# Report to the AER: WACC and Leverage

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## Author's Credentials

This report has been prepared by Graham Partington and Stephen Satchell. We have extensive experience as senior finance academics and have published several finance books and many research papers in finance. We also have extensive consulting experience, including work covering the cost of capital and valuation.

We have read the "Federal Court of Australia: Expert Evidence Practice Note", which is attached as Appendix 2. This report has been prepared in accordance with the guidance provided by the practice note. An expert witness compliance declaration follows the reference list at the end of our report.

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## Executive summary

Our discussion and analysis focuses on a number of features of WACC. We argue that WACC does not change a great deal with changes in leverage, largely because there are arbitrages that come into play. Except at extreme levels of leverage, the effects of arbitrage are likely to render the value of the firm relatively invariant to changes in leverage. In theory such arbitrage would hold the WACC constant. Whilst the conditions for such theories to apply are very unlikely to be satisfied in full in real markets, nevertheless these forces act to flatten the relation between leverage and the cost of capital. We also demonstrate mathematically, in the Appendix, that there are simple mathematical reasons, given the formula for WACC, as to why it will typically not move as much proportionately as the relative movements in leverage.

We examine competing theories of capital structure and try to determine which might be prevalent in capital markets. Here the empirical evidence seems quite inconclusive. The view that companies determine a priori some optimal capital structure and enact financing strategies that bring them to a specific optimal debt ratio seems very challenging to verify. The suspicion that companies have highly variable "optimal" capital structures both across companies and for a specific company through time implies hugely challenging econometric issues. Indeed, it is not obvious to us that firms are capable of precisely defining their optimal capital structure without making huge simplifications in their modelling.

Choosing between theories of capital structure, some analyses point to the pecking order theory as being the most prevalent in companies generally. This says, inter alia, that there is no target level of leverage, but rather that a firm's capital structure is a by-product of investment opportunities and a preference for internal finance. However, given the nature of utilities we suggest the pecking order theory is unlikely to apply to regulated energy networks, but we do not rule it out completely.

Once equity betas are measured, there are various ways one can take leverage into account in the calculation of an unlevered beta. It would have been helpful to find a survey of popular practice, but no such survey seems to exist. Anecdotally the Hamada procedure seems widely used. Some recent research suggests that computing a beta for debt seems to improve accuracy in measuring WACC, but the evidence is open to question. We also discuss the possibility that debt beta is a function of leverage. This seems intuitively reasonable but creates further estimation issues.

The AER has chosen to use the Harris Pringle/Brealey and Myers formula for beta relevering assuming risk free debt. On pragmatic grounds this is an understandable choice. It is not perfect but when it comes to estimating beta nothing is. The whole issue of relevering beta is problematical. In the past, we have questioned the benefits of relevering beta; we continue to do so.

Considering the theoretical arguments and empirical evidence from diverse sources, we conclude that the valuation impact of leverage is modest at best, the value of the debt tax shield is relatively small under a classical tax system and even smaller under an imputation tax system. Theory and evidence suggest that the relation between leverage and value is relatively flat and

thus there is a range of variation in leverage over which firm value and the cost of capital are likely to be little changed. We consider that small changes in leverage, say plus or minus five percent, are likely to have little appreciable effect on the cost of capital for Australian regulated energy networks and that even outside this range changes in the cost of capital are likely to be small until extreme levels of leverage are reached.

# Introduction

The AER has approached us for advice on the effect of leverage on the weighted average cost of capital (WACC). The full terms of reference can be found in Appendix 1 and key aspects of the terms of reference are given below.

The AER requires an expert advisor to examine the relationship between the overall cost of capital and the debt to equity ratio of regulated firms. This should include consideration of:

- **From a theoretical perspective**, would you expect the WACC for Australian regulated energy network monopolies to be relatively invariant to changes in gearing over a range of gearing values? If yes, over what gearing range and how invariant? In answering these questions, the consultant should have regard to:
  - market imperfections (including taxes, transaction costs and imperfect information)
  - the fact we operate under an imputation system in Australia
- **From an empirical perspective,** are there empirical reasons to believe (including prior academic work) how invariant the WACC (or overall rate of return) is likely to be to changes in gearing, and what does this imply for the invariance of the overall rate of return for Australian regulated energy network monopolies? In answering this the consultant should have regard to:
  - the relative degree of market imperfections that face the businesses we regulate as compared to business considered in any empirical study (including the fact we are under an imputation tax system while studies may have been focussed on a classical tax system)
  - the observed gearing over time of the proxy firms we used to determine the benchmark gearing in 2018.
- If you changed from the Brealey-Myers beta levering/ de-levering formula we currently use to a different formula, or any assumptions adopted in applying this formula such as a zero debt beta, would you expect the relative invariance of the overall rate of return to changes in gearing to alter materially? In answering this, consider how your answer accords to your earlier answers.

While we have requested the consultant to have regard to specific things above, these are non-exhaustive lists and the consultant should have regard to anything they feel necessary or appropriate for answering the question.

The expert advisor is requested to consider:

- Relevant academic literature on the rate of return with particular focus on academic work, either theoretical or empirical, that the consultant considers important to the choice of equity beta levering and de levering formulas, and on the sensitivity of the overall rate of return to changes in the gearing ratio
- practice in financial markets, including (but not restricted to):
  - approaches used by institutional investors
  - valuation techniques used by equity brokers/analysts.

# Some Basic concepts

## What is the cost of capital?

In order to establish a clear foundation for our discussion we begin with some basic concepts relating to the cost of capital. The cost of capital is the return that investors require in order to induce them to invest. It is therefore also known as the required rate of return, and when prices are in equilibrium expected and required rates of return are equal.

The key determinants of the required return are compensation for deferring consumption, reflected in the price of time, and compensation for bearing risk. That risk is that the returns actually received may not match the returns expected. The compensation for the risk comes in the form of a risk premium, which depends on the price of risk and the level of risk. The price of time and the price of risk are market wide variables, but the level of risk varies across firms. In the analysis that follows we do not consider the impact of capital structure changes on the general equilibrium of an economy. We assume that a firm changing its capital structure has a negligible impact on the pricing of cash flows in the economy.

## Investments and a constant WACC

The investments that a firm makes determine the firm's cash flows, their magnitude, timing, and risk. The required rate of return thus depends on the firm's investments, with higher returns required for investments in riskier assets. In perfect markets with no market frictions, such as taxes and transaction costs, the total cash flow to investors depends only on the cash flow generated by the assets. Thus, it is only the cash flow from the assets that determine firm value and risk, not the way those assets are financed. Williams (1938) described this as the Law of Conservation of Investment Value. Firms with high-risk assets will have a high cost of capital and firms with low-risk assets will have a low cost of capital. Absent market imperfections, firm value and the weighted average cost of capital are constants independent of leverage.

The classic paper that provides a rigorous analysis of the effect of leverage on value and the cost of capital is Modigliani's and Miller's (MM) 1958. They showed that, given investments, any differences in firm value due to leverage would be eliminated by arbitrage. The result is their famous Proposition I, that (p.268):

> *…the market value of any firm is independent of its capital structure and is given by capitalizing its expected return at the rate $\rho_k$ appropriate to its class.*

And the corollary that (p.268-269):

> *…the average cost of capital to any firm is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class.*

While controversial at the time of publication it is now widely accepted that the MM propositions hold in perfect markets. Becker (1978), for example, provides an alternative proof of the MM propositions, while Ross (1988) explains that the MM proposition holds under a much more general no arbitrage condition than in the original MM paper.

The MM results boil down to the fact that in perfect markets the total cash flows to investors are determined by the investment the firm makes, not how the investments are financed. The use of leverage repackages the cash from the investments between debtholders and shareholders but does not change either the total cash flow (debt plus equity cash flow) to the security holders or the total risk of the cash flow. As a company levers up, the decrease in the WACC caused by having a greater amount of cheaper debt is exactly offset by the increase in the WACC caused by the increase in the cost of equity due to financial risk. Therefore, a company cannot alter its WACC by altering its leverage. There is no optimal capital structure that either minimises the WACC or maximises firm value. The WACC in this case is given by the plain vanilla WACC as used by the AER:

$$\mathrm{WACC}_{\mathrm{pv}} = \frac{E}{V} r_e \ + \frac{D}{V} r_d$$

Where: $\mathrm{WACC}_{\mathrm{pv}}$ is the plain vanilla WACC

*E* is the market value of equity

*D* is the market value of debt

*V* is the market value of the firm (E+D)

$r_e$ is the cost of equity

$r_d$ is the cost of debt

The plain vanilla WACC gives the investors required rate of return overall and is sometimes known as the opportunity cost of capital.

Of course, real markets are not perfect, so it is natural to ask what are the effects of market imperfections? We will address this question in more detail later, for now we note that market imperfections can have effects on the firm's cash flow and so change firm value. However, relative to the effect of the investment cash flow on value, the effects of market imperfections tend to be less important. Furthermore, the market imperfections generally have effects that are appropriately handled by adjustments to the cashflow, rather than the WACC. However, for some valuation calculations it is possible to adjust the discount rate for market imperfections rather than allowing for them in the cash flow. This gives rise to the use of alternative definitions of the WACC.

## Definition and estimation of WACC

### Measurement and Causality

Since the cost of capital is fundamentally determined by the nature of the assets and the cash flows they generate it would be logical to measure the cost of capital using the assets. However, the cost of capital cannot be directly observed, it must be estimated. Such estimates are generally based on the prices of assets that are traded. Unfortunately, the assets that most firms invest in are not regularly traded. We do not, for example, observe weekly or monthly sales of transmission lines. Thus, instead of using the assets, the estimate of the cost of capital is based on the prices of the firm's issued securities since these are traded more frequently than the firm's assets.

As discussed above the cash flow to the firm's securities is derived from the cash flow from the firm's assets. Thus, the portfolio of securities issued by the firm inherits the risk return characteristics of the portfolio of assets that the firm has invested in and has the same required

return. As Figure 1 shows, causality for the required return runs from the assets to the issued securities, while measurement runs from the issued securities to the assets.

**FIGURE 1**


## Many WACCs

In the light of the discussion above "the WACC" is a convenient measurement instrument for estimating the investors' required return. Here we have used quote marks about "the WACC" because rather than a singular WACC there are many WACCs. It is easily seen that more than one WACC is possible by considering a perpetuity. A perpetuity can be valued by dividing the expected cash (C) flow by an appropriate discount rate r, which gives the present value of the perpetuity:

$$\text{Perpetuity Present Value} = C/r$$

For a given present value there are an infinite number of combinations of C and r that will give that present value. Thus, it should be little surprise to find that there is more than one WACC that can be used as a discount rate in a valuation. The key to getting the correct valuation is consistency, the cash flow and the discount rate must be defined consistent with each other and with the asset that is being valued. For example, if the expected cash flow from a firm's assets is \$10 in perpetuity and the firm's WACC is 10% then the value of the firm is \$100 (i.e. 10/0.1). Suppose the expected cash flow of \$10 comes from a before tax cash flow of \$20 subject to corporate taxes at 50%. Then the appropriate before corporate tax WACC is 20% and the resulting value \$20/0.2 = \$100. Here we have considered only two alternatives for WACC, but there are several others. We also sound a note of caution. In the case of perpetuities, it is relatively easy to adjust the discount rate to be consistent with the cash flow, but it is more difficult to get the adjustment right when cash flows vary over time.

## Adjust the discount rate or the cash flow?

Because some cash flows, typically taxes, can be accounted for by adjustments to the discount rate it is possible to have definitions for the WACC that make the WACC a function of leverage. This happens, for example, when adjusting the discount rate in order to allow for the tax shield benefits of debt under a classical tax system. Because tax adjustments can be either to the cash flows or the WACC, variation in WACCs with leverage can be a consequence of definitions rather than substance. The real question is whether the value of the firm changes with leverage.

Rather than adjusting the discount rate an alternative is to use the capital cash flow approach of Ruback (2002). The cost of capital is given by the plain vanilla WACC, which is used to discount the actual cash flow that is available to investors after allowing for actual taxes.

Ruback derives the following relation for the plain vanilla WACC:

$$\text{WACC}_{\text{pv}} = r_f + \beta_A\,(MRP).$$

Where: $\text{WACC}_{\text{pv}}$ is the plain vanilla WACC

$r_f$ is the risk free rate of interest

$\beta_A$ is the asset beta (systematic risk of the asset)
*MRP* is the market risk premium

Thus, as Ruback (2002) points out the plain vanilla WACC is independent of capital structure. It depends only on $r_f$ and the *MRP*, both of which are market wide parameters, plus the asset beta, which only depends on the risk of the firm's assets. The message is simple if all cash flow effects of taxes are handled in the cash flow, where they naturally belong, the WACC under Ruback's approach is a constant independent of leverage.[1] This is consistent with MM but goes beyond their results since it shows the plain vanilla WACC can be a constant even when there are market imperfections, taxes in this case.

The effect of other imperfections will depend on their risk. If the cash flows for imperfections have the same systematic risk as the other cash flows from the firm, then they will have no effect on the plain vanilla WACC (opportunity cost of capital). In other cases, the effect will depend on how much their systematic risk deviates from the systematic risk of the firm and also the present value of the cash flows expressed as a fraction of firm value. The smaller these values the less the effect.

## Leverage and the WACC Theory

### The importance of market imperfections

As discussed above, in perfect markets both the firm's value and its cost of capital are independent of its financing choices. To the extent that financing choices matter, therefore, it is due to market imperfections. Thus, our discussion will focus on market imperfections. The main market imperfections to be considered are taxes, transactions costs and imperfect information. These imperfections require our attention because they can cause changes in total expected cash flows and so affect firm value.

