Market Share and Firm Profitability

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I. Introduction

This research project investigates the relationship between a firm's market share and its profitability. Intuitively, this relationship is appealing. If a firm gains market share, sales should increase leading to increased profits. Empirically, this relationship has proven difficult to establish. This project will assess the market share-profitability relationship with proprietary information from a Fortune 500 firm, concentrating specifically on discovering and addressing econometric issues.

II. Literature Review

Extensive research in the marketing, accounting and strategy literature has studied the market share-profitability relationship. Buzzell et al. [1975] found a strong, positive relationship between market share and profitability. Hergert [1984] documented that market share and profitability appear to be positively related on average, but the relationship is weak overall and non-existent in many industries. Smirlock [1985] found that bank branches whose markets were clearly defined by geographic boundaries with no overlap had a strong positive relationship between market share and profitability; however, Markell et al. [1988] concluded that the link between market share and profitability is an occasional phenomenon rather than a universal law. Fraering and Minor [1994] suggested that the link is so unclear that firms should take heed before embarking on a strategy of increasing market share in order to increase profitability. These studies used various measures of profitability including return on investment [ROI], return on assets [ROA], and cash flow from investments. In sum, the results on the relationship between market share and profitability range from no significant association to a strong positive association.

III. Data

Market share and profitability data was obtained for 31 distributors of a Fortune 500 firm. Each distributor is independent of the Fortune 500 firm but is prohibited from selling similar products made by competitors. Two primary products offered by the distributors are a low horsepower engine and a high horsepower engine. All distributors have been categorized by market type, each having a different a customer profile, sales volume, and economic condition.[1] There are seven distributors categorized as Metropolitan, four categorized as Mining, five as Canadian, six as Direct, and nine as Other. Data for each of the 31 distributors was collected for five consecutive quarters beginning with the fourth quarter of 1997. For example, Distributor 1 reported five market share measures for the low horsepower engine, five market share measures for the high horsepower engine, and five profit before income tax measures. The resulting 155 observations will be used in this analysis. A description of the variables is presented in Table 1 and descriptive statistics are shown in Table 2.

IV. Econometric Models

This data provides an opportunity to examine seven econometric models. The first four and the seventh models assume iid while the random component of the fifth and sixth models are not assumed to be identically distributed across distributors. The econometric models to be tested are:

(1) Pooled

$$PBIT_{it} = \alpha + \beta_1 MS1_{it} + \beta_2 MS2_{it} + \varepsilon_{it}$$

where: PBIT = profit before income tax as a percent of sales
MS1 = market share for low horsepower engine
MS2 = market share for high horsepower engine
t = 1,2,3,4,5
i = 1,2,…31

This model assumes that there are no omitted distributor-specific variables, and the constant term and slope parameters are the same across distributors and across quarters. An assessment of how PBIT changes with market share across time and across distributor can be made with this model.

(2) Classic Cross-Sectional "Between" Model

$$PBIT_{i} = \alpha + \beta_1 MS1_{i} + \beta_2 MS2_{i} + \varepsilon_{i}$$

where: PBIT = profit before income tax as a percent of sales
MS1 = market share for low horsepower engine
MS2 = market share for high horsepower engine
i = 1,2,…31

[1] A detailed description of each market is not available to the researcher.

This model estimates how PBIT changes with market share across distributors. This model takes the two market share measures and averages each of them over the five quarters, removing the time component. If there is no variation in market share over time, then the coefficients of this model should be similar to those from Model 1.

(3) Less Restrictive Pooled Model - Time

$$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

where:
PBIT = profit before income tax as a percent of sales
MS1 = market share for low horsepower engine
MS2 = market share for high horsepower engine
Time1 = 1 if information from Q497
0 otherwise
Time2 = 1 if information from Q198
0 otherwise
Time3 = 1 if information from Q298
0 otherwise
Time4 = 1 if information from Q398
0 otherwise
t = 1,2,3,4,5
i = 1,2,…31

This model estimates how PBIT changes with market share across distributors controlling for time effects. Each quarter will have its own regression line with equivalent slopes but different intercepts relative to Q498. This model assumes the market share parameters are the same across distributors.

(4) Less Restrictive Pooled Model - Market

$$PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

where:
PBIT = profit before income tax as a percent of sales
MS1 = market share for low horsepower engine
MS2 = market share for high horsepower engine
MktO = 1 if distributor is in Other market
0 otherwise
MktM = 1 if distributor is in Metropolitan market
0 otherwise
MktMN = 1 if distributor is in Mining market
0 otherwise
MktD = 1 if distributor is in Direct market
0 otherwise

$t = 1,2,3,4,5$
$i = 1,2,\ldots 31$

This model assesses how PBIT changes with market share across time controlling for market effects. Each market will have its own regression line having equivalent slopes but different intercepts relative to the Canadian market. The market share parameters are assumed to be equal across quarters.

(5) Pooled Market Models - Time

$$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

where:

PBIT = profit before income tax as a percent of sales
MS1 = market share for low horsepower engine
MS2 = market share for high horsepower engine
Time1 = 1 if information from Q497
0 otherwise
Time2 = 1 if information from Q198
0 otherwise
Time3 = 1 if information from Q298
0 otherwise
Time4 = 1 if information from Q398
0 otherwise
$t = 1,2,3,4,5$
$i = 1,2,3,4,5$ (five markets)

Five regressions will be run, one for each market. This model estimates how PBIT changes with market share across markets controlling for time effects. This model does not restrict the relationships between the regressors and the dependent variable across time to be the same across markets.

(6) Pooled Time Models - Markets

$$PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

where:

PBIT = profit before income tax as a percent of sales
MS1 = market share for low horsepower engine
MS2 = market share for high horsepower engine
MktO = 1 if distributor is in Other market
0 otherwise
MktM = 1 if distributor is in Metropolitan market
0 otherwise
MktMN = 1 if distributor is in Mining market

0 otherwise
MktD = 1 if distributor is in Direct market
0 otherwise
i = 1,2,3,…31
t = 1,2,3,4,5

Five regressions will be run, one for each quarter. This model estimates how PBIT changes with market share across quarters controlling for market effects. This model does not restrict the relationships between the regressors and the dependent variable across markets to be the same across time.

(7) Fixed Effects Model

$$\boxed{PBIT_{it} = \alpha + \beta_1 Distr1_{it} + \beta_2 Distr2_{it} + \ldots \beta_{30} Distr30_{it} + \beta_{31} MS1_{it} + \beta_{32} MS2_{it} + \varepsilon_{it}}$$

where: PBIT = profit before income tax as a percent of sales
MS1 = market share for low horsepower engine
MS2 = market share for high horsepower engine
Distr1 = 1 if distributor is Distributor 1
0 otherwise
Distr2 = 1 if distributor is Distributor 2
0 otherwise
i = 1,2,3,…31
t = 1,2,3,4,5

This model addresses the issue if distributors vary within each market. This model estimates a separate intercept for each distributor in order to completely eliminate cross-sectional information in estimating the market share parameters.

V. Diagnostic Checks

Diagnostic tests will be run in order to assess whether any of the classical linear regression model [CLRM] assumptions are violated in these seven models. The correlation between the two market share independent variables is .12, implying no multicollinearity problems. For Model 1, the pooled model[2], the only violation was due to autocorrelation. The systematic relationship between error terms results in the least squares estimates no longer being efficient. These biased OLS estimators underestimate true variances and standard errors which inflate *t*-values. Therefore, the usual *t*-test and

[2] See Appendix A for details of diagnostic tests run for this model. The diagnostic tests for the remaining models are not shown in detail. The process of assessing CLRM violations parallels those displayed in Appendix A.

F-tests are not reliable. For this model, the *t*-values for MS1 and MS2 are -2.06 and .49 respectively. With the Newey-West[3] correction for autocorrelation, the *t*-values for MS1 and MS2 are -1.18 and .32 respectively. The correction for autocorrelation reduced the *t*-values and made the *t*-test and *F*-test more reliable. Without the correction, MS1 appeared to be significant which could have led to an incorrect inference.

Model 2, the classical cross-sectional between model, did not violate any of the CLRM assumptions. Model 3, the classic fixed effects within model-time, had two violations. The first violation was due to autocorrelation. The Newey-West correction was made resulting in *t*-value and *F*-value deflation. Once again, MS1 became insignificant after the correction for autocorrelation. The second violation for this model is the assumption that $\varepsilon_{it} \sim N(0,\sigma^2)$. CLRM assumes that the error term follows the normal distribution with mean 0 and homoskedastic variance. From the central limit theorem, if there is a large number of independent and identically distributed random variables, then, with few exceptions, the distribution of their sum tends to be a normal distribution as the number of such variables increases indefinitely. Due to the small sample size it is not unlikely that this assumption is violated. Since any linear function of a normally distributed variable is itself normally distributed, the violation of the normality assumption results in parameters of the market share variables not being normally distributed.

Model 4, the classic fixed effects within model-markets, had the same two violations as Model 3. The consequences and adjustments parallel those discussed in Model 3 above. Two of the five regressions associated with Model 5, had violations of autocorrelation [Markets O and D] and Market O had a violation of the normal distribution of errors assumption. The consequences and adjustments follow those outlined for Model 3. All five regressions associated with Model 6 did not violate any of the assumptions of CLRM. Model 7 violated only the normal distribution of errors assumption.

VI. Results

[3] The Newey-West correction for autocorrelation estimates ρ for four lags with each successive lag having a lesser effect on the previous error term. Due to the rather delayed response of market share to market shocks, this method of graduated lag effects seems appropriate.

The results of Models 1 and 2 are presented in Table 3. The pooled model OLS results show that the predictors as a group and each market share measure individually are not significant at the .05 level. Similar results occurred for Model 2. The results for Model 3 are presented in Table 4. In interpreting the results for Model 3, the fixed effects time model, a comparison of the unrestricted model with the restricted model must be made.[4] The *F*-test comparison of the two models results in an *F*-value of 2.2411. With this *F*-value, the null hypothesis that the two models are the same cannot be rejected. Adding the market share measures to the model does not help explain PBIT.

The results for Model 4 are presented in Table 5. In assessing the results for Model 4, the fixed effects market model, a comparison of the unrestricted model with the restricted model must also be made.[5] The *F*-test of the two models results in a *F*-value of 4.3181. With this *F*-value, the null hypothesis that the two models are the same can be rejected. Adding the market share variables to the equation helps explain PBIT. The predictors as a group are insignificant, all five market dummy variables are significant and the two market share measures are insignificant.

The results of the five regressions for Model 5 are shown in Table 6. In assessing the results for Model 5, a comparison of the results from the five separate models estimated for Model 5 must be made with the results of Model 3. A Chow test was performed to determine if the five separate regressions are structurally different than the model containing all five markets.[6] The Chow test resulted in an *F*-value of 11.435, indicating that the two models are not the same. The relationship between market share and PBIT is affected by market membership. None of the parameters as a group and time dummy variables proved to be significant. For the Other and Direct markets, the market share measures for high horsepower engines [MS2] proved to be significant with coefficients of .1394 and .1823 respectively. The market share measures were insignificant in the remaining three markets.

