

Business p. (IBM)

Capital Asset Pricing Model (CAPM)

Difficulty: **Intermediate**

Capital asset pricing model (CAPM) indicates what should be the expected or required rate of return on risky assets like IBM's common stock.

- Rates of Return
- Systematic Risk (β) Estimation
- Expected Rate of Return

Rates of Return

International Business Machines Corp., monthly rates of return

International Business Machines Corp. (IBM)					Standard & Poor's 500 (S&P 500)	
t	Date	$Price_{IBM,t}^1$	$Dividend_{IBM,t}^1$	$R_{IBM,t}^2$	$Price_{S\&P\ 500,t}$	$R_{S\&P\ 500,t}^3$
	Jan 31, 2012	192.60			1,312.41	
1.	Feb 29, 2012	196.73	0.75	2.53%	1,365.68	4.06%
2.	Mar 31, 2012	208.65		6.06%	1,408.47	3.13%
3.	Apr 30, 2012	207.08		-0.75%	1,397.91	-0.75%
4.	May 31, 2012	192.90	0.85	-6.44%	1,310.33	-6.27%
5.	Jun 30, 2012	195.58		1.39%	1,362.16	3.96%
6.	Jul 31, 2012	195.98		0.20%	1,379.32	1.26%
7.	Aug 31, 2012	194.85	0.85	-0.14%	1,406.58	1.96%
8.	Sep 30, 2012	207.45		6.47%	1,440.67	2.42%
9.	Oct 31, 2012	194.53		-6.23%	1,412.16	-1.96%

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10.	Nov 30, 2012	190.07	0.85	-1.86%	1,416.18	0.28
11.	Dec 31, 2012	191.55		0.78%	1,426.19	0.71
12.	Jan 31, 2013	203.07		6.01%	1,498.11	5.04
13.	Feb 28, 2013	200.83	0.85	-0.68%	1,514.68	1.11
14.	Mar 31, 2013	213.30		6.21%	1,569.19	3.60
15.	Apr 30, 2013	202.54		-5.04%	1,597.57	1.81
16.	May 31, 2013	208.02	0.95	3.17%	1,630.74	2.08
17.	Jun 30, 2013	191.11		-8.13%	1,606.28	-1.50
18.	Jul 31, 2013	195.04		2.06%	1,685.73	4.95
19.	Aug 31, 2013	182.27	0.95	-6.06%	1,632.97	-3.13
20.	Sep 30, 2013	185.18		1.60%	1,681.55	2.97
21.	Oct 31, 2013	179.21		-3.22%	1,756.54	4.46
22.	Nov 30, 2013	179.68	0.95	0.79%	1,805.81	2.80
23.	Dec 31, 2013	187.57		4.39%	1,848.36	2.36
24.	Jan 31, 2014	176.68		-5.81%	1,782.59	-3.56
25.	Feb 28, 2014	185.17	0.95	5.34%	1,859.45	4.31
26.	Mar 31, 2014	192.49		3.95%	1,872.34	0.69
27.	Apr 30, 2014	196.47		2.07%	1,883.95	0.62
28.	May 31, 2014	184.36	1.10	-5.60%	1,923.57	2.10
29.	Jun 30, 2014	181.27		-1.68%	1,960.23	1.91
30.	Jul 31, 2014	191.67		5.74%	1,930.67	-1.51
31.	Aug 31, 2014	192.30	1.10	0.90%	2,003.37	3.77
32.	Sep 30, 2014	189.83		-1.28%	1,972.29	-1.55
33.	Oct 31, 2014	164.40		-13.40%	2,018.05	2.32
34.	Nov 30, 2014	162.17	1.10	-0.69%	2,067.56	2.45
35.	Dec 31, 2014	160.44		-1.07%	2,058.90	-0.42
36.	Jan 31, 2015	153.31		-4.44%	1,994.99	-3.10
37.	Feb 28, 2015	161.94	1.10	6.35%	2,104.50	5.49
38.	Mar 31, 2015	160.50		-0.89%	2,067.89	-1.74
39.	Apr 30, 2015	171.29		6.72%	2,085.51	0.85
40.	May 31, 2015	169.65	1.30	-0.20%	2,107.39	1.05
41.	Jun 30, 2015	162.66		-4.12%	2,063.11	-2.10