### Transaction costs and imperfect information

We first consider the role of the transactions cost when issuing securities and the effect of imperfect information in security issues. We suggest that the transaction costs of security issues, to the extent that they are material, should be accounted for in the cash flow rather than by adjustment to the WACC. More importantly as we explain below issue costs and information are not expected to result in a systematic relation between WACC and leverage.

While the transactions costs of an equity issue are substantially greater than the transactions costs of a debt issue, equity issues provide permanent capital, while debt issues will typically need to be rolled over giving rise to transaction costs in the future. So, whether issuing debt or equity has lower transactions costs in the long run is an open question. It is clear that debt has the advantage that it can be raised more quickly than external equity. However, it is also the case that increasing equity via retained earnings is convenient and involves no issue costs. So, in terms of a ranking by transactions costs equity is often argued to be both at the top and bottom of the ranking.

In a world of imperfect information, where managers have more information about the firm than investors, the financing choices that firms make can convey information to investors. It is well understood that announcement of a seasoned equity issue (particularly rights issues in

[1] In the Ruback model the tax benefits from debt have the same risk as the firm.

Australia) tends to have a negative price impact. In other words, seasoned equity issues tend to be interpreted as bad news. One reason for this is that managers are less likely to make a share issue when they consider their company's shares are undervalued and are more likely to make a share issue when they consider that their shares our overvalued. It is therefore no surprise to find investors' marking the share price down when a seasoned equity issue is announced. Such an issue is usually bad news. In contrast the announcement of a debt issue has relatively little impact on the share price. This makes issuing debt preferable to issuing equity when external funding is required. However, if a firm can readily finance its investments from retained earnings, then it can avoid the information signalling arising from security issues.

Considering information signalling and transactions costs involved in security issues suggests that firms should prefer to use retained earnings, then they would issue debt and only issue seasoned equity as a last resort. This is the pecking order theory of capital structure, Myers Majluf (1984), which Brealey, Myers, Partington and Robinson (2000, p.547) describe as follows:

> *1. Firms prefer internal finance.*
>
> *2. They adapt their target dividend payout ratios to their investment opportunities, while trying to avoid sudden changes in dividends.*
>
> *3. Sticky dividend policies, plus unpredictable fluctuations in profitability and investment opportunities, mean that internally generated cash flow is sometimes more than capital expenditures and at other times less. If it is more, the firm pays off debt or invests in marketable securities. If it is less, the firm first draws down its cash balance or sells its marketable securities.*
>
> *4. If external finance is required, firms issue the safest security first. That is, they start with debt, then possibly hybrid securities such as convertible bonds, then perhaps equity as a last resort.*

The pecking order theory also suggests that some financial slack, that is positive cash balances and/or unused debt capacity, is valuable. If for example, a good investment opportunity comes along, but the firm has no financial slack, it must issue shares to finance the project. Rather than face the adverse information impact on share price of issuing equity it may pass up the investment. This is known as the under-investment problem.

The significance of the pecking order theory to the current report is that it implies there is no well-defined leverage target that firms stick to. The level of leverage is a by-product of the historic interaction of the investment demand for funds and the availability of internal finance, rather than an attempt to achieve a target leverage level in order to minimise WACC. Low leverage arises because companies have been highly profitable but have had limited opportunities for new investments, while firms with large investment demand for funds relative to profitability end up with high leverage. The implication of the pecking order theory is that the effect on WACC of other market imperfections, notably the interest tax shield, are second order effects relative to the information effects and/or the transactions costs of security issues. In turn these latter effects do not result in a systematic relation between leverage and WACC.

There is one other aspect of transactions costs to consider. If, as we shall later argue, the WACC changes very little for modest changes in leverage then there may not be much point in incurring the transaction costs of changing leverage. The cost benefit equation may not stack up, the more so if the benefits are uncertain due to ambiguity over the optimal level of leverage. Transactions costs can therefore be a deterrent to changing leverage.

## Utilities and Pecking Order Theory

The pecking order theory was intended to particularly describe the behaviour of large mature companies with large and relatively stable cash flows. Utilities fit this description and under the pecking order would be expected to have low levels of debt. However, as Brealey and Myers Partington and Robinson (2000, p.547) point out the pecking order theory is less successful in explaining the behaviour of utilities:

> *There are also mature, stable industries – electric utilities, for example – in which ample cash flow is not used to pay down debt. High dividend payout ratios give the cash flow back to investors instead.*

As regulated monopolies the adverse information effects of issuing equity may be less for network businesses. Equity in such utilities is sometimes described as a debt proxy. The debt like characteristics may make an equity easier to value, in which case managers have less scope for making opportunistic issues. In the USA where utilities are frequent issuers of equity, the negative effect of share issues is much smaller than for industrial companies. This may reflect less concern by investors about opportunistic timing of issues, given they are a regular occurrence, and/or that the equity of utilities is easier to value.

Many of the Australian networks are private businesses with concentrated ownership where the suppliers of equity are likely to have better information about the value of the business. Thus, adverse information effects from equity issues are likely to be less. However, utilities with concentrated ownership may prefer issuing debt in order to avoid ownership dilution.

There are other factors at work with respect to utilities' use of leverage. One is to do with agency costs which we discuss below. Another is gaming the regulated return. Under regulation, where the allowed return is based on the company's actual WACC, there is a perverse incentive to increase the cost of capital and thereby increase revenue. Consequently, the appropriate leverage level has been a source of some dispute in US regulatory hearings.

The solution as argued by Taggart (1981) is for regulators to set a leverage ratio to be used for computing the regulatory WACC, then leaving utilities to determine their own leverage ratios at a level which they see as being best for them. This is the practice adopted by the AER who have since 2002 adopted a regulatory gearing ratio (debt/equity) of 60%. Under this regime there has been substantial variation in the leverage ratios of companies with regulated networks. The AER (2018, Gearing, Table 3) reports observation of market value leverage ranging from 45% to 80%, for the period 2007 to 2016. The AER's results show that there is substantial variation in leverage ratios both within firms through time and across firms. While there is evidence of delevering post the GFC the variation in leverage ratios suggests that neither the regulatory leverage ratio, nor some optimal leverage ratio is tightly constraining network businesses' level of leverage. Our impression of debt management by the networks is that factors such as structuring their debt to reduce refinancing risk are of more concern than targeting a precise leverage ratio.

## Agency costs and conflicts of interest

Also arising from imperfect information is the effect of agency costs, which can have value effects that vary with leverage. Shareholders own the business, but managers control the assets and know more about the business than the shareholders. If managers always acted in the interests of shareholders, this would not cause a problem. However, human nature being what it is we might expect that sometimes managers would act in their own interests. This could take many forms from exploiting expense accounts to engaging in empire building takeovers that destroy shareholder wealth. Trying to align managers' and shareholders' interests through control measures and incentives creates extra costs. The combined wealth losses and control costs are called agency costs. Agency costs can be particularly acute when the firm has plenty of cash. One way to reduce available cash is to increase debt, which commits managers to distributing cash, reduces management's opportunity to overinvest and helps control agency costs. Conversely, increasing equity gives more flexibility to managers and increases opportunities to waste the shareholders' money.

## Expropriation

Higher debt levels can impose some discipline on management and thus help reduce agency costs. Thus, maximising the value of the firm may require higher leverage. However, there are two countervailing effects. One countervailing effect arises from the conflict of interests between shareholders and debt holders. Shareholders can benefit by the transfer of wealth away from the debt holders. Managers, who are appointed by shareholders, may be inclined to take action to engineer such transfers. This expropriation, for example, can occur by increasing the riskiness of the debt and as a result the market value of the debt will go down. The reduction in the market value of debt represents a gain in wealth to the shareholders. Debt holders are well aware of the risk of expropriation and seek to control it first by imposing covenants that restrict the level of leverage and also other covenants that are likely to be increasingly onerous as leverage increases. Thus, the effects of agency cost and expropriation risk can both affect the level of leverage and change the value of the firm, but the magnitude of these effects is likely to defy quantification. Thus, it is very doubtful that an optimal leverage ratio, based on these effects, can be clearly identified. It is clear that these effects do not enter into the formulae traditionally used in computing the WACC.

The other countervailing effect on high leverage arises from the underinvestment problem. High levels of leverage are likely to reduce financial slack. Lack of financial slack means greater risk of having to pass up attractive investments because equity needs to be raised to fund the investment. This not only has the problem of adverse information effects, but sometimes the shareholders may be unwilling to contribute more equity. It turns out that at high debt levels there can be an expropriation effect in reverse. If shareholders put in new funds there can be a wealth transfer to debtholders such that shareholders end up worse off, so naturally they will not supply additional equity.

## Investment, agency costs expropriation and utilities

The effect of agency costs and expropriation costs are likely to be mitigated in the case of Australian regulated networks. Many network businesses are private companies. It is well recognised that agency costs are greatly reduced in private companies and where a parent company provides debt finance, the incentive for expropriation is also mitigated. The use of stapled securities, where the equity trades with debt attached, also reduces the incentive for wealth transfers from debtholders. The relatively high leverage of the network businesses further suggests that suppliers of debt are not unduly worried about expropriation. Regulation

also reduces management discretion about investment and so mitigates agency problems like overinvestment.[2] Regulation may also mitigate any underinvestment problem. With the mitigation of expropriation risk, relatively safe (low beta) assets and relatively stable cash flows, higher leverage, not paying down debt and paying higher dividends instead, would not be surprising. Smith (1986) also suggests that higher dividends result in more frequent trips to the capital market to raise equity and this may increase monitoring of the regulators by the capital market helping constrain rate cuts. In addition, where the regulator uses a dividend growth model there may be scope for regulatory gaming.

### The effect of taxes and the after tax WACC

The Modigliani and Miller (1958) analysis is the foundation for subsequent theoretical work, which examines how the results may change with the introduction of corporate taxes and then personal taxes. This began with the work of Modigliani and Miller (1963) who showed that if the interest tax shield is accounted for by adjusting the cost of debt, rather than adjusting the cash flow,[3] then the WACC is given by:

$$\mathrm{WACC}_{\mathrm{at}} = \frac{E}{V} r_e \ + \frac{D}{V} r_d (1 - T_c)$$

Where: $\mathrm{WACC}_{\mathrm{at}}$ is the after tax WACC

$T_c$ is the corporate tax rate

The after tax WACC is sometimes known as the adjusted cost of capital and is a declining function of leverage. The after tax WACC gives the return that the company has to generate in order to deliver the investors' required returns, as given by the plain vanilla WACC.

Subsequent to the MM (1963) paper, there has been a great deal of theoretical literature which has investigated the relation between leverage and the value of the firm and/or magnitude of WACC, first allowing for the impact of corporate taxes and subsequently adding the effect of personal taxes.

MM assumed risk-free debt, but Stiglitz (1969) showed that their results can carry through assuming risky debt. Other work examined the effect of finite cash flows varying through time as compared to perpetual cash flows. Consideration was also given to the effects of fixing the quantity of debt or fixing the leverage ratio. The former case was considered to give rise to a risk-free debt tax shield and the latter to give rise to a risky debt tax shield with the same risk as the firm. Consideration was also given to the effect of rebalancing to a target leverage at the end of each period, or continuous rebalancing. The main consequence of this work was to show that the formulae giving the cost of levered equity and levered beta varies according to the assumptions made. A good summary of much of this work is given in Taggart (1991).

The key result for our current purposes is that if the debt tax shield is assumed risk free, the plain vanilla WACC should fall as leverage increases. This is because the portfolio of the firm's assets

[2] We note the claims of gold plating by the networks, but that sort of "overinvestment" is intended to be value enhancing and thus not an agency cost for shareholders.

[3] The tax shield can be valued as part of the cash flow using the APV approach of Myers (1974) or the capital cash flow approach of Ruback (2002). Indeed, these are the methods that should be used when future leverage levels are projected to change. The difference in the methods is in the assumed riskiness of the debt tax shield, which in the APV is usually taken to be the same as the risk of the debt, while in the capital cash flow method it is treated as being as risky as the assets.

now includes the debt tax shield, which being risk free (beta of the debt tax shield is zero) brings down the risk ($\beta_A$) of the portfolio of assets. However, if the debt tax shield is as risky as the firm's assets, then there is no change in the risk of the asset portfolio and hence no effect on the plain vanilla WACC.[4]

Miles and Ezell (1980) derived the important result that the after tax WACC could be used to value time varying cash flows with finite lives but only if the level of leverage is assumed to remain constant over time. In their words the WACC can be used (p.720):

> *…if the unlevered cost of capital, the cost of debt, the tax rate, and the market value leverage ratio are constant…*

Under the assumption of a constant leverage ratio, the after tax WACC provides a convenient way to allow for the interest tax shield. The assumption also conveniently implies that the tax shield benefit of debt is as risky as the firm and this in turn is consistent with a plain vanilla WACC that is a constant independent of leverage.

### Magnitude of the tax shield

The analysis of MM (1963) suggests that the effect of the tax shield on the after tax WACC and on firm value was substantial. However, the model led to the unpalatable conclusion that the optimal capital structure was 100% debt, in contrast to the much lower leverage ratios commonly observed. The logical conclusion was that the value of the tax shield implied by the model was too large and also that as leverage increased offsetting costs, notably bankruptcy costs, would be incurred. A lower value for the tax shield could arise for many reasons. For example, the effective tax rate could be lower due to tax losses, accelerated depreciation, investment allowances, and tax avoidance. More leverage increases the interest tax shield, and thus there is a greater chance that tax deductions exceed taxable income, so some of the interest tax shield is wasted.

A decline in the statutory corporate tax rate also reduces the value of the tax shield. In Australia, the corporate tax rate was 46% in the early 1980s and is now 30% and less for smaller firms. So declining tax rates are not a hypothetical effect. More importantly, the tax reforms in the latter half of the 1980's introduced an imputation tax system. The imputation tax credit at the personal level for corporate tax paid offsets the value of interest tax shields and in the limit could reduce the value of the debt tax shield to zero.