The results of the five regressions for Model 6 are shown in Table 7. In assessing the results for Model 6, a comparison of the results from the five separate models

[4] See Appendix B for the calculations of this comparison.
[5] See Appendix C for the calculations of this comparison.
[6] See Appendix D for the Chow test calculations.

estimated for Model 6 must be made with the results of Model 4. A Chow test was performed to determine if the five separate regressions are structurally different than the model containing all five quarters.[7] The Chow test resulted in an *F*-value of 2.015 indicating that the two models are the same. For the fourth quarter of 1997 [Time1], the parameters as a group were significant as was Market O, Market M and MS2. For the first and fourth quarters of 1998, the parameters as a group and the market share measures were not significant and all but Market O were insignificant. For the second and third quarters of 1998, all parameters but Market O and Market M were insignificant.

The results of Model 7 are shown in Table 8. The *F*-test comparing the restricted and unrestricted models failed to reject the null hypothesis that the models are the same.[8] Adding market share measures to the model does not help explain PBIT. Eliminating firm-specific effects does not help the market share measures to become significant.

VII. Conclusions

Two trends in the results merit mention.[9] As the models become less restrictive, the R^2's increase. The R^2 ranges from .0272 for the most restrictive model, the pooled model, to a high of .7307 for the fixed effect model. A second general trend can be seen in the significance of the market share parameters. As the models become less restrictive, the *p*-values of the market share parameters become smaller indicating higher significance.

Based on the results of OLS regressions of the seven models described above, one can infer that market share has an extremely weak effect, if at all, on profitability for the 31 distributors of this Fortune 500 firm. Market membership and firm specific effects had an effect on PBIT while time period did not. When analyzing each market separately controlling for time effects, two markets showed a significant association between profitability and the high horsepower market share measure. When analyzing each time period separately controlling for market effects, one time period showed a significant association between profitability and the high horsepower market share measure. The other twelve models failed to show a significant relationship between market share and

[7] See Appendix E for the Chow test calculations.
[8] See Appendix F for the *F*-test calculations.
[9] A chart summarizing this discussion in shown in Appendix G.

PBIT.[10] Overall, these results are consistent with prior research that there is no relationship or a very weak positive relationship between market share and firm profitability.

References

[10] Twelve of the fifteen models containing market share measures showed a negative coefficient for MS1 and ten of the fifteen models showed a positive coefficient for MS2.

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Table 1	
Variable	**Description**
PBIT	Profit before income taxes as a percent of total sales
MS1	Market share for low horsepower engine
MS2	Market share for high horsepower engine
Time1	Dummy variable for observations from Q4 1997
Time2	Dummy variable for observations from Q1 1998
Time3	Dummy variable for observations from Q2 1998
Time4	Dummy variable for observations from Q3 1998
MktM	Dummy variable for distributors in the Metropolitan market
MktO	Dummy variable for distributors in the Other market
MktMN	Dummy variable for distributors in the Mining market
MktD	Dummy variable for distributors in the Direct market

Table 2					
Variable	**n**	**Mean**	**Variance**	**Minimum**	**Maximum**
PBIT	155	.0465	.0003	-.0011	.1073
MS1	155	.3497	.0092	.1620	.7210
MS2	155	.1792	.0036	.0820	.5280
Time1	31				
Time2	31				
Time3	31				
Time4	31				
MktM	35				
MktO	45				
MktMN	20				
MktD	30				

Table 3

Model 1 - Pooled Model:* $PBIT_{it} = \alpha + \beta_1 MS1_{it} + \beta_2 MS2_{it} + \varepsilon_{it}$			
R^2 = .0272	*F*-statistic = 2.1232	*p*-value = .1232	SSError = .0424
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0546	5.2847	.0000
MS1	-.0290	-1.1752	.2418
MS2	.0112	.3247	.7459
Model 2 - Classic Cross-Sectional Between Model: $PBIT_i = \alpha + \beta_1 MS1_i + \beta_2 MS2_i + \varepsilon_i$			
R^2 = .0580	*F*-statistic = .7010	*p*-value = .5046	SSError = .0060
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0580	4.1481	.0003
MS1	-.0346	-1.1732	.2506
MS2	.0029	.0475	.9625

* Including Newey-West adjustment for autocorrelation

Table 4

Model 3 - Less Restrictive Pooled Model - Time:*

$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$

R^2 = .0463	*F*-statistic = 1.1976	*p*-value = .3107	SSError = .0416
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0562	5.3912	.0000
Time1	-.0021	-.4485	.6545
Time2	-.0064	-1.4385	.1524
Time3	-.0016	-.5674	.5713
Time4	.0000	.0235	.9812
MS1	-.0302	-1.2066	.2295
MS2	.0157	.3635	.7167

Model 3 - Less Restrictive Pooled Model - Time - *Restricted*:*

$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \varepsilon_{it}$

R^2 = .0174	*F*-statistic = .6649	*p*-value = .6173	SSError = .0429
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0481	17.4173	.0000
Time1	-.0006	-.1594	.8736
Time2	-.0059	-1.3323	.1848
Time3	-.0019	-.6835	.4954
Time4	-.0000	-.0182	.9855

* Including Newey-West adjustment for autocorrelation

Table 5

Model 4 - Less Restrictive Pooled Model - Market:* $PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$			
R^2 = .2509	*F*-statistic = 8.2608	*p*-value = .0000	SSError = .0327
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0674	6.956	.0000
MktO	-.0235	-3.7803	.0002
MktM	-.0185	-3.6615	.0003
MktMN	-.0118	-2.2150	.0283
MktD	-.0105	-2.2862	.0237
MS1	-.0356	-1.6048	.1107
MS2	.0338	1.0937	.2759

Model 4 - Less Restrictive Pooled Model - Market - *Restricted*:* $PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \varepsilon_{it}$			
R^2 = .20716	*F*-statistic = 9.7984	*p*-value = .0000	SSError = .0346
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0613	15.1727	.0000
MktO	-.0020	-3.3848	.0009
MktM	-.0196	-3.5998	.0004
MktMN	-.0141	-2.7840	.0061
MktD	-.0112	-2.2360	.0268

* Including Newey-West adjustment for autocorrelation

Table 6

Model 5 - Pooled Models - Market O:*			
$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
R^2 = .2414	*F*-statistic = 2.0157	*p*-value = .0874	SSError = .0106
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0099	.4947	.6236
Time1	-.0155	-1.9813	.0548
Time2	-.0097	-1.2035	.2351
Time3	-.0032	-.6612	.5124
Time4	-.0016	-.4452	.6587
MS1	.0266	.4431	.6602
MS2	.1394	4.2123	.0001
Model 5 - Pooled Models - Market D:*			
$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
R^2 = .3473	*F*-statistic = 2.0394	*p*-value = .1012	SSError = .0022
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0545	3.0127	.0062
Time1	-.0111	-1.847	.0776
Time2	-.0072	-1.286	.2112
Time3	-.0019	-.4642	.6468
Time4	-.0021	-.6001	.5543
MS1	-.0864	-1.7458	.0942
MS2	.1823	2.6379	.0147
Model 5 - Pooled Models - Market C:			
$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
R^2 = .0617	*F*-statistic = .1974	*p*-value = .9733	SSError = .0057
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0813	3.8005	.0013
Time1	.0049	.3515	.7293
Time2	.0007	.0589	.9537
Time3	.0010	.1058	.9169
Time4	.0003	.0281	.9779
MS1	-.0474	-1.042	.3112
MS2	-.0325	-.3846	.7050

* Including Newey-West adjustment for autocorrelation

Table 6 continued

Model 5 - Pooled Models - Market M: $PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
R^2 = .1790	*F*-statistic = 1.0173	*p*-value = .4344	SSError = .0066
Variable	Coefficient	*t*-statistic	*p*-value
Constant	.0614	6.3198	.0000
Time1	.0056	.5914	.5590
Time2	-.0025	-.2976	.7682
Time3	.0000	.0037	.9971
Time4	.0008	.1015	.9199
MS1	-.0059	-.2244	.8240
MS2	-.0982	-1.4367	-1619

Model 5 - Pooled Models - Market MN: $PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
R^2 = .5373	*F*-statistic = 2.5155	*p*-value = .0770	SSError = .0015
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0488	2.599	.0220
Time1	.0171	1.4076	.1827
Time2	-.0164	-2.0345	.0628
Time3	-.0089	-1.1723	.2621
Time4	-.0002	-.2466	.8091
MS1	.0628	1.6894	.1150
MS2	-.1465	-1.444	.1723

* Including Newey-West adjustment for autocorrelation

Table 7

Model 6 - Pooled Models - Time1: $PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
$R^2 = .4468$	*F*-statistic = 3.2305	*p*-value = .0180	SSError = .0048
Variable	Coefficient	*t*-statistic	*p*-value
Constant	.0458	3.5209	.0017
MktO	-.0261	-3.2710	.0032
MktM	-.0181	-2.1630	.0407
MktMN	-.0058	-.6110	.5470
MktD	-.0068	-.7812	.4423
MS1	-.0234	-.9937	.3597
MS2	.1035	2.7190	.0120
Model 6 - Pooled Models - Time2: $PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
$R^2 = .2339$	*F*-statistic = 1.2212	*p*-value = .3300	SSError = .0018
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0738	2.938	.0072
MktO	-.0261	-2.0929	.0471
MktM	-.0195	-1.4929	.1485
MktMN	-.0237	-1.5514	.1339
MktD	-.0124	-.9171	.3682
MS1	-.0555	-1.2910	.2080
MS2	.0283	.2950	.7705
Model 6 - Pooled Models - Time3: $PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
$R^2 = .3560$	*F*-statistic = 2.3036	*p*-value = .0695	SSError = .0040
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0707	5.9450	.0000
MktO	-.0029	-3.3414	.0026
MktM	-.0181	-2.5132	.0188
MktMN	-.0130	-1.5598	.1314
MktD	-.0121	-1.6610	.1092
MS1	-.0350	-1.3501	.1891
MS2	.0178	.3372	.7388

* Including Newey-West adjustment for autocorrelation

Table 7 continued

Model 6 - Pooled Models - Time4: $PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
R^2 = .3436	*F*-statistic = 2.094	*p*-value = .0917	SSError = .0037
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0744	6.7212	.0000
MktO	-.0201	-2.8291	.0093
MktM	-.0163	-2.1909	.0384
MktMN	-.0072	-.8445	.4068
MktD	-.0088	-1.1670	.2547
MS1	-.0395	-1.4793	.1521
MS2	-.0004	-.0077	.9939

Model 6 - Pooled Models - Time5: $PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$			
R^2 = .2378	*F*-statistic = 1.2481	*p*-value = .3177	SSError = .0054
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0713	5.1495	.0000
MktO	-.0192	-2.2127	.0367
MktM	-.0164	-1.8260	.0803
MktMN	-.0080	-.7816	.4421
MktD	-.0086	-.9462	.3535
MS1	-.0213	-.6322	.5333
MS2	-.0235	-.3324	.7425

