Do market-to-asset ratios provide reliable evidence on the cost of capital?

Note prepared for gas DNs

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1 Introduction

This note reviews the arguments set out by CEPA in a report prepared for Centrica on the cost of capital for gas DNs.[1]

CEPA's report places considerable emphasis on its interpretation of the market evidence on the divergence between companies' market values and the value of their regulated asset bases (RAB). Specifically, CEPA uses the market-to-asset ratio (MAR) to estimate the cost of capital and the cost of equity for firms in the gas distribution and water sectors using assumptions on several key parameters.

This note assesses CEPA's methodology and reviews the conclusions that are drawn from its analysis. Importantly, this note concludes that:

– the methodology used by CEPA does not appear to be consistent with commonly accepted principles for valuing financial assets;
– the assumptions retained in the valuation exercise represent an oversimplified—and arguably incorrect—view of how regulated businesses operate and create value within the regulatory frameworks typically used by UK regulators; and
– the analysis disregards the impact of certain important drivers of the MAR beyond the differential between the regulated rate of return and the cost of capital.

[1] CEPA (2007), 'The Allowed Cost of Capital—OFGEM: GDPCR 2008–2013', April.

Consequently, Oxera believes it would be inappropriate for Ofgem to place any weight on CEPA's analysis in the determination of the gas DNs' weighted average cost of capital (WACC).

The remainder of this note is structured as follows:

– section 2 briefly reviews the concept of the MAR, and explains why it might be assumed that this indicator contains some relevant information about the expected profitability and risk of regulated businesses;
– section 3 summarises the approach used by CEPA with regard to the interpretation of MARs in the gas and water sectors;
– section 4 assesses the validity of CEPA's arguments and conclusions; and
– section 5 concludes.

2 What are MARs, and what information do they contain?

The MAR represents the ratio between the market value (MV) of a regulated business and its regulatory asset base (RAB).

$$\text{MAR} = \frac{\text{Market value of regulated entity (including debt and equity)}}{\text{RAB}}$$

The market value of the regulated entity is usually calculated as the sum of the market value of net debt and the market value of shareholders' equity. It should be noted that the measurement of these individual components might raise significant methodological questions.

– The time periods over which the different components are valued should be consistent. That is, the MAR is a forward-looking measure insofar as the market value incorporates all contemporaneous information that could affect expectations of future returns. For example, the MAR continuously reflects investors' expectations regarding future regulatory decisions, individual companies' performances on OPEX, CAPEX, and quality of service, as well as changes in the wider macroeconomic environment. In contrast, regulatory assumptions underpinning the RAB valuation are only updated every five years.

– When the regulated entity is part of a wider group, a methodology for apportioning the market value 'premium' over tangible asset values (as reflected by, say, the RAB or the asset values entered in a group's balance sheet) would need to be adopted. This is because the market value premium may be 'focused' on a particularly profitable business segment. For a company with both regulated and unregulated assets, it may be difficult to apportion the total value of the group, since asset values are typically measured in a variety of ways and with widely varying depreciation profiles.

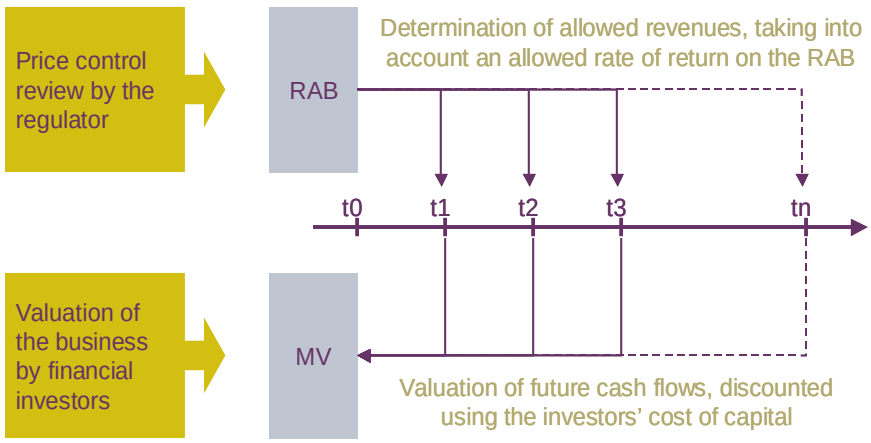
Notwithstanding these concerns, the MAR does provide an aggregate indicator of how financial markets respond to regulatory developments during a price control period. That said, this ratio could reflect a variety of factors other than simply the divergence between the assumptions of the cost of capital held by the regulator on one hand, and investors on the other. It is clear from the above discussion that the MAR needs to be interpreted carefully in order to provide meaningful information.

