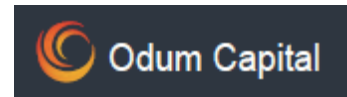


# Private Equity **V**aluation Model

The Significance of Volatility and Return on Invested Capital  
For Private Equity

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## Introduction<sup>1</sup>

The objective of this report is to document the intricacies of the valuation process private equity firms may sometimes overlook when considering a number of acquisition targets. Also, my objective is to shed light on an overlooked metric called Return on Invested Capital (ROIC) in relation to cost of capital (WACC). Through my current and past work with commercial banks and private equity firms, what I have noticed is that the basic discounted cash flow and pure play comparables may not be enough to determine the proper value of a company. Some middle market firms (\$10m - \$100m in enterprise value) do not have publicly disclosed financial statements that are readily available via Capital IQ or Thompson Banker. Also, using public firms as comparables may tend to overvalue the targeted private company because publicly traded firms usually have lower financing costs and easier access to capital.

There are numerous guesses a basic DCF and comparable analysis assume, such as growth rates and discount rates. However, in reality, market returns, capital costs, growth rates and capital expenditure can be volatile and fluctuate yearly, depending on leverage ratios and operating cash flows. PE firms should consider the impact of volatility in their valuation methods, to determine scenarios and risk/return profiles. In other words, if a firm is seeking a 25% return on investment, they must be willing to assume a level of risk intrinsic to that expected level of return. On the other hand, if a firm expected a return mirroring the ten year return on the S&P index, the risk profile and payoff are lower. The upside to risk is a higher payoff profile, if things go as planned. But, the downside is the additional capital a PE firm must inject into a business if they are unable to make a proper exit at the limit of the investment time horizon. ROIC should be utilized more often to determine value creation or erosion of an investment. This metric is essential to projecting the impact of additional capital and also the impact of net working capital, return on assets/equity and cash flow.

In this report, I will document my ten year forecasted valuation analysis of two acquisition targets. The acquisition targets are from very different business sectors, commodities and software industries, and have very different cash flows. Also, I will explain my statistical method of projecting volatile cash flow, fluctuating capital costs and the importance of return on invested capital, which is an essential and accurate metric of evaluating ROI in terms of discount rates.

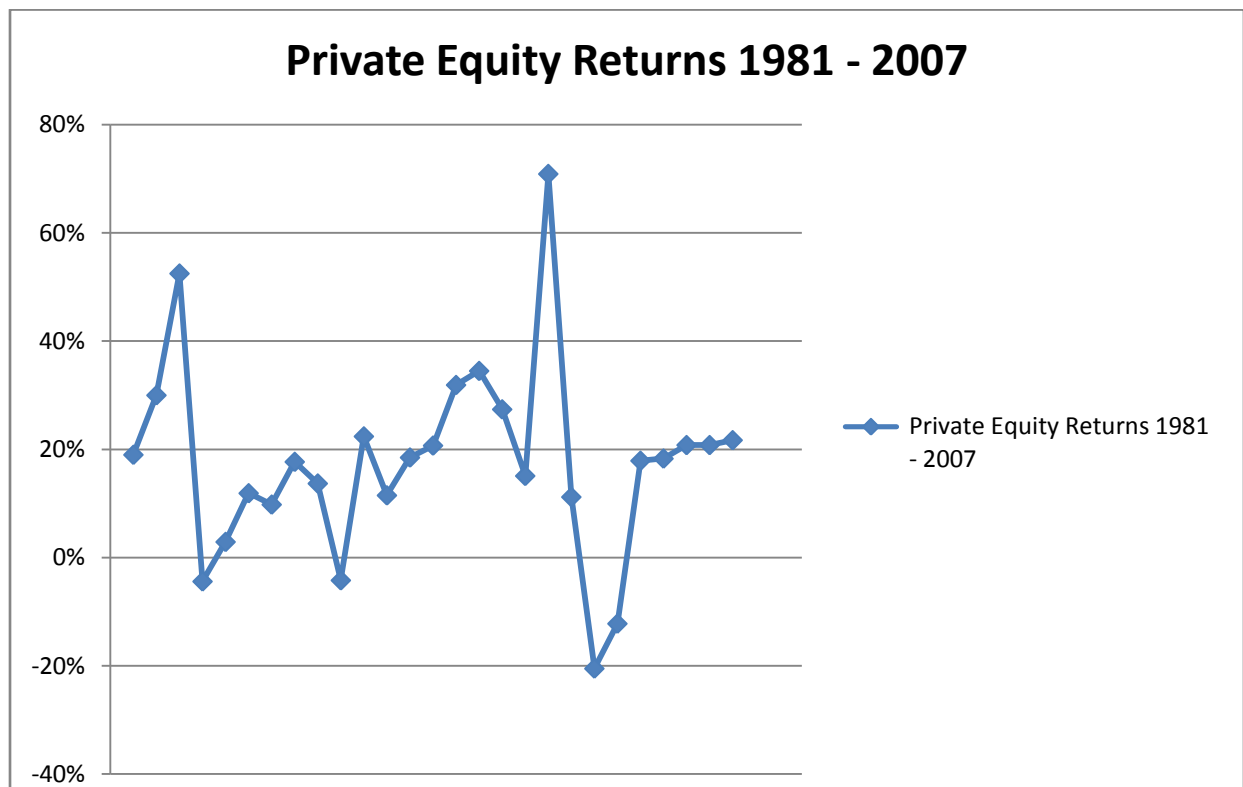
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1. Navigating the New World of Private Equity, Chicago Fed Letter, Federal Reserve Bank of Chicago

## Private Equity Methodology and Trends

In 2008, private equity firms were taken for a surprise, when access to capital and liquidity events was brought to a halt. Valuations were drastically reduced and firms were forced to inject additional capital into businesses that were seemingly predictable.

Due to the high leverage utilized in making acquisitions, private equity firms usually expect a 20% return on investment, and due to such a high expected return, they assumed a higher level of risk. In previous years, PE firms have been able to achieve extraordinary returns, thanks in part of cheap cost of capital and a surge in mergers and acquisitions.



PE firms were forced to adjust “quick flip” ideas (investments less than five – seven years) when liquidity events were delayed if not cancelled due to lower valuations. PE firms were forced to adjust to longer time horizons and acquiring firms with the intentions of creating value, investing in innovation or core competencies of the company and the PE firm.

The Federal Reserve Bank of Chicago also projects lower exit multiples and valuations for the private equity asset class, which consists of leveraged buyouts or funds utilized to acquire a firm with the intention of an IPO or to sell the acquired firm for a high EBITDA, EBIT or Sales multiples. Mergers and acquisition financing has fallen drastically, and firms have been caught off guard, such as the high profile KKR, Blackstone and The Carlyle Group. However, middle market private equity firms have been active, but have been forced to adjust to deferred liquidity events.

## Private Equity Trends<sup>2</sup>

- Between 2001 and 2007, \$2.7T of leveraged buyouts occurred largely in part to private equity firms.
- A bulk of private equity buyouts now occur within mature industries such as chemicals, machinery and also high growth sectors such as technology and biotechnology.
- 40% of exit events occur with a trade sale with another firm.
- 24% of exit events occur with a buyout by another firm.
- IPO's are losing significance as an exit event, accounting for only 13% as of 2007-2008.
- 6% of private equity acquisitions or buyouts end in restructuring or bankruptcy, due mainly to difficulty in maintaining debt service.
- Private equity acquisitions have a low rate of default, in comparison to corporate bonds and junk bonds.
- 58% of private equity exits occur at least five years after an acquisition.
- Only 12 % of private equity exits occur less than five years after acquisition.
- As of 2007, over 14,000 firms were recognized as private equity firms, under leveraged buyout status.

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<sup>2</sup> Globalization of Alternative Investments: Impact of Private Equity Report, 2008, by the World Economic Forum.

## The Acquisition Targets

The first of the two potential acquisition targets is a “Metal Company” (financials and other pertinent information were utilized from an actual metal and software company, therefore we shall refer to both as Metal Company and Software Company). This company collects, recycles and distributes processed metals in the US and particularly overseas, where emerging countries such as China and Brazil consume over 50% of global metals. The second company is “Software Company” that specializes in point-of-sale software for retail stores, gas stations, etc. This firm also provides credit card processing for retailers.

### Metal Company

Years: 30+

Employees: 10

Positive: Generates a lot of cash

Negative: Subject to market risk (spot prices)

Upside: Potential to generate more revenue via derivatives

### Metal Company Risk Profile

In order to properly project financials for the “Metal Company”, one must acknowledge the fact that forecasted sales growth cannot be assumed to be at an arbitrary number such as 10% or 15% for a fixed number of years. The commodities industry is extremely volatile and impossible (or extremely difficult) to forecast. Commodities based firms are subject to spot and forward price risk, and qualitative risk (such as political, war), which is difficult to project or imply in forecasts.

The Chicago Board Options Exchange (CBOE) VIX Index will be utilized as a proxy for the commodities industry, which I also utilized in projecting the income statement and balance sheet effects of the Metal Company.

“Metal Company” Projected 2009 Income Statement and Balance Sheet

**Income Statement**

Revenue	\$	5,949,487
COGS	\$	2,082,320
Gross Profit	\$	3,867,167
SGA	\$	594,949
Operating Expenses	\$	892,423
<b>EBITDA</b>	\$	2,379,795
Depreciation and Amortization	\$	148,737
EBIT	\$	2,231,058
Interest Expense	\$	148,107
Pre-Tax Income	\$	2,082,951
Income Taxes	\$	708,203
<b><u>Net Income</u></b>	\$	1,374,748

**Assets**

Cash	\$	1,487,372
Receivables	\$	892,423
Inventory	\$	1,189,897
other Current Assets	\$	1,586,530
Total Current Assets	\$	5,156,222
Fixed Assets	\$	1,487,372
non Current Assets	\$	594,949
<b><u>Total Assets</u></b>	\$	7,238,543

**Liabilities**

A/P	\$	535,454
N/P	\$	416,464
other Current Liabilities	\$	594,949
Total Current Liabilities	\$	1,546,867
Total Long Term Debt	\$	594,949
Total Debt	\$	2,141,815
Shareholders Equity	\$	5,096,727
<b><u>SE + Total Debt</u></b>	\$	7,238,543
NWC	\$	594,949
CAPEX	\$	506,699

## Software Company

Years: 10+

Employees: 13

Positive: Generates a lot of cash

Negative: Subject to cash flow risk (accounts receivables)

Upside: Potential to hedge accounts receivables in the forward market

## Software Company Risk Profile

The projected financials for the software company is more predictable than the metal company; however, there is an imbedded volatility within this industry. Software firms usually experience rapid double digit growth during infant years, however, this growth stabilizes just as quick, as these firms must innovate or acquire firms to maintain 10% growth rates. The S&P historical returns will be used as a proxy for growth rate and volatility for the Software Company.

### “Software Company” Projected 2009 Income Statement and Balance Sheet

#### **Income Statement**

Revenue	\$	6,887,143
Cogs	\$	1,170,814
Gross Profit	\$	5,716,329
SGA	\$	1,239,311
other Expenses	\$	929,484
EBITDA	\$	3,547,534
Depreciation and Amortization	\$	30,344
EBIT	\$	3,517,189
Interest Expense	\$	323,085
Pre-Tax Income	\$	3,194,105
Income Taxes	\$	1,085,996
<b><u>Net Income</u></b>	\$	2,108,109

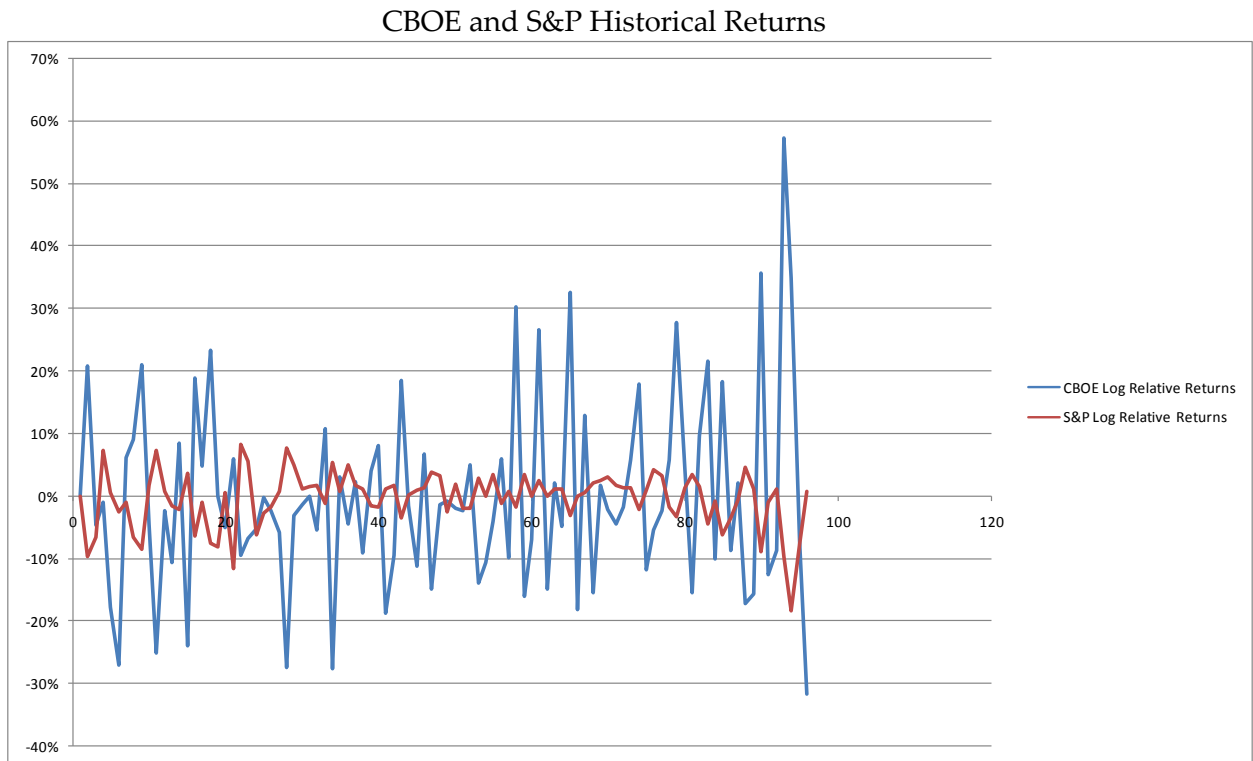
#### **Assets**

Cash	\$	1,612,957
Receivables	\$	3,761,220
Inventory	\$	250,000
other Current Assets	\$	1,560,061
Total Current Assets	\$	7,184,238
Fixed Assets	\$	606,887
non Current Assets	\$	5,566,819
<b><u>Total Assets</u></b>	\$	13,357,944

#### **Liabilities**

A/P	\$	297,967
N/P	\$	603,923
other Current Liabilities	\$	876,787
Total Current Liabilities	\$	1,778,677
Total Long Term Debt	\$	2,626,922
Total Debt	\$	4,405,599
Shareholders Equity	\$	8,952,345
<b><u>SE + Total Debt</u></b>	\$	13,357,944
NWC	\$	68,871
CAPEX	\$	471,799

Historical CBOE VIX Index and S&P returns are illustrated as follows:



Based on historical data, CBOE returns were substantial compared to the S&P, however the fluctuation in returns suggest a high level of volatility within the commodities industry.