* Including Newey-West adjustment for autocorrelation

Table 8

Model 7 - Fixed Effects Model - *Unrestricted*:

$$PBIT_{it} = \alpha + \beta_1 Distr1_{it} + \beta_2 Distr2_{it} + \ldots \beta_{30} Distr30_{it} + \beta_{31} MS1_{it} + \beta_{32} MS2_{it} + \varepsilon_{it}$$

R^2 = .7307	*F*-statistic = 10.3462	*p*-value = .0000	SSError = .0117
Variable	Coefficient	*t*-statistic	*p*-value
Constant	.04156	4.406	.0000
Distr1	-.0111	-1.7310	.0860
Distr2	-.0070	-1.1212	.2644
Distr3	-.0227	-3.6104	.0004
Distr4	.0019	.2839	.7769
Distr5	-.0203	-3.1347	.0022
Distr6	-.0279	-3.9625	.0001
Distr7	-.0046	-.6356	.5262
Distr8	-.0226	-3.4618	.0007
Distr9	-.0043	-.6145	.5400
Distr10	.0008	.1172	.9069
Distr11	-.0199	-2.6175	.0100
Distr12	-.0045	-.6120	.5417
Distr13	-.0488	-3.9496	.0001
Distr14	-.0100	-1.4222	.1575
Distr15	-.0007	-.0934	.9257
Distr16	-.0057	-.6557	.5132
Distr17	-.0078	-1.1181	.2657
Distr18	.0169	2.6328	.0096
Distr19	-.0014	-.2001	.8417
Distr20	.0082	1.2732	.2053
Distr21	-.0121	-1.9308	.0558
Distr22	-.0206	-3.0685	.0027
Distr23	-.0052	-.7516	.4537
Distr24	-.0129	-1.9656	.0516
Distr25	-.0080	-.8981	.3709
Distr26	-.0197	-2.8314	.0054
Distr27	-.0415	-5.6652	.0000
Distr28	-.0255	-3.7763	.0002

Table 8 continued

Model 7 - Fixed Effects Model - R*estricted*:

$$PBIT_{it} = \alpha + \beta_1 Distr1_{it} + \beta_2 Distr2_{it} + \ldots \beta_{30} Distr30_{it} + \varepsilon_{it}$$

R^2 = .7248	*F*-statistic = 10.8858	*p*-value = .0000	SSError = .0120
Variable	**Coefficient**	***t*-statistic**	***p*-value**
Constant	.0549	12.475	.0000
Distr1	-.0131	-2.1082	.0370
Distr2	-.0068	-1.0926	.2767
Distr3	-.0231	-3.7247	.0003
Distr4	-.0017	-.2763	.7827
Distr5	-.0220	-3.5383	.0006
Distr6	-.0258	-4.1489	.0001
Distr7	-.0018	-.2924	.7704
Distr8	-.0225	-3.6186	.0004
Distr9	-0034	-.5591	.5770
Distr10	-.0004	-.0771	.9386
Distr11	-.0168	-2.7027	.0078
Distr12	-.0012	-.2024	.8399
Distr13	-.0354	-5.6979	.0000
Distr14	-.0097	-1.5618	.1209
Distr15	.0022	.3599	.7195
Distr16	-.0001	-.0160	.9872
Distr17	-.0058	-.9948	.3466
Distr18	.0193	3.1141	.0023
Distr19	-.0010	-.1703	.8650
Distr20	.0088	1.4236	.1570
Distr21	-.0133	-2.1403	.0343
Distr22	-.0192	-3.0916	.0025
Distr23	-.0036	-.5816	.5618
Distr24	-.0128	-2.0664	.0409
Distr25	-.0023	-.3824	.7028
Distr26	-.0180	-2.9020	.0044
Distr27	-.0401	-6.4532	.0000
Distr28	-.0252	-4.0557	.0001
Distr29	.0232	3.7343	.0003
Distr30	.0109	1.7482	.0829

Appendix A

Pooled Model:

$$PBIT_{it} = \alpha + \beta_1 MS1_{it} + \beta_2 MS2_{it} + \varepsilon_{it}$$

Test for Heteroskedasticity

White Heteroskedasticity Test:

F-statistic	0.734812	Probability	0.598459
Obs*R-squared	3.730034	Probability	0.588901

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99   Time: 02:14
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000801	0.000819	0.977836	0.3297
MS1	-0.002225	0.003147	-0.706847	0.4808
MS1^2	0.003840	0.004103	0.935718	0.3509
MS1*MS2	-0.003822	0.006893	-0.554554	0.5800
MS2	-0.001219	0.002494	-0.488791	0.6257
MS2^2	0.005801	0.002850	2.035549	0.0436

R-squared	0.024065	Mean dependent var	0.000274
Adjusted R-squared	-0.008685	S.D. dependent var	0.000440
S.E. of regression	0.000442	Akaike info criterion	-12.57484
Sum squared resid	2.90E-05	Schwarz criterion	-12.45703
Log likelihood	980.5502	F-statistic	0.734812
Durbin-Watson stat	1.538633	Prob(F-statistic)	0.598459

H_0: $\Sigma(\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity
H_1: $\Sigma(\varepsilon_{it}^2) = \sigma_{it}^2 \Rightarrow$ variance changes with IVs, heteroskedasticity

$n(R^2) = 155*.024065 = 3.73$

λ^2_5 critical value at .05 = 11.0705

Fail to reject H_0

Appendix A

Pooled Model:

$$PBIT_{it} = \alpha + \beta_1 MS1_{it} + \beta_2 MS2_{it} + \varepsilon_{it}$$

Test of Autocorrelation

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 02:13
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.054600	0.010332	5.284699	0.0000
MS1	-0.029003	0.024680	-1.175171	0.2418
MS2	0.011193	0.034472	0.324704	0.7459

R-squared	0.027178	Mean dependent var	0.046463
Adjusted R-squared	0.014378	S.D. dependent var	0.016831
S.E. of regression	0.016710	Akaike info criterion	-5.326505
Sum squared resid	0.042440	Schwarz criterion	-5.267600
Log likelihood	415.8042	F-statistic	2.123220
Durbin-Watson stat	0.837886	Prob(F-statistic)	0.123181

Durbin-Watson *d* Statistic = .837886

Critical *d*-values for n=155, k`=2
[1.706 to 1.76 and 2.24 to 2.29]

H_0: No autocorrelation
H_1: Autocorrelation

Reject H_0: [.837886 < 1.706]
Positive autocorrelation

Appendix B

Model 3 - Less Restrictive Pooled Model - Time - *Restricted*:*

$$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \varepsilon_{it}$$

Model 3 - Less Restrictive Pooled Model - Time - *Unrestricted*:*

$$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

* Including Newey-West adjustment for autocorrelation

<u>F-Test Model Comparison Between Restricted and Unrestricted Model</u>

$$F_{m,n-k} = \frac{(SSE_R - SSE_u) / m}{SSE_u / (n - k)}$$

H_0: The models are the same.
H_1: The models are not the same.

$m = 2 \quad (\beta_5, \beta_6)$
$n = 155$
$k = 7 \quad (\alpha_1, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$

$$F_{2,148} = \frac{(.042865 - .041605) / 2}{.041605 / 148}$$

$F_{2,148} = 2.2411$
$F_{2,148}$ critical value is ≈ 3.06

Fail to reject H_0
The models are the same.

Appendix C

Model 4 - Classic Fixed Effects Within Model - Market - *Restricted*:*

$$PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \varepsilon_{it}$$

Model 4 - Classic Fixed Effects Within Model - Market - *Unrestricted*:*

$$PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

* Including Newey-West adjustment for autocorrelation

<u>F-Test Model Comparison Between Restricted and Unrestricted Model</u>

$$F_{m,n-k} = \frac{(SSE_R - SSE_u) / m}{SSE_u / (n - k)}$$

H_0: The models are the same.
H_1: The models are not the same.

$m = 2 \quad (\beta_5, \beta_6)$
$n = 155$
$k = 7 \quad (\alpha_1, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$

$$F_{2,148} = \frac{(.034588 - .032681) / 2}{.032681 / 148}$$

$F_{2,148} = 4.3181$
$F_{2,148}$ critical value is ≈ 3.06

Reject H_0
The models are not the same.

Appendix D

Model 5 - Less Restrictive Pooled Model - Time - *Restricted*:*

$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$

Model 5 - Pooled Market Models - Time- *Unrestricted*:*

$PBIT_{it} = \alpha + \beta_1 Time1_{it} + \beta_2 Time2_{it} + \beta_3 Time3_{it} + \beta_4 Time4_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$

* Including Newey-West adjustment for autocorrelation

Chow Test

$$F_{k,n1+n2-2k} = \frac{(SSE_R - SSE_u) / k}{SSE_u / (n_1 + n_2 + \ldots n_5 - 2k)}$$

H_0: The models are the same.
H_1: The models are not the same.

n_1 through $n_5 = 155$
$k = 7 \quad (\alpha_1, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$

$$F_{7,141} = \frac{(.041605 - .026539) / 7}{.026539 / 141}$$

$F_{7,141} = 11.435$
$F_{7,141}$ critical value is ≈ 2.08

Reject H_0
The models arrey- Tc 0 Tw rerer

Appendix E

Model 6 - Less Restrictive Pooled Model - Market - *Restricted*:*

$$PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

Model 6 - Pooled Time Models - Market- *Unrestricted*:*

$$PBIT_{it} = \alpha + \beta_1 MktO_{it} + \beta_2 MktM_{it} + \beta_3 MktMN_{it} + \beta_4 MktD_{it} + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

* Including Newey-West adjustment for autocorrelation

Chow Test

$$F_{k,n1+n2-2k} = \frac{(SSE_R - SSE_u) / k}{SSE_u \ / \ (n_1 + n_2 + \ldots n_5 - 2k)}$$

H_0: The models are the same.
H_1: The models are not the same.

n_1 through n_5 = 155
$k = 7 \quad (\alpha_1, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6)$

$$F_{7,141} = \frac{(.032681 - .029708) / 7}{.029708 / 141}$$

$F_{7,141} = 2.01518$
$F_{7,141}$ critical value is ≈2.08

Fail to reject H_0
The models are the same.

Appendix F

Model 7 - Fixed Effects Model - *Restricted*:

$$PBIT_{it} = \alpha + \beta_1 Distr1_{it} + \beta_2 Distr2_{it} + \ldots \beta_{30} Distr30_{it} + \varepsilon_{it}$$

Model 7 - Fixed Effects - *Unrestricted*:

$$PBIT_{it} = \alpha + \beta_1 Distr1_{it} + \beta_2 Distr2_{it} + \ldots \beta_{30} Distr30_{it} + \beta_{31} MS1_{it} + \beta_{32} MS2_{it} + \varepsilon_{it}$$

<u>F-Test Model Comparison Between Restricted and Unrestricted Model</u>

$$F_{m,n-k} = \frac{(SSE_R - SSE_u) / m}{SSE_u / (n - k)}$$

H_0: The models are the same.
H_1: The models are not the same.

