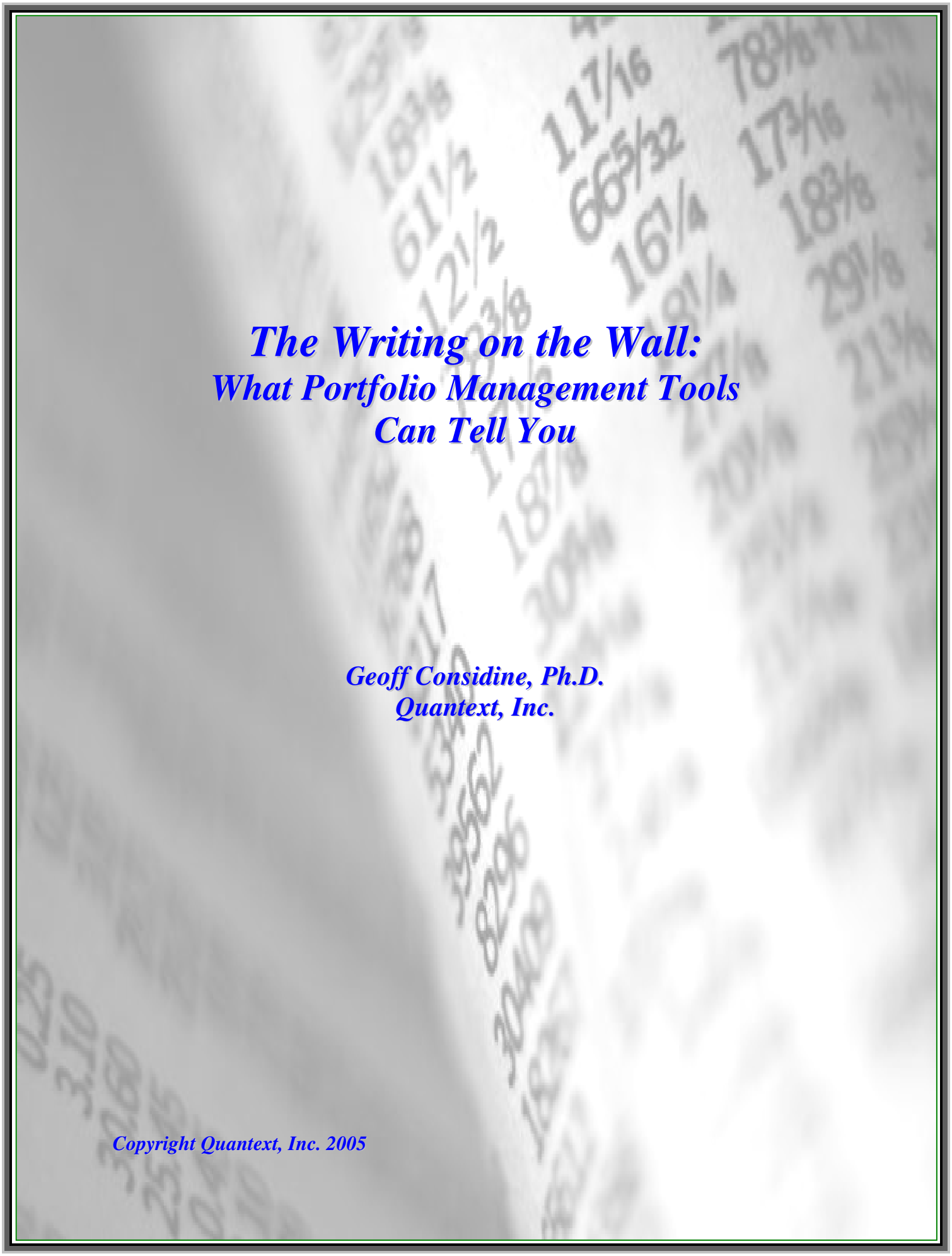

The Writing on the Wall:
What Portfolio Management Tools Can Tell You

Geoff Considine, Ph.D.
Quantext, Inc.

Introduction

As we move through 2005 and the stock market is essentially moving sideways, there is a tendency among many people simply to avoid looking at their portfolios. Plenty of investors are still down 30% or more since the bursting of the bubble in 2000. The danger in this is that we may not learn the important lessons of this market. By looking back at the dramatic market run-up and the subsequent 'pop', it is natural for people to wonder whether there were some clues about the coming decline. The good news is that there were market factors that warned of the potential for large losses and that we can learn a great deal from these market conditions.

