Global Economy – Global Risk
Assessing Currency Risk in Multi-National Proposals

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Introduction

The US Dollar is a free floating currency; its exchange rate is not fixed by the US government, but fluctuates with market forces. The US Dollar and other floating exchange rates are affected by external influences, including: Economic Factors (i.e. interest rates and inflation), Political Conditions (unstable political conditions are associated with unstable exchange rates) and "Market Philosophy".[1] While "…in a perfectly efficient market, exchange rates should be unbiased predictors of future exchange rates"[2], currency exchange rates are susceptible to hard-to-predict external forces; this susceptibility makes forecasting in the long term inherently risky. As contractors increasingly enter into long term multi-national proposals, it is imperative that all parties (both governments and contractors) understand the risk associated with fluctuating currency.

In a recent proposal, Northrop Grumman was considering a ten-year, Firm Fixed Price contract with the UK government. In order to price their offer, the Proposal Team solicited forecasted $/GBP exchange rates from the NGIT Treasury for the entire Period of Performance (POP). The forecasted rates as estimated by the Treasury were single points provided by year (contract payment period). Due to the nature of currency forecasting, the exchange rates predicted were a reflection of the current and expected future economic and political climate. Though the US and the UK are both stable countries with relatively stable economies, the likelihood that any one of the provided rates will be exactly realized is slim; the likelihood that all forecasted rates will be exactly realized is less.

In this particular situation, NGIT was to be paid by the UK government in GBP, but would pay their US employees in US$. The cost risk associated with the currency exchange rates is evident: if the NGIT Treasury overestimated the $/GBP exchange rate for 2008 (i.e. estimated $1/.50GBP for Jan 2008 and the average Jan 2008 exchange rate were to be $1/0.25GBP), NGIT would earn more profit than expected on the contract (each GBP would be worth *more* US$ than originally estimated). If, conversely, the NGIT forecast underestimated the $/GBP exchange (i.e. estimated $1/0.50GBP and the 2008 exchange rate were to be $1/0.75GBP) NGIT would earn less profit than expected on the contract (each GBP would be worth *less* US$ than originally estimated). The difference between profit expected and profit earned in either scenario is highly dependent on the exchange rate. In order to fairly represent the risk in the contract, the authors built a model which predicted an upside, downside and most likely scenario based on the NGIT Treasury forecast, historical data, and a Monte Carlo simulation.

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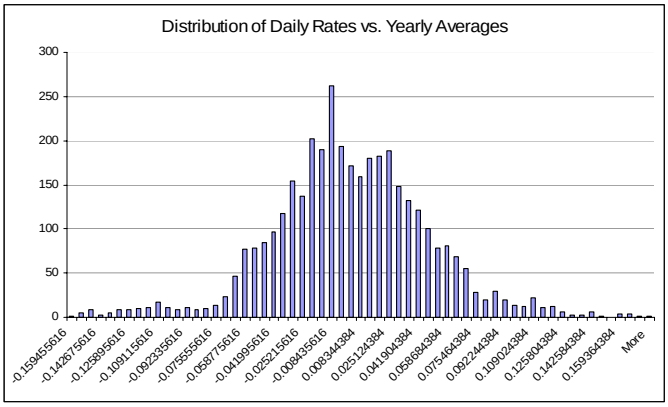
[1] "Foreign exchange market: Factors affecting currency trading." Wikipedia, the Free Encyclopedia. 8 April 2007 <www.wikipedia.org>.

[2] Livingston, Miles. Money and Capital Markets. Miami: Kolb Publishing Company, 1993. 384.

Assumptions

The following assumptions were made:

1. The year one (2007) proposal team estimate for the average US$/GBP exchange rate is accurate.
2. The NGIT Treasury forecast is assumed to be the best representation of how currency from the base year progresses to the following year.
3. For ease of illustration, the data provided by the NGIT Treasury was linearly regressed and used to approximate the yearly rise and run of the estimate. This methodology predicts the same mean output as would a model using the individual data points, but artificially tightens the overall risk distribution. Alternatively, for a more precise representation of the risk distribution, the model can be populated with actual % change per year.
4. The average of the variability in the past ten years of historical currency exchange rates is the best analogy for the variability expected in the future ten years of currency exchange rates. The error in currency prediction must be less than pure noise in the data; the historical variance therefore must generate wider error bands than the prediction bands generated by the true error in the predicted data. The error bands using either method are likely the same shape (tighter at the beginning, increasing in out years) but, due to the nature of currency estimates, the predicted error in earlier estimates is lower. A lower error initially compounds more slowly, and resultant error bands are therefore tighter. As is customary in risk analysis, the historical variance is a conservative proxy; the degree to which the analysis is conservative is unknown.
5. Currency fluctuation is normally distributed about the mean. To test this assumption, ten years of historical currency data were examined. To correct for long term trends/cycle, daily exchange rates were compared to yearly averages; the differences were plotted on a histogram and appear normal.



Methodology

First, we quantified the expected variability in the US$/GBP currency exchange over the next ten years. The prior ten years (1996-2006) were assumed to be *most similar* to what could be expected- economically, politically, and in the market- in the following ten years; thus, the actual exchange rates from 1996-2006 were found, by month. The variance per year was found (calculated as the variance between Jan and December of the same year) and the average variance for the ten year historical period was calculated. This average was used as a proxy for total variability in the currency exchange rate estimate; this represents the maximum total variability, as actual exchange rates should vary no more from the predictions per year than they historically fluctuate this year.