## Current Valuation Methods

### Discounted Cash flow

The basic DCF valuation method is the lingua franca of valuation, and is widely used and accepted. An estimated or historical growth rate is used, and a steady cost of capital is assumed.

The advantages are:

- Quick
- Generally understood
- Simple

The disadvantages are:

- Beta is assumed to remain stable
- Cost of equity is assumed to remain stable
- Volatility is disregarded
- Constant capital structure assumption

### Comparables

Private equity firms are accustomed to using comparable companies and transactions to determine a possible range of values for a target. Some firms use this method to extract a range of EBITDA and EBIT multiples, to determine how much they should expect to pay for a company.

The advantages are:

- Measurable
- Transparent/Accessible Information,

The disadvantages are:

- Pure Play (i.e., how do you compare a \$10B firm to a \$10m company)
- Scale
- Comparable Data

## Adjusted Present Value

By utilizing the Adjusted Present Value discounted cash flow method, I was able to forecast a reasonable cash flow analysis typical of a metal and software company. A number of volatility based assumptions were made in determining growth rates, cost of goods sold (COGS), selling general and administrative (SGA), capital expenditure (CAPEX), net working capital (NWC) and debt service.

### Metal Company

	2009	2010	2011	2012	2013
Sales Scenario	0.743575289	0.613517898	0.001590525	0.896186129	0.009412459
Sales Growth	0.178807226	-0.100624869	0.195310944	-0.392079291	0.370504202
Sales Up or Down	up	down	up	down	up
COGS Scenario	0.731530693	0.087841164	0.057189504	0.363704368	0.490188651
COGS Growth	0.776684392	0.310154218	0.365234866	0.373268515	0.344248508
SGA Scenario	0.377962246	0.080476793	0.00361928	0.198850129	0.161243565
SGA Growth	0.020192011	0.124824313	0.122592299	0.127818387	0.102938253
NWC Scenario	0.373014437	0.263701294	0.265166896	0.300993108	0.955789495
Net NWC		\$ (76,736)	\$ 261,268	\$ (359,110)	\$ 360,148
CAPEX Scenario	0.308304873	0.89926529	0.321918999	0.274788662	0.404498704
CAPEX Growth	0.014547112	0.063637133	0.060599719	0.037966796	0.062836497
Debt Service Scenario	0.009592308	0.127904715	0.933000442	0.019671069	0.782232218
Debt Service (Principal Payment)	0.19188543	0.191754781	0.101103579	0.136997316	0

A sales, COGS, SGA, NWC, CAPEX and debt service scenarios was generated by using a random variable function in order to project financials. For instance, under sales growth, a 60% probability of sales growth being between 5% and 75% was offset by a 40% probability of sales being between -50% and 4% per annum. This was necessary to imply the ferocious volatility intrinsic in the commodities industry, and to randomly project losses in the proforma statement. COGS and SGA were given probabilities in terms of industry cost structure averages of 80% chance of COGS being 70% and 80% of sales and SGA 30% chance of being 7% and 8% of sales. Debt service principal payment was necessary to imply the probability of the Metal Company paying a substantial portion of long term debt during periods of double digit sales growth. The following is an example of the projected cash flows of the metal company:

Income Statement	2009	2010	2011	2012	2013
Revenue	\$ 5,949,487	\$ 5,817,358	\$ 9,174,736	\$ 5,897,310	\$ 4,490,903
COGS	\$ 2,082,320	\$ 1,817,694	\$ 5,265,074	\$ 3,488,985	\$ 1,691,892
Gross Profit	\$ 3,867,167	\$ 3,999,664	\$ 3,909,662	\$ 2,408,325	\$ 2,799,011
SGA	\$ 594,949	\$ 413,091	\$ 508,720	\$ 525,193	\$ 358,636
Operating Expenses	\$ 892,423	\$ 872,604	\$ 1,376,210	\$ 884,596	\$ 673,636
<b>EBITDA</b>	\$ 2,379,795	\$ 2,713,969	\$ 2,024,731	\$ 998,536	\$ 1,766,739
Depreciation and Amortization	\$ 148,737	\$ 198,217	\$ 219,297	\$ 259,102	\$ 344,836
EBIT	\$ 2,231,058	\$ 2,515,752	\$ 1,805,435	\$ 739,433	\$ 1,421,903
Interest Expense	\$ 148,107	\$ 193,090	\$ 228,396	\$ 146,808	\$ 111,797
Pre-Tax Income	\$ 2,082,951	\$ 2,322,663	\$ 1,577,039	\$ 592,626	\$ 1,310,106
Income Taxes	\$ 708,203	\$ 789,705	\$ 536,193	\$ 201,493	\$ 445,436
<b>Net Income</b>	\$ 1,374,748	\$ 1,532,957	\$ 1,040,846	\$ 391,133	\$ 864,670

As you can see from above, net income fluctuates from year to year, which is more realistic than a standard DCF.

The Metal Company balance sheet was based on income statement effects, in particular the NWC, Capex, debt service and inventory and other current assets. Inventory and other current assets will be discussed later. For instance, if sales growth in a particular year were positive, NWC would be between 10% -15% of sales, since a Metal Company must spend a substantial portion of revenue on NWC. However, Capex was given a random variable based on sales growth. The snapshot of the balance sheet is as follows:

<b>Assets</b>	2009		2010		2011		2012		2013	
Cash	\$	1,487,372	\$	1,454,339	\$	2,293,684	\$	1,474,327	\$	1,122,726
Receivables	\$	892,423	\$	872,604	\$	1,376,210	\$	884,596	\$	673,636
Inventory	\$	1,189,897	\$	1,141,505	\$	1,095,080	\$	1,050,543	\$	1,007,818
other Current Assets	\$	1,586,530	\$	1,266,452	\$	1,010,949	\$	806,993	\$	644,185
<b>Total Current Assets</b>	\$	5,156,222	\$	4,734,900	\$	5,775,923	\$	4,216,460	\$	3,448,364
Fixed Assets	\$	1,487,372	\$	1,982,169	\$	2,192,968	\$	2,591,022	\$	2,870,199
non Current Assets	\$	594,949	\$	581,736	\$	917,474	\$	589,731	\$	449,090
<b>Total Assets</b>	\$	7,238,543	\$	7,298,804	\$	8,886,364	\$	7,397,214	\$	6,767,654
<b>Liabilities</b>										
A/P	\$	535,454	\$	523,562	\$	825,726	\$	530,758	\$	404,181
N/P	\$	416,464	\$	407,215	\$	642,231	\$	412,812	\$	314,363
other Current Liabilities	\$	594,949	\$	581,736	\$	917,474	\$	589,731	\$	449,090
<b>Total Current Liabilities</b>	\$	1,546,867	\$	1,512,513	\$	2,385,431	\$	1,533,301	\$	1,167,635
<b>Total Long Term Debt</b>	\$	594,949	\$	581,736	\$	917,474	\$	589,731	\$	449,090
Total Debt	\$	2,141,815	\$	2,094,249	\$	3,302,905	\$	2,123,032	\$	1,616,725
Shareholders Equity	\$	5,096,727	\$	5,204,556	\$	5,583,460	\$	5,274,182	\$	5,150,928
<b>SE + Total Debt</b>	\$	7,238,543	\$	7,298,804	\$	8,886,364	\$	7,397,214	\$	6,767,654
NWC	\$	594,949	\$	(14,802)	\$	839,345	\$	(359,315)	\$	(160,284)
CAPEX	\$	494,797	\$	210,799	\$	398,055	\$	279,177	\$	202,799

## Software Company

	2009		2010		2011		2012		2013	
Sales Scenario		0.243618984		0.344648841		0.056142308		0.500807612		0.217431165
Sales Growth		-0.095030611		0.036937831		0.066524664		-0.025574489		0.012086217
Sales Up or Down	down		up		up		down		up	
COGS Scenario		0.132042556		0.463866839		0.045145006		0.851229639		0.127215251
COGS Growth		0.151789554		0.195328129		0.159588314		0.133711901		0.155343473
SGA Scenario		0.438098532		0.937262448		0.314100958		0.684974583		0.323488927
SGA Growth		0.106464639		0.346868182		0.33153789		0.327351329		0.341541201
NWC Scenario		0.123827674		0.905537004		0.090782388		0.225516845		0.715991136
Net NWC	\$	68,871	\$	38,159	\$	71,263	\$	(27,897)	\$	13,455
CAPEX Scenario		0.182391439		0.312104058		0.832030573		0.561071883		0.950645773
CAPEX Growth		0.054980046		0.129404449		0.116096808		0.108539018		0.146794166
Debt Service Scenario		0.347913032		0.274100109		0.319614761		0.283092149		0.416130098
Debt Service (Principal Payment)		0		0.228170171		0.171499925		0.20279651		0.24040707

Similar to the Metal Company, sales, COGS, SGA, NWC, CAPEX and debt service scenarios were generated by using a random variable function in order to project financials for the Software Company. Sales growth was determined by an average of -0.04% with a standard deviation of 15%, truncated with a minimum of -10% and a maximum of 105% sales growth in order to imply the probability of an early jump in sales, followed by a steady decline. Also, this was necessary to properly compare both companies. The -4% and 15% standard deviation will be explained shortly. The following is an example of the proforma income statement of the software company:

<b>Income Statement</b>	2009		2010		2011		2012		2013	
Revenue	\$	6,887,143	\$	7,183,773	\$	6,917,874	\$	6,719,368	\$	6,701,984
Cogs	\$	1,170,814	\$	1,204,652	\$	1,170,050	\$	1,254,498	\$	1,104,999
Gross Profit	\$	5,716,329	\$	5,979,121	\$	5,747,824	\$	5,464,870	\$	5,596,985
SGA	\$	731,012	\$	2,331,603	\$	2,227,180	\$	2,331,418	\$	2,233,600
other Expenses	\$	548,259	\$	1,748,703	\$	1,670,385	\$	1,748,563	\$	1,675,200
EBITDA	\$	4,437,058	\$	1,898,815	\$	1,850,258	\$	1,384,889	\$	1,688,186
Depreciation and Amortization	\$	30,344	\$	81,780	\$	83,604	\$	69,216	\$	42,069
EBIT	\$	4,406,713	\$	1,817,036	\$	1,766,654	\$	1,315,673	\$	1,646,116
Interest Expense	\$	323,085	\$	287,351	\$	268,775	\$	268,775	\$	268,079
Pre-Tax Income	\$	4,083,629	\$	1,529,685	\$	1,497,880	\$	1,046,898	\$	1,378,037
Income Taxes	\$	1,388,434	\$	520,093	\$	509,279	\$	355,945	\$	468,533
<b>Net Income</b>	\$	2,695,195	\$	1,009,592	\$	988,601	\$	690,953	\$	909,504

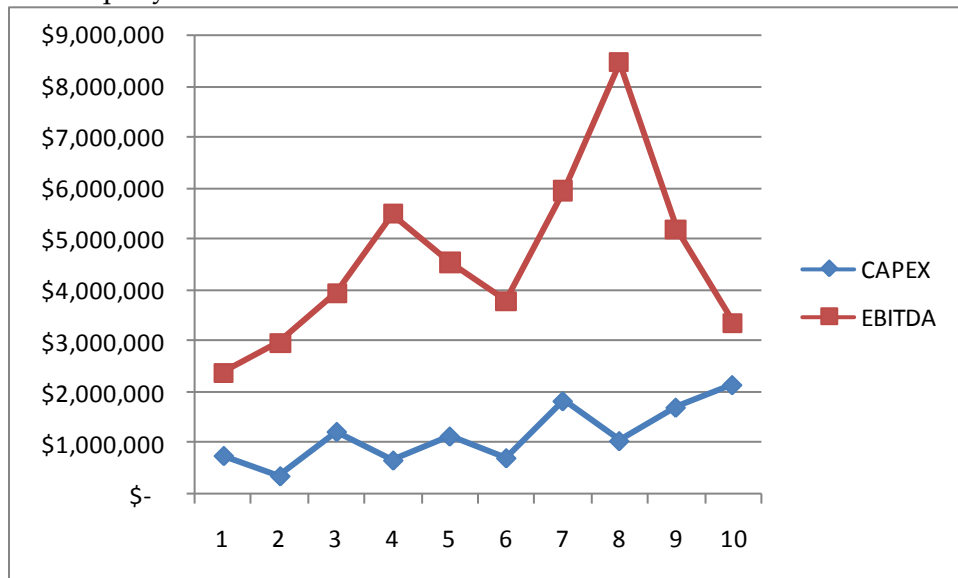
The five year projected financials resembles a more realistic picture of a Software company, where COGS, SGA, NWC, Capex and debt service were given varying probabilities based on industry averages. Random variables were also utilized just as the Metal Company previously.