$m = 2 \quad (\beta_{31}, \beta_{32})$
$n = 155$
$k = 33 \quad (\alpha_1, \beta_1 \ldots \beta_{32})$

$$F_{2,122} = \frac{(.012006 - .011747) / 2}{.011747 / 122}$$

$F_{2,122} = 1.345$
$F_{2,122}$ critical value is ≈ 3.07

Fail to reject H_0
The models are the same.

Appendix G

Models Listed From Most Restricted to Least Restricted

Pooled Model (1)
R2 = .0272   MS1 *p*-value = .2418   MS2 *p*-value = .7459

$\Downarrow$

Cross-Sectional Between Model (2)
R^2 = .0580   MS1 *p*-value = .2506   MS2 *p*-value = .9625

$\Downarrow$

Less Restrictive Pooled Model - Time (3)
R^2 = .0463   MS1 *p*-value = .2295   MS2 *p*-value = .7167

$\Downarrow$

Less Restrictive Pooled Model - Markets (4)
R^2 = .2509   MS1 *p*-value = .1107   MS2 *p*-value = .2759

$\Downarrow$

Fixed Effects Model (7)
R^2 = .7307   MS1 *p*-value = .2593   MS2 *p*-value = .2370

END END END END

Appendix B

Classic Cross-Sectional Between Model:

$$PBIT_i = \alpha + \beta_1 MS1_i + \beta_2 MS2_i + \varepsilon_i$$

<u>Test for Heteroskedasticity</u>

White Heteroskedasticity Test:			
F-statistic	0.387019	Probability	0.852933
Obs*R-squared	2.227130	Probability	0.816908
Test Equation:			

Dependent Variable: RESID^2				
Method: Least Squares				
Date: 04/20/99 Time: 02:40				
Sample: 1 31				
Included observations: 31				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001058	0.000886	1.194599	0.2435
MS1	0.002099	0.003827	0.548375	0.5883
MS1^2	-0.002715	0.007031	-0.386096	0.7027
MS1*MS2	2.18E-05	0.013887	0.001568	0.9988
MS2	-0.013717	0.011232	-1.221221	0.2334
MS2^2	0.035695	0.027017	1.321220	0.1984
R-squared	0.071843	Mean dependent var		0.000194
Adjusted R-squared	-0.113789	S.D. dependent var		0.000236
S.E. of regression	0.000249	Akaike info criterion		-13.58718
Sum squared resid	1.55E-06	Schwarz criterion		-13.30963
Log likelihood	216.6012	F-statistic		0.387019
Durbin-Watson stat	1.952778	Prob(F-statistic)		0.852933

H_0: $\Sigma(\varepsilon_i^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity
H_1: $\Sigma(\varepsilon_i^2) = \sigma_i^2 \Rightarrow$ variance changes with IVs, heteroskedasticity

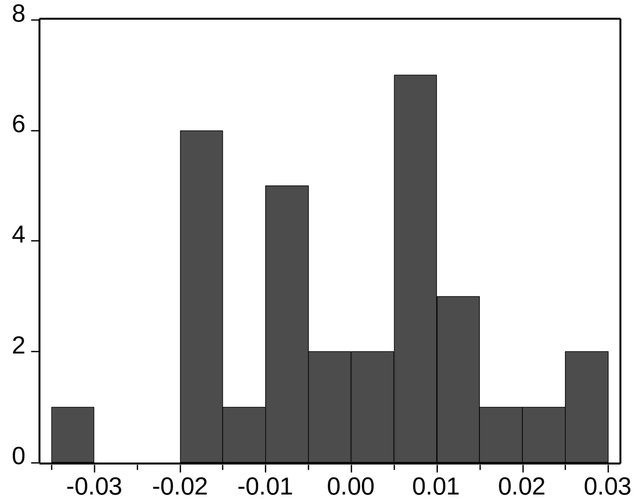
Fail to reject H_0: [p-value = .852933 > .05]

Appendix B

Classic Cross-Sectional Between Model:

$$PBIT_i = \alpha + \beta_1 MS1_i + \beta_2 MS2_i + \varepsilon_i$$

Test of Normal Residuals


8
6
4
2
0
-0.03
-0.02
-0.01
0.00
0.01
0.02
0.03

Dependent Variable: PBIT				
Method: Least Squares				
Date: 04/20/99 Time: 02:40				
Sample: 1 31				
Included observations: 31				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.058044	0.013993	4.148088	0.0003
MS1	-0.034620	0.029510	-1.173165	0.2506
MS2	0.002928	0.061709	0.047456	0.9625
R-squared	0.047681	Mean dependent var		0.046463
Adjusted R-squared	-0.020342	S.D. dependent var		0.014519
S.E. of regression	0.014666	Akaike info criterion		-5.514834
Sum squared resid	0.006022	Schwarz criterion		-5.376061
Log likelihood	88.47993	F-statistic		0.700958
Durbin-Watson stat	1.635107	Prob(F-statistic)		0.504608

Durbin-Watson *d* Statistic = 1.635107

Critical *d*-values for n=31, k=2
[1.297 to 1.57 and 2.43 to 2.703]

H_0: No autocorrelation
H_1: Autocorrelation

Fail to reject H_0: [1.57 < 1.635107 < 2.43]

Appendix C

Classic Fixed Effects Within Model - Time:

$$PBIT_{it} = \alpha + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

Test for Heteroskedasticity

White Heteroskedasticity Test:

F-statistic	1.290715	Probability	0.207190
Obs*R-squared	21.39794	Probability	0.208994

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99 Time: 03:04
Sample: 1 155
Included observations: 155

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000116	0.000665	0.174779	0.8615
DTIME1	5.35E-07	0.000684	0.000783	0.9994
DTIME1*MS1	-0.001269	0.001390	-0.913132	0.3628
DTIME1*MS2	0.002251	0.003173	0.709296	0.4793
DTIME2	0.001683	0.000628	2.680268	0.0083
DTIME2*MS1	-0.003065	0.001267	-2.420288	0.0168
DTIME2*MS2	-0.002125	0.002839	-0.748472	0.4555
DTIME3	0.000675	0.000543	1.241973	0.2164
DTIME3*MS1	-0.001687	0.001256	-1.343768	0.1812
DTIME3*MS2	-0.000796	0.002649	-0.300470	0.7643
DTIME4	0.000172	0.000530	0.324889	0.7458
DTIME4*MS1	-0.000638	0.001272	-0.501400	0.6169
DTIME4*MS2	-3.42E-05	0.002640	-0.012968	0.9897
MS1	-0.000580	0.002461	-0.235762	0.8140
MS1^2	0.002933	0.004057	0.723002	0.4709
MS1*MS2	-0.001926	0.008089	-0.238061	0.8122
MS2	0.000384	0.004054	0.094641	0.9247
MS2^2	-0.000673	0.007425	-0.090663	0.9279

R-squared	0.138051	Mean dependent var	0.000268
Adjusted R-squared	0.031094	S.D. dependent var	0.000453
S.E. of regression	0.000446	Akaike info criterion	-12.48508
Sum squared resid	2.72E-05	Schwarz criterion	-12.13165
Log likelihood	985.5934	F-statistic	1.290715
Durbin-Watson stat	1.477545	Prob(F-statistic)	0.207190

H_0: $\Sigma (\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity
H_1: $\Sigma (\varepsilon_{it}^2) = \sigma_{it}^{\ 2} \Rightarrow$ variance changes with IVs, heteroskedasticity

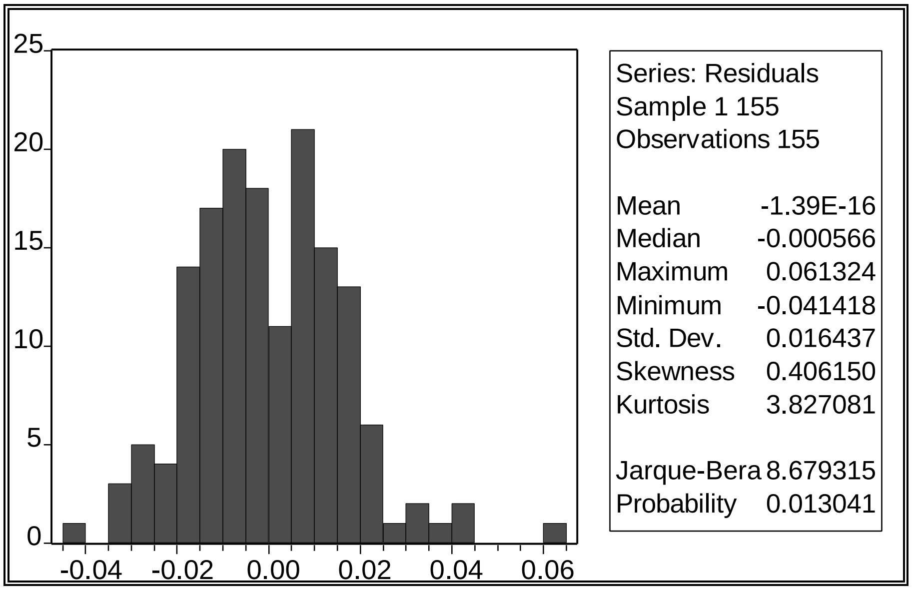
Fail to reject H_0: [p-value = .20719 > .05]

Appendix C

Classic Fixed Effects Within Model - Time:

$$PBIT_{it} = \alpha + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

Test of Normal Residuals



H_0: Residuals are normal

H_1: Residuals are notare 4 re 304130.BTBTB

Dependent Variable: PBIT				
Method: Least Squares				
Date: 04/20/99 Time: 03:04				
Sample: 1 155				
Included observations: 155				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056214	0.006678	8.418336	0.0000
DTIME1	-0.002056	0.004754	-0.432521	0.6660
DTIME2	-0.006355	0.004293	-1.480071	0.1410
DTIME3	-0.001621	0.004260	-0.380443	0.7042
DTIME4	4.82E-05	0.004264	0.011309	0.9910
MS1	-0.030218	0.014365	-2.103624	0.0371
MS2	0.015700	0.026496	0.592526	0.5544
R-squared	0.046304	Mean dependent var		0.046463
Adjusted R-squared	0.007641	S.D. dependent var		0.016831
S.E. of regression	0.016767	Akaike info criterion		-5.294749
Sum squared resid	0.041605	Schwarz criterion		-5.157304
Log likelihood	417.3430	F-statistic		1.197620
Durbin-Watson stat	0.817078	Prob(F-statistic)		0.310726

Durbin-Watson *d* Statistic = .817078

Critical *d*-values for n=155, k=2
[1.706 to 1.76 and 2.24 to 2.29]

H_0: No autocorrelation
H_1: Autocorrelation

Reject $\boldsymbol{H_0}$: [.817078 < 1.706]
Positive Autocorrelation

Appendix D

Classic Fixed Effects Within Model - Market:

$$PBIT_{it} = \alpha + \beta_1 MktO + \beta_2 MktM + \beta_3 MktMN + \beta_4 MktD + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

<u>Test for Heteroskedasticity</u>

White Heteroskedasticity Test:			
F-statistic	1.327085	Probability	0.184689
Obs*R-squared	21.91564	Probability	0.187985