Even under a classical tax system the value of the interest tax shield can be offset if personal tax on debt returns is higher than on equity returns. The intuition is that a tax advantage to debt at the corporate level is offset by a tax disadvantage at the personal level. The use of debt creates more cash flow after corporate tax, but that advantage is lost to investors because more tax is paid at the personal level.

Equity is generally considered to have a lower tax rate at the personal level. This because it is more difficult to avoid tax on interest relative to equity returns, which have a substantial capital gain component. Taxes on capital gains can be deferred and are generally at concessional rates.

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[4] Other financing effects on firm cash flows, arising from market imperfections, might have a different risk to the firm and so might change the asset beta. However, it is only the debt tax shield that has been analysed in this context.

Under a classical tax system allowing for differential taxes on interest and equity returns, Miller (1977) derives a market equilibrium where there is no marginal benefit from using debt and no optimal capital structure for a given firm. This is an important result as it shows that even under a classical tax system with interest tax shields at the corporate level, leverage can be irrelevant. Miller's result is probably too extreme and subsequent papers demonstrate this. For example, allowing for the effect of non-debt tax shields, some firms have more capacity to utilise debt shields than others and this is sufficient to perturb the Miller equilibrium. The key takeaway from this research is that the tax shield benefit of debt is reduced if personal taxes are considered.

The foregoing conclusion is even stronger under the Australian imputation tax system. Consider the case where a firm pays all its taxable profit out as a fully franked dividend and investors are able to utilise all the tax credits that they receive. In this case the shareholders recover all the corporate tax paid via their imputation tax credits. As a result, the value of the debt tax shield is zero. In reality not all corporate tax paid is recovered as imputation tax credits. All of the credits are not distributed and not all investors can use the tax credits, so not all corporate tax is recovered. The tax benefit of debt depends on the effective corporate tax rate allowing for imputation, which is often computed as $T_c(1-\gamma)$ where $\gamma$ is the value of imputation credits as a fraction of their face value.

We illustrate the foregoing ideas by considering two numerical examples taken from Brealey, Myers, Partington and Robinson (2000), with some minor textual changes. The tax rates may seem high by current standards, but they were the tax rates that prevailed about the time the examples were constructed. First an example under the conditions that prevailed under the previous Australian classical tax system

*Consider a firm paying half its earnings as dividends. Suppose there is a zero-tax rate on capital gains and this, combined with receipt of dividends by investors not liable for tax on dividends, cuts the effective tax rate on equity income to 7 percent. That is the tax rate on equity $T_{PE}$ = 0.07. If $T_p$ the tax rate on interest is 0.47, then*

| | *Interest* $ | *Equity* $ |
|---|---|---|
| *Income before tax* | 1.00 | 1.00 |
| *less corporate tax at $T_c$ =0.46* | 0 | 0.46 |
| *Income after corporate tax* | 1.00 | 0.54 |
| *less tax at $T_P$ =0.47 and $T_{PE}$ =0.07** | 0.47 | 0.038 |
| *Income after all taxes* | 0.53 | 0.502 |
| | *Advantage to debt* = $.028 | |

*Note: *The seven percent is calculated as follows: Half the returns are untaxed capital gains. Of the dividends paid about 30 percent were subject to tax and let us assume the average rate of tax was 47 percent. Then the tax take is (0.5 x 0) + (0.5 x0.3 x 0.47) =0.07 or 7 percent.*

Next an example under the Australian imputation system when the corporate tax rate was also reduced:

*We assume a 100 percent dividend payout and full use of imputation credits*

| | *Interest* $ | *Equity* $ |
|---|---|---|
| *Income before tax* | 1.00 | 1.00 |
| *less corporate tax at $T_c$= 0.36* | 0 | 0.36 |
| *Income after corporate tax* | 1.00 | 0.64 |
| *add corporate tax refunded as imputation credits* | 0 | 0.36 |
| *less tax at $T_P$ = 0.47 and $T_{PE}$ = 0.47** | 0.47 | 0.47 |
| *Income after all taxes* | 0.53 | 0.53 |
| | | *Advantage to debt $0* |

*Note: Under imputation, shareholder taxes are levied on the basis of the pre-tax profit represented by the dividend. In this case taxes are* $\left[\left(\frac{.64}{1-.36}\right)\times.47\right]$ *= $1.00 x .47.*

Brealey, Myers, Partington and Robinson (2000) also consider a more realistic case under imputation, allowing for a 50 % dividend payout with the balance of returns coming as capital gains, only 60% shareholders are able to use the imputation credits, and some shareholders are tax exempt. In this case there was an advantage to equity of $0.002.

The following conclusion about the effect of tax on value is reached by Brealey, Myers, Partington and Robinson (2000, p. 527):

> *We should be cautious about making general statements about the superiority of either debt or equity.*

We agree.

## Bankruptcy costs

The final market imperfection that we consider is bankruptcy costs. It has been extensively argued that as leverage increases the risk of bankruptcy increases. This creates a negative component to expected cash flows that would not arise for an unlevered firm. The expected value of the bankruptcy costs increases as the level of leverage increases. This so because as the level of debt grows so does the probability of not being able to service the debt and ending up in bankruptcy.

The additional costs are the direct costs of winding up the business and the indirect costs that arise from greater expenses and reduced revenues as the risk of bankruptcy increases. For example, there would be few of us keen on buying airline tickets from an airline that looked like it could fail. Suppliers are less likely to offer trade credit to firms with high financial distress risk and so on. Thus, there is a trade-off between the increased in expected distress cost and the increase in possible debt tax shields as leverage increases. This is commonly known as the static trade-off theory of capital structure.

With respect to regulated networks bankruptcy costs are likely to be relatively low. Being regulated monopolies they are inherently low risk businesses. The risk of overleveraging their low beta assets is constrained by the requirement to retain an investment grade rating. An investment grade rating reflects a relatively low default risk. Furthermore, bankruptcies in utilities are rare and if a network business was clearly heading towards financial distress, intervention from the regulator and regulatory relief seem highly likely. Utilities also have substantial tangible assets, another factor consistent with lower bankruptcy costs and hence more debt capacity. The staggered maturity of networks' debt financing is consistent with a concern for controlling refinancing risk and reducing the risk of financial distress.

## Theory Conclusions

Summarising the theoretical analysis, in the case of the plain vanilla WACC (opportunity cost of capital) the conclusion is that, with some exceptions, it is a constant independent of leverage. The after tax WACC is a declining function of leverage. This is due to the tax shield benefit of debt, but even under a classical tax system the benefit is diminished by factors such as alternative tax shields, personal tax effects, and bankruptcy costs. With respect to the after tax WACC for utilities in a classical tax system, we are inclined to agree with the conclusion of the National Association of Regulatory Utility Commissioners (2020, p.11):

> *The WACC curve is shaped like a very shallow dish such that large variances in capital structure ratios lead to minimal changes in overall costs…*

The tax shield benefits of debt are even smaller under an imputation tax system and so the relation between the after tax WACC and leverage in Australia is expected to be like an even shallower dish, more like a saucer.

The value effects of leverage require more than just consideration of the usual trade-off between increasing leverage for more tax shield benefits and the negative effect on value of bankruptcy costs. As leverage increases there is the positive effect of reducing agency costs and the negative effect of expropriation risk. There is also the need to consider the information effect of security issues.

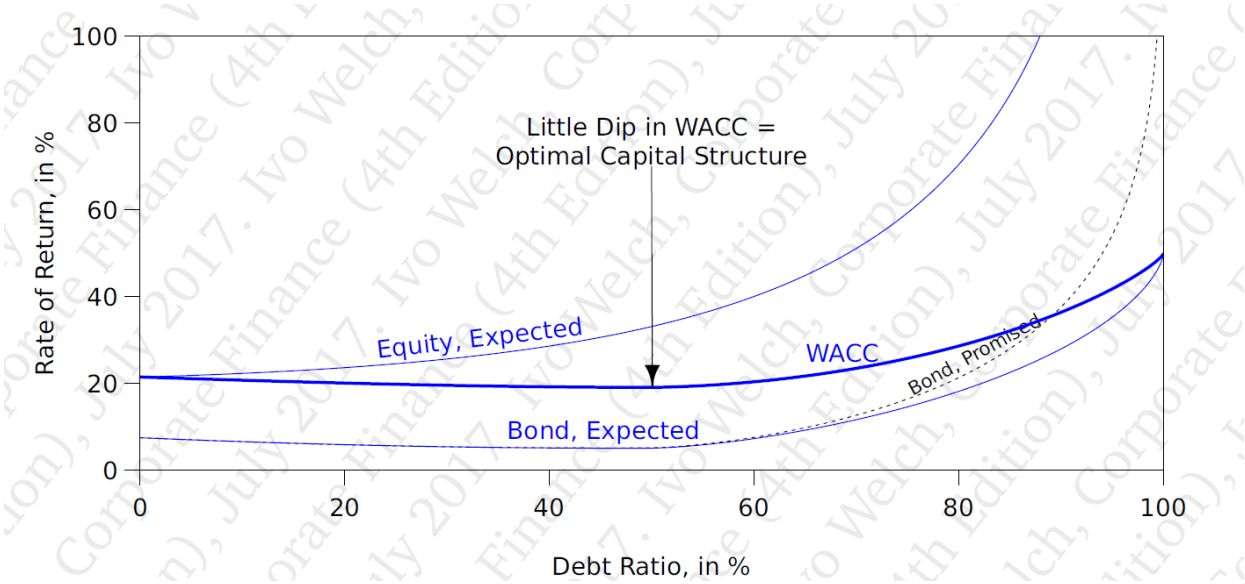
If the information effect of security issues dominates in determining the level of leverage, then the pecking order theory applies. If so then, other than at extreme levels of leverage, the variation of the after tax WACC with leverage is expected to be small. Our analysis suggests that the pecking order theory is less applicable to the network businesses than other firms, but we do not rule it out completely.

Agency costs and the costs arising from expropriation risks and also underinvestment, are conceptual in nature rather than well-defined dollar quantities. Thus, we think it unlikely that firms are able to define an optimal level of debt with respect to these factors. In the case of utilities these costs are likely to be smaller and this would flatten the value and leverage relation and the relation between leverage and the plain vanilla WACC.

Welch (2017, p.543) provides the following conceptual plot for the WACC considering all the factors discussed above. He also states that with some special exceptions (e.g., firms with extreme leverage):

> *For many other large publicly traded firms, the capital structure value function seems to be quite flat.*

**FIGURE 2: TAKEN FROM WELCH (2017) EXHIBIT 19.6**




It is clear that much theoretical work, and also corporate finance textbooks generally, take the plain vanilla WACC (opportunity cost of capital) to be a constant independent of leverage. It cannot be established theoretically what exactly is the net effect of bankruptcy costs, agency costs, expropriation costs, and underinvestment, but these costs are probably smaller and thus less important for utilities. Other than at extreme levels of leverage, a relatively flat value function with respect to leverage is quite feasible for the regulated networks. We would expect that small changes in leverage would not much, if at all, affect their cost of capital, and that over quite a wide range of leverage the effect would be small. However, the limits to that range cannot be established from our review of the theory.

# Empirical evidence

## Ideals and reality

The ideal experiment would allow observation of the overall cost of capital for identical investments at different levels of leverage. Three problems are immediately evident. First, the history of AER return determinations is replete with debate about the magnitude of the cost of capital and provides ample testimony on the difficulty of measuring the WACC. Second, the observation of different levels of leverage for identical assets/firms is not a regular feature of corporate life. Empirical practice, therefore, is to try to use samples of relatively homogenous firms (electric utilities in early studies) and/or statistical controls. It is difficult to ensure that this is done satisfactorily. Even the measurement of leverage is not without its problems. For example, alternative ways to measure leverage and the use of book values for debt rather than market values.

Another difficulty, as Graham and Leary (2011) observe, is that it is not likely that there is any one capital structure theory that works for all firms. Different market imperfections may be especially important for some firms, but unimportant for others. Given the difficulties of the empirical work definitive results are not easily obtained.

Lastly, there is the challenge of distinguishing tactics from strategy. As Myers (2001) puts it (p.82):

*We know much more about financing tactics—for example the tax-efficient design or timing of a specific security issue—than about financing strategy, for example the firm's choice of a target overall debt level.*

*Research on financing tactics confirms the importance of taxes, information differences and agency costs. Whether these factors have first-order effects on the overall levels of debt vs. equity financing is still an open question.*

## Leveraged buyouts and security exchange offers

Leveraged buyouts (LBOs) and security exchange offers, where companies offer to swap shareholders equity for debt (leverage increasing) or offer debtholders shares in exchange for debt (leverage reducing) provide cases where leverage changes, but the firm's investments are initially unchanged. This meets one of our requirements for a clean experimental design. Unfortunately, leveraged buyouts are transactions involving extreme levels of leverage and so it is difficult to generalise results to more usual levels of leverage. Leveraged buyouts may have large effects on value, but it is difficult to disentangle the role of tax benefits and expected cost savings of the LBO, particularly reduced agency costs.

Security exchange offers have been much studied and clearly show that leverage increasing exchange offers are good news, on their announcement, the share price rises. Leverage decreasing exchange offers are bad news, on their announcement, the share price falls. This, except for straight debt issues,[5] is a general tendency for leverage increasing and decreasing events, Smith (1986). For example, equity issues are bad news.

It is tempting to interpret the evidence as consistent with a reduced cost of capital due to increased tax shields as leverage increases and vice versa. However, there is a problem with this interpretation since it implies more leverage is always better. If more leverage is always better, this works against the idea of an optimal debt ratio. If firms do have optimal debt ratios, then sometimes they will be below the optimum and need to increase leverage and sometimes they will be above the optimum and will need to reduce leverage. As long as movement is towards the optimum level of leverage both increases and decreases in leverage should be value increasing.

