COMPETITION ECONOMISTS GROUP

Default price quality path reset

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1 Introduction

1. Vector has asked CEG to review the cost modelling underlying the Commerce Commission's default price quality path reset. The views expressed in the report are CEG's and not necessarily those of Vector.

2. The remainder of this report has the following structure:

   - Section 2 examines the timing assumptions in the cost modelling;
   - Section 3 examines the forecasts of operating expenditure use in the cost modelling; and
   - Section 4 examines the Commission's approach to 'claw back' of over or under recovery of costs due to delays in the implementation of the default price quality path reset.

2 Timing assumptions in the building block model

3. We have reviewed the timing assumptions in the Commission's building block model. We consider that the model contains three errors:

- there is an error in the calculation of tax liabilities estimated by the Commission;
- the Commission's model adopts an inappropriate back-loading of depreciation such that real return of capital in the early years of an asset's life is less than the real value of the asset divided by its remaining life; and
- there is an error in the way in which the Commission's model accounts for differences between outturn inflation and originally forecast inflation in the years to 2013/14.

2.1 Modelling interest deductions for tax purposes

4. This error flows from an incorrect use of an annualised interest rate to estimate the level of actual interest tax deductions that would be generated by a 44% geared EDB.

5. Specifically, the Commission's modelling estimates tax 'as if' companies pay their tax obligations, on average, in the middle of the year (rather than the end of the year). This assumption is consistent with the Commission's overall approach where it attempts to reflect the true timing of expenditures and revenues through the year.

6. The error we identify is that the Commission's does not amend its estimate of the absolute level of interest deductions to reflect this approach. Specifically, for the purpose of estimating the absolute level of interest tax deductions, the Commission assumes that interest is paid on debt in a lump sum at the end of the year.

7. In reality, and consistent with the Commission's timing assumption on when tax is paid, businesses pay interest throughout the year. On any individual debt instrument a business will generally pay at least 2 (semi-annual) coupon payments every 12 months. On many debt instruments businesses pay 4 (quarterly) coupon payments or pay interest calculated daily on outstanding balances.[1] Moreover, businesses stagger their debt issues so that, over the total portfolio of debt, coupon payments are further spread relatively evenly throughout the year

8. The effect of this is that the absolute amount of interest paid by a 44% geared EDB is not the amount calculated in row 176 of the building block model for each EDB. The

1 Common practice is for fixed rate debt to have coupons paid semi-annually, for floating rate debt to have coupons paid quarterly and for bank debt to be paid daily (although this practice can be departed from).

amount calculated in row 176 assumes that interest is paid in a lump sum at the end of the year. In reality, interest is paid throughout the year and, consequently, the absolute amount of interest paid is lower (although the NPV will be the same). As a consequence, the effect of this is that the Commission overestimates the amount of interest deductions available for tax purposes (and therefore underestimates the amount of tax liabilities). That is, while the Commission's model correctly estimates the present value of interest costs, it overestimates the absolute value of interest deductions by incorrectly assuming that all interest payments are made at the end of the year.

9. This error can be fixed by calculating a daily interest rate from the annualised interest rate and estimating notional debt costs as the interest payments that would be made 'as if' all interest payments were made in a lump sum in the middle of the year. (This is modestly above the interest deductions that would be calculated if it was assumed that interest was paid daily).[2] That is, the equation in cell E176 (and similarly all other cells in this row) would change from being:

- Current formula =(E169*Leverage*Debt+E149); to be
- Proposed formula = (E169*Leverage*Debt/SQRT(1+Debt)+E149).

10. The proposed formula more accurately reflects the actual practice of businesses such that debt costs are spread throughout the year. In CEG's view it might be open to the Commission to investigate further the actual profile of interest payments made throughout the year and to substitute a different formula to the one proposed that reflected a businesses' actual debt costs. However, in our view it is not open to the Commission to retain the assumption that 100% of all interest payments are made on the last day of the year because this is patently inconsistent with what EDBs actually do.[3]

11. We note that similar points were made in CEG's August 2011 report[4] and the joint report by Balchin and Hird where we stated:

> *This internally consistent modelling of financing costs and interest deductions is also consistent with how an efficient firm would expect to*

2 This interest rate would be ((1+Debt)^(1/365)-1)*365 = 7.632% compared to 7.633% using the proposed formula.

3 It is relevant to note that while the Commission's building block model assumes for the purposes of estimating interest tax deductions that interest is paid on the last day of the year (with the effect that interest tax deductions are maximised and modelled tax costs are minimised). The model does not, however, provide the same dollar compensation to EDBs for their interest costs. Rather, the Commission assumes that materially lower dollar compensation is required for interest costs because businesses receive their compensation earlier than the end of the year.

4 CEG, August 2011, Review of Draft Decisions Paper on Starting Price on 2010-15 Default Price-Quality Path For Electricity Distribution. See section 4.

> *arrange its debt financing obligations to match its cash flow to the extent possible, which may imply an even spread of interest payments over the year to approximate a midyear payment.*

12. Giving effect to this proposition is straightforward – the cost of debt that is used when calculating taxation liabilities merely needs to be converted to a midyear interest rate, as demonstrated by Hird. This adjustment should also be applied when applying Equations 3 to 5 from the Balchin report.

13. The Commission did not address these submissions in its most recent decision document. This may be an understandable oversight due to the fact that these submissions were made in the context of a different model that assumed tax was being paid at the end of the year. It may be that the Commission came to the conclusion that changing this approach (the assumed timing of tax payments) made the arguments put by CEG and PwC (Hird and Balchin) moot. However, for the reasons set out above this is not the case and, for the reasons set out above, we respectfully submit that the Commission address this issue in its final model.