The balance sheet for the Software Company was projected based on income statement financials. For instance, Accounts Receivables was determined to grow at the same rate of sales because the Software Company is paid sometimes months after a product or service is sold. The following is the five year projected balance sheet:

<b>Assets</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
Cash	\$ 1,612,957	\$ 1,795,943	\$ 1,729,468	\$ 1,679,842	\$ 1,675,496
Receivables	\$ 3,761,220	\$ 3,923,216	\$ 3,622,003	\$ 3,653,293	\$ 3,751,489
Inventory	\$ 250,000	\$ 359,189	\$ 345,894	\$ 335,968	\$ 335,099
other Current Assets	\$ 1,560,061	\$ 1,436,755	\$ 1,383,575	\$ 1,343,874	\$ 1,340,397
<b>Total Current Assets</b>	<b>\$ 7,184,238</b>	<b>\$ 7,515,103</b>	<b>\$ 7,080,940</b>	<b>\$ 7,012,977</b>	<b>\$ 7,102,481</b>
<b>Fixed Assets</b>	<b>\$ 606,887</b>	<b>\$ 1,635,590</b>	<b>\$ 1,672,083</b>	<b>\$ 1,384,313</b>	<b>\$ 841,388</b>
non Current Assets	\$ 5,566,819	5387829.749	\$ 5,188,405	\$ 5,039,526	\$ 5,026,488
<b>Total Assets</b>	<b>\$ 13,357,944</b>	<b>\$ 14,538,523</b>	<b>\$ 13,941,428</b>	<b>\$ 13,436,816</b>	<b>\$ 12,970,356</b>
<b>Liabilities</b>					
A/P	\$ 297,967	\$ 718,377	\$ 691,787	\$ 671,937	\$ 670,198
N/P	\$ 603,923	\$ 718,377	\$ 691,787	\$ 671,937	\$ 670,198
other Current Liabilities	\$ 876,787	\$ 1,077,566	\$ 1,037,681	\$ 1,007,905	\$ 1,005,298
<b>Total Current Liabilities</b>	<b>\$ 1,778,677</b>	<b>\$ 2,514,321</b>	<b>\$ 2,421,256</b>	<b>\$ 2,351,779</b>	<b>\$ 2,345,694</b>
<b>Total Long Term Debt</b>	<b>\$ 2,626,922</b>	<b>\$ 2,155,132</b>	<b>\$ 2,075,362</b>	<b>\$ 2,015,810</b>	<b>\$ 2,010,595</b>
<b>Total Debt</b>	<b>\$ 4,405,599</b>	<b>\$ 3,277,748</b>	<b>\$ 2,396,108</b>	<b>\$ 3,070,488</b>	<b>\$ 2,362,157</b>
Shareholders Equity	\$ 8,952,345	\$ 11,260,775	\$ 11,545,320	\$ 10,366,328	\$ 10,608,200
<b>SE + Total Debt</b>	<b>\$ 13,357,944</b>	<b>\$ 14,538,523</b>	<b>\$ 13,941,428</b>	<b>\$ 13,436,816</b>	<b>\$ 12,970,356</b>
NWC	\$ 68,871	\$ 44,494	\$ (27,282)	\$ (24,028)	\$ (2,272)
CAPEX	\$ 859,951	\$ 775,639	\$ 896,444	\$ 487,869	\$ 353,519

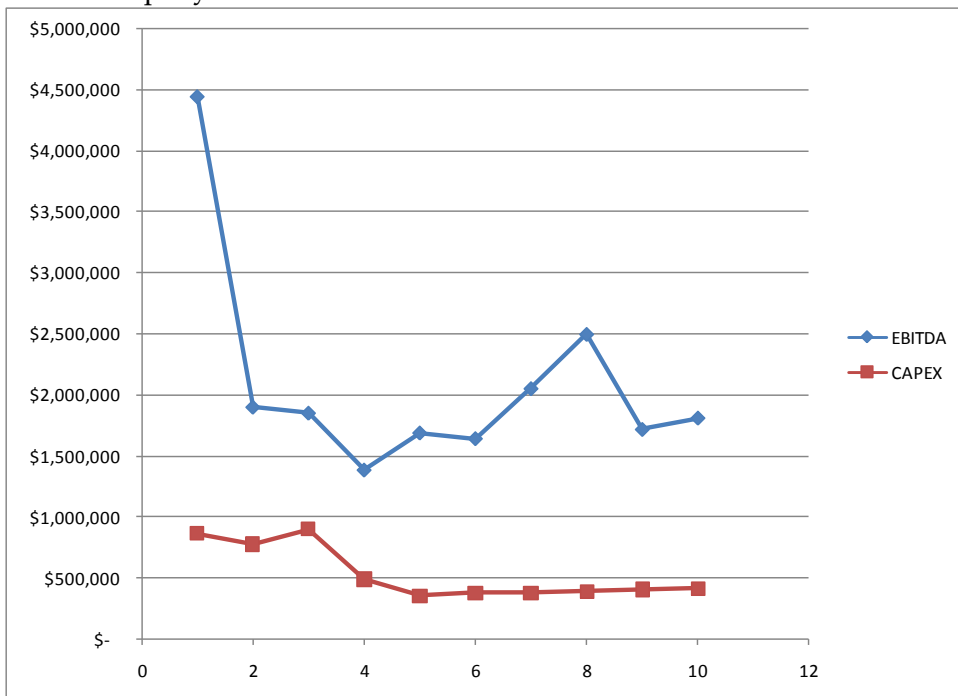
## Metal Company + Software Company EBITDA/CAPEX Comparison

Metal Company



One can observe the fluctuation of EBITDA in terms of Capex with the Metal Company's projections. This is practical since this company needs a constant level of Capex in relation to EBITDA, and in years 1 and 10, EBITDA and Capex come dangerously close to meeting each other, which is a signal of potential cash flow risk. A PE firm must be prepared to handle the volatile nature of a commodities based company.

Software Company



In terms of the Software Company, in Year 2, there is a huge drop in forecasted EBITDA in relation to Capex, which immediately induces a reduction in future Capex in relation to EBITDA. This forecast is also practical because the Software Company is very sensitive to cash outflows, such as Capex because a majority of its sales is tied to accounts receivables. A PE firm must be able to assume such unpredictable cash flow cycles when considering an acquisition of a service company with unpredictable accounts receivable conversion.

The APV (adjusted present value) method is necessary to project free cash flow of both companies, since the Metal Company needs a more substantial amount of Capex and NWC in comparison to the Software Company. The following are the results:

### Software

Valuation 1											
Value of Entity	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
EBIT	\$ 4,248,338	\$ 1,753,662	\$ 1,962,748	\$ 1,997,176	\$ 2,052,189	\$ 2,678,219	\$ 2,736,707	\$ 4,436,408	\$ 4,642,377	\$ 4,847,077	
Tax on Operating Income	\$ 1,334,586	\$ 496,500	\$ 558,328	\$ 570,034	\$ 554,978	\$ 750,439	\$ 762,805	\$ 1,314,921	\$ 1,332,800	\$ 1,395,742	
EBIAT	\$ 2,913,752	\$ 1,257,162	\$ 1,404,420	\$ 1,427,142	\$ 1,497,211	\$ 1,927,780	\$ 1,973,902	\$ 3,121,487	\$ 3,309,576	\$ 3,451,335	
plus Depreciation	\$ 30,344	\$ 59,530	\$ 58,173	\$ 79,066	\$ 79,500	\$ 71,715	\$ 94,331	\$ 99,353	\$ 132,293	\$ 119,759	
less Investment in NWC	\$ 68,871	\$ 67,061	\$ 127,719	\$ (20,964)	\$ 372,360	\$ 191,788	\$ 82,939	\$ 284,366	\$ 575,187	\$ 73,413	
less investment in Fixed Assets (net)	\$ 639,849	\$ 550,756	\$ 612,695	\$ 968,619	\$ 621,378	\$ 697,062	\$ 729,791	\$ 842,007	\$ 1,068,986	\$ 1,091,956	
<b>Software FCF</b>	\$ 2,235,376	\$ 698,875	\$ 722,178	\$ 558,552	\$ 582,973	\$ 1,110,645	\$ 1,255,504	\$ 2,094,468	\$ 1,797,696	\$ 2,399,725	
Residual Value											\$ 21,483,368
FCF plus Residual Value	\$ 2,235,376	\$ 698,875	\$ 722,178	\$ 558,552	\$ 582,973	\$ 1,110,645	\$ 1,255,504	\$ 2,094,468	\$ 1,797,696	\$ 23,883,093	
<b>Value of the Unlevered Firm</b>	\$ 18,599,430	\$ 14,207,994	\$ 13,693,478	\$ 16,088,950	\$ 17,342,494	\$ 18,712,803	\$ 19,709,779	\$ 20,674,184	\$ 20,908,247	\$ 21,465,443	
<b>Value of Debt</b>											
<b>Value of Equity</b>											
Interest Expense	\$ 323,085	\$ 293,369	\$ 320,606	\$ 320,606	\$ 419,902	\$ 471,045	\$ 493,162	\$ 568,993	\$ 722,376	\$ 741,953	
Interest Tax Shield	\$ 109,849	\$ 99,745	\$ 109,006	\$ 109,006	\$ 142,767	\$ 160,155	\$ 167,675	\$ 193,458	\$ 245,608	\$ 252,264	
Residual Value of Interest Tax Shield											\$ 2,536,584
Interest tax Shields plus Residual Value	\$ 109,849	\$ 99,745	\$ 109,006	\$ 109,006	\$ 142,767	\$ 160,155	\$ 167,675	\$ 193,458	\$ 245,608	\$ 2,536,584	
Value of Interest Tax Shields	\$2,718,595										
<b>Software Value of Assets</b>	<b>\$ 16,318,025</b>										

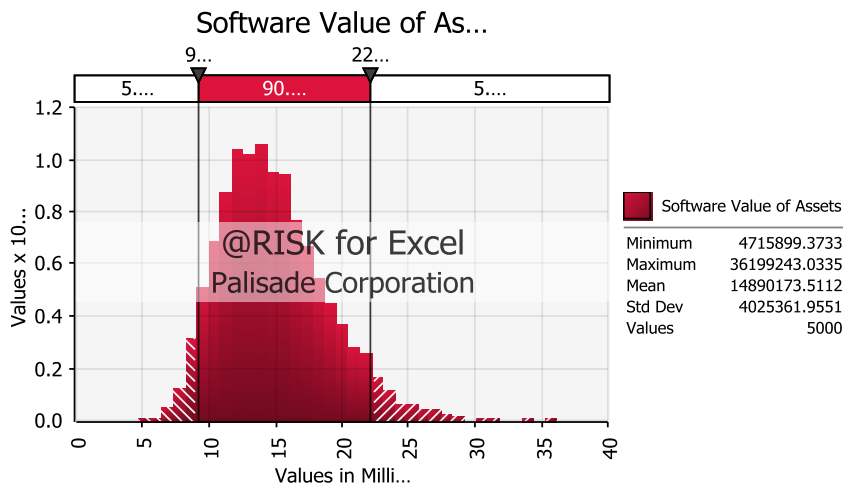
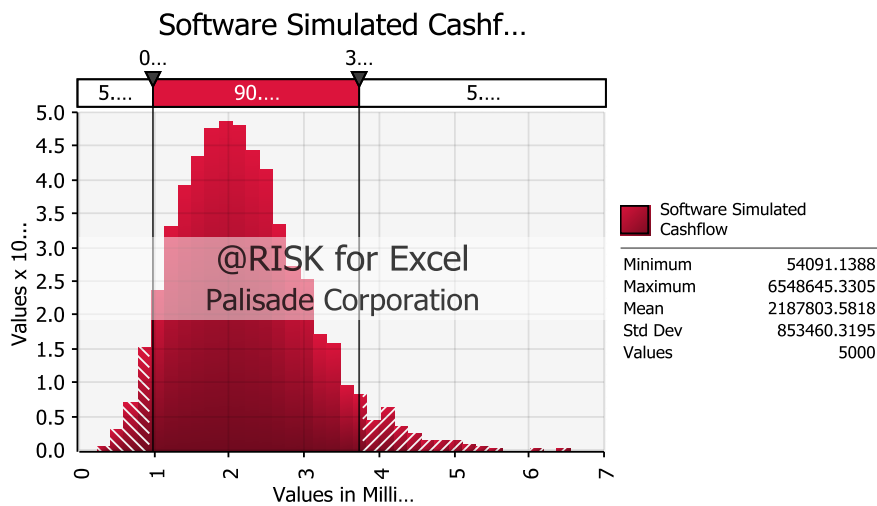
### Metal Company