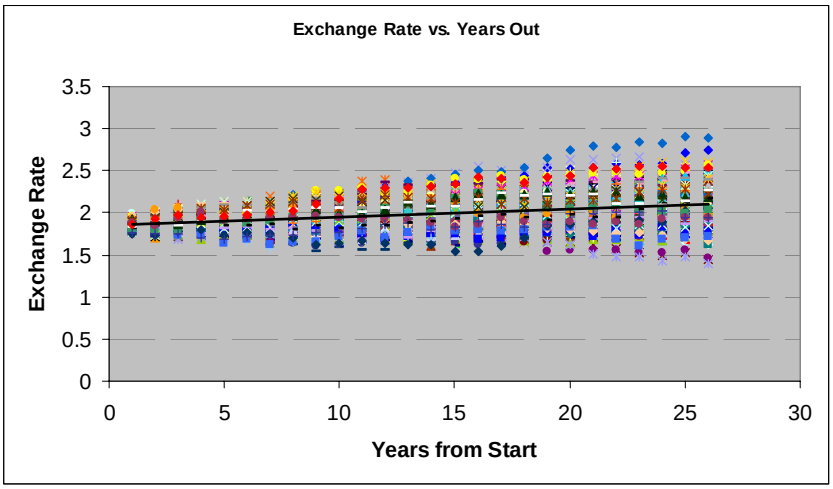
Second, the given forecasted data predicting the future exchange rate was regressed. Because the forecast approximated a straight line, the slope of the regression was a reasonable representation of the expected yearly progression of the currency exchange rate. As mentioned, this results in the same mean output but a tighter overall distribution than would a methodology using yearly percent change. The slope, intercept and their respective standard errors of the regression were used as inputs to the model.

As discussed in the first paragraph, current exchange rates are the best predictors of future exchange rates. This presents a compounding error problem: if the 2008 exchange rate is estimated incorrectly, the 2009 exchange rate, which is based on the prior year's rate, will include the error in the 2008 rate; the 2010 forecasted exchange rate will then contain the error in the 2008 rate *in addition to* the error in the 2009 rate. In order to address this problem, the risk was modeled by Monte Carlo as follows:

1. The 2007 estimate provided by the proposal team served as the base mean.
2. A line was generated using a Monte Carlo draw and the distributions of the coefficients of the regression; this line determined the mean for the 2008 exchange rate distribution.
3. Using a random number draw and a normal distribution with the aforementioned mean of the estimated exchange rate and the historical variance, the projected 2008 exchange rate was generated.
4. Steps 2-3 were repeated for all contract years. *n.b., The forecasted line only provides currency exchange estimates through 2013. From 2013-2017, a line with slope zero was used to move forward from the base year.*
5. The resulting estimated exchange rates were applied to the affected contract value by year. To quantify the risk, the difference between this estimate and the proposal team's estimate (in US$) by year was found.
6. The above process was repeated 5000 times using a Monte Carlo simulation.
7. The currency risk simulation was merged with the risk simulation for the entire proposal, thereby fairly representing the total program risk.

Results

Each run of the model creates a piece-wise linear function, allowing for propagation of error as seen in the graph below (every set of points with the same color represents one run of the simulation):



The model outputs the 20th, 50th, and 80th percentiles, labeled as Upside, Most Likely and Downside; due to the regression to the mean phenomenon, and the symmetry of the error term, the 50th percentile (or "Most Likely") is approximately zero.

Uses

Though initially built to model the distribution between US$ and GBP, the Currency Risk Model can be used to calculate the potential risk distribution for any two currencies. The risk distribution will differ significantly depending on the respective volatility of the currencies in question. The inputs required to calibrate the model are: years of the contract; affected cost (in base currency); average historical variance (for the length of time equal to the POP estimated); and the predicted exchange rates for each contract payment period.

Next Steps

Going forward, improvements can be made to the model's base assumptions. Specifically, historical currency variance was used as a proxy for the estimating error. Historical prediction data could be compared to the realized currency exchange rates, improving final outcome. As mentioned, yearly currency exchange variance models the maximum variance; this variance (in lieu of historical estimating error) may have overestimated the impact of currency risk.

In addition, the effect of currency fluctuations on cash flow may be an area for further study. Currency tends to conform to long-term trends; though overall the risk may have a low dollar value, yearly risk may be significant. For example, during a ten year contract, the first five years currency exchange rates may cause contract overruns, while the last five years may cause contract underruns. While the dollar impact to the total proposed contract may be zero, a situation such as this causes significant cash flow problems; in the future, trends in currency exchange rates can be further examined to investigate the potential impact.

Conclusion

Currency risk is an increasingly important factor in contract pricing. The goal of the model is to quantify the risk associated with currency, not predict future currency exchange rates. The volatility of currency exchange rates and the dependence of currency exchange rates on external events contribute significantly to risk in global proposals. The years of historical data used to model this problem were chosen to mirror the years of the contract. As evident in the data, economic and political climates can vary significantly during a period of that size, even in a relatively stable countries like the US and UK. The years between 1996 and 2006 included two presidential administrations, an unpredicted major terrorist event, peace, an economic boom, and the invasion in Iraq. The average of the yearly currency variances over the past ten years most closely represents what we expect on average in the years to come. When modeling the distribution exchange rates between more volatile countries, the yearly historical variances will reflect the currency fluctuation. It would be extremely unwise, however, for any contractor to enter into an agreement with payment depending on the predictability of an unstable currency. The model is best used to understand currency distributions for stable economies. In these cases, the model quantifies the risk associated with foreign currency transactions and provides decision makers with needed information before entering into contractual agreements.