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99 Time: 03:34
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000869	0.000656	1.324330	0.1876
MKTO	-0.001656	0.000998	-1.659185	0.0994
MKTO*MS1	0.003726	0.001996	1.866575	0.0641
MKTO*MS2	0.002707	0.002777	0.974601	0.3315
MKTM	0.000117	0.000621	0.188077	0.8511
MKTM*MS1	0.000508	0.001313	0.387103	0.6993
MKTM*MS2	-0.002099	0.001818	-1.154532	0.2503
MKTMN	-0.000280	0.000622	-0.450306	0.6532
MKTMN*MS1	0.000721	0.001407	0.512194	0.6093
MKTMN*MS2	-0.000216	0.001547	-0.139376	0.8894
MKTD	-0.000260	0.000592	-0.438770	0.6615
MKTD*MS1	2.86E-05	0.001299	0.022021	0.9825
MKTD*MS2	0.000818	0.001372	0.595877	0.5522
MS1	-0.004302	0.002219	-1.938442	0.0546
MS1^2	0.005619	0.003527	1.593017	0.1135
MS1*MS2	-0.001159	0.007660	-0.151308	0.8800
MS2	0.001953	0.002078	0.939989	0.3489
MS2^2	-0.003813	0.007272	-0.524289	0.6009

R-squared	0.141391	Mean dependent var	0.000211
Adjusted R-squared	0.034849	S.D. dependent var	0.000328
S.E. of regression	0.000323	Akaike info criterion	-13.13099
Sum squared resid	1.43E-05	Schwarz criterion	-12.77756
Log likelihood	1035.652	F-statistic	1.327085
Durbin-Watson stat	1.617228	Prob(F-statistic)	0.184689

H_0: $\Sigma(\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity
H_1: $\Sigma(\varepsilon_{it}^2) = \sigma_{it}^{\ 2} \Rightarrow$ variance changes with IVs, heteroskedasticity

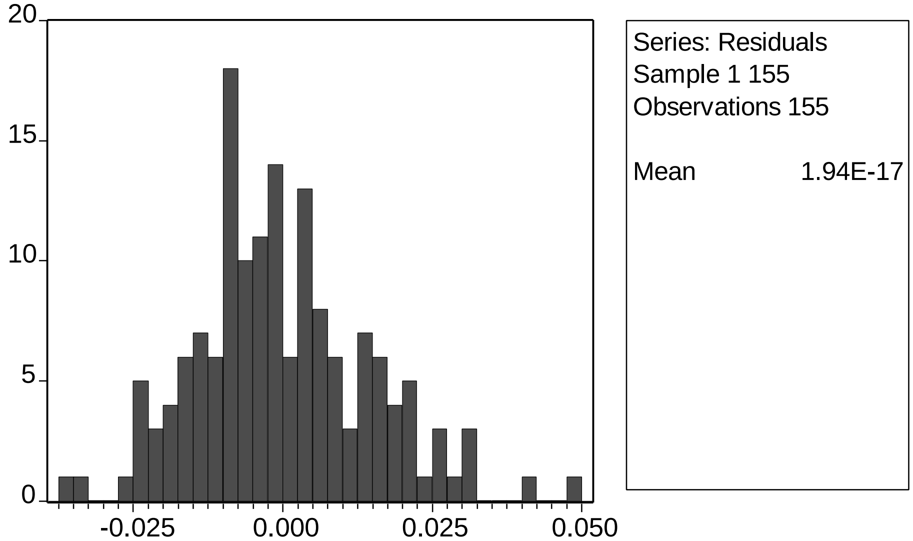
Fail to reject H_0: [*p*-value = .184689 > .05]

Appendix D

Classic Fixed Effects Within Model - Market:

$$PBIT_{it} = \alpha + \beta_1 MktO + \beta_2 MktM + \beta_3 MktMN + \beta_4 MktD + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

<u>Test of Normal Residuals</u>


20
15
10
5
0
-0.025
0.000
0.025
0.050
Series: Residuals
Sample 1 155
Observations 155
Mean 1.94E-17

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 03:32
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.067398	0.009689	6.956028	0.0000
MKTO	-0.023498	0.006216	-3.780295	0.0002
MKTM	-0.018452	0.005040	-3.661494	0.0003
MKTMN	-0.011828	0.005340	-2.215025	0.0283
MKTD	-0.010502	0.004594	-2.286178	0.0237
MS1	-0.035575	0.022168	-1.604751	0.1107
MS2	0.033778	0.030885	1.093677	0.2759

R-squared	0.250878	Mean dependent var	0.046463
Adjusted R-squared	0.220509	S.D. dependent var	0.016831
S.E. of regression	0.014860	Akaike info criterion	-5.536192
Sum squared resid	0.032681	Schwarz criterion	-5.398747
Log likelihood	436.0549	F-statistic	8.260784

White Heteroskedasticity Test:			
F-statistic	0.463908	Probability	0.948906
Obs*R-squared	10.17270	Probability	0.896212

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99 Time: 06:25
Sample: 1 140 IF MKTO = 1
Included observations: 45
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002649	0.005732	0.462062	0.6477
TIME1	-0.000169	0.001009	-0.167374	0.8683
TIME1*MS1	-0.001474	0.003523	-0.418464	0.6789
TIME1*MS2	0.002883	0.002142	1.345854	0.1895
TIME2	-0.002493	0.003111	-0.801340	0.4299
TIME2*MS1	0.004719	0.005650	0.835258	0.4109
TIME2*MS2	0.006848	0.008883	0.770938	0.4474
TIME3	-0.000137	0.000909	-0.150888	0.8812
TIME3*MS1	-0.000177	0.001964	-0.089976	0.9290
TIME3*MS2	0.001143	0.002479	0.461009	0.6485
TIME4	0.000745	0.001063	0.701142	0.4892
TIME4*MS1	-0.001985	0.002230	-0.889875	0.3814
TIME4*MS2	-0.000871	0.002434	-0.358018	0.7231
MS1	-0.016290	0.032782	-0.496917	0.6233
MS1^2	0.020708	0.040395	0.512644	0.6124
MS1*MS2	0.027066	0.059594	0.454166	0.6533
MS2	-0.002817	0.012293	-0.229170	0.8205
MS2^2	-0.012899	0.013135	-0.982061	0.3348

R-squared	0.226060	Mean dependent var	0.000235
Adjusted R-squared	-0.261235	S.D. dependent var	0.000424
S.E. of regression	0.000477	Akaike info criterion	-12.17021
Sum squared resid	6.14E-06	Schwarz criterion	-11.44754
Log likelihood	291.8297	F-statistic	0.463908
Durbin-Watson stat	1.574957	Prob(F-statistic)	0.948906

H_0: $\Sigma(\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity

H_1: $\Sigma(\varepsilon_{it}^2) = \sigma_{it}^2 \Rightarrow$ variance changes with IVs, heteroskedasticity

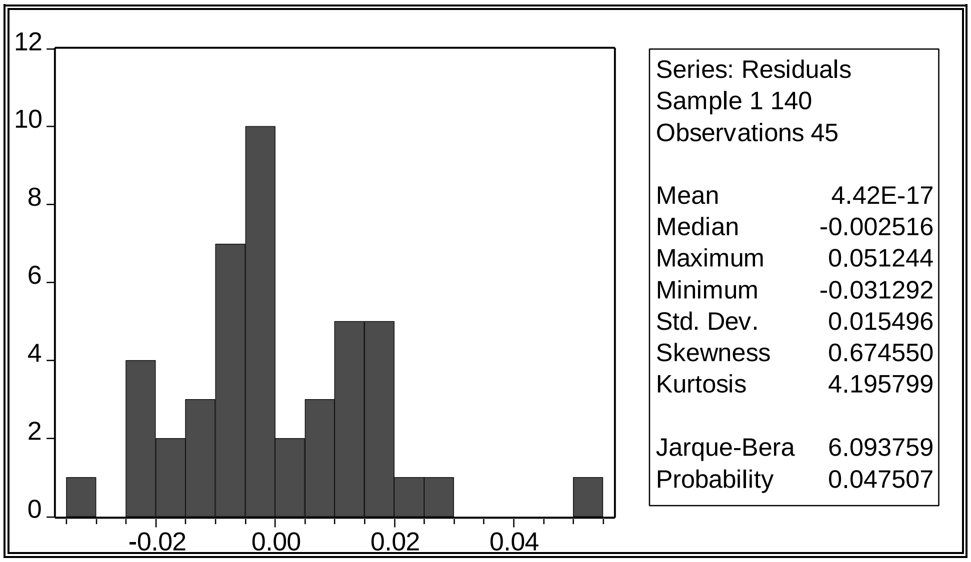
Fail to reject H_0: [*p*-value = .948906 > .05]

Appendix E

Individual Models - *Market O*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Normal Residuals



H_0: Residuals are normal
H_1: Residuals are not normal

Reject H_0: [.047507 < .05]
Residuals are not normal

Appendix E

Individual Models - *Market O*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Autocorrelation

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 06:24
Sample(adjusted): 1 140 IF MKTO = 1
Included observations: 45 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009898	0.020008	0.494718	0.6236
TIME1	-0.015472	0.007809	-1.981279	0.0548
TIME2	-0.009720	0.008056	-1.206470	0.2351
TIME3	-0.003219	0.004868	-0.661247	0.5124
TIME4	-0.001555	0.003493	-0.445199	0.6587
MS1	0.026635	0.060106	0.443132	0.6602
MS2	0.139382	0.033089	4.212313	0.0001

R-squared	0.241430	Mean dependent var	0.039224
Adjusted R-squared	0.121656	S.D. dependent var	0.017792
S.E. of regression	0.016674	Akaike info criterion	-5.207843
Sum squared resid	0.010565	Schwarz criterion	-4.926807
Log likelihood	124.1765	F-statistic	2.015714
Durbin-Watson stat	0.738542	Prob(F-statistic)	0.087426

Durbin-Watson *d* Statistic = .738542

Critical *d*-values for n=45, k=2
[1.43 to 1.615 and 2.385 to 2.57]

H_0: No autocorrelation
H_1: Autocorrelation

Reject $\boldsymbol{H_0}$: [.738542 < 1.43]
Positive Autocorrelation

Appendix E

Individual Models - *Market D*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test for Heteroskedasticity

White Heteroskedasticity Test:			
F-statistic	2.304661	Probability	0.073070
Obs*R-squared	22.96590	Probability	0.150364

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99 Time: 07:03
Sample: 46 120 IF MKTD = 1
Included observations: 30
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

