Leverage and WACC for Transpower

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EXECUTIVE SUMMARY

The Commerce Commission has recently proposed to assess the WACC of Transpower NZ Ltd using a leverage estimate based upon that of a number of comparator firms and also treating debt betas as zero. In response to this, PwC have argued that debt betas can be reliably estimated and that the appropriate value for Transpower is .08. In addition, assuming that the Commission will invoke debt betas of zeros, Professor Guthrie has argued that the Commission's proposed use of the leverage of comparator firms will bias down the estimate of Transpower's WACC, that use of Transpower's own leverage will bias up the WACC estimate, and that the Commission should invoke the actual leverage of Transpower so as to minimise the bias. Guthrie has also argued that bias could be eliminated by averaging over the leverages of Transpower and its comparators. This paper has sought to assess these arguments, and the conclusions are as follows.

In relation to PwC's beta estimate of .08, this arises from two estimation processes involving the use of CDS prices, one of which is subject to a decomposition process and the other to a regression process, and both are subject to considerable problems. The decomposition method uses CDS prices and default losses from inconsistent time periods, uses CDS prices that significantly deviate from their normal relationship with debt risk premiums during part of the period examined, and invokes assumptions about the taxation of CDS contracts that are unproven. In addition, PwC's regression process implicitly treats the CDS price as equivalent to the debt risk premium in spite of considerable contrary evidence, much of it presented in PwC's own report, and this raises significant doubts about the resulting debt beta estimates. In view of all this, I do not think that a high degree of reliance can be placed upon PwC's estimate of the debt beta.

In relation to bias arguments, which have been raised by Professor Guthrie, his first point that there will be upward bias in estimating Transpower's WACC when using Transpower's own leverage and a debt beta of zero is uncontroversial. Professor Guthrie's second point, concerning downward bias in estimating Transpower's WACC when using the leverage of comparator firms, might be valid. However, it implicitly presumes that Transpower's leverage is measured in a fashion consistent with that of the comparators; this is not the case, and the available evidence indicates that consistent measurement of the leverages would eliminate most of the WACC bias. It also implicitly presumes that Transpower chooses its

leverage independently of the Commission's process rather than in response to it, because bias is not a meaningful concept whenever the parameter being assessed is changed by a party who has an incentive to do so whenever the parameter is estimated. Notwithstanding Transpower's plausible explanation for their planned leverage increase, there are still some grounds to suspect that Transpower has reacted to the possible incentive to raise its leverage, the incentive is not trivial in dollar terms, and is larger in percentage terms than claimed by Professor Guthrie. Professor Guthrie's third point, that averaging over the leverage of both Transpower and its comparators eliminates both WACC bias and any incentive for Transpower to raise its leverage, might also be correct. However, it requires that the systematic risk component of Transpower's cost of debt be approximately half of the debt risk premium plus issue costs, and yet the papers cited by him in support of this condition do not do so.

Nevertheless, if the Commission uses comparator firms to assess Transpower's leverage and hence its WACC, it is possible that Transpower's leverage (measured consistently with that of its comparators) might exceed that of the comparators for genuine reasons and this would impart a downward bias to Transpower's WACC estimate. However the Commission also defines the cost of debt as the promised yield, this imparts an upward bias to Transpower's WACC estimate, and this mitigates the downward bias problem. In view of all this, I favour the Commission's proposal to assess Transpower's leverage by reference to comparator firms.

1. Introduction

The Commerce Commission has recently proposed to assess the WACC of Transpower NZ Ltd using a leverage estimate based upon that of a number of comparator firms and also treating debt betas as zero (Commerce Commission, 2010, paras 6.6.1-6.6.16). In response to this, PwC (2012a) have argued that debt betas can be reliably estimated and that the appropriate value for Transpower is .08. In addition, assuming that the Commission will invoke debt betas of zeros, Guthrie (2012a) argues that the Commission's proposed use of the leverage of comparator firms will bias down the estimate of Transpower's WACC, that use of Transpower's own leverage would bias up the WACC estimate, and that the Commission should invoke the actual leverage of Transpower so as to minimise the bias. Guthrie also argues that bias could be eliminated by averaging over the leverages of Transpower and its comparators. This paper seeks to assess these arguments.

