4.3.4 Green Parrot Risk Evaluation Exercise Answer

Unit: Unit 1 – Treasury Strategy

Module: Module 4 – Financial risk

Date: 1 March 2012

Summary: An exercise which uses commercial and market data to demonstrate the application of Chapman's methodology for risk evaluation in the treasury context, using foreign exchange risk as a model. The exercise can also be tackled as a case study.

Answer 1: Sensitivity analysis

a) *From the given budget numbers and exchange rates, analyse the build-up of Green Parrot's operating profit (Sales less cost of goods sold less other expenses) by currency. Hence derive a split of operating profit by currency, both in currency and in CHF terms.*

See accompanying ANSWER spreadsheet's Op Profit worksheet, rows 14-28. (In the absence of other information at this stage, it is assumed that the analysis by currency and by country are not materially different.)

b) *How sensitive is Green Parrot's operating profit to a general strengthening or weakening of CHF against global currencies? Why?*

Green Parrot is insensitive to a global strengthening or weakening of CHF (net FX risk on operating profit is 312-270 = 42 = 13% of operating profit. So 10% move across the board ought to generate 1.3% move in profit. See Risk Evaluation exercise answer.xls Sensitivity worksheet cells C16-E26.

c) *How sensitive is Green Parrot's operating profit to a strengthening or weakening of CHF against USD, GBP and EUR individually? Why?*

A move of any one currency in isolation improves operating profit pretty much 1:1 in percentage terms if either USD or EUR strengthen against CHF, but GBP is weighted 2:1 adverse under the same circumstances. This is a direct result of the magnitude and sign of the exposures. See Risk Evaluation exercise answer.xls Sensitivity worksheet cells C37-I39.

d) *What implications does this have for Green Parrot's FX risk management?*

If Green Parrot believes that CHF will move uniformly with other major currencies, it might be able to ignore FX risk altogether (but see 3f below). But it can't guarantee this. There is a definite risk of individual currencies moving independently - but they may not… If Green Parrot believes CHF is set to strengthen or weaken against the majors,

then it might selectively hedge to protect downside and maximise upside. But is this risk taking? Especially as on a headline basis, Green Parrot is insulated from FX risk - which may be what investors are buying. So a correspondingly neutral / mechanistic FX stance might be most appropriate.

e) *What are the limitations of the analysis so far?*
There is no indication of probability, or much quantification of the actual risk. (These aren't new issues, but Green Parrot does highlight them.) Potentially it encourages taking a view on individual currencies without considering their inter-relationships. It is not easy to conclude very much from sensitivity analysis alone. Because sensitivity analysis does not really consider probability of events, it is neither a one or two dimensional measure of risk, so while helpful in conceptualising the risk, does not permit the placing of the risk on a risk matrix, or allow one measure to fit into a risk budgeting approach.

Answer 2: Scenario analysis

*For the identified risk - **Increases in raw material and energy costs could affect future financial results**, envisage a scenario affecting that risk and consider the likely foreign exchange effect on Green Parrot's operating profit? You need to consider your sensitivity analysis of operating profit from Question 1 above when answering this question.*

Post your answers to this question to the Unit 1 Module 4 forum on the course website. There are no definitive answers; our aim here is to encourage debate and to get you thinking about the knock-on effects of wider issues.

Answer 3: Value at Risk

a) *Explain carefully the meaning and importance of the VaR numbers in rows 136-137 on the VaR worksheet. What is the significance of the portfolio VaR numbers in cells C155-156 on the VaR worksheet? Does the sign of the VaR numbers matter?*

The individual currency VaR numbers measure the maximum worsening in the reforecast CHFm operating profit *in relation to changes in the FX rate against that currency alone* that may occur in the period (here 7 days) at the stated confidence levels. The portfolio VaR number is an estimate of the maximum worsening in the (reforecast) CHFm operating profit *in relation to changes in all the FX rates under review* that may occur in the period at the stated confidence levels. The portfolio VaR allows for the correlations between movements in the CHF equivalent values of the income flows and the expense flows, and gives a better estimate than simply summing weighted individual VaRs. Because VaR looks at a one-tailed analysis in relation both to income/assets and expenses/liabilities, the VaR number could equally be a plus or a minus and so for an individual exposure the sign doesn't matter. The sign convention does matter, though, when considering correlated (portfolio) VaR calculations, although due to the squaring of individual VaRs, the portfolio VaR will always be zero or positive.

b) *Based on the currently available information, do you consider that these VaR numbers represent an acceptable level of financial risk for Green Parrot? What further information might you want to help you decide?*

