Economics 487

Homework #6 Solution Key
The Joint Distribution of Stock Returns

A. Excel Exercises: *(10 points)*

1. Test the stability of the parameters (α and β) for the *excess return* market models of ibm and msft over the full sample of January 1987 – August 2006. Specifically, for both companies, use a Chow test for a breakpoint in December 1996 to determine whether the parameters change between the two subperiods of January 1987 – December 1996 and January 1997 – August 2006. You can construct your F-statistics using dummy variable regressions or by conducting separate regressions for the two subperiods. Use a 5% significance level. What do your results imply about whether return covariances are constant across the full sample?

IBM

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-0.0037	0.0065	-0.5741	0.5665
Market	0.8107	0.1520	5.3331	0.0000
Dummy	0.0053	0.0092	0.5731	0.5671
Dummy*Market	0.5542	0.2102	2.6367	0.0089

	Restricted	Unrestricted
RSS	1.1867	1.1491
F-statistic	3.7868	
p-value	0.0241	

MSFT

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.0240	0.0081	2.9749	0.0032
Market	1.2196	0.1892	6.4451	0.0000
Dummy	-0.0208	0.0115	-1.8175	0.0704
Dummy*Market	0.3154	0.2616	1.2057	0.2291

	Restricted	Unrestricted
RSS	1.8146	1.7806
F-statistic	2.2164	
p-value	0.1113	

We can reject that alpha and beta are stable throughout the sample for IBM, but not for MSFT. IBM became riskier and had a higher alpha.

2. Test whether the error terms in the full sample regressions (1987-2006) are homoskedastic (constant variance). In particular, use the White test and a 5% significance level.

IBM

R^2	T	T*R^2	p-value
0.0065	236	1.5237	0.4668

MSFT

R^2	T	T*R^2	p-value
0.0038	236	0.9024	0.6368

We cannot reject homoskedasticity at the 5% level.

White's HACC

IBM

Least Squares Estimates		White's Ses	t-stats	p-value	LS Se's	LS t-stats	LS p-values
alpha*	-0.0016	0.0046	-0.3420	0.7327	0.00465	-0.3383	0.7354
beta	1.0979	0.1097	10.0087	0.0000	0.10616	10.3421	0.0000

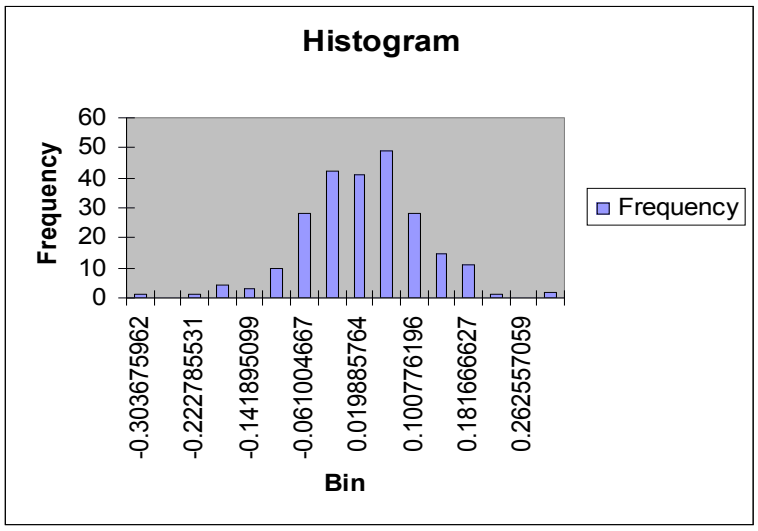
MSFT

Least Squares Estimates		White's Ses	t-stats	p-value	LS Se's	LS t-stats	LS p-values
alpha*	0.0134	0.0057	2.3576	0.0192	0.00575	2.3360	0.0203
beta	1.3921	0.1294	10.7546	0.0000	0.13127	10.6044	0.0000

3. Test the normality of the return data using the Jarque-Bera (JB) statistic. Plot the histograms for the four return series. Comment on your results. Then, test the normality of the estimated residuals from the full sample regressions (1987-2006) using the JB statistic. Plot histograms for the two residual series. Comment on your results.