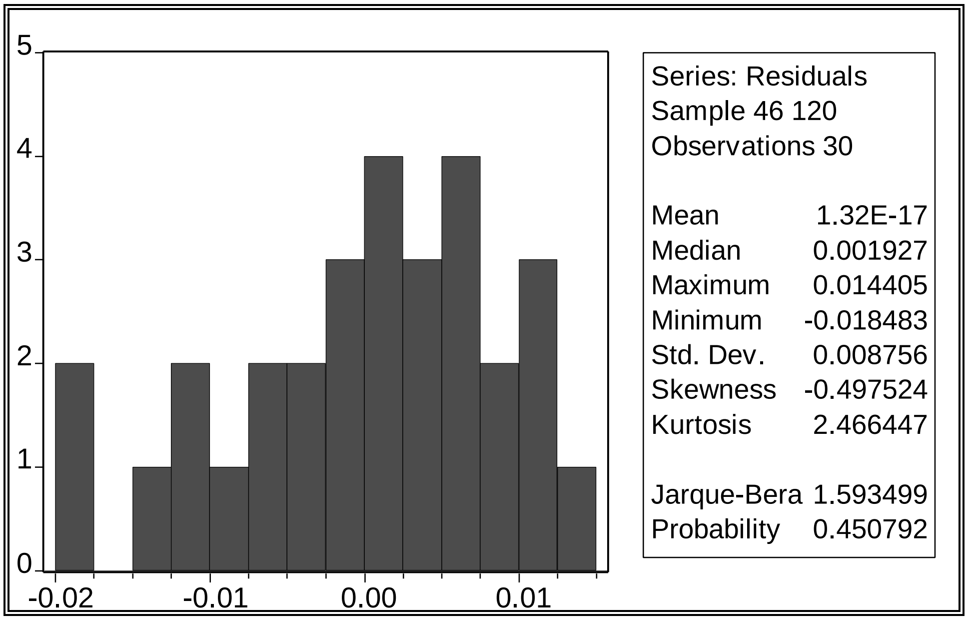
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001864	0.001448	1.287495	0.2222
TIME1	0.001055	0.000471	2.239782	0.0448
TIME1*MS1	-0.003348	0.001248	-2.683125	0.0199
TIME1*MS2	0.001051	0.002782	0.377629	0.7123
TIME2	0.000366	0.000433	0.844824	0.4147
TIME2*MS1	-0.002646	0.000884	-2.992539	0.0112
TIME2*MS2	0.003329	0.002281	1.459373	0.1701
TIME3	0.000364	0.000505	0.720797	0.4848
TIME3*MS1	-0.000781	0.001022	-0.763620	0.4598
TIME3*MS2	-0.000761	0.001585	-0.480000	0.6399
TIME4	-7.35E-05	0.000396	-0.185602	0.8559
TIME4*MS1	-0.000165	0.000724	-0.228541	0.8231
TIME4*MS2	0.000707	0.001521	0.464816	0.6504
MS1	-0.012530	0.004431	-2.828097	0.0152
MS1^2	0.015082	0.004892	3.082989	0.0095
MS1*MS2	0.014218	0.025039	0.567819	0.5806
MS2	0.004672	0.007729	0.604460	0.5568
MS2^2	-0.031496	0.023167	-1.359519	0.1990

R-squared	0.765530	Mean dependent var	7.41E-05
Adjusted R-squared	0.433364	S.D. dependent var	9.13E-05
S.E. of regression	6.87E-05	Akaike info criterion	-16.04938
Sum squared resid	5.67E-08	Schwarz criterion	-15.20866
Log likelihood	258.7407	F-statistic	2.304661
Durbin-Watson stat	1.588899	Prob(F-statistic)	0.073070

H_0: $\Sigma(\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity

H_1: $\Sigma(\varepsilon_{it}^2) = \sigma_{it}^2 \Rightarrow$

Test of Normal Residuals



H_0: Residuals are normal
H_1: Residuals are not normal

Fail to reject H_0: [.450792 > .05]

Appendix E

Individual Models - *Market D*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Autocorrelation

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99   Time: 07:01
Sample(adjusted): 46 120 IF MKTD = 1
Included observations: 30 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.054507	0.018092	3.012699	0.0062
TIME1	-0.011149	0.006036	-1.847173	0.0776
TIME2	-0.007169	0.005573	-1.286239	0.2112
TIME3	-0.001867	0.004021	-0.464234	0.6468
TIME4	-0.002107	0.003512	-0.600137	0.5543
MS1	-0.086417	0.049499	-1.745840	0.0942
MS2	0.182288	0.069104	2.637884	0.0147

R-squared	0.347262	Mean dependent var	0.050103
Adjusted R-squared	0.176982	S.D. dependent var	0.010838
S.E. of regression	0.009832	Akaike info criterion	-6.205294
Sum squared resid	0.002224	Schwarz criterion	-5.878348
Log likelihood	100.0794	F-statistic	2.039362
Durbin-Watson stat	0.956601	Prob(F-statistic)	0.101153

Durbin-Watson *d* Statistic = .956601

Critical *d*-values for n=30, k=2
[1.284 to 1.567 and 2.433 to 2.716]

H_0: No autocorrelation
H_1: Autocorrelation

Reject $\boldsymbol{H_0}$: [.956601 < 1.284]
Positive Autocorrelation

Appendix E

Individual Models - *Market C*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test for Heteroskedasticity

White Heteroskedasticity Test:

F-statistic	2.482798	Probability	0.057865
Obs*R-squared	13.84625	Probability	0.085862

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99 Time: 09:15
Sample: 56 155 IF MKTC = 1
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005565	0.001832	3.038025	0.0078
TIME1	0.000192	0.000262	0.732114	0.4747
TIME2	0.000249	0.000206	1.209370	0.2441
TIME3	-0.000156	0.000180	-0.863327	0.4007
TIME4	-0.000184	0.000185	-0.991823	0.3360
MS1	-0.037289	0.010571	-3.527509	0.0028
MS1^2	0.056719	0.016048	3.534460	0.0028
MS2	0.006663	0.008497	0.784144	0.4444
MS2^2	-0.022116	0.023573	-0.938169	0.3621

R-squared	0.553850	Mean dependent var	0.000228
Adjusted R-squared	0.330775	S.D. dependent var	0.000395
S.E. of regression	0.000323	Akaike info criterion	-12.96310
Sum squared resid	1.67E-06	Schwarz criterion	-12.52430
Log likelihood	171.0387	F-statistic	2.482798
Durbin-Watson stat	2.222856	Prob(F-statistic)	0.057865

H_0: $\Sigma(\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity
H_1: $\Sigma(\varepsilon_{it}^2) = \sigma_{it}^2 \Rightarrow$ variance changes with IVs, heteroskedasticity

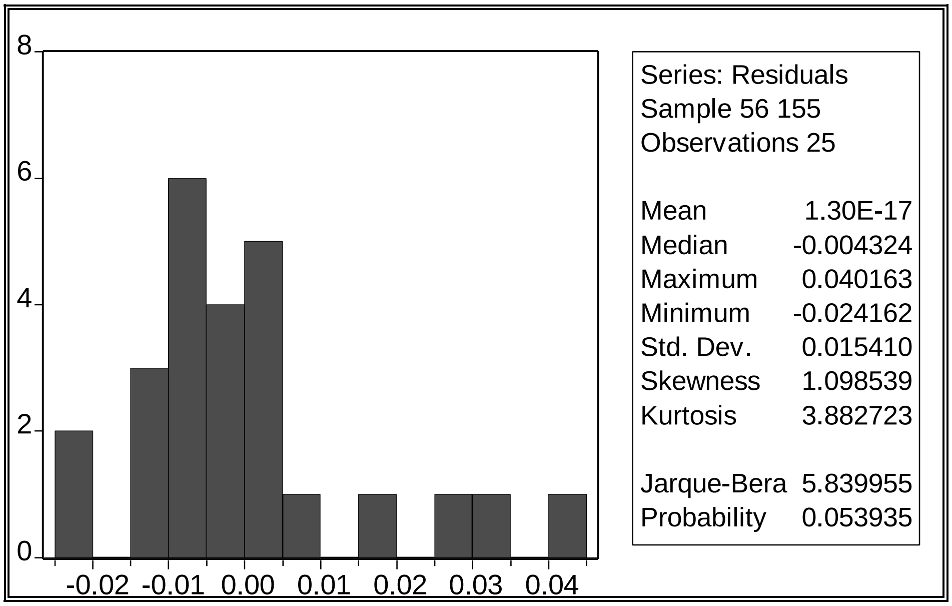
Fail to reject H_0: [*p*-value = .057865 > .05]

Appendix E

Individual Models - *Market C*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Normal Residuals



H_0: Residuals are normal
H_1: Residuals are not normal

Fail to reject $\boldsymbol{H_0}$: [.053935 > .05]

Appendix E

Individual Models - ***Market C***:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Autocorrelation

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 07:04
Sample(adjusted): 56 155 IF MKTC = 1
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.081295	0.021391	3.800450	0.0013
TIME1	0.004926	0.014014	0.351496	0.7293
TIME2	0.000667	0.011330	0.058880	0.9537
TIME3	0.001042	0.009847	0.105817	0.9169
TIME4	0.000286	0.010192	0.028100	0.9779
MS1	-0.047364	0.045455	-1.041997	0.3112
MS2	-0.032503	0.084512	-0.384595	0.7050

R-squared	0.061746	Mean dependent var	0.061260
Adjusted R-squared	-0.251005	S.D. dependent var	0.015909
S.E. of regression	0.017794	Akaike info criterion	-4.988429
Sum squared resid	0.005699	Schwarz criterion	-4.647144
Log likelihood	69.35536	F-statistic	0.197429
Durbin-Watson stat	2.008275	Prob(F-statistic)	0.973299

Durbin-Watson *d* Statistic = 2.008275

Critical *d*-values for n=25, k=2
[1.206 to 1.55 and 2.45 to 2.794]

H_0: No autocorrelation
H_1: Autocorrelation

Fail to reject $\boldsymbol{H_0}$: [1.55 < 2.008275 < 2.45]

Appendix E

Individual Models - *Market M*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test for Heteroskedasticity

White Heteroskedasticity Test:			
F-statistic	2.035014	Probability	0.076527
Obs*R-squared	23.46793	Probability	0.134628

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99 Time: 07:24
Sample: 16 130 IF MKTM = 1
Included observations: 35
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000107	0.000309	0.345397	0.7340
TIME1	0.000448	0.000489	0.916495	0.3722
TIME1*MS1	-0.002019	0.000668	-3.021449	0.0077
TIME1*MS2	0.001490	0.003381	0.440698	0.6650
TIME2	0.002057	0.001127	1.824983	0.0856
TIME2*MS1	8.51E-05	0.000740	0.115056	0.9097
TIME2*MS2	-0.009082	0.005964	-1.522824	0.1462
TIME3	0.000220	0.000112	1.961320	0.0664
TIME3*MS1	-0.000606	0.000527	-1.151092	0.2656
TIME3*MS2	-1.71E-05	0.001430	-0.011952	0.9906
TIME4	8.15E-05	0.000167	0.487134	0.6324
TIME4*MS1	-0.000383	0.000445	-0.861046	0.4012
TIME4*MS2	0.000132	0.001481	0.089237	0.9299
MS1	0.003107	0.003429	0.905943	0.3776
MS1^2	-0.002613	0.004376	-0.597151	0.5583
MS1*MS2	-0.000652	0.017703	-0.036834	0.9710
MS2	-0.007136	0.006970	-1.023736	0.3203
MS2^2	0.016147	0.037824	0.426895	0.6748

