

On the Assessment of Risk

Marshal E. Blume [1971]

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Agenda

- Introduction And Contribution
- The Rational Of β As A Measure Of Risk
- The Sample And Its Statistics
- The Stationary Of Beta Over Time
- Conclusion

Introduction and Contribution

- Introduction
 - β is can be used as a measure of risk for both *single security* and *portfolio*
 - Economics variables, including betas, usually change over time, but we can, at some level ,assess future value of risk based on historical value of beta
 - Blume purposes a way to *adjusted* the traditional beta so as to get a better assessment for future risk
- Contribution
 - An improved method of risk assessment

β as a measure of risk

- β represent *systematic risk* which cannot be diversified away
- It is a risk which is correlated with market portfolio
$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \quad \beta_i = \frac{\text{Cov}(R_i, R_m)}{\text{Var}(R_m)}$$
- To test empirical validity of the market model, this model is purpose
$$\tilde{R}_{it} = \alpha_i + \beta_i \tilde{M}_t + \tilde{\varepsilon}_{it}, \quad (1)$$
 - where β_i is the appropriate parameter for each security and ε is assume to be independent of M_t and $\text{Cov}(\varepsilon_i, \varepsilon_j) = 0$
- β as a measure of risk can be justified in 2 different ways
 - The portfolio approach
 - The equilibrium approach

β as a measure of risk

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- **The portfolio approach:** the risk of a portfolio as a whole

$$\text{Var}(\tilde{W}_t) = \left(\sum_{i=1}^n \frac{1}{n} \beta_i\right)^2 \text{Var}(\tilde{M}_t) + \sum_{i=1}^n \left(\frac{1}{n}\right)^2 \text{Var}(\tilde{\epsilon}_{it}) \quad (2)$$

- Wt is a portfolio with n securities with equal amount invested, each security have its beta as according to market model

$$\text{Var}(\tilde{W}_t) = \bar{\beta}^2 \text{Var}(\tilde{M}_t) + \frac{\text{Var}(\tilde{\epsilon})}{n} \quad (3)$$

A well diversified port will have this much risk

more risk if betas is bigger

less risk if n is bigger

β as a measure of risk

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- **The equilibrium approach**

$$E(\tilde{R}_{it}) - R_F = \beta_i [E(\tilde{M}_t) - R_F] \quad (4)$$

risk premium of security

risk premium of market

- The risk premium for an individual security is *proportional* to the risk premium for the market.
- Theoretically sound but usually not hold in the real world because of *riskfree* assumption

The Sample and Its Statistics

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- Data
 - Venue: NYSE
 - Date: July 1926 – June 1968 (42y)
 - Freq: Monthly
 - Data: Stock prices adjusted for dividend/capital gains
- 6 Sub Period



The Sample and Its Statistics

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- For each period, calculate beta for each stock

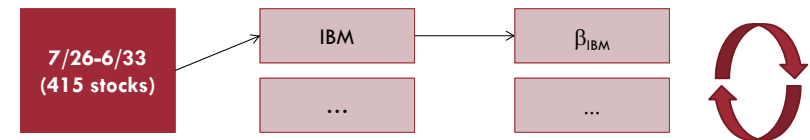


TABLE 1
DESCRIPTIVE SUMMARY OF ESTIMATED BETA COEFFICIENTS

Period	Number of Companies	Mean	Standard Deviation	Number of BETAS less than Zero	Fractiles				
					.10	.25	.50	.75	.90
7/26-6/33	415	1.051	0.462	1	0.498	0.711	1.023	1.352	1.616
7/33-6/40	604	1.036	0.474	0	0.436	0.701	1.015	1.349	1.581
7/40-6/47	731	0.990	0.304	0	0.300	0.543	0.872	1.186	1.606
7/47-6/54	870	1.010	0.409	2	0.473	0.727	0.996	1.263	1.565
7/54-6/61	890	0.998	0.423	0	0.458	0.678	0.984	1.250	1.558
7/61-6/68	847	0.962	0.390	4	0.475	0.681	0.934	1.199	1.491