42.	Jul 31, 2015	161.99		-0.41%	2,103.84	1.97
43.	Aug 31, 2015	147.89	1.30	-7.90%	1,972.18	-6.26
44.	Sep 30, 2015	144.97		-1.97%	1,920.03	-2.64
45.	Oct 31, 2015	140.08		-3.37%	2,079.36	8.30
46.	Nov 30, 2015	139.42	1.30	0.46%	2,080.41	0.05
47.	Dec 31, 2015	137.62		-1.29%	2,043.94	-1.75
48.	Jan 31, 2016	124.79		-9.32%	1,940.24	-5.07
49.	Feb 29, 2016	131.03	1.30	6.04%	1,932.23	-0.41
50.	Mar 31, 2016	151.45		15.58%	2,059.74	6.60
51.	Apr 30, 2016	145.94		-3.64%	2,065.30	0.27
52.	May 31, 2016	153.74	1.40	6.30%	2,096.95	1.53
53.	Jun 30, 2016	151.78		-1.27%	2,098.86	0.09
54.	Jul 31, 2016	160.62		5.82%	2,173.60	3.56
55.	Aug 31, 2016	158.88	1.40	-0.21%	2,170.95	-0.12
56.	Sep 30, 2016	158.85		-0.02%	2,168.27	-0.12
57.	Oct 31, 2016	153.69		-3.25%	2,126.15	-1.94
58.	Nov 30, 2016	162.22	1.40	6.46%	2,198.81	3.42
59.	Dec 31, 2016	165.99		2.32%	2,238.83	1.82
Average:				0.09%		0.95
Standard Deviation:				5.03%		2.98

¹ Data in USD \$ per share of common stock, adjusted for splits and stock dividends.

² Rate of return on common stock of IBM during period t

³ Rate of return on S&P 500 (the market portfolio proxy) during period t

Systematic Risk (β) Estimation

Variance _{IBM}	25.35
Variance _{S&P 500}	8.88
Covariance _{IBM, S&P 500}	8.47

Correlation Coefficient _{IBM, S&P 500} ¹	0.56
β_{IBM}²	0.95
α_{IBM} ³	-0.82

Calculations

$$^1 \text{Covariance}_{IBM, S\&P 500} \div (\text{Standard Deviation}_{IBM} \times \text{Standard Deviation}_{S\&P 500}) \\ = 8.47 \div (5.03 \times 2.98)$$

$$^2 \text{Covariance}_{IBM, S\&P 500} \div \text{Variance}_{S\&P 500} \\ = 8.47 \div 8.88$$

$$^3 \text{Average}_{IBM} - \beta_{IBM} \times \text{Average}_{S\&P 500} \\ = 0.09 - 0.95 \times 0.95$$

Expected Rate of Return

Assumptions

Rate of return on LT Treasury Composite ¹	R_F	2.88%
Expected rate of return on market portfolio ²	$E(R_M)$	13.12%
Systematic risk (β) of IBM's common stock	β_{IBM}	0.95

Expected rate of return on IBM's common stock³	$E(R_{IBM})$	12.65%
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¹ Unweighted average of bid yields on all outstanding fixed-coupon U.S. Treasury bonds neither due or callable in less than 10 years (risk-free rate of return proxy).

Calculations

² See Details »

$$^3 E(R_{IBM}) = R_F + \beta_{IBM} [E(R_M) - R_F] \\ = 2.88\% + 0.95 [13.12\% - 2.88\%] \\ = 12.65\%$$