The portfolio VaR indicates that statistically and if left unhedged, Green Parrot stands to lose at least CHF 7m in a week once every 20 weeks (ie 2-3 times a year) or at least CHF 10m in a week every other year. This is some 2% / 3% of operating profit in a week. Given the known shortcomings in VaR analysis (see below) this is probably understating the true risk and is probably unacceptable. VaR is a one dimensional measure of risk and so allows risk budgeting, so an upper limit might be set on currency VaR. Thus, for example, as [implied] volatility moves in the FX markets, the amount of hedging would also need to move to keep VaR constant. The FX VaR might also need to be seen in context with the other risks for Green Parrot and if the overall budget was too high, then the FX VaR should be reduced. However, it needs to be considered as to what value is being added to Green Parrot with these open exposures. Is a profit expected from these risks? Is the risk rewarded?

c) *If you consider that these FX risks are not acceptable, what would you do about them?*
In the short term, hedge with forward FX contracts or other appropriate derivatives. Medium to long term, consider structural changes to currency cost base ("natural"/operational hedging/offsets). Note that Green Parrot currently has no debt (why not?). If there was debt, swapping the financial liability into the currencies it is long of operationally could result in useful offsets. See also Question 4 below.

In fact most firms would hedge quite a significant part of this type of exposure, especially with the large GBP payable for cocoa. It is interesting to consider what might be an appropriate time horizon for this hedging however. Is the forecast period of one year a mere artificiality, chosen simply because it coincides with the planning cycle? In reality a better time horizon is probably a time until it can change its business model to suit new exchange rates. So if the firm needs three years to change production sites to suit a changed world of exchange rates, a more natural period for risk evaluation would be those three years.

It might be that all competitors are in a similar position to Green Parrot, in fact they probably are with regard to cocoa costs. In that case there is less case to evaluate risk over a long period. If Green Parrot has pricing power in the market, there is even less reason to extend the time horizon.

d) *Explain the effects of flexing the underlying currency exposures (to simulate hedging action or price / volume changes). Concentrate on the GBP exposure shown in the Sensitivity table cells J155-K173 on the VaR worksheet.*

The Sensitivity table for the GBP exposure on the VaR worksheet shows that because Green Parrot is short GBP but long of the other currencies, there is a risk-reducing offset between GBP and the other currencies. Reducing the GBP exposure (by hedging or by commercial means) reduces the 7 day portfolio VaR until about the (200) exposure level, after which VAR starts to rise. What this implies is that there is an optimal mix of currencies (at current volatilities and correlations) which will arrive at a minimum VaR – this can be solved for analytically if need be. VaR will only be reduced to Nil if each exposure is Nil. The optimum mix will depend on volatilities, correlations and exchange rates (as VaR is calculated in base currency terms), so it requires continuous review and adjustment.

e) *What are the theoretical shortcomings and practical limitations of using VaR analysis **in this context?** Do you consider that these shortcomings and limitations invalidate the methodology?*

Shortcomings include:

- FX rates don't follow a normal distribution, so the true risk is likely to be greater than predicted by VaR. Generating the distribution using Monte Carlo simulation (where the user sets the probabilities and correlations) is designed to overcome this.
- Different choices of historical sampling periods for FX rates produce different results. Here we have used the latest 6 months of data. The result could be radically different if we used a shorter or longer period (you should try adapting the model and see what happens).
- Non-trading days (weekends) may be included in the samples. (In this analysis the data runs Monday to Friday, but includes holidays.)
- Volatilities and correlations aren't stable over time, so the period used for historic data is influential. Using implied volatilities from the foreign exchange options market might make the modelling more realistic but even that is not a reliable guide to the future.
- The forecast data needs to be kept up to date and it should only be including FX effects on transactions not yet settled. Green Parrot needs the ability to maintain these forecasts – integration with a Group-wide cash flow forecasting routine would materially facilitate this (at minimal on-cost).
- There may be material differences between cashflows and accounting numbers – in this case operating profit should equate to cash although there may be timing differences. But as has been pointed out elsewhere, Green Parrot needs to be aware of who it is hedging for and why, and to communicate to its investors.

However, as with all models, the shortcomings of the model don't absolve us from the need to act decisively based on the best available analysis. VaR is a useful addition to the tool bag.

Answer 4: Overall / conclusions

a) *In Green Parrot's case, do the three analysis methodologies reinforce or contradict each other? Which of them do you find the most helpful?*

In this case it's uncertain that sensitivity analysis helps that much, despite its apparent accessibility; whereas VAR at least indicates what currency mix to hold to minimise risk and allows risk budgeting. VAR also helps monitor the risk position if Green Parrot decides to hedge currencies selectively. Note that sensitivity analysis suggests that a 20% global move in CHF is worth ~CHF8m on the full year's profit (Sensitivity worksheet, cells C22-D26) – which sounds unlikely; but the 7-day VAR is some CHF7m at 95% confidence (VaR worksheet cell C155) – and that is just a week's move. Statistically, one would expect to see such a move twice a year, and in practice we know that major moves occur more often than statistics suggest…

b) *What priorities (per currency) would you suggest in managing Green Parrot's currency exposures?*

One approach might be to minimise the 7-day VaR (and by implications any other period VaR) by calculating the currency mix corresponding to minimum VaR and then buying / selling currencies accordingly. Then layer in hedging progressively at attractive rates should they present themselves, but in a way that preserves the VaR within a range. Otherwise deal spot (and therefore achieve an average rate not too different from the accounting rate). In other words, deal enough to move the remaining exposure progressively inside a budgetary limit.