2. Assessment of PwC's Debt Beta Estimate

PwC (2012a) assesses Transpower's debt beta at .08 after providing and considering results from a number of different estimation methods, as follows. The first method is to use a time series of government bond rates and CDS prices on several foreign utilities (with an average BBB credit rating) over the period 2005-2009 to create a time series of notional corporate bond prices, determine the time series of returns for each such notional corporate bond, and then regress this time series on the relevant country's market index to yield an estimate of the debt beta for each firm. The results average .09. The second method is to regress the returns over the 2005-2009 period for a US corporate bond index, net of the government bond of matching maturity, on a US market index. The result is .339 for the BBB index. The third method matches the second except that Australian bonds are used and the period is limited to 2007-2009. The result is .106 for the BBB index.

The fourth approach is to start with the average CDS prices for each of several US utilities (with an average BBB+ credit rating) over the 2005-2009 period, deduct allowances for liquidity, expected default losses, and US state taxes to yield an allowance for systematic risk, which is then converted into a debt beta estimate using the NZ corporate tax rate and the TAMRP estimate favoured by the Commission. The resulting estimates average .07 over the companies. The fifth method matches the fourth except that PwC start with the debt risk

premium on a US corporate bond index with a BBB credit rating, and therefore the liquidity allowance is larger. Using two different liquidity estimates, the results range from .13 to .15.

Across these five approaches, PwC prefer those using data exclusively from utilities, because their default experience is different to corporate bonds in general, and I think this is sensible. This leads to them favouring their first and fourth methods, with results of .09 and .07 respectively. PwC average over these two results, to yield their estimate of .08.

In respect of PwC's fourth method (ibid, pp. 19-20 and pp. 25-29), involving estimating the systematic risk component of the CDS price and then converting this to an estimate of a bond beta using the Commission's MRP estimate of .07, there are four problems. Firstly, when deducting expected default losses, a liquidity premium, and an allowance for US state taxes from the CDS price to yield the systematic risk component, all components along with the CDS prices vary significantly over time. For example, Altman et al (2005, Table 1) gives default rates on publicly traded US corporate bonds over the period 1982-2001 that range from 0.84% in 1984 to 10.27% in 1991, whilst Xiang et al (2011, Figure 1) give CDS prices on US investment grade bonds over the 2005-2009 period that range from 0.3% to 3.6%. Consequently it would be important to consistently estimate these components. However, whilst PwC's CDS prices are averaged over the period Jan 2005-August 2009, their expected default losses are estimated from Moody's data over the period 1982-2008 (PwC, 2012a, page 28). Furthermore, CDS prices in the latter half of the Jan 2005-August 2009 period were up to 10 times their 'normal' level due to the Global Financial Crisis (Xiang et al, 2011, Figure 1) whilst the expected default losses estimated over the period 1982-2008 are likely to be more typical because the period is not dominated by a crisis. Coupling unusually high CDS prices with more typical estimates of expected default losses constitutes a mismatch that may have overestimated the resulting debt betas. In addition, Guthrie (2012a, pp. 18-19) examines a number of recent studies and concludes that expected default losses in recent times comprise 23% of the debt risk premium on BBB rated US corporate bonds. By contrast, using Moody's data on the same type of bonds since 1982, PwC (2012a, Table 10) estimate this fraction at only 9%, and this casts further doubt on the merits of combining default loss data from 1982-2008 with CDS prices from 2005-2009.

In response to this point, PwC (2012b, page 3) argue that it implies that their estimate of the debt beta (.08) is an upper bound. This is true. However, since PwC do not offer a lower

bound, they are implying that the appropriate estimate is anything between .08 and zero, and therefore the figure of .08 cannot be relied upon.

Secondly, the use of CDS prices to estimate a debt beta presumes that one would have obtained similar results using debt risk premium data if it had been available on the same companies. However the period in question is Jan 2005-August 2009 and the last year of this period was characterised by a very significant disruption to the normal relationship between debt risk premiums and CDS prices (Mitchell and Pulvino, 2009, Figure 7). Mitchell and Pulvino (ibid, section 5) attribute this unusual situation to major investors in financial difficulties who consequently liquidated long CDS positions coupled with capital shortages that temporarily prevented arbitrageurs from exploiting the resulting mispricing; this implies that debt betas estimated from CDS prices in this period would have yielded significantly different results to those estimated from debt risk premiums if the latter data had been available.

Thirdly, the process adopted by PwC involves applying an adjustment for US state taxes to CDS contracts that matches that for US corporate bonds (PwC, 2012a, page 28) and this presumes both that US State taxes apply to CDS contracts and that the tax treatment of them matches that for corporate bonds. Neither presumption is correct. Even among US states with income tax, some do not tax CDS contracts.[1] Furthermore, the impact of taxes on corporate bond yields is to raise them so as to compensate bondholders for the effect of the taxes and therefore deducting an allowance for them from a debt risk premium is appropriate. By contrast, even if CDS contracts are taxed, they are not taxed in the same way and the effect of taxes on CDS prices could be to reduce them in which case the tax effect would have to *added* back to the CDS price rather than subtracted.

