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Inflation, Inventory Accounting Methods and Stock Returns

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I. Introduction

In the past three decades, there has been consistent evidences that returns on commons stock are negatively related to inflation rates. Bodie (1976), Jaffe and Mandelker (1976), Nelson (1976), Fama and Schwert (1977) and Gultekin (1983) documented negative relationship between stock returns and both expected and unexpected components of inflation. Fama (1981), Geske and Roll (1983), and Solnik (1983) offered possible macroeconomic explanations for this negative relationship. On the other hand, Feldstein (1980), Summer (1981), Gonedes (1981), and French, Ruback and Schwert (1983) explored possible microeconomic explanations; they focused on the transmission of inflation's impacts through the tax shield effect and the nominal contract effect. Their evidences and conclusions are rather conflicting. While Feldstein asserted that historical cost accounting and inflation would erode a firm's tax shield, Gonedes found no such an effect in his study. Summer demonstrated evidence of a tax shield effect of inflation, but French, Ruback and Schwert could not detect any significant effect.

This paper examines the effect of a well-defined tax shield: the inventory accounting method.[1] In an inflationary environment, the LIFO (last-in-first-out) accounting method would give rise to a higher accounting income and a lower tax payment than the FIFO (first-in-first-out) accounting method. I tested a pair of alternative hypotheses - the accounting illusion versus the tax effect hypothesis. The accounting illusion hypothesis asserts that unexpected inflation increases the demand for securities associated with FIFO relative to those associated with LIFO. The tax effect hypothesis asserts otherwise. I found a small but discernable tax shield effect, specifically, the unexpected inflation in inventory price raises the relative price of LIFO securities to FIFO securities.

Stock market assessment of accounting methods is an interesting and intriguing subject. Numerous works set out to measure the stock market reaction to alternative accounting methods.[2] To study market behavior, one needs to observe the adjustment of market equilibrium in the face of some observable market disturbances. The research designs of all previous studies treat the change of accounting methods as a source of observable market disturbances. However, the change of accounting method is usually endogenously determined by managers.[3] Current literature often omits the variables that affect manager's motives of switching accounting methods. These omitted variables are crucial to our understanding of stock market reactions.[4] Without a model of the manager's behavior, it is difficult to interpret the empirical result. In this paper, the observable market disturbance is unexpected inflation, which is an exogenous variable. Hence we may provide a cleaner interpretation. Moreover, because the source of market disturbances is different from that of previous studies, this paper provides external validity checks to previous findings.[5]

The rest of this paper is organized into five sections. Section II develops a Box-Jenkins forecasting model as a proxy for the expectation of inflation perceived by the market. The forecasting error is a proxy for unexpected inflation. Section III analyzes the sample attributes and evaluates their implications to my study. I find that the LIFO firms and FIFO firms are fundamentally different in their production-investment opportunity sets. This underlying difference would weaken the stock market's discriminating reactions to LIFO securities from FIFO securities, in the face of unexpected inflation. Section IV describes the four statistical methods used in this study. It also briefly discusses the relative merit of these methods. Section V presents the empirical results. The last section concludes the paper with a summary and remarks.

II. Models of Unexpected Industrial Inflation

When the stock market is informationally efficient, the market discounts all the economic effects of accounting difference when determining the equilibrium market price. At the market equilibrium, stock returns shows no trace of economic effects of accounting difference. Market equilibrium is also not disturbed by expected inflation. This too has already been discounted in determining equilibrium market prices.[6] When unexpected inflation strikes the market, the tax-saving feature of the LIFO accounting method unexpectedly benefits its adoptor. On the other hand, unexpected inflation also generates unexpected higher accounting earnings for FIFO securities. These unexpected relative tax-savings and unexpected changes in relative accounting earnings sets off a relative price adjustment of LIFO versus FIFO securities. Observing these relative price adjustments provides evidence to a hypothesis about market behavior. Consequently, the first step of my study is to measure the market disturbances: unexpected quarterly inflation.

To measure unexpected inflation, one needs to develop a forecasting model as a proxy for market expectations. Several models for forecasting inflation are suggested in the literature. Fama (1975) developed an interest rate model in which expected real returns on treasury bills are constant over time. Hess and Bicksler (1975), Nelson (1976) and Bodie (1976) adopted a univariate Box-Jenkins model in their studies. Nelson and Schwert (1977) showed that inflation forecasts from a univariate Box-Jenkins model are about as reliable as those from Fama's treasury bill rate model.[7] If my interest were limited to one general price index, it would be feasible to explore several expectation models to test the sensitivity of my results. However, since my study needs to measure ten sets of unexpected inflation, it is better for me to focus my attention on one forecasting model - the Box-Jenkins model.

The inventories of each firm are a very small subset of the commodity space implied by the general price index. In reality, prices of different goods change at different rates. During a period of hyper-inflation, general price movement may dominate relative price movement. Hence, the inflation rate of a general price index could be a good proxy for the inflation rate of inventory prices. During a period of moderate inflation and economic structural change, the adjustment of relative price would dominate the general price movement. Then the inflation rate of the general price index bears no resemblance to that of inventory price. To determine whether we can use the general price index as a proxy for all inventory prices in this study, I calculate the coefficients of the Pearson correlation of ten four-digit SIC industrial inflation rates.[8] The results are reported in Table 1.

Insert Table 1 Here.

If all the coefficients in Table 1 are close to one, then the adoption of a general price index as a proxy for each firm's inventory price would not generate large measurement error. Otherwise we need a more narrowly defined industrial price index as proxy. The cross-sectional correlations of the ten industrial inflation rates are generally positive but small. The inflation rates of meat products and groceries are related somewhat closely. So are the inflation rates of petroleum products and metal products. The rest of the matrix does not indicate much correlation. These low correlations indicate that there are frequent relative price adjustments among these ten industries and that the adoption of a general price index as an over-all proxy for inventory prices would not be appropriate.

I constructed Box-Jenkins ARIMA models to proxy for market expectations. I use three criteria to choose the "best" inventory inflation forecasting model for each industry:

(1) All predictable movements in inflation which are conditional on past inflation should be eliminated. Therefore, the coefficients of autocorrelation for the unexpected inflation should be insignificant.

(2) The coefficients of the forecasting model should be stable over time so that the fitted residuals can be used as estimates of unexpected inflation.

(3) The forecasting model should be parsimonious. When several ARIMA models satisfy the first two criteria, we choose according to parsimony.

Table 2 summarizes the sample statistics for quarterly inflation rates, 1947-1979. The data are drawn from the DRI data base which is based on the Producers' Price Index compiled by the Bureau of Labor Statistics, U.S. Department of Labor. The description of DRI codes and SIC codes are matched closely.

Insert Table 2 Here.

In Table 2, I list the coefficients of autocorrelation and the coefficients of partial autocorrelaton, facilitating model indentification. The asterisk marks indicate significance at the 5% level. I can easily identify the inflation rates in industries 2600, 2911, 3310, 3499 and 3531 as an AR model of order one (AR(1)). Inflation rates in industry 3610 may be AR(1) or AR(2); based on criteria (3), I specify them as AR(1). The inflation model identifications for industries 2110, 2200, and 5411 are less clear. In addition to autocorrelation and partial autocorrelation, I check for stationarity and for outliers by plotting the data.

During the 34 years between 1947 and 1980, the U.S. economy underwent significant structural changes. To satisfy criteria (2), I limit the periods of model fitting to 1953-1973 for industries 2010, 2600, 3310, 3531, 3610 and to 1965-1980 for industries 3449, 3499, and 5411. The period of unexpeced inflation which is needed for studying the first group of industries is 1962-1973 and that for the second group of industries is 1970-1980. For industry 2200, I need the estimates of unexpected inflation for the period 1962-1980. Therefore the model-fitting period is 1953-1980. To test the stability of the estimated ARIMA model, I use Chow's F-test of stability. I divide up each model-fitting period into two equal-length subperiods. Chow's test is a test of the equality of coefficients in two time periods. Formally, the test statistic is given by the F ratio:

$$F(k,\ n_1 + n_2 - 2k) = \frac{Q_3/k}{Q_2/(n_1 + n_2 - 2k)} \quad ,$$

where k = number of parameters,

n_1 = number of observations in the first period,

n_2 = number of observations in the second period,

Q_1 = sum of squared residuals (SSR) in a regression over $n_1 + n_2$,

Q_2 = SSR in n_1 + SSR in n_2,

$Q_3 = Q_1 - Q_2$.

When I use the data of 1947-1979, the inflation rates of industry 2911 and industry 2600 show characteristics of AR(1) but the Chow-tests of stability are rejected at the 1% level. When the fitting period is reduced to 1953-1973, the inflation rates of these two industries show characteristics of white noise.[9] Table 3 summarizes the final model-fitting results. The three criteria of model-fitting are generally satisfied. The unexpected inflations, namely, forecasting errors, are intertemporally independent.

Insert Table 3 Here.

III. Sample Attributes and Tax Effect Hypothesis

The data are drawn from Compustat tape, CRSP tape and DRI tape. I chose ten four-digit S.I.C. industries for my study. Each chosen industry should have at least three firms concurrently and strictly adopting LIFO accounting methods for seven consecutive years or more.[10] There should be at least three matched firms adopting FIFO accounting methods in the same period. The ten industries so chosen are 2010, 2200, 2600, 2911, 3310, 3449, 3499, 3531, 3610 and 5411.[11] Description of these S.I.C. code is given in Column 1 of Table 2. The unit of sample data is firm/year. I choose sample periods and sample firms so as to maximize the sample size. For example in Table 4, consider four firms A, B, C, D, of the same industry but with different availability of data. Then I would chose firms A, B, C for the sample period 1963-1971 and dropped firm D from our sample.

I chose 24 firms/year as a result.[12] Since I am studying the association between stock returns and quarterly unexpected inflation, these 24 firms/year generate 96 "events" for my study. An "event" is one episode of quarterly unexpected inflation.

Table 4 Sampling Example

Data Availability	A	B	C	D
Starting Year	1962	1963	1962	1966
Ending Year	1971	1972	1972	1980

Insert Table 5 Here.

I first drew 96 firms from the Compustat tape. Subsequently, I examined the availability of daily "excess" stock returns in CRSP tape for these 96 firms. Our sample size has been reduced to 65 firms. The list of sample firms is given in Table 5. These 65 sampled firms generate 2404 events. For each of these ten sampled industries, I chose a compatible price index in the DRI tape. The matching of the S.I.C. code and the DRI code is given in Table 2. Generally, the descriptions of these two codes are closely matched.

The "excess" returns files on the CRSP tape contain the daily returns for each stock in excess of the daily returns on a portfolio of similar risk stocks. The market is divided into ten risk classes, or portfolios.

Excess return is the daily return on a stock in excess of the return on the portfolio to which it has been assigned. There are two versions of excess returns files: one version uses beta values and the other uses standard deviation values as measurements of risks. This study chooses the first version. Because we are constructing an "arbitrage" portfolio of LIFO and FIFO securities, the measurement errors in risk control have less impact in our study than in the case in general.

Gonedes (1979) points out that all firms with the same production-investment opportunity set would choose the same inventory accounting method. Lee and Hsieh (1983) find evidence that those firms which choose didfferent inventory accounting methods indeed have different income streams, inventory variablility and capital intensity. The sampling criteria for Lee-Hsieh is quite similar to that in this study. They require that all sample firms strictly adopt either LIFO or FIFO accounting methods for at least seven years. However, the sample periods of all the firms are not matched synchronously. The 808 firms in Lee-Hsieh's sample are more representative of the whole economy than my sample. I calculate some attributes of these two samples to detect possible sampling bias in my study.

Insert Table 6 Here.

Table 6 summarizes the sample attributes of this study and the Lee-Hsieh study. The t-statistics, which measure the significance of attribute differences between the LIFO sample and the FIFO sample, are calculated under the assumption that the attributes of the LIFO sample and the FIFO sample are mutually independent. However, in this paper, the LIFO firms and the FIFO firms are matched by industry and by sample period. Hence, the attributes of the LIFO and the FIFO sample in my paper may be positively correlated and the t-statistics could be biased downward.

The average firm size in my sample is larger than in the Lee-Hsieh sample. The average firm size for the LIFO subsample is larger than in the FIFO subsample. According to Keim (1983), the small-firm-returns anomaly is limited to very small firms. From Table 6, we can see that the return difference between LIFO and FIFO securities, if found in my study, is not due to the "small firm effect." The inventory/equity ratios of LIFO and FIFO samples are not significantly different. Therefore the relative importance of inventory price adjustment to stock returns should be similar between LIFO and FIFO subsamples. Hence, when I construct an "arbitrage" portfolio, I use equal weight for LIFO and FIFO securities. The debt/equity ratio can be a proxy for the stringency of the debt covenant. Because most debt is denominated in nominal terms and most assets are denominated in real terms, the debt/equity ratio can be an indication of the possible nominal contract effect of inflation. In this paper, the debt/equity ratio differences between LIFO and FIFO firms are insignificant.

