

The relationship between theta and MRP

Report for Envestra

27 September 2010

Executive summary

Instructions

1. The Strategic Finance Group: SFG Consulting (SFG) has been engaged by Envestra Ltd. To provide an expert opinion about the relationship between the estimate of the theta parameter and the estimate of the market risk premium (MRP).
2. This report has been prepared by Professor Stephen Gray, Professor of Finance at the University of Queensland and Managing Director of the Strategic Finance Group. A copy of my CV is attached as an appendix to this report. I have been provided with a copy of the Federal Court Guidelines for Expert Witnesses and have prepared this report in accordance with them. I understand that Envestra Ltd. will submit this report to the AER as part of its regulatory proposal.

Conclusions

3. Our main conclusions are that the AER's base-case MRP estimate of 6.0% (based on giving primary weight to long-term historical data) is in no need of reduction even if the estimate of theta were to be reduced from 0.65 to 0.23. The maximum adjustment that would be required is in the order of 0.1 - 0.2%, which is well within the bounds of error.
4. Any adjustment in relation to the proposed change in the estimate of theta is an order of magnitude smaller than the adjustment that would occur simply by beginning each of the AER's sample periods five years earlier.

Relationship between theta and MRP

5. We have been instructed that Envestra intends to submit that the theta parameter should be set to 0.23 in accordance with the estimate from the SFG dividend drop-off study.
6. We also note that in its Review of WACC Parameters Final Decision (Statement of Regulatory Intent, or SoRI), the AER adopted an estimate of 0.65 for theta and that this estimate of theta has a small consequential impact on the AER's estimate of market risk premium (MRP). Specifically, the AER's estimate of MRP is based primarily on a long-term historical average of annual excess market returns (i.e., the difference between the return on a broad stock market index over the course of a year and the return on government bonds available during the same year). The AER notes that stock market indices measure dividends and capital gains but do not incorporate any value in relation to franking credits. Consequently, the AER makes an adjustment for its assumed value of franking credits for each of the years since the introduction of dividend imputation in 1987.
7. The form of this adjustment is set out, by way of example, in the table below. This table sets out the adjustment for a single year in which the aggregate dividend yield (across the broad market) is 4%, 80% of those dividends are franked, the corporate tax rate is 30% and theta is assumed to be 0.65. These numbers are illustrative only – the AER uses the *actual* dividend yield each year (assumed to be 4% below) and the *actual* tax rate each year (assumed to be 30% below).

	Current AER approach
Dividend Yield	4%
Percentage Franked	80%
Franked Dividend Yield	3.2%
Franking credits for each dollar of dividends	0.43
Franking Credit Yield	1.37%
Theta	0.65
Return From Franking Credits	0.89%

8. The table above shows that if the dividend yield is approximately 4% and if approximately 80% of dividends are franked, there is a yield of 3.2% of franked dividends. Each of these dividends has a 43 cent franking credit attached to it, which amounts to a franking credit yield of 1.37%. If each of these franking credits is worth 65% of face value, the return from franking credits is 0.89%. This adjustment of 0.89% is then added to the market return that is computed as the percentage change in the stock market index (which incorporates only dividends and capital gains). This procedure is then followed in every year of the sample beyond 1987.
9. If theta was set at 0.23 instead of 0.65, the gross-up to reflect the assumed value of franking credits would be lower, as the 1.37% franking credit yield would be multiplied by 0.23 instead of 0.65.
10. The exact effect this has on the AER's MRP estimates is set out in Table 7.2 of the SoRI, which is reproduced below:

Table 7.2 Historical excess returns (arithmetic average, relative to 10 year bonds, 'grossed-up' for value of imputation credits distributed, per cent)					
Utilisation rate	0.00	0.28	0.5	0.65	1.00
1883-2008	5.9*	6.0*	6.1*	6.1*	6.2*
1937-2008	5.4*	5.5*	5.6*	5.7*	5.9*
1958-2008	5.7	5.9	6.1	6.2*	6.4*
1980-2008	5.0	5.3	5.6	5.8	6.3
1988-2008	3.8	4.3	4.7	5.0	5.6

Source: Handley⁴⁶⁵
 *Indicates estimates are statistically significant at the five per cent level based on a two-tailed t-test.