Valuation 1											
Value of Entity	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
EBIT	\$ 2,231,058	\$ 3,241,625	\$ 3,662,780	\$ 4,015,977	\$ 8,863,829	\$ 6,996,129	\$ 5,784,993	\$ 1,902,432	\$ 5,036,433	\$ 3,776,039	
Tax on Operating Income	\$ 758,560	\$ 1,102,152	\$ 1,245,345	\$ 1,365,432	\$ 3,013,702	\$ 2,378,684	\$ 1,966,898	\$ 646,827	\$ 1,712,387	\$ 1,283,853	
EBIAT	\$ 1,472,498	\$ 2,139,472	\$ 2,417,434	\$ 2,650,545	\$ 5,850,127	\$ 4,617,445	\$ 3,818,095	\$ 1,255,605	\$ 3,324,046	\$ 2,492,185	
plus Depreciation	\$ 148,737	\$ 182,842	\$ 281,789	\$ 390,260	\$ 881,701	\$ 732,971	\$ 602,147	\$ 435,158	\$ 488,006	\$ 766,352	
less Investment in NWC	\$ 594,949	\$ 299,835	\$ 482,695	\$ 1,695,552	\$ 1,535,013	\$ (537,249)	\$ (489,329)	\$ (625,830)	\$ 330,488	\$ 1,739,722	
less investment in Fixed Assets (net)	\$ 341,052	\$ 989,466	\$ 1,084,707	\$ 1,150,884	\$ 934,442	\$ 971,881	\$ 707,476	\$ 754,157	\$ 478,522	\$ 2,577,745	
<b>Metal FCF</b>	\$ 685,235	\$ 1,033,014	\$ 1,131,821	\$ 194,369	\$ 4,262,374	\$ 4,915,784	\$ 4,202,096	\$ 1,562,437	\$ 3,003,042	\$ (1,058,930)	
Residual Value											\$ (13,394,803)
FCF plus Residual Value	\$ 685,235	\$ 1,033,014	\$ 1,131,821	\$ 194,369	\$ 4,262,374	\$ 4,915,784	\$ 4,202,096	\$ 1,562,437	\$ 3,003,042	\$ (14,453,732)	
<b>Value of the Unlevered Firm</b>	\$6,070,716	\$6,192,935	\$5,983,631	\$5,647,681	\$6,204,499	\$2,767,374					
<b>Value of Debt</b>											
<b>Value of Equity</b>											
Interest Expense	\$148,107	\$237,284	\$226,028	\$394,864	\$547,715	\$455,865	\$374,656	\$270,793	\$303,702	\$476,936	
Interest Tax Shield	\$50,356	\$80,677	\$76,849	\$134,254	\$186,223	\$154,994	\$127,383	\$92,070	\$103,259	\$162,158	
Residual Value of Interest Tax Shield											\$4,034,747
Interest tax Shields plus Residual Value	\$50,356	\$80,677	\$76,849	\$134,254	\$186,223	\$154,994	\$127,383	\$92,070	\$103,259	\$4,196,905	
Value of Interest Tax Shields	\$2,376,482										
<b>Metal Value of Assets</b>	<b>\$8,447,197</b>										

The Value of the Assets (NPV of Cash flows + NPV of Interest Tax Shields) for each firm was calculated by utilizing a fluctuating cost of equity and debt, and also a fluctuating beta in relation to a constantly changing leverage for each firm. This is an important statement because in reality, if your cost of debt is 10% this year, there is a good chance (at least 50%) that your borrowing costs will increase or decrease next year.

## Software Company APV and FCF Analysis

With the adjusted variable factors such as costs of equity and debt and also expected market returns and beta, the results of simulated NPV of Software Cash flows and Value of the Software Firm were determined to be,

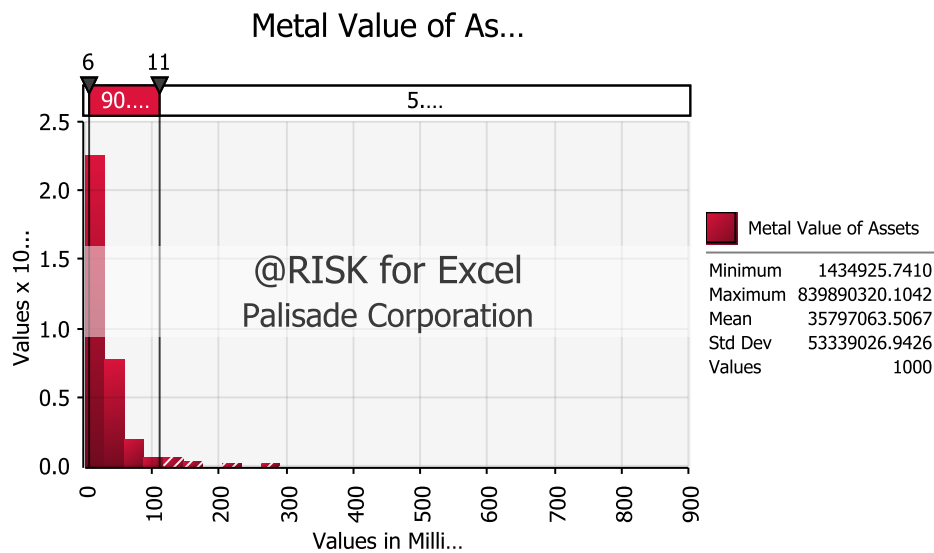
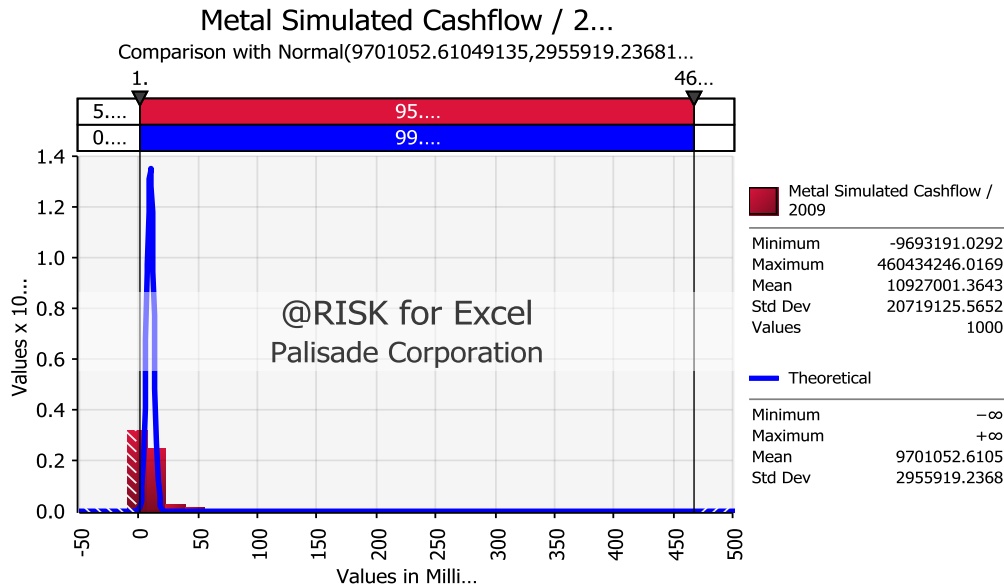


After 5000 iterations, the net present value of the Software Cash flows was determined to be \$2.2M, with a standard deviation of \$800K. This means, when forecasting the cash flows of this Software Company, the PE firm can safely assume that yearly free cash flow from the Software Company to average \$2.2M, with a forecasted cash flow range of \$54k and a maximum value of \$6.5M. With 90% certainty, cash flows

could be projected to fall within \$1M and \$3.7M per annum. The net present value of the Software Company was determined to be \$15m, with a standard deviation of \$4m, and an enterprise value in the range of \$5M and \$36M. With 90% certainty, the PE firm can assume the value of the Software Company to be within \$9m and \$22M.

## Metal Company APV + FCF Analysis

With the adjusted variable factors such as costs of equity and debt and also expected market returns and beta, the results of simulated NPV of Metal Company Cash flows and Value of the Metal Company were determined to be:



The net present value of the cash flow for the Metal Company was determined to be \$11M. In other words, a PE firm can expect annual cash flows of \$11M from the Metal Company over the course of ten years. However, the standard deviation was \$21M, based on a range of cash flows between -\$9M and \$460M. In short, with a 95% level of certainty, a PE firm can expect cash flows the Metal Company to within \$1.2M and \$467M, based on the simulation.

The value of the Metal Company was determined to be \$36M, with a minimum and maximum range of \$1.4M and \$830M. With a 90% degree of certainty, a PE firm can expect the value of the Metal Company to be within \$6M and \$100M over the course of ten years. Now, this wide range of values for the Metal Company, in actuality, is practical, due to the volatile nature of the commodities industry. This volatility will be explained in an upcoming section.

## Metal Company + Software Company Adjusted Variables

The beta for each company was calculated by the following formula:

$$\text{Levered Beta} = \frac{\text{Expected Return}}{\text{Risk Premium}}$$

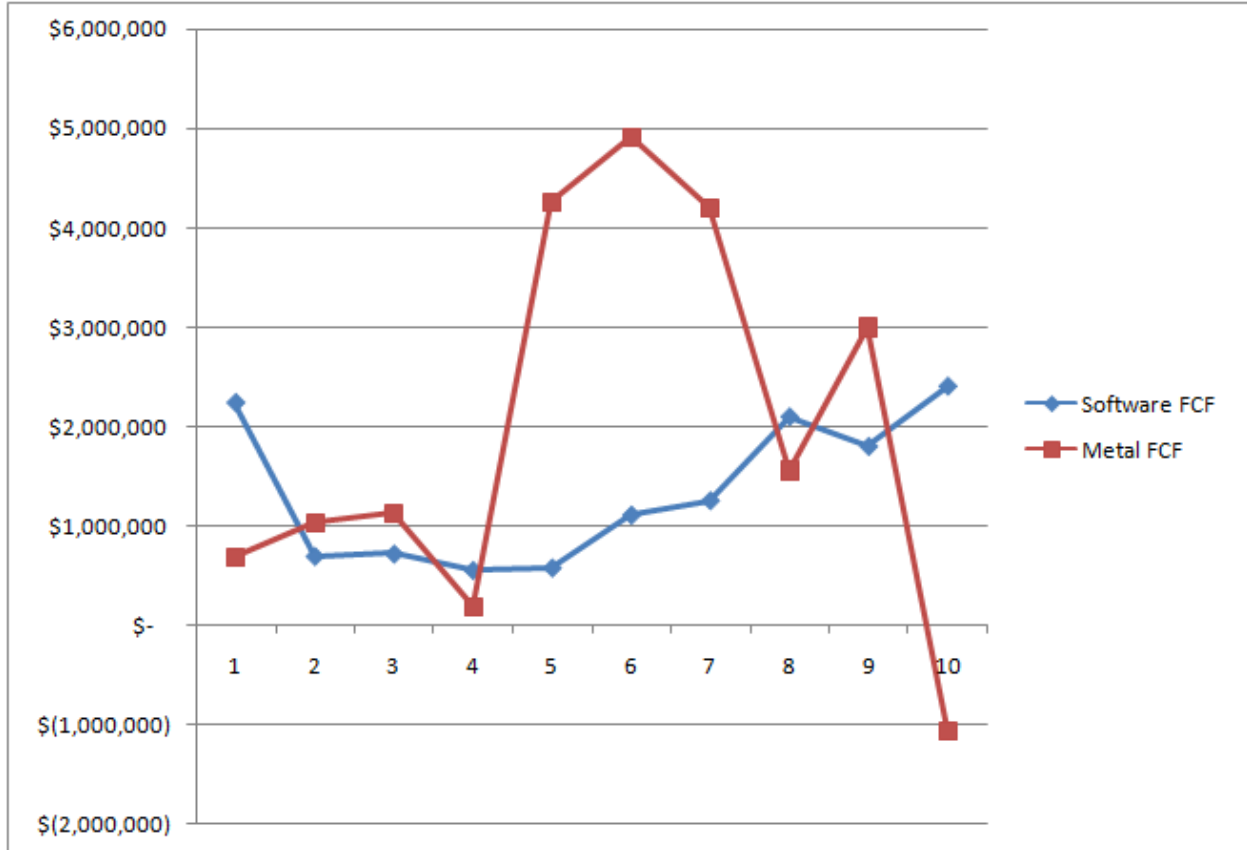
Expected returns were determined from the historical returns from the S&P and CBOE indices, and the risk premium was based on standard risk premiums for each index. To determine the value of the equity for each company, the following formula to calculate the Unlevered Beta was utilized:

$$\text{Unlevered Beta} = \frac{\text{Levered Beta}}{\{1 + (1 - \text{Tax Rate})D/\text{Total Capitalization}\} \text{Equity}/\text{Total Capitalization}}$$

This was essential because the forecasted financials for each firm, derived a fluctuating capital structure, which for the Software Company resulted in a cost of equity range of 10% - 13% per annum, and for the Metal Company, a cost of equity range of 12% and 17%. These percentages were based on fluctuating unlevered betas of 0.65 to 0.68 for the Software Company, and for the Metal Company, unlevered betas of 1.00 and 1.70.

These variables were important in determining realistic values and cash flows of each firm over ten years, without making blanket assumptions such as equivalent costs of equity and equivalent intrinsic risk, which could improperly help a volatile company if a lower beta is assumed, or hurt a steady company if a higher cost of equity is assumed.

A comparison snapshot of the projected free cash flow of both companies is as follows:



It can be observed from the results above that the Software Company will have a predictable free cash flow, compared to the Metal Company which could exhibit steady, if not impressive cash flow until between year 9 and 10 where free cash flow could drop to below zero without any warning from previous years.