The variability of inventories, the variability of before-tax income, inventory/asset and gross capital intensity are significantly different in the LIFO sample and the FIFO sample. The Lee-Hsieh sample exhibits the same phenomenon. In their paper, Lee and Hsieh give a detailed analysis of these attribute differences. The implication of these attribute differences on my hypothesis testing is briefly discussed here.

The two basic hypotheses to be tested in this paper are (1) the tax effect hypothesis and (2) the accounting illusion hypothesis. According to the tax effect hypothesis, the unexpected inflation will *ceteris paribus* increase the relative price of LIFO securities to FIFO securities. The accounting illusion hypothesis asserts otherwise. Since the sample attributes indicate that the LIFO firms and FIFO firms have more differences between them than do inventory accounting methods, the assumption of *ceteris paribus* does not hold.

Lee and Hsieh argued that the attribute differences reflect the fundamental differences in production-investment opportunity sets of LIFO firms and FIFO firms. LIFO firms, which are larger and more capital-intensive, have a more steady stream of sales orders, incur less unit cost on inventory management, and have a more stable before-tax income stream that the FIFO firms. Therefore, the LIFO firms have a "comparative advantage" in adopting LIFO accounting methods and the FIFO firms have a "comparative advantage" in adopting FIFO accounting methods. Unexpected inflation would make the LIFO tax-saving feature more atttractive to all firms, but not of the same degree. In the extreme, if there is no way for a FIFO firm to take advantage of the LIFO tax-saving feature, unexpected inflation would not make the FIFO security "disappointing" with respect to LIFO securities. In that case, the relative prices of that FIFO security would remain unchanged. Consequently, the underlying differences in production-investment opportunity sets would reuduce the tax effect of unexpected inflations.

The accounting illusion hypothesis assumes that investors base their investment decisions on accounting earnings alone. Hence the underlying differences in production-investment opportunity sets do not play a role in the investors' information set. Unexpected inflation would increase the relative demand for FIFO securities. The accounting illusion hypothesis is a null hypothesis with respect to the tax effect hypothesis.

IV. Methodology

A. Impact Horizon

The Bureau of Labor Statistics of the U.S. Department of Labor collects producers' price information for the week that contains the 13th day of each month. The official producers' price index data are usually not released until two or three weeks later. The financial market's reaction to a given month's inflation may start as early as the 7th day of that month or as late as the 9th day of the next mmonth. If I tried to find the relationship between stock returns and monthly unexpected inflations, I would encounter too much noise and measurement error to render meaningful empirical results. Moreover, the impact of inflation on stock returns is a flow variable; the magnitude of monthly flow may be too small to be detected and the data of annual flow may contain too much noise to be useful. Therefore, we choose three months as the impact horizon of unexpected inflation.

The timing of market reaction to the quarterly unexpected inflations cannot be determined a priori. Because there are abundant alternative sources for price information, the market reaction could start as early as the 7th day of a given quarter. If the market relies soley on the information provided by the Bureau of Labor Statistics, the market reaction could start as late as the 39th day of the given quarter. If the market relies on the quarterly financial statements or the 10Q provided by each firm, the market reaction might not start until well into the following quarter. Without prior knowledge of the timing of market reaction, matching quarterly excess stock returns with quarterly unexpected inflation would be a futile exercise.

In this study, I developed four statistical methods to measure the <u>time path</u> of excess stock returns with respect to the impact horizon. Although I had the data of daily excess returns available to my study, to measure the time path in terms of day would have been too detailed and too cumbersome for calculation and presentation. Therefore, I aggregated the daily excess returns into weekly and monthly data. The aggregation may have resulted in losing some useful information but it also reduced noise in the data. Weekly excess returns are the aggregation of the data of five trading dates and the monthly excess returns are the aggregation of daily excess returns from the 13th day of the given month to the 12th day of the next month.

B. Statistical Method.

The four statistical methods adopted in this paper are: The Piece-wise Least Square Method (PLS); the Ball-Brown Method; the Wilcoxon Test Method; and the Mann-Whitney U Test Method. The PLS method tries to measure the time path of monthly stock returns with respect to the quarterly inventory price inflations. The Ball-Brown method tries to measure the time path of weekly stock returns. The last two methods are non-parametric, and simply test the significance of the overall relationship between stock returns and inflations.

B.1. Piece-wise Least Square Method (PLS)

The PLS method regresses the stock excess returns R_t on the current and past unexpected inventory inflations as given in equation (1).

$$R_t = \beta_0 + \sum_{i=1}^{3} \beta_i A_{it} U_t + \sum_{i=1}^{3} \beta_{3+i} A_{it} U_t(-1) + \sum_{i=1}^{3} \beta_{6+i} A_{it} U_t(-2) + \varepsilon_t \quad (1)$$

The variable A_{it} equals 1.0 for the i-th month of the quarter in which unexpected inflation U_t is measured and zero otherwise. The variables $U_t(-1)$ and $U_t(-2)$ are the unexpected inflation rates lagged respectively by one and two quarters. January is the first month of the first quarter, February is the second month of the first quarter, and December is the third month of the fourth quarter of a given year. The observations of U_t are identical for each three-month set. Taking the observation of t = February 1975 as an example, equation (1) can be rewritten as:

$$R_t = \beta_0 + \beta_2 U_t + \beta_5 U_t(-1) + \beta_8 U_t(-2) + \varepsilon_t, \tag{2}$$

where U_t is the unexpected inflation of the first quarter of 1975 and $U_t(-1)$ is the unexpected inflation of the fourth quarter of 1974, etc. Therefore, equation (1) is the combination of three regression equations - one for the first month, one for the second month and one for the third month of each quarter.

Because the unexpected inflations, U_t, $U_t(-1)$ and $U_t(-2)$ are measured according to S.I.C. four-digit industrial code, equation (1) will be applied to industrial portfolios. For each of the ten S.I.C. four-digit industries, we construct three portfolios: a LIFO portfolio, a FIFO porrtfolio, and an arbitrage portfolio. Let R_t (LIFO) be a simple average of excess monthly returns of LIFO securities in an industry and R_t(FIFO) be that of FIFO securities in an industry. For an arbitrage portfolio, R_t(arbitrage) is the difference of excess monthly returns between a LIFO portfolio and a FIFO portfolio, i.e.,

$$R_t(\text{arbitrage}) = R_t(\text{LIFO}) - R_t(\text{FIFO}) \tag{3}$$

Therefore, R_t(arbitrage) is the excess return of simultaneously taking one dollar of long position on an LIFO portfolio and one dollar of short position on an FIFO portfolio.

The parameters, β_is, measure the time path of the impact of unexpected inflation on the stock returns; β_i is the increase of excess stock returns in the i-th month when the unexpected inflation between month one to month three increases by one percent. For example, β_9 is the impact of the unexpected quarterly inflation on monthly excess stock returns six months after the end of that inflationary quarter. Let $\hat{\beta}_{ij}$ be the estimated impact of unexpected inflation in month i on the j-th industry and let J be the total number of industries in the sample. Then

$$\sum_{j=1}^{J} \hat{\beta}_{ij}/J$$

is the estimated average impact in month i on the whole economy. The statistics

$$\sum_{i=1}^{I} \left(\sum_{j=1}^{J} \hat{\beta}_{ij}/J \right), \text{ where } I = 1, 2, \ldots, 9,$$

are the estimated cumulative average impact on the whole economy up to month I. However $\hat{\beta}_{ij}$'s are heteroscedastic across month (i) and industries (j). To facilitate interpretation and inference, I construct the generalized estimate of cumulative average impact (GECAI) according to equation (4):

$$\text{GECAI}(I) = \left(\sum_{i=1}^{I} \sum_{j=1}^{J} \frac{\hat{\beta}_{ij}}{S_{ij}} \right) / (I \cdot J), \quad I = 1, 2, \ldots, 9, \tag{4}$$

where S_{ij} is the estimated standard deviation of $\hat{\beta}_{ij}$. In the appendix I show that the approximate statistical distribution of GECAI(I) is Gaussian. Under the null hypothesis, $\beta_{ij} = 0$ for all i, j, I can have:

$$\text{GECAI}(I) \sim N(0, 1).$$

B.2. Ball-Brown Method

The second statistical method, the Ball-Brown method, is straightforward and intuitively appealing. In Ball and Brown's (1968) seminal work, they classify market disturbance into positive and negative unexpected accounting incomes. Portfolios are constructed according to the sign of each firm's unexpected accounting income and then the time path of portfolio excess returns is measured with respect to the announcement of accounting incomes. Similarly, we constructed portfolios according to the sign of unexpected quarterly inflation, on the one hand, and according to the firm's inventory accounting methods, on the other. Consequently, we measured the weekly time path of four portfolio excess returns, namely,

LR_k^+, LP_k^-, FR_k^+, and FR_k^-. The superscripts "+" and "-" indicate the sign of unexpected inflation. The subscript k is the week-index relative to the starting point of given quarterly unexpected inflation. The impact horizon of the quarterly unexpected inflation covers a period from k = 0 to k = 12. LR_k stands for the excess weekly returns of a LIFO portfolio and FR_k for the excess weekly returns of a FIFO portfolio.

To examine the impact of unexpected inflations on stock returns, we constructed three pseudo-arbitrage portfolios from LCR_k, FCR_k, and TCR_k, Subsequently we calculate the cumulative excess returns of these three psuedo-arbitrage portfolios from k = -5 to k = 42. The formulas are:

$$\begin{aligned} LCR_K &= \sum_{k=-5}^{K} (LR_k^+ - LR_k^-) ; \\ FCR_K &= \sum_{k=-5}^{K} (FR_k^+ - FR_k^-) ; \\ TCR_K &= LCR_K - FCR_K ; \\ K &= -5, -4. . . . ., 41, 42. \end{aligned} \tag{5}$$

The subscript K indicates the cumulative excess returns up to time K where K = 0 is the starting week of the quarterly unexpected inflations. LCR is the cumulative excess returns from taking one dollar of long position on the LIFO stocks five weeks before the start of positive quarterly unexpected inflation, and taking one dollar of short position on the LIFO stocks five weeks before the start of negative quarterly unexpected inflation. FCR is the cumulative exces returns from taking the same strategy on FIFO stocks. TCR is the cumulative excess returns from taking all the above strategies simultaneously.

In reality, it is impossible to know the unexpected quarterly inflation three weeks before the starting point of the given quarter. Hence the three "arbitrage" strategies in equation (5) cannot be actually carried out. That is why they are called pseudo-arbitrage portfolios. A more meaningful interpretation of equation (5) is that the three formulas measure the time path of relative price movement. LCR_K demonstrates the time path of relative price movements of LIFO portfolio with respect to the market as a whole. FCR_K illustrates the time path of relative price movements of the FIFO portfolio with respect to the market as a whole. TCR_K indicates the relative price movement of the LIFO portfolio to the FIFO portfolio.

B.3. Wilcoxon Method

The third statistical method is the Wilcoxon matched-pairs rank-signs test. We first define a pair of portfolio excess returns:

$$LR_k = LR_k^+ - LR_k^-,$$

$$FR_k = FR_k^+ - FR_k^-, \qquad (6)$$

$$k = -3, -2, \ldots, 16, 17.$$

The interpretations of LR_k and FR_k are similar to those of LCR_K and FCR_K, only they are not cumulative. These two variables LR_k and FR_k are matched according to k for k = -3 to k = 17, the period in which the impact of quarterly unexpected inflation is most likely to take place. Then the differences of the matched-pairs are ranked, ignoring signs, and the sums of the ranks for positive and negative differences are calculated. From the positive and negative rank sums, a test statistic Z is computed. Under the null hypothesis, for large sample sizes, Z is approximately Gaussian with mean zero and variance one.

B.4. Mann-Whitney Method

The fourth statistical method, the Mann-Whitney U Test, can be used to test whether two samples are from the same population. The input of this test is defined in equation (7):

$$TR_k = LR_k - FR_k, \qquad (7)$$

$$k = -30, -29, \ldots, 41, 42$$

The variable TR_k measures the impacts of quarterly unexpected inflation on weekly excess returns of a LIFO portfolio relative to a FIFO portfolio. The impact period is from k = -3 to k = 17 and the no-impact period is from k = -30 to k = -2 and from k = 18 to k = 42. Hence we can divide the 73 observations of TR_k into two groups: impact group and no-impact group.. The two groups are combined, and observations are ranked in order of increasing size. The test statistic U is computed as the number of times a score from group one precedes a score from group 2. The rationale is that if the two groups of observations are from the same population, i.e., there is no impact, the distribution of scorers from the two groups in the ranked list will be random; a non-random pattern will be indicated by an extreme value of U. For small samples (less than 30 observations), the exact significance level for U is computed using the algorithm of Dineen and Blakesley (1973). For larger samples, U is transformed into a normally distributed statistic, Z.

