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**To: Professor Sury,
cc: Mr. Wu**

From:

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Following our recent discussions, our team prepared the following analysis of the trailing 5-years performance of the security you specified, the Eastman Kodak Company (ticker KODK). To restate our intentions, our goal is to estimate KODK's expected return using both the Capital Asset Pricing Model (CAPM) and Fama French 3-Factor Model (FF3F).

Relevant data was gathered from Ken French's Data Library, including broad market, risk free rate, and factor returns.

Step 1: Security Characteristic Line and SML (CAPM)

Annualized Return (KODK): 19.12%

Annualized Standard Deviation: 0.98984714

Monthly Variance: 0.0816497795

Standard Error of Regression: 0.2670408917

- The standard error of the regression is the standard deviation of the residual. This is the measure of the slippage in the average relationship between Kodak and the S&P 500 due to the impact of firm-specific factors, and is based on in-sample data.

Adjusted R-Squared: 0.1266254698

- The R-square (.141428428) tells us that the variation in the S&P 500 excess returns explains about 14% of the variation in the Kodak series. The adjusted R-square corrects for an upward bias in the R-square that arises because we use the fitted values of the slope (beta) and intercept (alpha), rather than their true, but unobservable, values.

Alpha (Intercept): -0.017914533

- The standard error of the estimate, 0.034762921, is a measure of imprecision of the estimate. The t-statistic of -0.515334529 is the ratio of the regression parameter to its standard error, or the number of standard errors by which our estimate exceeds zero. This can be used to assess the likelihood that the true but unobserved value might actually equal zero rather than the estimate derived from the data. In this instance, a t-statistic of roughly -0.5 indicates that our estimate is not statistically significantly different from zero (or the null). A p-value of 0.608277971 reinforces this observation, namely that if the null hypothesis (null = 0) were true, there would be a 60% chance you would get our observation of this coefficient. Alpha's lower and upper 95% confidence intervals indicate that, assuming a normal distribution, there is a 95% chance or two standard deviations of error that our coefficient falls between -0.0875 and 0.0516. Combined, the t-statistic and p-values require us to fail to reject the null hypothesis; the alpha observed may be zero.

Beta (Slope): 2.556441135

- The estimate of the slope of the Security Characteristic Line (SCL) is 2.5564, as shown on the graph to be just slightly positively correlated with the market. The standard error of the estimate, 0.82706891, is a measure of imprecision of the estimate. The t-statistic of 1.881876004 is the ratio of the regression parameter to its standard error, or the number of standard errors by which our estimate exceeds one. This can be used to assess the likelihood that the true but unobserved value might actually equal one rather than the estimate derived from the data. In this instance, a t-statistic with a value around 1.9 indicates that our estimate is not statistically significantly different from one (or the null). A p-value of 0.064873668 reinforces this observation, namely that if the null hypothesis (null = 1) were true, there would be a 6.487% chance you would get our observation of this coefficient. Beta's lower and upper 95% confidence intervals indicate that, assuming a normal distribution, there is a 95% chance or two standard deviations of error that our coefficient falls between 0.900882838 and 4.211999433. Combined, the t-statistic and p-values require us to fail to reject the null hypothesis; the beta observed may be one.

Verification of a Valid Regression

- By looking at the residual plot, we can see that most of the points fall into the x axis or around the x axis. There are three abnormal points and only one which falls far off the x-axis. But we can also see from the fitting plot that there is also one outlier that matches up with our analysis.
- t-stat for alpha is not statistically significantly different from zero, which makes sense because even under CAPM assumption, Kodak is not giving an excess adjusted return.

Step 2: FAMA FRENCH THREE FACTOR MODEL ANALYSIS (FF3F)

Annualized Return (KODK): 7.66%

Annualized Standard Deviation: 0.98984714

Monthly Variance: 0.08164978

Standard Error of Regression: 0.268985132

- The standard error of the regression is the standard deviation of the residual. This is the measure of the slippage in the average relationship between Kodak and the S&P 500 due to the impact of firm-specific factors, and is based on in-sample data.

Adjusted R-Squared: 0.113861647

- The R-square (0.158919529) tells us that the variation in the S&P 500 excess returns explains a little over 15% of the variation in the Kodak series. The adjusted R-square corrects for an upward bias in the R-square that arises because we use the fitted values of the slope (beta) and intercept (alpha), rather than their true, but unobservable, values.

