Delhi Business Review ✠ Vol. 5, No. 1, January - June 2004

CORPORATE DIVIDENDS AND EARNINGS
IS THERE A LONG-RUN EQUILIBRIUM RELATIONSHIP ?

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THIS study examines whether earnings per share (EPS) and dividend per share (DPS) exhibit a long-run equilibrium relationship. Empirical evidence seems to suggest that EPS is cointegrated with DPS for the companies investigated in this study. Out of sample forecasts, adjusted R^2, and log-likelihood ratio test reinforce the superiority of error correction model.

Introduction and Rationale

Over the years, there has been much debate regarding the relationship between dividends and earnings. Questions such as 'do dividends matter?' and 'can dividends provide some signal for investors as to future corporate earnings?' continue to prevail. Obviously, growth in earnings and dividends is valuable to stockholders. In making investment decisions, dividends play an important role because they are tangible and concrete as compared to capital appreciation.

The objective of this study is to investigate the equilibrium relationship between corporate dividends per share (DPS) and earnings per share (EPS) to determine whether DPS plays a predictive role. Previous studies have examined EPS and DPS primarily in a univariate context, which does not allow for their dynamic interactions. The purpose of this study is to examine whether DPS and EPS exhibit a long-run equilibrium relationship. If empirical evidence suggests that DPS is cointegrated with EPS, then predicting EPS may be enhanced.

Background and Literature Review

According to signaling literature, as noted by John and Williams (1985), Kane, Lee, and Marcus (1984), and Miller and Rock (1985), companies appear to utilize earnings and dividends in various ways to convey information regarding riskiness and level of future earnings and dividends. Prior research, however, suggests that earnings over time are generally characterized by a random walk. Studies, such as Ball and Watts (1972), Watts and Leftwich (1977), Ederington (1979), reinforce this observation. On the other hand, some alternative models developed by Chant (1980) and Olson and McCann (1994) appear to imply that earnings are predictable.

More recent studies provide additional insight regarding dividend/earnings relationship. For example, Chiang, Davidson, and Okunew (1997) examined this relationship using a modified form of the Lintner Model. The objective was to determine whether changes in dividends convey any additional information regarding subsequent changes in earnings. They noted difficulty in isolating the relationship between dividend and earnings due to many of the other changes which occur simultaneously in the firm. Their results imply that changes in EPS and DPS are important in the explanation of returns.

Benartzi, Michaely, and Thaler (1997) began their research with the proposition that a number of dividend theories imply that changes in dividends contain information about a firm's future earnings. Their investigation, however, found only limited support for this notion. Changes in dividends indicate mainly what has happened

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to earnings. If earnings have increased quickly in years –1 and 0, dividends are then adjusted to reflect the improved earnings. Research by Lamont (1998) found that the aggregate dividend payout ratio forecasts excess returns on both stocks and corporate bonds in postwar U.S. data. Also noted was that high dividends forecast high returns while high earnings forecast low returns. Further, dividends and earnings contribute substantial explanatory power but only for short horizons. Long horizon stock returns, during the mid 1990s, were caused by high stock prices rather than earnings on dividends.

A study by Shirvani and Wilbratte (1997) concluded that current earnings were an indication of the corporation to pay dividends than either cash flows or stock prices. Their work was based on the multivariate cointegration tests developed by Johansen and Juselius. Research by Penman and Sougiannis (1997) provided evidence in support of the substitution of GAAP earnings for dividends as a forecast target in equity valuation analysis. It also documents a negative relationship between dividends and subsequent earnings. This finding contrasts with the positive relationship usually found when testing dividend signaling models.

Dewenter and Warther (1998) compared dividend policies of U.S. and Japanese firms and found that significant differences existed. They noted that information – asymmetry models supported the idea that managers were more informed than investors about the firm's prospects and that dividends provided some of that information to the market. Thus, dividend change announcements should be positively related to stock returns because higher dividends signal an improvement in current or future earnings. They also noted that managers were reluctant to reduce dividends because of possibly sending a negative signal related to earnings. Also, there is some reluctance to increasing dividends because they may have to cut them in the future.