2.2 Modelling real depreciation

14. The Commission's modelling provides a nominal amount of depreciation in each year equal to the opening RAB (ORAB) in that year divided by the remaining life of the asset (RL) (see row 61 of each EDBs cost model). However, the Commission also applies a revaluation to the ORAB equal to the assumed rate of inflation multiplied by the ORAB (see row 60). The net effect of these two operations is that the actual closing RAB (CRAB) returned to investors is given by:

$$CRAB = ORAB - ORAB/RL + ORAB*inflation \quad (1)$$

$$= ORAB*(1+inflation) - ORAB/RL \quad (2)$$

15. The real CRAB (expressed in the same dollars as the ORAB) is simply the above value divided by (1+inflation) which is equal to:

$$Real\ CRAB = ORAB - ORAB/(RL*(1+inflation)) \quad (3)$$

16. It follows that the amount of real depreciation (expressed in dollars of the beginning of the year) is equal to the ORAB less the Real CRAB which is equal to:

$$Real\ depreciation = ORAB/(RL*(1+inflation)) \quad (4)$$

17. This formula for real depreciation shows what is, in our view, an unsatisfactory element of the Commission's modelling. The amount of real depreciation returned to investors is:

- in the presence of positive inflation, less than the real depreciation implied by the remaining life of the asset; and

- reduces with increases in the level of inflation.

18. The effect of this is that the higher the inflation rate is, the more backloaded the level of *real* cost recovery will be. We are aware of no specific justification provided for this outcome and there is, to the best of our knowledge, no other regulatory cost model that has this characteristic.

19. For example, the AER's PTRM model first calculates required depreciation in real terms (ORAB/RL) but then escalates this for inflation.[5] Such that equation (1) above becomes:

$$CRAB = ORAB - ORAB/RL*(1+inflation) + ORAB*inflation \qquad \text{(AER 1)}$$

20. Following the same algebraic approach as set out above it follows that the real depreciation delivered by the PTRM is, as it should be, simply ORAB/RL and does not depend on inflation.

21. Apart from it being illogical for the real return of capital to fall with higher levels of inflation it is also problematic in terms of ensuring financeability of the assets. Times of high inflation tend to involve high nominal debt payments and higher than usual uncertainty about the level of input costs. In this context, a reduction in the real return of capital is likely to materially raise the ability to find (willingness to commit) both debt and equity capital to fund capital expenditure.

22. We recommend that the Commission amend its model to escalate depreciation in its model by inflation. This could be achieved at row D61 simply by multiplying the existing formula in this row (ORAB/RL) by the one plus the value in the corresponding column of row 38 (ie, 1+inflation).

2.3 Modelling inflation in previous years

23. In the course of a normal regulatory control period (ie, without any mid-period resets) allowable revenues grow in line with actual inflation. This ensures that the real rate of return determined in the initial regulatory decision is achieved (other things equal). That is, if actual inflation is higher than forecast actual nominal revenues are also and vice versa.

24. However, the Commission's model does not achieve this outcome. This issue was first identified by Mr Balchin of PwC Australia for Powerco[6] and was also raised in our joint report. The Commission's proposed amended model does not correct this problem.

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5 The PTRM is available on the AER website (eg, http://www.aer.gov.au/node/9926). The fact that nominal depreciation is set equal to real depreciation escalated for inflation can be ascertained by examining row 472 on the Assets sheet.

6 Balchin, J. (PwC, 2012) Draft Input Methodology for Default Price-Quality Paths – Inflation Issues.

25. Specifically, the Commission's model calculates a building block allowable revenue figure using forecasts of inflation. The Commission has then calculated a maximum allowable revenue figure for 2013/14 by equating the present value of expected revenue with the building block allowable revenue over the years 2012/13 to 2014/15, which also used forecasts of inflation.

26. The effect of this is to, perfectly reasonably, estimate the allowable revenues for the remainder of the regulatory period that would be appropriate if actual inflation in the first three years of the regulatory period was the same as forecast inflation at the time of the initial regulatory decision. Of course, actual inflation has not been the same and has been, as it happens, higher. Under a normal regulatory control period without any reset this would automatically give rise to commensurately higher allowable revenues.

27. However, the outcome of the above calculations in the Commission's model is that this does not occur (maximum allowable revenue figure for 2013/14 is estimated 'as if' actual inflation in 2010/11 and 2011/12 were precisely as forecast).

28. This can be fixed relatively easily by simply scaling up its current estimates of maximum allowable revenue from 2013/14 by the accumulated difference between forecast and actual inflation over the years to 2013/14. This factor is ratio of the accumulated forecast of inflation to 2013/14 in row 31 in the Commission's model to the accumulated actual inflation in row 31 in the Commission's model.

3 Forecasts of operating expenditure

29. The Commission has developed econometric models of network opex and non-network opex as functions of network characteristics. It uses these models, combined with forecasts of network characteristics, to develop forecasts for operating expenditure for each of the electricity distribution businesses.

30. The models that the Commission has estimated are:[7]

$$\ln\left[Network\ opex_{i,t}\right] = 0.563 + 0.948\ \ln\left[Line\ length_{i,t}\right] \quad (5)$$

$$\ln\left[Non-network\ opex_{i,t}\right] = 2.068 + 0.511\ \ln\left[Line\ length_{i,t}\right] + 0.309\ \ln\left[MWh\ supplied_{i,t}\right] + 0.030\ ICP/km_{i,t} \quad (6)$$

31. That is, the Commission's models forecasts changes in network opex based only upon changes in network length of supply. Non-network opex is modelled as being dependent upon network length of supply, electricity supplied and ICP density (ICPs per kilometre of network length).