While the MAR can provide an insight into the market's view of the level of profitability and risk carried by a regulated business, this interpretation of the MAR rests on an important theoretical link between the ratio's numerator and the denominator:

– the market value of the regulated business should represent investors' estimates of the present value of all the future cash flows accruing to them, discounted using their cost of capital (that is, capital markets should be *efficient*); and

– the regulator should set the allowed revenue of a regulated business so that it will be able to finance its operating and capital expenditures, and generate cash flows that will allow investors to earn a rate of return equal to their cost of capital (that is, the RAB should represent the asset value on which the company earns the *entirety* of its allowed rate of return).

Figure 2.1 The relationship between the RAB and the market value for regulated business (simplified illustration)



It follows that if investors anticipate that outturn business performance and economic conditions will be exactly in line with regulatory assumptions—and this needs to be the case for all future regulatory determinations, in perpetuity—then the market value of the business will be equal to its RAB. That is, the MAR would equal 1.

However, if investors expect that actual business performance and economic conditions will differ from regulatory assumptions, the MAR will not be 1. A MAR in excess of 1 represents a positive assessment by the market of the company (or sector), while a MAR below 1 represents a negative assessment.

Such a gap between the market value and the RAB could arise for at least three reasons:

– investors may be pricing in cash flows allowed by regulators in excess of the rate of return allowed on the RAB, such as quality-of-service incentives, quantity incentives, financeability payments (especially if they are NPV-positive), or other pain/gain-sharing mechanisms designed to incentivise firm performance (eg, Ofwat's system of 'carrots and sticks' embedded in the OPEX productivity assumption);

– investors may anticipate that outturn cash flows will differ from cash flows assumed by the regulator (this could be caused, for example, by the company being expected to spend more or less on operating or capital expenditure than assumed); and/or

– investors' assessment of their cost of capital (ie, the discount rate) may differ from the regulated allowed rate of return.

In its report, CEPA focused exclusively on the third reason. This note considers a wider range of explanations as to why MARs could be greater than 1.

3 What did the CEPA conclude about MARs and the implied cost of capital?

CEPA's assessment of the cost of capital of gas DNs places considerable emphasis on the interpretation of market evidence. Specifically, its report attempts to derive estimates of the cost of capital and cost of equity from MARs based mainly on recent transactions in the water sector and the recent sales of the gas DNs.

In principle, CEPA recognises that the MAR may be affected by factors other than the differential between the allowed rate of return and the true cost of capital. However, in practice, CEPA asserts that these factors are not significant, provided that the analysis is made at the sector, rather than company, level. CEPA states that:

> MR ratios for certain companies may be higher or lower than the values for other companies reflecting differential operating and capital efficiency, but the sector average MR ratio provides a useful cross-check on the CAPM derived WACC.[2]

As a result, CEPA's quantitative analysis does not control for these other factors. In the report's model, the cost of capital of a regulated company is inferred from its MAR according to the following formula:

> Implied cost of capital = regulated rate of return x (1 – market premium on RAB)

where the market premium on RAB equals (MAR – 1).

Provided that certain assumptions are made with regard to the cost of debt, it is possible to derive the cost of equity from this implied cost of capital.

The report then goes on to apply this analytical framework in the gas and water sectors on the basis of estimates of the MARs for selected companies. The MAR values used by CEPA are taken from secondary sources (ie, financial analysts' reports), although the way that these analysts calculated the MAR is not set out.

In particular, CEPA finds that:

– the cost of capital (ie, the 'vanilla' WACC[3]) implied by evidence derived from recent transactions in the water sector may be 150–180 basis points lower than the (presumed) allowed rate of return of 4.91% measured on a vanilla basis;

– the cost of capital implied by evidence from gas DN disposals may be around 70 basis points lower than the (presumed) allowed rate of return (4.91%).

On the basis of this analysis, as well as other considerations, CEPA concludes that the post-tax cost of equity range for gas DNs should be 6.5–7%.

It should be noted that CEPA's results rely on the following three additional assumptions.

[2] CEPA (2007), op. cit., p. 24.