On the Assessment of Risk

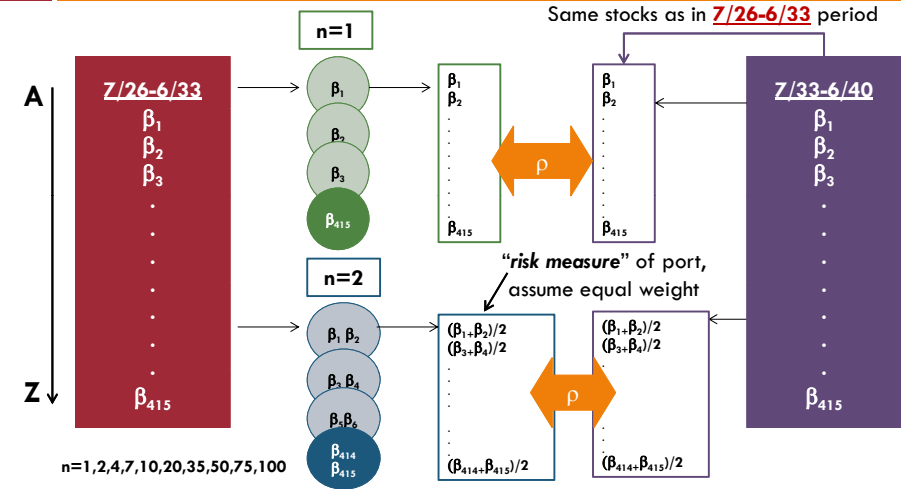
few stocks move opposite the market

The Stationary Of Beta Over Time

- Even though betas are not constant over time, investors may wish to act *as if* it is constant or *stationary* over time; reason may be bec..
 - [To assess risk] Investor wish to know the average β_i over time, but not directly on the value individual security
 - [To evaluate port] historical β_i maybe sufficient unbiased estimator of future value(given that it is stationary)
- In short:** we can use past betas to predict future betas, if it is stationary

The Stationary Of Beta Over Time

A. Correlation



The Stationary Of Beta Over Time

A. Correlation

TABLE 2
PRODUCT MOMENT AND RANK ORDER CORRELATION COEFFICIENTS
OF BETAS FOR PORTFOLIOS OF N SECURITIES

Number of Securities per Portfolio	7/26-6/33 and 7/33-6/40		7/33-6/40 and 7/40-6/47		7/40-6/47 and 7/47-6/54		7/47-6/54 and 7/54-6/61		7/54-6/61 and 7/61-6/68	
	P.M.	Rank	P.M.	Rank	P.M.	Rank	P.M.	Rank	P.M.	Rank
1	0.63	0.69	0.62	0.73	0.59	0.65	0.65	0.67	0.60	0.62
2	0.71	0.75	0.76	0.83	0.72	0.79	0.76	0.76	0.73	0.74
4	0.80	0.84	0.85	0.90	0.81	0.89	0.84	0.84	0.84	0.85
7	0.86	0.90	0.91	0.93	0.88	0.93	0.87	0.88	0.88	0.89
10	0.89	0.93	0.94	0.95	0.90	0.95	0.92	0.93	0.92	0.93
20	0.93	0.99	0.97	0.98	0.95	0.98	0.95	0.96	0.97	0.98
35	0.96	1.00	0.98	0.99	0.95	0.99	0.97	0.98	0.97	0.97
50	0.98	1.00	0.99	0.98	0.98	0.99	0.98	0.98	0.98	0.97

- Correlation is stronger when n is larger
 - For single stock or small portfolio, the previous data can *explain* a little
 - For a larger portfolio, previous data can *explain* a lot

The Stationary Of Beta Over Time

B. A Closer Examination

TABLE 3
ESTIMATED BETA COEFFICIENTS FOR PORTFOLIOS OF 100 SECURITIES
IN TWO SUCCESSIVE PERIODS

Portfolio	7/26-6/33		7/33-6/40		7/40-6/47		7/47-6/54		7/54-6/61		7/61-6/68	
	7/26-6/33	7/33-6/40	7/33-6/40	7/40-6/47	7/40-6/47	7/47-6/54	7/47-6/54	7/54-6/61	7/54-6/61	7/61-6/68	7/61-6/68	
1	0.528	0.610	0.394	0.573	0.442	0.593	0.385	0.553	0.393	0.620		
2	0.898	1.004	0.708	0.784	0.615	0.776	0.654	0.748	0.612	0.707		
3	1.225	1.296	0.925	0.902	0.746	0.887	0.832	0.971	0.810	0.861		
4			1.177	1.145	0.876	1.008	0.967	1.010	0.987	0.914		
5			1.403	1.354	1.037	1.124	1.093	1.095	1.138	0.995		
6			1.282	1.251	1.245	1.243	1.337	1.169				