32. We believe that the Commission has made some errors in implementing the results of these models to forecast opex. In summary, the Commission:

- estimates percentage changes applicable to network and non-network opex by utilising regression coefficients in a way that is inconsistent with how they were estimated. The coefficients should be utilised within the structure of the formula specified in the regression model;
- omits ICP density in calculating forecast opex. The exclusion of ICP density is not consistent with the use of the Commission's model, which includes a term for ICP density;
- applies the results of its models to estimate the growth of total opex whilst holding constant the split of network and non-network opex at 41%/59%. The results of the Commission's model indicate that network and non-network opex are growing at different rates and this split will not remain constant; and
- ignores interactions between changes in opex input prices and changes in real opex estimated by its models by applying these percentage change estimates *additively*. In our view, these changes should be treated *multiplicatively* with the use of the Fisher equation, consistent with the Commission's treatment of WACC parameters.

7 These coefficients can easily be identified from Table D.1 of the Draft Decision.

33. We are also concerned about the process that the Commission has applied to select its preferred model for network opex. The regression models investigated by the Commission indicate that total network length of supply, total electricity supplied and total number of ICPs are each highly significant in explaining network opex. In our view, sole reliance on total network length of supply to estimate network opex is unsafe. A model that relies upon two or all three of these factors would improve the robustness of the Commission's modelling.

3.1 Errors in implementing the Commission's opex models

34. We have identified a number of errors in the Commission's implementation of opex forecasting in its projections model. These errors and measures to correct them are discussed in the following sub-sections. We attach to this report a revised version of the Commission's non-confidential projections model which implements these suggestions in full.

3.1.1 Inconsistent use of model functional form and exclusion of ICP density

35. The Commission's preferred models for estimating future changes in network and non-network opex are shown at equations (5) and (6) above. These expressions can equivalently be written as (7) and (8) below:

$$Network\ opex_{i,t} = 1.755\left[Line\ length_{i,t}\right]^{0.948} \tag{7}$$

$$Non-network\ opex_{i,t} = 9.834\left[Line\ length_{i,t}\right]^{0.511}\left[MWh\ supplied_{i,t}\right]^{0.309} e^{0.030\ ICP/km_{i,t}} \tag{8}$$

36. If the outputs of these regressions are used to estimate the percentage change in network and non-network opex then the internally consistent formulae for percentage changes are given by (9) and (10) below:

$$\frac{Network\ opex_{i,t}}{Network\ opex_{i,t-1}} = \left[\frac{Line\ length_{i,t}}{Line\ length_{i,t-1}}\right]^{0.948} \tag{9}$$

$$\frac{Non-network\ opex_{i,t}}{Non-network\ opex_{i,t-1}} = \left[\frac{Line\ length_{i,t}}{Line\ length_{i,t-1}}\right]^{0.511}\left[\frac{MWh\ supplied_{i,t}}{MWh\ supplied_{i,t-1}}\right]^{0.309} e^{0.030\left(ICP/km_{i,t}-ICP/km_{i,t-1}\right)} \tag{10}$$

37. Having estimated network opex and non-network opex with this functional form, internal consistency requires the use of equations (9) and (10) to estimate the change in opex.

38. However, the Commission has implemented these equations as per equations (11) and (12) below:[8]

$$\frac{Network\ opex_{i,t}}{Network\ opex_{i,t-1}} - 1 = 0.948\left[\frac{Line\ length_{i,t}}{Line\ length_{i,t-1}} - 1\right] \quad (11)$$

$$\frac{Non-network\ opex_{i,t}}{Non-network\ opex_{i,t-1}} - 1 = 0.511\left[\frac{Line\ length_{i,t}}{Line\ length_{i,t-1}} - 1\right] + 0.309\left[\frac{MWh\ supplied_{i,t}}{MWh\ supplied_{i,t-1}} - 1\right] \quad (12)$$

39. Three differences are clearly discernible between the equations implied by the Commission's regression modelling at (9) and (10) and those that the Commission adopts to estimate changes in opex at (11) and (12).

40. Firstly, the coefficients estimated by the Commission's regression analysis are in all cases but for ICP density outcomes of log-log regressions. As can be seen in equations (9) and (10), this requires that the ratio of the dependent variable (opex) in period t to period t-1 is expressed with the coefficients as *powers* to the same ratio of the independent variables. By contrast in the Commission's model the Commission uses equation (11) and (12) which expresses the percentage change in the dependent variable (opex) as the estimated coefficient multiplied by the percentage change in the independent variables.

41. We note that the difference between these two methods is small for small growth rates and parameter estimates. This is a point we raise for completeness.

42. Secondly, in the case of non-network opex, the Commission's approach at equation (12) is to calculate separately percentage changes in non-network opex due to changes in total network of supply and total electricity supplied and to combine these *additively*. However, the functional form used in the Commission's regression analysis is such that these should be combined *multiplicatively* (ie, in the sense of the Fisher equation).

8 The Commission's implementation of these formulae can be observed at row 100 and rows 92-96 of the 'Opex' sheet of the Commission's projections model. The results of these percentage changes in the spreadsheet calculation is further multiplied by the proportion of network/non-network opex, a feature discussed in more detail at section 3.1.2 below.

43. Thirdly, the Commission has not utilised the coefficient estimated on ICP density in its forecast of non-network opex in equation (12). This appears to be an oversight as we cannot find any explanation for this in the Commission's Draft Decision.

44. The regression coefficients obtained by the Commission from estimating equation (6) were obtained with the inclusion of ICP density as a regressor. Different coefficients would have been obtained if ICP density had been excluded from this equation, but the Commission is clear in its Draft Decision that the inclusion of ICP density was intentional.[9]

45. It may be that the Commission simply adopted an ICP density forecast of zero on the assumption that no better forecast was available. However, we note that the Commission has already developed an implied forecast for future growth of ICP density once the assumptions of its constant price revenue modelling and its total network length of supply forecasts are combined.