C. Comparisons of Statistical Methods

Among the four statistical methods, PLS employs the most information from data and hence is theoretically the most powerful test. However, in reality, several considerations undermine the reliability of PLS. First of all, we may have measurement errors from our estimation of unexpected inflation. The match of price index to the firm's inventories is not perfect. The univariate ARIMA model of inflation forecasting may be a poor model for the market expectation. If the measurement error in the unexpected inflation is large, then to employ full information of the unexpected inflation, as PLS does, would give rise to rather unreliable results. In contrast, the Ball-Brown method, the Wilcoxon method and the Mann-Whitney method employ only the sign of unexpected inflation. If there are a great deal of measurement errors on the magnitude and little error on the sign of unexpected inflation, then the last three statistical methods may give rise to more reliable evidence than the PLS method.

Secondly, in PLS we specify β_is as constants over the whole sample period. Because the impacts of unexpected inflatios on stock returns depend on the firm's operation policy, the marginal tax rates, and the volume of inventory, etc., the β_is are in fact random variables. In the other three statistical methods, I base my inference on the rank and sign; the specifications of the tests are less precise but they also give rise to more robust evidence. The specification errors in PLS can reduce the power of inference; it may even lead to biased results. Thirdly, the normality of excess stock returns and unexpected inflation has not been convincingly established. While the validity of PLS crucially depends on the normality assumptions, the validity of the other three statistical methods is independent of the normality assumption.

Overall, none of these four statistical methods truly dominates the others. If there are no measurement erros on unexpected inflation, no specification errors on parameters and all sample data are drawn from a multivariate normal distribution, then PLS may generate more reliable evidence. Otherwise, the other three statistical methods may generate information useful to our inferential judgment. While the Ball-Brown method generates visual evidence on the time path of stock returns, the Wilcoxonn and Mann-Whitney methods generate summary inferential statistics from sample data.

V. Empirical Results

In this section, we will estimate the impact of unexpected inflations on stock returns. The tax effect hypothesis asserts that in an inflationary period, the tax-saving feature of the LIFO accounting method should make the stocks of its adopter relatively more attractive than those of the nonadopter. However, since the LIFO firms and the FIFO firms may be fundamentally different in their financial and operational policies, the impact of unexpected inflation on the relative attractiveness of LIFO securities over FIFO securities may be very small and difficult to detect. I employ four different statistical methods to detect such a weak signal from a set of noisy data.

Insert Table 7 Here.

Insert Table 8 Here.

Table 7 summarizes the results of PLS estimation of impact of unexpected quarterly inflation on stock returns of LIFO and FIFO portfolios. Table 8 summarizes the results of the arbitrage portfolio. The asterisk marks in Tables 7 and 8 indicate significance at the 5% level. A glance at Table 7 would give the impression that there is hardly any significant systematic impact at all. The F Ratio tests the null hypothesis that all the parameters in the given equation are zero. Out of twenty-two equations estimated in Table 7, only four F Ratios reject the null hypothesis. Table 8 shows even less evidence of systematic impact. In Table 8, I estimate the impact of unexpected inflation on the relative attractiveness of LIFO portfolios to FIFO portfolios perceived by the stock market. Out of eleven equations estimated in Table 8, not even one F Ratio rejects the null hypothesis of zero β_is in the regressive equations.

There are several reasons why I cannot find any trace of systematic impact in Tables 7 and 8. First, the "portfolios" in Tables 7 and 8 are generally composed of a small number of securities. The smallest portfolio, the LIFO portfolio of industry 3531, contains only one security. The largest portfolio, the arbitrage portfolio of industry 3310, contains 15 securities. When the portfolio is small, there is a great deal of idosyncratic noise in PLS estimation. Consequently, it is harder to detect the weak systematic signal. Second, the impact of unexpected inflation on stock returns is gradually impounded from month one on. Even if the total impact is significant, the monthly impact can be too small to be detected.

Of course, there is always the possibility that our model is poorly specified or that no impact exists at all.

Insert Table 9 Here.

To reduce the idiosyncratic noise and to boost the weak signal, I calculate GECAI's and report them in Table 9. The statistic GECAI(I) is the average t-ratios across industries and cumulative up to event-month I. The GECAI(I) can be viewed as an approximation of the t-ratio from an ordinary least-squared estimation if I could add all the disaggregate data into aggregate data. In this paper, because the exogenous variables (unexpected inflation) are industry-specific, I have to disaggregate the data in terms of industry. Moreover, I would like to observe the time path of the impact. Consequently I disaggregate the data in terms of event-month. The GECAI(I) adds together these disaggregate results and turns them into an aggregate statistic.

The "first period" in Table 9 indicates the aggregation of empirical results for the eight industries which have usable data in 1962-1971. The "second period" indicates the aggregation of the empirical results of the three industries which have usable data in 1970-1980. The "total period" indicates the aggregation of empirical results of all the eleven industries in Table 7 and 8. The time path of GECAI(I) demonstrates how the impact is accumulated throughout the impact horizon. Unexpected inflation seems to have equal impact on the stock returns of LIFO firms and FIFO firms. The cumulative signal of negative impact becomes stronger and stronger when the event time moves from the first month to sixth month. After the sixth month, the cumulative signal weakens. The information of quarterly inflation should be publicly available no later than the third week of the fourth month. According to Table 9, the stock market may take one and a half months after the information concerening quarterly inflation becomes publically available to assess the full implication of the information. This is probably because the impact of inflation depends on a firm's financial and operational activities; unless all this information is also available, the full impact of inflation cannot be correctly assessed.

The cumulative impact of unexpected inflation on the stock returns of LIFO portfolios and FIFO portfolios are consistently and significantly negative. This result is consistent with the findings of Fama (1982), Geske-Roll (1983) and Gultekin (1983). However, the implications are rather different. Their studies employed aggregate macroeconomic data and their results implied that when general prices of goods and services go up, the prices of all stocks go down. My study employs disaggregated micro-economic data and my findings imply that when relative prices of goods and services go up, the relative prices of securities of the given industry go down. How my results can be reconciled with their results is a very interesting question. More work needs to be done in this area.

We cannot find any significant impact of unexpected inflation on the relative attractiveness of LIFO securities over FIFO securities. The GECAI(I)s of arbitrage portfolio are not significantly different from zero in all three data periods and in all event-months. One possible explanation is that the specification of market expectation of inflation is not precise, which gives rise to severe measurement errors on the unexpected inflation. Another possible explanation is that the specification of PLS does not consider the structural differences among securities. Of course, it is also possible that there is no "tax effect." To examine these possibilities, I adopt the Ball-Brown method in which I use only the sign of unexpected inflation and not the magnitudes. Therefore the impact of measurement errors in unexpected inflations is somewhat alleviated. Also, the Ball-Brown method does not assume linear relationship between unexpected inflations and excess stock returns. Hence the importance of specification errors is also reduced.

The results of LCR, FCR, and TCR are plotted in Figures 1 to 5. The vertical axis is the cumulative excess returns and the horizontal axis is the event week. Week Zero is the one which contains the 13th day of January, April, July, and October, and Week Twelve is the one which contains the 13th day of the month, three months later. The period between week Zero and Week Twelve is the one in which quarterly inflation is measured. In the face of inflation, ceteris paribus, we expect the market to react differently with respect to securities associated with different inventory accounting methods. The time paths of LCR, FCR, and TCR demonstrate the movements of relative security prices.

Although my methodology originates from Ball-Brown (1968) and Fama-Fisher-Jensen-Roll (1969), there are two important differences in the nature of application. First, in their studies, the market disturbances are endogenous while in our study the market disturbances are exogenous. The endogenous market disturbances, such as stock-splits and earnings announcements may simultaneously carry other signalling and informational effects. Consequently, we observe significant market reaction to these disturbances. In contrast, the effects of exogenous market disturbances are isolated and small.

Second, market disturbance such as stock-split and earnings announcement are firm-specific. The market reacts directly and immediately to the firm involved in a given disturbance. My market disturbances of inventory inflation are not firm-specific. The differential impact on firms with different inventory accounting methods cannot be observed directly. Since the net impact of inflation works through a complicated accounting system, it is not clear that the market could react to disburbance immediately. Even if the market did react immediately to the distrubances, the impact may also work through other channels in addition to the inventory accounting method. Hence we cannot expect a clean trace of market reactions from our data.

Insert Figure 1 Here.

Figure 1 illustrates the time path of relative prices of LIFO securities to FIFO securities. The TCR, LCR and FCR in the Ball-Brown method correspond to the GECAI's of arbitrage portfolio, LIFO portfolio and FIFO portfolio in PLS method. The results in Figure 2 seem to support the Tax Effect hypothesis; the market favors LIFO securites over FIFO securities in an inflationary era. Moreover the market reaction starts from week zero. This result is consistent with Huberman and Schwert's (1982) finding that the market reflects much of the new information about inflation as it occurs, i.e., when the Bureau of Labor Statistics samples prices.[13] However, the TCR keeps on drifting for a period of 30 weeks. Hence, the market reaction also depends on other things such as a firm's financial and operational activities of which the information is not totally available in the impact horizon (between week zero and week twelve). The total impact is rather small; it averages about 3 cents over 30 weeks for each dollar of an arbitrage portfolio. The result does not allow any extra returns; even if one could out-forecast the market on inflation, the 3 cents extra return can be eliminated by transaction costs.

Insert Figure 2 Here.

Figure 2 illustrates the time paths of LCR and FCR. The result that both LIFO and FIFO portfolios are affected unnfavorably by the inflations is consistent with GECAI statistics in Table 9. The LIFO portfolio is less unfavorably affected than the FIFO portfolio. Hence it is consistent with the tax effect hypothesis that market perceives the relative tax advantage of LIFO securities over FIFO securities.

To examine whether the results in Figures 1 and 2 are consistent from period to period, we classify our sample into two groups: those that have at least seven years of continuous data from 1962 to 1971 and those that have at least seven years of continuous data from 1970 to 1980. We plot the TCR, LCR, and FCR in Figures 3 through 5. Consider the results. We can attribute the upward movement of the TCR time path in Figure 1 primarily to the subsample of 1970-1980 (see Figures 3 and 4). The downward movements of LCR and FCR time paths in Figure 2 are primarily attributable to the subsample of 1962-1971 as illustrated in Figure 5. The Tax Effect Hypothesis is supported in Figures 1 through 4. There is no trace of tax effect in Figure 5.

Insert Figures 3, 4 and 5 Here.

There are two possible explanations for these puzzling intertemporal inconsistencies: (1) the Learning Curve hypothesis and (2) the Measurement

Errors hypothesis. According to the Learning Curve hypothesis, the firms are slow to find ways to protect themselves against the unfavorable impacts of inflation. Therefore LCR and FCR are downward sloping in 1962-1971 (as in Figure 5) and are more or less horizontal in 1970-1980 (as in Figure 4). The firms learned how to protect themselves against unexpected inflation in the Seventies but not in the Sixties. Meanwhile, the market is slow to perceive the cash flow differences that can arise in an inflationary environment from different inventory accounting methods. Therefore LCR is larger than FCR and TCR is positive in 1970-1980 (as in Figures 3 and 4), but LCR is not different from FCR and TCR is hovering around zero in 1962-1971 (as in Figure 5).

Before 1972, the classification of LIFO and FIFO inventory accounting methods in the the Compustat data file is not very precise. The misclassification of inventory accounting methods may be the reason for the inconsistent results in FIgures 3, 4, and 5. According to Compustat User's Mannual (1980, p. 42):

> Beginning in 1972, if more than one (inventory accounting) method is used to value inventory, then all applicable (inventory method) codes will be used. --- If reported by the company, the methods are given in order of relative amounts of inventory values by each one. For years prior to 1972, a single code will indicate the method which was used to value the majority of inventory in that year.

Consequently, the subsample in 1962-1971 is subject to possible measurement errors. If much data in the 1962-1971 subsample concern firms with 51% of inventory valuated by LIFO method and 49% of inventory valuated by FIFO method, we would expect the noisy result in Figure 5.