IBM

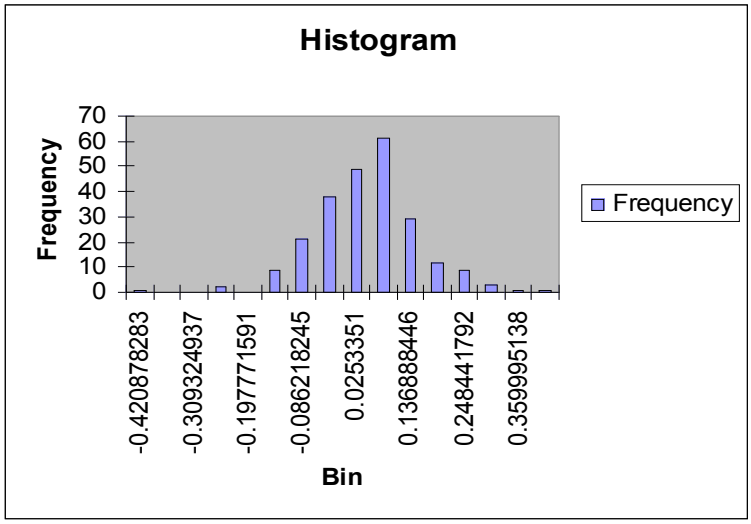
JB statistic	p-value
15.4208	0.0004



We can reject normality at 1% level. The 1987 crash appears to have distorted normality.

MSFT

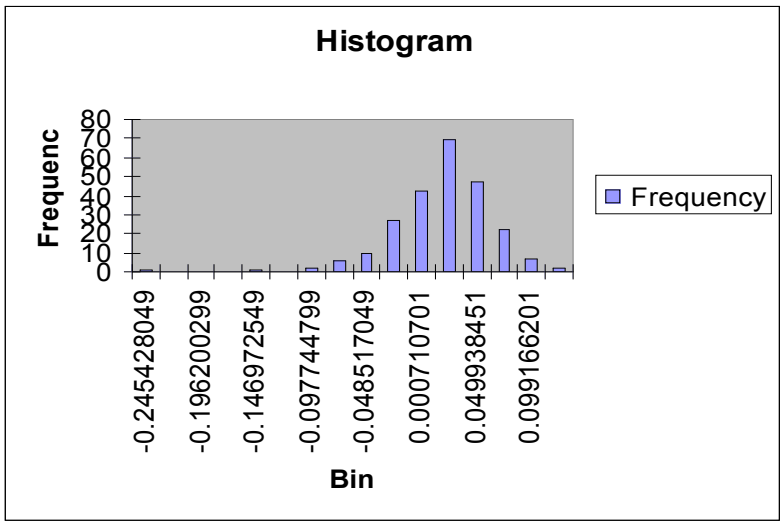
JB statistic	p-value
30.8493	0.0000



We can reject normality at 1% level. Excess kurtosis appears to be the problem.

Market

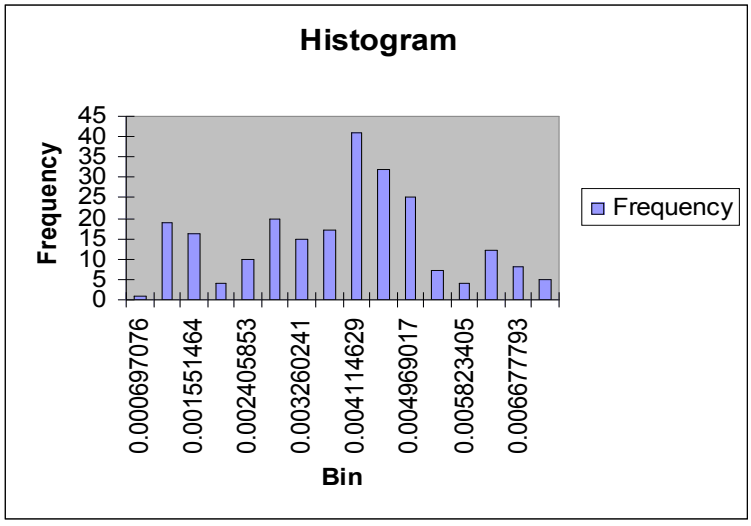
JB statistic	p-value
288.2671	0.0000



Again, we can reject at 1% level. Negative skewness and excess kurtosis are evident from the histogram.