46. Specifically, the Commission's modelling of constant price revenue develops a forecast of ICP growth. When this is combined with the Commission's forecast of total network length of supply an internally consistent forecast of ICP density falls out of it. There is no significant new work that is required by the Commission to correctly implement a forecast of non-network opex relying on ICP density.

47. Failure to do so would mean that businesses whose ICP density of supply must be increasing/falling given the other forecasts adopted by the Commission would be assumed to have no increase in ICP density (customers would end up paying less/more than the modelled cost of dealing with that ICP density growth).

48. We note that an alternative way of achieving consistency between these three forecasts (ICPs, total network length of supply (line length) and ICP density) would be to make the line length forecast consistent with a forecast of zero density growth. As discussed below, we consider that there may be some merit in this approach, especially for Vector, given that the line length growth forecasts are not robust in the sense that:

- They are based solely on historical averages with no attempt to make them internally consistent with the more robust forecast of ICP growth[10]; and
- They are, for Vector, based on only two data points.

9 See Draft Decision, para D20 and Table D.3.

10 An alternative method would be to make forecasts of ICP growth equal to growth in total network length of supply. However, we note that the Commission's methodology for estimating ICP growth (proxied by growth in residential customers) relies on Statistics New Zealand forecasts and appears considerably more robust than the methodology used to forecast total length of network supply. For example, in the case of Vector, the Commission's forecast of the latter appears to be based upon just two years of growth.

3.1.2 Holding the ratio of network opex and non-network opex constant

49. The regression models estimated by the Commission at equations (5) and (6) generally imply that network opex and non-network opex depend upon different factors and grow at different rates. The Commission has also applied a general assumption that network opex constitutes 41% of total opex and non-network opex constitutes 59% of the total.[11]

50. The Commission's proposal to apply a 41%/59% split of network/non-network opex is reasonable in 2011 as it reflects the ratio that exists in 2011. Given the potentially different growth rates of network and non-network opex over time, it would not be reasonable to assume that this proportion remains constant over time. For instance, if the Commission's regression model indicates that non-network opex grows faster than network opex, than it is easy to show that non-network opex, as a proportion of the total, must grow to exceed 59% over the forecast period.

51. However, the Commission's implementation of forecast opex holds constant the proportions of network and non-network opex in forecasting future total opex. Specifically, the Commission estimates growth in total opex (excluding insurance costs) using the following equation:[12]

$$\begin{aligned} Growth\ in\ real\ total\ opex_{i,t} &= 41\% \times Growth\ in\ real\ network\ opex_{i,t} \\ &+59\% \times Growth\ in\ real\ non-network\ opex_{i,t} \end{aligned} \tag{13}$$

52. In our view, the method summarised in equation (13) above is not capable of properly capturing the extent to which the differing growth of network and non-network opex influence the growth of total opex in a way that is consistent with the regression models estimated by the Commission at equations (5) and (6) above.

53. Consistent with the estimation of equations (5) and (6), we believe that network opex and non-network opex should be calculated separately using the growth specific to each and total opex estimated as the sum of these two elements. The 41%/59% split estimated by the Commission, consistent with its derivation, should be used only to define the initial split of total opex into network and non-network opex. If the Commission believes network and non-network opex growth rates will differ it should not assume the ratio of network and non-network opex will remain the same. Conversely, if the Commission believes it should assume a constant ratio for network

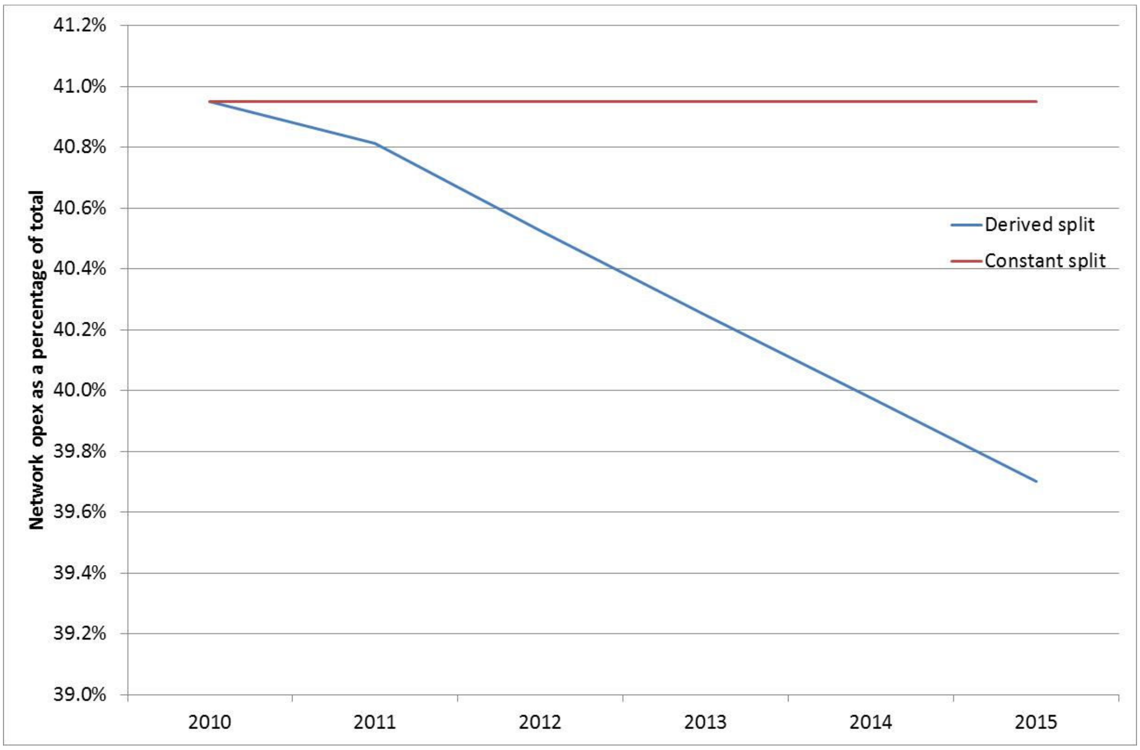
11 Where this total is understood to exclude a third category of opex, insurance costs.