To examine the Measurement Errors hypothesis, I carefully examine the 1962-1971 subsample. I print out the inventory accounting method codes in Compustat file for the whole period of 1962-1980. Code 1 represents FIFO and code 2 represents LIFO. I eliminate those firms which have only one code before 1972 but have more than one code after 1972. I infer that this change of code is not a change of accounting method; it is just a change of coding scheme. Hence these firms have a mixed inventory accounting system before 1972. After eliminating these firms (six of them), I recalculate the TCR, LCR and FCR. The results are illustrated in Figure 6 and 7 which demonstrate a weak evidence to support the Tax Effect hypothesis. The evidence in Figures 6 and 7 is much weaker than that in Figures 1 to 4.

Insert Figures 6 and 7 Here.

To examine the Learning Curve hypothesis, I review the LCRs and FCRs of all industries in the 1962-1971 subsample to see whether the downward drifting phenomena is universal across all industries. I find that the downward drifting of LCR and FCR in Figure 5 is attributed to two industries, 3310 and 2010. When these two industries are eliminated from my subsample, the downward slopes of LCR and FCR are no longer prominent. The results are reported in Figures 8 and 9; there is no trace of tax effect. Consequently, the Learning Curve hypothesis is not consitent with empirical evidence. The measurement errors in inventory accounting methods coding scheme can only partially explain the lact of supporting evidence for the Tax Effect hypothesis.

Insert Figures 8 and 9 Here.

The Ball-Brown method does not provide measurement of statistical significance. I employ two nonparametric statistical methods to calculate the statistical significance. The Wilcoxon test compares the excess return of a FIFO portfolio to that of a LIFO portfolio one by one according to the event week. The results are reported in Table 10. The sign of Z-statistics indicates that the relative prices of LIFO securities over FIFO securities increase during week -3 to week 17. The results are consistent with the Tax Effect hypothesis but they are not statistically significant.

Insert Tables 10 and 11 here.

The Mann-Whitney U-Test compares the relatitve price movements of LIFO securities over FIFO securities within the impact horizon (Week -3 to Week 17 or Week -3 to Week 27) to those outside of the impact horizon. The results are reported in Table 11. The sign of U-statistics are consistent with the Tax Effect hypothesis but they are not statistically significant.

Overall, my empirical evidence is consistent with the tax effect hypothesis. But the magnitude of tax effect is small and the noises are relatively large. Generally the support for the Tax Effect hypothesis is not statistically significant. In no case do I find evidence consistent with the Accounting Illusion hypothesis.

VI. Concluding Remarks

This paper measures differential impacts of unexpected quarterly inflations on securities associated with LIFO and FIFO accounting methods. I adopted four statistical methods for our investigation: Piece-wise least-square regression, Ball-Brown, Wilcoxon and Mann-Whitney. I detected a small trace of tax effect and I found no evidence of accounting illusion. Generally, my evidence is not statistically significant.

There are three reasons why the evidence of tax effect is so weak. First, as Lee-Hsieh (1983) pointed out in their study, the investment-production opportunity sets of LIFO and FIFO firms are fundamentally different. All firms try to match their inventory accounting methods with their operations in order to maximize their economic present value. A rational market would understand that the opportunity cost of adopting the FIFO accounting method by an ex ante FIFO firm is much less than by an ex ante LIFO firm. Hence the unexpected inflation would unexpectedly increase the relative attractiveness of LIFO securities over FIFO securities, but the magnitude of this increase could be rather small.

Second, the market disturbance in this paper is exogenous. Hence market reaction is not confounded by the signalling effect and informational effect that are often associated with an endogenous market disturbance, such as changing accounting method and stock split. Although the evidence is weak, we can more confidently identify it as a tax effect; because the internal threat of confounding factors is reduced.

Third, the impact of unexpected inflation works indirectly through the acccounting system and business operation. Unless we fully understand the transmission mechanism through which unexpected inflation affects a firm's present value of cash flows, we may not be able to capture all of the impact in our statistical evidence. How the inflation and fluctuation of real activities are transmitted to accounting numbers, cash flows and stock prices is yet to be explored.

Table 1 Coefficients of Pearson Correlation of Quarterly Industrial Inflation Rates, 1947-1979

F2010	F2200	F2600	F2911	F3310	F3499	F3531	F3610	F5411	F3449
1.0000									
0.1622	1.0000								
0.0020	0.6539	1.0000							
0.1281	0.4387	0.4938	1.0000						
0.0395	0.4254	0.5997	0.4746	1.0000					
0.0730	0.4801	0.7257	0.3773	0.7664	1.0000				
-0.0352	0.3422	0.6417	0.2864	0.5355	0.7298	1.0000			
0.0475	0.4726	0.6779	0.2743	0.5341	0.7004	0.7615	1.0000		
0.7792	0.3764	0.2879	0.3364	0.1769	0.2489	0.1698	0.1610	1.0000	
-0.0069	0.2657	0.4829	0.2462	0.5160	0.6232	0.5681	0.4632	0.0633	1.[illegible]

F stands for inflation rate. The four-digit numbers are SIC code.
2010 = Meat product, 2200 = Textile Product, 2600 = Paper and Allied Products,
2911 = Petroleum Refining, 3310 = Blast Furnaces and Steel Works,
3449 = Miscellaneous Metal Works, 3499 = Fabricated Metal Products,
3531 = Construction Machinery,
3610 = Electric Transmission and Distribution Equipment,
5411 = Retail Grocery Stores.

Table 2

Summary Statistics for Quarterly Inflation Rates, 1947-1979

Industry	DRI Code	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9	P_{10}	Mean	Std. Dev.	r_1	r_2	r_3	r_4	r_5
Meat Product (2010)	3018	-.098	.135	-.069	.178*	-.283*	-.064	-.157	.225*	-.235*	.133	.000834	.005913	-.0904	.1266	-.0461	.1588	-.2556
Textile Product (2200)	3037	.583*	.170	-.090	-.191*	-.207*	-.210*	-.125	.051	.114	.174	.000375	.001872	.5832	-.2576	-.1049	-.0588	-.0746
Paper & Allied Product (2600)	3085	.553*	.280*	.098	.049	-.069	-.150	-.033	.041	.016	.051	.000839	.002031	.5526	-.0365	-.0612	.0393	-.1371
Petroleum Refining (2911)	3056	.426*	.173	.193*	.053	-.007	.051	.025	-.081	-.037	.080	.00132	.004480	.4262	-.0100	.1496	-.1011	-.0071
Blast Furnaces & Steel Works (3310)	3095	.346*	.059	.091	.027	.067	-.071	.017	.171	.097	.0125	.001342	.002563	.3457	-.0690	.1065	-.0438	.0864
Misc. Metal Works (3449)	3105	.199*	.243*	.042	.082	-.041	-.050	-.015	.049	.006	.093	.001181	.002392	.199	.212	-.042	.033	-.062
Fabricated Metal Products (3499)	3104	.520*	.259*	.110	-.020	-.057	-.109	-.081	.083	.098	.077	.000900	.002166	.5202	-.0155	-.0266	-.0079	-.0080
Construction Machinery (3531)	3108	.534*	.209*	.114	.127	.065	-.044	-.045	.099	.142	.106	.001374	.001692	.5337	-.1060	.0666	.0758	-.0573
Electric Transmission & Distr. Equip. (3610)	3114	.553*	.163	-.018	-.017	-.059	-.105	-.026	.081	.131	.095	.000832	.001636	.5529	-.2052	-.0201	.0559	-.1098
Retail Grocery Stores (5411)	2981	.156	.163	.168	.152	-.194*	.007	-.066	.057	-.234*	.120	.000795	.002549	.1561	.1424	.1292	.0982	-.2824

Notes: P_i is the coefficent of autocorrelation for the i-th order. r_j is the coefficient of partial autocorrelation for the j-th order. DRI Code is the price index code in the DRI data base. SIC Code, denoted in parentheses under "Industry", is the Dept. of Commerce industrial code. Mean and Std. Dev. (standard deviation) are the estimated parameters of the sample data.

Table 3 Summary Statisti[illegible]rly Unexpected Inflation

Price Index	ARIMA Model	Period	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	F
2010	0, 0, 0, 0, 1, 1	1953I-1973IV	.012	.063	.087	.064	-.055	-1.06	.039	-.038	0.3222 (1,74)
2200	1, 0, 0, 0, 0, 0	1953I-1980IV	.041	.005	-.229*	-.042	-.070	.085	.038	.038	2.994 (1,110)
2600	white noise	1959I-1973IV	.008	.128	-1.21	.091	.110	.003	.145	.069	--
2911	white noise	1957I-1973IV	.079	.200	.195	-.005	.026	.047	.072	.006	--
3310	0, 1, 1, 0, 0, 0	1953I-1973IV	-.089	-.114	.162	-.049	.139	-.038	-.149	.251*	1.321 (1,80)
3449	1, 0, 0, 0, 0, 0	1965I-1980IV	.009	-.250*	-.016	.011	-.108	-.083	-.012	-.039	0.714 (1,62)
3499	1, 0, 0, 0, 0, 0	1965I-1980IV	.024	-.187	.006	-.153	-.030	-.069	-.081	.070	0.067 (1,62)
3531	0, 0, 0, 1, 0, 0	1953I-1973IV	.055	.021	.107	-.145	.068	-.160	-.142	-.065	2.464 (1,82)
3610	2, 0, 0, 0, 0, 0	1953I-1973IV	-.128	-.105	.095	.088	-.047	-.104	.022	.003	0.539 (2,82)
5411	1, 0, 0, 0, 1, 1	1953I-1973IV	-.085	.148	.177	-.072	-.024	-.048	-.058	.082	0.619 (2,72)

Notes: The price index column indicates SIC code. The ARIMA Model column indicates the specification of (P.D.Q. SP. SD. SQ.). The period column indicates the model-fitting period. P_i is the coefficient of autocorrelation of the i-th order. The asterisk indicates significance at the 5% level.

The F column indicates the Chow-test. The numbers without brackets are F statistic. The numbers within brackets are degrees of freedom.

(P.D.Q. SP. SD. SQ.) are the specifications of the ARIMA model as defined in Box and Jenkins (1976).

Table 5 List of Sample Firms

COMPANY NAME	CUSIP	SIC	ACCOUNTING METHODS		EXCHANGE		STARTING DATE	ENDING DATE
			LIFO	FIFO	NYSE	AMEX		
Esmark Inc.	296470	2010	x		x		1962	1971
Oscar Mayer & Co., Inc., Del	577896	2010	x		x		1962	1971
Rath Packing Co.	754093	2010	x			x	1962	1971
Halco Products Corp., NY	405363	2010		x		x	1962	1971
Geo. A. Hormel & Co.	440452	2010		x		x	1962	1971
Hygrade Foods Prods. Corp.	449060	2010		x		x	1962	1971
Graniteville Co.	387478	2200	x		x		1962	1969
Mount Vernon Mls, Inc.	623555	2200	x			x	1962	1969
Leghigh Valley INDS	32530	2200		x	x		1962	1969
Musingwear, Inc.	626320	2200		x	x		1962	1969
Spring Mills, Inc.	851783	2200	x		x		1970	1980
Standard Coosa Thatcher Co.	853326	2200	x			x	1970	1980
Concord Fabrics, Inc.	206219	2200		x		x	1970	1980
International Stretch Prods.	460380	2200		x		x	1970	1980
Head Corp.	582834	2600	x		x		1963	1973
Westvaco Corp.	961548	2600	x		x		1963	1973
Kimberly Clark Corp.	494368	2600		x	x		1963	1973
Crown Zellerbach Corp.	228669	2600		x	x		1963	1973
Atlantic Richfield Co.	048825	2911	x		x		1962	1970
Cities Svc. Co.	173036	2911	x		x		1962	1970
Sun Co. Inc.	866762	2911	x		x		1962	1970
Gulf CDA Ltd.	402185	2911		x		x	1962	1970
Royal Dutch Pete Co.	780257	2911		x	x		1962	1970
Allegheny Ludlum Indus., Inc.	17372	3310	x		x		1962	1971
Ampco Pittsburg Corp.	32037	3310	x		x		1962	1971
Bethelem Steel Corp.	87509	3310	x		x		1962	1971

Table 5 cont. (p. 2)