Risk-Free

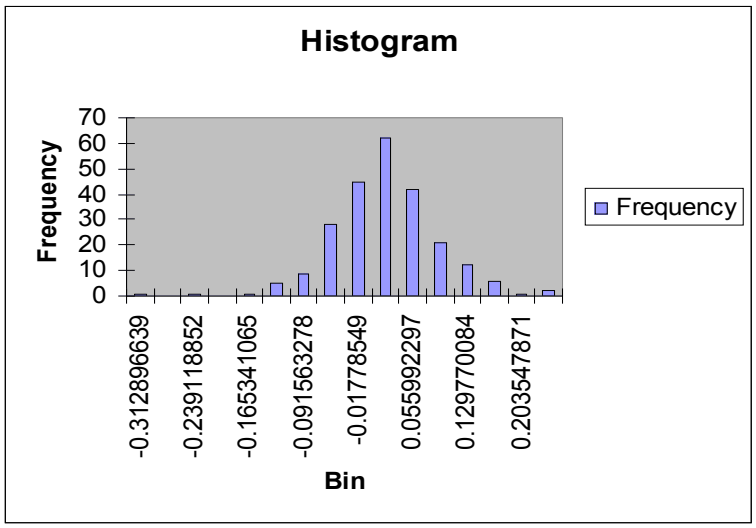
JB statistic	p-value
3.2280	0.1991



We cannot reject normality for the risk-free rate.

IBM Residuals

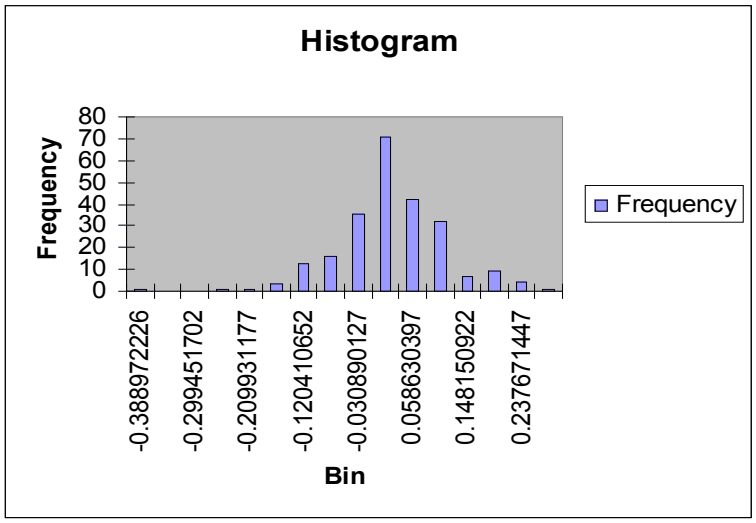
JB statistic	p-value
62.8782	0.0000



We can reject normality.

