta equity as if they were fully franked. The result is that the required return on stocks with betas below one (above one) are underestimated (overestimated).

107. The Lally Report contains an empirical analysis in each of its appendices. The data used in the analysis in Appendix 1 is not market data, but is instead the outcome of a

small set of regulatory determinations. Further, many observations in the limited time series are in fact created by Lally as a constant amount. As a consequence the estimate of the bankruptcy risk associated with Lally's preferred option, Option A, is understated. The same flawed dataset underlies the Lally Review's empirical analysis of output price variability in its Appendix 2. With a larger time series of market data it would have been clear that the CEG preferred option, Option C, gives rise to a less variable output price series than the output price series that results if Lally's preferred Option A is used in regulatory determinations.

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**Working Papers**

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Social Sciences and Humanities Research Council of Canada: 1993 and 1994

Australian Accounting Research Foundation Exposure Draft on Director and Executive Disclosures

Singapore Management University Quantitative Finance Programme: 2003-2010.

External Reviewer, Accounting & Finance Department, Monash University: 2002

External Reviewer, Research School of Finance, Actuarial Science and Applied Statistics, Australian National University: 2012

External Reviewer, BBA, MBA and MM programs University of Malaya: 2014-2018

**Discussant:**

Accounting & Finance Association of Australia and NZ Meetings: 2006, 2007

American Finance Association Meetings: 1986-900, 1994-95, 2006

Annual Conference on Financial Economics and Accounting: 1992 and 1996

ANU Summer Camp: 2008, 2009, 2010, 2011, 2012

Asia-Pacific Finance Association Meetings: 1999

Asian Bureau of Finance and Economic Research Meetings: 2014

Asian Finance Association Meetings: 2004, 2005, 2006, 2009

Asian FMA Meetings: 2010
European Finance Association Meetings: 1995, 2002, 2005, 2010, 2011, 2012
Fifth Annual Texas Finance Festival: 2003
Finance Down Under: 2011, 2012, 2013
FIRN Research Day: 2010
FIRN Annual Conference, The Art of Finance, Hobart: 2012
Paul Woolley Centre on Capital Market Dysfunctionality Conference: 2008, 2009, 2011
Simulation Based & Finite Sample Inference in Finance Conference: 2003
Singapore International Conference on Finance: 2008, 2009
Singapore Management University Summer Camp: 2014
Western Finance Association Meetings: 1993 and 1997
SIRCA Young Researcher Workshop 2012

**Session Chair:**

Accounting & Finance Association of Australia and NZ Meetings: 2003, 2004, 2005
Asian Finance Association Meetings: 2004, 2005, 2006, 2009
Asian FMA Meetings: 2010
Australasian Banking & Finance Conference: 2003, 2011
American Finance Association Meetings: 2001
European Finance Association Meetings: 2002, 2005, 2010, 2012
Western Finance Association Meetings: 1995

**Keynote Speaker:**

16th Malaysian Finance Association Annual Conference: 2014
La Trobe Conference on Financial Markets and Corporate Governance: 2012
Asian FMA Meetings: 2010
Accounting & Finance Association of Australia and New Zealand Meetings: 2003
Australasian Banking & Finance Conference: 2002

**Conference Organization:**

The Dollars and Sense of Bank Consolidation: MBS Conference 2002
Risk Management and Pricing for Financial Institutions: Lessons from the Closed-End Fund Industry: Wharton Financial Institutions Centre Conference 1995
Finance Down Under Conference: 2007, 2008, 2009, 2010, 2011, 2012, 2015
FIRN Asset Pricing Group Meeting: 2013, 2014

**Conference Presentations:**

Australian Conference of Economists: 2006
Asian Finance Association Meetings: 2004, 2005 and 2006
Asian FMA Meetings: 2010
Australasian Q-group: 1999, 2004
Finance Down Under: 2010

HKUST Annual Finance Symposium: 2004

Third National Symposium on Financial Mathematics: 2004

AGSM Finance and Accounting Camp: 1996, 1997 and 1999

American Finance Association Meetings: 1986, 1989, 1990, 1996, 1997, 1998

NBER Summer Institute: 1998

Annual Conference in Financial Economics and Accounting: 1995 and 1996

American Mathematical Society Meetings: 1996

European Finance Association Meetings: 1995, 2002, 2005, 2010, 2012

NBER Financial Risk Assessment and Management Conference: 1995

N.J.C.R.F.S. Conference in Security Design and Innovations in Financing: 1993

Western Finance Association Meetings: 1984, 1989, 1993, 2010

Sixth Annual Conference MSMESB: 1991

Australasian Banking and Finance Conference: 1989, 2007, 2011

ZEW Centre for European Economic Research, Mannheim: Conference on the Economics of Charitable Fundraising: 2009