Dyl and Weigand (1998) investigated changes in firm risk following the initiation of cash dividend payments. They found that the risk related to earnings and cash flow decreased precipitously after the dividend announcement. The authors discuss the issue of whether changes in dividends show any correlation with future changes in earnings. They cite the work of a number of other researchers which both support and negate a positive correlation between these variables. Obviously, more research is needed to confirm a positive relationship. In their study, Gombola and Liu (1999) examined the signaling, free cash flow, and wealth transfer hypothesis in explaining stock price reaction to specially designated (as opposed to regular) dividend announcements. While no support for either the free cash or wealth transfer hypothesis was found, the study noted strong support for the signaling hypothesis.

Garrett and Priestley (2000) focused on the issue of whether dividends signal anything about permanent earnings. To this end, they developed a behavioral model of dividend policy which allows for dividends to change in response to current shocks to permanent earnings. They found no evidence to support the notion that dividends can signal future permanent earnings.

Nissim and Ziv (2001) investigated the relationship between dividend changes and future profitability (as measured by either future earnings or future abnormal earnings). They found that dividend changes were positively related to earnings changes in each of the two years following the dividend change and thus provided support for information content of dividends hypothesis.

Naranjo, Nimalendran, and Ryngaert (1998) addressed the question of whether stocks with higher anticipated dividends yields earn higher risk-adjusted returns. They re-examine whether a yield effect exists and, if so, is it the result of previously documented anomalies or taxes. No support was found for a relation between stocks to the implied tax rate and return differences between high and low yield stocks.

While these studies represent some of the mainstream work being done in this area, no research was found which examined the long run equilibrium relationship between DPS and EPS based cointegration approach as proposed for this research. Previous studies have examined EPS and the DPS primarily in a univariate context which does not allow for their dynamic interactions. This investigation extends the existing literature by applying theory of cointegration, introduced by Granger (1981) and further developed by Engle and Granger (1987), which incorporates the short-run dynamics and the long-run equilibrium relationships.

The remainder of the paper is organized as follows: section III describes the data and methodology, briefly presenting the theory of unit roots and cointegration. More detailed discussions can be found in any of the popular texts such as Davidson and MacKinnon (1993). Section IV reports the empirical results. Here it is shown that EPS and DPS are integrated processes and furthermore they share a long-run relationship. The relevant error correction model (ECM) is estimated. Out of sample forecasts, adjusted R^2, and log-likelihood ratio test for the EPS from the ECM are compared to those from a benchmark model (BM). These findings contain potentially useful information in forecasting earnings. The last section contains a summary and conclusions.

Data and Methodology

The data employed in this study consist of the end of quarter EPS and DPS for a sample of fortune five hundred companies covering the period March, 1978 through March, 1997. A random sample of 50 companies was selected from the fortune 500 listing. The sample was then narrowed to 12 companies to assure that all the necessary data were captured for complete analysis. Since the stock market began to rise substantially after March 1997, later data were not included. All the companies under investigation have EPS and DPS available. The names of the companies with their Ticker symbols and SIC codes are provided in the appendix. The data are obtained from the Compustat tapes. There are 77 observations, 60 of them are used for model estimation and the remaining 17 are used for out of sample forecasts. This sample consists of large as well as small companies. EPS and DPS are denoted by EPS_t and DPS_t respectively at time t.

Dividends are generally paid out of earnings. The amount and the timing of the dividend paid is a function of the respective company's dividend policy. Therefore, the EPS_t can be expressed in terms of the DPS_t as follows:

$$EPS_t = \alpha\ DPS_t \qquad \text{......................} \ (1)$$

where a is a non-negative constant. Equation (1) suggests that there is a linear relationship between the EPS_t and the DPS_t.

Usually financial and/or economic time series are found to be nonstationary in their levels. Using nonstationary series in statistical estimation can lead to spurious regressions (Granger and Newbold (1974)). Traditional modeling uses differenced series, which is likely to remove the potential valuable long-run relationship. Engle and Granger demonstrate that if two time series are nonstationary but their linear combination is stationary, they are said to be cointegrated. If a dynamic regression specification is performed using first differences, then the model is misspecified because it excludes the error correction term as well as the short-run dynamics. As such it fails to take into account the effect of last period's equilibrium error on the magnitude and direction of the subsequent EPS changes. If the regression model employs variables in percentage form, it will be misspecified because it ignores the lagged values which capture the short-run dynamics. The modeling framework used in this study allows nonstationarity and incorporates both the short-run dynamics and the long-run relationship.