[3] The 'allowed rate of return' and 'cost of capital' refer to vanilla WACC measures (ie, pre-tax debt, post-tax equity), since this is the measure of returns that is consistent with Ofgem's modelling of allowed revenues (at DPCR4 and TPCR). That is, the so-called 'post-tax' approach to setting the allowed rate of return actually entails Ofgem modelling cash flows using the vanilla WACC plus the expected cash tax liabilities over the control period due to the difficulties associated with adjusting actual (levered) cash flows to unlevered (ie, assuming no financial leverage) cash flows.

– The ‘average’ MAR for the gas DN sales was 1.14—although this ratio was directly observed for the gas DNs following their divestment by National Grid, MARs derived from equity and debt valuations are subject to significant uncertainty, as discussed in section 2.

– Investors’ expectations of the allowed rate of return was 4.91%—CEPA assumes that investors expected Ofgem to adopt a post-tax cost of equity of 6.25% and a pre-tax cost of debt of 3.75–4.65%. Accordingly, investors would have expected a vanilla WACC of 4.69–5.25%, given gearing of 62.5% (with 4.91% seen as the ‘most appropriate’ scenario). Clearly, this assumption is problematic, given the succession of Ofgem determinations at this time (eg, multiple transmission extension reviews and TPCR).

– Investors’ actual cost of debt was 2.62–2.73%—again, this assumption is open to debate. CEPA states that this assumption was intended to be for illustrative purposes only.

Similar assumptions were used for the calculation of the impacts of MAR premia in the water sector, as follows:

– the observed MARs for water sector asset sales was 1.26–1.32;
– investors’ expectations of the allowed rate of return was 5.83%, based on a post-tax cost of equity of 7.7%, a pre-tax cost of debt of 4.3%, and gearing of 55%; and
– investors’ actual cost of debt was 2.48–2.81%, although this assumption was transaction-specific.

The same caveats apply to these assumptions in the water sector as for the gas DNs.

4 Is CEPA’s methodology appropriate?

This section reviews two important methodological issues raised by CEPA’s approach:

– the calculations made by CEPA do not seem to be consistent with commonly agreed principles for valuing streams of cash flows; and
– the assumptions used in these calculations disregard certain important factors that can drive MARs.

4.1 The methodology for deriving an implied cost of capital from the MAR should comply with cash-flow valuation principles

Because the MAR is defined by reference to the market value of a regulated business, any interpretation of this indicator should adhere to commonly accepted principles for valuing assets in a market environment.

4.1.1 The basic relationship

This issue can be illustrated by a simplified example where cash flows are equal to the RAB multiplied by the allowed rate of return, and where these are constant to infinity.

If cash flows are assumed to be constant in perpetuity, it can be shown that the present value of these cash flows can be valued using the following formula:

$$\text{Present value} = \frac{\text{Annual cash flow}}{\text{Cost of capital}}$$

This formula can be re-written as:

$$MV = \frac{RAB \times r}{k}$$

where MV is the market value of the regulated business (including equity and debt), r is the rate of return allowed by the regulator, and k is the WACC.

Rearranging terms gives:

$$k = \frac{r}{MAR}$$

The above formula differs markedly from the formula used by CEPA (using notation consistent with the formulae above):

$$k = r - r \times (MAR - 1)$$

Importantly, CEPA does not specify how its formula has been derived, although it is difficult to see how this formula is consistent with basic principles for valuing assets and discounting cash flows. This is because CEPA's formula seems to incorrectly assume that the divergence in MV and RAB values is proportional to the difference between the allowed rate of return (r) and the cost of capital (k).

The formula used by CEPA has the effect of underestimating the implied cost of capital that could be inferred from the MAR. This can be illustrated by adjusting the calculations for the Sutton & East Surrey scenario analysed in CEPA's report on the gas DNs' cost of capital.[4]

Table 4.1 Implied cost of capital for Sutton & East Surrey Water (assuming constant returns)

	CEPA	Adjusted valuation formula
Observed MAR	1.32	1.32
Allowed rate of return assumed by bidders (vanilla WACC, %)	5.83	5.83
Implied cost of capital (vanilla WACC, %)	3.96	4.42
Implied cost of equity (post-tax, %)	5.38–5.78	6.38–6.78

Source: CEPA (2007), op. cit., p. 27, and Oxera calculations.