MSFT Residuals

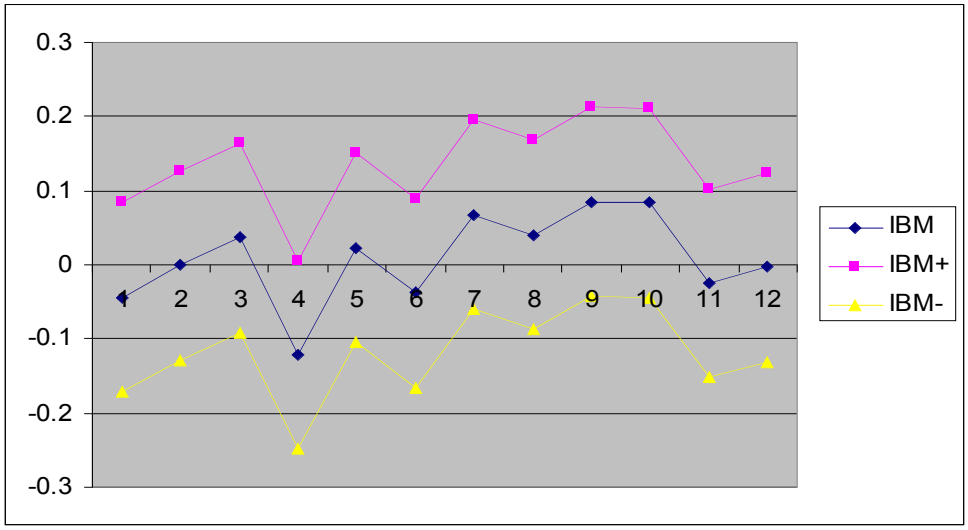
JB statistic	p-value
41.9649	0.0000

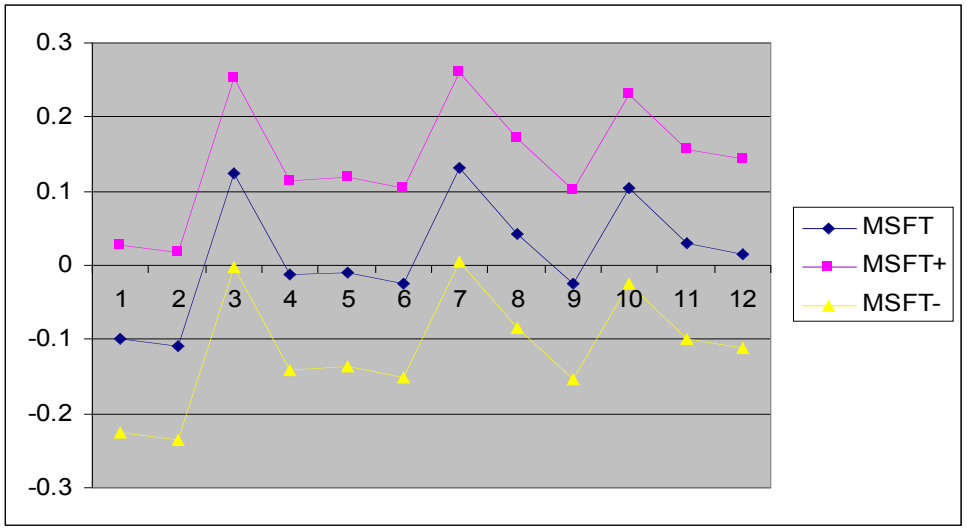


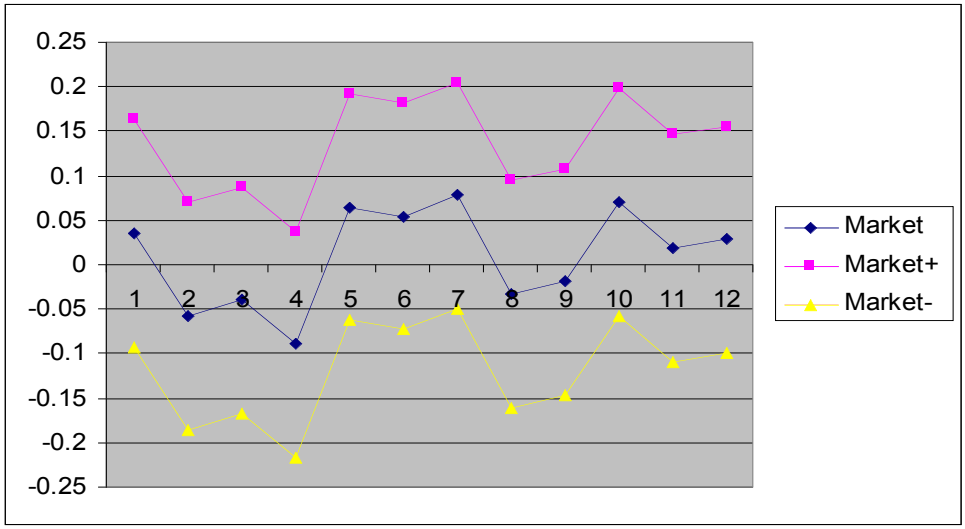
Again, we can reject normality.