**Seminar Presentations:**

Australian Graduate School of Management, Australian National University, Bond University, Boston College, Carnegie-Mellon University, Central Queensland University, Chinese University of Hong Kong, Columbia University, Commodity Futures Trading Commission, Cornell University, Dartmouth College, Deakin University, Duke University, Fields Institute for Research in Mathematical Sciences, Erasmus School of Economics, Hong Kong University of Science and Technology, Humboldt University, Indian School of Business, Insead, La Trobe University, Lancaster University, London Business School, London School of Economics, Macquarie University, Massey University, Melbourne Business School, MIT, Monash University, National University of Singapore, New York University, Northwestern University, NUS Risk Management Institute, Odense University, Ohio State University, Queen's University, Queensland University of Technology, Rutgers University, Singapore Management University, Stanford University, Tilburg University, University of Aarhus, University of Adelaide, University of Alberta, University of British Columbia, University of California Berkley, University of California Irvine, University of California Los Angeles, University of Chicago, University of Frankfurt am Main, University of Houston, University of Illinois Champaign, University of Oregon, University of Maryland, University of Melbourne, University of Michigan, University of Minnesota, University of New South Wales, University of North Carolina Chapel Hill, University of Queensland, University of South Australia, University of Sydney, University of Technology Sydney, University of Vienna, University of Western Australia, University of Washington in St Louis, Vanderbilt University, Victoria University Wellington, Washington University, Yale University

**Manuscript Reviewer:**

University of Chicago Press

Cambridge University Press

Academic Press

**Teaching Experience**

*Derivatives-related courses:* Honours, Masters and PhD courses on options, futures, swaps, mortgage-backed securities and exotics.

*Corporate Finance-related courses:* Honours, Masters and PhD courses on capital budgeting, mergers and acquisitions, corporate taxation, agency problems, information asymmetries, and security design.

*Corporate Governance*: MBA course

*Real Options and Resource Projects*: Undergraduate and MBA courses

*Financial Management:* Executive MBA course

*Executive Education*:

ABN Amro, Australian Graduate School of Management, KPMG, Liechtenstein Global Trust, Melbourne Business School, PaperLinx, PWC, Susquehanna Investment Group, Telstra Risk Management and Assurance, Turkish Capital Markets Board, Wharton School Pension Funds and Money Management Program

*Member of Thesis Committees*:

*Completed (first appointment)*:

Mahmoud Agha (University of Western Australia), Alya Al Foori (Sultan Qaboos University), Ken Bechmann (Copenhagen Business School), Jacob Boudoukh (New York University), Cynthia Cia (Monash University), Jennifer Carpenter (New York University), Yangyang Chen (Monash University), Adam Dunsby (Goldman Sachs), Michael Gallmeyer (Carnegie-Mellon), Pekka Heitala (Insead), Terry Hildebrand (Enron), Ron Kaniel (University of Texas), Youngsoo Kim (Alberta), Michele Kreisler (Morgan Stanley), Guan Hua Lim (University of Singapore), Hui Li (Deakin), Zhenhua Liu (RepuTex), Spencer Martin (Ohio State), Krishnan Maheswaran (Melbourne University), Ed Nelling (Georgia State), Ian O'Connor (Melbourne University), Rob Reider (J.P Morgan), Mark Vargus (University of Michigan), Chelsea Yao (University of Lancaster), George Wang (University of Manchester)

*In Progress*: Michelle Zhou, Bill Zu, Emma Leyi, Yichao Zhu

*External PhD Examiner*:

Aarhus University, Queensland University of Technology, University of Technology Sydney, University of Sydney, University of Western Australia, University of New South Wales, Massey University

**Administrative Positions**

University of Melbourne, Faculty of Business & Economics:

Acting Dean and Deputy Dean, Faculty of Business & Economics: 2006-2010.
Head, Department of Finance: 2010-2012.
Deputy Head, Department of Finance: 2008-2010.
FEC Advisory Board: 2007-2008
Convener Melbourne Derivatives Research Group: 2006-2010
Finance Seminar Convener: 2007-2009.
FIRN Local Coordinator: 2006-2011
PhD Coordinator, Department of Finance: 2007, 2009-2011.
Research and Research Training Committee: 1999, 2007, 2009-2011

University of Melbourne

Cost Containment Committee: 2007.
Business@Melbourne Coordinating Committee: 2007-2008.
Melbourne Business School Committee: 2006-2011
Academic Structures Committee: 2008-2009

University of Melbourne, Melbourne Business School:

Director Ian Potter Centre for Financial Studies: 2000-2005
Academic Planning and Development Committee: 2002-2005
Curriculum Committee: 2002-2005

The Wharton School:

Convenor Corporate Finance Workshop: 1995-1997
Wharton Fellows Fund Oversight Committee: 1993-1997
Recruiting Committee: 1995-1996
Finance Seminar Convener: 1992-1994

Stanford Graduate School of Business:

Finance Seminar Convener: 1988-1990
Deans Advisory Committee: 1986-1988