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## How Bumpy is the Ride Anyhow? Volatility Part One

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**V**olatility has become a vocabulary mainstay for market pundits in recent days. Some people embrace the mayhem, profiting from big swings in prices, while others disdain the uncertainty because it makes long-term financial planning difficult. Whatever one's perspective, experts foretell a bumpy ride ahead so it makes sense to understand what volatility means and how to measure it.

### Defining Volatility

Quicken.com defines volatility as "the measurement of the propensity of a stock, bond, mutual fund, commodity

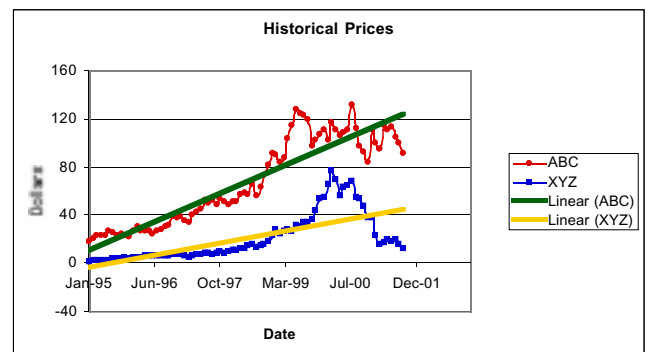
or market to rise or fall sharply in price."<sup>1</sup> The Washington Post.com Business Guide describes volatility as "a measure of risk based on standard deviation in fund performance over three years."<sup>2</sup> Other definitions, shown in Table One, are likewise dissimilar, highlighting the confusion about what it means to characterize something as "volatile."

About the only thing that people agree on is that volatility has something to do with movement in prices (or change in prices), but even that consensus is ambiguous. Consider a graph in Figure 1 of month-end closing prices for two technology companies, based on January 1995 through September 2001 data.<sup>3</sup> Stock prices rise for a long period of time and then drop around the spring of 2000. Is ABC more volatile than XYZ? Looking at the graph alone, it is hard to say. For one thing, should we characterize the entire 81-month period or

TABLE ONE: DEFINITIONS OF VOLATILITY

SOURCE	EXCERPTS OF DEFINITION
Campbell R. Harvey's Hypertextual Finance Glossary <a href="http://www.AFPonline.org/dictionary/bfglosa.html">www.AFPonline.org/dictionary/bfglosa.html</a>	"A measure of risk based on the standard deviation of the asset return."
Contingency Analysis <a href="http://www.contingencyanalysis.com/glossaryvolatility.com">www.contingencyanalysis.com/glossaryvolatility.com</a>	"The volatility of a financial variable is its degree of random variability."
Finance-Glossary.com	"A measure of a share's propensity to go up and down in price."
InvestorWords.com	"The relative rate at which the price of a security moves up and down; found by calculating the annualized standard deviation of daily change in price."
Quicken.com	"Measurement of the propensity of a stock, bond, mutual fund, commodity or market to rise or fall sharply in price."
Washingtonpost.com: Business Guide	"A measure of risk based on standard deviation in fund performance over three years."

FIGURE 1



continued



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look at shorter time periods? Second, it is better to evaluate movement relative to the trend line or the average stock price?

### Quantifying Volatility

Volatility can be measured in many different ways. Some prefer beta, an indicator of market risk for an investor assumed to hold a well-diversified portfolio.<sup>4</sup> Others use the standard deviation, a statistical assessment of total risk that looks at movement around the average. However, ABC's standard deviation from Table Two is hard to interpret because its \$67.40 average stock price is so much bigger than the \$20.72 average stock price for XYZ. We might be tempted to rank ABC as a more volatile stock but we would be ignoring the disparity in mean price incorrectly. The coefficient of variation addresses this problem by dividing standard deviation by average price.<sup>5</sup> On this basis, ABC is classified as less volatile than XYZ since its coefficient of variation is smaller, 0.54 versus 0.96.

**TABLE TWO: SUMMARY STATISTICS USING PRICE DATA**

1995 – 2001 YTD	ABC	XYZ
Average Stock Price (\$)	67.40	20.72
Standard Deviation (\$)	36.22	19.89
Coefficient of Variation	0.54	0.96

Even if everyone agrees on a common approach, data issues cloud the picture. Should returns be used in lieu of prices? What are the advantages of using daily data instead of weekly or monthly information? Does it matter where the data comes from? How do the data vendors compare?

The output is dramatically different when month-to-month return data is used instead of prices. Instead of ranking ABC as low risk, Table Three's results suggest otherwise.

**TABLE THREE: SUMMARY STATISTICS USING RETURNS DATA**

1995 – 2001 YTD	ABC	XYZ
Average Stock Return (%)	2.54	3.29
Standard Deviation (%)	9.99	13.19
Coefficient of Variation	3.93	4.01

A standard deviation of approximately 10.00 percent and a coefficient of variation of 4.00 each reflect the dramatic movement in stock returns for both companies. The moral of the story is clear. Analyzing volatility depends on the type of data used.

Complicating things further, volatility changes over time so the choice of calendar dates is yet another influence on output. Numbers provided in Table Four show that both companies experienced a lot of variability in month-to-month returns during the period from 1997 through 2000, following the more subdued earlier years.<sup>6</sup>

continued

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### Where Does This Leave Us?

Despite different definitions, alternative measurement methods and the impact of data choice on the final numbers, many companies nevertheless include volatility as part of their financial planning. Simulating future profitability, pricing derivative instruments and determining how to hedge depend on having good estimates of volatility. Part Two, featured in a future issue of *AFP Pulse*, will discuss these applications. ●

TABLE FOUR: SUMMARY STATISTICS  
USING RETURNS DATA

<b>1996</b>	<b>ABC</b>	<b>XYZ</b>
Average Stock Return (%)	4.77	4.85
Standard Deviation (%)	10.37	8.32
Coefficient of Variation	2.17	1.72
<b>1998</b>	<b>ABC</b>	<b>XYZ</b>
Average Stock Return (%)	5.23	8.41
Standard Deviation (%)	10.52	9.71
Coefficient of Variation	2.01	1.15
<b>2000</b>	<b>ABC</b>	<b>XYZ</b>
Average Stock Return (%)	-1.48	-1.84
Standard Deviation (%)	10.21	14.11
Coefficient of Variation	6.90	7.67

### Endnotes:

<sup>1</sup> Refer to the glossary linked from [www.quicken.com](http://www.quicken.com).

<sup>2</sup> Refer to the glossary linked from [www.washingtonpost.com](http://www.washingtonpost.com).

<sup>3</sup> The names of the two companies are disguised, to keep the focus on volatility.

<sup>4</sup> Beta and standard deviation are mentioned because they are frequently used but are certainly not the only ways to measure volatility.

<sup>5</sup> Like the standard deviation, a coefficient of variation close to zero indicates low variability, relative to the average. A coefficient of variation has no unit of denomination like percent or dollars. It is just a number such as 0.54.

<sup>6</sup> Standard deviation will always be a non-negative number. Returns can be either negative or positive. However, common practice is to ignore a negative return in the numerator and report the coefficient of variation in absolute value form.

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