Table 4.1 shows that using a simplified valuation formula that is consistent with accepted principles for discounting perpetuities, the implied cost of capital and cost of equity are 0.46% and 1% higher than those estimated by CEPA, respectively.

4.1.2 Additional timing factors

The formula provided above presents an overly simplified relationship. It does not capture all the timing factors and complications that are typically taken into account in a valuation exercise. In particular, the assumption that cash flows remain constant over time is unlikely to correspond to reality. Cash flows may vary significantly over time, and these fluctuations may have a substantial impact on what can be inferred from the MAR.

[4] CEPA (2007), op. cit., p. 27.

These variations may be due to a combination of factors. In regulated industries, the growth of the RAB is an important driving factor of cash flows over the medium to long term. The impact of this driver can be illustrated by amending the simplified formula provided above in order to account for a hypothetical constant growth rate.

If the RAB grows at a constant rate, g, to perpetuity, it can be shown that:[5]

$$MV = RAB \times \frac{r - g}{k - g}$$

Rearranging terms gives:

$$k = \frac{r - g}{MAR} + g$$

Again, CEPA's disregard of RAB growth has the effect of understating the implied cost of capital that can be inferred from the MAR. Table 4.2 illustrates this point with reference to the same scenario presented in Table 4.1.

Table 4.2 Implied cost of capital for Sutton & East Surrey Water (assuming constant returns and RAB growth)

	CEPA	Adjusted valuation formula
Observed MAR	1.32	1.32
Allowed rate of return assumed by bidders (%)	5.83	5.83
Annual growth rate of the RAB (%)	n/a	1.2
Implied cost of capital (vanilla WACC, %)	3.96	4.71
Implied cost of equity (post-tax, %)	5.38–5.78	7.03–7.43

Note: the growth rate assumption in this example is the cumulative average annual growth rate of the company's RAB over the 2005–10 period. See Ofwat (2004), 'Future water and sewerage charges 2005-10: Final Determinations', December, Appendix 7.
Source: CEPA (2007), op. cit., p. 27, and Oxera calculations.

Table 4.2 shows that when using a simplified valuation formula that is consistent with accepted principles for discounting perpetuities, and factoring in a reasonable growth assumption, the implied cost of capital and cost of equity are 0.74% and 1.65% higher than those estimated by CEPA, respectively.

It should be acknowledged that the outcome of this analysis is highly dependent on the specific growth rate assumption used. Moreover, in the above example, the growth rate is held constant in perpetuity. In regulated industries, costs and revenues are reassessed periodically in price control reviews, and the current regulatory determination will not necessarily be replicated identically beyond the next control period. As a result, the MAR is

[5] This formula relies on conventional timing assumptions used in discounted cash flow calculations—that is, cash flows (regulated returns on the RAB less CAPEX) occur at the end of each financial year, starting from the end of the first year. However, if it is assumed that CAPEX is incurred at the outset of the regulatory control period, it can be shown that the market value of the regulated assets are as follows:

$$MV = RAB \left[(r - g) \frac{1 + g}{k - g} - g \right]$$

also affected by investors' appraisal of long-term sector dynamics and their perceptions of the 'fairness' of future regulatory determinations (eg, the degree of regulatory 'commitment').

4.2 MARs may exceed 1 for reasons other than the differential between the cost of capital and the regulated rate of return

The gap between the regulated rate of return and the investors' estimate of the cost of capital is not the only factor driving the MAR. As explained in section 2, the MAR may also exceed 1 when regulators:

– attempt to incentivise greater firm performance by allowing additional revenues (or penalties) for, say, quality of service and pain/gain-sharing on OPEX; or
– investors anticipate that future cash flows will be above the regulator's assumptions.

As mentioned above, CEPA abstracts from these effects on the grounds that such variations are company-specific and will average zero at sector level, implying that investors do not expect any departure from regulatory assumptions in their cash-flow forecasts.

In contrast, this section argues that there are a number of reasons why investors could reasonably assume that expected cash flows may exceed regulatory assumptions, even at sector level. As shown below, this could have a positive impact on the market value of a regulated business, implying that, for a given MAR, the share of the premium attributable to a cost of capital being lower than the allowed rate of return is reduced.

4.2.1 'Carrots' and other regulatory incentives

A number of regulatory systems in the UK include additional incentive schemes related to the quality or quantity of the output delivered. These regulatory mechanisms may constitute a source of additional return for regulated companies.