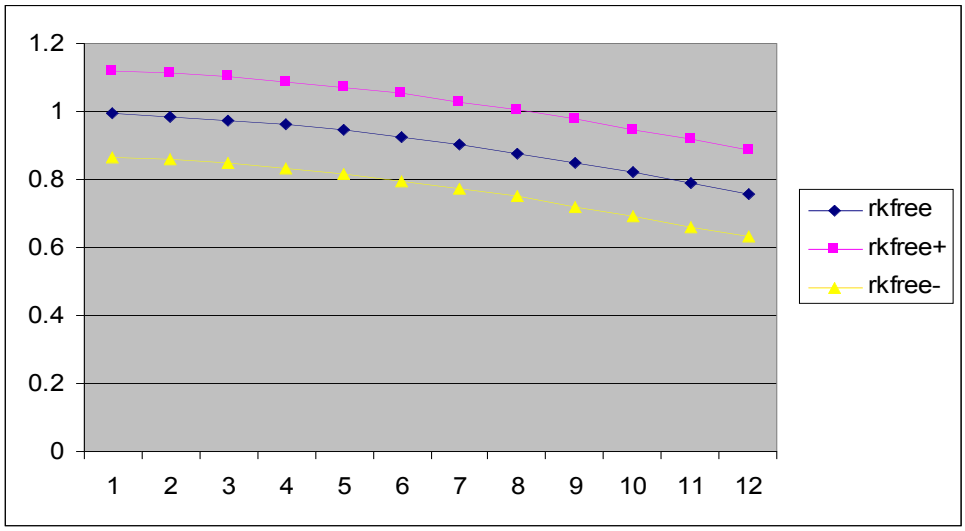
(Note: results may be different if you used breakpoint regression. These above results are for full sample regression without breakpoint.)

4. In this exercise, you will test for predictability of nominal asset returns (not excess returns) across time.
   a. Compute and plot the 12 lag sample autocorrelation functions for the four return series using the full data sample. Comment on any statistically or economically significant autocorrelations. Do the returns of any of the assets appear to be predictable from their past returns? Are your results consistent with the random walk hypothesis? Remember to plot the 95% confidence bands for the autocorrelations.