11. Table 7.2 sets out the historical estimates on which the AER relies. The different columns are for different estimates of theta.
12. On p.237 of the SoRI the AER says that “primary weight” should be applied to the long term historical estimates. Consequently, one should concentrate on the first three rows of the table as the last two rows present short-term estimates.
13. Based on the figures set out in Table 7.2, the AER concluded that the best estimate of MRP in “relatively stable market conditions” (p. xiv) is 6%. It then concluded that the appropriate estimate in the current financial market circumstances is 6.5% as the current circumstances have been affected by increased risk premiums associated with the global financial crisis.
14. Note that the estimates of MRP from the first three rows of the table (corresponding to longer-term estimates) average 6.0 when theta is set to 0.65 and 5.8 when theta is set to 0.28. On the surface, this may seem to justify reducing MRP from 6.5% (=6.0 base plus 0.5% for current market conditions) to 6.3% (5.8% base plus 0.5% for current market conditions).
15. However, the numbers in Table 7.2 are biased downwards in the following sense. Each of the numbers in Table 7.2 is constructed as the average of the “excess market returns” from each year of the sample period. The excess market return each year is computed as the return on the broad stock market index, grossed up to include the assumed value of franking credits, and minus the risk-free return for that year. Since the data began in 1883, the three biggest six-year streaks of high excess returns end in the years 1937, 1959 and 1980. Note that the start dates for the sample periods in Table 7.2 have been set in such a manner as to remove these substantially positive observations from the samples that are being analysed. With almost perfect precision. For example, by starting a sample period in 1937, the substantially positive excess returns of 20%, 32%, 14%, 20%, and 11% that occurred in 1932-1936 have been eliminated from the sample that is analysed.
16. If the second row of Table 7.2 used a sample that began five years earlier, but was otherwise identical, the estimates for theta set to 0.65 and 0.28 would be approximately 6.6% and 6.4% respectively.

17. If the third row of Table 7.2 used a sample that began five years earlier, but was otherwise identical, the estimates for theta set to 0.65 and 0.28 would be approximately 7.3% and 7.1% respectively.
18. All of these estimates are prior to the addition of 0.5% to reflect the increased risk premiums in the current financial circumstances.
19. From this, we conclude that the AER's base-case MRP estimate of 6.0% (based on giving primary weight to long-term historical data) is in no need of reduction even if theta were to be reduced to 0.23 – because there is such imprecision in the estimate, an adjustment of 0.1 - 0.2% is well within the bounds of error. That is, any adjustment in relation to the proposed change in the estimate of theta is an order of magnitude smaller than the adjustment that would occur simply by beginning each of the AER's sample periods five years earlier.

Declaration

20. In preparing this report, I have made all the enquiries that I believe are desirable and appropriate and no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Court.



Professor Stephen Gray
27 September, 2010.

References

Australian Energy Regulator (2009), “Electricity transmission and distribution network service providers – Review of the weighted-average cost of capital (WACC) parameters: Final Decision,” May, www.aer.gov.au.

Appendix: CV of Professor Stephen Gray

Stephen F. Gray

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Academic Qualifications

- 1995** Ph.D. (Finance), Graduate School of Business, Stanford University.
Dissertation Title: Essays in Financial Economics
Committee Chairman: Ken Singleton
- 1989** LL.B. (Hons), Bachelor of Laws with Honours, University of Queensland.
- 1986** B.Com. (Hons), Bachelor of Commerce with Honours, University of Queensland.

Employment History

- 2000-Present** Professor of Finance, UQ Business School, University of Queensland.
- 1997-2000** Associate Professor of Finance, Department of Commerce, University of Queensland and Research Associate Professor of Finance, Fuqua School of Business, Duke University.
- 1994-1997** Assistant Professor of Finance, Fuqua School of Business, Duke University.
- 1990-1993** Research Assistant, Graduate School of Business, Stanford University.
- 1988-1990** Assistant Professor of Finance, Department of Commerce, University of Queensland.

