### 6.9.4 A 1st "Good" Shape for Uncertainty – Commodities and Skews/Jumps

In many ways, the modelling (and trading) of commodities is the most difficult of all asset classes. Commodities have many idiosyncrasies (primarily due to supply/demand factors) that introduce tricky complications. This means that even when the uncertainty is modelled "accurately", the actual trading (e.g. rebalancing) may not be able to exploit model veracity due to liquidity or other constraints[290]. Detailed treatment of these matters is provided in [7] and [2], here only a cursory review of a few important factors is possible.

One relatively well-known aspect of commodity price behaviour is that of a "saw tooth[291]" price pattern. That is, it may rise slowly, but reverser very quickly. This behaviour can still produce a relatively "Normally'ish" distributed shapes, though shares some of the characteristics of jump-diffusion or leptokurtic processes. There can be a pronounced asymmetry in the speed at which the markets move in one or the other direction, and this may not be all that obvious from simple histogram or distribution analysis. Therefore, simple models of uncertainty may not capture or exhibit this aspect of the "real" trading/rebalancing problem.

Figure 6.9 – 4 illustrates a price history for spot gold price and a histogram for the same.

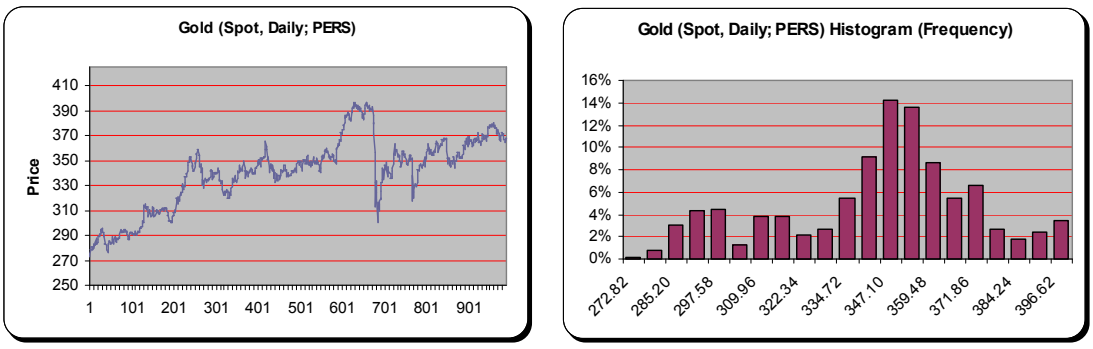




Figure 6.9 – 4. History of spot gold showing "saw-tooth" behaviour and "jumps", and its histogram.

[290] The authors would not consider any model "accurate" unless it specifically provide for a sensible accounting of holding period activity (including rebalancing, liquidity, etc.)

[291] In fact, saw-tooth behaviour is observed in other markets. For example, very pronounced "correction asymmetry" is observed in the equity markets.

The histogram includes the upward trending process, and that is in part responsible for the skewed "outright price" distribution. However, the pronounced negative tails is partially due to the very sudden, almost "jump-like[292]" large "corrections[293]" to the downside.

Figure 6.9 – 5 illustrates that "Diffs" history and the accompanying histogram. Remember that pre-processing to Diffs does not de-trend the history as such (though Diffs naturally have less pronounced trends). Importantly, the Diffs are proxy for (absolute) returns (i.e. P&Ls). The modelling considerations in this Section are favouring returns processes, and this Diffs representation provides a convenient form.

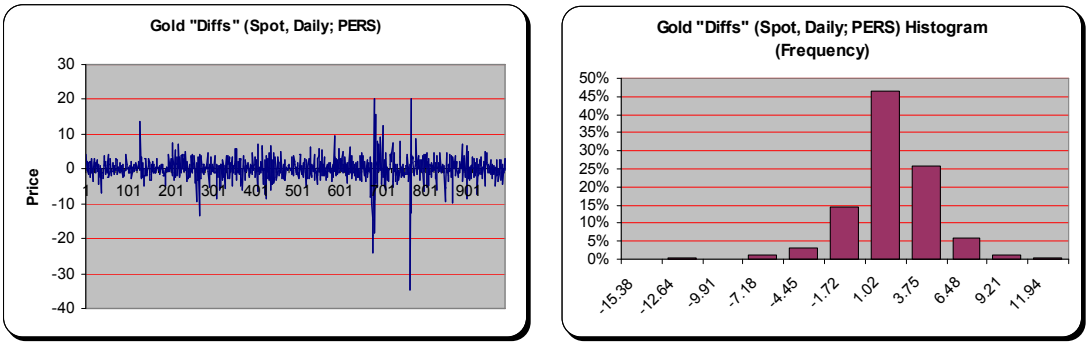




Figure 6.9 – 5. History of spot gold "Diffs" showing "saw-tooth" behaviour and "jumps", and its histogram.