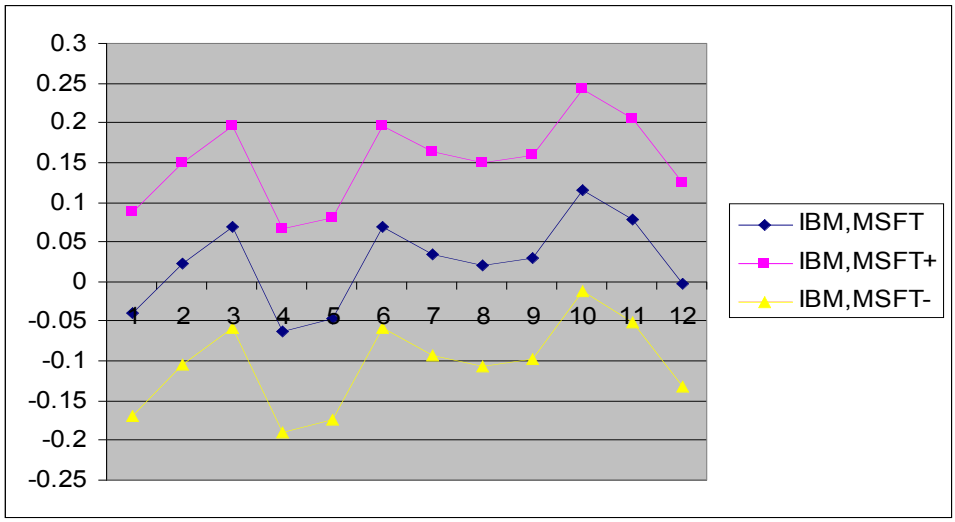




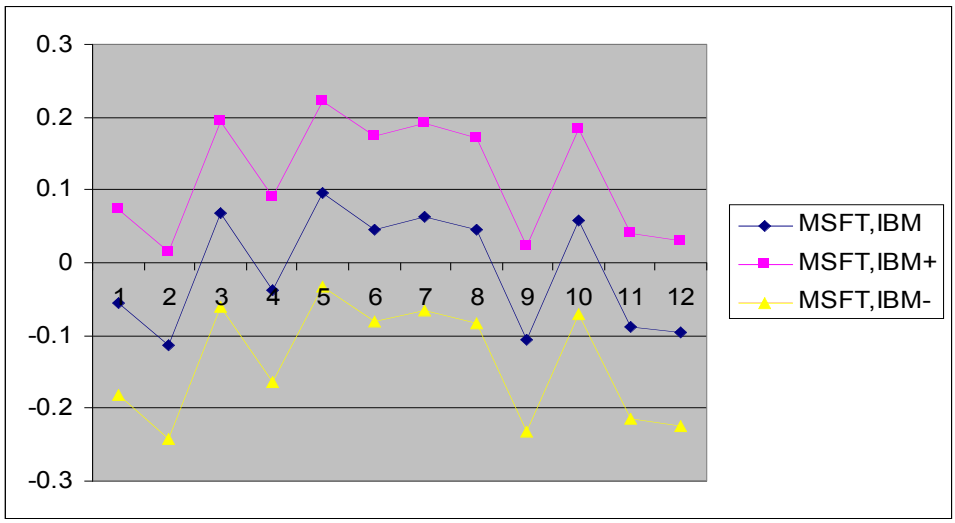


Only the risk-free rate appears predictable from past returns. It has strong momentum. The other returns have almost no significant autocorrelations.

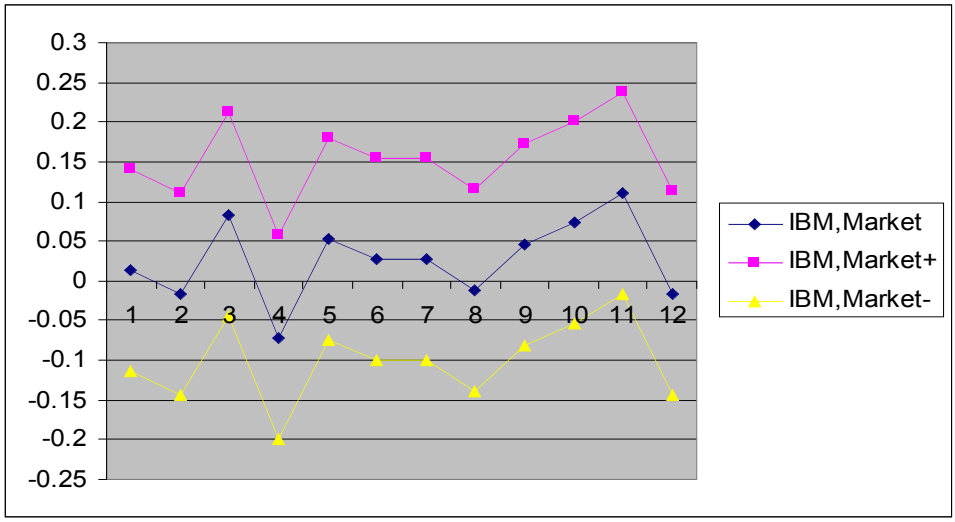
b. Compute and plot the 12 lag sample cross-correlation functions for the pairs (ibm, msft), (ibm, market), and (msft, market). Comment on any significant cross-correlations. Do the returns of any of the stocks appear to be predictable from past returns on any of the other stocks?



