Implementation of a calibrated DGM

A note prepared in response to a request by the Australian Energy Regulator

This note provides a guide to the 'calibrated' Dividend Growth Model (DGM) that was used to inform ENA's submission on the AER's Draft Equity Omnibus Working Paper.

Purpose of the model

The AER's 2018 RoRI rejected the use of a DGM approach to estimate the market risk premium (MRP) for two primary reasons:

- There is no single objective means for determining the long-run growth rate, and estimates are sensitive to the choice of growth rate; and
- There are concerns that the DGM approach might produce estimates that are systematically upwardly biased.

The calibrated DGM has been developed as a serious attempt to address these concerns directly.

- We start with the AER's preferred specifications of the two-stage and three-stage DGM;
- We adopt the same consensus dividend forecasts and timing conventions as the AER has used in the past;
- We adopt the AER's 2018 estimate of theta, and make the same adjustment for imputation credits that the AER has used in the past; and
- We then solve for the (unique) long-run growth rate that equates the mean DGM estimate with the AER's preferred estimate of the historical average MRP. For illustrative purposes, we have adopted a mean MRP figure of 6.1%, consistent with the 2018 RoRI.

The remainder of this note explains how the Excel-based calibrated DGM may be implemented by a user.

Calibration

Inputs selectable by the user include:

- Values of theta and the distribution rate (set to 0.65 and 0.90 as per the 2018 RORI)
- Corporate tax rate (set to 30%)
- The long-run MRP (set to 6.1% as per the 2018 RoRI)

The model requires several data sources:

- Monthly interest rates published by the RBA (F2)
- Bloomberg data containing the ASX200 index and associated dividend yield forecasts

The interest rates data are included in the model, and can be readily obtained from the RBA. We also include Bloomberg data up to July 2021. This can be readily updated by the AER. The data required is the same as that used in the DGMs developed by the AER for its 2013 Rate of Return Guideline.

The model also requires dividend yield forecasts for months prior to March 2006. This is constructed using Refinitiv (formerly Thomson Reuters) data, described in the next section.

Construction

Establishing the base MRP

The first step is for the AER to estimate the average excess return over some historical period, in the usual manner. This was the AER's preferred approach to the MRP in 2018.

For example, in 2018 the AER estimated that the average historical MRP over the 1988-2017 period was 6.1%. For the 2022 RoRI, the AER will re-estimate that figure using data from 1988-2021. Whatever that figure turns out to be then becomes the 'target' to which the DGM will be calibrated. This is selectable in the calibration model.

Populating the market-level DGM

The next step is to obtain values for the current market index and consensus dividend forecasts (for the market as a whole) from Bloomberg. This is the same data as the AER uses for its preferred specification of the DGM.

The DGM simply equates the present value of future dividends to the current observed index level:

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \frac{D_5}{(1+r)^5} + \cdots$$

Since we only have forecasts for the next 3 years, we assume constant growth thereafter, consistent with the AER's preferred specification:[1]

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_3(1+g)}{(1+r)^4} + \frac{D_5(1+g)^2}{(1+r)^5} + \cdots$$

We assume a value for growth (g). Any figure will do, as we will ultimately derive this figure from the data using the method set out below. Suppose we start with an assumption of 4.6%, the base case figure adopted by the AER since 2013.

At this stage, we have observations of one, two and three year ahead dividend yield forecasts, and our starting value of 4.6% for g. We can then solve for the implied required return on the market, r. That is, there is a unique r that equates the current observed price with the forecasted future dividends.

[1] We note that the AER's preferred specification accounts for the possibility that the calculation is being performed during Year 1, rather than right at the beginning of Year 1. In this case, the timing is simply adjusted accordingly. We have adopted the AER's timing conventions in all of our calculations. We also note that this formula pertains to the AER's two-stage DGM. The same approach can be applied to the three-stage DGM and produces near identical results. For some early months, the Year 3 forecasts were unreliable, we substituted with a transition from Year 2.

Applying the model to produce monthly MRP estimates

This process is repeated for each month from 1996-2021 (using the period in the above example). This will produce a different estimate of the required return on the market for each month. For some months the combination of dividends and price will produce a high estimate of the required return and in other months we will have a low estimate of the required return.