Indeed, certain regulatory regimes in the UK explicitly aim to allow the realisation of outperformance by companies as part of the overall incentive framework. For example, this could be achieved by setting the price limits on the basis of assumptions for efficiency improvements that are below what is deemed to be achievable by the companies. This kind of arrangement is most notably formalised in the water sector. In the 2004 periodic review, Ofwat stated that:

> The scope for efficiency improvements is around 2.4% a year for operating expenditure and 3.6% a year for capital maintenance. We have assumed about half of this in price limits.[6]

The water regulator describes the resulting incentive profile as a balance between 'carrots' and 'sticks'—the sticks represent the proportion of the scope for efficiency that is included in price limits, while carrots are the possible reward for outperforming the regulatory assumptions.

In the water sector, one can therefore argue that the possibility of recurring outperformance is built into the regulatory regime. While this is not explicitly the case in all regulatory systems in the UK, these considerations suggest that the possibility of increasing the value of the business throughout this channel should not be ruled out.

[6] Ofwat (2004), 'Future Water and Sewerage Charges 2005–10: Final Determinations', December.

All else being equal, this factor reduces the share of the MAR premium that can be explained by a difference between investors' assessment of the cost of capital and the regulated rate of return. If it is assumed that the regulated entity can realise unanticipated cost savings equal to 's' percent of the RAB each year to perpetuity, the simplified formula provided in section 4.1.2 above be re-written as:

$$MV = RAB\frac{r - g + s}{k - g}$$

Rearranging terms gives:

$$k = \frac{r - g + s}{MAR} + g$$

Thus, if the previous example (Table 4.2) is further augmented by retaining hypothetical annual savings amounting to 0.08% of the RAB, the following results are obtained (see Table 4.3).

Table 4.3 Implied cost of capital for Sutton & East Surrey Water (assuming constant returns, RAB growth, and 'carrots')

	CEPA	Adjusted valuation formula
Observed MAR	1.32	1.32
Allowed rate of return assumed by bidders (%)	5.83	5.83
Annual growth rate of the RAB (%)	n/a	1.2
Annual savings as % of RAB	n/a	0.08
Implied cost of capital (vanilla WACC, %)	3.96	4.77
Implied cost of equity (post-tax, %)	5.38–5.78	7.16–7.56

Note: In this example, a hypothetical value for s is estimated as s = (average annual forecast OPEX over 2005–10 × average total operating cost 'carrots' × 50%) / opening RAB = (20.7 × 1% × 50%) / 127.5 = 0.08%. See Ofwat (2004), op. cit, pp. 151, 272 and 274.
Source: CEPA (2007), op. cit., p. 27, Oxera calculations.

The above table shows that when using a simplified valuation formula that is consistent with accepted principles for discounting perpetuities, and factoring in the impact of a reasonable assumption for growth and unexpected savings, the implied cost of capital and cost of equity are 0.81% and 1.78% higher than those estimated by CEPA, respectively.

4.2.2 Financeability uplifts

In some cases, the revenues allowed by the regulator may include additional funds to ensure the financeability of the companies. Such allowances are not provided to cover the companies' expected cash expenditures, or their cost of capital. They are calculated separately from the common building blocks of the price control determination, and are allowed on top of these items, to enable the regulated entities to maintain an appropriate financial profile and retain investor confidence.

These adjustments may be designed so that they do not generate additional value for the companies' investors. For example, in the last distribution and transmission price control reviews, Ofgem modified the depreciation profile of the RAB so that target financial ratios could be maintained during the price control period. In that case, lower revenues in future regulatory periods offset the effect of higher revenues in the current period, since the RAB is depreciated more rapidly.

In other sectors, however, regulators may provide additional financeability funds in a way that enhances the valuation of the companies. Arguably, this is the case in the water sector, where Ofwat made adjustments to regulated revenues amounting to £430m in the 2004 periodic review, in order to fulfil its duty to enable companies to finance their activities. Overall, this represents 1.2% of the industry's total opening RAB.

The water regulator does not provide information on financeability allowances on a per-company basis. In addition, this framework was implemented only at the last review in 2004, and it is difficult to determine whether the same approach will be replicated in future regulatory periods. These factors make it difficult to estimate precisely the impacts on the costs of capital and equity of this policy on the future cash flows of a particular company. Nevertheless, it appears reasonable to assume that this scheme has influenced investors' perceptions and that some of its impact may be embedded in the water companies' market value.