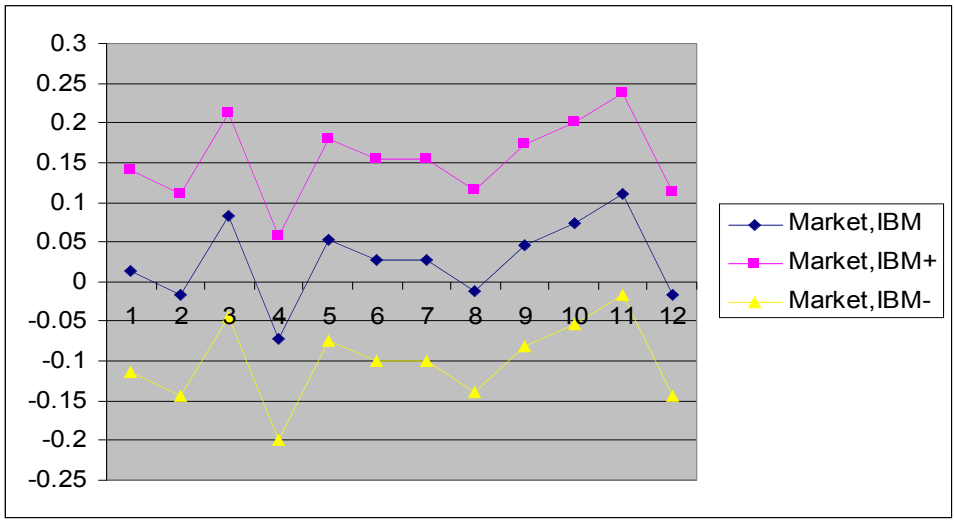
MSFT is not predictable based on IBM's returns.



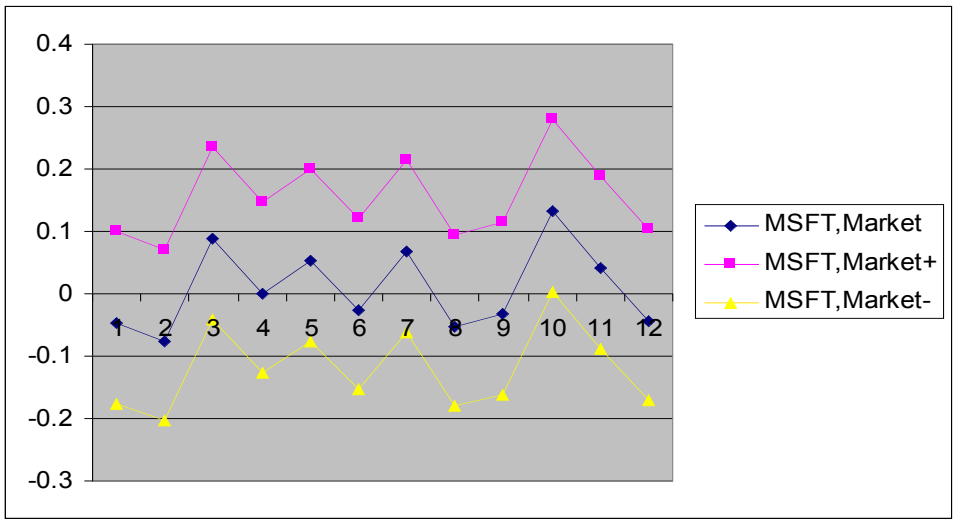
IBM is not predictable based on IBM's return.