Academic Awards

- 2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
- 2002 Journal of Financial Economics, All-Star Paper Award, for Modeling the Conditional Distribution of Interest Rates as a Regime-Switching Process, JFE, 1996, 42, 27-62.
- 2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).
- 2000 University of Queensland Award for Excellence in Teaching (a University-wide award).
- 1999 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.
- 1999 KPMG Teaching Prize, Department of Commerce, University of Queensland.
- 1998 Faculty Teaching Prize (Business, Economics, and Law), University of Queensland.
- 1991 Jaedicke Fellow in Finance, Doctoral Program, Graduate School of Business, Stanford University.
- 1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.
- 1986 University Medal in Commerce, University of Queensland.

Large Grants (over \$100, 000)

- Australian Research Council Linkage Grant, 2008—2010, Managing Asymmetry Risk (\$320,000), with T. Brailsford, J. Alcock, and Tactical Global Management.
- Intelligent Grid Cluster, Distributed Energy – CSIRO Energy Transformed Flagship Collaboration Cluster Grant, 2008-2010 (\$552,000)
- Australian Research Council Research Infrastructure Block Grant, 2007—2008, Australian Financial Information Database (\$279,754).
- Australian Research Council Discovery Grant, 2006—2008, Capital Management in a Stochastic Earnings Environment (\$270,000).
- Australian Research Council Discovery Grant, 2005—2007, Australian Cost of Equity.
- Australian Research Council Discovery Grant, 2002—2004, Quantification Issues in Corporate Valuation, the Cost of Capital, and Optimal Capital Structure.
- Australian Research Council Strategic Partnership Grant, 1997—2000, Electricity Contracts and Securities in a Deregulated Market: Valuation and Risk Management for Market Participants.

Publications

Gray, S., C. Gaunt and Y. Wu, (2010), “A comparison of alternative bankruptcy prediction models,” *Journal of Contemporary Accounting and Economics*, forthcoming.

Feuerherdt, C., S. Gray and J. Hall, (2010), “The Value of Imputation Tax Credits on Australian Hybrid Securities,” *International Review of Finance*, forthcoming.

Gray, S., J. Hall, D. Klease and A. McCrystal, (2009), “Bias, stability and predictive ability in the measurement of systematic risk,” *Accounting Research Journal*, forthcoming.

Treepongkaruna, S. and S. Gray, (2009), “Information volatility links in the foreign exchange market,” *Accounting and Finance*, 49, 2, 385-405.

Costello, D., S. Gray, and A. McCrystal, (2008), “The diversification benefits of Australian equities,” *JASSA*, December.

Gray, S. and J. Hall, (2008), “The Relationship Between Franking Credits and the Market Risk Premium: A Reply,” *Accounting and Finance*, 48, 1, 133-142.

Gray, S., A. Mirkovic and V. Rangunathan, (2006), “The Determinants of Credit Ratings: Australian Evidence,” *Australian Journal of Management*, 31(2), 333-354.

Choy, E., S. Gray and V. Rangunathan, (2006), “The Effect of Credit Rating Changes on Australian Stock Returns,” *Accounting and Finance*, 46(5), 755-769.

Gray, S. and J. Hall, (2006), “The Relationship Between Franking Credits and the Market Risk Premium,” *Accounting and Finance*, 46(3), 405-428.

Gray, S. and S. Treepongkaruna, (2006), “Are there non-linearities in short-term interest rates?” *Accounting and Finance*, 46(1), 149-167.