Let me take you back to those heady days. If you had the portfolio in Figure 1, and re-balanced each to maintain the equal weightings between them, the period from 1997 through 1999 would have been pretty exciting. The companies in this portfolio represented many of the darlings of the tech boom and they made a lot of people rich—at least for a while (on paper).

Fund Name	Percentage of Funds
NOVL	10.0%
DELL	10.0%
CSCO	10.0%
AAPL	10.0%
INTC	10.0%
JDSU	10.0%
ORCL	10.0%
MSFT	10.0%
YHOO	10.0%
EXC	10.0%
Sums to	100.0%

Figure 1: Sample 'bubble portfolio'

If you invested $1 in this portfolio at the start of 1997, by the start of 2000, you would have had $10 (Figure 2). How's that for serious growth?

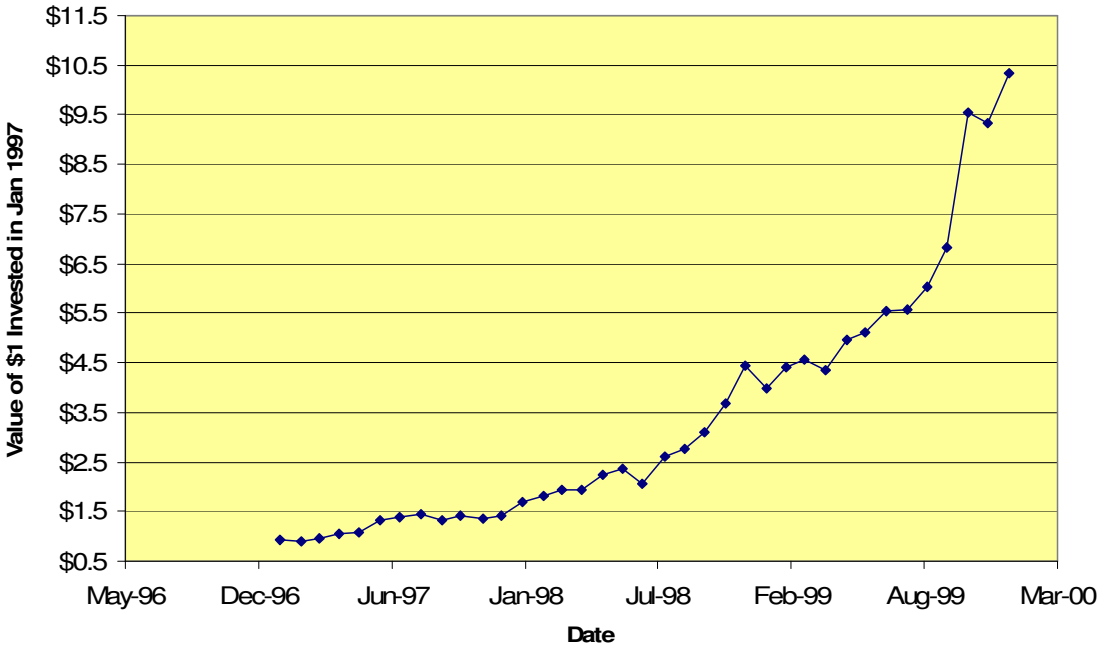

Figure 2: Performance of portfolio from Figure 1

For anyone familiar with these companies, the rest of the story is well known. From 2000 through 2002, this portfolio lost value very quickly (Figure 3). From January of 2000 through December of 2002, this portfolio dropped 62%.

The million (plus) dollar question is whether anyone looking at portfolio appreciation such as we see in Figure 2 could have known how possible it was to lose so much so fast. Figure 2 makes it look like it's impossible to lose money—and of course many people saw it just this way. In point of fact, even with such a strong bull market in these stocks, a portfolio risk model could have predicted substantial potential for loss.

To explore this issue, we have used the Quantext Retirement Planner (QRP) model but constrained it to use market data from the start of January 1997 through the end of December in 2000, the period shown in Figure 2. Using the market data for these firms

from this incredible growth period, the QRP is then used to calculate portfolio risk and return going forward.