Fourthly, in subtracting expected default losses from the CDS price, PwC implicitly assume that the payoff to a long CDS contract in the event of a default matches the default loss suffered by the bondholder. However this is not correct because the bondholder's loss is face value plus accrued interest net of the contemporaneous value of the bond whereas the long CDS contract holder receives only the face value of the underlying bond net of its contemporaneous value.

[1] Ceriani et al (2012, section 4.4.3) note that Tennessee taxes only interest and dividends.

To illustrate the last two points, and the potential scale of the error in the estimate of the debt beta that arises from them, consider the following highly simplified example. Suppose there are no liquidity premiums, the only taxes are state taxes at 4%, the risk free rate is 5%, the market risk premium is 5.5%, and a corporate bond trading at face value of $1000 matures in one year with a coupon of 6.3%, a 1% probability of default and a 50% recovery rate in the event of default. In respect of the state taxes, these will clearly apply to any corporate bond coupons received with a deduction for losses in default situations. Consequently the bond will pay $550.24 post-tax in one year if default occurs ($531.5 from the bond recovery and a tax saving of 4% of the capital loss of $468.5) and $1060.48 post-tax in one year if default does not occur. In respect of state taxes on CDS contracts, suppose any payoff is taxed and a deduction is granted for the CDS price paid.[2] Consequently, a long CDS contract over $1 of face value of the bond will deliver $0.4685 in one year if default occurs (being face value less market value at default date), less tax at 4% to yield $0.4497, and nothing otherwise. A portfolio of one bond (with value of $1000) and the appropriate number of CDS contracts will yield a payoff of $1060.48 post-tax regardless of whether default occurs, and the number of such contracts (N) is as follows:

$$N = \frac{\$1060.48 - \$550.24}{\$0.4497} = 1134$$

Since this portfolio of the bond and 1134 CDS contracts is risk free and there are no liquidity premiums, then the payoff can be discounted at the risk free rate of 5% to yield a value now and arbitrage would require that the CDS price now net of the immediate tax deduction benefit (C_n) must satisfy the following equation:[3]

$$\$1000 + 1134 C_n = \frac{\$1060.48}{1.05}$$

[2] Ceriani et al (2012, section 4.4.3) claim that the taxation of CDS contracts in the US is unclear but one possibility presented by them (for a contract purchaser) is for taxation of any contract payoffs coupled with a tax deduction for the purchase price paid. I consider this possibility, without precluding others.

[3] This calculation implicitly assumes that the CDS price is paid annually in advance. In fact, CDS prices are typically paid quarterly in arrears, but this technicality exerts little impact on the results.

The resulting CDS price net of the immediate tax deduction must then be C_n = \$0.0088 per \$1 of face value of the underlying bond. Before the tax deduction gained now, at 4%, the CDS price must then be \$0.0092.[4] Turning now to the bond, which has a debt risk premium (*DRP*) of 1.3% (6.3% - 5%), expected default losses (*DF*) of 0.531% (.01*\$531.5/\$1000), and a tax component (*TAX*) of 0.25% (.04*.063*.99), the debt beta must then be as follows:

$$\beta_d = \frac{DRP - DF - TAX}{MRP} = \frac{1.3\% - 0.531\% - 0.25\%}{5.5\%} = .094$$

This process matches that in PwC's tables 10 and 11, when they use corporate bond risk premiums. When using CDS prices, PwC's process for estimating the debt beta involves the same process shown in the last equation except that the CDS price substitutes for the debt risk premium and the resulting estimate for the debt risk premium would then be as follows:

$$\hat{\beta}_d = \frac{0.92\% - 0.531\% - 0.25\%}{5.5\%} = .025$$

Since this estimate is only a fraction of the correct value for the debt beta of .094, PwC's process for estimating the debt beta is significantly in error.