An alternative explanation for the results observed for security exchange offers is information signalling. As discussed in the theory section of this report equity issues signal bad news since they suggest shares are likely to be overvalued. It is also easy to understand that issuing debt in exchange for shares could be interpreted as a signal of management confidence about future cash flows. We conclude that the promise of a relatively clean experimental design has not translated to clear results about the relation between leverage and value.

## Classic MM and early empirical work

Modigliani and Miller's classic (1958) paper presented empirical evidence as well as their theory. Separately analysing samples for the utility industry and the oil industry, they find no significant relation between the cost of capital and leverage, and that the cost of equity is an increasing

[5] These tend to have small effects not significantly different from zero.

function of leverage. Hamada (1972) finds indirect support for the latter, through analysis of levered and unlevered betas.

Miller and Modigliani (1958) also find that the relation between leverage and the cost of equity has significant negative curvature for the utility industry. This is consistent with risky debt at higher leverage leading to a decline in the rate at which the cost of equity increases. Modigliani and Miller's results are in close agreement with their theory, but firm conclusions on the basis of this evidence would be entirely premature. There is only a crude proxy for the cost of capital, there are no controls for other variables that might affect the cost of capital, and there are unresolved econometric issues.

After the publication of Modigliani and Miller's (1963) paper on the debt tax shield and after tax WACC, they undertook further empirical work notably their (1966) study of the cost of capital for electric utilities where they found the debt tax shield made a substantive contribution to value. Empirical work by other researchers also examined the effect of leverage on the cost of capital of utilities, such as Brigham and Gordon (1968). The appropriate models and methodologies were much debated, see for example Gordon's (1967) criticism of MM's empirical work and Elton and Gruber's (1971) criticism of both Gordon (1967) and Brigham and Gordon (1968). Such debates underscore the difficulty of the empirical work and raised significant questions about the validity and interpretation of the results. Miller (1988) in his retrospective analysis, 30 years after the original capital structure irrelevance paper, places little weight on his (1966) results with Modigliani, or their earlier empirical work, or the empirical work of others. Thus, the early empirical work provides conflicting results and fails to provide compelling evidence about the validity of the MM propositions or the value of debt tax shields.

### More recent work

In more recent empirical work researchers have taken a different tack. Examining, for example, the relation between tax shields and leverage, or whether firms seem to be adjusting to a target level of leverage and if so how quickly. Some studies have examined whether the pecking order or the trade-off theory better explains capital structure. Studies on this different tack also have their challenges in successful implementation but there are stronger results than in the early work.

In contrast to the early empirical work, which focussed on electric utilities, it is common in more recent studies to exclude utilities from the sample of firms analysed. We also note that most of the research is based on companies operating in the USA under a classical tax system. However, with respect to G7 countries, Rajan and Zingales (1995) find that across countries levels of leverage and the determinants of leverage tend to be similar.

### Utilities and leverage

Regulated firms, such as electric and gas utilities, are consistently among the most highly levered firms, Bradley Jarell and Kim (1985). The effect of regulation on leverage is further investigated in Barclay, Smith and Watts (1995). They found a strong positive relation between regulation and both leverage and dividend payouts. These relations were highly statistically significant and also substantial in economic terms. They argue that this is a result of stable cash flows, which would support more leverage, and regulation which mitigates the underinvestment problem.

### Trade off theory

Myers nicely summarises the pre-1990 state of play in the title of his (1993) paper: "Still Searching for Optimal Capital Structure". He concludes that the static trade-off theory where

there is an optimal capital structure, from trading off debt tax shields against bankruptcy costs, does not explain capital structure. We next examine some of the evidence relevant to the trade-off theory, with respect to taxes and bankruptcy costs.

### Taxes

If the debt tax shield is valuable and firms attempt to exploit that value, then there should be a positive relation between leverage and firms' capacity to utilise debt tax shields. Whether this is a consequence of tactics or strategy is difficult to determine empirically. Bradley Jarell and Kim (1985), Long and Melitz (1985), Barclay Smith and Watts (1995) test for this relationship and find no support for taxes as a determinant of leverage. However, Mackie-Mason (1990) argues that the methods used in this type of study are not sensitive enough to detect tax effects. Thus, rather than studying levels of leverage he studies debt issues. He finds that firms are less likely to issue debt the higher the level of alternative tax shields, which can crowd out the debt tax shield. Graham (1996) also finds that firms with higher marginal tax rates are more likely to borrow.

Estimates of personal tax rates for debt and equity were made by Graham (2000) and consistent with Miller's (1977) theoretical analysis, the personal tax rate on equity is substantially below the personal tax rate on debt. This personal tax disadvantage to debt would substantially reduce the tax shield benefit of debt, but on the numbers in Graham's analysis the reduction would be not large enough to fully offset the debt tax shield leaving a net gain of 4.3% of value. A surprising result, as Graham observed, is that many firms could get a substantive tax shield benefit from increasing leverage but were not doing so. However, Blouin, Core and Guay (2010) revisit Graham's analysis and show that the magnitude of the tax benefit was overestimated.

### Bankruptcy costs and growth opportunities

Regressing leverage against proxies for bankruptcy risk and cost Bradley Jarell and Kim (1985) found that leverage varied negatively with these variables. While Mackie Mason (1990) finds that debt issues are more likely when firms have a higher fraction of tangible assets. This also suggests a bankruptcy cost effect as in bankruptcy loss of asset value is smaller for tangible assets.

Several studies have examined the relation between leverage and the market to book ratio, for example, Barclay, Smith and Watts (1995) and Barclay and Smith, (1999). The market to book ratio is often taken to be an indicator of growth opportunities and firms with a high market to book ratio are considered to be growth stocks. The consistent result is that there is a negative relation between market to book and leverage. Lower leverage for growth stocks is consistent with both avoiding the underinvestment problem (pecking order theory) and controlling bankruptcy costs (trade-off theory). Since growth stocks have sizeable investment opportunities financial slack is desirable to avoid the underinvestment problem, hence less leverage. For growth stocks, Bankruptcy costs are particularly high, since much of their value is represented by the present value of future growth, which shrinks to zero if the company is liquidated.

### Pecking Order v Trade-off

A strong result in the literature is a negative relation between profitability and leverage, found for example by Baskin (1989). This is a robust result that is consistently found across multiple papers and applies across countries including Australia. This result is consistent with the pecking order theory, where more profitable firms have more capacity to finance investments from retained earnings and also have more capacity to pay down debt. However, the result is a challenge to the trade-off theory as more profits gives more capacity to utilise debt tax shields

and thus under the trade-off theory there should be a positive relation between leverage and profitability. The riposte is that higher profits (more equity) reduce actual leverage and if firms only readjust to their optimal leverage with a lag a negative correlation between profitability and leverage arises.

Tests that seek to determine whether it is the pecking order or trade-off theory that determines capital structure have failed to provide a clear result. Fama and French (2002) examine the predictions of the trade-off and pecking order theories for dividends and debt. They then test which theory predictions best match the data. They point to considerable commonality in predictions of two theories, but where the predictions differed there was no overall winning theory. Representative of the conflicting results in the literature, Shyam-sunder and Myers (1999) find in favour of the pecking order while Frank and Goyal (2003) find against it.

### Variation in leverage ratios

Using a large panel data set, Graham and Leary (2011) show that there is substantial variation in both the time series and in the cross-section, for market and book value leverage ratios. They partition the total variation into three parts, between industries, within industries and within firms. They find that the within industry variation contributes most to total variation, closely followed by within firm variation, and between industry variation comes last. For market leverage the proportions of variation were 42%, 38% and 20% respectively. If firms were sticking tightly to their target leverage ratios, we would have expected the least variation for firms. We would also have expected more homogeneity for industries and most of the variation between industries.

Using a comprehensive set of proxies for variables expected to explain leverage Graham and Leary (2011) next examine how much of the variation in leverage between industries, within industries, and within firms, is explained by the proxy variables. For market leverage the percentage of variation explained was 29%, 20% and 11% respectively. In other words, the variables typically used to explain leverage do not explain most of the variation in leverage and have the least success in explaining variation for individual firms.

If firms had optimal target leverage ratios, actual leverage ratios would be expected to vary about the targets because of shocks to firm value or tactical exploitation of a particular financing opportunity. We would subsequently expect to see firms rebalancing towards the target capital structure. However, convincing evidence of this behaviour is in short supply. One strand of the literature looks at how fast firms appear to be adjusting to a target. Some of the results suggest this adjustment is painfully slow, others provide faster rates of adjustment, but even the fastest rates imply that full adjustment takes years to achieve, for examples see Fama and French (2002), Flannery and Rangan (2006), Kayhan and Titman(2007) and Elsas and Florysiak (2010).

### Value

Some papers directly test whether leverage adds value to the firm.

> *Despite our best efforts, our regressions produce no reliable evidence of tax effects*

These are the words of Fama and French (1988, p.821). They find that the relation between leverage and value is typically negative. They suggest that this could be interpreted as consistent with Miller's (1997) argument that personal taxes offset the benefit of the debt tax shield.

However, they think it more likely to be due to problems with the effectiveness of their control variables.

Van Binsbergen, Graham and Yang (2010) provide particularly interesting results. Using the method of Graham (2000) they simulate the firm's tax benefit function and also estimate the implied marginal cost curve for debt as perceived ex-ante by management. Their procedure gives an all-in cost of debt including effects such as those arising from bankruptcy costs and agency costs. From the cost and benefit functions they estimate the net benefit of leverage. The net benefit of leverage varies across firms, but for the typical firm near equilibrium, firm value is increased by about 4.5% of book assets.

Van Binsbergen, Graham and Yang (2010) also examine how costly it is for firms to diverge from their optimum leverage levels. They show that the cost of being underlevered or overlevered, relative to optimum leverage, is almost flat (close to zero) within plus or minus 20% of the optimum level of leverage. The effect starts to rise more sharply outside this range and is asymmetric. Overleveraging is more costly than underlevering, but for investment grade firms the asymmetry is minimal.

The net benefits of debt are also estimated by Korteweg (2010). He describes his method as follows:

> *I estimate the net benefits to debt financing using a new relation between a firm's market value, systematic risk (beta), and net benefits to leverage, extending the Modigliani and Miller (1958) result. In this model, net benefits are defined as the (ex ante) present value of all future benefits minus the costs of debt. Assuming that firms within an industry have the same asset beta, cross-sectional differences in equity and debt betas are entirely driven by the net benefits. I use this cross-sectional variation to identify the level of net benefits, and how they vary as a function of firm characteristics.*

Despite the difference in method to Van Binsbergen, Graham and Yang (2010). There are striking similarities in the results. Mean net benefits of debt are estimated to be 4.3% (median 4.0%) or 3.6% (median 3.8%) of value for alternative methods of defining industries. The plots of the benefits to rebalancing show very small effects about the optimum level of leverage. The scale of the plots in Korteweg (2010) make it difficult to precisely define the range of very small effects, but it appears to be roughly $\pm 10\%$ about the optimal level of leverage. The effects of underleveraging and overleveraging are asymmetric, but less so for investment grade firms.

### Imputation

Following the introduction of the imputation tax system in Australia there were changes in corporate financial policy. Dividend payouts increased, more firms offered dividend reinvestment programs, and leverage was reduced. Just because these events happened after the introduction of imputation does not prove a causal link, other factors might be at work. However, higher dividends are a logical consequence of imputation tax credits increasing the value of dividends. While lower leverage is a logical consequence of the personal tax effects of

imputation reducing the value of debt as a tax shield. A study by Pattenden and Twite (2008) provides evidence of the link between imputation and higher dividends. While Twite (2001) and Pattenden (2006) provide evidence of declining leverage due to imputation. Companies paying dividends with franking credits are also less likely to engage in tax avoidance, Mclure, Lanis, Wells and Govendir (2018), and Li and Tran (2019).

### Beta adjustment

In Aharon and Yargil (2019) the authors use an econometric approach to examine the beta-leverage relationship for sensitivity to such factors as bankruptcy costs and default risk. They use direct tests of beta relevering models such as those discussed later in section 3. A sample of 182 US industrial companies was used. There are a number of econometric problems with their approach, but their conclusion seems reasonably robust; namely that bond risk should be included, equivalent in our discussions under beta relevering below to not setting the beta of debt ($\beta_d$ )to zero. Models that use a non-zero $\beta_d$ seemed to fare much better.

## Conclusion on empirical evidence

With regard to the theories of capital structure, in the case of the pecking order theory there is no optimal level of leverage and in the case of the trade-off theory there is an optimal level of leverage. Unfortunately, the empirical literature is inconclusive with regard to whether it is the pecking order or the trade-off theory that best describes firm's capital structure. It is entirely plausible that some firms behave according to the pecking order theory and others according to the trade-off theory.

If firms had optimal levels of leverage, we would expect them to target those leverage levels. However, the variation in leverage ratios through time for individual firms suggests that they do not stick tightly to those targets. The evidence also suggests that if there are leverage targets the adjustment to those targets is rather slow. Variation in leverage ratios and apparent slow adjustment to targets might be because there are no leverage targets, or because the cost of capital is relatively flat around targets, or because the benefits of moving to the optimal level of leverage is offset by the cost of the transition. Some of the variation in leverage ratios might also be because of a mixture of pecking order and trade-off firms.

There is evidence that the tax shield benefit of debt and bankruptcy costs affect firm's financing choices. There is also evidence that personal tax rates on debt are higher than tax rates on equity which reduces the value of the debt tax shield. The Australian imputation system effectively reduces personal tax rates on equity for domestic investors and the evidence is consistent with the debt tax shield value being lower under imputation.