A variable y_t is integrated of order one (i.e., I(1)) if it requires differencing once to make it stationary. Consider two time series x_t and y_t , which are both I(1). Generally speaking, any linear combination of x_t and y_t will be I(1). However, if there exists a linear combination $z_t = y_t - \alpha - b\ x_t$ which is I(0), then x_t and y_t are cointegrated according to Engle and Granger with the cointegrating parameter β. Cointegration links the long-run relationship between integrated financial variables, to a statistical model of those variables.

In order to test whether the series are cointegrated, it is necessary to check that each series is I(1). Testing for unit roots is conducted by performing the augmented Dickey-Fuller (ADF) (1981) regression, which can be written as:

$$\mathbf{\Delta y}_t = a_0 + a_1\, y_{t-1} + \sum_{i=1}^{p} \mathbf{a}_i\, D\, y_{t-i} + e_t \qquad \text{......................} \ (2)$$

where p is large enough to ensure that the residual series e_t is white noise. For sufficiently large values of p, the ADF test loses its power. An alternative test proposed by Phillips and Perron (PP) (1988), which allows weak dependence and heterogeneity in disturbances, is performed using the following regression:

$$y_t = b_0 + b_1\, y_{t-1} + u_t \qquad \text{......................} \ (3)$$

where u_t is white noise.

Testing for cointegration is performed once it is found that each series contains one unit root. Test statistics utilize the residuals from the following cointegrating regression:

$$EPS_t = a + b\ DPS_t + e_t \qquad \text{......................} \ (4)$$

If the two series are cointegrated , then e_t will be I(0) . The ADF test is performed on the estimated residuals, e_t, from equation (4):

$$\Delta\ e_t = a\ e_{t-1} + \sum_{j=1}^{q} \phi_j\ D\ e_{t-j} + v_t \qquad \text{......................} \ (5)$$

where q is large enough to make v_t white noise. The estimated residuals are also subject to the following PP test:

$$e_t = a + b\ e_{t-1} + g_t \qquad \text{......................} \ (6)$$

where γ_t is white noise.

Once it is shown that the series are cointegrated, their dynamic structure can be exploited for further investigation. Engle and Granger prove that cointegration implies and is implied by the existence of an error correction representation of the series involved. Error correction model (ECM) abstracts the short and the long-run dynamics in modeling the data. The relevant ECM to be estimated is given by

$$\Delta\ EPS_t = a + \alpha\ e_{t-1} + \sum_{i=1}^{m} \gamma_i\ \Delta DPS_{t-i} + \sum_{j=1}^{n} \delta j\ \Delta EPS_{t-j} + u_t \qquad \text{......................} \ (7)$$

where m and n are large enough to make u_t white noise.

Engle and Granger propose a two-step estimation procedure for the estimation of the parameters of model (7). First, DPS_t is regressed on EPS_t and the residuals are collected from model (4) by using the ordinary least squares (OLS). The ECM with the appropriate specification of the dynamics is estimated by the OLS in the second stage. The appropriate values of m and n are chosen by the Akaike information criterion (AIC) (1974).

The existence of an error correction model implies some Granger causality between the series, which means that the error correction model can be used for forecasting. The error correction model is expected to provide better forecasts compared to those from a naive model. The forecasting performance of the error correction model will be compared to those from a naive benchmark model by means of adjusted R^2, likelihood ratio (LR) test, and root mean squared error (RMSE). The benchmark model (BM) is given by

$$\Delta EPS_t = c + d\ \Delta EPS_{t-1} + \xi_t \qquad \text{......................} \ (8)$$

where c is the intercept, d is the slope, and x_t is the random error term.

Empirical Findings

All the EPS and the DPS are tested to ensure they are integrated of order one i.e., I(1). The results of the ADF and the PP tests are shown in Tables I and II. The level series demonstrate that they have a unit root in their autoregressive representations. This evidence seems to suggest that the series are nonstationary. Now the difference series are checked for the presence of a unit root. The ADF and the PP tests clearly reject the null hypothesis of the presence of a unit root. This implies that the difference series are stationary i.e., I(0). Therefore, EPS and DPS are integrated of order one i.e., I(1).