In response to these second, third and fourth points above, PwC (2012b, pp. 3-5) argue that the second point can be dealt with by excluding data after August 2008, the third point can be dealt with by not making a state tax adjustment to CDS prices (on the grounds that state taxes either do not apply to CDS contracts or can be avoided), and the fourth point can be dealt with by invoking an adjustment formula (which suggests that the effect of this point is minor). With these modifications, PwC's average debt beta estimate changes only slightly from .069 to .056. In effect, PwC argue that the fourth point is minor (which is reasonable) whilst the other two points are each significant but have largely offsetting effects. However, in respect of the tax issue, PwC have gone from previously implying that the state tax treatment of CDS contracts matches that for corporate bonds to now stating that such taxes either do not apply to CDS contracts or can be avoided (ibid, page 5), but supply no evidence on either point whilst also providing references stating that the tax situation is unclear (ibid, page 4). Since the tax situation is unclear, and the impact of this issue on debt betas is

[4] The arbitrage arguments used here follow those in Duffie (1999).

material, any estimate of debt betas using CDS prices does not warrant a high degree of reliance.

In respect of PwC's new approach of ignoring CDS data after August 2008, this certainly removes the period in which CDS prices relative to debt premiums are most unusual. However, the period from August 2007 to August 2008 is also sufficiently unusual that estimates of debt betas from CDS prices are likely to be materially different from those using bond data. For example, Mitchell and Pulvino (2011, Figure 7) show that the difference in CDS prices and debt risk premiums oscillates between zero and 0.60% over this period even for investment grade bonds, and reference to the last two equations above reveals that such differentials would generate markedly different estimates of debt betas depending on whether CDS prices or debt risk premiums were used.

Turning now to PwC's first method (PwC, 2012a, pp. 22-23), involving a regression of returns obtained from notional bond prices on to market returns, PwC treat the corporate bond yield at each point in time as the sum of the contemporaneous government bond rate and the CDS price (ibid, page 22). Thus, PwC are implicitly treating the CDS price as equivalent to the debt risk premium. However a CDS price comprises allowances for expected default losses on the underlying bond, the relative liquidity of CDS contracts, the systematic risk of CDS contracts, and state taxes on CDS contracts, whereas the debt risk premium comprises allowances for expected default losses on the bond, the relative liquidity of bonds, the systematic risk of bonds, and state taxes on the bond coupons; apart from the systematic risk allowance, these components of the CDS price and the debt risk premium are different. In particular, PwC's own estimates for the liquidity premium in CDS prices (0.05%, see Table 9) and that in corporate bonds (0.51% or 1.03%, see Tables 10 and 11) are markedly different. In addition, as shown above and now accepted by PwC, the tax adjustments for CDS prices are different to those for corporate bond yields. Consequently PwC's notional bond prices would then be poor proxies for actual bond prices, and therefore the resulting estimated debt betas *may* be poor estimates of actual debt betas.

In response to this point, PwC (2012b, page 6) argues that these elements omitted from their notional bond prices may not affect the debt beta estimate and suggest that a responsibility to prove otherwise lies with a sceptic. I agree that the omitted elements *may* not affect the debt beta but the responsibility lies with PwC to demonstrate that this is so rather than with a

sceptic to demonstrate otherwise. Absent such a demonstration, one cannot rely upon debt beta estimates that presume rather than demonstrate the irrelevance of the omitted elements.

In summary, PwC's debt beta estimate of .08 arises from two estimation processes involving the use of CDS prices, subject to a decomposition process or a regression process, and both are subject to considerable problems. The decomposition method uses CDS prices and default losses from inconsistent time periods, uses CDS prices that significantly deviate from their normal relationship with debt risk premiums during part of the period examined, and invokes assumptions about the taxation of CDS contracts that are unproven. In addition, PwC's regression process implicitly treats the CDS price as equivalent to the debt risk premium in spite of considerable contrary evidence, much of it presented in PwC's own report, and this raises significant doubts about the resulting debt beta estimates. In view of all this, I do not think that a high degree of reliance can be placed upon PwC's estimate of the debt beta.

3. The Use of Comparator Firms' Leverage and WACC Bias

The Commission proposes to assess the WACC of Transpower using a leverage estimate based upon that of a number of comparator firms and to treat debt betas as zero, with comparator firms being used in part out of a concern that Transpower might raise its leverage if its WACC were assessed using its own leverage (Commerce Commission, 2010, paras 6.6.1-6.6.16). Since the debt beta is treated as zero, Guthrie (2012a, section 4.3) argues that use of Transpower's actual leverage will induce a slight upward bias in WACC. This occurs because Transpower's equity beta is estimated from comparators with lower leverage. For example, if one comparator is used with an estimated equity beta of 0.5, leverage of .40 and a debt beta of .10 whilst Transpower has leverage of .60 and a debt beta of .10, the estimated equity beta for Transpower will be of 0.75 if the debt beta is ignored and 0.70 if it is recognised. Thus, Transpower's estimated equity beta will be biased up and this will induce an upward bias in WACC. This point is accepted and is uncontroversial.