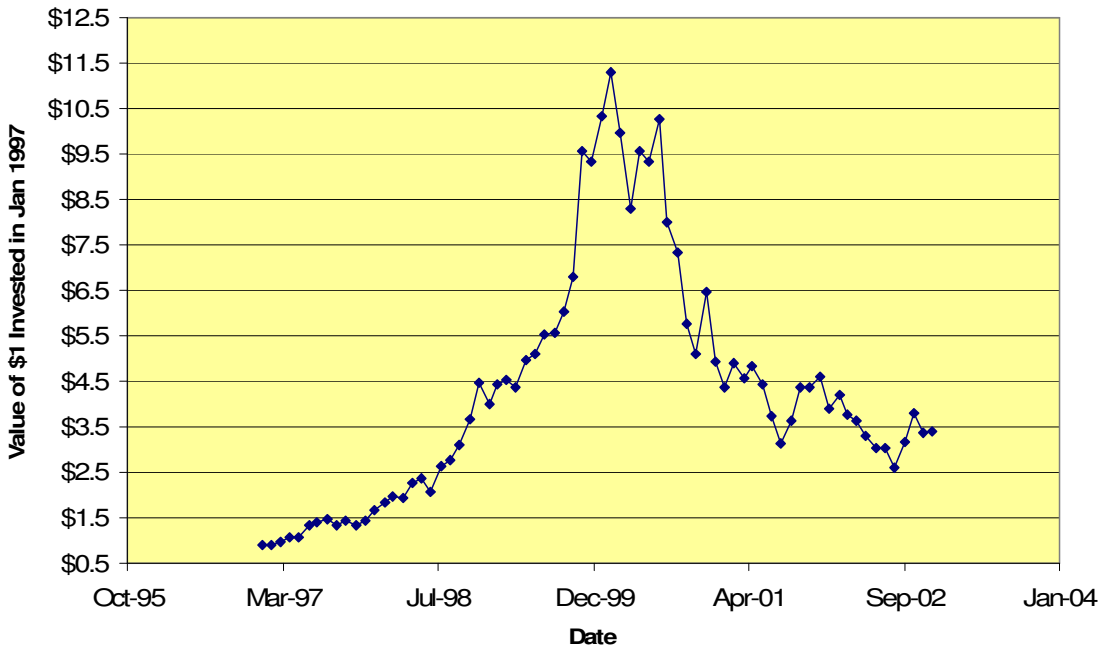

Figure 3: Portfolio for a longer time period

The really interesting question is whether the portfolio risk model would have shown the potential for loss in this portfolio, given that the historical period that the model uses for analysis shows only growth.

Quantext Retirement Planner

The Quantext Retirement Planner (QRP) starts with historical data on a series of stocks or funds in the portfolio. The user specifies the historical period which the QRP will use to calculate risk, return, and Beta for the individual stocks. In this case, we have specified the period from January 1, 1997 to January 1, 2000 (Figure 4). As we show screens from QRP, note that the variables that are input or can be changed by the user are in red. The pure historical statistics for these stocks are over this three year period are shown in the top half of the table on the left side of Figure 4. Most of these stocks show very high

Beta and very high Standard Deviation (SD) of returns. All values in this table are annualized. As a point of reference, see the bottom of Figure 4 which shows that the average return and standard deviation of return for the S&P500 over this three year period. Beta for the S&P500 is equal to 100%. The standard deviation in return is a measure of the volatility of a stock or fund and represents size of swings around the average that are common. The annualized standard deviation of return for the S&P500 over this three year period was 16.8%--less than half that for any of the individual stocks in the portfolio. Beta measures the degree to which a stock moves with the market and a high Beta means that a stock tends to amplify market swings.

Pure Historical Data					
Ticker	Beta	SD	Alpha	Average Annual Return	Check Data Length
NOVL	172.55%	80.90%	24.48%	64.24%	OK
DELL	178.55%	57.84%	62.94%	104.07%	OK
CSCO	142.99%	41.51%	43.28%	76.22%	OK
AAPL	65.07%	56.22%	63.77%	78.76%	OK
INTC	119.43%	41.92%	5.44%	32.95%	OK
JDSU	201.20%	61.31%	92.62%	138.97%	OK
ORCL	169.71%	74.18%	50.77%	89.87%	OK
MSFT	142.70%	42.03%	28.34%	61.22%	OK
YHOO	317.52%	99.10%	121.84%	194.99%	OK
EXC	8.12%	34.04%	22.80%	24.67%	OK
Risk-Return Balanced					
Ticker	Beta	SD	Alpha	Average Annual Return	
NOVL	172.55%	79.77%	24.38%	42.15%	
DELL	178.55%	57.03%	12.50%	30.89%	
CSCO	142.99%	40.93%	8.19%	22.91%	
AAPL	65.07%	55.43%	23.40%	30.10%	
INTC	119.43%	41.33%	10.81%	23.11%	
JDSU	201.20%	60.45%	11.86%	32.58%	
ORCL	169.71%	73.14%	21.39%	38.87%	
MSFT	142.70%	41.44%	8.47%	23.17%	
YHOO	317.52%	97.70%	18.34%	51.04%	
EXC	8.12%	33.56%	18.43%	19.27%	