Since it is shown that each series is I(1), it is necessary to test whether there exists a linear combination of EPS_t and the DPS_t series, that is I(0). If there exists a long-run relationship, they must be cointegrated. Results of the tests of cointegration are presented in Table III. The ADF and the PP tests reject the null hypothesis of no cointegration at the 10% level of significance except for the ADF test in several cases. The ADF test is known to have low power, therefore, the PP test is also used to confirm our results. This finding reinforces the notion that cointegration unites the long-run relationship between EPS and DPS.

Table I

Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests for unit root in the autoregressive presentations of the quarterly DPS and the EPS for twelve companies for the time period March, 1978 through March, 1997. From a total of 77 observations, 60 are used for model estimation and the remaining 17 are employed for out-of-sample forecasts.

	EPS		**DPS**		**Critical Value (10%)**
	ADF	PP	ADF	PP	
Levels:Ticker					
ALEX	-0.29	-1.44	-1.23	-1.92	-2.57
BMS	0.06	-1.11	-0.21	1.68	-2.57
DLX	0.81	-0.56	1.37	1.86	-2.57
DNY	-0.63	-1.96	-0.51	0.31	-2.57
DOW	-1.51	-2.07	-0.26	-1.61	-2.57
EIX	-1.71	-2.35	-1.20	-2.22	-2.57
GWW	1.12	-0.65	1.11	0.38	-2.57
HSY	0.43	-2.00	0.53	-0.86	-2.57
LLY	-1.18	-2.21	1.42	1.65	-2.57
MRIS	0.39	0.08	0.82	1.22	-2.57
RGS	-1.51	-1.47	-1.97	-2.11	-2.57
XRX	-2.37	-2.32	-1.90	-1.87	-2.57

Critical values are taken from MacKinnon (1991).

Table II

Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests for unit root in the autoregressive presentations of the quarterly DPS and the EPS for twelve companies for the time period March, 1978 through March, 1997. From a total of 77 observations, 60 are used for model estimation and the remaining 17 are employed for out-of-sample forecasts.

	EPS		**DPS**		**Critical Value (10%)**
First Difference: Ticker:	ADF	PP	ADF	PP	
ALEX	-4.56	-9.68	-3.81	-12.07	-2.57
BMS	-2.68	-17.69	-2.69	-8.66	-2.57
DLX	-3.91	-9.67	-2.59	-10.17	-2.57
DNY	-4.79	-8.82	-2.93	-10.07	-2.57
DOW	-3.34	-9.18	-2.86	-17.59	-2.57
EIX	-5.16	-13.53	-4.80	-29.16	-2.57
GWW	-2.92	-14.35	-2.65	-9.47	-2.57
HSY	-4.08	-9.59	-3.57	-13.17	-2.57
LLY	-4.95	-12.22	-2.71	-8.98	-2.57
MRIS	-3.96	-12.96	-3.43	-11.06	-2.57
RGS	-2.76	-15.26	-6.02	-17.16	-2.57
XRX	-4.63	-5.57	-6.21	-7.80	-2.57

Critical values are taken from MacKinnon (1991).

Table III

Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests for cointegration between the quarterly EPS and the quarterly DPS for twelve companies covering the time period March, 1978 through March, 1997.

Regressand: EPS	Regressor : DPS		Critical Value (10%)
Ticker:	ADF	PP	
ALEX	-4.27	-6.32	-3.04
BMS	-0.30	-7.86	-3.04
DLX	-1.37	-5.94	-3.04
DNY	-0.91	-5.45	-3.04
DOW	-0.10	-5.18	-3.04
EIX	-4.48	-9.98	-3.04
GWW	-1.91	-5.24	-3.04
HSY	-3.29	-6.69	-3.04
LLY	-2.20	-3.19	-3.04
MRIS	-3.40	-5.92	-3.04
RGS	-2.51	-12.93	-3.04
XRX	-3.08	-4.03	-3.04

Critical values are taken from MacKinnon (1991).

Cointegration suggests that the series have an error correction representation and, conversely, an ECM implies that series are cointegrated (Engle and Granger). The ECM (7) provides a parsimonious representation of equilibrium relationship between the series by expanding available information set. For example, the last period's equilibrium error is incorporated through the error correction term. Short-run deviations in one period are adjusted through lagged variables in the next period.

