Keywords: market risk premium, cost of equity, global financial crisis, options pricing, implied volatility.

RESPONSE TO 'ADJUSTING THE MARKET RISK PREMIUM TO REFLECT THE GLOBAL FINANCIAL CRISIS'

Bishop, Fitzsimmons and Officer's paper in JASSA: The Finsia Journal of Applied Finance *(Issue 1, 2011) proposes a method for adjusting the market risk premium (MRP) based on the implied volatility derived from prices of three-month and 12-month call options on the ASX 200. While it is widely recognised that the MRP was higher during the global financial crisis (GFC), there are some significant issues with the authors' proposed method of quantifying this variation which are identified in this response.*

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The paper by Steven Bishop F Fin, Michael Fitzsimmons SF Fin and Bob Officer SF Fin, 'Adjusting the market risk premium to reflect the global financial crisis', presents an interesting conceptual idea about deriving estimates of MRP from the implied volatility of traded index options. However, it:

> has an underlying inconsistency;

> materially overstates the size of the MRP shift;

> makes an inappropriate comparison with debt spreads;

> fails to consider other factors influencing the markets relied on by the authors; and

> is inconsistent between its use of measures of historic volatility and implied volatility.

Fundamental inconsistency

MRP is a long-term parameter in that equity cash flows by their nature occur over an extended period of time. There is, therefore, a fundamental inconsistency when using short-term information (data from three-month and one-year options) to estimate a long-term parameter such as MRP.

The paper by Bishop, Fitzsimmons and Officer attempts to get around this by putting forward (without discussion) a notional 'one-year MRP', which is not a well-defined concept (since there are no equity assets with cash flows only occurring over a one-year period). Furthermore, this leaves undefined the issue of how a 'one-year MRP' would be converted into a true (long-term) MRP. Although the paper has an endnote, which mentions the possibilities of assuming a 'glide' over three years or, alternatively, stepping down the MRP after two years to derive a long-term average, it does not discuss this further.

Size of MRP shift

The paper suggests that the normal level of MRP in Australia is generally accepted to have an average range of 6 per cent to 7 per cent (constant for all terms).

The paper also estimates that the current[1] 'one-year MRP' is 9.7 per cent. While the paper goes on to state that converting this into a longer term MRP requires further assumptions,[2] it may not be obvious to the casual reader that in valuing most equity assets (which involve long-term cash flows), even if a current one-year MRP of some 9.7 per cent is accepted,[3] it would still be consistent with a long-term MRP in the normal range. For instance, for a 20-year equity cash flow growing at 3 per cent per annum with a one-year MRP of 10 per cent grading down to 6 per cent MRP for years 4+ and a flat risk-free rate of 5.5 per cent per annum, the equivalent constant MRP is 6.95 per cent, as shown in Figure 1.

FIGURE 1: MRP shift for 20-year equity cash flow

Year	Cash flow	MRP	Rf	Ke	PV factor	PV	Const MRP	Ke	PV factor	PV
1	100	10%	5.50%	15.50%	0.8658	86.5801	6.95%	12.45%	0.8893	88.9318
2	103	8.67%	5.50%	14.17%	0.7584	78.1117	6.95%	12.45%	0.7909	81.4614
3	106.09	7.33%	5.50%	12.83%	0.6721	71.3043	6.95%	12.45%	0.7034	74.6185
4	109.2727	6.0%	5.50%	11.50%	0.6028	65.8685	6.95%	12.45%	0.6255	68.3504
5	112.5509	6.0%	5.50%	11.50%	0.5406	60.8472	6.95%	12.45%	0.5563	62.6088
6	115.9274	6.0%	5.50%	11.50%	0.4849	56.2086	6.95%	12.45%	0.4947	57.3495
7	119.4052	6.0%	5.50%	11.50%	0.4349	51.9236	6.95%	12.45%	0.4399	52.5320
8	122.9874	6.0%	5.50%	11.50%	0.3900	47.9653	6.95%	12.45%	0.3913	48.1192
9	126.677	6.0%	5.50%	11.50%	0.3498	44.3088	6.95%	12.45%	0.3479	44.0771
10	130.4773	6.0%	5.50%	11.50%	0.3137	40.9310	6.95%	12.45%	0.3094	40.3746
11	134.3916	6.0%	5.50%	11.50%	0.2813	37.8107	6.95%	12.45%	0.2752	36.9830
12	138.4234	6.0%	5.50%	11.50%	0.2523	34.9283	6.95%	12.45%	0.2447	33.8764
13	142.5761	6.0%	5.50%	11.50%	0.2263	32.2656	6.95%	12.45%	0.2176	31.0307
14	146.8534	6.0%	5.50%	11.50%	0.2030	29.8059	6.95%	12.45%	0.1936	28.4240
15	151.259	6.0%	5.50%	11.50%	0.1820	27.5337	6.95%	12.45%	0.1721	26.0364
16	155.7967	6.0%	5.50%	11.50%	0.1633	25.4347	6.95%	12.45%	0.1531	23.8493
17	160.4706	6.0%	5.50%	11.50%	0.1464	23.4957	6.95%	12.45%	0.1361	21.8459
18	165.2848	6.0%	5.50%	11.50%	0.1313	21.7046	6.95%	12.45%	0.1211	20.0108
19	170.2433	6.0%	5.50%	11.50%	0.1178	20.0500	6.95%	12.45%	0.1077	18.3298
20	175.3506	6.0%	5.50%	11.50%	0.1056	18.5215	6.95%	12.45%	0.0958	16.7901
						875.5996				875.5996