With respect to the net effect of leverage on value, the evidence is that the effect is relatively small. With respect to how this value contribution changes with leverage, Graham and Leary

(2011), after undertaking a careful review of empirical capital structure research,[6] make the following observation (p.339):

> *The implication that, for many firms, the value function is flat for ±25% or more deviation from optimal is intriguing because it implies that for many firms, capital structure choices are not first-order important. This may explain why it is difficult to document significant results in the broad panel. It also raises the possibility that empirical tests should focus on the subset of firms for which capital structure is most value relevant. It is also important to consider why estimated value functions may appear flat for many firms. Is it that capital structure truly does not matter for these firms, or could it possibly be that the value functions are estimated over a wide range of firms, perhaps averaging away offsetting effects across firms? Or, is the flatness of the value function related to the range of inaction predicted by costly adjustment models? Finally, we note that value functions have not been estimated conditional on governance or contracting characteristics.*

The empirical evidence is that the value function with respect to leverage is relatively flat. It is also clear that there is substantial variation in leverage ratios, even for individual firms over time. Most of that variation in capital structure remains unexplained. It is also clear that it has not been established that capital structure choices are of first order importance to firm's value. We conclude that if leverage affects value and if there is a value maximising optimal level of leverage it has left rather a weak track in the data.[7] The evidence favours quite substantial changes in leverage having relatively little effect on value.

## Overall conclusion on cost of capital leverage and value

Considering both theory and empirical results we consider that small changes in leverage, say plus or minus five percent, are likely to have little appreciable effect on the cost of capital for regulated networks and that even outside this range changes in the cost of capital are likely to be relatively small within quite a wide range of leverage. The National Association of Regulatory Utility Commissioners (2020, p.11) expresses a remarkably similar view.

> *As increasing financial leverage shifts weight from common equity to lower cost debt, it also increases both the cost of debt and the cost of common equity. In practice these offsetting effects cancel each other out over a wide range of capital structure ratios, so hypothetical capital structures that micro-manage a utility's capital structure ratios by 1% or 5% increment offer minimal opportunity to actually reduce the WACC.*
>
> *Despite these challenges, it is possible that a utility's capital structure can deviate so significantly such that a hypothetical capital structure is appropriate. One way to think about this is the 80%/20% rule. If a capital structure contains more than 80% common equity, for instance 100%,*

[6] Their review focusses on post 2005 research.

[7] We suspect that someone has said something very similar before, but we are unable to provide attribution.

*hypothetical capital structure ratios can be imputed to reduce the common equity ratio down to 80%. On the other hand, if a capital structure contains less than 20% common equity, for instance 0% or below, hypothetical capital structure ratios can be imputed to increase the common equity ratio up to 20%.*

The context of this quote is in determining when regulatory intervention, to prevent gaming/improve efficiency, justifies replacing the utilities leverage ratio with one determined by the regulator. The implication is that, within a leverage ratio range of 20% to 80%, the WACC varies so little that only outside this range is regulatory action justified. The range of leverage ratios observed for the AER's (2018) network comparators (45% to 80%) is within the range of the 80%/20% rule. Whether the precise limits for Australian networks are given by the 80%/20% rule has not been established empirically, but the range does not seem too unreasonable.

The 50% range for leverage variation, within which the empirical value function is relatively flat, as suggested by Graham and Leary (2011), is more restrictive than the 60% range given by the 80%/20% rule and the range in Korteweg (2010) is more like 20%. However, in contrast to the absolute bounds of the 80%/20% rule, the 50% result is for variation about the optimal leverage level for the firm, so the absolute limits of the range vary across firms. Whichever way you slice it, there appears to be considerable scope for networks to vary leverage without having a substantial impact on value. However, networks might consider leverage changes undesirable if they had adverse effects on financing tactics.

## Beta Relevering

The equity beta is, in a linear framework, the slope coefficient of the regression of the company's stock returns on the market index. WACC calculations incorporate levered and unlevered betas. Unlevered beta $\beta_u$ shows the volatility of returns without financial leverage and is equal to the asset beta $\beta_a$, while the levered beta is generally known as the equity beta $\beta_e$.

### Understanding the key relevering formulae

There are several formulae to lever/unlever beta. In order to help understand what drives the differences in these formulae we start with a simple general model for leverage adjustments to beta. Recall that *D* is the value of debt, *E* is the value of equity and $T_c$ is the corporate tax rate. No arbitrage ensures that the expected return on the portfolio of assets, including the debt tax shield, equals the expected return on the portfolio of securities issued against the assets. Given the CAPM, and that $V_u$ is the value of the assets with $V_{dts}$ the value of the debt tax shield, we can write:

$$\beta_u V_u + \beta_{dts} V_{dts} = \beta_d D + \beta_e E$$

Rearranging gives:

$$\beta_e = \beta_u + (\beta_u - \beta_d)\frac{D}{E} - (\beta_u - \beta_{dts})\frac{V_{dts}}{E} \qquad 1$$

This equation makes it clear why different assumptions about the risk and value of the debt tax shield can lead to different unlevering/relevering formulae. For example, under the assumptions of Modigliani and Miller (1963) debt is risk free so $\beta_d = 0$. They also assume a fixed quantity of debt in perpetuity, which gives a debt tax shield of value $T_c D$. Substituting in equation 1 gives:

$$\beta_e = \beta_u(1 + (1 - T_c)\frac{D}{E})$$

which is the Hamada formula commonly used in practice. Why this formula is commonly used in practice is not clear. Corporate debt is risky, so assuming that debt beta is zero is problematic. However, it is convenient. Debt betas are small and usually difficult to measure, as corporate debt is thinly traded or not traded at all. The assumption of beta equal to zero is an approximation which avoids this issue. However, a fixed quantity of debt in perpetuity is not a reasonable assumption. It is also inconsistent with the use of the after tax WACC, which is commonly used in practice. Another issue is that $T_c$ should be the expected marginal corporate tax rate, but this is not observable, so common practice is to use the statutory tax rate

Substituting for risky debt in the case of fixed debt in perpetuity gives:

$$\beta_e = \beta_u + (\beta_u - \beta_d)(1 - T_c)\frac{D}{E}$$

Which is the Conine formula.

An alternative assumption, and the only one that is consistent with the use of the after tax WACC, is to assume that the firm maintains a constant leverage ratio measured at market values. Thus, as the value of the firm changes, the firm must be assumed to rebalance its capital structure to maintain a constant leverage ratio. If that rebalancing is continuous the value of the debt tax shield is continuously uncertain. The value of the firm is only certain at time zero and is uncertain thereafter. Since the quantity of debt is a fixed proportion of firm value, the value of the tax shield varies exactly as firm value varies and so $\beta_{dts} = \beta_u$. Substituting into equation 1 gives:

$$\beta_e = \beta_u + (\beta_u - \beta_d)\frac{D}{E}$$

If $\beta_d = 0$ then the formula becomes:

$$\beta_e = \beta_u\left(1 + \frac{D}{E}\right)$$

which is the Harris and Pringle/Brealey and Myers formula, as used by the AER.

Firms do not rebalance their capital structure continuously. Rebalancing is likely to be periodic in nature. We might assume that rebalancing takes place once each period, say at the end of each year. Since the quantity of debt is known at the start of the year the debt tax shield is certain for the first year and $\beta_{dts}$ for the first year is zero. However, the quantity of debt is uncertain thereafter, $\beta_{dts} = \beta_u$. In this case and assuming riskless debt Miles and Ezell (1985) derived the beta adjustment formula:

$$\beta_e = \beta_u + \beta_u\left(1 - \frac{r_f \times T_c}{1 + r_f}\right)\frac{D}{E}$$

With risky debt the Miles Ezell formula becomes:

$$\beta_e = \beta_u \ + (\beta_u - \beta_d)\left(1 - \frac{r_d \times T_c}{1 + r_d}\right)\frac{D}{E}$$

Under imputation we could substitute (1-$\gamma$)$T_c$ for $T_c$ in the Miles and Ezell equation but, as will become apparent from subsequent discussion, the effect of this is so trivial as to not be worthwhile.

## Which formula to use?

Clearly the Hamada formula is not the correct formula to use when working with the after tax WACC, or even under the reasonable assumption that the quantity of debt grows over time as the firm grows. We have earlier suggested the convenience of not having to estimate the debt beta as a possible explanation for the popularity of the Hamada formula, but that also applies to the Harris Pringle formula. It is also sometimes suggested, for example Arzac and Glosten (2005) the Hamada formula is used because of (p. 458):

> *…a conscious attempt to account for the fact that debt seems to adjust with a lag to firm value, since that would tend to increase the value of the tax shield and decrease the value of the levered beta with respect to the values resulting from the assumption of constant leverage.*

Lally (undated) has addressed this issue by deriving a beta relevering formula which allows for a lag of more than one period for debt rebalancing. He concludes as follows (p.8):

> *Implementation of this model shows that the Miles-Ezzell rather than the Hamada model is a much better approximation for debt resetting frequencies less than ten years, and also for most of the interval between successive debt resets even when the debt resetting frequency exceeds ten years. This suggests that the Miles-Ezzell model is significantly superior to the Hamada model and ought to be used in substitution for it.*

We agree that the Hamada model is not the correct model for real world firms. However, it is commonly said that this is the model used in practice, for example in Arzac and Glosten (2005). We note that this is casual empiricism, we have seen no evidence from a systematic study. However, accepting what seems to be the prevailing view leaves us with a dilemma. This is because we place weight on the test of time and practical use in choosing an appropriate model. Maybe the Hamada model is good enough and analysts feel switching models would be an exercise in spurious precision.[8] Alternatively, maybe the use of the Hamada model is something to do with the incentives that analysts face.

[8] One could imagine the following internal dialog: I am going to have to allow for an increase in the cost of equity at higher leverage, but this whole beta relevering thing is a very iffy business and difficult to get right. I may as well just stick with the formula I know, the Hamada formula.

Given debate about the value of tax shields and the correct way to allow for them in valuation formulae, Arzac and Glosten (2005) revisit the issue of the correct valuation formulae for arbitrary cash flows when leverage is kept constant. After a rigorous analysis, their results, assuming risk free debt, are consistent with the Miles Ezell and Harris Pringle formulae.

There is, therefore, strong support for both formulae. The Miles and Ezell approach with periodic debt rebalancing seems a more plausible assumption than continuous rebalancing, but the latter is assumed under the AER's return calculations. However, this is not a matter of much consequence. Compared with the Harris Pringle formula, the Miles Ezell formula contains an extra term of:

$$-\beta_u \left( \frac{r_f \times T_c}{1 + r_f} \right) \frac{D}{E}$$

This reduces the equity beta as a consequence of the first year's tax shield being risk free. The size of this adjustment is exceedingly small. The adjustment scales the difference due to discounting at the risk-free rate rather than the cost of capital, when computing the present value of the tax benefit of the first interest payment. The scaling is by the product of leverage and the unlevered beta. Consequently, in practice there is very little difference in the relevered betas that result from using the Miles Ezell formula or the Harris Pringle formula. The Harris Pringle formula has the advantage of being the simplest formula of all those we have considered and requires the fewest inputs.

There is a question to be raised about inconsistency in the AER's decision to use a risky cost of debt in computing the WACC, but then using a beta relevering formula that assumes that debt is risk free. We address some of the issues this raises in the next section of the report. The AER could achieve consistency by using $r_f$ as the cost of debt when computing the WACC. This would also solve the problems that we discuss in the next section of the report. However, it would understate the cost of debt that the regulated networks actually incur.

### Risky debt and the AER's WACC

Following Ruback (2002) the plain vanilla WACC should be a constant independent of leverage. However, under the AER's approach using the Harris Pringle/Brealey and Myers formula, the estimate of the plain vanilla WACC rises gently with leverage in panel A of Table 1. The inputs are shown in the top left-hand corner of the of the table. The asset beta in panel A is obtained by unlevering the input beta using the Harris Pringle/Brealey and Myers formula. The equity beta at different levels of leverage is then obtained by relevering the asset beta using Harris Pringle/Brealey and Myers formula.

The upward drift in the plain vanilla WACC suggests an upward bias that is increasing with leverage. There are three likely sources of an upward bias in the WACC as calculated by the AER and all are to do with risky debt.

### Promised return on debt

First, is the use of the promised return rather than the expected return on risky debt. The promised return overstates the expected return due to the risk of default. As leverage rises the promised return rises to compensate for the increased risk of default. Thus, if the promised return on debt is matched to the different levels of leverage, the overstatement of the WACC increases with leverage. However, when same cost of debt is used to compute the WACC at all levels of leverage the upward bias will be constant, rather than rising with leverage.

### Non-zero debt beta

Second, is the assumption that the beta of debt is zero, this leads to an upward bias in the cost of equity when relevering the equity beta.[9] Bringing the value of the beta of debt into the adjustment formula will control this problem, but we then face the problem of determining the beta of debt.

Given the cost of debt, at the assumed level of leverage, it is possible to use the CAPM to back out the beta of debt. This process, however, assumes that all of the debt risk premium is due to systematic risk. This takes us back to our first problem above. The observed cost of debt is the promised return. The CAPM gives the expected return. Since the promised return is higher than the expected return, backing the debt beta out of the CAPM would give an upward bias to the debt beta.

In panel B of Table 1 we use the same input data as in panel A The difference from Panel A is that we allow for the effect of risky debt in the unlevering to get the asset beta, and also in relevering to get the cost of equity at different levels of leverage. The adjustments are based on the formula:

$$\beta_e = \beta_u + (\beta_u - \beta_d)\frac{D}{E}$$

We use the CAPM to back out the debt beta from the cost of debt, assuming all of the observed credit spread is due to systematic risk, or equivalently that the cost of debt is the expected return on debt. Since the same cost of debt is used at all levels of leverage the systematic risk of debt is assumed to be independent of leverage. The result, as Panel B shows, is that the $WACC_{pv}$ is now a constant independent of leverage.

[9] We note the AER undertakes both unlevering and relevering and in unlevering the bias is downwards. The net effect depends on whether unlevering or relevering dominates the final result. For unlevering from above the 60% benchmark used by the AER the unlevering has a bigger effect than the relevering and vice-versa below 60%.