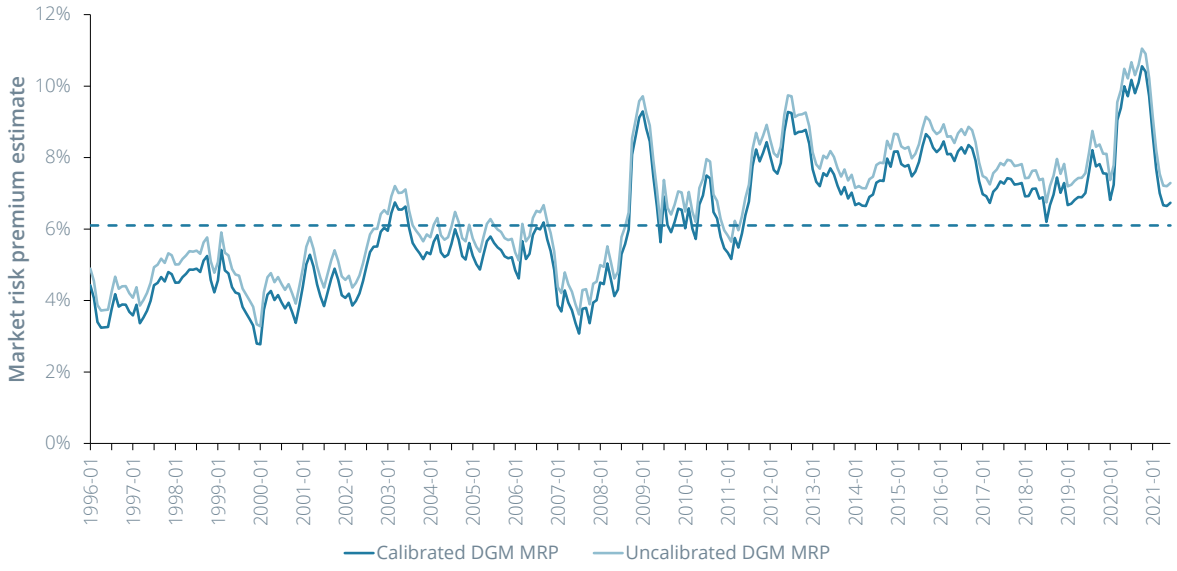
Steps 1 to 3 are entirely consistent with the way the AER has estimated its preferred specification of the DGM in every determination since 2013.

Calibrating the model back to the AER's historical MRP estimate

The last step is to 'calibrate' the output to be consistent with the AER's estimate of the average MRP over that historical period. We do this for the following reason. The basis for the AER's use of the historical excess returns approach is that actual market outcomes reflect investor expectations on average over a long period. That is, although actual outcomes might differ from what investors were expecting in a particular year, over the long-term average observed market outcomes will reflect investor expectations. Thus, in the 2018 RoRI, the AER concluded that, on average over that period, investors were expecting an MRP of 6.1%.

Consequently, for illustrative purposes only, we calibrate the DGM to ensure that the average estimate of the expected MRP is also 6.1%. In this way, both estimates reflect the same average expected MRP over the same historical period. We do this by altering the assumed long-run growth, g, until we have an exact match. This is illustrated as the 'Calibrated DGM MRP' in **Figure 1**.

Figure 1: Comparing a 'calibrated' and uncalibrated DGM MRP estimate



Source: Frontier Economics analysis of Bloomberg, Refinitiv and RBA data

How would the estimates of the calibrated DGM be used?

The calibrated DGM series would then be used by the AER to inform its selection of an MRP figure in the 2022 RoRI. For example, the AER may have regard to the most recent estimates at

the time of the RoRI and to estimates over the prior months or year. We would see the ENA using this information to produce a range that is supported by the DGM evidence – in the same way that the AER has regard to a range of different historical excess returns estimates.

The benefit of the calibrated DGM approach is that, whereas it produces the same average MRP as the historical excess returns approach, it provides an indication of whether the current MRP is above or below that long-run average.

Construction of ASX dividend forecast series prior to Bloomberg

Construction of an Australian market dividend forecast series must be accomplished if data prior to 2006 is to be included in the DGM MRP calibration model as the Bloomberg data commences in March 2006.

Constituents pre-2006

The first step is to identify the constituents of the 'market index'. This is performed using the "2021-08-23 Constituents.R" file, and uses Refinitiv data contained in "2021-08-20 ForTop200.xlsx".

For September 2000 onwards we were able to identify the ASX200 constituents directly using Refinitiv. Prior to that we construct the constituent list by identifying the 200 largest firms by market value as per Refinitiv. To do this we have used data on all dead and surviving firms listed on the ASX.

The R file creates two key outputs: a csv file containing the constituents for each month from December 1995 through to March 2006 ("MonthsStocks.csv"), and a file containing the list of all companies that were constituents at some point between December 1995 and March 2006 ("AllStocks.csv").

Dividend forecasts pre-2006

The next step is to download from Refinitiv the daily price, market value, and dividend forecast data for all companies identified in the first step. This is saved in "2021-10-02 Forecasts Price MV.xlsx".

This data is analysed, along with the file specifying the constituents each month, in "2021-10-02 DividendYield.R". For each month, the data of each on the 200 constituents are used to derive the 1 year, 2 year and 3 year ahead dividend yield forecasts for the constituent. After applying a filtering process, removing extreme yields, the remaining observations are weighted by market value to obtain the three market dividend yield forecast series. This is exported as "DividendForecasts.csv". This is then used in the DGM MRP calibration, merged with the Bloomberg data.

Further development work required

In principle, the period over which the DGM is calibrated should be consistent with the historical period used to estimate the average historical MRP. As noted above, the period the AER used for that purpose in the 2018 RoRI was the period 1988-2017.

In order to do this properly, we would need dividend forecast data from 1988 onwards. Bloomberg provides dividend forecast data from 2006 onwards. As explained above, we have been able to extend the series of dividend forecasts back to January 1996. Hence, further work is required to extend the dividend forecasts series back to 1988, in order to implement the calibrated DGM properly. We would be happy to work collaboratively with the AER in order to do this.

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