Guthrie (2012a, section 4.2) also argues that, since the debt beta is treated as zero, use of the leverage of comparator firms rather than that of Transpower will induce a slight downward bias in Transpower's WACC, because the comparator firms have lower leverage and true WACC increases with leverage. This point would be correct if

(a) Transpower's leverage were correctly measured, or at least measured in a fashion consistent with that of the comparators; and

(b) Transpower's leverage were set independently of the Commission's processes, i.e., Transpower has not and will not raise its leverage in the belief that its leverage would be used to assess its WACC and that the assessed WACC would rise faster with leverage than its actual WACC.

However, in respect of (a), Transpower's leverage is based upon the book value of equity whilst the leverage of the comparators is based upon the market value of equity and the market value of equity may exceed book value (even for regulated firms) due to the presence of various options. If this inconsistency were corrected for, the apparent difference in the leverage of Transpower (66%) and the comparators (44%) might be lessened. In a report prepared for Transpower, Cameron Partners (2010, page 12) provides evidence in support of a market value for Transpower that is 20-35% in excess of book value, implying market leverage of 48-54% rather than the book leverage of 66%. Since comparator leverage is 44% based on market value, then most of the discrepancy between Transpower's leverage and that of the comparators would appear to be spurious and therefore most of the alleged WACC bias would also be spurious. An alternative approach would be to compare Transpower's book leverage of 66% with the average book leverage of the comparators. For the most recent year for which market leverage data was collected (2009), the average book leverage of the comparators was 55%. So, using this approach, half of the apparent discrepancy between Transpower's leverage and that of the comparators is simply due to measuring it in different ways, and therefore half of the apparent WACC bias from using the leverage of comparator firms to assess Transpower's leverage is spurious.

In response to this point, PwC (2012b, page 6) argues that any excess of market over book value for Transpower's equity reflects considerations (such as the presence of options) that are irrelevant to Transpower's regulated activities and therefore should be and are ignored by the Commission. However the same argument would have to apply to the regulated comparators, i.e., book rather than market equity value would also have to be used for them. As noted in the previous paragraph, doing so also reveals that half of the apparent difference in leverage between Transpower and the comparators is spurious. Interestingly, despite providing detailed comments on a range of other issues, Guthrie (2012b) offers no comment on this question of whether the apparent leverage difference between Transpower and the

comparators is spurious, and the differential is crucial to his analysis; as the true leverage differential goes to zero, the bias problem raised by him also goes to zero.

In respect of point (b), if Transpower has or will raise its leverage in response to such an incentive, it would not be meaningful to say that the Commission's use of comparator firms' leverage will induce a downward bias in Transpower's WACC, i.e., bias is not a meaningful concept when the parameter being assessed is changed by a party who has an incentive to do so whenever the parameter is estimated. By way of analogy, suppose an entity B sought to estimate the height of person X inclusive of their shoe height and make a payment to them in accordance with their estimated height. A likely response from X would be to wear shoes with a thicker heel so long as the costs incurred in doing so were less than the increase in the funds received from B. Mindful of this possibility, B might use the shoe height of some comparator, and this might be less than X's shoe height. If X then complained that the payment to them was biased down by failure to use their shoe height in the calculation, the claim would be spurious if X had in fact reacted to the incentive, i.e., bias would not be meaningful in this event. Professor Guthrie is clearly aware of this concern. In response to it, he argues that if Transpower raised its leverage by ten percentage points then its assessed WACC would rise by only 0.08% more than the increase in its true WACC, and that this incentive to raise leverage is "extremely weak" (Guthrie, 2012a, para 39).

Regarding this incentive, PwC (2012a, Table 1) shows that Transpower's forecast leverage for 2014 is 20 percentage points higher than its actual leverage in 2010, i.e., its leverage has or is expected to rise dramatically over the very period in which the incentive to raise leverage may exist. This is prima facie evidence for the concern that the incentives for Transpower are strong rather than extremely weak. In addition, if the leverage shift were ten percentage points, a WACC incentive of 0.08% on Transpower's current asset base of $3.6b (rising to $4.8b in 2014) translates into $3m per year (rising to $4m in 2014). With a leverage shift of 20 percentage points (consistent with PwC's Table 1), the gain is $6m per year (rising to $8m in 2014). These benefits in dollar terms are not trivial, even if they are trivial in percentage terms. Furthermore, Professor Guthrie's figure of 0.08% arises from a formula that presumes that the systematic risk component of Transpower's cost of debt does not rise with leverage (Guthrie, 2012a, para 39). However, this is implausible; the systematic risk is likely to rise with leverage and therefore the incentive to Transpower would be larger than the figure of 0.08% claimed by Professor Guthrie. Furthermore, Professor Guthrie's

figure of 0.08% also arises from a formula that presumes that all of the expected default costs suffered by debt holders are a legitimate component of the cost of debt.[5] However, as will be shown shortly, some of the expected default costs are not a legitimate component of the cost of debt, and the effect of this is that Professor Guthrie's figure of 0.08% is again too low. Naturally, as this figure rises, the incentive effect for Transpower also rises.