	SD	Average Annual Return
S&P500	16.81%	23.04%

Start Date	End Date
1/1/1997	1/1/2000

GET DATA: ctrl-r

Months	Years
36	3.0

Use Historical Data
ctrl-u

Use Risk-Balanced Data
ctrl-e

Figure 4: Parameters derived from historical period from 1997-1999

The average annual returns for each of these companies are very impressive for the three year period. QRP allows the user to use historical data as the basis for planning but simply extrapolating history forward does not make sense. No rational person could believe that these levels of return would continue indefinitely. This is where the *Risk-Return Balanced* parameters come in. There are no immutable facts about the balance of

risk and return, except that they to tend to go hand in hand. For calculating the *Risk-Return Balanced* parameters, QRP automatically calibrates the projected average annual return so that the balance between projected return and volatility (standard deviation) is consistent with the long-term balance between risk and return in stocks and bonds. The projected standard deviation in the risk-balanced parameters also depends on the projected long-term standard deviation in return for the market as a whole—which in this case is quite close to the market standard deviation for this three year period, so the risk-return balanced SD is largely unchanged from the pure historical values. The main difference that we see between the *Pure Historical* parameters and the *Risk-Return Balanced* parameters is that Alpha and Average Annual Return are considerably lower in *Risk-Return Balanced* parameters. While you can use pure historical data for portfolio planning, this approach assumes that stocks or funds that have recently been winners will remain winners in the future. This is not what the markets show us. *The Risk-Return Balanced* parameters are a reasonable projection for portfolio management. This does not mean that we are being highly conservative, however. Note that based on the three year period from 1997-1999, the risk-return balanced projection is for DELL to have an average annual return of more than 30% per year—and that's not the highest.

When we click the button to use *Risk-Return Balanced* data in our portfolio calculations (ctrl-e or simply click the button), QRP runs the portfolio Monte Carlo simulation for the entire portfolio using these parameters. The portfolio projection yields Figure 5. We have assumed a long-term average return for the market as a whole of about 10%, which is what people were using back in the days of the bull market. We have also assumed that the average long-term standard deviation (SD) on market returns is around 16.5%, close to the historical value for the most recent three years and close to the long-term average for the S&P500 (the average for SD for the S&P500 over the last 60 years in 16.7%). The table marked *Historical Data* in Figure 5 is the historical performance of this portfolio over the period selected (1997-1999). The average annual return over these trailing three years is more than 85% per year, and the standard deviation in return is 39%, more than the twice the level of volatility for the S&P500. Further, the historical Beta is about 150%, which means that the portfolio tends to amplify market swings.

Fund or Stock Ticker	Beta	Standard Deviation (Annual)	Alpha (Annual)	Check
NOVL	172.6%	79.77%	19.21%	OK
DELL	178.5%	57.03%	7.15%	OK
CSCO	143.0%	40.93%	3.90%	OK
AAPL	65.1%	55.43%	21.45%	OK
INTC	119.4%	41.33%	7.23%	OK
JDSU	201.2%	60.45%	5.83%	OK
ORCL	169.7%	73.14%	16.30%	OK
MSFT	142.7%	41.44%	4.19%	OK
YHOO	317.5%	97.70%	8.82%	OK
EXC	8.1%	33.56%	18.19%	OK

Annual Return = Beta x (Annual Return on S&P500)+Alpha

Note: This definition for Alpha has rolled in the risk-free rate of return

Fund Name	Percentage of Funds	Average Annual Return
NOVL	10.0%	36.90%
DELL	10.0%	25.54%
CSCO	10.0%	18.84%
AAPL	10.0%	28.18%
INTC	10.0%	19.55%
JDSU	10.0%	26.42%
ORCL	10.0%	33.85%
MSFT	10.0%	19.11%
YHOO	10.0%	41.39%
EXC	10.0%	19.03%
Sums to	100.0%	

Simulated Portfolio Beta: 152.52%

Portfolio Stats	
Average Annual Return	Standard Deviation (Annual)
26.88%	34.49%

Historical Data	
Start: 1/1/1997	End: 1/1/2000
Average Annual Return	Standard Deviation (Annual)
86.60%	38.90%
Historical Beta: **151.78%**	

Market Index (S&P500)	
Average Annual Return	Standard Deviation (Annual)
10.30%	16.57%

Figure 5: Simulated portfolio using QRP Monte Carlo

The results from the Monte Carlo simulation, using the *Risk-Return Balanced* data that we selected are given in Portfolio Stats (Figure 5). The Monte Carlo model projects a long-term average return of 26.88% per year and a standard deviation of 34.49% per year. The projected return for this portfolio is about 1/3 of the return that is has seen over the trailing three years. Using the projected values, this is a high risk / high return

portfolio. There is nothing wrong with such a portfolio, but even before the crash it was clear that this kind of portfolio can lose money fast as well as making money fast.