**TABLE 1: EFFECT OF ALTERNATIVE RELEVERING FORMULAE**

| Inputs | |
|---|---|
| Cost of debt | 4% |
| Risk free rate | 2.8% |
| MRP | 6.0% |
| Equity Beta at D/V = 50% | 0.52 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Panel A** | | | | | | | | |
| **Unlevered Asset Beta = 0.26** | | | | | | | | |
| Debt/Value | 0.4500 | 0.5000 | 0.5500 | 0.6000 | 0.6500 | 0.7000 | 0.7500 | 0.8000 |
| Debt/Equity | 0.8182 | 1.0000 | 1.2222 | 1.5000 | 1.8571 | 2.3333 | 3.0000 | 4.0000 |
| Equity beta | 0.4727 | 0.5200 | 0.5778 | 0.6500 | 0.7429 | 0.8667 | 1.0400 | 1.3000 |
| Cost of equity | 0.0564 | 0.0592 | 0.0627 | 0.0670 | 0.0726 | 0.0800 | 0.0904 | 0.1060 |
| WACCpv | 0.0490 | 0.0496 | 0.0502 | 0.0508 | 0.0514 | 0.0520 | 0.0526 | 0.0532 |
| **Panel B** | | | | | | | | |
| **Unlevered Asset Beta = 0.36 and Debt Beta =0.20** | | | | | | | | |
| Equity beta | 0.4909 | 0.5200 | 0.5556 | 0.6000 | 0.6571 | 0.7333 | 0.8400 | 1.0000 |
| Cost of equity | 0.0575 | 0.0592 | 0.0613 | 0.0640 | 0.0674 | 0.0720 | 0.0784 | 0.0880 |
| WACCpv | 0.0496 | 0.0496 | 0.0496 | 0.0496 | 0.0496 | 0.0496 | 0.0496 | 0.0496 |

## Non-linear adjustment

Third, a bias arises because as the debt becomes riskier at higher levels of leverage an increasing quantity of business risk is being transferred from the shareholders to the debt holders. Although the equilibrium expected return on equity rises with leverage (due to increased financial risk) it does so at a decreasing rate. The equilibrium expected return on debt also rises with leverage because of increased systematic risk, and the promised return rises due to increasing default risk.

With risk free debt, or a cost of risky debt that is independent of leverage, there is a linear relation between the cost of equity and the level of leverage. However, the reality is that the cost of risky debt rises with leverage and consequently there is a non-linear relation between the cost of equity and leverage. This is why the cost of equity rises with leverage, but at a decreasing rate. If the method of adjusting for leverage does not allow for this then cost of equity will go up too quickly. The result is an upward bias in the estimated WACC, which increases with leverage.

We have rewritten equation 1 below, with the debt related betas and the value of the debt tax shield subscripted with $l$ to emphasise that they may change with leverage. One solution to the problem above is to use the rewritten equation 1a. Under this approach, the debt beta will rise with leverage. The marginal benefit of the debt tax shield will decrease with leverage due to the greater risk of lost interest deductions, because of crowding out, and to a higher probability of the tax shield being lost in default. It is less clear what happens to the systematic risk of the debt tax shield as leverage increases. However, we might continue with the usual assumption for

WACC that the risk of the debt tax shield matches the risk of the firm, $\beta_{dts} = \beta_u$. In which case the third term drops out of equation 1A and we conveniently avoid the need to estimate $V_{dts,l}$. The only value left that varies with leverage is $\beta_{d,l}$. If we can take the default and possibly liquidity components out of the credit spread, at leverage level $l$, then we can use the CAPM to back out the relevant debt beta from the cost of debt at level $l$. Alternatively, we can use the promised return on debt and accept an upward bias in the debt beta.

$$\beta_e = \beta_u + (\beta_u - \beta_{d,l})\frac{D}{E} - (\beta_u - \beta_{dts,l})\frac{V_{dts,l}}{E} \qquad 1a$$

If we further assume that the cost of risky debt is unchanged at different levels of leverage, then implicitly $\beta_d$ is assumed to be a constant independent of leverage. The equity beta adjustment is now linear, and we then obtain the results as in Panel B Table 1.

Another approach is to estimate the required return using the unlevered beta and the CAPM. As in Ruback (2002) this gives a WACC that is a constant independent of leverage. However, to estimate $\beta_u$ we will need to use an unlevering procedure and so face the foregoing problems essentially in reverse.

## Conclusion on beta relevering

The AER's task could be simplified by not relevering betas. This is not without precedent. We know of one well respected Australia valuation firm that eschews beta relevering. The accuracy of the approximation created by not relevering will obviously depend on the difference between a comparator firm's leverage and the AER benchmark of 60%.

In the example of Table 1 above at the 60% leverage ratio, the AER's approach leads to a 12 basis point overstatement (5.08% - 4.96%). Had we instead computed the WACC using the observed equity beta, giving the cost of equity at 50% leverage, there would have been a 19 basis point understatement (4.96% - (4.0% x 0.6 + 5.92% x 0.4)). In this case the absolute error is smaller with the AER's beta adjustment but the difference in the absolute magnitude of the errors is small. Depending on the case the rankings might change.

As we have often said getting relevering right is full of problems. This is not just confined to the choice of the correct method, but also the measurement of the inputs. Perhaps surprisingly even the measurement of leverage has its problems. A topical question is what to do about the capitalisation of operating leases, which under AABS 16, will have been applied to many Australian entities as at financial year end 30 June 2020.

The AER has chosen to use the Harris Pringle/Brealey and Myers formula for beta relevering assuming risk free debt. On pragmatic grounds this is an understandable choice. It is not perfect but when it comes to estimating beta nothing is.

# Appendix

## The WACC relationship some differential analysis.

Here we relax the law of one price, so MM results do not automatically apply, and we examine the limits to variation in WACC.

Define WACC = $\frac{K_e\mu_e}{K_e+K_b}+\frac{K_b\mu_b}{K_e+K_b}$.

Here we can regard $\mu_b$ as the required rate return on debt times 1 –T where T is the rate of corporation tax. We will compute the derivative of WACC with respect to $K_e$ whilst holding $K_b$ fixed (the partial derivative).

$\frac{dWACC}{dK_e} = \frac{K_{b(}\mu_e-\mu_b)}{(K_e+K_b)^2}$ (1)

Equation 1 tells us that WACC increases with $K_e$ as long as

$(\mu_e - \mu_b) > 0.$

By symmetry,

$\frac{dWACC}{dK_b} = \frac{-K_{e(}\mu_e-\mu_b)}{(K_e+K_b)^2}$ and so WACC decreases with $K_b$ as long as

$(\mu_e - \mu_b) > 0.$

The total differential will be,

$$\mathrm{d}WACC = \frac{dWACC}{dK_e}dK_e + \frac{dWACC}{dK_b}dK_b$$

$$\mathrm{d}WACC = \frac{dWACC}{dK_e}dK_e + \frac{dWACC}{dK_b}dK_b$$

$$= \frac{K_{b(}\mu_e-\mu_b)}{(K_e+K_b)^2}dK_e - \frac{K_{e(}\mu_e-\mu_b)}{(K_e+K_b)^2}dK_b$$

$$= \frac{K_eK_{b(}\mu_e-\mu_b)}{(K_e+K_b)^2}\left(\frac{dK_e}{K_e} - \frac{dK_b}{K_b}\right)$$

Conditions under which WACC is unchanged are when

$(\mu_e - \mu_b) = 0$ (unlikely); although this term could be very small and/or $\left(\frac{dK_e}{K_e} - \frac{dK_b}{K_b}\right) = 0$. This latter case corresponds to keeping the capital structure constant so that the gearing ratio will be constant.

A more interesting case would be a shift in either direction (i.e., towards more equity or more bonds whilst fixing total capital). This corresponds to $dK_e + dK_b$ =0.

In this case

$$\mathrm{d}WACC = \frac{dK_e K_e K_{b(\mu_e - \mu_b)}}{(K_e + K_b)^2}\left(\frac{1}{K_e} + \frac{1}{K_b}\right)$$

We see that most changes in gearing assuming fixed total capital have relatively little influence on WACC. Assuming that $(\mu_e - \mu_b) > 0$;it follows that

$$|\mathrm{d}WACC| = \frac{|dK_e| K_e K_{b(\mu_e - \mu_b)}}{(K_e + K_b)^2}\left(\frac{1}{K_e} + \frac{1}{K_b}\right)$$

We note that

$\frac{K_e K_b}{(K_e + K_b)^2}$ will lie between 0 and ¼ for non-negative capital values, therefore,

$$|\mathrm{d}WACC| \leq \frac{(\mu_e - \mu_b)|dK_e|}{4}\left(\frac{1}{K_e} + \frac{1}{K_b}\right)$$

Suppose as an example, that $K_e = 6{,}000{,}000{,}000\ \ K_b = 2{,}000{,}000{,}000.$

$|dK_e| = 1{,}000{,}000{,}000$ and $(\mu_e - \mu_b) = .03$ ; $\mu_e = .08$ and WACC $= 7.25\%$ then

$|\mathrm{d}WACC| \leq .005$ so that the upper bound is 50 bp. This tells us that if the quantity of equity $K_e$ changes by 16.7%; or if the quantity of debt $K_b$ changes by 50%, then WACC changes at most by 6.9% (0.5%/7.25%), in this case the actual change is below the maximum at 38 basis points representing a 5.2% change in WACC.

In the general case we can consider various scenarios

$$|\mathrm{d}WACC| = \frac{K_e K_{b(\mu_e - \mu_b)}}{(K_e + K_b)^2}\left(\left|\frac{dK_e}{K_e} - \frac{dK_b}{K_b}\right|\right) \leq \frac{(\mu_e - \mu_b)}{4}\left(\left|\frac{dK_e}{K_e} - \frac{dK_b}{K_b}\right|\right)$$

Example 1. Suppose now that $(\mu_e - \mu_b) = .03$ and that $\left(\left|\frac{dK_e}{K_e} - \frac{dK_b}{K_b}\right|\right) = .2$; then

$|\mathrm{d}WACC| \leq .0015$; so we would expect (at most)15bp changes.

Example 2. Suppose $|\ dK_e|$ changes by a billion but $dK_b = 0$, here, we allow the value of the company to change. As before $K_e = 6{,}000{,}000{,}000\ \ K_b = 2{,}000{,}000{,}000.$
$|dK_e| = 1{,}000{,}000{,}000$ and $(\mu_e - \mu_b) = .03;\ \mu_e = .08$ and WACC $= 7.25\%$; here a 17% change in the quantity of equity $K_e$ leads to a 58 basis points (8%) change in WACC with an upper bound of 87 basis points (12%).
These results indicate that for commonly observed values of the cost of debt and equity, the algebraic structure of WACC limits the capacity of WACC to move a great deal.

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## Expert Witness Compliance Declaration

We have read "Expert witnesses in proceedings in the Federal Court of Australia" which are attached as Appendix 3. This report has been prepared in accordance with those guidelines. As required by the guidelines, we have made all the inquiries that we believe are desirable and appropriate and no matters of significance that we regard as relevant have, to our knowledge, been withheld from the Court.

Signed

Graham. H. Partington

Steven. E. Satchell

# Appendix 1

## Terms of Reference

**Background**

The AER applies a 'building block' model to set regulated revenues for electricity and gas network service providers. The building blocks—return on capital, return of capital, operating expenditure and tax —reflect the expected costs that would be incurred by a benchmark efficient entity operating the network. This is a form of incentive regulation, as building blocks are estimated in advance for a regulatory control period (typically five years) and the networks retain any benefit (or bears any detriment) where it is able to reduce costs below the AER's estimates. Revealed costs are then used to inform building block estimates for the following control period, so that efficiency gains are passed on to consumers. The AER also operates a number of incentive schemes in conjunction with the building block framework.

The return on capital building block is set by applying a rate of return on capital to the regulatory asset base (RAB) each year. The AER estimates the allowed rate of return for regulated businesses using the approach set out in the 2018 RoR Instrument. The Rate of Return Instrument is binding under the National Electricity Law and National Gas Law. This means that the AER and network businesses are required to set the rate of return according to the current Instrument. There is a four year cycle for the development of the next rate of return instrument (the 2022 instrument), which is to be published in December 2022.

The 2022 instrument is to be developed through a comprehensive consultation process, with consumers, investors and businesses included throughout the process. The AER has already commenced its 'Pathway to 2022' work program for the development of the 2022 instrument. The AER must be satisfied that the approach to setting the allowed rate of return achieves the National Electricity Objective (NEO) and National Gas Objective (NGO), and the related revenue and pricing principles (RPPs).

While the 2022 Instrument does not have to adopt the 2018 approaches, the 2018 RoR Instrument applies the following key characteristics when estimating a businesses' allowed rate of return:

- It use a nominal vanilla weighted average cost of capital (WACC) formulation (used in a post-tax revenue model, i.e. effect of the interest tax shield is considered in cashflows)
- It assumes a 40% equity and 60% debt capital structure. When we determined to use this gearing ratio, the observed gearing was materially below 60%, but we determined to continue use this gearing ratio at least partly on the basis the WACC is likely to be relatively invariant to gearing.
- It uses a domestic Capital Asset Pricing Model (CAPM) to estimate the Return on Equity (RoE). This is estimated as:
    - The risk free rate is estimated from the yield on 10 year to maturity Commonwealth Government Securities (CGS) over a short averaging period prior to the commencement of the regulatory control period (between 20 and 60 business days).
    - Equity beta of 0.6 (fixed for the life of the 2018 instrument)
    - Market risk premium of 6.1 per cent (also fixed for the life of the 2018 instrument)
    - This means the RoE is the risk free rate plus a fixed premium of 3.66%.
- It uses a trailing average portfolio for the allowed return on debt, updating 10% of the portfolio estimate annually (i.e. a ten year rolling window of annual return on debt observations).
- Annual return on debt are based on debt costs for the benchmark BBB+ credit rating at a 10 year term, estimated by weighting A rated and BBB rated benchmark curves (from a number of providers) over an averaging period.
- Market data for the return on debt and risk free rate is sourced from averaging periods nominated by the network businesses in advance.
- It uses a gamma (assumed utilisation of imputation credits) value of 0.585, fixed for the life of the 2018 instrument.