In response to this dollar quantification of the incentive effect, Guthrie (2012b, page 4) claims that the figures of $3m and $6m fail to net out various non-quantifiable costs to Transpower from increasing leverage, as described in Guthrie (2012a, para 40). This claim is true but there are also non-quantifiable benefits to firms from increasing leverage. These include the signalling value of debt in the presence of asymmetric information (Ross, 1977), the reduction of underinvestment problems springing from the use of equity finance (Myers and Majluf, 1984), the reduction of agency costs springing from the use of equity finance (Jensen and Meckling, 1976), the disciplinary effects of debt (Jensen, 1986), and the financial flexibility arising from debt. It is not possible to say definitely whether the net effect of these non-quantifiable factors is positive or negative.

In addition, and in response to the suggestion above that Transpower might be raising its leverage in order to increase its assessed WACC (contingent upon it persuading the Commission to base Transpower's assessed WACC on its own leverage), Transpower (2012) offers a plausible alternative explanation for the leverage increase and claims that a 2011 review showed Transpower's leverage to be less than that of comparable companies. However, PwC (2012a, Table 1) reveals that Transpower's book leverage in 2011 was 56%, whilst the average book leverage of the Commission's comparators in the most recent year for which it has the data (2009) was almost identical at 55%. Consequently there is still room to suspect (as opposed to believe) that Transpower might be raising its leverage (to 71%) at least partly in order to increase its assessed WACC.

Guthrie (2012a, section 5 and para 45) also claims that using a leverage level that averages over Transpower's leverage and that of the comparators eliminates both the WACC bias and any incentive for Transpower to raise its leverage. Accordingly, he recommends this approach in the event that the Commission rejects the use of Transpower's own leverage. As

[5] These are included in the increase in Transpower's actual WACC as its leverage rises (Guthrie, 2012a, para 37).

noted by Guthrie (ibid, section 5), this argument requires that the systematic risk component of the cost of debt is approximately half of the total debt premium plus debt issue costs, and Guthrie presents evidence in support of this from a number of papers (ibid, Appendix A3). Guthrie's proposition, that averaging over the leverages of Transpower and its comparators will eliminate bias and any incentive for Transpower to raise its leverage, may be correct. However, there are a number of features of the papers cited by him that leave considerable doubts about Guthrie's belief that the systematic component of the cost of debt is approximately half of the total debt premium plus debt issue costs. For example, Guthrie (ibid, Appendix A3) cites results from Almeida and Philippon (2007), using data from 1985-2004, from Dick-Nielsen et al (2012), using data from 2007-2009, and from Dionne et al (2010), using data from 1992-1996. Given the substantial variation in these time periods, combining these results can only be sensible if the results from a given author would not materially differ over different periods. However, Dick-Nielsen et al (2012, Table 5) report markedly different results from 2005-2007 compared to 2007-2009, and Dionne et al (2010, Table XIII) report markedly different results for 1987-1991 compared to 1992-1996. These differences undercut the justification for Guthrie combining results from different periods.

In addition, Almeida and Philippon (2007, Table 2) also report results from various other sets of authors, one of these (Huang and Huang, 2003) reports results that are only half as large as those of Almeida and Philippon, and yet Guthrie ignores this paper despite drawing upon results from two other papers cited by Almeida and Philippon. In addition, Almeida and Philippon generate their results by assuming that the liquidity component of the debt risk premium is constant across both credit ratings and terms to maturity (ibid, pp. 2567-2568) whilst Dick-Nielsen et al (2012, Table 5) present results that are markedly inconsistent with both of these assumptions. In addition, all of these results used by Guthrie are from US BBB corporate bonds and yet Guthrie extrapolates the results to a regulated utility like Transpower. However, as shown in PwC (2012a, Table 7), the default losses on US BBB regulated utilities are only about one tenth of those for US BBB corporates in general and this suggests that the systematic risk component of regulated firms is much less than for equally rated corporate bonds in general.