Table IV presents the estimates of the parameters of model (7). The parameter estimates of model (8) are not presented to conserve space. They are available from the authors upon request. The intercepts from model (7) are found to be statistically insignificant. This appears to imply absence of a linear trend in the data generation process. The error correction coefficients are negative and statistically significant. This is consistent with the theory, i.e., error correction coefficient is expected to be negative. If the change in EPS ($DEPS_t$) is above its average value, the error correction term is positive. $DEPS_t$ must move downward to follow the long-run equilibrium path which makes coefficient negative. If $DEPS_t$ is below its average value, the error correction term is negative, but it must move upward in the long-run to follow equilibrium path and hence the coefficient is going to be negative. This coefficient measures the speed with which the system moves towards equilibrium. Lagged variables of $DEPS_t$ and $DDPS_t$ are statistically significant. These findings indicate that the deviations in one period are adjusted in the next period.

Model (7) incorporates the short- and long-run information in modeling the data. The model (8) fails to incorporate these important sources of information.

Cointegration implies the existence of causality between EPS and DPS changes. The estimated error correction model is used to develop seventeen out of sample one step ahead forecasts for EPS. These forecasts are then compared and contrasted with univariate forecasts from model (8). Tables V and VI present the summary statistics for these forecasts where it is observed that the adjusted R^2 from the ECM (7) is larger than that from the BM for all companies. The LR statistic is significant for all companies. In contrast to the benchmark models, the error correction model reduces the root mean squared error from a range of 3% to 65%. These findings suggest that the ECM (7) is more informative and significantly better than the BM (8) in forecasting the EPS.

Table IV

Estimates of the parameters from the error correction model (7) for EPS.

Regressor		Model for ΔEPS_t	
Ticker: ALEX		Coefficient	SE
	Constant	0.0077	0.0179
	e_{t-1}	-0.4063	0.1319
Ticker: BMS			
	Constant	-0.0004	0.0042
	e_{t-1}	-0.9902	0.0997
	ΔDPS_{t-1}	4.3400	0.8474
Ticker: DLX			
	Constant	0.0115	0.0071
	e_{t-1}	-0.0679	0.0304
	ΔEPS_{t-1}	-0.6595	0.0931
	ΔEPS_{t-2}	-0.5349	0.1121
	ΔEPS_{t-3}	-0.5046	0.1125
	ΔDPS_{t-1}	2.0080	0.5457
	ΔDPS_{t-4}	1.2355	0.5794
Ticker: DNY			
	Constant	0.0230	0.0064
	e_{t-1}	-0.1482	0.0546
	ΔEPS_{t-1}	-0.6580	0.1175
	ΔEPS_{t-2}	-0.6487	0.1195
	ΔEPS_{t-3}	-0.4974	0.1209
	ΔEPS_{t-6}	-0.2594	0.1157
	ΔEPS_{t-7}	-0.2606	0.1185
Ticker: DOW			
	Constant	-0.0039	0.0588
	e_{t-1}	-0.2225	0.0923
	ΔEPS_{t-4}	0.4785	0.1300
Ticker: EIX			
	Constant	0.0169	0.0123
	e_{t-1}	-0.5074	0.1359
	ΔEPS_{t-1}	-0.5546	0.1200
	ΔEPS_{t-2}	-0.6211	0.1046
	ΔEPS_{t-3}	-0.6974	0.0821
Ticker: GWW			
	Constant	0.0167	0.0066
	e_{t-1}	-0.4665	0.1649
	ΔEPS_{t-1}	-0.3156	0.1263
Ticker: HSY			
	Constant	0.0122	0.0066
	e_{t-1}	-0.7903	0.1457
	ΔDPS_{t-1}	-0.9124	0.4219
	ΔDPS_{t-3}	-1.3307	0.4227
Ticker: LLY			
	Constant	0.0170	0.0207
	e_{t-1}	-1.0104	0.1369
Ticker: MRIS			
	Constant	0.0100	0.0048
	e_{t-1}	-0.3796	0.1275
Ticker: RGS			
	Constant	0.0292	0.0540
	e_{t-1}	-1.0063	0.1593
Ticker: XRX			
	Constant	-0.0294	0.0487
	e_{t-1}	-0.6477	0.2924

Estimates of the parameters from the error correction model (7) for EPS.