12 That this is the Commission's formulation can be observed by: the formulae at row 100 and rows 92-96 of its 'Opex' sheet in its projections model, where it multiplies growth for network opex and non-network opex respectively by their proportion of total opex; and at rows 104-108 where it adds these results together.

and non-network opex then it should not unbundle them, and should instead forecast total opex.

54. By way of example, Figure 3-1 below shows the proportion of Vector's network opex resulting from the Commission's econometric modelling of network and non-network opex, with changes made as outlined above. The falling proportion of network opex is natural corollary of the Commission's derived growth rate for Vector's non-network opex being greater than its growth rate for Vector's network opex. Over the five year period, this proportion falls by 1.3%.

Figure 3-1 Forecast proportion of Vector's network opex



Source: CEG analysis, Commerce Commission data

3.1.3 Interactions between sources of opex growth

55. The regression analysis used by the Commission to model future network and non-network opex is based on real prices. The Commission combines the percentage changes estimated with its regression analysis with the change in opex input prices to estimate the overall change in forecast nominal opex. The Commission achieves this through the following formula:[13]

13 This formula is implemented by the Commission at rows 113-117 of sheet 'Opex' in its projections model. As a final step, insurance is added at rows 121-125.

$$Total\ opex_{i,t} = Total\ opex_{i,t-1}[1 + Growth\ in\ real\ opex_{i,t} + Growth\ in\ opex\ input\ prices_{i,t} - Growth\ in\ opex\ partial\ productivity_{i,t}] \quad (14)$$

56. The Commission's implementation of this formula fails to capture the interactions between growth in real opex, input prices and partial productivity.[14] That is, the different sources of growth in equation (14) above are applied *additively* when they should be applied *multiplicatively*, as in equation (15) below:

$$Total\ opex_{i,t} = Total\ opex_{i,t-1}\frac{(1 + Growth\ in\ real\ opex_{i,t})(1 + Growth\ in\ opex\ input\ prices_{i,t})}{(1 + Growth\ in\ opex\ partial\ productivity_{i,t})} \quad (15)$$

57. By way of example, consider a starting point of $100 opex and assume a forecast of doubling in real input costs and, separately, scale effects leading to a doubling of opex costs at any given level of input costs. The combined effects of these changes would be a quadrupling of absolute nominal opex (eg, a doubling of the initial value to $200 due to input costs growth and a further doubling again to $400 due to scale effects). However, the Commission's modelling assumes that absolute opex costs would only triple (eg, $100 initial value plus two additive increases of $100 each for input cost growth and scale growth).

58. The equation specified at (15) above recognises the interactions between all aspects of opex growth. It is also consistent with how the Commission treats WACC parameters through the use of the Fisher equation to convert between real and nominal returns.

3.2 Forecast total network length of supply

59. The basis for the Commission's forecast growth for total network length of supply is stated to be:[15]

> *"… a linear regression of network length and year for each supplier between 2003/04 and 2010/11. Therefore the growth rate is supplier specific."*

14 Although we note that the Commission has assumed that growth in opex partial productivity is zero and therefore there is no error created by the Commission's implementation of this particular growth factor.

15 Draft decision, p. 63

60. The Commission also notes that in deriving this value for Vector, it excluded data for Vector prior to 2009/10 since *"the network length includes the Wellington network now operated by Wellington Electricity Lines"*.[16]

61. It appears then that Vector's forecast growth for total network length of supply has been calculated from only two years of growth, whereas those for other suppliers have been calculated from a considerably longer history of data. In our view, it is unsafe for the Commission to rely upon such a short history of line length to estimate a parameter that is of such great significance in its regulatory framework. Moreover, as discussed in the next section, there is reason to believe that the forecast is inconsistent with more robust evidence sourced by the Commission on other cost drivers.

3.3 Choice of opex regression models in the context of quality of cost driver forecasts

62. The accepted method for approaching regression analysis is to first define the form of relationship that would be expected in theory. That is, to specify the variables that would be expected to influence the dependent variable and to specify the functional form though which this influence would be expected to be exerted. This choice might be consistent with accepted economic theory or through *a priori* reasoning about what one might reasonably expect.

63. The Commission has identified a number of variables that one might reasonably expect to influence operating expenditure. These include total network length of supply, total electricity supplied, total ICPs, ICP density and energy density. The Commission has investigated the effect that these variables, some individually and in various combinations, have on network and non-network opex respectively. As summarised at equations (5) and (6) above, the Commission's preferred regressions:

- express network opex as a function of total network length of supply only; and
- express non-network opex as a function of total network length of supply, total electricity supplied and ICP density.

64. Our primary concern relates to the Commission's decision to estimate changes in network opex solely by reference to changes in total network length of supply. This concern arises in the wider context that the Commission's investigations indicated that total network length of supply, total electricity supplied and total number of ICPs were all similarly effective at explaining network opex.

65. The fact that all three of these variables perform well in explaining network opex is not a surprise, because they are closely collinear. This is shown at Table 3-1 below

16 Ibid, p. 63.

based upon the Commission's entire dataset (calculated over 224 observations) and at Table 3-2 below for the part of the dataset that the Commission uses to estimate its regression coefficients (57 observations).