In view of all of these points, one cannot be confident that the systematic risk component of Transpower's cost of debt is about half the debt premium plus issue costs. Consequently, one cannot be confident that Professor Guthrie's proposal of averaging over the leverages of

Transpower and its comparators would largely eliminate both WACC bias and any incentive for Transpower to raise its leverage.

Nevertheless, given that the Commission proposes to use the leverage of comparator firms to assess Transpower's leverage and hence WACC, it is possible that Transpower's leverage (measured consistently with that of the comparators) does exceed that of the comparators and does so for genuine reasons; if so, the use of the comparators' leverage would impart a downward bias to Transpower's WACC estimate. As Guthrie (2012a, para 25) argues, this is important because downward biases in WACC estimates undercut a firm's incentive to invest. However, there is a mitigating source of upward bias described in Lally (2009, page 5) as follows. The Commission proposes to define the cost of debt as the promised yield on corporate bonds, which comprises the expected return to bondholders plus an allowance for bankruptcy costs plus an allowance for the value of the default option possessed by equity holders, and the inclusion of the latter in the cost of debt is unwarranted (because it is a mere transfer between debt holders and equity holders and therefore does not affect the WACC). Consequently, defining the cost of debt as the promised yield gives rise to an overstatement in the cost of debt and hence the WACC. Equivalently, the expected default losses suffered by bondholders are due to the default option possessed by debt holders and also to bankruptcy costs. However, PwC denies this and claims that the expected default losses suffered by bondholders are solely attributable to bankruptcy costs (PwC, 2012a, pp. 20-21).

To illustrate this point, and PwC's error, suppose that an unlevered firm will deliver a payoff of $155m or $55m in one year with equal probability, investors are risk neutral, the risk free rate is 5%, and there are no taxes (personal or corporate).[6] The value of the firm is then $100m, which equals the purchase price of the assets, and the cost of capital is the unlevered cost of equity, which is the risk free rate of 5%. Suppose now that the firm acquires some debt finance, promises a payment of $60m to debt holders (principal plus interest), and there are no bankruptcy costs, i.e., even in the presence of debt, the possible payoffs from the firm in one year are still $155m or $55m with equal probability. So, the value of the firm is still $100m and the WACC now involves a weighted average of the costs of debt and equity, but it should still be 5%. However, given the default option possessed by equity holders, the

[6] The example is intended only to illustrate the principle and not also the scale of the effect.

payoff on the debt will be \$60m in the good state and only \$55m in the bad state, and therefore the value now of the debt will be

$$B = \frac{.5(\$55m) + .5(\$60m)}{1.05} = \$54.76m$$

So, a promise of \$60m will allow the firm to borrow \$54.76m, and the promised yield on debt will then be 9.57% comprising the risk free rate of 5% and compensation of 4.57% to debt holders for expected default losses, which arise purely from the default option possessed by equity holders rather than from bankruptcy costs. Since the debt comprises 54.76% of firm value then the WACC defined using the promised yield on debt as the cost of debt will be

$$WACC = .4524ke + .5476kd = .5(5\%) + .5(9.57\%) = 7.50\%$$

The WACC is now too high, being 7.50% rather than 5%, because the cost of debt is wrongly defined as the promised yield. The implication for regulation is that the allowed WACC should be 5% rather than 7.50%. If the regulator allowed 7.50%, on the firm's asset base of \$100, the regulator would then set a price or revenue cap so that the firms' expected payoffs in one year would be \$107.5m. The resulting value now of the firm would be as follows:

$$V_0 = \frac{\$107.5m}{1.05} = \$102.4m$$

By contrast, the purchase price of the assets is only \$100m. So, shareholders would have been gifted \$2.4m through the regulator defining the cost of debt as the promised yield rather than the expected rate of return. Of course, it is not feasible for regulators to do otherwise. However, the result is that equity holders would be over compensated.

In response to this point, PwC (2012b, pp. 6-7) accepts that this is a source of upward WACC bias but argues by reference to 1982-2008 default loss data on US utilities with BBB+ credit ratings that the upward bias is only 0.01%. This may be a reasonable claim in relation to the period 1982-2008 in aggregate. However the period of concern here is the years shortly before 2010. This period was subject to a major financial crisis and both CDS prices and debt risk premiums rose dramatically (Xiang et al, 2011, Figure 1; Mitchell and Pulvino,

2011, Figure 7), presumably at least partly in the belief that the default rate would significantly rise (even if it didn't). Consequently, the allowance within the debt premium for the default option possessed by equity holders is also likely to have risen significantly. So, PwC's estimate of the upward WACC bias from the presence of this default option (0.01%) is likely to be far too low for the period in question.