- Some tendencies
 - Recal β port with same set of stocks as in previous period
 - See 1(lowest risk): low in 1st period and high in 2nd period
 - See 6(highest risk): high in 1st period and low in 2nd period
- Hence, estimated *beta coefficients* in one period are biased assessment of future value and tends to regress towards means

The Stationary Of Beta Over Time

C. Method of Correction

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- Regress the estimated values of β_1 in one period on the values estimated in a *previous* period

TABLE 4
MEASUREMENT OF REGRESSION TENDENCY OF ESTIMATED BETA COEFFICIENTS FOR INDIVIDUAL SECURITIES

Regression Tendency Implied Between Periods	$\beta_2 = a + b\beta_1$
7/33-6/40 and 7/26-6/33	$\beta_2 = 0.320 + 0.714\beta_1$
7/40-6/47 and 7/33-6/40	$\beta_2 = 0.265 + 0.750\beta_1$
7/47-6/54 and 7/40-6/47	$\beta_2 = 0.526 + 0.489\beta_1$
7/54-6/61 and 7/47-6/54	$\beta_2 = 0.343 + 0.677\beta_1$
7/61-6/68 and 7/54-6/61	$\beta_2 = 0.399 + 0.546\beta_1$

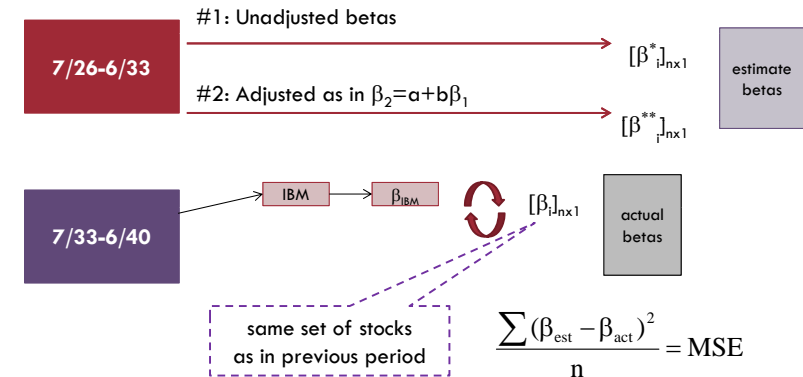
- This model assume that extreme beta will always adjust back to its mean
- Then, uses this *relationship*(α, β) to adjust for assessment

The Stationary Of Beta Over Time

C. Method of Correction

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- Compare future betas with actual beta(MSE)



The Stationary Of Beta Over Time

C. Method of Correction

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- To correct the assessment: beta of individual risk is adjusted by model in table 4, then the error of measurement is compared between the 2 method

TABLE 5
MEAN SQUARE ERRORS BETWEEN ASSESSMENTS AND FUTURE ESTIMATED VALUES

Number of Sec./ Port.	Assessments Based Upon							
	7/33-6/40		7/40-6/47		7/47-6/54		7/54-6/61	
	unadjusted	adjusted	unadjusted	adjusted	unadjusted	adjusted	unadjusted	adjusted
1	0.1929	0.1808	0.1747	0.1261	0.1203	0.1087	0.1305	0.1013
2	0.0915	0.0813	0.1218	0.0736	0.0729	0.0614	0.0827	0.0535
4	0.0538	0.0453	0.0958	0.0483	0.0495	0.0381	0.0587	0.0296
7	0.0323	0.0247	0.0631	0.0276	0.0387	0.0281	0.0523	0.0231
10	0.0243	0.0174	0.0535	0.0220	0.0305	0.0189	0.0430	0.0169
20	0.0160	0.0090	0.0328	0.0106	0.0258	0.0139	0.0291	0.0089
35	0.0120	0.0055	0.0266	0.0080	0.0197	0.0101	0.0302	0.0089
50	0.0096	0.0046	0.0192	0.0046	0.0122	0.0097	0.0237	0.0064
75	0.0081	0.0035	0.0269	0.0067	0.0112	0.0078	0.0193	0.0056
100	0.0084	0.0020	0.0157	0.0035	0.0114	0.0084	0.0195	0.0056

- Notice that the adjusted ones MSE are less than the other

Conclusion

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- Conclusion
 - Risks, or betas, usually changes overtime. However, if betas are stationary, we can use past betas to estimate future betas
 - The empirical results suggest that there is a regression tendency in the data generating process; therefore the beta estimation should be adjusted accordingly
 - The adjusted beta assessment result provide a better assessment of future risk