R-squared	0.670512	Mean dependent var	0.000188
Adjusted R-squared	0.341024	S.D. dependent var	0.000257
S.E. of regression	0.000209	Akaike info criterion	-13.80341
Sum squared resid	7.42E-07	Schwarz criterion	-13.00351
Log likelihood	259.5596	F-statistic	2.035014
Durbin-Watson stat	2.090240	Prob(F-statistic)	0.076527

H_0: $\Sigma (\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity
H_1: $\Sigma (\varepsilon_{it}^2) = \sigma_{it}^2 \Rightarrow$ variance changes with IVs, heteroskedasticity

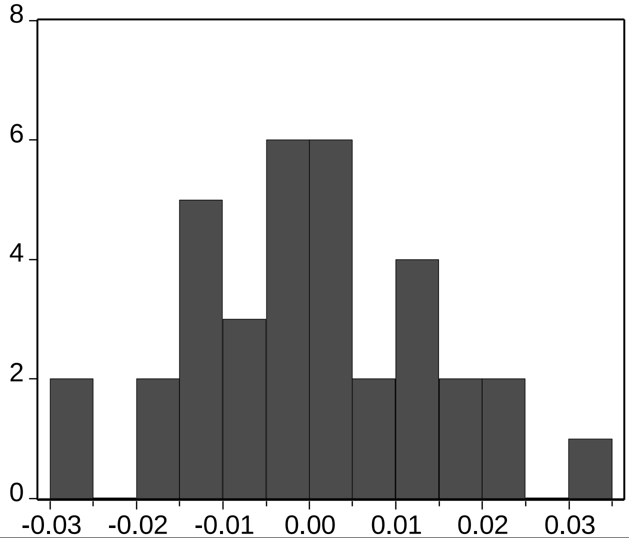
Fail to reject H_0: [*p*-value = .076527 > .05]

Appendix E

Individual Models - *Market M*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Normal Residuals



Series: Residuals	
Sample 16 130	
Observations 35	
Mean	9.68E-18
Median	-0.000143
Maximum	0.032211
Minimum	-0.029916
Std. Dev.	0.013929
Skewness	0.075304
Kurtosis	2.810400
Jarque-Bera	0.085504
Probability	0.958149

H_0: Residuals are normal
H_1: Residuals are not normal

Fail to reject H_0: [.958149 > .05]

Appendix E

Individual Models - *Market M*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Autocorrelation

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 07:23
Sample(adjusted): 16 130 IF MKTM = 1
Included observations: 35 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.061352	0.008506	7.212626	0.0000
TIME1	0.005648	0.006644	0.850190	0.4024
TIME2	-0.002477	0.010201	-0.242794	0.8099
TIME3	3.02E-05	0.005598	0.005396	0.9957
TIME4	0.000835	0.003657	0.228286	0.8211
MS1	-0.005909	0.033888	-0.174366	0.8628
MS2	-0.098234	0.066911	-1.468122	0.1532

R-squared	0.178974	Mean dependent var	0.041686
Adjusted R-squared	0.003040	S.D. dependent var	0.015372
S.E. of regression	0.015349	Akaike info criterion	-5.338717
Sum squared resid	0.006596	Schwarz criterion	-5.027647
Log likelihood	100.4275	F-statistic	1.017278
Durbin-Watson stat	1.334660	Prob(F-statistic)	0.434398

Durbin-Watson *d* Statistic = 1.33466

Critical *d*-values for n=35, k=2
[1.343 to 1.584 and 2.416 to 2.2657]

H_0: No autocorrelation
H_1: Autocorrelation

Reject H_0: [1.33466 < 1.343]
Positive Autocorrelation

Appendix E

Individual Models - *Market MN*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test for Heteroskedasticity

White Heteroskedasticity Test:

F-statistic	0.875494	Probability	0.564047
Obs*R-squared	7.780460	Probability	0.455204

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/20/99 Time: 09:29
Sample: 41 125 IF MKTMN = 1
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000111	0.001176	0.094598	0.9263
TIME1	0.000165	0.000239	0.691194	0.5038
TIME2	0.000167	8.20E-05	2.033326	0.0669
TIME3	-1.41E-06	7.62E-05	-0.018521	0.9856
TIME4	2.37E-05	7.52E-05	0.315600	0.7582
MS1	-0.001272	0.004800	-0.265051	0.7959
MS1^2	0.001636	0.005667	0.288668	0.7782
MS2	0.003209	0.005801	0.553177	0.5912
MS2^2	-0.013599	0.021274	-0.639231	0.5358

R-squared	0.389023	Mean dependent var	7.28E-05
Adjusted R-squared	-0.055324	S.D. dependent var	0.000101
S.E. of regression	0.000104	Akaike info criterion	-15.20468
Sum squared resid	1.19E-07	Schwarz criterion	-14.75660
Log likelihood	161.0468	F-statistic	0.875494
Durbin-Watson stat	2.635261	Prob(F-statistic)	0.564047

H_0: $\Sigma(\varepsilon_{it}^2) = \sigma^2 \Rightarrow$ constant variance, homoskedasticity
H_1: $\Sigma(\varepsilon_{it}^2) = \sigma_{it}^2 \Rightarrow$ variance changes with IVs, heteroskedasticity

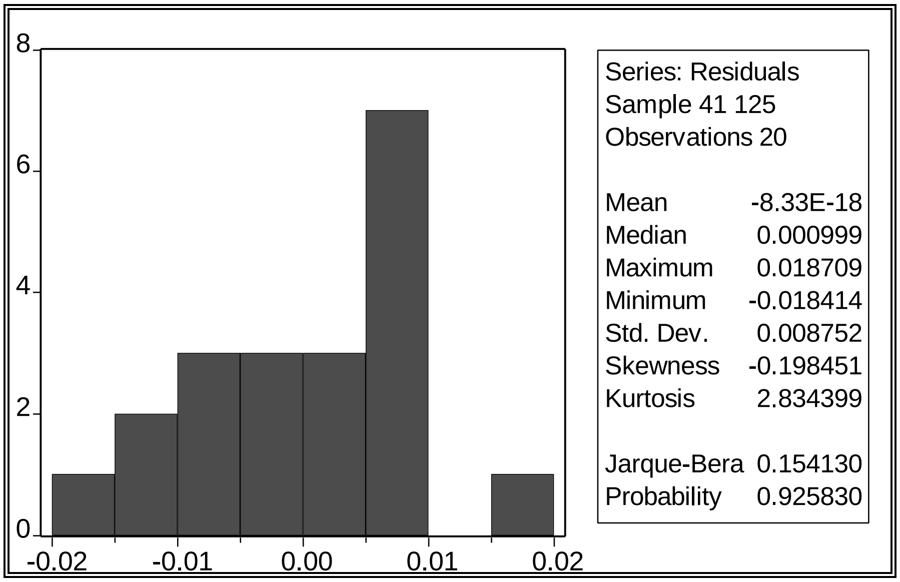
Fail to reject H_0: [p-value = .564047 > .05]

Appendix E

Individual Models - *Market MN*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Normal Residuals



H_0: Residuals are normal
H_1: Residuals are not normal

Fail to reject H_0: [.925830 > .05]

Appendix E

Individual Models - *Market MN*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Test of Autocorrelation

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 08:15
Sample(adjusted): 41 125 IF MKTMN = 1
Included observations: 20 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.048812	0.018776	2.599748	0.0220
TIME1	0.017122	0.012164	1.407579	0.1827
TIME2	-0.016351	0.008037	-2.034534	0.0628
TIME3	-0.008924	0.007612	-1.172336	0.2621
TIME4	-0.001862	0.007550	-0.246581	0.8091
MS1	0.062811	0.037179	1.689416	0.1150
MS2	-0.146507	0.101441	-1.444258	0.1723

R-squared	0.537253	Mean dependent var	0.047155
Adjusted R-squared	0.323678	S.D. dependent var	0.012865
S.E. of regression	0.010580	Akaike info criterion	-5.990414
Sum squared resid	0.001455	Schwarz criterion	-5.641907
Log likelihood	66.90414	F-statistic	2.515521
Durbin-Watson stat	1.896189	Prob(F-statistic)	0.076998

Durbin-Watson *d* Statistic = 1.896189

Critical *d*-values for n=20, k=2
[1.1 to 1.537 and 2.463 to 2.9]

H_0: No autocorrelation
H_1: Autocorrelation

Fail to reject H_0: [1.537 < 1.896189 < 2.463]

Appendix F

Pooled Model:

$$PBIT_{it} = \alpha + \beta_1 MS1_{it} + \beta_2 MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/18/99 Time: 12:06
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.054600	0.010332	5.284699	0.0000
MS1	-0.029003	0.024680	-1.175171	0.2418
MS2	0.011193	0.034472	0.324704	0.7459
R-squared	0.027178	Mean dependent var		0.046463
Adjusted R-squared	0.014378	S.D. dependent var		0.016831
S.E. of regression	0.016710	Akaike info criterion		-5.326505
Sum squared resid	0.042440	Schwarz criterion		-5.267600
Log likelihood	415.8042	F-statistic		2.123220
Durbin-Watson stat	0.837886	Prob(F-statistic)		0.123181

Classic Cross-Sectional Between Model:

$$PBIT_{i} = \alpha + \beta_1 MS1_{i} + \beta_2 MS2_{i} + \varepsilon_{i}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/18/99 Time: 12:01
Sample: 1 31
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.058044	0.013993	4.148088	0.0003
MS1	-0.034620	0.029510	-1.173165	0.2506
MS2	0.002928	0.061709	0.047456	0.9625
R-squared	0.047681	Mean dependent var		0.046463
Adjusted R-squared	-0.020342	S.D. dependent var		0.014519
S.E. of regression	0.014666	Akaike info criterion		-5.514834
Sum squared resid	0.006022	Schwarz criterion		-5.376061
Log likelihood	88.47993	F-statistic		0.700958
Durbin-Watson stat	1.635107	Prob(F-statistic)		0.504608

Appendix F

Classic Fixed Effects Within Model - Time:

$$PBIT_{it} = \alpha + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 03:04
Sample: 1 155
Included observations: 155

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056214	0.006678	8.418336	0.0000
DTIME1	-0.002056	0.004754	-0.432521	0.6660
DTIME2	-0.006355	0.004293	-1.480071	0.1410
DTIME3	-0.001621	0.004260	-0.380443	0.7042
DTIME4	4.82E-05	0.004264	0.011309	0.9910
MS1	-0.030218	0.014365	-2.103624	0.0371
MS2	0.015700	0.026496	0.592526	0.5544

R-squared	0.046304	Mean dependent var	0.046463
Adjusted R-squared	0.007641	S.D. dependent var	0.016831
S.E. of regression	0.016767	Akaike info criterion	-5.294749
Sum squared resid	0.041605	Schwarz criterion	-5.157304
Log likelihood	417.3430	F-statistic	1.197620
Durbin-Watson stat	0.817078	Prob(F-statistic)	0.310726