COMPANY NAME	CUSIP	SIC	ACCOUNTING METHODS		EXCHANGE		STARTING DATE	ENDING DATE
			LIFO	FIFO	NYSE	AMEX		
Carpenter Technology Corp.	144285	3310	x		x		1962	1971
Continental Stl. Corp.	212075	3310	x		x		1962	1971
Lykes Corp.	550890	3310	x		x		1962	1971
National Stl. Corp.	637844	3310	x		x		1962	1971
Republic Stl. Corp.	760779	3310	x		x		1962	1971
United Sts. Stl. Corp.	912656	3310	x		x		1962	1971
Nucar Corp.	670346	3310		x	x		1962	1971
R S C Inds., Inc.	749720	3310		x		x	1962	1971
Florida Stl. Corp.	343172	3449	x			x	1974	1980
Pittsburgh-Des Moines Co.	725038	3449	x			x	1974	1980
Riblet Prods. Corp.	762562	3449	x			x	1974	1980
Brooks & Perkins, Inc.	114331	3449		x		x	1974	1980
Buildex, Inc.	120085	3449		x		x	1974	1980
International Alum Corp.	458884	3449		x	x		1974	1980
Harley Co.	571154	3449		x	x		1974	1980
Park Electrochemical Corp.	700416	3449		x		x	1974	1980
Standex Intl. Corp.	854231	3449		x	x		1974	1980
Standard Alliance Industries	853037	3499	x			x	1974	1980
Crown Inds. Inc., Fla	228381	3499	x			x	1974	1980
Pentron Inds., Inc.	709686	3499		x		x	1974	1980
Diebold, Inc.	253651	3499		x		x	1974	1980
Mirro Corp.	604739	3499		x	x		1974	1980
Catepillar Tractor Co.	149123	3531	x		x		1962	1971
Allis Chalmers Corp.	19645	3531		x	x		1962	1971
Bucyrus Erie Co.	118745	3531		x	x		1962	1971
Clark Equip. Co.	181396	3531		x	x		1962	1971
Portec Inc.	736202	3531		x	x		1962	1971
Century Elec. Co.	156519	3610	x			x	1962	1970

Table 5, cont. (p. 3)

COMPANY NAME	CUSIP	SIC	ACCOUNTING METHODS		EXCHANGE		STARTING DATE	ENDING DATE
			LIFO	FIFO	NYSE	AMEX		
Ohio Brass Co.	677194	3610	x			x	1962	1970
Reliance Elec. Co.	759457	3610	x		x		1962	1970
U V Inds., Inc.	903422	3610	x		x		1962	1970
Federal Pac Elec. Co.	313675	3610		x	x		1962	1970
Gould Inc.	383492	3610		x	x		1962	1970
McGraw Elec. Co.	580628	3610		x	x		1962	1970
First National Stores, Inc.	335765	5411	x		x		1962	1972
Kroger Co.	501044	5411	x		x		1962	1972
Winn Dixie Stores, Inc.	974280	5411		x	x		1962	1972
Fairmount Foods Co.	305189	5411		x	x		1962	1972
Jewel Cos., Inc.	477196	5411		x	x		1962	1972

Table 6 Attributes of Sample

	This Study			Lee-Hsieh Study		
	FIFO	LIFO	|t|	FIFO	LIFO	|t|
Net Sales (in $ million)	435.56	807.62	1.61	152.01	440.62	2.75
Total Assets (in $ million)	427.75	725.60	0.95	109.76	345.64	3.68
Variability of Inventories	0.31	0.26	1.22	0.53	0.29	13.74
Variability of Earnings/Share	0.44	0.40	0.05	0.75	0.53	0.88
Variability of Before-Tax Income	1.04	0.024	1.46	0.91	0.24	2.35
Debt/Equity	1.056	1.07	0.06	1.34	1.42	0.58
Longterm Debt/Equity	0.44	0.48	0.31	0.54	0.62	1.19
Inventory/Asset	0.32	0.24	3.32	0.32	0.28	4.13
Inventory/Equity	0.76	0.62	0.96	0.79	0.84	0.67
Gross Capital Intensity	0.42	0.80	3.21	0.34	0.54	2.39
Sample Size	32	33		679	129	

Notes:

The variability is measured by the coefficient of variance which is a ratio between sample variance and sample mean. The gross capital intensity is measured by the ratio between gross capital stock and net sales where gross capital stock is the total fixed assets before depreciation. The absolute value of t-statistics, $|t|$, is calculated with the assumption that the LIFO sample and the FIFO sample are independent. Therefore $|t|$ value should be treated as a descriptive statistic, not as a definitive statistical test.

Table 7 Piece-wise Least Square Estimation of Impacts of Unexpected Inflations on Stock Returns of LIFO and FIFO Portfolios

Industries	Periods	Accounting Methods	F Ratio	R^2	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_9	[illegible]
2010	1962–1970	LIFO	1.00	0.024	−0.0116	−0.2397*	−0.0927	0.0791	0.0566	0.0472	0.0190	−0.1519	[illegible]
			(0.439)		(−0.112)	(−2.3181)	(−0.994)	(0.766)	(0.550)	(0.509)	(0.183)	(−1.466)	[illegible]
2010	1962–1970	FIFO	0.26	0.006	0.0237	−0.0964	−0.0621	0.0184	−0.0388	−0.0400	−0.0072	−0.0681	[illegible]
			(0.984)		(0.242)	(−0.984)	(−0.703)	(0.188)	(−0.398)	(−0.456)	(−0.074)	(−0.694)	[illegible]
2200	1962–1968	LIFO	1.36	0.033	−0.6976	−0.3433	0.1622	−1.5891*	−0.4060	−0.2581	−0.1798	−0.0306	[illegible]
			(0.205)		(−1.449)	(−0.715)	(0.350)	(−3.124)	(−0.799)	(−0.522)	(−0.356)	(−0.064)	[illegible]
2200	1962–1968	FIFO	2.62*	0.061	−0.5934	1.1016	0.0227	−2.0529*	0.0242	0.1859	1.5431*	0.3054	[illegible]
			(0.006)		(−0.852)	(1.584)	0.034)	(−2.788)	(0.033)	(0.260)	(2.219)	(0.439)	[illegible]
2200	1970–1980	LIFO	0.74	0.019	−0.0935	0.1579	0.1211	−0.1897	0.3019	0.2239	−0.0569	0.1858	[illegible]
			(0.672)		(−0.409)	(0.691)	(0.579)	(−0.837)	(1.332)	(1.096)	(−0.254)	(0.831)	
2200	1970–1980	FIFO	0.57	0.015	−0.4076	−0.0144	0.6599	0.0154	0.0160	−0.0027	−0.7092	0.5652	
			(0.822)		(−0.631)	(−0.022)	(1.117)	(0.024)	(0.025)	(−0.005)	(−1.123)	(0.895)	[illegible]
2600	1962–1971	LIFO	2.05*	0.048	−0.3424	0.0005	0.9540*	0.4187	−0.8937	−0.7514	−0.9973*	−0.0720	[illegible]
			(0.034)		(−0.684)	(0.001)	(1.985)	(0.752)	(−1.605)	(−1.456)	(−2.001)	(−0.145)	[illegible]
2600	1962–1971	FIFO	1.77	0.042	0.7220	0.2329	0.7264	−1.0573*	−0.2950	−0.8103	0.0383	0.1373	[illegible]
			(0.073)		(1.598)	(0.516)	(1.674)	(−2.103)	(−0.587)	(−1.739)	(0.085)	(0.305)	[illegible]
2911	1963–1970	LIFO	1.28	0.031	0.0266	−0.1757	0.0924	0.1646	−0.0393	−0.0425	0.0029	0.0594	−0.1972*
			(0.243)		(0.261)	(−1.727)	(0.937)	(1.564)	(−0.373)	(−0.433)	(0.028)	(0.579)	(−2.034)
2911	1963–1970	FIFO	0.88	0.021	0.0271	−0.2063*	−0.0562	0.0409	−0.1569	−0.0708	−0.0011	−0.0513	−0.1438
			(0.542)		(0.270)	(−2.051)	(−0.577)	(0.393)	(−1.507)	(−0.731)	(−0.011)	(−0.506)	(−1.501)
3310	1962–1970	LIFO	2.35*	0.055	−0.5713	0.1321	−0.2042	−0.1261	−0.6310*	0.0841	0.3117	−0.9225*	−0.1542
			(0.014)		(−1.875)	(0.426)	(−0.692)	(−0.405)	(−2.202)	(0.277)	(1.001)	(−2.887)	(−0.495)
3310	1962–1970	FIFO	1.24	0.030	0.8310	−1.0832	0.5756	−0.8163	−0.7721	−0.4753	0.9794	−1.9774*	0.6748
			(0.271)		(0.907)	(−1.162)	(0.649)	(−0.872)	(−0.822)	(−0.520)	(1.046)	(−2.057)	(0.719)

3449	1974–1980	LIFO	1.53	0.038	−0.3716	0.0108	−0.3546	−0.2402	−0.0326	−0.6144	0.2718	−0.5549	[illegible]
			(0.136)		(−1.201)	(0.035)	(−1.174)	(−0.800)	(−0.1085)	(−2.243)	(0.890)	(−1.818)	[illegible]
3449	1974–1980	FIFO	2.12*	0.052	−0.05809	−0.0619	−0.3881*	−0.1827	0.0508	−0.3773*	−0.2013	−0.4699*	[illegible]
			(0.027)		(−0.310)	(−0.330)	(−2.121)	(−1.003)	(0.279)	(−2.273)	(−1.088)	(−2.540)	[illegible]
3499	1974–1980	LIFO	1.18	0.030	0.0171	−0.1312	−0.0598	−0.1713	−0.2139	−0.2338	0.0837	0.0018	[illegible]
			(0.308)		(0.123)	(−0.949)	(−0.450)	(−1.275)	(−1.591)	(−1.894)	(0.617)	(0.013)	[illegible]
3499	1974–1980	FIFO	1.07	0.027	−0.1120	−0.1482	−0.1038	−0.3233	−0.2208	−0.3058	0.1424	−0.0922	[illegible]
			(0.387)		(−0.567)	(−0.751)	(−0.547)	(−1.684)	(−1.150)	(−1.734)	(0.735)	(−0.476)	[illegible]
3531	1962–1970	LIFO	0.49	0.012	0.1691	−0.5704	−0.0778	−0.6761	0.2164	−0.7347	0.0011	−0.3198	[illegible]
			(0.882)		(0.246)	(−0.831)	(−0.119)	(−0.923)	(0.295)	(−1.039)	(0.0016)	(−0.455)	[illegible]
3531	1962–1970	FIFO	1.24	0.030	−0.6485	−0.1667	−0.5914	0.8213	0.0203	−0.4075	−0.2456	−0.3894	[illegible]
			(0.271)		(−1.278)	(−0.329)	(−1.229)	(1.518)	(0.038)	(−0.780)	(−0.476)	(0.750)	[illegible]
3610	1962–1969	LIFO	0.91	0.022	−0.0387	−0.6340	0.0489	0.0207	−0.6677	−0.3371	0.5010	−0.6359	[illegible]
			(0.519)		(−0.101)	(−1.660)	(0.134)	(0.054)	(−1.728)	(−0.945)	(1.288)	(−1.630)	[illegible]
3610	1962–1969	FIFO	1.08	0.026	0.0088	−0.6869	−0.0093	0.2236	−0.8862*	−0.1917	−0.0978	−0.9750*	[illegible]
			(0.374)		(0.023)	(−1.807)	(−0.026)	(0.584)	(−2.305)	(−0.540)	(−0.253)	(−2.511)	[illegible]
5411	1962–1971	LIFO	0.86	0.021	−0.0411	−0.0135	−0.2229	−0.0294	−0.0102	−0.0283	−0.0692	−0.1354	
			(0.562)		(−0.315)	(−0.103)	(−1.816)	(−0.204)	(−0.070)	(−0.204)	(−0.521)	(−1.020)	[illegible]
5411	1962–1971	FIFO	0.36	0.009	0.1026	−0.0561	−0.0687	−0.0501	−0.0440	−0.1022	−0.0482	0.0188	[illegible]
			(0.954)		(0.969)	(−0.529)	(−0.690)	(−0.428)	(−0.373)	(−0.905)	(−0.448)	(0.174)	[illegible]

Notes: The columns of $\hat{\beta}_i$s show the estimated values of β_is by the number without parentheses and the t-ratio by the number within parentheses.

The F-Ratio column shows the estimated F-ratio values by the number without parentheses and shows the t-ratio by the number within parentheses.

The asterisk signs indicate significance at the 5% level.

Table 8 Price-wise Least Square Estimation of the Impacts of Unexpected Inflations on the Stock Returns of Arbitrage Portfolios of LIFO and FIFO Firms.