Table V

Summary statistics for seventeen one-step-ahead forecasts for EPS for the time period March, 1978 through March, 1997. BM[o] Benchmark Model (Model (8)).

TICKER	Statistic						
	Adjusted R^2		Log-likelihood LR[a]			RMSE	
	BM	ECM	BM	ECM		BM	ECM
ALEX	0.0057	0.1258	30.398	34.259	7.72*	0.7910	0.7022
BMS	0.4508	0.6626	110.077	125.212	30.27**	0.0927	0.0786
DLX	0.0439	0.6988	90.3283	127.683	74.71*****	0.3193	0.2435
DNY	0.0087	0.7279	59.130	100.624	82.99*****	0.9710	0.7736
DOW	0.0490	0.2130	-42.572	-36.371	12.40**	0.6578	0.6389
EIX	0.2417	0.7680	22.616	59.739	74.25****	0.1644	0.0587
GWW	0.2394	0.3214	91.652	95.595	7.89**	0.2472	0.2159
HSY	0.0477	0.4292	79.569	95.978	32.82***	0.2218	0.1647
LLY	0.2668	0.4754	15.631	25.675	20.09*	0.4761	0.3553
MRIS	0.1175	0.2008	113.543	116.515	5.94*	0.2519	0.2345
RGS	0.2980	0.3973	-36.419	-31.842	9.15*	0.4038	0.3271
XRX	0.0241	0.0621	-26.709	-24.518	4.38*	0.8616	0.7077

[a] The likelihood ratio test statistic: LR = 2 (log-likelihood (7) - log-likelihood (8))

* $\chi^2_{1,.05} = 3.84$, ** $\chi^2_{2,.05} = 5.99$, *** $\chi^2_{3,.05} = 7.81$, **** $\chi^2_{4,.05} = 9.48$, ***** $\chi^2_{6,.05} = 12.59$

Table VI

Summary statistics for seventeen one-step-ahead forecasts for EPS for the time period March, 1978 through March, 1997.

RMSE Ratio (ΔEPS_t)

Ticker	ECM/BM
ALEX	0.88
BMS	0.84
DLX	0.76
DNY	0.79
DOW	0.97
EIX	0.35
GWW	0.87
HSY	0.74
LLY	0.74
MRIS	0.93
RGS	0.81
XRX	0.82

To summarize, the evidence presented in this paper demonstrates that the ECM (7) is superior to the model (8) in predicting the EPS. Out of sample forecasts in terms of RMSE, adjusted R^2, and the LR test reinforce this observation.

Conclusion

This study investigates whether EPS and DPS share a long-run relationship by using quarterly series of EPS and DPS data. Each series is tested for the presence of a unit root in its autoregressive representation. It is found that each series is integrated of order one. EPS and DPS series are tested for the existence of an equilibrium long-run relationship. It is then observed that EPS is cointegrated with DPS for the companies investigated.

Cointegration implies and is implied by the existence of an error correction model. As mentioned earlier, the ECM integrates the short and the long-run dynamics in modeling the data and proves to be an informative modeling technique compared to the benchmark model. The evidence presented in this investigation shows that the ECM (7) is preferred to the traditional model (8) and, thus, ECM is more effective in forecasting the EPS. The superiority of model (7) over model (8) is established by means of RMSE, adjusted R^2, and the LR test. The ECM reduces the RMSE of the EPS changes by a considerable margin. It is believed that the investors, corporations, analysts, and others can benefit by using this framework in developing their investment, financing, portfolio management, and trading strategies. This research, of course, can be extended to several directions including a comparison with other earnings forecasting models used by analysts.

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Appendix

TICKER	SIC	NAME
ALEX	4400	Alexander & Baldwin Inc.
BMS	2670	Bemis Corp.
DLX	2780	Deluxe Corp.
DNY	2750	Donnelley (RR) & Sons Co.
DOW	2821	Dow Chemical
EIX	4911	Edison International
GWW	5000	Granger (WW) Inc.
HSY	2060	Hershey Foods Corp.
LLY	2834	Lilly (Eli) & Co
MRIS	6021	Marshall & Ilsley Corp.
RGS	4931	Rochester Gas & Electric
XRX	3861	Xerox Corp.