Classic Fixed Effects Within Model - Market:

$$PBIT_{it} = \alpha + \beta_1 MktO + \beta_2 MktM + \beta_3 MktMN + \beta_4 MktD + \beta_5 MS1_{it} + \beta_6 MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 03:32
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.067398	0.009689	6.956028	0.0000
MKTO	-0.023498	0.006216	-3.780295	0.0002
MKTM	-0.018452	0.005040	-3.661494	0.0003
MKTMN	-0.011828	0.005340	-2.215025	0.0283
MKTD	-0.010502	0.004594	-2.286178	0.0237
MS1	-0.035575	0.022168	-1.604751	0.1107
MS2	0.033778	0.030885	1.093677	0.2759

R-squared	0.250878	Mean dependent var	0.046463
Adjusted R-squared	0.220509	S.D. dependent var	0.016831
S.E. of regression	0.014860	Akaike info criterion	-5.536192
Sum squared resid	0.032681	Schwarz criterion	-5.398747
Log likelihood	436.0549	F-statistic	8.260784
Durbin-Watson stat	1.079035	Prob(F-statistic)	0.000000

Appendix F

Individual Models - *Market O*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 06:24
Sample(adjusted): 1 140 IF MKTO = 1
Included observations: 45 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009898	0.020008	0.494718	0.6236
TIME1	-0.015472	0.007809	-1.981279	0.0548
TIME2	-0.009720	0.008056	-1.206470	0.2351
TIME3	-0.003219	0.004868	-0.661247	0.5124
TIME4	-0.001555	0.003493	-0.445199	0.6587
MS1	0.026635	0.060106	0.443132	0.6602
MS2	0.139382	0.033089	4.212313	0.0001

R-squared	0.241430	Mean dependent var	0.039224
Adjusted R-squared	0.121656	S.D. dependent var	0.017792
S.E. of regression	0.016674	Akaike info criterion	-5.207843
Sum squared resid	0.010565	Schwarz criterion	-4.926807
Log likelihood	124.1765	F-statistic	2.015714
Durbin-Watson stat	0.738542	Prob(F-statistic)	0.087426

Individual Models - *Market D*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 07:01
Sample(adjusted): 46 120 IF MKTD = 1
Included observations: 30 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.054507	0.018092	3.012699	0.0062
TIME1	-0.011149	0.006036	-1.847173	0.0776
TIME2	-0.007169	0.005573	-1.286239	0.2112
TIME3	-0.001867	0.004021	-0.464234	0.6468
TIME4	-0.002107	0.003512	-0.600137	0.5543
MS1	-0.086417	0.049499	-1.745840	0.0942
MS2	0.182288	0.069104	2.637884	0.0147

R-squared	0.347262	Mean dependent var	0.050103
Adjusted R-squared	0.176982	S.D. dependent var	0.010838
S.E. of regression	0.009832	Akaike info criterion	-6.205294
Sum squared resid	0.002224	Schwarz criterion	-5.878348
Log likelihood	100.0794	F-statistic	2.039362
Durbin-Watson stat	0.956601	Prob(F-statistic)	0.101153

Appendix F

Individual Models - *Market C*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 07:04
Sample(adjusted): 56 155 IF MKTC = 1
Included observations: 25 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.081295	0.021391	3.800450	0.0013
TIME1	0.004926	0.014014	0.351496	0.7293
TIME2	0.000667	0.011330	0.058880	0.9537
TIME3	0.001042	0.009847	0.105817	0.9169
TIME4	0.000286	0.010192	0.028100	0.9779
MS1	-0.047364	0.045455	-1.041997	0.3112
MS2	-0.032503	0.084512	-0.384595	0.7050

R-squared	0.061746	Mean dependent var	0.061260
Adjusted R-squared	-0.251005	S.D. dependent var	0.015909
S.E. of regression	0.017794	Akaike info criterion	-4.988429
Sum squared resid	0.005699	Schwarz criterion	-4.647144
Log likelihood	69.35536	F-statistic	0.197429
Durbin-Watson stat	2.008275	Prob(F-statistic)	0.973299

Individual Models - *Market M*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 07:23
Sample(adjusted): 16 130 IF MKTM = 1
Included observations: 35 after adjusting endpoints
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.061352	0.008506	7.212626	0.0000
TIME1	0.005648	0.006644	0.850190	0.4024
TIME2	-0.002477	0.010201	-0.242794	0.8099
TIME3	3.02E-05	0.005598	0.005396	0.9957
TIME4	0.000835	0.003657	0.228286	0.8211
MS1	-0.005909	0.033888	-0.174366	0.8628
MS2	-0.098234	0.066911	-1.468122	0.1532

R-squared	0.178974	Mean dependent var	0.041686
Adjusted R-squared	0.003040	S.D. dependent var	0.015372
S.E. of regression	0.015349	Akaike info criterion	-5.338717
Sum squared resid	0.006596	Schwarz criterion	-5.027647
Log likelihood	100.4275	F-statistic	1.017278
Durbin-Watson stat	1.334660	Prob(F-statistic)	0.434398

Appendix F

Individual Models - *Market MN*:

$$PBIT_{it} = \alpha_i + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \beta_{5i} MS1_{it} + \beta_{6i} MS2_{it} + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 08:15
Sample(adjusted): 41 125 IF MKTMN = 1
Included observations: 20 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.048812	0.018776	2.599748	0.0220
TIME1	0.017122	0.012164	1.407579	0.1827
TIME2	-0.016351	0.008037	-2.034534	0.0628
TIME3	-0.008924	0.007612	-1.172336	0.2621
TIME4	-0.001862	0.007550	-0.246581	0.8091
MS1	0.062811	0.037179	1.689416	0.1150
MS2	-0.146507	0.101441	-1.444258	0.1723

R-squared	0.537253	Mean dependent var	0.047155
Adjusted R-squared	0.323678	S.D. dependent var	0.012865
S.E. of regression	0.010580	Akaike info criterion	-5.990414
Sum squared resid	0.001455	Schwarz criterion	-5.641907
Log likelihood	66.90414	F-statistic	2.515521
Durbin-Watson			

Classic Fixed Effects Within Model - Time [*Unrestricted*]:

$$PBIT_{it} = \alpha + \beta_1 Time1 + \beta_2 Time2 + \beta_3 Time3 + \beta_4 Time4 + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 05:42
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.048132	0.002763	17.41733	0.0000
DTIME1	-0.000558	0.003501	-0.159398	0.8736
DTIME2	-0.005887	0.004419	-1.332279	0.1848
DTIME3	-0.001865	0.002728		

Classic Fixed Effects Within Model - Market [*Unrestricted*]:

$$PBIT_{it} = \alpha + \beta_1 MktO + \beta_2 MktM + \beta_3 MktMN + \beta_4 MktD + \varepsilon_{it}$$

Dependent Variable: PBIT
Method: Least Squares
Date: 04/20/99 Time: 03:49
Sample: 1 155
Included observations: 155
Newey-West HAC Standard Errors & Covariance (lag truncation=4)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.061260	0.004038	15.17269	0.0000
MKTO	-0.022036	0.006510	-3.384823	0.0009
MKTM	-0.019574	0.005438	-3.599840	0.0004
MKTMN	-0.014105	0.005067	-2.783965	0.0061
MKTD	-0.011157	0.004990	-2.235986	0.0268

R-squared	0.207162	Mean dependent var	0.046463
Adjusted R-squared	0.186020	S.D. dependent var	0.016831
S.E. of regression	0.015185	Akaike info criterion	-5.505281
Sum squared resid	0.034588	Schwarz criterion	-5.407106
Log likelihood	431.6593	F-statistic	9.798446
Durbin-Watson stat	1.026486	Prob(F-statistic)	0.000000

Model Comparison Between Restricted and Unrestricted Model

$$F_{n-k,k} = \frac{(\text{ Adj } R^2_R - \text{Adj } R^2_u) / k}{(1 - \text{Adj } R^2_u) / (n - k)}$$

H_0: The models are the same.
H_1: The models are not the same.

$$F_{3,152} = \frac{(.220509 - .186020) / 3}{(1 - .186020) / 152}$$

$F_{3,152} = 2.147$
$F_{3,152}$ critical value is ≈ 3.06

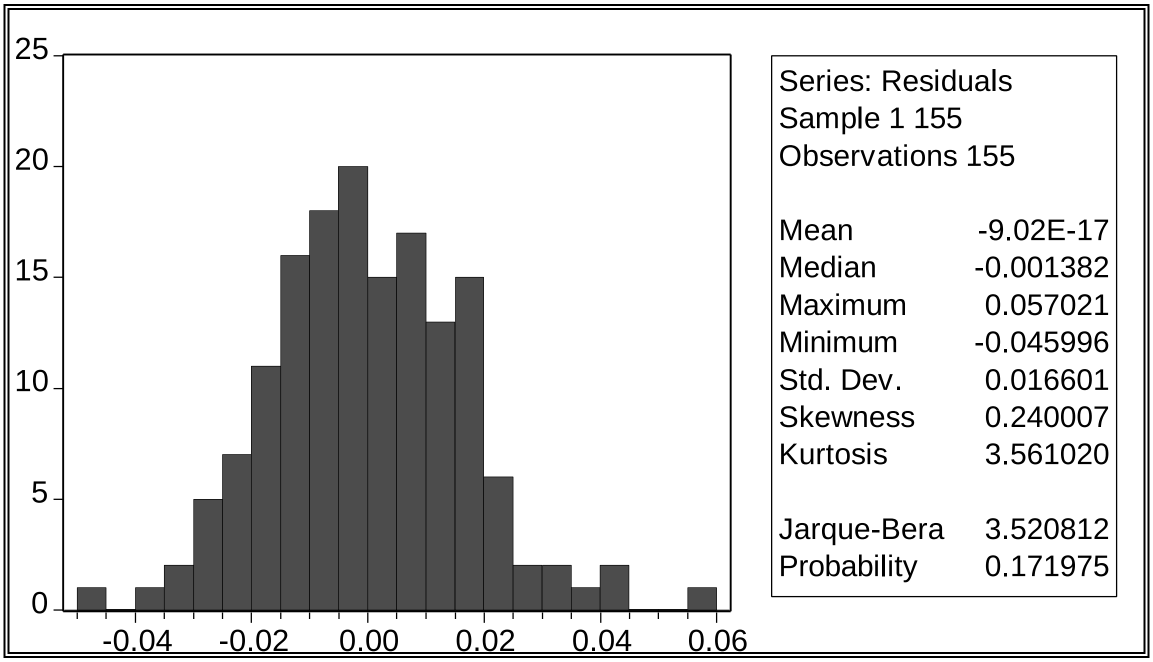
Fail to reject H_0
The models are the same.

Appendix A

Pooled Model:

$$PBIT_{it} = \alpha + \beta_1 MS1_{it} + \beta_2 MS2_{it} + \varepsilon_{it}$$

Test of Normal Residuals



H_0: Residuals are normal
H_1: Residuals are not normal

Fail to reject H_0: [.171975 > .05]