## Volatility

In the previous sections, expected returns, risk premiums and in particular, volatility were implied, but not assumed. Volatility for the Metal Company and Software Company were derived from historical data from the CBOE VIX Index<sup>3</sup> and S&P Index<sup>4</sup>. Returns and averages were annualized, and the results are as follows:

Historical Treasury Rates and Corporate Bond Rates										CBOE Log Relative Returns	S&P Log Relative Returns
Date	Moody's Aaa	Moody's Baa	Treasury 1yr	Treasury 3yr	Treasury 5 yr	Treasury 7 Yr	CBOE VIX	S&P			
31-Jan-01	7.15	7.93	5.16	4.76	4.77	4.86	61.45	1366.01	0%	0%	
1-Feb-01	7.1	7.87	5.1	4.66	4.71	4.89	75.57	1239.94	21%	-10%	
1-Mar-01	6.98	7.84	4.89	4.34	4.43	4.64	72.13	1160.33	-5%	-7%	
1-Apr-01	7.2	8.07	5.14	4.23	4.42	4.76	71.3	1249.46	-1%	7%	
1-May-01	7.29	8.07	5.39	4.26	4.51	4.93	59.67	1255.82	-18%	1%	
1-Jun-01	7.18	7.97	5.28	4.08	4.35	4.81	45.49	1224.38	-27%	-3%	
1-Jul-01	7.13	7.97	5.24	4.04	4.31	4.76	48.35	1211.23	6%	-1%	
1-Aug-01	7.02	7.85	4.97	3.76	4.04	4.57	52.86	1133.58	9%	-7%	
1-Sep-01	7.17	8.03	4.73	3.12	3.45	4.12	65.19	1040.94	21%	-9%	

CBOE Annualized Volatility	0.532967
Annualized Mean	-0.05176
SP Annualized Volatility	0.153568
SP Annualized Mean	-0.05225
Correlation(CBOE, SP)	-0.61084

Monthly commercial paper rates<sup>5</sup>, Treasury returns<sup>6</sup>, CBOE and S&P returns were observed from Jan 2001 to Dec 2008. The annualized averages for S&P and CBOE were almost identical at -5.2%. While the annualized standard deviation (volatility) for each was 53% for the CBOE and 15% for the S&P. However, an interesting observation was the non-correlated relationship between the CBOE and S&P. This is very important because it also gives more credit to the volatility factor, and also the fact that when the S&P is up, commodities are down, and a clear example is the current market, where the S&P is at historic lows, while the price of gold is at historic highs.

PE firms should imply such scenarios when valuing two different companies to prepare for any scenario in the future. Your company could be worth \$100M in ten years, or negative \$10M in five years, depending on the volatility of the sector. A traditional DCF does not capture this, and this may tend to under value or over value a company. A traditional DCF also does not capture:

- The probability that a company may need additional capital in the near future.
- The probability that a company would be best suited to acquire another company.
- Or a company would be more than likely favorable to be acquire years before investment time horizon.

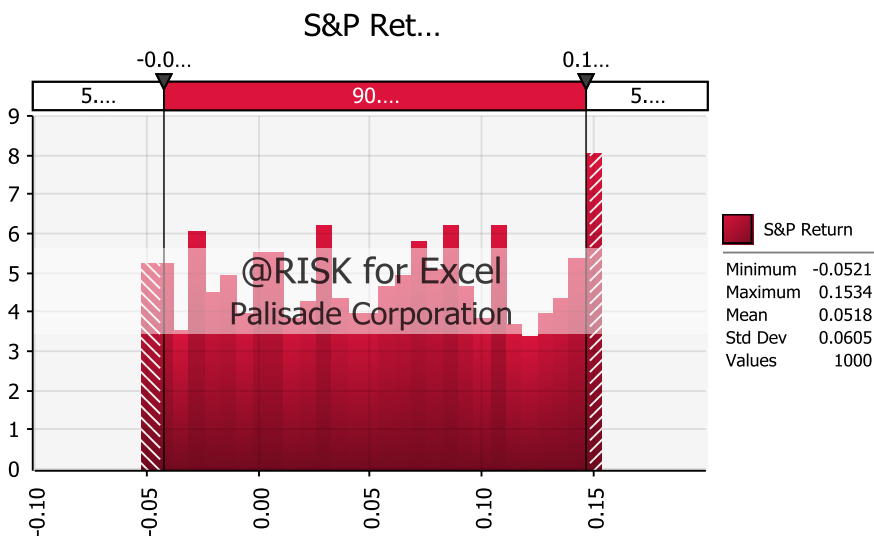
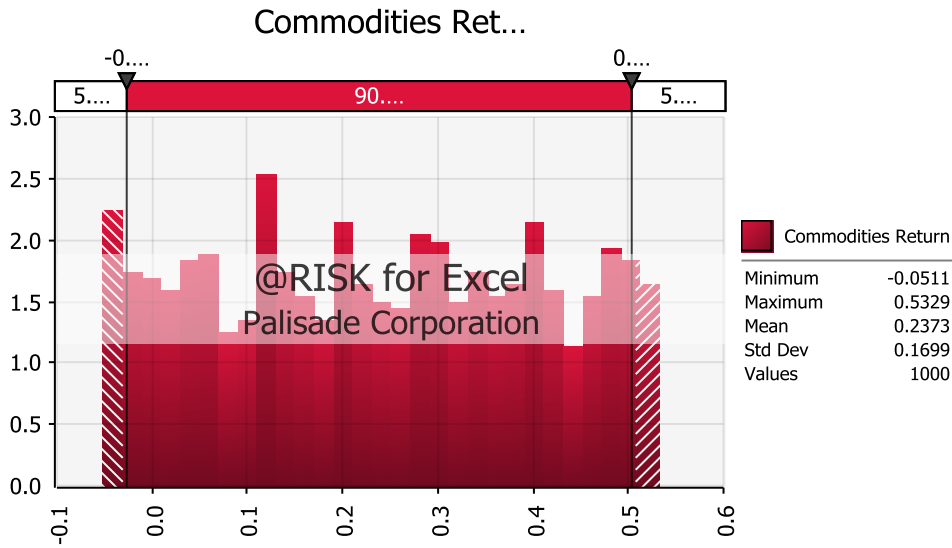
<sup>3</sup> Yahoo Finance

<sup>4</sup> CRSP

<sup>5</sup> Federal Reserve

<sup>6</sup> Federal Reserve

A simulated expected market return for each sector was conducted by utilizing the above annualized standard deviations and annualized averages to determine what investors should or can expect from an investment from each sector.



Based on the simulation, a PE firm can expect to make 24% ROI with a standard deviation of 17% with an acquisition of a commodities based company. With a 90% level of certainty, the PE firm can expect a return in the ranges of a loss of 5% to a gain of 53%. However, in terms of an S&P related company, the same PE firm can expect an ROI of 5% with a standard deviation of 6% and a 90% degree of certainty that an ROI of negative 5% and 15% can be achieved. These values were utilized in calculating the respective betas and cost of equity for the Metal Company and Software Company.

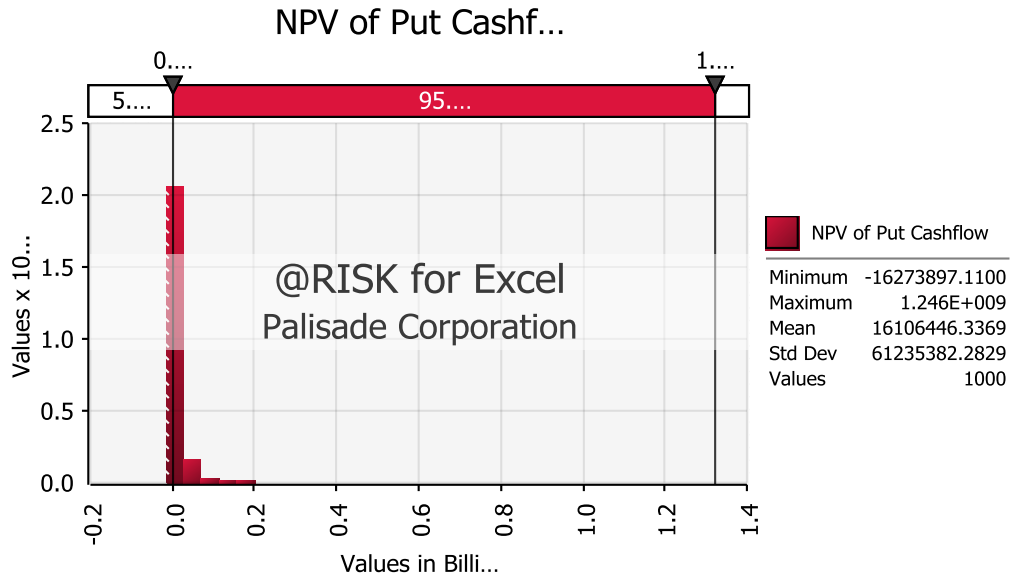
Since the Metal Company is subject to price risk in the spot market, its inventory and Other Current Assets is subject to volatile fluctuations on a daily basis. This can have tremendous balance sheet effects, because leverage ratios can change drastically overnight. A 30% debt to equity ratio can change to a 70% ratio, which would increase interest expense and perceived risk of the firm.

To counter this volatile price risk, a derivative factor was imputed in the cash flow of the Metal Company, to offset any fluctuation in fair market value of its inventory and other current assets. The derivative factor was utilized to simulate the possibility of offsetting price risk with the option of exercise a put whenever the asset price sunk below an agreed strike price. The model is as follows:

	2009	2010	2011	2012	2013
Sales Growth	0.122244892	0.201587164	0.270083737	0.746971141	0.387096481
Revenue	\$ 5,949,487	\$ 7,148,827	\$ 9,079,609	\$ 15,861,815	\$ 22,001,868
Inventory	\$ 1,189,897	\$ 379,413	\$ 120,980	\$ 38,576	\$ 12,300
other Current Assets	\$ 1,586,530	\$ 354,645	\$ 79,276	\$ 17,721	\$ 3,961
Total	\$ 2,776,427	\$ 734,058	\$ 200,256	\$ 56,297	\$ 16,262
Current Asset Price (2009)	\$1,000	\$1,044	\$233	\$52	\$12
Risk Free Rate	4%	4%	4%	4%	4%
Time	1	1	1	1	1
Volatility	53%	53%	53%	53%	53%
Strike Price	\$800	\$835	\$187	\$42	\$9
Up	1.70	1.70	1.70	1.70	1.70
Down	0.59	0.59	0.59	0.59	0.59
Asset Price at Expiration	\$1,731	\$1,474	\$172	\$67	\$6
Cashflows from Put	\$0.0	\$0	\$15	\$0	\$3
DPV of Put Cashflows	\$0.0	\$0	\$14	\$0	\$3
Units	2776	703	858	1079	1394
Total DPV Put Cashflows	\$0	\$0	\$11,912	\$0	\$3,838
<b>Put Cashflow NPV</b>	<b>\$2,013,557</b>				

The current asset price in 2009 is based on an arbitrary \$1000 value as a proxy for an average unit price of the commodity. The risk free rate and volatility was based on historic Treasury rates and the same volatility derived from the CBOE VIX Index. The strike price was determined by an 80% factor. In other words, whenever the current asset value dropped by 80%, the put option would be exercised.

The simulation of the put cash flow is as follows:



On average, the PE firm can expect an NPV of \$16M from cash flows from exercising the put with an extremely high standard deviation of \$61M. However, an NPV of put cash flows could be expected to fall between \$2M and \$1.32B with a 95% degree of certainty. The minimum and maximum values from the simulation were a negative \$16M and a positive \$1.2B. In other words, this put option creates value for the Metal Company, and this hidden value is absent in a basic DCF analysis.

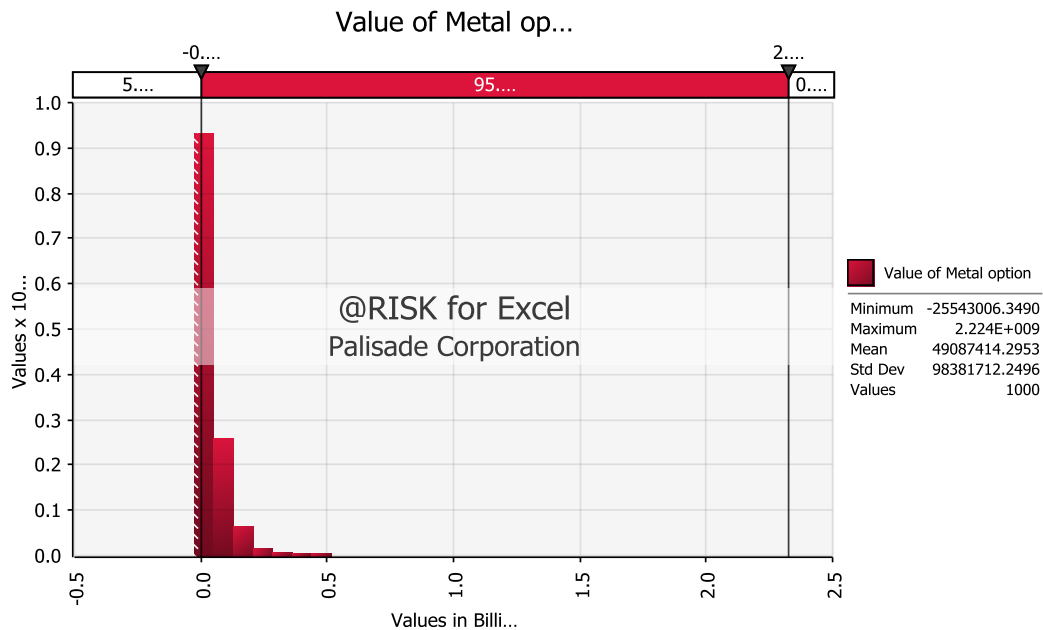
## Real Options Valuation Method

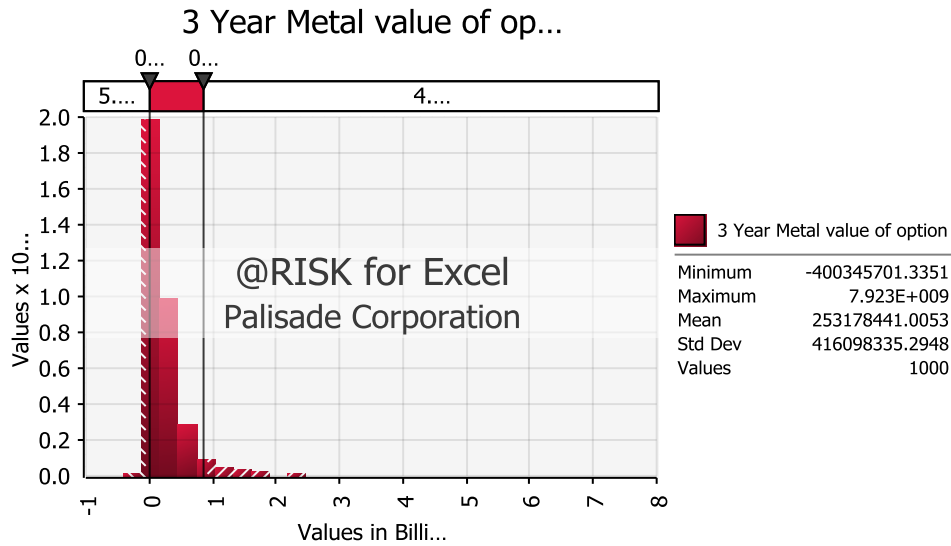
Based on volatility, a private equity firm can also predict the possibilities of an increase in value on a year to year basis, or an erosion of value. The PE firm can also forecast the possibility of an acquisition target to be utilized as a platform to acquire other companies. The Binomial Real Options Valuations should be utilized to calculate such possibilities in terms of a dollar amount.

