

NORTHROP GRUMMAN

DEFINING THE FUTURE

Inflation Risk

Assessing Inflation Risk in Multi-Year Proposals

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Introduction

- Inflation is the changing of prices over time
 - Can be due to many factors, such as money supply and demand for goods
- Due to the unpredictability of these factors, inflation rates can be very difficult to predict
 - Organizations such as Global Insight perform this function and are the basis of this model
- Inflation risk is inherent and often-overlooked are of potential risk in any multi-year contract
 - The longer the contract, the more inflation risk increases in the later years
- This paper will introduce a method to quantify the risk associated with inflation in a contract

Problem

- In performing independent evaluations of multi-year proposals, inflation is an often overlooked source of risk
- In any multi-year proposal, the contractor must bid inflation
 - These values are usually taken from a source such as Global Insight
 - These values are often included as single yearly values
 - Chances of these values being exactly as predicted is very small
- If the actual inflation is different than the projected rates, the contract may overrun or underrun
- Inflation values differ for each commodity, so the risk may be multiplied across the different aspects of the contract
 - The plan for the tool presented here is to include multiple CPIs and allow the user to choose specific ones (or possibly multiple ones for a single run of the model)

Assumptions

- The Global Insight predicted line for the specific index is the best predictor for the future inflation of the index
 - The random draws performed in this model are error terms and have a mean of zero
- The variation of historical inflation rates for a specific index is the best analogy for the yearly variability expected in the future years of this index
- The historical autocorrelation of the specific index is the best estimate for future autocorrelation of the same index
- If the Global Insight prediction values do not extend far enough into the future to cover the length of the contract, the final prediction value will be used for each additional year

Methodology

- Historical inflation values for a specific index was collected from the Bureau of Labor Statistics website
- Prediction line for the same index was obtained from Global Insight
- The historical data was tested for Normality using the Anderson-Darling test
 - Anderson-Darling was chosen over Kolmogorov-Smirnov due to the fact that the mean and variance of the hypothesized underlying distribution were estimated from the data
 - The data set passed the A-D test and was assumed to be normally distributed
- The variance of the historical data was obtained for use in the distribution to draw error values
- The Lag 1 through Lag n autocorrelation of the historical data is calculated
 - 'n' is the length of the contract - 1

Methodology

- A random draw was obtained from a Normal distribution with a mean of zero and a variance equal to the historical variance for this index
 - This variate equates to the error in the Global Insight prediction for 2008 and is multiplied by the dollars affected in 2008 to get the risk (or opportunity) value for 2008
- A Normal distribution with a mean of zero and a variance equal to the historical variance of the CPI is used to draw an error value for 2009
 - This error is multiplied by the dollars affected in 2009 and saved as the risk or opportunity for that year
- The random numbers used to draw the error values are autocorrelated based on the historical autocorrelation values from the CPI
 - The autocorrelation is done using the Correlation module (ERD, SCEA 2008)

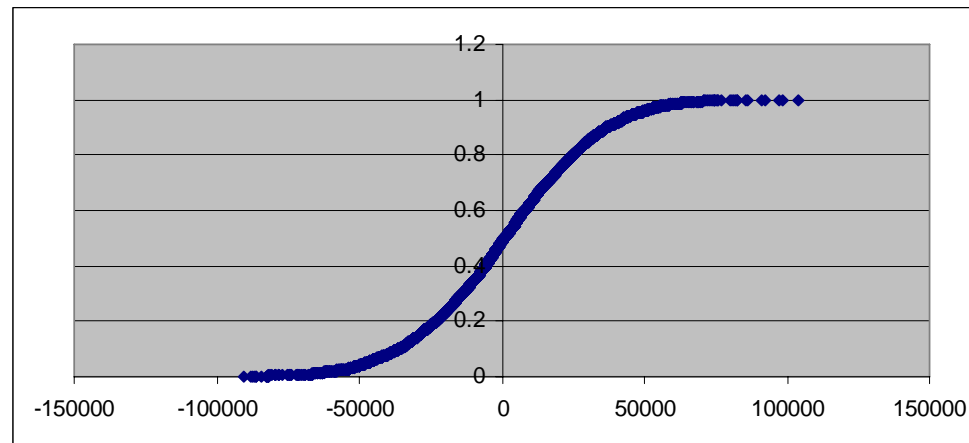
Methodology

- This process continues through to the end of the Global Insight projections
- If the contract exceeds the last Global Insight projection, the final prediction value is carried forward as a flat-line value throughout the out-years and the process above is continued until the end of the contract
 - Error values in the out-years are around the final projection value in the absence of any other data
- At the end of the contract, the error values are added and this completes one run of the Monte Carlo simulation
- The process is repeated 5000 times and a Cumulative Distribution Function (CDF) is created and the 20th, 50th, and 80th percentiles of the distribution are calculated

Results



- The 5000 run simulation gave a symmetric distribution around zero
 - This behavior is expected – Global Insight is assumed to be correct
 - The model presented here is intended to give a best and worst case scenario for the risk due to inflation fluctuation



- The total contract value used in the example problem was \$1.1M and the 80th percentile value obtained was approximately \$25k
 - The low historical variation and lower-than-expected autocorrelation values for this CPI can explain the relatively miniscule risk

Next Steps

- Checking for past prediction values versus the realized inflation rate could increase the accuracy of the model
 - Some historical variation may already be accounted for in the predictions, therefore, using the historical variance when drawing future values may be overstating the actual error
- Adding distribution fitting capabilities will allow for users to enter a new data set and use the correct probability distribution to find the error around predictions
 - Current tool does not have this functionality
 - Work was done on a data set that passed the Anderson-Darling test for Normality
- Further study into the autocorrelation is desired
 - One data set was found to have strong autocorrelation values
 - Data used here had very weak autocorrelation among the years
- Will include some of the more often-used CPIs and automate the tool for these to increase ease and speed of use

Conclusions

- Due to the abundance of multi-year proposals that are bid, a method to quantify the risk due to inflationary fluctuations is a valuable tool
 - Uncovering all sources of risk and quantifying them allow for more solid proposals and allow management to gain insight into the decision they are making
- The goal of the model presented here is to quantify the risk due to inflation, not to predict future inflation rates
 - The model predicts the error around the prediction used by the proposal team
 - This model may not be appropriate if due-diligence has not been performed in deriving the inflation numbers included in the bid
 - The example problem uses a Global Insight prediction line, but constant inflation values and other sources of prediction can be interchanged

References

- “Bureau of Labor Statistics Data.” 15 February 2008. www.bls.gov.
- “Global Insight”. 7 March 2008. www.globalinsight.com.
- “Inflation – Wikipedia”. 12 March 2008. www.wikipedia.org.

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