Industries	Periods	F Ratio	R^2	$\hat{\beta}_1$	$\hat{\beta}_2$	$\hat{\beta}_3$	$\hat{\beta}_4$	$\hat{\beta}_5$	$\hat{\beta}_6$	$\hat{\beta}_7$	$\hat{\beta}_8$	$\hat{\beta}_9$
2010	1962-1970	0.35	0.009	-0.03529	-0.1433	-0.0306	0.0606	0.0953	0.0872	0.0262	-0.0838	0.0447
		(0.958)		(-0.273)	(-1.111)	(-0.263)	(0.471)	(0.743)	(0.754)	(0.202)	(-0.649)	(0.387)
2200	1962-1968	1.35	0.032	-0.1042	-1.4449	0.1395	0.4638	-0.4301	-0.4439	-1.7141*	-0.3360	0.1715
		(0.208)		(-0.138)	(1.918)	(0.192)	(0.581)	(-0.540)	(-0.573)	(-2.276)	(-0.446)	(0.237)
2200	1970-1980	0.42	0.011	0.3140	0.1724	-0.5388	-0.2051	0.2859	0.2267	0.6523	-0.3794	-0.5537
		(0.923)		(0.496)	(0.272)	(-0.930)	(-0.326)	(0.455)	(0.400)	(1.053)	(-0.612)	(-0.954)
2600	1962-1971	1.50	0.036	-1.0644*	-0.2323	0.2276	1.4760*	-0.5986	0.0589	-1.0355*	-0.2093	-0.1305
		(0.146)		(-2.175)	(-0.475)	(0.484)	(2.709)	(-1.099)	(0.117)	(-2.124)	(-0.429)	(-0.298)
2911	1963-1970	0.56	0.014	-0.0006	0.0306	0.1486	0.1237	0.1176	0.0284	0.0039	0.1197	-0.0534
		(0.828)		(-0.005)	(0.270)	(1.356)	(1.057)	(1.004)	(0.260)	(0.035)	(0.371)	(-0.495)
3310	1962-1970	0.90	0.022	-1.4023	1.2153	-0.7799	0.6901	0.1411	0.5594	-0.6676	1.0549	[illegible]
		(0.528)		(-1.553)	(1.3229)	(-0.892)	(0.748)	(0.153)	(0.621)	(-0.723)	(1.114)	[illegible]
3449	1974-1980	0.69	0.018	-0.3135	0.0728	0.0336	-0.0575	-0.0834	-0.2371	0.4731	-0.0849	[illegible]
		(0.717)		(-1.054)	(0.245)	(0.116)	(-0.199)	(-0.289)	(-0.900)	(1.612)	(-0.289)	[illegible]
3499	1974-1980	0.43	0.011	0.1291	0.0171	0.044	0.1520	0.0069	0.0720	-0.0587	0.0939	[illegible]
		(0.919)		(0.608)	(0.080)	(0.216)	(0.737)	(0.033)	(0.380)	(-0.282)	(0.451)	[illegible]
3531	1962-1970	0.66	0.016	0.8176	-0.4037	0.5137	-1.4974*	0.1961	-0.3272	0.2467	0.0697	-0.1044
		(0.744)		(1.212)	(-0.598)	(0.803)	(-2.081)	(0.272)	(-0.471)	(0.360)	(0.101)	(-0.160)
3610	1962-1969	0.45	0.011	-0.0476	0.0529	0.0582	-0.2029	0.2186	-0.1455	0.5988	0.3391	0.0309
		(0.904)		(-0.110)	(0.122)	(0.141)	(-0.466)	(0.499)	(-0.360)	(1.358)	(0.767)	(0.074)
5411	1962-1971	0.75	0.018	-0.1437	0.0426	-0.1542	0.0207	0.0338	0.0739	-0.0209	-0.1541	0.2003
		(0.666)		(-1.018)	(0.302)	(-1.161)	(0.133)	(0.215)	(0.491)	(-0.146)	(-1.073)	(1.482)

Notes:

The columns of $\hat{\beta}_i$s show the estimated values of β_is by the number without parentheses and the t-ratio by the number within parentheses.

The F-Ratio column shows the estimated F-ratio values by the number without parentheses and shows the t-ratio by the number within parentheses.

The asterisk signs indicate significance at the 5% level.

Table 9 Generalized Estimation of the Cumulative Average Impact (GECAI) of the Unexpected Inflations on Stock Returns

GECAI (I)

Portfolio	Period	I=1	I=2	I=3	I=4	I=5	I=6	I=7	I=8	I=9
LIFO	First	-1.425	-2.740	-2.281	-2.244	-2.945	-3.240	-3.049	-3.738	-3.573
LIFO	Second	-0.859	-0.698	-0.918	-1.635	-1.558	-2.139	-1.708	-1.794	-1.848
LIFO	Total	-1.665	-2.701	-2.924	-2.769	-3.325	-3.879	-3.492	-4.127	-4.009
FIFO	First	0.065	-1.120	-1.148	-1.615	-2.381	-2.954	-2.455	-2.997	-2.898
FIFO	Second	-0.871	-1.067	-1.388	-1.908	-1.926	-2.702	-2.826	-3.073	-2.494
FIFO	Total	0.113	-1.170	-1.406	-2.115	-2.803	-3.719	-3.374	-3.980	-3.561
Arb.	First	-1.864	-1.838	-1.365	-1.571	-0.314	-0.165	-0.595	-0.513	-0.443
Arb.	Second	0.029	0.266	0.018	0.077	0.120	0.081	0.060	0.464	-0.116
Arb.	Total	-1.572	-1.428	-1.155	-0.448	-0.202	-0.096	-0.196	-0.194	-0.438

Notes: Under the null hypothesis of no impacts, the statistic GECAI (I) is normally distributed as N(0, 1). The value of the statistic is 1.96 at a two-tailed 5% significance level and is 2.58 at a 1% significance level.

The index I is the event-month relative to the starting month of quarterly unexpected inflations.

Table 10

Wilcoxon Matched Pairs Rank-Sum Test,
Week -3 to Week 17

Sample Period	Z-Statistics	2-Tailed Prob-Value
(1) 1962-1971	0.469	0.639
(2) 1970-1980	1.130	0.259
(3) 1962-1980	1.303	0.192

Table 11

Mann-Whitney U-Test

Sample Period	Event Weeks	Z-Statistics	2-Tailed Prob-Value
(1) 1962-1971	-3, 17	0.731	0.465
(2) 1970-1980	-3, 17	1.048	0.295
(3) 1962-1980	-3, 17	1.428	0.154
(4) 1960-1971	-3, 27	0.558	0.577
(5) 1970-1980	-3, 27	0.826	0.409
(6) 1962-1980	-3, 27	0.915	0.360

Figure 1

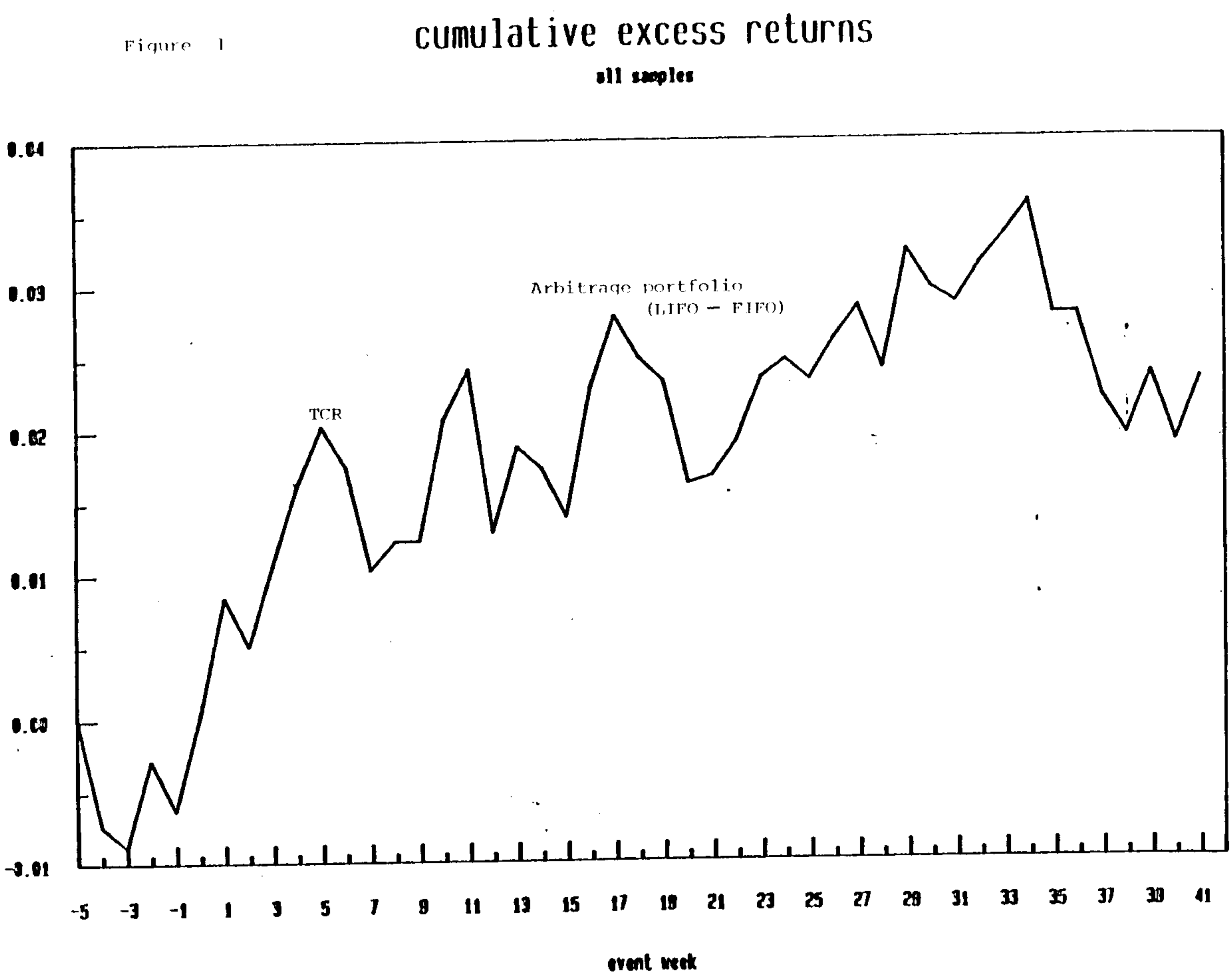
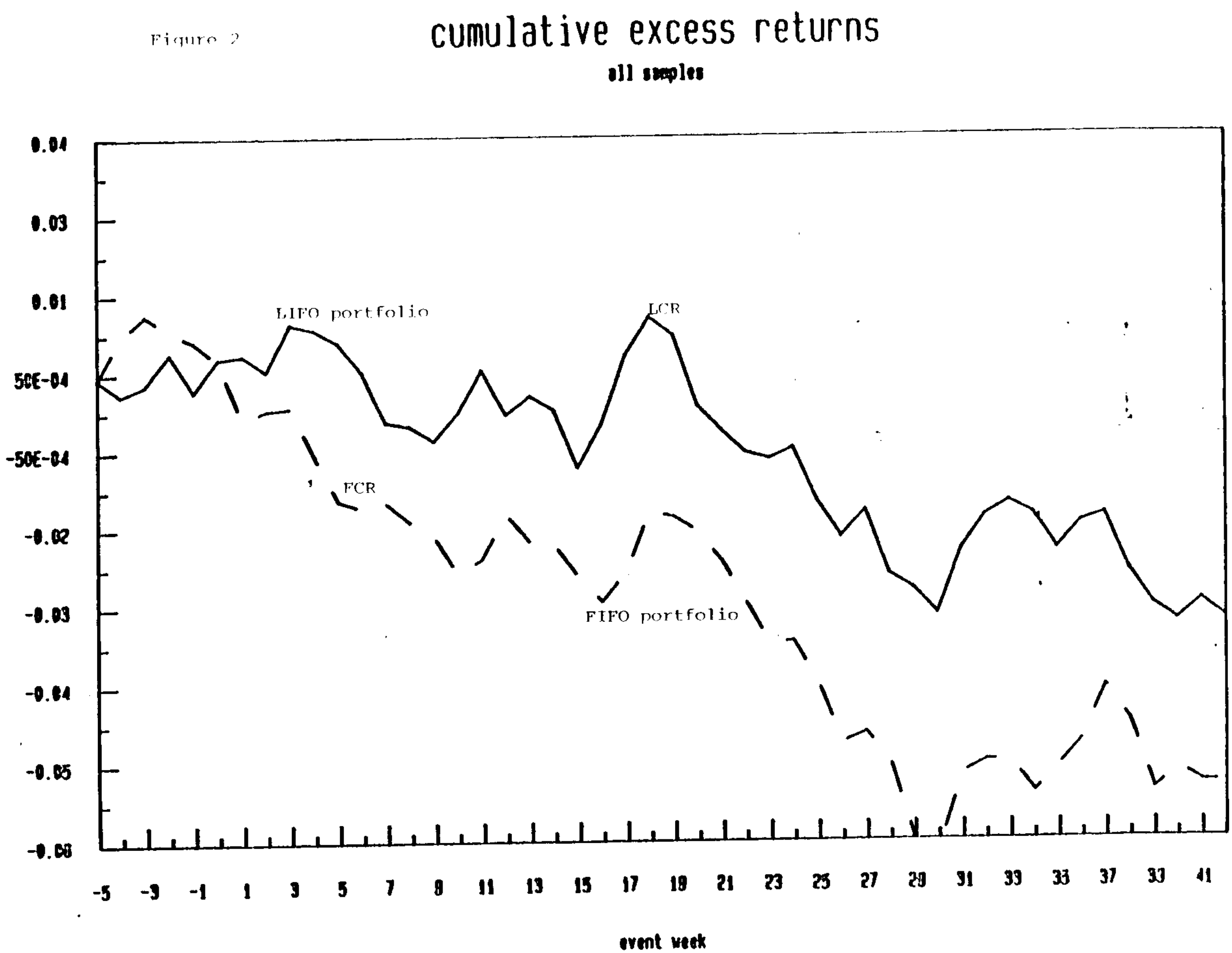

cumulative excess returns
all samples
0.04
0.03
0.02
0.01
0.00
-0.01
TCR
Arbitrage portfolio
(LIFO - FIFO)
-5
-3
-1
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
event week