In my simulation, I projected One Year and Three Year outcomes based on volatilities, risk free rate, underlying asset value, an assumed strike price and a derived probability factor. The underlying asset value is based on the net present value of each company based on a One Year Projection. The up and down movements were based on the annualized standard deviations, risk free rates and time factor (1 yr). The inputs and results were as follows:

Metal Company Binomial Inputs

Metal Company	
Year 1	
	2010
Strike Price	\$10,000,000
Underlying Asset	\$6,192,935
Time	1
Volatility	0.53
Risk Free Rate	4%
up	1.70
down	0.59
q	0.407276313
1-q	0.592723687
Value of Metal option	\$521,206



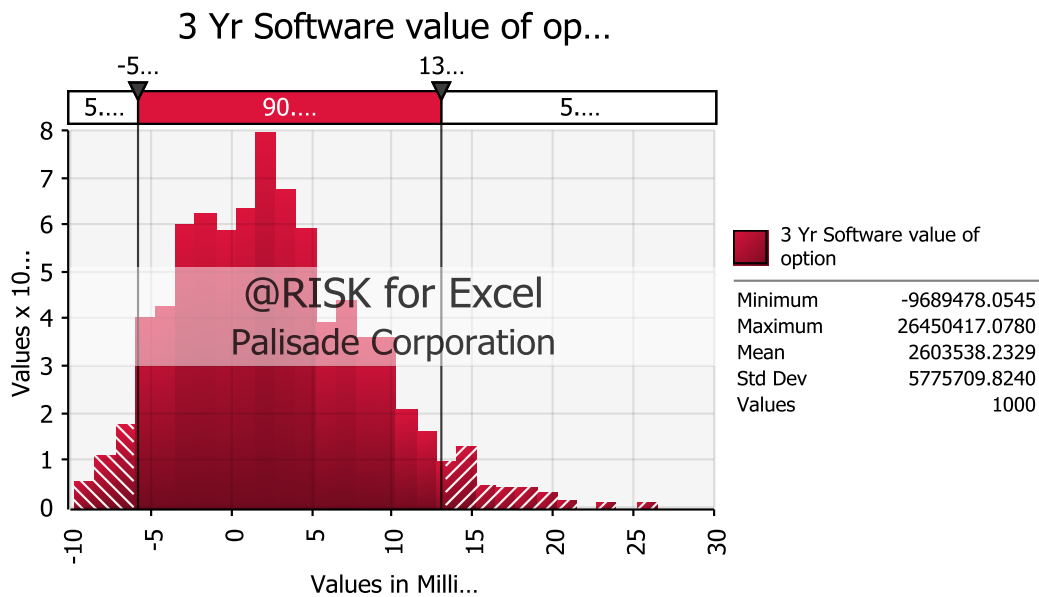
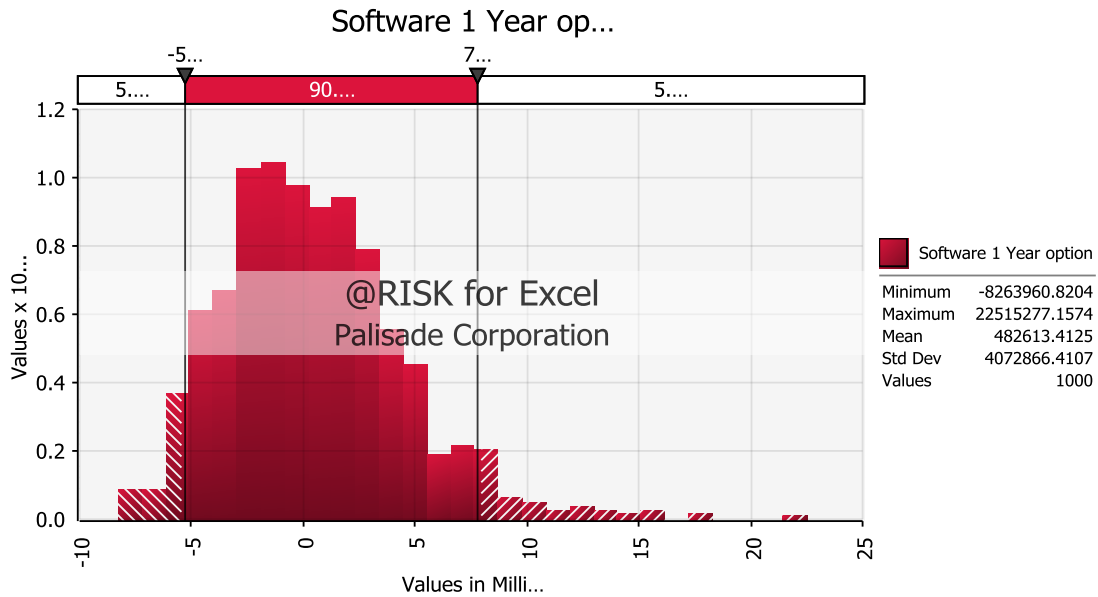


From the above simulation of the value of a One Year and Three Year Option on the Metal Company, it can be determined that the metal company could bring a loss of \$1M or a gain of \$2.3B within one year of an acquisition or if the firm was sold. In other words, if the PE firm decided to use the Metal Company as a platform to acquire another company in 12 months or, to sell the Metal Company in 12 months, with a \$10M possible acquisition cost or a \$10M projected price, the firm could expect to be able to purchase five companies after one year. The PE firm can also expect to sell the Metal Company for up to \$50M through competitive bidding.

In the Three Year simulation, the PE firm can expect to sell the Metal Company on average for up to \$253M through competitive bidding, with a standard deviation of \$416M! In short, with a 90% level of certainty, the Metal Company could be sold for between \$1M and \$850M within three years. However, this also means that the PE firm can expect to be able to purchase up to 25 companies by utilizing the Metal Company as a platform.

#### Software Company Binomial Inputs

<b>Software</b>	
Year 1	
2010	
Strike Price	\$10,000,000
Underlying Asset	\$14,207,994
Time	1
Volatility	0.153568269
Risk Free Rate	4%
up	1.165981995
down	0.857646177
q	
1-q	
Software 1 Year option	\$6,566,269



Based on the simulation results, it can be determined that a One Year Option on the Software company is \$490k, with a 90% level of certainty that the value would be within a loss of \$5.3M and a gain of \$7M, with a standard deviation of \$4.1M. A Three Year Option on the Software Company was determined to be \$2.6M, with a 90% degree of certainty that a range of a loss of \$5.7M to a gain of \$13.1M would be possible.

As you can see from the results, A One Year Option on the Software Company has a serious chance of eroding value, and a Three Year Option has a good chance of eroding value, with a better upside than the One Year Option.

This is another example of how volatility can help or hurt the valuation process, because a PE firm may decide to sell a company before the preferred time horizon or, a PE firm may reach the time horizon and realize that the company may not be able to obtain the necessary purchase price in the market. If the PE firm decides to keep the company, it will have to be ready to inject more capital into maintaining the business itself, and this must be factored in during the initial evaluation process.

## Sensitivity Analysis

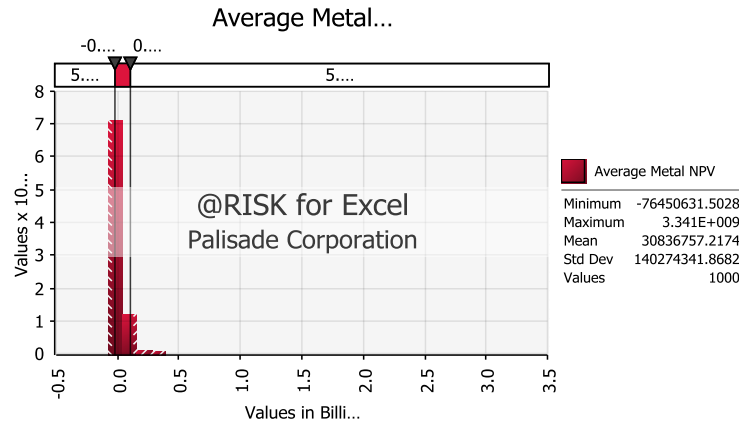
Now that we have determined possible scenarios and values of both companies, a sensitivity analysis (i.e. stress test) is necessary to determine which company would be able to sustain levels of cost of capital. This is essential to determine which firm would have the possibility of folding or withstanding an increase in costs of capital within a ten year investment horizon. The sensitivity analysis with a base discount rate of 12% was established, and the result is as follows:

Cost of Capital	12%	
	Metal	Software
Years	\$ (10,000,000)	\$ (10,000,000)
2009	\$ 520,231	\$ 2,096,685
2010	\$ 126,586	\$ 646,356
2011	\$ (312,346)	\$ 512,307
2012	\$ (547,530)	\$ 213,723
2013	\$ 2,184,540	\$ 1,110,595
2014	\$ 2,165,959	\$ 1,147,850
2015	\$ 4,171,357	\$ 711,667
2016	\$ 2,250,576	\$ 1,538,146
2017	\$ 1,847,121	\$ 1,416,034
2018	\$ 23,852,167	\$ 5,284,141
NPV	\$ 8,473,757	\$ 2,254,645

	Metal	Software	
	\$8,473,757	\$ 2,254,645	
5%	\$33,922,900	\$12,047,412	
6%	\$17,859,609	\$5,494,136	
7%	\$68,146,382	\$8,204,939	
8%	\$8,190,162	\$6,373,205	
9%	\$46,302,650	\$10,320,534	
10%	\$13,076,049	\$16,475,175	
11%	\$21,096,211	\$5,436,351	
12%	\$23,015,566	\$9,373,967	
13%	\$23,482,396	\$6,307,213	
14%	-\$1,628,461	-\$162,774	
15%	\$7,256,664	\$4,784,535	
16%	\$1,591,868	\$116,745	
17%	\$1,822,707	\$7,409,722	
18%	\$7,967,888	\$4,855,546	
19%	\$1,233,148	\$575,207	
20%	\$12,995,327	\$4,564,869	
21%	\$6,407,681	\$2,235,713	
22%	\$3,622,332	\$1,076,050	
23%	\$2,634,113	\$382,445	
24%	\$4,445,646	\$3,193,646	
25%	-\$694,526	\$998,739	
26%	\$24,349,000	\$462,273	
27%	-\$337,417	-\$1,920,148	
28%	\$1,188,516	-\$1,072,653	
29%	\$5,465,106	\$449,823	
30%	\$5,069,861	-\$1,181,011	
<b>Std Dev</b>	\$16,299,336	\$4,588,808	<b>Std Dev</b>
<b>Mean</b>	\$13,018,515	\$4,107,756	<b>Mean</b>
<b>Average Metal NPV</b>	\$17,845,713	\$12,751,999	<b>Average Software NPV</b>

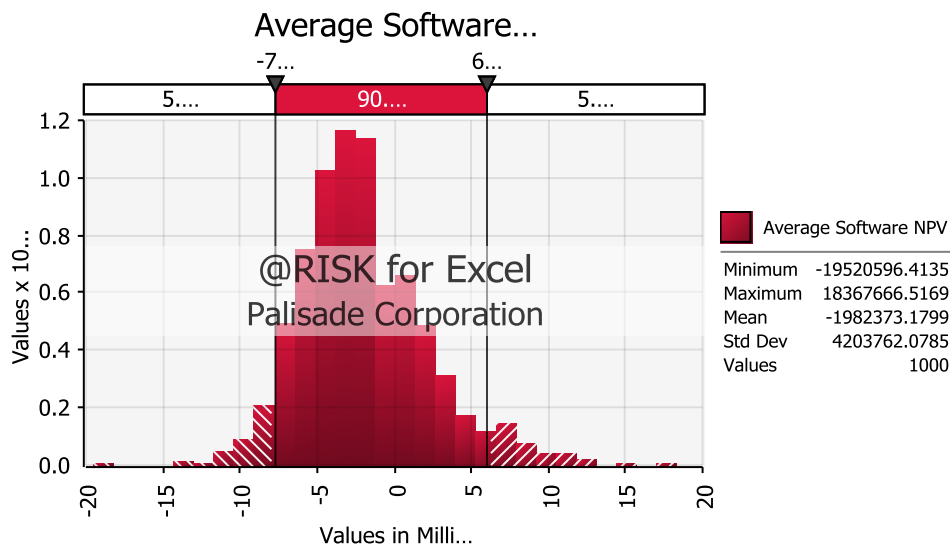
From the first simulation utilizing a range of discount rates, it can be observed that the Metal Company could average a \$8.5M net present value. In comparison with the Software Company which would average a loss of \$2.3M.

