LONDON METAL EXCHANGE

EXTRAPOLATION OF VOL SURFACES

Proposal by Ben Green

At the last Traded Options Committee meeting I promised a brief explanation of a simple method of extrapolating volatility surfaces beyond the marked point. It is as follows:

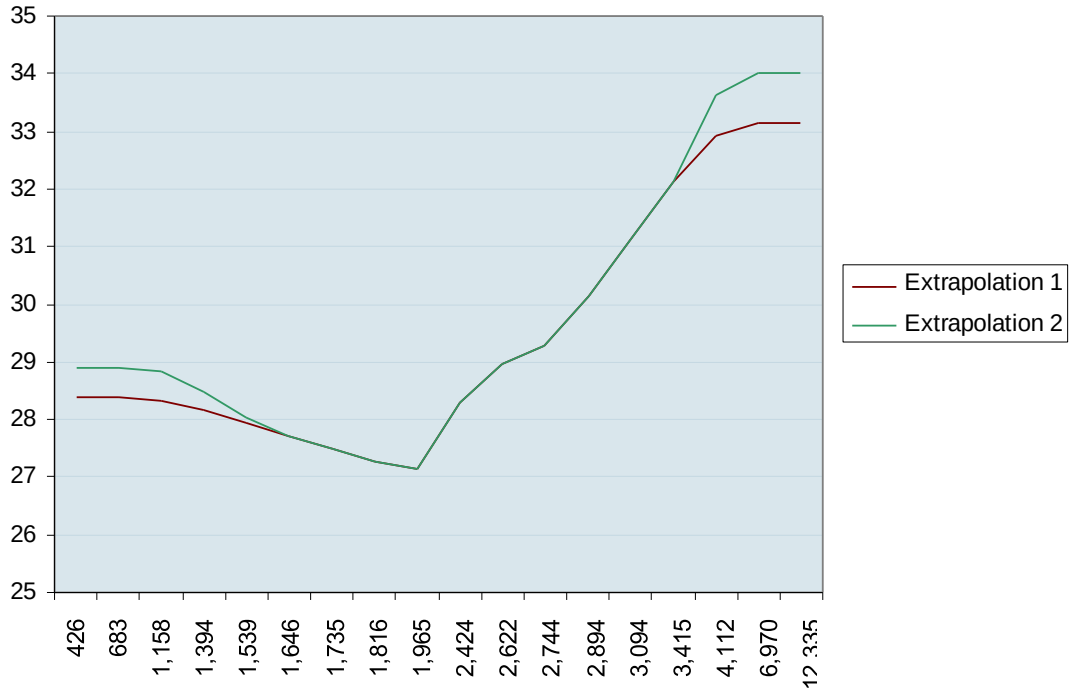
Take the current volatility surface in delta space. Simply add 0 delta points to either side and extrapolate linearly in delta space. If an extrapolation factor of 1 (ie. the slope in delta space between the 25 and 10 delta points is held constant beyond the 10 delta point) is used we obtain the following sample surface:

Implied Vol Surface (Extrapoltaion Factor: 1)								
Tenors	**0d**	**10d**	**25d**	**atm fwd**	**50 d**	**25d**	**10d**	**0d**
1w	42.07	41.89	41.62	41.81	41.83	42.54	43.68	44.43
1m	41.44	41.17	40.75	40.97	41.06	42.06	43.65	44.71
3m	36.11	35.65	34.95	35.22	35.45	37.04	39.58	41.28
6m	31.67	31.21	30.51	30.83	31.13	32.92	35.76	37.66
9m	29.55	29.06	28.33	28.61	28.96	30.74	33.66	35.60
12m	28.35	27.84	27.08	27.30	27.67	29.37	32.26	34.18
15m	27.17	26.66	25.89	26.08	26.46	28.08	30.91	32.80
21m	25.82	25.36	24.66	24.84	25.25	26.80	29.53	31.35
27m	24.80	24.37	23.74	23.91	24.32	25.79	28.39	30.12
39m	23.89	23.46	22.81	22.92	23.36	24.71	27.20	28.87
51m	23.22	22.80	22.17	22.24	22.68	23.90	26.24	27.80
63m	22.76	22.36	21.76	21.80	22.26	23.40	25.67	27.18

As a further example, if we use an extrapolation factor of 2 (ie. the slope in delta space between the 25 and 10 delta points is doubled beyond the 10 delta point) we obtain the following:

Implied Vol Surface (Extrapoltaion Factor: 2)								
Tenors	**0d**	**10d**	**25d**	**atm fwd**	**50 d**	**25d**	**10d**	**0d**
1w	42.25	41.89	41.62	41.81	41.83	42.54	43.68	45.19
1m	41.72	41.17	40.75	40.97	41.06	42.06	43.65	45.78
3m	36.58	35.65	34.95	35.22	35.45	37.04	39.58	42.97
6m	32.14	31.21	30.51	30.83	31.13	32.92	35.76	39.56
9m	30.03	29.06	28.33	28.61	28.96	30.74	33.66	37.54
12m	28.86	27.84	27.08	27.30	27.67	29.37	32.26	36.10
15m	27.68	26.66	25.89	26.08	26.46	28.08	30.91	34.69
21m	26.29	25.36	24.66	24.84	25.25	26.80	29.53	33.17
27m	25.22	24.37	23.74	23.91	24.32	25.79	28.39	31.85
39m	24.32	23.46	22.81	22.92	23.36	24.71	27.20	30.53
51m	23.65	22.80	22.17	22.24	22.68	23.90	26.24	29.37
63m	23.17	22.36	21.76	21.80	22.26	23.40	25.67	28.69

While this method seems very simple and crude, it results in the following surface cross sections in strike space (12m point used):



The cross section looks bumpy because it is being interpolated linearly. We are more interested in the extreme (<10 delta points) which can be identified as those areas where the two lines diverge (due to differing extrapolation factors).

Overall, this approach is clear and simple. Whether it is the most appropriate or not is subject to debate. As well as its simplicity, a further advantage is how well the wings behave on the extremes and the element of control one has over exactly how they behave by adjusting the “extrapolation factor”. How this factor will be agreed upon, or even whether it is constant is something that would need to be discussed.