Note that management needs to be careful to know what is an 'attractive rate'.

c) *Current levels for selling EUR are better than budgeted (current EURCHF 1.66 compared to budget 1.58). What would be the effect of taking advantage of these levels and closing out the exposure using outright forward FX contracts (ignore forward points)? Hint: Look at the Sensitivity table for EUR exposures on the VaR worksheet cells J179-K195.*

Closing out the EUR exposure entirely actually increases 95% 7-day VaR. So – is the reward worth the additional risk? Commercial management might well press to capture rates that are ahead of budget, but doing so increases the risk to the firm. VaR quantifies this, and also provides a tool to suggest what other action (buy GBP perhaps) would be necessary to keep the risk within permitted limits. With this information, a fully costed proposal could be put forward – ie to sell x% of EUR income necessitates buying y% of GBP expense to maintain VaR within tolerance; and the net gain / loss compared to budget is CHF Zm.

Also, one might debate the reward in closing out a currently open position which has already moved in our favour; if we left it open, it might move even further in our favour. And practically, how certain are the cashflows? Closing out the entire amount would re-expose Green Parrot to risk through over-hedging if EUR operating profit failed to meet forecasts. And there would be the minor cost of additional spreads involved in closing out surplus contracts.

d) *How might you use a VaR approach to support Green Parrot's FX hedging policy?*

Along the lines discussed above. Note how VaR allows money amounts to be assigned to risks, hence can include parameters such as "7-day VaR to be at all times less than CHFxx million / 0.y% of operating profit" (i.e. risk budgeting). And VaR allows hedging action to be quantified – adopting plan X crystallises gains or losses of CHF Am compared to budget / forecast, and reduces / increases risk by CHF Bm. Finally, use of VaR allows different risks to be managed on a common basis, thus allowing FX risk to be managed within Green Parrot's enterprise-wide risk management procedures.

e) *How would you update the position for successive weekly Treasury Committee meetings?*

Update volatilities, current rates and amend exposure information to reflect hedging action and revised commercial forecasts. Hence propose additional hedging action to bring 7-day VaR back within tolerance if need be, and assess effect on VaR if take advantage of individual opportunities in the market.

f) *On the Op profit worksheet in cells D34 and D35 there is space to calculate the (implied) 6 month VaR from the 1 week result – do this. How does the result compare to the result from the basic sensitivity analysis? How credible is the result?*

Using the holding period conversion formula from the VaR reading the result is CHF 35m at 95% confidence and CHF 50m at 99% confidence. One initial possibility we looked at initially was to ignore the exposure (of CHF 42m) as immaterial – even a 20% fluctuation would only cost some CHF 8m. However the 6 month VaR result indicates that if we were to ignore the exposure, then there is a 1 in 20 chance of a CHF 35m loss in 6 months (or 10% of operating profit), which is considerably more substantial. The implied 6 month result is probably not that credible – extending the holding period by 26x is a little extreme. Better would be to rework the analysis using 6 month changes – perfectly straightforward with modern data sets and the model is otherwise already prepared. But this result demonstrates that regarding the exposure as immaterial is likely to be unwise, and the methodology provides a simple means to set or vary the timing of Treasury Committee meetings.

Note: Calculation of Green Parrot's VAR

In the Green Parrot exercise we have deliberately used the "direct" method to calculate the volatilities of the currency pairs, to keep the maths simple and visible, and so you can see easily how the volatilities can be built up from historic data. It is these historic volatilities that are used here.

A better approach is probably to use implied, ie forward-looking volatilities wherever you can. History is not a guide to the future; implied volatilities price in the market's expectation of future movements; implied volatilities are also 100% consistent with option pricing in the market, as they are a component of the Black-Scholes option pricing model.

Using implied volatilities is not difficult, but you have to remember to use VaR = Principal x ($e^{(Z \times S)}$ -1), rather than the "direct" VaR = Principal x Z x S. However the differences arising from this are small and a more important decision is to use implied rather than historic volatilities.

Finally, we have been looking at operating profit as the basis for the exposures in this model. It might be appropriate to look instead at cash flow by currency, so that overall cash flow is maximised under these techniques. In that case, capex and working capital movements should be taken into account. It might be that a firm has cash flow cover covenants or needs to control the risk in debt or EBITDA for reasons of ratings or covenants.