- Gray, P., S. Gray and T. Roche, (2005), "A Note on the Efficiency in Football Betting Markets: The Economic Significance of Trading Strategies," *Accounting and Finance*, 45(2) 269-281.
- Duffie, D., S. Gray and P. Hoang, (2004), "Volatility in Energy Prices. In V. Kaminski," (Ed.), *Managing Energy Price Risk: The New Challenges and Solutions* (3rd ed.). London: Risk Books.
- Cannavan, D., F. Finn and S. Gray, (2004), "The Value of Dividend Imputation Tax Credits in Australia," *Journal of Financial Economics*, 73, 167-197.
- Gray, S. and S. Treepongkaruna, (2003), "Valuing Interest Rate Derivatives Using a Monte-Carlo Approach," *Accounting and Finance*, 43(2), 231-259.
- Gray, S., T. Smith and R. Whaley, (2003), "Stock Splits: Implications for Investor Trading Costs," *Journal of Empirical Finance*, 10, 271-303.
- Gray, S. and S. Treepongkaruna, (2003), "On the Robustness of Short-term Interest Rate Models," *Accounting and Finance*, 43(1), 87-121.
- Gray, S. and S. Treepongkaruna, (2002), "How to Value Interest Rate Derivatives in a No-Arbitrage Setting," *Accounting Research Journal* (15), 1.
- Gray, P. and S. Gray, (2001), "A Framework for Valuing Derivative Securities," *Financial Markets Institutions & Instruments*, 10(5), 253-276.
- Gray, P. and S. Gray, (2001), "Option Pricing: A Synthesis of Alternate Approaches," *Accounting Research Journal*, 14(1), 75-83.
- Dahlquist, M. and S. Gray, (2000), "Regime-Switching and Interest Rates in the European Monetary System," *Journal of International Economics*, 50(2), 399-419.
- Bollen, N., S. Gray and R. Whaley, (2000), "Regime-Switching in Foreign Exchange Rates: Evidence from Currency Options," *Journal of Econometrics*, 94, 239-276.
- Duffie, D., S. Gray and P. Hoang, (1999), "Volatility in Energy Prices. In R. Jameson," (Ed.), *Managing Energy Price Risk* (2nd ed.). London: Risk Publications.
- Gray, S. and R. Whaley, (1999), "Reset Put Options: Valuation, Risk Characteristics, and an Example," *Australian Journal of Management*, 24(1), 1-21.
- Bekaert, G. and S. Gray, (1998), "Target Zones and Exchange Rates: An Empirical Investigation," *Journal of International Economics*, 45(1), 1-35.
- Gray, S. and R. Whaley, (1997), "Valuing S&P 500 Bear Market Warrants with a Periodic Reset," *Journal of Derivatives*, 5(1), 99-106.
- Gray, S. and P. Gray, (1997), "Testing Market Efficiency: Evidence from the NFL Sports Betting Market," *The Journal of Finance*, 52(4), 1725-1737.

- Gray, S. (1996), "Modeling the Conditional Distribution of Interest Rates as a Regime-Switching Process," *Journal of Financial Economics*, 42, 27-62.
- Gray, S. (1996), "Regime-Switching in Australian Interest Rates," *Accounting and Finance*, 36(1), 65-88. Brailsford, T., S. Easton, P. Gray and S. Gray, (1995), "The Efficiency of Australian Football Betting Markets," *Australian Journal of Management*, 20(2), 167-196.
- Duffie, D. and S. Gray, (1995), "Volatility in Energy Prices," In R. Jameson (Ed.), *Managing Energy Price Risk*, London: Risk Publications.
- Gray, S. and A. Lynch, (1990), "An Alternative Explanation of the January Anomaly," *Accounting Research Journal*, 3(1), 19-27.
- Gray, S. (1989), "Put Call Parity: An Extension of Boundary Conditions," *Australian Journal of Management*, 14(2), 151-170.
- Gray, S. (1988), "The Straddle and the Efficiency of the Australian Exchange Traded Options Market," *Accounting Research Journal*, 1(2), 15-27.

Teaching

Fuqua School of Business, Duke University, Student Evaluations (0-7 scale):

- Financial Management (MBA Core): Average 6.5 over 7 years.
- Advanced Derivatives: Average 6.6 over 4 years.
- Empirical Issues in Asset Pricing: Ph.D. Class

1999, 2006 Outstanding Professor Award, Global Executive MBA, Fuqua School of Business, Duke University.

UQ Business School, University of Queensland, Student Evaluations (0-7 scale):

- Finance (MBA Core): Average 6.6 over 10 years.
- Corporate Finance Honours: Average 6.9 over 12 years.

2002 Australian University Teaching Award – Business (a national award for all university instructors in all disciplines).

2000 University of Queensland Award for Excellence in Teaching.

1999 Department of Commerce KPMG Teaching Prize, University of Queensland.

1998 Faculty Teaching Prize, Faculty of Business Economics and Law, University of Queensland.

1998 Commendation for Excellence in Teaching, University-wide Teaching Awards, University of Queensland.

1989 Touche Ross Teaching Prize, Department of Commerce, University of Queensland.

Board Positions

2002 - Present: Director, Financial Management Association of Australia Ltd.

2003 - Present: Director, Moreton Bay Boys College Ltd. (Chairman since 2007).

2002 - 2007: External Risk Advisor to Board of Enertrade (Queensland Power Trading Corporation)