Recently, there have been a number of concerns raised around the 'financeability' of the cash flows from the regulatory regime as a consequence of low interest rates. Under our current approach to estimating the return on capital, lower interest rates flow through into the estimate of both the return on debt and the return on equity. To the extent that the WACC is relatively invariant to changes in gearing over a range of values, these concerns are of less concern. We discuss this in both the 2018 RoRI methodology statement here at pp 392 - 405 and in a submission we did to an AEMC rule change process. The rule change process web page is here – submissions are under the Initiation tab, and the direct link to our submission is here.

The focus of this request for quote is to explore, at a relatively high level, the expected materiality of different gearing ratios on the overall rate of return.

*Summary*

The AER seeks advice on the rate of return approach for use in the AER's regulatory framework to determine the regulated rate of return that meets its legislated objectives—that is, setting a return on capital building block that achieves the NEO and NGO. This means our rate of return instrument should promote—to the greatest degree—efficient investment in, and efficient operation and use of, electricity or gas network services for the long term interests of consumers. We consider efficient financing costs are reflected in the prevailing market cost of capital (or WACC) for an investment with a similar degree of risk as that which applies to a service provider in respect of the provision of regulated services.

The AER requires an expert advisor to examine the relationship between the overall cost of capital and the debt to equity ratio of regulated firms. This should include consideration of:

- **From a theoretical perspective**, would you expect the WACC for Australian regulated energy network monopolies to be relatively invariant to changes in gearing over a range of gearing values? If yes, over what gearing range and how invariant? In answering these questions, the consultant should have regard to:
  - market imperfections (including taxes, transaction costs and imperfect information)
  - the fact we operate under an imputation system in Australia
- **From an empirical perspective,** are there empirical reasons to believe (including prior academic work) how invariant the WACC (or overall rate of return) is likely to be to changes in gearing, and what does this imply for the invariance of the overall rate of return for Australian regulated energy network monopolies? In answering this the consultant should have regard to:
  - the relative degree of market imperfections that face the businesses we regulate as compared to business considered in any empirical study (including the fact we are under an imputation tax system while studies may have been focussed on a classical tax system)
  - the observed gearing over time of the proxy firms we used to determine the benchmark gearing in 2018.
- If you changed from the Brealey-Myers beta levering/ de-levering formula we currently use to a different formula, or any assumptions adopted in applying this formula such as a zero debt beta, would you expect the relative invariance of the overall rate of return to changes in gearing to alter materially? In answering this, consider how your answer accords to your earlier answers.

While we have requested the consultant to have regard to specific things above, these are non-exhaustive lists and the consultant should have regard to anything they feel necessary or appropriate for answering the question.

The expert advisor is requested to consider:

- Relevant academic literature on the rate of return with particular focus on academic work, either theoretical or empirical, that the consultant considers important to the choice of equity beta levering and de levering formulas, and on the sensitivity of the overall rate of return to changes in the gearing ratio
- practice in financial markets, including (but not restricted to):
  - approaches used by institutional investors
  - valuation techniques used by equity brokers/analysts.

The expert should also be familiar with the following background documents (available on the AER website):

- the 2018 RoR Instrument
- the 2018 RoR Instrument final explanatory statement, particularly:
  - section 4 that sets out the AER's current approach to gearing, information on how gearing though time for various proxy firms we considered when determining to use a 60% debt to 40% equity ratio in the 2018 RoR instrument, and our analysis of the sensitivity of the overall rate of return to changes in gearing
  - section 7.12 that sets out our approach to levering and de-levering beta
  - Section 12.3 that sets out our considerations of financeability metrics
- The transcript to concurrent evidence session 1 we held on 15 March 2018 as part of setting the 2018 RoRI where experts discussed approaches (including formulas and assumptions) to levering and de-levering equity beta and the implications
- Our 2020 submission to the AEMC consultation paper on rule change derogations proposed by TransGrid and ElectraNet for financeability reasons.

The key deliverable is a written report that includes:

- An introductory section outlining:
  - the assessment work undertaken by the expert
  - the overall conclusions on the likely sensitivity of the WACC to changes in gearing over different ranges and under different assumptions.

- A section that discuss both the theoretical and empirical basis for any possible relationship between the overall rate of return and the level of gearing and the likely sensitivity of the overall rate of return to the gearing ratio. This should include:
  - Consideration of past theoretical and empirical work the consultant considers important
  - Consideration of market imperfections, including taxes under the imputation system
  - Evidence of different gearing used by firms and also changes in gearing through time
  - Consideration of different common beta levering / de-levering formulas that might be used to estimate the relationship and their limitations and sensitivity to assumptions used.

# Appendix 2

FEDERAL COURT OF AUSTRALIA

## EXPERT EVIDENCE PRACTICE NOTES (GPN-EXPT)

### General Practice Note

### 1. INTRODUCTION

1.1 This practice note, including the *Harmonised Expert Witness Code of Conduct* ("**Code**") (see **Annexure A**) and the *Concurrent Expert Evidence Guidelines* ("**Concurrent Evidence Guidelines**") (see **Annexure B**), applies to any proceeding involving the use of expert evidence and must be read together with:

(a) the Central Practice Note (CPN-1), which sets out the fundamental principles concerning the National Court Framework ("**NCF**") of the Federal Court and key principles of case management procedure;

(b) the Federal Court of Australia Act 1976 (Cth) ("**Federal Court Act**");

(c) the *Evidence Act 1995* (Cth) ("**Evidence Act**"**),** including Part 3.3 of the Evidence Act;

(d) Part 23 of the *Federal Court Rules 2011* (Cth) ("**Federal Court Rules**"**)**; and

(e) where applicable, the Survey Evidence Practice Note (GPN-SURV).

1.2 This practice note takes effect from the date it is issued and, to the extent practicable, applies to proceedings whether filed before, or after, the date of issuing.

### 2. APPROACH TO EXPERT EVIDENCE

2.1 An expert witness may be retained to give opinion evidence in the proceeding, or, in certain circumstances, to express an opinion that may be relied upon in alternative dispute resolution procedures such as mediation or a conference of experts. In some circumstances an expert may be appointed as an independent adviser to the Court.

2.2 The purpose of the use of expert evidence in proceedings, often in relation to complex subject matter, is for the Court to receive the benefit of the objective and impartial assessment of an issue from a witness with specialised knowledge (based on training, study or experience - see generally s 79 of the Evidence Act).

2.3 However, the use or admissibility of expert evidence remains subject to the overriding requirements that:

(a) to be admissible in a proceeding, any such evidence must be relevant (s 56 of the Evidence Act); and

(b) even if relevant, any such evidence, may be refused to be admitted by the Court if its probative value is outweighed by other considerations such as the evidence being unfairly prejudicial, misleading or will result in an undue waste of time (s 135 of the Evidence Act).

2.4 An expert witness' opinion evidence may have little or no value unless the assumptions adopted by the expert (ie. the facts or grounds relied upon) and his or her reasoning are expressly stated in any written report or oral evidence given.

2.5 The Court will ensure that, in the interests of justice, parties are given a reasonable opportunity to adduce and test relevant expert opinion evidence. However, the Court expects parties and any legal representatives acting on their behalf, when dealing with

expert witnesses and expert evidence, to at all times comply with their duties associated with the overarching purpose in the Federal Court Act (see ss 37M and 37N).

## 3. INTERACTION WITH EXPERT WITNESSES

3.1 Parties and their legal representatives should never view an expert witness retained (or partly retained) by them as that party's advocate or "hired gun". Equally, they should never attempt to pressure or influence an expert into conforming his or her views with the party's interests.

3.2 A party or legal representative should be cautious not to have inappropriate communications when retaining or instructing an independent expert, or assisting an independent expert in the preparation of his or her evidence. However, it is important to note that there is no principle of law or practice and there is nothing in this practice note that obliges a party to embark on the costly task of engaging a "consulting expert" in order to avoid "contamination" of the expert who will give evidence. Indeed the Court would generally discourage such costly duplication.

3.3 Any witness retained by a party 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 in the specialised knowledge of the witness[10] should, at the earliest opportunity, be provided with:

(a) a copy of this practice note, including the Code (see Annexure A); and

(b) all relevant information (whether helpful or harmful to that party's case) so as to enable the expert to prepare a report of a truly independent nature.

3.4 Any questions or assumptions provided to an expert should be provided in an unbiased manner and in such a way that the expert is not confined to addressing selective, irrelevant or immaterial issues.

## 4. ROLE AND DUTIES OF THE EXPERT WITNESS

4.1 The role of the expert witness is to provide relevant and impartial evidence in his or her area of expertise. An expert should never mislead the Court or become an advocate for the cause of the party that has retained the expert.

4.2 It should be emphasised that there is nothing inherently wrong with experts disagreeing or failing to reach the same conclusion. The Court will, with the assistance of the evidence of the experts, reach its own conclusion.

4.3 However, experts should willingly be prepared to change their opinion or make concessions when it is necessary or appropriate to do so, even if doing so would be contrary to any previously held or expressed view of that expert.

### *Harmonised Expert Witness Code of Conduct*

4.4 Every expert witness giving evidence in this Court must read the *Harmonised Expert Witness Code of Conduct* (attached in Annexure A) and agree to be bound by it.

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[10] Such a witness includes a "Court expert" as defined in r 23.01 of the Federal Court Rules. For the definition of "expert", "expert evidence" and "expert report" see the Dictionary, in Schedule 1 of the Federal Court Rules.

4.5 The Code is not intended to address all aspects of an expert witness' duties, but is intended to facilitate the admission of opinion evidence, and to assist experts to understand in general terms what the Court expects of them. Additionally, it is expected that compliance with the Code will assist individual expert witnesses to avoid criticism (rightly or wrongly) that they lack objectivity or are partisan.

## 5. CONTENTS OF AN EXPERT'S REPORT AND RELATED MATERIAL

5.1 The contents of an expert's report must conform with the requirements set out in the Code (including clauses 3 to 5 of the Code).

5.2 In addition, the contents of such a report must also comply with r 23.13 of the Federal Court Rules. Given that the requirements of that rule significantly overlap with the requirements in the Code, an expert, unless otherwise directed by the Court, will be taken to have complied with the requirements of r 23.13 if that expert has complied with the requirements in the Code and has complied with the additional following requirements. The expert shall:

(a) acknowledge in the report that:
  (i) the expert has read and complied with this practice note and agrees to be bound by it; and
  (ii) the expert's opinions are based wholly or substantially on specialised knowledge arising from the expert's training, study or experience;
(b) identify in the report the questions that the expert was asked to address;
(c) sign the report and attach or exhibit to it copies of:
  (i) documents that record any instructions given to the expert; and
  (ii) documents and other materials that the expert has been instructed to consider.

5.3 Where an expert's report refers to photographs, plans, calculations, analyses, measurements, survey reports or other extrinsic matter, these must be provided to the other parties at the same time as the expert's report.

## 6. CASE MANAGEMENT CONSIDERATIONS

6.1 Parties intending to rely on expert evidence at trial are expected to consider between them and inform the Court at the earliest opportunity of their views on the following:

(a) whether a party should adduce evidence from more than one expert in any single discipline;
(b) whether a common expert is appropriate for all or any part of the evidence;
(c) the nature and extent of expert reports, including any in reply;
(d) the identity of each expert witness that a party intends to call, their area(s) of expertise and availability during the proposed hearing;
(e) the issues that it is proposed each expert will address;
(f) the arrangements for a conference of experts to prepare a joint-report (see Part 7 of this practice note);
(g) whether the evidence is to be given concurrently and, if so, how (see Part 8 of this practice note); and
(h) whether any of the evidence in chief can be given orally.

6.2 It will often be desirable, before any expert is retained, for the parties to attempt to agree on the question or questions proposed to be the subject of expert evidence as well as the relevant facts and assumptions. The Court may make orders to that effect where it considers it appropriate to do so.

## 7. CONFERENCE OF EXPERTS AND JOINT-REPORT

7.1 Parties, their legal representatives and experts should be familiar with aspects of the Code relating to conferences of experts and joint-reports (see clauses 6 and 7 of the Code attached in Annexure A).

7.2 In order to facilitate the proper understanding of issues arising in expert evidence and to manage expert evidence in accordance with the overarching purpose, the Court may require experts who are to give evidence or who have produced reports to meet for the purpose of identifying and addressing the issues not agreed between them with a view to reaching agreement where this is possible ("**conference of experts**"). In an appropriate case, the Court may appoint a registrar of the Court or some other suitably qualified person ("**Conference Facilitator**") to act as a facilitator at the conference of experts.

7.3 It is expected that where expert evidence may be relied on in any proceeding, at the earliest opportunity, parties will discuss and then inform the Court whether a conference of experts and/or a joint-report by the experts may be desirable to assist with or simplify the giving of expert evidence in the proceeding. The parties should discuss the necessary arrangements for any conference and/or joint-report. The arrangements discussed between the parties should address:

(a) who should prepare any joint-report;

(b) whether a list of issues is needed to assist the experts in the conference and, if so, whether the Court, the parties o r the experts should assist in preparing such a list;

(c) **t**he agenda for the conference of experts; and

(d) arrangements for the provision, to the parties and the Court, of any joint-report or any other report as to the outcomes of the conference ("**conference report**").