Alpha (Intercept): -0.009394987

- The standard error of the estimate, 0.03714061, is a measure of imprecision of the estimate. The t-statistic of -0.252957268 is the ratio of the regression parameter to its standard error, or the number of standard errors by which our estimate exceeds zero. This can be used to assess the likelihood that the true but unobserved value might actually equal zero rather than the estimate derived from the data. In this instance, a t-statistic of roughly -0.25 indicates that our estimate is not statistically significantly different from zero (or the null). A p-value of 0.801227516 reinforces this observation, namely that if the null hypothesis (null = 0) were true, there would be a 80% chance you would get our observation of this coefficient. Alpha's lower and upper 95%

confidence intervals indicate that, assuming a normal distribution, there is a 95% chance or two standard deviations of error that our coefficient falls between -0.08379657 and 0.065006595. Combined, the t-statistic and p-values require us to fail to reject the null hypothesis; the alpha observed may be zero.

Beta (Slope): 2.243583121

- The estimate of the slope of the Security Characteristic Line (SCL) is 2.243583121, as shown on the graph to be just slightly positively correlated with the market. The standard error of the estimate, 0.882523835, is a measure of imprecision of the estimate. The t-statistic of 1.409121286 is the ratio of the regression parameter to its standard error, or the number of standard errors by which our estimate exceeds one. This can be used to assess the likelihood that the true but unobserved value might actually equal one rather than the estimate derived from the data. In this instance, a t-statistic around 1.4 indicates that our estimate is not statistically significantly different from one (or the null). A p-value of 0.164328241 reinforces this observation, namely that if the null hypothesis (null = 1) were true, there would be a 16.4% chance you would get our observation of this coefficient. Beta's lower and upper 95% confidence intervals indicate that, assuming a normal distribution, there is a 95% chance or two standard deviations of error that our coefficient falls between 0.47567544 and 4.011490802. Combined, the t-statistic and p-values require us to fail to reject the null hypothesis; the beta observed may be one.

Verification of a Valid Regression

- By looking at the residual plot, we can see that most of the points fall into the x axis or around the x axis. There are three abnormal points and only one which falls far off the x-axis. But we can also see from the fitting plot that there is also one outlier that matches up with our analysis.
- By looking at the ANOVA table, compared at a t-stat of value 2, we can see that RMRF, SMB, and HML are not statistically significant from zero, which leads us to think that all three factors are accurate features of the model.
- The adjusted R Square is lower than the CAPM model meaning it explains fewer data than the CAPM model.

STEP 3: COMPARISON OF CAPM AND FF3F

		CAPM	FF3F
Alpha	Intercept (alpha)	-0.017914533	-0.009394987
	Standard Error	0.034762921	0.03714061
	t-stat (null=0)	-0.515334529	-0.252957268
	p-value	0.608277971	0.801227516
	What does alpha's 95% CI mean	a	b
Beta	Mkt-RF_ret (beta)	2.556441135	2.243583121
	Standard Error	0.82706891	0.882523835
	t-stat (null=1)	1.881876004	1.409121286
	p-value	0.064873668	0.164328241
	What does beta's 95% CI mean	c	d
SE	Standard Error of Regression	0.267040892	0.268985132

a) Alpha - CAPM

- Alpha's 95% CI indicates the levels that we can be 95% certain the mean (coefficient) will be contained within this range (-0.0875, 0.0517). This is determined by looking at the alpha's t-stat. If the absolute value of the t-stat is greater than 2 (95% CI), then alpha's coefficient is statistically significantly different than the null (0) as it may be outside the 95% Confidence Interval range. However, in this regression, alpha's t-stat is -0.515335 (absolute value = 0.515) which is less than 2, indicating it is within the 95% Confidence Interval. This tells us that the coefficient produced by alpha is not statistically significantly different than the null (0) and that it is likely contained outside the range [-0.0875, 0.0517].

b) Alpha - FF3F

- Alpha's 95% CI indicates the levels that we can be 95% certain the mean (coefficient) will be contained within this range (-0.0838, -0.0650). This is determined by looking at the alpha's t-stat. If the absolute value of the t-stat is greater than 2 (95% CI), then alpha's coefficient is statistically significantly different than the null (0) as it may be outside the 95% Confidence Interval range. However, in this regression, alpha's t-stat is -0.25296 (absolute value = 0.25296) which is less than 2 meaning it is within the 95% Confidence Interval. This tells us that the coefficient produced by alpha is not statistically significantly different than the null (0) and that it is likely not contained outside the range [-0.0838, -0.0650].