One of the functions of QRP is that you can specify a time horizon and the Monte Carlo projects how much you are likely to make or lose over that period. In this case, using the data available at the start of 2000, we project that the portfolio has a 1% chance of losing 49.9% or more in the next year (1% percentile level) and a 5% chance of losing 31% or more in the next year (Figure 6).

Portfolio Value: **$100,000**

Time Horizon (days): 365
Portfolio Beta: 152.52%

Percentile	Portfolio Value	Gain / Loss	Return
1%	$50,144	-$49,856	-49.9%
5%	$69,003	-$30,997	-31.0%
10%	$81,471	-$18,529	-18.5%
15%	$90,330	-$9,670	-9.7%
20%	$97,754	-$2,246	-2.2%
25%	$102,780	$2,780	2.8%
30%	$108,718	$8,718	8.7%
35%	$114,409	$14,409	14.4%
40%	$118,593	$18,593	18.6%
45%	$123,161	$23,161	23.2%
50%	**$127,589**	**$27,589**	**27.6%**
55%	$131,972	$31,972	32.0%
60%	$135,893	$35,893	35.9%
65%	$140,198	$40,198	40.2%
70%	$145,400	$45,400	45.4%
75%	$149,898	$49,898	49.9%
80%	$155,351	$55,351	55.4%
85%	$161,892	$61,892	61.9%
90%	$169,615	$69,615	69.6%
95%	$184,813	$84,813	84.8%
99%	$207,143	$107,143	107.1%
Average	**$126,881**	**$26,881**	**26.9%**

Figure 6: Monte Carlo projected percentiles for portfolio return over one year

Further, when we project over the next two years (Figure 7), we find a 1% chance of losing at least 54.8% over this period and a 5% chance of losing at least 28.3% over this period.

Portfolio Value: **$100,000**

Time Horizon (days): 720
Portfolio Beta: 152.52%

Percentile	Portfolio Value	Gain / Loss	Return
1%	$45,249	-$54,751	-54.8%
5%	$71,737	-$28,263	-28.3%
10%	$89,247	-$10,753	-10.8%
15%	$101,689	$1,689	1.7%
20%	$112,117	$12,117	12.1%
25%	$119,176	$19,176	19.2%
30%	$127,516	$27,516	27.5%
35%	$135,508	$35,508	35.5%
40%	$141,385	$41,385	41.4%
45%	$147,801	$47,801	47.8%
50%	**$154,020**	**$54,020**	**54.0%**
55%	$160,176	$60,176	60.2%
60%	$165,683	$65,683	65.7%
65%	$171,729	$71,729	71.7%
70%	$179,035	$79,035	79.0%
75%	$185,353	$85,353	85.4%
80%	$193,011	$93,011	93.0%
85%	$202,198	$102,198	102.2%
90%	$213,045	$113,045	113.0%
95%	$234,391	$134,391	134.4%
99%	$265,753	$165,753	165.8%
Average	**$153,026**	**$53,026**	**53.0%**

Figure 7: Monte Carlo projected percentiles for portfolio return over two years

It is important to understand what these projections mean. First, the 1% percentile level means that you have a 1% chance of having this return (or worse) and a 99% chance of having this return or better.

Discussion

The projections shown here were generated using a fully automated simulation model (QRP) and using information that was available at the start of the year in 2000. The sample portfolio, equally allocated between some of the high-fliers of the late 1990's, is shown to be a high return / high risk portfolio. There is nothing inherently wrong with this portfolio, but it was clearly a high risk portfolio to put together. While the portfolio had tremendous gains in the late 1990's, it lost 37% in the year 2000 and 56% in 2000-2001. The QRP, using data from the late 90's bull market, generated risk projections that are consistent with the losses that this portfolio incurred (Figure 6 and 7). This does not mean that the QRP forecasted that the market was about to drop, but rather that this portfolio had a real potential to sustain heavy losses that was easily projected even during an historic run-up. For some people, seeing these portfolio projections may not have caused any change in behavior. For many others, however, I believe that having a concrete sense of the enormous loss potential of this sort of high volatility and high-Beta portfolio could have led to more conservative decisions that would have resulted in less dramatic losses.