Figure 2



cumulative excess returns
all samples
0.04
0.03
0.01
50E-04
-50E-04
-0.02
-0.03
-0.04
-0.05
-0.06
-5
-3
-1
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
41
event week
LIFO portfolio
LCR
FCR
FIFO portfolio

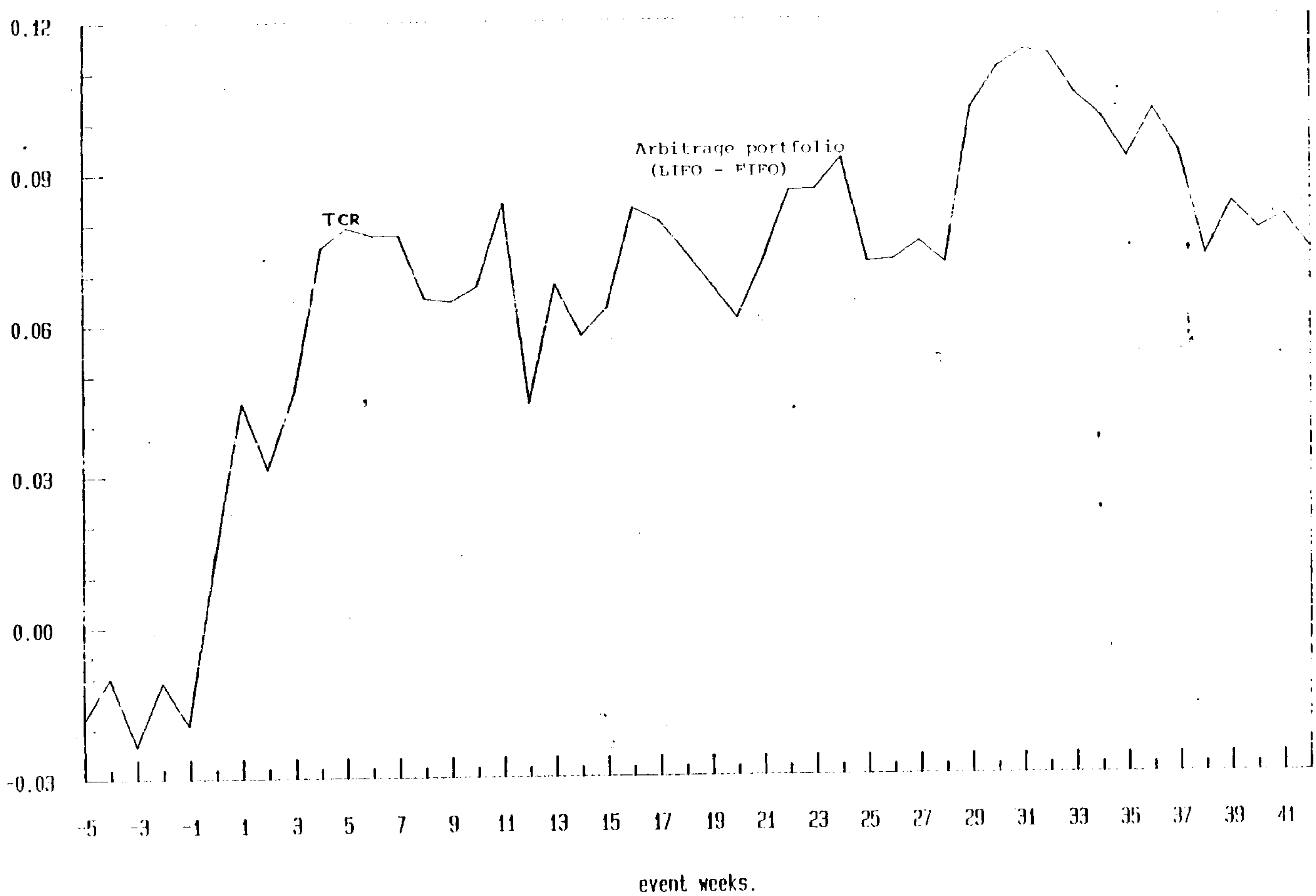


Figure 3 Cumulative Excess Returns, 1970 1980

Figure 4 Cumulative Excess Returns. 1970 1980

Figure 5

cumulative excess returns

sixties

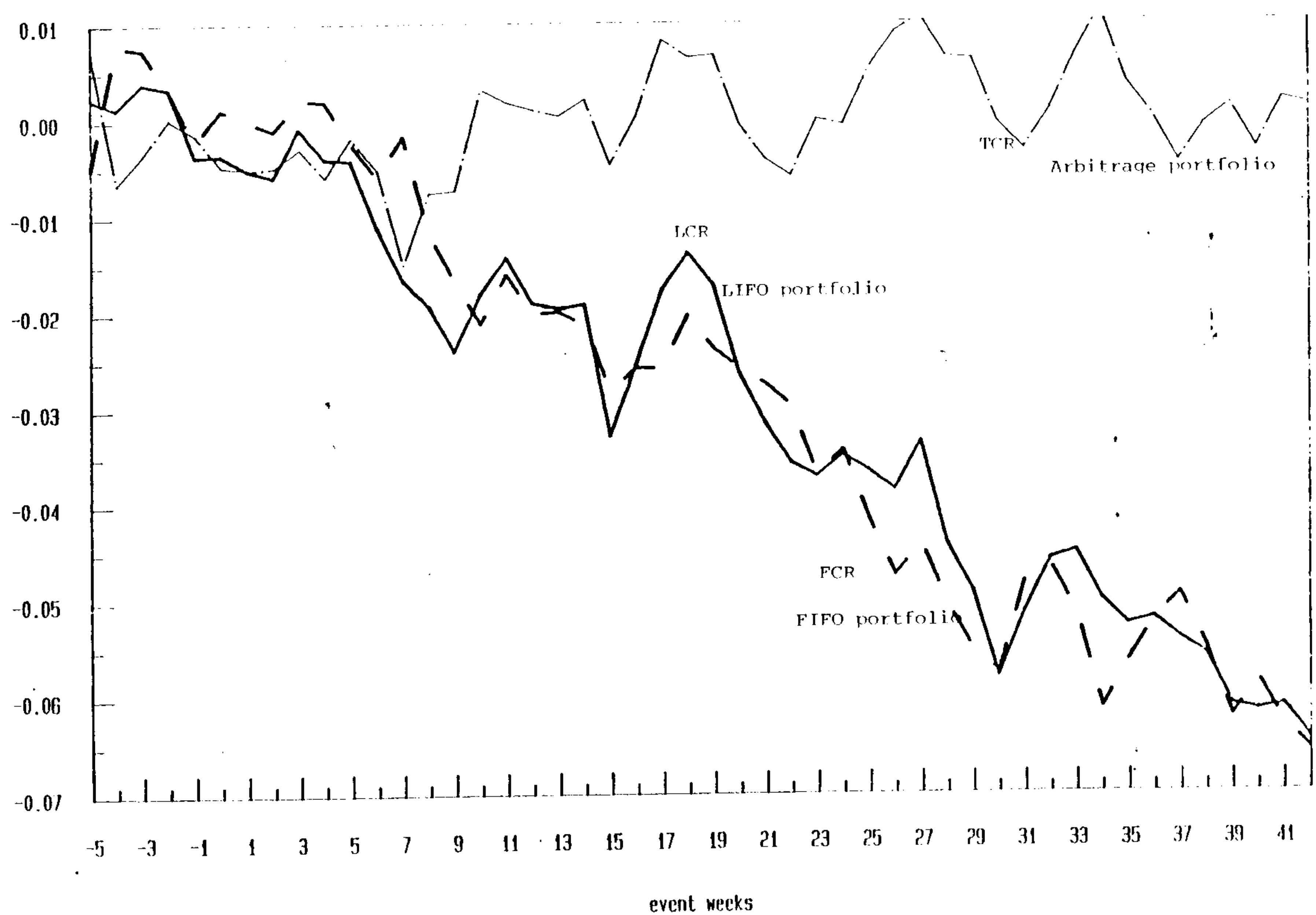


Figure 6 Cumulative Excess Returns. 1962 – 1971

Delete Imprecise Data.

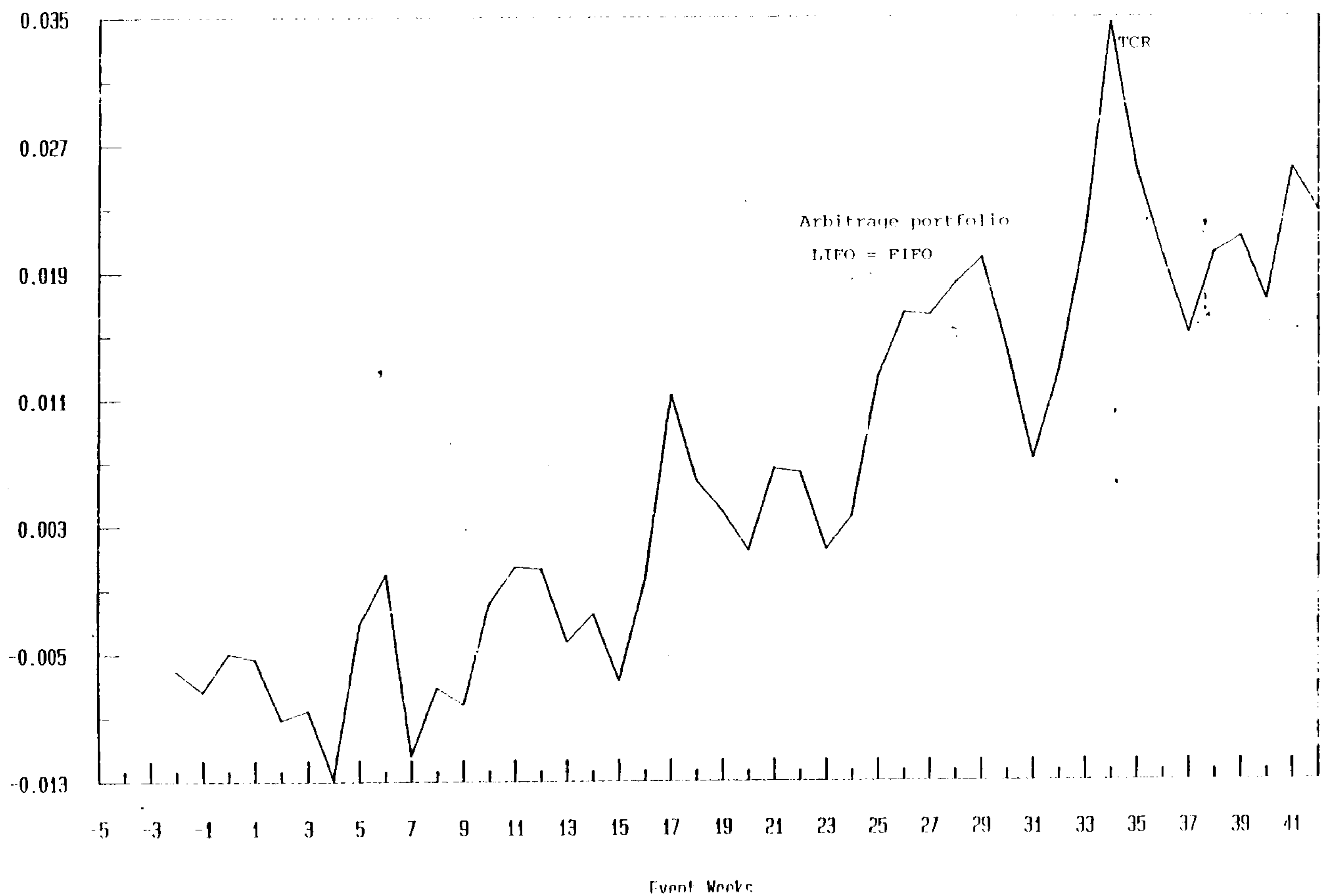


Figure 7 Cumulative Excess Returns. 1962 – 1971

Delete Imprecise Data.