Table 3-1 Correlation between independent variables (whole dataset)

	Total network length of supply	Total electricity supplied	Total number of ICPs
Total network length of supply	1.000		
Total electricity supplied	0.771	1.000	
Total number of ICPs	0.852	0.884	1.000

Source: Commission's opex model dataset

Table 3-2 Correlation between independent variables (regression dataset)

	Total network length of supply	Total electricity supplied	Total number of ICPs
Total network length of supply	1.000		
Total electricity supplied	0.836	1.000	
Total number of ICPs	0.830	0.971	1.000

Source: Commission's opex model dataset

66. Given the extent of collinearity between these variables, it is not particularly surprising that all three are similarly effective at explaining network opex. This collinearity also means that despite each of these variables being highly significant when individually regressed on network opex, they may not necessarily be individually significant when regressed in combination on network opex.

67. However, this does not mean that it is appropriate to utilise only one of these variables in making forecasts of network opex. We observe that:

- these variables are not perfectly correlated and there is variation between the different measures of network change that can potentially provide useful information about total opex. The importance of this variation cannot be underestimated when it is considered that the Commission's task is to accurately forecast opex for 16 electricity distribution businesses; and
- the basis for the Commission's forecast of total network length of supply appears weak when compared to its forecasts of total electricity supplied and total ICPs. Specifically:
  - The forecasts are based on historical average line length growth and no attempt has been made to reconcile these with the forward looking estimates of ICP growth developed by the Commission;

- In the specific case of Vector, the historical series available to the Commission is so short that its forecast for line length growth relies upon just two years of historical growth.[17]

68. The use of line length forecasts developed in this manner accentuates the potential problems with adopting a forecasting equation that relies purely on line length. It will be generally safer to rely on a regression that includes all 3 investigated explanatory variables (line length, ICPs and energy supplied).

69. The potential issues can be illustrated by examining scatter plots of the relationship between forecast line length and forecasts of ICP and energy supplied growth.

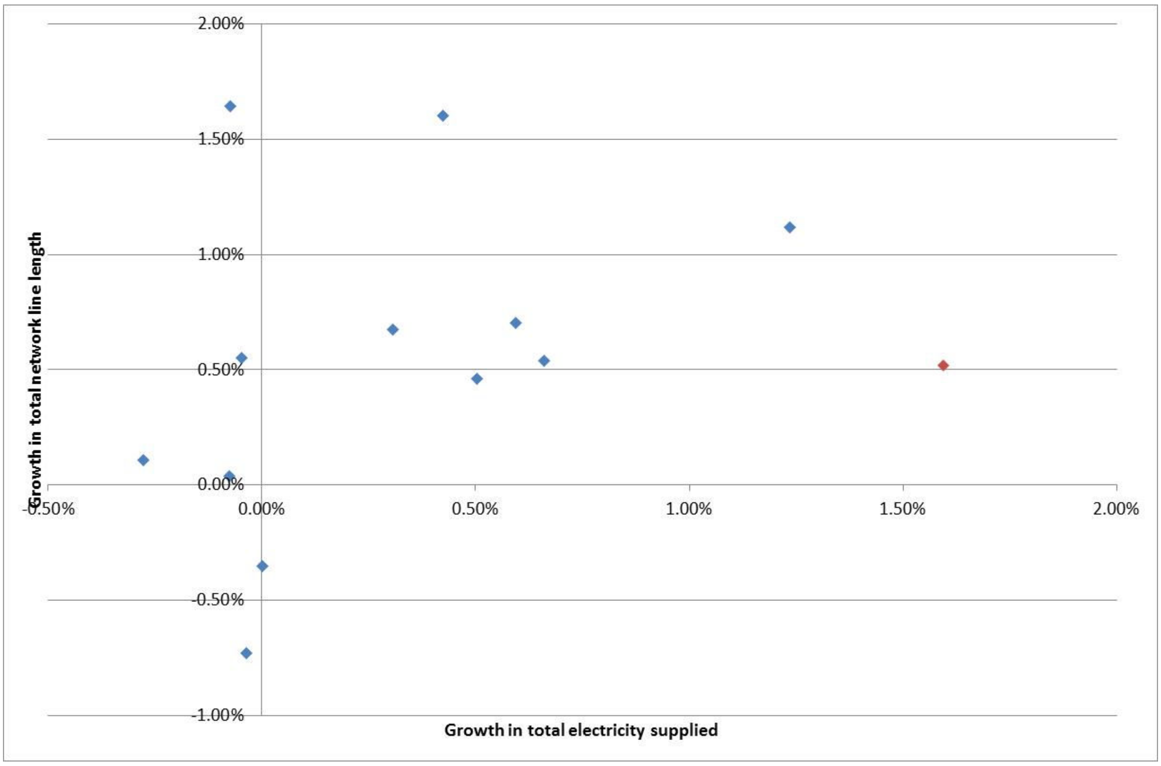
70. The issue of consistency can be highlighted by reviewing charts of the Commission's estimate of the growth rate for Vector's total network line length against its projected average growth rate for total electricity supplied and of total ICPs. In Figure 3-2 below, these comparisons are drawn with Vector. It can be seen that Vector has by far the highest assumed growth in electricity supplied and ICPs but one of the lowest forecasts for growth in line length.