Put more simply, the authors' dramatically higher MRP of 9.7 per cent, even if correctly calculated, is *only a notional one-year MRP, not a long-term MRP*. Under plausible assumptions (e.g. a reduction of MRP over four years back to a long-term rate of 6 per cent), this is actually consistent with the range of the *long-term MRP* that most practitioners and regulators currently adopt in practice.

Comparison with debt spread

The paper compares the calculated risk premium on debt (spread of seven-year BBB bond yield over 10-year Commonwealth bond yield) with the MRP calculated from the implied volatility of options.[4] The authors state that 'the relative consistency in the behaviour of spreads in these two markets gives us confidence in the approach we have adopted to estimate the forward equity market MRP'.

However, the observed debt spread data does not support the authors' case:

> first, the authors wrongly compare the short-term (one-year) MRP against longer term debt spreads (seven-year BBB bond yields net of 10-year Commonwealth bond yields), whereas the MRP appropriate for the seven-year term of the BBB bonds would not be at the short-term level, but rather considerably closer to the long-term level (how much closer would depend on what assumptions are made about mean reversion.) [5]

> second, debt is much less risky than equity, as is shown by the normal spreads (namely a MRP of about 6 per cent and BBB spread over Commonwealth bonds of 1.2 per cent), which are consistent with BBB debt having a beta of 0.2. Thus the authors' observed increased spreads for seven-year BBB bonds being similar to the observed increase in the one-year MRP implied by option values is much more than would be expected, even if there were no mean reversion in MRP. If other factors were unchanged, it would be more consistent for BBB spreads to increase in proportion to the MRP, not by the same amount. Put simply, the GFC was primarily a banking and credit crisis, which affected credit spreads dramatically, and only indirectly an economic crisis, with much smaller effects on the MRP than the normal relationship between debt spread and the MRP would indicate.

What the authors missed

The observed debt spreads during the GFC (and subsequently) were significantly affected by a number of abnormal factors such as:

> the artificial suppression of official rates by central bankers to support their economies;

- 'quantitative easing' in the United States, artificially depressing longer term US bond yields (with flow-on effects elsewhere);
- shifts in reserve holdings as banks and other financial institutions increased their holdings of government bonds; and
- the lack of liquidity in corporate bond markets.

Liquidity is very important to investors, but it is not separately allowed for in the capital asset pricing model (CAPM), which assumes all assets are fully liquid at all times. Accordingly, liquidity margins (and, particularly, increases in liquidity margins) should not be equated with risk margins as per the CAPM. A more reasonable interpretation of the observed bond spreads is that there was a blow-out of liquidity spreads for corporate bonds due to the GFC and this persisted for some time, particularly for BBB bonds, which is a thin market in Australia.

The end result is that the authors' assessment of the MRP is materially overstated due to their failure to distinguish between:

- the impact of risk and the impact of (significantly reduced) liquidity; and
- the different duration of those impacts.

Other factors affecting option values

The implied volatility calculated for option prices is also materially affected by factors other than the market's view of risk.

