BASIC MEASURES OF RISK

WHAT WILL YOU LEARN?

▶ Types of risk

▶ Basic measures of risk

TYPES OF RISK

‣Business cycle

‣Credit

‣Default

‣Interest rate

‣Exchange rate

‣Liquidity

‣Volatility

‣Political

‣Market

‣Legal

‣Operational

HOW DO WE MEASURE RISK?

‣The most common measure of risk is volatility of returns.

‣Volatility is measured by the standard deviation σ of a return distribution.

VOLATILITY

▶Given a sample of N returns,

EXAMPLE: RUSSELL 3000 QUARTERLY RETURNS

	R3000 Quarterly return %	Deviation from the mean	±σ
March 2003	**-24.66**	**-37.48**	**No**
June 2003	0.77	-12.05	Yes
September 2003	25.92	13.11	Yes
December 2003	**31.06**	**18.25**	**No**
March 2004	**38.19**	**25.38**	**No**
June 2004	20.46	7.65	Yes
September 2004	14.26	1.45	Yes
December 2004	11.95	-0.87	Yes
March 2005	7.09	-5.73	Yes
June 2005	8.05	-4.77	Yes
September 2005	14.57	1.76	Yes
December 2005	6.12	-6.70	Yes
Mean	**12.82%**		
Population std. dev.	**15.45%**		
Sample std. dev.	**18.13%**		

Source: Russell research database

ANNUALIZING VOLATILITY

SUMMARY

▸A common measure of risk is the volatility of returns, measured as the standard deviation of the return distribution.

MEASURING BAD VARIATION

WHAT WILL YOU LEARN?

▸Target semivariance
▸Downside risk

WHAT IS SEMIVARIANCE?

▸Semivariance is computed by squaring only negative deviations from the mean.

▸The square root of semivariance is called semideviation.

TARGET SEMIVARIANCE

▸Suppose you have a return target, or a minimal acceptable return (MAR).

▸Target semivariance is the expected squared deviations below the target.

  ▸Target semideviation is the square root of target semivariance.

▸Target semideviation is a measure of downside risk.

LOWER PARTIAL MOMENTS (LPM)

▸ Target semideviation is a special case of lower partial moments (LPM) methodology for dealing with downside variation.

▸ Formula for a lower partial moment of degree p

EXAMPLE: RUSSELL TOP 50 INDEX QUARTERLY DOWNSIDE SEMIVARIANCE

Quarter	Return %	d(i)	Deviation	
200109	-13.39	1	-13.39	
200112	8.98	0	8.98	
200203	-1.69	1	-1.69	
200206	-16.40	1	-16.40	
200209	-15.93	1	-15.93	
200212	10.55	0	10.55	
200303	-2.52	1	-2.52	
200306	13.95	0	13.95	
200309	1.16	0	1.16	
200312	10.17	0	10.17	
200403	-0.57	1	-0.57	
200406	1.04	0	1.04	
Tau	0			
Mean Squared deviation = target semivariance				59.2957
Target semideviation				7.700

Source: Russell research database

UPSIDE SEMIDEVIATION

▸ Upside risk – upside semideviation – is the converse of downside deviation.

SUMMARY

▸ A common measure of risk is the volatility of returns, measured as the standard deviation of the return distribution.

▸ Downside semivariance is a special case of the LPM methodology with power $p = 2$ and target equal to the mean.

▸ Downside deviation is useful when comparing distributions that are not normal and have different means.

TRACKING ERROR AND RESIDUAL RISK

WHAT WILL YOU LEARN?

▸ Tracking error
▸ Residual risk

TRACKING ERROR

▸ Tracking error is the standard deviation of the arithmetic excess return.

RESIDUAL RISK

TRACKING ERROR VS. RESIDUAL RISK

▸When beta is equal to 1, the tracking error and the residual risk are equal.

▸When beta is not equal to 1, the tracking error and the residual risk differ from each other.

SUMMARY

▸Tracking error and residual risk

▸When alpha equals the arithmetic excess return, residual risk equals tracking error.