### *Conference of Experts*

7.4 The purpose of the conference of experts is for the experts to have a comprehensive discussion of issues relating to their field of expertise, with a view to identifying matters and issues in a proceeding about which the experts agree, partly agree or disagree and why. For this reason the conference is attended only by the experts and any Conference Facilitator. Unless the Court orders otherwise, the parties' lawyers will not attend the conference but will be provided with a copy of any conference report.

7.5 The Court may order that a conference of experts occur in a variety of circumstances, depending on the views of the judge and the parties and the needs of the case, including:

(a) while a case is in mediation. When this occurs the Court may also order that the outcome of the conference or any document disclosing or summarising the experts' opinions be confidential to the parties while the mediation is occurring;

(b) before the experts have reached a final opinion on a relevant question or the facts involved in a case. When this occurs the Court may order that the parties exchange draft expert reports and that a conference report be prepared for the use of the experts in finalising their reports;

(c) after the experts' reports have been provided to the Court but before the hearing of the experts' evidence. When this occurs the Court may also order that a conference report be prepared (jointly or otherwise) to ensure the efficient hearing of the experts' evidence.

7.6 Subject to any other order or direction of the Court, the parties and their lawyers must not involve themselves in the conference of experts process. In particular, they must not seek to encourage an expert not to agree with another expert or otherwise seek to influence the outcome of the conference of experts. The experts should raise any queries they may have

in relation to the process with the Conference Facilitator (if one has been appointed) or in accordance with a protocol agreed between the lawyers prior to the conference of experts taking place (if no Conference Facilitator has been appointed).

7.7 Any list of issues prepared for the consideration of the experts as part of the conference of experts process should be prepared using non-tendentious language.

7.8 The timing and location of the conference of experts will be decided by the judge or a registrar who will take into account the location and availability of the experts and the Court's case management timetable. The conference may take place at the Court and will usually be conducted in-person. However, if not considered a hindrance to the process, the conference may also be conducted with the assistance of visual or audio technology (such as via the internet, video link and/or by telephone).

7.9 Experts should prepare for a conference of experts by ensuring that they are familiar with all of the material upon which they base their opinions. Where expert reports in draft or final form have been exchanged prior to the conference, experts should attend the conference familiar with the reports of the other experts. Prior to the conference, experts should also consider where they believe the differences of opinion lie between them and what processes and discussions may assist to identify and refine those areas of difference.

### *Joint-report*

7.10 At the conclusion of the conference of experts, unless the Court considers it unnecessary to do so, it is expected that the experts will have narrowed the issues in respect of which they agree, partly agree or disagree in a joint-report. The joint-report should be clear, plain and concise and should summarise the views of the experts on the identified issues, including a succinct explanation for any differences of opinion, and otherwise be structured in the manner requested by the judge or registrar.

7.11 In some cases (and most particularly in some native title cases), depending on the nature, volume and complexity of the expert evidence a judge may direct a registrar to draft part, or all, of a conference report. If so, the registrar will usually provide the draft conference report to the relevant experts and seek their confirmation that the conference report accurately reflects the opinions of the experts expressed at the conference. Once that confirmation has been received the registrar will finalise the conference report and provide it to the intended recipient(s).

## 8. CONCURRENT EXPERT EVIDENCE

8.1 The Court may determine that it is appropriate, depending on the nature of the expert evidence and the proceeding generally, for experts to give some or all of their evidence concurrently at the final (or other) hearing.

8.2 Parties should familiarise themselves with the *Concurrent Expert Evidence Guidelines* (attached in Annexure B). The Concurrent Evidence Guidelines are not intended to be exhaustive but indicate the circumstances when the Court might consider it appropriate for concurrent expert evidence to take place, outline how that process may be undertaken, and assist experts to understand in general terms what the Court expects of them.

8.3 If an order is made for concurrent expert evidence to be given at a hearing, any expert to give such evidence should be provided with the Concurrent Evidence Guidelines well in advance of the hearing and should be familiar with those guidelines before giving evidence.

## 9. FURTHER PRACTICE INFORMATION AND RESOURCES

9.1 Further information regarding Expert Evidence and Expert Witnesses is available on the Court's website.

9.2 Further information to assist litigants, including a range of helpful guides, is also available on the Court's website. This information may be particularly helpful for litigants who are representing themselves.

J L B ALLSOP
Chief Justice

25 October 2016

## *Annexure A*

HARMONISED EXPERT WITNESS CODE OF CONDUCT[11]

APPLICATION OF CODE

1. This Code of Conduct applies to any expert witness engaged or appointed:

   (a) to provide an expert's report for use as evidence in proceedings or proposed proceedings; or

   (b) to give opinion evidence in proceedings or proposed proceedings.

GENERAL DUTIES TO THE COURT

2. An expert witness is not an advocate for a party and has a paramount duty, overriding any duty to the party to the proceedings or other person retaining the expert witness, to assist the Court impartially on matters relevant to the area of expertise of the witness.

CONTENT OF REPORT

3. Every report prepared by an expert witness for use in Court shall clearly state the opinion or opinions of the expert and shall state, specify or provide:

   (a) the name and address of the expert;

   (b) an acknowledgment that the expert has read this code and agrees to be bound by it;

   (c) the qualifications of the expert to prepare the report;

   (d) the assumptions and material facts on which each opinion expressed in the report is based [a letter of instructions may be annexed];

   (e) the reasons for and any literature or other materials utilised in support of such opinion;

   (f) (if applicable) that a particular question, issue or matter falls outside the expert's field of expertise;

   (g) any examinations, tests or other investigations on which the expert has relied, identifying the person who carried them out and that person's qualifications;

   (h) the extent to which any opinion which the expert has expressed involves the acceptance of another person's opinion, the identification of that other person and the opinion expressed by that other person;

   (i) a declaration that the expert has made all the inquiries which the expert believes are desirable and appropriate (save for any matters identified explicitly in the report), and that no matters of significance which the expert regards as relevant have, to the knowledge of the expert, been withheld from the Court;

[11] Approved by the Council of Chief Justices' Rules Harmonisation Committee

(j) any qualifications on an opinion expressed in the report without which the report is or may be incomplete or inaccurate;

(k) whether any opinion expressed in the report is not a concluded opinion because of insufficient research or insufficient data or for any other reason; and

(l) where the report is lengthy or complex, a brief summary of the report at the beginning of the report.

SUPPLEMENTARY REPORT FOLLOWING CHANGE OF OPINION

4. Where an expert witness has provided to a party (or that party's legal representative) a report for use in Court, and the expert thereafter changes his or her opinion on a material matter, the expert shall forthwith provide to the party (or that party's legal representative) a supplementary report which shall state, specify or provide the information referred to in paragraphs (a), (d), (e), (g), (h), (i), (j), (k) and (I) of clause 3 of this code and, if applicable, paragraph (f) of that clause.

5. In any subsequent report (whether prepared in accordance with clause 4 or not) the expert may refer to material contained in the earlier report without repeating it.

DUTY TO COMPLY WITH THE COURT'S DIRECTIONS

6. If directed to do so by the Court, an expert witness shall:

(a) confer with any other expert witness;

(b) provide the Court with a joint-report specifying (as the case requires) matters agreed and matters not agreed and the reasons for the experts not agreeing; and

(c) abide in a timely way by any direction of the Court.

CONFERENCE OF EXPERTS

7. Each expert witness shall:

(a) exercise his or her independent judgment in relation to every conference in which the expert participates pursuant to a direction of the Court and in relation to each report thereafter provided, and shall not act on any instruction or request to withhold or avoid agreement; and

(b) endeavour to reach agreement with the other expert witness (or witnesses) on any issue in dispute between them, or failing agreement, endeavour to identify and clarify the basis of disagreement on the issues which are in dispute.

ANNEXURE B

CONCURRENT EXPERT EVIDENCE GUIDELINES

## APPLICATION OF THE COURT'S GUIDELINES

1. The Court's Concurrent Expert Evidence Guidelines ("**Concurrent Evidence Guidelines**") are intended to inform parties, practitioners and experts of the Court's general approach to concurrent expert evidence, the circumstances in which the Court might consider expert witnesses giving evidence concurrently and, if so, the procedures by which their evidence may be taken.

## OBJECTIVES OF CONCURRENT EXPERT EVIDENCE TECHNIQUE

2. The use of concurrent evidence for the giving of expert evidence at hearings as a case management technique[12] will be utilised by the Court in appropriate circumstances (see r 23.15 of the *Federal Court Rules 2011* (Cth)). Not all cases will suit the process. For instance, in some patent cases, where the entire case revolves around conflicts within fields of expertise, concurrent evidence may not assist a judge. However, patent cases should not be excluded from concurrent expert evidence processes.

3. In many cases the use of concurrent expert evidence is a technique that can reduce the partisan or confrontational nature of conventional hearing processes and minimises the risk that experts become "opposing experts" rather than independent experts assisting the Court. It can elicit more precise and accurate expert evidence with greater input and assistance from the experts themselves.

4. When properly and flexibly applied, with efficiency and discipline during the hearing process, the technique may also allow the experts to more effectively focus on the critical points of disagreement between them, identify or resolve those issues more quickly, and narrow the issues in dispute. This can also allow for the key evidence to be given at the same time (rather than being spread across many days of hearing); permit the judge to assess an expert more readily, whilst allowing each party a genuine opportunity to put and test expert evidence. This can reduce the chance of the experts, lawyers and the judge misunderstanding the opinions being expressed by the experts.

5. It is essential that such a process has the full cooperation and support of all of the individuals involved, including the experts and counsel involved in the questioning process. Without that cooperation and support the process may fail in its objectives and even hinder the case management process.

## CASE MANAGEMENT

6. Parties should expect that, the Court will give careful consideration to whether concurrent evidence is appropriate in circumstances where there is more than one expert witness having the same expertise who is to give evidence on the same or related topics. Whether experts should give evidence concurrently is a matter for the Court, and will depend on the circumstances of each individual case, including the

[12] Also known as the "hot tub" or as "expert panels".

character of the proceeding, the nature of the expert evidence, and the views of the parties.

7. Although this consideration may take place at any time, including the commencement of the hearing, if not raised earlier, parties should raise the issue of concurrent evidence at the first appropriate case management hearing, and no later than any pre-trial case management hearing, so that orders can be made in advance, if necessary. To that end, prior to the hearing at which expert evidence may be given concurrently, parties and their lawyers should confer and give general consideration as to:

   (a) the agenda;

   (b) the order and manner in which questions will be asked; and

   (c) whether cross-examination will take place within the context of the concurrent evidence or after its conclusion.

8. At the same time, and before any hearing date is fixed, the identity of all experts proposed to be called and their areas of expertise is to be notified to the Court by all parties.

9. The lack of any concurrent evidence orders does not mean that the Court will not consider using concurrent evidence without prior notice to the parties, if appropriate.

## CONFERENCE OF EXPERTS & JOINT-REPORT OR LIST OF ISSUES

10. The process of giving concurrent evidence at hearings may be assisted by the preparation of a joint-report or list of issues prepared as part of a conference of experts.

11. Parties should expect that, where concurrent evidence is appropriate, the Court may make orders requiring a conference of experts to take place or for documents such as a joint-report to be prepared to facilitate the concurrent expert evidence process at a hearing (see Part 7 of the Expert Evidence Practice Note).

## PROCEDURE AT HEARING

12. Concurrent expert evidence may be taken at any convenient time during the hearing, although it will often occur at the conclusion of both parties' lay evidence.

13. At the hearing itself, the way in which concurrent expert evidence is taken must be applied flexibly and having regard to the characteristics of the case and the nature of the evidence to be given.

14. Without intending to be prescriptive of the procedure, parties should expect that, when evidence is given by experts in concurrent session:

   (a) the judge will explain to the experts the procedure that will be followed and that the nature of the process may be different to their previous experiences of giving expert evidence;

   (b) the experts will be grouped and called to give evidence together in their respective fields of expertise;

(c) the experts will take the oath or affirmation together, as appropriate;

(d) the experts will sit together with convenient access to their materials for their ease of reference, either in the witness box or in some other location in the courtroom, including (if necessary) at the bar table;

(e) each expert may be given the opportunity to provide a summary overview of their current opinions and explain what they consider to be the principal issues of disagreement between the experts, as they see them, in their own words;

(f) the judge will guide the process by which evidence is given, including, where appropriate:

(i) using any joint-report or list of issues as a guide for all the experts to be asked questions by the judge and counsel, about each issue on an issue-by-issue basis;

(ii) ensuring that each expert is given an adequate opportunity to deal with each issue and the exposition given by other experts including, where considered appropriate, each expert asking questions of other experts or supplementing the evidence given by other experts;

(iii) inviting legal representatives to identify the topics upon which they will cross-examine;

(iv) ensuring that legal representatives have an adequate opportunity to ask all experts questions about each issue. Legal representatives may also seek responses or contributions from one or more experts in response to the evidence given by a different expert; and

(v) allowing the experts an opportunity to summarise their views at the end of the process where opinions may have been changed or clarifications are needed.

15. The fact that the experts may have been provided with a list of issues for consideration does not confine the scope of any cross-examination of any expert. The process of cross-examination remains subject to the overall control of the judge.

16. The concurrent session should allow for a sensible and orderly series of exchanges between expert and expert, and between expert and lawyer. Where appropriate, the judge may allow for more traditional cross-examination to be pursued by a legal representative on a particular issue exclusively with one expert. Where that occurs, other experts may be asked to comment on the evidence given.

17. Where any issue involves only one expert, the party wishing to ask questions about that issue should let the judge know in advance so that consideration can be given to whether arrangements should be made for that issue to be dealt with after the completion of the concurrent session. Otherwise, as far as practicable, questions (including in the form of cross-examination) will usually be dealt with in the concurrent session.

18. Throughout the concurrent evidence process the judge will ensure that the process is fair and effective (for the parties and the experts), balanced (including not permitting one expert to overwhelm or overshadow any other expert), and does not become a protracted or inefficient process.