If we now take the three years of historical data from January 1, 2002 through January 1, 2005, how do the projections look for the same portfolio? Remarkably, given how different this historical period is from the period 1997-1999, the projected risk and return for this portfolio is not dramatically different (Figure 8). The simulation model's projected parameters are for long-term planning and the long-term business prospects for these firms, while uncertain, have not diminished over the stock market decline. Certainly the market's opinions of the firms' prospects have been volatile, but the fact that the projected long-term average and standard deviation are reasonably stable is a manifestation of the quote often attributed to Warren Buffett that the stock market is a betting machine in the short-term and a weighing machine in the long-term. The long-term measurable potential of these firms has not changed dramatically, so their projected statistics should be reasonably stable.

Fund or Stock Ticker	Beta	Standard Deviation (Annual)	Alpha (Annual)	Check
NOVL	244.2%	71.99%	18.04%	OK
DELL	93.6%	23.65%	6.59%	OK
CSCO	184.5%	41.35%	7.81%	OK
AAPL	128.7%	40.95%	12.24%	OK
INTC	202.7%	45.22%	8.22%	OK
JDSU	268.3%	63.81%	11.99%	OK
ORCL	124.0%	42.09%	13.20%	OK
MSFT	100.2%	24.40%	6.41%	OK
YHOO	216.1%	53.93%	11.43%	OK
EXC	35.3%	13.85%	6.57%	OK

Annual Return = Beta x (Annual Return on S&P500)+Alpha

Note: This definition for Alpha has rolled in the risk-free rate of return

Fund Name	Percentage of Funds	Average Annual Return
NOVL	10.0%	38.17%
DELL	10.0%	14.35%
CSCO	10.0%	23.30%
AAPL	10.0%	22.89%
INTC	10.0%	25.00%
JDSU	10.0%	34.09%
ORCL	10.0%	23.51%
MSFT	10.0%	14.85%
YHOO	10.0%	29.26%
EXC	10.0%	9.48%
Sums to	100.0%	

Simulated Portfolio Beta: 160.54%

Portfolio Stats	
Average Annual Return	Standard Deviation (Annual)
23.49%	29.02%

Historical Data	
Start: 1/1/2002	End: 1/1/2005
Average Annual Return	Standard Deviation (Annual)
18.01%	29.74%
Historical Beta: **159.78%**	

Market Index (S&P500)	
Average Annual Return	Standard Deviation (Annual)
8.30%	15.07%

Calculator by Quantext

Figure 8: Looking ahead for our 'bubble portfolio.'

Conclusions

The purpose of this analysis has been to show that a good portfolio management tool can help to provide insight into the risk-return characteristics of a portfolio that may not be evident from simply looking at recent performance. The Quantext Retirement Planner is a portfolio management tool for individuals that provides the capability to simulate future portfolio and market outcomes so as to account for risk and return characteristics of a total portfolio.

In this discussion, we are looking only at a single feature of portfolio management: simulating future risk and return. This is the starting point for effective planning. Too often, investors chase the best recent returns in stocks and funds, with predictably deleterious effects on long-term portfolio performance. Similarly, there is a natural human tendency to discount the possibility of something that has not happened for quite a while. Indeed, this is how market bubbles grow. The longer the market goes without a downturn, the more aggressive investors become. The risk-return balanced portfolio simulation in QRP can help investors to overcome these hurdles in their long-term portfolio management.

About Quantext and QRP

Quantext Retirement Planner is a portfolio management and planning tool for individuals. The QRP is a Monte Carlo tool, which means that it simulates hundreds of possible market futures. Each simulated future outcome for the market and portfolio is a possible future evolution of the market and your portfolio. Monte Carlo is critical if you are to account for the impact of uncertainty on your future and this is discussed at length at http://www.quantext.com/MCFaq.html. The simulated portfolios in QRP are comprised of stock, stock funds, and bond funds. QRP can also account for employee stock options and their impact on the total portfolio. QRP's ultimate output is to project the probability that your portfolio will successfully provide a specified level of income into the future. You can see an online presentation on QRP at: http://www.quantext.com/QRP_files/frame.htm.

Quantext is a private consulting and software firm based in Boulder, CO. For more information about our firm and for contact information, please visit Quantext.com.