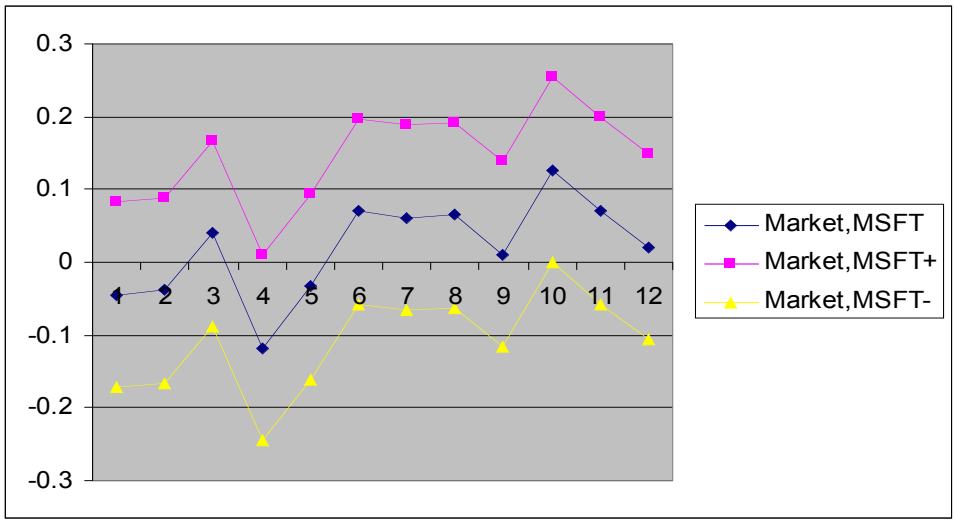
Market is not predictable based on IBM's returns.



IBM is not predictable based on Market returns.

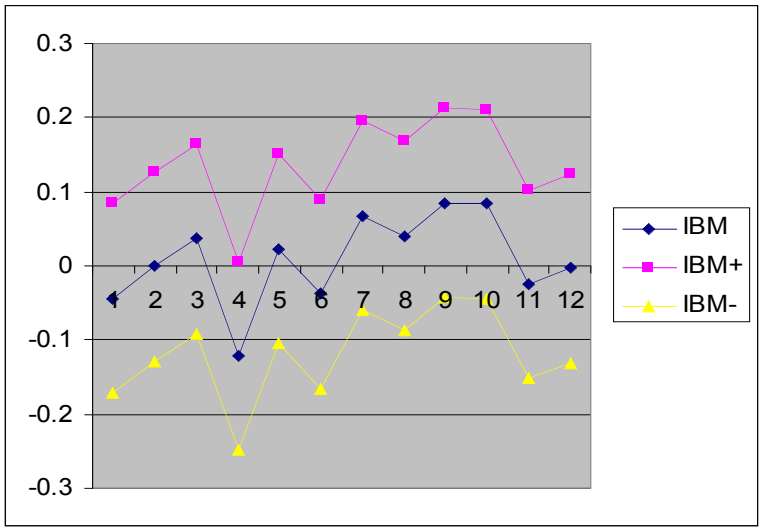


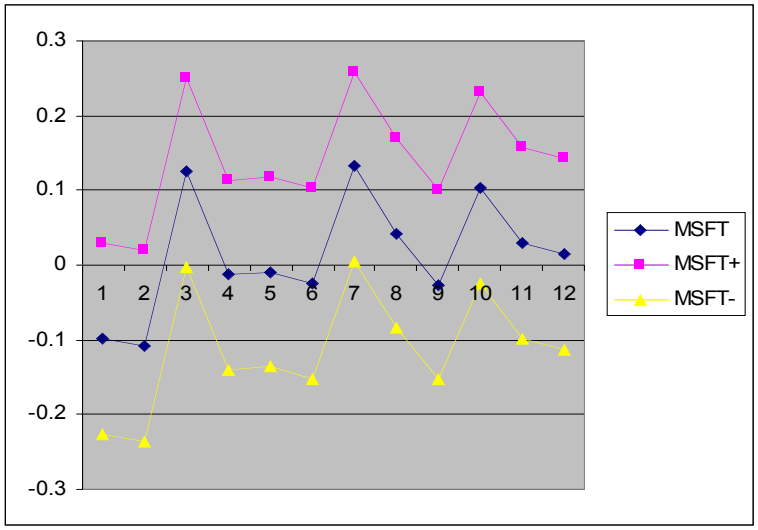
Market is not predictable based on MSFT's returns.



MSFT is not predictable based on Market returns.

c. Compute and plot the 12 lag sample autocorrelation function of the residuals from the full sample regressions (ibm and msft). Use the Box Q statistic to test the null hypothesis that the residuals are not autocorrelated at up to 12 lags





	IBM	MSFT
Q-stat	8.2875	7.4206
p-value	0.7623	0.8286

Neither residuals appear predictable.