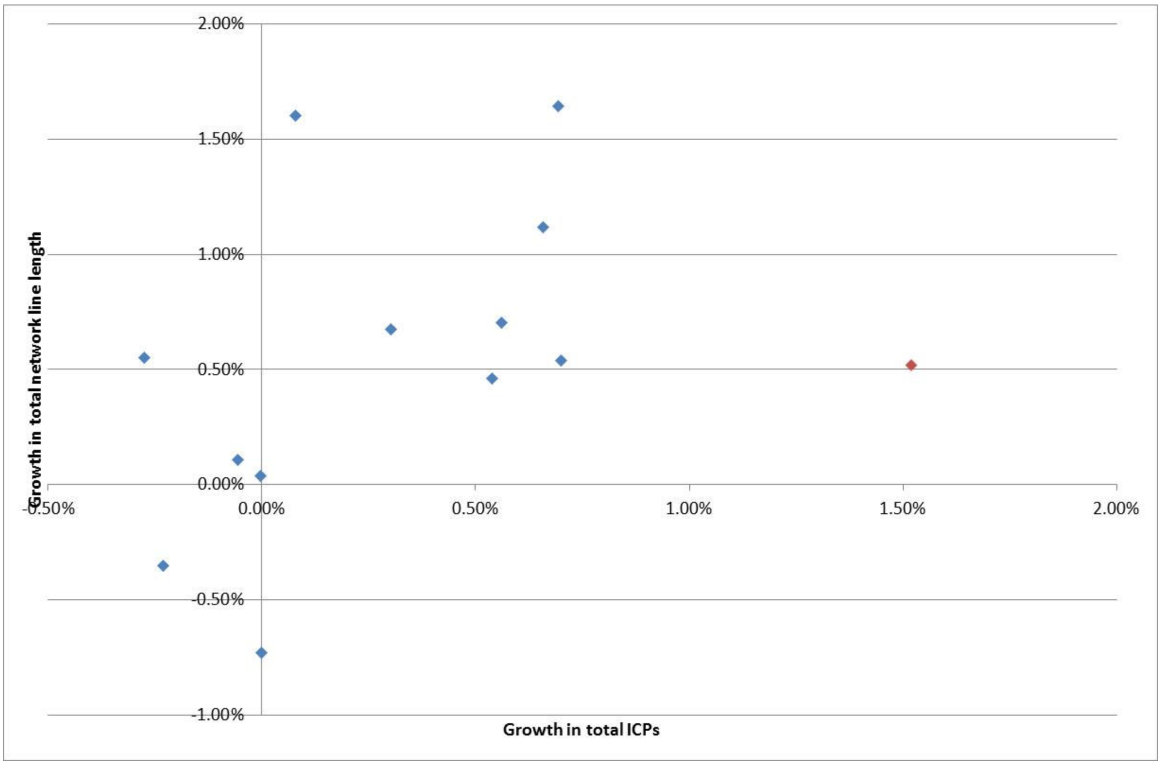
71. In the non-network opex model chosen by the Commission this anomaly is much less likely to cause Vector's non-network opex growth to be underestimated because other cost drivers (energy growth and ICP density (which grows if ICPs are growing faster than line length) are included. Consequently, the impact of any error in the line length forecast is materially weakened.

72. By contrast, because network opex is estimated using a model based purely on the forecast of line length, any inaccuracy or inconsistency in the line length forecast relative to other forecasts is fully reflected in the network opex forecast.

[17] Draft decision, p. 63

Figure 3-2 Comparison of forecast network changes





Source: Commission modelling

73. Vector's line length forecasts are far from the only anomaly. For example, The Lines Company is assumed to have higher line length growth than Vector (0.55%) but negative growth in ICPs (-0.28%) and negative growth in energy supplied (-0.05%). Similarly, Electricity Invercargill is assumed to have the lowest line length growth (-0.73%) but constant ICP numbers and very modest declines in energy supplied (-0.04%). At the other end of the spectrum, Aurora Energy has the highest line length growth (1.64%) but very low ICP growth (0.08%) and only modest forecast energy supplied growth (0.43%).

74. The effect of this is that companies like Vector and Electricity Invercargill with low assumed line length growth (which does not feed into assumed revenue growth) relative to ICP and energy supplied growth (which do feed into assumed revenue growth) tend to get one side of the coin but not the other. That is, they are assumed to have high revenue growth (due to high forecast sales growth) but not the cost growth to go with this (due to costs only being forecast based on line length and these firms low estimates of historical line length). This will result in overstatement of current and projected profitability and inappropriately high (downward) P0 adjustments.

75. We consider that these problems can be be mitigated by using a regression model for network opex that utilises at least one other regressor and/or by setting line length in a manner consistent with the other forecasts (eg, by forecasting line length to grow with ICPs). In relation to the former suggestion, the Commission has investigated such models, and we note that a model relying upon both total network length of supply and total electricity supplied appears to have a number of features making it preferable to the Commission's preferred model. A comparison between these models is shown at Table 3-3 below.

Table 3-3 Comparison of network opex regression models

	Commission's model	Alternative model
ln (network length of supply)	0.948***	0.537***
ln (electricity supplied to ICPs)		0.428***
Constant	0.563	1.220**
Adjusted R^2	0.81	0.87

Source: Commission dataset, CEG modelling.
Notes: Both regressions have been estimated using robust standard errors

76. We consider that the alternative model that we have proposed is preferable the Commission's because:

- it avoids sole reliance on total network length of supply, which appears to be the least robustly estimated forecast network indicator;

- it includes an additional variable, electricity supplied to ICPs, which is significant at the 1% level. The Commission's model, by excluding a relevant variable, is likely to suffer from omitted variable bias; and
- consistent with the inclusion of a relevant variable, the adjusted R-squared of the alternative model is higher than the Commission's.

77. We recommend that the Commission adopt this alternative model and include total electricity supplied in its regression model for forecasting network opex.

4 Claw back

4.1 Discount rate

78. The Commission raises the potential use of a discount rate other than the 75th percentile of the WACC to calculate the present value of any claw back.

79. We support consideration of such an approach. As we have described in previous reports submitted to the Commission, the WACC should, in principle, be applied to profits (or net cash flows). This is because the WACC is the discount rate used to value the stream of income available to pay financiers (debt and equity).

80. The WACC should not, except by coincidence, be used to discount an individual component of the cash-flows.[18] Rather, the discount rate used should be specific to the risks associated with that cash-flow.