In summary, Professor Guthrie's first point, that there will be upward bias in estimating Transpower's WACC when using Transpower's own leverage and a debt beta of zero, is uncontroversial. Professor Guthrie's second point, concerning downward bias in estimating Transpower's WACC when using the leverage of comparator firms, might be valid. However, it implicitly presumes that Transpower's leverage is measured in a fashion consistent with that of the comparators; this is not the case, and the available evidence indicates that consistent measurement of the leverages would eliminate most of the WACC bias. It also implicitly presumes that Transpower chooses its leverage independently of the Commission's process rather than in response to it, because bias is not a meaningful concept whenever the parameter being assessed is changed by a party who has an incentive to do so whenever the parameter is estimated. Notwithstanding Transpower's plausible explanation for their planned leverage increase, there are still some grounds to suspect that Transpower has reacted to the possible incentive to raise its leverage, the incentive is not trivial in dollar terms, and is larger in percentage terms than claimed by Professor Guthrie. Professor Guthrie's third point, that averaging over the leverage of both Transpower and its comparators eliminates both WACC bias and any incentive for Transpower to raise its leverage, might also be correct. However, it requires that the systematic risk component of Transpower's cost of debt be approximately half of the debt risk premium plus issue costs, and yet the papers cited by him in support of this condition do not do so.

Nevertheless, if the Commission uses comparator firms to assess Transpower's leverage and hence its WACC, it is possible that Transpower's leverage (measured consistently with that of its comparators) might exceed that of the comparators for genuine reasons and this would impart a downward bias to Transpower's WACC estimate. However the Commission also defines the cost of debt as the promised yield, this imparts an upward bias to Transpower's WACC estimate, and this mitigates the downward bias problem. In view of all this, I favour the Commission's proposal to assess Transpower's leverage by reference to comparator firms.

4. Conclusions

This paper has sought to assess whether PwC's debt beta estimate of .08 is reliable and whether various claims by Professor Guthrie about WACC bias are valid, and the conclusions are as follows.

In relation to PwC's beta estimate of .08, this arises from two estimation processes involving the use of CDS prices, one of which is subject to a decomposition process and the other to a regression process, and both are subject to considerable problems. The decomposition method also uses CDS prices and default losses from inconsistent time periods, uses CDS prices that significantly deviate from their normal relationship with debt risk premiums during part of the period examined, and invokes assumptions about the taxation of CDS contracts that are unproven. In addition, PwC's regression process implicitly treats the CDS price as equivalent to the debt risk premium in spite of considerable contrary evidence, much of it presented in PwC's own report, and this raises significant doubts about the resulting debt beta estimates. In view of all this, I do not think that a high degree of reliance can be placed upon PwC's estimate of the debt beta.

In relation to bias arguments, which have been raised by Professor Guthrie, his first point that there will be upward bias in estimating Transpower's WACC when using Transpower's own leverage and a debt beta of zero is uncontroversial. Professor Guthrie's second point, concerning downward bias in estimating Transpower's WACC when using the leverage of comparator firms, might be valid. However, it implicitly presumes that Transpower's leverage is measured in a fashion consistent with that of the comparators; this is not the case, and the available evidence indicates that consistent measurement of the leverages would eliminate most of the WACC bias. It also implicitly presumes that Transpower chooses its leverage independently of the Commission's process rather than in response to it, because bias is not a meaningful concept whenever the parameter being assessed is changed by a party who has an incentive to do so whenever the parameter is estimated. Notwithstanding Transpower's plausible explanation for their planned leverage increase, there are still some grounds to suspect that Transpower has reacted to the possible incentive to raise its leverage, the incentive is not trivial in dollar terms, and is larger in percentage terms than claimed by Professor Guthrie. Professor Guthrie's third point, that averaging over the leverage of both

Transpower and its comparators eliminates both WACC bias and any incentive for Transpower to raise its leverage, might also be correct. However, it requires that the systematic risk component of Transpower's cost of debt be approximately half of the debt risk premium plus issue costs and yet the papers cited by him in support of this condition do not do so.

Nevertheless, if the Commission uses comparator firms to assess Transpower's leverage and hence its WACC, it is possible that Transpower's leverage (measured consistently with that of its comparators) might exceed that of the comparators for genuine reasons and this would impart a downward bias to Transpower's WACC estimate. However the Commission also defines the cost of debt as the promised yield, this imparts an upward bias to Transpower's WACC estimate, and this mitigates the downward bias problem. In view of all this, I favour the Commission's proposal to assess Transpower's leverage by reference to comparator firms.

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