In its initial proposals, Ofgem noted that two of the gas DNs sold in 2005 had relatively weak financeability positions. As a result, the regulator suggested that certain adjustments might be allowed in the final proposals, including 'NPV positive measures'.[7] It is not inconceivable that the market value for the affected gas DNs also includes the impacts of these potential measures, and that some this effect was also embedded in the MARs examined by CEPA. The implication of this factor for the interpretation of MARs is similar to the impact of the other factors reviewed.

4.2.3 Outperformance of regulatory assumptions and merger effects

An additional explanation for why cash flows would differ from regulatory assumptions is that companies may achieve greater cost savings than the regulator assumed in its decision. Such savings can be realised on OPEX, CAPEX, or corporation tax. Regulated companies can typically keep cost savings in excess of regulatory assumptions for a certain period of time, depending on particular regulatory arrangements (sliding-scale and claw-back mechanisms, pass-through clauses, etc). Equally, regulated companies bear some of the risk of underperformance.

Companies can outperform regulatory cost assumptions in the normal course of business, but they can also achieve cost savings as a result of more structural changes. Mergers, in particular, may allow companies to exploit scale or scope economies that were not anticipated by the regulator at the time of the price control review. For example, in 2005, a consortium including Scottish & Southern Energy acquired two gas DNs. This company owns and operates electricity distribution networks in the same geographical areas, and it is therefore likely that the new group is in a position to restructure its activities so as to realise cost savings that were not achievable in the preceding configuration. As a result, these gas DNs may be worth more to Scottish & Southern than to the seller National Grid.

This effect is, by its nature, more exceptional than cost savings achieved in the normal course of business. However, it is particularly relevant for the interpretation of MARs that are calculated on the basis of the price paid by investors in acquisitions. In this case, the market value taken into account in the ratio will include a control premium that is partly justified by these anticipated savings. Again, this provides an alternative explanation for MARs above unity that is not taken into account in CEPA's work.

[7] Ofgem (2007), 'Gas Distribution Price Control Review Initial Proposals Document', May.

5 Conclusion

This note has argued that a wide range of factors may influence the market value of regulated companies, and that any analysis of their MARs has to control for these factors in order to be meaningful. Moreover, the methodology employed by CEPA does not appear to be consistent with commonly accepted principles for valuating financial assets. Indeed, the assumptions used in CEPA's valuation exercise represent an oversimplified—and arguably incorrect—view of how regulated businesses operate and create value within the regulatory framework.

The numerical examples contained in this note suggest that the share of the MAR premium that can be explained by a differential between the regulated rate of return and the actual cost of capital may be much smaller than that asserted by CEPA. Moreover, CEPA's analysis contains a number of assumptions that may or may not be consistent with recent capital market developments, notably in relation to the cost of debt. These concerns, together with the difficulties associated with the 'focusing' of any observed MAR premium suggest that MARs are rarely going to be exactly equal to 1 in practice.

Appendix 1 Implications of RAB growth for the analysis of MARs

Assuming that the RAB of a regulated company grows by g% per year to perpetuity, at the end of any given financial year t, the regulated entity will:

– receive a regulated return equal to its RAB at the beginning of the year multiplied by the regulated rate of return r;

$$\text{Return}_t = \text{RAB}_{t-1} \times r$$

– spend an amount of CAPEX equal to its RAB at the beginning of the year multiplied by the growth rate g;

$$\text{CAPEX}_t = \text{RAB}_{t-1} \times g$$

This means that total cash flows at the end of each year will be:

$$\begin{aligned} CF_t &= \text{Return}_t - \text{CAPEX}_t \\ &= \text{RAB}_{t-1} \times (r - g) \end{aligned}$$

Given that:

$$\text{RAB}_{t-1} = \text{RAB}_0 \times (1+g)^{t-1}$$

The previous equation can be written as:

$$CF_t = \text{RAB}_0 \times (1+g)^{t-1} \times (r - g)$$

This can also be written as:

$$CF_t = CF_{t-1} \times (1+g)$$

The formula for discounting cash flows growing at a constant rate to perpetuity is:

$$\text{Present value}_0 = \frac{CF_1}{k - g}$$

In this case, this yields:

$$MV_0 = \frac{\text{RAB}_0 \times (r - g)}{k - g}$$

or:

$$k = \frac{r - g}{\text{MAR}} + g$$