Figure 8

cumulative excess returns

sixties, exclude3310&2010

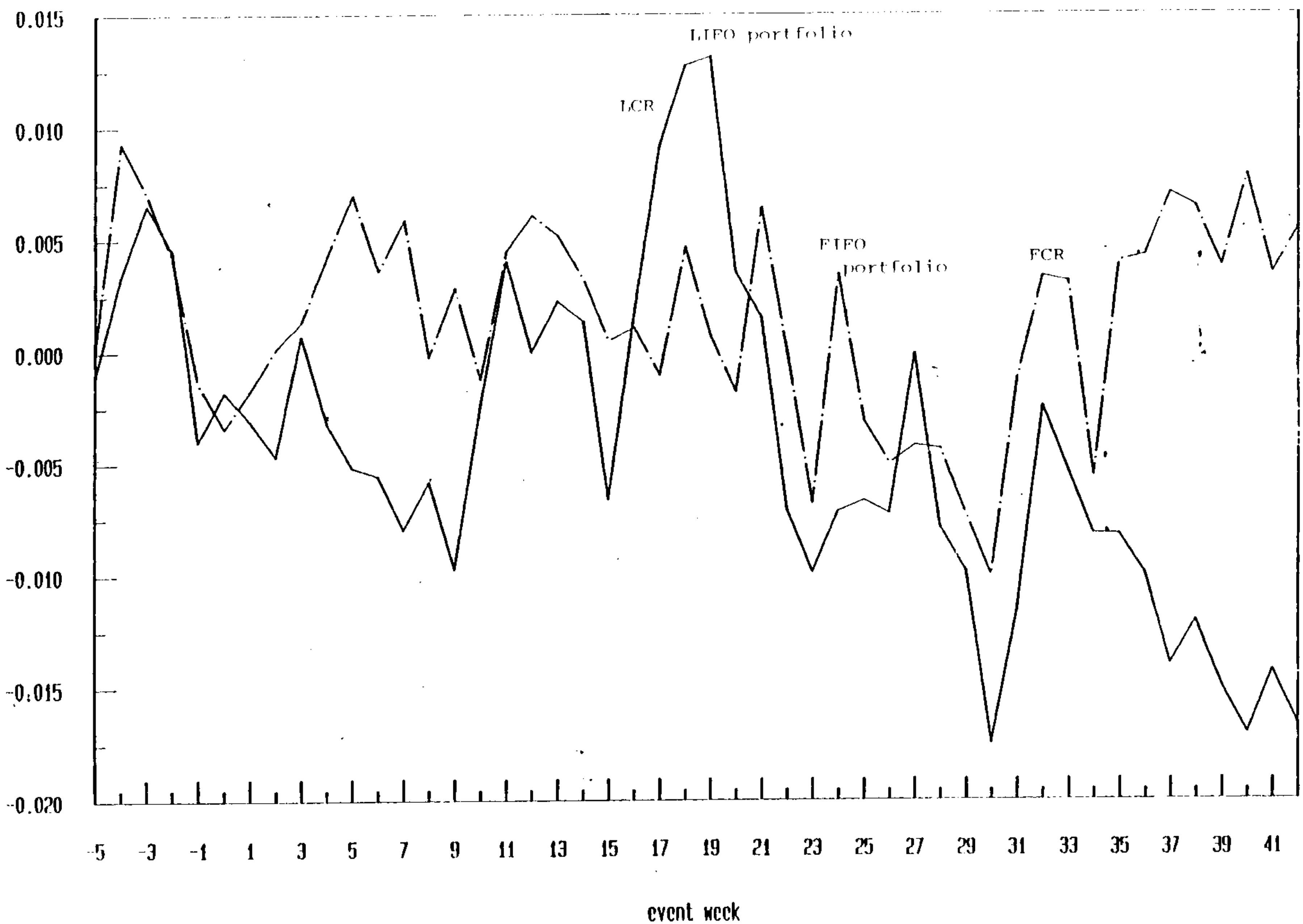
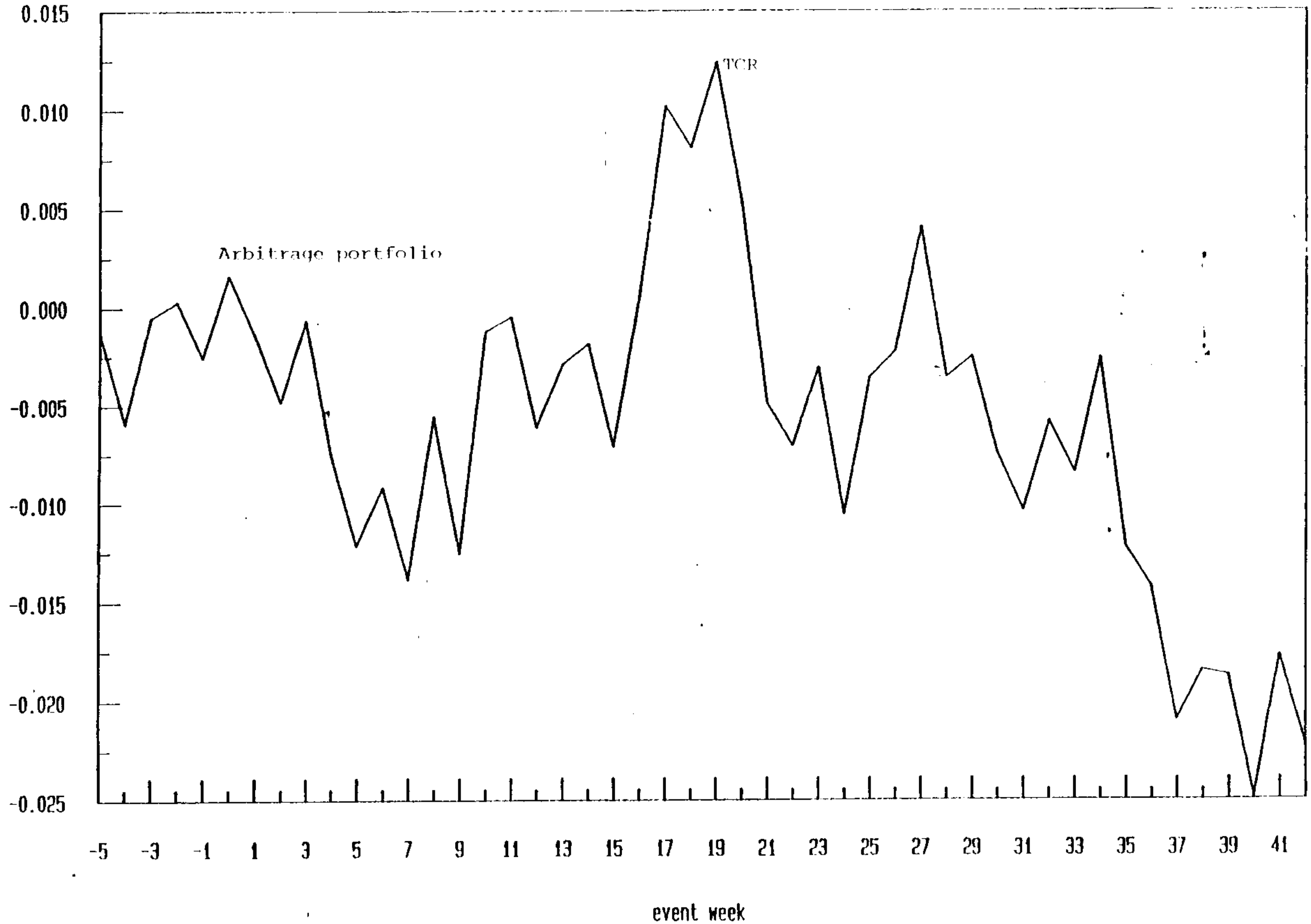


Figure 9

cumulative excess returns

sixties, exclude 2010&3310



Appendix: Statistical Distribution of GECAI (I)

Consider the following four assumptions:

A1 The monthly excess portfolio returns R_t and the unexpected quarterly unexpected inflation U_t, $U_t(-1)$, $U_t(-2)$ are multivariate normal.

A2 Within each industry j, U_t, $U_t(-1)$, $U_t(-2)$ are independent.

A3 The variables U_t, $U_t(-1)$, $U_t(-2)$ are independent across industries.

A4 $\beta_{ij} = 0$ for all i, j.

The assumption A1 can be justified by the Central Limit Theorem. Assumptions A2 and A3 can be justified by the nature of unexpected inflation. Assumption A2 has been demonstrated to be a reasonable one in Section II. However, even if A2 is true, A3 does not necessarily hold; then we need to apply the multivariate ARIMA model to estimate the unexpected inflation. Assumption A4 is the null hypothesis to be tested in this paper.

Under assumptions A1 and A4, we can have the statistical distribution of $\hat{\beta}_{ij}$ as in equation (a1)

$$\hat{\beta}_{ij} \sim \text{iid } N\ (0,\ \sigma_{ij}). \tag{A1}$$

Therefore the statistic $\frac{\hat{\beta}_{ij}}{S_{ij}}$ is of student-t distribution. Since the degree of freedom of these t-statistics in this paper are well above 50, we can use normal distribution as a proximate, i.e.,

$$\frac{\hat{\beta}_{ij}}{S_{ij}} \sim \text{iid } N\ (0,\ 1) \tag{A2}$$

Because GECAI (I) is a linear transformation of $\frac{\hat{\beta}_{ij}}{S_{ij}}$, hence we have:

$$\text{GECAI (I)} \sim \text{iid } N\ (0,\ 1).$$

FOOTNOTES

1. Feldstein, Gonedes, and French-Ruback-Schwert did not specifically examine the tax effect of inventory accounting methods. Summer's study was not very rigorous. He admitted that "The value of FIFO inventories is estimated as the book value of inventories if the firm reports that any non-LIFO method of accounting is its principal method. Otherwise, the value of FIFO inventories is taken to be zero. This procedure is flawed because many firms account for part of their inventories using each method. There is, however, little alternative given the difficulty of valuing LIFO inventories." In this paper, my sample is limited to those firms strictly adopting either LIFO or FIFO methods. I approximate the inventory price by the S.I.C. four-digit industrial price indices which is a much better proxy than the general producer's price index used by Summer.

2. For a comprehensive literature survey, please see Lev and Ohlson (1983) and Ricks (1982).

3. There are two kinds of accounting change: voluntary and regulatory. For a regulatory accounting change, all the firms take the change on the same day. Consequently, the possibility of randomizing away the systematic effect of omitted variables is greatly reduced. Since the inventory accounting change is a voluntary change, we will focus our discussion on the endogenous voluntary accounting change.

4. Biddle and Lindahl (1982) find association between market reaction to the change of inventory accounting methods and the tax savings and earnings numbers. Because tax savings and earning numbers are both endogenously determined by a manager's behavior and accounting methods, their findings cannot be viewed as strong evidence about the effects of omitted exogenous variables.

5. The study of stock market reaction to accounting change runs into several methodological difficulties. First, the precise date of the accounting change cannot be observed. Current literature generally uses the date of financial reporting as a proxy for the information release date. The resulting measurement error not only introduces noise into the study but also gives rise to possible biased results. The impact horizon of unexpected inflation can be measured more precisely than the accounting change. Second, the samples of LIFO-switching are concentrated in 1974-75. The lack of randomization could lead to spurious and biased interpretations. My sample spreads about evenly over twenty years and affords better randomization.

6. There is possible spurious correlation between stock returns and expected inflation as being documented by Fama and Schwert (1977) and Giltekin (1983). However it is beyond the scope of this paper.

7. For a summary and comparison of inflation forecasts, please see Fama and Gibbons (1982).

8. A detailed description of industrial price data will be given in the next section.

9. For a more detailed presentation of modelling procedures and results, please see Lee (1983).

10. Starting in 1972, the Compustat inventory method code tabulates all methods disclosed in a firm's annual reports in order of application (i.e., the primary method is reported first, the next most widely employed method second, etc.). For years prior to 1972, sometimes a single code may indicate the method which was used to value the majority of inventory in that year. Therefore, the data before 1972 can be less "pure" than the data after 1972.

11. There are fifteen industries that satisfy our criteria. The omitted fiive industries are: 2030, 3079, 3350, 3580, 5311.

12. If firm D were included, the sample period would be shortened to 1967-1971 and the sample size would be reduced to 20 firms/year.

13. Huberman and Schwert's study takes Israel's bond market as a case.

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