After a simulation the following was the result for the Metal Company:



The Metal Company could be valued on average at \$31M with a huge standard deviation of \$140M. With a 90% level of certainty, the range of values would be a loss of \$20M and \$103M. However, the minimum value was a huge loss of \$76.5M and a maximum gain of \$31M. Clearly, the downside outweighs the positive.

The simulated sensitivity analysis of the Software Company is as follows:



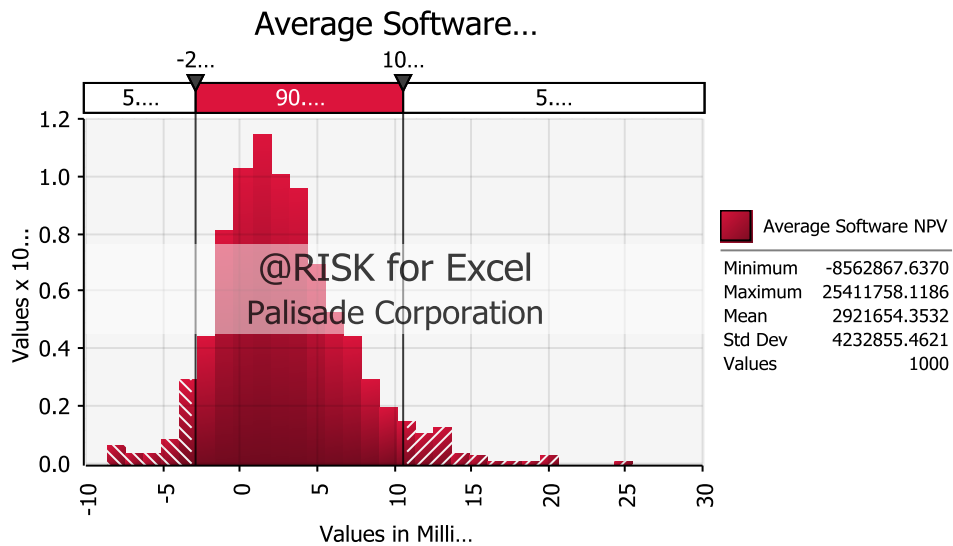
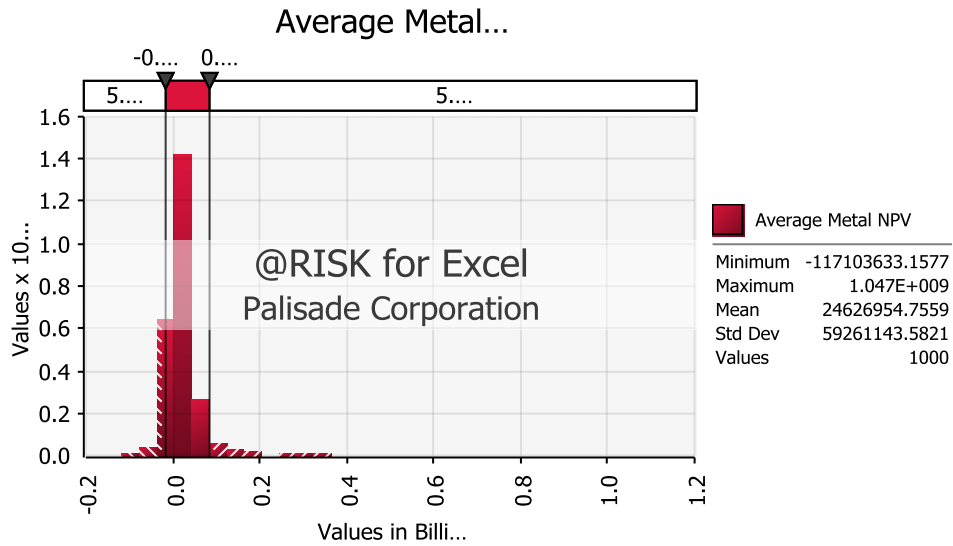
On average, the simulated sensitivity analysis projects a loss of \$2M for the Software Company, with a 90% degree of certainty that the value would be within a loss of almost \$8M and a gain of \$6M. The minimum and maximum NPV's were a loss of \$20M and a gain of \$18M, with a \$4M standard deviation.

Both simulations from the sensitivity analysis were based on a \$10M acquisition price, which tended to yield a more than likely negative NPV during the analysis. So, the acquisition price was reduced to \$5M, and yielded the following results:

Cost of Capital	7%	
	Metal	Software
Years	\$ (10,000,000)	\$ (10,000,000)
2009	\$ 958,550	\$ 2,045,951
2010	\$ 386,283	\$ 625,329
2011	\$ 1,425,100	\$ 1,644,387
2012	\$ 944,850	\$ 680,324
2013	\$ 859,277	\$ 690,904
2014	\$ 2,445,367	\$ 299,002
2015	\$ 2,060,965	\$ 1,428,808
2016	\$ 3,722,041	\$ 725,911
2017	\$ 126,356	\$ 1,012,080
2018	\$ 26,955,208	\$ 8,540,291
NPV	\$ 12,580,585	\$ 1,215,690

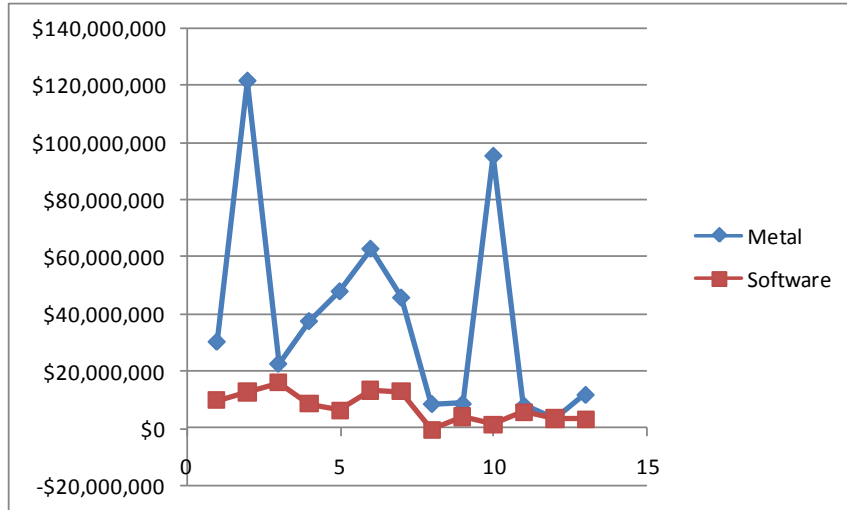
	Metal	Software	
	\$12,580,585	\$ 1,215,690	
5%	\$103,994,936	\$8,517,110	
6%	\$7,651,543	-\$965,133	
7%	\$13,364,142	\$5,412,534	
8%	\$13,925,673	-\$841,244	
9%	\$48,535,995	-\$1,247,555	
10%	\$20,910,643	\$3,334,053	
11%	\$53,005,484	\$38,262	
12%	\$13,557,972	-\$586,960	
13%	-\$2,769,111	-\$4,409,967	
14%	-\$1,913,956	\$5,261,559	
15%	\$7,071,537	-\$3,633,028	
16%	-\$3,892,435	-\$734,057	
17%	\$52,991,152	-\$6,357,145	
18%	\$10,106,645	-\$5,070,642	
19%	-\$2,176,164	-\$2,641,274	
20%	-\$109,742	-\$977,263	
21%	\$175,641,055	-\$3,330,552	
22%	\$43,624,134	-\$3,407,090	
23%	-\$6,590,786	-\$6,176,913	
24%	\$14,524,327	-\$4,523,215	
25%	\$116,816,386	-\$3,522,659	
26%	-\$4,001,653	-\$2,810,495	
27%	-\$7,629,521	-\$5,763,056	
28%	\$58,935	-\$4,792,046	
29%	-\$7,146,564	-\$4,921,652	
30%	\$13,348,744	-\$5,075,106	
Std Dev	\$44,526,629	\$3,826,265	Std Dev
Mean	\$25,880,745	(\$1,893,213)	Mean
Average Metal NPV	\$6,989,782	\$1,272,709	Average Software NPV

The simulation results are as follows:



The sensitivity analysis confirms that the Metal Company would be able to withstand higher costs of capital, in comparison to the Software Company. However, cash flows from the Software Company were more stable and easier to predict, which an attribute that PE firms often require is. In short, volatility helps the Metal Company in terms of an increase in capital costs.

A comparison of the sensitivity analysis for both companies is as follows:



## Return on Invested Capital (ROIC)

As mentioned earlier, one of the most important yet overlooked investment metric is Return on Invested Capital (ROIC), which can be described as a way to determine if value has been created or destroyed in reference to an investment. ROIC is a good way of measuring capital intensive firms, and a commodities-based company and a software-based company both fit this criteria. The Metal Company spends a huge portion of capital on net working capital, Capex and COGS. However, the Software Company utilizes huge portions of capital on SGA, licensing fees and COGS, and to a lesser degree Capex and net working capital.

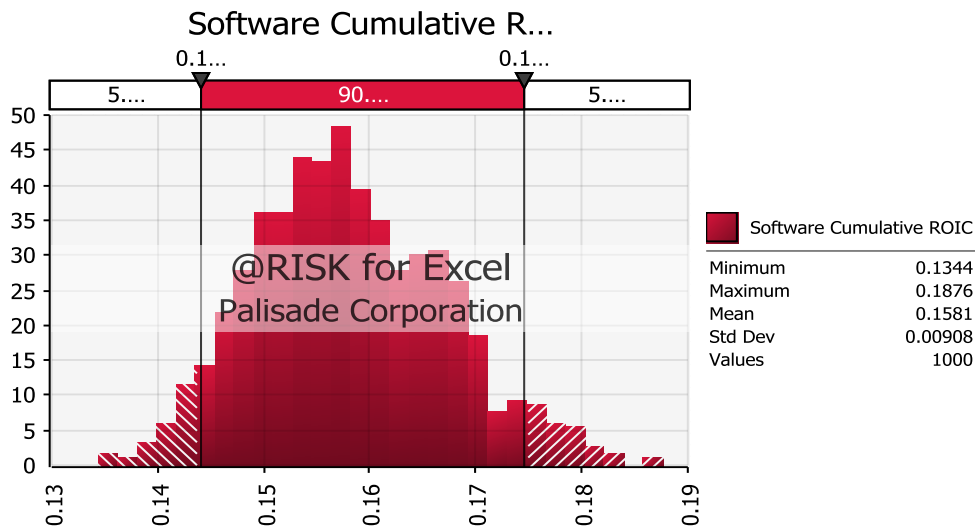
A PE firm should consider how much value additional capital infusion is creating for a company within a portfolio. If a company cannot be sold at an expected or suitable multiple, a PE firm should consider the alternatives in terms of cost of capital. Is it worth investing an additional \$15M into the company than to sell the company at a break even amount? What if you sold the company slightly below breakeven? What if you received an offer but decided to take your chances and hold off for another year or two?

### ROIC Formula

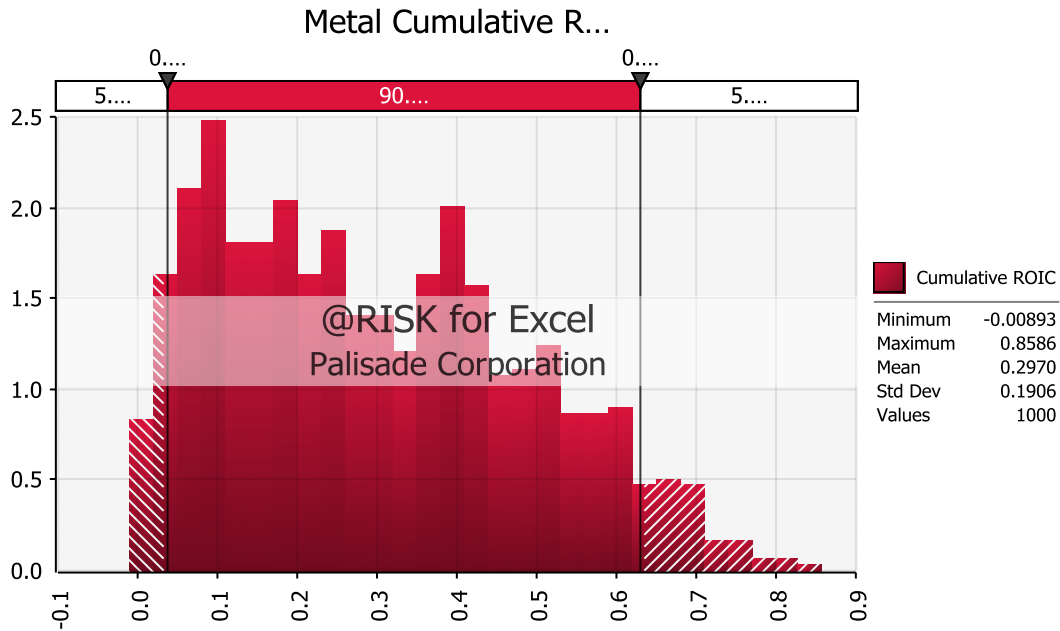
$$= \frac{\text{Net Operating Profits after Taxes}}{\text{Invested Capital}}$$

$$= \frac{(\text{Net Income} - \text{Interest Income} - \text{Interest Tax Shield} + \text{Non-Recurring Costs} + \text{Interest Expenses} + \text{Taxes Paid on Capital Gains})}{(\text{Total Assets} - \text{Cash} - \text{Cash Equivalents} - \text{Long Term Investments} - \text{Non-Interest Bearing Current Liabilities})}$$

A simulation was conducted to determine the expected annual ROIC for each company, and the results are as follows:

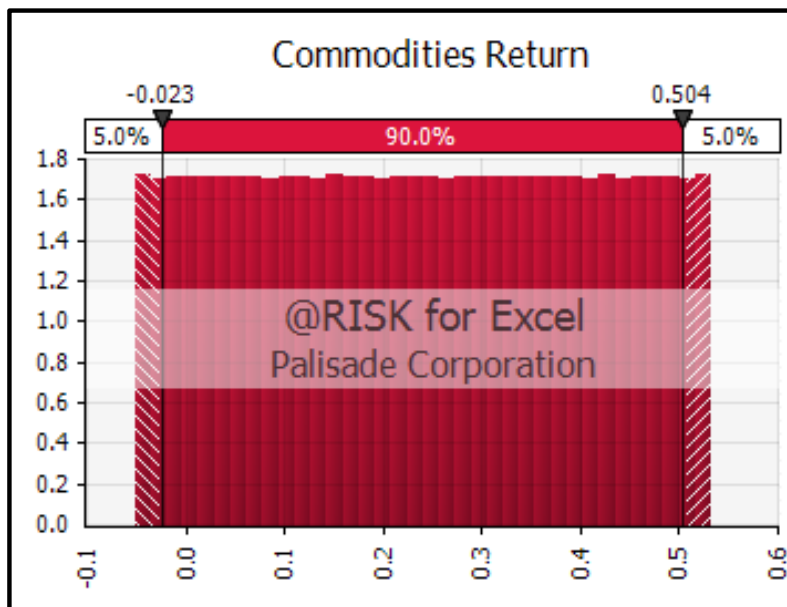
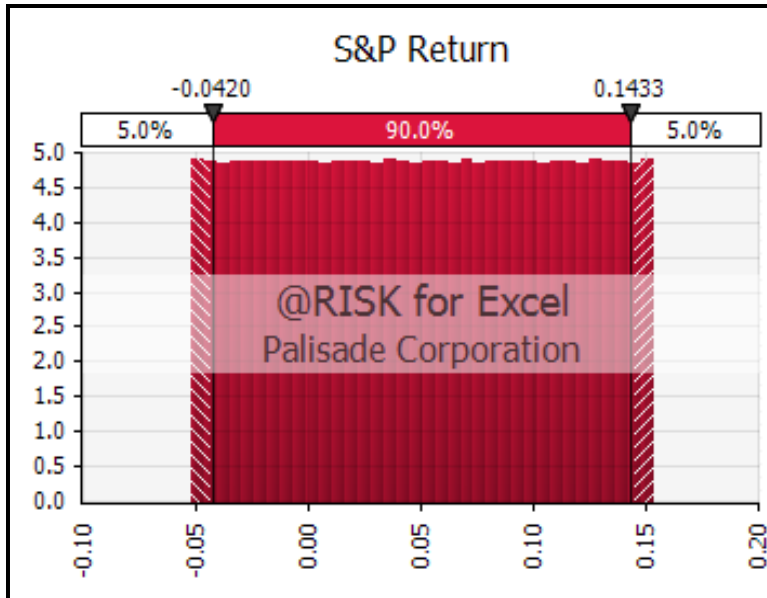


The simulation provided an average of 16% ROIC for the Software Company, with an impressive standard deviation of less than 1%. An ROIC of 14.4% and 17.5% can be expected, with a 90% level of certainty. The minimum and maximum ROIC values were 13.4% and 18.7%, which means a PE firm can expect to generate an annual ROIC between those minimum and maximum figures.



The Metal Company simulation provided an average ROIC of 29.7% with a standard deviation of 19%. A PE firm can expect annual ROIC to be between 4% and 63% with a 90% degree of certainty. The minimum and maximum ROIC values from the simulation were a negative 0.08% and a maximum of 86%.

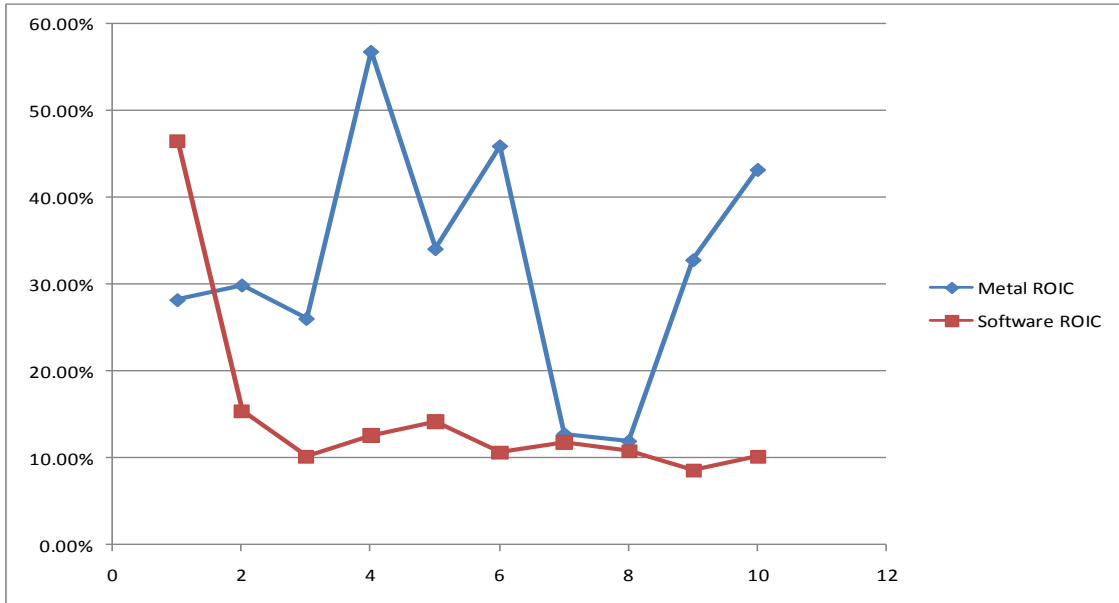
These results are very impressive because based on the thorough analysis of both the Metal Company and the Software Company, the PE firm can expect an ROIC of 16% with the Software Company and almost 30% for the Metal Company. These figures can be attributed to the intrinsic volatility of each company, based on historical industry returns. Also, these results mirror what an investor normally expects in the S&P Index and the CBOE Index. Historically, the expected returns from both are as follows:



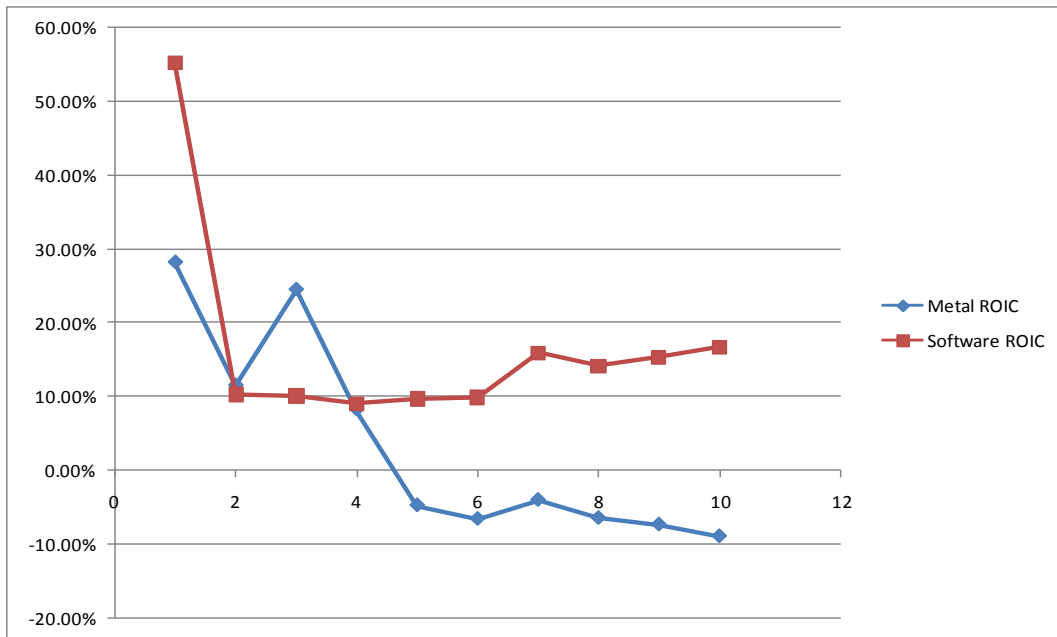
On average, investors in the S&P expected a 10% – 15% over a ten year investment horizon while risk neutral investors in the CBOE VIX Index expected a 20%-25% return over the same time horizon.

The following ROIC comparisons illustrate how volatility will obviously affect the creation or erosion of value.

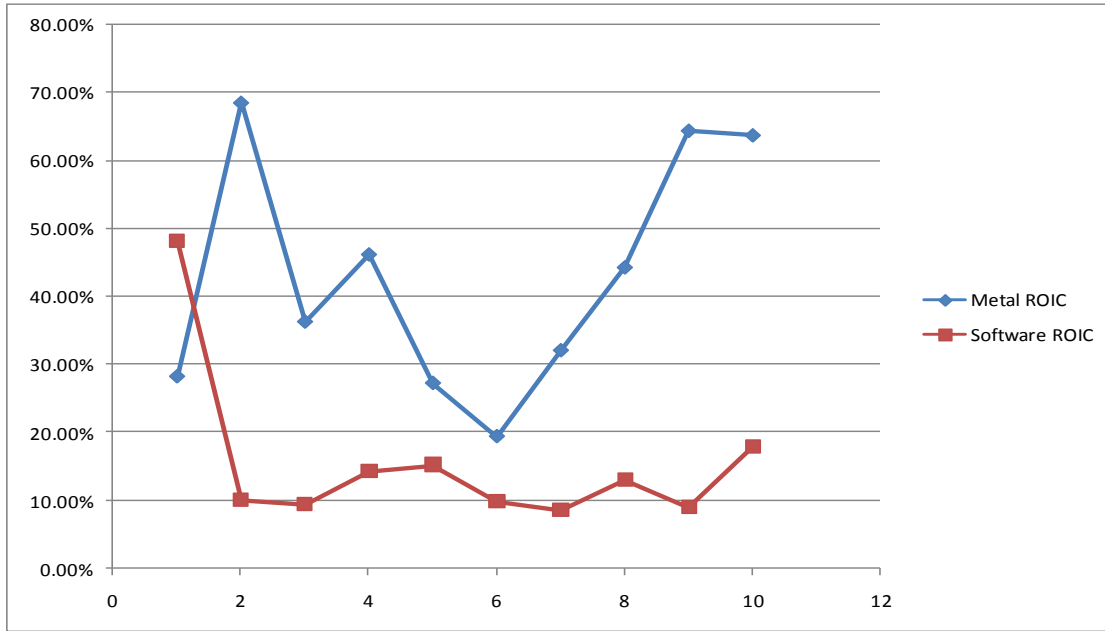
### ROIC Comparison 1



### ROIC Comparison 2



### ROIC Comparison 3



The three graphs illustrate how steady the ROIC for the Software Company is, with hovering above 10% in all scenarios. However, the Metal Company hovers above 30% in scenario 1 and 3, however it completely drops below zero in scenario 2, which means it has destroyed value and most likely reach bankruptcy levels.

## Conclusions

- **Outcome**

The outcome of this thorough analysis was that the Metal Company provides a better return for the PE firm based on risk profiles, ROE and ROIC. In other words, for instance, if the PE firms cost of debt is 12%, cost of equity is 17% and a weighted average cost of capital of 14%, the Metal Company provides a better investment opportunity because the average ROIC would be more than the cost of capital.

- **Assumptions**

A number of assumptions were made due to the lack of pertinent results obtained when simulations were truncated to achieve a level playing field. The assumptions were built into the proforma income statement projects by utilizing probabilities to determine the likelihood of a positive sales growth, SGA reduction, COGS as a percentage of sales, likelihood of an increase in principal payment of debt, net working capital and Capex. These assumptions were also based on industry cost averages and cost structures. A volatility based income statement growth rate was utilized initially but the results were an uneven playing field relative to the Software Company.

- **Positive and Negative Observations**

A positive observation was the confirmation that a basic DCF and Comparable valuation was not enough for a PE firm (or any substantial investor) to utilize when making investment decisions. This project extracted hidden values in both companies, which would not have been possible with a basic DCF. Also, using comparable analysis would have been insufficient because comparable transactions from a previous calendar year may over or under value the company. This could cause substantial errors in capital budgeting, acquisition or liquidation valuations. A negative observation is the issue of volatility. Volatility played an integral role in projecting the Metal Company as the hands down favorite in comparison with the Software Company. However, a seasoned investor would be able to see the case for and against volatility. An increased volatility reduces the viability of projections because the results from a simulation could be of a wide range of values, as was the case of the Metal Company, where as the Software Company had a range of values within a reasonable standard deviation. Another negative observation I noticed was the difficulty in fairly comparing two different companies from uncorrelated sectors. When the S&P is down, there tends to be a capital flight to commodities such as gold, and vice versa. In other words, when the S&P is down, there is a good chance that the commodities index is up.

- **Problem with Model**

The problem with this model is that not enough iterations were utilized in the simulations. A sufficient number would have been at least 50,000 iterations per simulation. Although this process would have proven to be cumbersome, it may have produced more reliable values, especially with the high volatility of the Metal Company.

- **Limitations**

All financial models are wrong, and it is difficult if not impossible to predict tomorrow, based on what happened today. This is where qualitative factors come into play. However, qualitative variables such as potential tariffs, taxes, wars, subsidies, regulation, etc, cannot be measured, and therefore difficult to forecast. The best one can do is imply realistic probabilities and estimates (i.e. guesses), and frequently cross reference results with historical data and industry averages.

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