The Diffs' histogram looks "Normal'ish", but the negative skew is still noticeable. Since the Diffs exhibit very little trending, and since the histogram shows low but finite probability very far to the down-side, the uncertainty can be seen as due to the large "corrections". Notice that it is also possible to have asymmetry due continual and pronounced preference to one-sided moves of smaller sizes (as opposed to a few large one-sided moves). Saw-tooth pattern arise in both contexts, but may be more often associated with the "few but large" kind.

This type of shape is suggestive of a Weibull distribution, which also has the property of modelling uncertainty with "large events" (e.g. failures") occasionally, and exhibits skew. In practice, the Normal distribution is used since some consider it "close enough" and since all of the risk neutral/market convention/regulatory frameworks in built around that.

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[292] In this context, as opposed to that in Section 6.9.3, there may be reason to believe the jumps to be related to the diffusion. For example, it can be shown that when certain markets (e.g. S&P Index) rise too quickly, then there is a greater likelihood for a sudden correction (and the faster/further rises appear to result with bigger more sudden corrections).

[293] The word "correction" refers to a "movement" in the market. It is in bit of a spoof or euphemism, since it implies that "we really knew that the market was overbought, and so it had to correct", and now "we can pat ourselves on the back".

The most common "solution" to "saw-tooth risk" is to somehow incorporate "extra fees" into the pricing of securities and derivatives. For example, options traders will often "skew the smile". A "vol skew" or "vol smile" is a common tool used in options trading (see [1], [4], [8], or [9]). This is not a skew in the statistical sense, but rather a device that allows options further away-from-the-money to be priced at (almost always) increasingly higher prices, but expressed in terms of increasing "standard deviations (vols)" used as inputs to the pricing formulas. A vol skew used in markets exhibiting pronounced down-side saw-tooth behaviour will "price" out-of-the-money puts with a relatively higher fee (compared to the at-the-money puts), as shown in Figure 6.9 – 6.

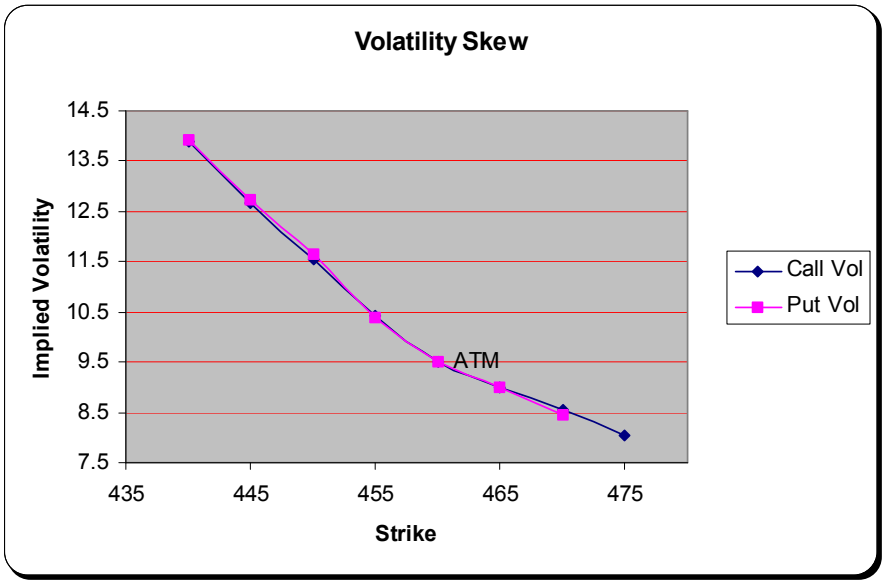


Figure 6.9 – 6. A "vol skew" plot showing implied volatility from quoted options at various strikes.

Using this type of pricing/risk management process, the out-of-the-money puts are still priced with a Normal distribution-based model, but now with increasing "price" (expressed in term of implied volatility). As such, the net effect is that the sequence of options prices taken across decreasing strikes produces a "pricing effect" that could have been achieved with a "skewed distribution" (but now keeping the symmetric distributions, and using many of them with adjustments).

Technically, a collection of symmetric distributions-based options prices taken together with a "vol skew" does not truly equate to a "proper skewed distribution". For example, the effects on Vega and Delta will be different; but those subtleties are left to later Chapters and books in the Series. However, this approach does have the benefit of avoiding the rather messy process of not only deriving an entirely new risk neutral framework, but then also avoiding the need to convince the rest of the market/traders and the regulators to use it as well.