c) Beta - CAPM

- Beta's 95% CI indicates the levels that we can be 95% certain the mean (coefficient) will be contained within this range (0.9009, 4.2120). This is determined by looking at the beta's t-stat. If the absolute value of the t-stat is greater than 2 (95% CI), then beta's coefficient is statistically significantly different than the null (1) as it may be outside the 95% Confidence Interval range. In this regression, beta's t-stat is 1.8819 which is less than 2, similar to the measure of alpha above. This tells us that the coefficient produced by beta is not statistically significantly different than the null (1) and that it is likely not contained outside the range [0.9009, 4.2120].

d) Beta - FF3F

- Beta's 95% CI indicates the levels that we can be 95% certain the mean (coefficient) will be contained within this range (0.4757, 4.0115). This is determined by looking at the beta's t-stat. If the absolute value of the t-stat is greater than 2 (95% CI), then beta's coefficient is statistically significantly different than the null (1) as it may be outside the 95% Confidence Interval range. In this regression, beta's t-stat is 1.409 which is less than 2 meaning, similar to the measure of alpha above. This tells us that the coefficient produced by beta is also not statistically significantly different than the null (1) and that it is likely not contained outside the range [0.4757, 4.0115].

Difference in Results

- The difference between these two models is that the FF3F model considers two additional risk premia that are considered when building the model: the capitalization (SML) risk and the value (HML) risk
- FF3F diversifies the portfolios based on market, idiosyncratic, and other risks as they are sorted into quantiles, or groups

CAPM

- Pros
 - Easier to interpret, and thus understood by the client

- Works well with industry portfolios
- Cons
 - Does not include other factors in its analysis
 - Since 1980, CAPM has not seemed to work with size portfolios
 - CAPM is not work with growth/value stocks

FF3F

- Pros
 - Includes two extra factors that CAPM does not highlight → capitalization and value factor
 - Diversifies the portfolio so that market, idiosyncratic, and other risks cancel out
 - If the stock has more risks other than its reaction towards the market risk, it would show a better explanation of the elasticity of the stock and the market.
- Cons
 - Does not explain the continuation of short term returns
 - If the stock's exposure to other risks is not high enough to be taken into account, this model will only complicate the estimation, without giving a better prediction

Recommendation

While the expected return value for KODK is much higher under CAPM, the team recommends considering the FF3F model on account of its additional considerations. This measure also more conservatively aligns with expectations of return per unit risk. It is important to note, however, that no factor was seen to be statistically significant. In future analysis, we may consider additional factors, such as momentum, that could potentially provide more insight into the security's expected returns.

STEP 4: EXPECTED RETURN CALCULATION

Expected Return for CAPM = 19.12%

Expected Return for FF3F = 7.66%

- The expected values for RMRF, SMB, and HML were obtained by taking the average of their respective column from the data extracted from Ken French's Data Library

CAPM	Ri = rf + (B)*(Rm - rf)														
Expected	Ri	=	rf	+	B	*	Rm - rf								
Return =	Ri	=	0.09%	+	2.55644114	*	0.54%								
	Ri (monthly)	=	1.47%												
	Ri (annual)	=	19.12%												
FF3f	Ri = rf + (b)*(RMRF) + (s)*(SMB) + (h)*(HML)														
Expected	Ri	=	rf	+	b	*	RMRF	+	s	*	SMB	+	h	*	HML
Return =	Ri	=	0.09%	+	2.24358312	*	0.54%	+	2.82349365	*	-0.0016783	+	0.29317982	*	-0.0071333
	Ri (monthly)	=	0.62%												
	Ri (annual)	=	7.66%												

CAPM	
	<i>Coefficients</i>
Intercept (alpha)	-0.017914533
Mkt-RF_ret (beta)	2.556441135

FF3F	
	<i>Coefficients</i>
Intercept (alpha)	-0.009394987
Mkt-RF_ret (beta)	2.243583121
SMB_ret (s)	2.82349365
HML_ret (h)	0.293179816

E(X)	
E(RMRF)	0.54%
E(SMB)	-0.17%
E(HML)	-0.71%
E(RF)	0.09%

"I attest that this assignment has been completed in accordance with the academic integrity protocols and honor codes of the McCombs School of Business and the University of Texas. I relied on no unauthorized resources (including material submitted or produced by other students—past or present, individuals not listed below, internet message boards, solution manuals, or other forms of outside assistance). This work product is the sole result of my efforts and is being submitted as such.
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