81. In the case of claw-back of over-recovery by a business one approach is, as pointed out by the Commission, to treat the amount to be clawed back as a loan from customers to the business and to assign a discount rate that reflected the risks attached to the repayment of the over-recovery. As the Commission notes, this cash flow item may be uncertain but it does not necessarily have any systemic risk – as the uncertainty relates primarily to Commission decision making. In the CAPM, a risk free cash flow should be discounted at the risk free rate.

82. However, given households did not willingly enter into the arrangement, and likely have a cost of funds that is above the risk free rate, such an approach would not fully compensate them in reality. A more reasonable approach would be to set the discount rate to reflect the EDB's cost of debt.

83. It should also be recognised that if the households did formally lend to an EDB they would have to pay tax on the interest that they received (and the EDB would receive a tax deduction). By contrast, there will be no tax paid on any implicit interest returned to households for over-recovery in the form of lower future prices. Therefore, in order to compensate households (and penalise EDBs) 'as if' over-recovery was in the form of a loan the after tax cost of debt should be used as the discount rate.

84. From the EDB's perspective this is likely to be reasonable if they could simply use the excess funding they received to pay down the same amount of debt. Similarly, from the customers' perspective this will be reasonable to the extent that the amount

18 The exception to this is if the end result of such a calculation will be that the present value of that component will be added to the present value of all other components – as is done in the Commission's building block model. In this case, discounting each cash-flow element individually using the WACC and summing the answers gives the same result as discounting the sum of each element using the WACC.

involved was small (as it generally will be per customer) and they could adjust other assets/consumption at relatively low cost to fund the over-payment.

85. However, in the case where there has been an under-recovery a potentially important difference is that the financial resources (net wealth) of an EDB will be much smaller than the collective financial resources of its customers. For example, the Commission assumes the equity value of Vector is around $1.2bn while the population of Auckland is over 1.2m people. Even if the mean net worth per Aucklander was only $100,000 this would still be 100 times the net worth of Vector.[19]

86. This is important because the need to fund any under-recovery is concentrated on the EDB while the need to fund any over-recovery is spread out amongst all customers. In a world with perfect capital markets and zero transaction costs this difference could reasonably be ignored. However, in the real world the ability of any entity to raise capital to fund selling at prices below cost (paying prices above cost) will tend to be greater the larger is the shortfall (over-payment) as a proportion of the size of that entity.

87. To see that this must be the case consider an extreme example where, instead of a single EDB having to fund a $100m shortfall in revenue, a single household must fund a $100m overcharging. Clearly, the average single household would be simply unable to do so and would be bankrupted by such overcharging. This is because financial markets are not perfect and a household would be unable to go to a bank or other intermediary and obtain a loan for $100m on the uncertain security of the Commerce Commission at a later date deciding that this was indeed the level of overcharging and that the Commerce Commission would require the EDB to refund this to the household with interest. By contrast, if the $100m was spread over 500,000 households this would come to $200 each and most would be able to fund this with relative ease.

88. The same logic, although in a less extreme manner, applies to requiring an EDB to fund a $100m shortfall. The EDB will have much larger financial resources than the average household. However, $100m for the EDB will still be a much larger proportion of their net assets than $100m spread over 500,000 households will be of the net assets of the households. While the EDB will likely be able fund this, it will find it more difficult than the average household, to convince any financial investor (debt or equity) to fund their revenue shortfall. This is especially so in the context where the investment being funded is an uncertain amount of 'under charging' (to be determined by the Commerce Commission at a later date) with an uncertain level of interest (again to be determined by the Commerce Commission at a later date).

19 In 2001 a survey by the New Zealand retirement found the mean net worth of unpartnered individuals was $97,900 and the mean for couples was $322,300 http://www.cflri.org.nz/files/retirement-files/Media/research-library/net-worth-of-nzers.pdf .

89. The discussion above suggests that the discount rate applied to under recovery by an EDB should be higher than the discount rate applied to overcharging by an EDB (for which the EDB's cost of debt may be a reasonable proxy). However, whether this is as high, or higher, than the 75th percentile of the WACC is difficult to determine (and will tend to depend on the size of the under-recovery itself relative to the size of the EDB). Nonetheless, in our view the 50th percentile of the WACC range would be a reasonable benchmark to set in this regard.

90. Of course, the EDB will be taxed on whatever implicit return (discount rate) is used to used to calculate the present value of past under-recovery. This is because any additional revenue as a result of a positive discount rate will automatically be taxed. Consequently, the appropriate discount rate to used is a pre-tax discount rate (ie, scaled up for tax costs).

4.2 Other issues

91. There are a number of other issues around the claw-back that we have addressed in a separate report provided to the Commission.[20] The Commission did not feel able to consider that report in the preparation of this decision as it was provided before the Commission called for submissions. We now consider that the Commission should have regard to the contents of that report.

92. We further note that there appears to be an important area in which the recommendations of that report differ to the proposed approach of the Commission. Specifically, we recommended that the Commission estimate the amount to be clawed back by estimating the amount of over (under) recovery that resulted from prices being too high (low) but that the Commission should exclude the impact of volumes being higher (lower) than forecast.[21]

93. However, in Box L.4 on page 140 of the Revised Draft Reset paper the Commission appears to envisage a claw back that compares estimated costs in 2012/13 (on which MAR 2012/13 is based) with actual revenues. This means that if an EDB had higher than expected volumes in 2012/13 it would be assumed to have 'over-recovered' even if its prices to customers were no higher than would have been set by the Commission. The opposite is also true.

94. The effect of this is that the claw-back not only claws back:

- the effect of higher (lower) prices (which would not have been the case has the regulatory decision been taken earlier); but

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20 Application of claw-back a report for Vector, June 2012

21 See section 2 of that report.

- also claws back higher than forecast volumes (which are independent of the delay in the regulatory decision).

95. In our view this will overestimate over-recovery when volumes are higher than forecast and *vice versa*.