In particular, structural changes that alter the attractiveness of writing options will alter the supply of option writers and, hence, will alter option prices. During the GFC (and remaining in place after it), a number of changes were made which had the effect of reducing the attractiveness of writing options, including:

- the Australian Clearing House (ACH)[6] increased margin requirements;[7]
- restricting ACH's eligible collateral to fully paid stocks in the ASX200 (plus specific cover);[8]
- increasing core liquid capital requirements for clearing participants from $100,000 to $2,000,000 in December 2008;[9] and
- the low interest rate paid by the ACH on cash-backed margin calls; the financial impact of which was greatly exacerbated by the combination of collapsing equity values, widening option spreads due to option market illiquidity, increased margin requirement noted above and the necessity to lodge cash security at a time when liquidity was at a premium.

Furthermore, buy/sell spreads for options widened considerably, reducing the liquidity of the market and, hence, reducing the attractiveness to option writers (noting that option buyers are more often at least potential long-term holders of the underlying security, who wish to protect their position, whereas option sellers are more often speculative and, hence, more likely to wish to close out their profitable positions early).

These significant market changes have meant that some of the observed shift in implied volatility calculated from option prices is due to factors other than expected risk over the option term. As a result, by calculating MRP movement directly from shifts in implied volatility, the authors overstate these changes and this also causes their current MRP estimate to be overstated.

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Historic and implied volatility

Historic volatility is actual volatility over a period, whereas implied volatility is calculated from option prices under the assumption that the Black-Scholes pricing formula applies.

The paper uses historic volatility to calibrate MRP per unit volatility but then uses implied volatility to estimate current short-term MRP. This implicitly assumes that the two measures are equivalent. However, this is not the case as implied volatility is generally higher than historic volatility.

There are a number of reasons for this, including:

- imperfections in the assumptions underlying the Black-Scholes option price formula as a description of actual market behaviour and, hence, the completeness of its calculation of value;[10] and
- the general preponderance of option buyers (seeking protection from volatility on underlying assets) over sellers.

Accordingly, the authors' failure to allow for the inconsistency between actual historic volatility and implied volatility again causes them to overestimate the MRP.

Some conclusions

The paper's underlying conceptual idea of measuring MRP by reference to implied option volatility is worthy of further research. But its resulting assessment of MRP is materially overstated due to the authors':

- comparison with debt spreads of non-matching terms, which is not a comparison of like with like;
- failure to allow for the fact that debt spreads were materially impacted by other abnormal factors;
- wrongly attributing and perpetuating (short–term) liquidity aberrations into (long-term) risk margins;
- failure to allow for the material adverse impact of structural changes to the option market during the GFC; and
- failure to differentiate between actual historic volatility (a factual matter) and implied prospective volatility (a mathematical calculation from an option model), even though these are, in practice, typically different.

In an ideal world, further empirical research might conceivably allow for each of these errors to be corrected. However, in my view, this is unlikely to occur due to the measurement problems involved.

The authors are to be commended for proposing an interesting alternative approach to calculating the MRP. However, their estimated current MRP of 9.7 per cent is very materially overstated as an estimate of true (long term) MRP. At a more fundamental level, the calculation of a long-term MRP based on short-term option volatility represents a fundamental (and presently insurmountable) mismatch.

The views contained in this paper are those of the author and not necessarily those of his firm. ■

Notes

1. Date not stated but presumably December 2010.
2. Examples of 'glide' over three years or step-down after two years to long-term average are given in an endnote to the paper.
3. Which this author does not accept.
4. I note that it is not stated whether this implied volatility is based on a 90-day option, one-year option or some other term or terms.
5. For instance, assuming a grading to long-term MRP by year 4 (as for equity cash flows calculated above) would mean that a 10 per cent one-year MRP would be equivalent to an overall MRP of some 7.3 per cent for a seven-year bond.
6. This was the clearing house at the relevant time, but has subsequently been replaced by ASX Clear Pty Limited.
7. For instance, the ASX margin intervals for S&P/ASX 50 Options (XFL) and S&P/ASX 200 Options (XJO) increased (in a series of steps) from 6 per cent in June 2008 to 14 per cent in January 2009, effectively more than doubling the proportion of value required to be held as risk margin (which is calculated as the worst change to value of position from the underlying security changing to somewhere in the range from an increase by the margin interval to a decrease by the margin interval).
8. Announced in the ASX Market Information document, 'Overview of risk management changes to ASX's central counterparty practices', released on 7 July 2008.
9. Also announced by the ASX in the risk management changes document released on 7 July 2008.
10. As shown, for instance, by volatility 'smile', where deep out-of-the-money and deep in-the-money options generally trade at higher implied volatility than at-the-money options for the same asset and term. Under the assumptions underlying the Black-Scholes formula, all of these options should trade at prices consistent with the same volatility.